Fine WoodWorking

Greene and Greene

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Cover: Writing desk, designed by Charles Sumner Greene and built by John and Peter Hall, for the Robert R. Blacker house, Los Angeles, 1907. Photo, left, shows leather boss that protects table surface when writing flap is open. Greene and his brother Henry were among America's leading adherents of the Arts and Crafts philosophy inspired by the writings of John Ruskin and William Morris. An analysis of the Greene brothers' furniture, by Alan Marks, begins on page 40.

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September 1978, Number 12

DEPARTMENTS

ARTICLES

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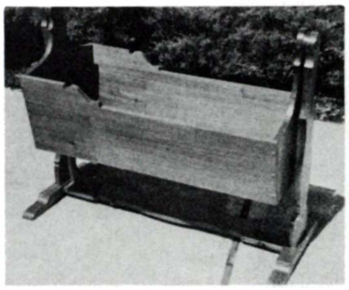
In the last two issues of *Fine Woodworking* different people have related alternate ways of obtaining wood besides buying, such as from crates for motorcycles and plate glass coming from Japan. I also have a way of obtaining wood that I would like to pass on to your readers. Living within easy traveling distance of the beach in northern California, I can get small redwood logs (8 in. in diameter and 2 ft. to 3 ft. long) and saw them up into 1-in. thick slabs on my table saw. The wood is of course wet from the beach, but by standing the lumber on end in a warm, dry room, I can air-dry the redwood in about three months with little or no warpage. The only drawback is the sand and gravel that might get in the wood when on the beach, but by careful picking and washing the logs before sawing, this can be eliminated.



Here is a photo of one of the two cradles I have built with redwood off the beach. The cradle is of early American style and is joined together by small redwood wedged dowels. The finish is clear satin Deft.

—*Darwin S. Knight, Angwin, Calif.*

I have been reading the correspondence resulting from your articles on steam and heat bending of wood and am surprised to find that no one mentioned the time-honored wood steam box used by boat builders for the past few hundred years. The long wooden box is built to accommodate whatever wood is to be bent. One end is usually closed and the other has a cloth curtain hanging over it. The closed end has either a hole in the wood into which a length of hose from the boiler can be inserted, or a short length of pipe over which the hose can be slipped. When only one end of a long piece of wood is to be bent, that end is put in the box and rags packed around the opening to hold in the steam.

Wood boxes have the advantage over metal in that they hold the heat better and do not cause the steam to condense as soon. They are also easier to fabricate to the shape and size most suitable. I have used both solid wood and plywood with good success.

Since boat-building is often done in an open shed, the boiler can be heated with a charcoal burner, which can be placed near the work, resulting in a short steam hose. A charcoal burner should never be used in a closed location because it generates carbon monoxide.

—*Howard C. Lawrence, Cherry Hill, N. J.*

In response to Henry Fisher's letter (Summer '78) regarding the problems encountered while turning a bowl with birch dowels inserted: His problem is, he is using dowels with the end grain exposed instead of face-grain plugs, which would cut easily, with no deflection of the tool that causes chipping. . . .

—*Chris Gutzeit, Suffern, N. Y.*

We would like to take issue with David Adamusko on several points in his article "Building Green" (Summer '78, pp. 68-69). We too live in an area where green hardwoods are readily and cheaply available from local mills and have had experience in "building green."

While it is true that roughsawn lumber offers advantages in some applications—for instance, rough 2x6 oak floor joists

are roughly equivalent to nominal 2x8 pine—working with planed or "dressed" wall studs, roof joists and decking is easier and gives superior results. Roughsawn lumber varies quite a bit in dimension from board to board, making everything more difficult. Around here one can have boards planed for $25 per thousand board feet, so the savings in using rough lumber is minimal.

An old contractor one of us was working for once idly asked, "You ever seen a house built with green oak have the nails rust out after four or five years?" The tannic acid in green oak attacks the steel nails. Since then we have used only galvanized nails. We have had little trouble with nails popping in oak, but one thing to keep in mind is that longer nails will tend to pop more than nails of optimum length.

Tar paper won't protect roof decking from the heat of the sun, although it will allow water vapor to escape while protecting the deck from rain, so it appears in that respect Mr. Adamusko did the right thing, but for the wrong reason. We just wonder why he didn't save himself a lot of trouble and stack his lumber under cover with strips between boards and let it dry for a few months before nailing it on his roof. It wouldn't have taken any more time, and partly seasoned oak isn't that hard to nail through. On a low-pitched roof or one that is subjected to snow loads, a ¾-in. crack between the roof boards can get you into a heap of trouble.

It is quite simple to avoid making soffits by putting blocking between the rafters and between the false rafters on top of the exterior walls. Short overhangs might discourage bats and insects, but long overhangs discourage rot and make the house cooler in summer.

Mr. Adamusko states, "Particle board gives a very rigid shell to the frame, and it will hold siding nails." If you want to build a lasting structure, stay away from particle board—with the possible exception of floor underlayment. Particle board will eventually disintegrate from exposure to moisture (tar paper is not a vapor barrier) and we know from bitter experience that it will not hold nails. A much better sheathing material is black insulation board, which is cheaper than particle board, does not need covering with tar paper, adds to the insulation value of the wall and is quite insect and vermin-proof. The only drawback is that blackboard does not provide racking resistance, but that can be provided by let-in bracing or by plywood corner sheathing.

Mr. Adamusko says, "Carbide-tipped blades offer the only efficient means of working green lumber." False. The key to cutting wet lumber lies in having enough set in the teeth of whatever saw you are using. We have built houses without electricity and we can testify that a well-sharpened appropriate handsaw is quite efficient, requires little effort and is a joy to use....

Traditional building techniques were developed—often by trial and error—over a long period and every aspect of building design has one or several reasons behind it. One can often save money and obtain superior results by departing from accepted practice, but one should have a thorough understanding of how a building works and the properties of the materials before doing so. There are good reasons for building with seasoned lumber that the readers of *Fine Woodworking* should all be familiar with, and when possible it is best to buy lumber a year or so ahead of time and let it dry. The saving is in buying direct from the mill, not in "building green."

—*J. Harvey Baker, David Baker, Waynesboro, Tenn.*

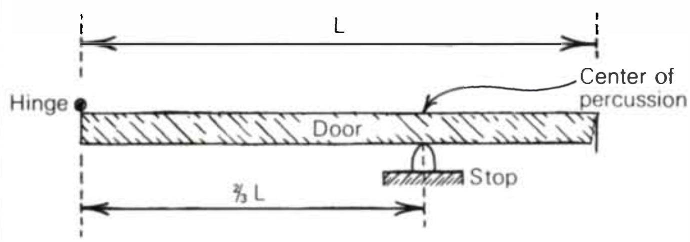
The cover picture of the Winter '77 issue was especially interesting to me, since I wrote my senior major history of art paper on that highboy. The paper investigated the attribution of the highboy to Thomas Affleck. I traced the records

back to the original owner, Judge Henry Wynkoop of Bucks County, Pa., but could find no basis for the attribution. Much evidence was in fact against it, and some of it was stylistic. Affleck worked in the latest fashion, which at that time in Philadelphia was the Chinese Gothic style. He also used mahogany, a more expensive wood than the "rustic" walnut of this highboy. Interestingly, in 1831 the Wynkoop highboy was valued (in the will of Dr. Reading Beatty of Bucks County) at $5. It was quite out of fashion when it was 60 years old. There are few furniture designs that are distinctly American. The highboy is one of them.

—*George Pilling, Springville, Calif.*

The letters on "The Right Way to Hang a Door" in the Summer '78 issue have prompted me to pass along an old wrinkle and a point of some interest on the same general subject, the placing of the doorstop.

The position at which a doorstop is placed should, in principle, bring the door to rest without causing any force at the hinges. This point is called the center of percussion and is known to baseball players as the point where the ball is hit without any sting on the hands. Think of the door as a simple, thin rod of length L hinged at one end. The center of



percussion of a thin rod is at a point two-thirds of the length of the rod from the hinge. This is the point at which a stop should be placed, and I have heard that old tradesmen knew this as a rule of thumb. It should, however, be borne in mind that the door is not a simple rod as shown and that the stop should ideally be placed as shown but halfway up the door. Such a position is not usually desirable, at least on the grounds of appearance, and doorstops are always placed near the floor. This compromise position does result in hinge forces because the door is not the simple rod shown in the figure.

—*Frank R. Archibald, Needham, Mass.*

Re the leg vise (Summer '78, page 16): Although the diagram isn't meant to show one how to use the vise, the location of the peg in front of the bottom of the vise gives the impression that that's where it belongs. Placed there, it does no good and the bottom swings in to the leg when the vise is tightened. To work correctly, the dowel must be placed behind the vise tail, holding it out while the vise is tightened.

—*Alan Walker, Laguna Hills, Calif.*

Re "Notes on Finishing" by Ian Kirby (Summer '78, p. 64): To say that the best surface is a smooth-planed one on which to apply a stain certainly is cross-grained to the old masters, even the modern masters of finest pieces. What happened to the scrapers that are used yet today?

Staining kills visual qualities. Leaves wood bland, lifeless. I thought staining was done to magnify the grain of the wood, enhance, beautify.

I take the position that Kirby is one of those craftsmen who is set in his ways or methods, making all others tolerable but not really acceptable. I feel that I can produce with lacquer,

LETTERS (continued)

for instance, almost any sheen, matte or patina that can be produced with any other method. I really believe it's what you learn to work with. And isn't beeswax gummy when mixed with turpentine?

—*Raymond E. Blue, Winston-Salem, N.C.*

Until your last issue I had really looked forward to your publication. I'm sick of reading of the bickering back and forth in these "I'm better than you are" letters. I'm enclosing a one-year renewal check, hoping that this will stop. If not, I'm afraid you will lose one subscriber at least.... I also believe I'm not the only person that feels this way.

—*E. R. Clair, Howard, Pa.*

I look forward to reading *Fine Woodworking* with some enthusiasm. The Letters column is particularly interesting, because it is professional sharing. The professional dueling or "roasting" that prevails in some letters is funny, but I suspect the humor is often unintended....

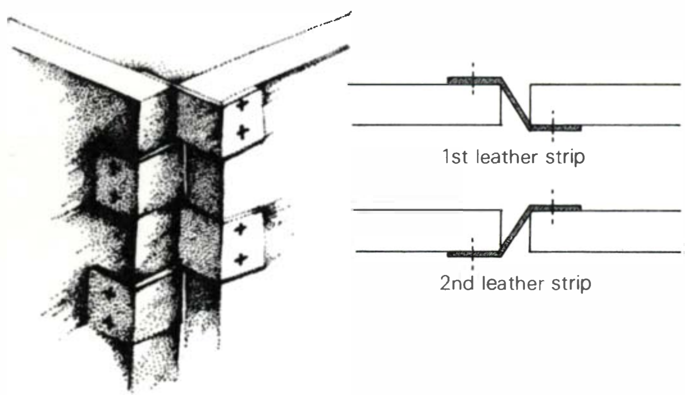
I would like to take issue with one Mr. Do-Better who shot at John Harra's "Routed Edge Joint" (Winter '77, p. 66) in the Spring '78 letters. He cites Harra's error as .0455 in., .0106 in. and .0026 in. for radii 12 in., 24 in. and 48 in. respectively.

It must be exciting to work that close with wood, but I have never found a feeler gauge or micrometer in any woodshop that I have ever worked in. Perhaps it is self-incriminating, but I have never even felt the need for one (except maybe for machine adjustments).

It might soothe Harra's wounds to know that an old cabinetmaker once told me the only practical use for the 1/100-in. scale on the framing square was for filing fingernails.

—*Vince McGavisk, Dansville, N.Y.*

I greatly admired the screen and the laborious hinge of wood by Tim Mackaness (Spring '78, p. 69). For anyone making screens the old method using alternating leather strips makes



a hinge with full 360° rotation. The screen folds easily in both directions, and square corners are quite practical.

—*Tom DeVerter, Birmingham, Mich.*

In reply to questions about gluing rosewood, many workers recommend washing the gluing surfaces with one solvent or another and sometimes suggest using a special type of glue. In my experience, it is virtually impossible to remove any significant amount of resin from rosewood using only a solvent rag. You can rub all day and still get the color or resin on the rag. In any case, I have determined through experiments that solvent washing is superfluous, while the important requirement is that the gluing surface be fresh and not oxidized, and also not "polished" by the heating and beating of dull power tools or by the use of worn sandpaper. With fresh clean-cut

surfaces, I have had very good results gluing both Indian and Brazilian rosewood with Titebond (yellow) glue. One caution—Titebond will sometimes run the color of rosewood, so it is best to minimize squeeze-out, especially where there is adjacent light wood. There is no need to gag over solvents, some of which are hazardous in skin contact.

—*William D. Woods, Phoenix, Ariz.*

I enjoyed William R. Cumpiano's fine article on bending guitar sides with a hot pipe (Spring '78, p. 62) except for several minor points.

There is a long-standing bias among luthiers to the plasticizing of wood with steam or boiling water, a prejudice that recalls Kierkegaard's definition of truth: a demonstrably false premise held with the most passionate conviction. Cumpiano refers to boiling as a harsh and vigorous treatment that leaves the wood lifeless and crack-prone. Hardwood logs and flitches are softened by boiling for many hours before being sliced into veneers that retain the general character and appearance of the sawn wood. And my guess is that the stability of these veneers in terms of cracking would not be markedly different whether boiled or sliced dry. Bending wood on an iron many times hotter than boiling water is at least as harsh as boiling and certainly more risky. Cracking is common for beginners and by no means rare for the expert, and charring of surface wood is an acceptable hazard to hot-pipe benders.

Boiling rosewood for about an hour does leach out pitch and a portion of the resinous content. Maple and cypress seem little affected by boiling. If the wood really emerged lifeless or lost all of its resinous content, I would do all bending on a bending iron because I feel that the resinous content of wood, Brazilian rosewood particularly, is a tonal asset.

When Cumpiano refers to a recalcitrant piece of mahogany as having lost its "memory," he appears to have misconstrued the meaning of wood memory. The memory factor in wood bending refers to the tendency of bent wood to return to its earlier unbent condition. This process is accentuated by the presence of moisture, and bent curves tend to become more acute with the loss of moisture. Cumpiano's piece of mahogany was not suffering from a failure of memory but a stubborn memory.

For steel-string guitars with their relatively shallow curves, I do bend wood on a hot pipe. For classic guitar sides with their more acute curves, I use the form described on p. 27 of my book, *Classic Guitar Construction,* (E. P. Dutton, 201 Park Ave. South, New York, N.Y. 10003). This is basically a box in the shape of half of a guitar, the undulating side covered with sheet metal. I have modified this design so that the bottom of this form is open. I use a 75-watt bulb in the large end and a 60-watt bulb in the small end. The boiled wood is quickly positioned on the form, covered with a strip of moistened cotton canvas and the waist is battened down to within ¼ in. of the form. The bouts are pulled down tight, held by end clamps with just enough pressure to permit slight movement. The waist is clamped and the end clamps screwed tight. Twelve hours of heat is enough to dry the sides.

The wet canvas quickly shrinks tight and acts as a compression band. Rippling is seldom more than minimal even on wood sawn off the quarter, and symmetry is guaranteed. Although I do not build guitars on anything like a professional scale, I have never cracked a side using this method with rosewood, maple and cypress. Springback is negligible and the argument about whether to build a so-called "relaxed" guitar or one with tensions is not exactly moot since there is no way of freeing the bent sides from the memory pressure that to some degree always exists in the finished instrument.

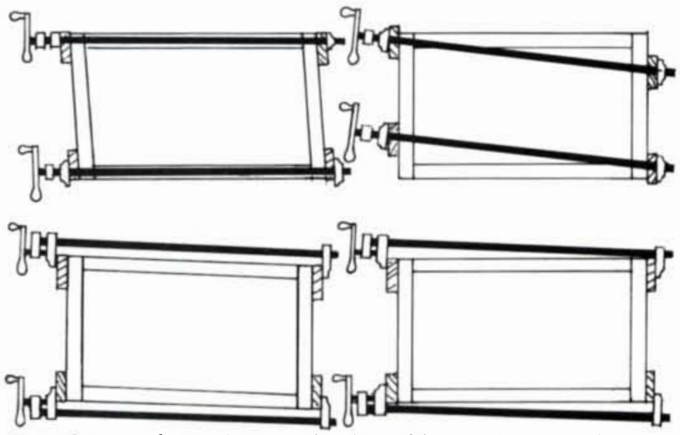
—*Irving Sloane, Brussels, Belgium*

Methods of Work *is a forum for readers to exchange the tools, jigs and tricks they've devised. Send precise details, sketches (we'll redraw them) and negatives with photographs, if any. We pay at the rate of $100 per magazine page, minimum $20, upon publication.*

Clamping boxes

Clamping and squaring large box pieces can be a problem. The pressure of the clamps often pulls the piece out of square at the critical moment of final tightening. The first hint is obvious but often forgotten: Get all the parts ready to glue and assemble, have all your clamps extended to the length you will need, and tape your softwood clamping blocks either to the work or to the clamp faces before applying any glue. Proper preparation saves precious time.

After assembling, tighten opposing clamps in small increments. When the pieces are just snug, measure the diagonals



Out-of-square boxes, left, can be aligned by repositioning clamps to oppose the pull, as shown at right.

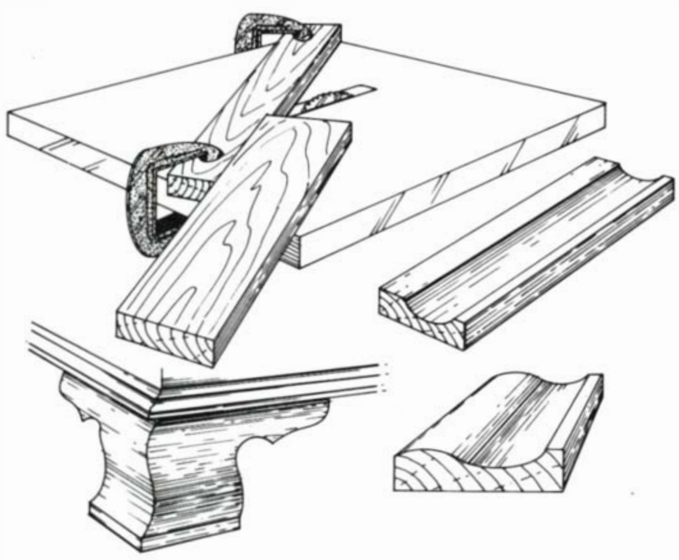
for squareness. A folding rule with a slide extension is indispensible here. If the work is out of square, move the clamps slightly to oppose the pull, i.e., make the clamps pull more parallel to the longer diagonal. A very small movement will make a lot of difference.

This process becomes much more complicated if all four sides of the rectangle are open and being glued at once. But I have clamped together a post-and-rail crib with all four sides openwork and no top or bottom. Using eight clamps, I pulled it square in all directions at once. A final hint, which most know: Don't wipe the glue. It will be much easier to chip it off the surface than to sand it out of the pores later.

—George Pilling, Springville, Calif.

Ogee molding

Ogee molding is easy to make using the table saw with a jointer or hand plane. By setting up a diagonal fence on the table saw, the boards, usually 3 in. to 5 in. wide, are hollowed, leaving a flat section along each edge, one narrow and



one wider. For 4-in. molding of the type usually used for bracket feet on case pieces, I usually leave a ¾-in. flat along one edge, which will remain flat. Along the other edge is a wider plane, which I joint or hand-plane into the graceful curve that makes this molding so useful. For safety, always use a push-stick and make several passes over the table-saw blade, raising it perhaps ⅛ in. at each pass. The fence is simply a board with a straight edge, clamped to the saw table at about 30° to the line of the blade. Other moldings, chair seats and even raised panels with beautiful curves forming the rise may be made using variations of this method.

—James B. Small, Jr., Newville, Pa.

Veneering cylinders

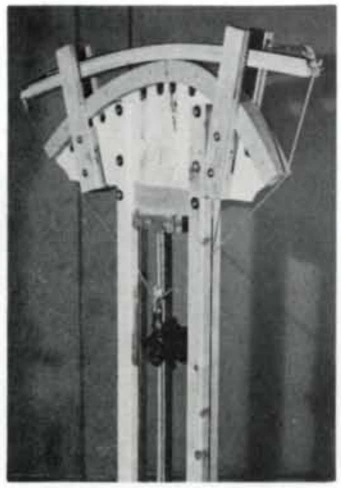
Paul Villiard in *A Manual of Veneering* makes two suggestions, among others, for veneering cylinders. (1) Use photographic print flattening solution to make the veneer flexible; and (2) clamp the veneer by wrapping the veneered cylinder in several layers of friction tape.

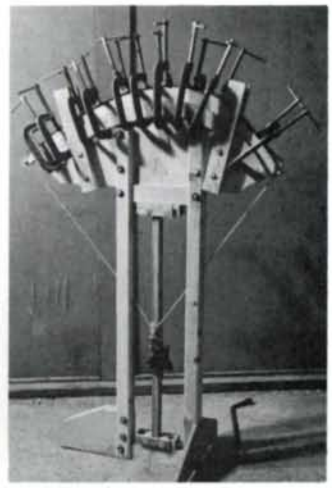
After veneering a large tapered cylinder, I offer these comments: (1) The print flattening solution produced very good results on a wavy and brittle zebrano veneer 1/28 in. thick. (2) As an alternative to friction tape, I used strips of rubber bicycle inner tube. The strips are cut about ½ in. to ¾ in. wide from an old tube. The strips should be cut as long as possible in a continuous cut around the tube. The strips are then stretched as tightly as possible around the veneered cylinder after gluing. I found I was able to get a much tighter wrap with one layer of rubber than with several layers of tape. And the rubber strips are reusable and virtually free if discard tubes are used.

—*David J. Lutrick, Seattle, Wash.*

Steam-bending jig

An inexpensive jig for steam-bending or bent laminations can be rigged up using an ordinary automobile bumper jack to supply the clamping force. First weld *U*-bolts to either end of a flexible steel strap of about the same length and width of the stock to be bent—I used a 36-in. by 1½-in. section of band-saw blade. Now attach a small pulley to the jack. With the jack installed in the jig framework so that its force is





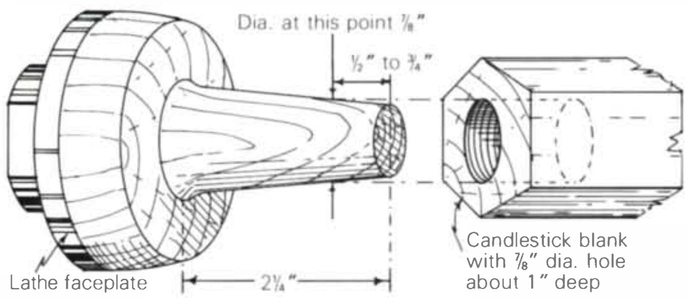
directed away from the bending form, thread wire rope through the pulley and jig framework, then attach it to the *U*-bolts with steel rope reinforcing loops and rope clamps.

Place the steamed or laminated material to be bent between the relaxed strap and the bending form head, then use the jack to pull it around the form. Clamping from the tightest point on the curve outward to each end will ensure perfect laminations. The form is secured to the jig with four bolts; other forms may easily be substituted.

—*Steve Voorheis, Missoula, Mont.*

Tapered turning head

When lathe-turning candlesticks or other items that have a center hole, the hole can be perfectly centered by drilling it first before turning is started, and then using a tapered turning head, such as the one shown. If the candlesticks are to be



for standard ⅞-in. diameter candles, taper from a large diameter of about 1⅛ in. down to a minor diameter of about 13/16 in. or slightly less. The important dimensions are ⅞-in. diameter at ½ in. to ¾ in. from the small end, along with a smooth, straight taper.

The predrilled wood blank is slipped over the tapered head. Care must be taken not to overtighten, of course, as the taper will split the wood blank if too much force is applied. Making the overall length of the taper about 2¼ in. and using

the diameters indicated seem to provide good tightness and good tool clearance for standard candlesticks.

Cutting away stock from the top of the turning adjacent to the tapered head shortens the workpiece and consequently loosens the grip of the head, so if you must cut at that point, be sure to remove only a small amount before stopping the lathe and retightening the tailstock. When finished, the work can be removed easily by backing off the tailstock and moving the work slightly from side to side until loosened. The result is a perfectly centered hole. This method has one other advantage: You proceed with turning *after* you know that you've drilled a good clean hole.

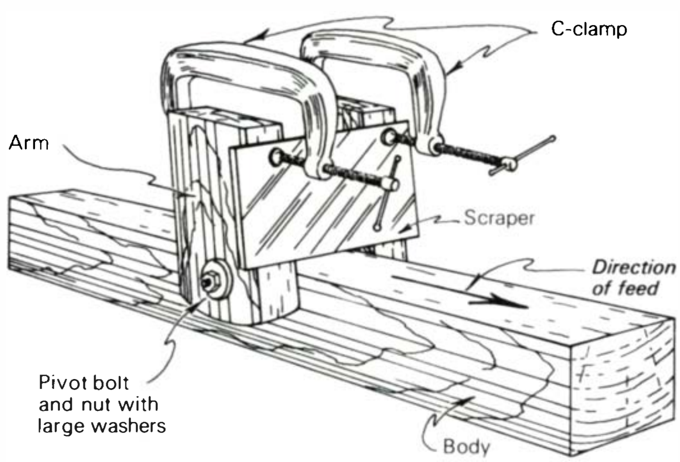
The same concept can be applied for other center-hole pieces as well by turning other tapers with different diameters. If you have several tapers, it's best to mount each one permanently on its own faceplate to ensure concentricity.

—L. L. Chapman, Newark, Ohio

Veneer strip thicknesser

For decorative inlay and border work, it is often an advantage to have all the strips of uniform thickness, or to alter the thickness for a special design. A simple scraper thicknesser assembled from scrap hardwood will do a quick and accurate job. A trued-up 2-in. square about 14 in. long forms the body of the jig, while two identical rotating arms (say 1 in. by 2 in. by 5 in.) support the scraper and adjust the cut and thickness by means of a common pivot bolt (say ⅜ in.). The scraper is clamped to the arms with two small *C*-clamps.

To use the thicknesser, clamp one end of the body in the vise and loosely position the arms at an appropriate scraper angle. Clamp the scraper to the arms as shown, using shims on the body to determine thickness and to orient the edge parallel. Tighten the pivot nut and make fine adjustments by tapping with a hammer. Feed the strips under the scraper in



the direction shown and pull them through. Sometimes it helps to angle the strip to the blade. If the strips pull hard, rotate the arms and take a lighter cut. When sharpening the scraper, file straight across only about three-quarters of its length, then taper away at the end. This will permit starting the strips under the scraper near one arm, then sliding them over under the straight-cutting section for thicknessing.

—William D. Woods, Phoenix, Ariz.

Sanding small pieces

While doing some restoration work, I needed to inlay a patch in a veneered surface. The piece to be inlaid was a bit too thick. Ordinarily, one would sand it flush with the surface after gluing. In this case, sanding would have been impossible without marring the surrounding finish. I had to devise a way of holding the small piece so that it could be sanded evenly. I

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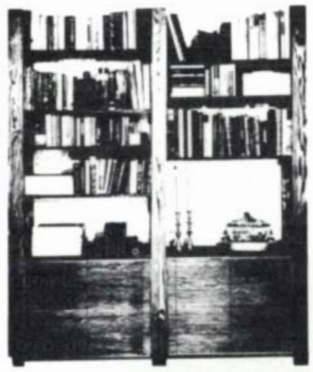

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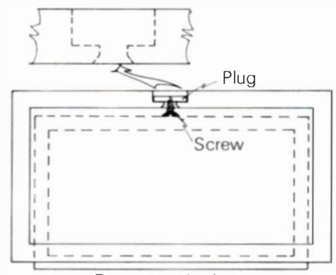
put coarse-grit sandpaper on the bench, then put the veneer patch on it. This way it could be easily and evenly worked with a sanding block, using a finer grit. When a thin workpiece is sandwiched between two grits, it locks into the coarser grit as pressure is applied and is held firmly.

—Joseph T. Ponessa, Moorestown, N.J.

Drawer "push"

I have seen several small boxes whose beautiful forms are interrupted by a knob. Indentations for the fingers to pull the drawer out may also work against the design of the box. My father taught me an alternative to these "pulls" and that is to push the drawer out. First drill a hole about two-thirds the depth of the thickness of the back of the box. If the rear wall is ¾ in. thick, I drill down ½ in. Now drill a small hole the remaining distance through the wall of the box, then countersink the small hole on the inside of the box. Make a plug ¼ in. thick and fasten it from the inside with a screw that will move freely through the small hole. Pushing the plug in causes the screwhead to push the drawer out enough so that one can get hold of the drawer in front to pull it out the rest of the way.



Drawer pushed out

—John Roccanova, Bronx, N.Y.

Coating nails

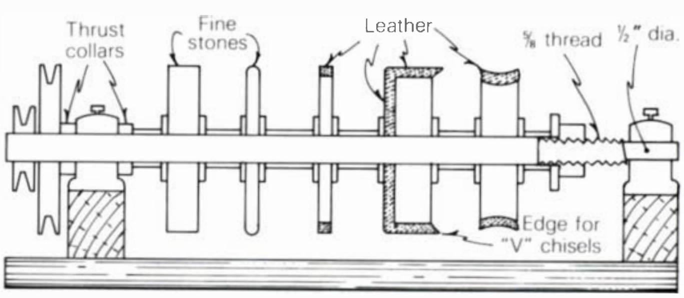
Nails coated with rosin are difficult to pull out. To coat your own nails or brads, dissolve about 4 tablespoons of powdered rosin in about a half pint of denatured alcohol. Store in a tightly covered container. Pour a small amount of the solution into an old shallow pan or dish, then swirl the nails around in the solution until they are covered. Dump the nails onto old newspapers. Stir occasionally to separate the nails until they are almost dry, about five minutes. Then let them dry thoroughly.

—Price G. Schulte, St. Louis, Mo.

Sharpening setup

I have assembled a jackshaft on two sleeve pillow bearings. The shaft diameter is ⅝ in., except for the extreme end, where it is reduced to ½ in. and rests in a ½-in. pillow block bearing. To the inside position of the bearing the shaft is threaded for a ⅝-in. thrust nut, a stop collar at the opposite end of the shaft (inside the other bearing) and between the two are spacer sleeves and thrust or side plates for as many grinder or leather wheels as one wishes.

The shaft is driven by a ⅓-hp motor rotating backwards, or away from you, and has two step pulleys, one for grinding



speed and the smaller pulley (driving) for honing my woodcarving or regular chisels. I made the discs of hardwood and covered their sides and periphery with leather.

—George P. Calderwood, Long Beach, Calif.

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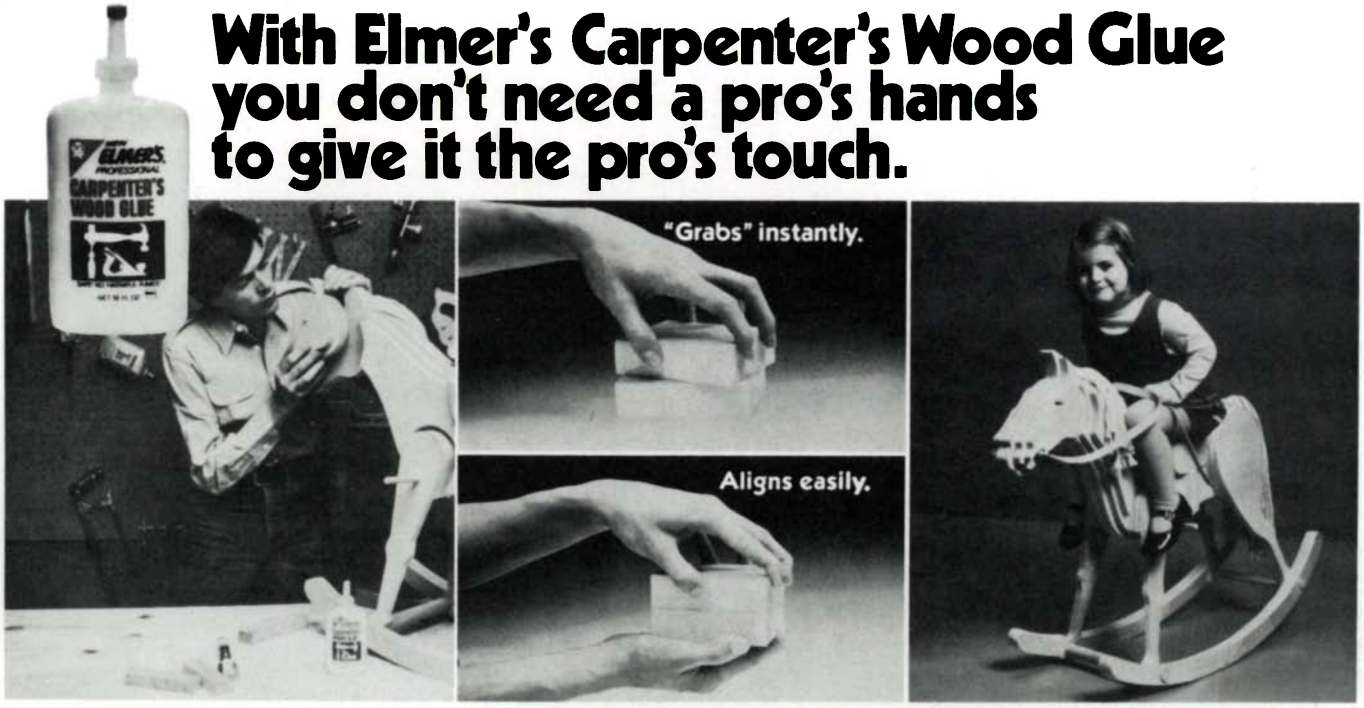

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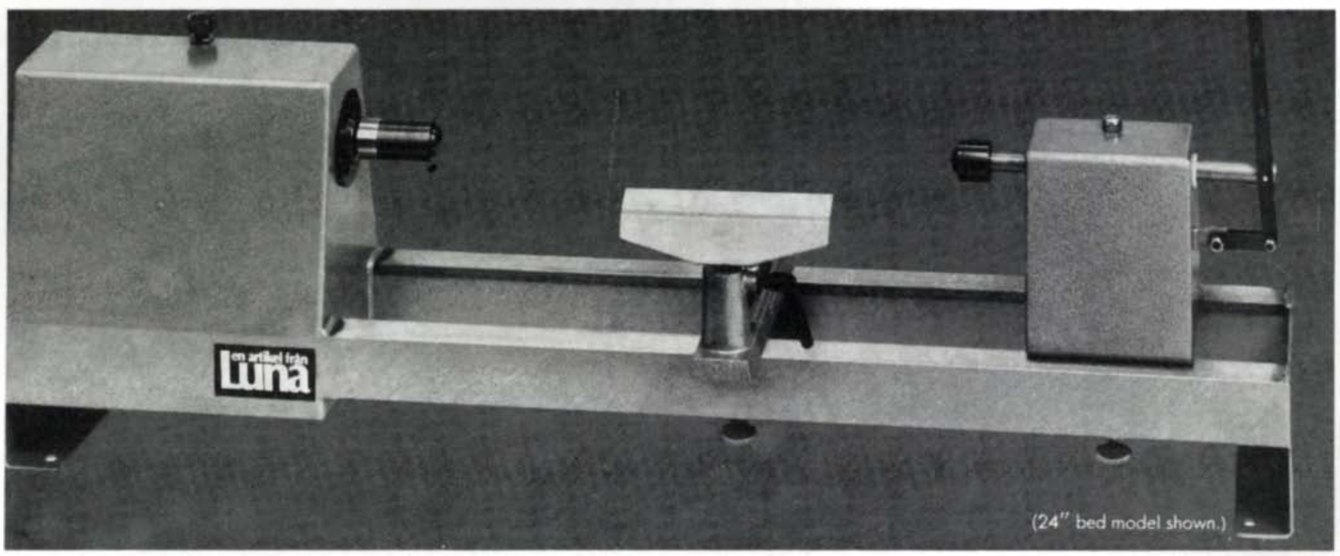

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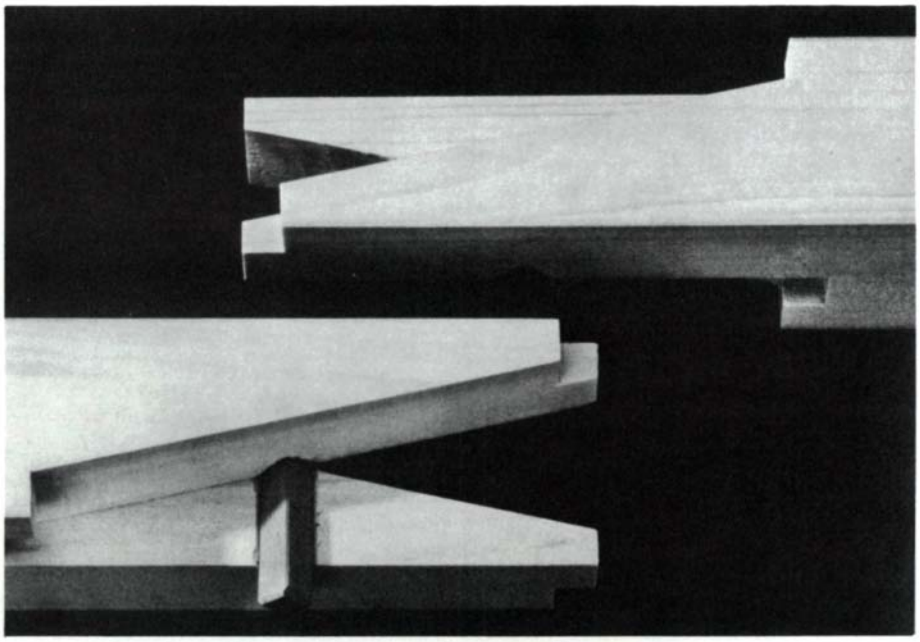

Tsuka-tsugi, *halved rabbeted oblique scarf joint, from* The Art of Japanese Joinery. *Its name translates as "crossbill joint," because it resembles the overlapping beak of the crossbill finch. It is used to splice the exposed battens and coping in coffered ceilings.*

The Art of Japanese Joinery by Kiyosi Seike, translated by Yuriko Yobuko and Rebecca M. Davis. *Weatherhill/Tankosha, distributed in America by Charles E. Tuttle Co., Drawer F, Rutland, Vt. 05071. Japanese edition, 1970; English edition, 1977. $8.95 paper, 128 pp.*

The Japanese enjoy a reverence for wood that is not difficult to understand: Their Pacific archipelago has little stone suitable for building, but has always been forested and reforested with a wide variety of workable timber. And for inexplicable yet intuitively understandable reasons, Japanese culture has endowed trees with a soul, or *kodama.* Something of this spirit of the tree is evident, even to a Westerner, in Japanese woodworking.

The result is that while the great buildings of the West were made of stone, the Japanese reserved their ingenuity for wooden construction. As the Greek artisans developed a high esthetic order in stonework, Japanese carpentry relies on a sophisticated modular system called *kiwari jutsu*, the art of determining construction proportions. These standards derive from the size of available timbers and from the size of men. They govern not only the thickness of posts, for example, but also the space between them, the size of rooms, doors and windows, the height of ceilings. These standards are still in use, changed in detail but not in essence for about a thousand years.

The Japanese joiner knows more than 400 different joints for wood, a joint for every conceivable situation. They fall into two broad categories: splicing joints, or *tsugite*, for making timber longer than it grew, and connecting joints, or *shiguchi*, for making timber branch, most often at a right angle. Some of the joints are designed purely for strength, others for beauty, some for supporting loads and others for resisting the tendency of timber to twist as it dries. And, it turns out, the most complex joints may have contributed more to the carpenter's reputation as a wizard than to the strength of the building. These days, many splicing joints are routinely reinforced with iron plates and bolts.

Kiyosi Seike, professor of architecture at the Tokyo Institute of Technology, has chosen 48 of the basic joints for explication in *The Art of Japanese Joinery.* Most are common to all three main branches of Japanese architecture, and many are also standbys in the West. Yet even the variants on the scarf, lap, mortise-and-tenon and dovetail have a Japanese flavor that is strangely beautiful to us in their proportions or in their combination of elements in a single joint. A few of the joints are wholly exotic, included to amaze and challenge the reader.

After an informative appreciation of the role of wood and the history of building in Japan, Seike explains the basic functions and requirements of joinery in general. Then he proceeds through the sample joints, discussing the strengths and weaknesses, appropriate uses and possible variations of each. He does not—nor was it his intention—tell us much about how to lay them out or cut them. But the photographs are so clear that the reader, in most cases, can figure it out. Others, such as the lapped goose-neck mortise and tenon with stub joints, remain imponderable.

Although the text (and the translation from the Japanese original) is excellent, the best part of this book is the photographs, both of finished buildings and of sample joints. They are simply brilliant, superb. The male and female halves of each joint lie side by side, or partly inserted, on a dead black field. The lighting is arranged to render the surfaces precisely and to eliminate any confusing shadow. Sometimes one joint fills a page, sometimes two. In every case, the reader can see exactly how it goes together, what has to mate with what. The photos alone make the book worth its price.

Weatherhill, the publisher, specializes in bringing Asian culture to the West. With the overwhelming advantages of excellent text and perfect photographs, it is difficult to understand why Weatherhill has failed to produce a wholly exemplary book. But the drawings that accompany the text are barely adequate, both in number and clarity. The photos are grouped in the middle of the book, which looks good and is easiest to print. But they could have been integrated with the text. The reader, already taxed by the complexity of the material, is left thumbing helplessly from page to page, his concentration fragmented, to find the joints the author is describing. And somewhere the editors must have mislaid a photograph. For although Seike describes four variants of the stub tenon splice, only three are shown—one of them twice.

Nonetheless, the book is a beautiful and valuable addition to woodworking literature. Seike, while describing a very complex joint where post, pole plate and crossbeam meet, hopes that it may be a "challenge to some adventurous Western carpenter, who appreciates the beauty of joinery as I do." No doubt it will.

—*John Kelsey*

Drawings of Musical Instruments, *Division of Musical Instruments, National Museum of History and Technology, Smithsonian Institution, Washington, D.C. 20560.*

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RULES

- Each entry must be of original design and the primary material must be wood. A designer and a craftsman may enter jointly. Period furniture must be "after the style of," not a precise reproduction of an antique or a published plan.
- A maximum of four entries per craftsman, please.
- Send a glossy black-and-white photograph showing an overall view of each entry, along with as many supplementary photos, details, closeups, drawings and notes as you feel necessary to convey what you have made. We need a sharp black-and-white photograph with good contrast, at least 5x7 in size, to judge and to publish. The background should be featureless—plain white or black, grass, sand, snow, etc.—in order to emphasize the work itself. Be sure to leave adequate space around the object within the picture area, so that we have some layout flexibility.
- Snapshots, Polaroids, color slides, color prints and blurry photographs cannot be reproduced and therefore will not be judged.
- Put your name on the back of every photo. Be careful that ball-point pens don't emboss or mar the image, and that wet ink on the back of one photo doesn't rub off onto the next.
- Each entry must be accompanied by its own entry blank. Blanks are available upon request from the Taunton Press, or clip the one below, zerox or hand-copy it.
- Deadline for entries is Dec. 31, 1978.
- If you want your photos returned, enclose a stamped, self-addressed envelope. All entries will be kept until the book is published in June, 1979.
- The decision of the editors is final. Craftsmen whose work is selected for publication will receive a complimentary copy of Design Book 2, and may purchase additional copies at wholesale price.

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Name ______________________

Street address ______________________

Town or city ______________________ State __________ Zip __________

Title and/or function of entry ______________________

Woods and other materials used ______________________

Dimensions (length, width, height) __________ Price (optional) __________

Principal techniques used, unusual techniques (enclose separate sheet if necessary) __________

____

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Period, if after the style of ______________________

Category in which you wish to be judged

☐ Accessories ☐ Architecture ☐ Beds, benches, couches
☐ Cabinets and chests ☐ Carving ☐ Chairs ☐ Desks
☐ Instruments ☐ Marquetry ☐ Miniatures ☐ Tables ☐ Tools
☐ Toys ☐ Utensils ☐ Other (please specify)__________

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Remarks (on design, construction, function, craftsmanship, life...) enclose separate sheet if necessary ______________________

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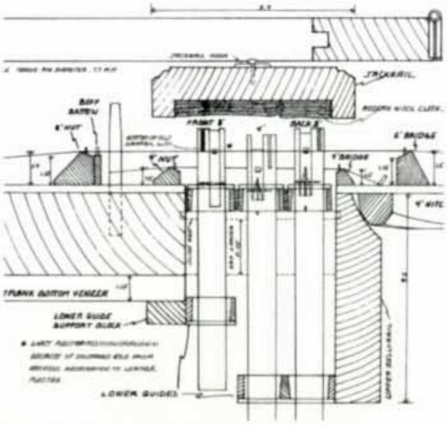


Detail, French harpsichord, 1760.

are single-manual and double-manual harpsichords, an English bentside spinet, a virginal, a fretted clavichord, a grand piano, a fretless banjo, plucked and hammered dulcimers and various instrument stands. The cost ranges from $10 to $35, and a list of prices and other particulars is available from the Smithsonian on request.

The drawings are direct-reading diazo blackline prints on paper. They are prepared at the time the instruments are being restored, which allows accurate documentation of the internal bracing and supports.

In general the drawings represent the existing state of the instruments and include the distortions created by stress and deterioration over the years. Where the original state can be determined it is indicated and labeled. These prints are presented primarily as research documents and are not guaranteed to contain every detail needed to make an exact copy, but an experienced builder or one willing to do a bit of research would have few problems.

They contain a full-size plan view and elevation with various sections and details of construction. The parts are labeled using traditional terminology, and although these instruments were built in inches and feet the Smithsonian gives measurements in the more universal metric system. Where parts are noticed to be not original they are labeled "not original." Where it is discovered that a series of modifications has been made, an attempt is made to determine when it was done.

The action on the drawings of keyboard instruments is shown apart from the cases, with its own plan and elevation. Attention is drawn to the construction and working parts describing the different materials used.

Many of these old instruments were lavishly decorated. The drawings show clearly the various types of soundboard paintings, block-printed papers and inscriptions. Often the method of application and the different kinds of materials are listed.

Early builders were involved with building instruments, not with writing books or making drawings. It is therefore extremely valuable for the musical instrument maker of today to have the opportunity to see and examine early instruments. To arrive at an authentic design it is necessary to compare instruments of different periods, different countries, and even those by the same maker so one may base one's work on knowledge of designs and methods of earlier makers. These drawings provide that information.

—*Joe Esposito*

Britishisms

George Bernard Shaw stated it best (he usually did) when he wrote that England and America are two countries separated by a vast ocean and a common language. No one is more aware of this fact than the American craftsperson who picks up a book written by a British woodworker. Cramps, lino, paraffin oil, Bath brick—these words might as well be written in Chinese or Greek for all the sense they make to Americans. And the American counterparts of these words are just as confusing to the English. So when one goes through a book such as Pain's *The Practical Woodturner* or Joyce's *Encyclopedia of Furniture Making* and comes across a term like "Russian tallow," one becomes confused. Worse, Russian tallow isn't in the dictionary, not even in the ten-volume *Oxford English Dictionary*.

As a professor of English literature who teaches the history of the English language, an amateur woodworker and bookbinder, and a devoted reader of crafts books written in England, I've compiled a list of Britishisms that I have tracked down, sometimes with great difficulty. I'd like to share some of them with you. Let me start with one I've already mentioned, Russian tallow. It seems that in the 19th century, about the time that Napoleon took a left turn at Moscow and went to Waterloo, the English began using the word "Russian" as a synonym for anything refined, good, fancy or pure. Thus terms such as Russian tallow, Russian leather, Russian preserves, etc. began to creep into books and advertisements. Russian tallow is simply pure tallow. I always keep a tin in my workbench tool tray to dip screws into. A good retail source—25¢ for a 1-oz. tin—is the Heritage Store, P.O. Box 444E, Virginia Beach, *BOOKS (continued)*

Va. 23458. It is sold by the name "mutton tallow."

Another item often asked about is Bath brick. Today even most Britons don't know what it is because it's such an old-fashioned item. Bath brick is a fine-grained crushed stone from a place near Bath, a natural spring familiar to vacationers, readers of ancient Roman history or Jane Austen's *Emma.* There is no exact American equivalent, but rottenstone is close. Readers of Jane Austen may also have figured out that lumber rooms in England don't contain what Americans think of as lumber, but old furniture. To the island race, lumber is timber.

Armenian bole is jeweler's rouge, red rouge or red buffing bar (at the hardware store). However, the bars we use on buffing wheels are usually mixed with something to stick the powder together (usually wax or tallow). Buffing bars are perfect for strops or buffing, but not for gilding. The powdered form used to be common in every drugstore, for coloring skin creams. That's why all those old books tell you to get some from your local chemist. (Druggists in England are chemists, and hardware-store clerks are ironmongers.) I once spent half a day in London trying to track some down. Talas, 104 5th Ave., New York, N.Y. 10011, sells Armenian bole as a thick paste—$2.95 for a 6-oz. tin.

The table below gives some British terms and their American equivalents. If you have others you'd like to share or would like to know about, I'd like to hear from you. Write to me c/o *Fine Woodworking*.

British	American
Cast	Warp
Clash	The grain in quartersawn oak
Cramp	Clamp
Deal	Pine or fir, usually 9 in. by 3 in. by 6 ft. or more
Flap	Leaf of a table
Fitment	Built-in
G-cramp	C-clamp
Glass paper	Sandpaper
Lino	Linoleum
Lumber	Old furniture in storage
Paraffin oil	Kerosene
Spirits of wine	Alcohol (denatured or grain)
Spirits of varnish	Shellac
Studdard's solution	Naphtha
Stuffed over	Overstuffed (as a chair)
Ticketer	Burnisher
Tallboy	Highboy

—*Sandy Cohen*

Joe Esposito's drawings appear frequently in this magazine; Sandy Cohen teaches at Albany (Ga.) State College.

Q & A

Consulting editors A. W. Marlow and George Frank invite questions from readers about cabinetmaking and finishing. Although these two old-timers can each count a half-century before the bench, some questions still fall outside their experience. We then turn to a regular contributor who has the necessary expertise or throw the issue to the readers—for there's always more to learn. Send questions, and answers and comments to Q&A, Fine Woodworking, *Box 355, Newtown, Conn. 06470.*

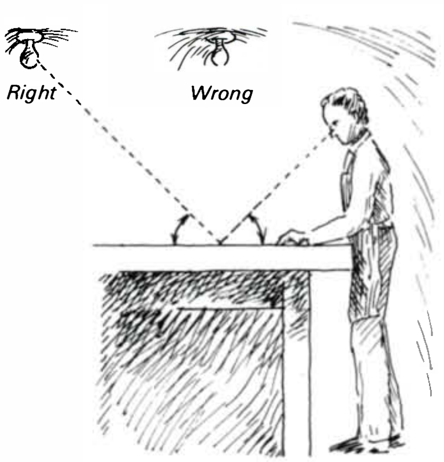
Before the year is over we will be able to add an extra room to our woodworking shop. We intend to use this room exclusively for woodfinishing. The room is not very big, only 12 ft. by 15 ft., but adequate for our hobby. We have a small spray outfit and an exhaust fan in one corner. Our problem is the lighting. The room has a 9-ft. ceiling but no light whatsoever. What is the best lighting for a finishing room?

—Eva Eshleman, Allentown, Pa.

A very pertinent question, congratulations. More finish on wood is ruined by improper lighting than by any other single cause. Yet few people worry about the light in the finishing room, and I've never seen any guidelines in books. So here is my own answer, and it may turn out to be controversial.

You must have as much light as you can possibly create, and it must be as close as possible to natural daylight. Your best bet is the long 6-ft. or 8-ft. fluorescent fixtures, with half the tubes cool white and half daylight-imitating. Install them as high as possible, well sheltered from dust, and clean them frequently.

Don't install the lights directly over the working area. The object you are working on should reflect the light to your eyes. Assume you are working on a flat object on top of your bench. If you put a flat mirror on top of your bench, you should be able to see in it the whole light fixture. The lower the angle of reflection, the better it is, the ideal being about 45°. This means that the



angle between your eyes, the work and the light should be about 90°.

I would go a step further and install one or two movable lights about 6 ft. off the floor, so you can arrange the light to reflect off the top of a high piece like a chair or chest.

Lights near the work or over the spraying area will have to be inside protective fixtures, and you might have to use incandescents. But all artificial lights distort colors—incandescents add a definite red hue. Never match colors by artificial light. Do it by daylight and in shadow. *—G.F.*

In reading Antiques Magazine *I notice what appears to be an arbitrary use of the terms "curly" and "tiger" in reference to maple. Can you clear up the tiger/curly/fiddleback distinction?*

Also, in reading various how-to books on clock-case construction, I notice that the directions for the swan's neck molding and the cove molding at the waist are rather deficient. How does one hand-carve such moldings?

—Murray Linker, Gaffney, S.C.

"Curly" and "tiger" are not arbitrary terms. They refer to two distinct grain patterns. "Curly" designates curls and swirls in an infinite variety of configurations. "Tiger stripe" can be compared to a procession of long surf rollers coming up on a beach, one right after another. This makes a distinct stripe pattern. "Fiddleback" should be applied to tiger-stripe maple rather than to mahogany because it's maple that is used for fiddle backs.

To make curved broken pediment (swan's neck) molding by hand, remove as much waste wood as possible on a tilted band-saw table. Then, as the book says, carve by hand. Straight line moldings can be roughed out on the circular-saw table, leaving very little handwork. *A.W.M.*

I am attempting to do some French polishing on dark walnut. Please tell me what is the best filler to use? I have also heard about "open-pore" French polishing, although no one seems to know how to do it and it may be quite attractive. Do you know what it is?

—E. Thomas Akyali, New York, N.Y.

First, about the filler. If you would do real French polishing, you would use no filler at all. Part of French polishing is to work pumice stone into the surface of the wood with a special pad that the English call a "rubber," the French a "tampon." The tampon's heart is wool from old socks or sweaters. It is about the size and shape of an egg, that later will fit the inside of your palm, where

Q & A (continued)

you hold it quite firmly. The wool's role is to hold and to release slowly the alcohol, and later the liquid shellac. The wool is wrapped in a porous fabric—linen is best if you can find any—which covers it snugly and smoothly on the bottom. This bottom side becomes quite flat, since it will slide and slide on the surface of the wood.

You feed the wool with a few drops of alcohol at a time and you sprinkle some finely ground pumice stone on the surface to be polished. Now, with broad circling motions you begin to force the pumice into the pores. The pumice first will fill up the small spaces of the linen, and being abrasive it will cut off invisibly small particles of the wood. Together these will slowly fill up the pores under the pressured rubbing of your fists. Since the pumice carries with itself the finest possible wood dust, it takes on the color of the wood. It thus becomes invisible, practically part of the wood itself. It is the finest method of filling the wood.

However, not all French polishers go through this slow and tiring process. They use various kinds of fillers. One common recipe: Powdered chalk or simple whiting powder is the filling agent, colored with dry powdered colors to match the wood. The binder is rosin (or colophony), also powdered, and the carrier is mineral spirits. The spirits are frequently tinted (for dark walnut) with some asphaltum paint. The amount of rosin is about 10% to 15% of the colored chalk. Another recipe is talcum powder colored with dry pigment. The carrier and the binder are shellac and alcohol. This type of filler is difficult to use without skill and experience—in fact, the whole process may be too hard to learn from description alone and you may have to find someone to show it to you (Winter '75, p. 44).

Open-pore French polishing was practiced widely in the first 20 years of this century. First the wood is sanded impeccably, then the dust is brushed or blown off, leaving all the pores open. The tampon is moistened with a few drops of shellac, further cut with a little alcohol. Again the rubbing begins, except that this time the tampon works with the grain, each passage leaving a breath of shellac on the wood. Repeat until a pleasant shine appears. No pumice is used, no attempt is made to fill the pores, and no oil is used either. The tampon should never be too moist, and each film must dry before the next one is applied. This type of French polishing does not have the bright glossy shine of the filled version, but it

Q&A (continued)

is far easier to obtain and still quite pleasant to look at. —*G.F.*

I am making a terrarium having a solid-wood base, wood corner stiles and wood top with removable lid, all having panes of glass rabbeted into the appropriate wooden parts. Since I intend to put plants and soil inside I am concerned with moisture. How should I protect the wood?

—*Mike Mills, Cleveland, Ohio*

The problem is how to make the wood completely impermeable, and there is no simple answer. One of the main reasons for finishing wood is to protect it against moisture, and nearly all finishes do so to a certain extent. A heavy coating of wax will keep water out of the wood for a few hours. Shellac will resist longer, varnish longer yet, and special marine varnishes will protect the wood for years, maybe. You should experiment with marine varnishes and also with the new epoxy finishes. —*G.F.*

Wood technologist Bruce Hoadley adds, "The problem is the same as putting a post in the ground, and there really is no good answer if you must use wood. No finish will exclude constant moisture. You could arrange the glass parts not in grooves, but joined to each other with epoxy or silicone sealer, and let the wood be decorative. Or think of it as a redwood planter and don't put any finish on it."

How efficient are pneumatic drum sanders compared to a conventional solid-drum type? Can compound angles and curves such as chair seats be sanded with them? I suspect that until sandpaper is made as flexible as the pneumatic drum, little advantage is gained.

—*D.H. Trowbridge, Los Gatos, Calif.*

You are right. I doubt that you would want to wait for flexible paper for the drum. Probably as good a job could result by using a flexible sanding wheel (see "Sanding," page 79). In either case, final hand-sanding would be necessary. —*A.W.M.*

Does epoxy glue have any properties that make it unsatisfactory for wood?

—*S.A. Haskell, Milwaukee, Wis.*

Bruce Hoadley replies: "Epoxies develop high strength bonding with most woods and are fairly durable against moisture and high temperature. They are especially useful in bonding dissimilar materials, such as wood to metal, or wood to glass. Since the adhesive cures by chemical reaction rather than by loss of solvent, very little

shrinkage of the glue takes place, making epoxy a good gap-filling adhesive.

"The above features make epoxy especially appropriate for inlaying metal or irregular wood shapes, as in musical instruments. Principal reasons for its limited use in woodworking are probably high cost and short pot life. Also, the fact that it gets hot as it cures sometimes causes problems, and the difficulty of cleaning, mixing and spreading is an aggravation."

I'm building a card table like the one in A. W. Marlow's book Classic Furniture Projects. *The design calls for bellflower leg-drop inlays, which I have been unable to find.*

Earl Wintermayer, Niceville, Fla.

I could also use this information. My only sources are Constantine (2065 Eastchester Rd., Bronx, N.Y. 10461) and Craftsman Wood Service (2729 South Mary St., Chicago, Ill. 60608) plus one wholesale-only firm. There are others who make really good custom inlays but I've never tracked them down.

—A.W.M.

Is it general knowledge, or is there any scientific evidence, that a saw or sanding burn will weaken a glue joint?

—Edmund H. Anthon, Akron, Ohio

Bruce Hoadley replies: "Definitely. Charring amounts to chemical and mechanical damage to the structure of the wood, which inhibits adhesion and contaminates the glue line. For the best adhesion, you must have a smooth, clean and preferably newly machined surface."

My questions revolve around lacquers and I have been unable to find answers in the literature. Where does lacquer fall in the scheme of hardness? How appropriate is lacquer for tables and surfaces that are subjected to hard use? Is it a popular finish? What techniques are common?

—R. C. Legge, Jr., Rochester, N.Y.

As of today lacquer finishes are the best. They offer excellent protection to the wood and if they are properly applied enhance its natural beauty. Moreover lacquers are versatile and there is a special kind for nearly every need.

The difficulty is that lacquers must be sprayed. To work with them one needs compressed air and a spray gun. Spraying lacquer creates a fire hazard and charges the air with noxious fumes, which is why for the home craftsman lacquering is almost out of reach. There are some brands on the market that can be applied by brush; Ace is one of them. If you can get some, experiment

with it. There also are so-called "padding lacquers," to be applied somewhat like French polish. The best is Qualasole, manufactured by Behlen Bros., Box 698, Amsterdam, N.Y. 12010. —*G.F.*

I recently inherited a solid oak roll-top desk from my grandfather and of course there is an ink stain on the writing surface. Are there any successful methods for removing or bleaching ink stains from oak?

—*Larry Sanford, Ypsilanti, Mich.*

Sorry, I don't know of any chemical that would tracelessly eliminate the ink spots. The only way to do it would be through scraping and sandpapering.

If I did know about some magic chemical I would be loath to give it to you. To my mind a modern desk with inkspots is dirty, but an old desk without inkspots is not an old desk. You are lucky to have your grandpa's desk—leave the inkspots alone. —*G.F.*

I just graduated from high school and got a job as a carpenter's helper. Before hiring me the carpenter asked, "Have you got a toolbox? And tools?" I said I did. "Have you got a sister?" I said yes, she is two years older. "Then swipe one of her lipsticks, put it in the toolbox, and be on the job at 8 o'clock in the morning." I did that, and have been on the job four weeks now, but the lipstick is still unused. Was the man making fun of me or does lipstick really belong in a toolbox?

—*Larry Twardy, Sarasota, Fla.*

A lipstick is definitely a carpenter's tool, used to set locks or bolts properly. Rub some lipstick on the tongue of a lock and it will mark very accurately where the lock strikes the door jamb. It will also locate obstructions properly and accurately when installing cabinets or paneling. —*G.F.*

I've noticed wood sizes are given as 5/4, 8/4, etc. This is new to me—what size wood are they talking about?

—*David Munsey, Fort Meyers, Fla.*

Roughsawn lumber is usually specified in quarters of an inch, so 5/4 lumber was about 1¼ in. thick when it left the saw. When the board has dried, it will be a little less than 5/4 thick, and when it is planed smooth you'll be lucky to finish with an inch of thickness. Rough lumber sold as 4/4 usually dresses around ¾ in. thick.

Supplies

Exotic materials and unusual supplies are a constant problem for the woodworker. Readers have recently asked us

Q & A (continued)

where to find the ones listed below. We'll verify any answers before passing information along.

—Hardware for the adjustable tray on a highchair;
—Harp strings, or the materials from which to make them;
—Mechanism for a jack-in-the-box;
—Good hardware for pepper mills and salt shakers;
—Parts, particularly the lathe live center, for Supershop #9428, once made by Power Tools Inc. of Beloit, Wis.;
—Pure, unthinned tung oil and lemon oil;
—A really good finish for the inside of turned cups and mugs.

Follow-up

Re Paul Doty's question about finishing rosewood (Summer '78): It is very likely that the tacky urethane is caused by the rosewood itself and not by his finishing sequence. Rosewood contains resins that inhibit or prevent the drying of traditional varnishes. The darkest areas of the wood are normally the highest in resin content and hence the worst offenders. In finishing rosewood, it is absolutely necessary to use a finish that is not sensitive to the resin, at least for the initial sealing coats. Commonly, a lacquer sealer is used to prime the wood, then lacquer or varnish is applied over the dry sealer. A vinyl sealer could also be used. I use tung oil as sealer and finish on rosewood and have had very good results.
—William D. Woods, Phoenix, Ariz.

I was surprised to read that George Frank would suggest a flammable paint remover ("Q&A," Summer '78). Oxalic acid might clear the grey color from oak after cleaning off old paint, although fresh remover almost always avoids such problems. The grey is associated with a poor cleaning job.
—R.E. Blue, Winston-Salem, N.C.

ADDENDA, ERRATA

At the last minute, just before you finish that fancy carcase, you might drop a tool onto the drawer front or plane a little too much off the drawer side. You might not notice the flaw until the cabinet is on its way to the customer. Or you might see it all happen, with a wrench in the gut, and frantically set to repairs—only to magnify the flaw.

So it is with magazines. In Summer '78, in Bud Kronenberg's account of making a spinning wheel, near the bot-

A & E (continued)

tom of page 43, seven lines appear twice. There is a hyphen's difference—we inadvertently put a last-minute correction in the wrong place, and apologize. Counting up from the bottom to the end of the 16th line, it should read: "Locate the spoke holes using my stupid method or your superior math. With the rim together, chances are your drill press will not fit inside to drill the holes. I've found that I can be accurate enough with a simple drill jig and an electric hand-drill. If you're making a very small wheel, you may have to hack a few inches off your bit to get the drill inside the rim.

"The best time to start assembling the wheel is on a quiet evening when. . . " and it's right again.

• • •

In Summer '78, page 64, we list Ernest Schaefer of Union, N.J., as a leather supplier. Schaefer advises that he does sell leather, but only by the ton to commercial bookbinders. He can't fill small orders, although he does sell 22-carat gold leaf for tooling, in 200-ft. rolls, for about $20 a roll but variable according to the daily price of bullion.

• • •

The Early American Industries Association no longer sells Richard Martin's *The Wooden Plane* (reviewed in Summer '78), but Iron Horse Antiques, RD 2, Poultney, Vt. 05764, still has a few copies at $12.95 each.

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Our "Events" column, page 37, is a feature that we hope will keep woodworkers informed about current exhibitions, gallery shows and lectures. If you have work in a show or know of a good show, please urge the sponsors to send us details three months in advance.

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Art credits: 8, 18, 28, 42-43, 60-61, 66-67, 70-73, Christopher Clapp; 10, 84-85, Dave Louen; 14-16, 20, 47-48, Joe Esposito; 25, Smithsonian Institution; 42, courtesy Randell L. Makinson; 51, James Krenov; 53-57, Stan Tkaczuk; 75, F. H. Gottshall; 83, U.S. Forest Products Laboratory.

Photo credits: Cover, 3, 40-45, Marvin Rand; 4, Darwin Knight; 16, Steve Voorheis; 22, Charles E. Tuttle Co.; 38-39, Bud Kronenberg; 41, 43-45, 73, 87, Alan Marks; 46, Don Carstens; 49-50, Louis Schnakenburg; 51, Bengt Carlen; 52-56, A. Mattia; 58-59, G. Frank; 60-64, Peter Green; 65-66, Bob Griffith; 65, 67, D. Langsner; 69, Arkansas Industrial Development Commission, Emily Wing; 74-75, Bruce Gottshall; 76, 78, Ted Wahlberg; 79-81, Ben and Lisa Green; 84, U.S. Forest Products Laboratory; 85, B. Hoadley; 87, Richard Starr, Jane MacKenzie, Robert E. Barrett; 88, David Leveille, Hunter Kariher. All others, staff.

CLASSIFIED

HARDWOOD LUMBER. Wholesale prices, kiln dry, best grades, surfaced or rough. Walnut, cherry, oak, maple, ash, poplar, cocobolo, padauk, zebrawood, mahogany, teak, etc. One dollar for price list. WOODENWARE, Box 10, Brownsville, MD 21715.

LOCAL LUMBER CO. Fancy hardwoods, custom milling and kiln drying. 161 Bowers Hill Road, Oxford, CT 06483. (203) 888-6509.

CARVING TOOLS of finest German steel. 7½ in. overall. 8-piece set, $34. Robert Halliday, 82 Glenwood Road, Glen Head, NY 11545.

Applicants sought for APPRENTICESHIP in a small handwoodworking shop. Write for details to Brian Considine, Cabinet Maker, Post Mills, VT 05058.

WOODWORKER. Experienced with hand and power tools, to utilize his skills in craft of pipe-organ building. Holtkamp Organ Company, 2909 Meyer Avenue, Cleveland, OH 44109. (216) 741-5180.

Woodworkers SWISS ZYLISS VISE. Regular $112.50, now $67 postpaid. Woodworkers Bargain Catalog $1. Rego, Downing Street, Fall River, MA 02723.

Craftsmen—show pride in your fine work. Personalize your pieces with engraved solid BRASS PLATES. Send $1 for sample plate. Print name or title. V-B, 807 E. Dana, Mt. View, CA 94040.

THICKNESS PLANER. 11" wide. Build yourself. Dependable. Brochure $1. Plans $10. Planer, RD1, Oley, PA 19547.

SNAKEWOOD (*Piratinera Guianensis*) wanted for Baroque bows. Write or call William Salchow, 1755 Broadway, New York, NY 10019. (212) 586-4805 w/amount, sizes and cost.

COATED ABRASIVES. Discount prices. Garnet, silicon carbide, stickit discs. Sampler and trial kits. Full grit ranges. Price list 25¢, refunded first order. Ohio Woodshop Specialties, 190 Anderson Drive, Jackson, OH 45640.

UNIQUE WOODS: French and black walnut, oak, buck-eye, olive and redwood lumber and burl slabs, tables, clocks, doors, gunstocks, grapevine trunks, etc. Call (209) 568-2307 or write to Bill Emerson, 20097 Avenue 196, Strathmore, CA 93267.

Calling All Ontario Sculptors, Wood Craftsmen and Designers
Out of the Woods

A juried exhibition of contemporary woodwork and sculpture by Ontario designer-craftsmen, March - September 1979, circulating in six public art galleries in Ontario. Juror: Wendell Castle. Adjudication by photographs; deadline for entries: November 1, 1978. Full details and entry forms from:

Cambridge Public Library
and Art Gallery
20 Grand Avenue North
Cambridge, Ontario. N1S 2K6

4-WEEK WOODWORKING WORKSHOPS Jan., Feb., March. At Paolo Soleri's experimental architectural project, Arcosanti. Beginning and intermediate carpentry and joinery. Write Arcosanti Winter Wood, Mayer, AZ 86333.

GOLD LEAF (German & Italian), 500 Sheets, $115 (postpaid). Jacobs Metal Leaf, 53 Main Street, Monsey, NY 10952.

SKILLED WOODWORKER to make pipe organs. Noack Organ Co., Main & School Streets, Georgetown, MA 01833.

WOODWORKING SHOP and home with six acres of land on Wells River; two miles from I-91. S. E. Harned, So. Ryegate, VT 05069.

Are you interested in WOODTURNING as a hobby? Take a two-day intensive course for beginners from a qualified instructor. For further information write: PRACTICAL WOODTURNING, P.O. Box 171, Brampton, Ontario, Canada, L6V 2L1.

CABINETMAKER'S TOOLS INVENTORY CLEARANCE. All new merchandise. 30% off list. The finest imported and domestic tools: stones, chisels, specialty planes, clamps, etc. One-day sale Saturday, October 21, 10-6 PM only. Terms: cash, no checks please. Handcrafted, 744 W. Fullerton, Chicago, IL 60614. (312) 871-6665.

WALNUT DOWELS. Furniture Parts. Toy Parts. Catalog 25¢. Woodworks, Box 79238, Saginaw, TX 76179.

SELECT HARDWOODS. For price list send self-addressed stamped envelope to William F. Brooks Hardwood Supply, RFD 2, Box 71, Ludlow, VT 05149.

IRONS AND CUTTERS. Offering the country's largest selection of plane irons and cutters at unbeatable prices. Send 25¢ for lists to The Tool Works, 76 Ninth Avenue, New York, NY 10011.

TEAK LUMBER. Dealing solely in teakwood since 1961. B. Axelrod & Co., The Godown, 201 Florida Street, San Francisco, CA 94103. (415) 626-4949. Open by appointment only.

NEW AND USED BOOKS on wood, woodworking, woodcarving, turnery, etc. Frequent catalogs, 50¢. R. Sorsky Bookseller, 520 E. Garland, Fresno CA 93704.

Low-cost American BASSWOOD. Large inventory. For prices send SASE to: Phillips Supply Company, P.O. Box BM, Norton, MA 02766.

MAIL ORDER EXPERT starting company to offer handcrafted furniture and accessories. Send photo and wholesale prices of pieces you can make in quantities. Handcrafts, 9548 Bridlewood Trail, Spring Valley, OH 45370.

GLUE SPREADERS, industrial style. For fast, economical and uniform application of white or yellow cabinet glues and contact cement. 1 package of 3 sizes. Send $2. DAKA, R.D. 8 Floral Road, Flemington, NJ 08822.

FINE HARDWOODS and White Pine, air dried and kiln dried. Semler Hardwood, R.R.4, Perth, Ontario, Canada. Phone (613) 267-4630.

MITER SAW. 2-hp and 10-inch 60-tooth CARBIDE BLADE all new, only $280 ppd. with ad. Free brochure or send $2 for complete catalog. Bimex, Dept. FW, 487 Armour Circle, Atlanta, GA 30324.

Fully equipped, well-established REFINISHING business. Sale includes corner building. Annual gross: $35,000. Mark Wilch, 1615 Madison Street, Denver, CO 80206.

KINGWOOD VENEER, 25 sq. ft., $15 postpaid USA. Many other beautiful veneers also available. A Cut Above Veneers, P.O. Box 139, Greensburg, OH 44232.

TOOLS AND SUPPLIES for the wood craftsman. Seabright Hardware, 1749 Noriega Street, San Francisco, CA 94122. (415) 731-1274. Inca dealer.

Make WOODEN TOYS! Fine hardwood wheels, $2.95/32 assortment. Smoothly machined. Cange, 24N1 Cedar, Fairview Heights, IL 62208.

WAUSAU, WISCONSIN, personal demonstration of Inca woodworking machines and Luna wood lathes. Demonstrations planned for larger Midwest cities. Call (715) 675-2229. Mark Duginske, 1010 First Avenue North, Wausau, WI 54401.

CANADIANS. Demonstrations and immediate delivery. Inca Swiss-precision woodworking machines, Myford ML8 woodturning lathes, W&H molder-planers, Shopsmith multipurpose machines. $1 for literature (will refund $5 with purchase). J. Philip Humfrey, #111, 747 Don Mills Road, Don Mills, Ontario, Canada M3C 1T2. (416) 421-5565 or (416) 887-5302 evenings and weekends.

WOOD & TOOL EXCHANGE

Wanted to Buy

Sears Craftsman 6-in. thickness planer. State price and condition. Halfred Wertz, 28 DeWalt Drive, Mechanicsburg, PA 17055.

Stanley planes new or old. All types wanted from Nos. 1 to 444. Higher price paid for Nos. 1, 9, 51, 52, 54, 62, 64, 72, 85, 87, 97, 104, 105, 141, 144, 164, 196, 212, 340. None for sale. Ivan E. Bixler, 6943 Cozaddale Road, Goshen, OH 45122.

Two table extensions for older Delta Homecraft 8-in. table saw (22 in. x 5 in.). Also any other accessories for same. Contact T. Spach, P.O. Box 54, Concord, MA 01742.

Stanley and Sargent metal iron planes of all kinds. Any condition. Also hand tools, catalogs prior to 1960. Please write or call Jacques Dahan, 30 Ocean Parkway, Brooklyn, NY 11218. (212) 871-6312.

Faceplates for Walker Turner Lathe 1-in. 12 thread RH or LH. F. Beltz, 2308 Stackhouse Drive, Yardley, PA 19067 or call (215) 493-2646.

Cuban Cocus. Am making concert flute of wood and gold keys. Presently using Granadilla for body. Also want to make body of Cocus as this is the best wood. Must be Cuban, Jamaican will not do. Need 2 small pieces. Perhaps you have some of this extremely rare wood in your private stock or know of someone who does. Any leads would be dearly appreciated. Also leads on good Granadilla. Emmett Day, 2232 12th West, Seattle, WA 98119.

For Sale

Forty redwood root burl slabs and bases, dry and ready to work. Sizes up to 3 ft. x 7 ft. S. Svedvik, Box 86, Nelson, WI 54756. (715) 673-4035, 448-3174.

Violin wood. Beautifully flamed, seasoned maple back (2 pc.) large enough for viola, $35. C. Mills, 3509 W. 72nd Place, Chicago, IL 60629.

SITUATIONS WANTED

Seeking apprenticeship/partnership in custom woodwork. Willing to relocate. Graduate student with two years experience in woodworking. S. A. King, 3105 Monroe, Columbia, SC 29205. (803) 254-8342.

Apprenticeship sought with furniture builder and carver. No experience, but willing to work hard to learn. Would prefer N.W. Conn. or S.W. Mass. area. Write Robert White, 184 Dean Drive, New Britain, CT 06053. (203) 223-5456.

College graduate seeks apprenticeship in furniture/cabinetmaking with experienced craftsman. Wants to relocate in northern New England. Some independent experience. Recommendations on request. Please write Douglas Parker, 38 Linden Street, Frostburg, MD 21532.

Seeking an apprenticeship with a cabinetmaker or a boat builder. Have basic woodworking skills and desire to learn. References on request. Prefer eastern New York or New England area. Write Mark Zabella, 18 Ramsey Avenue, Amsterdam, NY 12010. (518) 842-6947.

Willing to relocate, seeking position in cabinet shop. Three years experience including kitchen cabinets, special cabinets and other furniture. Hand and power tools. Portfolio available. Miguel Apaza, P.O. Box 295, Deadwood, SD 57732. (605) 578-1426.

Young teacher very interested in new career seeks apprenticeship with cabinet/furniture maker. Some woodworking and refinishing background. Will relocate in eastern states, prefer central PA. Please contact Anthony J. Smiraglia, 204 Deerfield Road #1, East Syracuse, NY 13057.

Woodworker very interested in working in/on fine homes seeks position with architect/builder or master. Experienced in architectural, furniture making and repair, and stained glass. Portfolio on request. Please contact Vincent Scuderi, 136 20th Avenue S.E., St. Petersburg, FL 33705.

The CLASSIFIED RATE IS $1.50 per word, minimum ad 15 words. Payment must accompany order. The WOOD AND TOOL EXCHANGE and SITUATIONS WANTED rate is $1.00 per line, minimum three lines. The exchange is for private use by individuals only. Commercial accounts must use Classified. Allow 30 letters or spaces per line, including name and address. Send to: The Taunton Press, Advertising Dept., Box 355, Newtown, CT 06470. Please inquire for DISPLAY CLASSIFIED RATE.

EVENTS

This column is for gallery shows, major craft fairs, lectures and exhibitions of general interest to woodworkers. To list your event, let us know at least three months in advance.

American Wood—New furniture by contemporary craftsmen, including Steven MacIntosh, Dick Shanley, Robert Whitley, David Ebner, Stephen Proctor, Irving Fischman, Mark Lindquist, Robert March, Francisco Perez. Sept. 28 to Nov. 6, Makers Gallery, 124 Spring St., New York, N.Y.

Group show—Recent furniture and accessories by Wendell Castle, William Keyser, Alphonse Mattia, Bob Stocksdale, Robert Worth. Oct. 15 to Nov. 30, Richard Kagan Gallery, 326 South St., Philadelphia, Pa.

The Form of Furniture—Original furniture by Kean College students, faculty, alumni. Oct. 9 to Nov. 1, College Gallery, Morris Ave., Union, N.J.

The Harmonious Craft: American musical instruments—A wide-ranging exhibition of traditional and innovative instruments, at the highest level. Sept. 29 through next Aug. 5, Renwick Gallery, Smithsonian Institution, Washington, D.C.

Renwick Multiples—Pieces by contemporary craftsmen, now on national tour. Sept. 2 to Oct. 8, Plymouth (N.H.) State College; Oct. 28 to Nov. 26, Morris Museum of Arts and Sciences, Morristown, N.J.

St. Louis Spring Craft Market—A major wholesale fair, sponsored by American Craft Enterprises and the American Crafts Council. All crafts, juried. Entry deadline, Nov. 1; fair date, May 3-6. Write ACE, Box 10, New Paltz, N.Y. 12561.

Handmade Musical Instruments—Convention and exhibition of the Guild of American Luthiers, Sept. 12-16, Southwestern University, Winfield, Kans.

Young Americans: Fiber, Wood, Plastic, Leather— Sept. 10 to Oct. 22, Jacksonville (Fla.) Art Museum; Nov. 19 to Dec. 31, Norton Gallery & School of Art, West Palm Beach, Fla.

Out of the Woods—Major exhibition of woodworking by Ontario craftsmen. Entries due Nov. 1; show opens March 5, 1979, at Cambridge Public Library, 20 Grand Ave. N., Cambridge, Ont. N1S 2K6, Canada.

Marietta College Crafts National '78—Showcase for new work, all crafts, Oct. 28 to Nov. 26, Marietta (Ohio) College.

California Craftsmen—Second biennial show, Oct. 7-29, Monterey Peninsula Museum of Art, 559 Pacific St.

International Woodworking Machinery and Furniture Supply Fair—Largest annual industry show, new machines, new designs. Sept. 16-20, Kentucky Fair and Exposition Center, Louisville.

Community Workshop

Residents of a retirement village enjoy excellent facilities, cooperative spirit

by Bud Kronenberg

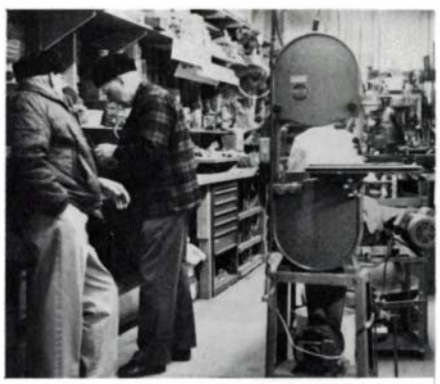
Will your woodworking activities come to a halt if you move to a retirement community? Definitely not, if you choose your residence with care. Woodworkers at Heritage Village, in Southbury, Connecticut, an adult community of 5,000 people, are experiencing the most active and rewarding woodworking years of their lives. I called John Conrad, a Heritage Village resident whom I've known for some time, to find out more about the woodworking activities there. He agreed to meet me at the village

workshop, housed in a former barn. It's not pretentious, but is obviously weather-tight. I wasn't prepared for the sight I'd see when John opened the door. In the first of seven rooms we'd be seeing was an enviable array of woodworking equipment: two 10-in. table saws, a 12-in. planer, three radial arm saws, a large inboard/outboard lathe, two jointers, a doweling machine, a jigsaw, a table sabre saw, a drill press, two disc sanders with vacuums, along with a band saw and other equipment. The shop has some of the most beautiful workbenches you'll ever see. Most are made from 3-in. laminated maple, acquired when a local bowling alley was dismantled. One 30-ft. wall has a continuous bench, with bench hardware spaced at appropriate intervals. All of the power equipment is of commercial grade because of heavy usage.

As members visit their community workshop they're requested to sign in and out. Last year there were over 7,000 visits, and some of the ardent members are in the shop every day. Next John took me to a large annex, the layout and pattern room. It's profusely equipped with layout surfaces, and the walls are covered with hanging templates while chests are full of patterns. All rooms are spacious, well lit and kitchen-clean.

Then we took a look at the paint room, which is sealed off from the dust of the shop. A sign warns that no sandpapering is allowed here. The equipment includes a compressor and sprayer, infrared drying lamps and a lot of clean dry space with plenty of worktables. The area is very well lit, with its fluorescent system and its large windows. Along one wall are about 25 feet of shelves that hold almost any type of finishing material you could imagine. Members save their leftovers for the next person.

The machine shop, our next stop, has vertical and horizontal milling machines, two screwcutting lathes, a power cut-off, a metal-cutting band saw, a power hacksaw, grinding equip-



ment, a drill press, taps, dies and accessories. The most popular activity in the community workshop is woodworking, but the machine shop performs a valuable function in the repair and maintenance of the woodworking equipment. Members have made their own custom router bits, along with authentic reproduction hardware for case goods.

The absence of small hand tools is noticeable in the work areas, but as I found out, and suspected, they're available and in abundance. They're kept in a room called the "crib." This area is padlocked and screened in. It has shelves, drawers and racks, with everything in its place. All small tools, including hand-held power tools, are kept here. Members of the board of directors work from a shop supervisor duty roster, and one of the duties of the supervisor is to unlock and lock the "crib," noting the coming and going of its contents.

What does it cost to take advantage of these excellent facilities? The total cost to each member, exclusive of materials, is only $5 a year. To rent a locker to keep "private" tools, there's an additional charge of $8 annually. Why is it so inexpensive? How did it get started? How does it run so smoothly? Here are some of the answers: Heritage Village is an adult condominium community where purchasers are co-owners of certain common areas, including a meeting house, activities building, swimming pools, work studios and other facilities such as the barn housing the community workshop. Members of the workshop have use of the building free from normal rental and utility costs. Well, not exactly free, because a small portion of their monthly condominium maintenance fee is used to maintain the common areas and buildings.

The developer of Heritage Village thought the community workshop would make condominium living more attractive, especially to people who would hesitate to move to a place where they couldn't pursue their woodworking craft. Some of the first residents, like "Doc" Wallace, John Conrad, and "Doc" Cooper, provided organizational leadership needed to create bylaws and sound procedures. At their annual meeting, workshop members vote on their nine-member board of directors. The board can approve new equipment purchases up to $1,000. The entire membership must approve expenditures of more than $1,000. The current membership is 331 key-carrying men and two women. Any resident of Heritage Village can use the facilities without being a key-carrying member of the workshop. A $2,500 annual budget has been found sufficient for equipment maintenance, expendable supplies and new equipment. As you may have suspected, many tools have been donated by persons moving into the village.

Members admit that problems of tool and equipment abuse do arise, but to a minor degree. They are handled in a constructive way. The on-duty shop supervisor lends a helping hand, but only when invited to, or if there's risk of injury to person or equipment. Before members are allowed to work in the shop, they're required to sign a waiver.

When I was in the shop, "Doc" Cooper, who's retired from a prominent position at New York Hospital, was finishing a reproduction of an early

Queen Anne corner chair. I asked him about the overall quality of work done by members. He thinks, in general, the talent and workmanship is quite advanced and constantly improving because people now have more time to pursue their hobby. The projects range from an intricate restoration of a Chinese chest-on-table to case goods, tables and chairs, carvings, to repair of storm windows and sticky kitchen-cabinet doors.

The workshop has made a considerable contribution in community service. Members have volunteered to make special furniture for a nearby home for retarded children. Recently they were asked to make some items to be sold at the children's fund-raising bazaar. They responded enthusiastically, completing some items, and partially finishing others so the children could have the joy of painting and helping in the construction. The Heritage Village Men's Club wanted a sizable game table. John Conrad volunteered and made a heavy solid oak table with an easily replaceable felt playing surface.

It appears to me that the members of the Heritage Village community workshop have a near-perfect solution to the problems faced by senior woodworkers. They have the best facilities, competent sources of assistance, and all at a minimum cost. But really what makes it work is the people—their spirit, attitude, and sincere desire to cooperate. □

Bud Kronenberg makes spinning wheels in Southbury, Conn.

Gamble house entry and living room. Paneling and beams are Burmese teak, with ebony pegs and wedges. Doors are amber favrile glass.

Greene and Greene
A study in functional design

by Alan Marks

It took more than 40 years for American designers and architects to finally recognize the significance of Charles and Henry Greene. In 1952, the American Institute of Architects called them the "formulators of a new and native architecture," an honor bestowed on them both individually and for their work together. Another 25 years elapsed before the first major public showing of their furniture and furnishings.

The Greene brothers distinguished themselves as architects by building essentially wooden structures at a time (around 1900), in a place (the western states) and on a scale (residential) that made their construction both practical and economically feasible. The Greenes melded the design principles of their various influences—the Arts and Crafts movement, Japanese art, English country houses, to mention only a few—into a style that remains widely acclaimed.

The David R. Gamble house in Pasadena, Calif., designed and entirely furnished by the Greene brothers in 1908, stands open to the public today, a permanent monument to their design philosophy. The curator of the Gamble house, Randell L. Makinson, and the curator of the Los Angeles Municipal Art Gallery, Virginia Kazor, collaborated on an exhibition of the Greene brothers' furniture and furnishings in

Gamble house, Pasadena, Calif., 1908. Now a museum, the house is open Tuesdays and Thursdays and the first Sunday of every month.

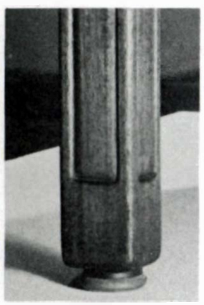
Alan Marks, of Pacific Grove, Calif., is a professional woodworker and a frequent contributor to this magazine.

Los Angeles in 1977. More than 40 pieces of furniture from collections around the country were displayed, in addition to paintings, architectural drawings and renderings, lanterns and light fixtures, wrought iron, leaded glass, hardware and even a living-room carpet, also designed by the Greenes.

Prior to their formal architectural education at Massachusetts Institute of Technology (1888-1891), Charles and Henry Greene attended Calvin Woodward's Manual Training High School in St. Louis. There, in addition to studying academic subjects, they were required to spend two hours a day in the shop. The first year exposed them to woodworking and carpentry with an emphasis on understanding the characteristics of wood. The second year, they were taught metalworking, and the third, toolmaking. Little of the work shown on these pages is theirs, however, with the exception of isolated carving and inlay work by Charles Greene. The Greene brothers were primarily designers, with Charles responsible for most of the furniture and fixtures. To supervise construction of furniture, they employed two brothers, John and Peter Hall, whose family had moved to the United States from Sweden while the brothers were young.

John and Peter inherited their professional skills and knowledge from their father, a cabinetmaker. In fact, many of the techniques used by the craftsmen they employed in their Pasadena shop and mill reflected traditional Swedish practices. It may be assumed that much of the knowledge Charles Greene acquired about furniture joinery came from his intimate association with John and Peter Hall.

Close scrutiny of the furniture reveals Charles Greene's approach and consideration for the wood. He appears, for example, to have designed and built the game-room armchair from the Fleishhacker house around the rare, striated piece of mahogany from which the back slats were cut. Its curved and rippled surface also inspired the curved back legs and carving details. Some of the sparse carving and inlay work on various cabinet doors and chair legs appears to be his inspiration. On furniture for the Blacker house (1907), delicate carving on leg bottoms gives a streamlined, sculpted effect through the smallest of means; the cut deepens downward, defining a new, inward-sloping plane within its boundaries. It also punctuates the meeting of the legs with the floor and enhances their upward sweep.



Though defining a Greene and Greene design philosophy is difficult, superb craftsmanship and attention to detail run like a thread through their work. The Greene and Greene approach is not always "honest." That is to say, the architects were capable of misrepresenting construction, often implying joints that do not exist. Massive timbers were employed out of proportion to the weight they bear, and beams sometimes serve no other purpose than to decorate. Square, highly polished ebony plugs might cover the screws that secure tenons, but half of them could as well be decoration. Or the joints could be doweled entirely with plugs masquerading as functional, as on a chair I examined. Screws made good sense in a period when the brittle organic glue used made any joint, even the most carefully fitted, subject to cracking under stress and changes in humidity. Though modern glues lessen the chance of this happening, using screws still has its "strong" points today. Plugs restrict design possibilities of course, but the Greenes embraced this limitation. They used plugs as accents to set off the spartan qualities of their work.

Fleishhacker armchair, mahogany and leather, 1925.

The most cohesive aspect of their work is design: Their houses are entities complete unto themselves. Furniture, landscaping, fixtures, masonry, door handles, fire screens—all reflect the same theme. In the words of Charles Greene, "Thus it may be seen that in a work of art as in a piece of tapestry, the same thread runs through the web, but goes to make up different figures. The idea is deeply theosophic, one life, many manifestations; hence, inevitably, echoes, resemblances—consonance."

The Greene brothers' work differs from the conventional architecture of their time. Deeply influenced as they were by the Arts and Crafts movement, they eschewed ornamentation for its own sake and to hide construction. Other influences, such as Charles' love of Japanese art, were shared by many of their era. But Louis Sullivan built in steel and concrete, Frank Lloyd Wright added glass to his palette, and William Morris preferred brick, while the Greenes timbered their framed structures with redwood and Douglas fir. After experimenting with woods indigenous to the United States and, for the most part, California, the brothers imported ebony, teak and mahogany. Two of their affluent clients were lumber merchants and no doubt the Greenes were given the run of their mills at favorable prices.

The phrase "spartan elegance" only partly describes their special flair. Throughout the detailing may be felt Charles Greene's impeccable touch, his preoccupation with "threes" or "trines," the small accents. Their work hasn't any

Live oak inlay.

curves to speak of and it stands as a study in strictly proportioned rectilinear length, depth and width. The native California oak tree, which appears in their inlay, stained glass and carving, symbolized organic life. This oak grows in a gnarled, angular fashion, a grotesque, weathered tree that could as soon grow horizontally or downward as upward. No graceful curves here. The furniture impresses us most with its decorative austerity or its simple elegance, but only rarely with its grace. It is as if the furniture itself echoes the oak's strange, fascinating disjointedness.

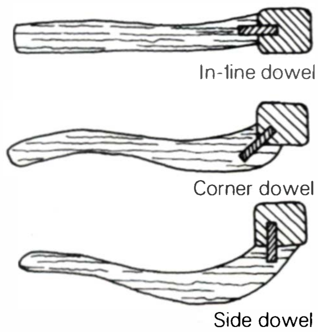
Because edges, joints and pegs are rounded, the rectangularity of the design appears less sharp and disconcerting, more friendly to eye and hand. Ends of beams and other projecting pieces were first rounded with a shaper and then the corners of the ends were rounded to an even greater radius. As a result, the furniture and interiors have the worn look wooden objects acquire when used and fingered daily.

Designing with projecting or overhanging elements has a distinct advantage besides the esthetic one; it eliminates the precision fitting required when pieces are joined flush. Two pieces joined on a piece of Greene furniture rarely meet on the same level. This has a decorative function but also requires less accurate work. Two pieces that are joined at right angles on the same plane are often rounded at their junction as, for example, on the Blacker house armchair, where the arms join the rear legs. This emphasizes their separateness, provides a dark shadow line and, once again, minimizes the effect of pieces out of square, differences in level, etc.

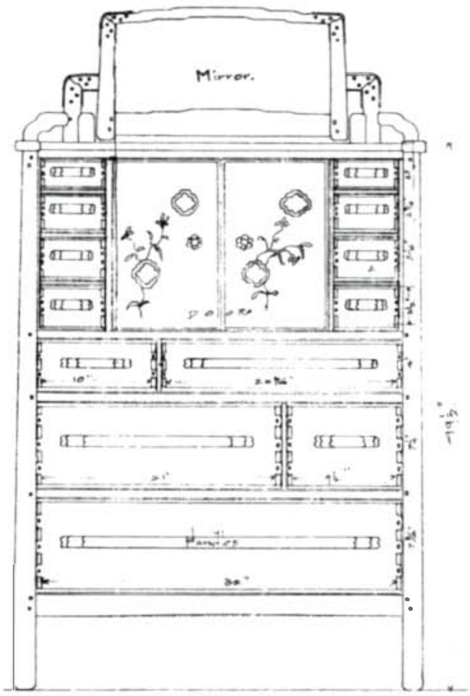
Placement of the lower rails used to strengthen chair or table legs largely determines the piece's "gesticulation," and generally speaking, the Greene furniture has these bracing members placed low. Thus the pieces are visually anchored to the floor and the decisive upward rise of the legs is broken only by the intersection of a seat or tabletop. This kind of framework gives the illusion of a sturdy rectangle, but bracing placed higher up strengthens more. The Greenes used such wide seat rails, however, that low placement of the bottom rails hardly weakens the structure.

The subtle upward taper of the legs of certain pieces of furniture is apparent only after careful examination, as on the sketch for the Gamble house chiffonier. One can only assume the purpose to be subliminal. We sense that weight is being supported but do not perceive it directly. The downward thickening of the legs implies this weight.

Construction of the living-room armchair from the Blacker house is out of the ordinary. Normal armchair assembly necessitates that the front and back units be assembled and glued together independently, then joined by seat rails and stretchers. Arms generally go on last and can be attached to the rear legs in one of three ways. Doweling through the corner is strongest because it provides the most glue surface and because the dowels would sooner break than pull out. In-line doweling comes next in strength, and also lends itself to mortise and tenon construction. Side doweling, the weakest of the three, permits a graceful design and gives more room for shifting one's back. However, if someone should sit on the arm, dowels might snap or the arm might split along its grain. The Greene and Greene adaptation of these joints is a glue, screw and plug version. For in-line doweling, they presumably tenoned the arm and pinned it with a screw hidden beneath an ebony plug. For a corner dowel, they screwed into the arm. This could, if it utilized an optimum length and



Blacker armchair, mahogany, 1907.

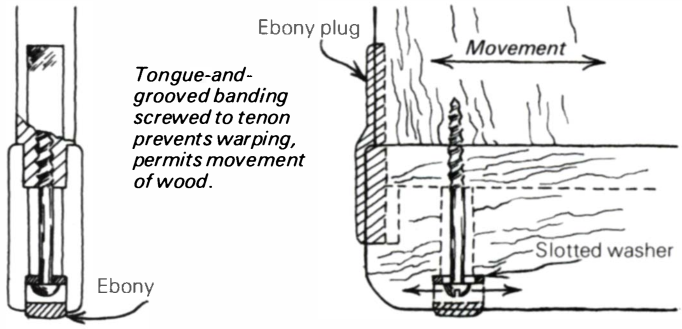


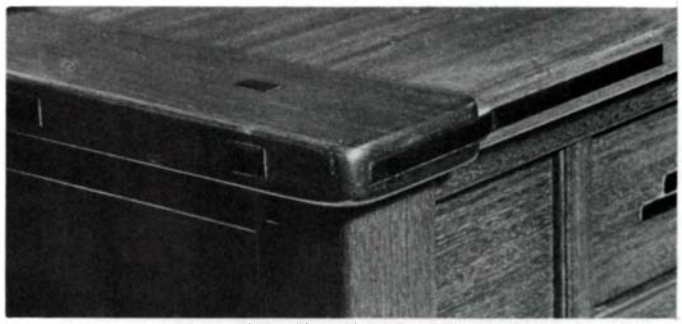
Gamble chiffonier, walnut, 1908, with fruitwood vines, ebony hexagons.

gauge screw, eliminate all of the above objections to this construction. But following normal assembly sequence, it could be exceedingly difficult to get a screwdriver in the space between the leg and slats. The Blacker house chair is unique because its builder glued together only part of the rear leg assembly and left the final gluing of the top piece and slat assembly until last. The partially assembled back was connected with stretchers to the fully assembled front. Then the arms were fitted, screwed in place and plugged. The final step was fitting and securing the slat assembly and top rail.

Several aspects of their table construction deserve attention. The majority of Greene tabletops and desk tops are solid wood. Others were veneered but only when the design required it, such as those with simple marquetry or inlay. Others are edged with massive hexagonal or otherwise polygonal bandings. Of the rectangular, solid wood ones, all have banding tongue-and-grooved across the end grain to prevent warping. They are secured with screws, not glued. Expansion and contraction of the top is accommodated in a fully satisfactory way. Bandings were drilled with spaced, oversized holes for the screws. Rectangular mortises were chiseled to a depth of about ⅜ in. and fitted with slotted washers. Screws biting tightly into the tenon secure the banding and slide back and forth in their washers as humidity changes. The banding overlaps the tabletop and movement of the two pieces relative to each other is unnoticeable. Ebony plugs are glued into the tabletop, but float in special mortises in the bandings.

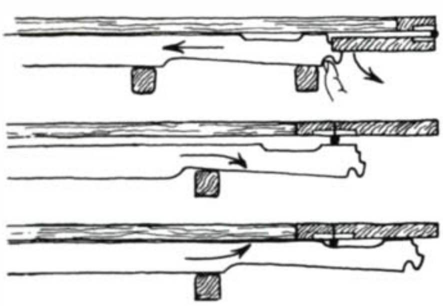
Henry Greene gets credit for some straightforward solutions to table extension problems in the dining table from the Richardson house. Leaves folding beneath the table, out of the way, are no innovation, but two details deserve attention. His supporting sliders do double duty as notched holders for the tucked-under leaves. The ganged hinges are oriented to reveal only the round barrel when the leaf is folded under. The hinge barrels would obstruct the action of the sliders, unless one cleverly formed the sliders to drop down slightly to clear the hinge barrel as they pull out, then come up to provide support. A short notch cut in the top of the slider pro-

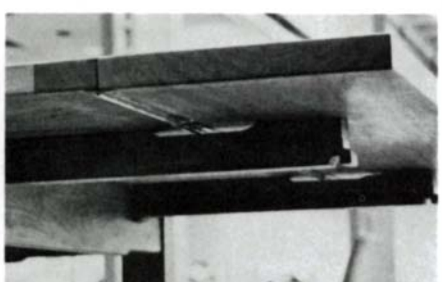




Detail, construction of breadboard ends.

Gate-leg table (oak, 1912) with dog-leg rail and stretcher. Design details are discussed on the next page.





Extension table and mechanism (walnut, 29 in. by 84¼ in. by 39 in.) from the Richardson house, 1929. The slider goes in, releasing the leaf, then comes out and up to support it, clearing the hinge barrel en route.

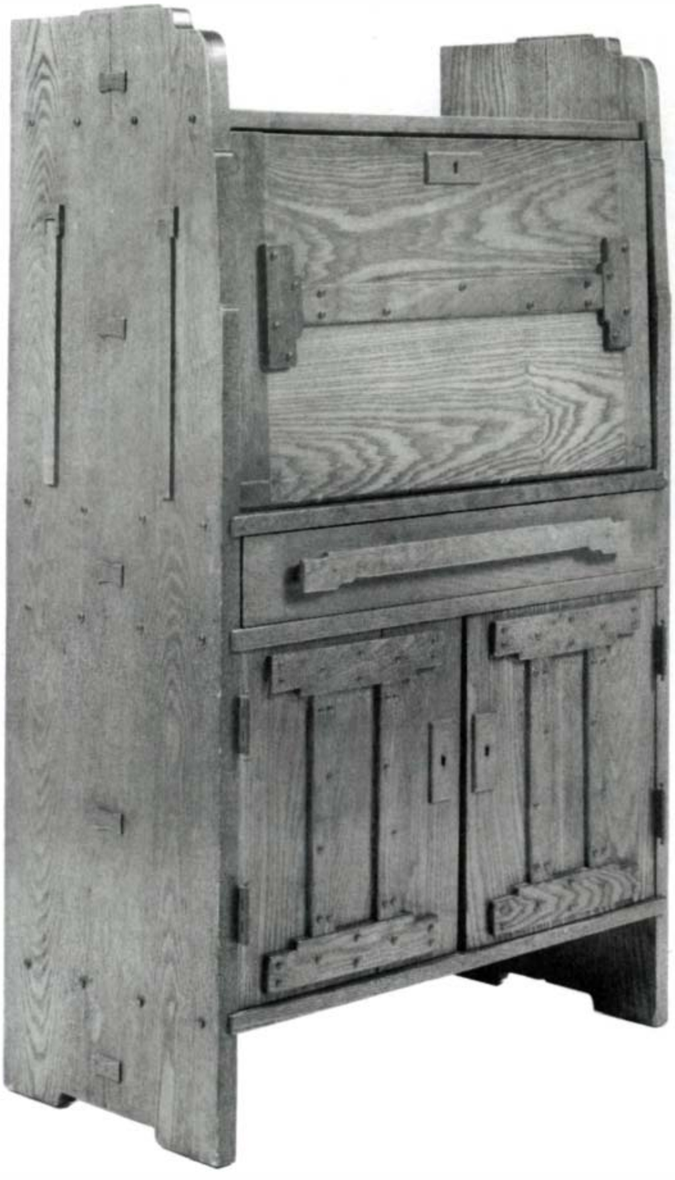
vides clearance during the last inch or so of its extension, when it comes up to full supporting level.

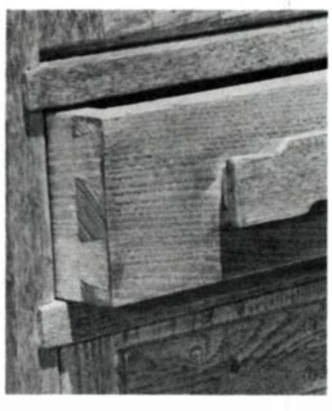
The Greene and Greene gate-leg table offers a most congenial solution to the problem of enabling leaves to fold down against the legs without having to employ a notched stretcher. Such a stretcher would make impossible a refined, slender construction of the undercarriage. Here, the stretcher and the upper rail have a dog-legged curve to accommodate the supporting leg of the gate. Not only is this a clever solution, but also one quite in keeping with the style of the rest of the table—the series of three steps on the lower gate-leg stretcher, the steps of the side rails and those on the folding leaves. The two lengthwise stretchers bracing the undercarriage are retracted to provide ample room for legs and feet. The lower pivot of the gate leg attaches where the stretchers meet, and it would seem that the dowel that pins these stretchers also forms the pivot. The dog-legged top rails are composed of two separate, lapped pieces of mahogany. This construction saves work and wood, and circumvents the need to find and desecrate a prime 6-in. square mahogany beam.

The Greenes used a number of techniques for supporting the fold-down lids of their writing desks. The Blacker house writing desk (1907), shown open on the magazine cover, contains two separate units, a lidded cabinet and the table to which it is fastened. Its lid folds down to rest on the center portions of two decorative bosses, which feature a piece of thick leather partly inlaid into the wood. On another desk from a Gamble house bedroom (not shown), opening the lid actuates levers that slide out two supporting arms beneath it as it is lowered. They retract flush when it is closed.

A third approach is to have a drawer slide out as support, as on the ash desk from the Tichenor house (1904). This piece was done the year before the association with Swedish cabinetmakers John and Peter Hall. The Greenes had experimented with a host of different woods, among them oak, fir, redwood, cedar and, in this instance, ash. As a result of the Halls' influence, no doubt, they turned from native woods to mahogany, both Honduras and Cuban. Mahogany is a cabinetmaker's delight. It contains few if any knots or imperfections; it stains easily, has unobtrusive (some might say boring) grain structure, and is available in large dimensions. It is interesting to note the contrast in style between this piece of furniture and what succeeded it. Its edges and corners are left sharp. The wood is light in color. Whether it is dowel ends or the ends of plugs protruding is hard to say, but they are round as compared to the later square or rectangular ebony plugs. Surfaces of the drawer handles were left flat and are unappealing to touch. The overall gesture of the piece is upward, whereas later cabinets are horizontal. Door panels are heavily battened and the amount of battening is hardly justified, except as decoration. One might term this a "rustic" piece. Rusticity appears to go hand in hand with an obvious construction, appropriate in function, yet overdone in the size and/or number of reinforcing elements. This construction emphasizes sturdiness and possesses a charming, decorative awkwardness.

The piece is designed around an "*I*" motif. Several groups consist of verticals sandwiched by two horizontals, or the opposite, a horizontal bookended by two verticals, and this gives cohesion to the piece as a composition. Even the reversed-bevel block-wedged scarves joining the planks that make up the cabinet sides echo this theme. Two seemingly superfluous elements adorn each side, and these narrow verticals, topped by the small, *U*-shaped blocks into which they fit, appear inset as mere ornamentation. Actually, only the front pair deserve this label. The rear two hinge in their





Tichenor desk of ash, 1904, is early example of Greene and Greene style. Drop front rests on open top drawer, right. Vertical bars on side of case appear ornamental, but rear piece pivots upward in U*-shaped block to reveal a through mortise. This allows false back to be withdrawn, giving access to second compartment behind pigeonholes. Far right, drawer details and overlapping partitions.*

blocks and swing upward, revealing through mortises. At the same time they expose the end of a board that serves as a false back for the pigeonholes. When it is slid through either one of the mortises, a secret storage space becomes accessible.

Another construction detail left out of later designs is the method of concealing mortises for the bottom and drawer partitions. Stylistically, these overlaps give the drawer and bottom sections an existence independent of the vertical sides with their stepped, retreating rise, and they tie in with the horizontal batten in the desk lid.

The Blacker house writing desk is typical of later work. Here are the rounded edges and flattened corners, the ebony pegs and the refined construction typical of all work done under the Halls' aegis. This piece features frame-and-panel construction in table sides, bottom and to the left and right of the drawer section. The tabletop is screwed fast to the carcase along sides, front and back. Presumably the screws repose in slotted holes to allow for movement, as do the screws that fasten the breadboard ends. Each drawer slides on two frame members into which are mortised bottom panels and drawer partitions. The smaller drawers are guided by a central track of oak, and the middle drawer runs on two oak tracks. Having no doubt observed how the weight of a drawer as it is pulled out causes it to glide on the upper rear portions of the sides and on the bottom, the designer felt safe in stepping the upper sides in the middle to reflect the steps of the ornamental leg braces, the door bosses, the ebony drawer-front decoration and the upper cabinet top joints.

The latter overlap and their pinning screws are hidden by ebony pegs. Details of hidden carcase construction will remain a matter of guesswork until the joints separate with age and under use, but this does not appear imminent. It is impossible to determine for certain how the legs were fastened to the framework, but it seems probable that after the central drawer section was completed, the end leg and panel assemblies were doweled into it and glued. In any case, the tabletop was screwed on last.

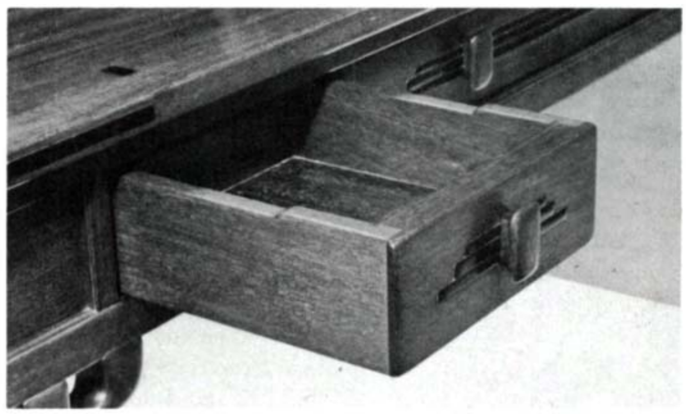
Drawer fronts were joined using half-blind tongue and rabbet construction, not a particularly strong one, but here justified because it permits an overhanging front. With the sides in effect drawn in, there can be no friction with the frame and as a result, the drawers glide well.

One of the nicer features of these later cabinets is the attention given to parts not ordinarily seen, such as backs, which were as nicely finished as fronts; bottoms, which were paneled as noted; and insides, not neglected, but instead well sanded with edges adequately broken.

Original specifications for the fine interior finish work in the Gamble house give us some idea of how the furniture was treated. Instructions mention four steps. First the wood was treated chemically in two coats. When thoroughly dry it was to be sanded lightly with 00 sandpaper. The chemicals were not named, but were probably a bleaching agent such as oxalic acid followed by wiping with acetic acid. Second, the wood was to be filled and stained. When the stain had set, it was to be wiped with cheesecloth and rubbed smooth. After drying, it was again sanded. After 48 hours, a coat of pure, undiluted boiled linseed oil was brushed on (step three) then wiped off until the surface was dry. It was then polished briskly with woolen cloths to a uniform surface, creating great friction and heat. Finally, when the work was approved by the architect, it was treated again with linseed oil, wiped and polished. □

Drop front of Blacker desk (1907, mahogany and ebony with fruitwood inlay) is supported by tabletop, cushioned by leather bosses. Details of the drawer and oak track are shown below.

Side drawer runs on oak track.



Drawers have stepped sides and ebony details.

Further reading

Greene and Greene, Architects in the Residential Style, by William R. Current and Karen Current (Morgan and Morgan Press, 145 Palisade St., Dobbs Ferry, N.Y. 10522), $10.95.

Five California Architects, by Esther McCoy and Randell L. Makinson (Holt, Rinehart, Winston, 383 Madison Ave., New York, N.Y. 10017), $10.00.

Greene and Greene (Vol. 1) Architecture as a Fine Art and *Greene and Greene (Vol. 2) Furniture and Related Designs*, by Randell L. Makinson (Peregrine Smith, Inc., 1877 E. Gentile St., Box 667, Layton, Utah 84041), each $24.95.

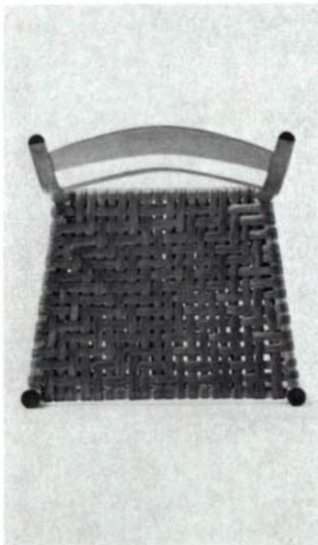
Holding the Work
Shaving horse and low bench

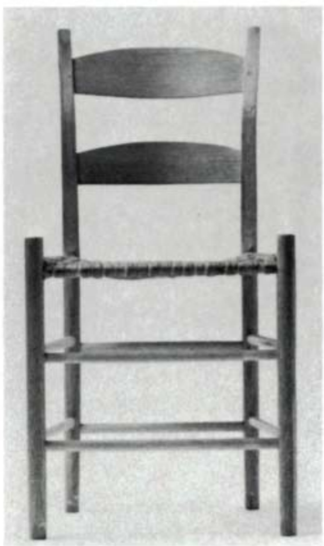
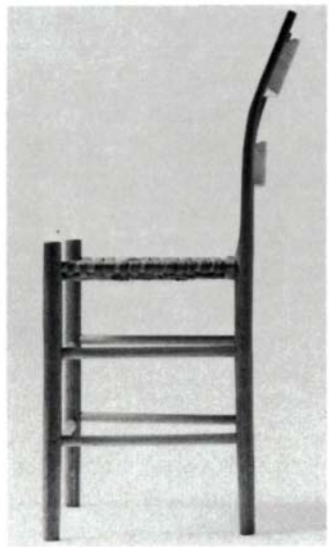
by John D. Alexander, Jr.

EDITOR'S NOTE: The post-and-rung chair at right is one of the basic seats that for centuries has kept Western man off the ground. It is light, rugged and beautiful. The vertical posts are white oak, the horizontal rungs and the back slats are hickory, and the seat is woven from the supple inner bark of the hickory tree. The chair is not hard to make, when you know how. It is explained in a new book, *Make a Chair from a Tree: An Introduction to Working Green Wood*, by John D. Alexander, Jr. (The Taunton Press, Inc., Box 355, Newtown, Conn. 06470, 1978. $7.95, paperback, 128 pp.)

The key to making a post-and-rung chair is working the wood green, as it comes off the tree. Green wood is relatively easy to cut, bore, shave and shape. As it dries, it hardens and shrinks. In chairmaking, the posts are shaped green, dried a little, then mortised to accept the rungs, which also are shaped green. But the rungs are well dried, then tenoned a hair oversize. When the tenons are driven home, they take on moisture from the post wood, expand tightly in their mortises, and then the whole joint dries to equilibrium with the atmosphere. It shrinks tightly together. A few further subleties—the post mortises interlock, the tenons are shouldered, notched and flattened for a dovetail effect and the grain direction of all the parts is carefully orchestrated—make a joint that just won't come apart.

Alexander, 47, is a Baltimore lawyer who has spent the last dozen years investigating old tools and chairs and figuring out how they were used and made. This article is taken from his chapter on working surfaces and holding devices. For more on splitting green wood into usable pieces, see "Cleaving Wood," p. 64 of this issue.



A chopping block is necessary. In the woods, use the stump of the tree you are harvesting. The stump, cut off immediately above the roots, makes a good block for the shop. Its flared, curved wood is not good for much else. Tall and short blocks, side by side, make it easy to hew out long back posts, because they can be shifted from one block to the other. A white oak, elm, locust or catalpa block will last outdoors for a long while, but use whatever is available. Work in a cleared area, with no one in the plane of travel of the hatchet head.

You need a low workbench and a shaving horse, although the shaving horse can be modified to serve as both. I'll describe the low bench first. The standard cabinetmaker's bench is not as useful for chairmaking as a bench that is low, narrow and heavy—a bench that can be moved, sat upon and battered.

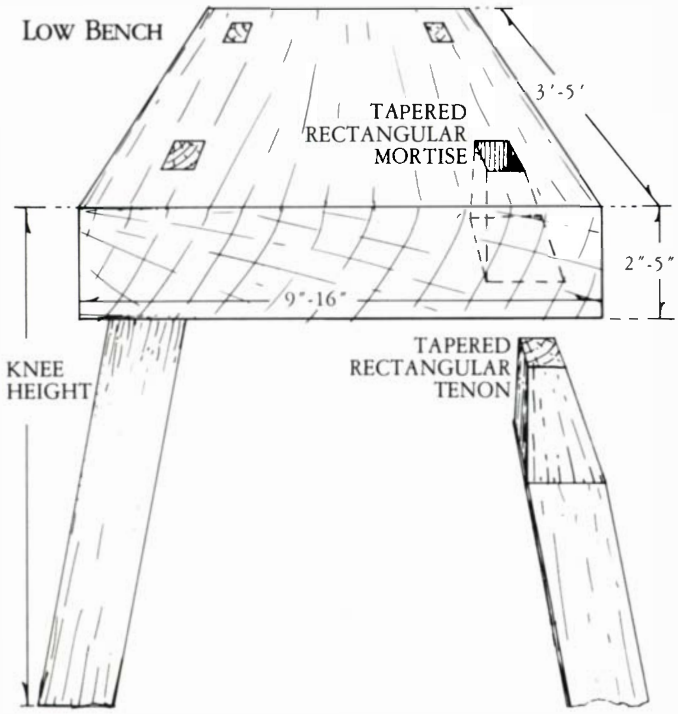
The body of a low bench is a heavy slab. Split a slab between three and five feet long out of heavy hardwood. White oak is best both for weight and for resistance to weathering. Work while the wood is still wet. Make the slab anywhere between two and five inches thick and between nine and sixteen inches wide. The bench should be low enough and narrow enough to be straddled comfortably, either standing or sitting. When you sit astride the bench, your legs should be comfortable. Fixed dimensions are not important—make the bench fit yourself and your task. You will spend a lot of time at this bench, so design it carefully. The important thing is a flat top. If no logs are available, use heavy planks or 2x4s glued face-to-face.

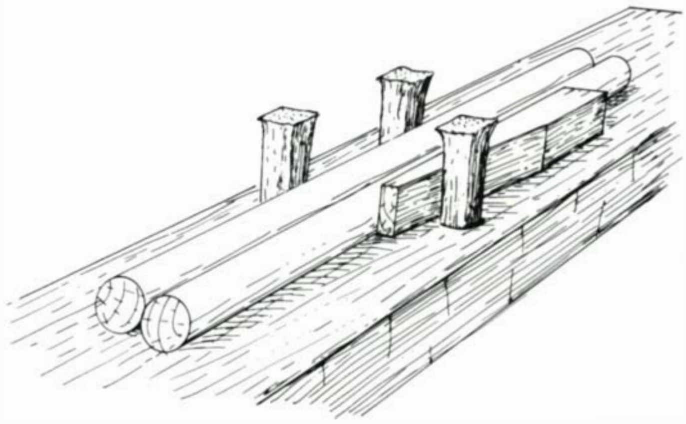
The bench posts taper up into the bench surface. It is easier to cut and adjust them if the posts come right through the slab. If you don't have a tapered reamer for making conical mortises in the slab, tapered rectilineal mortises and tenons chopped out of the green wood with a heavy chisel will also do a good job. Don't permanently secure the posts in the slab because they will swell and shrink throughout the life of the bench. If the movement of the wood makes the posts project above the slab, trim them off. If they become loose, drive a wedge alongside them.

Make the posts from wood that isn't good enough for chairs. Taper them to fit the tapered mortises. Drive them home. Building the bench is a good introduction to wet woodworking in general and to post and slab construction in particular. You will learn how to hew, chisel and bore wet wood. Almost no mistake is fatal with this bench. The harder you pound on it, the tighter it will become.

When moving the bench, be careful that one of the heavy posts doesn't fall out and smash your foot. I wasn't. I have never taken the time to put in stretchers.

What you have made is the ancestor of the common Wind-





The low bench should be heavy and about knee height, so it can be locked between the knees whether the maker is sitting or standing. It is made of split green wood or from scrap lumber. Tapered pegs driven into round holes in the bench, right, hold work for boring or mortising. A wedge locks the pieces in place.

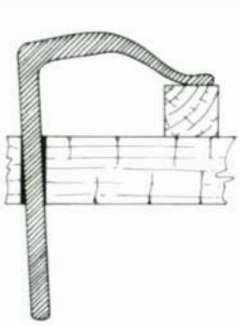
sor chair. Your bench (also called mare, horse, buck or trestle) allows you to align your body with your work. The bench puts the work at your waist rather than at your chest. You can sit down at and on your work, which is a big help. Once you are sitting on the bench or standing astride it, locking it between your knees, you, the work and the bench become one mechanical system—if you can secure the work to the slab.

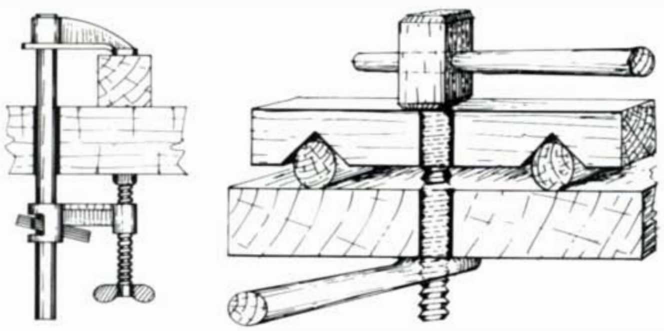
To secure work for boring or mortising, drive three or four square tapered pegs into round holes in the bench. Lay sticks between the pegs and lock them in place with a wooden wedge or wedges. Space the holes and pegs so that posts can be held down singly and in matching pairs. The simplicity of this holding system was hard to accept until I tried it. It was the last method I tried.

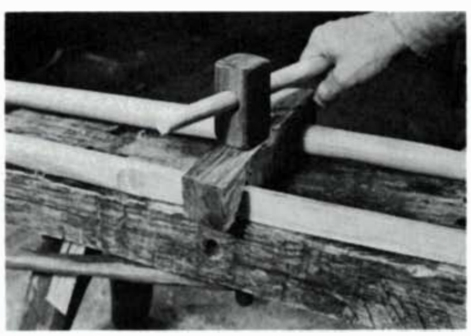
You can also use screws as holding devices. Wooden screws of ⅞-in. or 1-in. diameter are more than strong enough. Because permanent handles get in the way, make the screws with large heads and drill holes through them. You'll always have rung rejects (factory seconds) lying around to put into the holes for handles.

Hold-down yokes are fastened to the bench top by boring a hole through the middle of the slab to accept the wooden screw bolt. I don't tap vertical holes in the bench, but use a wooden screw bolt from above the slab and a wooden lever nut from below. A deep-engagement pipe clamp also works, with the pipe running through a hole in the bench and the screw beneath the bench. Run the pipe up through a hole in the hold-down yoke and screw a threaded pipe flange or sleeve on the top end. Protect your tools by covering with wood any metal projecting above the bench so metal doesn't strike metal.

I use the English style of shaving horse, also called a bodger's bench, cooper's shaving bench or shaving brake. It holds posts, rungs and slats for drawknifing and shaving. The crossbar on the horse securely locks the workpiece in place. The shaving horse is a perfect holding device: The harder you







More holding systems (left to right): the holdfast, the pipe clamp, the hold-down yoke. A holdfast works by spring action. A tap at its knee jams it against the sides of a hole in the bench. A pipe clamp can be run through a hole and tightened underneath the bench, but cap the metal with wood to protect tool edges. A hold-down yoke will secure matching posts side by side. It is tightened by a square-headed wooden screw fitting loosely through the bench into a wooden lever nut below.

pull the tool toward you, the harder your feet push the lever arms away from you. The crossbar is thus forced down on the workpiece.

The horse design I use allows more adjustment than some versions, and it makes the horse adaptable for various tasks. My horse has two horizontal parallel beams, like a lathe, rather than a solid slab. The work surface is nailed (with deeply countersunk nails) to a tiller that fits between the beams. Pegs driven through the sides of the beams and the tiller adjust the surface to any angle or height. I made my shaving horse from scrap hardwood lumber. White oak is excellent, but almost any wood will do. Of course you can split the parts out of green wood.

The shaving horse crossbar is square in cross section. Its round ends friction-fit into the side lever bars. Thus the crossbar can rotate and will always seat squarely on the work. One surface of the bar is notched to hold square-sectioned sticks corner up.

Shaving-horse dimensions depend on the worker. The height and size of the bench should allow the worker's heels to rest on the ground while his toes touch the lever foot bar.

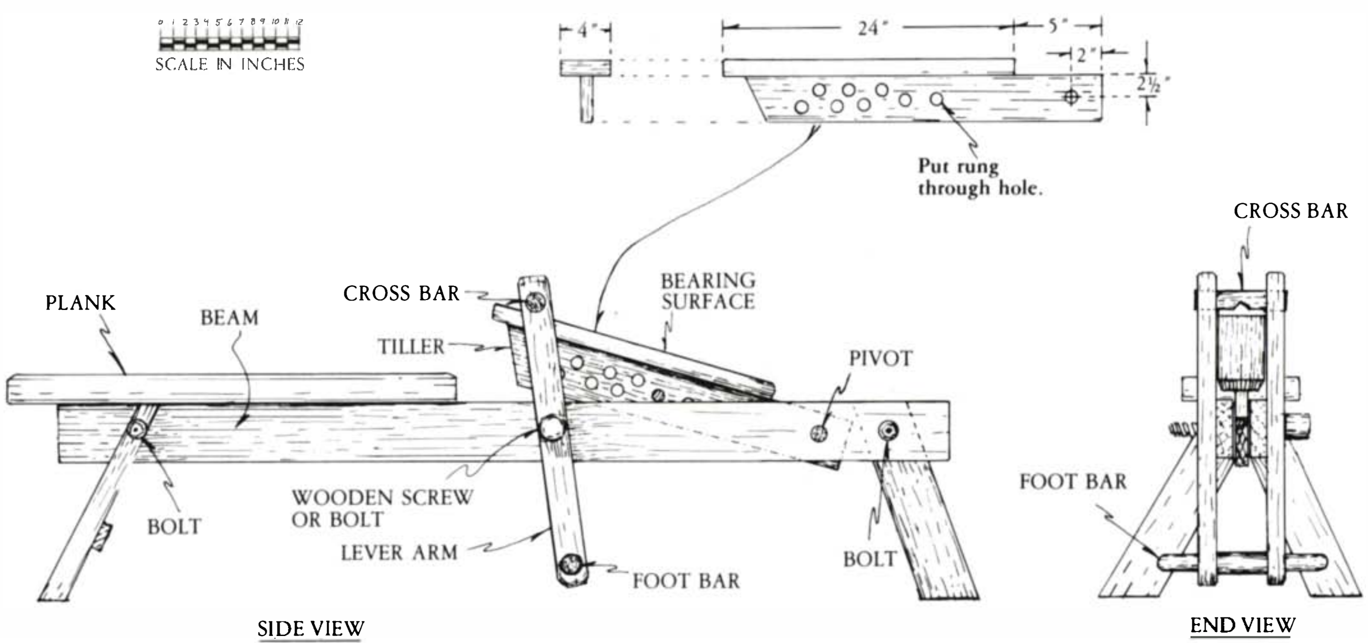
To make a shaving horse double as a low bench, mount a heavy plank on the beams. You'll find a separate low bench a help, but you can get started without one. If you make both a horse and a bench, or two benches, make them the same height, so they can double as sawhorses or be used to hold larger pieces of work laid across them.

Because the work surface is adjustable, the shaving horse has a variety of other uses. I hold sharpening stones or tools with it: both my hands are free to control sharpening pressure and angle.

Take time to make a tool box or rack. Tools get lost easily, and edges become nicked and ruined in the mess. The rack must be easy to move from one work area or bench to another. I have a rack made of sticks with tapered ends (conical tenons) jammed into mortises that are bored and taper-reamed through post-wood rejects. The rack is bound together by a toggle rope. A twist or two on the rope adjusts for dimension and design changes.

Now we are ready to make a chair. □

SHAVING HORSE



This style of shaving horse is light enough to be toted into the woods for drawknifing split sticks right where the tree is felled.

A post-and-rung tool rack can be made quickly from spare and rejected chair parts, bound together with a toggle rope.

Designer, Hans J. Wegner; cabinetmaker, Johannes Hansen.

Scandinavian Styles
Exhibit features Krenov, Copenhagen cabinetmakers

by Per Mollerup

In May 1978, Den Permanente (The Permanent Exhibition of Danish Arts and Crafts) of Copenhagen put up two exhibitions, each a gem of its kind for anyone interested in the fine art of cabinetmaking. One was a display of 66 items made by nine master-craftsmen in Copenhagen. All the designs were originally introduced at the annual exhibitions of the Copenhagen Cabinetmakers' Guild from 1927 to 1966. The other, smaller exhibition was a series of one-of-a-kind items by James Krenov, Sweden's artist-cabinetmaker. Although both exhibitions offered furniture of high artistic quality and superb craftsmanship, there is a world of difference in the process by which the two categories of furniture originated and in the philosophy behind them.

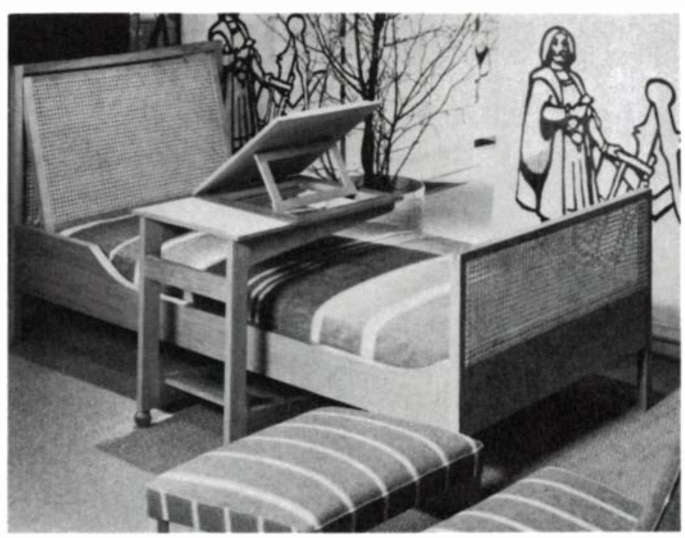
* * *

When the Copenhagen Cabinetmakers' Guild hit upon the idea of staging an annual exhibition in 1927, it was by no means because the craft had much to boast about. On the contrary, there was a strong feeling that with the rise of industrial production, the times were moving against the craft. But farsighted members believed that an annual showcase of this kind could be used as a lever to turn the tide. The next generation would be using the term "product development."

There is very little from those early years that manufacturers hold up with pride. But gradually, as the annual exhibitions found their final form and became a regular furniture feature, a useful relationship was built up between the cabinetmakers and outside designers. The gap widened between the mind that conceived the furniture and the hand that made it. But this alliance of mind and hand contained the first seeds of the Golden Age of Danish furniture-making in the 1950s and 1960s, the era of the "big-name" designers.

The Guild exhibitions thus became the nucleus of a peaceful contest of skills between the best in the industry, an event that encouraged the investment of extra effort and the blooming of high hopes. Of course, contemporary critics complained (as they do of the more industrial Scandinavian Furniture Fair today) that nothing was happening. But looking back over those years via Den Permanente's exhibition, you see that in fact a lot was happening.

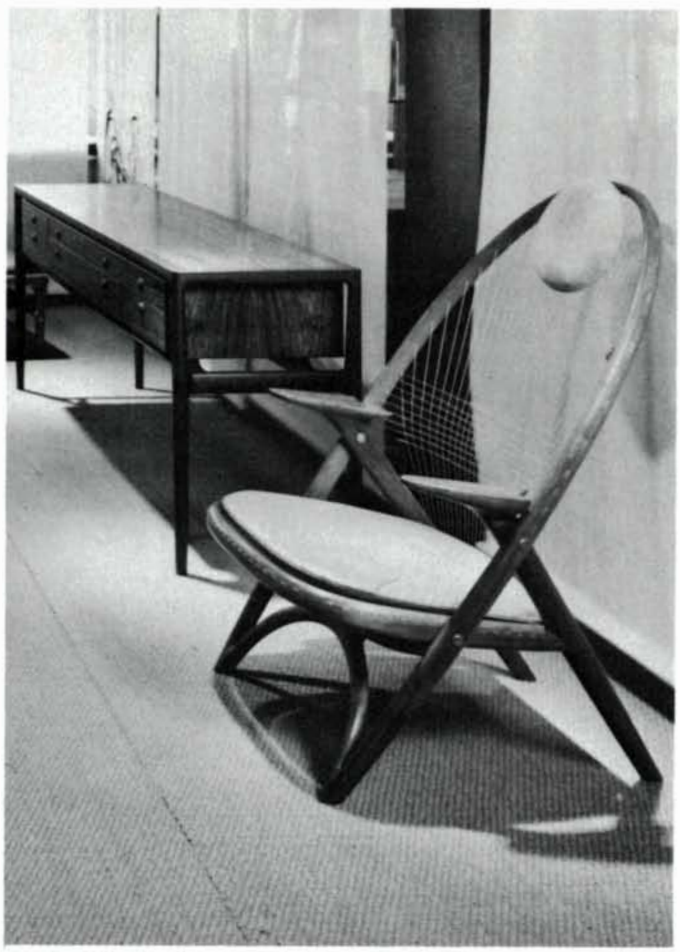
And in retrospect we see the exhibitions had an effect the organizers had scarcely anticipated—and certainly did not wish. The annual displays became a source of inspiration for



Designer, Rigmor Andersen; makers, J. Christensen and E. Larsen.

Per Mollerup, of Copenhagen, is editor and publisher of the international furniture design magazine, Mobilia.

Designer, Grete Jalk; cabinetmaker, Henning Jensen.



Designer, Vestergaard Jensen; cabinetmaker, Soren Horn.

the very industry they were designed to keep at bay. And today many items of industrially manufactured furniture can be traced directly back to cabinetmaker's models introduced at Guild exhibitions. Some of these industrial items were also on show at Den Permanente. In 1966, after an uninterrupted period of 40 annual exhibitions, the Copenhagen Cabinetmakers' Guild suspended these events on account of a wavering economy. Since then, many have tried to revive this important activity, so far without success.

• • •

James Krenov, no doubt a familiar name to readers of *Fine Woodworking,* has established a reputation on two fronts: as an exceptionally original cabinetmaker and as an industrious lecturer and writer (*A Cabinetmaker's Notebook* and *The Fine Art of Cabinetmaking*, both published by Van Nostrand Reinhold, 7625 Empire Drive, Florence, Ky. 41042).

Den Permanente's show included 16 pieces by Krenov. Four of them are shown on the opposite page.

Normally the word designer is applied to the person who decides the form of an object. These days the designer is not likely to be the person who then physically makes the object. As suggested earlier, this separation of mind and hand was an important part of the background to the worldwide success of Danish furniture-making a decade or two ago.

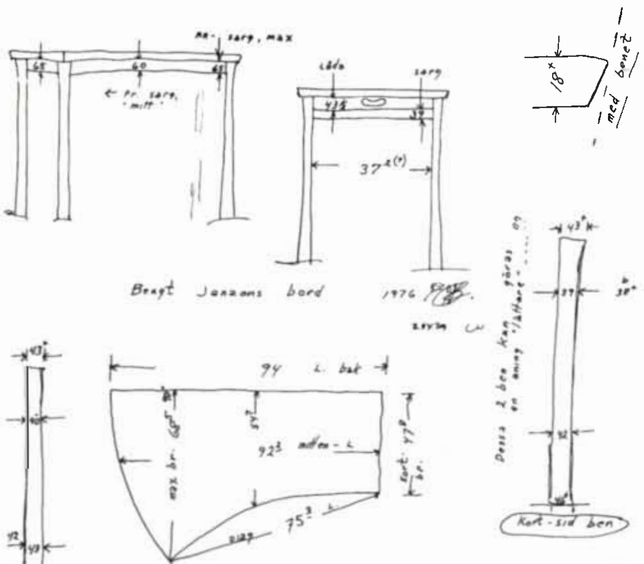
In Krenov's case, it is difficult to use the word "design" at all. True, he decides the form and so to some extent may be considered the designer, but the precise, final form is not predetermined—it emerges from the dialog between master and material as the work proceeds. With Krenov, design is a consequence of the type and nature of the wood; design stems from a love—indeed a veneration—of his material. It will be obvious that each Krenov item is unique.

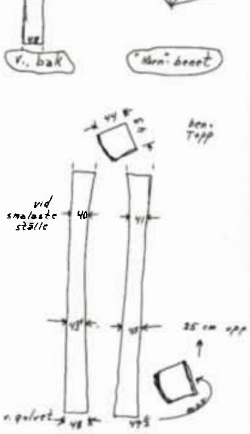
Can Krenov justify his approach to cabinetmaking in an age when we coldly, deliberately bend nature to our will, and even destroy it in order to satisfy the most vulgar, artificially created "needs?" The question, of course, is strongly biased, and the answer can only be yes. Apart from reminding us that he who really conquers nature is himself doomed to lose, Krenov discreetly teaches us the natural potential of wood. The solution to a timber problem may be surprising and logical, if you are wide awake. Take, for instance, Krenov's small writing table: The drawer opens on the right, so the user doesn't have to move the chair backward in order to take out paper or pen.

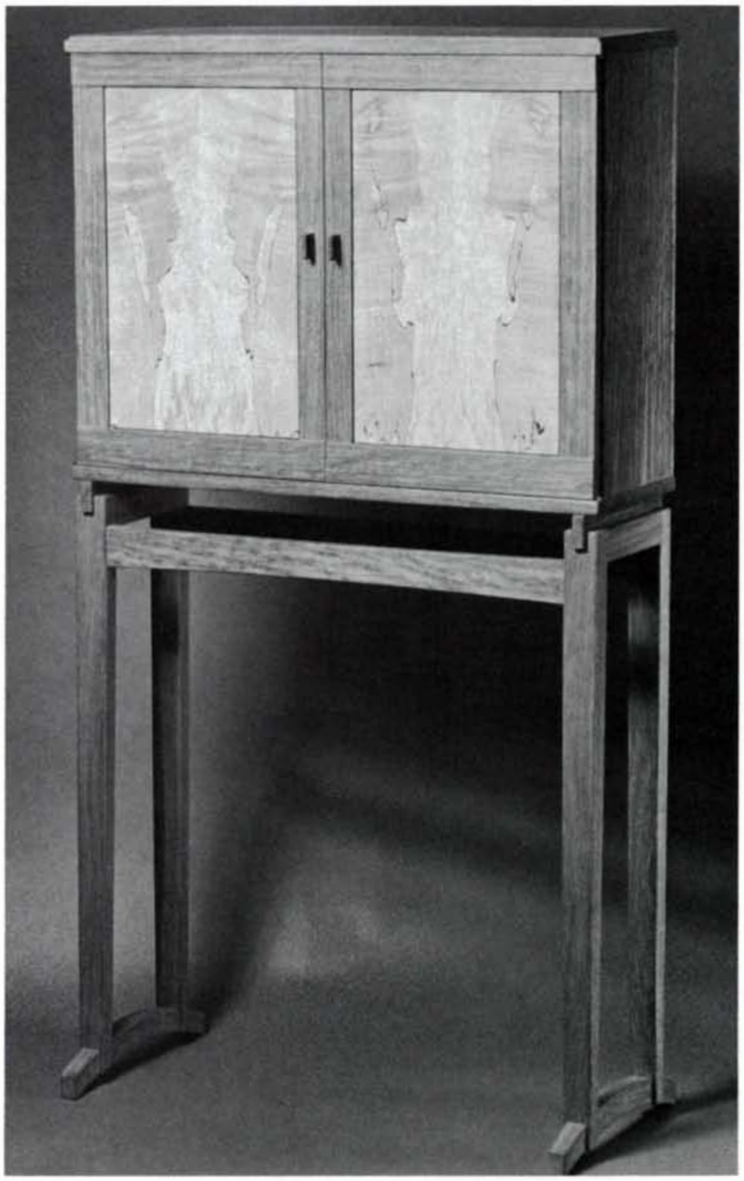
Krenov plainly does not make furniture for the masses. But his furniture brings a message that no one working with wood would be advised to ignore. □

Designers: Ole Wanscher, Poul Kjaerholm, Jorgen Gammelgaard.

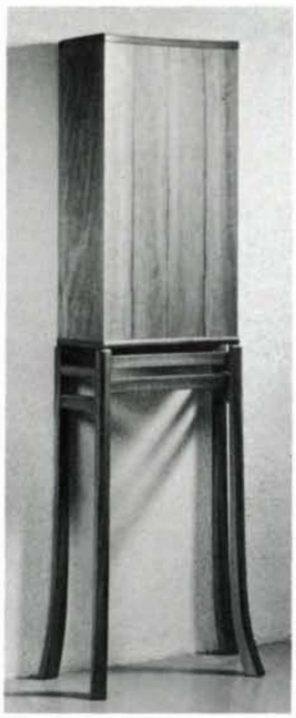
Krenov's measure-up sketch, below, is for an oak writing table; photo inset, a slightly different table, walnut, 29 in. high. Krenov's inspiration is always the wood. His furniture is not designed or drawn in advance—the precise form and detailing unfold as the work proceeds. When it's done he takes measurements for future reference. He writes, 'If I do return to a theme, I don't ever make it exactly the same way. I start where I left off, with the measure-up as an orientation, a suggestion, and the wood to show me the way from there. . .'



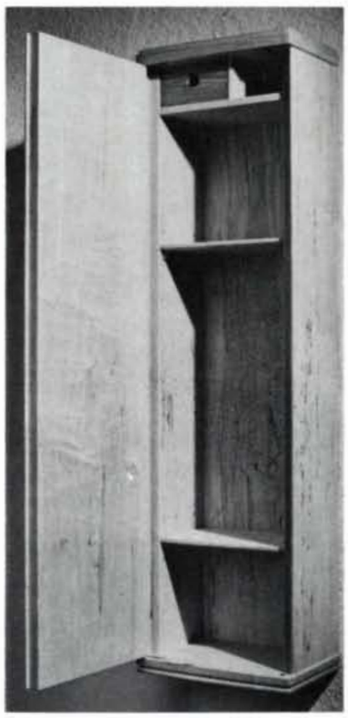




Cabinet of brown oak, with spalted maple doors, 55 in. high.



Cabinet, 63 in. high, pearwood, blackwood; drawers, rosewood, cedar.



Spalted maple cabinet, 33 in. high, with brown oak drawer.

Tambours

Precise measuring and machining make slats run smoothly

by Alphonse Mattia

Tambours are flexible doors, made up of a series of thin wooden slats. They are either glued to a fabric backing or threaded together with wires. The slats have tongues at each end, which run in tracking grooves cut into the carcase. Tambour doors can open vertically, as in a roll-top desk, or horizontally, as in a buffet.

Most people refer to tambours as "roll-tops" because of the familiarity of the American oak roll-top desk. Tambours, however, originated in France during the 17th century. Tambours were very popular in Louis XV (1715-1774) and Louis XVI (1774-1792) work, and again in England during the Sheraton period in the early 19th century. They did not reach the general public in America until the oak roll-top desk came into fashion early in the 20th century. Tambours are also used in Scandinavian contemporary furniture.

Tambours are efficient and offer several advantages over other door systems. Space is saved because doors do not swing out from the carcase. They give greater access to the carcase opening than sliding systems where the doors must overlap. Tambours can also follow or accentuate graceful curves in the piece. Wired tambours offer the advantage of allowing the back of the tambour to be exposed, since it is not covered with fabric. The fabric-backed method stabilizes the tambour and controls warpage better. I prefer the fabric method and will concentrate on it in this article.

Design

Tambours are a sophisticated door system, which must be an integrated element of a total design, not attempted as an afterthought. Every aspect of the piece should be planned out, from shape or form right through to details, because tolerances and clearances are very important considerations.

The initial concept should be developed through sketches and made final in accurate full-scale drawings. Mock-ups should be made where full-scale drawings do not supply enough information.

Precision is essential. The tongues must be of a shape and size that will slide smoothly in the grooves. The carcase must be glued up square with duplicate tracking grooves directly opposite each other. Design a form that you will be able to control accurately through the building stages. This is not to say that your piece must be a rectangle, but keep your first attempt fairly simple and small.

With vertical tambours, weight becomes important. A large tambour that opens from the bottom may be too heavy, and one that opens from the top may fall open under its own weight. If you plan to have a reverse curve in the track, you will have to cut a clearance angle on the sides of each slat.

One common problem with tamboured pieces is that warpage in the carcase will affect dimensions between the tracking grooves, usually at unsupported corners or over long expanses. Be sure your carcase is structurally sound. Internal parts can be designed to add rigidity to the carcase. Tamboured pieces often have a false back and sides, which conceal the fabric side of the tambour when it is opened and also prevent the contents of the cases from interfering with the travel of the doors. They may also support compartments, partitions, shelves or drawers. These parts have to be located to allow enough clearance for movement of the doors. I try to

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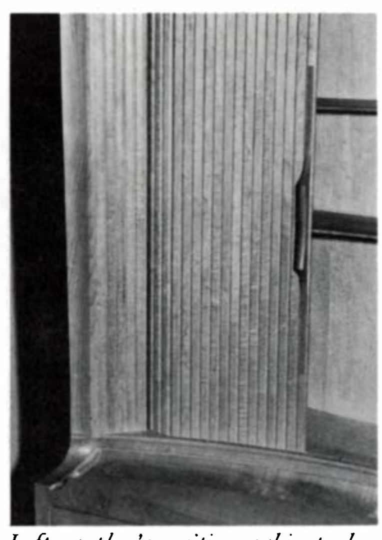
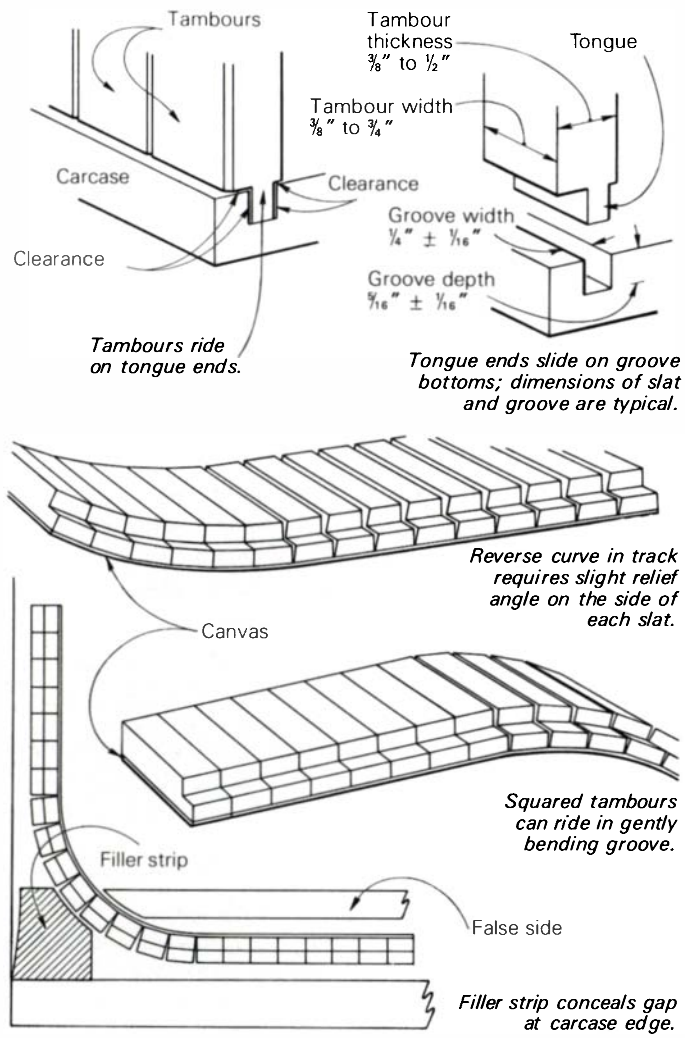
Designer/craftsman Alphonse Mattia is assistant professor at the Boston University Program in Artisanry.



Left, author's writing cabinet, bubinga and figured maple. Above, detail of Richard Tannen's tall maple cabinet; fixed slats are filler strip.



Tongue ends slide on groove bottoms; dimensions of slat and groove are typical.

Reverse curve in track requires slight relief angle on the side of each slat.

Squared tambours can ride in gently bending groove.

Filler strip conceals gap at carcase edge.

provide as much clearance as possible to prevent later problems, such as rub marks on the tambour surface. The space where the tambour enters the carcase can be made to appear narrower by use of a filler strip or a thickened carcase edge.

Tambours are usually shouldered on the exposed side to conceal the carcase groove. The tambour can then be fitted to the groove at the tongue without distorting the shape of the tambour. Tracking grooves vary in width, depth and radius of curve. Generally speaking, tracking grooves range in width from 3/16 in. to 5/16 in. They may be smaller in delicate, silk-backed work, or larger in heavy applications. Grooves should be a little deeper than they are wide. A 3/16-in. groove should be about 1/4 in. deep; a 1/4-in. groove should be 5/16 in. deep.

Tambours for a 1/4-in. groove might range from 3/8 in. to 3/4 in. wide, and from 3/8 in. to 1/2 in. thick. The tambour width is the dimension parallel to the direction of the groove; the tambour thickness corresponds to the width of the groove. A rectangular tongue (wider than it is thick) will ensure steadier travel in the groove. For a narrow tambour, say 5/16 in., I would probably switch to a 3/16-in. groove for this reason.

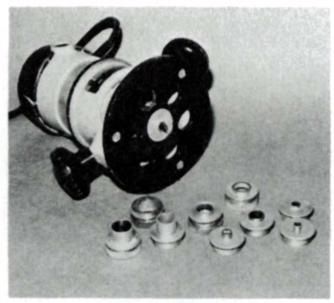
The radius of the tracking grooves should be checked carefully to make sure that the tambour can travel the bend comfortably. This can be checked on paper. Draw the groove by using a compass to construct two parallel lines at the proper radius. Be sure that a paper rectangle the size of the tambour tongue will fit in the groove. This will tell you a lot, but is no substitute for routing a sample groove to the desired radius in a piece of scrap plywood and testing a glued-up sample of your tambour. A 6-in. square of tambours can easily be made by cutting the appropriate tongues on one end of several short strips and gluing them to the fabric with Titebond. This should not take long and will be well worth the effort.

One last word about design—you should decide how you will attach the handle to your tambour, because the attaching strip may interfere with internal parts of the cabinet.

Making templates and routing grooves

A template, or pattern, for routing the tracking groove is needed to transfer the groove accurately from the drawing to both sides of the carcase. The easiest way to make grooves is to run a router against the template. It is best if a single template can be reversed for alternate sides of the carcase, so that slight inaccuracies in the curve will be duplicated.

Before you make the template, decide how it will guide the router. I usually use rub collars, which are available for most routers in a variety of sizes. Choose a size that has a convenient distance from rub surface to cutting edge. You will have to account for this distance when you construct your template. A 1/4-in. bit with a 1/2-in. O.D. rub collar will give you a difference of 1/8 in. This means the template has to be 1/8 in. smaller than the inside line of the groove.



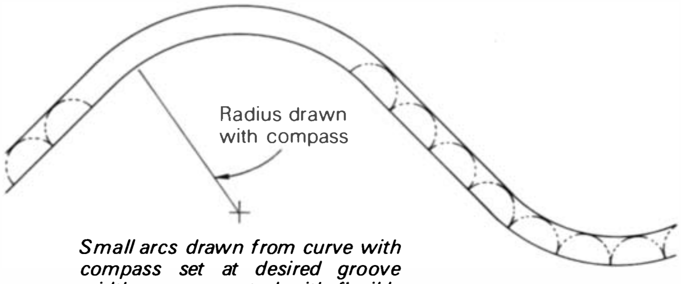
Router and rub collars.

You could run the router directly off the edge of the router base, but this can be inconvenient. The router will be more difficult to handle and discrepancies in the template will be magnified because of the large distance from the base-plate edge to the groove.

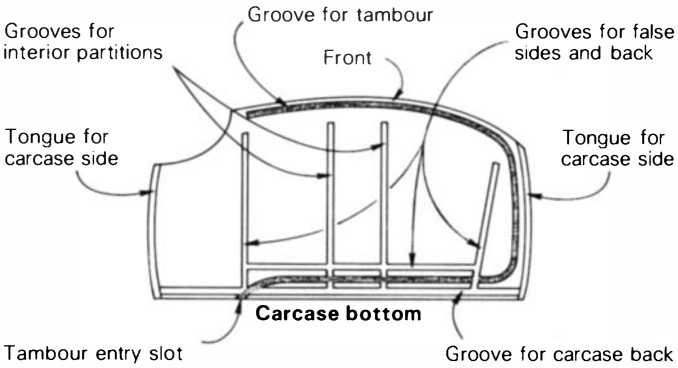
Get the bit and collar before making the template. It is very annoying to construct a template for a 1/2-in. rub collar and then find out that the local hardware dealer has every size except 1/2 in. A new carbide bit will help make a clean, clear track.

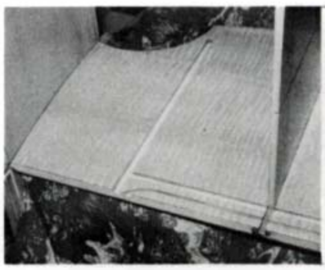
Once you know the size of the rub collar, you can construct accurate template lines on the full-scale drawing. To parallel a curved line, set a compass to the distance that you want between the two lines. With the point on the original line, lay out a series of arcs from the line. Then construct a new line through the top points of the arcs by using a French curve, flexible drawing spline or bending sticks. Circular arcs can be drawn with a compass.

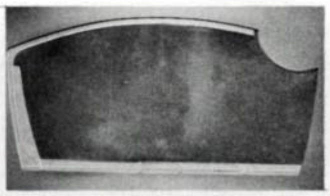
When you draw the template, consider reference points that you can use to orient the template on both sides of the carcase. The template can be laid out to conform to some fixed line or shape on the carcase, such as a bottom edge or corner where the groove does not pass. Templates can be clamped in place, or better yet, screwed down in two or more inconspicuous spots that can be filled later. Screwing the template down will save you the aggravation of having to move clamps during routing. These screw positions can also provide an ideal reference for locating the template on the sides. A template attached in this manner can be removed, cut down and relocated to pattern other grooves in the cabinet (unless you plan to make a duplicate cabinet, in which case you'll want to keep all the templates intact). For example, the same template could be used to flush-trim the outside shape of the



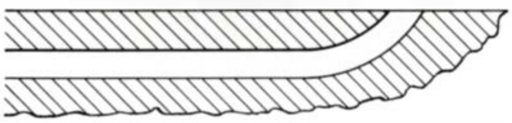
Small arcs drawn from curve with compass set at desired groove width are connected with flexible drawing spline.



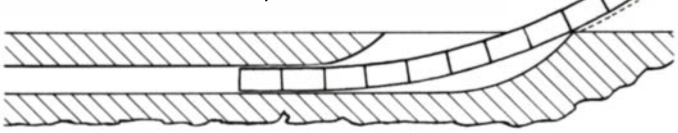




Template (above) guides grooves for tambour. Internal cabinet parts (left) add rigidity.



If tambour entry bends backward (above), slot must be routed out or widened by hand (below).



carcase, then be removed, cut down and relocated to rout the tambour grooves, removed, recut and relocated to cut grooves for the false sides, back, shelves and other internal parts.

Template lines should be transferred from the full-scale drawing to the template with tracing paper. I glue the tracing to a piece of Masonite or Baltic birch plywood using spray adhesive or rubber cement. Fir plywood has too many voids that will cause problems when routing. Cut the template as accurately as you can, cutting on the waste side of the line. Lumps can be filed, but be sure you check the accuracy of the template against the full-scale drawing. If inaccurate, it's best to get a new piece of Masonite and start over.

Note that tambour entry slots can be part of the template, or hand-cut later if that is easier in your particular design. Remember that if the entry slot bends backwards, you have to cut a clearance angle on the tambour, or else widen the slot.

To familiarize yourself with the feel of running the router against the template, fasten the template to a piece of scrap plywood and make a trial cut. The router cuts best when run against the direction of rotation. This may mean that on one side you will have to lower the router down into the wood to start the cut. This is awkward, but is better than trying to run with the rotation. I usually rout at full depth with a carbide bit. Most routers are slightly inaccurate, and two settings may make a tiny ledge in the groove that will cause later problems. Make sure the bit is fastened securely in the router. Some ½-in. routers do not hold ¼-in. shank bits snugly. It is common for a ¼-in. bit to slip in the collet. If this happens you will have to fill the grooves, reset the bit and rerout. Other routing mistakes can sometimes be repaired the same way. It may be necessary to widen the groove slightly at a tight radius, to aid tambour travel. This can be done by removing the template, filing the radius a tad, relocating and rerouting. Or the radius can be eased during sanding.

After the first groove is routed, orient the template on the other side. Double-check positioning and rout again. I sand grooves with little fitted sanding blocks. They should be sanded as smooth as possible without deforming them. Finish with a coat of thin shellac and polish with paste wax.

With the grooves complete, continue building the rest of the carcase. Prefinish the inside before assembly. Take precautions to ensure that no glue will run into the grooves or into areas with limited access, such as between a false side and the carcase side. Make sure that your cabinet is glued up square.

Machining the tambours

Tambour slats will be ripped longer than their finished size. Then they will be shaped, presanded and glued to a fabric backing. After gluing up, the tambour will be cut to its final length, and shoulders and tongues will be cut on the ends. Plan on making about one-third more tambours than you need. If you need 60, make 80 or 90. This will not require that much more time or material, and it is convenient to be able to discard chipped or warped tambours. Tambour stock should be sawn down to 3-in. to 5-in. widths, 1 in. or so longer than the finished length. Anything much wider will be difficult to resaw. Then resaw the sections about $\frac{3}{16}$ in. thicker than the finished thickness. (This depends on the length of the tambour—shorter tambours require less excess than longer ones.) These slats should be allowed to warp, at least overnight and preferably for several days. Then the slats should be dressed down to the finished thickness.

Now slats should be ripped to width. Rip a few to see if they are coming off the saw fairly straight. A little bit of warp can be tolerated in this dimension. A light jointer pass between each sawcut will help keep the tambours straight. If they are warping too much you will have to rip them oversized, allow them to warp again, dress them on the jointer and either thickness-plane or rip them to exact width. It is best to avoid running them over the jointer—this is dangerous with such small strips. If you must, make sure the jointer knives are sharp and use a push-stick. Now cut the strips to length, leaving ¼-in. to ½-in. excess at each end. Remember to account for the tongues.

When the tambours are cut to size, they should be stacked with stickers between them so they are exposed to air on all sides. Stickers should be of equal thickness and should be placed directly over each other just as when stacking lumber. I find it is better not to restrict movement and warpage. Later, before assembly, you can discard the worst tambours.

Tambours can be machine-shaped in many ways, but if you plan to do this there are a few things to remember. If they are completely rounded over on the top surfaces, you may have to cut the tongues ahead of time, because a rolled-over tambour might not sit flat on the glue-up board. Rounded tambours and most other shapes require presanding. Tambours that have a relief angle to travel in a back curve can also require presanding. On a first attempt keep shaping fairly simple, such as a simple chamfer or cove cut on the edges of the tambours to accentuate the individual strips.

To shape the tambours you will need a shaper or a router mounted in a table. Set the chamfer or cove bit to the proper height. Clamp a fence at the right distance. Clamp finger boards in place to hold the tambours tightly against the fence and table. Push each tambour through with the next one. Try not to pause when picking up the next one, as this can cause burn marks. Repeat on the second edge of each tambour.

If you have to cut a relief angle, make a jig that will hold the tambour securely as it is slid past the angled blade of the table saw. You need hardly any angle at all. Slide the tambours through once for the first side and again for the second.

If you are going to presand, make another jig to hold the tambour. A few minutes of work here will save a lot of time later. Rabbet a piece of wood to receive the tambour and hold the tambour in place with two small stop blocks. Tambours should be stacked again with stickers while you prepare a glue-up board.

Gluing up

You will need to make a board that will hold your tambours tightly together and flat and square while you glue the fabric onto the back. I use a piece of ¾-in. chipboard. It should be about 2 in. wider on each side and about 8 in. longer (2 in. at the back, and 6 in. at the front of the board) than the size of the tambour you are gluing up. Make sure you figure on enough tambours to recede into the carcase, so that you will not see the last slat when the door is closed.

Dress two pieces of wood about 1¼ in. to 1½ in. wide and as long as your glue-up board. Cut a rabbet in each piece that will receive the thickness of the tambour. The rabbet should be tight, so that when the strips are screwed down they will clamp the tambours firmly to the board. For the ends of the jig, make three thinner strips to fit under the rabbet. These should be the same length and thickness as the tambours, and about 1¼ in. to 1½ in. wide. Also make two or three pairs of opposing wedges the same thickness as the thinner strips. These will be used to clamp the tambours tightly together.

Screw the first rabbeted strip down to the particle board. Then screw down one of the thinner strips, checking with a framing square to be sure that it is 90° to the rabbeted strip. Put the tambours in place, face down, and screw down the other rabbeted strip. Once the strips are aligned, loosen the screws and remove the tambours.

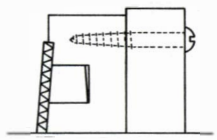
Lay out the tambours on a flat surface, face up. Sort out the worst and arrange the remaining ones for color and grain pattern. You can tolerate a reasonable warpage between tambours, because it will be forced out by the clamping action of the glue-up board. Discard any tambours that arch severely away from the flat surface.

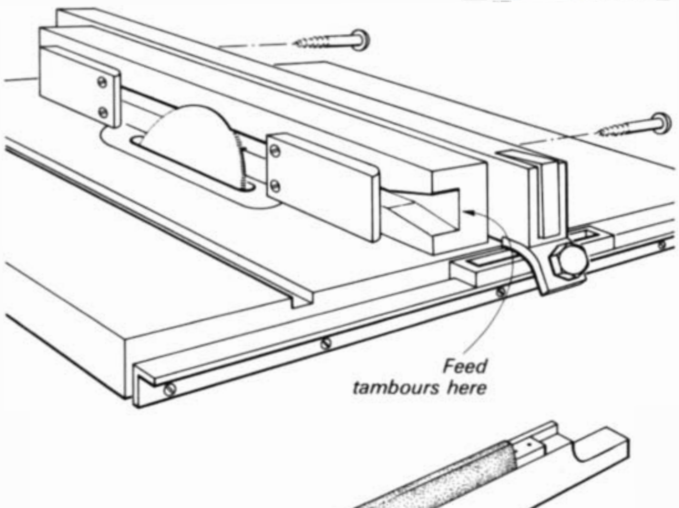
Slide tambours face down into the jig in the order you want. Keep in mind where the handle will be attached. Slide

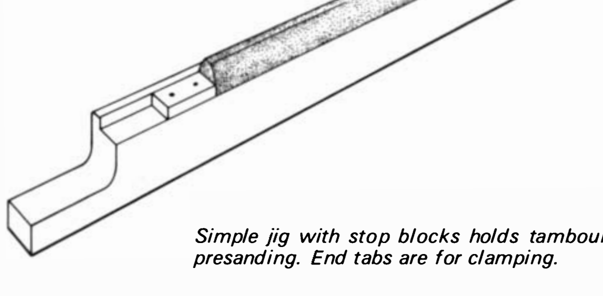
Stickered tambours dry unrestrained; warped ones will be discarded.

Finger board holds tambour against fence, for shaping.

Table-saw jig for cutting relief angle on tambour sides is screwed to rip fence.

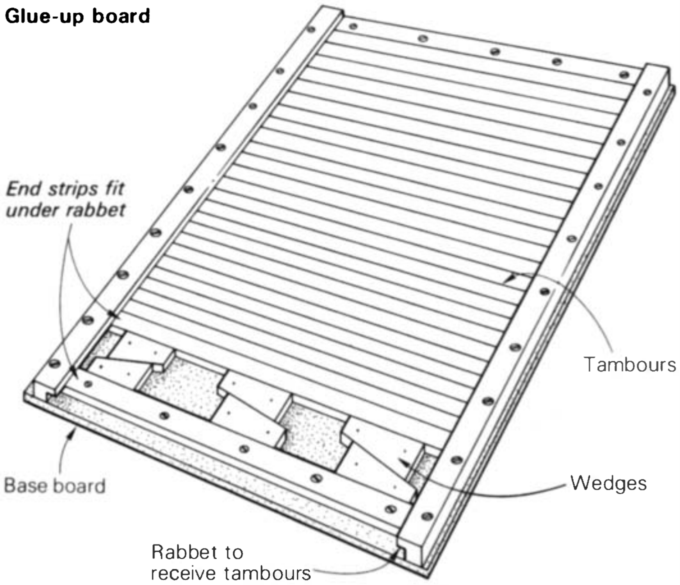


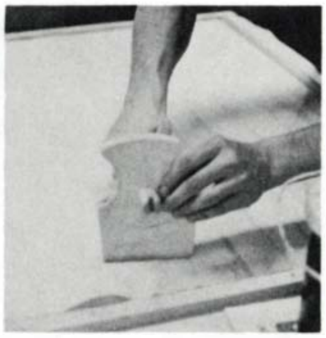




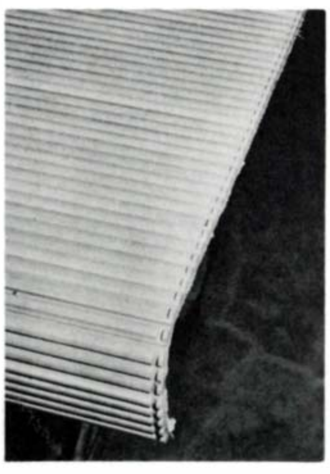
Simple jig with stop blocks holds tambour for presanding. End tabs are for clamping.

Glue-up board

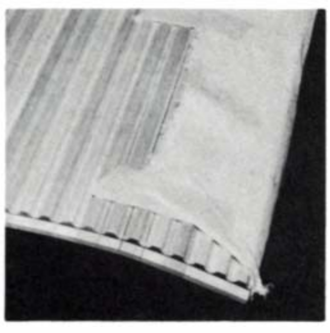




Glue is brushed on a tambour section. Then a veneer hammer, working from center to edges, smoothes out the canvas.



After tambour is glued up, tongue shoulders are sawn (left), then waste is routed from front and back (above). Canvas flap is for attaching handles.



in one of the remaining thinner strips. Screw down the last strip about 2 in. behind the second strip, depending on the size of the wedges. Then tap the wedges into place to squeeze the tambours together tightly. You don't need any more pressure than is necessary to take out warps and close gaps, to prevent the glue from oozing down between the tambours. Screws in the rabbeted strips should be snug but not all the way home. While tightening the wedges to close gaps, you may need to tap the tambours down flat to the board with a scrap piece. Continue to tighten the screws in the rabbeted pieces and the wedges until the tambour is tight and flat. Then lock the wedges with a few brads.

An alternative method eliminates the third thinner strip and the wedges. Draw the whole tambour up tight with two or three bar clamps. Then screw down the second thin strip and remove the clamps. This works, but you must be careful not to deform the glue-up board with clamp pressure.

While silk, linen and leather can be used as a tambour backing, I prefer unprimed canvas. A good art-supply store will have a selection of canvas types and weights. Generally, 10-oz. canvas is best.

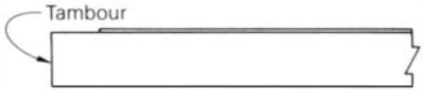
Now calculate the distance between the shoulders of the tambours. The tambours are still longer than final dimension and you want to be sure the canvas will clear the tongues. Remember, canvas stretches. Subtract about an additional ⅜ in. on each side. The canvas should be about 2 in. or 3 in. longer at one end than the tambour, for attaching the handle.

Now you are ready to start gluing. You can use Titebond or liquid hide glue, but I recommend hot animal glue for two reasons. Hot glue can be reheated with an iron, allowing you to correct minor problems. And, if used at the right consistency, it will not penetrate between the tambours. It should just begin to bead up as it runs off the mixing stick—like a thick syrup. You will need a veneer hammer (Spring '78, p. 52) or a suitable wooden alternative.

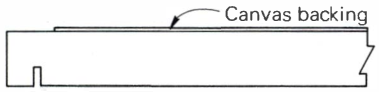
It is important to get a good bond on the first tambour. Be careful not to get glue on the adjacent thin strip of the glue-up board—wax or masking tape can be used as a glue resist. Spread the glue with a 1-in. or 2-in. brush over about a 4-in. section of the tambour. Start at the handle end. Move quickly—you do not want the glue to cool. Lay the canvas over the tambour, and remember to allow for the overhang for the handle. Be sure the canvas is straight and centered. Now, using the veneer hammer, work from the center toward the ends to even out the glue and smooth the canvas. You don't need a lot of pressure. Draw the hammer parallel to the tambours. If you draw the hammer perpendicular to the tambours you will stretch the canvas, causing the tambour to roll backwards when taken out of the glue board. Then the tambour will not lie flat. You are trying only to even out the glue, smooth the canvas and ensure a good spread of glue. Try not to overwork, or you will saturate the canvas with glue, causing it to become brittle when dry.

Working quickly, flip the canvas back over the area you have just done and pull the canvas back from the glue about ½ in. in a straight line. This will ensure a good overlap of glue. Spread another 4-in. section, lay the canvas back over the tambour and smooth out with the hammer. Repeat over the entire tambour. Don't wait for the glue to dry each time. You may be surprised at how easily the canvas pulls back from the glue. Don't worry—the bond will not be strong until the glue has completely dried and matured. Don't tug on

Making tongues



1 *Saw the tambour to length.*

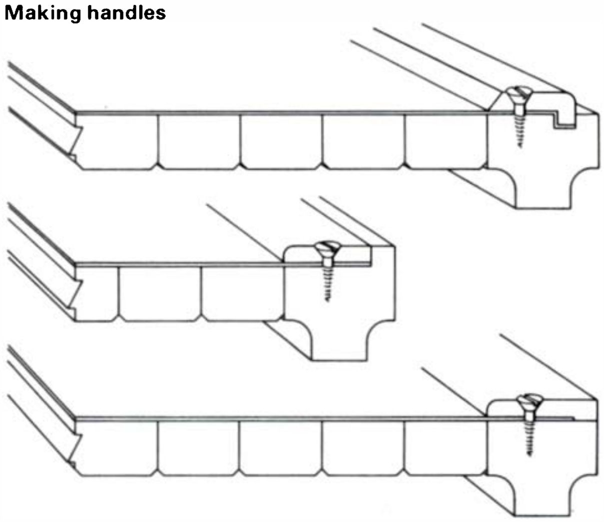


2 *Cut the shoulder of the tongues on the table saw.*

3 *Rout 1/16" from the back of the tongues to even out discrepancies.*

4 *Rout out the waste from the front of the tongues.*

Making handles



Handles, whatever the design, are usually attached with a backing strip that is screwed to the back, sandwiching the canvas. A lip conceals the canvas from view.

the canvas. Let the tambour dry overnight before you remove it from the glue-up board. Leave the tambour straight after you remove it—don't flex the joints yet.

Fitting tambours

All tambour measurements should be tested with an extra tambour strip and checked at intervals along the grooves in the carcase. It is common to have some variation in the distance between the grooves, so measure for a tight fit at the narrowest point. The tambours should run on the ends of the tongues, not on the shoulders, to avoid causing rub marks on the carcase. It is better to start with a tight tambour and to plane or sand it to a perfect fit.

First cut the tambour to exact length. Trim excess canvas from the back end and tape the handle flap out of the way before running the tambour through the table saw. To figure the length, measure the distance from the bottom of one groove to the bottom of the other groove at the narrowest part of the carcase. The tambour should be just shy of this dimension (about 1/32 in. shorter). Since you will want to center the canvas over the tambour, you will need to make two settings on the table saw, running the best edge against the fence in the first pass.

The tongues are formed by first sawing the shoulders, then routing out the excess wood above the tongues. This way, the router will not chip the exposed edges of the tambours. To make the shoulder cut, set the saw fence to the length of the tongue—much safer than running the whole tambour between the blade and the fence. Make sure the shoulder cut allows clearance between the tambour and the carcase. Finally, you'll need to remove 1/16 in. from the back of the tongue after the shoulder is cut, to even out discrepancies. Therefore set the height of the blade 1/16 in. lower than the thickness of the finished tongue.

After cutting the shoulders, I remove the excess wood with a shaper or router table setup. Set the fence a little short of the length of the tongue (the saw kerf from the shoulder cut is a safety zone) and use a straight cutter bigger than the length of the tongue. Set it just high enough to kiss off the back of the tambour—1/16 in. is plenty—and run both edges. Then raise the bit, flip the tambour over, and rout the front side. Whole chips will fly off, so safety glasses are essential.

Now try the tambour. It probably won't fit. Try to figure out which dimension is off before going wild with the rabbet plane. Problems can be caused by too long a tambour, too thick a tongue, too little clearance at the radii, or shoulders that rub. A sharp rabbet plane, a crisp 90° sanding block and patience are necessary to fit the tambour. As you get close to the final fit, use finer sandpaper. When the tambour is running smoothly, polish with paste wax. You can also lubricate sparingly with paraffin, but too much will gum up the track.

Handles, finishing and stops

The tambour handle should be an integrated part of the total design, relating to other details on the piece. You want a handle you can grasp easily. One that is too narrow or extends out too far will be prone to binding. If you wish to install a lock or latch, you will have to design the handle with enough material to accommodate it.

Cut stock for the handle with tongues on the ends. This can be done by hand, with a dovetail saw. Try the handle in the groove to check the tongues. Then do all necessary shaping and sanding. The canvas should be trimmed slightly smaller than the width of the handle. I like to size the canvas end with a little Titebond to prevent unraveling.

Handles are usually attached with a strip of wood that is screwed to the back, sandwiching the canvas. I like to cut a slight lip on the edge of the attaching strip to conceal the canvas when the door is open. This lip is easier to cut before the strip is ripped off a larger piece of wood. Attach the handle to the tambour on a flat surface and make sure it is tight against the first tambour before you try to install it in the carcase. Once the holes are drilled you can remove the handle, install the tambour in the carcase and screw on the handle.

Apply finish before you install the tambour. Spread the tambours open, and use a dry brush or rag between them. Don't get finish on the fabric or you will shorten its life.

Plan on making a stop. The handle won't do because repeated use will weaken the canvas where the handle meets the tambour. A ripped canvas will mean a big repair job. Stops can be strips screwed or glued to the inside of the back of the carcase or small pieces screwed into the grooves. □

Stains, Dyes and Pigments

The wood grain should remain readable

by George Frank

We all love wood because of its endless variety of grain. To put the natural markings of the wood in evidence is the true task of anyone who tries to beautify it through finishing. Concerning beauty in woodfinishing, I have set up a rule for myself: The first requisite of a beautiful finish is that the wood must remain "readable." This means not only that the grain must be clearly visible after finishing—that is self-evident. It also means that from the grain of the wood, qualified people can read the whole history of the tree: its origins, age and environment, its fights for survival, its adventures.

Woodfinishing is the stepchild of the woodworking industry. Even its vocabulary is poor and misleading. We use the word "staining" when we refer to a chemical action that changes the color of the wood, to a process where a dye brings this change about, or to a process where we cover the wood with a colored film, or a thin layer of colored pigment. Only this last method should rightly be called staining. The first two should be called dyeing. The difference between dyeing and staining is like the difference between getting a deep suntan and using makeup to imitate one. While stains always reduce the readability of the wood, they have great merits, especially on the production line. Ease of application is one, but far more important is that stains help to achieve uniform coloring, and this, especially on the assembly line, is a fair compensation for the reduced readability.

Chemical action

Cuban mahogany has the color of raw steak. Sponge it with a solution of potassium dichromate, a yellow crystal, and its color deepens considerably. Not only does it become a dark rusty red, but the contrast between the light and dark markings becomes more accentuated. This chemical process, wrongly called staining, really enhances the beauty of the wood. Napoleon's craftsmen often used this process, and most French Empire furniture is "stained" by this method.

It is a well-known fact that wheat-colored oak becomes brownish-grey when sponged with ammonia. Here is a short story about another chemical action: In 1938, a Pennsylvania manufacturer imported a shipload of timber from Europe. To mystify the competition, he gave it a name—palazota. It looked like bird's-eye maple, but was whiter and had more eyes in it. He made bedroom suites of it and sold them successfully. By 1942, the market was saturated with white palazota bedrooms, and dealers asked for something new. Since he had over two-thirds of his lumber still in stock, he tried stains. His stains obliterated most of the delicate markings of the wood, and the stained palazota did not sell. That is when I was called in. After three weeks of experimenting, I found the answer. A weak solution of ferrous sulfate brought unbelievable changes to this wood. The miniature eyes opened up considerably, while the flat areas remained almost unchanged. The wood seemed to acquire a third dimension, depth. When I added some coloring dyes to the ferrous chemical, I produced a whole new gamut of decorative effects. Regardless of whether the palazota was tinted grey, brown, gold or red, its markings always came out loud and clear. Three years later, the manufacturer did not have a single board left in his factory.

George Frank, 75, is a consulting editor of this magazine.

A simple example illustrates the possibilities: Apply potassium dichromate solution to a piece of birch or maple and the wood becomes pleasantly dyed a rich yellow color. Apply it to a piece of oak, and the wood becomes a dark rusty brown. So far so good. Now imagine that you can get somehow a cake of logwood extract, more scientifically called extract of campeche wood. Dissolve one ounce in a pint of water, and with this wine-like brew you sponge the three pieces of wood you are experimenting with. Let dry, sandpaper lightly and apply the potassium dichromate solution. After an hour you will find that the birch and the maple have become rusty brown, and the oak a rich chocolate color.

Potassium permanganate is a common chemical. One ounce dissolved in a pint of water will stain most hardwoods a pleasant brown. But the tint will fade and change color—from brown-violet to brown. If the color you get is too dark, wash down the wood with a fairly strong solution of sodium thiosulfate (available from photo-supply stores as hypo solution). You will get a nicely bleached wood.

Another woodfinishing concoction can be prepared by mixing equal amounts of ordinary vinegar and water, then throwing in all the rusty iron you can find—old nails, screws, hinges, tools and so on. Let sit for a week, then filter through a piece of cloth. The resulting liquid will produce a silvery grey color on oak. It won't be so effective, though, on woods lacking tannic acid. This can be remedied by prestaining with a mordant made of an ounce of tannic acid in a quart of water. Obviously the vinegar mixture is rather iffy, since its strength depends on the amount of iron the liquid will absorb. Ferrous sulfate dissolved in water (about 1½ oz. to one quart water) will produce a more positive and very pleasant grey color on oak.

Dyeing

Until about 1870, dyes for textiles or for wood were always extracted from plants, insects or animals, and rarely from minerals. For example, to obtain one pound of the dye called Tyrian purple, Mediterranean fishermen had to bring up close to four million mollusks (*Murex branderis*), break their shells individually and carve out a small sac from their bellies, which contained the coloring matter. The price of this dyestuff was so high that in ancient Rome, its use was reserved by law to royalty and to the princes of the church (hence its popular name, cardinal purple). Another red dye was brewed from a little bug, *Coccus cacti L.* Seventy thousand of these bugs had to give up their lives so that men could brew one pound of dye from their dried bodies. Only a hundred years ago, England imported seven million pounds of these dried insects annually. Tea is not only one of the most popular beverages in the world, it is also an excellent dye, used mostly on antique reproductions, since it conveys to the wood a pleasant golden hue, characteristic of many fine antiques. There are a few hundred of these natural dyes that can be used on wood, but progress has relegated them mercilessly to obsolescence.

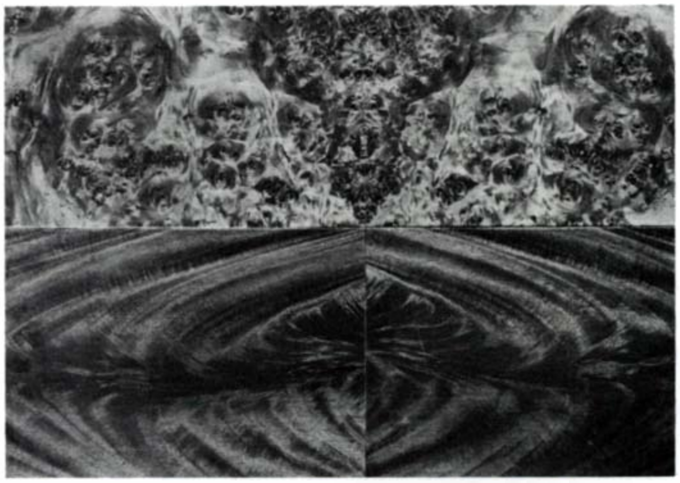
A little over 100 years ago, W. H. Perkin accidentally came across the first aniline dye. Others were discovered in rapid succession and the era of synthetic dyes began. Between the two wars, a giant industry was born in Germany, the manufacturing of colors and dyes. A huge company, I.G. Farben, had almost a monopoly, and its subsidiary, Arti A.G., specialized in dyes for wood. There were no wood-coloring problems in Europe during the 1930s because Arti always had the answer. They had simple dyes that would give the selected color to nearly any wood. Other dyes involved two applications, a prestain, or mordant, which was followed by the dye, resulting in deeper penetration and more positive coloring. The most important tools in any woodfinishing shop during this period were a pharmacist's scale and a graduated glass to weigh and measure the proper amount of dye and water. All these dyes were properly numbered and matched a master color chart. Arti also supplied dyes to be dissolved in alcohol or in oils, for special needs. Before World War II, Arti tried to gain a foothold on the American market, evidently without success. I do not know of any manufacturer here that markets dyes for wood with proper color samples and reliable instructions. This does not mean that American-made dyes are inferior to European. I simply deplore that they are presented in a very haphazard way.

Pigments

Any solid substance that can be reduced to powder can become a pigment. With the proper carrier and a binder, it can become a pigmented stain. All pigmented stains have the same formula: pigment, carrier and binder. Again, let me give you an example from my past. The first person who ever sought my professional help was a small-town manufacturer of a line of children's furniture, such as playpens and high chairs. The local lumber he used varied so much in color that he simply could not obtain a uniform light finish. I mixed for him equal amounts of powdered chalk and French ochre powder, and stirred the mixture into a pail of lukewarm rabbit-skin glue solution. This simple stain not only solved his coloring problem, but also acted as a sealer on his wood. In this instance the chalk-ochre combination was the pigment, the water was the carrier and the glue was the binder.

The most popular and the best-known pigment-stains are the commercial oil colors. They contain very finely ground pigments mixed into the oil (the carrier), to which a drying agent is added (thus the oil becomes the binder, too). Almost always, the carrier in this mixture is extended with turpentine or other paint thinner. Pigment stains in general do not change the color of the wood. But even after the most thorough wiping off, some of the pigment remains on the wood and adds its own color to it.

There appears to be a clear-cut difference between the three ways of changing the color of wood. The reality is far



Top, ferrous sulfate brings out contrasting figure in 'palazota' maple, Bottom, mahogany treated with potassium dichromate gives illusion of great depth.

more complex. The three methods can be and very often are intermixed. My story about coloring the palazota illustrated how chemicals can be combined with dyes to create new horizons in changing the color of the wood. But that is just one story out of thousands. Chemicals can be mixed to dyes, dyes can be mixed to pigment-stains, and all three can be combined together to improve the quality of the finished products, this time correctly called "stains." Nearly any stain purchased in a paint store contains pigments, dyes and some chemicals (for deeper penetration), and all do an adequate job for the amateur, even for the average professional. The fine woodworker sticks to chemicals, natural dyes maybe, or accepts synthetic dyes to color the wood, but seldom uses pigment stains in spite of their great advantages and simplicity.

Application

Waterstains, dyes and chemicals should be generously applied with a sponge. The area to be dyed should be thoroughly soaked and then the excess should be taken off with the same sponge, squeezed out, to leave the wood uniformly moist. The stronger the concentration, the more potent the stain or dye. Chemical dyes, more than aniline dyes, should be used in weak concentration and applied repeatedly, since they show their final effect only after thorough drying, and it is far more difficult to lighten the wood than to darken it.

Some dyes can be dissolved in alcohol or lacquer thinner. Therefore, a liquid shellac can be further diluted and tinted with colored alcohol and the resulting colored shellac when applied would convey a tint to the surface. The same goes for the lacquer—if the thinner is colored, it becomes a tinting lacquer. Wax, varnish, shellac and lacquers can be tinted with dyes dissolved in their respective thinners. They can also be "loaded," that is, some finely ground coloring matter can be mixed into them—a fourth way of "staining" the wood. These four ways are very much like the four strings on a violin. The melodies one can play on these four strings are really endless, but the beauty of the melody depends on the person holding the bow. □

EDITOR'S NOTE: H. Behlen & Bros., Inc., Box 698, Amsterdam, N.Y. 12010 makes and sells a wide range of stains, pigments and dyes. Their products are also sold by Constantine, 2065 Eastchester Rd., Bronx, N.Y. 10461. For chemicals, check in the Yellow Pages under "Hobby Supplies" and "Chemicals."

Spindle Turning

How to sharpen and use roughing-down and coving gouges

by Peter Child

For turning between centers, standard roughing-down gouges and coving gouges are best. These spindle gouges have only two shapes of blade. The roughing-down tool has a deep, U-shaped flute ground straight across with no pointed nose, and the coving gouge has a shallower flute with a pointed "lady's fingernail" nose.

Roughing-down gouges have an even thickness of metal all around the cutting edge and a very short single bevel of 45°. Unlike bowl gouges, they have no keel. Three sizes are commonly available: ¾ in., 1 in. and 1¼ in. The first and last sizes should both be the choice of the turner if possible; the 1-in. size is the economy combination tool.

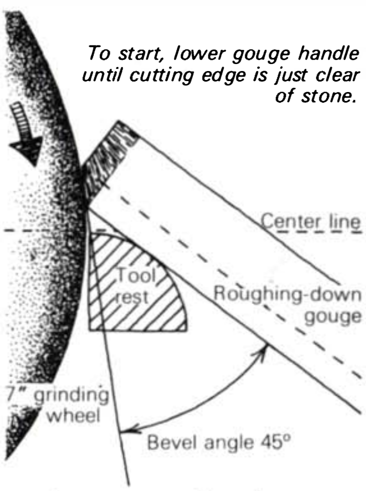
Coving (spindle) gouges have a longer bevel than roughing-down gouges. Four sizes will handle all the turner's requirements: ¼ in., ⅜ in., ½ in. and ¾ in. Any work requiring larger coves, hollows or long curves can be done better with roughing-down gouges, so gouges larger than ¾ in. aren't necessary. Both roughing-down and coving gouges should have long, heavy-duty handles to facilitate control—mine are at least 10 in. long.

Gouges are cutting tools. They fashion a cove or hollow by cutting down from each side alternately until the desired shape is reached. A gouge is rarely the exact size of a desired cut. A customer of mine complained that a ¾-in. gouge supplied was in fact 13/16 in. and consequently of no use to him. He was obviously misusing the gouge as a forming tool, pushing it straight into the revolving wood and scraping out a hollow which he required to be exactly ¾ in. across. Using a gouge as a scraper is wrong. An important woodturning principle is that cutting tools always work from large diameter to small: Revolving wood cannot be properly cut "uphill." This means that the tool must have room to work, especially at the bottom of the cove, so it is impossible to cut a ¾-in. cove with a ¾-in. gouge. It would be better to use a ½-in. gouge.

Most woodworking tools are properly shaped by the factory grinder and finisher, and sharpening is all that is needed before using them. Woodturning tools are an exception and have remained so, despite the efforts of professional turners to educate manufacturers. So be very critical regarding the shape and bevel length of brand-new gouge blades. You may find that a roughing-down gouge is not ground straight across, a condition which must be remedied on the grindstone. The bevel length will almost certainly be too long, not the correct angle of 45°. Sometimes a lot of metal (and money) has to be ground away before the correct angle is reached. As a temporary measure, a very short 45° angle can be ground on the longer bevel. This is against another basic woodturning principle, which is that no tool has more than one bevel on the cutting edge. Successive grindings, however, will eventually get down to one bevel of 45°. Do not try this dodge on new coving gouges.

The grindstone is an important tool in the turner's shop and should be used not only as a "grind" stone but as a "sharpening" stone. The grit grade must not be so coarse that a sharp edge cannot be ground, or so fine that an edge can easily be burned at the tip. A good medium grit is a Carborundum (silicon carbide) dry wheel A54-N5-V30W or an equivalent grade. The diameter should not exceed 7 in. and the width should be at least 1 in. The stone should revolve towards the user at the fastest speed possible, although not

English master turner Peter Child, author of The Craftsman Woodturner, *wrote about turning bowls in the Winter '76 and Summer '77 issues of* Fine Woodworking.



To sharpen a roughing-down gouge, hold the blade on the rest and lower the handle until the cutting edge is just clear of the stone. Roll the bevel slowly from side to side, keeping the point of contact at right angles to the stone. As the bevel comes up (photo sequence), the bright mark shows the operator for the first time where he is removing metal. Lift or lower the handle until the center of the bevel is reached, then continue to roll the blade with no variation in height until the bevel starts to hollow out and fit the stone.

faster than the safety rpm marked on its side. Safety glasses are a must, but provided the stone is maintained and used as described, I don't find other guards essential.

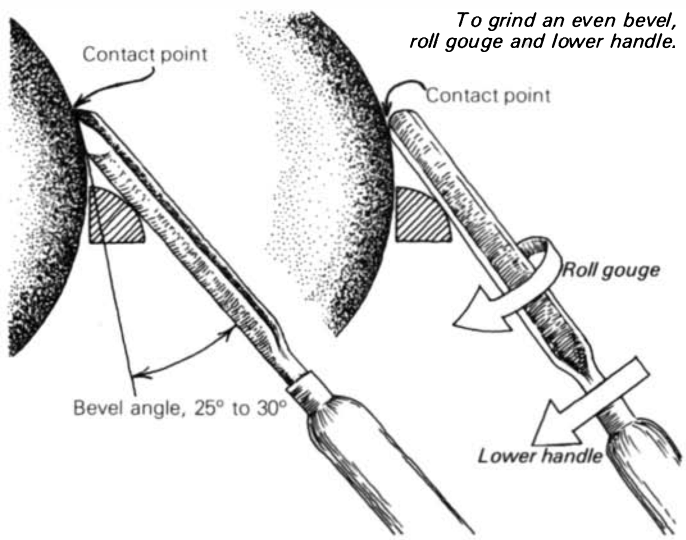
The stone must be kept to its original shape and completely free from dirt, swarf and glazing. As an example, after, say, three new tools have been shaped and sharpened, the stone will need cleaning. This is achieved with either a diamond or star-wheel dressing tool. The latter is much cheaper and just as effective.

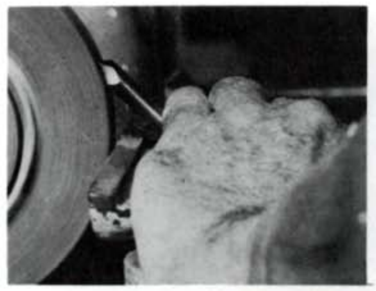
Hollow grinding is when the whole of the bevel of the tool, from heel to sharp edge, is in full contact with the stone's circular surface, and thus takes on the negative contour of the stone. Grinding has to stop at the exact moment the cutting edge of the tool comes in contact with the stone. This sounds simple but when I watch my pupils trying to do it I realize how frustrating doing this properly is to learn.

Beginners at grinding usually make several common mistakes. First, they hold the tool far too firmly and stiffly when approaching the stone. The more relaxed hold is with one hand over the tool, holding it down on the rest, with just the fingers of the other hand around the handle. There should be just enough firmness to hold the tool in place. An efficient stone of the right grit will do its work all by itself and need not be pushed. Pressure leads quickly to burning, whereas with no pressure the tool can be rested on the running stone for considerable time before it even gets hot.

Inclining the head to one side to see if the tool is being presented at the proper angle is another common fault. There is little control when watching from the side. The head and eyes should always be directly behind the blade and handle.

Another fault—lifting the blade off two or three times to inspect it—results in the bevel surface looking like a badly plowed field. It is almost impossible to replace the blade at the exact grindstone height from which it is taken.





Start sharpening a coving gouge at the center, then roll the blade over to the left while lowering the handle, as in the drawing. The blade rides up so that its left edge contacts the stone at the same height the center did. Then roll to the right the same way (photos top and above left). To hone by hand (photo, right), brace the gouge against the lathe and move the stone around the bevel. Keep the stone in firm contact with the point and heel.

Roughing-down gouges

With a roughing-down gouge we are grinding a straight-across edge, and it is important to roll the blade so that at all times it is at right angles to the stone. With a right-handed operator, his right hand on the handle keeps the tool at this angle, and his eyes on the edge tell his hand what handle adjustments to make. The diagram and photos show how to proceed. A stream of sparks traveling on top of the flute indicates that the edge has been reached, and I advise beginners to stop right before or just at this point. What happens is that the edge is broken into thousands of little cutting burrs or sawteeth, like a tiny breadknife or steak knife. Such an edge works well in woodturning and when blunt is quickly and easily resharpened. Over-grinding the edge produces only comparatively few thick burrs, easily broken and blunted by the revolving wood. To avoid over-grinding, stop as soon as the sparks travel on top of the edge. Then the operator should point the gouge straight at his face and look directly at the edge. The places that reflect light have not yet been reached by the sparks. After two or three more careful passes on the stone, these areas of light should have disappeared and the edge will be sharp. Another test is to feel around the inside of the flute with a fingertip. There should be a minute roughness all around. I now go directly to the lathe, without any attention from the oilstone, where the tool cuts efficiently for a short time before it needs to be resharpened. When this is required, the heel of the bevel is put into contact with the stone and the handle is gradually lifted until the sparks appear at the edge—it takes just a few seconds.

The beginner, who should stop grinding just before the hollowing-out bevel meets the cutting edge, should hand-hone to a finish with a flat medium to fine oilstone, keeping it firmly in contact with the heel of the bevel and the edge of the tool, in a dead straight plane without any rocking motion. The partly hollow-ground bevel will save time in sharpening, because there is less metal to remove than if the bevel were totally flat. The tool can be used for a considerable period, hand-honing at frequent intervals until the hollow in the bevel almost disappears. Then it must be formed again. A completely hollow-ground tool is perfect, a dead straight bevel is good, but the slightest trend towards a "belly" or roundness of the bevel means the tool is useless.

Coving gouges

I have a "black-iron" coving gouge, entirely handmade before I was born, which is a beautiful tool to use. The underside is slightly more than a half of a circle in shape and a finger moves around it smoothly without hindrance. Imagine a pencil cut lengthwise down just above the diameter; the bigger portion would be the same shape as my gouge. A gouge works with a rolling or scooping action, depending on the task, so it should be obvious that the fully rounded pencil shape is ideal for both purposes, the underside offering no resistance to the edge of the tool rest.

Nowadays, for cheapness or lack of skilled labor, most coving gouges are brutally stamped out by machine, which, at best, can produce only a half circle. At worst the underside of the tool has two almost straight sides, two corners and a semicircular bottom. Imagine this doing a smooth full roll on a rest! It is well worth the time to remedy these defects by grinding—it would be exceedingly difficult to make them worse. Again, the blade of the gouge is not likely to be the ideal shape. Common faults are a second bevel at the tip, a flattened cutting edge, the top not nearly rounded over, leaving corners, (the term "lady's fingernail" is very descriptive of the proper shape), and often the bevel is not long enough.


To rough from square to round: Lift the handle until the edge contacts the blur, traverse from left to right and roll the gouge.


End of first cut; small chips are 'corners' wood. Now go back again, slowly rolling the gouge, handle always lower than cutting edge.


When wood is cylindrical, gouge produces long, even shavings.

Unlike the roughing-down gouge, which always has a 45° bevel, the bevels of coving gouges can be varied to suit the user, although they must not be too short. As a guideline, measure the breadth of the bevel of the roughing-down gouge, and at least double this for the coving gouges. The bevel of the ¼-in. gouge will perform better if it is longer than that of the ¾-in. gouge.

Begin grinding with the blade on the rest, flute up, with the point of the gouge in the middle and just clear of the stone. Unlike grinding the roughing-down gouge, it is not good enough just to roll the blade from side to side because this operation would soon remove the point. The handle must be lowered as the blade is rolled to the left, so the extreme left-hand corner rides up to the same height that the point was when the operation started. The movement is then reversed, raising the handle as the point rolls onto the stone and lowering it as the right-hand edge comes around. A beginner should try some dry runs on a motionless stone, experimenting by look and feel with the movement needed to grind the bevel evenly. I keep the handle straight up and down during the whole operation. A beginner might find it easier to move the handle slightly from side to side, although I don't think the bevel can ever be ground as evenly this way. Again, the grinding need not be continued right to the edge. The safer but more laborious method of hand-honing can finish it off.

Roughing down a cylinder

Any piece of wood about 10 in. long and from 2 in. to 3 in. square with lengthwise grain will do for practice in roughing down a cylinder. Unseasoned wood of medium hardness will cut more easily and show the beginner if he is using the tools correctly. Mount the wood between centers and adjust the tool rest at a height just below center line and about ⅛ in. clear of the corners, testing this by rotating the wood by hand. Lathe speed should be anywhere between 1,000 and 2,000 rpm. Place a lamp at the back of the lathe so that it shines on the work but not in your eyes.

Start the lathe and stand back. You will see a distinct round shape, surrounded by a blurred border. The blur is the corners of the wood, which progressively have to be removed. Place the 1¼-in. gouge on the center of the rest, handle lower than the blade, flute directly uppermost, edge above and just away from the work. The left hand (assuming a right-handed turner) should be over the flute, holding the blade quite firmly down on the rest. Lift the handle until the edge contacts the blur. There should be only a slight jolt. Working from either direction, take the gouge along the rest to the end and back again, removing small chips of wood on the way. The chips will increase in size as the work progresses, until a cylinder shape results. Do not concentrate the gaze on the tool edge all the time—when you feel it is cutting properly, look at the top of the revolving wood, where you should actually see the cutting action. You can stop the lathe at intervals to see what is happening, or without stopping, trail the finger tips lightly over and around the back of the turning wood. Any slight irregularity means it is not circular at that point.

Stop the lathe when the wood is a cylinder. Don't worry now about exactness of size all along the length. At this stage you can demonstrate to yourself in safe, slow motion the correct cutting, not scraping, action of the gouge. Place the gouge on the rest, flute facing upwards with the heel of the bevel touching the wood. This means that the handle will be held well down from the horizontal and the actual cutting edge will be just clear of the wood. Have the lathe turned slowly by hand. The blade will be in contact with the wood, just rubbing it lightly. Move the gouge slowly along, and at the same time gradually lift up the handle. When the angle of cut is correct, the edge will start to remove a thin shaving and the bevel will be in full contact with the wood surface. If the handle is lifted too high, the bevel will leave the wood, the cutting action will stop, and the resultant scrape of the edge will not only remove wood in a most unsatisfactory manner but will also immediately blunt the sharpest of edges.

Working with the flute facing fully upwards all the time is not a good idea, because only the center of the edge is cutting. The whole edge has been sharpened and so it all can be used—roll the gouge as it travels along the rest. The 1¼-in. gouge is a powerful tool that can remove large quantities of wood in a hurry. Unlike the bowl gouge, it has no ugly tendencies. If the butt of the handle is braced on the hip and the legs splayed, the blade can be swung from end to end by sideways movement of the hips. The body powers the cut, the hands control it.

Long slow curves are easy with the 1¼-in. gouge. Cut with light pressure, starting from the extreme left end of the wood, then roll gradually towards the middle, increasing pressure and thereby removing more wood at the center. Stop, and repeat the cut from the right side towards the center. Watch the top of the wood while cutting, because this helps keep the curves smooth.

For surface smoothing hold the gouge down on the rest with the flute over on either side. Bring the handle up until the blade starts cutting. Don't roll the blade, but watch the top of the wood and take smoothing cuts by pulling or pushing the blade along the rest.

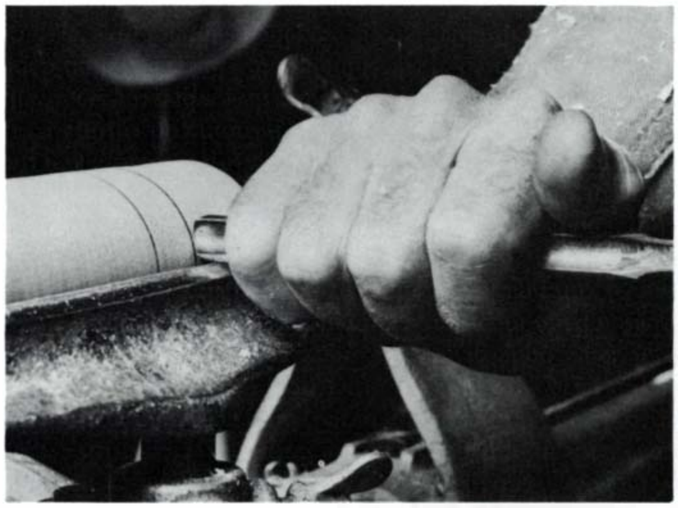
Some economists think they can take a large-size heavy-duty pointed-nose coving gouge with a shallow flute, grind the nose square, and use it in place of a deep-throated roughing-down gouge. This does not work nearly as well.

Cutting coves, hollows and balls

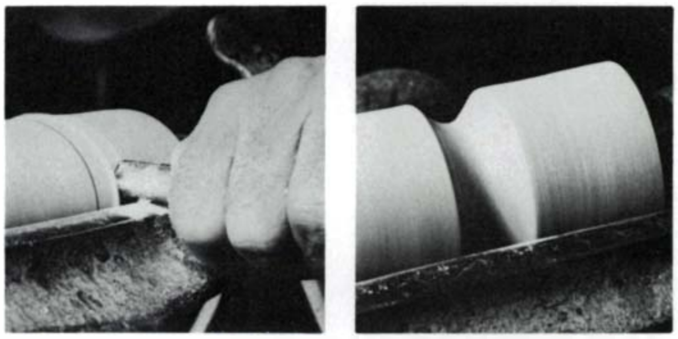
Imagine a large capital "S" standing upright as in normal print. Lean it over to the right at an angle of 45°. Gouges can make the "ball shape" (top of the "S") and the hollow (middle and tail). It is impossible to cut the cove at the tail of the "S" in one operation, because after cutting halfway the gouge would be forced uphill. Coves can be scraped uphill, but no amount of abrasive paper will eliminate the damage caused to the wood fibers.

To form coves, make a cylinder between centers, about 2 in. in diameter and of any length. Use a pencil on the rest, and with the wood revolving, mark a line, then another one not more than ¾ in. away from the first, and not less than ⅝ in. Pick a ½-in. spindle gouge, and with the flute on the left side of the rest, try to enter the point into the line on the right. Unless you are lucky, the gouge will skid along the rest to your right. Until the point of the gouge has penetrated the wood there is no back-up support from any part of the bevel. The turning wood rejects the gouge and makes it skid.

Position the tool rest below center height so that with the gouge held completely horizontally, on its side, flute facing



To start a cove, hold the gouge firmly and push its point in slowly.



Remove half the waste in one cut by pushing firmly in and rolling the gouge onto its back. Right, the finished cove.

left, the point of the gouge is pointing directly at the right-hand line and in a position to make contact at center height of the wood. Push the point forward so that it is just in contact with the wood and hold it there, rubbing the surface. Holding very firmly, push the point in slowly. Only very little penetration is needed—$\frac{1}{16}$ in. is too much. Once some penetration has been achieved without skid, the danger is all over. If you still cannot manage it, remove the skid marks and make small notch marks with a parting tool instead of pencil lines, then proceed. Now, holding firmly down on the rest, push straight into the wood while twisting the gouge so that it is turning over on its back (flute ends up facing upwards), removing, quite brutally, half the waste wood towards the left. Try to remove this half in one attempt. Otherwise you will leave a "collar" of waste in the center of the cove.

Repeat from the left-hand line and remove the other half of the wood. If you find you do leave a collar, you are not taking out enough waste with the two cuts, or else you are trying to do too large a cove with too small a gouge. The result of these two scooping cuts does not look pretty, but the cutting actions that follow clean it all up nicely.

Using the right-hand side of the cove again, present the blade, flute facing left, with the point at the position at which the cut has to start. Keep just inside the rough-cut beginning—otherwise you will skid away again. Keeping the bevel just slightly away from the wood will enable you to put the point in and start the cut. The handle will be just down from the horizontal and a little over to the left. The full cut is completed by swinging the handle over to the right (thereby bringing the bevel into contact) and proceeding down the right-hand slope, gradually rolling the gouge over on its back

To start a ball shape, rub the bevel on the line, roll the gouge and lift the handle. Start each successive cut a little closer to the center line, but don't move the tool along the rest during any one cut.

(flute up) to finish at the bottom of the cove. Do not go past center of bottom. Sometimes I will allow just a little way past so that this area cleans up nicely without ridging.

Reverse the directions and cut down from the left-hand line. If you do not attempt heavy cuts you can do these alternate ones nice and slowly, watching and feeling the cut working properly. Alternate cuts from side to side will deepen and shape the cove to your satisfaction.

The coving gouge, which many beginners think is just for hollows, can also form quite attractive ball shapes. Right at the full diameter it cannot finish as cleanly as the skew chisel or the beading and parting tool, but it can get quite near.

Make the usual practice cylinder, 2 in. in diameter between centers. Somewhere along cut down a groove to about ½-in. in diameter. To give room for the gouge to work, widen it to 1 in. in length. Repeat the process 2 in. away so that you are left with a 2-in. block with room to work at either side. Pencil a line around the center of the block. Then pencil two more so that the wood has three equidistant lines running around it. We will start work from left to right.

With the lathe stopped place the gouge on the wood with the point upwards at the right-hand line, the bevel straddling the line, and the flute up. Turn the lathe slowly by hand. Keeping the blade on the rest and at a right angle to the wood, slide the blade down the wood, keeping the bevel rubbing, until the point takes hold and starts a small cut. Keep this going by gradually twisting the blade over to the right while progressively raising the handle. This action continues until the corner of the block has become slightly rounded and the gouge comes off the cut. You will find that the gouge has to be rolled and the handle lifted a surprising distance to accomplish such a short area of cut.

Start the lathe and do a similar cut, increasing the rounded area. Do another with the lathe stopped, slowly so that you can feel how much more freedom and lift you have to give the tool to keep it going over each full cut. Then you can gradually progress back to the block's center line, increasing the rounded area down to the ½-in. short spindle. You are cutting from large diameter to small with the bevel rubbing all the time. Down at the ½-in. spindle, the gouge will have been rolled over so much in order to keep it cutting that the flute finally ends up facing completely right.

Ensure that whatever hand is on the rest does not move along at all during any one cut. Keep your tool bevels at the correct length, hollow ground or dead flat, and sharpen often. And above all, do not try to cut wood uphill. □

Cleaving Wood

Froe follows long fibers

by Drew Langsner

Many craftsmen today have little, if any, experience with the ancient practice of cleaving. Yet before factory-made saws became widespread, cleaving and hewing with an ax were the primary means of reducing wood in size or dividing it into smaller pieces. In cleaving, a tree trunk is split lengthwise into halves, then quarters and sometimes eighths or sixteenths, depending on the diameter of the log and the intended use of the wood. The resulting pie-shaped pieces are squared with a drawknife, then cleaved along tangents to the annual rings with a froe or knife into halves, quarters and so on. These tools allow the use of leverage to follow the grain, rather than a straight line, which a saw must do.

Cleaving has advantages over sawing. Because cleaved material follows the long fibers, it is much stronger than wood sawn by hand or machine. With cleaving, there is no sawdust, but more waste. Cleaved wood will take and hold bends better than sawn wood. And cleaving is faster than hand-sawing.

The crudest examples of cleaving are fence posts and rails, especially black-locust posts and oak rails, which are renowned for their strength and durability. At the other extreme are fine, yet very durable, baskets, woven from splints of white oak, ash, willow or hazel. Other traditional uses of cleft (or "rived") wood include shingles, wall lathing, tool handles, bucket staves, special dowels, "tree-nails" (pegs used in timber-frame buildings), ladder rungs, agricultural implements and small boat ribbing. The technique of cleaving also lends itself to carving projects and chairmaking.

Equipment

Cleaving requires a few basic tools. A peavey or cant hook is useful for maneuvering logs more than 1 ft. in diameter. A 6-lb. to 16-lb. wedging maul ("go-devil") or a sledge hammer, a heavy wooden cudgel, two or three iron wedges (a narrow timber wedge is handy), two wooden "gluts" (large wooden wedges) and a hatchet are useful for splitting the log longitudinally. Gluts are easily hewn from any straight-grained hardwood, usually saplings or limbs of hickory or oak. The beveled sides should be flat. Chamfer the edge around the head to prevent premature fraying. Gluts should be seasoned about one month before being put to use, lest they split and fray too easily. Gluts can be driven with a sledge or go-devil, but will last much longer when pounded by a wooden cudgel. A "brake," or hardwood crotch, holds the wood when the smaller sections are cleaved with a froe and froe club.

The design and workmanship of the froe are critical to its effective cleaving. A froe blade should be 6 in. to 10 in. long, and at least ⅜ in. thick. The cross section of a good froe has a narrow angled edge formed by slightly convex tapered sides beveled the full width of the blade. The back (striking) edge should be nicely rounded to minimize wear on the froe club. Froe eyes are forged or welded shut. The orifice must be

Hewing: With an iron wedge driven into the end of a white oak log (top left), wedges are leap-frogged along the cleft. Two 3-in. gluts and a dogwood cudgel complete the split (bottom left). Then quarters are cleaved into eighths with a pair of wedges and a 10-lb. go-devil (above). Note the splitting break at left, propped up by crossed saplings.

smooth. Froes with a tapered eye use a swollen handle, not unlike an adze or mattock haft. These seem to work loose just as easily as round eyes with parallel sides. The handle should be 1½ to 2 times as long as the blade. It may be any stout hardwood, cleaved of course, then well seasoned before fitting. A small wooden wedge should be dabbed with glue and driven into a slot sawn across the end grain.

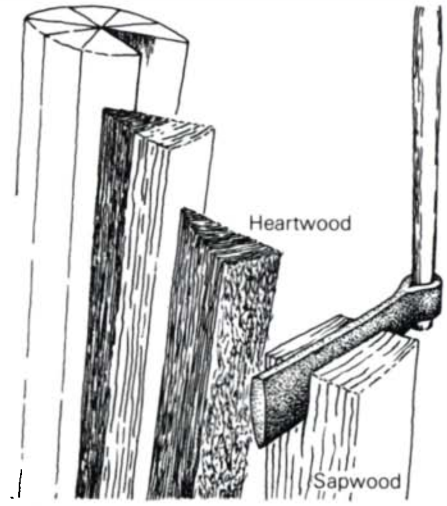
I have found that a long narrow club is most convenient for cleaving with a froe. A short fat club tends to be in the way. Froe clubs are made from almost any dense hardwood. I've used apple, hickory, dogwood and oak. Clubs made from green saplings and limbs generally check. To avoid checks, use a quarter section from a larger tree. The club (which is unavoidably expendable) should be seasoned a few weeks so that its surface hardens before it is used.

Woods

You can cleave a fairly wide range of deciduous and coniferous woods. For work that requires strong or tough materials, select oak, hickory, ash or locust. White oak makes fine splints and is used in many bending applications. Most other eastern oaks cleave nicely, except for maul oak and swamp white oak, both of which are almost impossible to split. Hickory, of course, is famous for toughness and ability to take impact, but it is rather stringy and sometimes hard to work (especially when seasoned). Ash is lighter and very nice to split. Locust cleaves easily, but the grain usually warbles, resulting in distorted splints that are "foxy" (uneven or brittle). Beech was preferred by English chair bodgers, the itinerant woodsmen/turners who traditionally made legs and rungs for Windsor chairs.

Among the softwoods, one can choose from pine, hemlock, cedar and redwood. Very fine-grained pine makes superior bucket staves, and sometimes excellent shingles. Hemlock cleaves very easily, though the grain may twist or warp. Its main use is tobacco sticks and tomato stakes. Cedar and redwood may be cleaved into shingles, or made into long-lasting fence posts and rails.

Short bolts of many other woods, such as apple, linden, walnut, dogwood and holly can be cleaved into chunks for



A froe is driven into the wood with a mallet, then worked along the long fibers by leverage. Long pieces of wood may be supported in a brake (far left); short chunks can rest on a stump (left). The diagram shows the cleaving sequence for basket splints. Heartwood is usually discarded; squared-off sapwood is split into halves, quarters, eighths and sometimes sixteenths. A froe makes the first cuts; finer splits are made with a knife.

carving, and bowl and spoon-making. Hazel is traditionally used for bucket hooping and basket materials. Willow rods make nice baskets, too. Until the blight, chestnut was often cleaved for fence posts and shingles.

Felling a tree

When choosing timber for cleaving, select straight-standing trees that are free of knots, scars, twists or other irregularities. White oaks for basket splints should be 5 in. to 8 in. in diameter, with minimal taper at the butt end. Trees with evenly spaced annual rings are preferred, but you can know this only if you have already taken other trees from the same site.

A large body of folklore suggests the ideal time of year, phase of the moon, and prevailing wind conditions for felling. A compilation of all this advice quickly leads to contradictions. My experience in felling trees at various times throughout the year has led to no conclusions whatsoever. I have cut white oaks for basketry that were of the same age and that grew side by side—I found one beautiful to work and the other only mediocre. In general, I recommend cutting trees for cleaving as near as possible to the time when the wood will be worked or used. Oak shingles, for instance, should be rived out and installed green; seasoned shingles may warp or split while being nailed. An exception would be where well-seasoned material is needed, such as for bucket staves, in which case the wood should be bucked and cleaved into quarter or eighth sections whenever possible.

For reasons of esthetics and conservation I prefer to fell timber as close as possible (almost flush) to the forest floor. Discard the lowermost section of stump if it's tapered or punky. Buck the log into bolts. Length depends on intended use: from 20 in. for shingles to 10 ft. for fence rails.

Cleaving the log

Using a wedge and maul, score a radial line from the central pith to the bark. If the wood is already cracked, you must follow along the cleft, because it's impossible to control cleaving once the integrity of the annual rings is broken. I begin by driving a wide, flat timber wedge into the end grain, but one can use a regular splitting wedge. In either case, the first wedge will open a cleft along the bark.

Insert a splitting wedge and drive it within an inch of its head. The cleft will lengthen as the wedge is pounded into place. Place another wedge into the cleft where it's ⅜ in. to ⅝ in. wide. Again, drive to within an inch of the head. Leapfrog the wedges one past the other until the end of the log is reached. Occasionally a wedge will stick in place. Tapping the sides of the head to the left and right will usually free it.

At this point small or easily cleaved logs simply break apart. Tougher logs require a pair of gluts. When inserting a glut try to find a place free of cross fibers. More gluts are ruined when the leading edge intersects cross fibers than by damage caused by pounding. Leapfrog gluts from one end to another, as with iron wedges.

If the log still isn't halved, roll it over and look for any incipient cracks on the reverse side. Sometimes it's necessary to clear off bark with a hatchet before any fissures are located. Drive wedges or gluts into the back side. The log should divide into halves, although it may be necessary to sever stubborn cross fibers with the hatchet. I prefer to do this kind of hatchet work two-handed. Be careful not to strike implanted iron wedges.

Follow the same procedure for cleaving quarter sections and eighths, if the bolts are still too heavy to haul to the shop. Green worked wood should be left in sections that are as large as possible, because small segments dry out much faster. Big sections, however, check more as they dry. Wood should be removed from the forest floor. Many species are subject to invasion and attack by fungi and insects. Ambrosia beetles infest and ruin oak felled in the spring and summer.

The next step is cleaving the radial sections. Most craftsmen hold the wood in place with a brake, a narrow crotch from the trunk or branch of almost any suitably shaped hardwood. The brake may be lashed to posts driven in the ground. Or lay the big end across a log and support the legs with two saplings placed opposite each other, each one running beneath the near leg and above the far leg. The saplings work against each other, and the device is surprisingly rigid and self-supporting. Insert the wood into the brake. Place the froe crosswise at the approximate half-way point, or along the division of sapwood and heartwood. Strike with the club. Once the blade is in, rotate the handle downwards. One may have to strike the protruding blade again but usually the cleft opens and the froe is simply slid downwards. With tough wood I sometimes hold the split open by placing a stick into the wide end of the cleft. If the cleft starts to run out (divide unevenly to one side) rotate the piece 180° and continue to work from the other side. For thinner pieces, subdivide each bolt in half until you reach the required thickness. Attempts to cleave into uneven pieces, such as thirds, will usually fail. One can sometimes save a wild split by reversing the wood and starting again from the other end. The splits should meet, but it may be necessary to separate the two halves with a knife or hatchet.

Basket splints

White oak splints for basketry should be made promptly after the tree is felled. If this cannot be done, submerge the bole under water, but use as soon as possible. Five to six feet is about the maximum length for fine cleaving and weaving basketry. Cleave radial sections 1 in. to 2 in. wide. Split off the heartwood. Remove the bark with a drawknife, and shape to a square or rectangular cross section. Cleave in halves and quarters tangent to the annual rings. Once the wood is reduced to a thickness of about ½ in., it becomes possible to use a knife rather than the more awkward froe. To start, work the knife across a corner of the end grain, or tap in with a light mallet. Twist (rotate) the knife to open the cleft. As soon as possible, insert both thumbs into the cleft and place the second joint of your index fingers externally just below the cleft. Begin to pull the splint apart by using successive knuckles as a fulcrum while pulling your thumbs away from each other. This process requires a "feel" that comes with practice. If the splint starts to run out on one side, pull down and harder on the other side. Sometimes the wood fibers must be pared with a knife to keep the splint running evenly.

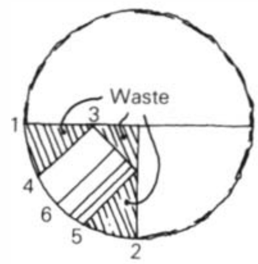
Good white oak will cleave to less than ¹⁄₁₆-in. thickness. The splints may be smoothed with a spokeshave, scraper or penknife. They are sorted and tied in bundles, and may be stored until needed.

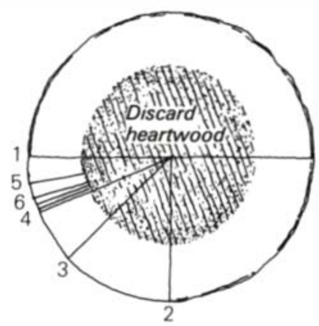
Shingles

Shingles may be split from conifers (especially cedar, redwood and some pines) or hardwoods (generally red oaks). The tree diameter can be as little as 12 in., but 24 in. or more is much better. In any case, the wood must be straight-grained and free of knots and other imperfections. First crosscut into bolts of desired length, usually 18 in. to 24 in. There are several methods of proceeding. Swiss shinglemakers often use fine-grained 12-in. pines. They halve and quarter the bolts, then split off the heartwood and thin pie-shaped segments on the sides, to form a square bolt, which is usually split into halves, quarters and eighths.

With a larger hardwood bolt, the circumference can be divided into equal segments (3½ in. is excellent), then split into halves, quarters, and then the smaller sections. Any wavy or twisted heartwood is discarded. If the resulting segment is more than 5 in. wide, it is split in half. Each squarish section is split into 16 shingles.

Top left: White oak stick supported by brake lashed to two posts is worked into basket splints. Then thin splints are held between the knees and further divided. A small knife opens the cleft (top right), then the pieces are pulled apart by inserting the thumbs into the cleft and sliding the fingers down the outside (bottom).





Above, Swiss system of single-splitting; right, riving shingles from a large red oak. Numbers indicate splitting sequence.

In either case, the individual shingles are split across the annual rings. Parallel split shingles will warp unacceptably. Place the froe in the exact center of each segment, or it will run out, resulting in uneven shingles and too much waste. Most shinglemakers use a brake to hold their wood in place, but in Switzerland a leather knee pad is used to hold the material against a knee-high bench. Most shingles need dressing out—curves and bumps must be smoothed before installation. Smoothing is usually done on a shaving horse, using a sharp drawknife. The shingles should be tied into very tight bundles (use a vise to press them together) if they are not installed immediately. □

Drew Langsner, of Marshall, N.C., apprenticed with a Swiss cooper. His most recent book is Country Woodcraft *(Rodale Press, Emmaus, Pa.).*

Whetstones

How novaculite is quarried and finished

Ben diverse maner of whetstones,
and some neden water and some neden oyle
for-to whette.
—from a work by John De Trevisa, 1398

by William G. Wing

Whetstones have been around a while, as the 600-year-old quotation from De Trevisa suggests. Stone tools were among the things that got people to come down from the trees and start acting like people. This isn't meant to suggest whetstones are quite that old, because stone cutting tools got their edges mostly by chipping and flaking. But even before metal tools were made, some edges were obtained by abrasion—by rubbing the edges on harder stones. When metal tools did come in, abrasion was absolutely necessary.

The constant problem in abrasives, though, is the trade-off between speed and smoothness. The brilliant insight that led to forming the abrasive in the shape of a wheel, the grindstone, gave speed but left a rough edge on the tool or weapon—all right for hacking off someone's head but not good for careful slicing. A "fine" edge could be produced only by final rubbing on something harder and smoother than the grindstone. This was the process that came to be know as whetting or honing. The fact that both words are among the few that have stayed alive and healthy from Old English shows how basic the operation is.

Workmen in every region had to find the best whetstones they could. When farmers pioneered into the wilderness of America, their survival depended on good cutting edges on axes and scythes. One can imagine them moving westward, testing any likely-looking rock on their axes. They picked up a lot of advice from the Indians who, as Stone Age people, knew a lot more about rocks than the newcomers did.

This is the way—by reports from Indians—that pioneers in central Arkansas learned of quarries producing superior white, almost translucent, spear and arrow points. There were Indian quarries in the Ouchita Mountains near the valley filled with hot springs (known today, appropriately, as Hot Springs). The rock was quarried in open pits, by fires built against outcrops, which were then cracked off by being doused with cold water. Some of the pits were so deep it was obvious that mining had been going on for a long time.

How quickly this hard rock was put to use as a whetstone is not recorded. It was early, though—a letter written in 1818 says that 200 pounds of whetstones, priced at $2 a pound, had been shipped out by flatboats on the Ouchita River the previous year. (The Ouchita runs into the Red River, which empties into the Mississippi.)

Hard Arkansas (pronounced "Ar-kan-zus") stones, and a softer variety that picked up the name Washita (from Ouchita), developed a market on the East Coast and in Europe but did not rise to the top quickly. A host of whetstone varieties were available in the last century: Ayr stone, snake stone, Charnley Forest stone, Norway ragstone, Cutler's greenstone, and so on. Remember that interest went far beyond the workshop—until the disposable razor blade was invented, every man had the choice of raising whiskers or learning how to keep an edge on a razor. Turkey stone, which was mined somewhere in Asia Minor, finished in Marseilles and shipped by the ton into America, set the standard of excellence. Eventually, though, it was superseded by Arkansas stones, of the mineral novaculite.

With such a background, with so many kinds of stones available, with a planet composed mostly of stone, why have Arkansas stones, from one little patch of hillside near Hot Springs, established themselves as the standard of excellence? To find out, I seized a chance to visit the leading manufacturer of Arkansas whetstones last summer.

The Hiram A. Smith Whetstone Co., Inc., is located on the fringe of the suburbs of Hot Springs. It is said to account for about 70% of the production of Arkansas whetstones, and it is now being run by the fourth generation of Smiths. James A. Smith, the president, is named after his great-grandfather, who got the family into the whetstone business because the land he had acquired for real-estate speculation happened to include the best of the stone deposits.

Until 1964, the company simply mined and shipped raw stone for finishing overseas. Smith's father, Hiram, began developing lapidary knowledge of his own. He developed a stone-cutting saw, essentially a flat steel disc about two feet in diameter. Small industrial diamonds—"sweepings"—were glued along the rims. The saw was mounted overhead, like a radial arm saw, but the operator pushed the stone through the saw while it was bathed with a stream of cooling and lubricating oil. In 1976, the Smiths built an integrated plant and now have about 75 employees and all the business they can handle. "I guess we sell about 100,000 stones a month," Smith said. Most are sold under other companies' labels.

Raw stones are found in the quarries within about 30 feet of the surface. Holes from four to eight feet deep are drilled in the rock with jackhammers, and then filled with explosives. Dynamite can't be used because it shatters the rock; instead, a low-density explosive, which goes "whoomp," is tamped into the 1¾-inch dia. holes. After the blast, every broken piece of rock is examined by an expert, who taps the rocks with a dressing hammer. More than two-thirds of the broken rocks are rejected and thrown on the waste pile. The rest, mostly in sizes slightly larger than the human head, are scooped up into a truck and carried a few miles to the plant.

The first process is cutting each piece of stone into its optimum size. The slabber has a sharp eye for chitchat (rubbish stone), quartz lines, sand deposits and short cracks, and he tosses away about half of the stone that has been brought in from the quarries as below standard. He then decides how to cut each of the remaining stones to obtain the longest possible pieces from each. The hope is to get 20-in. lengths, but novaculite is a much-fractured rock and such long pieces are

Bill Wing, of Englewood, N.J., is a writer and an amateur woodcarver.

rare. Next, dicers cut the slabs into standard widths, ranging from wide hones to pocket sharpeners. Then the stones are cut to standard lengths by clippers. The aim at each step is to produce a stone of the highest possible value.

After being cut, the stones are finished. From 200 to 300 stones are "lapped," or polished, at a time as they ride on a revolving iron plate covered with industrial grit. Polishing continues by lapping the stones with increasingly fine grits. Edge bevels are ground by hand on abrasive wheels. At the same time that these flat whetstones are cut and polished, files are cut and hand-finished in a variety of cross sections.

After finishing, the stones are assessed once more and about a fourth of them are discarded. The arithmetic doesn't quite work out, but Smith says that of all the rock quarried only about 5% gets to market. The surviving stones are then graded into four categories of hardness.

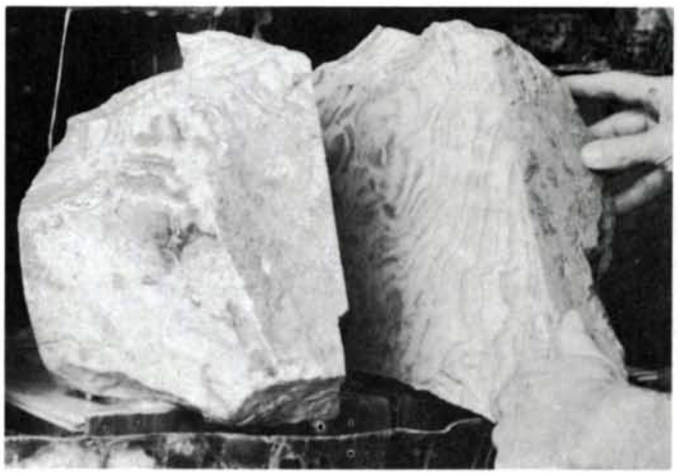
The softest and coarsest grade is called Washita, sometimes called calico stone in the old days because of its very showy grain and colors. This grade will produce an edge most quickly, but not an edge of the finest quality. The second grade up the scale of hardness is called soft Arkansas. This, a greyish and sometimes mottled stone, is described by Smith as the best general-purpose grade—that is, the best compromise between speed of sharpening and quality of edge. The next grade is hard Arkansas, a clear white stone said to be the best for the final polishing of an already sharp edge. Finally, at the top of the ladder, is black hard Arkansas, which Smith's catalog describes as the "supreme ultimate." Blacks, which range in color from ebony to dark grey, are for specialists, those who need to touch up an already extremely sharp edge. Because black novaculite is rare and hardly ever occurs in long pieces, its price is correspondingly high.

After grading, some stones are glued together in combinations of grades, some are glued on paddles or blocks and some are fitted into sets. The standard flat whetstone goes into a lacquered red-cedar box; the label under which it is to be sold is then stamped in gold on the cover. Smith no longer makes the boxes, but buys them under contract. (Smith has the best of both worlds with the red cedar. Its red and cream streaks make the boxes look exotic and expensive. Actually, the wood is readily available locally, since little cedar trees cover northern Arkansas and southern Missouri.)

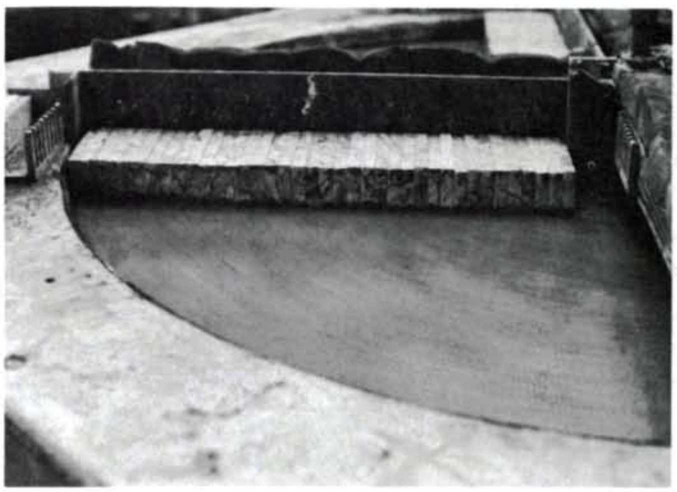
Smith talks candidly about the fact that his company's control of its raw supplies and its insistence on selling only first-quality stones enable it to maintain fairly high prices. The chief reason for downgrading a stone from first to second-class quality is the presence in the novaculite of small pockets of a softer material, called sand pits. Seconds will sharpen an edge just as well as firsts, Smith says, unless the pits are so big they snag the blade. If you can find them, they cost only a quarter as much as firsts. But since quality is the essential reason for owning an Arkansas whetstone, and since they last so long that the initial price is amortized over a long period, there is little reason for buying anything except a first-class stone. Natural stones last longer than industrial ones, not because they are harder, but because the bonding agent that holds together the particles in manmade stone breaks down.

Insistence on quality also stems from the fact that Arkansas stones were hurt badly in the past when the market was flooded with bad stones. L. S. Griswold, a geologist who in 1890 wrote the only comprehensive work on Arkansas stones, told how inferior stones were passed off as first quality.

Blocks of novaculite blasted out of a quarry at the Hiram A. Smith Whetstone Co., Hot Springs, Ark. Only about 5% of the novaculite quarried will become finished whetstones.



Raw Washita stone has been halved on diamond-edged steel wheel.



Stones are lapped, or polished, on a grit-covered iron plate.

Often, they were polished with pumice because the powder filled and concealed defects. Smith says bad stones are still being sold; some of them are not novaculite at all but a softer mineral called tripoli.

How, then, can you judge a good stone in the marketplace? Smith said the customer's best procedure is to rely on the reputation of the company selling the stone. Also, he said, a good stone looks good. Griswold said almost the same thing in his book: "Good stones seldom have a poor finish." Check the edges and sides to see if they have been ground true. Griswold also recommends things that wouldn't be tolerated today: testing for defects with a knife point and scratching the surface with your fingernails. (If you can scratch it, the stone is soft; if your nails come off, it's hard.)

To use the stones, Smith advocates standard sharpening techniques. He is not a purist about lubricant: Use a little oil, he says, but if you don't have oil, use water. When customers complain the stones won't sharpen, invariably, Smith says, they are not using enough muscle. After use, he recommends washing the stone with soap and water, and then drying it.

Novaculite is a form of quartz, and it is almost pure silica. Technically, novaculite is a kind of chert, which is similar to flint. It is composed of a dense mass of crystals that range in size from one to ten microns (a micron is a thousandth of a millimeter). No matter how smooth the stones feel, they can be seen through a microscope to be covered with protrusions that scratch away metal. The crystals are interspersed with spaces (pores) that seem to play a role in sharpening, too, because they hold the oil.

Jim Smith says the stones work so well because they "polish while they sharpen." This brings us around to the vagueness of sharpening terms, which need to be sorted out. All the

(to top of next page)

Sharpening

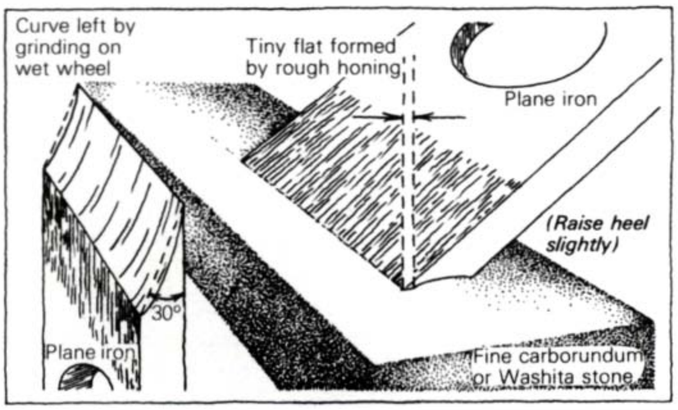
A sampling of techniques and tips

Everyone agrees that precise, efficient woodworking is impossible without properly sharpened tools, but there are probably as many ways to get a keen edge as there are practicing craftsmen. The bewildered novice is confronted by a vast array of sharpening equipment and advice, and as the following confirms, there are no absolutes, only preferred ways. Some of the writers are professional woodworkers; others, informed amateurs. All describe what works for them.

The cutting edge

Three steps form the cutting edge: wet grinding, rough honing and fine honing. I feel strongly that dry grinding on any wheel will damage the hardness of the blade edge. Even if you watch carefully and cool the metal in water after each pass, can you definitely say that you have not removed the temper on the terminal .001 in. of the blade, where the edge is actually formed? It seems ridiculous to me to dry-grind a blade and then to use a hard Arkansas stone or to strop the edge afterward. The first cut will dull the edge, and the tool will never cut as well as it would have had it been wet-ground. I even use wet grinding for metal lathe bits and feel it makes a difference. Your blade was carefully heat-treated for a purpose. Don't ruin it.

I use a wet wheel, either manmade or natural, grit from 40 to 100, and turning in either direction to remove the surplus metal, form the edge angle and facilitate resharpening. Edge angles will vary from 2° for a straightedge razor, which is never ground, to 90° for scrapers used to form barrel channels in rifle stocks. My acute-angle block plane, (the only metal plane I use) is ground to around 20° but cuts with the angle up, so blade angle is about 32°. My other planes are about 30°, with 35° for wood chisels. Planer knives are ground to about 30°. Knives should have angles close to 40° but should seldom be ground, with kitchen knives the one exception. No knife should ever show grind or hone marks on the flat of the



blade, but should be tipped well up away from the stone in honing. Scissors and tin snips are ground around 85°.

After grinding, wire edges are removed by rough honing to prepare for the final edge. Many woodworkers abhor a wire edge; instead, welcome it, for after you acquire proficiency, you are only 20 seconds or so away from a shaving edge. Your aim in rough honing is to form a narrow flat (a micro-bevel) along the front edge, using a fairly fine carborundum or Washita stone with thin oil for cutting fluid. I use diesel fuel with a bit of crankcase drainings added. Oil alone is too thick for fast cutting. Set the blade on the stone with both heel and toe touching, raise the heel slightly and lock your wrists to hold that angle. Give the blade a dozen or so strokes, either reciprocating or figure eight, holding the angle constant. Check to see if you have formed a narrow flat; if so, turn the blade over. With the blade flat on the stone, make one stroke toward the edge to remove the wire edge now formed.

The next few strokes are the ones that produce a fine edge with a minimum of effort. Position the blade on the stone, raise the heel as before, and make one stroke toward the edge. Now turn the blade over and make another single stroke with the blade flat on the stone toward the blade edge. Rotating the blade with each stroke, make six or eight single strokes toward the cutting edge on alternate sides of the blade, and you should have a shaving edge. If not, go back to rough honing and try again. From the fine wire edge to the shaving edge takes 5 to 10 seconds if properly done. If you wish, you may repeat the rough and fine honing on an Arkansas stone and/or use a leather strop, but I feel the blade processes of sharpening—grinding, whetting, honing, stropping and polishing—remove metal from an edge by abrasion. All the way down the line to buffing with jeweler's rouge, or stropping on the heel of the hand, the purpose is to get the saw teeth on the edge smaller and smaller. The term "polishing" can be confusing, but in the case of edge tools, "polish" means to produce a bright surface finish by abrasion. The key is always the size of the scratches produced on the edge of the tool.

An 1876 book on grindstones makes it clear: "If we were to examine the surface of a tool that has just been removed from a grindstone, under the lens of a powerful microscope, it would appear as if it were like the rough surface of a field which has been recently scarified with some implement which formed alternate ridges and furrows... (the edge) seems to be formed of a system of minute teeth rather than to consist of a smooth edge." The tool, therefore, is ground and polished with finer and finer grit "to reduce the serrature." An Arkansas geologist gave the same sort of explanation. There is no magic in novaculite, he said. The scratches always can be seen through a microscope, no matter how small they are. The fine edge comes from the regularity of the size of the individual crystals in the Arkansas whetstone.

There is also no magic, the geologist said, in the fact that novaculite is mined only in this one spot. The Hot Springs region of Arkansas is interesting geologically, as evidenced by the hot springs, and the fact that it is one of the two best places in the country to find rock crystal, and the fact that Arkansas—alone among the fifty states—has a diamond mine. But other regions are interesting geologically, too, and there is no reason for believing commercial deposits of novaculite will not turn up somewhere else. □

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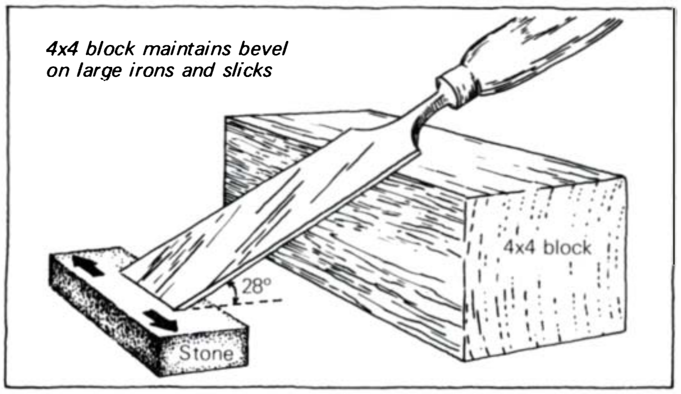
fresh from the fine honing will be as sharp as a stropped blade that has made a couple of cuts in hardwood, and you will have wasted the extra time. I realize that in woodcarving, especially in softwoods, a stropped edge may be required, but this is seldom true for planes and chisels. A blade properly fine-honed will shave hair from your arm and will smoothly cut a hard pine knot or rock maple.

To resharpen, repeat the second and third steps until the blade has worn enough to need lengthy honing, with a wide flat on the edge. One could skip the grinding and sharpen solely with the oilstone, but grinding makes it easier and quicker. Another test for sharpness is drawing your thumbnail along the edge with light pressure. If the pull is even along the edge, the blade is sharp. Or hold it in a good light and look for a bright line or spot. If you see one, that part is dull, for a sharp edge is invisible. Check for the wire edge in rough honing by drawing the ball of your thumb along the flat of the blade and out over the edge. If you do not feel the wire edge, it needs more honing.

—W.A. Haughey, Burlington, Colo.

Grinding and honing

Many techniques will produce a keen edge; those described here were acquired from a craftsman with over 50 years at the bench. They work well for me. To grind the bevel of a chisel or plane iron preparatory to honing, a good first step is to mark a square edge on the flat side of the blade (with a felt-tip pen, grinding ink or a glasscutter's diamond) as a guideline for the edge. I prefer to mount a ¾-in. by 6-in. medium carborundum grindstone on the lathe, for two reasons. First, the tool rest offers a large and firm bearing surface on which to steady the blade, a real boon for accuracy. Second, low speeds on the order of 1200-1500 rpm can be used, with less danger of drawing the temper. However, grinding on the lathe with an unshielded stone does pose some safety risk, and should be done cautiously and only at low speeds. Patience is a real asset because trying to remove too much steel too fast will draw the temper of the best tool. The slower the better. Never allow a blade to become too hot to hold while grinding; quench frequently in cold water. Do not use oil on the grindstone because it may cause deterioration and crumbling. I check the angle frequently with a protractor bevel; on plane irons, I use an angle of 24° for soft-



woods, 28° for hardwoods. The blade is passed rapidly and evenly from side to side at the proper angle over the width of the blade until the guideline is reached. Allowing the blade to remain stationary for too long generates heat and usually causes an uneven grind. As a final step, I touch the bevel lightly to the side of the grindstone to take off any high spots.

After grinding to the proper bevel, I remove most of the burr with several heavy strokes on a coarse oilstone with the bevel and the flat side. Then I set to work with a fine India (artificial) stone, using a light penetrating oil. Special oils are sold for honing but I have found those used to free up rusty bolts, such as Liquid Wrench, work just as well. At this point, the woodworker is often advised to rock the iron in a figure-eight movement, holding the heel of the bevel slightly off the stone, in the direction of front to back. I feel this is wrong for several reasons. It is very difficult to maintain a constant acute angle, which is crucial for a keen edge; it produces inequalities over the width of the edge; it causes hollowing of the stone, it is laborious and inefficient. I place the entire bevel absolutely flat on the stone and hone with a constant side-to-side movement, keeping the edge of the iron parallel to the long axis of the stone. I traverse the full length of the stone, changing positions every several strokes, continuing until a highly polished, nearly mirror surface is obtained. Then I reverse the iron and hone the flat side in the same fashion, keeping the entire surface flat on the stone. Honing the flat side of the iron will remove most of the burr, leaving a fine burr on the bevel side. Then I reverse the iron and hone on the bevel, side to side, keeping the bevel absolutely flat on the surface of the stone. Several cycles of alternate honing of bevel and flat side are needed to remove the burr, each cycle shorter as the burr becomes finer. By the time the burr is nearly gone the edge should be keen, and the surface of the bevel mirror-like. The polished surface, however, is irrelevant. The important thing is the edge. A keen edge, when directly illuminated, will not reflect light.

The experienced woodworker uses generous amounts of oil, wiping it off as soon as it becomes black and applying fresh oil. Allowing the porous surface to become glazed will surely ruin a stone. When honing the flat side of the iron, keeping it flat on the stone is mandatory. Honing large plane irons and chisels, such as slicks, can become tiresome. A convenient guide can be made with a heavy block of wood such as a 4x4. Lay the block parallel to the stone and place the bevel on the stone. Move the block toward the stone until the iron rests on the long edge of the block, keeping the bevel flat on the stone. If the block and the stone stay parallel, the angle will be constant and the cutting edge square.

Using an inexpensive artificial stone as above, a satisfactory edge can be obtained, at least for rough work. However, a small white Arkansas stone is a good investment and will produce a fine razor edge. I use it in exactly the same way as the fine India. Only a small amount of honing on the Arkansas should be required for a proper edge.

These techniques do not produce a secondary bevel, or "micro-bevel." This is a personal preference. I feel if the blade is properly ground for its intended purpose in the first place, a micro-bevel isn't necessary. For example, I prefer to have extra plane irons ground for hard and soft woods. I find it harder to produce a razor edge with a secondary bevel because the angle is more difficult to regulate. However, the techniques can be modified during the later stages to produce a secondary bevel if desired. One must keep the heel of the bevel the same distance above the stone during each stroke, though, or the edge will not be keen.

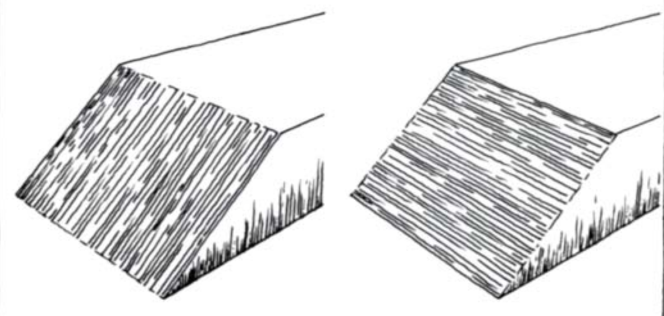
The final stage consists of stropping the bevel and flat side with a piece of leather dressed with jeweler's rouge. The latter can be purchased from jeweler or craftsman supply houses in the form of a bar that is rubbed on the leather. Glue the leather to a block of wood. Strop in the same manner as honing, with the bevel and flat side flat on the leather surface. The edge should not be stropped directly or it will be blunted. The result should be a bevel with a gleaming surface like an old-fashioned razor and a super-fine edge.

—Daniel A. Symonds, Towson, Md.

Which way to hone?

When honing on a flat stone, some workers advise moving the tool in a figure eight, some in a straight line back and forth, and some from side to side. I've always been confused by these various instructions, since it seems to me that one way should have something to recommend it over the others. Although I don't have any scientific evidence, logic tells me always to work the tool back and forth over the stone with the cutting edge perpendicular to the direction of honing.

The edge of a tool is a narrow wedge, and most of its work is done by the last few microns of metal. Grinding and honing polish the metal by making smaller and smaller scratches in it. What looks mirror bright to the unaided eye is, under the microscope, an uneven terrain of ridges and gullies. On a tool honed my way, the ridges and gullies run off the edge,



Hone this way . . . *. . . not this way.*

which is made up of tiny points supported by a relatively broad base of metal. But on a tool honed the other way, the scratches are parallel to the cutting edge. This seems liable to weaken the very edge you have worked so hard to create. It may break right off in a long sliver of metal, dull after the first cut. So when we have a choice, we should sharpen and hone in the way that leaves these microscopic scratches parallel to the direction of cutting.

—R. Bruce Hoadley, Amherst, Mass.

Brush and buff

Over the years I have collected a drawerful of stones, strops and hones. However, I now get along with almost no use of any of them. Instead I sharpen everything (except saws) on a grinder, a wire brush, and a coarse buff. First I shape the tool on the grinder until a wire edge appears, dipping the tool in water more and more frequently as the grinding gets close to the edge. Because the sharpening process is so simple and so little trouble, I feel free to experiment with long bevels, skew chisels, etc., for special purposes. Next I knock off the wire edge on the rotary wire brush. The last step is to charge the buff, which runs at about 2100 rpm, with white emery and proceed to polish the edge. I buff for a short time on the wrong side of chisels to cut off any wire edge that might come with working on the right side. I can shave with anything I sharpen. At the slightest sign of dullness, the tool goes back to the buffing wheel for a few seconds. The buffing wheel is not only faster than the oilstone but also cleaner.

—John Owen, Isaacs Harbor, N.S.

Resurfacing stones

Usually, stones become hollow due to long use, but even a new stone may not be really flat. Lack of honing oil can clog or glaze a stone so badly that no amount of rubbing your edge tools on it will have much effect. My early attempts with machine surface-grinding old stones on a silicone-carbide wheel produced a totally useless, glass-smooth surface.

In a short evening I flattened my remaining stones and unglazed the others (eight stones in all) by lapping them. The method is simple: Just pour some kerosene onto a piece of plate glass, sprinkle on about a tablespoon of 60-grit carborundum powder and start rubbing. As the kerosene dries out, add more. When the powder no longer "bites," sprinkle on another spoonful. Rub over the whole surface of the glass to avoid wearing hollows in it. Very fine stones such as Washita or hard Arkansas may be too rough after this treatment, but another minute of lapping on the other side of the glass with kerosene and 220 wet-or-dry silicone-carbide paper removes the roughness. After that, the stone should hone better than ever. Keep on lapping once in a while to prevent your stones from getting hollow again.

—Rich Baldinger, Schenectady, N.Y.

Hand grinder

I learned to sharpen tools on a conventional motorized grinder, went over to the sandstone water-trough variety and was finally converted to a hand grinder. The hand grinder does the job well without any chance of ruining the tool and gives a lot of sensitive control over the result. You don't have to worry about the stone disintegrating or softening if kept in water continuously, and it doesn't wear unevenly or crumble. The pronounced hollow grind makes honing a snap. One develops more of a direct, personal relationship with one's tools when they are ground this way, and this probably has a subtle effect on workmanship as well. And a hand grinder is about one-quarter the price of motorized types.

My grinder has a 1:20 ratio. It is model #1107 from Gustav Kunz, 30 Hannover-Wulfel, Volgerstrasse 9m, West Germany. Woodcraft Supply, 313 Montvale Ave., Woburn, Mass. 01801, and Silvo Hardware Company, 107-109 Walnut St., Philadelphia, Pa. 19106, sell something similar.

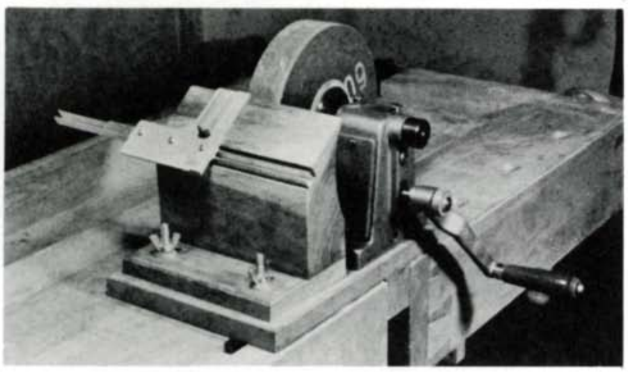
I have kept the wheel the grinder comes with, though I discarded the stock tool holder. I also added a few washers to eliminate the disengagement feature of the crank handle.

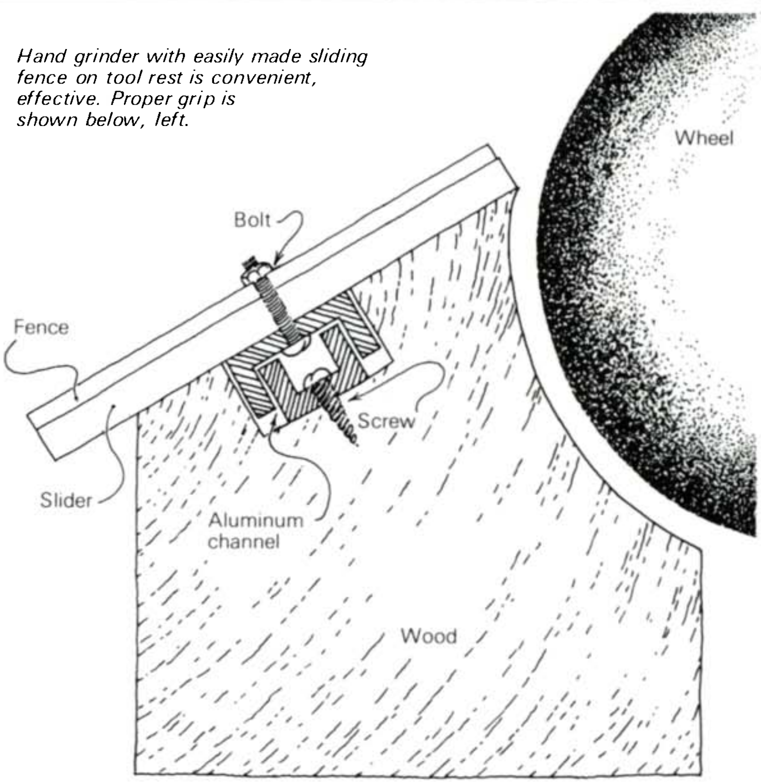
It was especially bothersome to use a clamp and to have to readjust the tool rest each time, so I glued and screwed a block underneath the mounting board for clamping in my end vise. The rest itself is fastened to the board by two bolts equipped with large butterfly nuts or wing nuts. The heads of these bolts lie countersunk in two slots in the mounting board, so adjusting the rest is a matter of positioning it properly and tightening the nuts. Once made, the adjustment remains when you take the grinder off the bench. When the wheel diameter changes with wear (mine lost 5 mm in two years) or if the angle need be changed (I grind both chisels and plane blades at 26°), a wedge can easily be inserted between the rest and the base. When set up this way, the grinder is always ready for use at a moment's notice.

My tool rest has an optional sliding fence that holds the blades at precisely 90° to the edge of the wheel. Making a slider like this is easy. Most builder's supply stores and hardware stores sell anodized aluminum channel. One length of channel having a base measurement of 3/8 in. and one measuring 3/8 in. between the legs are needed, about 12 in. of the former and 6 in. of the latter. Cut a rabbet in the tool rest slightly deeper than the combined height of the 12-in. piece plus the thickness of the wall of the 6-in. piece. The rabbet should be as wide as the width of the 6-in. channel plus 1/8 in., or about 9/16 in. With wood screws, fasten the long piece, open side up, to the rest. Leave about 1/8 in. between it and the rabbet wall. Bandsaw all but 1/8 in. off the legs on the shorter channel and fasten it to the fence with 4/40 screws. Clearance is important here. Be sure to center the screwheads in the channel. The fence may be made of 3/32-in. plastic, aluminum or brass sheet. Double up on the thickness at the fence edge—use epoxy, first abrading the surfaces. My knob is 2 in. long, held from underneath by two deeply countersunk woodscrews.

The edges of the channels may need breaking or adjusting to permit free sliding. To ensure that the fence edge lies at precisely 90° to the channel guides, hold an accurate try-square against the inset channel and adjust the fence edge to meet its blade exactly. To use this tool rest, turn the wheel toward you with the right hand, while the blade is held lightly against the slider by the thumb of the left. The index finger holds the blade down flat against the surface of the rest and the three remaining fingers rest on the left side of the knob. The index finger also feeds the blade into the rotating wheel as the hand moves back and forth. □

—Alan Marks, Pacific Grove, Calif.





Hand grinder with easily made sliding fence on tool rest is convenient, effective. Proper grip is shown below, left.

Cockleshell

Giant carving gives corner cupboard class

by Franklin H. Gottshall

The beauty of a corner cupboard can be greatly enhanced by incorporating a hand-carved cockleshell in the design. Such a shell is sure to be a show stealer, and from this standpoint alone it is worth all the effort it takes to make.

It took me two weeks to build and carve the shell shown, which measures 34 in. across on the inside at the base. Some storage space is lost on the shelf where the shell is put, but the great amount of interest it imparts more than compensates for the loss.

I designed this cupboard to be as high, wide and deep as possible, in order to have maximum storage space. This permitted me to put in such a large shell. I was fortunate to find a 2-in. plank of California sugar pine 22 in. wide and 16 ft. long at the lumberyard. Others may not be able to duplicate my good fortune and will have to glue several planks together to achieve the required widths.

The layers needed to build the shell up to height can be bandsawn out of glued-up segments. Ten semicircular layers were required to build up this shell. The table gives the sizes I cut. Smaller shells would, of course, require less material. With proper planning there is very little waste.

Hand-carved cockleshell enhances large corner cupboard.

When the layers have all been sawn to shape, they should be joined together on the outside of the arc with glue and wood screws. I used 2½-in. #14 flathead screws and countersunk the heads.

It is important to be careful when drilling holes for these screws so there is no danger of cutting into the screws when carving or smoothing up the inside of the shell. Arrow *A* in the diagram at the top of the next page points at the line to which waste must be trimmed. The dotted lines on layers 8 and 9 show the waste formed on the inside of the shell by stacking the layers. This waste must be removed. A cardboard template with a 17-in. radius curve may be used to help you do this smoothing properly.

Before you start to carve, glue a facing board to the front of the shell. This ensures a flat surface, while hiding the glue lines and other imperfections. Notice the direction of the grain on the facing board. A 45° angle cut on both ends of the top of the board positions the shell easily for carving.

Start smoothing the inside of the shell with wide gouges. Finish with sharp scraper blades and garnet paper. Use coarse-grit garnet paper first, and finish up with finer grit paper until the surface is completely smooth.

The broken line *B* shown in the top diagram is one of several you should draw to help you space the widths of grooves and fillets uniformly. The shell shown has 19 grooves. You can make more or fewer, but I advise making an odd number. First draw center lines where each groove is to go, making the first up the center of the shell. Then you can draw border lines for each groove and fillet. There is no great harm if a fillet at the bottom of the shell is a little wider or narrower than the others, but the grooves should all be the same width. A cardboard template helps lay out these lines.

Because it will be difficult to space grooves and fillets close together near the bottom, it is better to use another design here to fill this small area, as I did on my shell.

When all the carving and smoothing has been done on the inside, you are ready to cut the molding around the scalloped edge on the front of the shell. I cut mine with a router.

Put as many coats of finish on the outside of the shell as you put on the inside. This prevents unequal drying, which causes checking or splitting. This should be done before fastening the shell into the cupboard. I used several coats of spar varnish on the back of the shell. The inside was finished with pale green latex paint. I anchored this shell by screwing the outside of the bottom layer into the back of the shelf, and the top into the top of the cupboard. □

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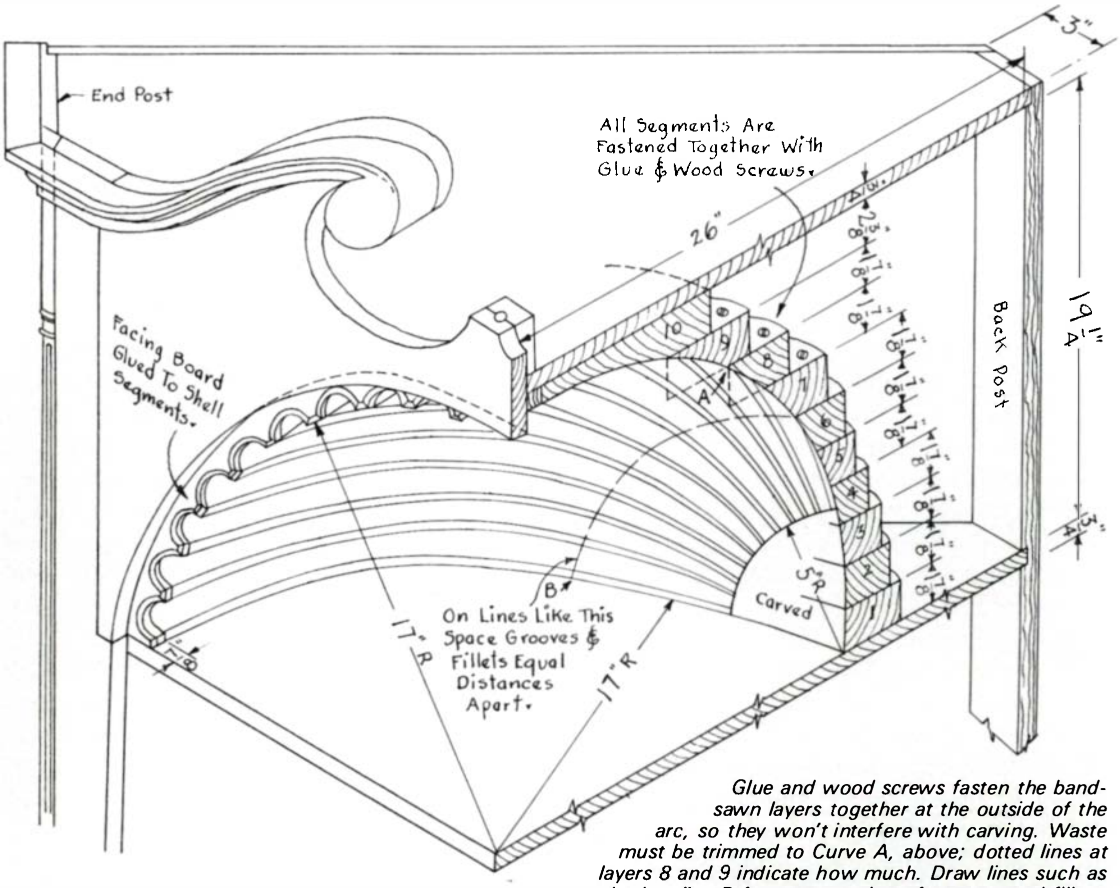
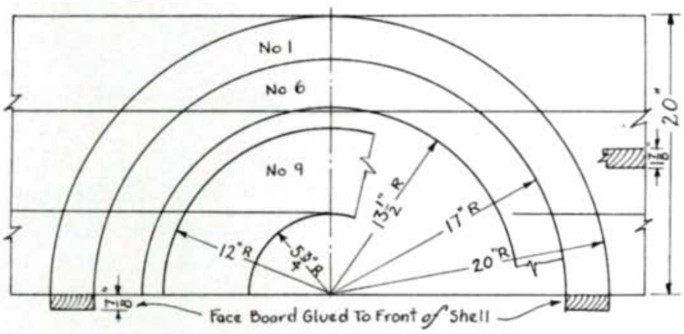
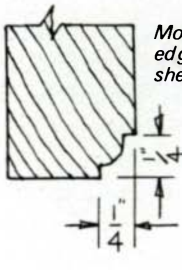
Dimensions of each layer		
No.	Inside	Outside
1	17″	20″
2	16¾″	19¾″
3	16½″	19¼″
4	15¾″	18½″
5	14¾″	17½″
6	13½″	17″
7	11⅞″	16″
8	9½″	14″
9	5¾″	12″
10	*Do not bandsaw inside.*	10″

Table above gives inside and outside radii for laying out ten semicircular layers, numbered from bottom of shell to top. If a board wide enough for the largest layer cannot be obtained, several planks can be glued together to get the necessary width. Several layers can be bandsawn on the same segment of board to minimize waste. In the diagram below, the first, sixth and ninth layers have been nestled on a segment made by gluing three boards together edge to edge.

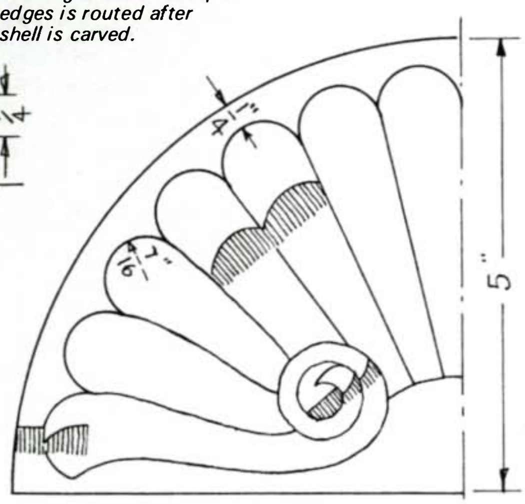


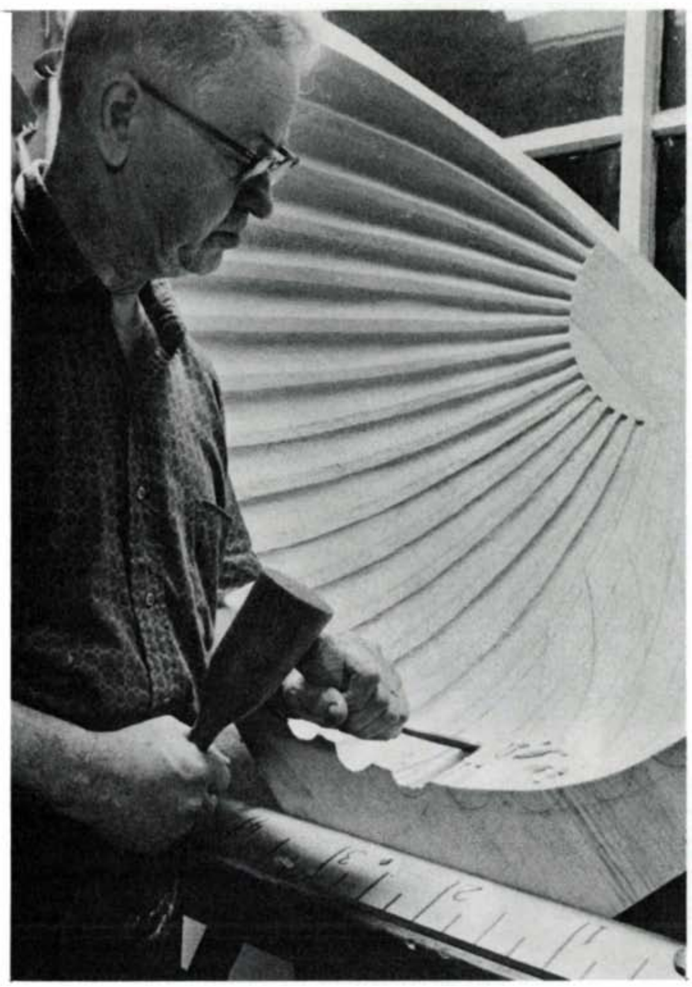
Glue and wood screws fasten the bandsawn layers together at the outside of the arc, so they won't interfere with carving. Waste must be trimmed to Curve A, above; dotted lines at layers 8 and 9 indicate how much. Draw lines such as broken line B for even spacing of grooves and fillets.





Molding around scalloped edges is routed after shell is carved.



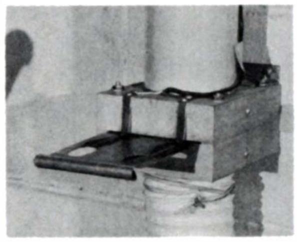


Small shell-and-volute design, above, fills semicircle at shell bottom. Right, angle-cut faceboard steadies shell as Gottshall carves grooves.

Dust Collection System

Damper-controlled setup keeps basement shop clean

by Doyle Johnson

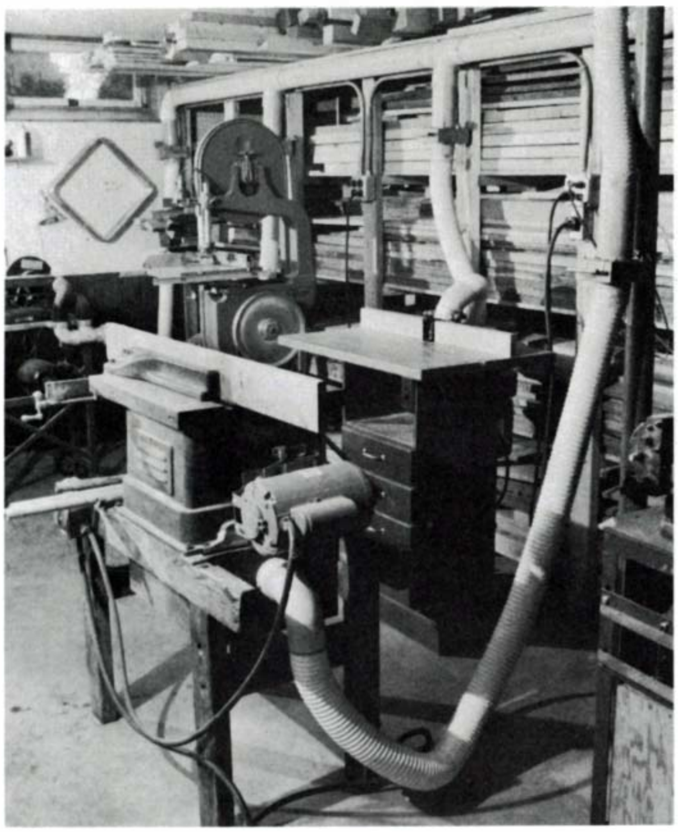


Opening the damper slide starts the collector.

One problem confronting all woodworkers is how to combat the dust generated by power tools. My shop is in the basement of my home, and my concern over the mess and health and fire hazards led me to design a dust-collection system for my stationary power tools. I wanted the system to be conveniently located at each tool so no time would be wasted in moving hoses or cords. Therefore I installed permanent piping to the machines with a positive shut-off damper at each, so that the collector would run at full capacity at the operating tool.

In designing and installing a system like this, keep the collector as close as possible to the tools. Use as much pipe and as little hose as you can, to reduce resistance and make the system more efficient. To ensure compatibility, locate sources for all the components before you start construction.

I chose a ½-hp cast aluminum industrial collector (model 50) manufactured by the Cincinnati Fan and Ventilator Co., 5345 Creek Rd., Cincinnati, Ohio 45242. The specifications of this model are 110 volt, 450 cfm, 7-in. static pressure, 9150 fpm velocity using a 3-in. hose, with a noise level of 73 db. The collector retails for about $245. The unit has a totally enclosed fan-cooled motor and is suitable for outdoor installation. It is designed to fit a 20-gal. or 24-gal. waste can, but I modified a 55-gal. drum with a removable top to accept it. Since the collector is weatherproof, I put it outside to eliminate the chore of carrying the refuse up the stairs, to save space and to get the noise out of the shop. I covered the dust-filter bag with a trash-can liner with the bottom removed to keep it dry. The unit was in service through last winter and survived about 84 in. of snowfall without any problem. I plan to build a small louvered enclosure with doors for it, to muffle the noise and reduce the chance of theft.



Overhead piping and vertical hoses do not interfere with machines. Dampers are conveniently close to each tool.

I decided on 3-in. schedule 30 (thin-walled) PVC drainage pipe instead of metal vent pipe to reduce the noise and to take advantage of a larger choice of fittings. The smooth sweeping bends of the plastic pipe prevent material from settling out as it passes a drop to another machine. Because of building codes, schedule 30 PVC pipe may not be available in some areas, but it costs about 40% less than the heavier schedule 40 pipe. Schedule 30 pipe costs $6 for 10 feet. Fittings cost a dollar or two each.

PVC pipe can easily be cut on a radial arm saw and can be permanently joined with solvent cement. But I found the joints airtight without cement, and I can remove the pipe if I ever want to rearrange my tools. Duct tape can be used if a joint is suspicious. I secured the pipe to the building with perforated plumber's tape.

After looking through several catalogs, I couldn't find a suitable damper. I could have used standard dampers and wired the system to a wall switch, but instead I designed one of maple and sheet metal, with control contacts to start the collector when any damper is opened. Felt seals make a positive seal on the sheet metal slide. I started with two pieces of maple long enough for all the dampers I needed; the drawing gives the dimensions and steps involved.

Each damper needs two contacts for operating the control relay. They are made of .025-in. brass shim stock. Lay out the contacts on flat stock and drill the holes. Then cut and bend them to shape as shown in the drawing. Smooth the edges and curved end for good electrical contact with the slide. These contacts are suitable only for low-voltage applications.

To assemble the damper, place the slide between a set of damper bodies and bolt together using ³⁄₁₆-in. by 3-in. screws. Attach the mounting brackets, tighten the bolts and check for smooth operation of the slide. Next place the unit in the vise, insert one of the seals and push it against the slide until it seats evenly. Hold in this position and drill holes to secure the seal with #8 x 1-in. self-tapping screws. Repeat the procedure for the opposite side. The seals should fit into the damper bodies snugly. If the hole is too large, a wrap or two of 1-in. masking tape around the PVC will tighten the fit. Af-

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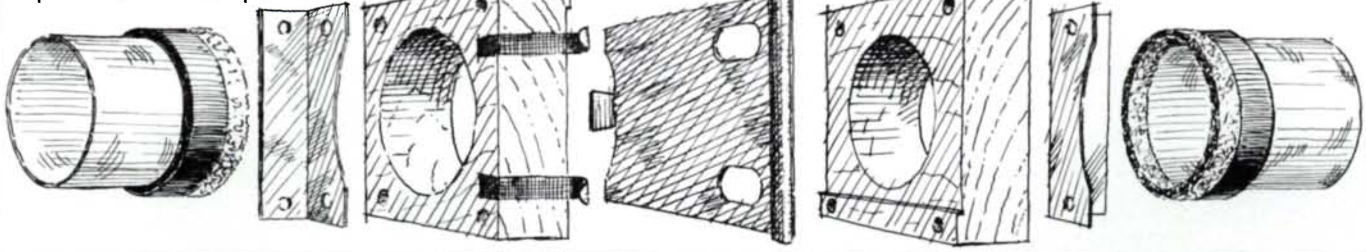
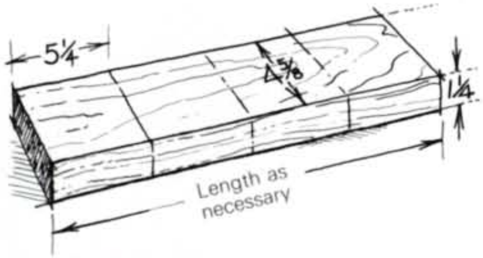
Doyle Johnson, 43, of Crown Point, Ind., is electrical supervisor for a steel company. An avid woodworker, his green lumber supply competes with his wife's car for garage space.

Exploded view of damper

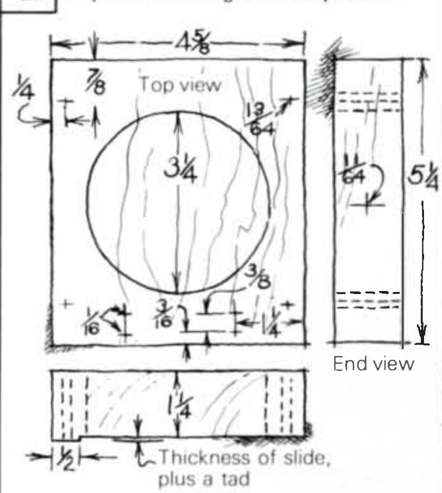


1 *Start with two pieces of maple stock. . .*

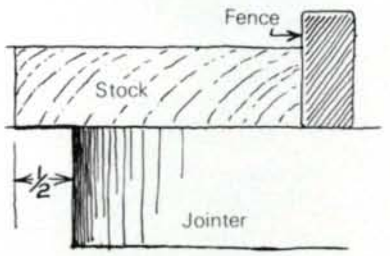


Machine them to width and thickness, long enough for all the damper bodies you'll need.

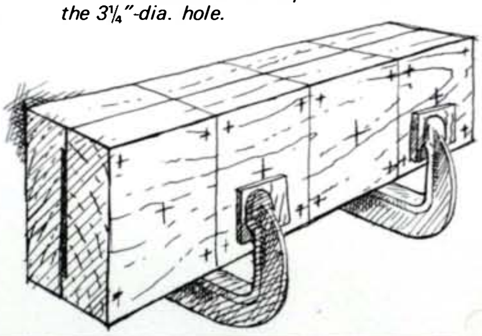
2 *Lay out all drillings on one piece. . .*



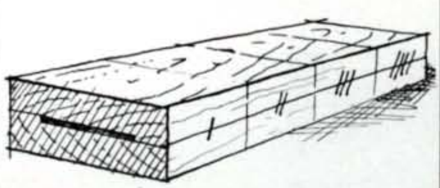
3 *Joint the slot for the slide with ½" overhanging the knife. Remove just enough from each piece to let the slide move freely.*



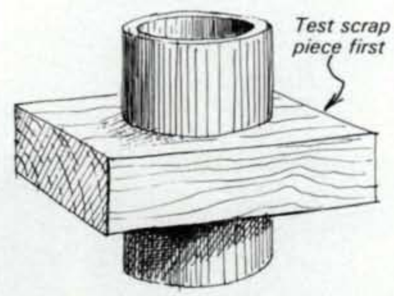
4 *Clamp together and drill for screws, electrical contacts and a pilot hole for the 3¼"-dia. hole.*



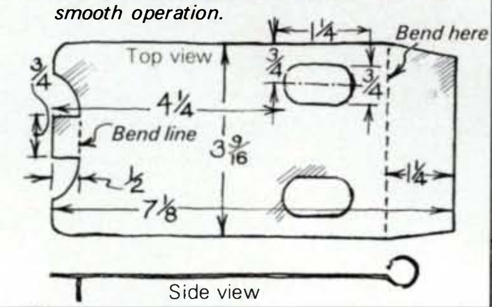
5 *Mark for cutting to length and match-mark each unit for assembly.*



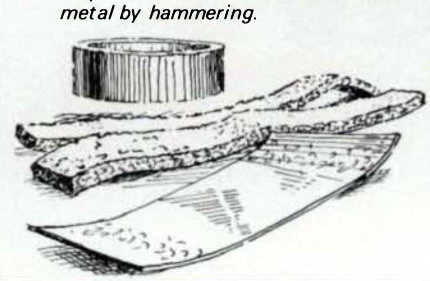
6 *Before cutting pieces to length, circle-cut 3¼" holes. Test cutter setting for snug fit on 3" PVC pipe on scrap piece first.*



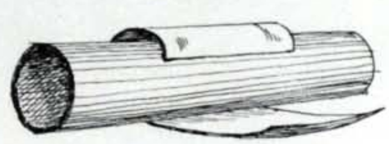
7 *The damper slide is 28-gauge sheet metal. The bent tab acts as a stop. Drill the holes ½", then ream them oval with a rotary file in an electric drill. Form the handle by wrapping the wide tab around a ⅜" rod held in a vise. File the corners round for smooth operation.*



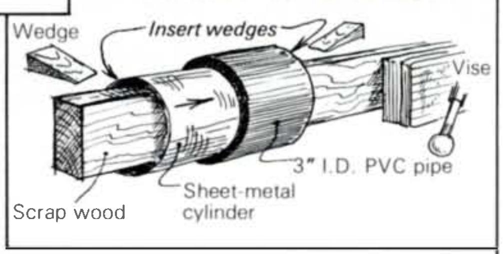
8 *Damper seals are made from 3" PVC pipe, 28-gauge sheet-metal pieces 3" by 10" and felt cut into 1" by 10" strips. Curl the ends of the sheet metal by hammering.*



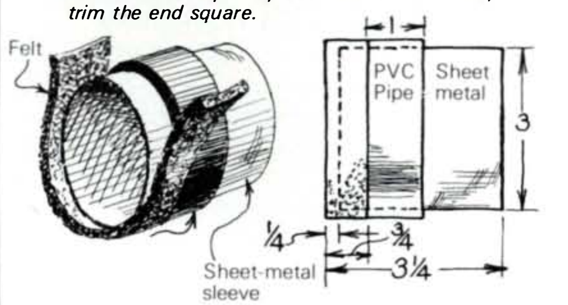
9 *Roll around the outside of a scrap length of PVC pipe.*



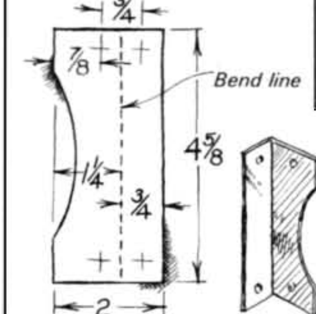
10 *Slide the cylinder inside a 2½" length of PVC pipe, mounted on a scrap board held in the vise. Use two small wedges to force the sheet metal snugly against the pipe. Sheet metal is then drilled and riveted.*

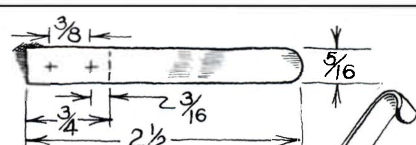


11 *Slide the sleeve into a 1" ring of 3" PVC pipe and wrap strips of felt around the end. Use contact cement to build up a layer as thick as the PVC, then trim the end square.*

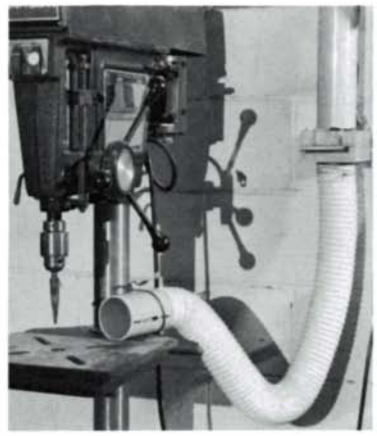


12 *Brackets are made from sheet metal, contacts from shim brass.*

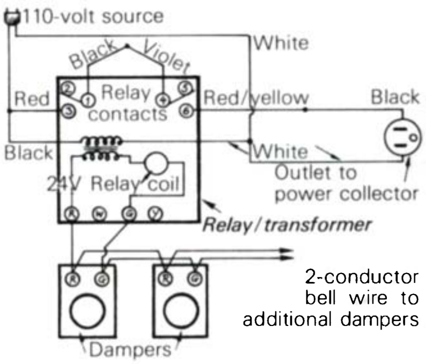


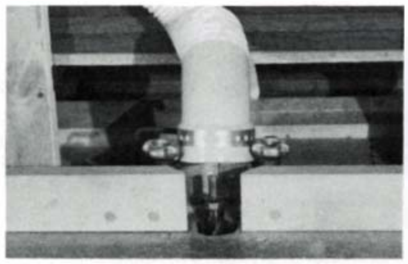


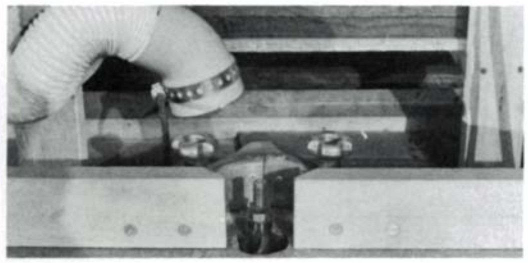
The flexible brass rides over the damper slide when it is open.



Collector mounted outdoors on 55-gal. drum, left, is connected to machinery inside shop in various ways. Center, semicircular catcher of ¼-in. Masonite and ½-in. plywood funnels debris from radial arm saw into the pipe about 1 in. above catcher bottom. Blade-guard pick-up could also be built. Saw, used mainly for crosscutting, is tight against wall; more space would permit deeper catcher with bottom pick-up. Right, suction hose attached to short pipe is clamped to drill-press column. Damper links hose to overhead pipes.

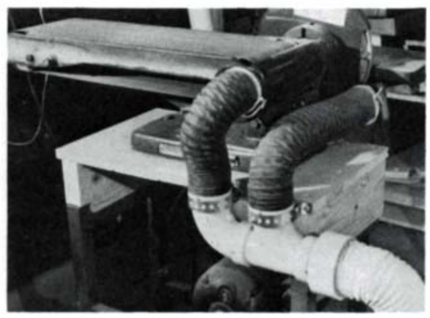






Shaper setup, above, has 45° PVC elbow with sheet-metal sleeve inside. A ⅜-in. threaded rod, bent L-shaped and clamped to elbow with plumber's tape, secures hose to table. Sheet metal closes off area behind cutter. Hose unit swings away to change cutters. Wiring for dust-collection system is diagrammed at left.

Band-saw take-off, far left, is in bottom of sealed-off lower blade guard. Hose is long enough to rest guard on floor while changing blades. Left, table-saw take-off is through a hole in drawer where blade throws sawdust. Hose detaches for vacuuming shop floor. On belt and disc sander, right, system connects to dust pick-ups for shop vacuum.



ter assembly, a small bead of silicone sealer or gutter sealant between seal and body will prevent leakage. This allows the damper to be taken apart if the seals ever need replacement.

The contacts are now attached with #6 x ½-in. sheet-metal screws. Adjust the wipe on the contacts by bending the curved tip up or down to meet the slide. Close the slide and move from side to side; if the contact touches the metal, adjust or trim the contact slightly. Lubricate the slide where the contacts ride by rubbing with a soft lead pencil or graphite-based lubricant to reduce friction and ensure good contact.

For controlling the power to the collector, I selected a 24-volt switching relay/transformer, the kind that controls furnace blowers for air conditioning. The 24-volt circuit is safe to connect to the damper contacts with ordinary doorbell wire. I bought a Sears Model #541.9211D, rated at ¾ hp, 110 volts, for about $15. Its relay controls power to a weatherproof receptacle at the collector. I have enough capacity on the shop lighting circuit to operate the collector system and have it connected so it works only when the lights are on.

I anchored the dampers in easy reach from each machine and ran 3-in. hose to the machine itself. Since hose similar to the 5-ft. length furnished with the collector cost almost $2/ft., I used 3-in. clothes-dryer vent hose at $.60/ft., which has proved satisfactory. To link the hose to a pipe, one of the sleeves like those on the dampers works fine. To go into a hub on a fitting, just put a short piece of pipe over the sleeve. The metal sleeve protrudes 1½ in. on each side of the damper, which allows connection of 3-in. pipe or hose. To secure the hose I used a double wrap of #14 AWG wire twisted tightly.

In adapting my machines for dust collection, I found that each presented its own problems. The objective is to get maximum air flow around the cutter and into the collector, and I devised solutions (shown above) with that in mind.

I have about $325 invested in my dust-collecting system and am satisfied with its performance. To further illustrate the capacity of this unit, I co-own a 12-in. thickness planer with a brother and have it in his shop. We made and installed a collector hood, connected the collector to it with a 5-ft. length of 4-in. hose and found that it does a beautiful job of collecting shavings while planing 12-in. boards. The only problem is that the 55-gal. drum is jammed full in a matter of minutes. □

Sanding

The basic tools and techniques

by Ben Green

Sanding equipment includes (left to right) a Merit Sand-O-Flex, a belt sander, a drum sander, an orbital sander and a sanding block.

Many woodworkers don't have a clear understanding of the role of sanding in finishing and refinishing. Commonly asked questions include: Does this need sanding? How much? What paper and what sander should I use? What is coarse grit? Should the final sanding always be done by hand? Almost everyone agrees that some sanding must be done, grabs the sandpaper and gives it a shot. If sanding is incorrectly or hastily done, however, the finish will never be as fine as it could be. Sanding is work and takes time, but the many recent improvements in equipment and abrasive papers make it possible for today's finisher or refinisher to surpass even the most meticulous craftsman of yesteryear.

Equipment needs depend on the job being done and the kind of shop being outfitted. A well-equipped shop would have a belt sander, an orbital (pad) sander, a Sand-O-Flex, drum sanders (attached to an electric drill), a sanding block and various pieces of stationary bench equipment. For those just starting out, however, about $20 will buy an orbital sander that will do an excellent job.

The belt sander, designed for fast sanding of large, flat surfaces, is ideally a part of the cabinet shop, though optional for the refinishing shop. It effectively sands new wood before it is assembled and sands down large surfaces that have been glued up from narrower stock. In the refinishing shop the belt sander is useful for sanding down tops that have been reglued, warped areas or pieces that were particularly rough to start with. Belt sanders should have a low center of gravity and a 4-in. belt. Vacuum pickup is a must. Belt sanders are heavy, powerful and quick-cutting. It is important to keep them flat to the work, which is why the 4-in. width and the low center of gravity are important. Make sure the belt size is standard, such as 4 in. by 24 in., or 4 in. by 36 in. Standard belts are more readily available and competitively priced.

The orbital sander removes stock quickly and smoothly by the circular motion of its sanding pad. In a typical shop, it probably does about 90% of the sanding. There are two popular sizes. The size that takes ⅓ of a sheet of sandpaper is best in a refinishing shop. If a cabinet shop has a belt sander, then the ⅓-sheet size is a good companion to it, otherwise the ½-sheet size is better, because it is large enough and heavy enough to cut down new wood before it is assembled. There are two popular orbit speeds, 4,000 and 10,000 rpm. The 10,000 speed doesn't work faster, but is somewhat easier to handle. Some pad sanders can be shifted from orbital to inline motion, and while this appears to be desirable, I do not find it very useful. Orbital motion cuts faster than inline motion, and in the 120 to 320-grit range will not leave swirl marks, as commonly thought. The price range of ⅓-sheet orbital sanders is from about $20 to $100. If you have extra money to spend on equipment, this is the place to spend it. Top-of-the-line sanders last longer and can be worked harder, accomplishing more in a given period of time.

The Sand-O-Flex (manufactured by Merit Abrasive Company) is useful in a refinishing shop but would be optional in a cabinet shop. It has six sanding surfaces backed by bristle brushes that contour the sandpaper to the surface being sanded. It can be attached to a ¼-in. or ⅜-in. electric drill or to a flexible shaft on an electric motor. It is one of the few methods of effectively sanding turned, carved or irregular surfaces. The Sand-O-Flex sells for less than $20, and sandpaper refills cost about $2. The sandpaper comes in coarse, medium and fine (fine is 150 grit). It is either scored or unscored, but scored is the best for irregular surfaces. The Sand-O-Flex should not be confused with tools called "flap sanders." Flap sanders are less expensive but cannot be refilled with sandpaper. I find they do not do as good a job as the Sand-O-Flex.

Small drum sanders attached to an electric drill are useful for irregular edges, such as those cut with a band saw or jigsaw. Several sizes are available. Something in the 1½-in. to 2½-in. diameter range is a useful size to have. A sanding block is a must for hand-sanding. It gives the hand something large to hold on to and apply pressure to, and it ensures that the abrasive paper is applied flat to the surface, avoiding the uneven pressure that would be applied by three or four fingers. A good sanding block uses ¼ of a sheet of sandpaper and has a rubber surface between the paper and its metal parts. Don't buy a block that must use special paper—the paper will be more expensive than cutting your own from regular sandpaper sheets.

Stationary bench sanding equipment includes belt sanders, disc sanders and drum sanders. Their usefulness is so limited in the small shop that the expense of owning them is usually not justified. The common disc sander that is attached to an electric drill can be used for fast cutting if nothing else is available, but use it with extreme care, with about 100-grit paper, and only as a preliminary step.

Modern abrasive papers allow the refinisher a quality that was not available even as recently as 50 years ago. They are somewhat confusing in their generic names and in the different methods of grading.

Silicon-carbide paper, either black or white in color, is the best available. Its features are hardness (resistance to wear), adhesion of the grit to the backing, and resistance to loading (filling up the grit with the abraded surface). Black silicon carbide is generally waterproof, for wet sanding with water or finishing liquids. There is no difference between the two when comparing equal grits of both. Silicon carbide is difficult to find but worth the effort and the price.

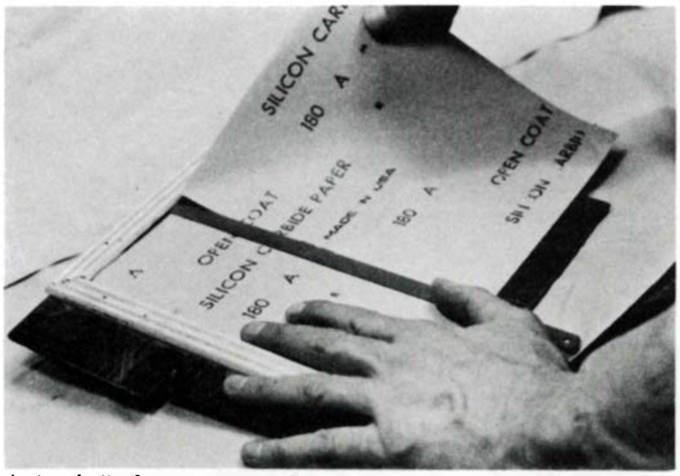
Aluminum-oxide paper, grey in color, is a good abrasive, readily available and close in quality to silicon carbide. Garnet paper, the most widely used good-quality abrasive

Ben Green, 40, works at Sears, Roebuck and Co., Chicago. He has been teaching furniture refinishing for four years.

paper, is the choice of many refinishers and cabinetmakers. Its popularity is probably due to the fact that it has been on the market longer than the other good abrasive papers. Flint, the original "sandpaper," is a waste of money and should be used only when absolutely nothing else is available.

Select an abrasive paper according to personal preference, price and availability. Papers can be purchased in large packages of 50 to 100 sheets at a considerable saving. Abrasive paper can be kept indefinitely if it is stored flat and wrapped in plastic to protect it from moisture.

Paper for orbital sanders and sanding blocks can be cut from regular sheets—cheaper than buying precut paper. A cutting jig can be constructed from a piece of Masonite or plywood, a hacksaw blade and two strips of wood.



A simple jig for cutting standard sandpaper to fit an orbital sander is made by mitering and gluing two strips of wood to a base of Masonite or plywood. The hacksaw blade is glued only under the top strip. To use, slide the paper under the blade and against the side strip. Then rip, with the thumb holding the blade down.

Sandpaper grading

The most common gradings on sandpaper package labels are "fine," "medium," and "coarse," and degrees of these, such as "very fine." These terms are practically useless to the serious finisher, because their meaning is variable. Two accurate methods of describing sandpaper grading are the use of aughts and grit numbers. High grit numbers, such as 400, and many aughts, such as 10/0, represent very fine abrasive paper. Low grit numbers, such as 80, and few aughts, such as 2/0, represent coarse abrasive paper. At least one of these grading methods will be printed on the backing of most abrasive paper, although it may be necessary to open the package to find the grade.

Grit #		Aughts
400 320	Very fine	10/0 9/0
280 240 220	Fine	8/0 7/0 6/0
180 150 120	Medium	5/0 4/0 3/0
100 80	Coarse	2/0 1/0
60 50	Very coarse	1/2 1

Sanding is a critical step in the total finishing/refinishing process. When refinishing, the proper application of paint and varnish remover may leave the work so clean and smooth that it is tempting to proceed directly to the final finish. Don't. When building a new piece, the wood may look so nice that the maker is tempted to skip sanding. Again, don't. Every piece of furniture that is being refinished or finished for the first time can be vastly improved by a good sanding.

The first rule is to sand with the grain. You must resist the natural tendency of the arm to work in an arc. Position the piece so that the grain of the wood runs with the body and not opposite it. On most jobs, sanding should start with 120-grit (3/0) abrasive paper. If the piece is already quite smooth, start with a finer grit, such as 150. On the other hand, if the piece is especially rough, begin with a coarser grit, such as 100. Coarse grit papers should always be used sparingly and carefully because the scratches they make are too deep and hard to remove at later stages.

All areas of the piece that are to be finished should receive the same amount of sanding. The initial sanding should correct any bad spots, such as burns or gouges that can't be filled, and when it is done all areas of the piece should be the same color and smoothness. Any crack filler that has been used in repairs should have been smoothed out.This step accomplishes most of the work and the next two steps will only lighten the color and smooth out the surface slightly.

Certain areas, such as depressions, warped boards and tool burns, will require the application of more pressure. In effect, these areas will become "dished out," but only slightly, and will not be noticeable unless closely inspected.

After initial sanding, the piece must be sanded twice more with finer paper. The second sanding should use 180-grit paper. Final sanding should use 280-grit paper or finer. These are suggested grits—use what is available. Don't skip the intermediate sanding; in particular, don't go from coarse paper to very fine without an intermediate paper. Sanding removes imperfections but if an intermediate grit is skipped, then the big scratches left by initial sanding will not be removed and will show through the finish. This is true for sanding by hand or with an orbital sander.

When trying to judge if a piece has been sanded enough, feel it as well as look at it. Stain and finish don't cover up a poor sanding job. In fact, they tend to amplify imperfections such as swirls left by an orbital sander.

Ideally, the final sanding with the finest paper should be done just before applying the first coat of finish or stain. In any case, the time between the final sanding and the first coat of finish or stain should not exceed 24 hours. It is too easy to soil or damage a project, and raw, unsealed wood can pick up moisture from the air. It may appear perfect after standing a week after the final sanding, but stain or finish will often show up dark areas, or an edge that might have been slightly bruised will show up dark. If some time has passed since the final sanding, a quick touch-up with the final paper will prevent a serious problem later.

Wet-sanding, feathering the grain after the final sanding and then sanding again, is an old but commonly used technique. Many people think this is the best way to get a smooth finish, but I think that modern abrasive papers and a good orbital sander have eliminated the need for it. To wet-sand, the wood should be slightly dampened with a rag or sponge after the final sanding. After the wood has dried, the grain will be slightly raised; these "feathers" are then cut off with fine paper. This step is necessary if the wood is going to be stained with a water-based stain, but not if you use modern penetrating oil or non-grain-raising stains.

Power equipment can speed up the sanding of any piece and make it a great deal easier. Most of the principles that apply to hand-sanding also apply to power sanding, but always remember that power-sanding cuts away more material than hand-sanding does. The use of coarse papers should therefore be restricted with power sanders. Never sand cross-grain with a power sander, and take care to avoid rounding off an edge, corner or the raised part of a carving.

Many pieces can be completely sanded with an orbital sander. As with hand-sanding, the starting grit should be 120, the intermediate 180 and the finish 280 or finer. There is no reason to hand-sand over an area that has been properly sanded with an orbital sander. Always move the orbital sander with the grain of the wood, in a natural swirling motion, allowing its weight and its motion to do the work. The sander can be held on areas that are particularly rough or discolored because it will cut even when standing still.

Belt sanding does not eliminate any hand or orbital sanding steps, but is only preliminary to initial sanding. Use nothing coarser than an 80 or 100-grit belt. If the belt sander has both a low and high speed, use the low speed.

Sanding new wood before assembly is advantageous because the parts can be worked on flat before they are connected. They are easier to get to and there are no inside corners. Plywood is generally smooth enough not to need any sanding before assembly. Regular mill stock should be sanded with a belt sander and a 100-grit belt, followed by an orbital sander with 120 or 150-grit paper. At this point paper finer than 150 should not be used, because assembling, handling and storing will soil or mar the piece to the point where the final sanding would only have to be repeated.

Turnings should be sanded to 280-grit or finer while still chucked in the lathe. Even though some sanding may have to be repeated after the piece is assembled, these pieces can be sanded effectively only while they are rotating in the lathe.

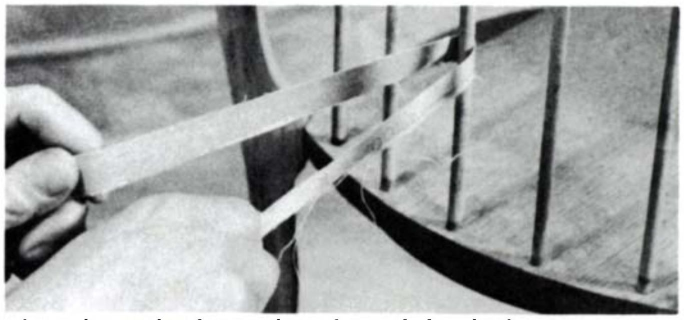
After the project is completely assembled, touch-up sanding with the initial paper will have to be done. Glue joints should be carefully sanded with coarse paper, followed by intermediate and fine sanding.

Irregular surfaces are difficult to sand because most power sanding equipment conforms only to a flat surface. This is a problem for the refinisher, because old pieces usually have intricate carving, spindles or applied decoration. Many times these irregular areas will stand out after the piece is finished, because they were not sanded as well as the flat surfaces. Start with an extra good job of cleaning with paint and varnish remover. After the top coats of paint or varnish have been removed, the paint remover should be applied again and carefully worked into corners and crevices with a pointed stick. After the last coat of paint remover has been removed with a coarse rag or fine steel wool, the surface should be scrubbed with a dry scrub brush. If a water-wash paint remover has been used, these areas can be scrubbed with a brush and soap and water. The grain will be raised but getting the wood completely clean is worth it.

Whenever water is used on wood, it should be immediately and thoroughly dried, especially in cracks or crevices. Allow the piece to dry overnight before starting to sand.

Molded edges can be sanded with a wadded-up piece of used sandpaper. Start with 120 grit, follow with 180 grit, and finish with dry 4/0 steel wool.

Sand spindles by twisting some wadded sandpaper around them, or by twisting the paper with one hand and the turning with the other.



Places that are hard to reach can be sanded with a long, narrow strip of sandpaper worked like a shoeshine cloth.

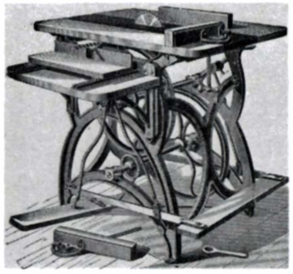
The sanding of carved surfaces, applied decorations, pressed wood designs or intricately molded edges is best started by wadding up a used piece of 120-grit paper. Use a gentle scrubbing motion to work the wadded sandpaper into the intricacies of the design, but take care not to rub off the sharp corners that give the design its character. If deep or delicate areas of the design cannot be reached with the wadded sandpaper, they should be gently scraped with a small knife blade. Then follow with a wadded, used piece of 180-grit paper. The final step should be a gentle scrubbing with dry 4/0 steel wool.

Turnings can also be sanded with a wadded piece of sandpaper that is wrapped around the spindle. Either twist the paper around the turning, or if the piece is apart, twist the paper with one hand and the turning with the other. Follow with 180-grit paper and finish with dry 4/0 steel wool. Closely spaced spindles can be sanded with a long, narrow strip of sandpaper that is wrapped around the turning and worked like a shoeshine cloth. These narrow strips can be cut from paper-backed abrasive paper, but emery cloth or used sander belts are much stronger. The edges of the narrow strips are very sharp and can make a mark in the turning if they are not moved carefully. It may be necessary to cut strips of varying widths to reach all surfaces of the turning. This will be cross-grain sanding but it compares to the way such pieces were sanded while still on the lathe. The final sanding should be with a wadded piece of 280-grit paper, going with the grain.

No matter how good a building project or how fine an antique, a poor job of finishing results in only mediocre projects and so-so antiques. The proper equipment, good abrasive paper and a consistent approach to sanding will provide the basis for a fine finish. □

Used Machinery
Where to start looking

by David Landen



Hand and foot power circular saw, Carpentry and Building, *1889.*

For a woodworker setting up shop, used machinery is often the only choice. If one knows how to find and assess it, one can buy used machinery for half the price of new, and for considerably less if one is willing to undertake serious repair work. On the other hand, industrial machines usually require three-phase electric power. They take time to find and more time and money to fix, and they eat floor space in the shop. And it is easy to make serious mistakes.

Without three-phase power, one is limited to small machines with small motors in the 2 to 3-hp range, and the price of used single-phase equipment is almost as high as new because so many hobbyists are competing for it. Rewiring for three-phase power is expensive or impossible, unless the building is in an industrial area. Another solution is to purchase a device that converts single-phase current to three-phase. The cheapest phase converters ($100 to $150) will start and run one large machine at about 80% efficiency; more expensive rotary models (about $500) can handle several machines at once at close to full efficiency.

To illustrate the possibilities, a man I know in North Carolina found a ripsaw, a planer and a variety saw abandoned in a pasture. He got them running and used them for several years to produce furniture, before selling them for more than the reconditioning had cost him. On the other hand, I once bought a used 36-in. band saw. It is an impressive machine, 8 ft. tall with a huge milled table, 14-in. depth of cut, 32-in. throat, and a 5-hp motor. Moving it required a forklift, a front-end loader and a flatbed trailer. I replaced the bearings and turned a new drive shaft to get it going, and now I use it perhaps four times a year to rip a badly cupped board. Sometimes it cuts firewood. The rest of the time it sits covered with dust, crowding my shop. I'd sell it or even give it away, but I would have to tear out a wall to move it.

Some sources for used machinery:

Want ads. The daily newspaper is a good place to start looking, but frustrating since woodworking equipment is often buried in long lists of other items, or else is mislabeled and inaccurately described. Sometimes more things are for sale than are listed. Time-consuming, but can be rewarding.

Auctions. Trade journals, such as *Furniture Design and Manufacturing* (220 S. Riverside Plaza, Chicago, Ill. 60606; single copy, $1.25) and *National Hardwood Magazine* (4077 Viscount, Memphis, Tenn. 38118; single copy, $1.00), are the best places to find machinery auctions. Internal Revenue Service auctions are publicized on courthouse bulletin boards and by notes nailed to the door at the site. Most auctioneers will send periodic notices of sale if asked by letter.

Obviously, auctions of the equipment of large cabinet shops, mill shops, furniture factories and lumberyards will be worthwhile. But any large industrial auction, farm sale or estate sale is a good bet. In fact, the more remote from woodworking the business, the cheaper the machinery is likely to be, because other buyers come for the primary offerings.

Weekend auctions and flea markets generally don't have much woodworking equipment, and they are attended by amateurs who will bid close to the new price. Midweek auctions of industrial machinery are attended by professional buyers purchasing for factories or resale. Unfortunately, there is no guarantee that auctioned machinery will be anything but difficult to move back to the shop. One must locate all the fences, attachments, cutters, pulleys, sharpeners and guards, and make sure they are included in the sale.

Government surplus. Federal, state and local governments all dispose of used equipment. Some agencies publish bid lists, some sell by lots, some through surplus agencies. For federal surplus, contact the General Services Administration in Washington, D.C., or write your congressman. Most items are sold in large lots via incredibly intricate procedures, but the equipment often is nearly new.

The state-level arrangement is everywhere different, and can be tracked down by telephone to the state capitol; one might also ask highway maintenance men, junkyard owners and used equipment dealers about how the stuff comes to the market. In many states it is possible to visit the surplus depots, inspect the machines and make bids.

The best local source is the school system, which disposes of used machinery through state or county agencies. School vocational shops often replace everything at regular intervals, for accounting reasons or to meet new safety regulations, and their machines can be well worth hunting up.

Industrial equipment dealers. There are companies everywhere that deal in new and used industrial woodworking equipment. Most of it is simply too large for cabinetmakers: gang ripsaws, multiple-head planers, plywood peelers. But such firms usually have such useful items as 16-in. jointers, 24 and 30-in. thickness planers, stroke sanders, band saws and table saws. Prices of course depend on condition, but smaller industrial machines are usually competitive with used cabinet-shop equipment. And they are heavy and durable.

A helpful trade journal is the *Classified Exchange* (Box 30123, Memphis, Tenn. 38130; $10 a year). More than 100 dealers in 27 states advertised in one recent issue, and their ads give a good idea of available items and their going price.

Dealers are generally straightforward about the condition of their machines and usually will offer a warranty if they have rebuilt a machine. Most of the other sources discussed here sell the stuff as is, and let the buyer beware. In general, if the tables and other milled surfaces are true, and castings that house the bearings are sound, one can replace most other parts at reasonable cost, providing the manufacturer is still in business. If not, then having parts made is very expensive. □

David Landen, of Chapel Hill, N.C., has equipped his cabinet shop with used machinery.

BRUCE HOADLEY

Knife checks in veneer—how they are formed, how to cope with them

When considering veneer and its quality, we usually think only of characteristics such as species, thickness and figure, or defects such as knots, stain or pitch streaks. Beyond that, veneer is veneer. But of most serious concern should be knife checks. These are parallel-to-grain fracture planes produced in the veneer at the time of its manufacture and which may go unnoticed, only to cause agonizing problems later. Because they are probably the most common cause of checks in the finished surfaces of veneered work, the woodworker should understand what these knife checks are, how they are formed, how to detect them and how to cope with them.

Sawn veneer does not have these checks, but today most veneer is knife-cut by peeling (rotary cutting) or slicing. In either method, the basic cutting action is similar. A knife sharpened to an angle approaching 0° would distort the wood structure the least, but would, of course, break too easily. Veneer-cutting knives are therefore sharpened to an angle of about 21°—a compromise between a small angle that would minimize distortion of the wood structure and a blunt angle that would minimize knife breakage. This means that as the knife separates the veneer from the flitch, the separated layer of wood is severely bent, and stresses build up in the region near the knife edge. When the strength of the wood is exceeded, the stress is relieved by failure, and the plane of failure thus formed is called a knife check, or lathe check. This bending and breaking cycle is repeated as cutting continues, so each layer of veneer has checks at fairly regular intervals.

The side of the veneer that was against the knife and has knife checks penetrating into its surface is called the loose side, or open face. The other side is called the tight side, or closed face.

To prevent knife checks, lathes and slicers are equipped with a pressure bar or nosebar, a solid bar or roller that bears against the veneer as it is being cut. Its pressure holds the cell structure together in the region where checks usually develop. Too much pressure crushes the cell structure of the veneer, so there is a theoretical optimum opening between the knife and the pressure bar that produces the highest-quality veneer. Experience has shown that checks can be minimized or eliminated when the distance between the pressure bar and the knife is 80% to 90% of the thickness of the cut.

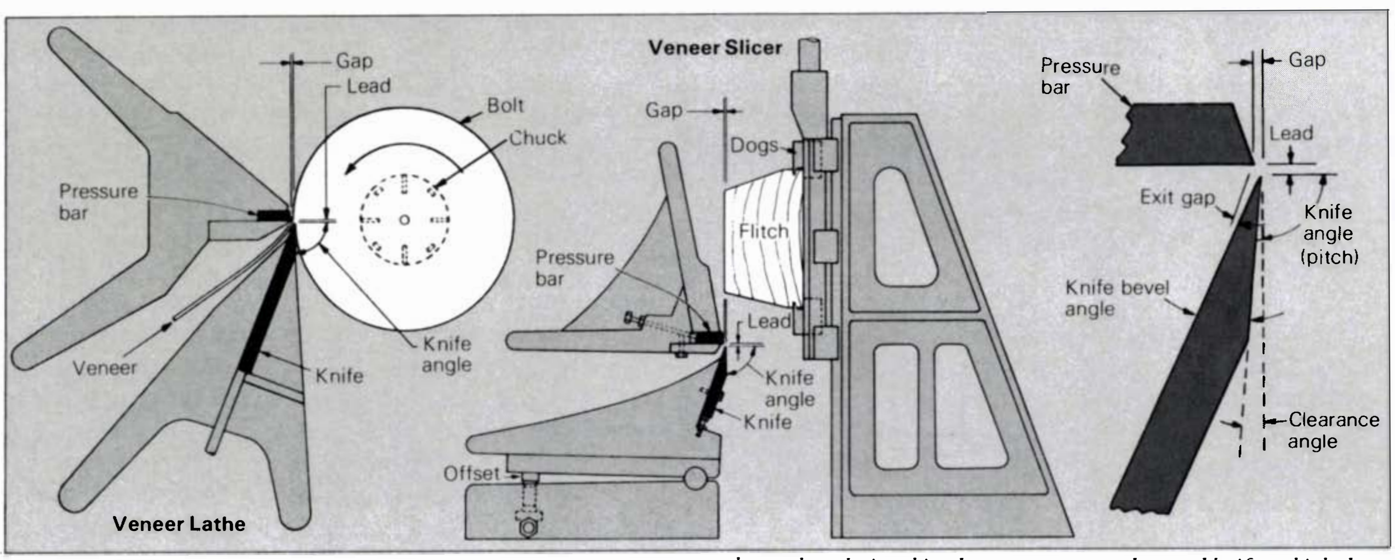
The terms tightness and looseness refer to the relative depth of knife checks. In producing veneer without nosebar pressure, tightness is improved by cutting lower-density species of wood, by heating the wood, and by thin cuts.

Anatomical features of the species being cut are also related to checking. If structural planes of weakness—such as the large rays of oak or the earlywood layer in ring-porous hardwoods—coincide with the probable plane of check formation, the checks will be worse. Diffuse-porous hardwoods with fine, well-distributed rays are more likely to yield tight, uniform veneer.

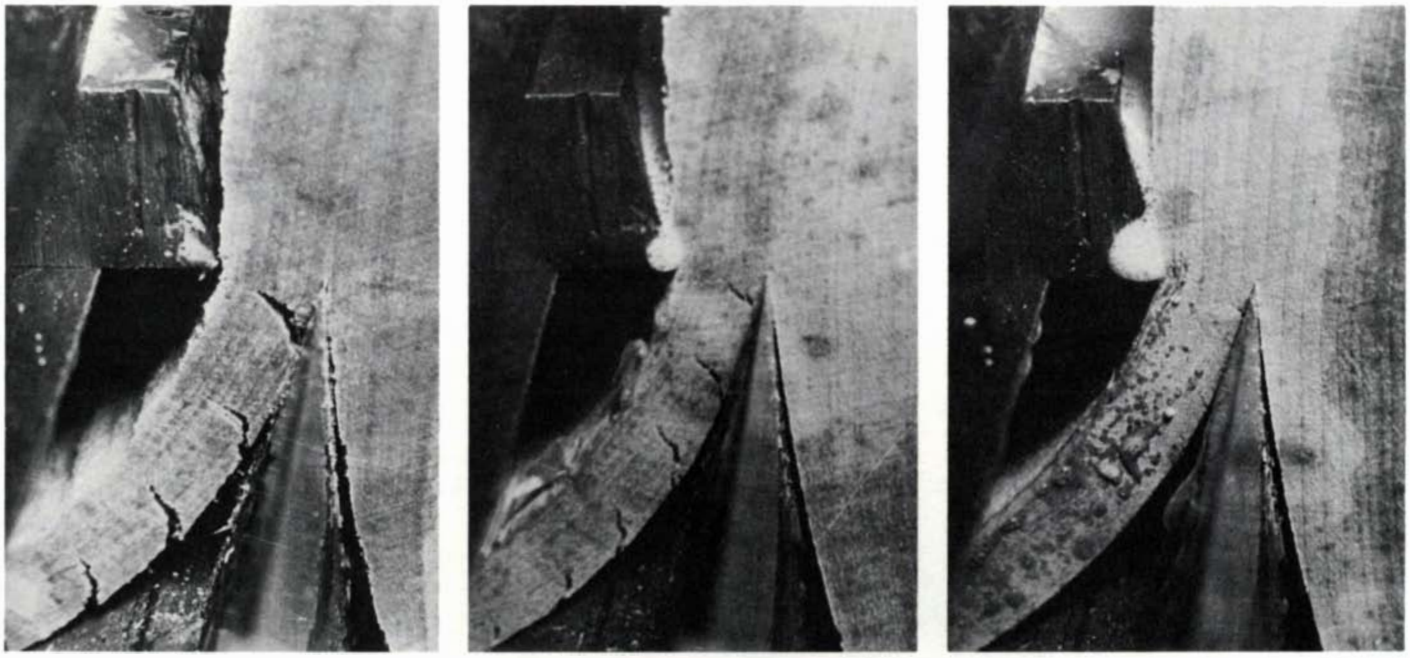
The tightness of veneer can be assessed in a number of ways. Surface roughness or corrugation (especially of the loose side) is commonly associated with checking. Veneer having any suggestion of a washboard surface is probably loosely cut.

Manually flexing the veneer will help you see the checks. In addition, the veneer will feel stiffer when flexed to close the checks, but will feel more limp when the checks are flexed open. Tightly cut veneer will flex about as easily both ways, so if you can't tell, it's probably cut well.

In some woodworking applications, it is critical to know the



Softwoods for plywood are rotary-cut with a veneer lathe, left, while hardwood veneers are usually sliced, center. The diagram at right shows the relationships between pressure bar and knife, which determine the quality of the veneer.

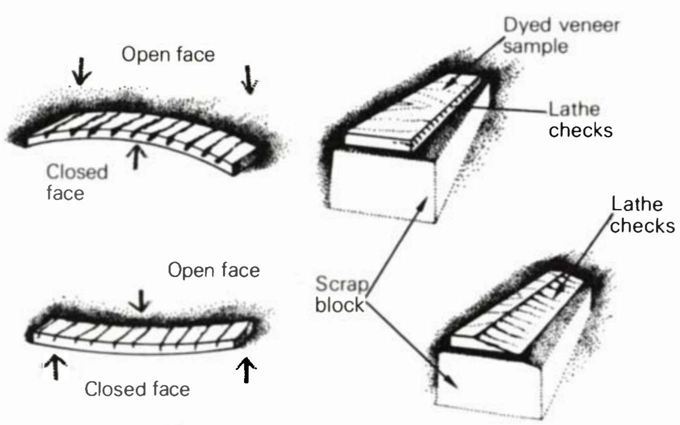


With nosebar retracted, left, veneer checks seriously as it curls over the knife. A little nosebar pressure, center, reduces the amount of checking. When the nosebar pressure approaches 15% to 20% of the veneer thickness, right, checks are nearly eliminated.

actual depth of the checks. This can be determined by staining with an alcohol or spirit solution of dye such as machinists' layout dye, then beveling the veneer. Cut sample strips of veneer from the ends of sheets and stain them liberally on both sides, keeping the stain away from end grain. Allow to dry thoroughly, then glue or cement the veneer onto blocks of scrap wood. When the glue is set, bevel the veneer with a fine sander disc, or with a sharp chisel or knife. The relative depth of the checks will be apparent across the bevel.

The consequences of knife checks should be quite obvious. The most common problem is parallel-to-grain cracks in the finish on veneered surfaces—nearly always traceable to knife checks. This problem is especially aggravating because it is usually a delayed reaction, appearing months or years after the piece is finished. A surface may be flawless at completion, but the normal shrinking and swelling of the wood in response to seasonal humidity fluctuation cause hidden knife checks to migrate to the surface and through the finish itself.

This problem is second only to delamination as a cause of the bad reputation veneered products have undeservedly acquired. One frequently sees it when softwood structural plywood such as Douglas fir is used for finished or painted surfaces. Structural plywood is designed to carry stresses parallel to the grain direction of its plies, and this capability is little affected by knife checks. Apparently, little serious effort is made to control tightness of veneer in manufacturing commercial softwood plywood. Plywood manufactured with surfaces of medium or high-density impregnated paper overlay (designated M.D.O. and H.D.O.) is best where smooth painted surfaces are needed. Large lumberyards usually stock M.D.O. plywood, which is routinely used for outdoor signs and similar products.



Loosely cut veneer feels more limp when the checks are flexed open, stiffer when the checks are closed. To gauge check depth, dye both sides of a sample and glue it to scrap wood. Bevel the veneer and compare the dye penetration to the bevel length.

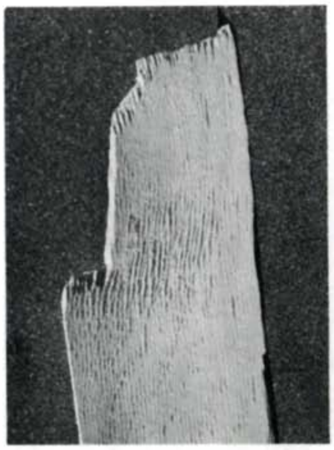
End-grain plywood surfaces may also reveal finish defects caused by knife checks. This is especially common when moisture loss results in excessive shrinkage stress.

Another visual effect of knife checks is bleed-through of glue, which shows up as a series of evenly spaced lines on the veneered surface. This is especially apparent in light-colored woods such as maple or birch sapwood.

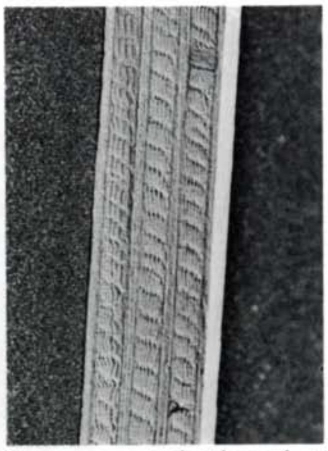
In woodworking, veneer should routinely be inspected for tightness. Checks penetrating no more than 25% of the thickness of the veneer can be tolerated under most circumstances. When laying up veneer, spread the loose side with glue. With luck, the glue will penetrate the checks and perhaps glue them closed. It may help to lay the veneer over a slightly convex surface so the checks will be open to the glue. (This will also ensure that the tight side is the exposed face on surface plies.) Care must then be taken not to sand through the tight side of the veneer. I have seen countless situations where veneer surfaces have been sanded right down to expose the knife checks—and the glue in them.

Bookmatched surfaces are a predicament, because the veneers must be placed with alternate open and closed faces up. In such cases, it is important to have relatively tight veneer to ensure uniformity. You may have seen bookmatched patterns in which the finish quality alternated with each piece of veneer, a consequence of knife checks.

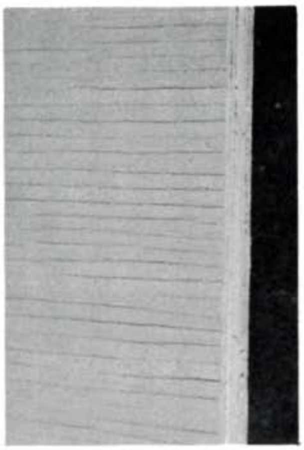
Lathe-check troubles are not limited to visual surface effects. Critical mechanical problems may also result. Most typical is some form of rolling shear developed when plywood is stressed in the form of a beam over a short span, so that high

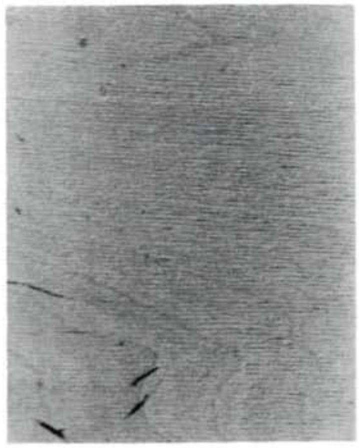


This maple veneer is so loose that the surface is corrugated.



Core veneers in fir plywood are usually checked.





Left, checks broke through paint on fir plywood in a year. Baltic-birch panel, right, was smooth when finished with Deft two years ago.

levels of horizontal shear are developed. If the shear coincides with the direction of stress that opens the checks, rolling shear failure may result. The edges of plywood panels "broomed" over in this manner are often misinterpreted as "delamination," which erroneously implies glue failure.

I do not have any specific recommendations for finishing veneer that has knife checks. I think a finish that would provide the best moisture barrier and thus reduce dimensional variation would be best. Also, if the checks were on the surface, any finish that would seal them shut would help. A finish like linseed oil would have little to offer. A low-viscosity lacquer or varnish in multiple coats might work best.

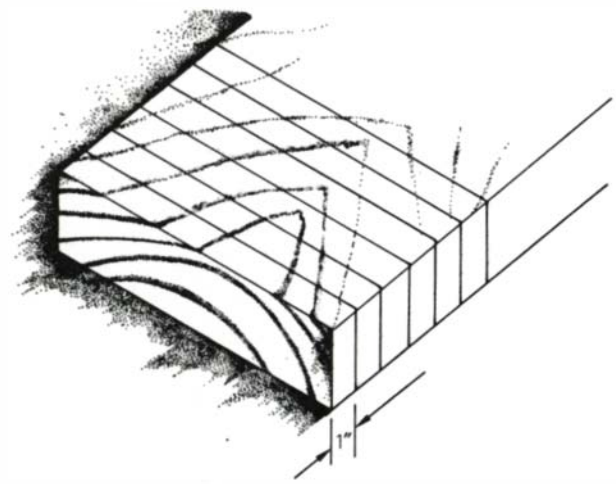
On the whole, most hardwood cabinet veneer produced by reputable mills is cut with adequate production quality control to ensure reasonable tightness. But beware of "clearance" sales or "closeouts," because loose veneer is hardly a bargain at any price. The best guideline is to buy veneer from reputable dealers and know how to detect, and cope with, the occasional loose veneer. □

Bruce Hoadley is professor of wood science and technology at the University of Massachusetts, Amherst. He wrote his doctoral dissertation on veneer cutting.

EDITOR'S NOTE: Impregnated paper overlay for plywood is available in roll form, usually in 52-in. widths. It has no grain direction and is often glued down as crossbanding when veneering over plywood or chipboard. One brand is "Yorkite," manufactured by NVF Co. of Yorkland, Del.

This simple cutting experiment will help you understand how knife checks develop and affect veneer.

1 *Crosscut four to six 1-in. sections from the end of a plank of medium or low-density wood with even grain (e.g., eastern white pine, basswood).*

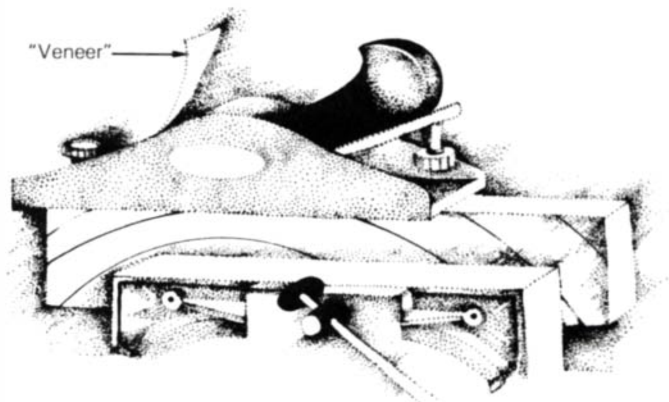


2 *Immerse the wood in water for several days. (The idea is to bring the wood back to the fiber-saturation point. If you start with green wood, the soaking is unnecessary.)*

3 *When ready to cut, heat half the pieces to near boiling while still immersed. Allow at least an hour for the pieces to heat through.*

4 *Clamp a cold piece in a wood vise, side grain up.*

5 *Using a block plane with the throat opened up and the iron set for a thick cut (1/16 in.), plane across the grain a ribbon of wood from the 1-in. face. Your "shaving" will be a strip of veneer.*



In cutting, you will probably feel the regular clickety feeling of the cyclic knife checking. Since your plane does not have a nosebar, your "veneer" will probably have lots of knife checks. Experiment with different thicknesses of cut and with the hot pieces. Notice how much tighter the veneer is when you cut it thinner. Or when hot wood is cut. Can you readily recognize the "open" and "closed" faces in every strip?

EDITOR'S NOTEBOOK

Of tenons, planes and presidential desks

by John Kelsey

Conducting a magazine that attempts to be a forum for its readers often produces interesting material that somehow never finds its way into print. For example, almost two years ago cabinetmaker Michael Lynch of San Francisco offered a hose-clamp compression joint he finds useful. Lynch turns the end of a spindle a couple of thousandths of an inch larger than the hole it will fit into. "Then the ends of the spindles are slightly reduced in diameter by slipping a worm clamp (used to tighten hoses onto fittings in car engines) over it and screwing the gear to compress the wood fibers." He figures the tenon remains compressed until it takes on moisture from the glue in the mortise, then expands to its original size, locking the joint tightly together.

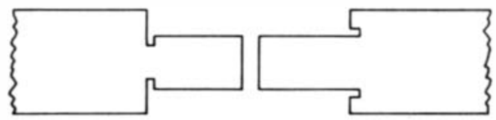
Old-time chairmakers used a similar trick, by drying tenoned rungs and leaving mortised posts somewhat green. If the joint was tight at assembly, the rung would quickly take on moisture from the post and expand. Then the two would shrink together to equilibrium with the atmosphere. Lynch said that industry commonly squeezes round tenons of uniformly dry wood to get an interference fit, whence his idea. I knew that Bruce Hoadley at the University of Massachusetts had worked on industry's problem, so I sent Lynch's remarks to him for comment.

Hoadley, direct as usual, bought a handful of hose clamps and began tightening them around tenons. Trouble was, they all broke before his instruments could measure any compression. He agrees that such a joint will work in principle, but doesn't think enough pressure can be generated by a 39¢ clamp. A further difficulty is the phenomenon of "compression set." Up to a point, deformed wood springs back when you add water. After that point, the fibers suffer permanent damage and never return to their original size, which is why the handle of a hammer, left out in the rain, will swell tightly in the head, then become forever loose when the wood dries. The powerful industrial clamps are calibrated to avoid this.

So we agreed to disagree: Hoadley can't measure any compression before the clamp breaks, yet Lynch's method works for Lynch. He adds, "I have been around long enough to know that the chairs hold up."

Another tip about tenons came from correspondence earlier this year with a reader in upstate New York. Like many, he saws his tenons fat so they can be trimmed to fit their mortises. He'd found it difficult to get a square corner where the cheek and shoulder come together. His answer was to set the table saw a little deep when cutting the shoulder, leaving a shallow kerf in the cheek, as in the left drawing.

The trouble with this trick is that it severs the wood fibers at the surface of the tenon cheek from the main body of wood. Yet those fibers, with glue, are what keep the tenon in the mortise. Nevertheless, I sent the letter along to Andy Marlow in York, Pa., to see what he could add, and got a surprise: "Make the clearance cut with the tenon surface instead of against it. This method retains maximum gluing surface and is normal procedure in my shop." The drawing is at right, the clearance cuts exaggerated for clarity.



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While President Carter was in Germany during July, cabinetmaker Robert C. Whitley took his place in the Oval Office. Whitley, of Bucks County, Pa., who is conservator at Independence Hall and has reproduced many pieces of historic American furniture, was at the White House to measure, photograph and draw the President's desk. It's big—7 ft. by 5 ft.—and very ornate. It was made at Queen Victoria's order with English oak timbers salvaged from the HMS Resolute, which had been lost in the ice attempting to find the Northwest Passage. Victoria gave the desk to the American people in gratitude for the return of the wrecked ship. Several presidents used it, then it was consigned to basement storage, where Jacqueline Kennedy rediscovered it and brought it back to light. Now the Kennedy family wants an exact replica for the JFK library being built near Boston, and Whitley has the commission.

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When I wrote in Summer '78 about grinding the center of a gouge edge back of the corners, I thought I had a hot tip. Several readers, however, wrote to point out that the trick is thoroughly explained by Alexander Weygers in his book *The Making of Tools* (Van Nostrand Reinhold, 1973). Weygers sees the edge of the gouge as falling on the surface of a cylinder when it is new, and on the surface of a cone when it is correctly ground. Robert Katz of San Diego, Calif., adds that violin-makers always sharpen their gouges so that the outer edges cut the wood in advance of the center. "By sharpening this way it is possible to cut wood cleanly in any direction, even highly figured curly maple," Katz says.

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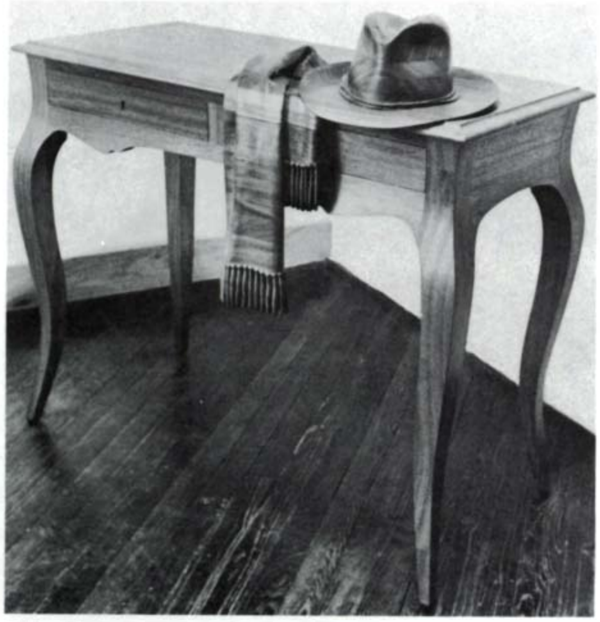
A couple of generations ago, all manner of special-purpose planes were in production and readily available. But many of the old companies are long out of business. Survivors like Stanley have dropped most of their specialty tools to concentrate on industrial equipment and mass-market tools for the weekend handyman. Stanley says this is economic necessity, demand just isn't high enough.

But now there is a new market among the growing numbers of serious amateur woodworkers. It is still small by Stanley's standards, but plenty big enough to support lavish mail-order tool catalogs and the small manufacturers who supply them. More than that, this new market has encour-

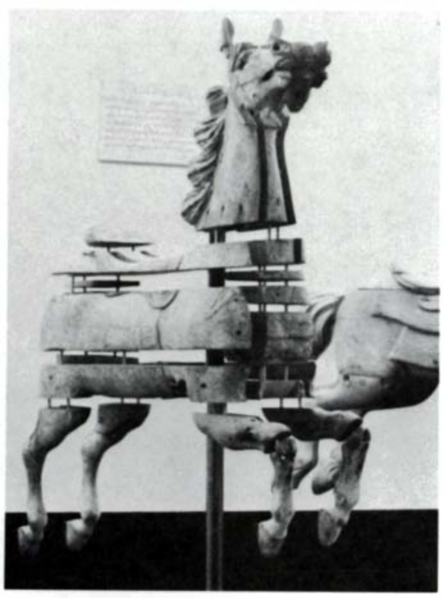


This table is from a group of recent furniture called "illusions," made by Wendell Castle of Scottsville, N.Y., and shown last spring in Manhattan. Not only does the unwary person double-take upon realizing that the hat and scarf are stacked wood, he also must wonder whether it's even a table. The classical legs have a horizontal glue line about six inches off the floor, a relic of the stacking process. The illusions series includes an umbrella stand with umbrella (Summer '78), a tall coatrack with sheepskin coat, a chair with a jacket draped over its back, a table with a solid mahogany cloth. The table with hat and scarf is doussie wood, and it's now at Richard Kagan's gallery, 326 South St., Philadelphia. It costs $11,000.

The wholesale-retail craft fair held each June at Rhinebeck, N.Y., is probably the largest in the country. It attracts top-flight work and first-rate customers. Woodworkers were well represented among the 500 exhibitors, and the level of work shown was considerably higher than two years ago, the last time we attended. Besides the usual run of production turning and carving for the gift-shop trade, quite a few furniture designers and sculptors took space to show a few fine pieces, hoping to make a gallery connection or land a rich commission. It's a worthwhile pilgrimage for any woodworker, a chance to see excellent work and to meet the people who make it.

Craft Enterprises (an American Crafts Council subsidiary), gives a prize to the best booth. This year it went to Mark and Melvin Lindquist (below), turners of spalted wood. Taste and class, and the crowd loved it.

Jane MacKenzie, of Glen Echo, Md., did well at Rhinebeck with a line of animal furniture—rocking rams, lion benches, alligator tables—and now has to decide whether to remain a small partnership or to find larger quarters and hire employees. The kangaroo high chair is 51 in. tall, pine and red oak, and sells for $250.



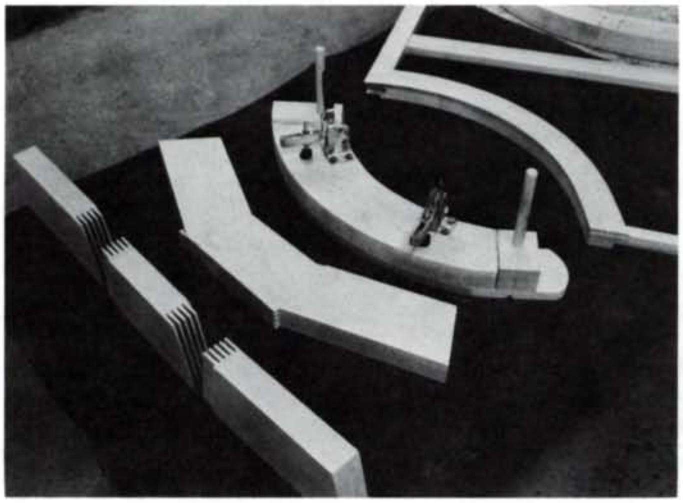
The heyday of the merry-go-round began in the Gay Nineties and ended with the Great Depression. Its legacy is some of the finest carving in America, now highly prized by collectors. A number of readers have written to wonder how a carousel animal is made—this photo (left) contains the answer: stacked lamination. It was shown this summer in Monterey, Calif., along with several dozen marvelous steeds. Its permanent home is the Redbug Workshop, carousel restorers, at 3024 Ashby Ave., Berkeley, Calif.

Britain's Woodworker *magazine sponsors an annual competition and show at Wembley, where Ian Barrand, an apprentice church-carver, took the carving prize with his Biblical Group (right). The photo was taken by reader Harold C. King of Croyden, England, who receives $25 for sending it to us. You will too if a photo you take at a local show is published in this space.*

aged a number of independent toolmakers to reproduce some good old tools of yore.

One is Ken Wisner, a mechanical engineer and precision machinist who is reproducing and refining old planes from the Stanley catalogs, mostly by hand. He makes a cast-bronze edge-trimming block plane, similar to the old Stanley No. 95. Its purpose is to pare an edge precisely square to the face of a board. It has a right-angled sole, like angle iron, one side of which rides the face of the board while the other bears on the edge to be planed. The blade sits at a very low angle and encounters the wood aslant, thus making a crisp, shearing cut. Wisner also makes a universal beader like Stanley No. 66, a right-angle chisel for squaring the ends of mortises, and plans to introduce a heavy, low-angle plane with adjustable throat for difficult woods, like Stanley No. 9. His address is 259 Whaley St., Freeport, N.Y. 11520.

It's also possible to buy parts and irons for many old planes including Stanley Nos. 45 and 55 universal molding planes. Bart Slutsky of the Tool Works has made it his business to buy up residual hardware stocks and discontinued lines from the dealers around Manhattan and has built up a reasonable inventory of old but never used tools and parts. He also sells new tools and some used planes. His address is 76 9th Ave., Suite M2, New York, N.Y. 10011. □



Jigs that made the woody's parts (top) would fill the finished car. Wheel-well apron (center) is shaped from square stock. Rebuilt Model A has chassis by Ford, body by Kariher.

Wooden Wagon

In 1930 and '31, the Ford factories cranked out several million of the Model *A*. About 2,700 of them were station wagons with wooden bodies—the original "woody."

Because the car industry drew heavily on the traditions of carriages and wagons, the Model *A* was not unique. A few Detroit models had steel-clad wooden frames until the 1950s; luxury cars have always used wood lavishly inside and out. One of the most beautiful cars ever made was the Hispano-Suiza roadster with tulipwood body, produced in a limited edition from 1910 to 1925 for King Alfonso XIII of Spain.

In 1976 and '77, in Rochester, N.Y., D. Hunter Kariher, a woodworker, and Daniel Colombo, a collector of antique cars, took two of Ford's woodies apart. Kariher and his coworkers at Liberty Hill Woodworks made careful measurements and drawings of all 700 parts, then designed and made 250 different jigs for the table saw, shaper and router. They made two whole cars and the parts for seven more, all as close to the Ford original as they could manage.

Most of the body is hard maple, with red oak floor boards, basswood roof slats and birch plywood panels. The curved parts are assembled from solid stock, with machine-cut finger joints. The other joinery is mainly mortise and tenon. Bolts connect the various subassemblies to metal corner plates and hold the body on its chassis. For a weatherproof finish, Kariher hot-sprayed each part with modern marine varnish.

Kariher sold his drawings, parts and jigs to Colombo earlier this year, and Colombo has put the woody into limited production. A new body on a rebuilt Model *A* chassis is $19,500. Although out of the Model *A* trade, Kariher is ready to make cars out of wood for collectors or for the custom-car circuit, one of a kind and one at a time.