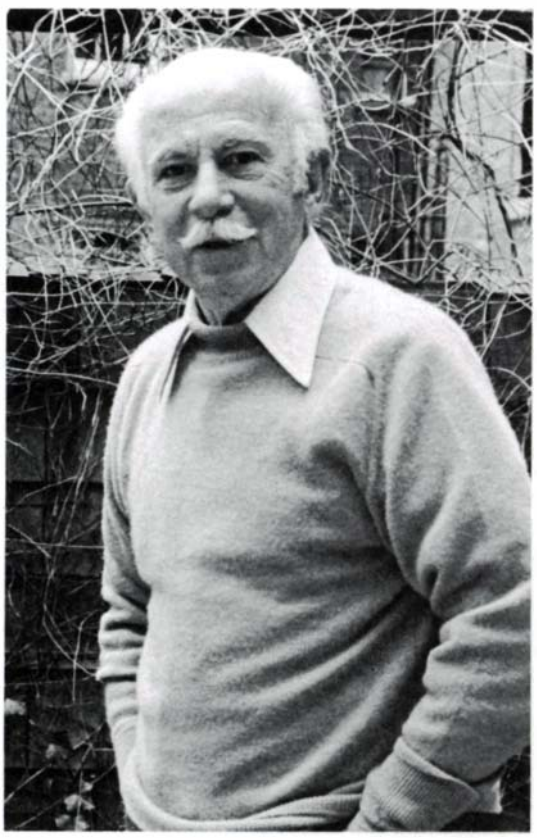
Fine WoodWorking

MAY/JUNE 1982, NO. 34, $3.00

Making Shoji

A master craftsman shares the secrets and stories of a lifetime



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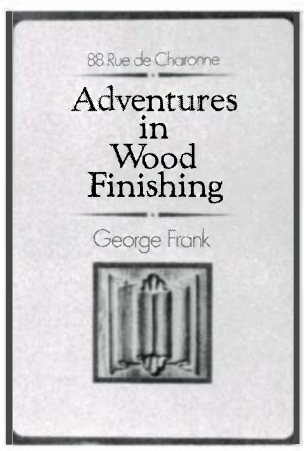

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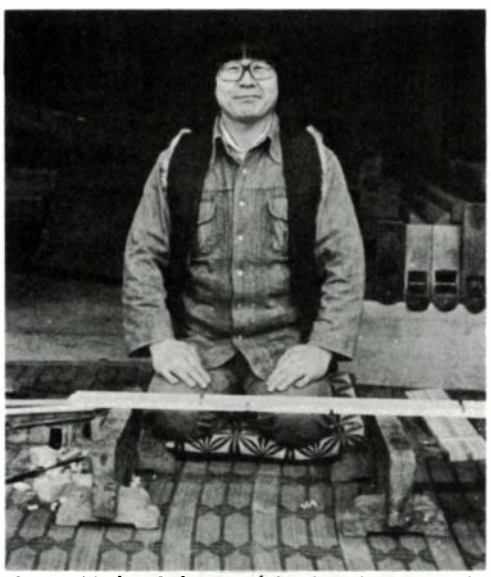

Cover: Toshio Odate explains how he spaces the mortises that hold the latticework (kumiko) *in a traditional Japanese sliding door* (shoji). *This photo was snapped during a weekend workshop at the Brookfield (Conn.) Craft Center—Odate commenced by moving a room ful of workbenches out of his way and arranging his tools on a mat. To the Western eye, Japanese woodworking is characterized by a remarkable economy of tools, materials and energy. The craftsman (above) strives always to cut directly to the line.* *More on p. 50.*

Fine WoodWorking®

MAY/JUNE 1982, NUMBER 34

DEPARTMENTS

ARTICLES

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Letters

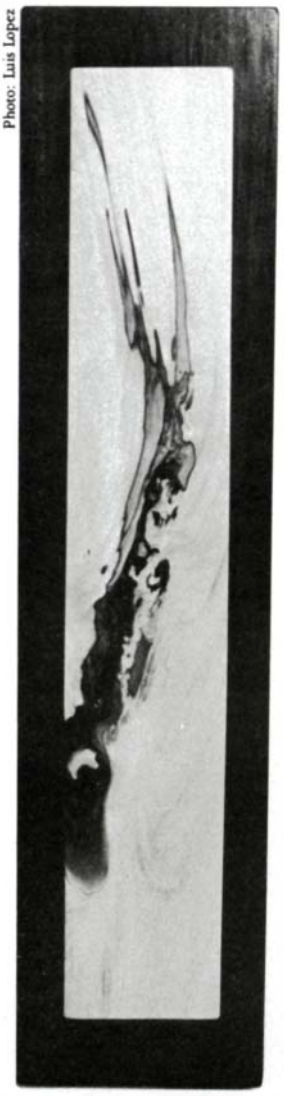
Photo: Luis Lopez

Over the past several years I have encountered a number of boards that were very striking in appearance due to the defects they contained. Ordinarily these boards, or the defective sections, would be discarded as useless for any furniture or cabinet work. But I found myself putting them aside, usually standing them against a wall where I could look at them frequently. After a while the defective section would define itself as a design area and I would square up the board accordingly. I have made a few of these into decorative panels which can be hung on the wall like paintings.

The idea of simply mounting a board as a wall decoration originated with a poplar board that arrived with lumber for my school shop classes. This 9-in. board was marked almost its entire 8-ft. length with a wide band of stain. The colors were mostly greenish, yellowish and reddish streaks, but with a bright, teal-blue sweep resembling a bird's open wing. I stood the board aside and soon realized that I would not be able to cut it up. The board looked like an abstract painting so I decided to treat it as such. To set off the design I used a backing of plywood painted flat black. The result is very dramatic and gratifying.

With time and finishing, the colors have become primarily tones of brown with a hint of the original green, and the teal blue has become black. The panel does not suffer from the loss of the original colors since the shadings and the dramatic sweep of the design are still present. The piece retains its strong visual impact.

I've made a number of these panels with various woods. All the panels were sanded and finished with two coats of flat polyurethane. This eliminates any interference from reflected light yet leaves the wood with a natural appearance, though urethane does impart a definite yellowish hue. For hanging I prefer to use two screw eyes along the top edge of the backing piece and clear fishing line. If the panel design is attractive in more than one position, it can be centered on the backing piece and a flexible hanging arrangement can be had by using more screw eyes. —*Cornelia Orentlicher, New York, N.Y.*

Regarding source information on planes manufactured by the Stanley Rule & Level Co., you were right to suggest the Early American Industries Association, as they can provide detailed information. There's also a book, however, entitled *The Stanley Plane*, by Alvin Sellens, published by the EAIA in 1975 and obtainable through The Iron Horse, Star Route, Bomoseen, Vt. 05732. It is the most comprehensive study of just about every plane that Stanley made, giving illustrations, physical descriptions, and period of manufacture. In addition to the catalog reprints available through Roger Smith, Ken Roberts Publishing Co., P.O. Box 151, Fitzwilliam, N.H. 03447, has been producing Stanley Catalog reprints for at least the past 10 years and his are the finest I've seen.

—*D.H. Osborne, Jr., Rye, N.H.*

Being an amateur woodturner I am interested in submitting some of my work for evaluation by others, but after reading the comments in "The Turned Bowl" (*FWW* #32, Jan. '82) I get a rather uneasy feeling as to what the results might be.

It seems like the judges as well as the author are technical peers who look for technical characteristics instead of the beauty or usefulness of the object. Who cares if the wall thickness is uniform—who would know unless the item was segmented or carefully measured—and who cares if there is no obvious means of holding the item as it is being made?

As for felt bottoms, put down in the article, I think felt bottoms are an exquisite finish to an object of art. Not only does felt look good and feel good, it sets well on a display surface. The beauty of the wood, the beauty of the shape, possibly its usefulness, and its finish should be requisites in the judging. Objects made from rotten wood and that have missing parts have little value except as curiosities and have no place in a display of fine art.

—*Jack Gardner, Anaheim, Calif.*

Regarding Jim Haber's article about converting a printer's saw for woodworking (*FWW* #32, Jan. '82), I'm a machinist and I saw this article when a customer came in asking me for an estimate on the conversion. I advised him not to do it, because you suggest welding onto a high-speed spindle. The heat of welding might change the strength properties of the steel, so I wouldn't risk welding onto any arbor running faster than about 100 RPM. It's too dangerous. Instead I'd turn a new shaft in one piece.

I got interested in the problem and found a used Hammond Glider, but out here in L.A. it cost about $750, not $300. By the time you finished the conversion you'd have spent a lot more than $1,000. On the other hand, a stock Hammond Glider without any modifications would be valuable in any shop, it's a real nice machine.

—*Gene O'Neill, Canoga Park, Calif.*

I thought the article on "Slip Joints on the Radial Arm Saw" by Curtis Erpelding (*FWW* #32, Jan. '82, p. 71) was most interesting and descriptive. In his discussion of dovetail mortises, he suggests tilting the saw to cut the mortises and the need to "make the cut in one pass." If, however, he uses the tenon jig (Fig. 3, p. 75) rotated 90° clockwise and readily modified to support the stile, the mortises can be precisely cut in multiple passes just like he cuts the tenons, with the saw blade parallel to the saw table.

—*Ross G. Roepke, Tullahoma, Tenn.*

I've just been to a two-day workshop on Japanese tools. The use of these special tools was so easy on the arms that my arthritic pain in my hand muscles did not act up. Now, would it not be wise to tell disabled and retired people more about these tools? I know a couple of people who are interested in woodwork, but the conventional tools are not as controllable and can cause pain when pressure has to be applied. Not so with these Japanese tools....

—*Albert B. Gilbert, Carmel, N.Y.*

Almost every time I look into a magazine that advertises tools, machinery, materials or a service, I wonder how much of each advertisement I must read before I find the line that tells me to please send for their catalog, brochure or descriptive folder at $1.00 per copy (refundable with the first order).

I know printing is expensive. But I wonder if some advertisers don't actually make more money from selling their advertising literature than they do from selling the product they advertise.

I have done some selling in my time but I have never asked a prospect to advance me the cost of my gasoline or travel fare. Each day a newspaper is delivered to my home. I pay for that newspaper. Not for the advertising that is in it but for the news matter. The advertiser pays for the space he uses. I buy this magazine not for its advertising, but the advertiser rides into my hands and attention upon the reading material the magazine editors have sifted and assembled. If an advertiser has stirred my interest enough that I ask for his descriptive material, I should not have to pay him to spin his yarn. *—F. Eldon Heighway, Phoenix, Ariz.*

J.A. Hiltebeitel's method for bandsawing integral drawer bottoms (FWW #31) is an excellent method. But this method can be used to cut any shape, even drawer shapes that reverse in direction, if the proper angle is achieved. If I am wrong please show me the light. *—Anthony J. Cruz, Harrison, N.J.*
EDITOR'S NOTE: You're right.

Since no saw arbor runs perfectly true and since sawblades tend to fit rather loosely, the odds are that the freshly sharpened blade has only some of its teeth cutting. The way to correct this is to have a reference mark scratched onto the arbor and on each blade. The blade should always be mounted on the arbor the same way, with marks aligned. Then the sawblade is lowered, turned on and slowly raised into the jointing stone, just until each tooth is touched. The back of each tooth is then filed until the flat spot from the jointing operation disappears.

Another tip: Keep a wad of waxed paper in your back pocket. Use it to keep the surfaces of machines slick so that your workpiece runs smoothly. In cutting large panels I rub the waxed paper on the saw table, fence, sawhorse and on the panel itself. I have never had any finishing problems induced by the very small amount of wax on the workpieces.
—John C. Zwart, Salem, Ore.

About 48 years ago my first job in a woodworking mill was to prepare the hot hide glue in a cooker. The following cold glue formula was used for repair work throughout the plant.

Prepare a solution containing one part sodium nitrate to seven parts water by weight. Soak one part animal hide glue with three parts solution for two hours. Heat in a water bath at 160° to 180°F for two hours. Cool. If too viscous on cooling, add a small amount of solution and reheat.
—Eli S. Eisenhard, Boyertown, Pa.

Thanks for the excellent article by Tom Gerson on shop-built bar clamps (*FWW* #32). We have just made a dozen for our shop. While making these clamps I came up with an easier way to make the headstock. This method eliminates the mortise used to house the nut for the clamp screw.

Instead of cutting a mortise in the headstock, counterbore the ⅜-in. clamp screw hole as deep as the length of the nut (about 1 in. for half an Allthread connector) and about the same diameter as the distance across the flats of the nut (⅞ in. for a ⅜-in. connector). Insert into this hole from the small end, a bolt with a washer under the head. Thread the half-

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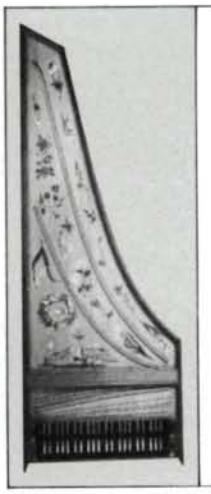

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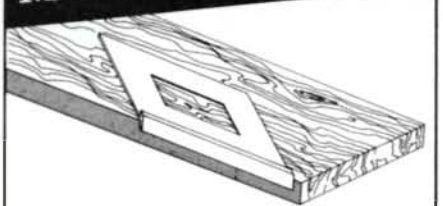

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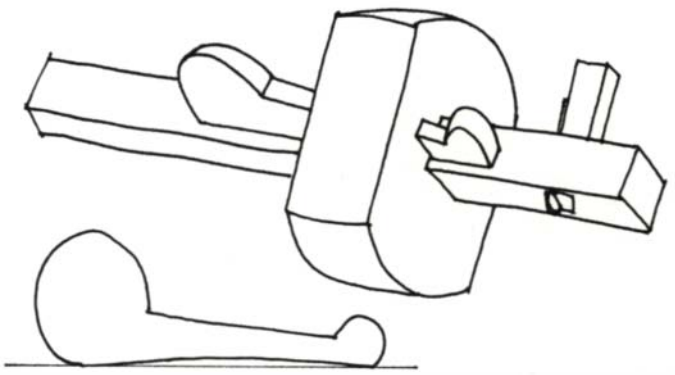
connector onto the bolt, and with a wrench on the bolt head, draw the nut into the ⅛-in. hole. The nut will broach the hole to its own exact size and shape to hold it securely captive. It's a good idea to clamp the headstock block while drawing in the nut to prevent the block from splitting....

—Floyd W. Foess, Federal Way, Wash.

I like the article "Cutting Gauge" by John Lively (*FWW* #32, p. 82). I have made marking gauges using similar methods, the difference being an improvement on the wedge fence lock that helps prevent losing the wedge. The improved wedge can be offset from center or moved to the side of the beam to eliminate interference with the cutter.

—Wallace List, N. Huntingdon, Pa.



Some new tools are not very well made for the job they are supposed to do. I have had a recent experience with my 12-in. Sears Craftsman tablesaw, when the motor failed. I had to purchase the whole motor assembly when only the winding burnt. With a conventional electric motor, you may have the option of repairing the part at fault.

My point is that there is a new generation of power tools (planers, bandsaws, tablesaws, jigsaws, jointers) that have an integral motor rather than a separate conventional motor. When the motor fails, separate components cannot be repaired, thus the whole unit must be replaced. I feel that this trend to make "motorized" tools is an inferior form of machine construction and will cost the woodworker more money and down time. Many imported tools are made this way and are sold at a cheaper price than domestic equipment. An article on this would interest a lot of woodworkers.

—Clarence Marshall, Sheet Harbour, N.S.

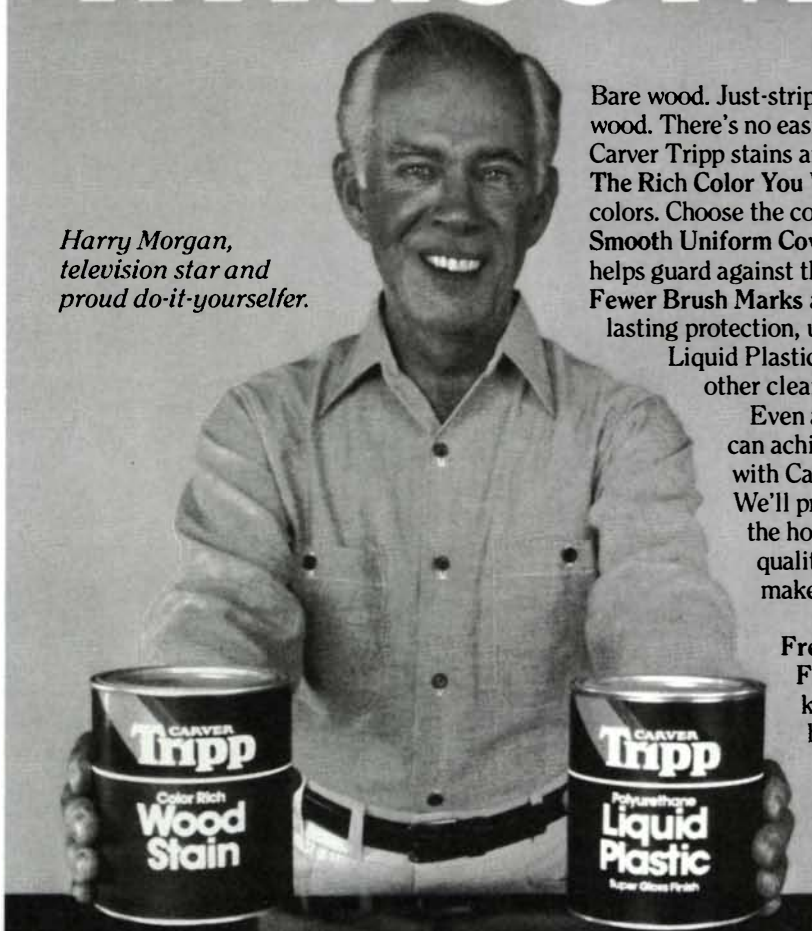
Re John Ward's article in *FWW* #31, Nov.'81, about business. As a professional woodworker I found John's article realistic, as it takes much extra effort to get a new business into the profit column.

But I don't agree with: "Don't start anything in the shop that someone else can't finish." Either John has to limit the shop's quality level to the employee with the least experience (a stifling dilemma) or hire all employees with John's ability level (not feasible)....

—Billy C. Largent, San Luis Obispo, Calif.

I enjoyed very much the article on woodlot management by Irwin and Diane Post in your March issue. Woodlot management is going to prove very important in the next century as the number of people grows and the area of forested land decreases. I do disagree with the authors on one small point.

FROM RAW WOOD TO RARE BEAUTY WITHOUT A RIPPLE



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While they write that one can mark either the cull trees or the crop trees, I prefer to mark just the culls. An article in the *Journal of Forestry* for September, 1979, indicated that tree and log marking paint has been associated with cambial necrosis in sugar maples. Apparently it can cause cankers and stem swelling, which can reduce the value of the tree.... Since the cull trees will be removed anyway, marking them instead of the crop trees seems to be safest.

—Charles Starks, West Stockbridge, Mass.

I was bothered by several things mentioned in the article "Timber" by George Nakashima (*FWW* #32, Jan.'82). After inspecting literally millions of board feet of lumber at every stage of moisture content, I have yet to witness cherry or ash lumber that has taken on a blue stain. In fact, the only blue stain I have ever seen was in pine and hemlock lumber, after it had laid in log form for too long. It is also my opinion that Nakashima was incorrect when he wrote that lumber is steamed with sawdust to rectify the "raw" look of kiln drying. This is simply not done, at least not commercially....

—Gregg Macey, Apalachin, N.Y.

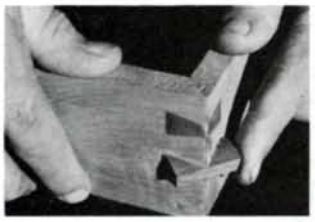
I have experienced the darkening effect of finishes on redwood as mentioned by John Stoughton (*FWW* #32, Jan. '82). I am presently experimenting with Ultra-Seal by Chemco, followed by Ultra-Glo. These might be found in crafts or plastics shops. Ultra-Seal looks and goes on like white glue. It dries clear with the least darkening I've found. Ultra-Glo is a two-part plastic, but I'm guessing that some other finishes could be used over the sealer. I'd like to know if anyone has another solution. *—Frank Morgan, Kodiak, Alaska*

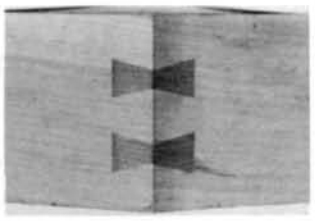
Re Bruce McQuilkin's rosewood desk (*FWW* #32, p.104). I agree that the desk is elegant—with one exception. I never cease to be amazed that a woodworker of McQuilkin's obvious taste and skill would spoil so lovely a creation by using tacky brass hands on the clock in the desk. Reproduction clocks may require metal hands, but modern clocks do not.

I have built many clocks and always use wooden hands. I begin by slicing thin strips of the wood I want to use on the bandsaw. These are sanded smooth and shaped on the belt sander. I then cut the centers from the metal hands supplied with the clock works and epoxy them to the wooden hands. When the epoxy has set, I clean out the center with a Dremel.

—Max Hunsicker, Mt. Gretna, Pa.

MCQUILKIN REPLIES: Actually, the hands are gold-plated.





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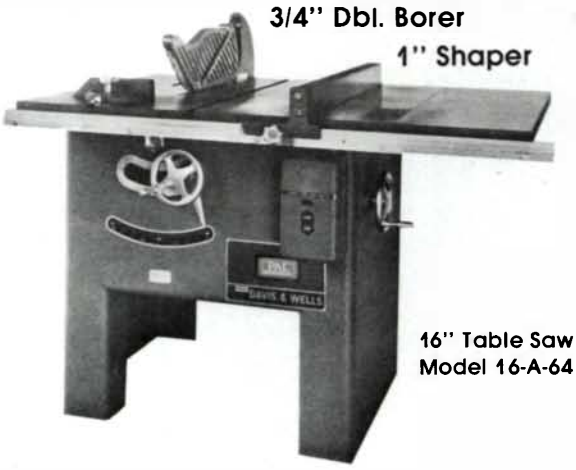

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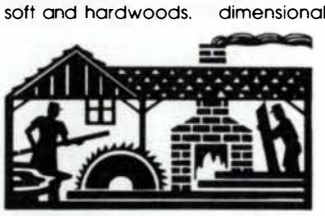

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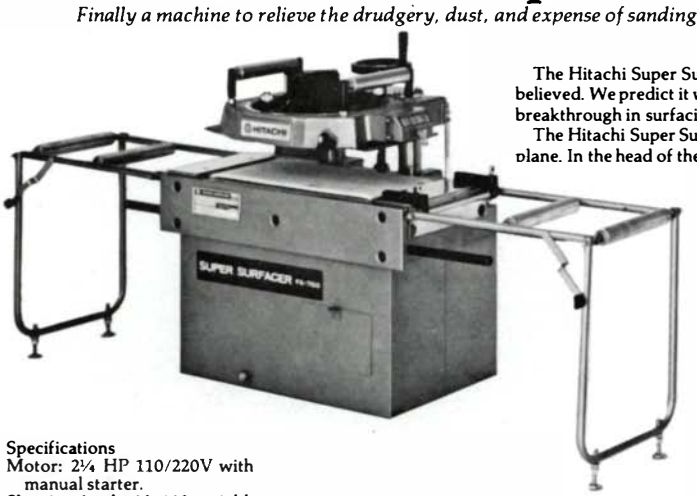

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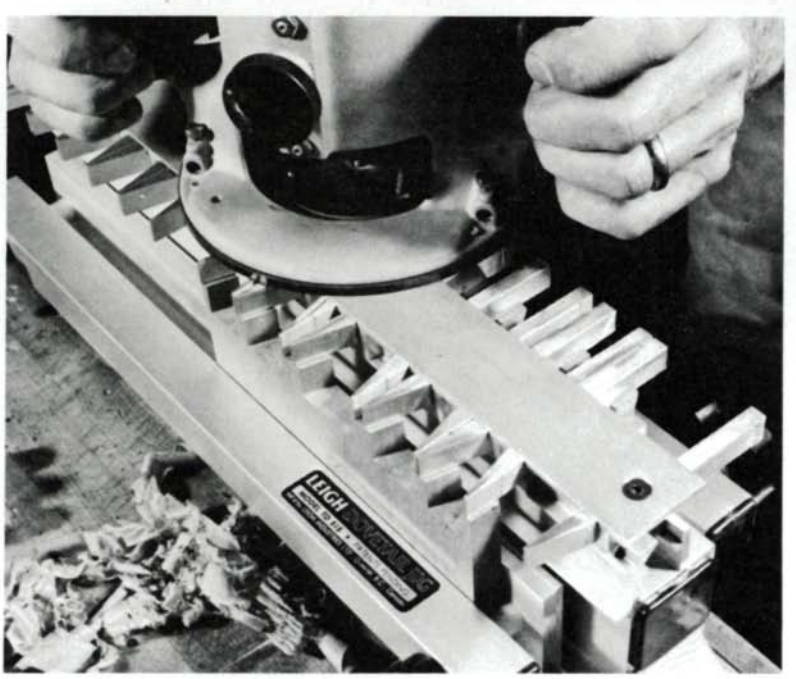

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More jointer-knife sharpening jigs

EDITOR'S NOTE: We've published several jointer-knife sharpening jigs in past Methods of Work columns (see *FWW* issues #30, #27 and #23). Each one has prompted readers to send us letters with refinements, variations and new ideas.

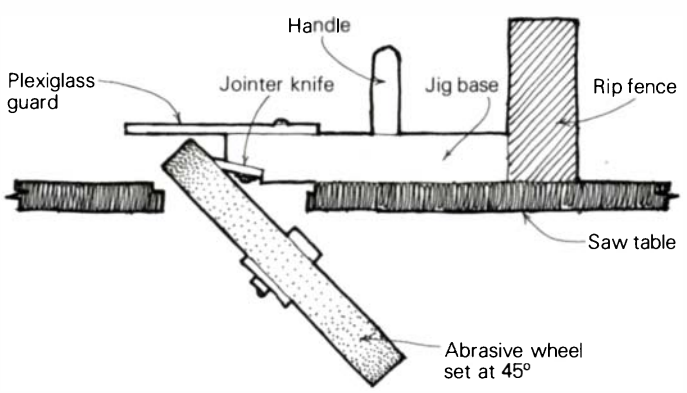
However, to add a point of caution to all these methods based on the table saw and drill press, Carl Henry of Houston, Texas, writes: "At a wooden-boat school I attended last summer we used a grinding wheel mounted in a table saw to remove a lot of metal from a set of large planer knives. An hour later smoke began to pour from the sawdust in the saw's base. The hot embers from the grinding had been smoldering there in the sawdust. I recommend cleaning out the saw completely before and after sharpening."

John Gibbons of Madison, Wis., adds another cautionary note: "Grinding operations on the table saw spray a stream of abrasive dust all over the saw's gears, trunnions, bearings and other working parts. This grit will cling to these parts and grind away at their machined surfaces. Those who expect continued smooth operation of their machinery would be well advised to avoid such abusive practices."

For those who will take the necessary precautions, here are three more ways to sharpen jointer and planer knives. *—Jim Richey*

Here's a simple jig I use on my table saw to sharpen the knives of my 16-in. thickness planer, different from the methods in *FWW* #30, Sept. '81. The jig is nothing more than a block of hardwood with an angled shoulder to give the right sharpening angle. The knives on my planer are slotted so I use screws and washers through the slots to fasten the knife in place.

To use the jig I put a fine-grit 6-in. abrasive wheel on the tablesaw arbor and tilt the arbor to 45°. I use the rip fence for rough adjustment and the blade-height crank for fine adjustment. *—John Kolkman, Thornhill, Ont., Canada*

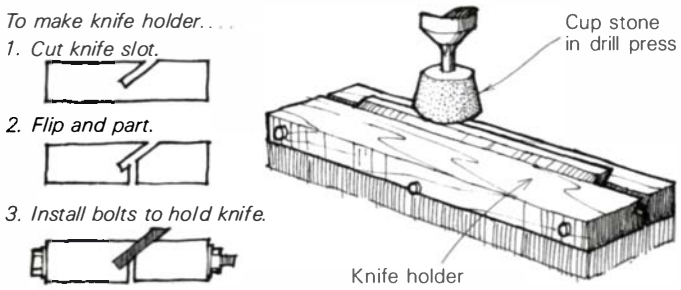


I built several variations of the cup-stone-in-drill-press jointer knife sharpening jigs described in the Methods of Work column *(FWW* #23, July '80 and #27, March '81). All proved unsatisfactory because they either distorted the blade or didn't hold it securely. However I've modified the design of the knife-holder block and have had good success.

Start with a maple 1x3 a couple of inches longer than the jointer knives. Drill a ¼-in. hole at each end across the width of the block. The distance between holes should be about 1 in. greater than the knife length. Drill an additional hole midway across the block well below the centerline. Now cut a groove in the block at the sharpening angle (I used 36°), but don't cut into the hole you drilled midway across the block. Flip the board over and cut the board so that it looks like the sketch at the top of the next column. Insert ¼-in. carriage bolts in the holes, insert the blade in the slot and tighten the nuts. Don't over-tighten, or you'll distort the blade.

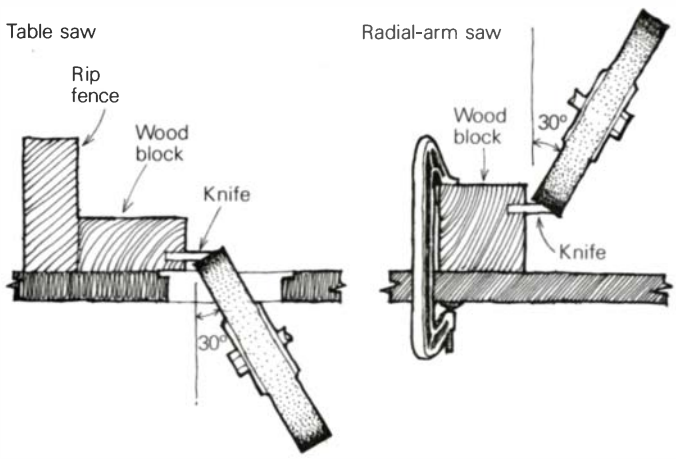
The knife holder can be fastened (glue one part only) to a base and slid under the cup-stone freehand. Or you can devise a two-part jig with a sliding track in the base as shown with other holders in the Methods column.

—George Pfeiffer, Seward, Neb.



The sketch below shows my method for grinding jointer knife blades on the table saw. The blades are ground on the circumference of the grinding wheel, not the side.

A similar setup allows blade grinding on the radial-arm saw. Clamp the blade holder to the table parallel to the saw arm. Mount the stone in the saw arbor and run the arbor/stone unit back and forth on the radial-arm to grind the knives. Feed the stone by lowering the arm. *—Mark Palmquist, Lilburn, Ga.*

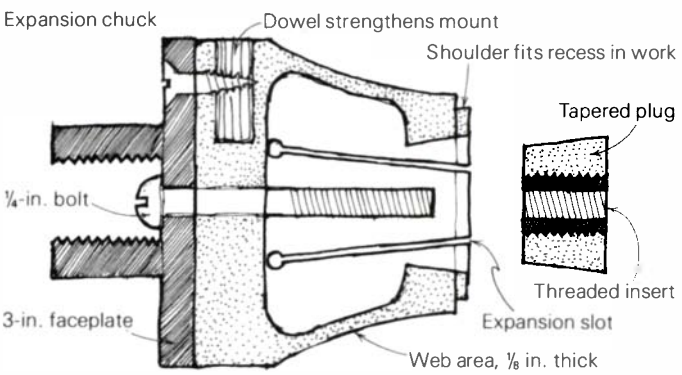


Expansion chuck

I needed a lathe chuck to hold work without screw holes. This shopmade expansion chuck is invaluable for turning small trays, dishes and vases. A single ¼-in. machine screw pulls a tapered wooden plug into a matching tapered section thereby expanding the chuck and tightening it in a prepared recess in the base of the workpiece.

Make the chuck from a block of hardwood (I used Honduras mahogany) that has been permanently screwed to a small faceplate. Since the wood grain is perpendicular to the faceplate, install three birch dowels in the base of the block to increase the holding power of the mounting screws.

The overall shape of the chuck is somewhat arbitrary, but proper expansion can be achieved only if the webs are thin. After you have turned the outside to shape, carefully hollow the inside to give about ⅛-in. thickness to the web region. Fit the plug blank with a threaded steel insert, then turn the plug to match the taper of the chuck body. A 7° taper is about



right. After turning is complete, drill stop-holes and cut eight expansion slots in the chuck body.

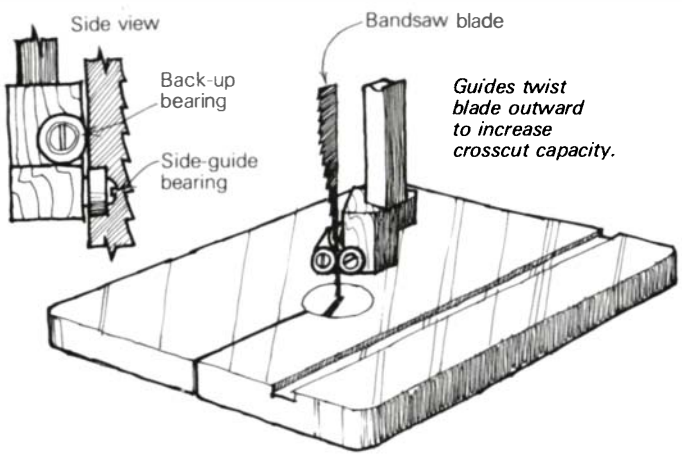
—R.E. Hollenbach, Livermore, Calif.

Increasing the bandsaw's throat capacity

To increase the throat capacity of my bandsaw, I designed two blade guides to replace those provided with the saw. The new guides twist the blade outward 25°, as is done on a metal cut-off saw. The guides were made from maple and fitted with three ⅜-in. ball bearings held in place with screws. Two of the bearings act as the side guides and the third is the back-up bearing for the blade. Of course the guides had to be designed within the limitations and characteristics of the bandsaw.

The results were gratifying; I can now crosscut a 10-in. board without the board hitting the bandsaw's column.

—Ralph Luman, Virginia Beach, Va.



Clearing a clouded finish

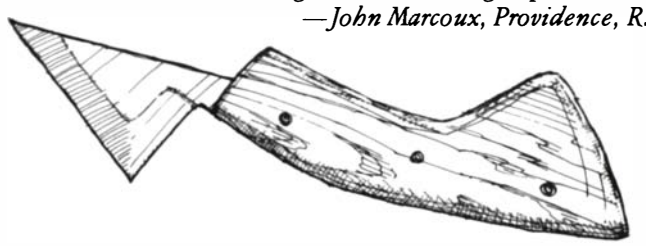
It's a hot, muggy day and you've just shot a heavy coat of lacquer on a nice project. A few minutes pass and you discover the finish has clouded with moisture. Here's how to clear the finish. Shoot the clouded area with acetone. The acetone will clear the finish and bring the moisture to the surface. Quickly wipe it off. To continue, thin the lacquer and shoot sparingly.

—Robert M. Vaughan, Roanoke, Va.

Woodworker's knife

This knife design with a triangular head sharpened on two sides is especially useful to woodworkers. The blade cuts not only like a conventional knife, but it also cuts on the pull stroke. This gives very good control and leverage, and makes the knife usable in situations where the chisel is inadequate. I've used it for whittling, for scoring, for cutting patterns in veneer and even for trimming brush on fishing trips.

—John Marcoux, Providence, R.I.



Wedged loom joint

I devised a wedged half-lap joint to replace the tusk-tenon joint traditionally used in loom construction. The joint fills all the requirements I wanted: it can be taken apart, won't vibrate loose, is easy to make and finishes flush and neat. In my ver-

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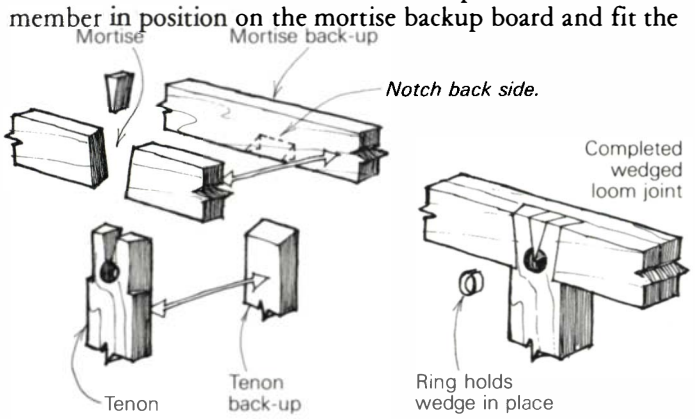
sion the joint members are made up from two face-glued planks. The double-plank approach greatly simplifies cutting the joint and fitting the mortise to the tenon.

To make the joint, start with one of the four boards that will later form the mortise. Crosscut the board with the miter gauge set at 88° and the blade angled at 15° to make both sides of the mortise (flop one board). Miter the end of the tenon backup board at 30° and then cut a 30° notch in the mortise back-up board. The mitered end should wedge tightly into the notch.

To make the tenon, first locate and drill a large hole on the tenon's centerline. This hole helps prevent the joint from cracking and allows the tenon walls to flex. Next bevel the sides of the tenon at 15° and cut the angled slot for the wedge. The sides of the tenon should be left parallel. Later the wedge will spread them to fit the angled mortise.

Glue the tenon to its mitered backup board. Place this member in position on the mortise backup board and fit the two mortise pieces against the sides of the tenon; the mortise pieces touch the tenon only at its shoulder. Mark the position of the mortise pieces, remove the tenon member and glue the mortise pieces in place. After the glue sets you're ready to assemble the joint by tapping in the wedge.

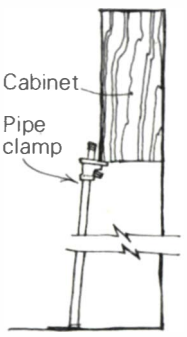


I recommend you oven-dry the wedges for two hours or so before you drive them in. This will reduce the chance of their shrinking and needing to be driven in further after you've trimmed them flush. Even so, leave the wedges in place for a few weeks before finishing flush. If the wedges persist in loosening, cut a short section of brass tubing the same diameter as the tenon hole. Cut a tapered section out of the ring so that, when inserted in the hole, it bites the wedge where it enters the hole. *—Irving Sloane, Brussels, Belgium*

Holding cabinets in place

If you make a lot of kitchen cabinets and work alone, as I do, you know that it is difficult to hold the cabinets in position while you're fastening them to the wall. This method uses pipe clamps to solve the problem. Remove the screw end from your long pipe clamps. Slide the adjustable stops up the clamps and use the clamps to wedge the cabinets in place.

—Randy Hazlett, Ashland, Ohio



Flush rule joint for oval tables

Simon Watts says (in his article in *FWW*#18, P. 62) that he does not like "oval-shaped drop-leaf tables because the curve crossing the rule joint makes part of the joint project in an un-

sightly way." I agree that the projection is unsightly, but there's a simple solution that makes the rule joint flush in both the open and closed positions: bevel the edge of the table top.

Figure 1 shows how the corner of a rule joint projects when the leaf is lowered. The edge of the table continues to curve whereas the top corner of the rule joint swings down in an arc perpendicular to the line of the rule joint. But if the edge of the table is beveled at angle *a* determined from the tangent to the oval at the rule joint, the lower edge of the table top is farther out on a radius than the top corner of the leaf. When the leaf drops (figure 2), the edge and the corner match.

Recently I made a drop-leaf table incorporating this method and was pleased with the result. Later I visited Williamsburg and noticed that many of the oval drop-leaf tables of colonial times also have beveled edges. So, my idea is far from original.

—James H. Smith, Champaign, Ill.

Figure 1

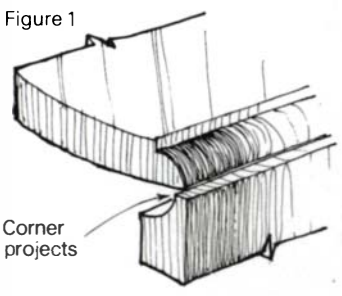
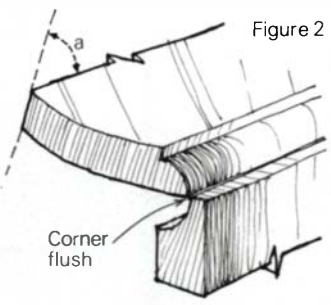
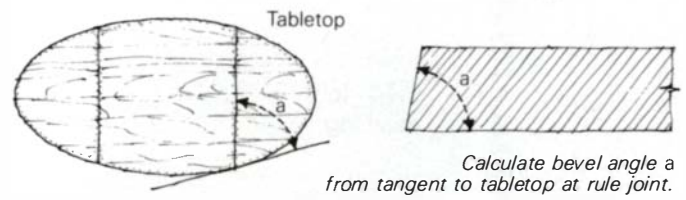


Figure 2

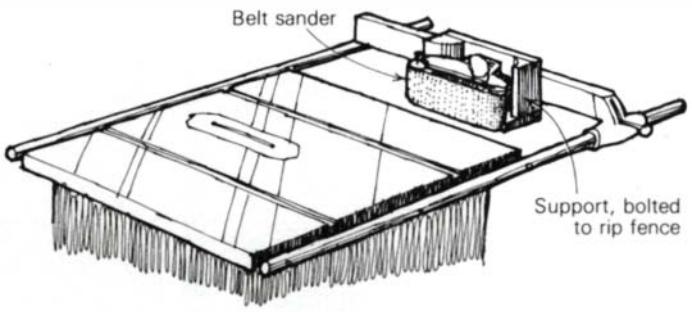




Calculate bevel angle a from tangent to tabletop at rule joint.

Edge-sanding fixture

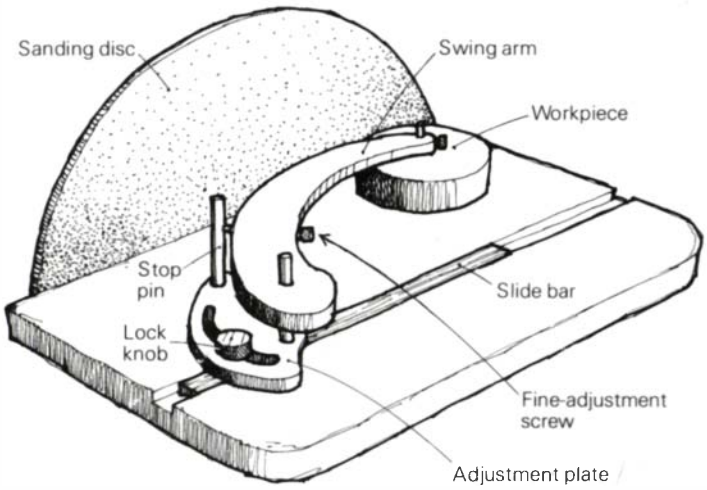
Here's a fixture that turns a belt sander into an edge sander. Simply build a wooden fixture that supports and locks your belt sander in a horizontal position. Bolt the fixture to the tablesaw's rip fence as shown, and use the saw's flat cast-iron surface for the work. *—Wayne Hausknecht, Tucson, Ariz.*



Two boss spinners

While visiting a woodworking pattern shop I ran across this tool called a "boss spinner." It is used with a disc sander to make wooden discs of varying diameters and thicknesses. As I found it, the unit was made from wood. Aluminum would perhaps give more accurate adjustment.

The boss spinner consists of three main parts: a slide bar that fits the channel in the sander table, an adjustment plate and a swing arm. A slot in the adjustment plate allows gross



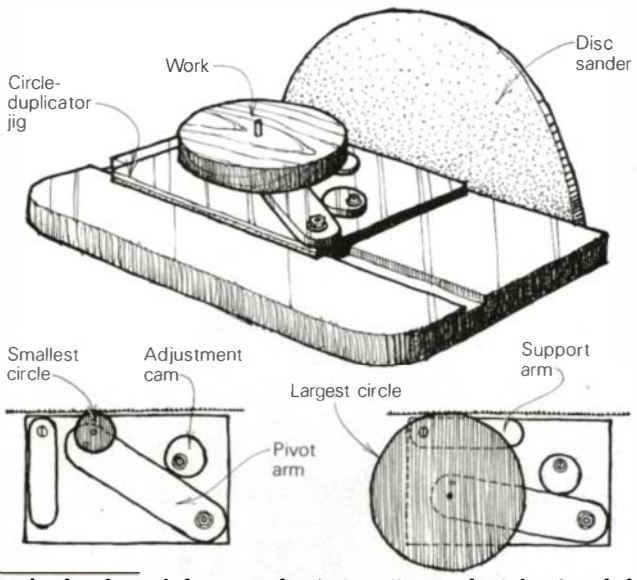
circle size adjustment while a screw in the swing arm provides fine adjustment. The sketch shows only one pivot hole and adjustment screw in the swing arm. You can extend the capacity of the spinner by drilling a series of pivot holes and installing a fine-adjustment screw for each position.

To use the boss spinner, first set the rough radius: With the fine-adjustment screw against the stop, rough-adjust the radius of the disc with the adjustment plate and locking knob. Set the rough radius about 1/16 in. oversize. Now position the circle blank under the center pin. Feed the workpiece into the sander and rotate by hand until the fine-adjustment screw hits the stop. From there, use the fine adjustment screw to reach the final diameter.

—Richard M. Williams, Cleveland, Ohio

My circle duplicator uses 3/16-in. thick aluminum for its arm, adjustment cam and base, which is laminated with epoxy to a piece of hardboard that slides in the slot of my disc sander. Start with rough, oversize blanks and position the adjustment cam so that when the swing arm touches it, you have an accurately sized disc. The cam can be locked in position for accuracy. My device handles diameters from 2 in. to 6 in.

—Jay Wallace, Ashland, Ore.



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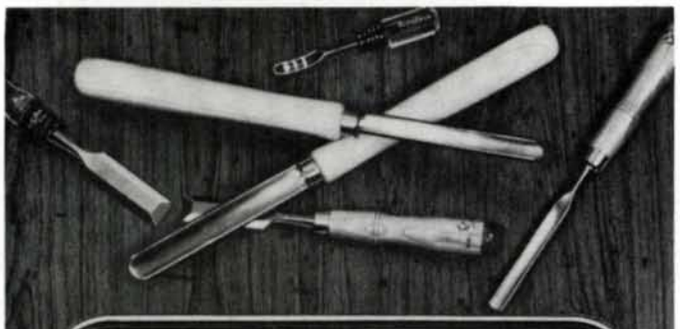

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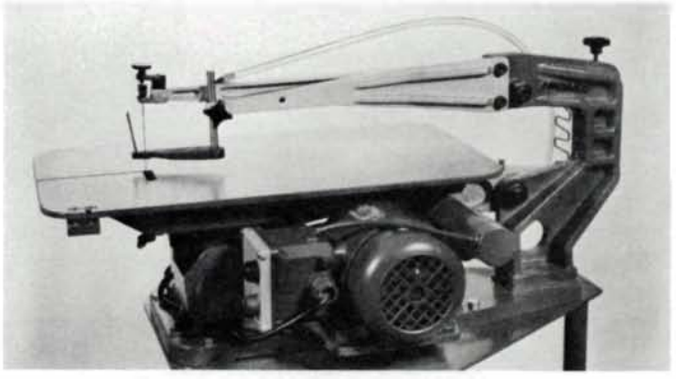

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THE BEGINNER'S LAMENT

BY ROSS LOWELL

We are all beginners, at one time or another, in one area or another. I'm a beginner with wood. If woodworking is anything like my profession, the initial state of enthusiastic bliss is bound to be followed by a series of setbacks, frustrations and challenges. It's the inevitable result of exchanging innocence for semi-knowledge.

Some of the difficulties are genuine dilemmas, and those of us just starting out in this craft face our fair share of them. Experienced craftsmen offer apparently contradictory advice, leaving me wondering whether to dowel or not to dowel, whether to buy a lot of hand tools or a few stationary machines or a single all-purpose contraption, whether to hollow-grind or flat grind, whether to work solid wood or plywood.

Part of the trouble is that we inundate ourselves with so much information from so many sources, hoping to find the one perfect way to do the job, that we are liable to be paralyzed with possibilities. The problem becomes less confusing and more fascinating as we gradually discover that there are a lot of good ways to skin a cabinet, that excellence has more to do with integrity, experience and talent than with any particular set of techniques. All those various approaches are tributes to human imagination and resourcefulness.

One particular conundrum that we novices face contains a bizarre irony, a form of frustration that separates the dedicated from the temporarily infatuated. It's this: Many of those ingenious jigs that fill the columns of *Fine Woodworking* need only one thing to construct them properly—the completed jig. Since a shooting board is required to plane precise right angles, and since the shooting board itself needs smooth, 90° angles in its construction, how do we make it without a shooting board? It's like needing the missing eyeglasses to find the eyeglasses. But, that's only half of it. The significant part of this jig dilemma was underscored by my 9-year-old son when he said, "Dad, you're spending all this time making things to make things. Suppose, afterward, you decide not to make anything?"

Perhaps it's only rationalization, but the whole getting-ready process feels like a necessary stage not unlike warm-up exercises. After all, tools are not the only things that need to be sharpened. In the case of us beginners, our skills and our design sense tend to be pretty dull. What better way to hone and polish them than to make a series of potentially useful jigs? And if the truth be known, a few freeform and jointless objects have meanwhile emerged from the piles of sawdust and shavings. It's positively amazing what can be done with a primitive drawknife, and no jigs.

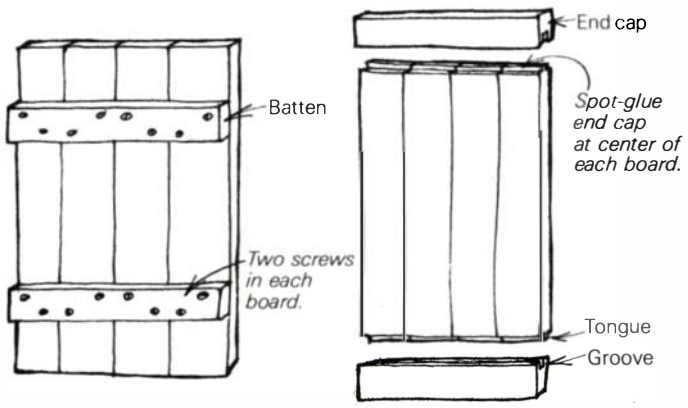
There is a final dilemma. One purpose of woodworking for us amateurs is to create beautiful and occasionally even useful objects for our families and friends. Yet the process of fabrication is both time-consuming and solitary. This ultimately sociable craft seems to our families (and even sometimes to us) to be a very selfish, unsociable activity. But deep down we know that beautiful objects created with our own hands, in quiet moments, are the stuff of happiness and sanity. □

In his other life, Ross Lowell shoots movies, and invents and manufactures lighting systems for location photography.

Making board-and-batten doors—*I've recently completed kitchen cabinets for my parents' new home and I was thinking of using local pine milled into V-joint tongue-and-groove stock for the doors. I plan to use 3-in. wide boards and to cleat or batten them together from the back. What are your comments on this type of door and how can I minimize warping and twisting?*

—Earl Woodworth, Dartmouth, Novia Scotia

IAN J. KIRBY REPLIES: This type of door construction is rather crude but with care, it can be made to work satisfactorily. When you screw the battens to the individual boards which make up the doors, use two screws in each board, as in the drawing below:



This will provide sufficient triangulation to keep the door from sagging from its own weight when it is installed. Normally, screwing a crossgrain member to an assembled panel invites trouble from seasonal wood movement, but in this case the boards are only 3 in. wide and the total movement across their width probably won't be troublesome. It might be a good idea to drill a slightly larger clearance hole for the wood screw's shank portion to allow for some movement.

Board-and-batten doors are, unfortunately, prone to warping and twisting and there is no certain way to avoid the problem. One way of stabilizing the doors might be to mill a tongue on the end of the assembled boards, then install a grooved end-cap, as in the drawing above. But instead of gluing the entire length of the cap, spot glue it at the center of each board. This will allow for some movement and will minimize the chance of cracking. [Ian J. Kirby is a consulting editor to this magazine.]

Curing lacquer orange peel—*I read with great interest George Morris' article on lacquer finishing (*FWW *#31, p. 90), but I saw no mention of how to cure orange peel—the crinkling disfigurement of the lacquer film as it dries. I've tried various solutions including thinning the lacquer, changing nozzles on the spray gun and moving the gun more slowly during spraying. Nothing seems to work. Do you have any suggestions? —Michel Chevanelle, Acton Vale, Quebec*

GEORGE MORRIS REPLIES: Orange peel is caused by the lacquer drying or turning to gel on the surface it is sprayed on before it has a chance to flow and level. If thinning the lacquer doesn't help, try raising the temperature of your spray area or of the surface being sprayed. Spraying conditions that are too cool cause the lacquer to gel before it can flow and level itself—it then dries in a rough, orange-peel surface. Heating the lacquer slightly may also help, but use only a non-flame heat source. I usually put the lacquer cup in front of a heat register for a few minutes before spraying. If the air pressure to the spray gun is too low, the lacquer will not atomize properly resulting in the poor flow and leveling that cause orange peel. Airless type spray guns can be particularly troublesome in this regard. Holding the gun at just the right distance from the surface is also important and you should move it just steadily enough to apply as much lacquer as possible without causing drips and runs. If nothing else seems to work, lacquer manufacturers make additives that can be mixed into their finishes to retard orange peel. Finally, you can correct an orange peel surface by wet-sanding back to the previous coat and respraying the surface with fresh lacquer. [George Morris makes and finishes guitars in Post Mills, Vt.]

Caring for tools in a cold shop—*Like many craftsmen, I've invested a good deal of money in power and hand tools. My equipment is kept in the garage, which doubles as my workshop. I heat the garage only when I'm woodworking and I've noticed that when I bring a cold tool into the house, it seems to get damp and I'm worried that my tools will be damaged by rust. Any suggestions?*

—William A. Schmitt, Chicago, Ill.

SIMON WATTS REPLIES: The heat in my shop is on only when I'm there during the winter. The temperature drops well below zero. The machines groan a bit when you first start them up but as soon as the lubricant in the bearings warms up, they run normally. Rapid changes in temperature and humidity can produce condensation, but it shouldn't be a big problem if you don't make a habit of taking tools and machines into a warm and humid house. The problem I have with cold workshops is the freezing of glue and paints. White and yellow glues are no good after they've been frozen and latex paints turn to a useless curdle after three or four freeze cycles. Consequently, I keep these items in the house until I'm ready to use them.

RICHARD STARR REPLIES: If you wipe your tools off quickly when you bring them into the house, a little condensation shouldn't hurt them. I don't see a cold garage being as harmful to tools as a damp basement can be. Summer's humidity condenses on the cool walls and on everything else in the room and when that happens, you've got a serious problem. The best solution I've found is to spray tools with a light mist of WD-40, a non-greasy, water-absorbent lubricant available from auto supply stores. It won't harm finished or unfinished wooden parts, and an occasional application will prevent rust. [Simon Watts and Richard Starr are contributing editors to this magazine.]

Moisture problems with green framing wood—*I am hoping to build a house this year using green framing lumber, but I am concerned about some seemingly insurmountable problems. Specifically, I'm worried about installing dry lumber cabinets on a wet house frame. Won't the moisture exchange between the two ruin my cabinets? How about warping around frames and windows... is this a problem as the green lumber dries? In* FWW *#31, p. 30, housewright Ed Levin says long beams should be temporarily supported in midspan because green lumber gains strength as it loses moisture. How long is temporary and does the one year per inch of thickness drying rule apply here? How can I insulate my house and still have air flow around the beams to dry them out? Sorry to ask so many questions but I'll be too old to replace rotten and warped timber in another 20 years.*

—Kenneth E. Bress, Loudonville, N.Y.

ED LEVIN REPLIES: If you have a moisture problem, it will be with general relative humidity and not with local wet spots around framing members. Green oak releases its moisture very slowly, and I have never seen any real problems in woodwork adjacent to new oak timbers. Assuming a very rapid dry-

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FINISHING SANDER
Model: BO 4510

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

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

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

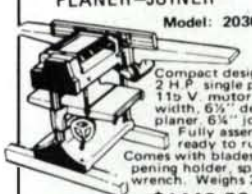
3/4" HAMMER DRILL
2 Speed

Model: 8419-B2

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

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

PLANER–JOINER
Model: 2030



Compact design. 2 H.P. single phase 115 V. motor. 12" width, 6½" depth planer. 6¾" joiner. Fully assembled, ready to run. Comes with blades, sharpening holder, spanner wrench. Weighs 275 lbs.

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

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

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

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

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

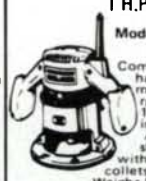
16" CIRCULAR SAW 5402A/9387 LIST: $404 **$299.50 ppd.**

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

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

BAND SAW 2116 LIST: $1936. **$1449.50 ppd.**

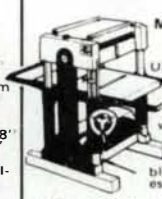
1 H.P. ROUTER
Model: 3608B



Compact design for easy handling. 4.8 amp motor turns at 23,000 rpm, and developes 1 H.P. All ball bearing construction. Accepts 3/8" & 1/4" shank bits. Comes with 3/8" and 1/4" collets, wrenches. Weighs 5 lbs.

List: $118. **$84.99 ppd.**

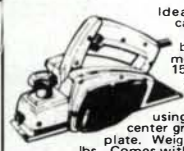
15 5/8" PLANER
Model: 2040



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

LIST: $1730 **$1289.50 ppd.**

3 1/4" PLANER
Model: 1900B



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

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

10" MITER SAWS
Model: 2400B

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

$279.99 ppd.

Model: 2401B

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

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

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

4" X 24" BELT SANDER
Model: 9401

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

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

BOSCH Power Tools

Orbital Action Jig Saw– VARIABLE SPEED
Model: 1578

THE TOP OF THE LINE! Speed Control Solid-State Electronics maintain full power output even at low speeds required for very hard materials. 1000-3000 strokes per minute. Unique blade motion and blade speed control provides the right combination for all your cutting requirements. Light—5.5 lbs.

LIST: $215. **159.99 ppd.**

ORBITAL ACTION JIG SAW– Variable Speed
Model: 1580 VS

Industrial duty—The same superb construction as Model 1578 but variable 1000—3400 strokes per minute speeds. Barrel-grip puts your hand behind the blade for precise handling on intricate patterns. Rotating "mushroom" handle for extra control, under severe cutting. Can be easily removed for cutting in tight quarters. Weighs 5 lbs.

LIST: $215 **159.99 ppd.**

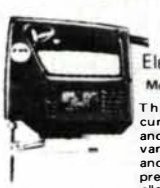
AEG
Electric power tools from AEG-TELEFUNKEN

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

A professional-quality AEG circular saw, designedto deliver the utmost in rugged performance for carpenters, builders and masonry contractors. Excels on cross-cuts, rip cuts, and angle cuts. Powerful 12 amp. motor 5800 rpm. Maximum depth of cut at 90° 2 1/2", at 45° 1 7/8". Comes with blade wrench and 18-tooth carbide-tipped blade. Weighs 13.4 lbs.

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

Electronic Variable-Speed JIG SAW
Model: JSE-35



This jig saw has the capability to handle straight, curved and plunge cutting operations with ease and safety. Powerful 3.7 amp. motor with variable 300—2700 spm. Capacity in steel 1/8", and 1 3/4" in wood. Electronic control maintains preset speed with full torque. Selection of speeds allows optimum performance cutting various materials. Heavy-duty shoe tilts 45° left and right. U-shaped shoe allows unobstructed view of cutting line. Adjustable blade support roller. Comes with two hex wrenches and assortment of five blades. Weighs 4 lbs.

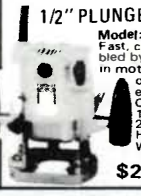
LIST: $105. **$79.50 ppd.**

Variable-Speed RECIPROCATING SAW
Model: RSK 540-E

A convenient variable-speed switch with lock-on button allows for selection of up to 1700 or 2400 strokes per minute. Trigger speed control eliminates sliding at the start of a cut. Rated current at 115V AC powerful 5 amp motor. Stroke length 5/8". No-load speed of 0—1700 spm and 0—2400 spm. Variable speed control — select the speed to suit the material. Rocker for easy entry cuts. Comes with heavy-duty steel carrying case and blade assortment. Weighs 7 lbs

LIST: 179. **$129.50 ppd.**

1/2" PLUNGE ROUTER
Model: TR-12



Fast, clean cuts enabled by powerful built in motor. Three stages of cutting depth easily selectable. Capacity 1/2" 12.2 amps, 22,000 rpms. Height 10 5/8". Weighs 12.3 lbs.

$219.99 ppd.

Hitachi

3 1/4" PLANER F 20 A Wt 6.1 lbs. **$97.00 ppd**

12-1/8" PLANER, 6 5/8" JOINER F1000A Wt. 320 lb. **$1499.50 ppd**

PLUNGE ROUTER TR8 Wt. 6.4 lbs. **$148.50 ppd**

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LAMINATE TRIMMER KIT
Model: 91263-5

A heavy duty ¾ H.P. laminate trimmer complete with accessories in metal carrying case. Kit contains: 91263 Trimmer, compact trimmer tilt base solid carbide combination straight and bevel trim bit, router base, ledge guide, shoe guide, edge guide assembly, wall follower bracket, "V" grooving bit, wrench and metal carrying case.

LIST: $235. **$189.00 ppd.**

3 1/2 H.P. Super Duty Router 90300 LIST: $430. **$349.50 ppd.**

1 2/3 H.P. Builders Kit 91298-5 LIST: $475. **$379.50 ppd**

Milwaukee SAWZALL
Variable Speed

Model: 6507 with case

Ball and rolling bearing motor. 4 amps. 0—2400 strokes per min. Trigger variable speed. Length of strokes 3/4". Comes with 11 blades, carrying case. Has quick-lok removable cord. Weighs: 7 lbs. Shipping weight: 18 lbs.

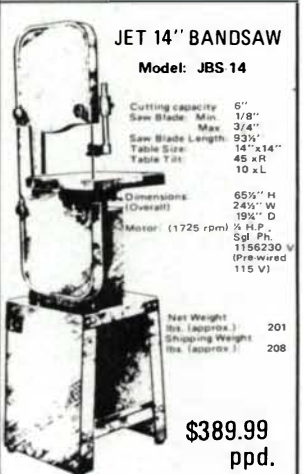
LIST: $175 **$139.99 ppd.**

Two Speed SAWZALL
Model: 6611 with case

Same as Model 6507, but has 2 speeds, 1700/2400 strokes per. min. Permanent cord.

LIST: $162. **$134.50 ppd.**

JET 14" BANDSAW
Model: JBS-14



Cutting capacity	6"
Saw Blade: Min.	1/8"
Max.	3/4"
Saw Blade Length	93½"
Table Size	14"x14"
Table Tilt	45° R 10° L
Dimensions (Overall)	65½" H 24½" W 19¾" D
Motor (1725 rpm)	½ H.P. Sgl. Ph. 1156230 V (Pre-wired 115 V)
Net Weight lbs. (approx.)	201
Shipping Weight lbs. (approx.)	208

$389.99 ppd.

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ing rate, slow air turnover and limited ventilation in the house, a green timber frame would add, at most, one percentage point to the equilibrium moisture content of the house. This translates to a 1/32-in. increase in the width of a 12-in. wide flatsawn oak board. By contrast, the typical seasonal variation in relative humidity inside a house located in the Northeast could produce dimensional changes of as much as 3/8 in. in the same board.

Until recently, the real problem with green house frames has been excessive interior dryness, which leads to rapid drying and excessive checking of the timber. For years, timber framers have advised owners to install humidifiers to slow down the moisture exchange. But during the past few years, houses have been constructed much more tightly and this has drastically slowed the drying rate. If the house is too tight, the escaping moisture can elevate interior relative humidity to the point where some kind of dehumidification is needed. The best remedy in this case might be an air-to-air heat exchanger which will ventilate the house and keep the humidity within the comfort range for people and woodwork.

To enclose and insulate your house, you can use a product developed just for timber-frame construction. It is a stressed-skin panel consisting of 3½ in. of isocyanurate insulation sandwiched between an interior layer of drywall and an exterior layer of plywood or chipboard sheathing. The panels span floor to ceiling and they are splined together and nailed right to the timber frame. The panels eliminate the need to build a separate frame to hold fiberglass insulation batts. For information on these panels, write Amos Winter, Box 34, Spofford, N.H. 03462.

As for supporting beams in midspan, you need do so only if you are heavily loading timbers of low strength woods that have high initial moisture contents, such as poplar. Temporary midspan supports aren't required with oak. [Ed Levin is a professional housewright in North Canaan, N.H.]

Understanding motor horsepower ratings—*It seems to me that the horsepower ratings on electric motors used to be straightforward. If you wanted a 3/4-HP motor, that's what you bought. Now, there's all this talk of "developed" horsepower and I get the impression that when some manufacturers say they've got a motor with a 2½ HP at full development, they really mean 1 HP straight on. Are we, as motor users and buyers, being lied to?* —*Matt Olsson, Pekin, Ill.*

MICHAEL REKOFF, JR. REPLIES: You aren't being lied to, but you aren't being told the entire truth, either. In the past, motors were given horsepower ratings based on their capacity to deliver that power on a continuous basis without burning up from excessive heat build-up. Induction motors, the type used for most woodworking equipment, will actually deliver as much as 3½ times their rated power. But at these peak power levels, the motor is unable to dissipate the internal heat generated and it will soon burn out—in as little as a minute or two in some cases—or it will blow its own internal circuit breaker.

Confusion arose when advertising hype got ahead of the laws of physics. Manufacturers of some tools began quoting the developed or peak power of the motors they used rather than the rated or continuous power. Their claims are, of course, not strictly false. The motors will develop the higher horsepower figures, but they won't last very long. It's easy to tell when inflated claims are being made by judging the size

of the motor. If a 2-HP motor looks suspiciously small, read the fine print and see if the rating is quoted as developed horsepower. If so, the motor is capable of delivering less power continuously—say ¾ HP. Generally, the more power a motor has, the larger it must be. The larger size gives the motor sufficient surface area to quickly dissipate the heat it generates when delivering its rated power. [Michael Rekoff, Jr. is an electrical engineer at the University of Tennessee.]

Removing gray color from oak—*When we stripped the varnish from an old, oak wardrobe we own, the wood retained a grayish color. All our efforts to remove this have failed. Do you have any ideas on how we can solve this problem?*

—Pam Dillard, Savannah, Ga.

GEORGE FRANK REPLIES: It sounds like you cleaned the wood well physically, yet the remaining gray color indicates that the wood may not be chemically clean. I suggest using a fairly strong solution of a good cleanser such as Spic and Span—a mixture of 4 or 5 ounces in a gallon of water should work—to wash down the piece. Use a good stiff brush and plenty of elbow grease. As I am bit of a dare devil, I would use my trusty wire brushes and since this takes some skill you should first experiment on an unseen part of the wood. Scrub the wood well with the bristle brush and allow the cleanser to penetrate. Sponge off the excess water and use the wire brush in a sweeping motion, with the grain direction. Instead of the cleanser, you could use a weak solution of lye (1 oz. in a gallon of water). Rinse the wood clean with water after the lye treatment. When it has dried, a mild solution of oxalic acid can be used to restore the wood to its natural color. [George Frank is a consulting editor to this magazine.]

Calculating wood moisture content—*I am confused by contributing editor R. Bruce Hoadley's method of calculating moisture content in his book* Understanding Wood. *I understand the formula*

$$MC = \frac{\text{original weight} - \text{oven-dry weight}}{\text{oven-dry weight}}$$

and the values that are plugged in. Shouldn't the denominator of the fraction be the original weight of the wood and not the oven-dry weight? Doesn't using dry-weight figures instead of original weights result in inflated moisture contents?

—Robert L. Koch, Tarkio, Mo.

R. BRUCE HOADLEY REPLIES: Expressing moisture content (MC) as a percentage of the dry wood substance by weight makes good sense if we keep in mind that the dry weight of a given piece of wood is a fixed quantity; the amount of moisture varies. You would have a new set of rules for each piece of wood tested if MC were calculated by original weight. For example, suppose you had a sample with an original weight of 115 lb., a dry weight of 100 lb. and a net weight loss of 15 lb. Using the original weight as your basis, the calculation would be as follows:

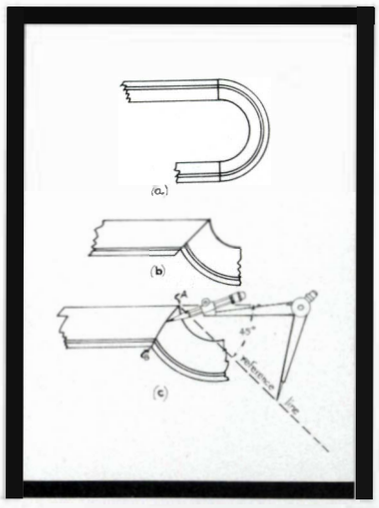
$$MC = \frac{15}{115} = 0.1304 = 13.04\%$$

Using the dry weight formula results in this:

$$MC = \frac{15}{100} = 0.15 = 15\%$$

Suppose now that the amount of moisture in the wood doubles so that the original weight rises to 130 lb. with 30 lb. of that weight being water. Inserting the new figures into the dry-weight formula shows, correctly, that the amount of

INCH-SCALE SPOKEN HERE



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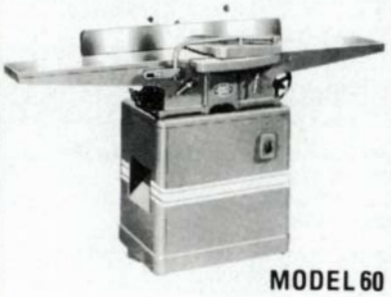

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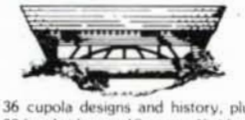

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moisture in the wood has risen to 30%, or doubled. But the original-weight formula shows an incorrect figure of 23% moisture, a less than doubled increase.

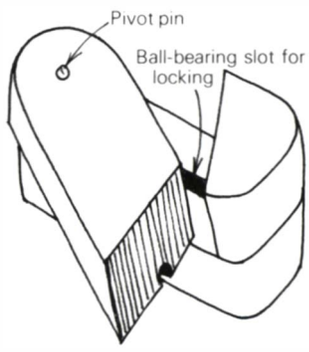
Consider the parallel logic used in calculating interest rates. The rate is computed by comparing the interest amount to the principal rather than to the principal plus the interest. If the latter were true, we would need a different base for every interest rate and a 10% rate would no longer be twice the 5% rate on the same loan. [R. Bruce Hoadley is a contributing editor to this magazine.]

Setting jointer knives—*How far should jointer knives protrude from the cutterhead? How far can they be ground down before they have to be replaced or, in other words, how far can they be jacked up in the cutterhead groove before there isn't enough contact to hold them safely?*

—Floyd W. Foess, Federal Way, Wash.

JIM RAMSEY REPLIES: At Rockwell, we use the Underwriters Laboratories Inc. standard that says jointer knives should protrude ⅛ in. beyond the cylindrical cutterhead. If they project further, they can hit the edges of the infeed and outfeed tables. We use a dial gauge to set them accurately at the factory, but for practical purposes a square placed on the jointer outfeed table works just as well, although it's slower. Jointer knives should be replaced when they have been sharpened so many times that the full face of the lock-bars won't bear against the side of the knife. When the knives get that narrow, they have to be extended too far from the bottom of the cutterhead groove and there is insufficient surface area to hold them safely in place. [Jim Ramsey is plant manager at Rockwell Power Tool's Tupelo, Miss., plant.]

Readers Want to know:



About 50 years ago, I used to make puzzles out of scrap stock, and I gave them to the school children who passed my shop. The puzzles I made looked like the drawing at right, and I made them from ¾-in. stock. I'd like to make the puzzles again but for the life of me, I can't remember how the ball bearing floated for locking and unlocking the puzzle. Age does take its toll. Can anyone help me?

—V. Liden, LaGrange Park, Ill.

I'm doing research for an article on wooden locks. I'd appreciate hearing from anyone who has information or drawings on this subject. *—Roger Schroeder, Amityville, N.Y.*

Readers Can't Find:

I'm looking for a source of good quality pepper mill mechanisms. The ones I've used so far aren't worth putting into good wood. *—Mrs. W.P. Scott, Normal, Ill.*

. . . a list of mills or sawyers who specialize in domestic and imported lumber "sawed in the *boule*" (through-and-through). *—Barry Slaughter, Bend, Ore.*

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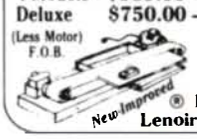

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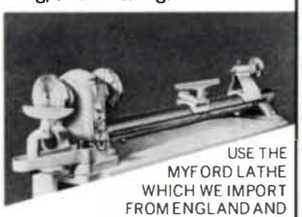

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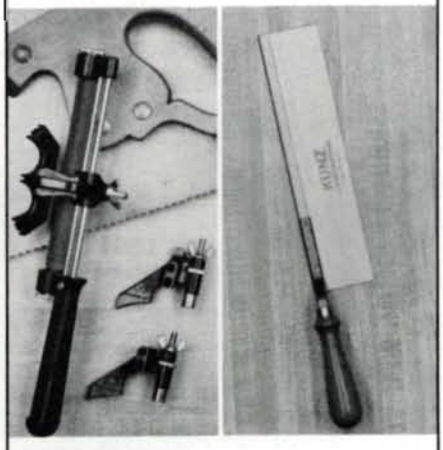

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Barnacle Parp's Chain Saw Guide by Walter Hall. *Rodale Press, 33 E. Minor St., Emmaus, Pa. 18049, 1977. $7.95 paper, $10.95, cloth; 288 pp.*

Chain Saw Service Manual (no author named). *Intertec Publishing Corp., Box 12901, Overland Park, Kan. 66212, 1980. $8.95, paper; 336 pp.*

Chain Saws: Buying, Using, Maintaining, Repairing by Robert A. Ouellette. *Tab Books, Inc., Blue Ridge Summit, Pa. 17214, 1981. $6.95, paper; 144 pp.*

Crosscut Saw Manual by Warren Miller. *Forest Service, U.S. Dept. of Agriculture, 1977; available from U.S. Government Printing Office, Washington, D.C. 20402 (document no. 7771 2508). $1.50, paper; 27 pp.*

A Manual of Sharpening Hand Woodworking Tools by J. K. Coggin, L. O. Armstrong and G. W. Giles. *Reprinted by Interstate Printers & Publishers, 19 N. Jackson St., Danville, Ill. 61832. $1.00, paper; 48 pp.*

Professional Timber Falling by D. Douglas Dent. *Author published; available from Bailey's, Box 550, Laytonville, Calif. 95454, 1974. $8.95, paper; 182 pp.*

Many woodworkers find that their best materials are obtained directly from round logs. Turners and sculptors can take advantage of natural formations and unusual sizes. Furniture makers can use portable chain-saw mills for custom on-site sawing. Other woodworkers have found that ring-porous woods (oaks, ash, hickory) and many conifers are used to advantage by splitting out stock along growth fibers. Round logs can sometimes be purchased from sawmills or log brokers, but buying from a dealer can be expensive (you'll most likely be charged at the rate of sale for potential sawn board feet in the log), and the selection may be limited. The alternative is cutting trees yourself. Often this wood may be taken free for the asking, or at firewood rates.

The basic tool for harvesting timber used to be the two-man crosscut saw, generally seen today as a symbol of drudgery. However, these saws cut some of the great virgin stands of timber. They were a vast improvement over axes.

Even today, crosscut saws have advantages. They are cheap. Used two-man saws sell for $5 to $20. The rust can usually be cleaned off, and the steel is often excellent. The new crosscuts that I have tried are inferior to older saws.

The timber saw is a social tool, and the two people required to work with one can have a productive, peaceable, safe time together. (The same cannot be said for chain saws.)

Working with a crosscut saw is surprisingly fast and efficient, if the saw is sharp. But that's the rub. The new crosscut saws I've seen have to be completely refiled. A well-sharpened crosscut makes "noodles," excelsior-like shavings the width of the saw kerf, several inches long. A saw that makes noodles is a real joy to use.

A Manual of Sharpening Hand Woodworking Tools, originally prepared for vocational agriculture students in the 1940s, systematically outlines and illustrates how to sharpen a crosscut saw, as well as wood chisels, plane irons, handsaws, auger bits, butcher knives, axes and cabinet scrapers. Some of the methods may seem unsophisticated, but the techniques

definitely work. This book is an excellent introduction to sharpening almost any cutting edge used for practical work.

An even better treatment of saw sharpening is Miller's *Crosscut Saw Manual.* This booklet is one of those rare treats that occasionally come out of the U.S. Government Printing Office. The author, a Forest Service wilderness ranger, has made a detailed study of crosscut saws, covering how crosscut saws work, making a saw vise, filing (the bulk of the text) and choosing and using a saw. There is also a carefully prepared glossary. The drawings and photographs are excellent.

Felling timber is dangerous. In D. Douglas Dent's excellent book, *Professional Timber Falling,* the safety of the faller and efficiency in utilization of timber are the main considerations. Dent explains basic felling techniques, then deals with unusual, even esoteric situations.

The book is written for professional loggers who generally use chain saws exclusively. But most of the techniques can be used with crosscut saws or even felling axes. Any careful reader can understand the methods and (more important) the reasons for safe, efficient procedures.

Barnacle Parp (*nom de plume* of Denver Post editor and poet Walter Hall) is a chain-saw lover whose book is a thorough, readable guide to the purchase, safe use and day-to-day maintenance of chain saws. It glosses over electric chain saws, a subject of interest to some woodworkers (these saws are quiet, can be used indoors and are relatively inexpensive).

Serious chain-saw users spend more time filing chain than all other maintenance operations combined. A dull chain is slow cutting, hard on the engine, and difficult to cut straight with. Parp's chapter on sharpening is excellent. He recommends mechanical filing jigs, like those made by Granberg and Oregon. These goofy-looking contraptions are almost a necessity if you want to hand-file sharp chain.

Dull chains and sawdust-clogged, overheated motors cause most chainsaw problems according to Robert Ouellette. A chainsaw repairman for 27 years, Ouellette claims that three out of every four repairs passing through his shop could have been done by the owners of the saws themselves. And he explains how, moving from simple things—chain sharpening by hand and repair of broken starter rope and springs—to the complexities of the motor. He covers repairs to the ignition system, offers a lengthy section on how to tune-up, repair and rebuild the carburetor and gives tips on revitalizing an ailing guide-bar. His frank comparisons of the various makes of chainsaw are valuable, as are his hints on diagnosing the cause of malfunctions. His explanations are pretty clear, but more illustrations would have been helpful to those unfamiliar with internal combustion engines.

Chain-saw users who want (or need) to tear down a chain saw can refer to the recently revised *Chain Saw Service Manual.* This no-nonsense text is practically unreadable until you're in trouble, but then, suddenly valuable. The section devoted to service apparently comes from manufacturers' publications, so coverage is uneven and clarifying information must be picked up by checking out repair procedures or construction details for different saws.

Chain saws are dangerous, and chain-saw books generally carry a liability disclaimer. *Chain Saw Service Manual* states: "Persons engaging in the procedures do so entirely at their own risk." The knowledge of saw sharpening, safety and maintenance can reduce the risk, and these books are a good place to start.

—Drew Langsner

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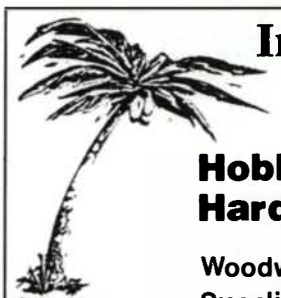

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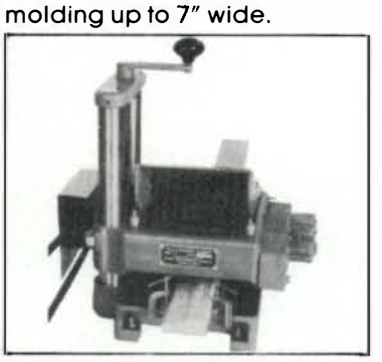

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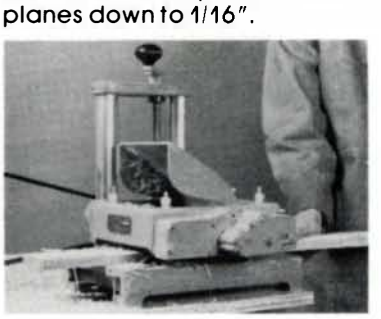

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CABINET IN THE SKY

BY WILLIAM TANDY YOUNG

Your grandfather may have helped build the railroad; your father may have been a barnstormer. My future generations will have to settle for tales of the daring steps I took and wild, ill-advised lengths I went to while surviving as an independent professional woodworker.

Consider an escapade from my career in Florida. A pleasant interior designer (when you don't trust them, you call them decorators) showed me drawings for a large cabinet, nearly 10 ft. long and 8 ft. high, with bronze-mirrored backs, yards of moldings, fluorescent lights, an antiqued lacquer finish, and a host of other features comprising a paean to "the Florida look." After the meeting, as I watched the designer walk out the open doors of my shop, I realized how much I wanted to keep those doors open for business—I took the job despite the fact that I worked alone, had no compressor or spray booth, and knew nothing about antiquing.

Cabinet in the apartment.

The contract, deposit, cutting list and securing of materials all followed in smooth, logical sequence. All components were meshing neatly into the plan. Then I discovered that the light fixtures I'd received were not the rapid-start models I needed, and by that time I was committed to using them. While learning the subtleties of alternate wiring, I managed to assure the designer of my ingenuity and my utmost respect for the approaching deadline. Soon, the three carcase sections that comprised the cabinet and all attendant fittings were complete, save for two operations: finishing and mirror work. Bartering against a future job, I now had spray equipment and was eager to put it to use, remembering former spraying experiences fondly. I had no spray booth, so I was forced to use my whole shop—isolating electrics, covering machines and staging two fans in prime locations. Despite the fans, the shop was consumed in such a cloud during the first minute of spraying that I was forced into the parking lot to reconsider. Floridians are noteworthy for finding ways and places to spray. Ultimately, I decided to move some cars and finish up in the parking lot, to the great dismay of the Cuban restauranteurs next door. Understandably, they did not want customers pawing through the overspray, especially since half the men always had substantial cigars going. To me, half the cigar smokers looked and dressed like city inspectors.

Finally, I was ready to antique the works, and I went to get expert help from Patrick, an alchemist friend. We got the tint mixed in the vile-smelling medium, and under his guidance I was soon "leaving it in the corners" like a true practitioner. Completing the finishing took me past the deadline, which enshrouded the designer in a vapor cloud of her own.

I could not chew nails about time limits, however, because I was now in the mirror business and needed serenity. I planned to bond ⅛-in. DS Bronze mirror to ¼-in. plywood and to let the resulting sandwich into a rabbet in the carcase back before delivery. Despite all care, one mirror cracked while being fitted. I called my mirror man for another piece. Suddenly there was a citywide scarcity of the stuff. By the time I called the tenth man, I had gotten pretty proficient at asking for "one-eight-DS-bronze." I finally asked him what DS meant. His reply: "Double strength."

Phone call number eleven was to my client: delivery was being delayed. Call number twelve was to mirror man number ten. I had just cracked a second pane of bronze, and as long as the stuff was so damned-double-strong, I suggested, why didn't he just go ahead and cut a double order?

An expensive lesson, that; nevertheless, the cabinets were soon ready to go. I contacted my trusty delivering buddy, Ted, for help. He had flown in the Second War, has his own shop, and still believes that nothing can whup him. In a rented truck, we arrived at the ocean-front highrise condominium. By popping the ceiling out of the elevator cage we were able to squeeze the smaller sections up to the third floor, down the narrowest hallway in area code 305, and into the apartment, confirming ourselves as genuine risks to building security and composure in the process. We insulted the larger mid-section a bit while getting it into the elevator and out into the hall, then found that in no way was it going to go through the apartment doorway. I called the designer, explained the problem and advised her, "Hire a crane or change your name." I then told Ted, "That decorator sure has sold those good folks a nice hall cabinet."

By the following day, the decorator's wagons were well circled. I was asked to meet her moving specialists and a crane at 2 P.M. The plan was to hoist the offending carcase over the balcony in a sling and pull it into the living room. The crane, however, was late, and the moving specialists decided to pass the time (and save the boss some money) by coaxing the section in themselves. Inspired plans for heroic, craneless solutions circulated more wildly with each passing minute, but to no avail. Finally, the fellow rumbled proudly in with his "biggest outfit" and we all resolutely tugged the cabinet back downstairs.

The crane man lowered his outriggers against a 40-MPH ocean breeze, took a decorator check for one hour's time and cranked up. It was a spectacle. As it started to rain, curious folks jammed the balconies. Up and in the cabinet went, amidst profuse, shouted instructions in workingman's code that the fellow in the air-conditioned cab couldn't possibly have heard. The sight of the swinging carcase proved dramatic and no doubt enlivened the day for those in the gallery.

As the crane left the scene, we were fastening toweled-off cabinet sections together, hanging doors, and taking compliments from the new owners, who were now the most famous tenants in the building. When the woman said that her husband had also been in the furniture business, I asked (in my delirium) if he'd made furniture for a living. She replied incredulously, "Oh, no; he warehoused it." □

William Tandy Young, 28, now works in Hartford, Ct. Photo by the author. Fine Woodworking *buys readers' adventures. Suitable length is 1,500 words or less—up to six typed pages, double spaced. Please include negatives with photographs.*

SUCCESSFUL CABINETMAKING IN THE 80's

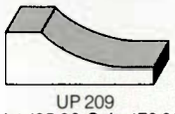
TO BE SUCCESSFUL IN A TOUGH MARKET REQUIRES:

1. THE RIGHT PRODUCT

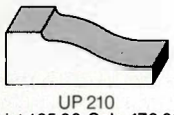
Cabinet styles change. Your customers are looking for today's styles, and if that's what you're selling, you have a competitive edge. Freud has the cutters for what's happening in your market, now!
*Select among 26 different raised panel cutters, 16 different rail and stile sets and start selling the cabinet door that's the right product for today's customer.

**All cutters 3 wing 1¼" bore.*

Freud offers 26 different raised panel cutters. Here are 7 of our favorites.



UP 209
List 185.80 Sale 172.00



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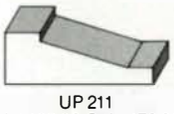

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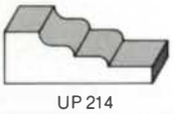
List 185.80 Sale 172.00

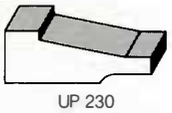
UP 212
List 185.80 Sale 172.00

UP 213
List 191.30 Sale 177.00

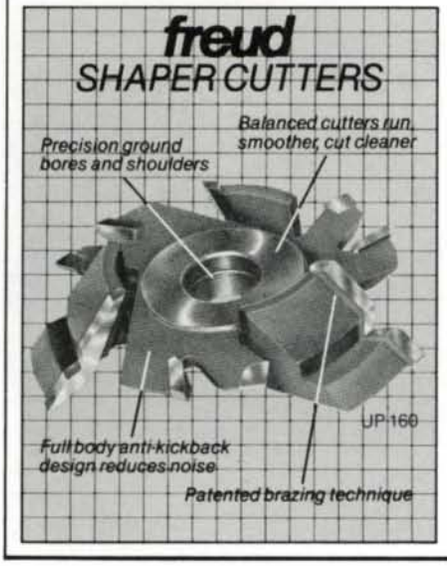


UP 214
List 214.40 Sale 199.00

Bottomcutter Fits ¾" panel flush with rail and stile.



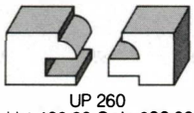
UP 230
List 107.70 Sale 100.00



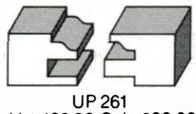
2. THE RIGHT PRICE

Today's cabinet buyer is more price conscious than ever. If your cabinets are going to be priced right, every tool in your shop has to be more productive than ever. For your shaper that means cutters that are affordable, quick to set up, clean cutting, and require little maintenance. And that describes Freud cutters. Freud shaper cutters are always competitively priced, and at these prices you're getting the right product at a super price.

Freud offers 16 different rail and stile sets. Here are 6 of our favorites.



UP 260
List 423.90 Sale 399.00



UP 261
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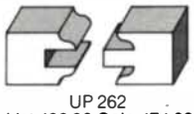
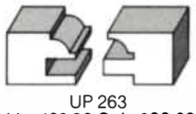


UP 262
List 499.90 Sale 474.00



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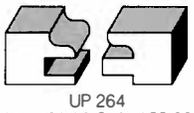

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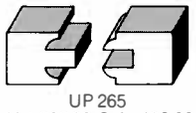


UP 265
List 505.90 Sale 480.00

(Each set consists of 5 cutters and 1 spacer.)

Freud offers 16 different door lip cutters. Here are 4 of our favorites.

UP 291
List 180.30 Sale 167.00

UP 293
List 180.30 Sale 167.00

UP 296
List 180.30 Sale 167.00

UP 299
List 180.30 Sale 167.00

Bushings All cutters come with 1¼" bore. Order bushings if you need to reduce bore.

1", ¾" 6.00 per pair

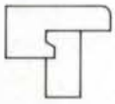
** All cutters for ¾" stock.*

3. THE BOTTOM LINE

Freud cutters are money makers. Here are 3 hard reasons why:
Freud cutters start sharper. Freud hones their cutters sharp with 600 grit, the competition usually stops at 180 or 220 grit, The sharper the cutter the cleaner the cut.
Freud cutters stay sharper. No one uses harder carbide than Freud, many competitors use softer carbide. The harder the carbide, the longer the cutter stays sharp.
Freud uses more carbide. Compare the size of the tips, Freud's are 50% larger than most of their competitor's. The larger the carbide, the longer the cutter lasts. 3 hard reasons Freud cutters mean more profit for you.

Freud offers 2 precision drawer cutters.

UP 160
List 357.40 Sale 332.00



UP 240
List 109.90 Sale 102.00

Prices in U.S. dollars.

Woodworker's Supply
OF NEW MEXICO
5604 Alameda N.E.
Albuquerque, NM 87113

☐ Woodworker's Supply catalog $2.00

☐ The entire Freud Shaper Cutter Catalog is available for $5.00, free with order.

I understand that if I'm not completely satisfied with my Freud shaper cutters, I may return them in 14 days for a complete refund.

Qty. Description Price

Shipping $3.00 per cutter

Total

NAME

ADDRESS

CITY

STATE ZIP

MASTERCARD OR VISA EXP. DATE

ORDER TOLL FREE 1-800-224-2028 EXT. 340
Limited quantities, offer ends Aug. 31, 1982

POWER TOOL SALE

Dust Collection System

With more wood dust and shop related illness becoming apparent, dust collection is no longer a luxury but a matter of basic health care.

Keeping your shop environment healthy and hazard free is as easy as turning on your saw or planer, with our Dust Collection System.

We have chosen this Dust Collection System based on 20 years of shop experience

We based our needs upon horsepower, high static pressure, large volume of free flow air, extra large filter area, low noise level, return of heated air, ease of installation and cleaning including single or multiple machines use. Using this practical approach our highly efficient system takes up less floor area too.

A complete 1 hp system able to handle from 1 to 3 machines starts at $560. The 2-5 hp systems able to handle from 1-7 machines simultaneously range in cost from $750 to $1250 and up. Please call for quotes on specific systems

ROUTER BITS CARBIDE TIPPED

—All Router Bits are top Industrial Quality with a money back guarantee *3 bit minimum

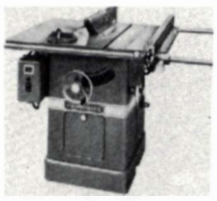
Shank Diam.	Cutting Diam.	Cutting Length	Overall Length	Bit #	Price Ppd	
¼"	¼"	¾"	2¼"	1	$ 7	
¼"	¼"	1"	2½"	2	$ 8	
¼"	⅜"	¾"	1¾"	3	$ 8	
¼"	½"	¾"	1¾"	4	$ 8	
¼"	⅜"	1"	2"	5	$ 9	
¼"	¾"	¾"	2"	6	$10.50	
½"	⅜"	1"	2¾"	7	$ 8.50	
½"	½"	1¼"	2⅞"	8	$ 9	
½"	¾"	1"	2⅝"	9	$11.50	
¼"	½"	1"	2⅝"	10	$10	FLUSH TRIM BIT WITH B.B.
½"	½"	1"	2⅝"	11	$11	FLUSH TRIM BIT WITH B.B.
¼"	¼" radius	1"	2⅝"	12	$25	ROMAN OGEE WITH B.B.
¼"	⅜" radius	1"	2⅛"	13	$19	ROUND OVER BIT WITH B.B.
¼"	¼" radius	¾"	2½"	14	$17	ROUND OVER BIT WITH B.B.
¼"	½" radius	¾"	2⅛"	15	$21	ROUND OVER BIT WITH B.B.
½"	¾" radius	1"	3"	16	$38	ROUND OVER BIT WITH B.B.
½"	1" radius	1¼"	3¼"	17	$70	ROUND OVER BIT WITH B.B.
½"	½" radius	1"	2¾"	18	$37	ROUND OVER BIT WITH B.B.

Router Bit Adaptor for Powermatic #26 Shaper or Rockwell Shaper $92 ppd.

GREENLEE

Greenlee brad point drills; have precision ground flutes that shave the inside of the hole smooth, a sharp brad point that prevents skating and two razor sharp cutting spurs keep holes extra clean. Made from the finest grade of high carbon steel, tempered for long life, designed for use in drill press or ⅜" portable drills. The set includes ⅛", 3/16", ¼", 5/16", ⅜", 7/16", ½" bits and a protective pouch. **Sale $22**

Sizes 9/16", ⅝", ¾", ⅞" & 1" all have ½" shanks and are loose packed, cost **$44** both sets together **$59 PPD.**



Powermatic

10" Table Saw Model 66 complete with: 48" rails; single phase 2hp (115/230 volt) motor; push button switch. **Sale $1460**

Table Saw Accessories Biesemeyer T-square fence system with 72" rails & 32" extension table **$250.** 3 hp Motor & Controls 1 or 3 Ø add **$170**

6" Joiner Model 50 complete with: single phase ¾hp (115/230 volt) motor; single phase push button switch; stand. **SALE $99 9**

8" Joiner Model 60 complete with: stand, 1½hp single phase or 3 phase motor, push button switch. **Sale $1450**

12" Planer Model 100: complete with 1 or 3 phase 3hp motor, safety over load switch. **Sale $2499**

Planer Accessories: 5hp motor and controls add **$200,** Grinder/Jointer attachment add **$525.**

Shaper Model 26 complete with: 2hp 115/230 volt motor 1 or 3 phase, push button switch, interchangeable ¾" and ½" spindles. **Sale $1660** with 3hp motor and controls add **$270.**

14" Bandsaw Model 141 complete with: single phase push button switch; stand; ¼" blade; ¾hp motor **Sale $1099**

Freud SAW BLADES

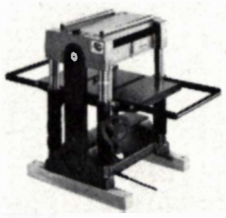
Model	Diam	Teeth	Arbor	Use	PPD. List/SALE
72 ME	10"	40	⅝"	All Purp	$66 /$44
73 MD	10"	60	⅝"	Cut Off	$76 /$50
84 MD	10"	50	⅝"	Rip/Cross	$72 /$50
71 MA	10"	18	⅝"	Rip	$61 /$41
72 MF	12"	48	⅝-1"	All Purp	$82 /$61
76 MB	12"	48	⅝-1"	All Purp	$99 /$75
Futura 2000			¾/1¼"	Doors	$599/$480
Perfecta		3	¾"	Molding	$220/$185
Wood Working Box		3	¾"	Doors & Molding	$379/$305
Cassette 65 Plus		3	¾"	Molding	$428/$365
72 MD	9"	36	⅝"	All Purp	$62 /$42
74 ME	10"	80	⅝"	Thin Kerf	$96 /$64
DADO 3	6"	18	⅝"	¼-13/16	$133/$100
DADO 3	8"	18	⅝"	¼-13/16	$162/$115

Rotary Phase Converters

Arco rotary phase converters convert single phase 220 volt electricity into 3 phrase 220 volt electricity easily & safely. Arco rotary phase converters are available from 1 hp to 150 hp. Price range $300 and up.

Catalog

The catalog contains the widest collection of professional tools, hardwood lumber, supplies and accessories ever printed between two covers. Valuable information, new products, special purpose tools, hard-to-find items, in all sizes; professional supplies, all industrially priced. **Send $3 for this valuable catalog.**



Makita

15⅝" Planer 2040 2hp 115 volt 6500 rpm motor; full cutting range: ¼" thru 7⅝"; 2 quick set knives; speed reducing kit; delivered assembled **Sale $1199/used $950**

12" Planer/6" Joiner 2030 2hp 115 volt motor; full cutting range: ¼"-6¼"; 2 quick set knives; speed reducing kit; assembled. **Sale new $1299/used $1050**

New Product: Our Triple Ball Bearing Guide System now turns the 2116 resaw into a super scroll saw, able to accept blades from 2⅜" to as thin as ⅛" without further alteration. May be purchased directly from us or through your local dealer. Complete with instructions **$210 PPD.**

16" Band Saw 2116; 2 hp., (115/230 volt), 1 or 3 phase high torque 1150 rpm motor, 2" wide blade. Can accept down to ⅛" blades. List $1880. **Sale New $1299/Used $1050**

2116 with triple bearing guide system **$1499**

Router 3600 B Plunge Cutting, full 2¾hp, 22,000 r.p.m., 12 amp, accepts ¼" & ⅜" & ½" shank bits, wrenches, **Sale $203 PPD.**

Blade Sharpener 9820-2 Sharpens planer & jointer knives up to 15¾" wide, 7⅞" wheel, water cooled, 560 rpm, 1.6 amp., med. grit stone & wrenches & blade holder. **Sale $170 PPD.**

Finishing Sander B04510 Heavy duty; double insulated; 12000 rpm; 4⅜" x 4" pad size. **Sale $48 PPD.**

Unidrill 6000R Drill/Screwdriver combination; 3.3 amp motor; ⅜" capacity; quickchange clutch; reversible; variable speed 0-2600rpm belt clip. **SALE $112PPD.**

3600B accessory pack, guide holder, straight guide, trimmer guide, ½" and ¼" carbide tipped router bits. **$28 PPD.**

Much needed speed reducer kit for Makita 2030 and 2040. Reduces feed rate by 40%. Easy to install $37 PPD.

Hardwood Sample Pack

Our lumber sample pack contains 32 species of American and imported hardwoods (¼ x 2 x 6"); one pint of DPS (the ultimate sealer), one pint of P.F., the polymerizing tongue oil finish, and finishing instructions...plus the Fine Hardwood Selectorama. **Sale $43 ppd.**

DPS
Deep Penetrating Sealer

DPS penetrates deeply, seals, stabilizes and applies easily. It retards the movement of moisture from inside and outside by lining the cellular walls and sealing those cells.

Polymerization is complete in 24 hours, leaving a dry, clear, non-toxic, water-proof finish.

DPS penetrates from 1-4" deep on end grain, and up to 1/8" deep on surface grain.

DPS can be applied by rag, brush, spray or by dipping. It will enhance the wood's natural color and can be mixed with any oil based stain. Varnish, shellac, lacquer, enamels or urethanes may be applied over DPS; or two coats of DPS will provide a durable undercoat for all finishes.

Introductory Pint: $6 including shipping.

John Harra Wood & Supply Co.

511 West 25th Street, New York, NY 10001 212-741-0290

Events

Listings are free but restricted to workshops, fairs, lectures and exhibitions of direct interest to woodworkers. The July issue will list events from June 15 to Sept. 1: deadline May 5; the Sept. issue will list events from Aug. 15 to Nov. 1: deadline July 7.

ARKANSAS: **Exhibit**—"Eureka Works in Wood," May 1-July 31. Legacy Gallery, 53-A Spring St., Eureka Springs, 72632.

CALIFORNIA: **Woodworking Exhibition**—June 18-July 5, 22th District Agricultural Assoc. fairgrounds, So. California Exposition in Del Mar,
Excellence in Woodworking—May 14-16, Los Angeles Convention Center. Trade show, seminars by Ian Kirby. Contact Marvin Park & Assoc., 600 Talcott Rd., Park Ridge, IL 60068.
Chair Making with Carolyn and John Grew-Sheridan, May 15-16, 500 Treat Avenue, San Francisco. Call U.of Calif., (415) 642-4111.
Juried Craft Fair—Fort Mason Center, San Francisco. Trade, Aug. 12; public, Aug. 13-15. Write American Craft Enterprises, Box 10, New Paltz, NY 12561.
Courses—"Strength Design of Furniture," May 26, and " Upholstered Frames," May 27 at Los Angeles Furniture Mart, 1933 S. Broadway. Contact R. Szymani, (415)231-9582.
Show—of Northern California woodworking associations, May 28-June 6 at Artisans Guild Store, 45050 Main Street, Mendocino. Contact Mendocino Woodworkers Association, Box 991, Mendocino, 95460.
Show & Workshop—by Sam Maloof, May 29-June 30. Preregistration $45. Gallery Faire, Box 263, Mendocino, 95460.
Show— May 29-31, Artisan Woodworkers, 21415 Broadway (Hwy. 12), Sonoma, 95476.
Show—Woodcarving, May 22-23 in Conference Bldg., Balboa Park, San Diego. Contact Rodney Cole, Box 376, Lakeside, 92040.
Lecture—John Ebels on finishing, May 10 at 3871 Grand View Blvd., W. Los Angeles; May 11 at 7626 Miramar Rd., San Diego; May 12 at 1836 Fourth St., Berkeley. **Workshop**—with Sam Maloof, June 12. The Cutting Edge, 3871 Grand View Blvd., W. Los Angeles, 90066. (213) 390-9723
Juried Show—"Sculptural Expressions in Contemporary Furnishings," Oct. 8-Nov. 27. Contact Flood Gallery, 3921 California St., San Francisco 94118.
Woodworker's Fair—May 8, at Woodline, the Japan Woodworker, 1731 Clement Ave., Alameda, 94501. (415) 521-1810
Juried Show—Sonoma Woodworker's Association, May 8-16, at Luther Burbank Performing Arts Center, Santa Rosa.

COLORADO: **Furniture Workshops**: Jere Osgood, June 21-July 2; John Nyquist, July 26-Aug. 6; Sam Maloof, Aug. 21-22. Turning: David Ellsworth, July 5-9. Basic Woodworking: Richie Marks, July 12-16. The Fine Art of Woodworking: Wendell Castle, July 19-23. Chairmaking: John & Carolyn Grew-Sheridan, Aug. 9-20. Shaker Furniture: Walker Weed, Aug. 23-27. Anderson Ranch Arts Center, Box 2410, Aspen, 81612. (303) 923-3181

CONNECTICUT: **Wood Carver's Day**—May 1 at Mystic Seaport.
Workshop—Joinery, June 12, $22. Farmington Valley Arts Center, (203) 678-1867.
Crafts Expos—Berlin, June 11-13 and Aug. 27-29. American Crafts Expos, Inc., Box 368, Canton, 06019. (203) 693-6311
Workshop—Japanese tools, Robert Major, May 22-23. Fine Tool Shops, 20 Backus Ave., Danbury, 06810. (203) 797-0772
Course—Wooden boat construction and repair, with Simon Watts, Aug. 16-22. Brookfield Craft Center, Box 122, Brookfield, 06804. (203) 775-4526

FLORIDA: **Competition**—Multipurpose furniture, May 15-July 4, Metropolitan Museum, 1212 Anastasia Ave., Coral Gables, 33134.

GEORGIA: **Classes**—Bob Kelley, joinery, May 8-9; F.J. Tangerman, woodcarving, May 22 and June 5; Toshio Odate, June 18-20. Highland Hardware, 1034 N. Highland Ave. NE, Atlanta. (404) 872-4466.

ILLINOIS: **Workshops**—Woodcarving, May 17-21; Wallace Gusler, Aug. 2-5. Campbell Center, Box 66, Mt. Carroll, 61053.

INDIANA: **Workshop**—"Strength of Furniture," May 4-6. Contact Dr. Cassens, Purdue University, Ag. Annex II, W. Lafayette, 47907. (317) 494-3644.
Exhibit—Furniture by Elizabeth Bradbury, June 1-12, Ind. State U., Terre Haute.

IOWA: **International Wood Carvers** Congress, July 30-Aug. 8. Contact Chester Salter, 2815 W. Locust St., Davenport, 52804.

KANSAS: **Woodcarving Show**—May 1-2, Town East Square, Wichita.

KENTUCKY: **Woodturning**—June 10-12.
Joinery—July 1-3. Berea College, CPO 758, Berea, 40404. (606) 986-9341

MAINE: **Course**—Larry Hunter, June 13-25 at Haystack Mountain School of Crafts, Deer Isle, 04627. (207) 348-6946

MASSACHUSETTS: **Workshops/Exhibitions**—Ash Splint Basketry, May 8-9. National

Invitational Furniture Exhibition, July 15-Sept. 11. Craft Fair—trade, May 14; retail, May 15-16. Worcester Craft Center, 25 Sagamore Rd., Worcester, 01605. (617) 753-8183
New England Buyer's Marketplace, all crafts, May 10-11, Hynes Auditorium, Boston.
Crafts fair—Non-traditional, innovative work, June 25-26. DeCordova Museum, Sandy Pond Rd., Lincoln, 01773. (617) 259-8355
Crafts Expo—June 25-27 at Topsfield. To exhibit, write American Crafts Expositions, Inc., Box 368, Canton, Ct. 06019. (203) 693-6311
Woodcarvers Exhibit—Northshore Shopping Center, May 7-8, at Peabody.
British Crafts Exhibition—May 8-28, at Westminster Gallery, 132A Newbury St., Boston, 02116. (617) 266-6704

NEW HAMPSHIRE: **Workshops/Seminars**—Japanese woodworking tools, May 15-16, with Robert Major; Wooden plane workshop, June 5, with Larry Bickford; Dovetail Joinery, June 12, with Robert Major. Mahogany Masterpieces, RFD 1, Box 600, Wing Rd., Suncook, 03275. (603) 736-8227

NEW JERSEY: **Lecture**—"An approach to Woodworking," by Ian Kirby, May 1. Brookdale Community College, Lincroft, 07738.
Masters Exhibition—Until May 6, Guild of Designer-Woodworkers, Kean College of N.J., Fine Arts Bldg., Union, 07083.
Workshop—Japanese tools, May 29-30, with Robert Meadow, at Peters Valley. Contact Sherrie Posternak, Peters Valley, Layton, 07851.

NEW YORK: **Rocking Furniture**—Antique and contemporary furniture, toys and art, through June at Gimbels.
Art and Woodcarving Show—May 1-2, Village Hall, W. Main St.,Canajoharie, 13317
Northeast Craft Fair—Duchess County Fairgrounds, Rhinebeck, N.Y. Trade, June 22-23; public, June 25-27. American Craft Enterprises, Box 10, New Paltz, 12561.
Workshop—Japanese tools, May 15 and June 19. Tuning wood for musical instruments, May 16 and June 20. Robert Meadow School of Hand Woodworking, 2449 W. Saugerties Rd., Saugerties, 12477. (914) 246-5207
Classes—Woodworking, lathe. Craft Students' League of the YWCA, 610 Lex. Ave. at 51 St. (212) 755-2700
Woodworking Exhibition—Area craftsmen, May 8, Queensbury High School, Glens Falls, 12801. (518) 793-4781

NORTH CAROLINA: **Seminar**—Ian Kirby, May 28-30. Fee $95. Sponsored by Maco Crafts. Contact Russ Brahmer (704) 369-9906
Country Workshops—Hand tool techniques, with Wille Sundqvist: (beg.-int.) July 5-9, (int.-adv.) July 12-16; Make a chair from a tree, with John Alexander Jr., July 26-30; Country woodcraft, with Drew Langsner, Aug. 9-13. Country Workshops, Route 3, Box 262, Marshall, 28753. (704) 656-2280
Courses/Workshops—Full summer schedule, including many woodworking. Write for brochure to Penland School of Crafts, Penland, 28765. (704) 765-2359

OHIO: **Radial-arm saw**, router, June 4-6, with Wally Kunkel (Mr. Sawdust). Mueller Co., 101 East Benson St., Cincinnati, 45215.

OKLAHOMA: **Seminar**—Wallace Kunkel, Mr. Sawdust: radial-arm saw, router and router table, June 12-13. Fine Tool and Wood Store, Oklahoma City.
Woodcarving Show—at Woodland Hills Mall, 71st and South Memorial, Tulsa, July 8-11. Contact Ray Bollinger, 2112 S. 107 East Ave., Tulsa, 74129. (918)627-0862

OREGON: **Exhibition**—LATHEWORKS, Turned Forms in Wood, by John Whitehead. Through May 29 at Contemporary Crafts Gallery, 3934 S.W. Corbett Ave., Portland 97201.

PENNSYLVANIA: **Exhibition**—Guild X Gallery, May 17-June 30, Bethlehem and Sawmill Rds., Applebachsville, Bucks County.
Workshop—with Robert Meadow, luthier and Bonnie Robiczek, lutenist, May 6-8. Contact Christopher Weiland, Dept. of Art, Indiana Univ. of Pa., Indiana, Pa. 15705.
Seminar—Basic woodworking, Tage Frid, May 22-23. Western Penn. Woodworkers Club, Box 8520, Pittsburgh, 15220

TENNESSEE: **Courses**—Bruce Beeken, steambending, June 7-18; James Schriber, woodworking for beginners, July 5-16; Michael Hurwitz, intermediate & advanced woodworking, July 19-30; Judy McKie, furniture design, Aug. 2-13; Tommy Hill, canoe building, Aug. 16-27. Appalachian Center for Crafts, Rt. 3, Smithville, 37166. (615)597-6801
Workshops—Furniture, Alphonse Mattia, June 14-25; Turning, Mark & Melvin Lindquist, July 12-19. Arrowmont School, Box 567, Gatlinburg, 37738. (617) 436-5860

TEXAS: **Houston Woodcarvers Show**—May 7-8, Memorial City Mall, I-10 and Gessner, Houston.

VERMONT: **Weeklong Workshops**—Conservation and restoration of furniture, June 7-12; Woodworking skills, June 14-19 and July 19-24; Drawing for woodworkers, June 14-19 and July 19-24; Carcase and drawer making, June 21-26 and Aug. 2-7; Design for woodworkers, June 21-26 and July 26-31; Frame and panel, June 28-Aug. 3; Furniture techniques, July 26-31; Seating and chairmak-

ing, Aug. 9-14. Kirby Studios, North Bennington, Vt. 05257-0154. (802) 442-3119
Exhibition—Furniture by Michael Coffey, May 7-June 18. Vt. St. Craft Center at Frog Hollow, Middlebury, 05753. (802) 388-3177
WASHINGTON: **Juried Exposition**—Open to craftsmen in Pacific Northwestern States, late September through mid-October. Deadline May 15. Contact Allied Arts of Seattle, 107 S. Main St., Seattle, 98104. (206)624-0432

WEST VIRGINIA: **Juried Exhibition**—Woodworking, June 20-July 31. Write John Ellis, Stifel Fine Arts Center, 1330 National Road, Wheeling, 26003
Turning Workshop—Palmer Sharpless, July 12-16. **Traditional Furniture**—Mack Headley, July 26-30. Cedar Lakes Craft Center, Ripley, 25271. (304) 372-6263

WISCONSIN: **Seminar**—Radial-arm saw, router and router table, with Wally Kunkel. June 25-27, at The Wood and Tool Store, N34 W24041 Capitol Dr., Pewaukee, 53072.

NOVA SCOTIA: **Courses**—Lathe instruction, furniture making, Detyk Jones, Fall '82. Contact Richard Tyner, 32 Edmonds Grounds, Halifax, N.S. B3N 1M6
Seminar—Woodworking Skills, with Ian Kirby, May 7-9. Woodcraft Mfg. Co., Ltd., RR 2, Armdale, Halifax County, N.S. B3L 4J2.

SASKATCHEWAN: **Wood '82**—Saskatchewan Wood Workers' Guild Show, June 5-13. SEDCO Center, U of S. Contact Don Florizone, 6 Rita Cres., Saskatoon, Sask. S7N 2L5.

ENGLAND: **Woodcarvers' Seminar**—International, June 12-13. Parnham House, Beaminster, Dorset (0308). Contact John Makepeace at this address.

Connections

In the last few years woodworkers have formed a number of local organizations. These groups generally meet monthly at the shop of a member to exchange technical information, to show slides of members' work, and to socialize. Some guilds have been able to organize exhibitions and sales of members' work, and to buy lumber or tools in bulk for the benefit of the members. To help readers connect with groups in their areas, we've surveyed the guilds in our files—the ones listed below are active and open to new members. For readers who don't live within the orbit of one of these groups but wish they did, the Letters columns in FWW #29 and #31 discuss how some guilds were formed. If you belong to a group that isn't here, drop us a line—we'll list the group next fall.

Austin Woodworkers Guild
225 Congress, Suite 156
Austin, Tex. 78701

Baltimore Woodworkers Guild
c/o June Woodward
126 Regester Ave.
Baltimore, Md. 21212

Guild of Designer-Woodworkers
c/o Kean College of New Jersey
Fine Arts Building (VE 115)
Union, N.J. 07083

Kishwaukee Woodworkers
c/o Hardwood Connection
420 Oak Street
DeKalb, Ill. 60115

Mendocino Woodworkers Association
PO Box 991
Mendocino, Calif. 95460

Michigan Woodworkers' Guild
PO Box 7802
Ann Arbor, Mich. 48107

Northwest Guild of Fine Woodworkers
c/o Huggins Woodworks
5723 285th Southeast
Issaquah, Wash. 98027

Olympic Peninsula Guild of Woodworkers
PO Box 314
Port Townsend, Wash. 98368

Pacific Northwest Guild of Master Upholsterers
7728 44th Ave. W.
Mukilteo, Wash. 98275

San Diego Fine Woodworking Association
PO Box 99656
San Diego, Calif. 92109

Santa Cruz Woodworkers Association
c/o Joel Herzel
1211 Laurent St.
Santa Cruz, Calif. 95060

Washington Woodworkers Guild
c/o Ed Mark
1565 Dunterry Pl.
McLean, Va. 22101

Western Pennsylvania Woodworkers Club
c/o Thomas Peer, Box 8520
Pittsburgh, Pa. 15220

Woodworkers Guild of Georgia
PO Box 5592
Atlanta, Ga. 30307

Atlantic Woodworkers Association
c/o Larry Graham
149 Nestor Cres.
Dartmouth, N.S.
Canada

Ontario Woodworkers Association
c/o Robert Kroeker
PO Box 354
Virgil, Ont.
Canada L0S 1T0

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Rare, vintage oak Hammacher-Schlemmer combination workbench/tool cabinet, "The Wooten Desk of Workbenches," conceals maple bench, vise and 92 tools. Kaplan, 40 First St., Troy, NY 12180. (518) 272-3456.

Walnut and oak, 5000 bd. ft. Lengths to 12 ft., widths to 4 in., to 4 in. thick. Also turn and carve blocks. $2/bd. ft. and up. Will resaw full width to veneers, boards, slabs. Brian Burns, Palo Alto, CA. (415) 327-5335.

Emmert woodworker's vise. Excellent cond. Wt., 90 lb. Best offer. S. Cooley, 4617 Ithaca Rd., Horseheads, NY 14845. (607) 739-2151.

22-in. thickness sander, 1½HP motor. New, $300. (201) 359-0885.

Ebony and plainsawn rosewood, sizes 1½ in. wide by ⅜ in. thick by 6½ and 8 in. long. Would like to unload lots of it fast. Box 32, Haddon Hts., NJ 08035. (609) 546-2903.

Ohio Tool Company #96 plow plane. Excellent condition. Pictures on request. Susan Hyatt, 2407 N. French St., Santa Ana, CA 92706.

Stanley #55, mint $400, good $300. Antique plow planes, usable, 8 blades—from $85 for unhandled plow to $1250 for mint boxwood plow, ivory tips, w/handle. Call John Moody, eves. (812) 867-6219.

Parts drawings and instructions for Walker-Turner, Crescent, Yates-American, Delta, DeWalt, Atlas, etc. machines. $5 each. Send model, make, S.N., env. Andy Gilchrist, Box 12959, Philadelphia, PA 19108.

6 matched pieces of crotch walnut, 1½"-2½" thick. AD 2½ yrs. 40" wide at crotch tapering to 30" over 6 ft. length. Flitch cut. Reasonable. Also quantity of cabinet-grade cherry. L. Irion, Paoli, PA. (215) 644-7516.

Rockwell 13-in. thickness planer, Cast-iron model, excellent condition. Four sets of knives. $1750. Rt. 1 Box 62, Culpepper, VA 22701. (703) 825-1489.

Wanted to Buy

Shopsmith equipment: Mark 7, Mark 2, bandsaw, belt sander, jointer, jigsaw, sprayer, power mount adaptor kit for 10ER. Old pubs and accessories. D. Huse, Box 9003, Reese AFB, TX 79489. (806) 885-2396.

Satinwood—Feather crotch veneer up to 50 sq. ft. Plank, straight grained, ⅛ in. thick or more, up to 25 bd. ft.; ⅛ in. by 1/16 in. stringing. PO Box 594, Gt. Barrington, MA 01230. (413) 528-4252.

Stanley planes, all kinds including 54, 85, 87, 94, 144, 164, 196, 212, 340, 444 and others. Old Stanley catalogs, wooden planes. I.E. Bixler, 6943 Cozaddale Rd., Goshen, OH 45122. (513) 722-2531.

Zerox copies of instruction manual for adjusting mechanism of Sears 10-in. radial-arm saw, model #11329001 circa 1958. S.N. Brand, 33-25 150th Pl., Flushing, NY 11354.

New or near new M-405 Skil 4-in. belt sander for cash or will trade choice carving or turning wood. Contact I.D. Johnson, Strawberry Point, IA 52076. (319) 933-4930.

Hammond Trim-O-Saw as described in *FWW* #32, p. 90. Restorable condition. G. Smith, 415 Estante Way, Los Alamos, NM 87544.

Used tailstock for Rockwell 46-200 series, 12-in. wood lathe. Also chisels, centers. 1703 Jumper Ct., Vienna, VA 22180. (703) 281-4251.

Thickness planer, home-shop size. Send price and data to T.W. Taylor, PO Box 298, Anderson, SC 29622.

For trade: Osage orange blocks. Want unusual wood for bowls. Henry Fisher, 4636 Dundee Ave., Columbus, OH 43227.

14-in. bandsaw, Delta or equivalent; wood lathe, Rockwell 46-150 or equivalent. Norman Krasnow, (212) 377-5311.

20-in. dia. sassafras logs. W. Durland, 209 Ridgewood, Monroe, NC 28110. (704) 283-5611.

SITUATIONS WANTED

Los Angeles. Would like to join or organize woodworkers' group in L.A. Westside area to share space and equip. and improve woodworking skills. John Houck, (213) 553-3939 days or (213) 472-7009 eves.

Apprenticeship sought with master cabinetmaker. 2 yrs. voc. training in cabinetmaking and related areas. Grad. May '82. Will relocate, references. Ken Reigel, 107 W. Douglas St., Rice Lake, WI 54868. (715) 234-3371.

Seeking entry-level position in quality shop of trad./reproduction furniture. 4 yrs. varied woodworking and cabinetry exper. Consider relocation within Northeast for serious career opportunity. (212) 549-9394.

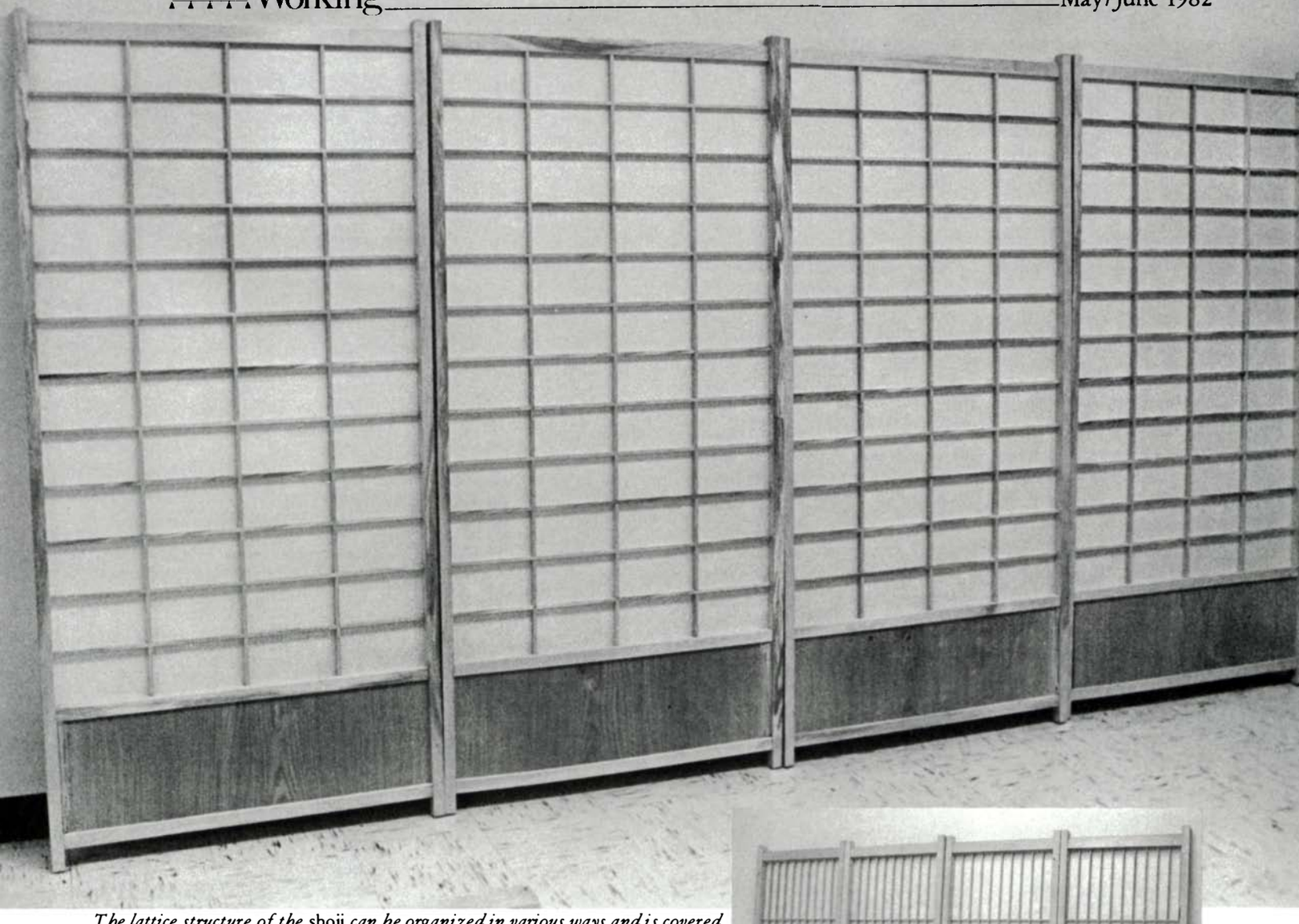
Cabinetmaker, 6 yrs. exper. in fine furn., restoration and semi-production work, seeks summer position in country setting, time and circumstances flexible. D. Fracapane, 25 W. 70th St., Apt. 3A, N.Y.C., NY 10023.

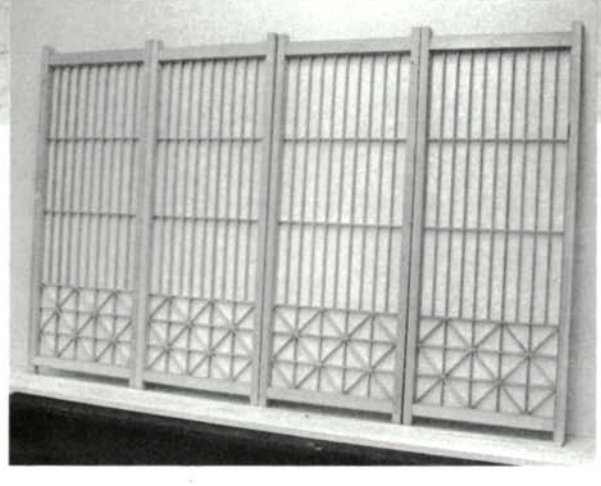
Desire work with master cabinetmaker. Have tools, experience and desire to learn. Willing to relocate to Oregon or New England. Greg Kent, 2033 Cable St., San Diego, CA 92107.

Craftsman willing to relocate. 6 yrs. prof. experience in small custom furn. shops incl. 1 yr. supervisory. Responsible for projects print thru finishing. Steve Grotenhuis, 1326 Taylor, St. Paul, MN 55104.

Reliable hard worker seeks apprenticeship in cabinetry or carpentry. Have tools, 2 yrs. experience and strong abilities. Dan Shapiro, 2727 29th St. NW, Washington, DC 20008. (202) 332-2681.

The CLASSIFIED rate is $3 per word, minimum ad 15 words. Payment must accompany order. Commercial accounts must use Classified. 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. Please inquire for DISPLAY CLASSIFIED rate. Send to: *Fine Woodworking*, Advertising Dept., Box 355, Newtown, CT 06470. Deadline for the July/August issue is April 23rd; for the Sept./Oct. issue, June 25th.





The lattice structure of the shoji *can be organized in various ways and is covered with rice paper. Above are common* (ma) shoji; *at right,* tokonoma shoji.

Japanese Sliding Doors

The traditional way to make *shoji*

by Toshio Odate

The traditional Japanese house allows for very flexible living. The house is post-and-beam, with the spaces between posts filled by doors, most of them sliding. Thus any wall, interior or exterior, can at different times become an entrance or an exit, a window or an open space, as the people desire. In this article I am going to show you the authentic way of making a sliding door. Although there are many kinds of sliding doors, the kind that Westerners associate with Japan are called *shoji*. This type of door consists of a softwood frame filled by a light latticework of thin wooden strips (called *kumiko*), to which is glued a layer of rice paper. The rice paper filters the light from outside into the home, for the people to enjoy.

When I was 16 years old, I was apprenticed to a *tategu-shi*, a maker of sliding doors. My master and I would carry the tools on our shoulders from house to house and place to place. We often worked out-of-doors, under an overhang, or in a vacant cowshed. Everywhere we went we made the planing boards, beams and horses on which we could prepare the customer's materials, and when we were done, this equipment remained with the customer. We would stay at a single job for as short a time as one week, or as long as three months, working from dawn to dark, whatever the weather. After seven years of this, I could call myself *shokunin*, which means craftsman. Such an apprenticeship is the only way to acquire a skill in Japan, for these kinds of knowledge are nowhere written down and never pursued as hobbies. I don't imagine you can become *shokunin* simply by reading my article.

For that matter, I am no longer *shokunin*. I have been in America 24 years now, and my commitments are different.

But I am still a skillful person, and because of my unusual life I can be a bridge from the traditional Japanese way to the American craftsman who wants to understand. You may find new uses for *shoji* and other ways to make them. Each craftsman has his own experience and training. I can not tell you how to make American *shoji*, but I can describe for you how the *tategu-shi* has always made Japanese *shoji*. If you know where the design comes from, even if you change it to suit your own life, you will know what you are doing.

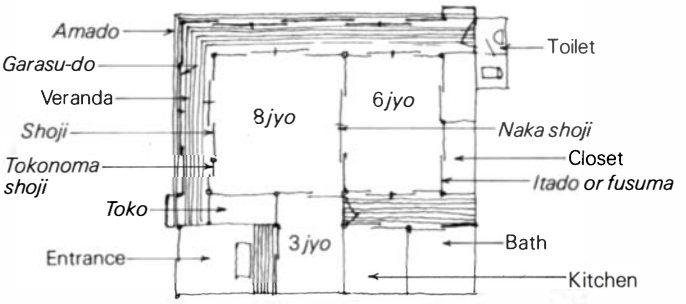
Varieties of sliding doors—*Shoji* is only one of the many kinds of sliding doors. The outermost door of a Japanese home is a wooden storm door (*amado*) which is closed tight every evening and left open during the day. Behind the storm door is a glass door in a wooden frame (*garasu-do*). The *shoji* is next. Often there is a narrow veranda, 3 ft. to 4 ft. wide, between the glass door and the *shoji*. This hallway borders the living space and is used to pass from one room to another (figure 1). Sliding room dividers separate the interior spaces. These room dividers can be *shoji* (with translucent rice paper), *fusuma* (with opaque paper and a very thin frame), *itado* (with wood panels), or a combination of *shoji* and *itado*. A living/dining room is commonly converted into a bedroom at night. Dining tables are folded flat, and beds are soft mattresses that are folded and stored every morning. Most rooms have a built-in closet with sliding doors (*fusuma* or *itado*) for household supplies.

The seven traditional styles of *shoji* are shown in figures 2 and 3. The one I will describe how to build is the common (*ma*) *shoji*, whose frame contains three vertical *kumiko* and either nine or eleven horizontal *kumiko*, with a hipboard (*koshi-ita*) at the base. This *koshi-ita* is a solid wood panel and is called "hipboard" perhaps because it is the height of your hip when you sit on the floor. The size of the hipboard varies according to the total height of the *shoji*, but the spacing between the horizontal *kumiko* depends on the two sizes of rice paper available: 28 cm wide and 25 cm wide. The edges of the paper overlap on top of the horizontal *kumiko*. The wider paper is used with the nine horizontal *kumiko* to produce the classic *mino* proportions. The narrower paper is used with the eleven horizontal *kumiko* to produce the more contemporary *hanshi* proportions. These two variations, and more, are possible in all the styles of *shoji*.

Rice paper (*shoji gami*) sometimes is watermarked with a pattern, commonly of plum trees, blossoms, pine trees, bamboo leaves or chrysanthemums. Sometimes these patterns are realistic, sometimes abstract. Because they are watermarks, you can see these patterns best from the inside of the room when daylight passes through the paper. The effect is like sitting with a beautiful garden outside, the pattern on the paper like the shadows of trees and flowers. Bringing nature inside the home is characteristic of the Japanese. The cultivation of miniature trees, *bonsai*, is another example of this.

Preparation—It is a common saying among Japanese craftsmen that when an apprentice can accurately prepare door materials he knows how to make a simple sliding door. People see the finished product and they say, "He is neat," or "He has skill," but actually most of the quality of the work is in the preparation of the materials. For typical dimensions of the parts, refer to figure 3. I begin with the hipboard. If you do not have stock wide enough to make it out of one piece,

Fig 1: Floor plan of a traditional Japanese house



Sliding doors allow for a flexible living area. Jyo *is 6 ft. by 3 ft., the size of the grass mats* (tatami) *used to cover the floor.*

Fig 2: Varieties of *shoji*

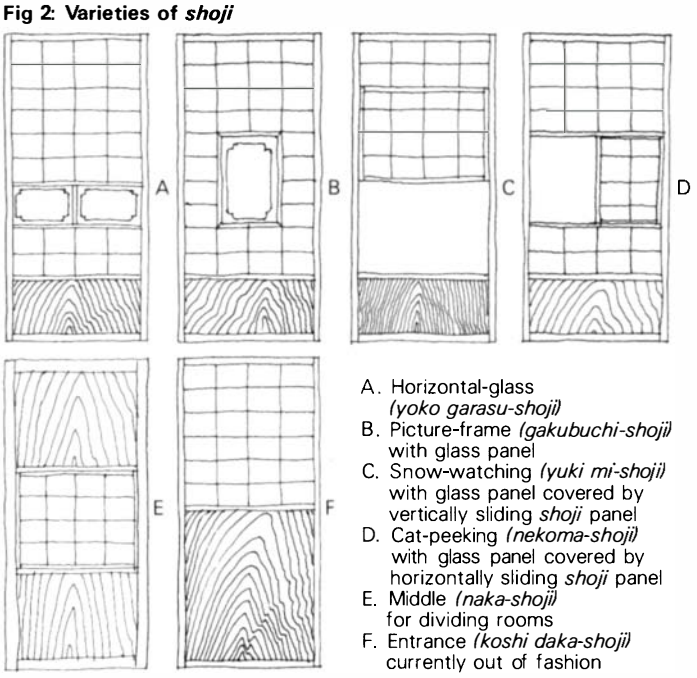
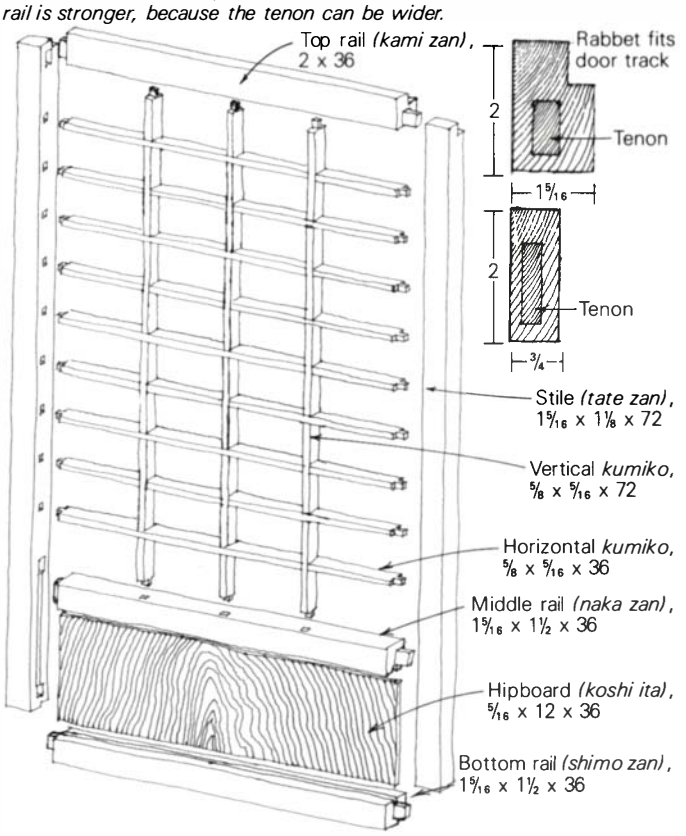


Fig. 3: A typical *ma-shoji*

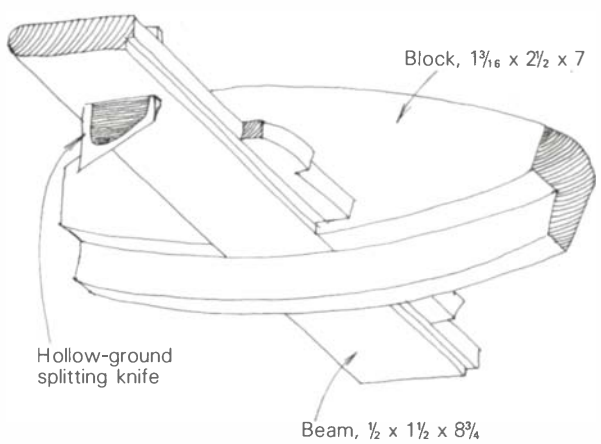
There are two alternate top rail designs. The rail can be 15/16 *in. thick and rabbeted to fit the track it slides in, or* 3/4 *in. thick, unrabbeted. The thicker rail looks more finished, because the rabbet covers the track. The thinner rail is stronger, because the tenon can be wider.*

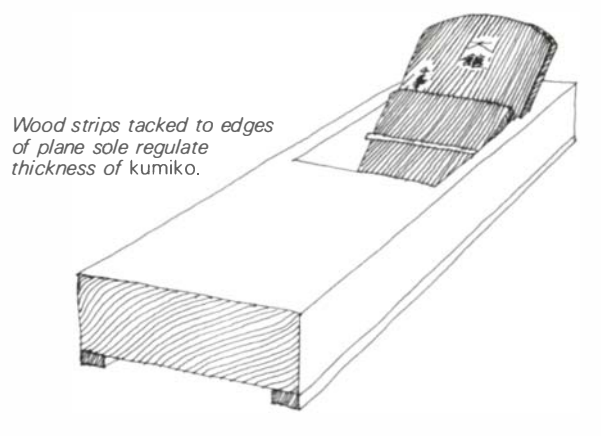


The tategu-shi *(sliding-door maker) begins by planing his stock to size, left. He uses planes that cut on the pull stroke, and he supports the wood on a* kezuri-dai, *that is, a beam held at one end by a triangular support and lodged against anything sturdy at the other. A nail driven into the beam stops the work against the pull of the plane. Traditionally, the* kezuri-dai *is fashioned at the work site and left behind when the craftsman finishes the job and moves on. Layout, above, is done with a thin, narrow square and a marking knife. Similar pieces, here both stiles for one* shoji, *are clamped together and layout lines struck across the stack.*

Fig. 4: Two tools for sizing *kumiko*

Splitting gauge splits kumiko *strips without kerf-waste.*





you begin by gluing it up. This way the glue will be dry when it comes time to plane the hipboard and cut it to size.

Next I prepare the stiles. The front face, which will face out of the room and receive the paper, must be planed flat and free of twist. Next plane the inside edge perpendicular to the front face, but instead of being straight along its length, it should bow slightly. This will hold the stile tight against the ***kumiko***. The large tenons of the rails will be made to fit tight in the mortises of the stile—so tight that they will have to be hammered home. But the ***kumiko*** are delicate. Bowing the stile to press gently against the ***kumiko*** shoulders, instead of making the tiny mortises and tenons hold the parts snug, I call the "thoughtfulness of the craftsman."

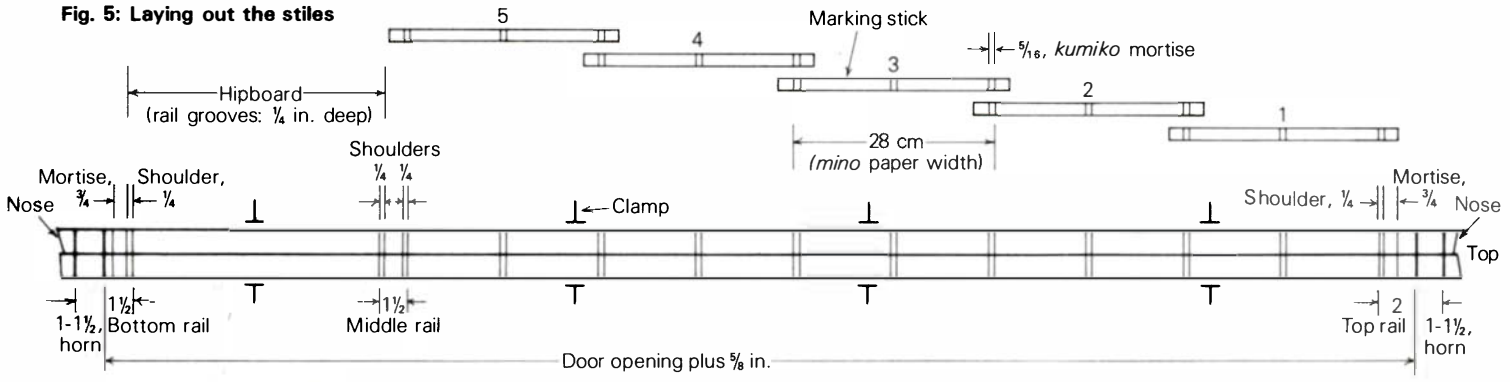
Once the front face and inside edge are planed, gauge the width of the face with a marking gauge and plane the outside edge. Then gauge the thickness of the edge and plane the back face. This is the face that will show in the room. All the frame parts of the ***shoji*** are planed in this order. Plane the ***kumiko***-facing edges of the top and middle rails and the inside edge of the bottom rail to bow in. Now I cut the stock to rough length and turn to the ***kumiko***.

Apprentices being trained today use a tablesaw and a thickness planer for preparing ***kumiko***. The hand method I describe here is the one I learned. I begin by planing perfectly flat a 1-in. thick redwood board, 6 ft. long. Mark it to ⅛-in. thickness, and plane the back face to the mark. Plane the edges of the board square to the face.

Now I use a splitting gauge (figure 4), which is like a marking gauge but larger and heavier. I score the board, first one face, then the other, until I can snap off the ***kumiko***. I plane the edge of the board again, then split off another ***kumiko***, repeating the process until I have plenty of extra pieces.

Next I wet the knifed surface of each piece with a damp

Fig. 5: Laying out the stiles



For a pair of shoji, *lay out four stiles at once. Lay out* kumiko *mortises from the top rail with a marking stick, varying the size of the hipboard to fit the* shoji *to the door opening.*

Fig. 5a: Determining height of *shoji*

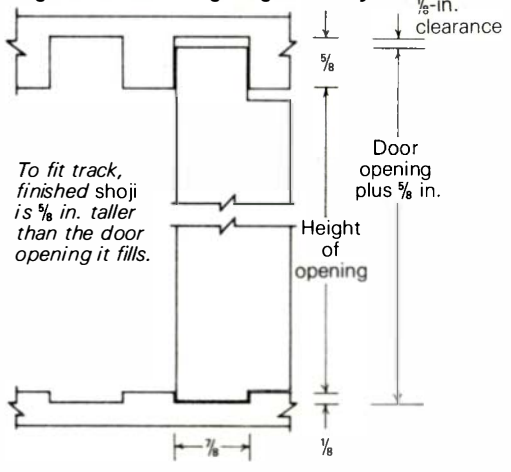
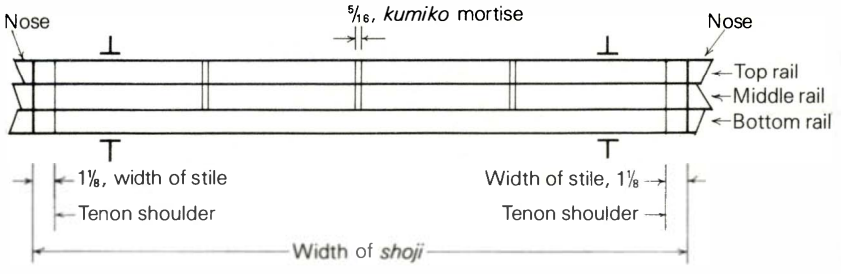


Fig. 6: Laying out rails



For a pair of shoji, *lay out six rails at once. Width of* shoji *(length of rail) equals width of opening plus width of one stile, all divided by 2.* Kumiko *mortises are marked on top and middle rails only. Space between* kumiko *equals distance between stiles minus combined width of* kumiko, *all divided by number of spaces.*

cloth, to relieve the pressure made by the knife. If you don't do this, the ***kumiko*** will eventually swell after they are assembled, and cause trouble. I lean the ***kumiko*** against a wall so the air can move around them until they are dry, and then plane the split edges square. To make sure they will be exactly the same width, I plane three or four ***kumiko*** at once, using a plane I reserve for this purpose. It has wood strips tacked to the bottom to stop the cut (figure 4).

Laying out the joints—The wall opening and tracks built by the house carpenter determine the outer dimensions of the *shoji*. The width of the rice paper determines the spacing of the horizontal ***kumiko***. Marking out this spacing from the top rail determines where the middle rail goes, and thus the *tategu-shi* finds the height of the hipboard. All other measurements are according to the discretion of the craftsman. The measurements in the drawings are typical.

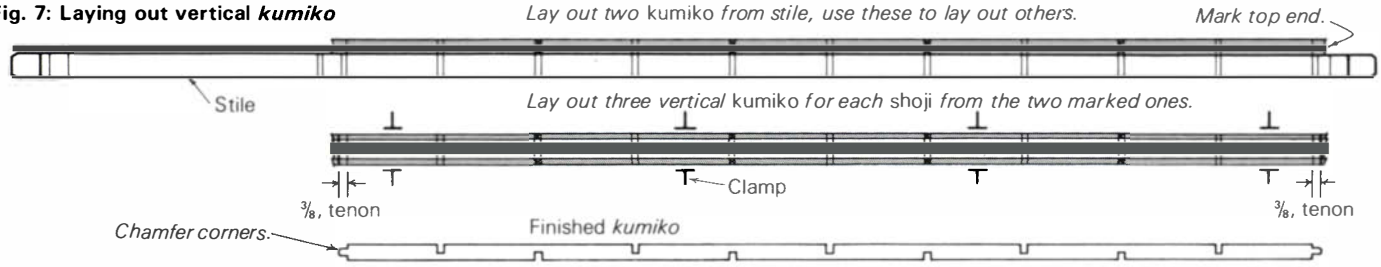
For speed and accuracy you lay out similar pieces, both stiles for instance (or four, when one opening requires two *shoji*), at the same time. Use clamps to keep the pieces aligned. The *tategu-shi* uses his clamps mostly for layout, almost never for assembly. I strike finished mortise heights and tenon shoulders across the width of the stock, using a square and a marking knife. Pencils and pens are not so accurate as the knife, and are used only for marking to rough length. I mark the stiles first, then the rails, then the ***kumiko***.

The stiles: It is customary to orient the stiles the way the wood grew in the tree. So, I make sure the largest growth rings are at the bottom of the stiles when I start to lay them out. Clamp the stiles together, inside edge up, and mark the finished height of the *shoji*, 5/8 in. longer than the height of the opening it will fill. The extra length fits the tracks, top and bottom, in which the *shoji* will slide (figure 5). Next I make a mark for the horns, 1-in. to 1½-in. past the finished height on either end. Most of the horns will be cut off later, but for now they keep the stiles from splitting when the rail tenons are driven into their mortises, and they also protect the ends of the stiles from damage during the work. Mark the width of the top and bottom rails next, and within those widths mark the mortise height.

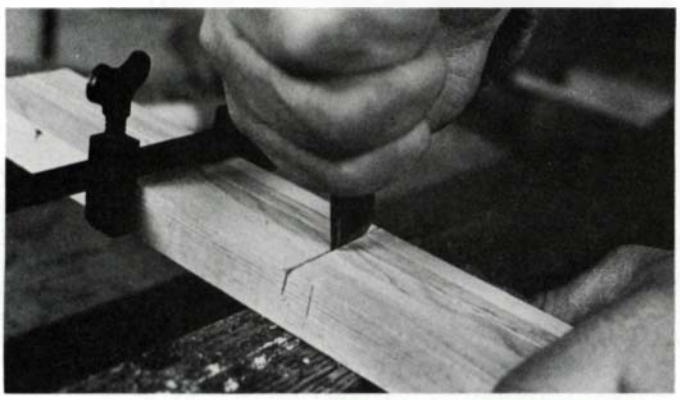
Next I mark off the mortises for the ***kumiko***, using a marking stick. The stick carries the width of the paper and the position of three ***kumiko*** in relation to that width. Figure 5 shows the layout of ***kumiko*** mortises for the ***mino***-size paper, 28 cm wide, which gives nine horizontal ***kumiko***. The stick has two ***kumiko*** mortises marked just inside the paper width, plus one centered between them. I begin at the mark for the top rail, overlap it the width of one ***kumiko*** mortise, and knife off the other two mortises. Reposition the stick to overlap the last mortise marked, and mark the next two mortises. I continue in this manner five times, until I have marked off nine ***kumiko*** mortises, and then I mark off the top of the middle rail. Finally I mark the width of the middle rail, and within it the mortise height. I square all these knife marks across all four stiles, saw off the noses (the waste beyond the horns), unclamp the stiles and chamfer the ends against damage.

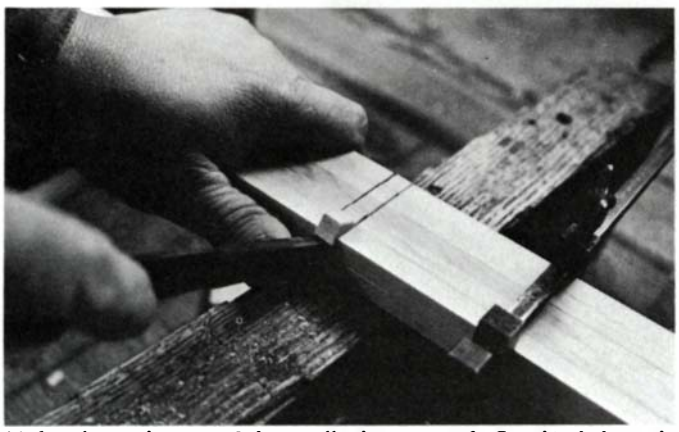
The rails: When two *shoji* fill a door opening, they overlap each other by the width of a stile. The width of each *shoji* thus is figured by adding the width of a stile to the width of the opening and dividing by two. The final rail length will be shy of this dimension, because the tenon is not quite a through tenon, but for now, I clamp the rails together, inside edge up, and mark their length as the *shoji* width (figure 6). Next I mark off the width of the stiles, which locates the tenon shoulders. The mortises for the vertical ***kumiko*** are marked next, equally spaced between the two stiles. I use a

Fig. 7: Laying out vertical *kumiko*

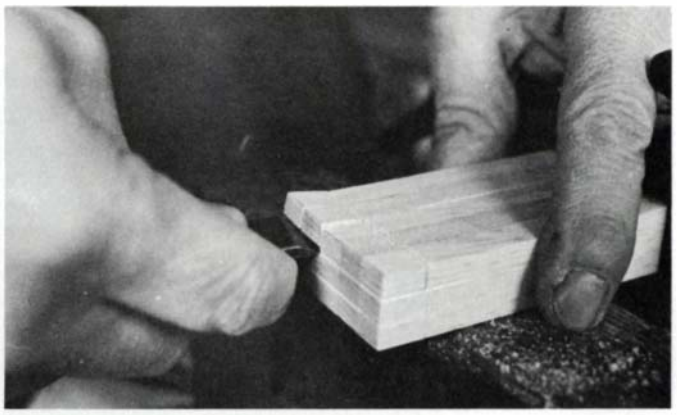


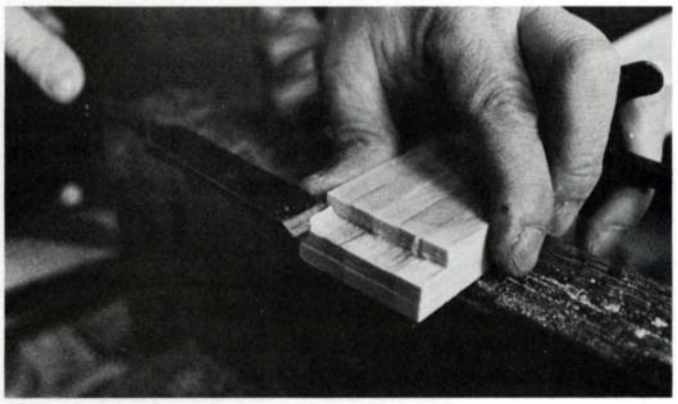
Odate clamps the kumiko *(the thin strips that form the* shoji *grid) together in a stack and saws the notch shoulders a hair more than halfway through. A piece of scrap starts the saw correctly.*





To break out the waste Odate pulls the corner of a flat chisel along the kerf (top). Then he clears the waste with a mortise chisel run in the notch, bevel-side down (above).





With the kumiko *still clamped together, Odate makes their tenons. First he saws the shoulders, then breaks off the waste with a chisel pushed in from the end grain (top). The index finger on the bottom of the chisel acts as a stop to protect the shoulder. He cleans up the tenons by paring with the chisel across the grain (above). When all the tenons have been formed and their top and bottom corners chamfered with a few strokes of a plane, he unclamps the stack, fans out the* kumiko *and chamfers the other two corners (below).*

marking stick, as for the horizontal ***kumiko***. Lastly I saw off the noses squarely, and unclamp the rails.

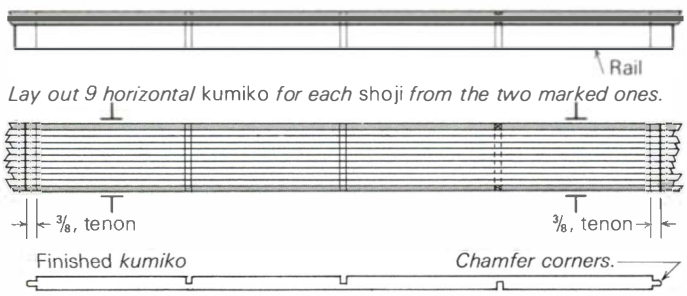
Vertical kumiko: To lay out the tenons and the notches for the half-lap joints on the vertical ***kumiko*** I transfer the layout lines from one of the stiles to two of the ***kumiko***, and then from these two to the rest of the ***kumiko*** (figure 7). I clamp the two marked ***kumiko*** on either side of the stack of unmarked ***kumiko*** to strike the layout lines across the stack. It's a good idea to make two extra ***kumiko*** and not use the marked ***kumiko*** in the finished ***shoji***. The vertical ***kumiko*** get notched alternately front and back. So I square every other notch around the underside of the stack. Last, I mark the tenon shoulders and lengths.

Now, while the vertical ***kumiko*** are still clamped together, I saw the notches and the tenons (photos, facing page). You cut both shoulders of one notch first, using a piece of scrap to start the saw correctly. Saw a hair more than halfway through the ***kumiko***, break out the waste with a chisel, and clean up by running a mortise chisel, bevel-down, along the bottom of the notch. I insert a scrap of ***kumiko*** in this notch as security in case a clamp shifts while I'm cutting the other notches.

Next I cut the clamped ***kumiko*** stack to final length. To cut the tenons, square the shoulder lines around all four sides of the stack. Gauge the tenon on the end grain of the stack and on the faces of the two outside ***kumiko***, then saw the shoulders. These are small tenons, so instead of sawing in from the end grain to meet the shoulder, I use a chisel to break off the waste. My index finger on the underside of the chisel acts as a stop to keep the chisel from damaging the ***kumiko*** shoulders. In all but the straightest-grained stock, I break a little bit wide and pare the tenons to the line.

Before removing the clamps, I chamfer the upper and lower edges of the tenons. Then I remove the clamps and fan out the stack to chamfer one corner, then the other. The vertical ***kumiko*** are now ready.

Fig. 8: Laying out horizontal *kumiko*



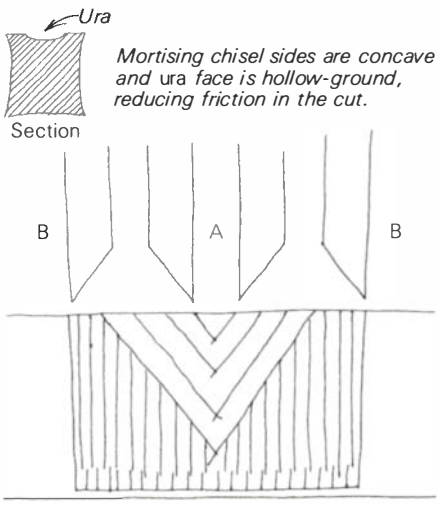
Horizontal kumiko: Many people think that the ***kumiko*** overlap, every other one, as if they are woven. But ***kumiko*** will not bend that much. They are only partly woven. When there are three vertical ***kumiko***, for instance, the notches in the horizontal ***kumiko*** are two, adjacent, on one face, one on the other (figure 8). They are marked out and cut exactly like the vertical ***kumiko***.

Cutting the joints—The ***kumiko*** notches and tenons have been cut while the ***kumiko*** were clamped up for layout. The joints on the stiles and rails are now cut on the pieces individually, mortises first, then tenons. Cutting the tenons last lessens the danger of damaging them. The quality of a craftsman's skill is judged by his speed and accuracy. It is considered most important to make each cut with the saw or chisel the final cut—you go directly to the layout line. The

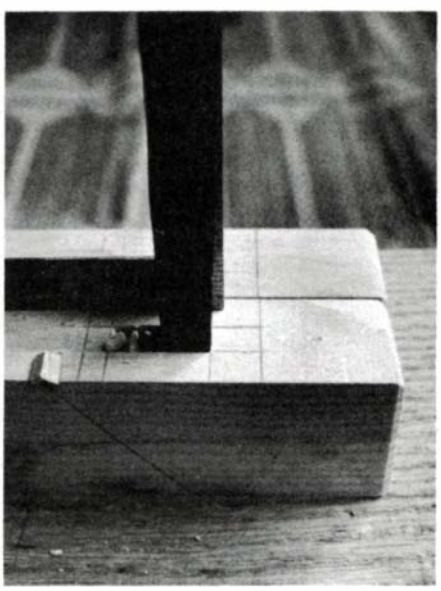
Like the planes, Japanese saws cut on the pull stroke. The long handle is usually held with two hands, spaced well apart for maximum power and control. There are three basic sawing stances, each suited for a different sort of cut. For crosscutting, left, Odate supports the stock on two low horses, holds it steady with his foot, and saws through. For sawing shoulders, as at top left of facing page, Odate sits so he can see where the cut has to stop. And for ripping, as for tenon cheeks, center and right, he supports the stock on one horse so he can see the layout lines on the near edge and on the end grain at the same time. To avoid cutting into the shoulder, Odate saws on an angle into the near edge first, then turns the stock over to cut into the opposite edge, finishing with the saw straight up and down.

The tategu-shi *sits on the wood to steady it while he mortises it, above, stabbing his chisel frequently in a box of cotton wadding soaked with vegetable oil, to reduce friction. The chisel has three concave sides and a hollow-ground face (figure 9 and photo, top of facing page). He chops from the middle out, always with the face toward the middle of the mortise, except for the final cuts at either end of the mortise. These are angled slightly from the perpendicular (photo, right, includes a square for illustration only) to taper the mortise for a tight fit when the tenon is driven in.*

Fig. 9: Mortise chisel/chopping method



A: Begin in the middle of the mortise and chop out toward the ends, alternating sides, always with the ura *face toward the middle.*
B: At ends of the mortise, turn ura *face around.*



least contact lessens the chance of error and keeps the work crisp. Should the *shokunin* make a mistake, no matter how small, his error remains in the work, and even if only he knows it, it is a permanent reproach. Nothing can be done about it. So you learn not to make mistakes.

Japanese mortises are somewhat different from Western mortises, and so are some of the tools used to cut them. To get maximum strength in a delicate frame, the *tategu-shi* shapes his mortises with walls that taper in, to compress the fibers of the tenon without crushing them. The natural springiness of the wood enhances the mechanical strength of the joint. He works to very close tolerances: a shaving here or there makes all the difference. It is thought coarse to show end grain, so through-joints are used only in heavy entrance doors, rain doors, and doors that carry glass. For strength and refinement, the main joints of the *shoji* must be as deep as possible without going through. The bottom is paper-thin, thin enough for light to show through. But no mark must show on the outside. One slip and the wood is ruined.

You gauge the mortise width, making sure the fence is always on the front face of the stock, then chop your mortises with a chisel exactly as wide as the mortise. Japanese mortise chisels are rectangular in section and will not turn in the mortise. Three sides are slightly concave, and the face, called *ura*, is hollow-ground (figure 9 and photo, facing page). This reduces friction in the heavy cuts. Stabbing the chisel frequently into a box of cotton wadding soaked in vegetable oil further reduces friction. The edges of the chisel scrape and true the long-grain sides of the mortise.

The *tategu-shi* strikes his chisels with an iron hammer, not the wooden mallet used in the West. He works from the middle of the mortise out, alternating cuts at either end, the *ura* always facing toward the middle. As the chisel cuts, it follows the bevel, so each cut shears toward the middle. As you near the ends of the mortise, you turn the *ura* around and chop straight down. The last cut at each end is with the chisel tilted slightly into the mortise. This tapers the walls just enough to pinch the tenon when it is driven in.

The *tategu-shi* does not lever waste out with the chisel as he chops, as does a Western woodworker. Instead he uses a small harpoon-shaped tool called *mori-nomi* (photos, facing page). Its face is flushed against the mortise wall, and the tool is tapped down and quickly jerked up. Its hook catches the chips and clears them out. Chopping, alternately with the

mortise chisel and the *mori-nomi*, proceeds quickly until the final depth is approached. Then you slow down and gauge the depth with a piece of *kumiko* cut to length. Score the remaining wood with the chisel, and remove the last fibers from the bottom of the mortise with a *sokozarai-nomi*, another tool I have not seen in the West. It is a thin, goose-necked tool with a small spade-like bend at its end. This tool is not tapped with a hammer, but used like a scraper, with one or two hands, to level the bottom of the mortise.

The *kumiko* mortises need not be as deep as the mortises for the rail tenon because the bow in the stiles and rails holds them tight. The *kumiko* mortises are too small to be scraped in the usual way. So, you chisel to within ⅛ in. of the final depth and use a small steel rod to tap the wood down for clearance (about 1/16 in. deeper than the length of the *kumiko* tenon). This method works best in softwood.

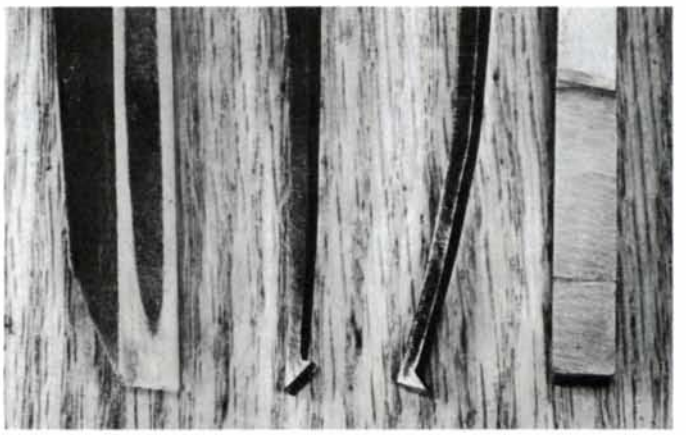
The tenons on the rails are cut in much the same way as they would be in the West, although the *tategu-shi* holds his work differently and uses Japanese saws which cut on the pull stroke. First extend the shoulder lines (marked on the inside edge when the stiles were clamped together for layout) around the other three sides of each rail. Gauge the tenon thickness on the two edges and on the end grain. Saw the shoulders first, on all the rails, then line the rails up to saw the cheeks. The photos on p. 55 show how to proceed, sawing with the stock supported at an angle, so you can see the lines on both the end grain and the edge of the stock. Saw at an angle to the near edge of the shoulder, then turn the stock over to finish. This way there is less danger of oversawing into the shoulder. To cut the narrow third and fourth shoulders, you should not saw the shoulder right on the line, because the set of the saw can damage the first two shoulders sawn. Instead, saw a little wide of the shoulder and trim with a chisel. All shoulders cut, saw the length of the tenon ⅛ in. to 1/16 in. less than the depth of the mortise. Finally, chamfer the end of the tenon so it will go in easily.

Last, plow-plane the grooves that will hold the hipboard, and rabbet the bottom rail (the top too, if you are using the thicker top rail), so the *shoji* can fit into its track in the wall opening (figures 3, p. 51, and 5a, p. 53).

Assembly—The Japanese prefer natural surfaces. The *shoji* receives no finish except a final planing of all its parts, to clean them from handling. The finish plane takes off the slightest shaving, with only one or two passes. Pressing the plane hard against the stock burnishes the surface and brings the wood to a warm glow.

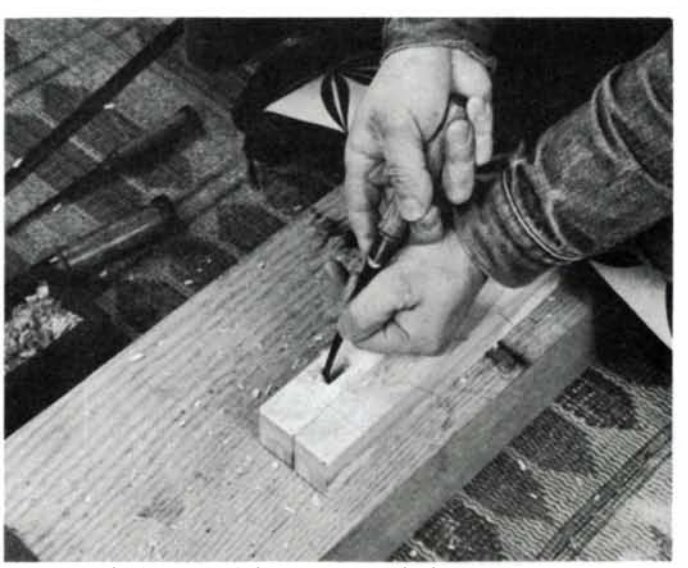
Cut and plane the hipboard to fit, allowing room for the wood to move across the grain, finish-plane its two faces, and chamfer all its edges. Finish-plane all other exposed surfaces of all other parts and lightly chamfer the edges of the main frame parts, except the inside front edges, where a chamfer would create a gap between them and the *kumiko*. Now at last, you're ready to assemble. I use rice glue that I make myself, so the *shoji* can be taken apart if it ever needs repair. Any starch glue, like wallpaper paste, will do.

Assemble the *kumiko* first. Group the horizontals together and the verticals together to make quick work of applying the rice glue to the shoulders of all the notches. Do not put any glue in the bottom of the notches, because glue here would prevent the *kumiko* from fitting tightly. Tap the *kumiko* together using a hammer. Fit the assembly into the mortises

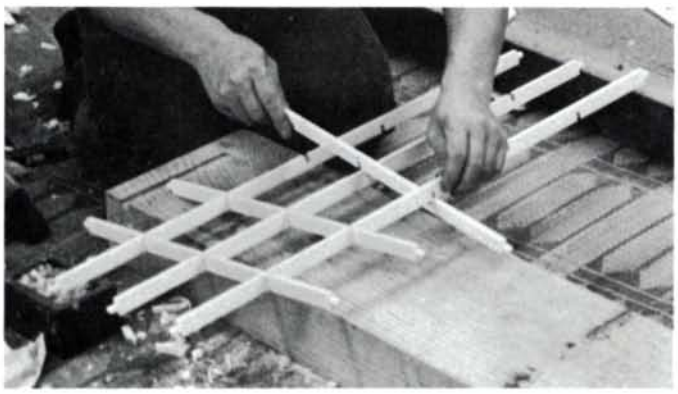


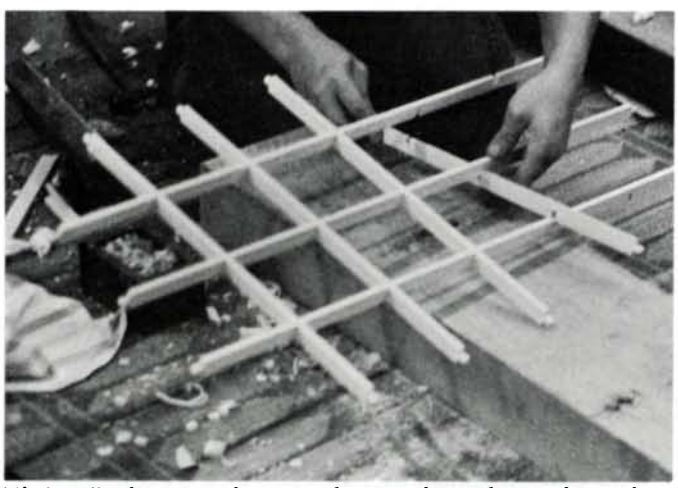
The tategu-shi's *mortising tools. From left to right, a mortising chisel, with hollow-ground face* (ura)*; a* mori-nomi, *whose harpoon-like hook is tapped down and jerked up to remove chips; and a* sokozarai-nomi, *which scrapes the mortise bottom flat and also lifts out chips. Last is a steel rod for tapping flat the bottoms of small mortises.*

Removing chips with the mori-nomi.

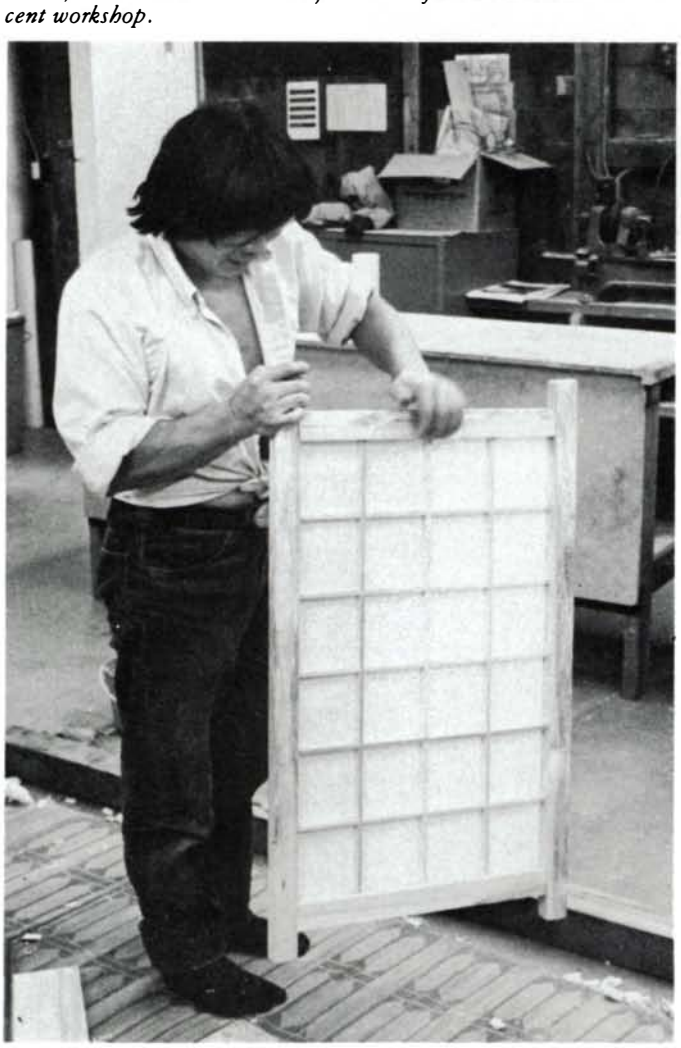


Scraping the bottom of the mortises with the sokozarai-nomi.





The kumiko *lap joints alternate, above, and must be eased into place. Below, Odate holds a small* shoji *he made for demonstration at a recent workshop.*



in the top rail. No glue is needed here. Fit the hipboard into the groove of the middle and bottom rail, and fit the *kumiko* assembly into the mortises in the middle rail.

Now you are ready to add the stiles. First take a hammer and tap around the mortises so the edges of the rail shoulders will fit tight. Then apply glue to both stiles at once. Tap the rail tenons into one of the stiles, stopping when the *kumiko* tenons just begin to engage, then start the other stile in the same way. Make sure both stiles are going on straight, and tap them home with a hammer. Hammer on a small block of wood with chamfered edges to avoid damaging the stock. When the tenons fit tight, check to be sure the *shoji* is square and flat. Tap and twist it into shape if it is not.

Installation—With assembly, the tense part of the *shokunin's* challenge is accomplished. Installation is the joy of displaying your work. Place the *shoji* on the outside ledge of the bottom track and check the stiles against the door frame for alignment. Cut the bottom horns as close to the bottom rails as possible, but if necessary at slightly different heights to align the stiles parallel to the door frame. Rabbet the horns, like the bottom rail, to fit the groove in the track. Now put the *shoji* back on the ledge (not in the groove yet) and press the top of the *shoji* up against the outside of the top track. Make a mark on the inside face of each horn where the track meets it, add $\frac{5}{8}$ in. to this mark, and you will have the length to which the top horns should be cut. Once they are cut, rabbet them to fit the track.

Applying paper—Rice paper has a smooth side, which is on the inside of the roll, and this should face out when the paper is applied to the screen. The horizontal strips are pasted to the *shoji* with rice glue, and they overlap one another like shingles, so the seams will not collect dust. Paper is traditionally applied by the housewife and customarily changed during the last week of the year, so that the paper is bright white for New Year's Day, signifying a fresh start. Old paper is easily removed by moistening it.

Besides the traditional *mino* and *hanshi*-size rolls, paper companies now make rolls one meter wide to be pasted on vertically in one piece. This opens up many possibilities in the spacing and patterns of the *kumiko*, which have always been carefully positioned to accommodate the traditional-size papers. This kind of change creates freedom in design, but it raises questions about pride in craftsmanship.

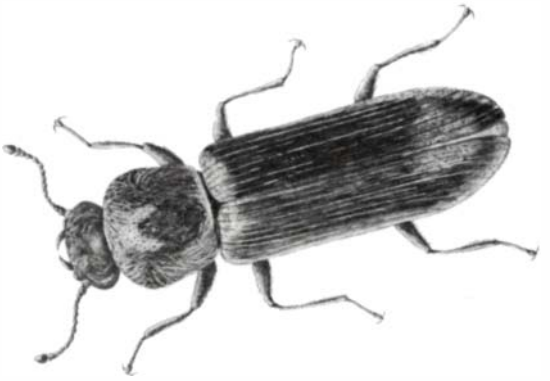
* * *

Well, finally you have finished and neatly installed a pair of *shoji*. You can appreciate now their character. The *shoji* paper draws in not only light, but light's warmness, softness and taste. The frames and *kumiko* that support the paper are not heavy or coarse. You open and close the *shoji* gently. The *shoji* has everything you need to feel peaceful. You retreat from the bustling world outside, you take off your shoes when you enter your home, and you sit down on a thin mattress in a room of *shoji* walls. You can call this place an oasis of life. □

Toshio Odate was trained as a tategu-shi *(sliding-door maker) and is now a sculptor, living in Woodbury, Conn. This article was prepared with help from Audrey Grossman. Odate wrote on sharpening techniques in* FWW *#29; his work appears on the back cover of* FWW *#26. Drawings by the author.*

Powderpost Beetles

Controlling the bugs that dine on your wood



by Tom Parker

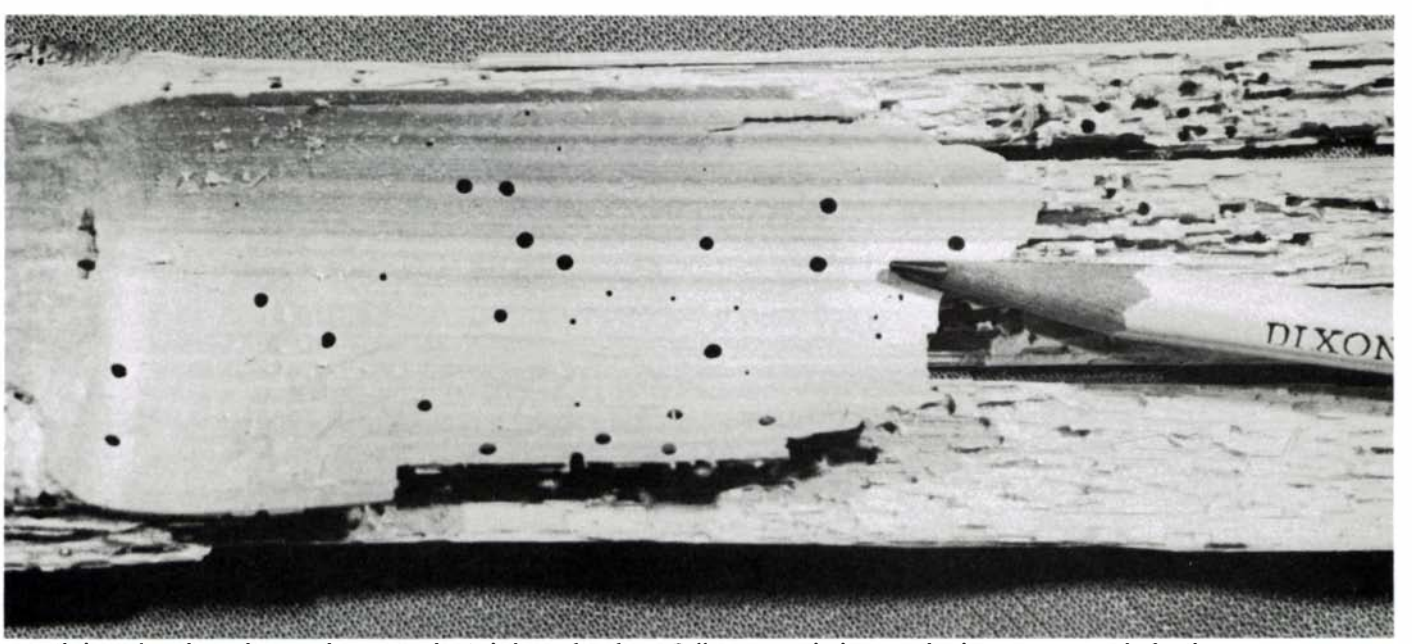
For practically every kind of wood that we have come to use, there is an insect that likes to make a meal of it. Termites are undeniably the most destructive wood-eating bugs, but powderpost beetles run a close second. Once established, powderpost beetles can do enormous damage despite their small size. They display a tenacious talent for survival—one species can even gnaw its way through lead-sheathed telephone cables to get at the paper insulation inside. It's worth the small amount of time and effort to inspect your lumber piles and structures for powderpost. If you catch an infestation early on, it can be eliminated before the beetles riddle your wood to the point of collapse.

Though there are dozens of species of wood-boring insects, American woodworkers are likely to encounter only two types of powderpost: anobiids and lyctids. A third family, bostrichids, is rarely seen. All are less than ¼ in. long, the anobiids being slightly larger than the lyctids. Anobiids are found in both hard and softwoods, but they do not infest living trees. The beetle life cycle runs about a year. The adult lays its eggs in checks or cracks in lumber having a moisture content between 8% and 30%. Each egg hatches into a larva which eats its way through the wood, forming circuitous galleries. As the cycle nears its end, the larva pupates into an adult beetle and emerges from the wood leaving a tell-tale round exit or flight hole. The lyctid life cycle is similar, but it infests only large-pored hardwoods, laying its eggs inside the open pores. Emerging adults may lay up to 50 eggs in the same board or they may fly off to a new source of food nearby.

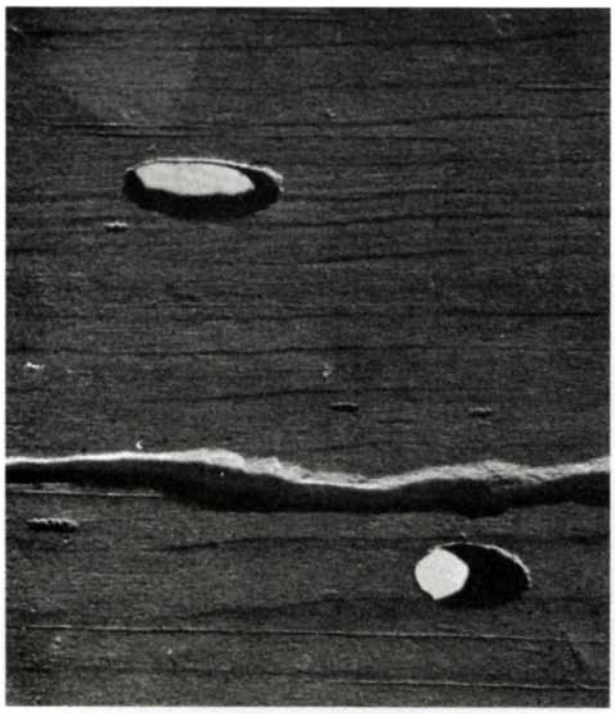
I've seen insect infestations in all parts of the country in a wide range of woods. Powerpost are particularly fond of freshly cut and stacked lumber, but they'll gladly eat wood in old furniture, particularly if the piece doesn't have a hard surface finish like shellac or lacquer. Ash, oak, elm, walnut, cherry, poplar and a host of softwoods are susceptible to powderpost attack. The beetles eat only the sapwood, feasting on the starch stored in the parenchyma cells. They may occasionally wander into heartwood, but the lack of nutrients and the extractives in heartwood make it unattractive.

Wood suspected of infestation should be inspected closely. On horizontal surfaces, small, crater-shaped piles of powdery sawdust surrounding small round holes strongly indicate active powderpost beetles. Vertical surfaces may show drift lines where the powder has fallen away from the hole and collected on the nearest horizontal surface. Anobiids bore an exit hole 1/16 in. to ⅛ in. in diameter; lyctids leave a hole 1/16 in. or smaller. A better way to identify the beetle is to rub a bit of the powder or "frass" between your fingers. If it feels distinctly granular, anobiids are responsible. Lyctid frass is as fine as talcum powder and virtually disintegrates at the touch.

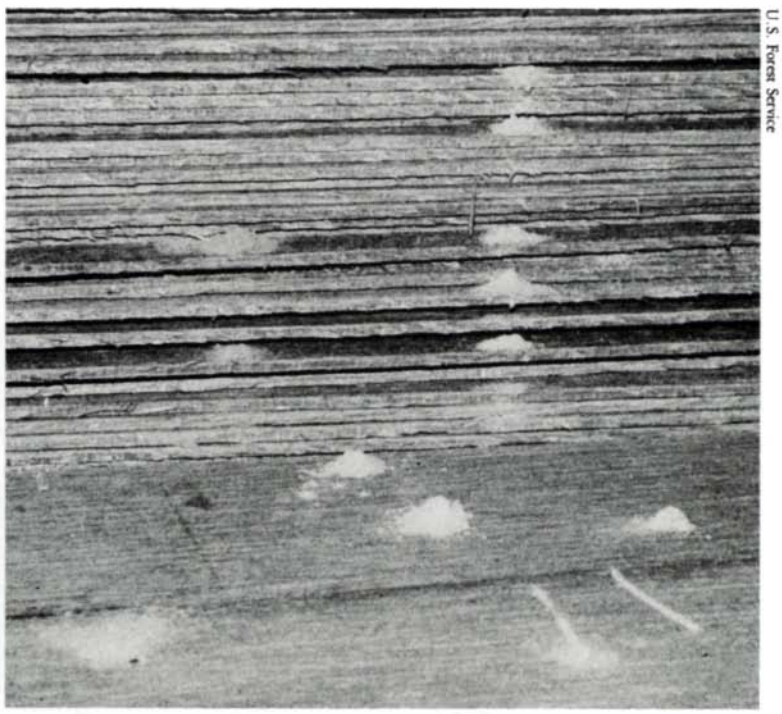
Holes in the wood but no signs of frass may indicate an infestation or damage done by some other type of insect before the tree was cut. Inspect the exit holes closely. If they appear dark or weathered or if holes in old furniture have drops of finishing materials in them, the infestation is probably over. Bore-holes that pass entirely through the wood are likely to have occurred before the wood was sawn, since no sensible wood-eating insect chews its way in one side and out the other. Similarly, wood surfaces that show exposed grooves or galleries were probably sawn after the infestation, and the insects have long since gone. The best way to handle the pow-



Pencil shows lyctid powderpost damage and exit holes in bamboo. Galleries at right have made the piece extremely fragile.



This infestation, caused by a boring beetle, is over. Holes that pass entirely through a board, or exposed galleries (across center of photo), indicate the wood was sawn after infestation.



U.S. Forest Service

Frass piles around this lumber are a sure sign of powderpost infestation. The powdery nature of the frass indicates that lyctids are at work. Beetles can completely destroy the wood if left unchecked.

derpost problem is, of course, to avoid it in the first place. Look for beetle frass and exit holes in any lumber you are buying while it's still in the stack. If you are air-drying lumber outside, store it up off the ground and cover it with plastic or canvas once it no longer needs exposure for drying. In new home construction, particularly where wooden structure is exposed above a dirt crawl space, I always tell contractors to install a layer of heavy plastic on the ground under the beams to keep the wood from absorbing ground moisture. Vents in crawl spaces and foundations will keep moisture below levels attractive to powderpost beetles. During construction, don't throw wood cutoffs and waste into the crawl space and don't bury it near the house either since that invites other kinds of wood-eating insects. If you're putting in new vents and sealing off the soil beneath an existing crawl space with polyethylene sheeting, do only half of it at a time, or the wood will dry out too quickly.

You can rid infested wood or furniture of beetles in several ways. Rough lumber can be kilned so that all parts of the wood are heated to 150° for three hours. That should kill powderpost beetles at all stages of their development. Interestingly, high kiln temperatures may make the wood more attractive to powderpost infestation later on. Above 113°, parenchyma cells are killed quickly and their starch content is fixed. Kilning below 113° depletes the starch and lessens the food available to the insects. Even this wood, however, may retain enough starch to support an infestation.

If you cut away badly riddled portions of once-infested sapwood, you can use the rest of the wood. Be sure to burn the sapwood cutoffs. A coat or two of a hard surface finish such as varnish or lacquer should prevent any remaining adult beetles from laying their eggs.

I've found one of the easiest and most effective weapons against powderpost beetles is the pesticide lindane. Following the instructions furnished with the product, mix a 1% emulsion of lindane, and spray or paint it on infested wood or on lumber that you want to protect. The emulsion will crystallize in the wood and kill the beetles as they emerge to lay eggs. It will also kill newly hatched larvae as they tunnel into the wood. Lindane can be used on in-place structural timbers, log cabins, barns, wagons and other outdoor objects. On old furniture, it might be wise to apply the emulsion on an unseen part of the furniture to see if it stains or discolors the finish. After it has dried lindane is considered safe for use around children and pets, but I wouldn't put it on lumber that will eventually come into contact with food.

When massive infestations in old houses or furniture can't be treated with lindane, there is an expensive last resort. Fumigation with highly toxic gases such as methyl bromide or Vikane is a sure-fire way to end powderpost problems. To fumigate a building, the entire structure is covered with a huge tarp and carefully sealed. The gas is pumped in under controlled conditions, and special monitors and fans ensure a uniformly deadly mixture. After 24 hours the building is thoroughly ventilated, and sensitive instruments sample the air for safety. Furniture and lumber can be similarly treated in air-tight chambers or temporary tents. But I suggest turning to fumigation only after all else has failed. The gases are extremely dangerous and are so penetrating that they can seep through a concrete-block wall in minutes. These gases are sold only to licensed users, so you must hire a professional to do the actual fumigation. The bill is likely to be large—I recently fumigated a museum in Pennsylvania, for example, and the job cost $15,000 and took a week. That particular building had other kinds of insect infestations, and fumigation was the only choice. Woodworkers who inspect their lumber carefully and use common-sense storage techniques will invite the powderpost beetle to have his next meal elsewhere. □

Tom Parker is an entomologist who specializes in the control of insects that infest museums, historic houses and libraries. He conducts seminars throughout the country.

Using the Tablesaw

Some basic rules for safe, accurate results

by Ian J. Kirby

Ripping is the tablesaw's forte, but it's a versatile machine, used for dimensioning wood as well as for cutting joints. The tablesaw is so simple and universal that it is frequently used without the operator's ever having taken the time to learn its common-sense fundamentals. In most small shops the tablesaw usually has improper guards and an inadequate rip fence. In the interest of keeping fingers attached to hands, a review of tablesaw basics may be of value.

The ordinary tablesaw is nothing more than a steel table with a circular blade projecting through its surface. The blade projection is adjustable for cutting wood of varying thicknesses. The blade can be fixed perpendicular to the table, or it can be tilted for cutting wood at an angle.

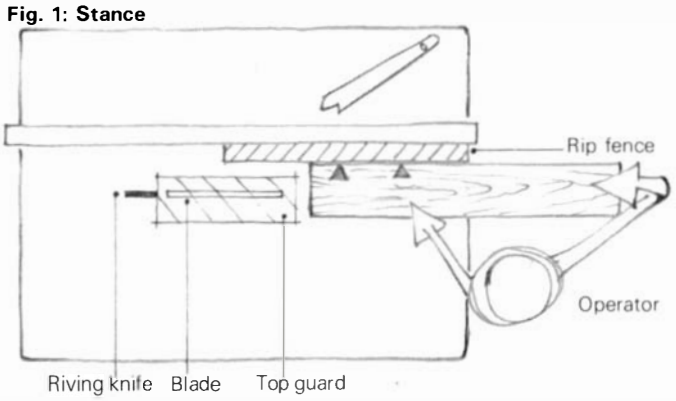
For safety's sake, tablesaws need a blade guard, though even the best guard can't keep fingers out of the blade. A guard should serve as a visual reference to the blade's location, warning the sawyer of the danger zone—any point within 9 in. of the blade. The best guard is mounted on an arm suspended above the blade. The guard should not be attached to the riving knife or splitter, and it should be adjustable, set as close as possible over the stock being sawn. There are several variations of this mounting method and any guard is better than no guard.

The machine's electrical power switch should be easy to reach, mounted on the saw cabinet just under the table or on a nearby wall or post. When switching on, place one finger on the start button and a second on the stop button. This allows for a quick shutoff if something goes wrong. A foot-activated switch allows the sawyer to control the wood with both hands while operating the switch. Many saws have mechanical or electrical brakes that stop the blade quickly when the switch is turned off. In the absence of a brake, use two push sticks—one rubbing each side of the blade—to stop its coasting. When changing rip-fence settings never stick a tape or rule between a moving blade and the fence. Wait until the blade has completely stopped. The saw depth of cut should be set so the blade protrudes about ½ in. out of the workpiece. Carbide-tipped blades should be adjusted so the entire tooth projects above the wood during the cut. A 10-in. saw should be operated at 3,000 to 3,500 RPM at the arbor, or at a speed that runs the blade's periphery at 10,000 feet per minute.

Noise can be a major barrier to safe machine operation. The racket muddles thought and can force the operator to adopt timid and unsafe working practices. So ear protection—as well as goggles—should always be worn when using the saw. To concentrate without the distraction, the novice woodworker can develop safe habits by practicing moving wood past the blade with the machine switched off.

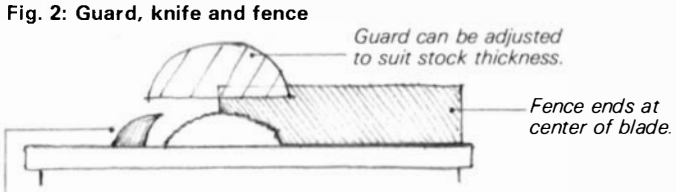
Ian J. Kirby is a consulting editor to this magazine. He teaches woodworking and design in North Bennington, Vt. Drawings by the author.

Fig. 1: Stance



Stand to one side of the blade when ripping. Hold the work against the fence with the left hand, feed with the right.

Fig. 2: Guard, knife and fence

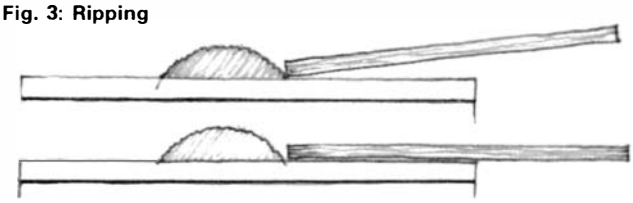


Proper stance is also important to safe tablesaw operation. When ripping or crosscutting, the operator should stand with his weight equally distributed on both feet. Stand to one side of the sawblade to stay out of harm's way and to have a better view of the cut. Figure 1 shows a good position—during ripping, kickbacks can be hurled from the saw like spears and you could be skewered.

Because the tablesaw is at its best when used for ripping, the rip fence is its most vital attachment. The fence should be mounted parallel to the blade. Whether it's used on the right or left side of the blade is the preference of the operator. Virtually all of the tablesaws sold in the United States have rip fences extending the full length of the saw table. This fence forces the wood to remain in contact with the back of the blade during the rip, thus inviting binding, burning and kickbacks, particularly when cutting refractory wood. The fence should end at the front of the blade, just where the cut is completed. This allows both pieces to move clear of the blade for safer, cleaner results. The quickest fix for tablesaws equipped with a full length fence is to fit them with a board ending at the center of the blade, as in figure 2. Actually, it's good practice to mount a board on the steel fence of any machine. This will prevent damage if the blade accidentally touches the fence.

To keep the kerf from closing up and pinching the blade during ripping, tablesaws should have a riving knife or splitter mounted in line with and just beyond the back of the blade. The knife is a fin-shaped piece of steel, tapered in sec-

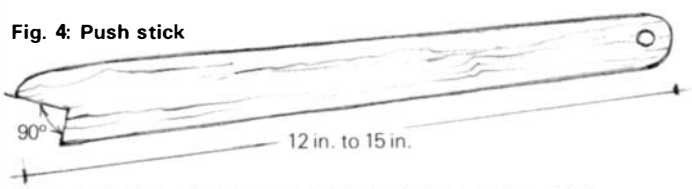
Fig. 3: Ripping



Feed the stock angled to the rear or flat against the table, above.

Never start the cut with the front of the board elevated, below.

Fig. 4: Push stick



Make push stick of solid wood or plywood, ¾ in. to ½ in. thick.

Fig. 5: Crosscutting

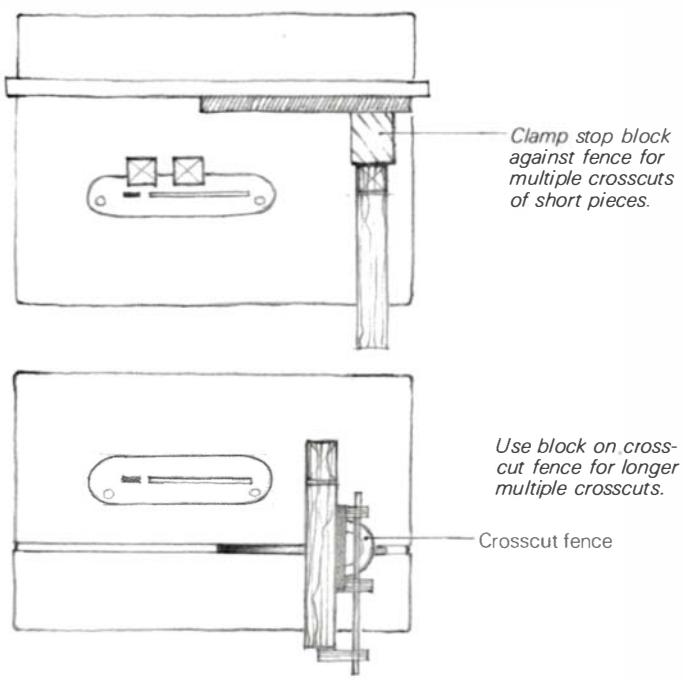
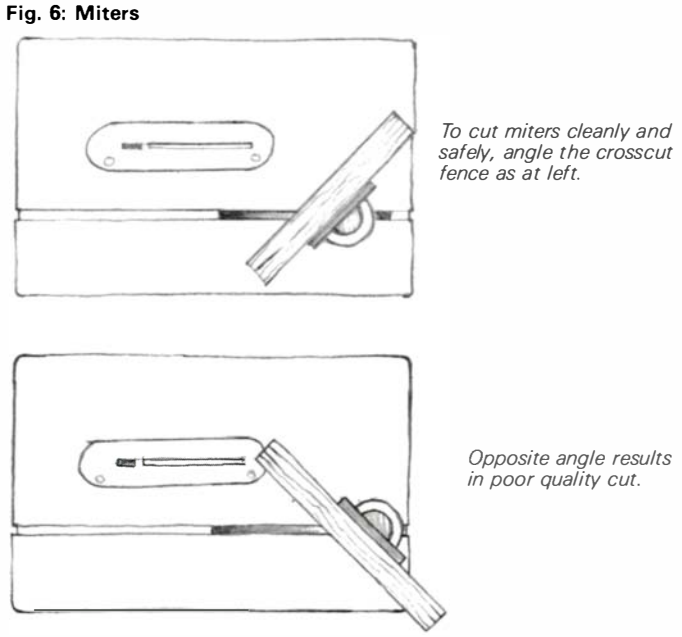


Fig. 6: Miters



tion and as thick at its back edge as the kerf is wide. It should be permanently mounted at a height just below the top of the blade's arc, as in figure 2. The knife should maintain this relationship to the blade for every cutting depth. Some saws, particularly the cheaper variety, have no riving knife at all, but the payback in safety and improved cutting makes it worth the effort to install one.

When ripping, the wood should be offered to the blade very gently at first, especially when using carbide-tipped sawblades, whose teeth are brittle and can break under heavy impacts. Feed the board into the saw flat against the sawtable or angled as in figure 3. Never touch the board to the blade with its front end tilted above the table, or the blade will grab the stock and slam it to the table. Make sure a push stick is handy before starting any cut; keep one on the sawtable on the opposite side of the fence. Figure 4 shows a simple push stick design. Keep plenty of sticks around—their absence is no excuse for a missing finger. With the cut started, hold the wood against the fence with your left hand (if the fence is to the right of the blade), while feeding the stock into the blade with your right hand. As the rip progresses, make sure you hold the board firmly against the fence. Keep your eye on the contact point between board and fence—some wood may tend to run away from the fence during the cut. Feed into the saw at an even rate. If fed too slowly, the blade will burn in the kerf, while too quick a feed will stall the saw. Never move your left hand beyond the leading edge of the blade. This is unsafe and merely pushes the waste to the blade, not the stock to the fence. As the cut nears its end, remove your left hand from the wood and use a push stick to complete the rip.

If the saw stalls during a rip, withdraw the wood quickly, or turn off the saw immediately—a good reason to have a foot-operated switch. It isn't advisable to rip warped or twisted boards, but when you must, crosscut the stock into the shortest lengths possible, and then rip with the concave side of the board up, so the wood is level with the table as it meets the blade. Rip a cupped board as close to its center as possible and exert even pressure, to minimize rocking during the cut. Long boards or large panels should be cut with the help of a second person, or use a table or roller on the saw's off-feed side for support. The sawyer's helper should clearly understand that his job is only to support the stock (keeping it level with the table and parallel to the blade) as it comes off the saw and not to pull it through—he could pull the sawyer's hands into the blade. When the cut is complete, the takeoff man then takes control of both pieces.

Wood is crosscut on the tablesaw with the miter gauge or crosscut fence. This angle-adjustable attachment usually runs in grooves milled in the table surface parallel to the blade. The fence must slide smoothly in the grooves. A board about 12 in. in length can be attached to the crosscut fence to offer more support to the stock. Crosscut fences are sometimes equipped with clamps to stop the work from slewing as it is fed through the blade.

Crosscutting should be done from the same stance as ripping. To test 90° crosscuts, cut a test piece and check it with a square rather than attempting to square the blade directly to the crosscut fence. With the crosscut fence set, hold the stock firmly against it while advancing the wood evenly into the blade. Only practice will reveal the best way to grip the stock against the fence. When the cut is complete, move the crosscut fence beyond the back edge of the blade or back to the

starting point. To avoid binding the stock against the blade, slide the wood slightly away from the blade as the crosscut fence is returned. Small stock may have to be clamped to the crosscut fence to be crosscut safely. To crosscut many parts to the same length, clamp a stopping block to the rip fence ahead of the blade as in figure 5, or attach a stop block to the crosscut fence. Never bring the rip fence over to stop the length of a crosscut, as the cut piece is liable to lodge between the fence and the blade, and bind or kick back.

For 45° miters make a test cut to set the crosscut fence accurately. Grip the stock firmly and feed it into the saw as shown in figure 6, the blade shearing with the grain. Because of the fibrous nature of wood, mitering it from the opposite direction results in a cut of lesser quality. □

Choosing a blade

Which blade for which cut? That's the first problem the woodworker faces when using the tablesaw. You want to rip and crosscut, leaving smooth, tear-out-free edges on solid wood or plywood. No blade does everything well. Many types of blades are available but you need only a few to start out.

There are two categories of readily available sawblades: those made of high-speed steel and those of steel with tungsten-carbide tips brazed on to form the teeth. New high-speed steel blades are inexpensive and although they dull quickly, you can easily resharpen them yourself. For information on sharpening, see *FWW* #10, p. 80. Carbide blades cost more and cut smoother, but you must send them out for sharpening, which is expensive. You have to weigh cost against use—carbide blades are preferred for repeated high-quality cuts.

High-speed steel blades—There are three basic types of steel blade: rip, crosscut and combination. These blades can have spring-set or hollow-ground teeth. Teeth on most steel blades are ground in the same way—with the tops of the teeth alternately beveled, and the fronts left flat or beveled. Set—the alternate and uniform bending of teeth to the right and left—creates clearance for the blade during cutting. This keeps the blade cool and prevents binding and burning. For ripping heavy wood to rough dimensions use a hefty high-speed steel rip blade (figure 1) with a lot of set and 20 to 40 teeth. The thicker the wood, the fewer the teeth. This blade will produce a quick but fairly rough cut with little binding or burning. Rough crosscutting can be done with a steel crosscut blade with 40 to 60 teeth (figure 2), but a combination blade (figure 3) will do the job just as well. Combination blades, designed to rip and crosscut, are a good value for the money. They have four alternating front-beveled teeth followed by a flat or raker tooth with a deep gullet to clear sawdust quickly and prevent overheating. Properly sharpened and set, a combination blade will work well for most general purpose work.

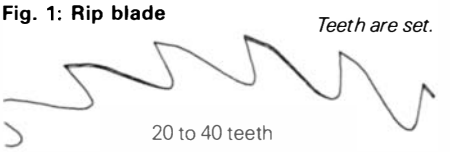
The hollow-ground combination blade (figure 4) tends to be a smoother cutting blade than the spring-set. This blade has about the same number of teeth as the combination, but its teeth have no set. The body of the blade below the gullets is ground thinner than the teeth so the saw won't bind. Tolerances for a hollow-ground blade are small—it must be accurately cut and sharpened to work well, otherwise it will bind and burn.

Tungsten-carbide blades—Plywood, particleboard and solid wood impose different loads on a sawblade. Carbide blades are better for plywood and particleboard. For a given type of blade, sharp carbide almost always produces a smoother cut than sharp steel, and because it is harder, carbide stays sharper longer than steel does. Carbide blades don't have set, and usually the tops rather than the fronts of the teeth are ground. A good general purpose carbide combination blade for solid wood and man-made boards (figure 5) should have between 40 and 60 teeth ground in a series of four alternately top-beveled teeth, followed by a flat or raker tooth. If you can afford only one carbide blade, this is the type to buy.

For ripping only, a 24-tooth carbide blade with flat-ground teeth (figure 6) is excellent. If you need to cut plastic sheets or laminates, choose a 50 to 70-tooth carbide blade that has alternating triple-beveled teeth with a raker tooth in between (figure 7). Properly sharpened and maintained, all carbide blades leave a smooth, almost finished surface. For more information on saws and blades see *FWW* #23, pp. 72-75 and #24. pp. 48 and 49. —*I.J.K.*

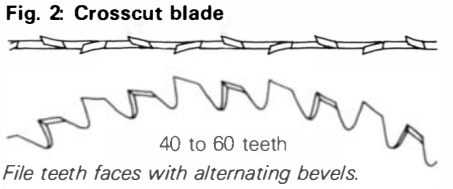
High-speed steel blades

Fig. 1: Rip blade



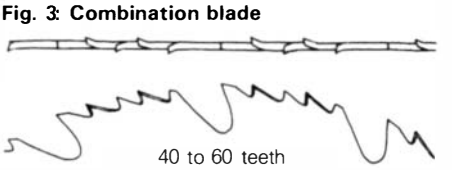
File teeth faces perpendicular to blade.

Fig. 2: Crosscut blade



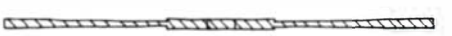
File teeth faces with alternating bevels.

Fig. 3: Combination blade



Raker tooth, with deep gullet, clears chips.

Fig. 4: Hollow-ground combination



Blade body below teeth is ground thinner (here exaggerated). Teeth have no set.

Carbide-tipped blades

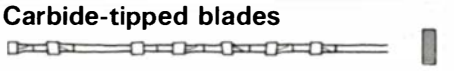
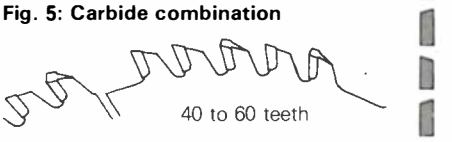


Fig. 5: Carbide combination



Four alternating top-beveled teeth are preceded by flat-ground, raker tooth.

Fig. 6: Carbide rip

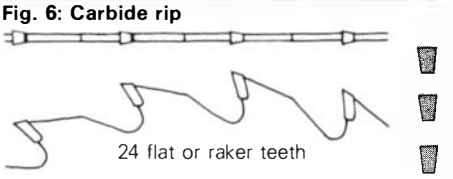
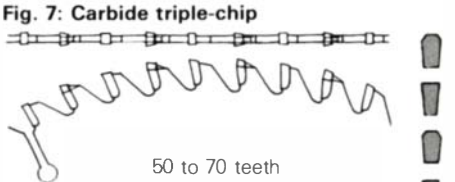


Fig. 7: Carbide triple-chip



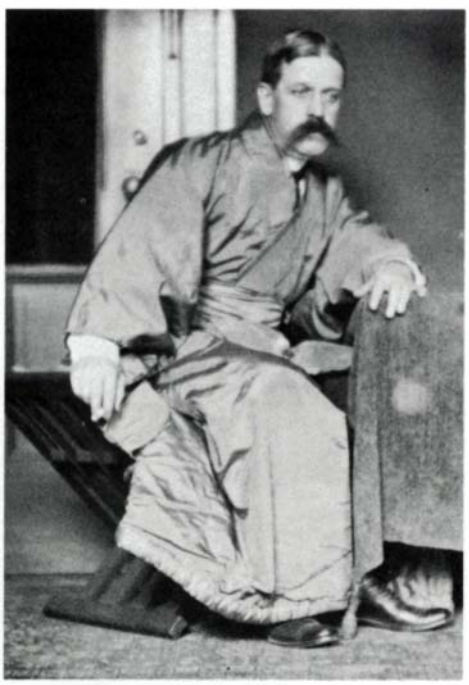
Triple-chip tooth alternates with raker tooth.

Refining the Craftsman Style

The legacy of Harvey Ellis

by David Cathers

Harvey Ellis signed on with Gustav Stickley's renowned Craftsman Workshops as a designer in May, 1903. An aesthete and a dissipated romantic, Ellis could not have been more unlike the robust, moralizing Stickley, the leading American exponent of the Arts and Crafts style and philosophy. Yet Ellis' impact on Craftsman furniture was immediate, drastic and lasting. Where Stickley's designs employed massive, powerful oak members, bristling with through tenons, unrelenting rectilinear forms and heavy wrought-iron hardware, Ellis' furniture was delicate, light and colorful. Stickley preached against the dishonesty of applied ornament. True decoration, he insisted, developed naturally from materials, structure and methods. His furniture showed exactly how it was put together. Ellis, on the other hand, subordinated structure to form, introduced abstract decorative inlays and relied upon discrete, hidden joinery as the typical elements of his designs.



Harvey Ellis.

Ellis trained as an architect in the 1870s, and while still a young man he produced several notable commercial buildings in his home city of Rochester, N.Y. During the 1880s and 1890s, as a journeyman designer and draftsman working for midwestern architectural firms, he created brilliant architectural designs—for small wages and no recognition.

Ellis' talent for design did not spill over into other areas of his life. He had no talent for success. By his early twenties he was drinking heavily, establishing the pattern of drunkenness and dissolution that marred most of his life. He was as careless with his money as with his own well-being. "He was," wrote his friend Hugh Garden, "an artist and romanticist who loved to indulge his peculiar taste for life in the nearest and readiest direction, careless of the result and apparently without any marked ambition." In January, 1904, nine months after he had joined Stickley, Ellis died. Years of heavy drinking had taken their toll. He was 52.

It is the inlay which draws today's admirers to Ellis' work. The pewter, copper and stained woods added color to Craftsman furniture and it added expense—fine inlay is difficult and time-consuming to produce. Ellis' most characteristic inlay patterns are abstracted floral and plant forms. Other patterns show the influence of Japanese and American Indian designs. He delighted in fairy tales, and he adapted sailing ships, woodland scenes and other motifs from those stories for his inlay. His patterns are whimsical or abstract, usually symmetrical, and always prominent in the furniture. Ellis, like Stickley, designed for oak, but he either fumed it nearly black or avoided quartersawn stock—the flashing patterns would have been at odds with his delicate inlay.

In January, 1904, Stickley introduced Ellis' inlaid oak furniture in *The Craftsman*, the magazine he founded to publicize Arts and Crafts ideals. Stickley, the scourge of applied ornament, stretched himself, and the language, to avoid being criticized on this front. Inlay, Stickley said, added interest to otherwise plain, flat surfaces, accented vertical structure and gave a slenderness to heavy members. Ellis' inlay, he wrote, "bears no trace of having been applied. It consists of fine markings, discs and other figures of pewter and copper, which, like stems of plants and obscured, simplified forms, seem to pierce the surface from underneath."

Ellis' inlays grab our attention. But they shouldn't be allowed to overshadow his other innovations which radically altered the stolid Craftsman style. Ellis added bowed sides, paneled backs and deeply arched aprons to Craftsman casework. He produced several versions of an attenuated tall-back chair, close relatives of chairs by the British architects C.R. Mackintosh and C.F.A. Voysey, designers Ellis much admired. And, finally, Ellis introduced veneered panels to Craftsman furniture.

The inlay quickly disappeared from the line after Ellis' death, but all of his structural elements became standard Stickley features from 1904 onward. Though his life was tragically cut short, Ellis exerted a long-lived influence on Stickley and on his contemporaries. Ellis' subordination of structure to form led to an ever-increasing purity in Craftsman designs, and eased Stickley into one of the main currents of 20th-century design: unadorned, geometric and sophisticated form. "Harvey Ellis was a genius," said his friend and fellow architect, Claude Bragdon. "Had it not been for the evil fairy which presided at his birth and ruled his destiny, he might have been a prominent, instead of obscure, figure in the aesthetic awakening of America."

David Cathers is the author of Furniture of the American Arts and Crafts Movement, *published by the New American Library. For more on Gustav Stickley and Craftsman furniture, see "Gustav Stickley,"* FWW #2, Spring '76. *A collection of reprints from* The Craftsman *magazine, edited by Barry Sanders, is published by Peregrine Smith, Inc.*

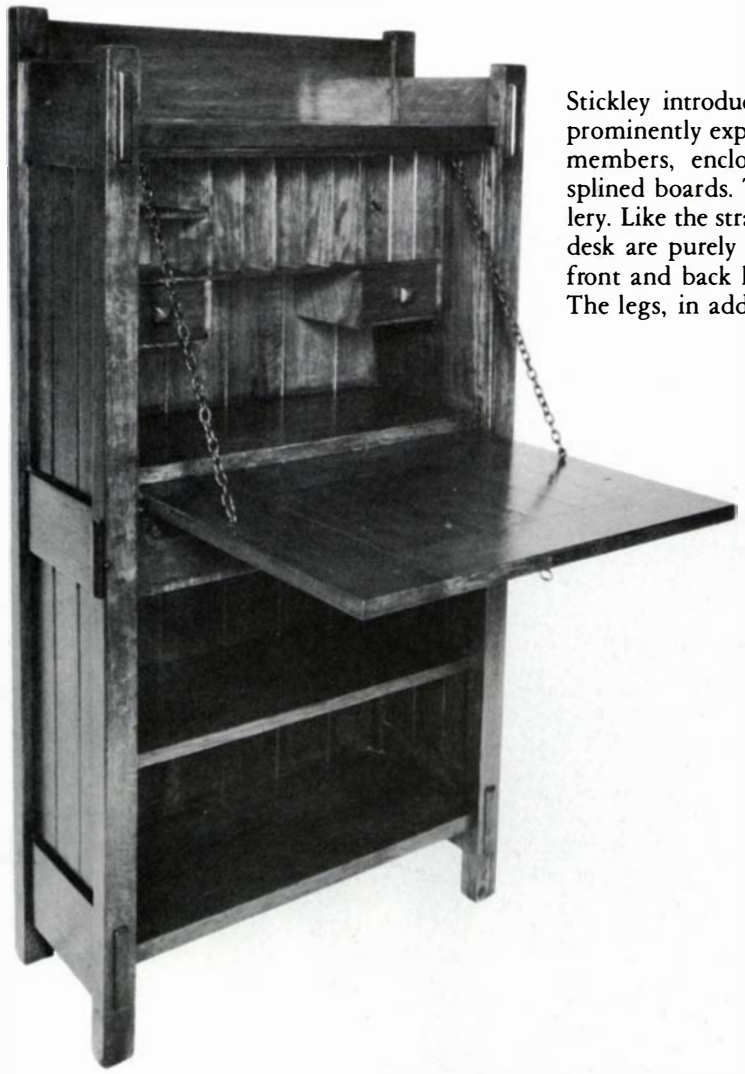
Photo: courtesy the Margaret Woodbury Strong Museum

Stickley's 1901 armchair, left, is straightforward, with practically no decoration. Stiles, rails and stretchers are pinned mortise-and-tenon, the tenons carried through in the larger members. The arms of the chair are little more than stretchers, evidence of Stickley's commitment to expressed structure, sometimes to the detriment of comfort.

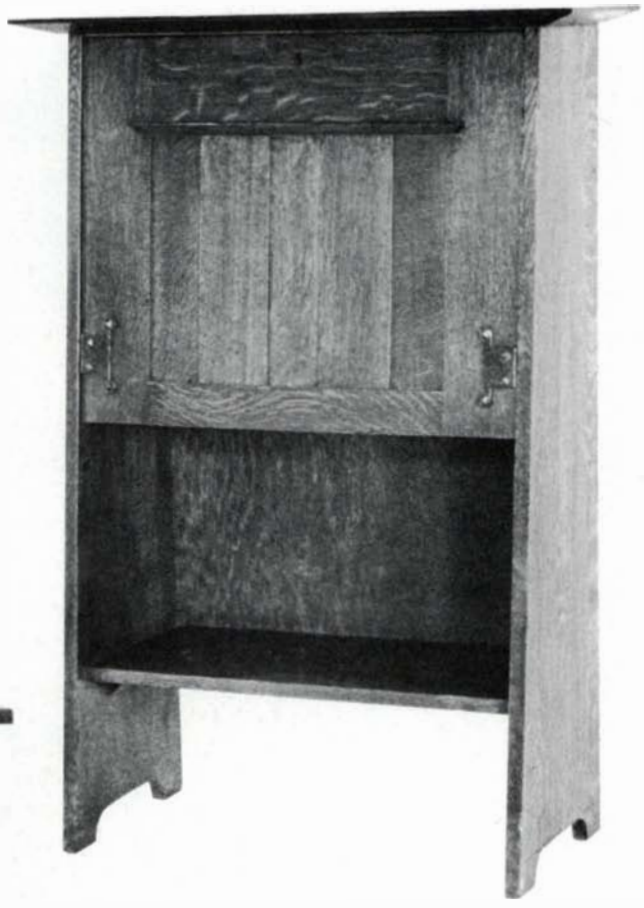
Ellis' chair, below, designed two years later, is also straightforward. But the scaling down of the members and the elimination of through tenons permits our attention to focus on the chair's form, a cube. Its severity is relieved by the comfortable cushion and the graceful, abstract inlays, set off by a grain-obscuring ebonized finish.

The Ellis sidechair, above, exhibits all the characteristics associated with Ellis' designs— graceful and delicate lines, a curved apron, tapering legs and a high back. Ellis had a superb eye for line, as his inlay shows. The pattern, a favorite, shows Mackintosh's influence. It is probably abstracted from floral or human form, and its termination, a torii, the Japanese gate form, reflects Ellis' love for Japanese art. After Ellis' death Stickley altered the stretchers, removed the top rail and sold this version as a standard item until he declared bankruptcy in 1915. *(continued next page)*

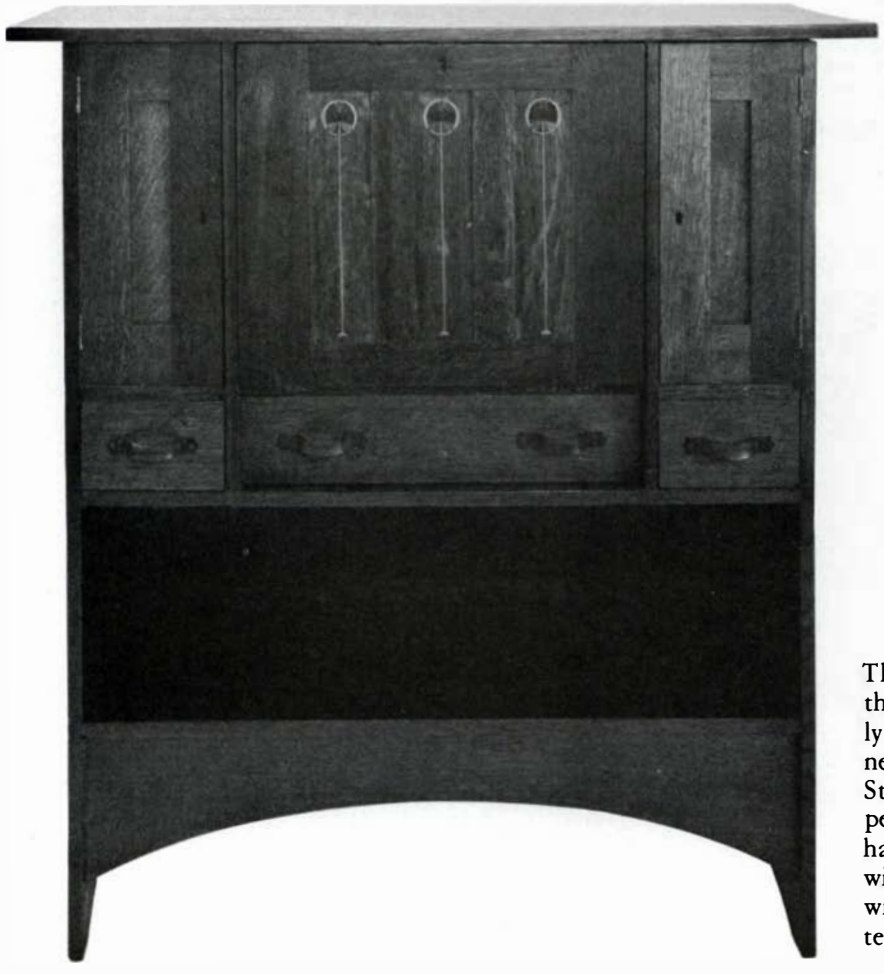
Photos: courtesy the Jordan-Volpe Gallery



Stickley introduced this desk, left, in 1901. It is absolutely rectilinear, with prominently expressed structural features. It is framed of massively overscaled members, enclosing panels assembled from chamfered, butt-joined and splined boards. The chamfering is echoed in the small door in the desk's gallery. Like the strap hinges and the chamfering, the decorative elements of the desk are purely structural, Large, double-pinned through tenons pierce the front and back legs, and stand slightly proud of the otherwise flat surfaces. The legs, in addition, rise decoratively above the line of the top rails.

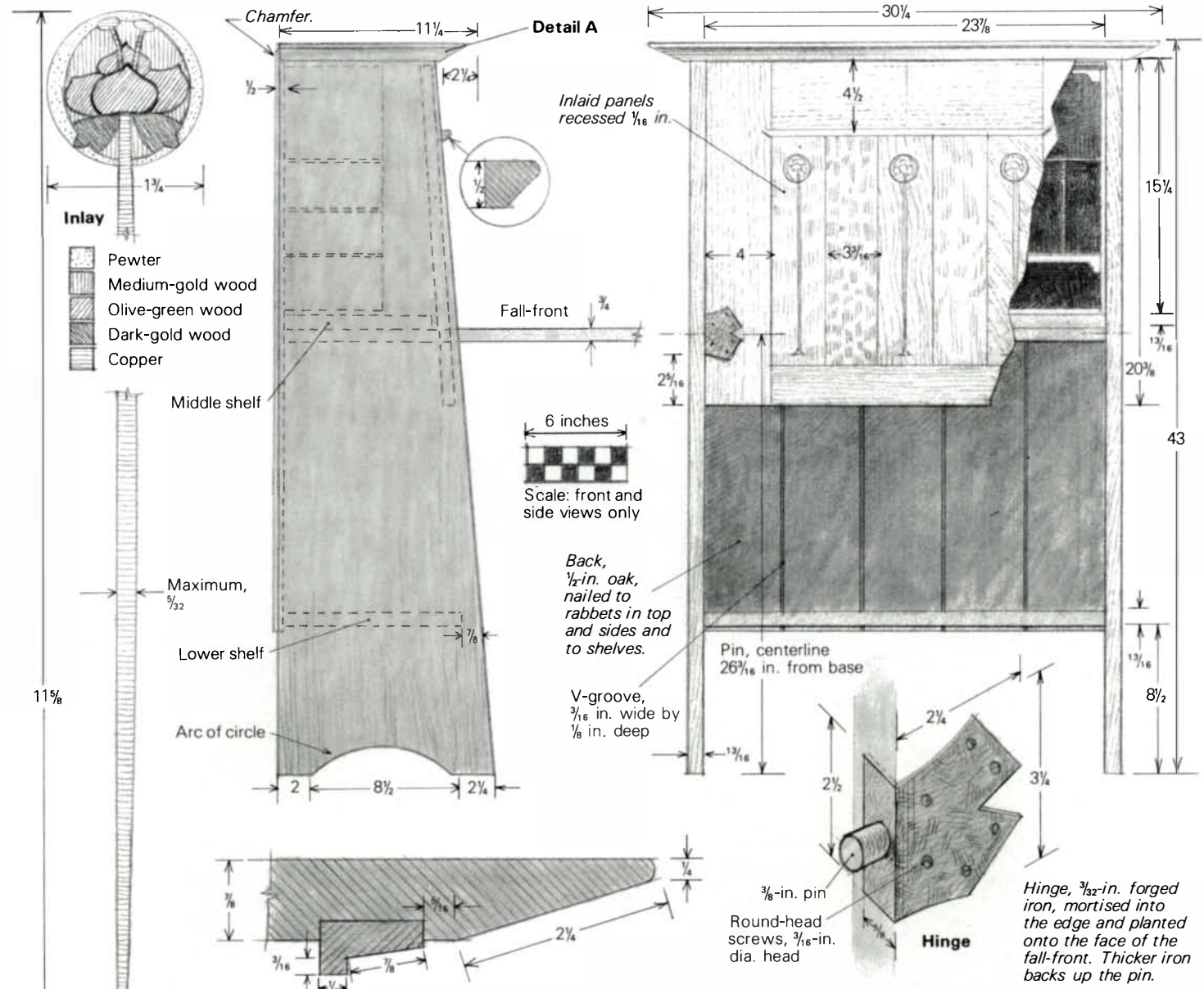


Ellis's desk, above, a 1903 design, is a marked contrast to Stickley's. Ellis has followed Stickley's dictate of simplicity, but has subordinated the structure to a refined, pure form with gently tapering sides and a wide overhanging top. The horizontal lip attached to the fall-front, which breaks up this flat plane and reiterates the shape of the overhanging top, might be said to violate Stickley's proscription against applied ornament. But it functions as a handle as well as decoration.



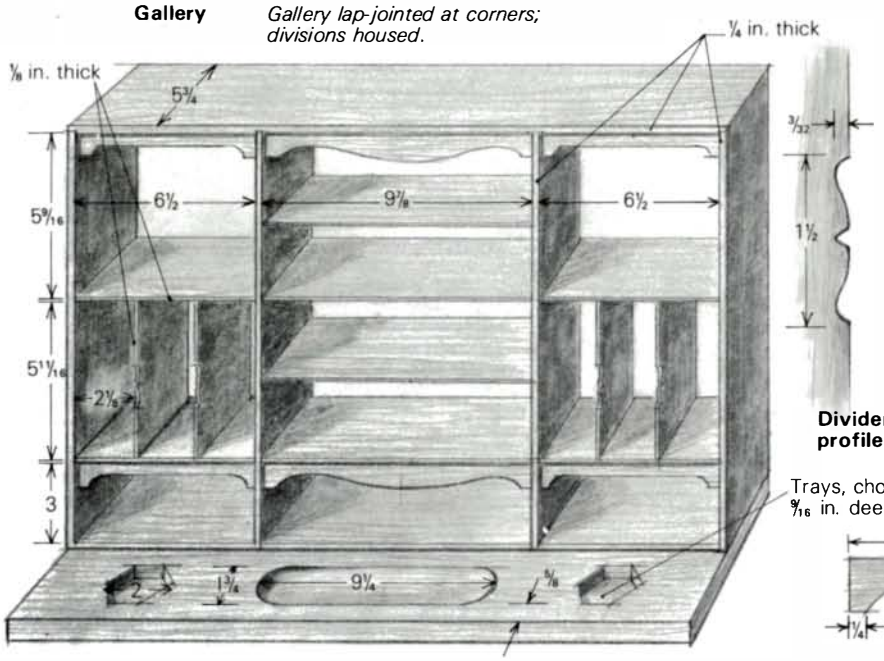
The fall-front desk, left, shows many of the features that Ellis introduced to Craftsman furniture. The deeply arching underrail gives this wide desk a sense of lightness that contrasts with the conscious sturdiness of Stickley's earlier designs. Gently rounded cutouts repeat this curve at the bottom of the plank sides. Ellis has replaced Stickley's expressed structural decoration with his own stylistic signature: the arching curves, the wide overhanging top, a paneled oak back and the attenuated inlay pattern.

Photos: H. Peter Curran, courtesy the Jordan-Volpe Gallery

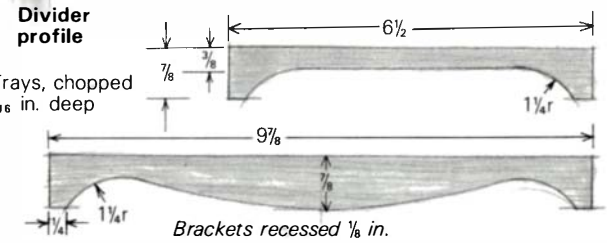


Detail A: Section through top

Gallery *Gallery lap-jointed at corners; divisions housed.*



Divider profile



Brackets recessed ⅛ in.

Writing desk by Harvey Ellis

Stickley made a number of desks according to this Ellis design, some with inlay, some, like the one at left, without. This small, simple desk is solid oak throughout, quarter or rift sawn for stability. The sides are tenoned (or sliding dovetailed) into a shallow dado running the width of the top, and stopped at the front. The shelves are similarly joined to the sides. The back, glued-up and nailed in place, makes the carcase rigid. The rails of the fall-front are mortised and tenoned to the stiles. The fall-front panels, glued to each other, are fitted tight and dry into grooves. The panels are flush with the rails and stiles on the inside writing surface.

Drawing: Roger Barnes

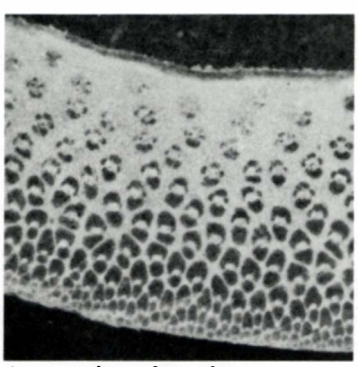
Fly Rods from Split Bamboo

With a hand plane and lots of gadgets

by L. U. Beitz

The anonymous craftsman who in 1859 tried fastening a split-bamboo tip to the butt of a hickory fishing rod started a revolution in rod technology and craftsmanship. Charles F. Murphy of Newark, N.J., soon became the first builder to make a complete six-sided split bamboo rod of Calcutta cane. Previous rods were turned and shaved from the springiest woods available: lancewood, greenheart, ash, hickory. They were heavy by any standard, up to 15 or 20 ounces, and positively limp compared with bamboo.

A typical flyfishing rod before bamboo was about 12 ft. long, consisting of two or three sections connected by thread wrappings or metal ferrules. The rod would have been turned round to about ¾-in. diameter just above the handgrip, and would have tapered smoothly to about ⅛ in. at the tip. When they discovered bamboo, last century's makers reproduced the shape of the rods they already knew. To do this, they split and planed Calcutta cane into triangular sections, tapering in length, then they glued the strips into a hexagonal shape. People tried turning the rods on the lathe to round them, but quickly discovered that turned rods lacked strength—the cane is weakest toward its pith, and every precious fraction of its outside surface must be conserved. You can't sand away protruding edges when you make fly rods. If you do, the rod will be stronger in one direction than in the other, resulting in an erratic action. For the tip of a fly rod, a four-foot sliver of bamboo has to be beveled to a perfect equilateral triangle, and tapered from ⅛ in. to 1/32 in. Then five other pieces have to match it exactly—all this using a material that, ounce for ounce, resembles wood less than it does steel (see Bamboo, p. 70).



Section shows fiber density.

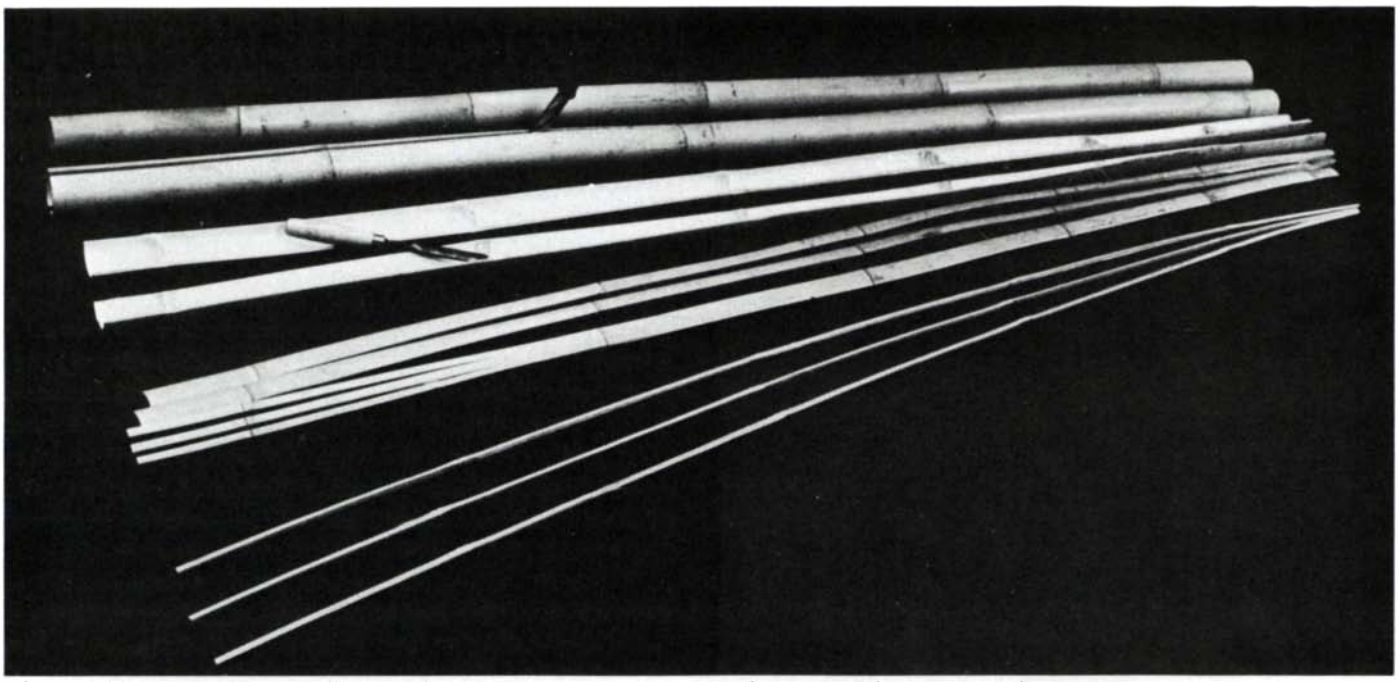
A fishing rod is basically a spring used to store energy. In spinning or baitcasting rods, the energy is transmitted to a relatively heavy lure that then pulls the light line from the reel. In flyfishing, however, it is the weighty line itself that is cast (almost like snapping a whip), and the nearly weightless fly goes along for the ride. A good caster is able to put as much energy into a long cast as he would into driving a railroad spike—just about all he has. Sometimes that's what it takes to get the fly to the wily trout. A thick rod suffers too much from air resistance. A weak rod can't store enough energy for decent casts—it merely breaks. The test of strength-for-weight makes bamboo the finest natural material for fly rods. Its only competition comes from man-made materials (fiberglass and graphite) that closely imitate its structure—long, stiff fibers in a binding matrix.

Rodmakers since Murphy's day have refined their techniques and their concepts of what a good fly rod should be. The old rods were long: 12 ft. to 15 ft. was not uncommon. Length, in a wooden rod, compensated for weakness—if you couldn't make a long cast, the rod got you halfway there anyway. The early bamboo rods were nearly as heavy as wooden ones. They were way overbuilt, but fishermen took generations to get used to a weak-looking rod. Toward the end of the century, progressive makers (Hardy in England, Leonard in America) introduced lighter and shorter rods at every opportunity. Then Tonkin cane replaced the weaker Calcutta cane. By the mid-forties, fifties, and sixties, master rodcrafters and designers such as Everett Garrison, "Pinky" Gillum, Lyle Dickerson, George H. Halstead and Jim Payne, were making the finest rods ever produced in the world. Their rods are now collector's items, selling for four figures. About a dozen companies are still engaged in bamboo rodcrafting. Although their output is excellent in quality, many people have had a hand in the making of each rod. Some of these production rods are priced in the $500-$600 range. Today, a few dedicated builders carry on the tradition of the hand-split, hand-planed, precisely balanced split-bamboo fly rod. In this article I'll describe the building of such a rod. I've included the taper specifications of a rod by Garrison, from which I made the 7½-footer shown along the bottom of these pages. At the end there's a source list for the materials and equipment you need to try these methods yourself.

Selecting and splitting the cane—Let's start building a two-piece (butt and tip), 7½-ft. fly rod, plus an extra tip. Alternate use of two tips prolongs the life of the rod, and if one tip is damaged while fishing, the angler isn't cast adrift.

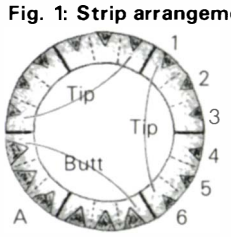
The Tonkin cane pole, or culm, runs a standard 12-ft. length, with a diameter of 1¾ in. to 2½ in. Its nodes—humpy rings around the circumference—are closer together toward the bottom, about 10 in. apart, spreading to near 16 in. at the top. It is from the thin-walled top that we plot out the

Author's 7½ ft. split-bamboo fly rod shown actual size, with ebony ferrule plug.

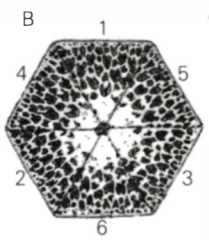


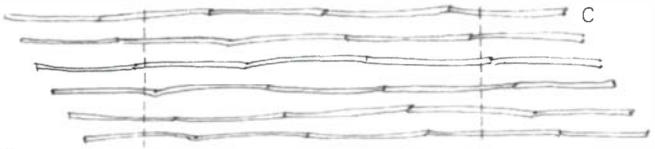
The long fibers in Tonkin cane allow it to be split into many narrow strips that retain lightness, strength and resiliency.

Fig. 1: Strip arrangement



A. To arrange the strips that will become the finished rod, split the culm into at least 18 pieces (dotted lines), choosing pieces for each butt and tip section from adjacent parts of the culm. Tapered triangular strips will be planed from the dense outer part of the culm.





B. Strips will be alternated for balanced action in the glued-up rod. C. Stagger the brittle nodes to avoid weak spots, then trim rough sections to length before filing and planing.

sections of a 7½-ft. rod. The stouter end can be used for making an 8-ft. or 8½-ft. fly rod; these use thicker strips.

Saw the 12-ft. culm into two 6-ft. lengths. Put aside the thicker piece and place the other piece on the bench to be split up. We'll aim to split strips the full length of the piece, and it's not hard to do—the fibers run very straight.

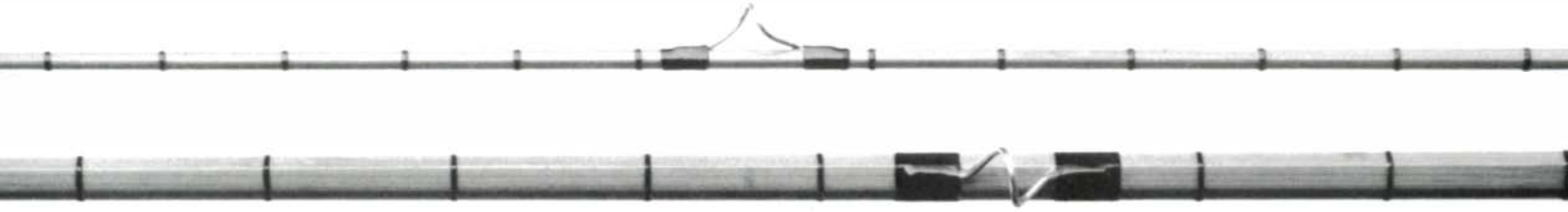
Study the culm carefully, planning to avoid scuffs, scars, water stains and other imperfections. A few minor water blemishes are bound to show up, since only one culm in a thousand is absolutely perfect in all respects. Look for an overall light-straw color. Greenish culms, or deep yellow ones should be allowed to season several months longer.

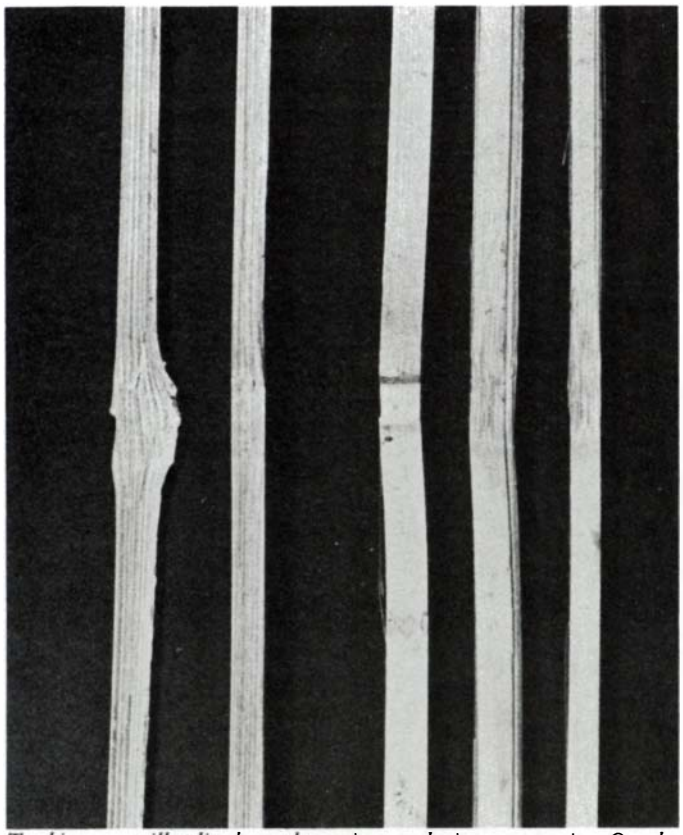
Now using a stout knife split the culm down its length into halves, starting at the thicker end. Be careful—bamboo edges can be glass-sharp. Along the U-shaped split half, at each node, is a solid interior wall or dam which must be cut out with a gouge before further splitting. After you've leveled the inside of the culm, split each half into three preliminary pieces, each about 1 in. wide. Then split each of these 1-in. pieces into three or four strips—you'll need at least 18 good strips for the three rod sections. These strips are considerably wider than they will be after planing. Because the culm structure varies slightly in density around its circumference, number each strip so you can make each rod section from adjacent parts of the culm, as shown in figure 1A. To even out irregularities and keep the rod's action uniform, strips that were adjacent in the culm should be placed opposite each other within each rod section (figure 1B).

Next, stagger the nodes. Lay the six strips that will comprise the tip section of the rod in their proper sequence on the bench. The first strip stays put. Move the next strip about 2 in. along the length of the first. Shift the following strip another 2 in., and so on (figure 1C). This will stagger the nodes in a helix along the finished rod. Check the positions of the nodes along the entire length of the tip. If any are too close together, move the strips a little to balance them out.

Now mark and cut all the wood to length. Cut the 12 strips for the two tip sections to 47 in. long, the butt strips to 46½ in. These lengths allow 1 in. to be cut off each end after the strips have been glued together.

Filing and straightening the nodes—The 18 split strips are considerably oversize at this stage. Before proceeding with the planing, we must remove the bumps at the nodes. To flatten the nodes, place each one in a metal vise and file it down level with the enamel on the outer surface of the cane. The upper





Tonkin cane will split along the grain, producing wavy strips. On the left is the side view of a node as split from the culm. The second piece has been leveled inside and out. To maintain fiber continuity, split the culm (third piece, enamel face), file the nodes level with the surface of the enamel (fourth piece), then heat-bend the strips over an alcohol lamp until they are straight (far right).

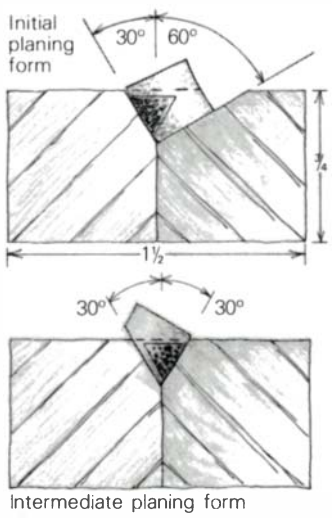
Bamboo

Bamboo is technically a grass—and the fastest growing plant in the world. Researchers have clocked some of the Orient's 1250 species at a growth rate of nearly 4 ft. a day. The type used for fly rods *(Arundinaria amabilis)* is cultivated on high, windy bluffs where a less hardy plant would fail. It grows hollow, its ¼-in. walls reinforced by solid plugs every foot or so at the nodes. The 3-in. diameter stems break through the ground and shoot up to 40 ft. tall in just two months. After this initial spurt, the walls toughen over the next 5 or 6 years until they are densely packed with long, resilient fibers. If you break a piece of high quality bamboo, the fibers will stand out in a bundle of 6-in. lances. Poor quality bamboo breaks leaving fibers only half-an-inch long. The growing conditions are part of the difference, and nowhere are they better than in a 25-sq. mile area around Tonkin, China. Tonkin cane is currently available after a 50-year hiatus in trade with China. While synthetics such as fiberglass and graphite fiber may match its lightness, stiffness and strength, they can't match the beauty and traditional appeal of Tonkin cane.

surface is now level (as shown in the photo, left), but the strips are not yet straight. Straightening the nodes is not easy, but it's critical—we want the longest fibers possible in the finished rod. If you leave a little crook or bump in the node area, the plane will rip the fibers there, undercutting the cane, which will weaken the finished fly rod.

We straighten the strips over an alcohol lamp, wearing gloves. At each node, hold the concave underside of the strip over a low flame until it becomes pliable. Then you can bend it straight. Easy does it. Too much pressure or too little heat will crack some of the fibers in the strip. The flame may scorch the underside, but these areas will be planed away.

Preliminary planing and removal of enamel—Each strip must now be planed to a tapered triangle. We use two planing forms. The first, shop-made from hard maple, has a 90° V-notch, oriented 30° to one side, 60° to the other. This V will hold a rectangular strip with its enamel side down, so a 60° angle can be planed on one of the inner sides. Don't plane the enamel face. It is the strongest part of the cane and it must be conserved. When you've planed one side of the strips to 60°, they're ready for another planing form, this one with a 60° V-notch. You can make a 60° wooden form. The easy way to do this is to joint two 1-in. by 2-in. maple boards (5 ft. long, more or less) and then bevel them to the correct angle on the jointer. Place these beveled edges together to form a V-groove. Then taper the edges of the boards until the groove has the correct size and degree of taper. The width of the faces on each strip should conform to column C in the rod-taper chart (p. 73). Fasten the boards together, and you will have a non-adjustable form—good for a rod or two. This form is so easy to make that you might as well make a few of them in graduated sizes, saving the most precise form for those last few strokes with scraper or plane.



Intermediate planing form

Instead of a series of wooden forms, I now move over to the same adjustable machinist-made form that I use for final planing. I set it wide enough to give the strips good support. Place a strip, enamel face down, snugly in the 60° V-notch and plane a 60° angle on its other inner side. Then turn the strip in the form and lodge it with the enamel surface up. We want to remove as little as possible from the enamel face, but we have to true it so it registers in the form. Using a scraper (since the plane would remove too much material) take two or three passes to remove the thin layer of enamel, making the surface true and flat and bringing out the nice grain beneath. There will be no further scraping or planing on this surface.

Binding and heat-tempering—When you've planed the sides of each of the 18 strips down to approximately 50% larger than the rod designer's specified tapers, they're ready for a heat treatment to dry and toughen the cane's fibers.

The six-strip sets for each of the three rod sections (one butt, two tips) are nestled into shape, then tightly wrapped with cotton twine by a binding machine—this will keep them from warping when they're in the tempering oven. The binding machine operates by means of a stout linen cord wound into a double loop over the hex section, as shown in figure 2. A weight suspended from a pulley provides the proper tension, a couple of pounds. Turning the crank moves the rod section along a cradle. Cotton cord, feeding off its spool through a tension device, wraps around the hex in a spiral for the full length of the section. When you reverse the linen loop you get a snug criss-cross wrap.

After the three sections have been bound, they're heat-treated in an oven to temper the bamboo and increase its resilience. My oven is a length of heavy-gauge aluminum pipe with a perforated propane-fueled gas pipe underneath. The three rod sections are placed inside and rotated by a small rotisserie motor. The sections cook for two hours at about 350°F. Then they're turned end-for-end for another two hours. The once-tight binding is now quite loose, because the cane has shrunk from moisture loss.

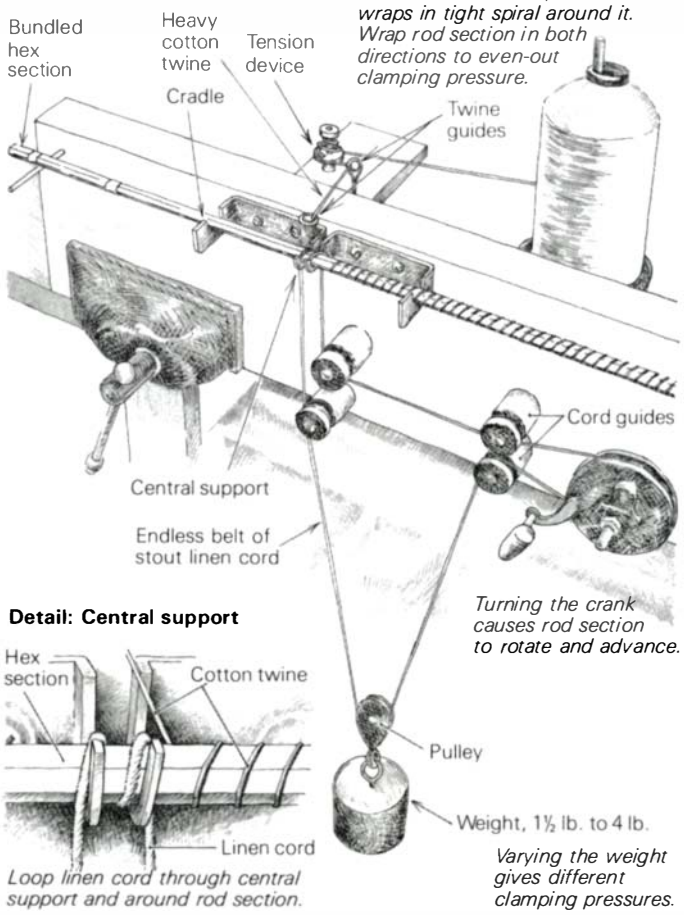
Final planing—With the binding removed, the 18 strips are ready for final planing. My final planing form, made of twin steel bars, as shown in the photo on the following page, has screws set every 5 in. One-eighth turn of a screw opens or closes the notch 0.001 in. A 30° angle on the inside edge of each bar forms the required 60° V-notch. The angles are machined on both top and bottom of the form—one for thin tips, the other for hefty butt sections.

I start with the screws of the form adjusted larger than the final taper specifications. I gradually plane the sections, still oversize, to their required taper, alternating the two inner faces. I prefer to begin with a Stanley No. 60 low-angle plane set to take a 0.004 in. or 0.005 in. shaving. Measure the shavings with a micrometer—you want to know how much bamboo you're removing with each pass. Keep the plane level with each sweep to maintain a perfect triangle. Flip the stock between every couple of passes.

You will note that the strips are becoming quite flexible when they are bent in one plane (perpendicular to the enamel face), yet are much stiffer when bent sideways. The hexagonal glue-up will maximize this directional stiffness.

The strips will still be considerably oversize. What we are aiming for is not the final size but the correct taper, so we can take full-length passes. When the taper is right to within 0.010 in., go to a precise plane such as the Stanley No. 9½. This tool, like the low-angle plane, must be razor sharp. Taking off shavings of 0.002 in. with each pass, work each strip down. It's a slow process. Check each strip frequently with a micrometer, as you plane the bamboo down closer and closer

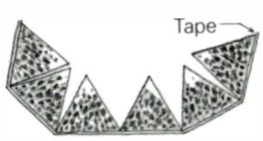
Fig. 2: Rod-wrapping machine



Drawings: Christopher Clapp

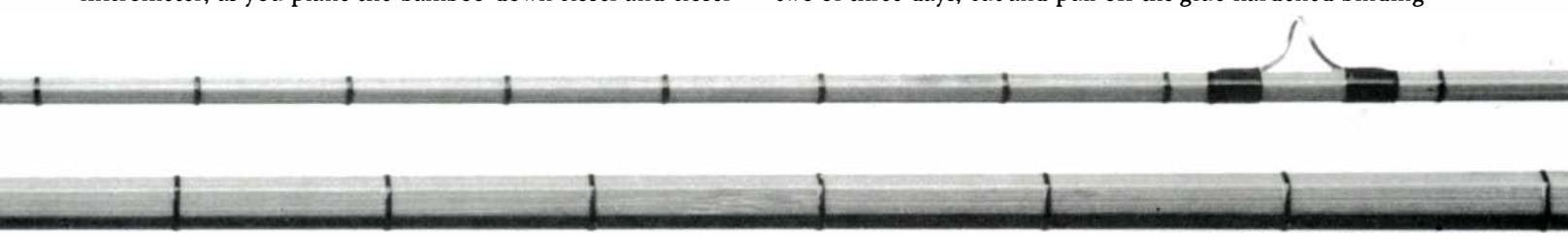
toward the perfect taper. Perfection is when each strip conforms precisely to the design at every 5 in. along its length.

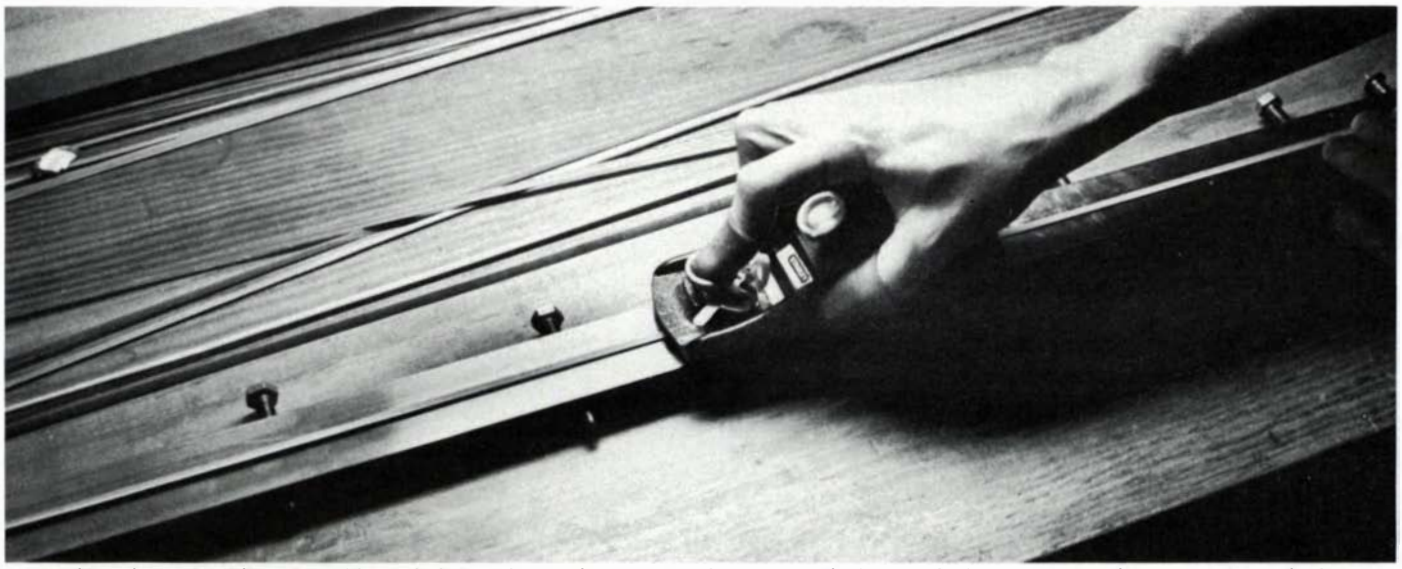
Gluing—Now bundle the thin strips together in proper order, and bind the sections with masking tape every 10 or 12 inches. Using a razor blade, cut each tape so the hex can be opened up and spread apart on the bench. Saturate the exposed edges with strong waterproof and heat-resistant glue, using a wide bristle brush. I use Nelson's Urac 185 or Elmer's resorcinol glue. A 7½-ft. rod with an extra tip will show more than 60 linear ft. of glue line. The Urac formula is honey-colored and thus invisible. The Elmer's will leave a purplish threadline joint.



With glue applied to all surfaces, fold the strips back into their hex shape (the tape indexes them) and wipe off excess glue. Then re-bind the section with the wrapping machine and wipe off as much squeezed-out glue as you can. Before hanging the section up to dry, hand-twist out any curves to minimize the final straightening procedure later on.

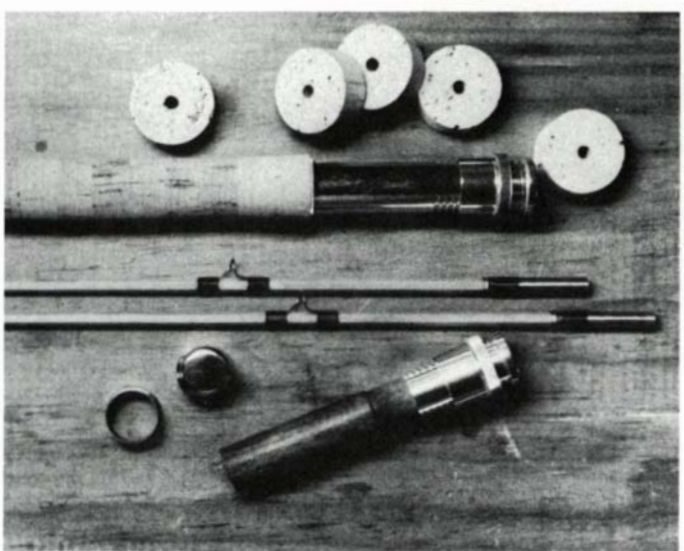
Filing and sanding—After the glued sections have cured for two or three days, cut and pull off the glue-hardened binding





A machine shop made this adjustable steel planing form. The top side is for rod tips, the bottom for butts. Turning the screws adjusts the form to 0.001-in. tolerances at 5-in. intervals along its length.

Heat from an alcohol lamp softens the bamboo fibers and allows rod straightening. Keep the rod moving to avoid scorching it.



Cork rings, reel seat, mesquite insert, and butt cap, together with a finished rod grip that has been turned to shape.

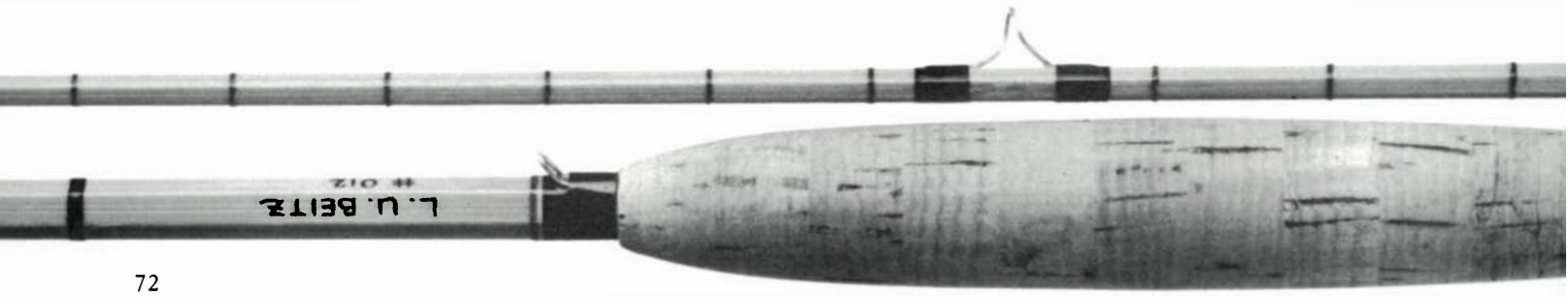
cord. With a smooth file, clean off the bumps and humps of remaining glue. But remove only glue residue, don't disturb any of the cane surface. Take care to file flat and not to round any edges off the hex. The butt is fairly easy to file, but filing can be mighty tricky on the last 15 in. of each tip, where the diameter goes down to 0.063 in.

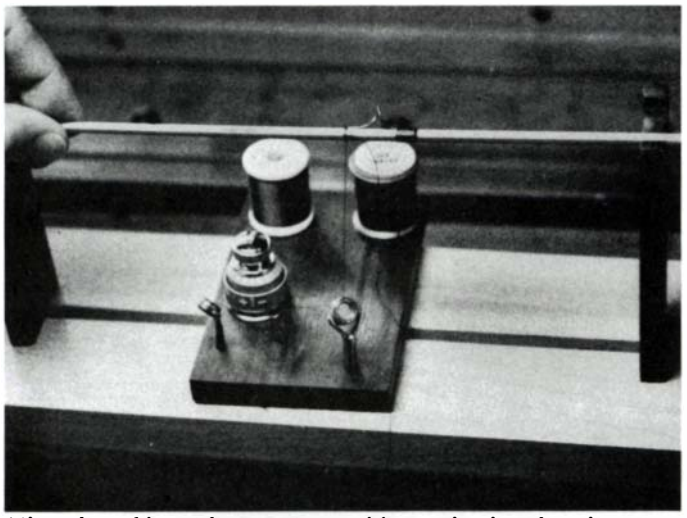
Now run a sanding block with 400-grit sandpaper over each surface. Finish up with 600 grit. When I have completed this painstaking business of filing and sanding one of my rods, I usually knock off for a day or two and go fishing.

Final straightening, fitting of hardware and reel seat—Now sight down each of the flats for any bow, curve or twist. Over the alcohol burner, heat the cane where it requires corrections, moving the section actively to keep from scorching it. When cane and glue become pliable, crooks and curves can be eased straight. This trick also works to straighten older rods that have gone out of shape.

To mount the nickel-silver ferrules that will connect the rod sections, round off the edges at the end of the hex in the lathe. Removing too much bamboo will result in a weak point in the rod, so don't use too small a ferrule size. You want a pretty tight slip-on fit. Glue the ferrule on with a five-minute epoxy, which sets with slight expansion. Handgrips are made from cork rings that can be bought with various sized holes through their centers. Boil the rings to soften them, slide them up the butt section, and glue them together. When they have dried, turn them down on the lathe to shape. Then fit the reel seat and its wooden sleeve insert (I use mesquite).

Wrapping of guides, varnishing—Well, you now have a handcrafted split-bamboo rod blank. All that's needed for completion is to wrap on the line guides, install a tip-top guide on each tip and varnish the cane. Most commercial rods use strong but bulky nylon for wrapping, but a fine split-





This adjustable guide-wrapping tool keeps the thread at the proper tension. Turning the rod produces a silk-smooth wrapping that secures the guide. The wrapping will be varnished for protection.

bamboo rod calls for traditional pure silk. A rod-wrapping tool, which works like a simplified, finger-powered version of the binding machine, keeps the correct tension on the thread by means of a clutch or by the pressure of a spring against the spool. The rod section is turned against this tension until each guide is snugly wrapped in place. For the sake of tradition, I've added decorative intermediate windings between the guides on this rod—they are not necessary for strength.

After you have wrapped the guides along the rod section, at appropriate intervals which you can judge from the full-size photograph, treat the silk with a coat or two of color preserver to prevent its darkening when it's varnished. Then clean the bamboo thoroughly. It is traditional to write the maker's name, the rod length and the weight line for which it was designed on the flats of the shaft near the grip. Use permanent India ink; the rod may last a hundred years.

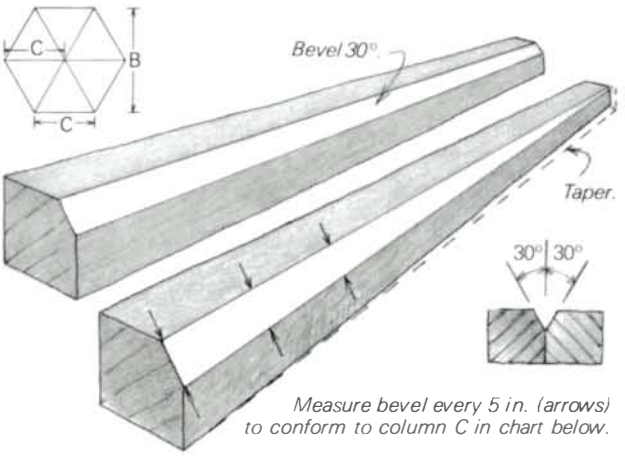
Varnishing is another meticulous job and must be done in a warm, dust-free room. I use tung-oil varnish and red-sable brushes. While the varnish is drying, I make a ferrule plug to keep the female ferrule free of dust or dirt when the rod is not in use. I use ebony, but any hardwood will do. Turn a 2-in. long, ⅜-in. sq. piece to about 1/32 in. less than the male ferrule, leaving a larger decorative knob on one end. Then glue on a ½-in. wide cork ring to the part that will fit into the female ferrule. When it's dry, turn the cork to the exact size of the ferrule, and cut off the excess wood.

In between coats of varnish (three or four coats applied over a span of some six or eight dry days) you can sew a cloth sack partitioned to fit the rod sections. An aluminum tube for storage and travel will protect your work. □

Les Beitz makes split-bamboo fly rods in Austin, Texas, researching and working from rod specifications that were developed by the craft's most notable designers. He spends about 95 hours working on each $600 rod.

Photo: White Light Studios

Forms, tapers and materials



Measure bevel every 5 in. (arrows) to conform to column C in chart below.

To make the tapered planing form, square-up and joint two hardwood pieces. Bevel a corner of each piece to 30° for its full length. Then taper one face of each piece, so the bevel will match column C in the rod-taper chart. Fasten the pieces together to form a tapered V-notch. Several graduated sizes can be made for planing the rough bamboo to final size.

Rod taper specifications:

Below are the measurements for the fly rod that appears full size along the bottom of these pages. It is a medium Garrison pattern, designed for a No. 5 line. The intermediate silk windings between the guides on the L.U. Beitz rod are decorative and optional.

—Column A measures inches from the tip to the butt.
—Column B is diameter of the rod from face to face.
—Column C is the width of the bevel in the form.
—Ferrule size is 13/64 in., and the guide spacing may be judged from the photograph.

Tip Section			Butt Section		
A	B	C	A	B	C
0	0.063	0.036	50	0.206	0.119
5	0.078	0.045	55	0.220	0.127
10	0.100	0.058	60	0.233	0.134
15	0.117	0.068	65	0.247	0.143
20	0.131	0.076	70	0.260	0.150
25	0.144	0.083	75	0.275	0.159
30	0.156	0.090	80	0.306	0.177
35	0.168	0.097	83	0.309	0.178
40	0.181	0.104	90	0.317	0.183
45	0.194	0.112	No. 4½ top guide		

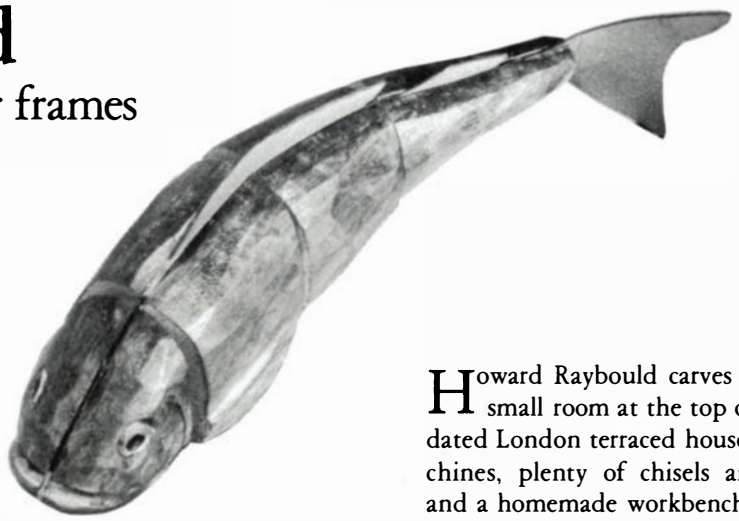
Sources:

- □ **Tonkin cane culms:** Charles H. Demarest, Inc., 45 Indian Lane, P.O. Box 67, Towaco, New Jersey 07082.
- □ **Steel planing form and binding apparatus:** Hoagy Carmichael, Cliffield, Indian Hill Rd. Bedford, N.Y. 10506.
- □ **Reel seats, ferrules, aluminum tubes:** Rodon Manufacturing Co., Inc., 123 Sylvan, Newark, New Jersey 07104.
- □ **Guides, tip-tops:** Perfection Tip Company, 4550 Jackson Street, Denver, Colorado 80216.
- □ **Silk thread, cork rings, color preserver:** E. Hille, The Anglers Supply House, Inc., P.O. Box 996, Williamsport, Pennsylvania 17701.
- □ **For further reading** about rodcrafting and Everett Garrison's influence, see Hoagy B. Carmichael's *A Master's Guide to Building a Bamboo Fly Rod*, 1977, from Martha's Glen Publishing Co., Katonah, N.Y. 10536.
  For the views of an innovative fisherman/rod-designer with tournament flycasting in the back of his mind, read Charles Ritz's *A Fly Fisher's Life*, 1979, Max Reinhardt, London.

Howard Raybould

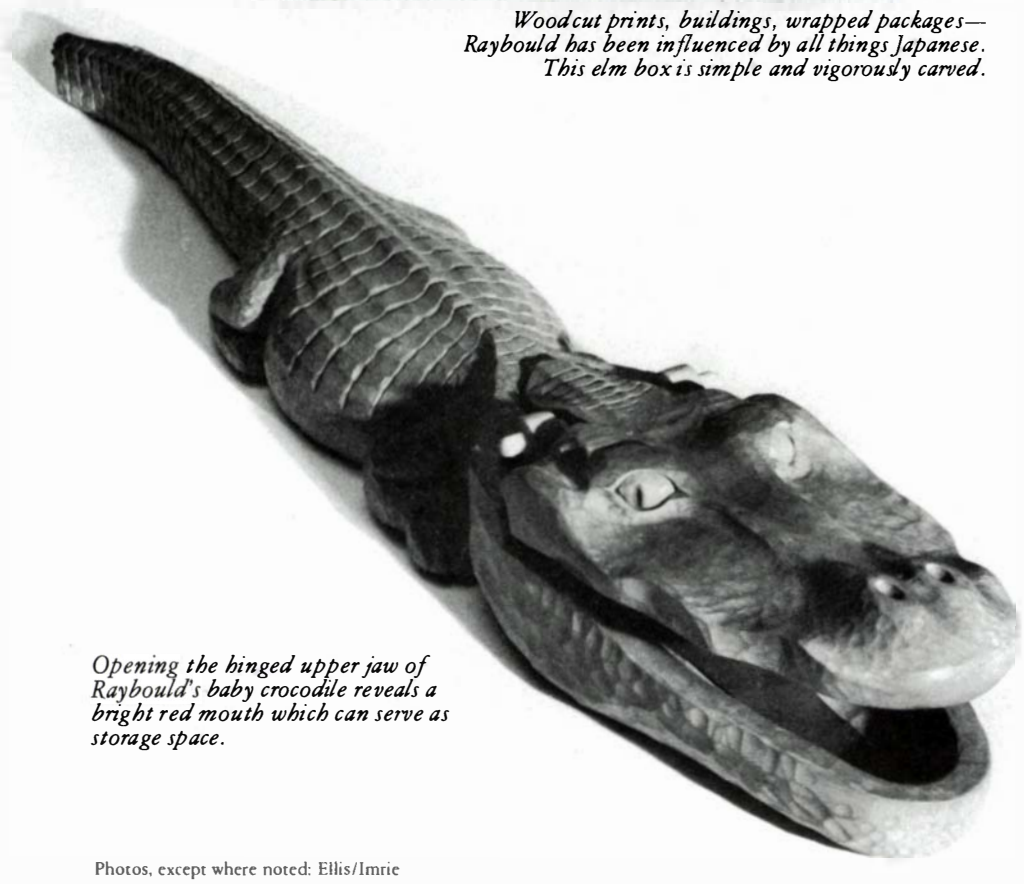
Ornamental carver of mirror frames and crocodiles

by Tony Taylor



The wiggly body of this little fish is chamfered to allow for movement and then painted iridescent blue, shading into red. The body segments are glued to both sides of a leather spine that also forms the fins and tail.

Woodcut prints, buildings, wrapped packages—Raybould has been influenced by all things Japanese. This elm box is simple and vigorously carved.



Opening the hinged upper jaw of Raybould's baby crocodile reveals a bright red mouth which can serve as storage space.

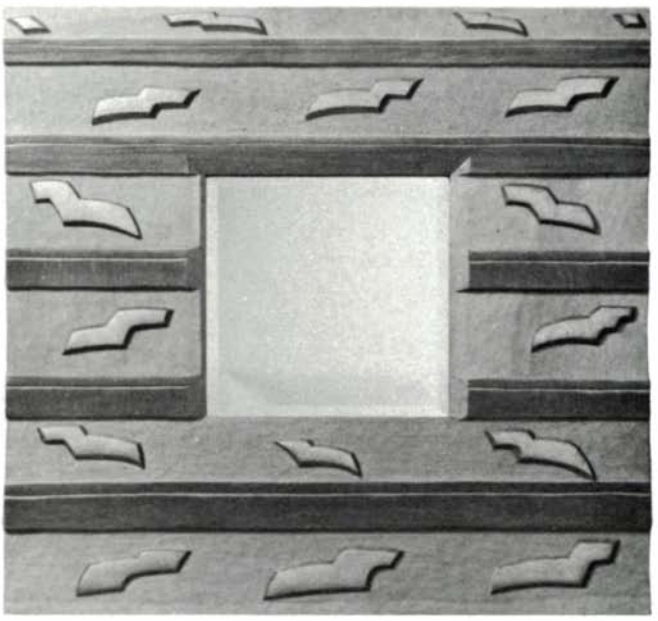
Photos, except where noted: Ellis/Imrie

Howard Raybould carves wood in a small room at the top of a dilapidated London terraced house—no machines, plenty of chisels and gouges and a homemade workbench. In just a few years, Raybould, 35, has also carved a comfortable niche for himself in the world of British craft, earning a place on the Crafts Council index, receiving a Churchill Fellowship (which he used for travel in Japan) and teaching around the country. A 1978 exhibition, "The Framing of Howard Raybould," enlarged his appreciative, if somewhat bemused audience, and mirror frames have replaced architectural carving as his bread-and-butter work.

Why mirror frames? "Makers are makers because they stop and look and think," he explains. "You say to yourself, 'I don't like this, I think I can do something better.' That's how I started doing mirror frames."

He doesn't fuss over construction, assembling the yellow-pine frames with simple lapped or mitered joints. Then the carving starts. Raybould may use a repeating pattern, or he may go for a pictorial approach, carving the sides of the frame into hanging curtains or the intertwining branches of two trees. Whatever image he carves, he usually heightens the texture by staining or painting areas in soft pastel colors. His objectives are uncomplicated. "I just try to capture something that feels good," he says. "The frame should match anything in the room without being overpowering, it's got to be active and passive at once. There is endless variety in this limited form." Raybould often turns to boxes and toys. His toy crocodiles are lifelike, bright green and playfully threatening; his colorful snakes and fish come with bodies articulated to slither or swish.

Raybould learned traditional carving skills working for a firm of architectural carvers following his graduation from art college. He grew dissatisfied with the formality and convention of tradi-



Raybould's mirrors can be subtle, blending pattern, texture, color and simple shapes, as in the square mirror, right. Or they can be more elaborate and whimsical, as in this circus tent bathroom mirror.

tional carving, and in 1974 he left the firm to develop a style of his own. He wanted to express himself through his work. His sources of inspiration are wide ranging: architecture, sculpture, textiles and travel. He has a sharp eye for detail, pattern, color and texture, the elements of ornament and decoration, the carver's stock in trade. At first glance, his work may seem jokey, almost amateurish. A second look reveals careful carving, skill and taste. His pieces are amiable and positive.

Agreeing with William Morris, Raybould believes that decoration should give pleasure in the making as well as in the use. Carving, he says, adds something individual to a piece, something decorative and personal. "I think we've got a bug about ornament," he adds. "We tell ourselves it's superficial, or that the Victorians overdid it, or the Shakers did without it. We're confused about the whole thing. If you're going to do, let's say, 18th-century ornament it will look terrible, unless you're as good as the 18th-century craftsman. But if you take ornament and try to relate it to the age you're living in or to the function of the object you are making, then it might look all right. It must be integrated. And for me this means it must be personal."

Raybould nodded toward his sunlit window. "In one sense carving is all about organizing light and shadow, but ultimately carving is feeling, ornament is emotion." □

Tony Taylor is a joiner and furniture-maker living in London.

Raybould's tiny workroom is well-stocked with carving tools. The fish, about ready for painting, is made of jelutong, one of the soft, easily workable woods that Raybould prefers.

Stereo Equipment Cabinets

Take the heat off your audio gear

by Carl Spencer

Housing audio and electronic equipment in specially designed casework is not a new idea. Thomas Edison's first commercially available phonographs came complete with their own wooden cases, and even Marconi's early radio sets had their own boxes. The casework was originally devised to protect the fragile gear from damage, and the consumer from electric shock. Retailers quickly learned that the appearance of the package was often more of a selling point than the sound of the equipment.

RCA

This RCA record player/radio combination was a forerunner of modern audio equipment cabinets. This cabinet, constructed of veneers and solid wood, was closed up to hide and protect the electronics.

Even today there is lively competition at antique shops for the beautiful old AM-shortwave radios from the 1920s and 1930s. That some of the old radios still operate is only a portion of the appeal. Modern stereo furniture—for which there is a growing market—has its roots in the prepackaged high-fidelity consoles first marketed just before World War II. With the advent of FM radio and stereophonic sound, the console became common in the American home. By the 1950s, the console had evolved into a tuner, phonograph, amplifier and two speakers all permanently installed in a single wooden cabinet that fit the decor of the day. Many even incorporated television sets. Consoles remain popular, probably because they combine and conceal, with a minimum of wires and controls, what some people see as unsightly and confusing equipment. The console's advantage, an all-in-one package, proved to be its weakness as well. If the amplifier or the television died beyond repair, one could only replace the entire unit or limp along indefinitely with half of an entertainment system. Some old consoles could be retrofitted with new gear, but variation in case construction and proportions made that remedy costly in money and trouble. The console's shortcoming teaches a valuable lesson to the designer of modern stereo cabinets: good casework will outlast the electronics, so it makes sense to design for equipment changes.

By the 1960s, "component" audio systems confronted consumers with more storage problems. The audiophile could buy separately the best amplifier, tuner, speakers and turntable—each from a different manufacturer. While some people didn't care about the resulting tangle of patch cords, others wanted their systems to look as neat as the old consoles did. Thus the modern stereo cabinet industry was born.

The early 1970s saw a resurgence of the console approach as stereo "racks" began replacing the cinderblock and pine board shelving that had been pressed into service by early component fans. The racks were supports that organized the equipment with maximum exposure—for better or for worse. Little attention was paid to good equipment placement, tidying up the wires, or dustproofing and ventilating the electronics. The racks were more attractive than boards and bricks but still offered little protection for sensitive equipment. As the "baby boom" kids of the 1950s began having their own children, they found that nothing can so thoroughly devastate a phono stylus or decorate a room with yards of magnetic tape quite like a two-year-old. Audio equipment also needs protection from thieves; it is easily stolen and resold. Equipment racks are simple to spot in a room, and some even have casters. A burglar can just unplug the system and roll it out to the trunk of his car—a perfect 60-second crime.

The problems of designing cabinets for stereo components can be solved in ways that improve the appearance and function of the equipment while protecting it from children and thieves. Wires can be run out of sight, panels can be installed for dustproofing and ventilation, and all of the equipment can be housed in attractive cabinetry that permits quick changes when the system is replaced or updated.

Case design and equipment placement—The shape and style of stereo casework is up to the aesthetic bent of the client and the maker. Vertical designs are generally superior to the traditional horizontal layouts. Few people "drive" their audio gear like a car, nor do they sit in front of it while using it. Adjustments are made after the listener has walked up to the equipment so it is sensible to assume the user will be standing. Vertical formats are also less expensive to build: there is no finished countertop to add to the carcase.

Heat is the bane of electronic gear, and ignoring it can shorten the life of expensive systems. Always locate the receiver, amplifier and other heat-producing components near the top of the case. This keeps the rising heat away from the other units, and also puts the various scales and controls at eye level, easy to read. Other frequently adjusted equipment that can be set by ear or by feel can be mounted wherever convenient. If the system you are housing has both amplifier and tuner, mount the tuner below the warmer amplifier. Some systems use preamplifiers and they ought to be mounted below but as near to the main amplifier as possible. This will ensure short patch cords and a clean signal between the units. Some systems solve this three-component problem by combining all three units in a receiver. If so, the receiver should be mounted above the other units.

Turntables should be as close as possible to waist height. Mounted too low, one's view of the turntable is blocked by

the shelf above it, making it difficult to put a record on the spindle. If it's too high, the oblique view makes it equally hard to operate, and the inevitable result is scratched records. Leave enough room for opening the turntable dust cover if you mount it on open shelving. Never put turntables on pull-out platforms. Turntable designers go to great lengths to produce balanced, vibration-free equipment. The sloppiness in even the best ball-bearing drawer slides will defeat this sophisticated engineering for which you've paid so dearly.

Cassette recording decks are available in both front-load and top-load designs. They should be mounted as near to eye-level as the case and amplifier placement permit. If frequent taping of records is anticipated, the deck could be placed on a fixed shelf at the same level as the turntable.

Televisions complicate stereo cabinet design because they compete for the ideal equipment locations, and they are nearly always wider and deeper than stereo components. Usually, it's best to keep the TV elsewhere, but if it must go in the stereo cabinet, the best position seems to be centered at sitting eye level. Horizontal formats favor television-stereo combinations because they permit more spacing between the heat-producing components. Don't mount any equipment above televisions; they generate large amounts of heat.

Mounting, dustproofing and ventilation—Stereo equipment can simply sit on a shelf or it can project through a vertical panel mounted in the front of the cabinet. Shelves should be cut to allow for wire runs and for cooling ventilation, either by leaving a 1-in. space between the back of the shelf and the carcase back or by boring holes in the shelf. To panel-mount equipment, an opening the exact size of the component chassis is cut in the panel and the unit is slid in, supported behind the panel by shelves or cleats to keep the weight of the gear from bulging the panel. Panel mounting looks neat, and the equipment is less available to thieves. What thief has time to extract equipment from something that looks so intimidating? I've had customers who have lost their speakers, televisions and silver to burglars, but so far none have lost stereo components that I've set into panels. Another tip on security: don't bother with locks on stereo cabinet doors. If a burglar encounters a locked cabinet, he'll assume there's something really valuable inside and break the doors with a crowbar, perhaps leaving the equipment anyway.

Besides improving security, panel-mounting aids dustproofing and ventilation. Dust finds its way into cabinets and settles on equipment heatsinks, reducing cooling efficiency and shortening equipment life. Closely fit panels seal out the dust and actually improve ventilation by suspending the equipment in a cooling bath of moving air. Panels should be mounted so they can be removed from the rear of the case, and modified for new equipment.

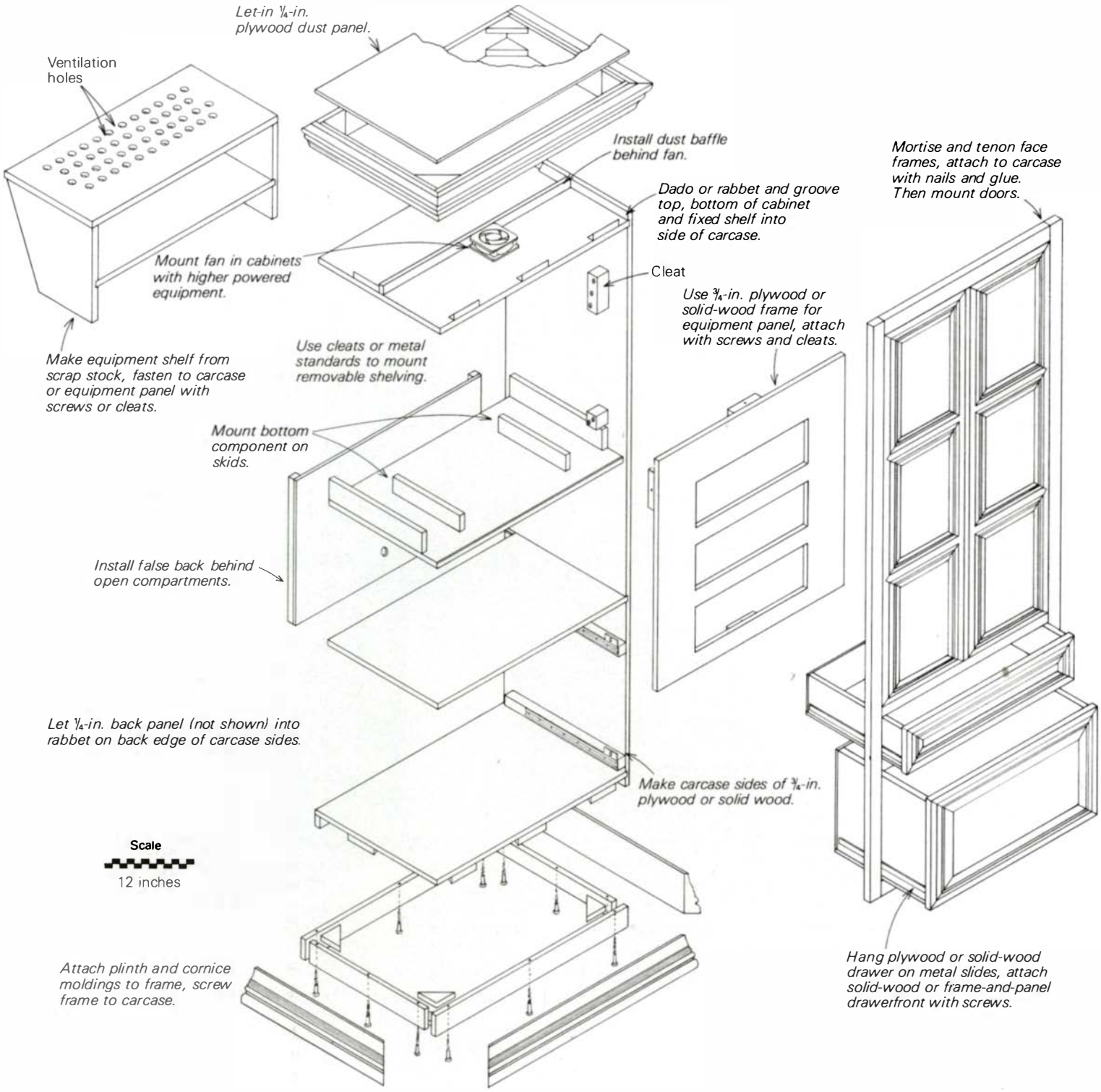
Cabinets with open compartments can be fitted with false backs to give a finished appearance. The actual cabinet back should be removable and have an access panel to permit equipment installation and connection.

Cabinets can be ventilated by drilling a row of 1-in. diameter holes in the lower back of the equipment compartment to draw in cool air and to exhaust heated air out the top through a slot. The ventilation flow should be baffled to force the air to turn a corner on its way out—this keeps dust from filtering into the equipment compartment when the system is off. Higher-powered equipment (more than 50 watts per channel) may need a "whisper" fan mounted in the top of the case to draw hot air out. A commonly available 55-cfm fan can cool the largest amplifier. Figure on using a fan if the temperature inside the cabinet when the stereo is on is more than 10° warmer than the room temperature.

Vertical cabinets can have shelving for turntables and top-loading cassette decks. Other components are panel-mounted for protection against dust and theft.

Books, records or additional equipment can be stored behind doors, on open shelving or in drawers. Store record albums at the bottom of the cabinet where it is cooler. Their weight will add to the stability of the case—an important consideration here in earthquake-prone California.

All of the design requirements I've mentioned can be altered to suit special equipment or the whims of builders and clients. Rapid-fire innovation in electronics, in fact, is changing the shapes and sizes of components faster than ever, allowing cabinet design to develop too. There's a constant demand for cabinet work both for the protection of the equipment and for the convenience and satisfaction of those who have it in their homes. *(continued next page)*

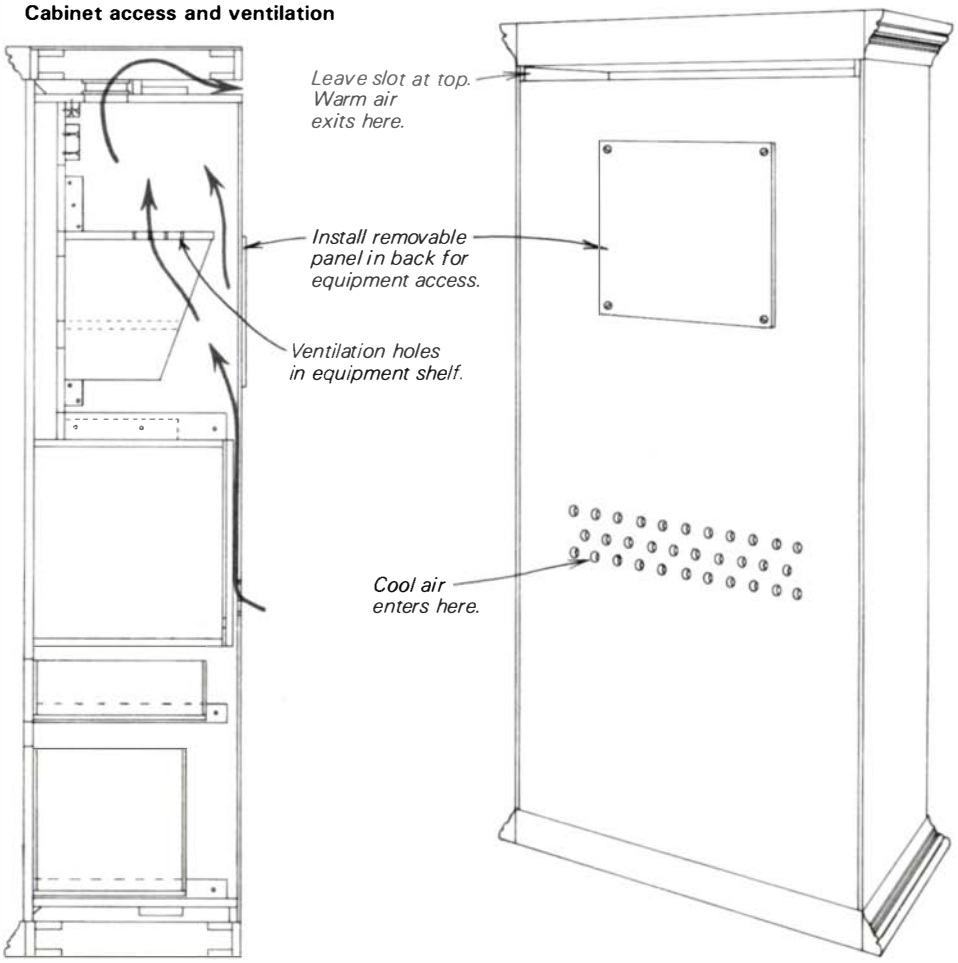


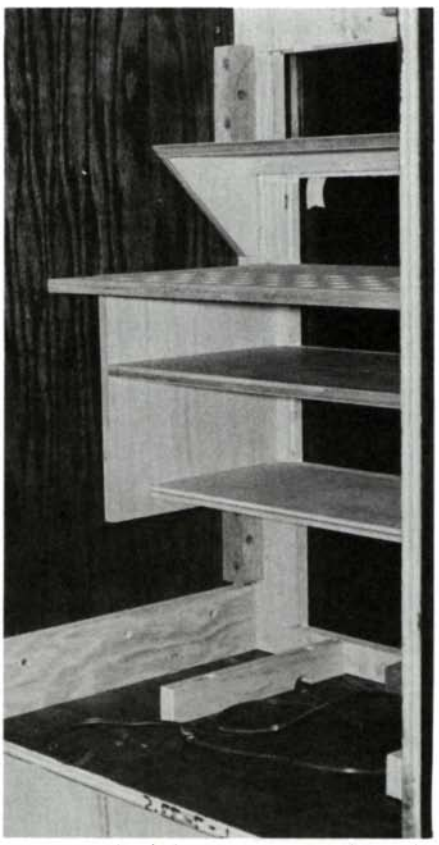
A basic audio cabinet

Stereo cabinets can be made of solid wood or plywood, with traditional joinery or the simplest knock-up construction. Whatever way, the placement of the equipment governs the cabinet's size and shape. I make five or more cabinets at once in small production runs using what's basically kitchen cabinet construction: plywood carcases with solid-wood face frame and door frames. I measure the equipment that will go into a case, leaving room for accessories that might be added later.

First I cut parts for the face frame from 5/4 lumber planed to 1 1/16 in. thick. The frames are mortised and tenoned together, but dowels could also be used. I make the face frame 1/16 in. wider than the plywood case and trim it flush later, so I won't have to sand the veneer. While the face frame is in clamps, I cut the door rails and stiles from ¾-in. stock, and join them with mortise and tenons. I glue ¼-in. plywood to the back of the frames for panels, but you can float the panels in ¼-in. grooves milled in the rails and stiles.

Cabinet access and ventilation





A removable shelving unit, made from plywood scraps, supports the equipment. The shelf is attached with screws or wedged between cleats. Holes in upper shelf are for amplifier ventilation.

Next, I rip the major carcase components—sides, top, bottom, shelving and equipment panel—from ¾-in. A-2 cabinet plywood. You can use solid wood, or substitute cheaper plywood or even particleboard for unseen parts, like the carcase top and bottom.

I join the top, any fixed shelves, and the bottom to the carcase sides with fully-housed dado joints that are nailed and glued. This joint is quick, and it has proven to be strong enough for the stresses involved. Before assembly, I rabbet the back edges of the carcase sides for the ¼-in. plywood back, which can later be attached with screws.

With the case squarely assembled, I attach the face frame with glue and nails and make certain the edge of the frame is flush or slightly proud of the plywood. When the face frame is cured and cleaned up, I trim the doors to size before hanging them. These can be lipped, flush or overlay doors. Hang the drawers with metal slides, particularly if they're intended to store weighty record albums. Record drawers need at least 100-lb. slides.

The equipment panel is next, and you must carefully measure the components going into it. Some have front bezels slightly larger than the chassis. If so, cut the panel openings to fit the chassis and slide the gear in from the front. Otherwise, cut the panel openings to fit the exact outside of the bezel. I plunge-cut these openings on my tablesaw, but a saber saw or router would also do the job. I slide the completed panel in from the back of the case so it's 2 in. from the back of the face frame. This leaves clearance for equipment knobs. The panel is held in place with screws so it can be removed for equipment additions. I make a removable shelf unit from scrap wood that supports the equipment inside the case (photo above). The shelf unit slides in from the back and is held in place between two cleats. Shelves must be level, or the equipment will project unevenly from the openings.

Test-fit the equipment by sliding it in. Rubber feet mounted on some chassis may have to be removed. I've found it unnecessary to attach the equipment to the cabinet, but for extra security, it could be blocked or wedged in place. If there's a fan or built-in lighting, install these next. Plan on connecting them to switched outlets on the stereo gear so they'll go on and off when the equipment does; it's a heat-insurance policy for the components.

Next fit plinth and cornice molding. I make up frames to which I can then attach the molding—this allows me to cut the plywood carcase sides shorter, reducing waste. The molding could, of course, be glued and nailed directly to the case. After filling all the nail holes and sanding the case, I spray-lacquer the cabinets, rubbing them by hand between coats. Any finish is suitable, however, including oils and varnishes, whatever suits the needs of the client. Move the cabinet to its location before installing the equipment, to avoid damaging the gear. Make the connections through the removable access panel just before you set the cabinet in the room. □

Carl Spencer owns Presidential Industries, a stereo cabinet manufacturing company in Riverside, Calif. He is the author of Designing and Building Your Own Stereo Furniture, *published by Tab Books Inc., Blue Ridge Summit, Pa. 17214. Photos, except where noted, by Carl Spencer.*

On Pleasing the Eye

The visual language of chair design

by Alan Marks

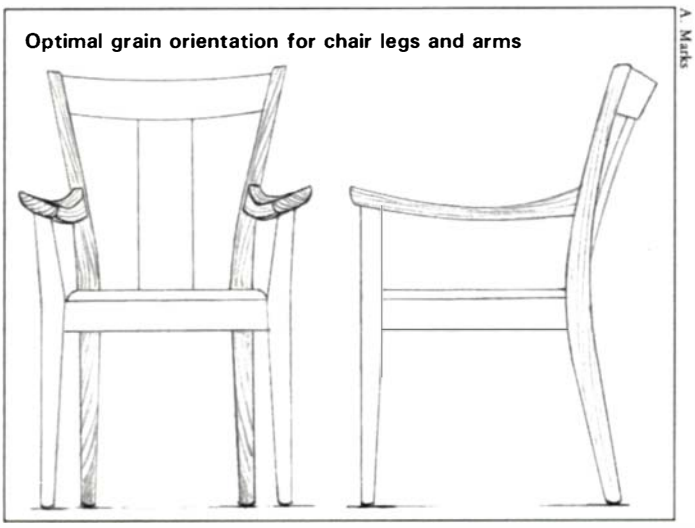
A chair can be bold, humble, witty, or dignified. It can be bizarre, lewd or grotesque. Some even make a political statement. All such themes are valid. Swedish designer Carl Malmsten spoke of the chair as "the most rich in variation, the most captivating, the most difficult to master member of the furniture family." With so much to choose from, where do we begin? There is no objectively "right" way for a chair to look any more than there is one standard for human dress. And as with human dress, chairs are intended to be seen as much as to be used.

A chair is a piece of functional sculpture that we can usually walk entirely around, and see from many angles. The designer at his drawing board approaches the chair full scale, in front, side and rear elevations. In the process from conception to finished chair, this is a necessary step—the making of working drawings. But whoever views the finished chair this way? Obviously a full-scale drawing alone is not enough.

As an extension of my sketchbook, I build a prototype. By gluing on and cutting away wood and by shaping and reshaping complex curves, I refine my drawing through this three-dimensional facsimile. When evaluating a prototype, I bear in mind the angles from which it will ordinarily be seen. Some views are harder than others to get right, but ideally a chair should look right from all angles, favoring the view we expect to see most frequently. The best way to view any chair is from ordinary standing height. If it is a dining chair, it will be seen most frequently from the rear. Easy chairs get looked at obliquely from the front.

Although prototypes are an important aid in getting a chair to look right, even more essential are the concepts a designer uses to interpret what he sees. It is not enough to simply recognize when something doesn't work. You must know why. The elements of a chair's design overlap and interweave, making it difficult sometimes to pin down exactly what is wrong with it. But these individual elements can be isolated and discussed separately.

Materials and their effect—In a complicated piece, small visual inconsistencies go unnoticed, but in a simple piece no sins are forgiven. Anything wrong in appearance will stick out a mile. Contemporary designs, with their emphasis on simple lines and unstained wood, are especially vulnerable to improper material selection. Grain direction can work against lines, leading the eye in contrary directions. In mildly figured woods, such as birch and mahogany, it has less of an effect. But, as much as possible, grain should parallel the form, as shown in the drawing. This makes sense not only visually, but practically as well, in terms of strength. In addition, it permits the use of shaper jigs with less danger of split-out.



Whenever possible, pieces for legs should have diagonal end grain. Then, the figure will be consistent on all the faces of the leg. When growth rings parallel any one side, they produce a figure that can appear at odds with the other lines of the chair. Back legs often curve back and diverge upward. Orienting the wood so that the end grain runs symmetrically and the figure curves outward will accentuate the flare of the legs themselves.

Chair arms usually curve down to the center and gently out. The end grain of such arms should run diagonally outward and cup up.

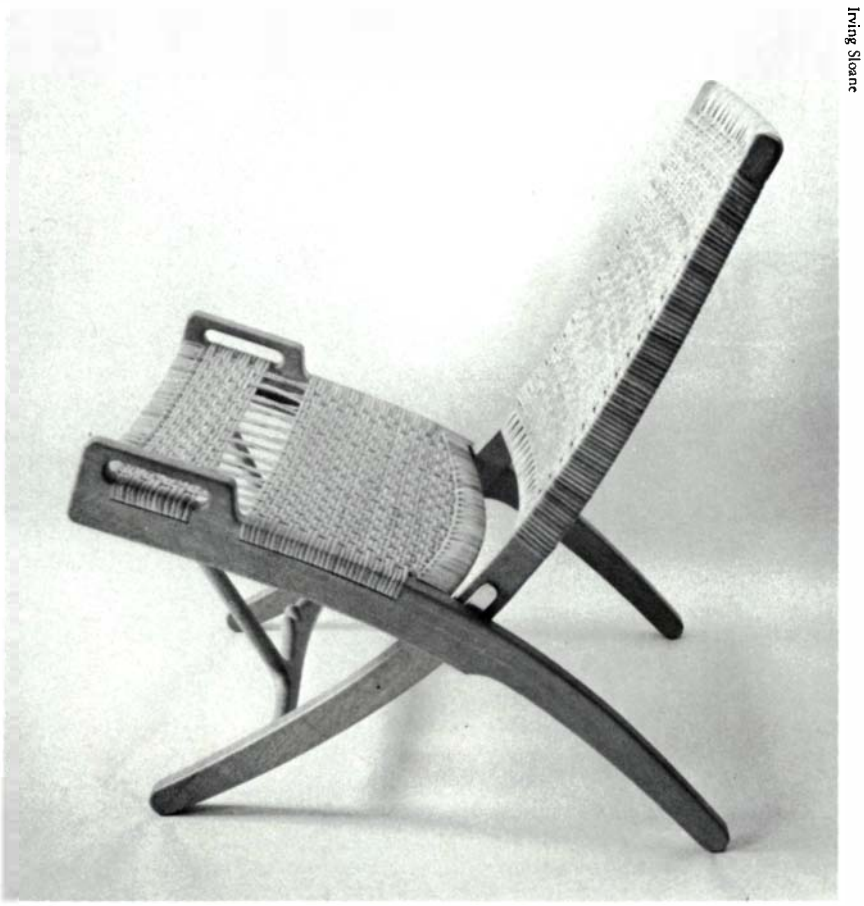
The upholstery used with wood—fabrics, leather and cane—must also be chosen with care. Two important elements, color and texture, come into play here. The color should pick up on one of the tints in the wood, but it shouldn't be so similar as to blend. It is best to strive for a pleasing contrast. Texture also should be complementary. Open-grain woods, like oak, go nicely with smooth-grained leathers. Rough-textured fabrics can work if their woven "grain" is more pronounced than that of the wood. For a more explicit weave, use cane, which comes in various widths and profiles, or use straps of reinforced fabric. Patterns should be neither too quiet nor too loud for the figure and color of the wood. Floral patterns often enhance ornately carved furniture.

Evaluating what we see in terms of function—Our physical relation to a chair is metaphoric as well as actual. Like us, a chair has arms, legs, feet, a back. Its arms receive ours, its back supports our back. We sit on its seat. It is a parallel extension of our own body. We have no trouble imagining ourselves into a chair.

When we first see a chair, we try to classify it as to its par-

This completes Alan Marks' series on chair design, the first two parts of which appeared in FWW *#31 and #32. Marks designs and makes prototypes for production in addition to pieces on commission at his studio in Pacific Grove, Calif.*

Stendig Inc.



Irving Sloane

The gentle bentwood curves and inviting spaces of Thonet's Corbusier chair, above, promise comfort. But there is comfort also in the dynamic opposition between the lines of Hans Wegner's folding chair, right.

ticular use. We expect to sit upright at the dining table, lower and more comfortably when we read, and more informally still in an easy chair. If a chair cannot be categorized, if it is ambiguous or odd, we don't know what to make of it, and the impact of the design is compromised. We just don't feel like sitting there.

When we have decided what the chair is supposed to do, we can decide how capable it looks. We often react emotionally. The softest looking easy chair promises the most comfort. Is there enough space between the arms? We don't want to find ourselves crowded when we sit. Does the back look accommodating? We shy from a chair that seems to assert its shape at our expense.

The eye likes to make sense of structure in terms of function. Our experience tells us something about appropriate thicknesses and widths. Massive shapes where strength is not needed are as disturbing as structural members that look frail. We are also sensitive to the balance of the whole. We mistrust a cantilevered or a pedestal chair. We want a chair to look stable, for we want to feel secure in it. We are soft, vulnerable beings, easily damaged. The eye, in the service of the body, sees friendliness or danger in objects as it tries out a potential resting place. It recoils from sharp projections. The Chinese built high-pitched roofs with thorny hip rafters jabbing through the eaves, to discourage evil spirits from appropriating their homes. A chair built that way warns us off.

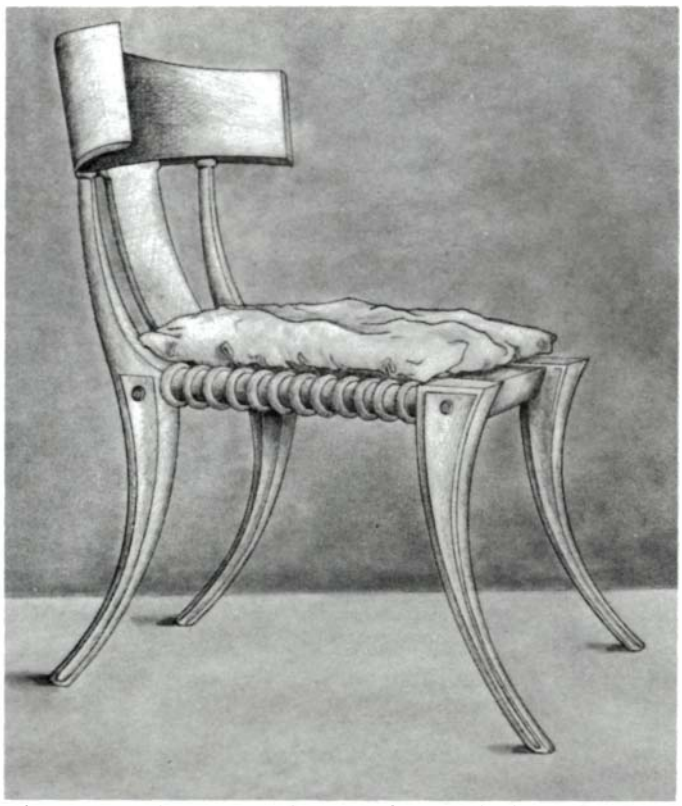
On the other hand, Thonet's Corbusier chair, above left, is one of the most inviting of classical chairs. Its arms embrace the seat protectively, offering physical and psychological refuge. Its organic shapes are familiar. Despite no upholstery, its bentwood curves offer a friendly softness that promises comfort. The eye likes these curves.

Thinking in terms of vectors—A physicist uses the term vector to speak of forces tending to move an object in a given direction. In perceiving a design, the eye acts like a moving object. It moves along the lines of a chair as if according to vectors, which dictate the direction and proportionate impetus of the movement. Used in this sense of the word, vectors may be either straight or curved. If the vectors describe a contained, circular path, such as in Thonet's bentwood chair, the eye is drawn also to the interrelation of the enclosed, or negative, shapes. These have direction and proportion as well. Even the weave of the caning produces small round shapes. As a visual aid, you may find it helpful to draw-in the vectors on a sketch. They can be shown as arrows. The length of an arrow, together with the force with which it is drawn, indicates its relative impetus.

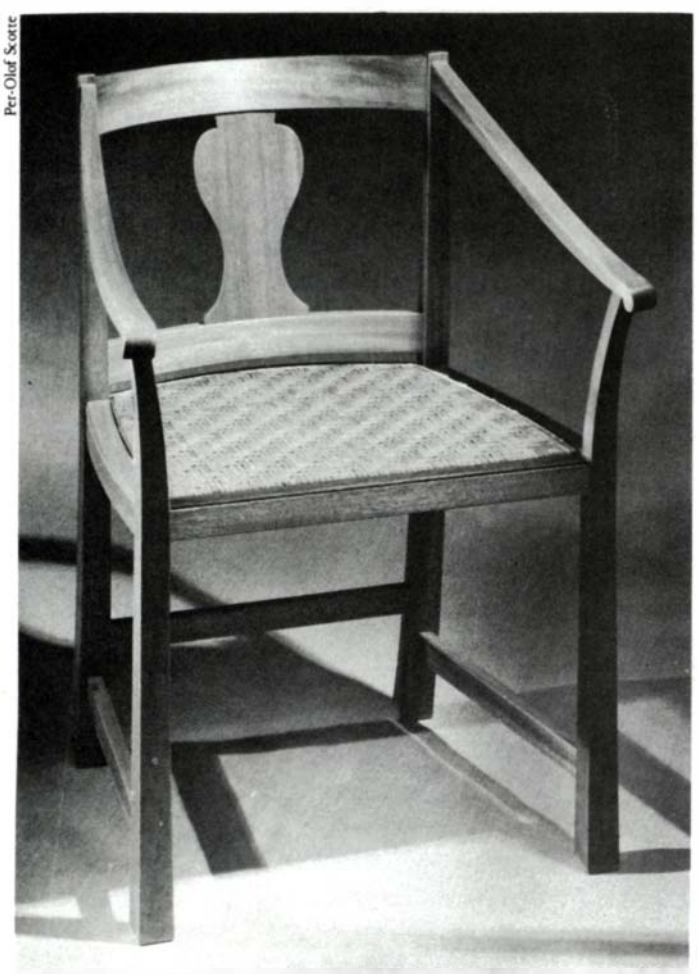
The vectors in a chair can be variously directed. Their total, however, must balance and make sense with regard to gravity. A physicist, speaking of a chair as an object at rest, would describe the relationship between it and the floor like this: The component of force exerted by the chair upon the floor is exactly counterbalanced by an equal opposing force, the reciprocal push of the floor upon the chair. Likewise, a chair pushes against my back and bottom with a force exactly equal to my weight.

We are conscious of these forces, even if we don't put them into words. The eye, following vectors, seeks a visual balance that is parallel to the physicist's physical one.

Hans Wegner's folding chair, above right, achieves this balance between two simple, opposing vectors: a vigorous thrust from the back leg up to the front of the seat, countered by an equally vigorous thrust from the front leg up to the back. This is a successful design. It leads the eye on an inter-



The klismos *is known to us from reliefs dating back to 500 B.C. Its gracious curves reflect what we know about ancient Greek culture: One puts the body at ease in order to liberate the mind creatively. No originals survive, but in close copies these sublimely relaxed legs flex, making them as compliant to the body as they are to the eye.*



Per-Olof Scotte

Carl Malmsten designed this chair for the bureaucrat with both feet upon the ground.

esting tour of all its features, from the cut-out handle at the front of the caned seat, down along the arrow-shaped back leg, back up to the juncture and down the front leg, before being released at that exalted upward sweep of the back. Less successful chairs provide too many traps for the eye or too many exits. The eye is a lazy tramp. It prefers pleasant excursions that require the least exertion.

Whenever members join at acute angles, a direction results. If an arm juts past its support, it leads the eye that way. A leg pointed as it meets the floor seems to retreat from contact. If it meets the floor without changing thickness, it visually counterbalances the force of gravity. If it thickens, it capitulates and flows into the earth. If the back legs project above the crest rail they can burst out like two spears of radiating energy. We can begin to identify with the chair; we can feel what it is "doing."

Gesture and character—A chair more than any other piece of furniture conveys an impression of motion, action frozen in gesture. Chairs crouch, leap forward, stand on light tiptoe or rest ponderously. Vectors help in analyzing gesture because they clarify the dynamics of the various curves and components and their interaction. If you diagram what simple movements are taking place, as indicated by major members, it is often possible to improve upon a gesture by balancing it visually (see box, right). But a fundamental understanding of gesture involves personifying the chair, imagining it has human attributes, a personality or character. It is as if the chair has an attitude toward what it is doing.

A good design is easy to understand. It projects a distinct character through its visual response to gravity and through an implied relationship to the person sitting in it. No detail is insignificant. In an unsuccessful design, extraneous or contradictory elements distract us from perceiving character. In a very poor one we don't distinguish character at all. Like a person, a chair may be said to have a weak character.

What is the chair's attitude toward its task as a beast of burden—is it a joy or a strain? The front legs tell most: Do they look confident, cocky, burdened, buoyant or stodgy? The rear legs have to support most of the weight. Making them massive shows this. They can complement the character of the sitter by reflecting his way of being in the world: unbending, barely coping, sensitive, defensive, lax. The relationship between the two pairs of legs, front and back, is of utmost importance. If the front and back are the same dimensions, at 90° to the floor and not tapered, the chair says, in effect, "a job is a job." The Greek *klismos*, top left, speaks volumes on the subject of leg personality.

If a chair has arms, it shelters and protects its occupant. It literally embraces a human body. It can do this with sensitivity to its delicate burden or with mechanical efficiency.

To what extent does a chair's attitude and gesture, its character, parallel our own, act on our emotions? Can we speak, as designer Carl Malmsten did, of its having "congenial, hail-fellow-well-met generosity," or "a graceful, feminine manner?" Malmsten described the chair he designed in 1916 for the Stockholm City Hall, left, in this way: "The vertical, substantial legs, which thicken as they meet the floor with a slight outward curve, as well as the emphatic rail construction, give the undercarriage a powerful bureaucratic bearing which is echoed by the austere outward curvature and lift of the upper legs. The vertical back slat introduces a softer up-

lifting element. The seat's slight thickness fits in with the other restrained and powerful dimensions. The chair suits every resolute, organization-minded, albeit not hard-boiled bureaucratic, person with both feet upon the ground."

The chair and society—The character of a chair has always been a social indicator. A survey of its metamorphosis through history reveals a lot about changing social attitudes. Many cultural groups do not use chairs, preferring to squat or sit on the ground. In others, the chair has been reserved for the exclusive use of kings and high dignitaries, "chairmen."

The chair has functioned as a symbol of power. It elevates us above the lowly earth, poises us on four rigid pillars of strength, symbolically at the center of the four directions, in a state of majestic rest. The monarchs of the East and of the West alike modeled the legs of their thrones after those of powerful beasts. When chairs became more common among Europeans, the image of a beast at rest found expression in the ball-and-claw foot. Perhaps chairs proliferated in our society as an aspect of democratic progress. Everyone's house was a castle, everyone's chair a throne.

What we now consider "classical" chair designs embody the social aspirations of their times. Cultures that do not use chairs at all, such as the Japanese, seem to have advocated submission to nature or to fate. If the culture sees us in a position of mastery over nature, it may prefer such processed materials as laminates, bentwood, chromed steel and plastic. A culture uncertain of its goals looks backward in time for direction. It may demand a traditional chair made from traditional materials, or it may rejuvenate the forms of some classical period. On the one hand, our culture seems to yearn for such continuity, but on the other, some contemporary one-off chairs seem without precedent. Social harmony is not always the goal of the artist. Sometimes designers try to challenge values and incorporate new insights.

I believe we grope toward a reconciliation between our nostalgia and the demands and discoveries of modern times. We have worked out new techniques. We have investigated the most efficient use of materials, and have even developed a few new ones. We have studied human engineering, as well as pure form and composition. It remains for us to integrate what we have learned. □

The visual effects of changing a design

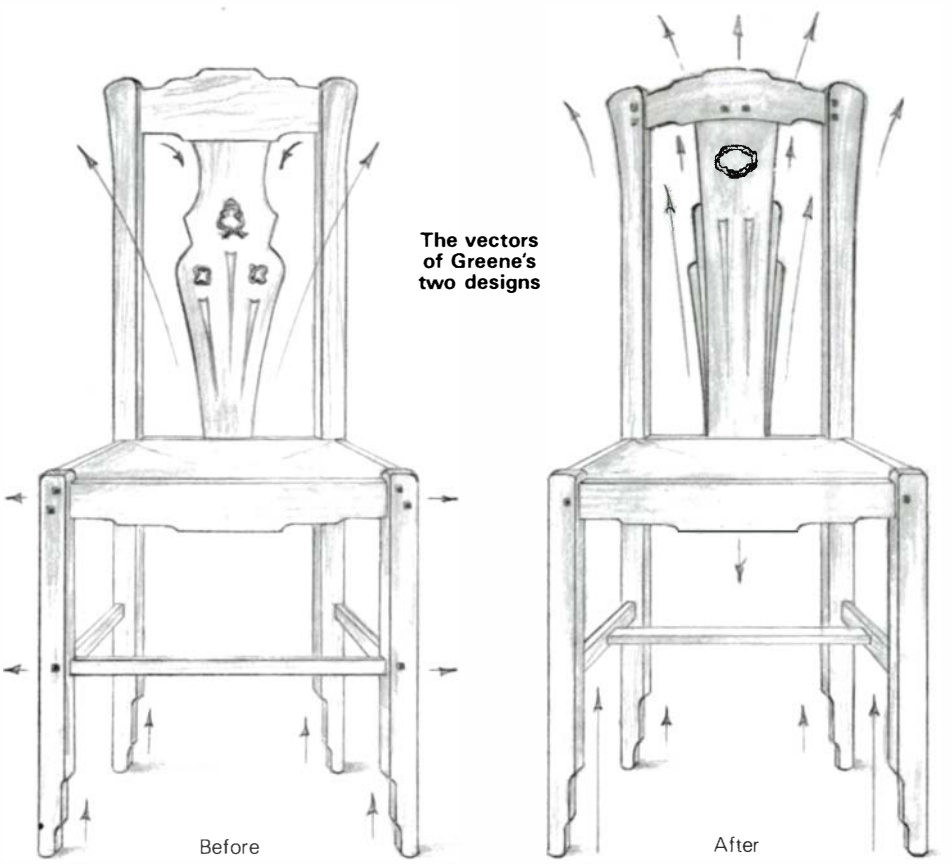
These two drawings give a before-and-after comparison of a chair designed by architect Charles Greene *(FWW #12, p.40)*. In the original version, on the left, a rung is shown connecting the front legs. In his final version, on the right, he moved the rung under the seat, perhaps to accommodate people who like to tuck their legs under a chair.

In its original position, the rung ties in with the horizontal line of the front seat rail and provides a visual platform from which the back rises. These two horizontals anchor the flowery upward spread of the splat. Moving the rung under the seat forfeits its visual reinforcement of the seat rail.

To illustrate the negative effect this has, cover the rung in the original drawing with your finger. You will not feel comfortable with what remains. The eye is now immediately drawn to the splat because it no longer finds anything of interest below the seat. In addition, because the splat resembles the shape of a bouquet of flowers in a vase, it directs the eye to the side in curves that cross the axis of the back legs, whose lines are drawn inward by the widening of the crest rail. These two sets of vectors interfere with one another, creating visual ambiguity and weakening the chair's character.

Greene's change in the splat rectified this. The splat on the right still swells as it rises, but its impetus is now contained within the legs. The crest rail bows upward in response to this thrust. Previously an ambiguous design, the chair now lifts the eye in unity. The upward spring of the legs, in the original version attenuated by the horizontals, now moves through to the top of the chair.

To compensate somewhat for the change in rung placement, the drop at the center of the front seat rail has been widened. As a subtle acknowledgment of the force of gravity, it is the only element in visual opposition to the lift of the others. It provides a yin for the chair's yang. —*A.M.*



The vectors of Greene's two designs

A. Marks

What To Do With a Walnut Beam

John Hallam's blockfront treasure

When John Hallam of Livermore, Calif., finished building a secretary with 12 secret compartments, he figured he could take a bit of a rest. But then two passing strangers offered him a bargain he couldn't refuse—two 8x8 walnut beams 8 ft. long. His wife, Jo Ann, noting that the hallway ceiling was 8 ft. high, asked for a china cabinet to fit.

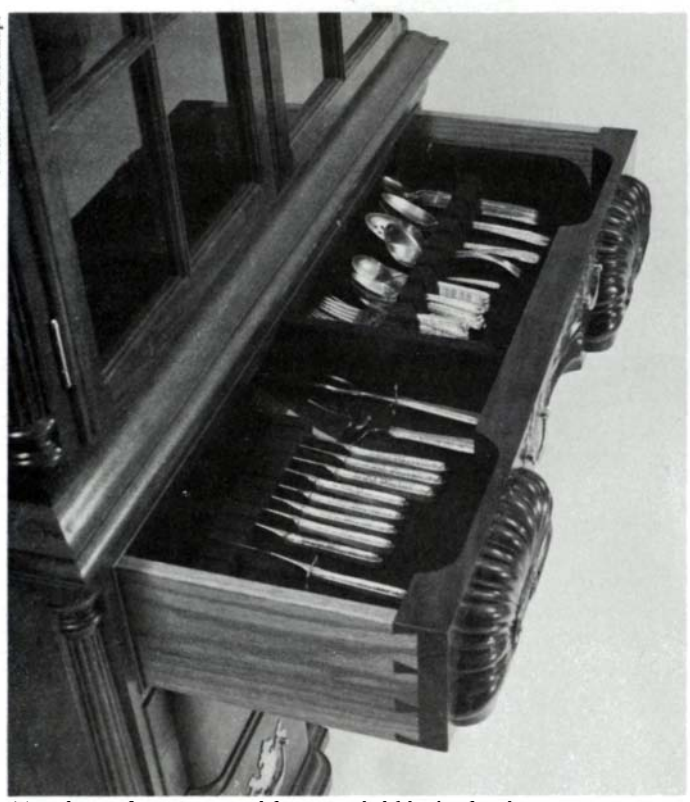
Hallam proceeded to draw up the plans. He augmented his basic machine tools (a Shopsmith and a router) by buying and tuning-up a Sears table saw. He enrolled in the local high school's adult education woodworking class so he could use their planer on weekends. For making the cabinet's wide curved moldings, he devised a way to use his Shopsmith as an overarm router, as shown in the photos on the facing page.

Hallam took his time making the cabinet, enjoying every phase of the project. He spent a couple of months researching the design for the shells on the drawerfront, then took a year to finish the drawer. "I worked 12 hours a week on the average, though 12 hours a day, sometimes. I really enjoyed carving that drawer."

He said the most fun in the three-year project came from steam-bending the trim and the mullions for the doors *(FWW #8*, Fall'77), which he had never done before. He used copper pipe, a packstove, and faith, bending the steamy pieces around a 27-in. bicycle wheel. He figures he did pretty well, since he cracked only three strips.

Hallam admits to having done "a lot of carving," but still he picked up new skills and tricks, including regrinding router bits, before he was through with this job. Through? He still has the other walnut beam. . . . —*Jim Cummins*

Photos: Don Breithaupt



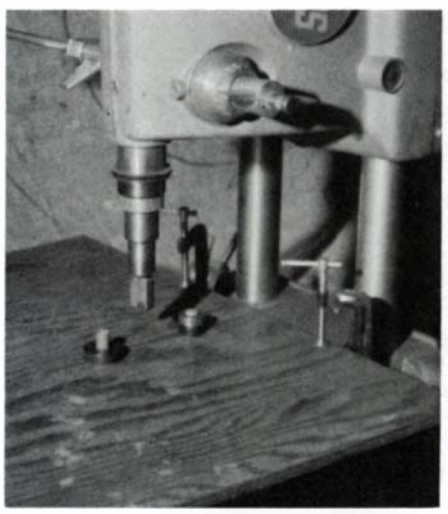
Top drawerfront is carved from a solid block of walnut.

China cabinet, designed and built by John Hallam. Hallam's shop is half-a-garage; his basic machine tools are a Shopsmith, a Sears table saw, and a router.

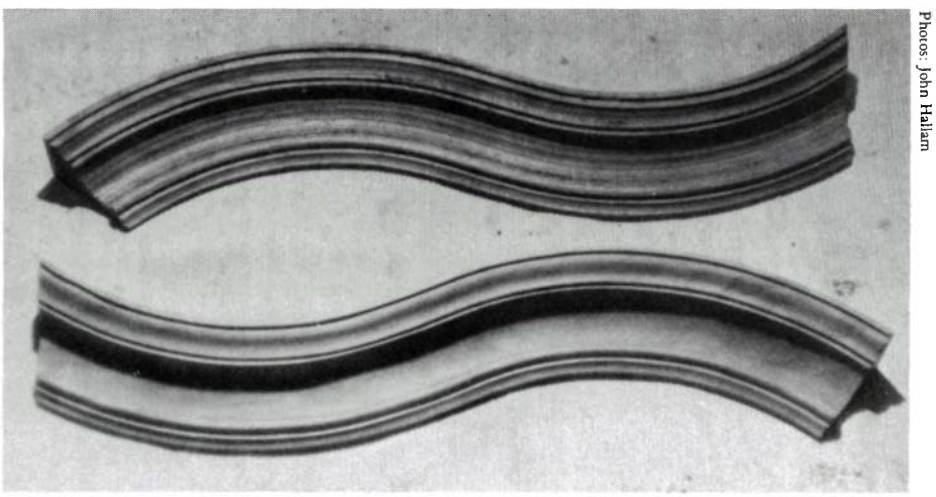
Routing wide moldings

by John Hallam

The Shopsmith runs at a peak speed of 5500 RPM, slow for routing, but a shop-made jig serves as a guide that lets you go slowly enough to get a clean cut. Make the jig from a piece of plywood with ½-in. dowels screwed on from the bottom (photo below). The shaper collars on the dowels must turn freely so the work doesn't bind.



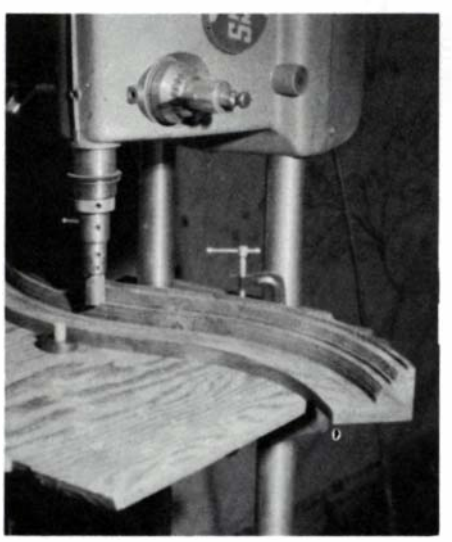
Design the molding with enough flat surface to bear against the collars, and with about an inch extra on the ends as a bearing surface for starting and finishing the cuts. Remove excess wood on the bandsaw. Attach the dowels to the board so they're slightly wider than the work. If the screw holes in the dowels are a little off center, you can make fine adjustments by rotating the dowels on the resulting eccentric axis. Feed the work against the back collar. The front collar prevents the work from moving forward and ruining the contour.



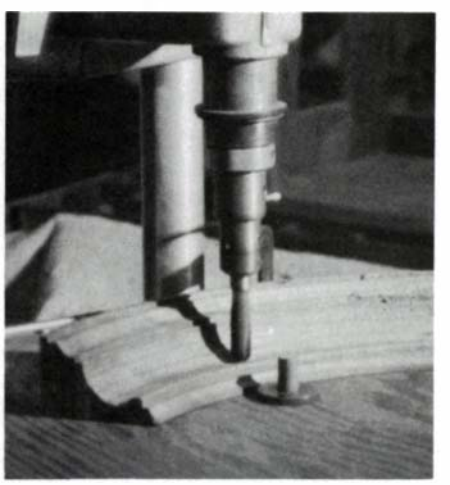
Photos: John Hallam

Top molding is hot off the Shopsmith; its mate has been hand-smoothed.

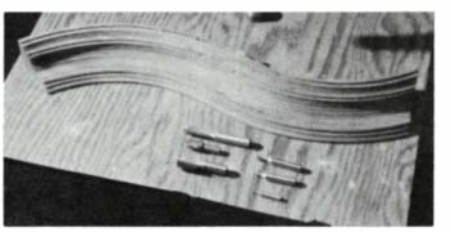
Start each cut by pushing one end of the work against the back collar, and rotating it into the cutter. Take a series of overlapping light cuts. Draw a line through the shaper-collar centers, and use this line as a guide on the radius of the curves as you feed the work. Feed straight moldings straight through. Below, a 1-in. straight router bit performs the initial shaping, wasting the wood rather than shaping the profile.



Draw the molding outline on the end of the stock. Then with a ½-in. core-box (round-nose) bit, start removing wood, repositioning the jig as necessary. Work down close to the penciled outline. You'll find that slight wandering between the dowels doesn't affect the shape much.



With an assortment of ⅛-in. and ¼-in. fluted straight and core-box bits, define the small coves and beads. You could also use specially ground cutters to achieve almost any molding shape.



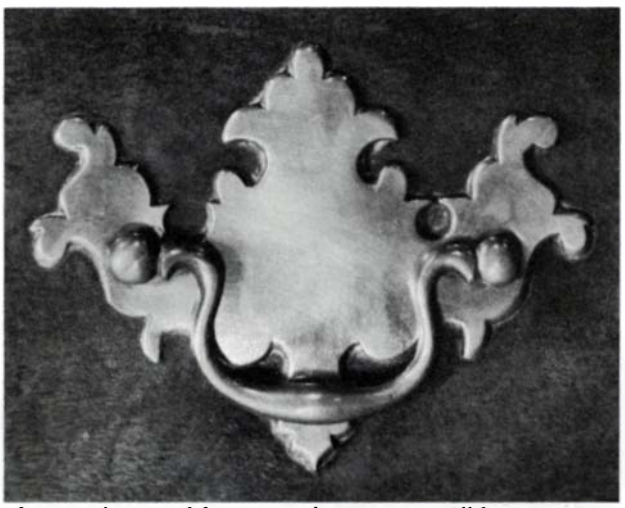
The process leaves a slightly ridged surface (photo, top), which can then be smoothed with carving tools, scrapers and sandpaper. It takes me about two hours to cut a pair of curved and return moldings, and another three to four hours for the final smoothing. □

Period Furniture Hardware

How it's made and where to get it

by Simon Watts

Everyone who makes or restores period furniture is bound to face the problem of choosing the appropriate hardware. The choice is complicated by the wide range of hardware available from many different periods, as well as by several distinct levels of authenticity and quality. This question of authenticity often troubles people most. What is the "correct" hardware for a particular piece of period furniture? All reproduction hardware is copied and there is no such thing as a genuine copy. The copy may be so close to the original that it can be spotted only by an expert, or it may depart to the point of caricature. If your furniture is a faithful copy of an historical original, then you should use only the best hardware. This means accurate copies taken from the right period and, when possible, made in the same way. On the other hand, if your furniture is "in the style of"—similar in appearance but using materials and methods inconsistent with the period—then the choice of hardware is broader. Recognizing this, a number of reputable firms now offer a choice between expensive and historically correct hardware, and a cheaper alternative made at least in part by machine. Modern versions of old hardware are not necessarily inferior, and sometimes the opposite is true. Drawn brass hinges, for example, are stronger and work more smoothly than do the original cast versions.



If you make period furniture, chances are you'll be using reproduction hardware. Original brasses like this pull-with-escutcheon from a Newport bureau, c. 1780, are rare.

How hardware was made—To choose period hardware intelligently, you must know the materials and the manufacturing processes in use at the time the furniture was made. This is not as difficult as it seems. Prior to 1750, hardware makers really had limited choices of materials and techniques. They could cast hardware by melting metal and pouring it into molds to cool and harden, or they could forge parts by heating the metal and beating it into the desired shape with hammers. After 1750 the development of the brass rolling mill opened up new design possibilities, and for the first time hardware could be produced on a large scale. Further improvements in technology eventually brought about stamped and die-cast hardware—and with it the excesses of ornament—that enjoyed great popularity in the Victorian era.

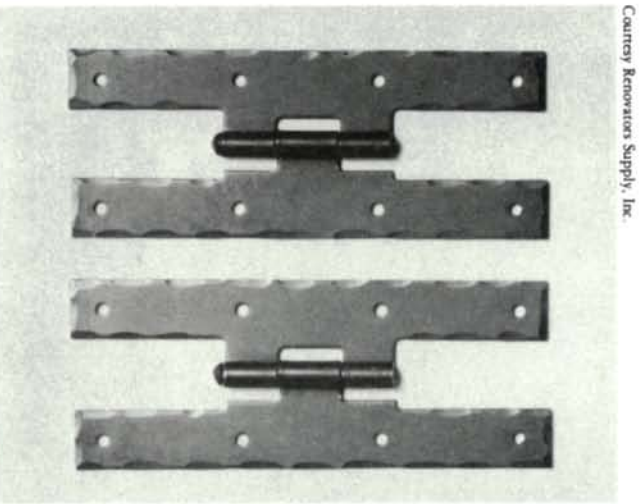
Practically all furniture hardware made in America during colonial times was forged by hand by local blacksmiths. Iron was the favored material because it was available and easily worked. Colonial blacksmiths forged a huge variety of hardware—from the most delicate thumb-latches to massive hinges suitable for the heaviest doors. When heated sufficiently, iron becomes semi-plastic. In this state it can be hammered out in thin sections, bent, cut, folded back on itself and even welded. It is this hammering that gives wrought or forged iron its distinctive look. No two forged pieces look exactly alike—there is a pleasing variation and asymmetry. Hand-wrought iron still has many applications on accurate period reproduction furniture and in the restoration of colonial-period architecture. In trying to meet the current demand for this hardware, modern manufacturers often use machines to speed production of forged parts. The basic shape is stamped out by a press and then hammered only to add detail. If you suspect you are looking at hardware made this way, just put two pieces side by side. Although the surface detailing will vary, their profiles will be identical.

Hand-forging is still done with hammer, anvil and coal fire, but its modern version (machine or drop-forging) uses dies and huge power forges. A red-hot bar of metal is placed on a massive iron table on a die in the shape of the hardware to be made. An upper die mounted in a heavy, power-driven hammer is then slammed onto the metal to forge the part. Some metal is squeezed out between the dies, and the eventual trimming of this waste leaves a faint trace that often remains visible after finishing. Machine forgings are identical and lack the surface variations of hand-forged hardware. The forging process toughens materials, so forgings tend to be stronger than castings in the same metal. They also have a distinct "grain" caused by the flowing of the hot metal. This is conspicuous if the surface erodes; an old forged anchor looks like weathered wood.

Historically, casting was used only for brass furniture hardware, particularly that made before 1750. Colonial furniture makers in America did use brass hardware, but by law it had to be imported from England. This fact causes confusion even today. Some good reproductions made in brass are patterned after originals that were made only in wrought iron. The familiar rat-tail hinges and H-L hinges are examples of this; however accurate they may be in form, brass versions cannot be considered authentic.

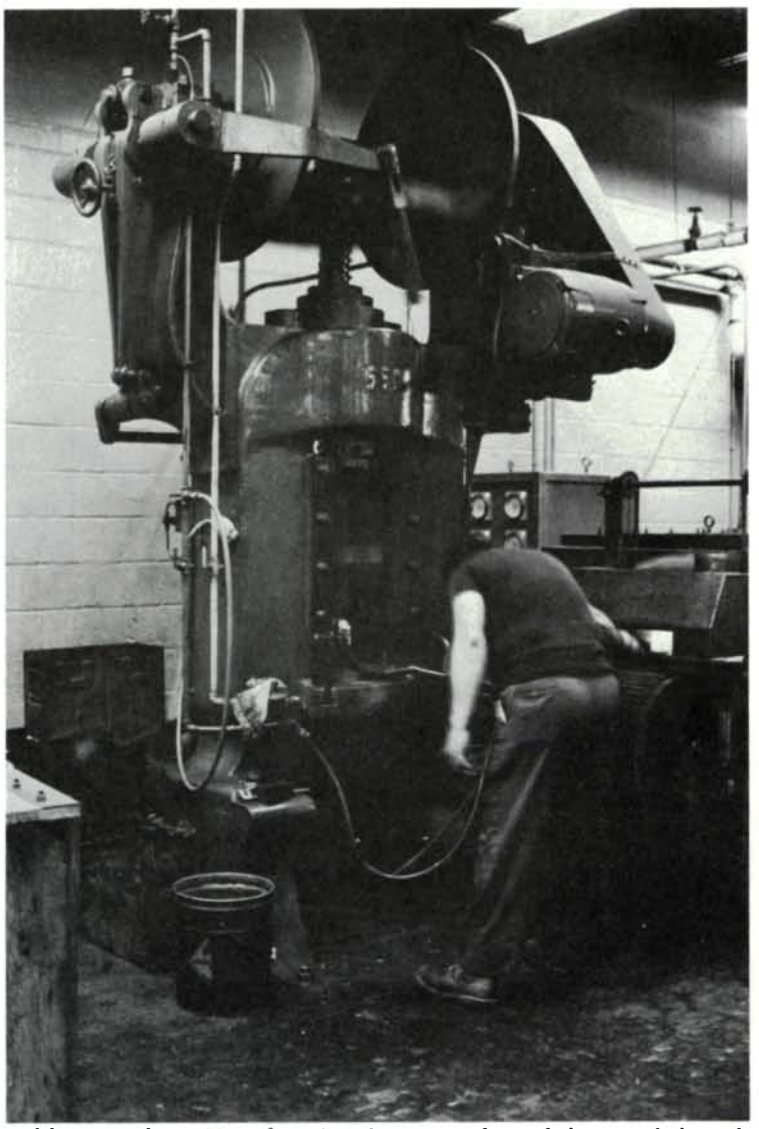
Brass was commonly used to make a type of hardware known as the pull-and-escutcheon. These "brasses," typically

The basic tools of the blacksmith—fire, hammer and anvil—have remained unchanged for hundreds of years, and the smith's products are similar to those made by his colonial forebears. Wrought thumb-latches and H-hinge by Woodbury Blacksmith and Forge Co., right, show the distinctively varied profiles left by the process—no two are identical, and the marks left by the smith's hammer and anvil are evident.

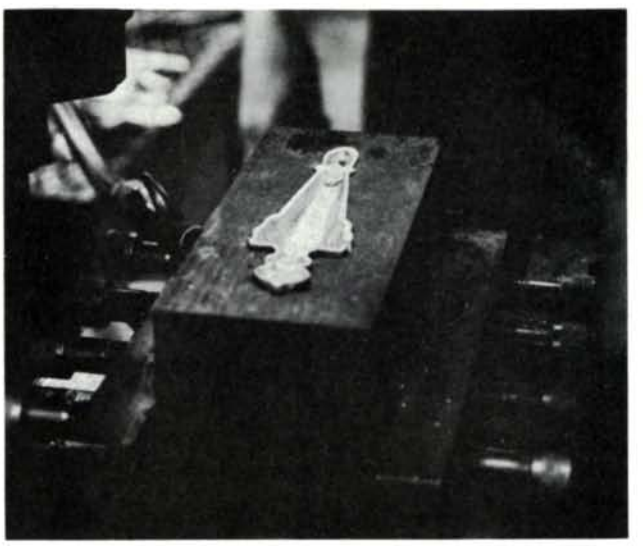


Courtesy Renovators Supply, Inc.

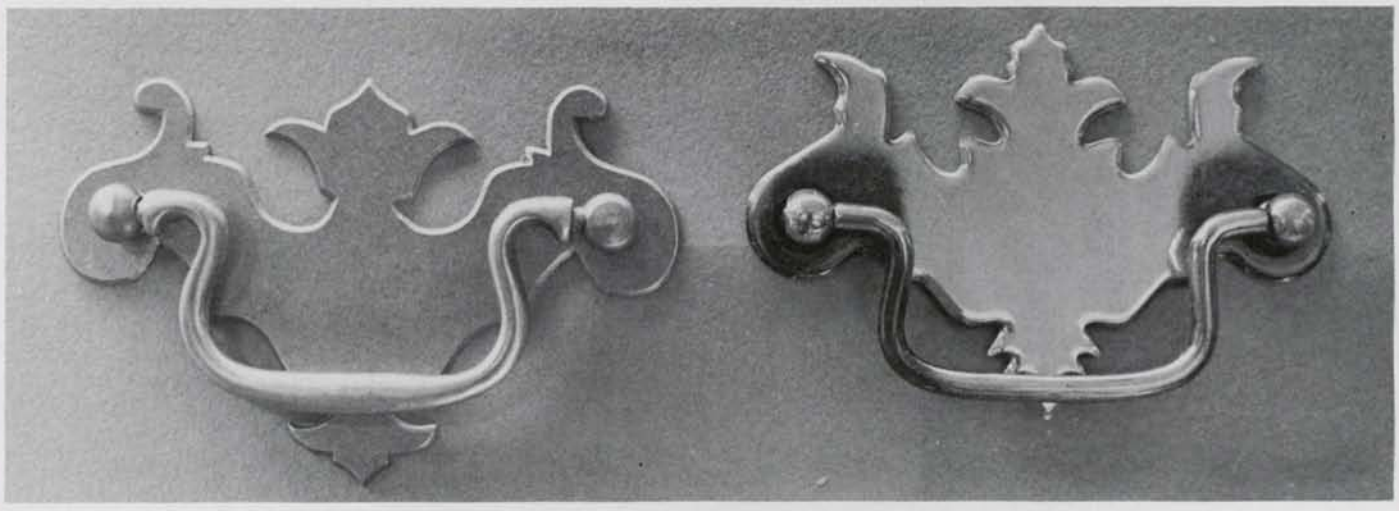
H-hinges, above, show a mass-production attempt to mimic a wrought look. Profiles of the hinges are identical, but edges have been hammered to add surface detail.

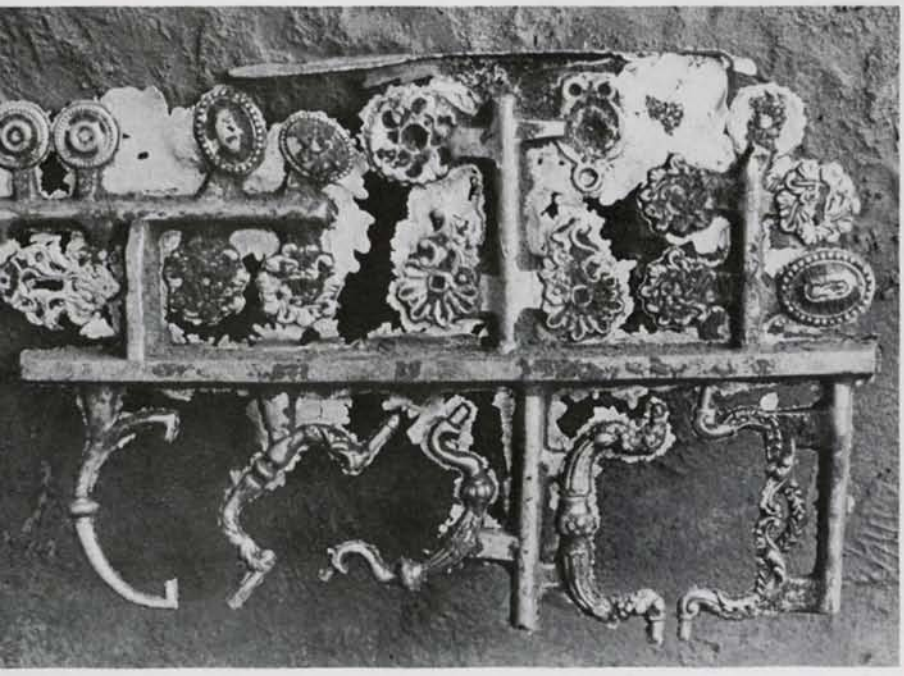


Baldwin Hardware Manufacturing Corp. uses four of these English-made power forges, above. At right is a lower die into which a hot brass rod will be placed. When the upper die slams down, a new piece of hardware is instantly formed, needing only edge-trimming and a shine. Forged parts can be made with fair detail, but each one is identical to the next.



Sand-casting is slow, highly skilled work. Above, foundryman Joe Bossio of Franklin Alloys tamps sand around a pattern which will then be removed to form a cavity shaped like the hardware to be made. At the Horton Brasses foundry, right, co-owner Jim Horton and an assistant pour brass into a gate, an opening in the mold. Too much moisture in the mold can cause the hot brass to geyser back out of the gate, an occupational hazard of foundry work.





A close look will reveal the difference between cast and stamped parts. The Chippendale pull, above left, is all cast—backplate, bail and loose posts. The pull, above right, is a thin stamping with its edges bent down to create the illusion of thickness. The bail is of bent brass wire, and instead of loose posts the pull is attached to the drawer with studs fastened to the backplate. The assortment of knobs, bails and escutcheons, left, has just come from the sand mold. Even after polishing, you can recognize them as castings by the slight irregularities and traces of the flash lines where the two parts of the mold met. Below, backplate cast in a sand mold is recognizable by the pitting and unevenness on the back side. The front will be polished smooth. This plate has an identification number cast into it at lower right.

consisting of a floral-shaped backplate (escutcheon), and a bail mounted between a couple of posts, were a feature of Chippendale and Queen Anne style furniture. Brass, a copper/ zinc alloy, is difficult to forge and impossible to weld. But its low melting point makes it ideal for small sections of furniture hardware because it can be poured hot enough to run easily into all the crevices of a mold before it hardens. Thus, brass casting was a good way to make the thin escutcheon, the slender bail, and the threaded posts and nuts that attach the pull to the drawer front. Compacted sand molds (sand-casting) and later metal molds (die-casting) were used in brass hardware manufacture. Sand molds must be made in two halves so they can be separated and the pattern extracted before pouring. This leaves a distinct joint or flash line on the casting that remains visible after finishing. A sure way to tell a sand casting is by the slight pitting in the surface of the metal caused by the sand. Although mostly removed in polishing, pitting can be seen in hard to reach corners of a part. Since a sand mold is destroyed when extracting the casting, no two castings are ever quite the same. They may have slight irregularities or be slightly heavier on one side. Die-castings are smoother and any two in a thousand will be identical.

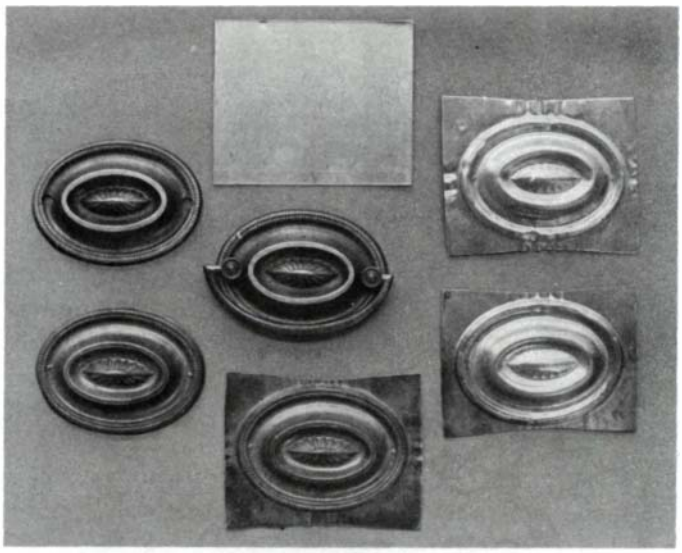
After the 1750s, the advent of the rolling mill made quantity production of brass sheet possible. Until then, sheet had been used sparingly because it was cast and hand-hammered to thickness. The rolling mill inspired an entirely new design in brass—the Hepplewhite. Instead of being cast, the escutcheon is a thin brass sheet struck between two steel dies often engraved with exquisite designs. Hepplewhite bails were cast but the cast posts were soon replaced by ones machined from newly available brass rod.

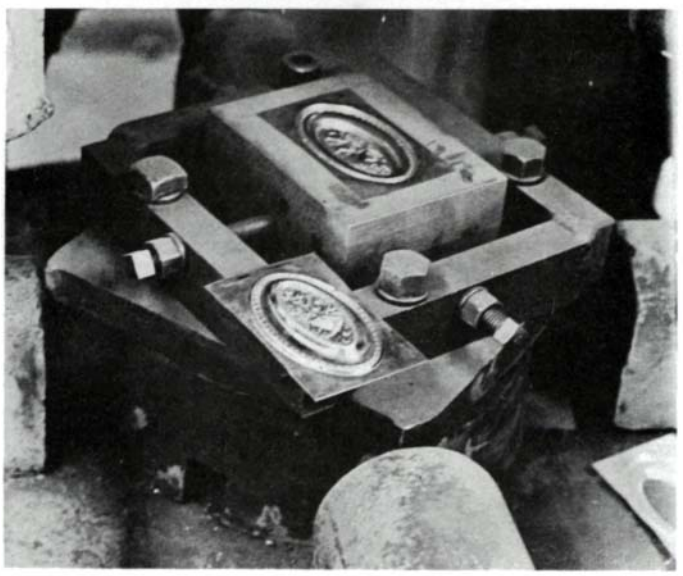
Later, the powered blanking press could untiringly stamp out brass sheet to any profile required. This machine could be adapted to cut slots and holes, and to bend and fold the metal. The invention of the screw lathe made possible the replication of accurately machined parts by the thousands.

The unleashing of all this technology did not at first result in any new style of hardware but in the debasement of the old. Copies of earlier hardware continued to be made, but most of the subtle irregularities of sand casting, hand-filing and polishing were lost. It took a while for designers to make the most of the blanking press's potential for new approaches to hardware design. Much of the later, machine-made Victorian hardware has a directness and vigor that is still appealing.

Up to the 19th century, cast iron was little used for hardware. Its melting point is too high to be easily poured in thin sections and it is brittle. But with the new coke furnaces, cast iron came into wide use. Hinges, rim locks, cabinet catches and window hardware were made cheaply and in huge quantity. Cast-iron hardware soon replaced forged for most applications. Later still, a process called extrusion produced hardware that was stronger. Extruded parts are made from metal that is passed through a heated die and then cut into lengths. Extruded stock, also called "drawn," is easily identified by the fine, parallel lines that run along its surface, in the direction of extrusion.

Brass remains a popular metal for period hardware. Polished brass is usually given a coating of clear lacquer to prevent surface discoloration. Some firms lacquer all of their products while others do so only if the customer insists. Brass can be darkened or antiqued, by chemicals that duplicate the effects of time. Cheaper hardware is darkened and then

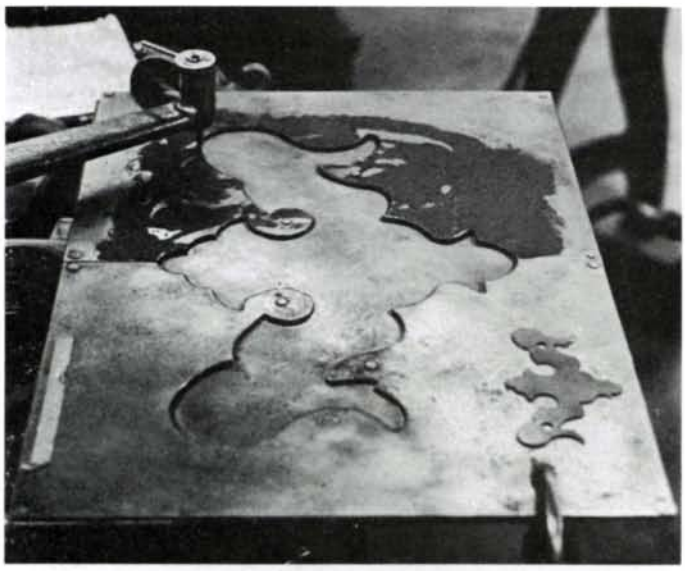


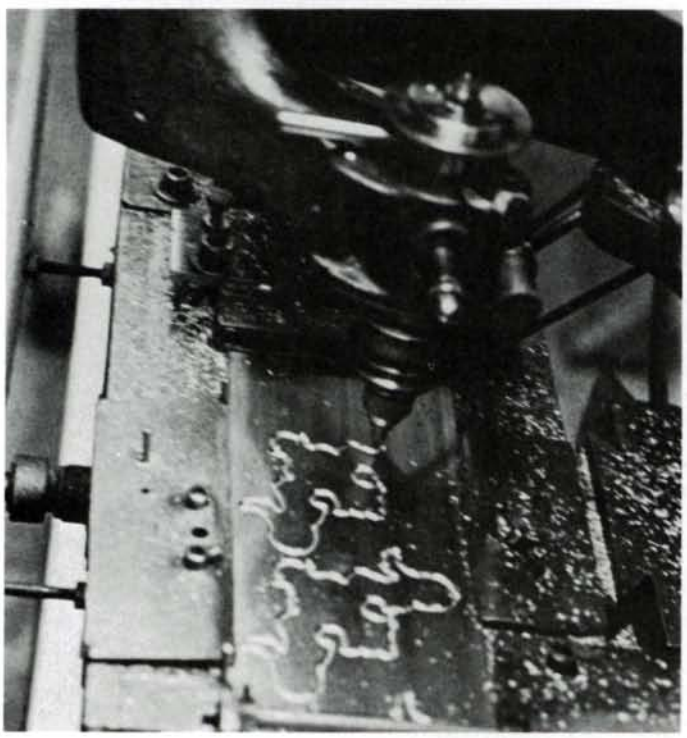


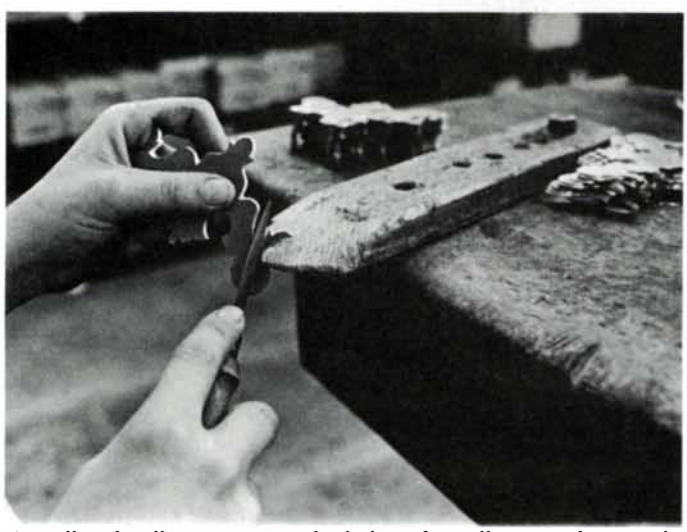
The invention of the rolling mill made possible large quantities of sheet brass and a new style of hardware. At top are the various steps in the making of a Hepplewhite oval pull, starting with a brass blank. The soft metal is struck once, softened by annealing and then struck again for the fine detail. Above is the lower die of the blanking press.

buffed on a satin wheel to create highlights and to simulate wear. Brass can be finished to look like other metals and sometimes other metals are made to look like brass. A small file will uncover the deception. The most frequent substitutes for brass are anodized aluminum and brass-plated steel or zinc alloys. Aluminum is too light to fool anyone; steel will reveal itself to the magnet.

Buying period hardware—The largest period hardware manufacturer is Ball and Ball of Exton, Pa. With a staff of only 42, the firm uses an adroit mixture of skilled handwork and clever machinery to meet the demand for 900 individual items spanning several periods. With its own foundry and blacksmith shops, Ball and Ball makes iron and brass hardware and has recently added Victorian items to its line. Much of the hardware, iron strap hinges for example, is offered handmade or semi-handmade. The former are made in the traditional way, while the latter are cut out of rolled sheet with a nibbling machine—a compromise for sure but a far cry from the manufacturers who stamp their hinges from a coil of pre-textured sheet. "They think they are duplicating a hand-







At Ball and Ball in Exton, Pa., backplates for pulls are made not only by the traditional sand-casting method, but by a metal-cutting pantograph. An overlarge template, top, guides the machine's cutter, center. The pantograph-cut plates are then filed by hand to sharpen the detail of the edge, above

forged finish," says Whitman Ball, "but they are just making modern junk. Unfortunately a lot of people buy it because the price is right."

For some of its brasses, Ball and Ball casts its backplates thick and then sands down the front. The result is practically indistinguishable from an original, thin casting. For those not needing this museum-level authenticity, the firm cuts backplates out of sheet brass on a metal-cutting pantograph. These look like castings until you turn one over and see the diagonal sanding scratches instead of the pitted unevenness of a sand casting. They will also sand-cast posts and even nuts to match, but most are made on automatic screw machines.

The firm even uses cast bails. When asked, Whitman Ball admitted being tempted to substitute a stamping. "But every one of them would be absolutely identical. It just wouldn't look right," he maintains. Ball and Ball sell direct only, from the Exton showroom as well as by mail. If a catalog item can't be filled from stock, there may be a lengthy delay. The firm's 108-page catalog costs $4 and is available by writing them at 463 West Lincoln Highway, Exton, Pa. 19341.

Horton Brasses of Cromwell, Conn., makes fewer items, but the service is speedier than Ball and Ball's. Both firms will copy from a customer's patterns. Horton sells brass and iron hardware and has its own foundry. It's a family-run business and Jim Horton specializes in the decorative "chasing" of brasses, done entirely by hand. A backplate, drilled and finished, is set on a thick iron block and the design is transferred with a single hammer blow to a small, steel stamp. Some dies are elaborate, others are plain circles, dots, crescents or lines. Horton casts its own bails, but they use a blanking press for most of the backplates. Horton's prices are retail and there is a quantity discount. For the 36-page catalog, send $2 to P.O. Box 95, Cromwell, Conn. 06416.

Period Furniture Hardware Co. is a small. merchandise-jammed shop at the foot of historic Beacon Hill in Boston. One wall is small drawers, a sample of their contents screwed to the fronts. This company makes less than half of the brass, iron and other items they sell. Instead, they buy from other manufacturers such as Baldwin Hardware Manufacturing Corp. They too try to offer their customers a choice—but within limits. When I visited the shop recently, the manager was explaining to a customer why three apparently similar door knockers were priced differently. "This is imported from England," he said, pointing to one knocker, "this is a machine forging, and this we make ourselves." The English import, $65, is marred by conspicuous sand pits. The manager snorts. "They think these pock marks make it more authentic, but that's rubbish. The old ones were perfect." We both examine the $45 machine forging. "Notice there are no sand pits, the surface is perfect but there's no detail either." Period Hardware jobs out its casting work—its own version of the knocker at $160 is perfect. The company has a large variety of architectural and household hardware, and I found its selection of weathervanes unique. Period Hardware sells wholesale and retail and its 126-page catalog can be had for $3 by writing to 123 Charles St., Boston, Mass. 02114.

Baldwin Hardware Manufacturing Corp. is best known for door hardware, but the firm also has two lines of colonial brassware that include cabinet knobs, candleholders and a range of household hardware. Baldwin sells no iron hardware nor do they do casting—most of their products are made on four massive forging machines. Adjacent to each is a gas-fired

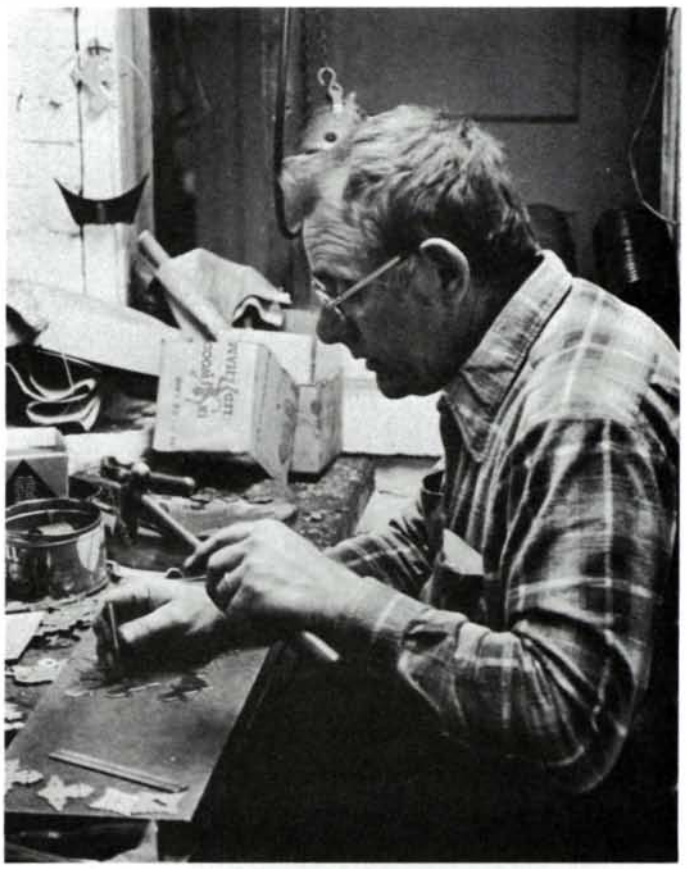
furnace. One man continuously feeds pre-cut brass rod into the furnace at one end while another swiftly places the hot metal between two steel dies that strike the finished part. The process takes less than a minute. Employing 600 people, Baldwin is a factory and there is no attempt to add authenticity by using archaic methods. They choose original patterns carefully and then make close copies in the most efficient way. Baldwin uses forging where another manufacturer might cast the part. Locks need the strength of forging, but other items like candleholders seem a trifle over-engineered. Baldwin hardware is handsome, durable and reasonably priced but it has a uniformity that may not suit everyone. No sales are made from the factory and all of Baldwin's products are sold by retailers and wholesalers throughout the country. Write Baldwin for a catalog at Box 82, Reading, Pa. 19603.

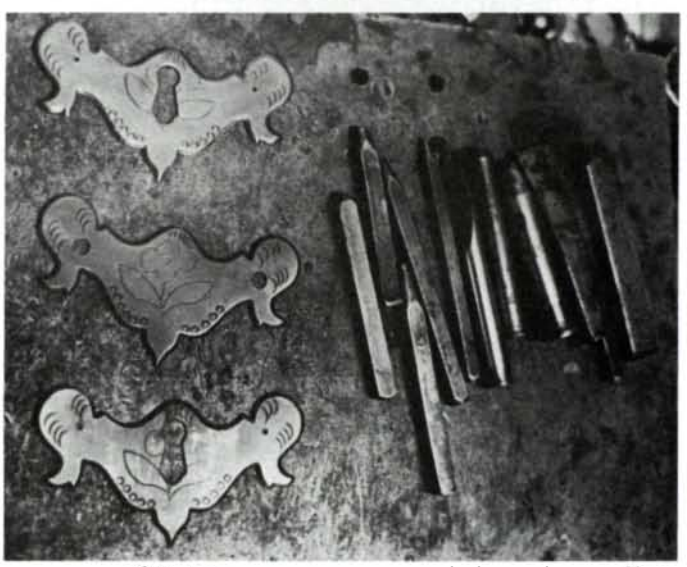
The Renovators Supply was born out of the frustrations a young couple encountered when searching for hardware to restore their old farmhouse. A combination of large volume and foreign labor allows Renovators to sell period hardware very competitively. Renovators buys some of its hardware outright for resale and has some of it manufactured to order—much of it abroad. "We produce handmade components at low labor rates and then do the final assembling and finishing here," says Claude Jeanloz, Renovators' co-owner. They offer a considerable selection of hardware including house fixtures, iron, brass and Victorian reproductions. There are no pretensions to making exact copies, and traditional designs are freely adapted to modern needs. Much of their wrought iron has been stamped out by machine and then hammered by hand for detail. This results not in an inferior product but an excellent value for the money. Renovators sells mail-order only and offers quantity discounts. The firm's 35-page catalog can be had by writing to Millers Falls, Mass. 01349.

Frequently, a search through all the period hardware catalogs won't reveal the hardware needed for a particular job. If iron work is wanted, you might find a local blacksmith who can make it for you. This is not as fanciful as it sounds. Handworking of iron has made a remarkable comeback and the Artist-Blacksmith Association of North America has some 1,500 members. You can contact them by writing ABANA, Upper Gates Road, North Canaan, N.H. 03741.

Tony Millham of Westport, Mass, is a member of the blacksmith association, an accomplished smith and one of a number of craftsmen who publish a catalog featuring handwrought hinges, door hardware, latches and bolts. "I let people order whatever they want. I may tell them it's wrong for their period or a wrong combination of materials, but I'll make it for them anyway," says Millham. He works mostly with the traditional tools of the trade—forge, hammer and anvil. But he also has an electric trip hammer, a bandsaw and welding equipment. To many, blacksmithing has the charm and nostalgic appeal of an earlier era, but as Millham points out, turning out quality reproduction hardware day after day is a struggle. He's firmly committed to his trade yet he sees some irrationality in the quest for authenticity. "People get neurotic about it. They all want it to be 'right,' but right is just what some expert tells you. I wish people would have more fun and simply choose what pleases them. After all, they are the ones who have to live with it." □

Simon Watts is a contributing editor to this magazine. Photos by the author, except where noted.





Jim Horton of Horton Brasses, is an expert in the hand-chasing of brass pulls. A drilled backplate is placed on a steel surface, top, and detail is stamped in the surface with a single hammer blow to a steel die. Horton uses dozens of stamps with various designs, as above. Below is a close-up of a flower-motif stamp.

Repairing Finishes: Two Ways

1. Burn-in resins hide deep scratches

by Rick Bütz

It's frustrating to discover a deep scratch in a nicely finished piece of furniture. A scratch rarely goes unnoticed and it may be unfairly interpreted as a glaring defect in the furniture itself. With any luck—and light damage—a surface scratch may be easily rubbed out with steel wool, but usually not.

Over the years, furniture makers have developed lots of tricks for touching up damaged finishes. A favorite method for repairing deep scratches is called "burning-in." The repairer fills the scratch with melted shellac resin, matches the color and grain of the surrounding wood with stains and a small brush and, finally, touches-in the appropriate finish. Damage to oil, varnish, shellac and lacquer finishes can be burned-in; polyurethane and other plastic finishes sometimes blister.

For burn-in work, you'll need shellac sticks of various colors, a special knife, a heat source, padding lacquer and powdered blending stains. Burn-in sticks are sold in hundreds of colors, but I keep only a dozen on hand in the colors of woods I usually repair. Clear or translucent sticks are available and they can be color-matched using the blending stains. Burn-in or shellac sticks are made of various pigments and resins and have a consistency similar to the wax used for sealing letters. My burn-in knife is like a palette knife with a curved, flexible blade. A small alcohol lamp is a good heat source. Use the lamp carefully; never leave it burning unattended. Although electrically-heated knives can be used, I prefer the alcohol lamp for its more delicate heat control.

To repair a scratch heat the knife tip with the concave side toward the flame. This keeps any soot that forms from contaminating the resin. Judging the proper temperature takes practice. If the resin bubbles and smokes when it touches the knife, it's too hot. If it forms drops that quickly resolidify, it's too cool. When it's right, it's almost watery. Once you've found the correct temperature, hold the knife like a pencil and carefully flow the hot resin into the scratch. The knife can touch the wood surface, but you must keep it moving to get an even flow. Fill the scratch, clean the knife by heating it and wiping it with a rag, then level the resin by heating the knife once more and moving the convex face quickly over the surface. Keep the knife moving whenever it's hot enough to soften the resin, or you will damage the surrounding finish. Aged shellac and varnishes can be particularly sensitive to heat. If the resin from the burn-in stick bubbles up and sticks like chewing gum instead of flowing smoothly when heated, the stick is probably stale and should be replaced. The sticks have a shelf-life of six months to two years and if cracked and checked are probably stale.

When the scratch is completely filled and the surface is smooth, the final leveling is done with a piece of 600-grit wet/dry sandpaper wrapped around a small felt block. With water as a lubricant, gently remove any excess resin. Be careful not to sand through the finish surrounding your repair.

There's another method using a different burn-in stick—called a Nolift-stick—which was developed several years ago by Mohawk and Behlen. It uses a resin stick that dissolves in a solvent that won't affect the surrounding finish. During sanding the solvent is used as a lubricant and can be applied directly with a felt block. The solvent is called Brasive by Mohawk; Behlen sells it as Abrosol.

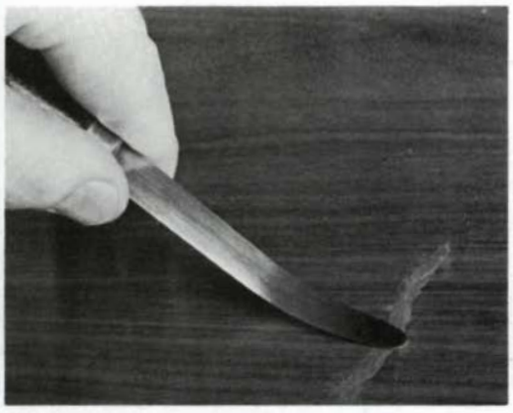
Regardless of which stick is used, once the surface of the repair is level with the finish around it, color and grain differences can be matched. The traditional method of applying color over a small area is to use a French polishing technique with padding lacquer and finely powdered blending stains. These dry stains come in many different shades and can be mixed to create an infinite range of colors. You can match the most delicate shades with surprising control. Padding lacquer is compatible with many finishes, but you should experiment with it before trying to repair a valuable piece. If the lacquer's gloss is higher than the surrounding finish, you can rub it out with fine steel wool. An alternative to commercially made padding lacquer is a traditional French polish solution of equal parts of boiled linseed oil, 5-lb. cut shellac and alcohol. Experiment with the proportions to get a quick-drying mixture.

To use the padding lacquer or French polish, make a cloth rubbing pad out of lint-free, absorbent cloth. Fold the cloth upon itself to make a ball about the size of an egg. Apply a small amount of padding lacquer to the cloth and tap the palm of your hand against it to evenly disperse the liquid. Don't saturate the cloth. Then apply the lacquer over the scratch by stroking lightly in the direction of the grain, with the pad barely touching the wood. You want to build up a thin layer of lacquer, to which the stain will adhere.

Next, select the desired color of blending stain and apply a thin layer with your index finger. Again, pad lacquer several times over the filled area and wipe a thin layer of the stain from your fingertip onto the surface. Once the stain has been applied, lightly pad lacquer over it. The powder will dissolve when it comes in contact with the liquid, and create a stained finish. Repeat this process until the desired shade has been gradually built up over the burned-in area. If the color should go too dark or doesn't match, clean away the stain with alcohol or padding lacquer solvent. Let the finish dry for a few minutes before starting over. Padding technique requires a little practice, but in time, you will be able to match the most subtle color variations. The real secret is to apply the padding lacquer with as light a padding stroke as possible. This will prevent the stain from "shifting" or washing away. It's better to apply too little stain than too much, as it is easy to darken an area but impossible to lighten it without starting over. Experimenting on scrap pieces will give you a taste of controlling color. Use as little stain as possible to achieve the desired effect.

With the wood color matched, the grain lines can be touched in. If the original wood finish shows porous grain texture, as in oiled walnut, teak or oak, it's a good idea to duplicate this texture in the repair. Use a needle or razor blade to carefully scratch the grain texture

For repairing finishes you'll need (from left to right) an alcohol lamp, resin sticks, a burn-in knife, and a felt sanding block. To match colors, blending stain, French polish or padding lacquer, a cloth pad and a fine brush are used.



With the heated burn-in knife, concave side down, fill in the scratch by flowing hot resin into it (above, left). Be careful not to get the knife too hot. When the scratch is filled, reheat the knife and wipe it clean with a rag before leveling the built up resin (above, center). Keep the knife just hot enough to make the resin flow as you work it. After the repair has been leveled and sanded with 600-grit wet/dry sandpaper, apply padding lacquer or French polish to act as a base for the powdered blending stain (above, right). The stain evens out color differences. Use a fine sable brush to touch-in grain detail over the repair (left). Then pad over a couple of coats of padding lacquer and when that has dried overnight, gently rub out the repair with steel wool and blend it into the surrounding finish.

into the resin. Then mix a few drops of padding lacquer and dark powder stain on a small piece of glass. Carefully paint in the grain lines over the repair, using a fine sable brush. Blend these lines and carry them into the natural grain on either side of the repair. After letting the repair dry for 30 minutes, lightly pad several layers of padding lacquer over the patch to seal and protect it.

You can let the padding lacquer serve as a final finish but it's better to apply a coat of the finish used on the rest of the piece. Once dry, the entire repair can be rubbed with steel wool or pumice to match the gloss. The result will be an invisible repair permanently bonded to the wood and indetectable under the closest scrutiny. □

Rick Bütz is a professional woodcarver and he repairs furniture in Blue Mountain Lake, N.Y. Photos by Ellen Bütz. Materials for burning-in can be purchased in professional quantities from H. Behlen and Bros. Inc., or from Mohawk Finishing Products, both at Route 30N, Amsterdam, N.Y. 12010, and by mail order from Constantine's, 2050 Eastchester Rd., Bronx, N.Y. 10461, or Garrett Wade Co., 161 Avenue of the Americas, New York, N.Y. 10013.

2. Knife technique makes the difference

by John Revelle

You can fill scratches by burning-in on new furniture and in refinishing, repair or restoration work. In the first two, knife technique isn't important since the repair will be finished over. In repair and restoration work, however, a hot knife in a clumsy hand can damage as much as it can fix.

When burning-in already finished work, I like to run the resin into the scratch and smooth it completely with my knife, skipping padding lacquer and stains and all but a cursory sanding. I prefer the Nu-Glo sticks made by the Star Chemical Co. Inc. These sticks were developed for marble repair and have an indefinite shelf life. They don't crack and go stale as do other types. Mohawk sells an equivalent product called MF or marble-fill stick. There's an assortment of colors so it's not hard to match whatever wood you happen to be working on. Since I don't use stains, I pick a stick that exactly matches the background color of the wood I'm repairing.

I've found that Star's Opal #750 knife works best for me. The tool has a ¾-in. wide flexible steel blade with a shallow bevel ground on one side of its skewed working end. It's sometimes sold as a cement finisher's knife. I use the electric knife-oven sold for the Opal knife. If you use two knives, one can be heating while you work with the other. It takes about a minute to bring a knife to the right temperature. To make a repair I heat the blade and touch the bevel side of the knife's heel (its obtuse point) to a resin stick so it melts just a small bead. I quickly push the resin-coated heel into the scratch at a point farthest away from me. Rocking the knife gently back and forth flows the resin evenly into the scratch. I repeat the process until there is just enough to fill the scratch level with the surrounding surface. Then I wipe the hot knife clean with a rag or a paper towel and reheat it. To level the patch, I drag the heated knife along the scratch, bevel-side down, in light rapid strokes, lifting the knife off the surface between strokes. Moving the knife continuously is critical. You can light a cigarette with a hot knife, so stopping it even for an instant will char the finish around the repair.

Small repairs can be done with just a bead or two of resin, larger ones take more. Take care not to mound the resin above the level of the surface around it, or the repair will be conspicuous. If you do get too much resin in the repair, hold the knife firmly, bevel down, and with short, chevron-shaped strokes work the excess resin back and down into the scratch. If air bubbles turn up, pierce them with the heel of a hot knife and rework the resin. The temperature of the knife can be varied to help control resin flow. As the knife gets cooler, the material gets harder to spread. With practice, you should be able to smooth the resin without sanding. But if you can't get a perfect surface with the knife alone, complete the smoothing with 400-grit or 600-grit wet/ dry paper.

With the scratch filled and leveled, you can grain the wood with a hot knife and a resin stick that matches the color of the grain lines in the wood. Draw a hot knife's sharp edge through the darker stick to coat it from heel to toe,

To fill a scratch, apply a bead of resin to the heel of the hot knife. Then push the resin-coated heel into the scratch and rock it gently to distribute the resin.

Clean and reheat the knife and drag it bevel-side down to smooth the resin to the surrounding surface.

then press the sharp edge straight into the repair in the same direction as the grain you are simulating. Some of the darker color will transfer to the patch. Continue the process until the grain lines match the surrounding wood. You can smooth the patch by dragging it with a hot knife as before. If you're repairing an open-grained wood, skip the smoothing step and sand with 400-grit wet/dry paper using mineral spirits or sanding oil as a lubricant.

Finally, I match the repair to the sheen of the existing finish by rubbing with fine steel wool or a soft cloth and rottenstone. I usually don't put any finish over the repair since I'm never sure what the original is. Overlaying with the wrong finish will often cause more problems than it will cure. □

John Revelle is a professional furniture restorer in Rohnert Park, Calif. Photos by the author. The materials he describes can be purchased from Star Chemical Co., Inc., 360 Shore Drive, Hinsdale, Ill. 60521.

Plate Joinery

We test two machines that make fast, tight joints

by Paul Bertorelli

Doweling is a quick and strong way to make carcase and frame joints, but the problem with dowels is accuracy. Even the best jigs maddeningly tend to misalign the holes in a way that isn't evident until after the joint is glued and driven home, with no hope of adjustment.

Faced with that trouble with dowels, a Swiss cabinetmaker named Herman Steiner during the 1950s tried substituting spline-like, eye-shaped plates of compressed wood. Instead of a drill and jig, he used a small circular saw to scoop out a short kerf, into which he could insert the thin plates. The joint proved quick to cut and to assemble. More important, the parts could be slid along the slot into alignment after assembly. The compressed beech plates then absorbed moisture from the glue and swelled, making the joint tight and strong.

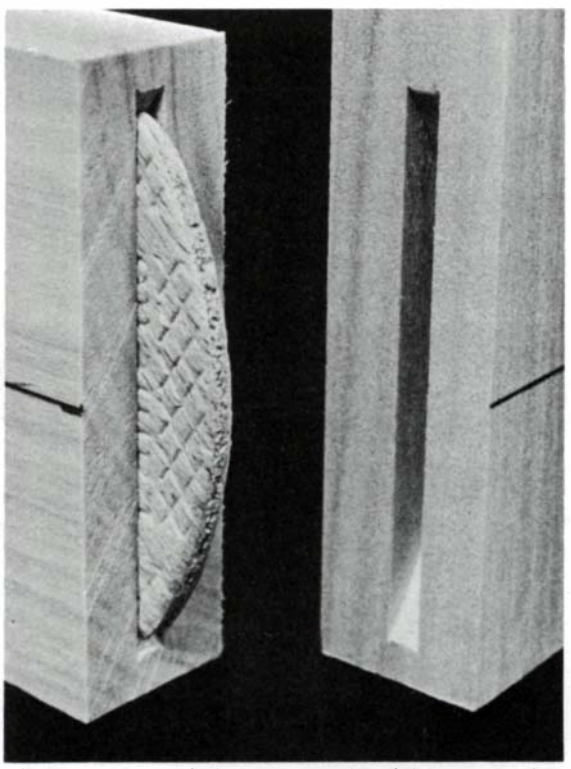


Plate joints are made by inserting a beech biscuit into slots milled with a specialized portable plunge cutter. The cross-hatch pattern on the biscuit holds glue and speeds the biscuit's swelling, thus tightening the joint.

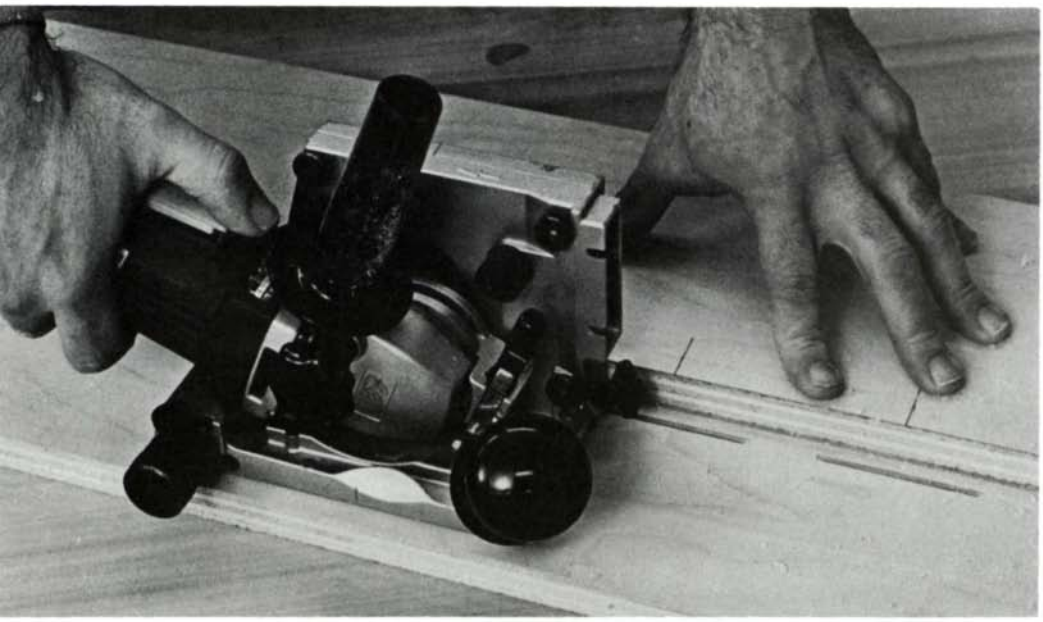
Steiner's invention developed into biscuit or plate joinery, a technique widely used in Europe but just becoming known in North America. Plates can connect carcases or frames in solid wood or in plywood, and especially in particleboard. Plate-joining machines are as portable as routers and require very little set-up. When making large carcases whose components may be difficult to pass through machines, plate joiners can be brought right to the job.

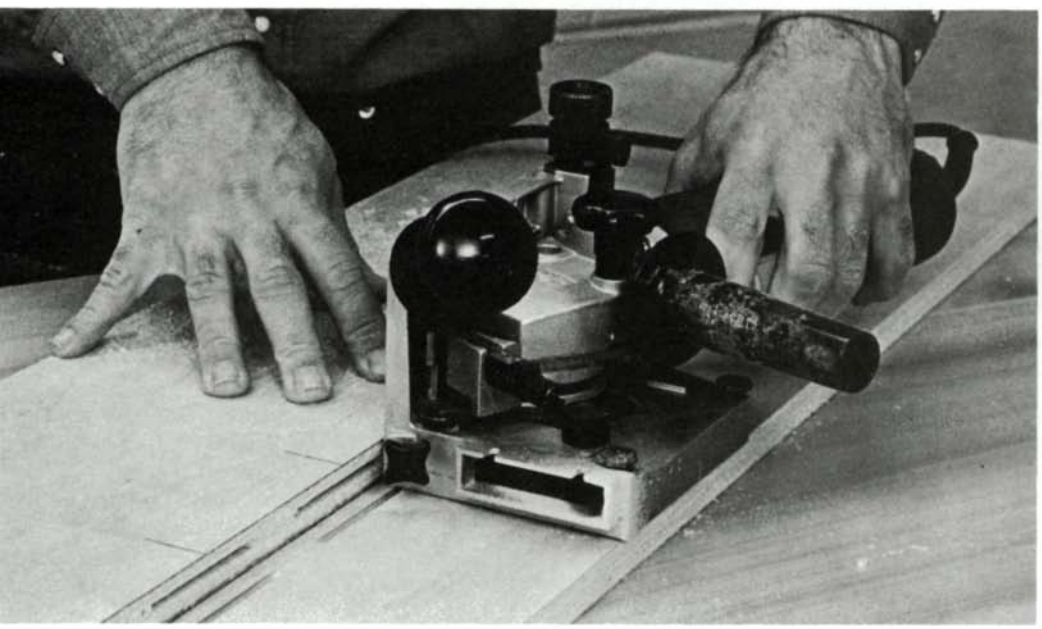
Steiner Lamello Ltd., the firm that sprang from Steiner's tinkering, has marketed its system in the United States for the past ten years. This summer the German tool firm Elu will offer a similar system. The Lamello machine (called a Minilo) costs about $580, the Elu about $300. Both companies say their machines are best suited for small shops where hand methods can't keep pace but where heavier equipment isn't justified. In my experience they've pegged the market. I used the Minilo in a small production shop for nearly two years and found that it worked well as a substitute for doweling, tongue-and-groove or even mortise-and-tenon. I recently borrowed an Elu machine from that firm's U.S. outlet for testing and found that, with some qualifications, it too makes an attractively quick and simple joint.

The plate does it—Steiner tried various sizes and shapes of wooden inserts, and even dabbled with plastic ones. He finally settled on three plates of the same thickness and shape (their edges are arcs of the same circle) but of different lengths and widths. Elu calls them biscuits, but the beech plates sold by both firms are virtually identical. Both make the same three sizes: No. 0 (about ⅝ in. wide and 1¾ in. long), No. 10 (¾ in. wide, 2⅛ in. long) and No. 20 (1 in. wide, 2½ in. long). The plates are die-cut from beech blanks with the grain running diagonally to the plate's length. Thus they are nearly impossible to snap across their width. The plates are compressed and embossed with a cross-hatch pattern that holds the glue, which you squirt into the slot before assembly. At first the plate fits its slot loosely. But as the compressed beech absorbs moisture from the glue, it swells in its slot. This swelling action is what makes the joint so tight and reliable. If there's enough glue in the slot, the joint tightens to maximum strength every time. Any water-based glue seems to work, sometimes even a little too quickly. I once misassembled a plywood carcase and tried to pull the yellow-glued Lamello joints apart after just ten minutes. I ended up with a lot of broken plywood.

Both machines consist of a high-speed motor powering a 4-in. carbide-toothed sawblade through a right-angle drive, attached to an adjustable base. Both machines have a spring-loaded mechanism that keeps the blade inside its base until you plunge it into the work to make the cut. Then the spring slips the blade back out of the wood and into its guard, while you move on to the next slot. The Minilo motor and blade move in a straight line, while the Elu swivels on a pivot; otherwise they both mill slots the same way.

Apart from speed, the big advantage of plate joints is being able to slide assembled parts into alignment. The machines cut a slot slightly longer and deeper than the actual dimensions of the joining plate. This tolerance allows the entire joint to slide along its length by as much as ⅛ in. The slot width is critical and is fixed at 5/32 in. Spacing of the biscuits depends on the joinery situation, although the closer together they are, the stronger the joint. For maximum strength, the plates can be end-to-end (on about 2½-in. centers) and side-by-side (in stock thicker than about ⅝ in.). In most applica-





To cut slots with the Elu, above left, the cutter index is aligned with each pencil mark and the motor-cutter assembly is pivoted, plunging the blade into the stock. The edge of the mating board acts as a fence and must not be moved during the plunge, or an oversize slot will result. Slots in the mating part are cut by repositioning the machine, left. Above, glue has been squirted into the slots, and the beech plates inserted. The metering nozzle and glue bottle sold by Lamello are on the bench. Now the joint is assembled and pulled up tight with clamps, screws or nails. Clamps can be removed in as little as 10 minutes, because the plates swell, locking the joint.

tions, you cut the mating parts as if for nailing or butt-joining. You bring the parts together and strike pencil marks about 5 in. apart across the line of the joint. Then cut the slots in both parts by setting these marks to a centerline on the base of the machine. Add glue and the plates themselves, and assemble. The joints can be pulled up tight with clamps, screws or nails and need be held tight only until the plates swell. As with any joint, the final position of the parts must be marked accurately. And you have to hold the machine and its positioning guide rock-steady while cutting, or the slot will splay out and will be too wide for the biscuit.

Despite its versatility, the plate isn't always the best joint. When joining boards edge-to-edge, for example, a spline or an accurately placed dowel will draw warped or bowed surfaces into plane. Until the glue swells it, the plate is too loose in its slot to align two surfaces. I've tried to use plate joints to edge-join slightly bowed plywood panels and found that the method won't get the faces within a veneer thickness.

The plate joint can substitute for a mortise and tenon in a frame, but within limits. The rails have to be at least 1⅞ in. wide, the length of the No. 0 biscuit slot, or else the edges of the slot will show. A protruding plate can be trimmed flush, but the result is never as neat as a well-made mortise and tenon. In frame stock thicker than ⅝ in., two plates should be used side-by-side.

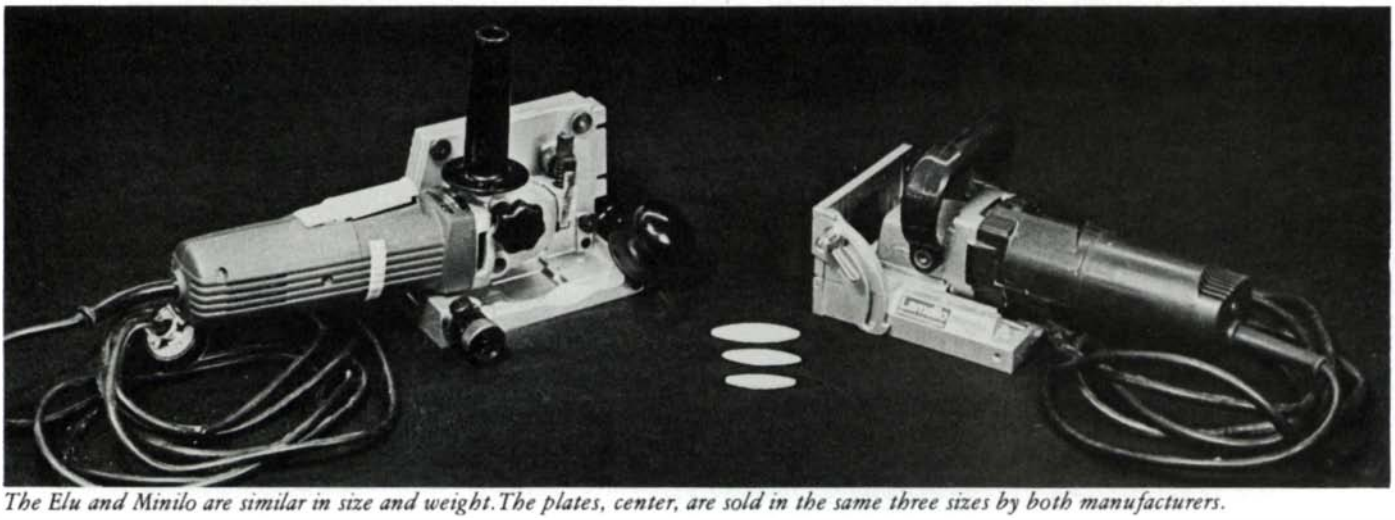
Controlling the amount of glue in the slots is important. Too little and the plate won't swell. Too much and you get a messy river of squeeze-out. Lamello sells a bottle with a split nozzle for metering glue, although at $20 it seems overpriced.

I've seen no data comparing the strength of plate joints with traditional joinery. So I assembled a few test joints in poplar with dowels, stub tenons and plates. I was surprised to find that only the plate-joined piece couldn't be wrenched apart by hand, although it did succumb to a swift kick that broke the wood, not the glue line.

Comparing the machines—Both the Elu machine and the Minilo are well-crafted. But after I used each in the shop for a few hours, I found the Elu system to be generally less refined. The Swiss-made Minilo has a slick, detent-type depth adjustment, a real help when you want to switch plate sizes. I had to struggle with the Elu's stiff, threaded stop for depth set-

These frame joints were cut by placing the parts together and marking them, as with doweling. Using two plates in stock thickness makes for a stronger joint.

The Minilo's front fence can be set at 45°, making it the better machine for slotting lengthwise miters. Spring-loaded pins in the machine's front guard lock the Minilo against sliding during the plunge, a feature lacking in the Elu.



The Elu and Minilo are similar in size and weight. The plates, center, are sold in the same three sizes by both manufacturers.

ting. To locate the plate in the wood's thickness, Lamello uses a flip-down fence that rides atop the stock. A simple plastic snap-on template accommodates thinner stock, and also does double duty as a guide for plate spacing, typical of this machine's thoughtful design evolution. Elu's base rides on the bench top, which means there must be no debris under the stock, and it uses a tedious screw to adjust the cutter to the stock's thickness.

Both machines are at their best when making carcase joints. For cutting frame joints, the Minilo is handier than the Elu. Its front fence flips down and locks parallel to the cutter, and gives you plenty to hang on to while making the plunge. The Elu has no front fence, making it tough to hold both stock and machine at once, unless you clamp the stock down.

The Elu does have one feature the Minilo lacks. With a clamped guide or side fence (sold with the machine), it can cut a continuous groove faster and cleaner than a router does. Set to its full depth, the Elu could even be used as a panel saw for stock up to ⅝ in. thick.

The real difference between these machines is price. When I bought my Minilo, it was the only game around, so I winced and paid the $580. It turned out to be worth it. The machine paid for itself every day by speeding carcase and frame joinery, and I soon wondered how I had ever gotten along without it. Yet, after trying the Elu, I'm sure it is more than half the machine for half the money. And despite its design shortcomings, I'd put up with its relative crudeness—particularly if I weren't going to use it in production every day.

The decision whether to buy a plate joiner ought to be guided by clear purpose. If you enjoy creating complicated, fussy joinery with little regard for time, one of these machines would only take some of the joy out of your woodworking. But if you find joinery a chore anyway, the plate joiner will make you wonder why you ever bothered with many traditional joints. A plate joiner is fast—a specialized power tool for doing lots of work quickly. □

Paul Bertorelli is assistant editor of this magazine. The Lamello system is available through local tool outlets. It is imported by Colonial Saw Inc., 100 Pembroke St., Kingston, Mass. 02364. The Elu will be sold by Elu Machinery, 9040 Dutton Dr., Twinsburg, Ohio 44087.

by Richard Starr

WOODTURNING ON A METAL LATHE

Is there something different about Michelle Holzapfel's turned work? One turner, after learning how a piece was made, thought it appeared mechanical. She agrees: "My work has changed since I picked up this method. It has a removed quality which I like."

When Holzapfel first encountered the lathe, she knew she had found her craft. She began developing skills with the woodturner's usual selection of tools—keep the bevel rubbing, lift the handle, roll the tool, swing the handle. It's frustrating learning a delicate craft from books. "I can remember a few times having the feeling of being in control," she said, "but the effort to cut correctly diverted my energy from making the shape I wanted."

Holzapfel's lathe was assembled by her machinist father from odd parts, and it includes the cross slide and compound that metal-lathe operators use for precision work. When she tried these controls for shaping wood, she put her hand tools away forever.

Remember the drawing toy you had as a kid, with a screen and two little knobs? One knob made the stylus move up or down, the other moved it right or left, and you wound up with a sketch that looked like an etching. Remember the frustration in trying to draw a curved line? It took heroic concentration yet everything still came out with jagged corners. Controls on a machinist's lathe work the same way. The cutting tool is mounted rigidly in the mechanism and moved at right angles to the lathe bed by the cross-slide crank. The compound crank controls longitudinal movements. Holzapfel moves the controls simultaneously and independently to develop the graceful curves usually associated with freehand turning.

Many of us who turn wood are in love with the dance, those odd contortions we perform that echo the evolving shape on the lathe. Holzapfel's turning is more cerebral. She stands quietly in deep concentration, twirling a couple of cranks. Her control is as sure as any hand-turner's and her work is as fine. But she is free of worry about the tool digging in or catching in a crevice. "At first I missed the flexibility of using hand tools," she said, "but within a matter of days the machinery just fell away. I have no thought of bevels rubbing or anything but where the edge is and where I want it to be. I'm really free to concentrate on the shape.

"Because I don't have to hold the tool, I don't get tired. If I alternate sitting and standing, I can work eight, nine, ten hours a day."

Instead of the risk of working freehand, Holzapfel savors the adventure of working burls, crotches and spalted wood. Though her pieces are elegantly formed and superbly polished (two rubbed coats of tung oil and a third left to set on the surface), a bowl's contour may be interrupted by included bark, or the eye may be distracted from the delicate shape of a plate by a random spalt pattern. It is a harmonious discord that gives Holzapfel's work its vitality. "If a piece of wood is flawless," she said, "I don't know what to do with it. Working perfect wood bores me to tears."

With her husband, David, Holzapfel shares a shop, two children and a basic approach to wood. He makes tables of wildly shaped slabs in what he calls an "aformal" style. Their showroom in Marlboro, Vt., is called "Applewood," the translation of their German name.

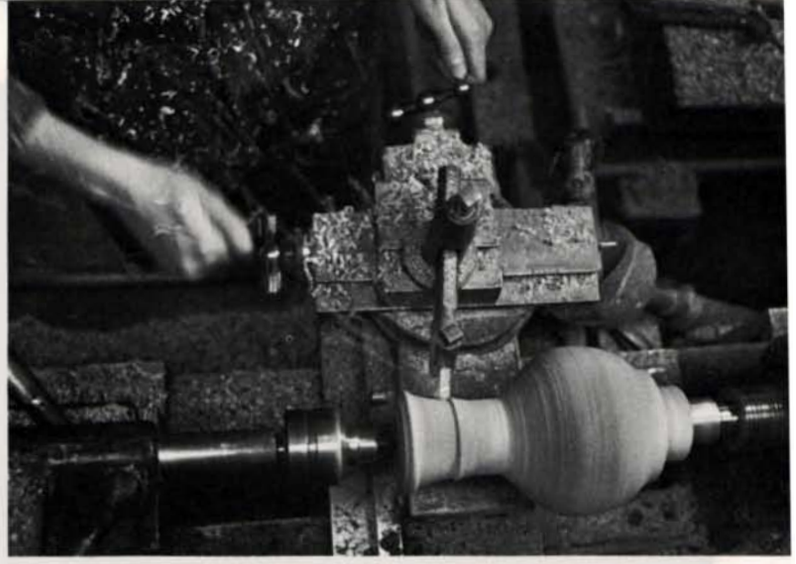
"We have a common philosophy taking off in two completely different directions," said Michelle. "David believes in real randomness while I want to formalize things. But we both try to let the wood talk to us."

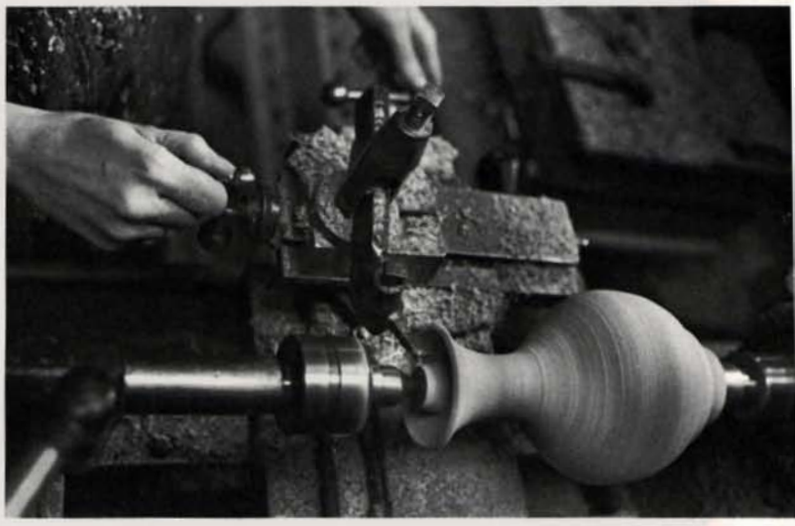
Reflecting on her technique, Holzapfel believes that handicapped persons could use it to gain access to turning. "A handicap is just a limitation. In a way, I consider myself handicapped. I can't build enough muscle to turn with hand tools for hours. I would have given up turning long ago, but through sheer luck I came upon a way." □

The drive system of Holzapfel's lathe, above, harks back to the days of steam and lineshafts. The motor is mounted below the headstock and drives a jack shaft by means of a belt. The jackshaft drives a second shaft above it, and pulleys on the two give twin speed ranges. The upper shaft has a four-step pulley that mates with a counterpart on the headstock shaft giving a total of eight speeds. An idler on the belt works through a ratcheted lever to engage and disengage the lathe from the motor. The idler will also work as a slip-clutch, allowing very low speeds when revving up heavy, eccentric chunks. Instead of hand-held gouges and skews, Holzapfel grinds her own tools from tool-steel blanks. Pictured at right are a parting tool, a left-hand cutter and a right-hand cutter. Each tool has its own holder. The tools, say Holzapfel, stay sharper longer than hand tools and require only a touch-up on the grinder once a week.

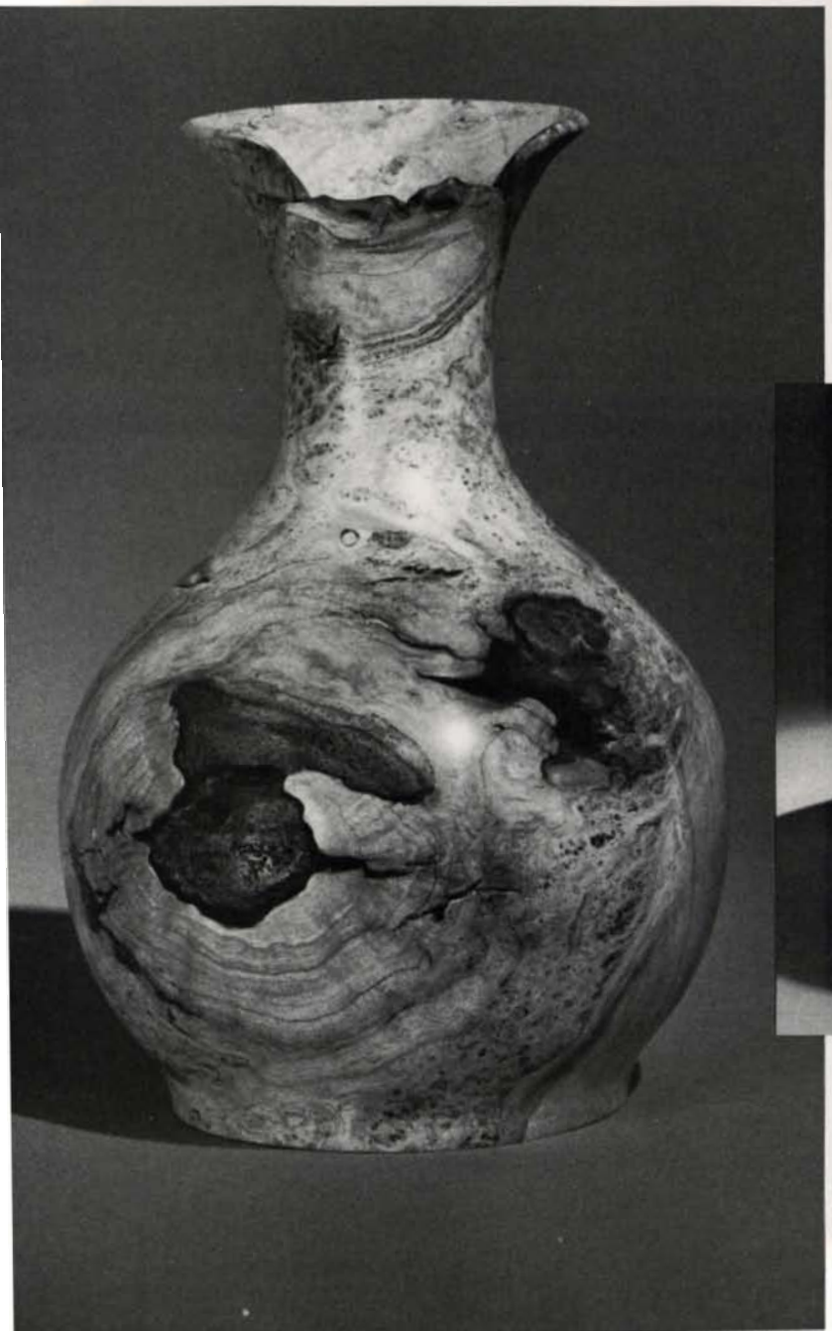
Richard Starr is a contributing editor of this magazine. Photos by the author.

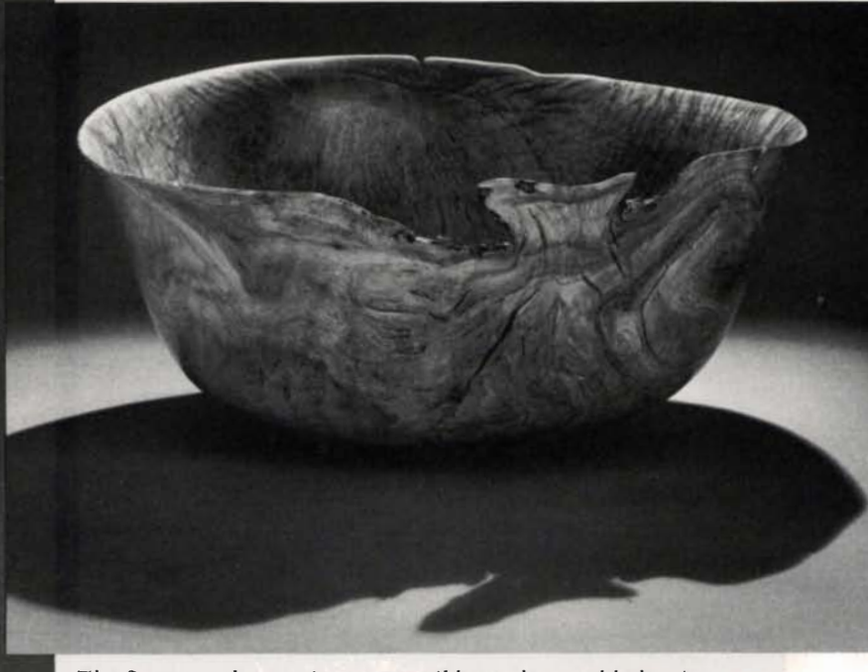
Chucking up odd-shaped pieces, Holzapfel rounds them off as quickly as most turners would with hand tools. Standing to the side, above, keeps her out of the path of flying chips. Rounding off at low speeds, she runs the lathe slowly and since it's bolted to the floor, vibration is minimal.





Holzapfel uses a diamond-point tool, top, to shape a cherry vase. Having become accustomed to the machinist's lathe, she finds it easy to trace a contour while reducing its diameter, a feat of considerable coordination with a compound tool rest. Above, she uses a left-hand cutter to shape a vase's flaring top. Cross slides and compounds are available for many woodturning lathes and old metal lathes of all sizes can be adapted for woodturning.





The finest wooden turnings are possible on the metal lathe. At left, the vase's flare was intentionally interrupted by included defects, as was the thin-walled bowl, above. Metal-working tools leave fine ridges which can be removed quickly by 60-grit sandpaper. Holzapfel sands down to 600 grit before applying a tung-oil finish.

Horgos' Gambit

When Bill Horgos was studying art in San Francisco, he used to go out to Union Square and get interesting characters to model for the class. Now he works in wood, and with this Law and Order chess set, he's back to sketching street people.

The pieces (the largest is 5½ in. tall) are characters we all see in daily life—bikers, cops, lawyers, salesmen. After three years work, on and off, Bill showed the set last summer at the Pacific States Craft Fair. To our surprise, everybody saw the humor right away. Cops, bikers and little old ladies alike were able to say, "Hey, that one looks just like a guy I know."

The original set is made of boxwood, maple, rosewood, vermilion, walnut, ebony, brass, ivory and gold. Because the response has been so good we've begun to cast a limited edition in bronze. The first one sold for $8,000 before the second emerged from the foundry. —*Lilli Heart Horgos*

Photos: Lloy