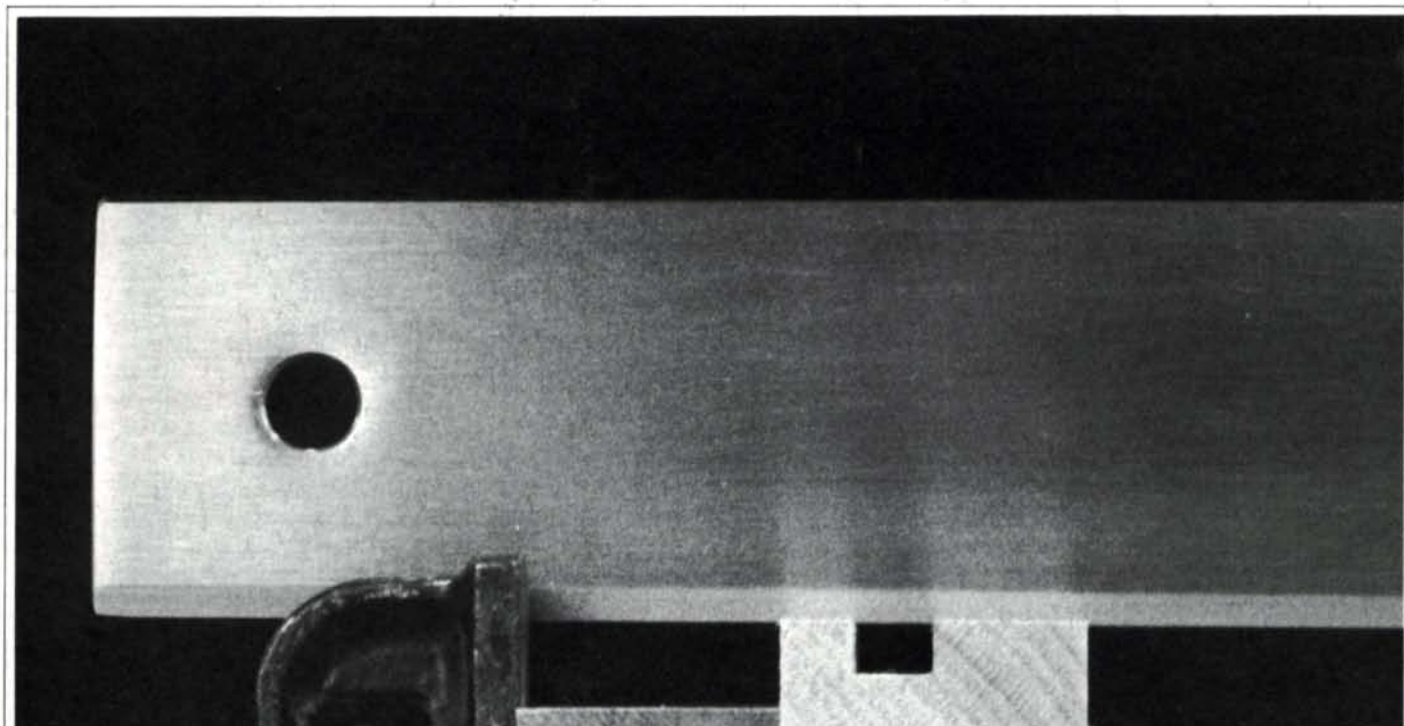
NOVEMBER/DECEMBER 1981, NO. 31, $3.00

# Fine WoodWorking



*Gluing Up*

# Fine WoodWorking

NOVEMBER/DECEMBER 1981, NUMBER 31



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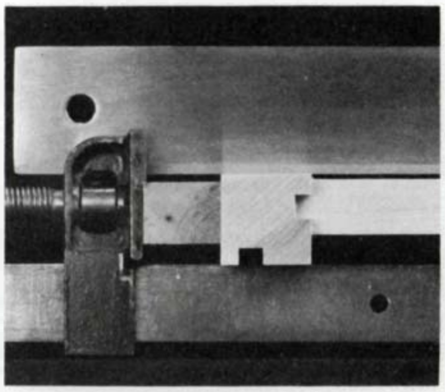

*Cover: An accurate glue-up requires a sturdy bar-clamp, plus a pressure block of appropriate size and in the right place to direct the clamp's pressure to the shoulders of the joint. The straightedge shows that the face side of this leg and of its mate are in the same plane. Thus the next stage of the assembly is likely to go together squarely. In the small photo above, the straight-edge is gauging the outside of the leg, not the inside face where alignment matters. The next stage of assembly is liable to go out of square, with no remedy. This is why a careful dry-clamping is worth the time and trouble. More about gluing up on p. 86.*




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# Letters

I'm writing to commend you for your recent articles comparing products by brand name (sharpening equipment and the article on Rockwell and Powermatic, *FWW* #30, Sept. '81). I find the experiences of other workers with their equipment to be very helpful, and I would like to urge you to continue comparative articles such as these. I especially liked the fact that you were willing to criticize some of the equipment, since many magazines seem unwilling to really examine an item carefully, perhaps for fear of offending the advertiser. Keep up this good work and your readers will continue to trust you.

*—Charles J. Ockstein, Mansfield Center, Conn.*

...I think I can cure your aversion to using oilstones because you don't like dirty oil all over your hands—don't use oil. A long time ago I learned a trick from a meatcutter who had to keep his knives constantly sharp. Instead of using a light grade of oil, he used liquid dishwashing detergent. It will do the job of lubricating the stone and is very good at carrying away the bits of metal and stone created during sharpening, but best of all you can clean up immediately by rinsing in running water.

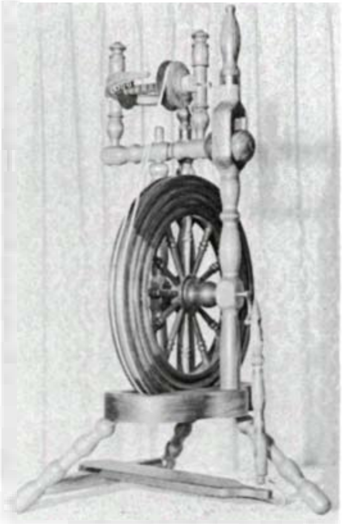
*—Fred J. Gaca, Zion, Ill.*

Your test of hand grinders was incomplete, possibly because it takes a little practice to turn a crank and move a blade at the same time. Once you master this and have changed to a white aluminum-oxide wheel kept true with a diamond you have the best tool for controlled, cool removal of precious tool steel. For sharpening knives and chisels of small cross section the hand grinder is unsurpassed. A half-inch wheel is adequate.

Of course a power grinder is necessary, especially for lathe

*Here's a photo (below) of one of the spinning wheels I've built. The original was made especially for the Joseph Smith home in Nauvoo, Ill., during the 1830s. I took the design from* Popular Mechanics, *who called it the spinning wheel that won the West. I enlarged it from a 12-in. wheel to an 18-in. wheel and I changed the base to suit my fancy. The wood is black walnut. I have made a few as a hobby.*

*—Wallace Van Eaton, Yakima, Wash.*

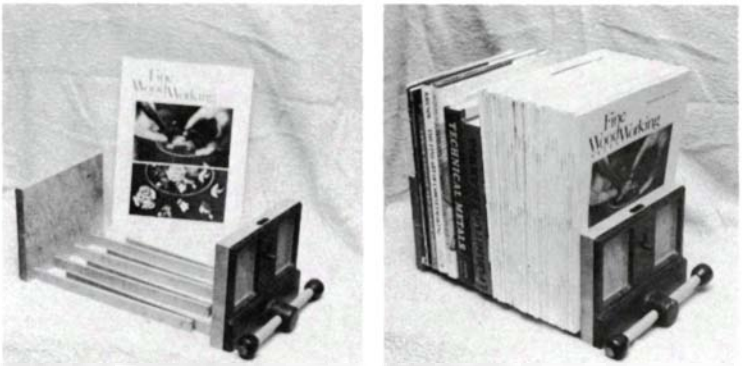


*The oriental armoire is walnut with walnut burls on the front and walnut stumpwood on the sides. The hardware is imported and good quality. We have an artist, Wanda Walker, who does all the hand-painting. The owner of our shop is Dean House. When we started, Dean did all the designing and woodworking. Now, 18 months later, we employ five men. About half our orders are for oriental furniture....*

*—Pauline House, First Edition Furniture, Broken Arrow, Okla.*

*I enclose a photo of the crest of the Royal College of Veterinary Surgeons (left), which I carved from a baulk of lime wood; the floral decorations are in the style of Grinling Gibbons. It measures 54 in. tall and 9 in. wide, mounted on a plain dark wood panel. The finish was a daily application of linseed oil brushed on and the surplus brushed off for about six weeks.*

*—F.C. Greer, Lancastershire, Eng.*



*I put all your back issues on my desk with a pair of bookends, and two minutes later picked them up off the floor. My new bookends won't exceed the expansion feature until 1989.*

*—John Morgenthau, Acton, Mass.*

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tools subjected to great friction and abrasion, in which case an oilstone may be used sparingly if at all. In this regard, some people seem to overkill the final edge. The best edge is one not overdone and barely suitable for the type of work or ornery character on the wood at hand.

Dirty oilstones are all too prevalent and inefficient. It is surprising what soap and hot water will do for your favorite stones. I use Windex on mine instead of messy oil. . . .

*—John W. Wood, Tyler, Tex.*

. . . I was quite surprised not to find any mention of the white grindstones (aluminum oxide in a vitrified white bond) now being offered by several of the mail-order suppliers. I have been using them for several years and never intend to buy another one of those grey carborundum wheels which are so likely to burn the temper. Although it is still possible to burn the steel with a white stone, one has to be awfully careless. They are more expensive and do wear away faster, but that's a reasonable trade-off. . . . *—Lewis C. Cooper, Chester, N.J.*

Stimulated by your recent article, "Woodworking in Mendocino," *FWW* #29, July '81, John Rocus and I proposed the formation of an Ann Arbor Woodworkers Association. John put up a notice at his booth during the Ann Arbor summer art fair and I put an ad in the "tools for sale" section of the local newspaper. The response was much greater than either of us anticipated. A family picnic last Sunday brought together 20 woodworkers (both professionals and amateurs) and perhaps an equal number were unable to make the picnic but were interested in joining. A brief questionnaire indicated a broad range of skills, woodworking interests and possible directions for the Association. Suggested activities included technique exchanges among members, a juried show and perhaps eventually a storefront exhibit of members' pieces, bulk wood purchasing and information-sharing concerning aspects of the local woodworking scene. A second meeting in two months was resoundingly defeated in favor of monthly meetings. Since most of us had been working in isolation from each other the picnic turned into a pleasant surprise for all of us. I'm sure that your article elicited similar responses in other parts of the country and we would be interested in hearing about them.

*—Charles Tamason, 622 S. First, Ann Arbor, Mich.*

I am sending pictures of a table and chairs that I made. I have been working on furniture since 1923. There are eight chairs, two of them with arms. The wood here is big-leaf maple. The

raised part of the center of the table is a lazy Susan. The pedestal is burly maple from a tree that was growing on our property. To me it is the Mt. St. Helens big blast. . . .

*—T.E. Haag, Tualatin, Ore.*

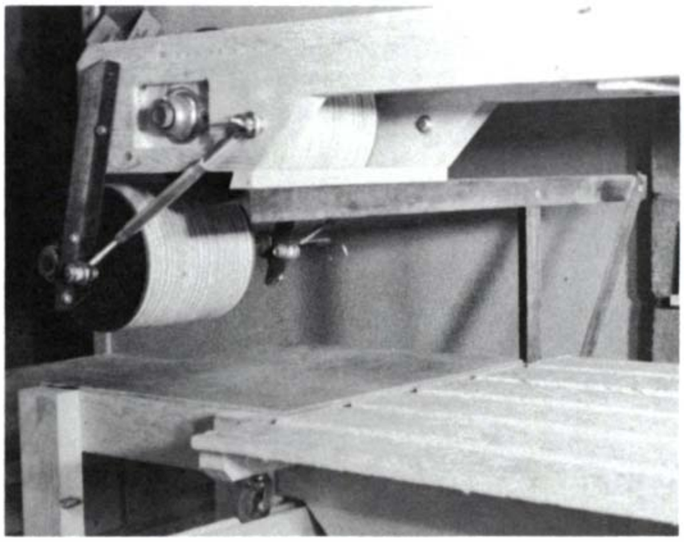
In A.W. Marlow's article on the stroke sander *(FWW #29, July '81)* he discusses splicing the sanding belt and the importance of cutting the same angle on both ends. The desired result can be obtained by laying the two ends of the strip on top of one another after giving one end a single twist, thus placing the abrasive side of one end adjacent to the back side of the other. Align the edges of the two ends over a distance of 18 in., then cut through both with the same cut of a sharp knife. No matter what angle is cut the ends will fit and align perfectly.

*—C.D. Iddings, Tulsa, Okla.*

. . . We have available at times, from the plywood mills in this area, used, ripped and otherwise ruined sandpaper belts. These are over 48 in. wide and vary in length to over 8 ft. long. I have obtained them from zero cost to never more than $4. From these belts can be made superb stroke belts. These belts rip easily and truly longitudinally, and *voilà*, no gluing. Discs, orbital and hand-sanding sheets can also be cut from the remaining paper. . . .

*—Warren Foote, Olympia, Wash.*

Here are a few notes for another approach to stroke-sander design. I made my drums from ¾-in. plywood rings with solid plywood end plates (two layers at each end). The shaft is locked to the drum by two steel cross-pins inserted through a hole in the shaft and sandwiched in a recess between the end plates. The pin at one end is set at 90° to the pin at the other.



The tracking mechanism shown in the photo consists of a turnbuckle on each side of the idler drum, with a pivoting angle-iron arm. This arrangement allows accurate tracking adjustment and belt tightening, and quick belt changes (a wing nut releases the turnbuckle from its stud). I mounted the sliding table rails on vertical shelf standards, permitting gross table-height adjustment for sanding work of various thicknesses, such as completed drawer assemblies. The top portion of the sanding belt rides over a 12 in. by 48 in. hardwood platen, providing a sanding surface for hand-held objects.

I purchase rolls of floor-sander abrasive belts (12 in. wide), glue them into stroke-sander lengths, then rip the belt down

the center for two 6-in. belts. For the joint, I use an overlapped angled splice with silicone caulk as adhesive. Scrape off the abrasive in the splice area. Finally, put the power switch at the tracking-adjustment end of the sander. Otherwise, one does a quick sawdust shuffle from one end of the machine to the other after replacing a belt and trying to reach the adjustment device before the belt runs off the drum.

*—Bruce Bozman, Addison, N.Y.*

Robert M. Rose's letter about how I saw mother-of-pearl *(FWW* #29, July '81), deserves some response. His elucidation of the theory behind the jeweler's saw is sensible and no doubt correct. However, the fact remains that after years of sawing the orthodox way, with the saw's handle below the work, I found I preferred doing it wrong.

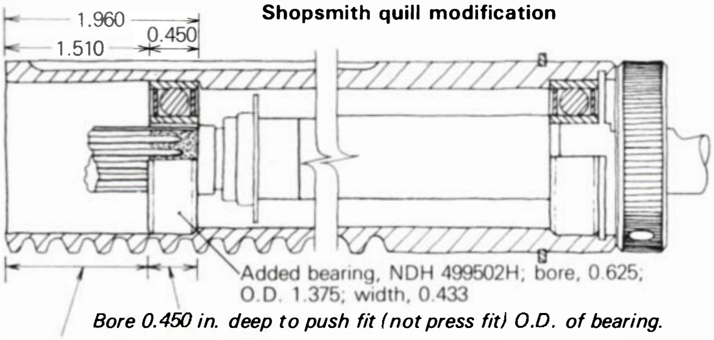
I tried turning the saw upside down at the suggestion of Chuck Erickson of Erika Banjos. We discussed mechanized methods of sawing pearl to make this tedious job go faster. He described attempts at using tiny, diamond-coated bandsaws and lasers, but each of these proved unsuitable. He had concluded that the fastest and most accurate way was the good old hand saw, used upside down. After some practice I found I had much more control, the fingers being far more sensitive than the wrist. I break fewer blades, actually they become dull and break only if one continues to push them through the cut. As to my vision, the saw is just not in my way.

The real point is that one should never be afraid to try something unorthodox, as this is often how important discoveries are made. I am neither pedant nor academician, just a craftsman seeking the best and fastest way to achieve my goals. If it works, I'll use it.

*—Richard Newman, Rochester, N.Y.*

The letter from James E. Harriss on quill modifications for the Shopsmith *(FWW* #29, July '81) was interesting indeed. My six-year-old Mark V has experienced the same side-to-side play in the quill since I purchased it. I did the same basic bearing addition, although instead of using an NSK 6202Z bearing (0.5906-in. bore) as Harriss did, I used an NDH 499502H (0.6250-in. bore). The drawing shows the specs. Using the NDH bearing there is no need to do any grinding of the splines. But to get a press fit of the bearing, the shaft must be either lightly and evenly dimpled or else knurled-and-turned to press-fit diameter between the end of the splines and the shoulder. The stock bearing used in front of the quill (SKF 466041) will also work but it is 0.003 in. larger in the outside diameter than the NDH bearing. I was extremely impressed with the results of the modification.

**Shopsmith quill modification**




I was misled, though, by the estimate of less than $20 for

the modification. I had to try a few shops before I found a machinist willing to do the work, and I neglected to get an estimate. I believe I was in a state of shock when the bill was handed to me. I had to pay, but Harriss could have had quite a few quills modified for the amount I paid to have just one quill bored. Anyone who is considering the quill modification should check around and above all get an estimate because prices will vary extremely. My after-the-fact investigations provided estimates from reasonable to astronomical. . . .
*—Steve Aga, Glendale, Ariz.*

Several years ago I tried removing a cup from a wide board by wetting the concave side and placing the board on grass with the convex side facing up (Q & A, *FWW* #29, July '81). The cup disappeared for about a week, then began to reappear. I then removed the cup by the following method. I cut a series of grooves parallel to the grain, about ⅛ in. wide, ½ in. deep and an inch apart on the concave side and clamped the board to a flat surface. The grooves were then coated with glue and a strip of wood was forced into each groove. After the glue had set, the wood strips were scraped flush with the now flat board. The grooves are stopped to prevent the ends of the strips from showing on the board ends. I have used a bench saw and also a router to cut the grooves and find the saw method easier. . . . *—Warren I. Newcomb, Arlington, Va.*

Please don't print any more of that nonsense about heavy and thin coats of wax (Q & A, *FWW* #30, Sept. '81). If wax is properly applied to any surface and then properly buffed, a molecular film is left. It cannot be too heavy or too thin, it is *molecular.* If the reader used a non-drying penetrating oil, the oil residue mixing with the wax caused his woes. Wax should not be used on any wood surface that has been finished with an oil product until the surface is perfectly dry. Otherwise it mixes with the wet oil and causes a mess. If Don Newell thinks he is getting the wax off with paint thinner, especially if it is one of his thick coats, it just ain't so. He is only spreading it thinner. Get wax off with perchloride, the fluid used by dry cleaners. Saturate a cloth with it and wipe the surface, and do it two or three times. *—Charles F. Riordan, Dansville, N.Y.*

The article on building stairs *(FWW* #30, Sept. '81) reminds me of something I miss on virtually all your articles: a bibliography. My library includes *Stair Building and Hand Railing* by John F. Dowsett, The Library Press, London, 1929. This gives a broader insight into the matter of stair building. For instance the article mentions 1-in. treads. Dowsett talks about treads that are 1¼ in. thick for light stairs and 1¾ in. thick in fire-resisting stairs. . . . The bibliography will be valuable to anyone wanting to learn more. *—Paul Sundback, Hartstown, Pa.*

Editor's note: We know of only two stair books in print: *Stair Layout* by Stanley Badzinski Jr. (American Technical Society, Chicago, 1971) and *Handbook of Doormaking, Windowmaking and Staircasing,* ed. by Anthony Talbot (Sterling Publishing Co., New York, 1980). Neither book is especially good. The out-of-print list includes *Practical Staircase Joinery* (Cassell and Co., New York, 1889) and *Practical Handrailing* (Funk & Wagnalls, New York, 1905), both edited by Paul N. Hasluck; *Stair Builders' Guide* by Morris Williams (David Williams Co., New York, 1914) and *Stair Building* by Gilbert Townsend (American Technical Society, Chicago, 1941). The last is the best.

ERRATUM: In *FWW* #30, Sept. '81, p. 89, the height of the frame in the drawing should have been 28, not 29.

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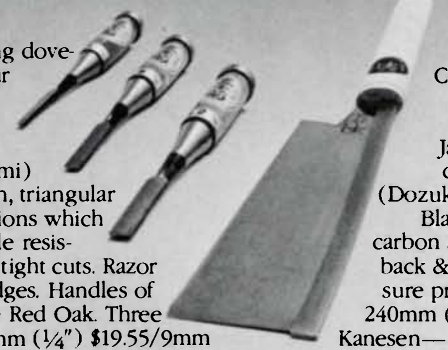

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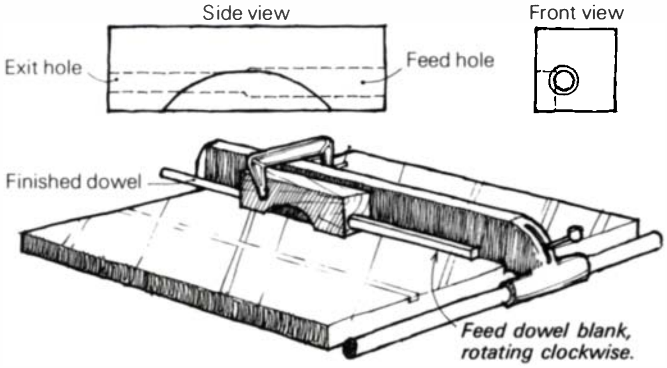
## Making dowels with the table saw

I prefer to make my own dowels for several good reasons. I can make any size dowel in any length from any wood. My system is simpler and certainly less expensive than the commercial dowel-making tools that are limited to only a few sizes. The drawings show the complete tooling required: a hardwood block and your table saw. The block size isn't critical, but it should be thick enough to clamp easily to the saw's rip fence and long enough to cover the sawblade in use. This last point is important because you'll need to reach across the saw to withdraw the finished dowel.

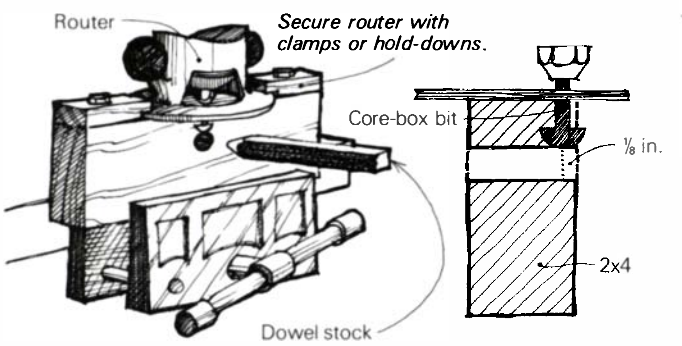



To construct the fixture, first drill a dowel-sized exit hole through the length of the block. Enlarge this hole from the front, halfway through the block, to produce a feed hole. The diameter of the feed hole should be the same as the diagonal of the square dowel blanks you plan to use. As a guide the diameter of the feed hole shouldn't exceed the exit hole by ¼ in. Now clamp the block to the saw's rip fence. Center the block over the blade. In a succession of cove cuts (made by raising the sawblade into the block) cut a channel from the edge to just into the wall of the exit hole. The best blade to use to channel the block and make dowels is a heavy, small-diameter carbide-toothed blade. Next rip the dowel blanks so they will turn easily in the feed hole. With the block clamped and the fence locked, start the saw and insert the blank. Rotate the blank clockwise and feed slowly until the blade starts cutting. Adjust the block's position with the rip fence until the dowel fits snugly in the exit hole. It's a good idea to withdraw the dowel and check the size of the first few inches.

In smaller sizes, which are difficult to rotate by hand, I cut a short dowel on one end. Then I chuck the short dowel in my portable drill. A slow feed and a slow rotation yield the smoothest dowels. —*Larry Churchill, Mayville, Wis.*

## Making dowels with the router

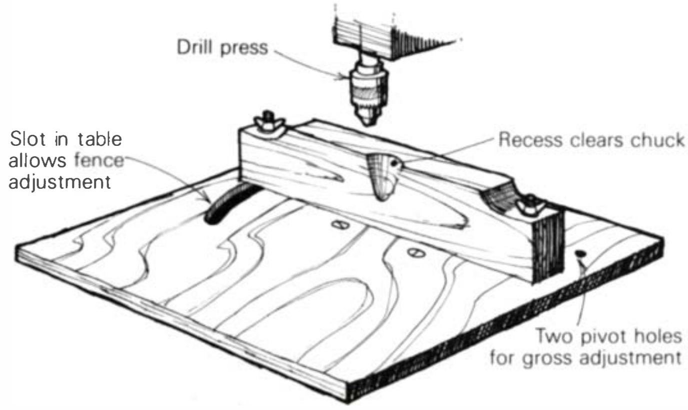
Here's how to make dowels of any size with a simple router setup. First drill a pilot hole through a 2x4 the same diameter as the dowel you want to produce. Chuck a core-box bit in your router, rout a recess in the front of the 2x4 just above the hole and clamp the router in position. Center the bit




right over the top of the hole with the shaft of the bit inset about ⅛ in. into the 2x4. Make sure the leading edge of the bit is precisely at the circumference of the hole. Now turn on the router and push the dowel blank into the hole, rotating the blank with a hand drill. Taper the front of the blank for easier starting. —*G. Weldon Friesen, Middlebury, Ind.*

## Adjustable drill-press fence

This drill-press fence is quickly adjustable for boring holes the same distance from an edge or for routing with the drill press. The base is plywood; the fence is hardwood and adjusts using wing nuts and an arc-shaped slot in the base. The sketch shows the details. —*Pendleton Tompkins, San Mateo, Calif.*



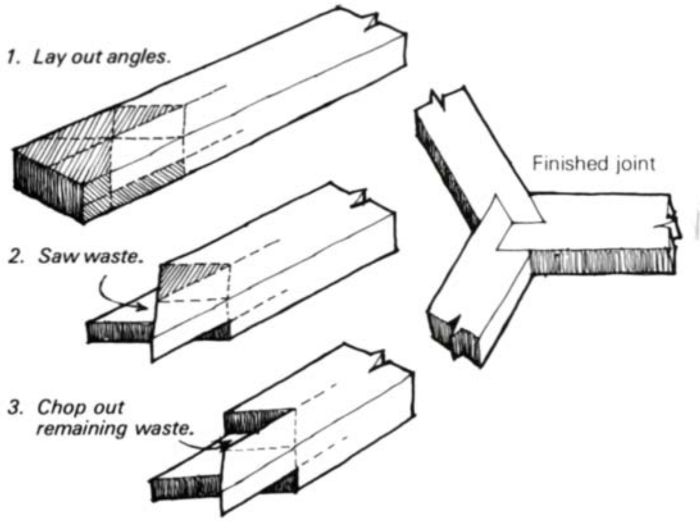

## Three-member lap joint

Here's a variation of the lap joint I discovered while trying to find a way to connect three stretchers on a three-legged table. The joint is attractive and strong. Each member overlaps the other two members with a large edge-grain glue surface.

To lay out the joint scribe a centerline on both faces and both edges of all pieces. Set a bevel gauge to 60° and use it to mark the diagonal lines shown in the sketch. Saw away what waste you can, then finish chopping out the waste with a chisel. Take care to keep the glue surfaces flat and the edges that show crisp.

By changing the angle of the layout you can adapt this joint to any number of members, odd or even.

—*David Nebenzahl, Flagstaff, Ariz.*

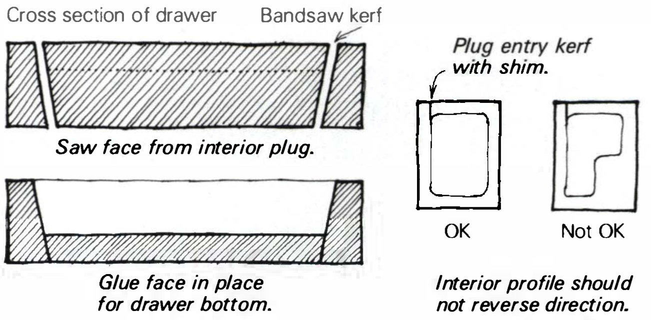



## Bandsawn drawer bottom

By carefully bandsawing the center section from a solid-wood drawer at an angle, you can use a slice of the the interior plug for the drawer bottom. If you intend to use the top face of the plug for a prescribed thickness of drawer bottom, carefully

determine the cut angle using mathematics, a scale cross-section drawing or trial-and-error test-cuts on a piece of scrap. The proper angle varies depending on the thickness of the drawer blank, the thickness of the desired botom and the width of the bandsaw blade's kerf. The method will not work with drawer shapes that reverse direction, as shown below.

*—J.A. Hiltebeitel, S. Burlington, Vt.*

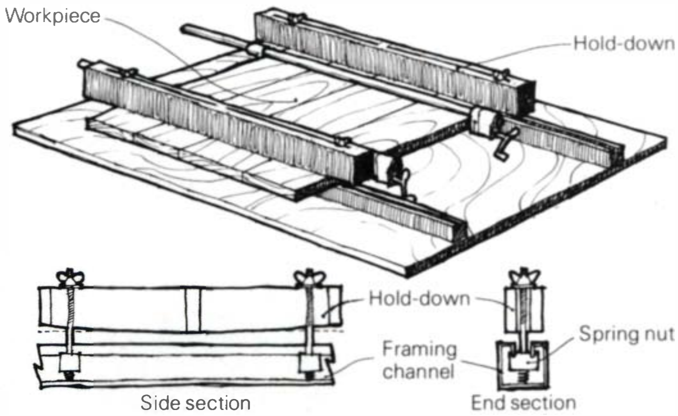



## Glue-up rack

This inexpensive glue-up rack keeps edge-glued stock perfectly flat under the pressure of bar clamps. The rack is made from industrial framing channel which is available under several trade names (Super Strut and Kindorf are two) at electrical and plumbing-supply houses. You'll need two lengths of channel, four ⅜-in. spring nuts (made especially for use with the channel), two homemade hold-down boards and other hardware as shown in the sketch.

To make the hold-down boards, glue two 1x3s together with ½-in. spacers between. Plane a slight curve on the bottom so pressure will be even along their length. Assemble the rack as shown. To use, slide the spring-nut/threaded-rod assembly right up against the edge-glued workpiece. Tighten the wing nuts to apply downward pressure and flatten the workpiece.

*—Lloyd Winters, Ft. Wayne, Ind.*




## Jig indexing mechanism

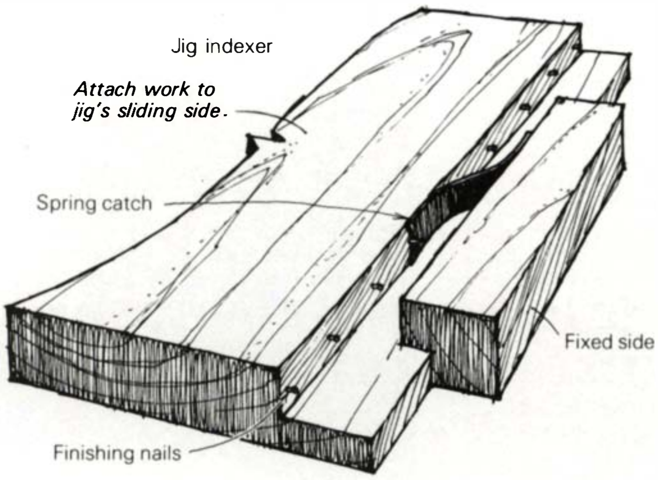
This indexing mechanism can be incorporated into a variety of woodworking jigs for the table saw, drill press, overarm router, and other machines where accurately spaced cuts, dadoes or holes are required. The idea was originally given to me by Herman Kundera, a knowledgeable woodworker from San Bruno, Calif.

The mechanism consists of a spring catch mounted to the jig's fixed or base side and stops of finishing-nail heads set in the sliding side of the jig. The locations of the catch and the

nails can be reversed if it's more convenient. For precise, accurate spacing, predrill holes for the finishing nails with a slightly undersized bit. Vary the nail spacing as required for the particular job at hand. Although I made my spring catch from a piece of hacksaw blade (anneal for bending and drilling, then reharden and temper), any thin piece of metal would make a serviceable catch. Fasten the catch to the jig with a roundhead screw.

In using the jig you will slide one part against the other. The spring will ride up and over the nail head and then click down. When you feel the spring click, move the jig back until the spring catch registers against the nail. Now you're ready to proceed with cutting, drilling or whatever.

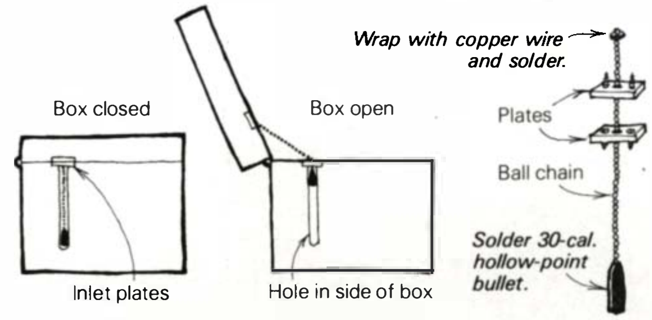
*—Donald M. Steinert, Grants Pass, Oregon*




## Chest lid stop

Here is a sketch of a chest lid stop that has worked well for me. It is simple to make and is completely out of the way when the lid is closed. The stop consists of two brass or aluminum plates, a short length of ball chain and a 30-caliber hollow-point bullet for weight. Drill a hole for the bullet in the side of the box and inlet the two plates to complete the construction. Be sure to position the top plate right over the bottom plate. Other construction details are shown in the sketch.

*—John Warren, Eastham, Mass.*




## Cross-threaded faceplate

For years I have transferred lathe faceplate projects from the inboard spindle to the outboard spindle. Since the outboard spindle is left-hand threaded, this meant dismounting the work from one faceplate and mounting it on another. I recently simplified this procedure by cross-threading a spindle-sized nut and welding it to a 6-in. disc of ¼-in. steel. Now I can transfer the workpiece from inboard to outboard spindle without changing faceplates. If you tap the nut freehand

you'll undoubtedly have a bit of wobble at one position or the other. Cross-threading does weaken the threads. But they are strong enough to take the forces encountered on a wood lathe. *—Johnathan D. Clark, Rochester, N.Y.*

## Homemade glue bottle

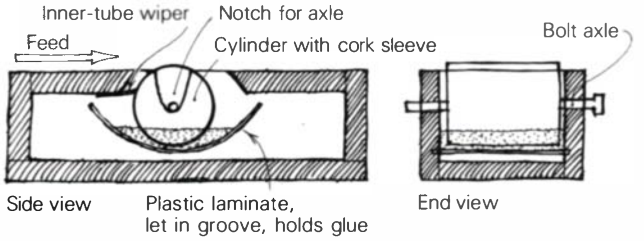
Woodworkers who use white or yellow glue and favor a brush applicator will appreciate this homemade glue bottle. It's unbreakable, practically spill-proof and free. Just cut off the top of a plastic bottle at the shoulder, invert and press in place. As you use the glue be sure to push the top down to eliminate air in the container. Most glue drips will run back into the bottle, but those that don't will peel off easily.

*—Carl E. Roos, Pottsville, Pa.*


Plastic bottle — *Cut off top at shoulder.* — *Invert top, press in.*

## Glue spreader for lamination

This glue spreader makes easy the tedious job of covering thin laminations with just the right amount of glue. The heart of the spreader is a cork-covered cylinder. The cork has the right




texture to pick up and deposit the right amount of glue. Make the spreader frame from plywood. Cut a semicircular groove in each side of the frame to hold a piece of plastic laminate which acts as a glue reservoir. Notch the sides of the frame so the glue-spreader cylinder can be removed for cleaning. Tack a piece of rubber inner tube to the frame so that it will scrape excess glue from the cylinder as it rotates. I use a commercial white glue mixed with water to get a better consistency for spreading. *—Rod Davidson, Port Angeles, Wash.*

## Vacuum-aided oil finish

Here is a method for oil-finishing small articles such as gearshift knobs and knife handles in dense hardwoods like cocobolo and rosewood. Normally, these woods don't readily accept oil to any depth. First I submerge the wood article in a jar of Watco oil and put the jar in a homemade vacuum chamber. I keep the wood under vacuum for several hours until it nearly stops bubbling. Then I slowly release the vacuum and allow the air pressure to push oil into the pores of the wood that formerly held air. After a couple of hours I remove the wood and wipe it dry. The deep penetration slows drying time somewhat. Our vacuum pump is an old compressor. We

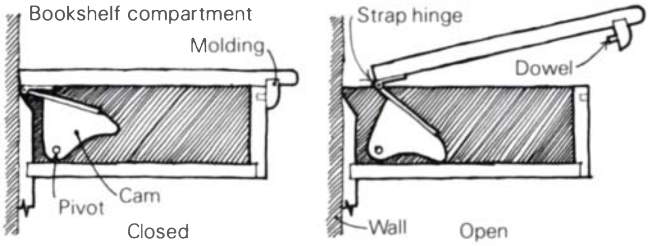
hooked up the vacuum chamber to the inlet side. This method doesn't require a hard vacuum—any vacuum at all achieves a better result than just rubbing in the oil.

—*Jerry Blanchard, Pebble Beach, Calif.*

## Cam hinge reveals hidden compartment

The sketch below shows how I used a modified hinged lid to construct a hidden compartment in the top of a bookshelf I was building. When the compartment is closed, there are no seams. The dowels lock down the front, making the top snug and tight. The pivoted cam rolls the top forward so it will clear the wall.

—*James B. Eaton, Houston, Tex.*




## Aligning hinged box tops

To assure that the tops of small hinged boxes will align perfectly with the bottoms, seat the hinges first with "5-minute" epoxy and install the screws later. Smear a thin coat of the epoxy on the hinges, place them in position (separating the leaves slightly with a wedge if necessary) and put the top on the box, aligning all around. To be safe, give the epoxy a full half-hour to set, open the box top, drill pilot holes and install the screws.

—*H. W. Reid, Cincinnati, Ohio*

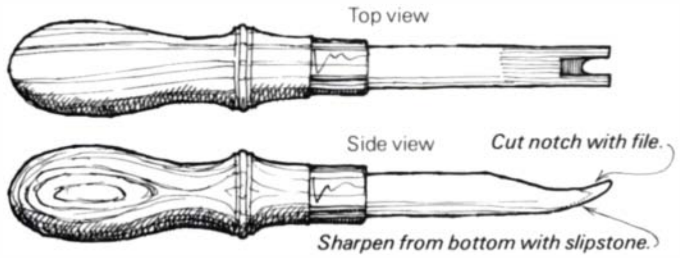
## Edging with a leathercraft tool

To break the sharp, hard corners on straight or curved boards I use a simple tool that leather workers will find familiar. It's called a leather edger and is available in several sizes wherever leatherworking tools are sold.

If you're not near a source of leatherworking tools the edger is easy to make at home. Start by inserting one end of a 4-in. length of drill rod in a handle. Shape the other end of the rod into a curved fork with two tines about ⅜ in. long. Use the edge of a small rectangular file to cut the slot from the top and to form the appropriate cutting angle. Sharpen the cutting edge between the tines from underneath with a thin, rounded slipstone.

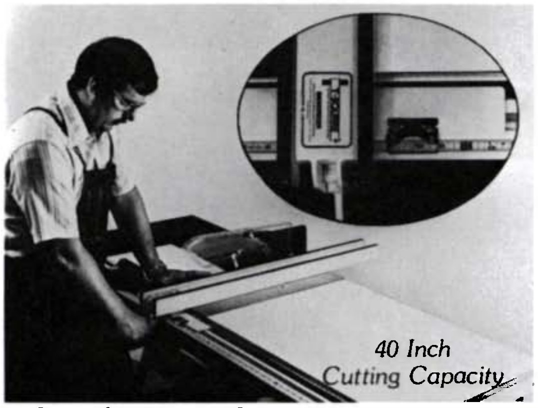
To use, push the tool along an edge with the grain. It should remove a thin, curled shaving and leave a delicately rounded edge in one pass.

—*Norman Odell, Quathiaski Cove, B.C., Canada*




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








*I recently acquired two split-bamboo flyrods. One is a Grampus, the other a Southbend. I want to remove the present finish, which is badly deteriorated, and then refinish both rods. I am reluctant, however, to use a varnish remover, as it may cause the glued sections of the rod to separate. What is the best way to remove the finish and apply a new one?*
*—Bill Evans, Gainesville, Fla.*

LES BEITZ REPLIES: You're absolutely right in not wanting to use strong chemicals to remove the varnish from those old rods. Most early split-bamboo rods were made with hide glues, and such treatment would weaken the segments. Varnish is best removed by scraping with a dull pocket-knife blade.

The silk wrapping on the guides should be frayed with the knife and taken off. Do this by scruffing the silk where it covers the foot of each guide. When the wrap is loose, peel it off the bamboo. All guides and the tip-top removed, lay the rod section on your bench and begin scraping away the brittle, worn varnish, beginning at the thicker end of each section. Scrape forward, or away from you.

Aged, dry varnish comes off quite easily, but gummy varnish will take a little more work. Use care and work slowly to avoid rounding off the edges of the hexagon shape. A traditional 9-ft., 3-piece, 2-tip flyrod will require about two hours to scrape down properly. Next, sand down the six flats of each section, using 400 or 600-grit paper on a perfectly flat sanding block. A few passes along each flat should do. Again, take care not to round the neat, sharp edges of the hex.

Clean the cane sections with alcohol and lint-free cloth. Wrap the guides and tip-top back on where they were originally placed. Most of the larger tackle shops can provide replacement guides and thread. Finish off the work with three or four coats of a fine-quality varnish. I prefer to use marine varnish with a small amount of tung oil added to it. Because of the delicate nature of a split-bamboo rod, apply the varnish with a fine sable-hair artist's brush. [Les Beitz makes split-bamboo flyrods in Austin, Tex.]

*In his book on joinery, Tage Frid recommends the bowsaw. There are several available from tool-supply houses, but I'd like to know which one he recommends. Better yet, where can I get a Danish saw like the one he uses. One other thing, Frid is always talking about Cascamite glue. I've never heard of it. What kind of glue is this?* *—Albert Pound, Botsford, Conn.*

TAGE FRID REPLIES: First I recommend that you buy a good 11-point blade and make the frame yourself, as I described in *FWW* #8, Fall '77, p. 59. I have used the bowsaw sold by Woodcraft Supply (313 Montvale Ave., Woburn, Mass. 01888); it works fine, but I found it a little heavy. You can get a real Danish saw, made by Ben Dixen, from Three Crowns Supply, 3850 Monroe Ave., Pittsford, N.Y. 14534. This saw has an 8-point, 15-in. blade, and I think it's very good, especially for dovetails. It costs $17.95, plus handling and shipping.

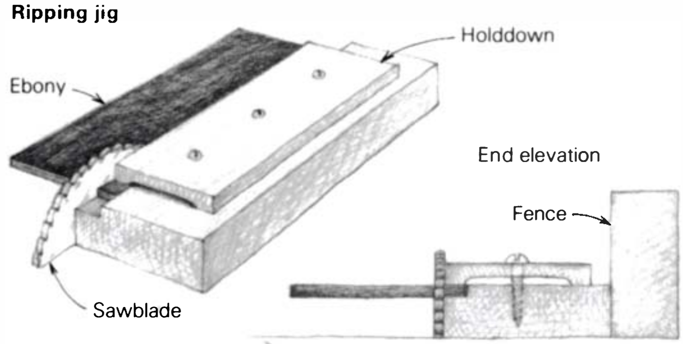
Cascamite is the brand name for Elmer's plastic-resin glue. Other brands of plastic-resin glue will probably work as well.

*I'm restoring a 1930 Brunswick pool table. Much of its mahogany veneer is in bad shape and many of the 170 inlays are damaged and missing. These are 5/8-in. square ebony frames with 3/8-in. square mother-of-pearl escutcheons inside them. I would like to reveneer the entire piece and make new inlays. Do you have any advice on an efficient and accurate way to make 170 inlays?* *—Jim Smith, St. Louis, Mo.*

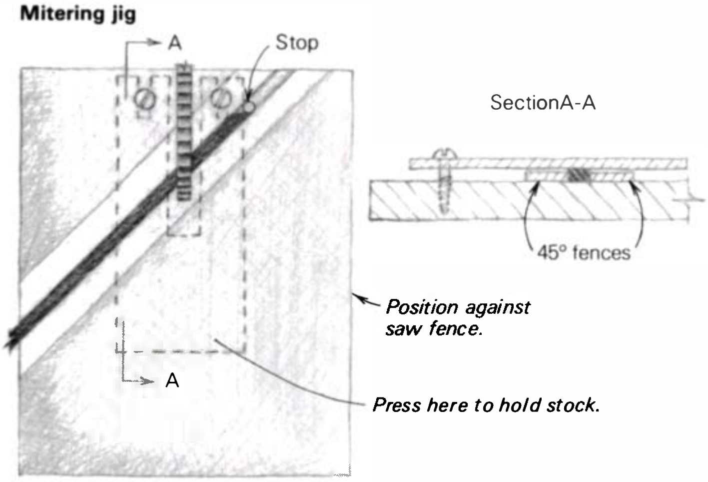
RICHARD NEWMAN REPLIES: There are two ways of doing this: inlaying the pearl into a thicker square of wood, or mitering the wood frame around the pearl square. I would choose the latter and proceed as follows: First buy the mother-of-pearl squares cut to exact size. Cutting pearl is tedious and potentially unhealthy, and this is not a shape that requires the hand of the artist. Use pearl that has been prethicknessed to 0.05 in. Here are some suppliers who can help you: Erika Banjos, 14731 Lull St., #3, Van Nuys, Calif. 91405; John L. Rie, 196 Ashburton Ave., Yonkers, N.Y. 10701; Pearl Works, Rt. 3, Box 122, Mechanicsville, Md. 20658.

Dealing with such small pieces of wood is pretty hairy, especially with large-scale machinery. You will therefore need to build the ripping and mitering jigs shown below. These will keep the thin pieces of wood from fluttering about and self-destructing, and they will protect your fingers.

**Ripping jig**




**Mitering jig**




Begin by planing the ebony to a thickness of 0.05 in., and then rip it into 1/8-in. wide strips using the ripping jig. Cut more strips than you need to make up for damaged pieces and trial runs. For both ripping and mitering, use a sharp blade with many teeth, like a thin-rim veneer blade. Now miter one end of a strip, flip it over and insert it in the mitering jig up to the stop, which should be initially set from a mark on the stock. Cut four sides for one frame and see how the miters close up around the pearl; keep adjusting the end stop until the fit is perfect.

To cut the mortises for the inlays, you could use a Dremel tool with a router base and a jig *(FWW* #27, Mar. '81, p. 50), or a 5/8-in. chisel guided by a template. However, I'd be tempted to get a 5/8-in. hollow chisel for a machine mortiser, regrind it and use it as a punch. The waste could then be removed with a chisel. The mortise should be shallow enough to leave the inlay slightly proud of the surface for later leveling.

The units can be preassembled or inlaid as separate pieces all at once. Use epoxy glue mixed with black aniline dye as an adhesive/filler. Be sure to seal the mahogany first with a wash coat of shellac followed by a coat of wax. This will keep the black epoxy from staining the adjacent wood. Put a generous glob in each mortise and press the inlay in so that it bottoms out evenly. Glue should squeeze out all around. A clamp or

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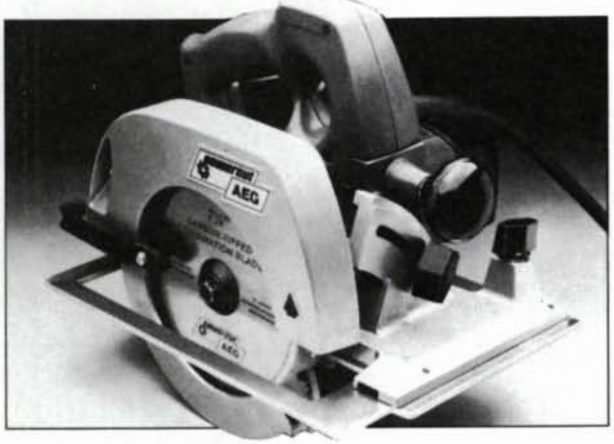


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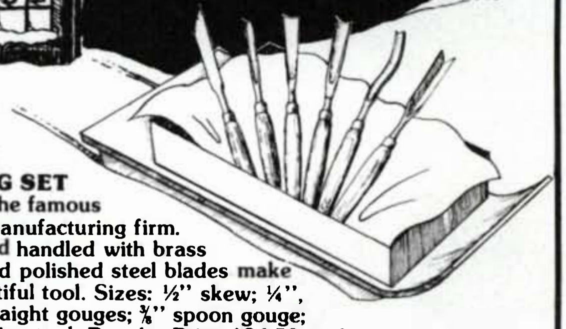

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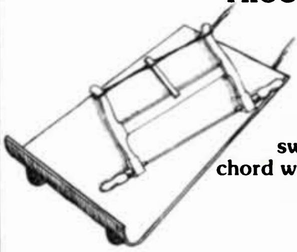

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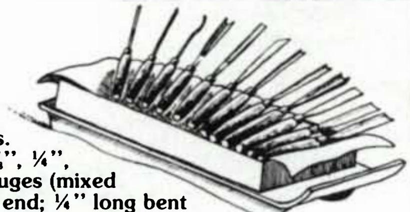

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weight will help. When the glue is hard, level the inlay with a file. This is tricky as the pearl is much harder than the wood, so be careful not to eat away the softer mahogany. Finish with abrasive paper on a hardwood block. Take the pearl right up to 400 grit and it will really shine. [Richard Newman is a designer and cabinetmaker in Rochester, N.Y. His blanket chest is shown on p. 97 of this issue.]

*I have a Sperber chainsaw mill and plan to mill the wood for an addition to my home. I would like to use poplar for the framing and red oak for the siding. I'm going to air-dry the oak for a year, tongue-and-groove it and apply it vertically. Is oak suitable for door and window frames as well? Is poplar a good choice for a framing lumber?* —*Jim Ryan, Putnam Valley, N.Y.*

ED LEVIN REPLIES: As a timber-frame carpenter who works primarily in red oak, I was struck by your choice of oak for siding and poplar for framing, because my intuitive choice would have been the other way around. However, some thought and consultation have convinced me that your scheme is workable, with the following qualifications.

Fell and mill the poplar just before use and frame up as soon as possible, letting the wood season in place. If you have to leave the material in the log for any length of time, peeling is recommended. Likewise, if the finished stock cannot be used immediately, sticker it. Choose the material carefully, discarding knotty, shaky or twisted pieces, as well as those having sloped grain.

Poplar is slightly weaker than white pine, putting it toward the lower end of the spectrum of structural timber. Floor and roof framing members should thus be bigger than is usual. Poplar's high initial moisture content (close to 100%) means that the green wood must carry its own weight in water along with any building load. This, coupled with significantly lower strength when green (dry poplar is almost 40% stiffer than green), calls for close attention to the sectional dimensions of floor and roof framing during seasoning. Longer members may need temporary midspan support to prevent permanent sagging. Poplar's strength does not begin to increase substantially until moisture content drops below 25%.

Oak was a common siding material in Colonial times—principally in the form of clapboards. Vertical tongue-and-groove red oak should make a beautiful and durable exterior siding. Narrow boards will minimize cupping. For both siding and window or door frames, drill pilot holes in the dry oak and use non-corroding nails or screws to avoid getting dark streaks on the wood. [Ed Levin, of North Canaan, N.H., is a professional housewright.]

*I'm planning to build an oak dining-room table and haven't settled on whether to make a refectory (trestle) style table or the conventional four-leg type. Are there inherent advantages or disadvantages to either design? I have oak boards of varying widths. Should I make the tabletop from a few wide boards, with a greater tendency for cupping, or use a large number of narrower boards, with more glue joints?*

*Also, I want to use breadboard ends on the top. Are there any tricks for cutting the tongues and grooves accurately?*
—*Brent J. Stojkov, Concord, Calif.*

SIMON WATTS REPLIES: Trestle tables have the advantage of offering more seating space for top size because there are no table legs to interfere with chair legs and diners' knees. You must place the trestles at least 14 in. in from each end of the

top so people sitting at the head and foot won't bang their knees. Another advantage is that trestle tables are easy to make knock-down by through mortising the uprights to receive the tenoned stretcher, which is wedged on the outside.

Proportions for such a table should be 1 to 3, or 1 to 4. I usually make them 30 in. to 36 in. wide to seat one person comfortably at either end, and 6½ ft. to 8½ ft. long. Too long a trestle table top can sag in the middle because there are no rails (aprons) to support it. The thickness of the top should vary according to its length. I make them 1¼ in. to 1½ in. thick for smaller tables and 2 in. thick for longer ones.

I think that the average tabletop looks best when glued up from an odd number of boards 5 in. to 8 in. wide each. You will have no trouble with the top cupping if you secure it on both sides to the horizontal members atop the uprights.

I personally don't have much use for breadboard ends and cannot recommend that you use them. Inevitably you get unsightly gaps and projections as the top expands and contracts with the seasons. This movement degrades the glueline, and eventually your breadboard will fall off, unless the tabletop is tenoned into it and provisions are made in the joinery to accommodate the cross-grain movement of the top. If you are determined, you can cut the tongues on the top with a dado blade in your table saw and then groove the breadboards also with the dado blade. But before you go to this added trouble, ask youself why you're doing it.

*I've made several dovetailed jewelry boxes with floating-panel bottoms. The dovetails seem to be pretty near perfect, but come June both tails and pins recess slightly from the surrounding wood. The recess is only perceptible with a fingernail, but still it's annoying considering the work involved. Should this problem be expected because of summer humidity, or am I doing something wrong?*

—*Charles A. Tamason, Ann Arbor, Mich.*

JOHN KELSEY REPLIES: You're suffering the consequences of the modern preference for exposed, decorative joinery instead of decorative moldings. In traditional woodworking, joinery and end-grain are always concealed, either by the geometry of the joint or else by a decorative molding, precisely to avoid the problem you've uncovered. As you surmise, the thickness of the wood is changing along with the ambient humidity, causing the pins and tails to protrude and recede alternately as the year turns around. If you don't want moldings, you can minimize the movement by selecting quartersawn wood instead of flatsawn, and by applying a thorough lacquer, varnish or tung-oil finish. Or, you can conceal the movement by taking your decorative joinery a step further, emphasizing the through dovetails by chamfering their edges or rounding them over. Finally, you can change your attitude toward the annoyance by accepting the joint's cyclical changes as yet another aspect of wood's living nature. This last solution may be the happiest.

*I recently purchased a Powermatic Model 160 thickness planer, and am not happy with the way it stops feeding after the wood leaves the infeed roller. The boards must be pulled by hand to plane the last several inches. No amount of adjusting the pressure bar or the outfeed roller seems to help. Any advice?*

—*John Ellenz, Tipton, Kans.*

JIM RAMSEY REPLIES: If feeding stops after the stock leaves the infeed roll, one of two problems (maybe both) exist—either the table rolls are too low (they should be set at 0.007 in.

above the surface for finish planing), or the pressure bar is too low. More than likely, it's the pressure bar that's causing the trouble, and the easy way to adjust it is as follows:

Turn the two pressure-bar adjusting bolts clockwise several turns. Start the machine and feed a 3-ft. long 2x4 into the planer on the extreme left-hand side of the table. When the stock contacts the pressure bar, it will stop. If your machine is equipped with a shaving hood, the next adjustment may be made with the machine running. If not, you must shut the power off before adjusting the pressure bar. With the shaving hood in place and the planer running, turn the pressure-bar adjustment bolt counterclockwise in ¼-turn increments on each side of the machine. While you are doing this, have an assistant apply gradual pressure to the end of the stock. When the pressure bar reaches the cutting arc of the knives, the stock will free up and feed smoothly. Now raise the table by one turn of the wheel, and repeat this operation on the right-hand side of the machine. Don't raise the pressure bar beyond the cutting arc of the knives, or you will get snipe on the leading and trailing ends of the board. [Jim Ramsey is product manager at Powermatic-Houdaille, McMinneville, Tenn.]

## Follow-up:

**Re: Dick Boak's method of finishing** oily woods with lacquer, I can confirm that the method for making lacquer adhere to rosewood *(FWW* #27, March '81, p. 24) works quite well, but some readers might be interested in simpler alternatives.

If a lacquer finish, such as the one used by Martin Guitar, is desired, the vinyl-seal step and perhaps even the lacquer-seal step can be avoided by spraying on several light coats of shellac (3 lb. cut or less). Don't brush it on because this can cause blotchy running of the pigment from the pores of the wood, as the denatured alcohol used to thin the shellac also dissolves the pigment. Filler may also be dispensed with as the build-up of shellac and subsequent lacquer coats will eliminate all but the tiniest indications of the pores below the surface.

Two other finishes are possible. One is to apply a wet coat of Waterlox (a tung and linseed mix) and then wipe it off before it begins to set up. Let dry for 24 hours and repeat, after first sanding lightly with 320-grit paper. Wet-sand the final coat (it could take three or more) with mineral oil as a lubricant, and then wipe clean. When dry, apply a coat of wax. Finally, you could use Watco Teak Oil, which is manufactured specifically for finishing rosewood, teak and other resinous woods.

The lacquer gives a spectacular finish but is easily scratched. On most furniture, scratches can be repaired by rubbing with 4/0 steel wool. The successive-coat finish (Waterlox) has a more in-the-wood look and is more scratch resistant, but does not show off the figure and color of the wood as well as the lacquer finish. Watco Teak Oil seems to dissolve and disperse the pigment, darkening the whole appearance and reducing the vibrancy of the wood's color and figure.

*—Joshua Markel, Philadelphia, Pa.*

## Readers can't find:

Does anyone know of a source for new solid-brass saw-handle screws? These come in two halves—a male and a female, with one face slotted to accept a screwdriver.

*—David Blackley, Matthews, N.C.*

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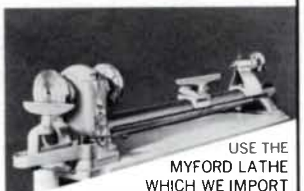

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**Trains and Boats and Planes and Custom-Building Wooden Toys** by C.J. Maginley. *Hawthorn Books, 260 Madison Ave., New York, N.Y. 10016, 1979. $12.95 hardcover; 184 pp.*

**Rodney Peppe's Moving Toys** by Rodney Peppe. *Sterling Publishing Co., Two Park Ave., New York, N.Y. 10016, 1980. $6.95 softcover, $14.95 hardcover; 119 pp.*

**101 Quality Wooden Toys You Can Make** by Hugh M. Ryan and Judith Ryan. *Tab Books, Blue Ridge Summit, Pa. 17214, 1979. $5.95 softcover, $12.95 hardcover; 224 pp.*

**The Art of Making Wooden Toys** by Peter Stevenson. *Chilton Book Co., Radnor, Pa. 19089, 1971. $9.95 softcover; 250 pp.*

This time of year woodworkers with children and grandchildren have good reason to set aside their heavy projects and turn to the lighter pursuit of making toys. Wooden toys have a look and feel that can't be matched by injection-molded plastic, which usually appears starkly realistic in terms of scale and detail. Well-conceived wooden toys are rather impressionistic, inviting the imagination to participate and to fill out what is incomplete, and they are very touchable. Most wooden toys are fairly easy to build, and they don't consume lots of time. What is difficult and time-consuming, however, is deciding what toy to make and how to hit upon the right design. Here are four books about how to design and make wooden toys.

C.J. Maginley's *Trains and Boats and Planes* is aimed at the beginning woodworker. It offers photographs, plans and step-by-step instructions for building over 50 toys; the uncluttered format, the interesting play between the text, drawings, photos and materials lists makes everything abundantly clear. Maginley, it seems, really likes to make trucks, and gives most of the space in his book to them. By comparison, we don't get many designs for boats and planes and trains, as the title suggests. We get fire trucks (four of these), trailer trucks, dump trucks, lumber trucks and delivery vans, and several cars. If you like toy trucks, you'll like Maginley's book.

His four airplanes are also appealing, especially the jetliner with its clothespin jet engines. Maginley has paid careful attention to how this toy feels, how it balances in the hand, and advises that ballast (sections of metal rod) be added to the fuselage forward of the wings to get the correct distrubution of weight. But the best toy in the book is the freight train, which is particularly well suited to Maginley's building-block style. It's a steam locomotive followed by eight cars, including a box car, a log car, a gondola, a tank car and a caboose. This toy train has charm and warmth that come from its soft texture, its playful proportions and its understated details.

If you fancy brightly polychromed mechanical toys, *Rodney Peppe's Moving Toys* is for you. A picture-book artist by trade, Peppe brings his graphic skills and his eye for color together with his stronger affection for the circus to create an especially delightful book of unusual toys. Inspired by 19th and early 20th-century examples, most of Peppe's kinetic toys are two-dimensional and made from thin birch plywood. There are tumblers, acrobats, clowns, a double-headed strong man, a carousel, a monkey and a lion, a blinking owl and more.

The most interesting of these is a monkey that climbs a string. Tighten the string and up he goes; relax it and he climbs down. The monkey's secret is a double-drum mechanism inside his chest. Another ingenious plaything is the

sand-toy Leotard, a jointed acrobat; powered by a sand-driven wheel, he performs various movements in a random sequence.

The format of Peppe's book is fresh and engaging, there is good talk on techniques and the text is easy to read. Each project is accompanied by schematic drawings, and there are color photographs of the finished toys. This book is fun.

In sharp contrast to the books by Maginley and Peppe is *101 Quality Wooden Toys You Can Make*. The toys described are clunky and unimaginative, in several cases just plain ugly. The photographs are poor, some of them so fuzzy that the toy can't be distinguished from the background. The by-the-numbers text is dull and tedious. At $5.95 it's not a good buy.

Best of all these books is Peter Stevenson's *The Art of Making Wooden Toys*. This book addresses directly the business of designing toys, first by defining what a toy is and then by telling how to achieve the best results by finding that happy midpoint between too much and too little detail. Stevenson advises us to never look at another toy to get our designs, but to study the real object carefully, noting its proportions in terms of itself—how many wheel diameters high is the top of a truck cab, how many wheel diameters long is the trailer? What we want to do in designing a successful toy is to "capture the concept and mood of the real object without locking in the imagination too closely."

Seductive on first impression, too much realism can confine the imagination, so the child soon gets bored and the toy gets tossed in the closet to await the annual purge. But the toy that survives the vagaries of a child's mercurial imagination is a toy that can be renewed with every change in mood and mind. Such toys are classics, and children will always like them.

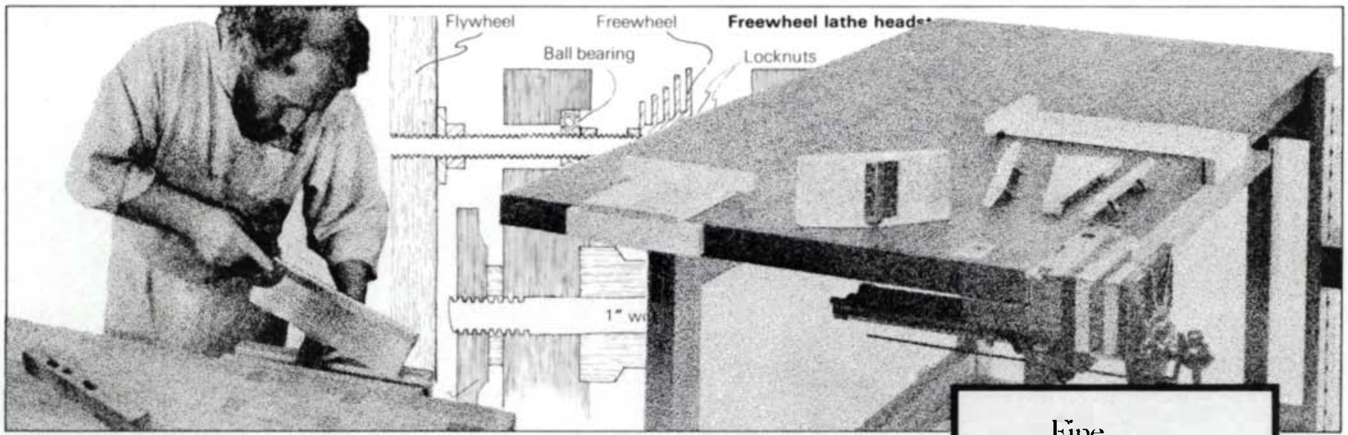
The meat of the book is plans and instructions for building 23 different toys, not similar toys but widely diverse toys, everything from Prince Valiant's broadsword and shield to the Red Baron's tri-wing Fokker. Also included are riding toys for older kids—a pedal racer, a moon crawler and a pedal truck. Almost all of Stevenson's toys have a timeless quality, though the designs are light and cheerful. If you're going to buy only one book on toy making, get this one. —*John Lively*

**Movable Insulation** by William K. Landon. *Rodale Press, Emmaus, Pa. 18049, 1980. $9.95 softcover; 379 pp.*

Most people's windows are obscured by curtains or drapes. These keep neighbors from peering in, but do little to keep out the cold or to conserve heating fuel. For woodworkers who are interested in alternative window treatments and ways to save expensive heat, this book is a good source of general information about window heat loss and gain, and it offers specific strategies for making windows more than heat-robbing holes in the wall.

Of principal interest are instructions (accompanied by numerous illustrations) for building interior pop-in shutters, thermal shades, folding screens, louvered shutters and rolling shutters. Also there are three chapters on making insulated exterior shutters. Those planning to build solar heat systems will find the sections on constructing insulated panels to assist passive space heating and passive water heating helpful.

Most of the designs for shutters are first generation and aren't pretty, but they do provide the theoretical foundation needed to make them effective insulators. In a way this is an advantage, as the craftsman is left free to refine their appearance to suit his own taste. —*John Lively*

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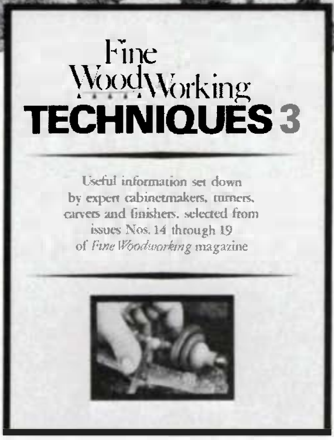


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# Canoeists Meet

Birch bark and lapstrake canoes are built from the outside in, wood-and-canvas canoes from the inside out, and stripper canoes from their thin wooden core to their fiberglass shell, both inside and out. The annual get-together of the Wooden Canoe Heritage Association, held this year on the weekend of July 31 in Dorset, Ont., revealed such essential canoe lore in slide shows and friendly chats in addition to numerous actual examples. More than 130 amateur and professional boat builders and inland-water travelers came to share their enthusiasm for what they've decided is the most important vehicle indigenous to North America. Many brought their canoes, and it was possible to examine closely and to compare all sorts of designs, from meticulously restored Old Towns and Peterboroughs to an innovative plywood lapstrake canoe that weighs only 12 lb.

Jack McGrievy, a canoe restorer from Cato, N.Y., told how to increase the potency of paint remover (cover it with a plastic garbage bag while it works) and how to maintain symmetry when replacing broken ribs (work from both ends, alternating new and original ribs). Tom McKenzie of Madison, Wis., explained how birch bark, turned outside in, curls and compresses around the ribs, while the ribs, bent green, spring back to stretch the bark tight. The weekend's highlight was a four-mile paddle down St. Nora's lake to the Kanawa International Museum, which contains the world's largest collection of paddle-propelled boats. About 250 of its 600 craft are on display, including birchbarks from various Eastern tribes, Northwestern dugouts, Alaskan kayaks, reed and balsa boats from South America, and early manufactured lapstrake and wood-canvas canoes. The museum is about to acquire ten more craft from the South Pacific. —*Rick Mastelli*

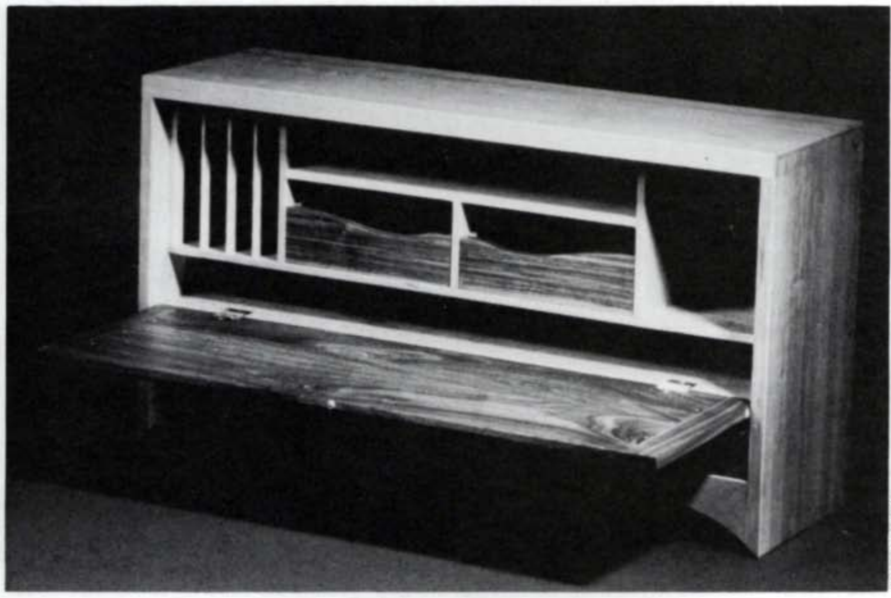
Membership in the Wooden Canoe Heritage Association costs $10 a year ($12 Canadian) and includes a subscription to the quarterly *Wooden Canoe*. Write WCHA, Box 5634, Madison, Wis. 53705. The Kanawa International Museum is located off Hwy. 35, just south of where it crosses Lake Kushog at Ox Narrows. For more information, write Kirk A.W. Wipper, 10 Douglas Cr., Toronto, Ont. M4W 2E7.

*Kanawa Museum curator Rick Nash is building this 20-ft. birchbark in the traditional way—between stakes and a form weighted to the ground with rocks.*

Geoffrey B. Platts

# WINNERS

*Steel Driver,* carved in black walnut (22 in. tall) by John Rocus of Ann Arbor, Mich., won the Marples purchase prize for woodcarving last August at the Mississippi Valley Fair in Davenport, Iowa. Wall-hung desk by Lawrence Bickford of Berlin, N.H., won the best-in-show award at the American Crafts '81 exhibition held this summer at the Currier Gallery in Manchester, N.H. by the League of New Hampshire Craftsmen. It's made of cherry and walnut, and measures 42 in. by 22 in. by 12 in. deep.



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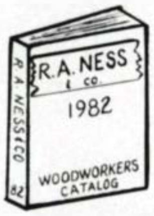


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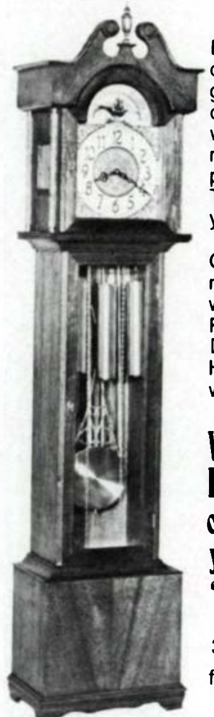

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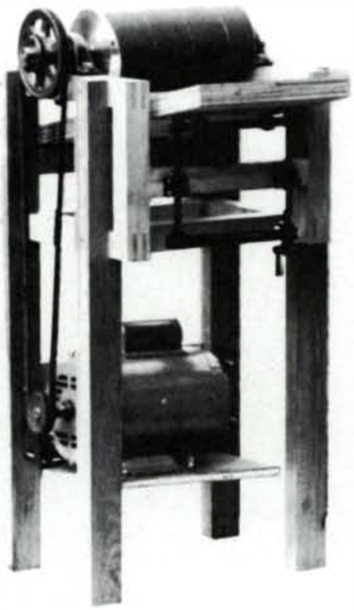

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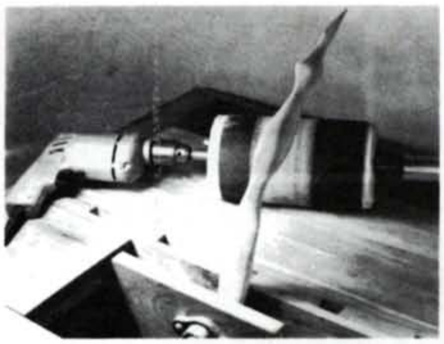

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# Events

*Events listings are free but restricted to workshops, fairs, lectures and exhibitions of direct interest to woodworkers. The next deadline is Nov. 1, for events beginning Jan. 1 to Mar. 15.*

*ARKANSAS:* Competition and exhibition of toys designed by artists, Dec. 4 to Jan. 3. Entry deadline, Nov. 6. Arkansas Arts Center, PO Box 2137, Little Rock, Ark. 72203.

*CALIFORNIA:* **Furniture Design Workshop** with Sara Jaffe, Nov. 6-7. Write Dept. B, University Extension, University of California, 2223 Fulton St., Berkeley, Calif. 94720.
**Mendocino Woodworkers Association Annual Show,** opens Nov. 27. Contact Clyde Jones, Box 95, Caspar, Calif. 95420.
**Carousel Animal Exhibiton** to Dec. 31. Kaiser Center Art Galleries, 1 Kaiser Plaza, Oakland.
**Contemporary Furniture** at the Signature Gallery. New location, 551 Pacific Ave., San Francisco.

*FLORIDA:* **Carving Show**—Dec. 5-6, Community Bldg. of St. Petersburg Beach.
**Design Competition,** multipurpose furniture, May 15 to July 4. Entry deadline, Feb. 1. Contact Arango, Metropolitan Museum Art Center, 1212 Anastasia Ave., Coral Gables, Fla. 33134.

*GEORGIA:* **Workshops**—hand tools, Nov. 14-15; machine woodworking, Dec. 12-13; $50 each. John McGee, 218 S. Blvd., Carrollton, Ga. 30117.

*ILLINOIS:* **Woodcarving Show,** Nov. 1, Belle Clair Exposition Hall, Belleville.
**Excellence in Woodworking** trade show and gallery, Oct. 30-Nov. 1, Hyatt Regency Hotel, Chicago.
**Demonstrations**—traditional woodworking methods, Roy Underhill, Nov. 7; bird carving, Richard Lemaster, Dec. 5. Frog Tool Co., 700 W. Jackson Blvd., Chicago, Ill. 60606.

*INDIANA:* **Conference of the Designer/Craftsman Guild of Fort Wayne,** Nov. 7. Contact Debby Lehman, 2320 Indian Village Blvd., Fort Wayne, Ind. 46809.

*MASSACHUSETTS:* **International Wood Collectors' Society meeting,** Nov. 6-8. Contact Zimmerman, RFD 3, Box 59, Putney, Vt. 05346.
**Continuing Furniture Exhibit**—The Society of Arts and Crafts, 175 Newbury St., Boston.

*MICHIGAN:* **Fruit Belt Woodcarvers Show,** Nov. 7-8, Orchards Mall in Benton Harbor.

*NEBRASKA:* **Carving Show**—Mid-America Woodcarvers/Central Flyways Decoy Club, Nov. 6-8 at Regency Fashion Court, Omaha.
**Exhibition**—handmade furniture and rugs. Deadline for entries, Dec. 15. Contact Craftsmen's Gallery, 511 S. Eleventh, Omaha, Nebr. 68102.

*NEW HAMPSHIRE:* **Seminars**—Japanese woodworking techniques, Toshio Odate, Jan. 9-10; European woodworking machinery, Robert Major, Jan. 16. Contact Mahogany Masterpieces, RFD 1, Wing Rd., Suncook, N.H. 03275.
**Competition** for New England craftsmen, March 22 to April 28; includes wood, clay, metal, glass and fiber. Entry deadline Jan. 11. University Art Galleries, U.N.H., Durham, N.H. 03824.
**Workshops**—woodturning with Rude Osolnik, design for crafts with William Katavolos, Jan. 17-20.
**Seminar '82,** League of N.H. Craftsmen, 205 N. Main St., Concord, N.H. 03301.

*NEW YORK:* **Exhibition**—includes work in wood by Wendell Castle and George Sugarman, through Nov. 25. Pratt Institute Gallery, Brooklyn.
**25th Anniversary Exhibition,** through Dec. 30, American Craft Museum, 44 W. 53rd St., NYC.

*NORTH CAROLINA:* **Craft Festival,** including basket-making, furniture finishing and shingle-making, Nov. 1. Onslow County Museum, PO Box 384, Richlands, N.C. 28574.

*OHIO:* **Exhibit** by Lorain County Woodcarvers, Nov. 14-15, 2401 Cleveland Rd., Huron. John Thorne, 144 Spring St., Amherst, Ohio 44001.

*OREGON:* **Woodcarving Show**—Western Woodcarvers Association, Dec. 4-6. Western Forestry Center, 4033 S.W. Canyon Rd., Portland.

*PENNSYLVANIA:* **Exhibit**—woodwork by Geoffrey Noden, Thomas Green and Edwin Germaine Young, Nov. 15 to Jan. 1. Jeffrey Greene Design Studio, Ney Alley, New Hope, Pa. 18938.

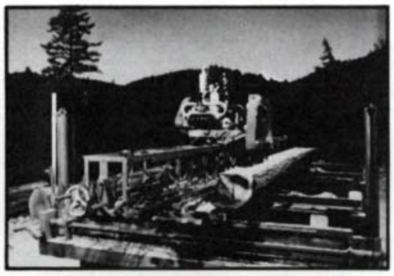
*TENNESSEE:* **Lamination Workshop** with Jere Osgood, Nov. 13-15. Appalachian Center for Crafts, Box 347 A-1, Rt. 3, Smithville, Tenn. 37166.

*TEXAS:* **Bowl turning demonstration** by Bob Stocksdale, Nov. 14-15. The Wood & Tool Store, 1936 Record Crossing, Dallas, Tex. 75235.
**1982 Dallas Craft Market**—open to trade April 22, to public April 23-25. Deadline for exhibitors, Nov. 16. Contact American Craft Enterprises, Inc., PO Box 10, New Paltz, N.Y. 12561.
**Exhibit**—Alamo Area Wood Carvers, Nov. 28 at Wonderland Shopping Mall, San Antonio.

*UTAH:* **Show and Sale** by Utah woodturners, Nov. 13-15. Write Utah Turned Art Assoc., c/o Christiansen, 3086 N. 150 E., N. Ogen, Utah 84404.

*VIRGINIA:* **Carving Show** by Northern Virginia Carvers, Nov. 28-29, Community Cntr., Vienna.

*WEST VIRGINIA:* **Crosscurrents '82** juried woodworking show, June 20 to July 28. Entry deadline, Feb. 15. Stifel Fine Arts Center, 1330 National Rd., Wheeling, W. Va. 26003.



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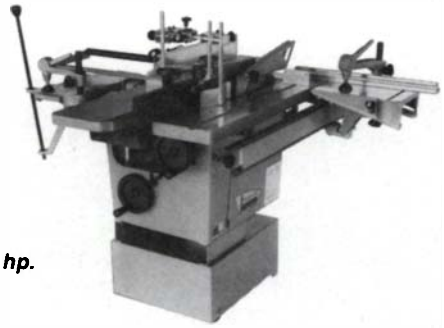

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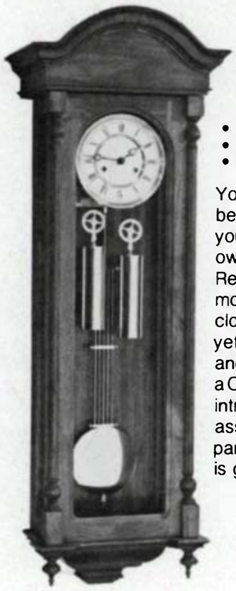

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# THE PREYING TREE

BY JOSEPH WHEELWRIGHT

It is not for me to say whether certain objects of Nature are imbued with a power beyond their physical being. Perhaps the human mind simply confers a special power on them. Whichever is the case, I am often halted on my walks through the forest or along the shore by the heartbeat of some casual offering of Nature. These found objects have become the basis for my recent works of art.

It is no accident, I suppose, that the fanned tail of the ruffed grouse mirrors the shape and color of certain fungi found in its habitat, or that the shape of some trees is akin to the form of our own species. We all have a common ancestor back there somewhere.

In the woods of Vermont in 1978, I met up with a dying beech tree of strikingly human character. Most beech trees have a taut, leatherlike skin stretched over their musculature, but this one had the form of a human figure as well. The tree met the ground on two massive legs, each 10 ft. long. The space between the legs, left by years of rot, was large enough to walk through. At the hip the body bent backward, narrowing at the waist and broadening to the shoulder twenty feet up. The shoulder appeared to be a more recent growth, probably having arisen out of the wound of a broken predecessor. From the shoulder sprang an even newer growth, a powerful, perfectly vertical young arm straining for the light and reaching thirty feet up before branching. The poor tree had been hemmed in by great hemlocks at the crown and by hornbeams at the trunk. I set about clearing the area immediately, to give him air and to get a better look at this one-armed, headless giant. I removed some of the dirt around the feet to help him stand up smartly.

*With chain and crane, author hoists the hand. At right, the Preying Tree.*

Later in the summer, in another beech tree I spotted a near-perfect hand, the wrist of which appeared to be of similar diameter to the end of the giant's arm. I decided to join the two.

With the aid of a long ladder and ropes I hoisted a couple of 16-ft. 2x8s up to where the joint would be. These were nailed to the arm on one end and to nearby trees on the other in order to serve as floor joists for a small, triangular platform. Once this work deck was secure, I cut off the crown of the tree where the wrist was to be. I then built a wooden crane to support the chain hoist which would raise the 300-lb. hand.

The next Sunday morning several neighbors helped me gently remove the hand from its tree, and we lugged it up the hill to meet the giant. Our chain hoist was not long enough to bring the hand up to the deck in one pull, but by chaining it halfway up and rehooking, we made it on the second lift.

Next came the question of joinery. I decided to use the dovetail. With a bowsaw and chisels I cut the tail socket into the arm first, a single, centered, 10-in. by 8-in. cavity at the bottom, 6 in. deep. Then I cut the tail in the hand to match. Using the wooden crane, I upended the hand and bapped it home with my beetle. I used cement as glue, thinking the grey would be a fine match. This was a silly mistake; the cement would not take to the sappy wood, and besides, the joint was so snug that most of it squeezed out messily.

All that remained to be done was some final carving around the fingertips, and then I dismantled the platform. The effect was startling; whereas originally the tree had been in a posture of supplication, its arm reaching longingly to the sky as if to take a gift, it now scratched menacingly at the heavens. I had wanted to call it the "Praying Tree," but it chose the name "Preying Tree." □

*Joseph Wheelwright works wood in Boston, Mass. and E. Corinth, Vt. His work can be seen at Allan Stone Galleries, 48 E. 86 St., New York, N.Y.* Fine Woodworking *buys readers' adventures. Suitable length is 1,500 words or less—up to six typed pages, double spaced.*

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# The McKinley Connection

## A craftsman wrestles the demons of industrial design

*by Stephen Hogbin and John Kelsey*

Most people, given the will and some tools, can learn how to work wood. Much more difficult is figuring out what to make, how the thing shall function and appear—that is, how to design.

Some craftsmen argue that this is not a problem, on the grounds that since we cannot hope to improve the 18th-century classics, we should reproduce them or recombine their time-tested elements. While this view produces some fine craftsmanship, the trouble is that times have changed. We have power tools and man-made materials today, and whether we like it or not the way people live has also changed. People want coffee tables and tea trolleys, stereo cabinets and lounge chairs, all manner of woodenworks that our ancestors had no need of, and for which we have no classical precedent. To have such furniture, we must design it ourselves.

Other craftsmen argue that the ability to design is innate, that some people are born with it while the rest of us are not. It must be nice to be one so anointed, but if good designers are born, then there is no hope for the rest of us. Yet we persist, and we do seem to get better at it, the more we search.

The truth seems to be that design is a skill and a method, like any other technical procedure. Designing can be taught, perfected in practice, and most anybody can start wherever he is and become better at it. Some people have more potential than others, but that is true of any activity.

The question now becomes how to study design. At most colleges, it means studying industrial design. The trouble with that is that industrial design by definition is for mass production. Thus it must search for easily reproducible models that can tumble off an assembly line with minimum human intervention, and so it often amounts to making and meeting interminable lists of requirements, in order to tailor the skin of the product in such an impersonal way that it can satisfy some particular market segment. What can this have to do with the craftsman woodworker, who wants to express his own and his client's individuality in work that machines cannot automatically do, and who will make only one or a few of each design?

It turns out that a synthesis of industrial design and woodworking craftsmanship is possible, albeit difficult. The work of Donald Lloyd McKinley offers an instructive example.

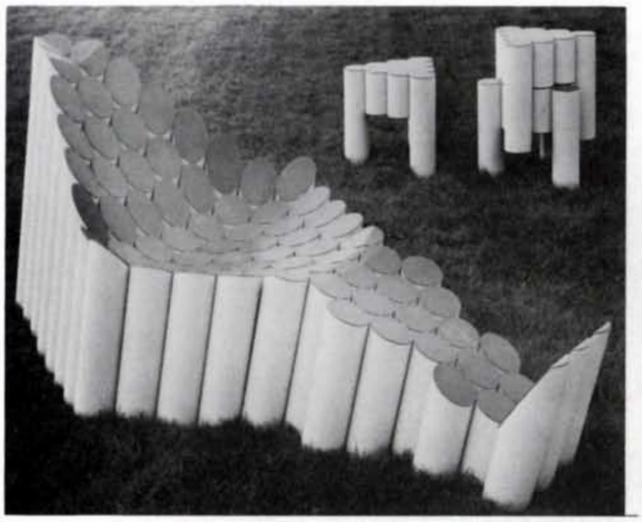
* * *

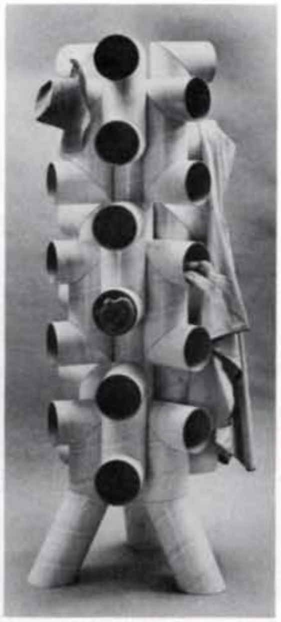
Don McKinley, 49, learned the crafts of ceramics and woodworking at the State University of New York at Alfred, and took a master's degree in industrial design from Syracuse University. He worked for four years as an industrial designer for Gunlocke Co., a manufacturer of office and institutional furniture, spent one year (1962-63) studying furniture design in Finland, and another year (1976-77) as craftsman-in-residence in Tasmania, Australia. McKinley moved to Toronto in 1967 to set up Sheridan College's crafts division, then in 1972 quit administration to teach full-time in the school's woodworking and furniture design studios. Earlier this year, the Koffler

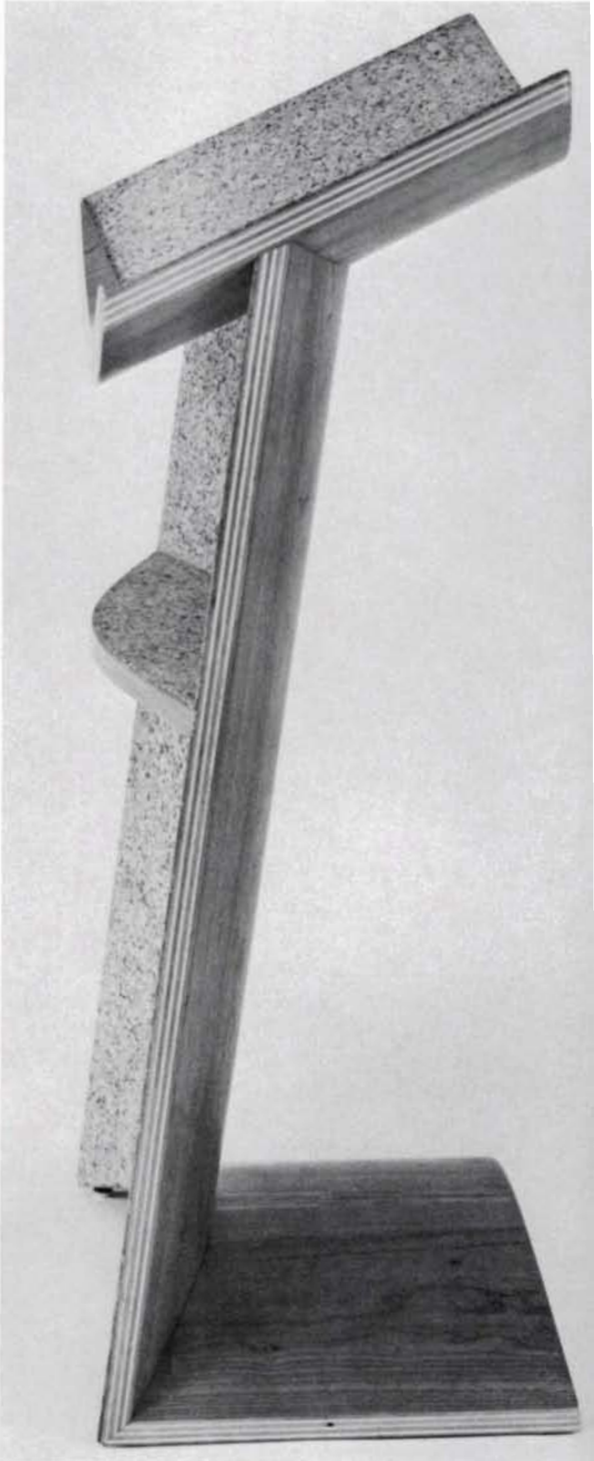
*Walnut salad bowl, steambent and coopered (1974, above), made with scrap offcuts from steambent chair parts. Two-height drafting chair with coopered seat and dovetailed footrest (1976, left).*

*Split-level shelf in teak, with mirror and McKinley (1979, right). Formed plywood chaise lounge (1975, below), the second generation of the ribbon-form lounge chair.*

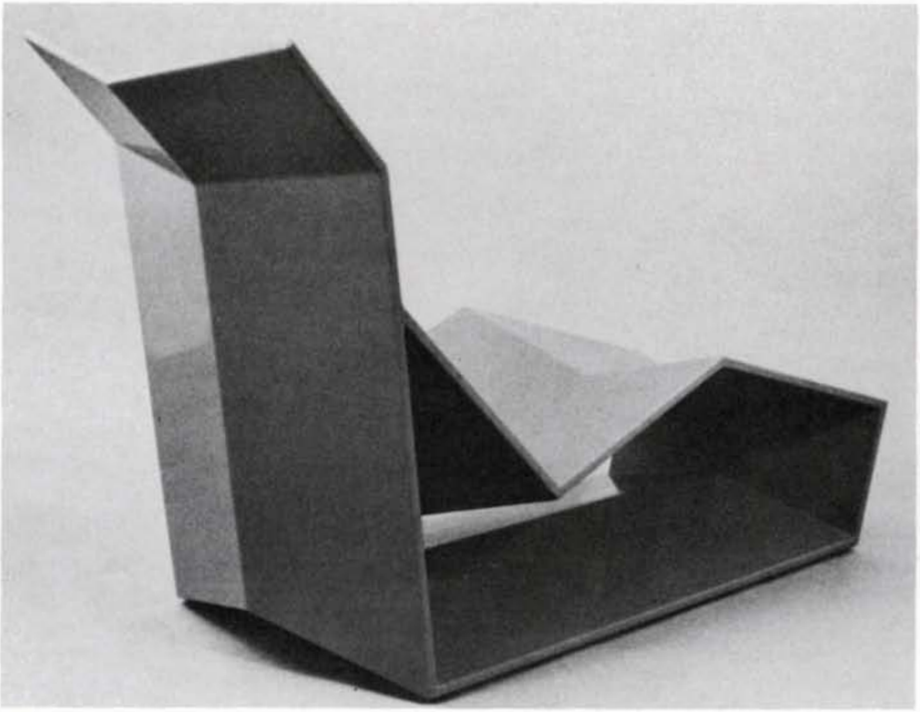
*Chair and ottoman, 4-in. plastic tubes joined by pop-rivets and solvent cement, capped with blue plastic (1969, below). In background, three stacking tables. Modular coat rack, 6-in. cardboard tubes, 78 in. high (1969, center).*



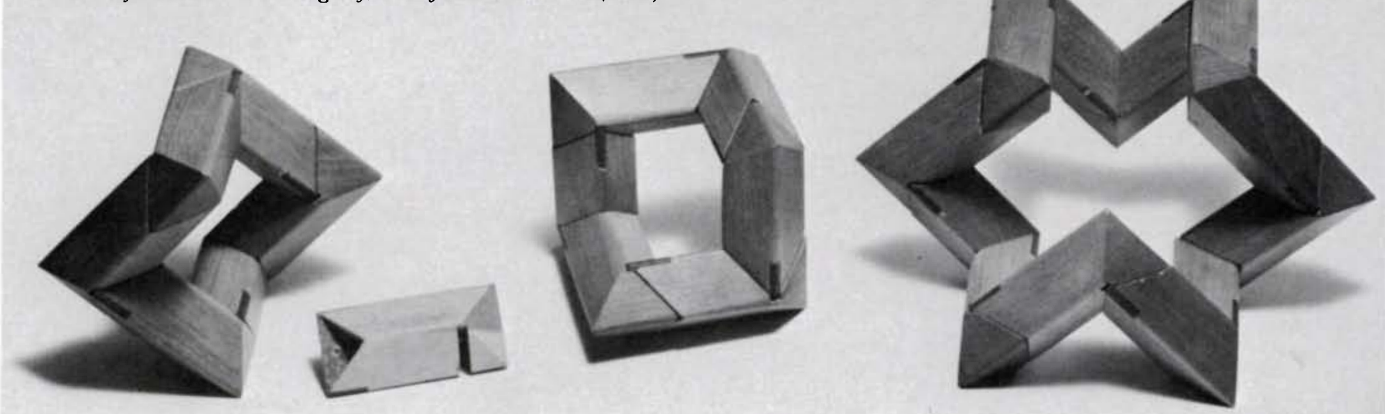




*Dihedral lounge chair (1971, below) was made from a single sheet of poplar plywood, joined with splines. McKinley describes it as "an attempt to have a single, angular cross section continue along a folded path and produce a coherent seating surface." This led to the lounge chair shown on the previous page, and thereby to the lectern at right (1973). All its curved parts come off the same bending mold.*



*Friction-fit modular building toy, cherry and hardboard (1972).*



Gallery in Toronto staged a 15-year retrospective exhibition of his work.

What's instructive about McKinley is the way in which he has progressed from the cool impersonality of industrial design to the warmly organic sensitivity of the wood craftsman. He's been able to develop the methods of professional design and to adapt them to his own uses, and although he's ranged widely during the 15 years represented in these photographs, a number of themes are constant.

In terms of form, McKinley is fascinated by furniture built from identical modules that represent fundamental geometric elements: line and plane, circle and cylinder, surface and cross section. Sometimes the module is a discrete part, but more often it comes from an endless ribbon of constant cross section, like an extrusion, which he cuts, folds and rejoins. Lately it's a natural extrusion—a slab sawn from the outside of a tree in the process of making lumber. In terms of material, McKinley usually makes do with what grows locally, or with what somebody else has thrown away. He delights in finding unexpected value in scrap, in turning mundane materials to surprisingly new uses. In terms of function, McKinley prefers such small, personal furniture as chairs, tables, mirrors and jewelry boxes, and he likes each piece of furniture, in these days of the small apartment, to do more than one thing, or at least to get out of the way with style.

Finally, what makes McKinley's work accessible to the amateur woodworker and to the small producer is the fact that it's all been designed and made during the off-hours of the full-time teacher. Having to put student's needs ahead of his own interests and problems, he's not had the time a professional designer would invest in a good idea. On the other hand, teaching for a living has allowed him to pursue ideas without regard to profit potential, simply because they're interesting.

**Before wood**—Early in his career, McKinley discovered the advantages of working with such waste materials as wooden arcs trimmed from steambent chair parts, or the cardboard tubes on which upholstery fabric is rolled. This was in the mid-1960s, when we had seen the whole earth photographed from space and had just recognized its resources as finite, whence recycling. McKinley maintains that his position was not philosophical, that he is just a natural tightwad. He also notes that a stack of waste material is risk-free—you can cut and try and start all over without fretting about expensive materials.

The French call such a person a *bricoleur*, which more or less means, "native genius." The true *bricoleur* has an almost magical ability to perceive usefulness in otherwise useless stuff, to get beyond labels and find new meaning in ordinary things.

From experiments with soda straws and glue (easier to handle than full-scale upholstery rolls), McKinley in 1967 discovered a lounge chair in cardboard tubing, cut and capped. Although amusing, the cardboard chair quickly frayed apart. Then white plastic sewer pipe came on the market. This mundane material was durable, washable, workable and still pretty cheap. His chair with ottoman (top left) became part of the S.C. Johnson collection of contemporary crafts. McKinley glued and pop-riveted a lot of tubing together during those years, pipes side-to-side, side-to-end and end-to-end. He fooled around with tin cans and cardboard tubes as big as 24 in. across, and developed playful furniture that included chairs, stools, tables, lamps and wine racks.

This plastic furniture was the direct fruit of the industrial designer's method, in which a problem is formally stated, its parameters investigated, and a universe of possible solutions explored via words, sketches and models. One of the important tools in the industrial designer's arsenal is the forget-proof checklist with such headings as Function, Economics, Materials, Process, Structure and Form. Each heading can carry any number of subheadings, but for all their apparent completeness such lists leave little room for the personality of the maker or for the personal needs of the product's ultimate user. For all their wit, there's not much McKinley in this plastic furniture.

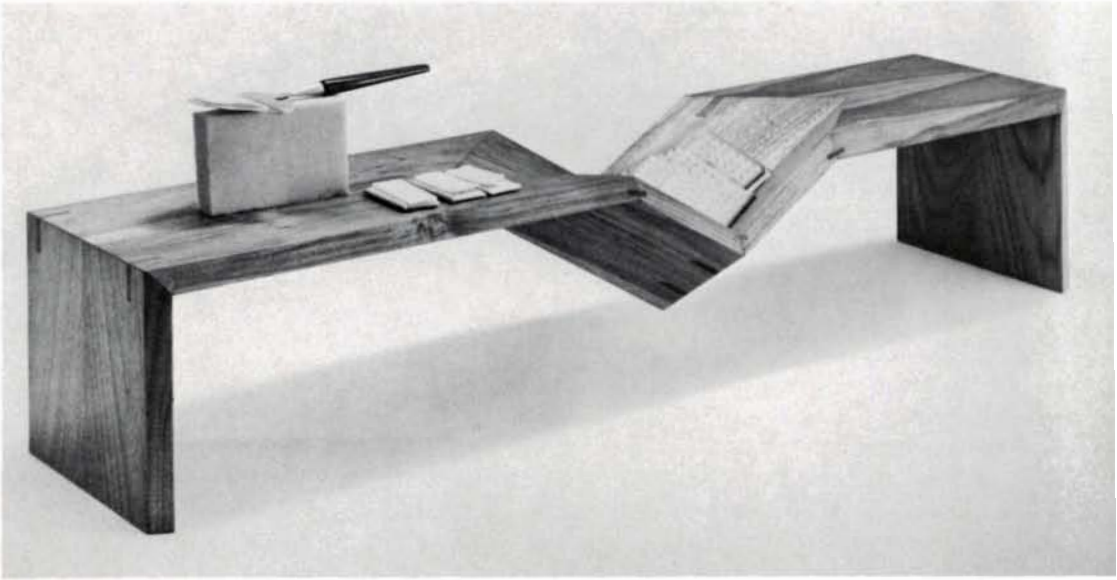
There isn't any wood here either. What is here, besides inventiveness, is structural investigation (a tube is very light for its volume, yet it can support enormous forces), geometrical investigation (the tube is only a circle made tall, but slice it at various angles and see what cross-sectional shapes result), and investigation of module (all tubes are the same shape, so bunches of them automatically have rhythm and symmetry). But for all of that, plastic sewer pipe is sterile stuff, even when pushed to such limits as these.

**The infinite ribbon**—Another constant theme apparent in McKinley's work is wood as extrusion, as if squeezed like clay through a die, into an infinite ribbon of constant cross section. McKinley can cut, fold and rejoin the ribbon, but the design exercise permits no additional shapes, and requires the ribbon to outline a furniture surface while flowing to rejoin itself. Thus the "dihedral lounge chair" (1971, far left) from a single sheet of poplar plywood, mitered and splined together. Its seating surface is similar to the pipe chair's, but where that was a structural exercise, the exercise here is in material limitations and flat planes in space. Where the pipes provided a very visible means of support, here the sitter must trust the maker's invisible joinery.

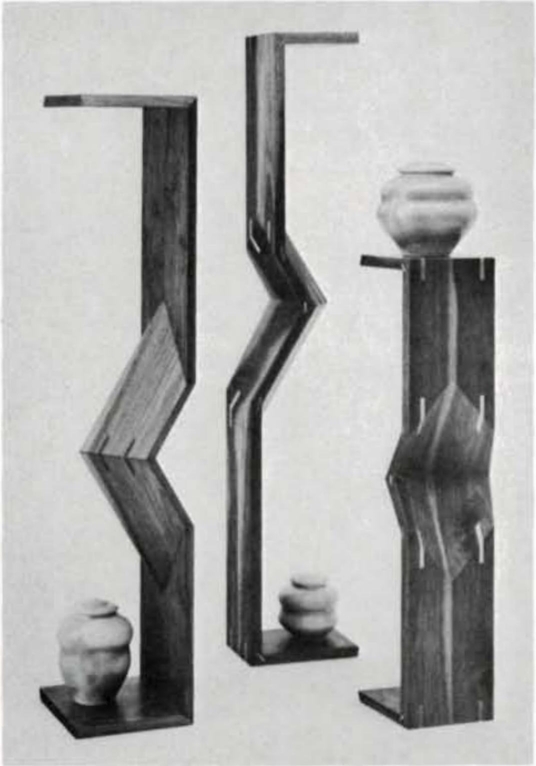
The designer in industry always takes his first-generation solution through a series of prototypes before arriving at the production model, refining both the form and its method of manufacture. The professional craftsman goes through a similar evolution each time he returns to a piece he's made before. The pressures of teaching (along with his personal inclination to check out an idea and move quickly onward) make it rare for McKinley to get beyond a first-generation prototype. But the lounge chair idea did become a second generation, this time in formed plywood (bottom of p. 51) which smooths out the shapes and simplifies the manufacture. The dihedral fold becomes a smooth arc cross-laminated on a bending form, out of ⅛-in. maple plies faced with mahogany veneers. Loose splines join the miters, which are reinforced by solid wood butterflies. Surprisingly, this second chair remains comfortable even after a long sit.

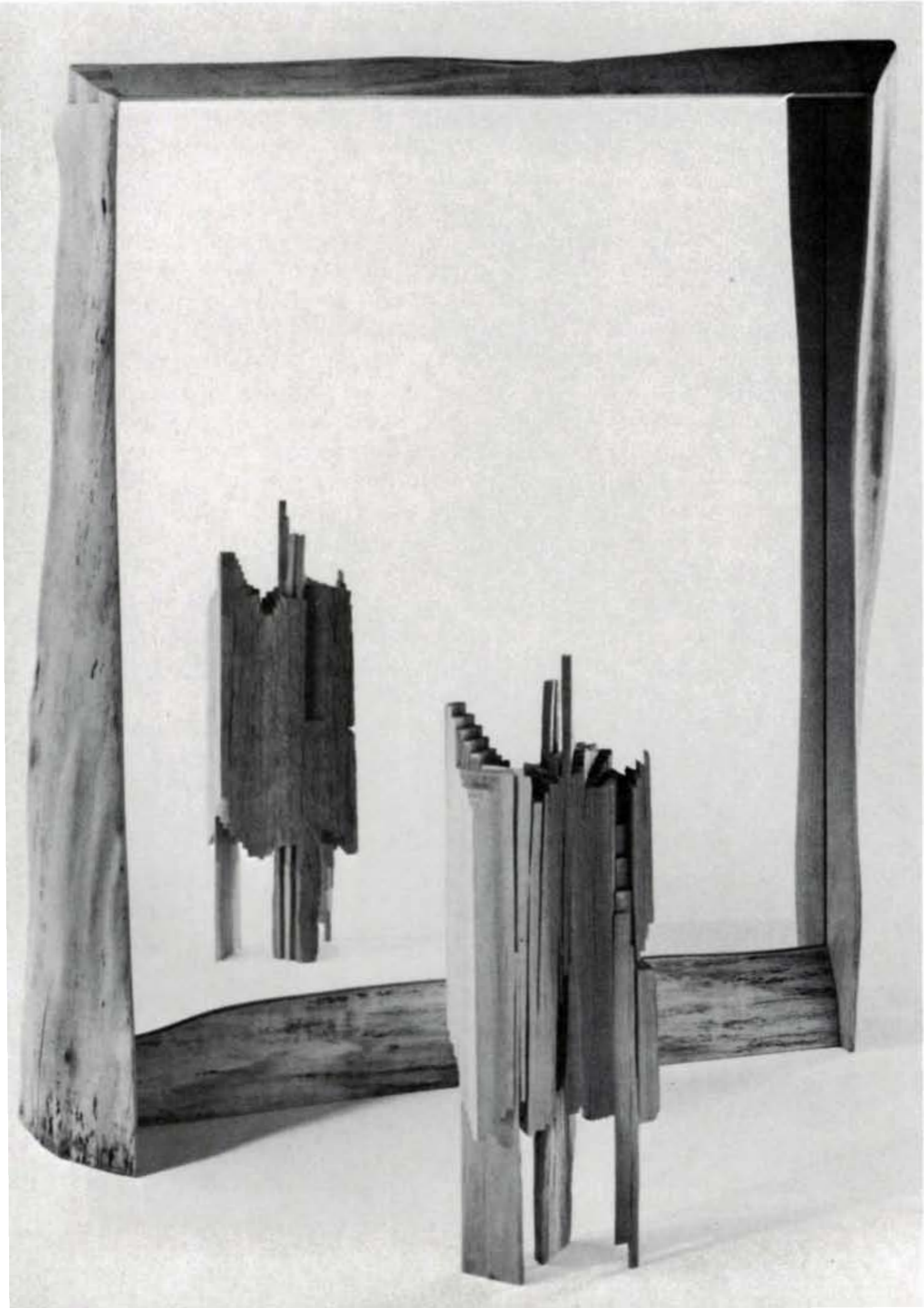
Every piece of the chair comes off the same bending mold and has the same cross section. Not only that, the *bricoleur* in McKinley also made a side chair, lectern (left), rocking chair and even a receptionist's desk off that same mold. Such ingenuity is admirable, but it's also contradictory. Whereas the industrial designer must be concerned about economical manufacture, the individual craftsman who's making only one piece needn't worry half as much. In this work McKinley still has his design-for-production habits, and he's still treating wood as anonymous, homogenous material.

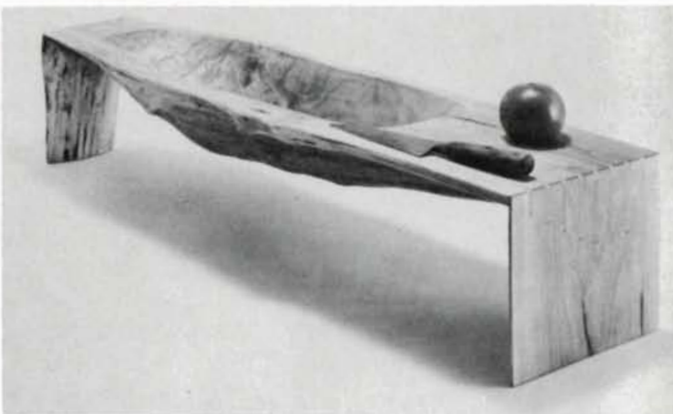
**The wooden module**—This friction-fit building toy (1972, facing page), shows another aspect of McKinley's interest in



*Work stool with three-level footrest (1977, left). Faceted cheese board and biscuit bowl, walnut with through-splines and cross-joint feathers (1979, above and at right), can be stood on end or hung on a wall for storage.*







*Cambium-surfaced salad bowl with integral cutting board, maple slab, mitered with inserted cross-splines (1979, above). Reversible mirror, cambium-surfaced maple with finger joints (1979, left). The small sculpture reflected in the mirror was made by ax-splitting a 7-in. piece of red cedar 2x4, then reassembling all the splints with some of them shifted vertically.*

the module, this time short, square sections of cherry wood with slots and hardboard splines, one end beveled convex, the other concave. These pieces can be joined into forms of almost any length, but most readily into an endless ribbon twisting back upon itself. The precedent is scientific model-making, for example, ball-and-stick models of molecular structure. Like a molecule, McKinley's assembled toy disguises the shape of its individual parts. Nor is it easy to see what other shapes might be built with the module, until you discover them by playing with the toy. The module itself is a discrete form, but an assembly of them is multiformal and ambiguous. If a piece of furniture could take multiple forms, might it not also have multiple functions?

**Module and multiple function**—This work stool with three-level footrest (27 in. high, 1977, far left) was designed by fooling around with the building toy. It demonstrates in solid wood all the things that happen when you rotate and join a square stick. It's made of white ash with maple wedges and pins, and like the quick brown fox, it just about uses up the alphabet of the rotated square.

The central joint in the stool's understructure looks weak. Yet it's vigorously engineered, the stem "double-saddled onto the intersection, quadruple-doweled and reinforced with a steel rod tensioned between two brass barrel nuts." It has not broken—the perceived weakness is only skin deep.

The cross-pieces at floor level are turned up on edge, making the stool seem poised and alert. Their edges visually slice the ground, drawing one's attention to the stool's unexpected relationship with the floor. A stool with three heights for resting the feet itself seems playful and unexpected, a response McKinley tries to evoke.

In the two-height drafting chair (1976, p. 51), he takes the multi-functional idea a step further. It's made of Tasmanian huon pine, a disappearing species normally used in boat-building. It can be used as a chair, or as a stool with footrest, eliminating one whole piece of furniture from the thicket around the drafting table. While it continues McKinley's exploration of ribbon-with-constant-cross-section, he's finally stopped thinking in terms of production multiples. Instead of plies bent on a reusable mold, these curved planes are coopered from solid wood. And here McKinley also recognizes the aesthetic appeal of exposed joinery, whereas his earlier work prefers the neatness of concealed splines. But he can't resist making a joinery joke of the splines that reinforce the stool's caster sockets—they're decorative dovetails.

**The craftsman emergent**—Although it's almost the size of a coffee table, McKinley calls the form at top right on the facing page "a faceted cheese board and biscuit bowl." The contemporary ritual of serving hors d'oeuvres gathers the guests, stimulates their palates, and focuses their attention on one another. By bringing all the food together on one small piece of furniture, McKinley hopes to assemble the crowd around it. When the party's over, the board-bowl gets smoothly out of the way. Three of them stand on end (center) to display porcelain made by McKinley's late wife, Ruth Gowdy McKinley.

The form of the piece develops from the ribbon-in-space idea behind the lounge chairs, although now without the artificial limitation of constant cross section. McKinley is also working as a craftsman in touch with his wood, rather than as an industrial designer who is manipulating some amorphous stuff. The process starts with a thick plank, chosen for attractive figure, which is resawn, book-matched, cross-cut, mitered and rejoined. McKinley notes, "The bowl can be assembled along its centerline only after all the compound miters have been cut and grooved for splines; grooves for cross-splines or feathers are cut only after each half has been glued up." Absolute grain continuity is not possible where the faceted bowl meets the flat sections.

Although the board-bowl is a valiant attempt to solve the contemporary problem of ritual form, a quarrel must be made with the way it functions. The problem of ritual is finding types of furniture that are appropriate vehicles for the craftsman's skill, since there's not much incentive to hand-make what mass production can do as well. In earlier times, religious and community rituals often created a suitable setting for craftwork whose manufacture required maximum effort. Few such rituals remain in contemporary life, but one that does is the convivial ceremony of eating with friends.

The quarrel is that while the design succeeds in eliminating the clutter of bowls and cheese boards atop a coffee table, it leaves the guests with nothing to pass from hand to hand. Since the board-bowl is three to four feet long, it's not possible to reach politely from one end to the other. If made shorter and wider, it might do more to enhance the hors d'oeuvres. The plank would have to be wider than what's commonly available, but that is only a matter of finding the right plank.

**The cambium surface**—McKinley's current work, which he describes as "cambium surfaced" (p. 50 and bottom left), is made from sawmill offcuts that would otherwise have become firewood. Their origins are in rustic furniture, but these pieces go far beyond mere adulations of nature expressed in crooked sticks nailed together. Many craftsmen avoid furniture that could be called rustic, seeing it as necessarily crude. But this simplistic perception isolates the craftsman from the inspiring shapes that grow in the trunk, limbs and roots of living trees. It's not easy to work well with wood straight off the tree, because the tree demands to be carefully appraised and sensitively applied. That's why so much rustic furniture is so bad.

These are controlled forms that require exacting workmanship, for the idea is to retain the whole layer of once-living cells where the tree grew its new wood. A slip in joinery and that muscular continuity is gone, and so is the work done thus far. These pieces continue McKinley's interest in extrusion and cross section, but instead of a uniform section it's now an organically changing recollection of how the tree grew. The sawn edge and flat surfaces echo the industrial designer's interest in geometry, but the shape of that hard edge also results from the tree's growth. The contrast is entirely pleasing. The *bricoleur*-craftsman is in charge, directly finding furniture forms in sawmill scrap. Starting from such thoroughly manufactured materials as plastic pipe, McKinley has come full-circle to work with nature instead of attempting to control it. From industrial design's cool stripping away of subjective content, he's found a way to reveal himself by letting the wood speak for itself. There's joy here, and purpose too. □

*In this critical collaboration, most of the insights come from Stephen Hogbin, a designer/craftsman working in Owen Sound, Ont., while most of the writing is by John Kelsey. Don McKinley provided the photographs of his own work, and Patricia Wilmot of Toronto supplied biographical detail.*

# On Designing Chairs

## How to develop ideas into working drawings

*by Alan Marks*

Chairs obsessed my teacher, the Swedish designer Carl Malmsten. Starting with his prize-winning piece in 1916, he designed dozens of successful chairs, mainly for production. By nature a perfectionist, he continually revised his manufactured models, periodically updating his drawings, until his death in 1972. "It's not bad," he'd say, "but it could perhaps be made even better." His critiques of his students' work were sharp, and his criteria for good chair design were pointed: (a) Is it strong and practical? (b) Does it look good? (c) Is it comfortable, not only at first but also during a long sit? (d) Is it economically feasible to make?

This article is Part I of a series. Designing seating for comfort is the subject of Part II. Part III covers aesthetic concerns—making the chair look right. But the first thing to talk about, here in Part I, is how best to use paper and pencil to draw chairs, exploring the basics of chair design.

Before considering anything carefully, I play around with chair ideas in side elevation. These are rarely more than guidelines, and I try to make them as outlandish and unpremeditated as possible. After a dozen or so of these, I choose one to develop further. Probably the final design will bear no resemblance to it, but it serves as a starting point.

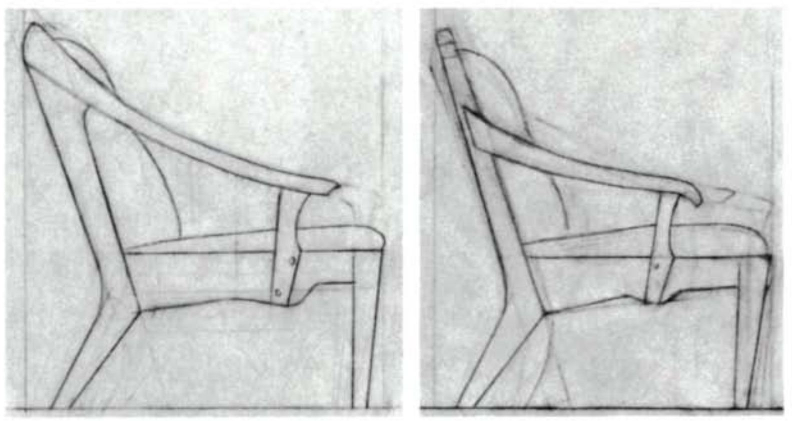
From the chosen idea I work up a drawing in 1/10 scale, in millimeters. I find metric dimensions easier to convert to full scale. Two millimeters on the small sketch become twenty on the large drawing. On the paper I mark off seat height and depth, back angle, overall estimated height and armrest height, if there are any armrests. I do the side elevation first. It is the most critical and will largely determine the appearance of the front and back. Into the limits marked out, I try to fit the most promising side view. This usually takes quite a bit of adjustment. Unless you are uncommonly sure of yourself, you need to erase a lot. I use a light-grey, plastic eraser, as it doesn't smudge or abrade the paper the way pink or art-gum erasers do.

Translucent drafting paper is best for sketching. If you plan to have commercially processed copies made, you must use translucent paper. But it has another advantage: You can change the design without erasing the previous version. Simply tape a new piece of paper over the earlier version and trace it, changing as much of the design as you like. When you fold back the top sheet, you can make useful before-and-after comparisons. But even if the second version is better, don't discard the first. Build up as many thicknesses of changed sketches as needed, saving them all. Often an element you drop at one stage will be just what you want later on.

It isn't easy to reproduce complex curves in symmetrical pairs using standard flexible rules. A quick and accurate method is to use your translucent paper as if it were carbon paper. Lay a suitably sized piece over the curve and trace it using a 2B lead. Now turn the paper over and you have a mirror image. Position it on the drawing and trace heavily over it with your pencil. A light deposit of graphite will indicate the curve, and it can be drawn in darkly by hand.

Sometimes a preliminary drawing, of curved splats for example, turns out less than symmetrical for being drawn freehand. The halves are subtly different, like the halves of your face. Which looks better? To tell, hold a mirror along the centerline, mirroring first one half and then the other. The better version will usually be apparent. On paper, simply erase the less desirable half and use the copying method described above to transfer the better half.

Having done a preliminary sketch to your satisfaction, tape a large piece of paper to a drafting board and enlarge it to full


Preliminary sketches

Sketches of easy chair "Little Egypt"

scale. I use discarded roll ends of newsprint, had for the asking at the local newspaper press room. Since it doesn't cost anything (drafting paper is quite expensive) and because you're not doing a final drawing, you won't feel bad about consuming it. To enlarge, draw a vertical reference line alongside the side view and measure up from the floor line and over from the vertical to established points. This method is simpler and quicker than the standard grid method of enlargement. Probably, what looked great at 1/10 scale will need substantial revision in the blowup, so change whatever looks wrong, except the contour of the back, which is pretty much determined by human anatomy (which will be discussed in a later article). When the side view is satisfactory at full scale, reduce it back to 1/10 scale on drafting paper. Next to this drawing transfer with the T-square dimensions needed for a front view. Work on this until it seems right, then enlarge it to full scale on newsprint and refine it. When you are done, simply tape a piece of translucent paper over the newsprint and make a final working drawing.

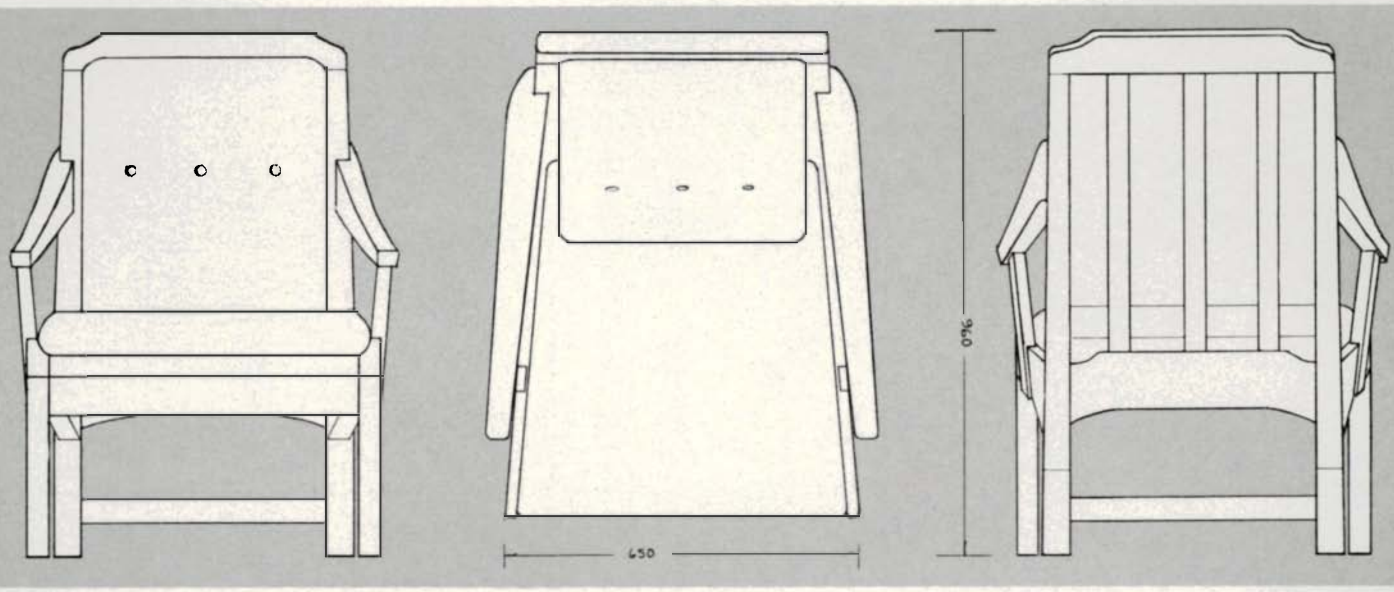
For many one-off pieces of furniture—tables, cabinets and stands—you have the choice of making a full-scale working drawing or taking the particular planks of wood you will use and letting their size and figure shape the design. Of course, if the design is complex, a working drawing will eventually be necessary. Chairs are complex, and they must fit the human body, so working drawings are essential. Comfort can't be left to chance; it must be carefully engineered. An advantage of full-scale drawings is that during construction you can take measurements directly from them, with ruler or tape measure.

Still, a drawing has limitations. It is impossible to see from a flat drawing how a solid element will appear in fact. Thicknesses, curves and overhangs have an unpleasant habit of doing unpredictable things when seen in three dimensions. The width of a set-back table apron or of a chair's front rail may look fine on the drawing, but in the solid it disappears under the overhanging top or seat. It's difficult to guess from a drawing how much will remain visible. So no matter how final the drawing, it should still be seen merely as a guideline. I always have a black-line copy made of my "final" drawing, and then I pencil in the alterations as construction proceeds. When I have completed the piece, my copy reflects all revisions. I transfer these changes to my original drawing, discard the copy, and have a new one made to keep on file for prospective clients and to enable me to duplicate the piece.

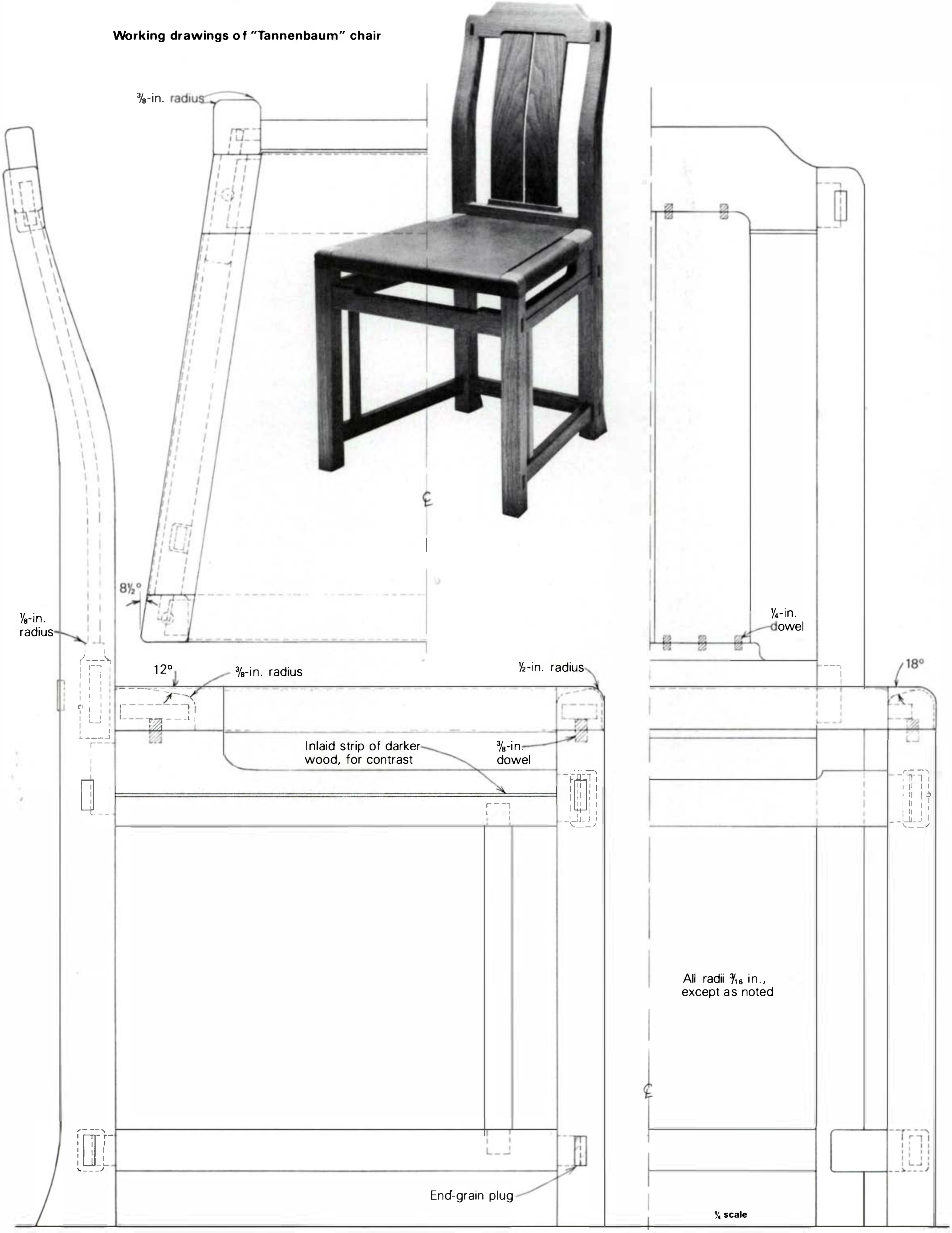
You can approximate the effects of perspective and of viewing at an angle if you stand the working drawing, mounted on the drafting board, vertically against a wall. It helps if you draw the piece close to the bottom of the paper and mount it close to the board's bottom edge. You can look at the views from above or at an oblique angle or at a combination of both. This strategy assumes you have a board to draw on, not a fixed table. Use a piece of shop-grade birch plywood, 38 in. by 50 in. minimum. The 38-in. width will accommodate 36-in. drafting paper (which also comes in 42-in. and 48-in. widths). A 38-in. by 50-in. board is big enough for most chairs, though lounge chairs require a 48-in. by 60-in. board and wider paper. I lay my board on two work stands similar to the sawhorses shown in *FWW* #24, Sept. '80, p. 78.

Working drawings of chairs generally require three views, side, front and top, and they should be condensed and superimposed as much as is practical. Because the front view and the top view are symmetrical, I draw a vertical centerline to the left of the side view and show half of a front. Another centerline, drawn horizontally through the side view, either slightly above the seat or below it, locates the top view. It also is symmetrical, so only half of it need be drawn. The position of the halves depends on what's least confusing. Some designers superimpose all three views, but the advantages are dubious. Erasures become a complex nightmare, and it is sometimes difficult to indicate clearly all the necessary information, because so many lines crisscross. I transfer dimensions from view to view with a T-square and triangle. Partially superimposing and drawing halves cuts down on drawing time without sacrificing clarity, and it results in smaller drawings that are much less clumsy to handle in the shop. To depict the back of a chair, one side of the vertical centerline shows a front half and the other a back half.

While thinking about appearance, you must keep construction in mind. Plan to make things easy for yourself. On curved pieces, leave at least one surface flat as a reference for layout and machining. To determine the minimum dimensions of a blank, draw rectangles around the curved piece, in side and top views. I leave flats on curves at points, for example, where rails or arms attach to legs. Butting one flat sur-



Working drawings of "Tannenbaum" chair



face against another is easier than mating to a curved surface.

When designing arms for easy chairs or sofas, where a large curve can be pleasing, or when drawing curved legs, it is important to design with regard to available stock. If you chainsaw-mill your own lumber you can write your own ticket. But commercial wood in 12/4 planks is scarce. Bent laminations or steambent parts are more practical when their shape integrates two or more functions, such as combined front-leg/back-leg/armrests. An alternative to laminating, bending or stacking, is splicing. Often a spliced joint can be a decorative feature. Sometimes you can find grain curved to match the shape you need, but most often pieces must be sawn from straight-grained planks. Because chairs take a real beating, areas of grain running across a curve should be avoided. Thus, curves can't be too radical in solid stock.

Curves are most efficiently cut using a shaper jig. Jigging ensures exact repetition of dimensions and guarantees squareness. You can rely on the consistency of pieces through subsequent machining operations. I prefer not to settle on the final appearance of curved chair arms until after I've made a prototype of the whole chair. I hand-shape the arm at that point and transfer its shape to my drawing. Then I make jigs.

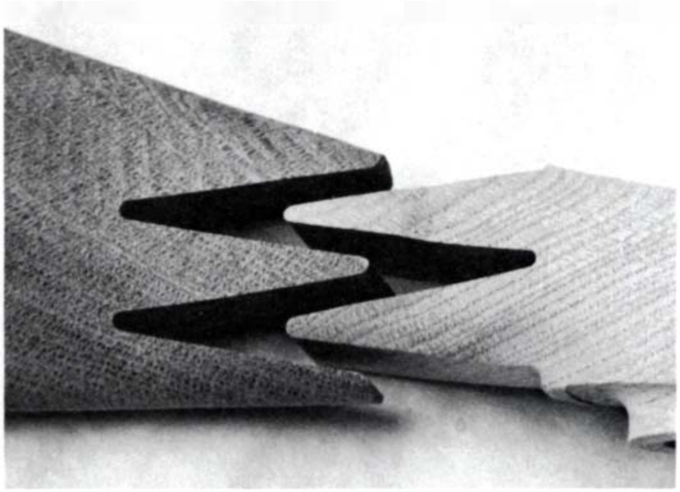
Some complicated shapes can be done only by hand, but drawing them facilitates repetitions. At appropriate intervals on the drawing, revolved sections, usually crosshatched, show the shape. Templates made from these revolved cross sections can be saved for the next run.

In the drawing stage, the strength of joints has to be kept in mind as well. Depending upon the relative stength of the wood used, dimensions will vary. Oak is stiff and strong, and furniture of oak could be made very slender. Pine, on the other hand, must be used lavishly.

Major weaknesses in chairs show up when the back is leaned upon heavily. People love to tilt back on a sidechair's rear legs after a good meal. This relaxes them at the chair's expense. Auxiliary rails between front and back legs alleviate the strain. Though it is conceivable to build a sidechair with seat rails wide enough to withstand the after-dinner tilt, I always suspect seat rails alone of being inadequate. Arms on chairs will provide the necessary bracing, but the method of attaching them to the rear legs should be carefully considered. Attaching directly to the front of the rear legs makes it likely that the joint will pull out. For maximum strength, an arm should attach from the side as well (see *FWW* #12, Sept. '78, p. 42). When the front leg does not serve as a riser to anchor the arm in front, a separate riser can be attached to the seat rail and an auxiliary side rail added below the seat.

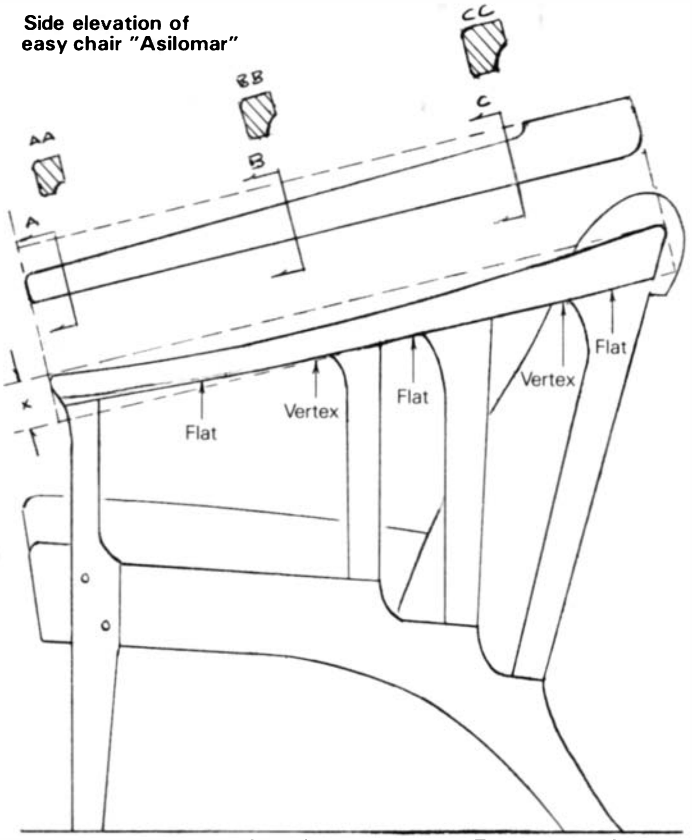
Make sure your design will go together properly by imagining an assembly sequence as you draw. For a conventional chair, front legs with connecting rails usually get glued up as a unit, and back legs with splats and rails form another unit. The next glue-up occurs when front and back assemblies get joined by the side rails. Arms often get glued on as a final step. In rare cases, however, it may be necessary to assemble the back only partially, depending upon the splat and top-rail construction. The most complicated chair to design and assemble is an armchair whose rear legs splay outwards, at an angle to the seat rails. Knowing in what order a chair is to be assembled ensures that it can indeed be done. □

*Alan Marks is a frequent contributor to this magazine. Photo and drawings by Alan Marks ©1977, 1980.*



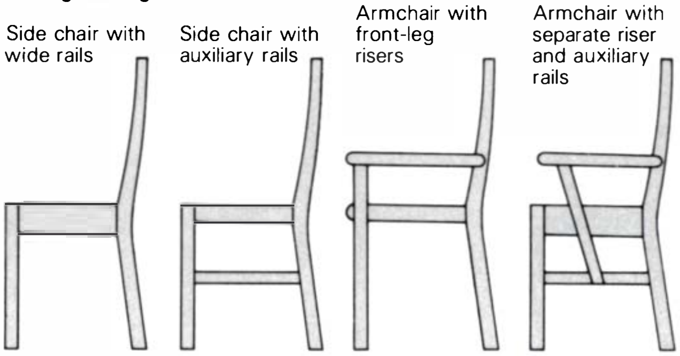
*To produce curved parts, splicing is an alternative to laminating, bending or stacking. This splice between arm and back is from Hans Wegner's Classic chair (see* FWW *#21, March '80, pp. 36-42).*

**Side elevation of easy chair "Asilomar"**



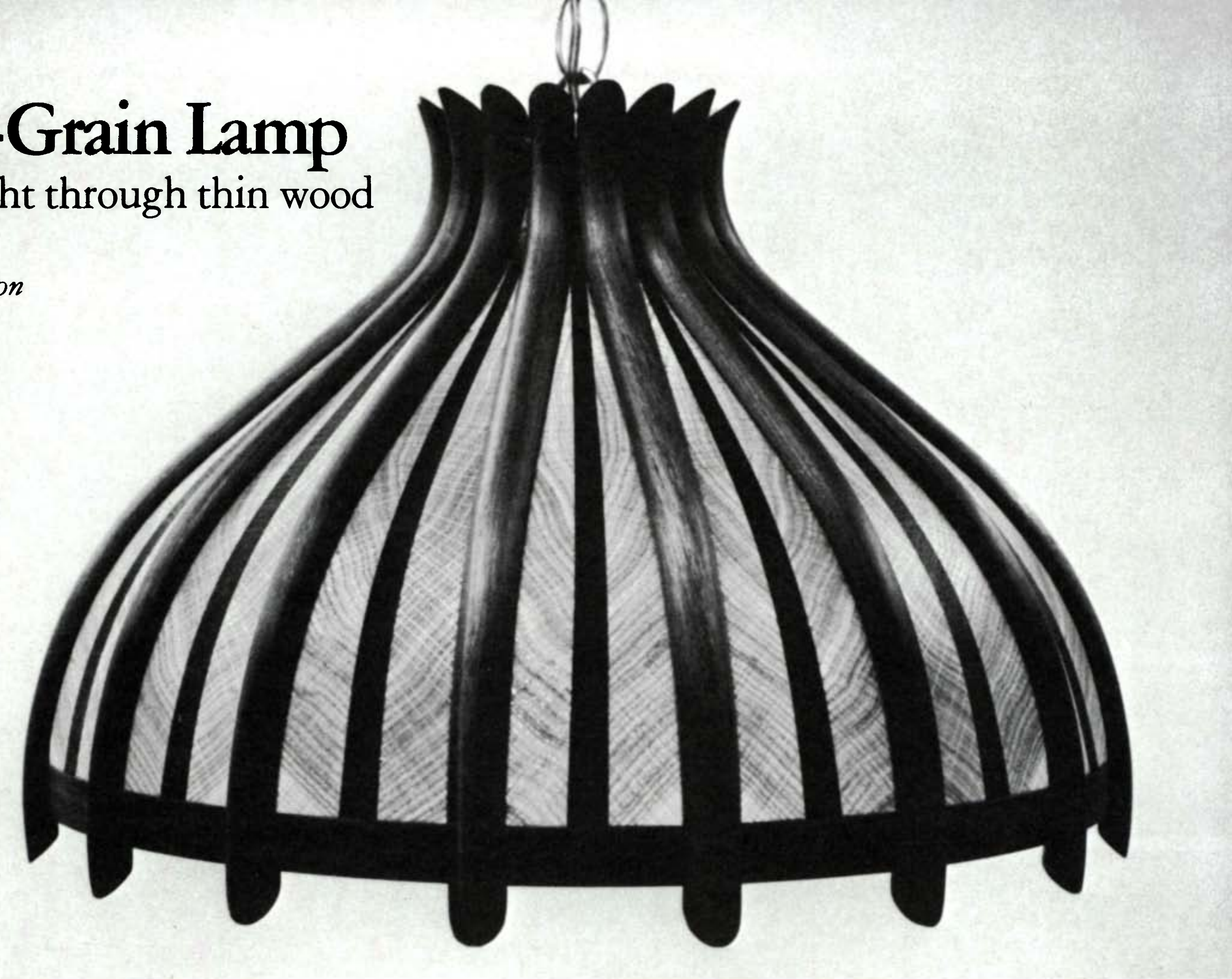

*Note that only the top surface of the arm is curved. The bottom surface consists of three flats, facilitating the butt-joining of the verticals, while maintaining the appearance of a smooth curve. Revolved sections of the arm indicate otherwise difficult-to-illustrate transitions. Dashed lines around curved members determine blank size.*

**Strengthening chair structures**



# An End-Grain Lamp
## Seeing the light through thin wood

*by James G. Mattson*



Properly worked, end grain can be the most attractive surface of a piece of wood. But it is difficult to smooth, tends to chip out in machining, exchanges moisture readily, glues badly and expands, contracts, warps and checks, often without moderation. In thin sections it is especially troublesome, and just about useless as far as I could see. Then I made an unexpected discovery. I was cutting stretchers for a red oak coffee table and the stop-block slipped, leaving all the stock 3⁄16 in. too long. Upon recutting, the windstream from the radial-arm saw lifted one of the wafer-thin off-cuts and dropped it on top of the fence, right in front of the work lamp I had positioned there. As I picked it up to throw away, I passed it in front of the lamp and realized I could see light through the wood. Upon closer inspection, with the ceiling lights off, the beauty of the end-grain red oak flashed forth—there were waves of large, open earlywood pores banded by cell-studded latewood and crossed by hard, dark ray-lines. The color was a warm red.

Discovering a new property of a familiar material can be an inspiration. The lamp I designed to take advantage of the translucency of end grain can best be described by considering the parts of a wheel. At the top center is a hub, a small-diameter, solid-wood disc that holds the lamp's hardware. From the hub, 16 nine-ply, strip-laminated spokes radiate and curve down to intersect a four-ply rim. The inner faces of the spokes are notched at top and bottom to receive the hub and rim. All the parts are grooved along their edges to house the end-grain panels. Instead of cutting these grooves, which is a problem in such narrow, curved stock, the grooves are formed by laminating narrower strips along with the full-width plies. The plies for the bent laminations and the panels are all 1⁄16-in. thick.

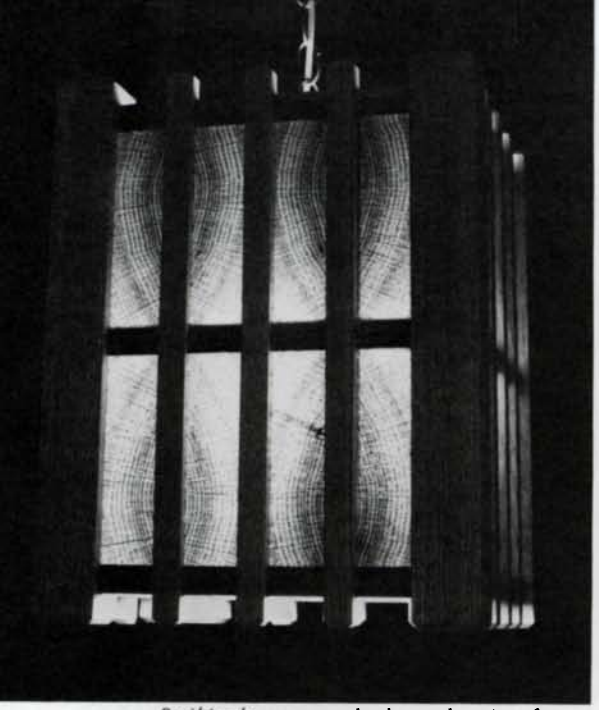
Begin construction by sawing the plies for the strip-laminated parts from 7⁄8-in. thick boards (I used walnut) at least 51 in. long for the four rim plies, 13 in. long for the two hub plies, and 15 in. long for the 144 spoke plies. I use a sliding hold-down jig to rip them on the radial-arm saw, but the table saw will work as well. By using a sharp carbide-tipped blade and orienting the strips in their original order, the glueline is unnoticeable, and there's no need to joint the stock between rippings. To shape the plies that will form the groove in each spoke, stack 16 of the spoke plies against the radial-arm-saw fence, and raise the blade to remove a 5⁄16-in. depth from the edge of the stack. Waste the central portion of the stack, stopping about 2¼ in. from each end. Flip the stack and repeat along the opposite edge to form I-shaped strips. To size the plies that will form the groove in both hub and rim, rip one ply for each unit in half.

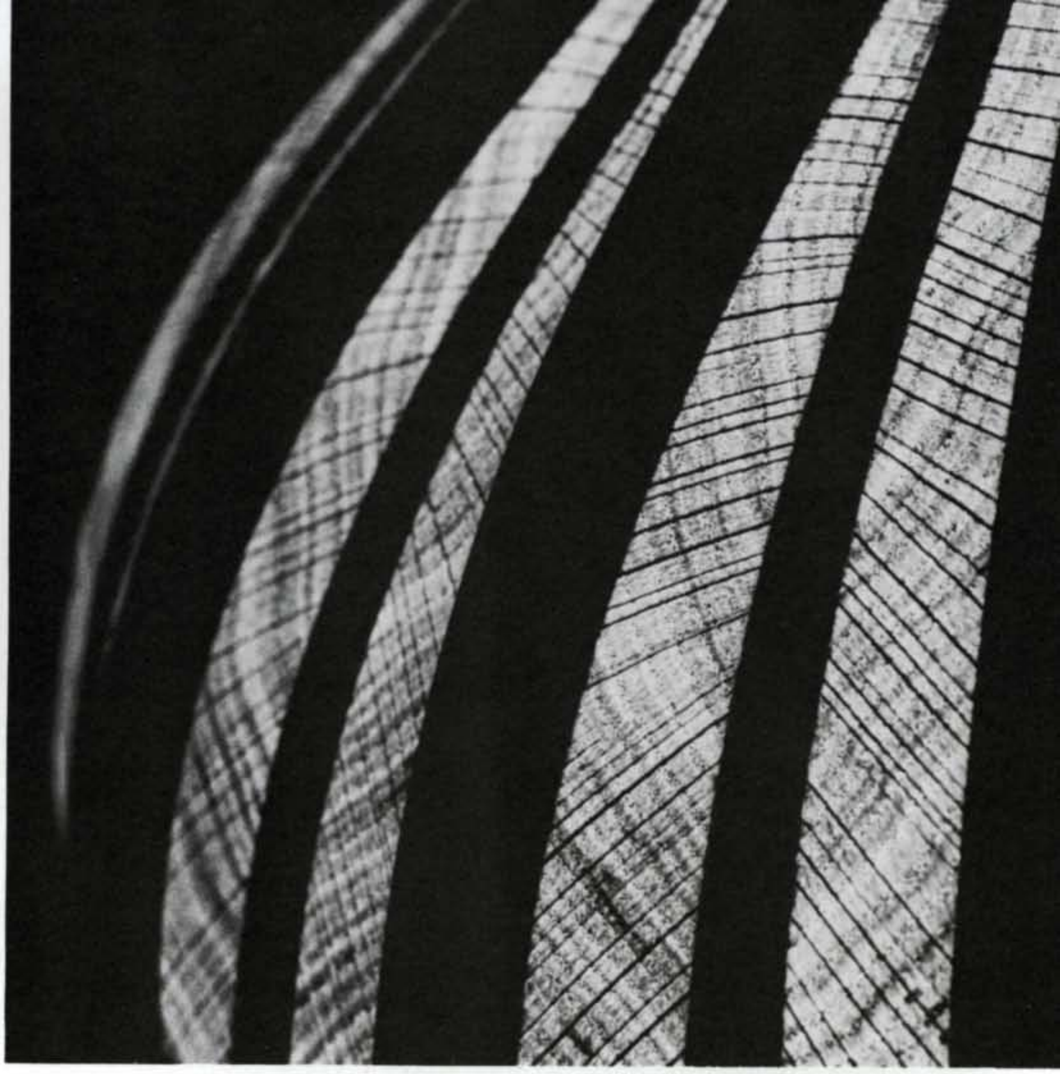
To glue up the spokes I use a plastic-resin glue and a form bandsawn from Formica-covered chipboard, which I scrounged from a countertop fabricator. The Formica, lightly coated with silicone lubricant between curings, resists glue. Arrange the nine plies that will form each spoke so that the I-shaped strip is the third from the inside. To speed gluing I use a motorized glue spreader (model 40-B, $600 from Black Bros., PO Box 310, Mendota, Ill. 61342) and a dielectric glue drier ($1,495 from WorkRite Products Co., 1315 S. Flower St., Burbank, Calif. 91502). With minor modifications—a new switch and a smaller glue tank—the spreader has become a valuable addition to my shop. The usefulness of the wood welder, on the other hand, has proved limited. It is ideal for gluing up these lamps, since it takes only a minute to run the roller electrodes along the length of a spoke. But as the owner's manual says, these welders should be used intermittently, and turned off as much as on, or they will burn out.

To glue up the rim, I use a two-part plywood fixture (a cir-



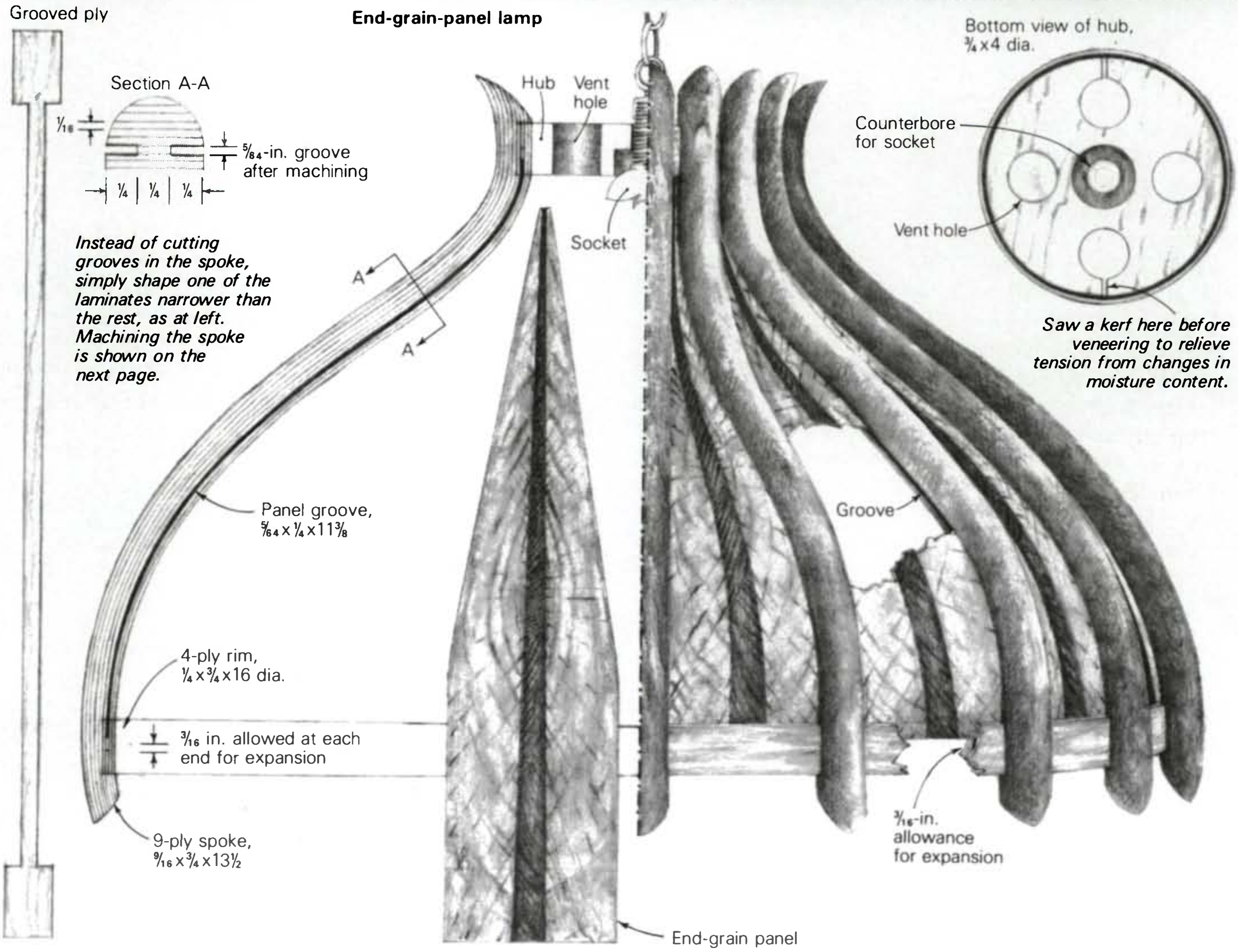
Photos: Christopher Klassen; drawings: Barbara Smolover

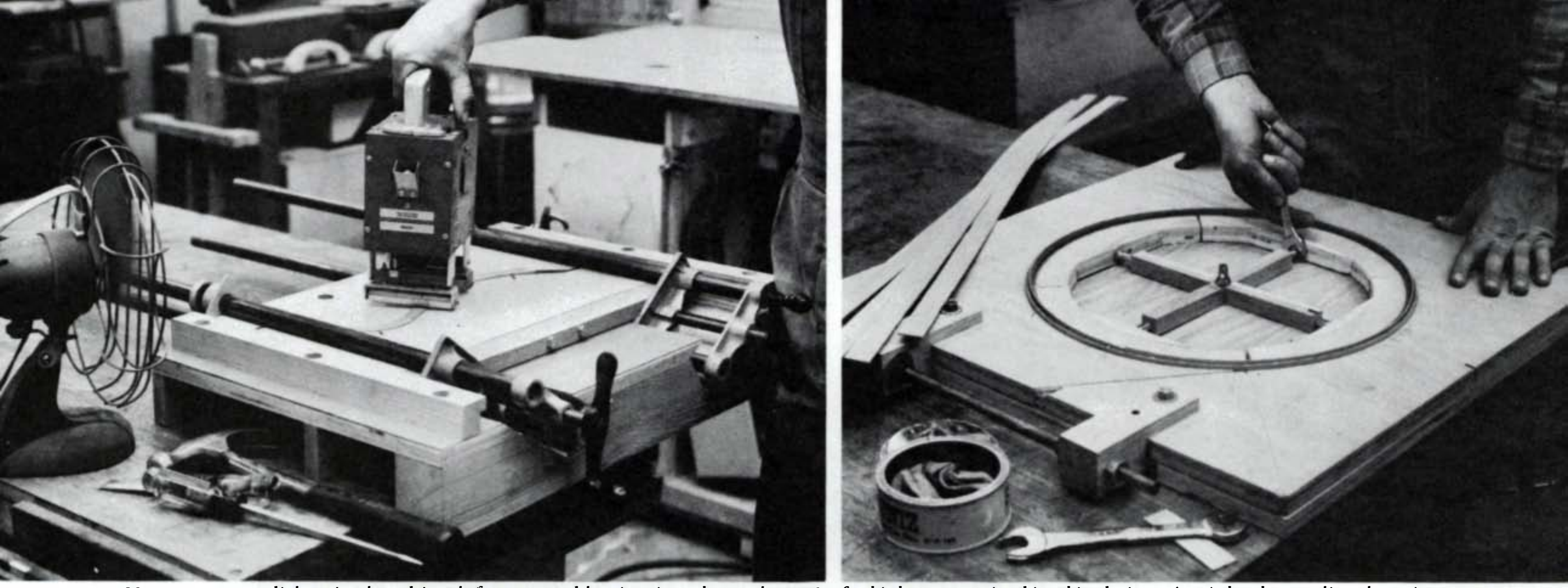




*Strikingly patterned, the end grain of most woods (here red oak and walnut) is translucent when sawn 1/16 in. thick—ideal for lamp shades. The fragile panels are supported on four sides in frames, and are free to expand and contract in their grooves. The bentwood, strip-laminated lamp (right, and on facing page) consists of 16 bent spokes, a hub at top and a rim; the three-part panels were sliced from a laminated block. The construction of the lamp above is simpler and more straightforward than the bentwood lamp, but it nonetheless has a warm, interesting appearance, with its bookmatched end-grain panels and stark rectangular forms.*

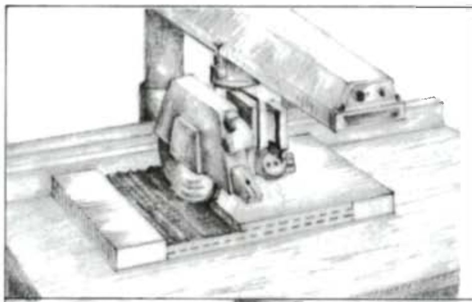
**End-grain-panel lamp**



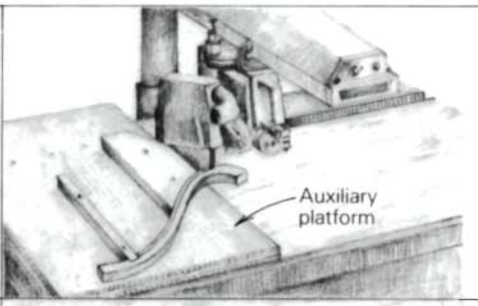


*Mattson uses a dielectric glue drier, left, to speed laminating the spokes, 16 of which are required in this design. At right, he applies clamping pressure to the laminates that will form the rim of the lamp.*

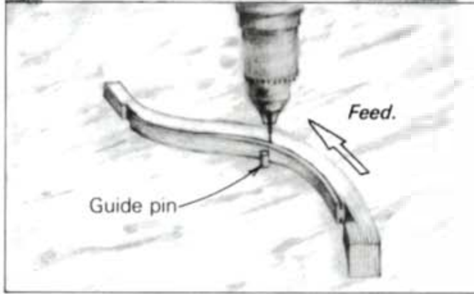
**Machining grooved, bent-laminated spokes**



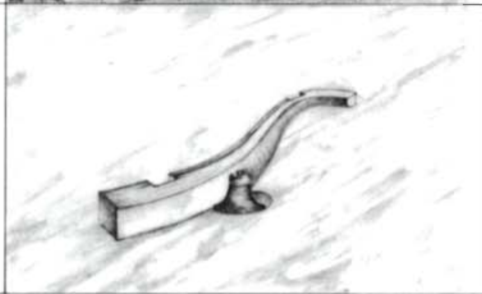
*Step 1: Before glue-up, stack plies that will form groove in spokes against radial-arm-saw fence. Waste 5/16-in. depth from stack with a dado blade. Waste central portion of stack, stopping about 2 in. from each end. Flip stack and repeat.*




*Step 2: After gluing up spokes (photo above left), cut 3/4-in. dado in spoke for rim and for hub. Mount spoke on auxiliary table to bring it level with radial-arm-saw arbor. Tilt blade guard back, fix stop clamp on arm, and pull blade into spoke.*




*Step 3: Clean excess glue from groove using 5/64-in. end mill in drill press and auxiliary platform with guide pin. A router table can also be used.*



*Step 4: Round over edges of spoke on router table.*

cular form and a base). The form is made by bandsawing a disc slightly larger than the rim diameter from a plywood square that is one-third larger than the circle. This accommodates a veneer liner to smooth out the irregularities of the bandsaw cut and to reduce the circle to the exact diameter needed. The piece of plywood that is the base of the fixture is attached to the form along the edge opposite from the entry cut. The entry cut allows the mold to be wedged open slightly so the cured rim can be withdrawn. To make the clamping blocks, quarter the disc removed from the center of the form and bandsaw off four 1½-in. deep arcs. The arc of the blocks conforms to the inside of the form and not the inside of the work, which helps to distribute clamping pressure evenly. Bolts threaded into T-nuts in a central crosspiece exert the clamping pressure.

Lay up the plies to form the rim, working from the outside in; the first ply becomes the exterior of the rim, the second, narrow ply forms the groove for the end-grain panel, and the two inside plies provide most of the strength. To get the ends of the plies to meet tightly, cut them a hair longer than the circle they will make. Remember that glue takes up space, and inner plies that fit tightly during a dry run might be too long in glue-up. You want a slight buckle where the ends of the strip abut, so the strip will snap into place under clamping pressure. Apply glue to the inside surface of a strip only after it is in the form; this leaves the surface you have to handle free of glue. Stagger the joints in successive laminates around the form, and center clamping pressure over the joints.

Now veneer the perimeter of the hub; the inside ply is half the width of the outside one, and it forms the groove for the end-grain panel. Holes are bored in the hub to receive the lamp pipe and to vent heat from the bulb. Before gluing up, saw a slot into each of the two vent holes along the grain to reduce the stress that will be created by changes in the moisture content of the veneer-bound hub. Because of the tightness of the curve, these laminates require steaming before they are bent. I use hose clamps to hold them on the hub while the glue is drying.

The panels for this design are sawn 1/16 in. thick off a blank that is glued up from three wedge-shaped pieces of wood—a center strip of walnut flanked by two book-matched pieces of red oak. It is important that these be of good quality, as even small surface checks will significantly affect the strength and appearance of the thin panels. Because they are so fragile, it is wise to make the blank large enough to enable you to slice off about twice as many panels as you will need. Once the panels are in the grooves of the lamp, they are adequately supported and won't break easily. I form the wedges for the panel blank using an angled table and passing the stock through a thickness sander, though they can also be bandsawn roughly to shape and planed for smooth glue interfaces. Glue up the blank (I use a veneer press), and trim it to final size on the jointer or using a hand plane. It's best to saw off the panels using a hollow-ground planer blade; 1/16 in. is the optimum thickness for the panels, as that affords a good balance between strength, flexibility and translucency.

Machining the spokes is next, beginning with the curved-bottom notches that receive the rim and hub. I use a 7-in. dia. dado blade on the radial-arm saw and a raised auxiliary platform to position the spoke level with the saw arbor. This requires tilting back the blade guard to expose the blade midway in its cutting arc, and clamping a stop on the arm of the saw to limit the depth of the notch. Although the arc produced by pulling the blade straight into the spoke is not identical to the arc of the rim or hub, the fit is better than it would be with a straight-bottomed dado. Next, using an end-mill cutter mounted in the drill press and a guide pin in an auxiliary table, I clean the excess glue out of the groove that will receive the panel. A router table could be used as well. The edge of the stock rides against the pin. Since the ply that forms the groove is slightly narrower than the 5/64-in. dia. cutter I use, the groove is sized in the same operation. I then round over the edges of the spokes on the router table using a 3/8-in. carbide bit with a ball-bearing pilot. I cut the ends of the spokes to final length on the radial-arm saw using the same platform I used to cut the dadoes, and then all the pieces of the frame are sanded.

Begin assembly by lightly clamping with rubber bands all the spokes to the hub, spacing them equidistant around the perimeter and lining up all the panel grooves. Then slip four spokes (in opposing pairs) from under the rubber bands, apply glue and replace them, clamping them to the hub using C-clamps and V-grooved blocks. When dry, remove the rubber bands and the unglued spokes. Insert the rim in the dadoes of the glued spokes, and gently slide the first panel in the groove in the right-hand side of one of the spokes. Taking a quadrant at a time, insert without gluing the rest of the parts. Glue is unnecessary because the panels hold the unglued spokes around the rim. Even so, there is enough play in the spokes to allow the last panel in each quadrant to be slid up in the spokes' grooves, high into the hub groove, and then bent gently and slipped down into the rim groove. Work the loose spokes around the lamp so the panels fit the grooves to the same depth.

I dip the completed lamp in a vat of Watco Danish oil and let it drain in various positions to allow the oil to seep out of the grooves. To further ensure against dried oil limiting the movement of the panels in the spokes, I spray the lamp with compressed air. I apply three coats this way, one per day, wet-sanding after the second and third dunkings.

I have other ideas for using end-grain panels; they can be used as decorative features for boxes, cabinets and chests. I was recently approached by someone who wanted end-grain panels incorporated in a headboard. The next lampshade I want to make will use the panels in a standard tapered cylinder to create a marquetry picture—a maple half-round sun setting over a dark cherry or mottled mahogany landscape under a sky of flaming red oak. Searching through the lumber pile for the proper end-grain patterns will make an enjoyable beginning for that project. □

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*Jim Mattson, 26, is a woodworker in Eugene, Ore.*

# Living-Room Table

## Designing from limitations

*by James Blackburn*

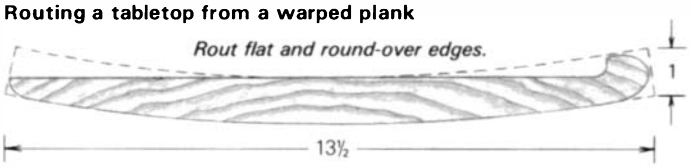
As craftsmen of one-of-a-kind items, we often must find a balance among design, function and construction. We usually start with some preconceptions—a design feature, a new technique, or a functional need, and must then integrate these aspects. A table I recently completed (pictured on the next page) illustrates this creative process.

The function was supplied by my mother-in-law, who wanted a small table that could be pulled over the arms of an overstuffed living-room chair, where it would serve as a working, writing or eating surface. She had seen one with a scalloped rim on the outside edge, and she thought the legs should not be too plain. I reasoned that the legs should fold, because I would have to ship the table. Thus, the function was clear and a part of the design was given. I had only to complete the design and devise the construction.

Design is always a process with limits; not much can come from a problem that has no parameters at all. The given limitations define the universe of solutions in which we work, and help us to separate the reasonable solutions from the possible ones. Where a professional designer would explore the whole problem on paper and then order wood milled to his specifications, I must work with the materials I have, so I turned next to my wood bin to see what might become a tabletop.

The strikingly figured roughsawn cherry plank I found was 13½ in. wide but only 1 in. thick, and somewhat warped. Planing its two faces would have produced much too thin a board. A solution, however, was to rout a flat surface across the concave face of the board for the tabletop, leaving the two ends and one long edge thick, and keeping the bottom face

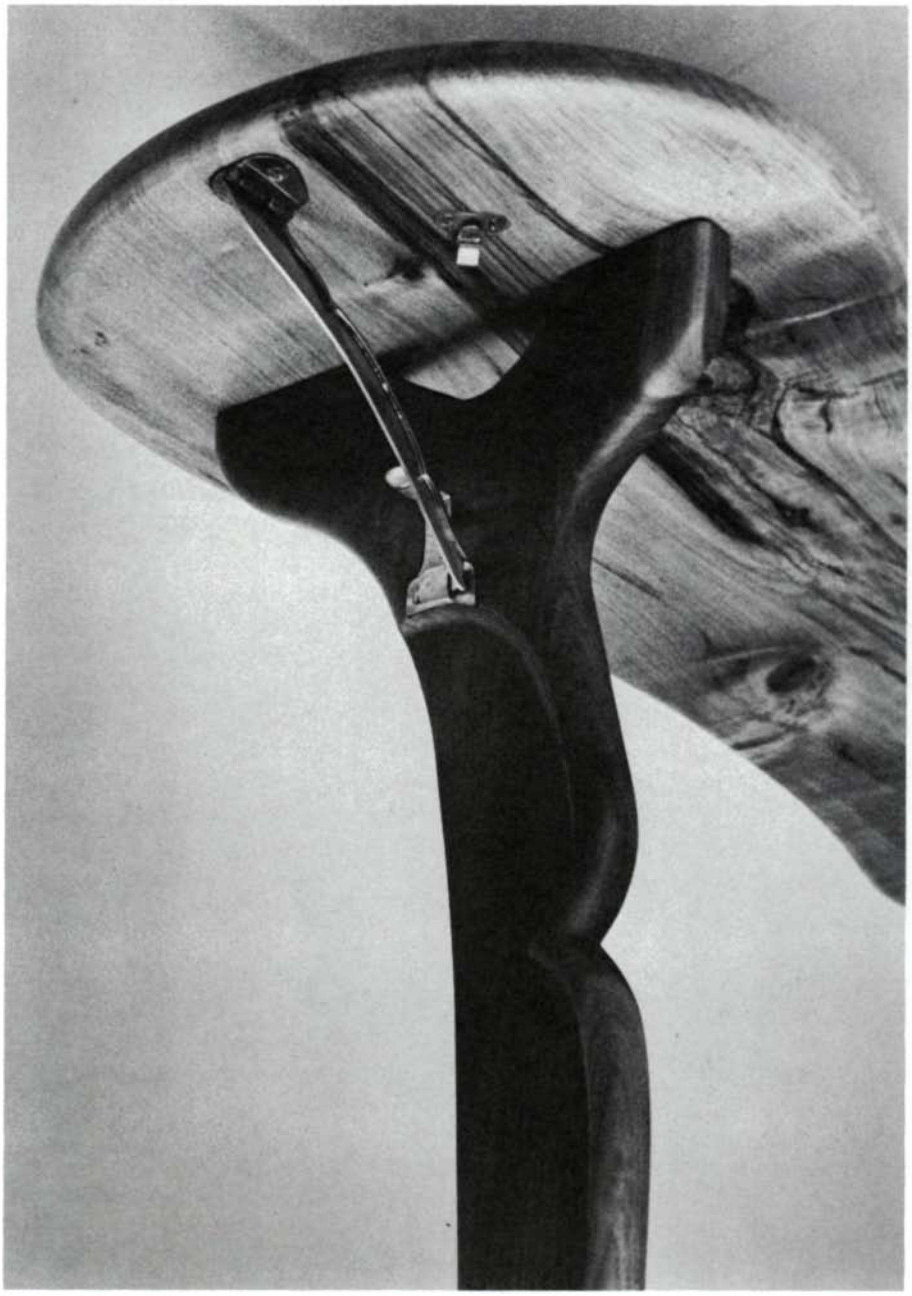
**Routing a tabletop from a warped plank**




convex. These edges could be scalloped, and their thickness would maintain the board's strength and visual weight.

To rout, I clamped the plank to my workbench and laid a 2x4 along each of the two long edges. A frame of 1-in. boards laid across the 2x4s provided support for the router base. I routed the whole top flat, except for the rim at the back and ends, and then sawed the outline of the tabletop from the plank. After rounding over with a router the entire bottom edge and the edge of the rim, the first problem of construction had been solved—a beautifully figured plank had been saved from the scrap bin and turned into a tabletop.

Designing the hinged legs came next. A couple of simple posts and feet seemed most appropriate because they would detract least from the lovely table surface. The top of the legs should allow for expansion and contraction of the top across the grain, so a long piano hinge was out. Since it was to be a



*Unusual function and flawed materials can be inspiring design parameters. This cherry table, made to fit over an upholstered armchair, includes homemade brass hardware (at left and above) that allows the legs to fold for storage. A router produced the flat surface of the tabletop, leaving a decorative and functional scalloped rim (at top) and salvaging a thin, warped, otherwise useless plank.*

pair of hinges on each leg, I decided to use a Y-shaped top for the legs, affording wide spacing of the hinges and a bit of air between the members. To allow for the uneven surface of the underside of the table and for the fact that the legs had to fold one on top of the other, I mounted the hinges on individually thicknessed shims.

Good practice in design carries through a theme. I already had a design motif, the scalloped rim around three edges of the top, so I carried this scalloped edge down the legs, using the same routing technique. Double mortise-and-tenon joints fasten the feet, the center portions of which are undercut so the table doesn't rock.

Often a piece of furniture can be ruined by using readily available but inappropriate hardware. Hardware should be as carefully considered as joinery and finishing. The design problem in this table was the need to slide it over the arms of an overstuffed chair. The usual diagonal metal braces, such as fold under the legs of card tables, would interfere with the chair. Outside braces with a different folding and attachment scheme were needed. After some thought I decided to orient the hinge axis along the length of the table. To attach the brace to the leg, I used a notched, right-angled tab on the brace that slips into a boxlike fixture on the leg. The tab extends through the box so the notch holds it in place, yet light pressure releases it, allowing the brace to be slid from the box and flipped back against the underside of the table. I made a small catch from 40-mil brass stock to hold the folded brace against the bottom of the table. The braces themselves are sawn from 60-mil brass sheet stock. I brazed a narrow strip of the same material to the inner edge to make the brace more rigid and to repeat the scalloped-rim motif in the hardware. The other hardware includes brass cap plates for the feet, and brass spring tabs to hold the legs and leg braces in their folded position. Folding the top leg down with a slight pressure causes it to seat into the tab with a pleasing snap.

I count the successes this way: I balanced design, function and construction, I saved a beautiful plank from the scrap pile, and I satisfied my mother-in-law—all in one project. □

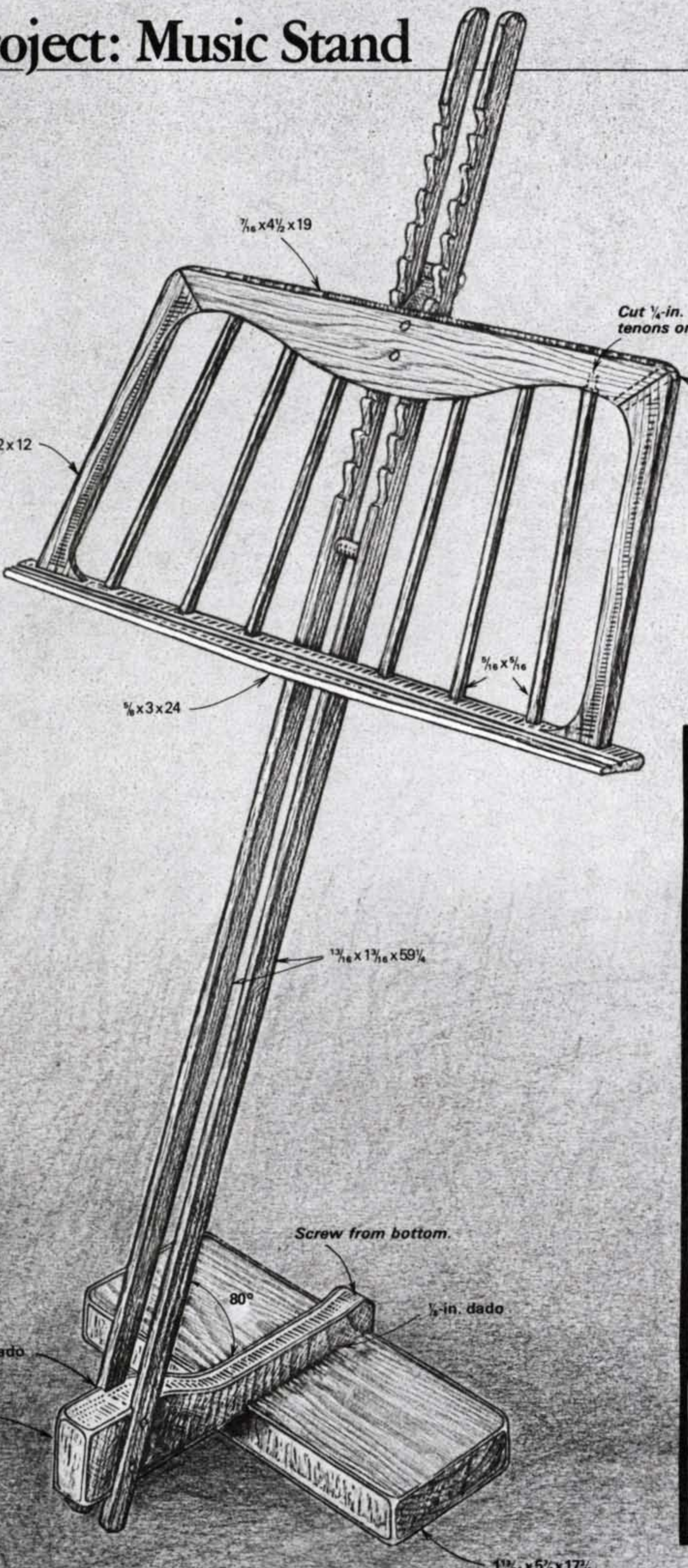
*James Blackburn is a design engineer in Minnitonka, Minn.*

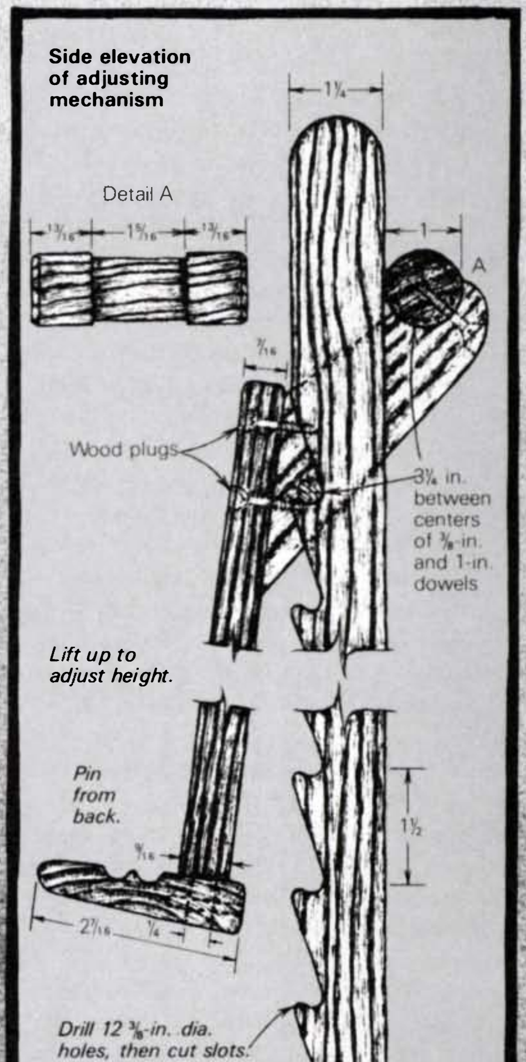


Photos: Paul Hisrich

# Project: Music Stand

*by John D. Freeman*




Illustrations: E. Marino III

# Cross-Country Skis, the Easy Way

*by George Mustoe*

Though it took me a long time to make the discovery, cross-country skis are relatively simple to make. Ski building originally seemed intimidating because of the numerous laminations and the long curve from the tips through the arched or "cambered" bottom. However, in a recent and inexplicable attack of common sense, I stumbled upon a simple method for building skis that requires only a bare minimum of materials and effort. Based on 1980 prices, a pair of skis will cost about $20 for materials.

**Preparing the laminations**—Figure 1 shows a ski whose upper and lower surfaces, along with the thin wedge that fortifies the tail, are made from hardwood; hickory is most common, but birch, ash and oak work well too. Select straight-grained lumber with no knots, cracks or other defects. The two core laminations are of softwood to minimize weight; spruce, cedar, fir or pine will do. The final ski will be a compromise between a heavy, mountain touring ski and a light, racing model. However, you can modify the thickness of the inner layers to obtain just about any degree of durability and rigidity.

Saw the hardwood strips to a thickness of ⅛ in. and the softwood core strips to a thickness of 3/16 in., both from stock 2½ in. wide. Plane and sand the sawn surfaces smooth.

The lamination lengths given in figure 1 will vary depending upon the length of your ski. Feel free to experiment; significant variation exists among the various commercial brands, so if your skis come out looking unusual, just act smug. Starting about 6 in. from the ends, plane the core layers to a gradual taper so they will make a smooth joint.

**The bending form**—This form consists of three separate units: the base plate, the T-shaped form used for the main body of the ski, and the form used to bend the tip (figure 2a). When in use these three parts are bolted together into a single unit. To manufacture skis of other lengths you will have to make other main body forms. However, the same base plate and tip-bending form can be used regardless of the ski length.

The base plate is made from a length of warp-free 1x4 lumber, at least 4 ft. long. Glue or nail several pairs of wooden blocks to it for attaching the main body with machine bolts.

The main body form is also made from a warp-free 1x4. Draw an outline of the ski bottom along one edge of the board. The recommended method is simply to trace the contour of a commercially made ski. If a ski of the appropriate length is not available, don't be afraid to make your own pattern. The main consideration is that you include a reasonable amount of curvature, or camber. You can draw a smooth curve by tracing along a thin strip of wood bent around a series of tacks in the body-form blank (figure 2b). Cut along the line using a jigsaw or coping saw, and smooth with a plane and a sanding block. Make sure this surface is square with the sides of the board.

Once the correct outline has been shaped, cut a number of notches at 4-in. to 6-in. intervals for inserting C-clamps during lamination. The form is completed by nailing on a 2¼-in. wide piece of ¼-in. plywood (figure 2c). Align the center of the plywood with the 1x4. The result is a form that is T-shaped in cross section. The upper surface is only ¼ in. thick, thus only small C-clamps are needed to assemble a ski.

The form used to bend the curved tip consists of a sandwich made from three layers of ¾-in. thick solid lumber or plywood (figure 2d). The curvature can be copied from a commercially made ski, or it can be drawn freehand. Try to achieve a smooth curve that rises about 2½ in. vertically in a horizontal distance of about 8 in. Note that the tip form is designed so that it slips over the front end of the main body form as shown.

Assemble the base plate, tip form and main body form using machine bolts. Sand the upper surface and apply one or more coats of shellac or varnish. When the finish has dried, rub on a coat of paste wax, to prevent the ski from sticking to the form during lamination.

**Lamination**—Begin by sorting out the pieces of wood you will need to build one ski. Dampen the first 12 in. or so of the hardwood strips using a rag dipped in hot water. This will reduce the amount of force needed to bend the curved tip. Coat one surface of each strip with glue, and place the resulting sandwich on the bending form, aligning one edge of the wood strips with one edge of the form. The strips should extend slightly beyond either end of the form. Tighten the clamps of the tip form so that the two hardwood layers are pressed against the form surface. Coat with glue both surfaces of the softwood core layers and the wedge-shaped tail piece, and slide them into position between the two hardwood layers. Use C-clamps with wooden pads to press all of these strips against the form. If you don't have enough C-clamps, you can cut C-shaped forms from scrap plywood that will slip over the clamping platform of the main body form (figure 3). Wedges between these C-shaped forms and the laminations will provide adequate clamping pressure. Avoid excessive pressure that would squeeze out too much glue and produce a weak bond. Remove exuded glue with a damp rag to make clean-up easier. Leave the ski on the form for about 12 hours to allow the glue to harden completely, although this time will vary according to the room temperature. Do not remove the ski from the form until you are certain that the glue has thoroughly cured.

**Shaping**—Use a coping saw or jigsaw to cut the tip to a point and to trim the tail to the exact length. Sand the ski to remove glue stains, and if necessary plane the edges parallel.

Next cut the center groove in the ski bottom using a router with an edge guide. This groove serves as a rudder to keep the ski pointed straight ahead as it glides through the snow; on most models the groove begins about 12 in. back from the tip of the ski for maneuverability. A straight, ½-in. dia. bit can be used for this task, setting the depth to about 3/32 in. Alternately, a core-box bit having rounded corners will make a more professional-looking groove.

Finally, it is necessary to plane the edges of the ski to obtain the proper

**Fig. 1: Basic construction and typical dimensions**

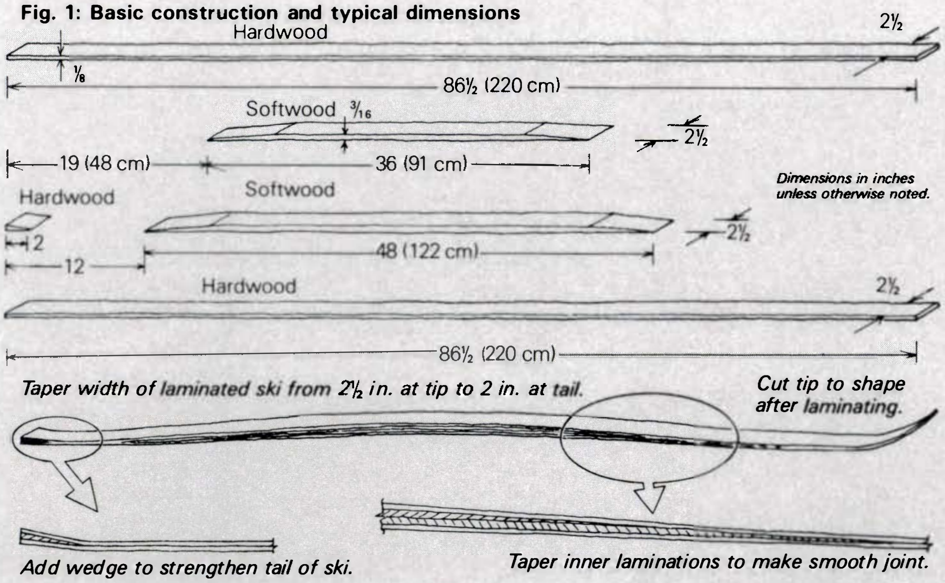



**Fig. 2a: The complete bending form**

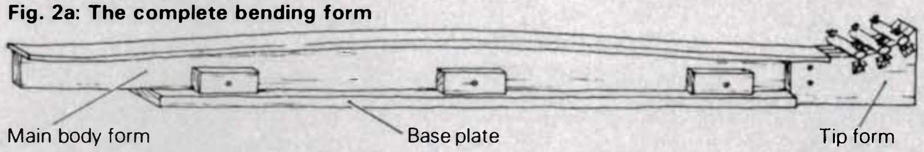



**Fig. 2b: Determining outline of main body form**

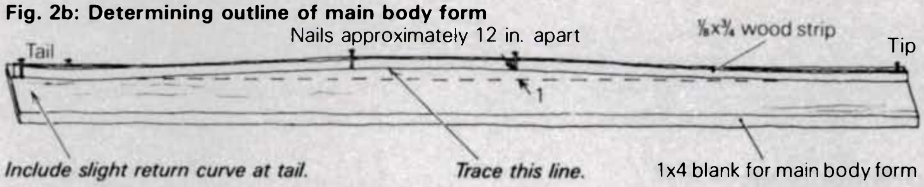



**Fig. 2c: Main body form**

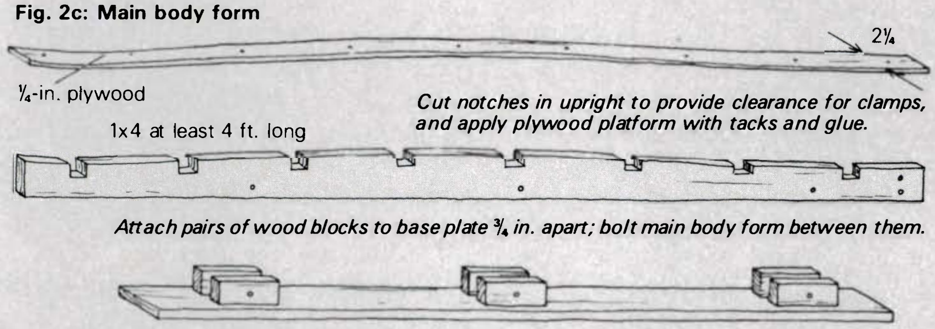



**Fig. 2d: Tip form**

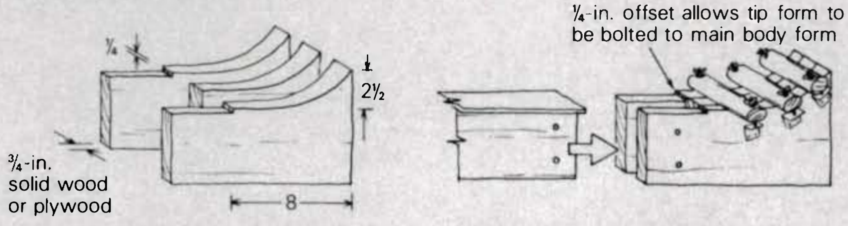
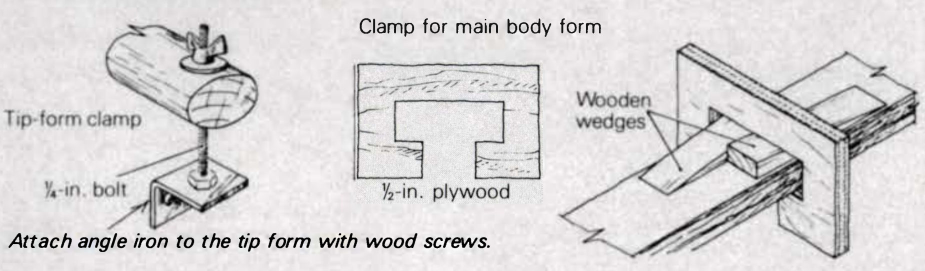



**Fig. 3: Homemade clamps**




Drawings: Christopher Clapp

amount of side cut; the ski should be about ½-in. narrower at the tail than at the forward end, and the outline should be gently concave. Also relieve the bottom surface of the tail to produce a slight upswing that will enhance maneuverability. Perform whatever final sanding is necessary to remove tool marks or surface blemishes, then apply two or three coats of clear gloss varnish, sanding lightly between coats. Do not varnish the bottom surface of the ski, since this would prevent proper adhesion of ski wax. Instead, treat the bottom with a commercial base preparation such as pine tar.

Alternately, waxless skis can be made by routing the soles for mohair strips or multistep plastic bases. Both these materials are available from ski shops or the manufacturer—Rossignol, Industrial Ave., Williston, Vt. 05455.

To mount bindings, first locate the balance point of the ski by placing it across the edge of a thin wood strip. Pin bindings should be mounted so the leading edge of the binding is about 1 in. in front of the balance point. Heavy cable bindings should be placed on the ski in approximate position before determining the balance point. Then move the bindings slightly forward. When bindings are properly placed the ski tip should point downward at about a 20° angle when the user lifts the boot.

Now that your skis are completed, you can easily check the performance—just take them skiing. But before you leave the house it's possible to determine how well the degree of camber matches your weight. Place the skis side by side on a smooth floor, inserting a piece of paper between the skis and the floor directly beneath where your feet will be placed. Now stand on the skis as if you were actually out on a trail. If the paper can still be slid sideways with only slight friction, the camber is perfect. If it's not, there's not much you can do about it, except make adjustments in length and thickness of laminations in your next pair. But try your skis out first. Most cross-country skiers can tell little difference in performance from slight variations in ski lengths or degrees of camber. A less-than-perfect fit need not limit your fun. □

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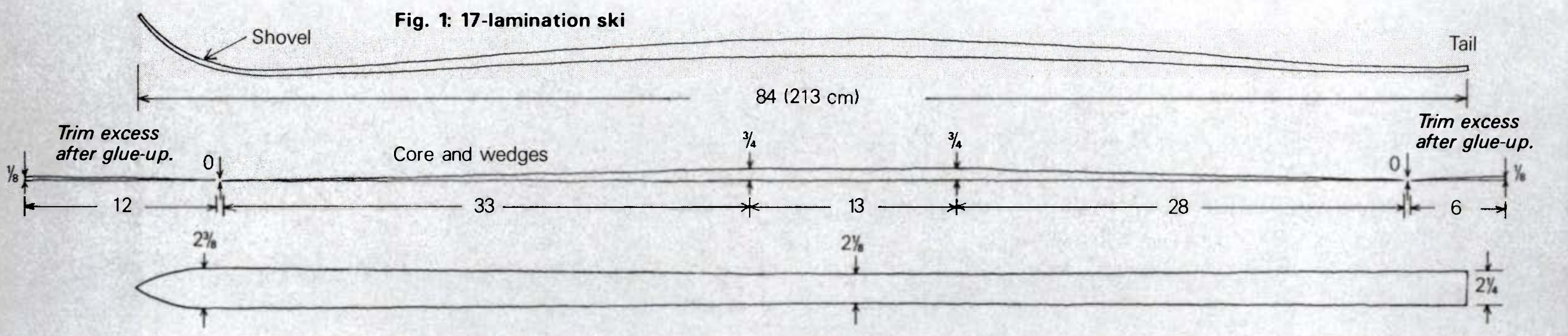
*George Mustoe is a part-time geology technician and woodworker who lives in Bellingham, Wash.*

# Cross-Country Skis, Norwegian Style

*by Richard Starr*




Walker Weed of Etna, N.H., has been making his family's cross-country skis since he learned the method in Norway some years ago. He taught the method at Dartmouth College where, until his recent retirement, he was director of the craft shops.

In the old days, when skis were of solid wood steambent to shape, you could stiffen your ski by rebending it to a deeper camber. Laminated skis hold their shape much longer than solid skis, but no adjustment is possible once the ski is glued together. The degree of stiffness must be accounted for during construction, and depends not only on camber but also on laminate thickness, type of wood and character of the particular pieces you use. There is an element of trial and error in learning to make well-tuned wooden skis. Modern skis, usually a combination of plastics or wood and plastics, perform better and require much less maintenance than those made of wood. You can buy a better ski than you can make, though high-quality skis are expensive. You'll save money and get extra satisfaction from running trails if you make the skis yourself.

Weed's method is a little more complex than Mustoe's (p. 66), but it produces stronger, lighter skis in pairs that will match more closely in balance and flexibility. This is achieved by laminating the ski across its width as well as across its thickness, and by systematic placement of matching laminations (figure 1). Also, the tips are reinforced with an extra lamination, and the sides of the softwood core are protected with strips of hardwood.

Weed uses hickory soles for toughness and birch tops to save weight. If you were to make both surfaces of the same wood, you could saw all four pieces for a pair of skis from a single piece of laminated stock. If you use different woods you must glue up separate pieces for tops and soles.

To make a 210-cm ski, the average size for adults, begin with a piece of straight-grained hardwood at least 86 in. long, 3½ in. wide, and an inch or so in thickness, depending on the thickness of your sawblade and on how many parts you will need from the lamination. Witness-mark the face of the board (figure 2), then rip it into six strips slightly more than ½ in. wide so that jointing or thickness-planing the sawn surfaces will yield ½-in. wide stock. Lay the strips in their original relationship according to the witness mark, then turn alternate strips end for end and upside down. By doing this you will distribute variations in grain and density through the lamination, resulting in a stronger ski. Glue the strips with Weldwood plastic resin or Cascamite (Elmer's plastic resin).

When the glue has dried, you have a lamination 3 in. wide and an inch or so in thickness. Witness-mark a side and an end of the lamination, then joint one face and thickness-plane its opposite face. Saw a strip 3⁄16 in. thick from one face, plane the newly exposed face of the lamination and saw off the next strip. If you are using a single laminated blank for soles and tops, number the strips as they come off and use adjacent pieces in matching positions in each ski. Plane each strip ⅛ in. thick, backing it with a piece of plywood while planing.

The stock for the core is 76 in. long, 3 in. wide and 2 in. thick, laminated across the 3-in. width. Out of this will come two blanks ¾ in. thick. The center is three ½-in. wide softwood strips (spruce is best), with outer layers of ¾-in. wide hardwood. You make this lamination from scraps, but for maximum strength and match, flip the central softwood strip end for end, as in the procedure described above, and use hardwood cut from the same board and arranged as shown in figure 3. After gluing, saw the lamination across the gluelines and plane the two pieces to ¾ in. by 3 in. by 74 in.

Cut the wedges and cores from these strips using the dimensions in figure 1. Supported on a wedge made from scrap, Weed puts these pieces through a thickness planer to get a perfect taper feathered down to zero thickness. (See "Tapered Laminations" by Jere Osgood, *FWW* #14, Jan. '79, pp. 48-51).

Weed's bending form (figure 4) is simpler than Mustoe's, though it requires more material and larger clamps. Laminate a block of solid or fir plywood 3 in. by 7½ in. by 90 in. Square it up, then scribe the shape of a good ski on the wide face. After bandsawing, smooth the curved surfaces, checking across the curve for squareness to the sides. Cut a series of steps on the front end as clamp seats, screw five or six aligning blocks along each side and wax everything likely to come in contact with glue. To clear the clamp ends, rest the form on horses or support it off the workbench on blocks. Weed suggests using a clamp every 3 in. or closer. If you run short, make clamps from hardwood strips and carriage bolts as shown in figure 4. From ¼-in. plywood scraps, cut 3-in. wide strips and butt them up against one



Drawings: Christopher Clapp

another to cover the length of the ski and protect it from clamp damage.

When using Cascamite or Weldwood plastic resin, always dampen the wood with a rag to avoid dehydrating the glue. Apply adhesive to both surfaces with a brush and be sure to leave no dry spots. Clamp the ski from one end to the other or from the middle toward the ends, but never at random. Be sure the witness marks (top and edge) of corresponding pieces are in the same positions when gluing up the second ski.

Rather than scraping and chipping off dried glue, Weed saves time by belt-sanding it off, since these glues don't clog sandpaper. With the cleaned edge bearing on the fence of the table saw, he trims the other edge straight, using a carbide-tipped blade. Then, reversing the ski and setting the fence in a little, the sanded edge is sawn clean and straight. The ski now has parallel edges.

To cut the round-bottom groove in the bottom surface to help the ski track straight, Weed uses a molding head on a table saw (figure 5). The groove must be less than ⅛ in. deep to avoid cutting through the bottom lamination, and should be about ½ in. wide; a cutter whose radius is ½ in. will do the trick. Clamp a board about 8 in. wide to the saw as shown in figure 5, and raise the running cutter up through it; the board functions as a short table to accommodate the ski's camber. Set the fence so the groove is centered on the ski, and check the depth setting on a piece of scrap. The ski's groove starts just behind the shovel and ends just before the tail; mark these positions on the ski's top. By matching these marks with lines on the saw fence indicating the position of the cutter, you can start and end the groove quite accurately.

Relieving the sides to produce a concave contour in plan gives better edge bite in the snow and assures that the track cut by the shovel is wider than the rest of the ski. It is usually a gentle curve rather than a straight taper. You can take three width dimensions from an old ski, at the shovel, foot and tail, or use measurements given in figure 1. Be sure that the side camber is centered on the groove, and use a long, flexible batten through the three points to get a smooth curve. Bandsaw the sides, cut the tip shape, and smooth all edges with spokeshave and sandpaper. Chamfer the top corners but leave the bottom corners square. □

**Fig. 2: Laminating hardwood blank for tops and soles**

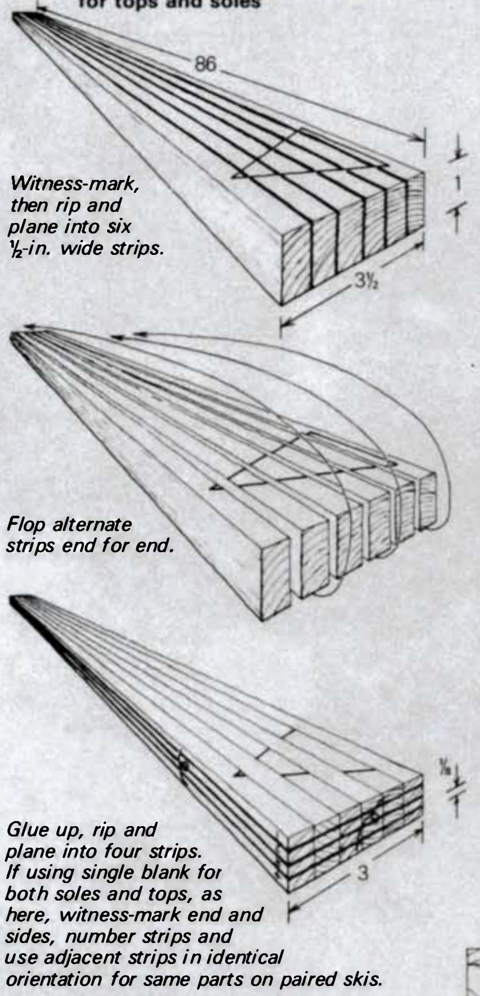
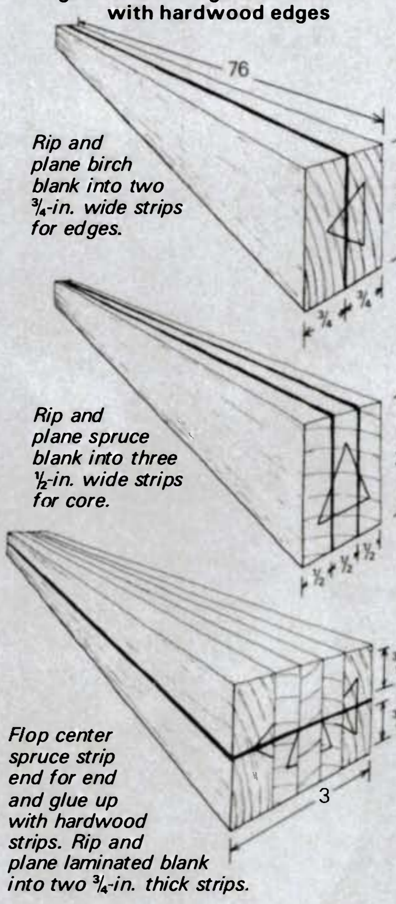
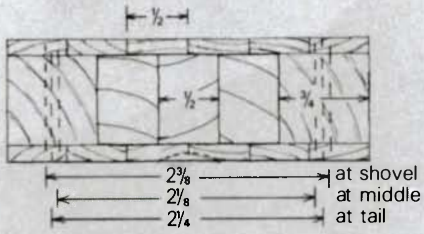



**Fig. 3: Laminating softwood core with hardwood edges**




End view of glued-up blank

**Fig. 4: Bending form**

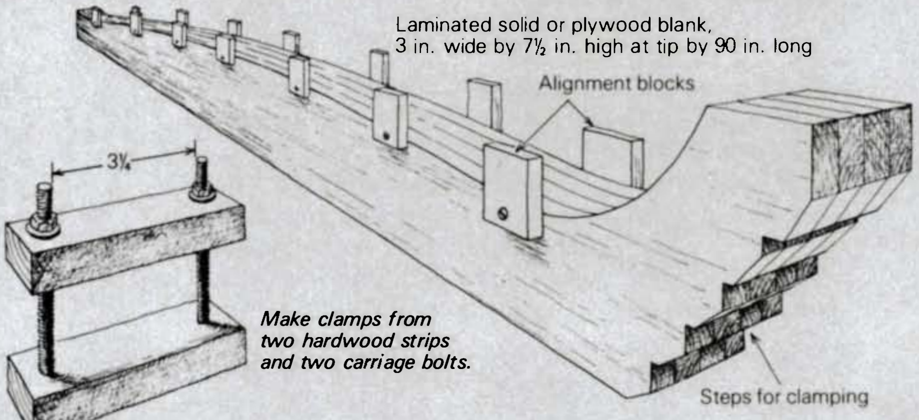
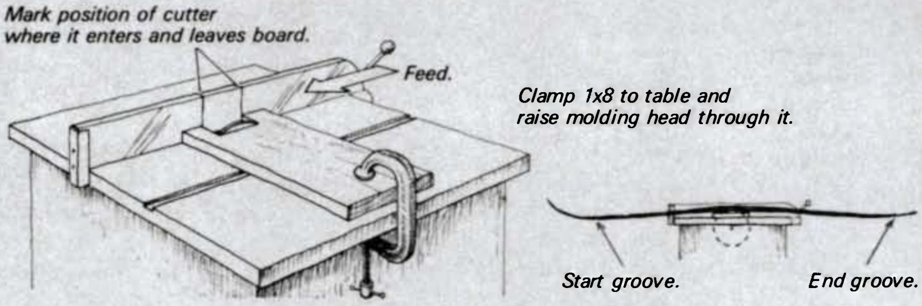
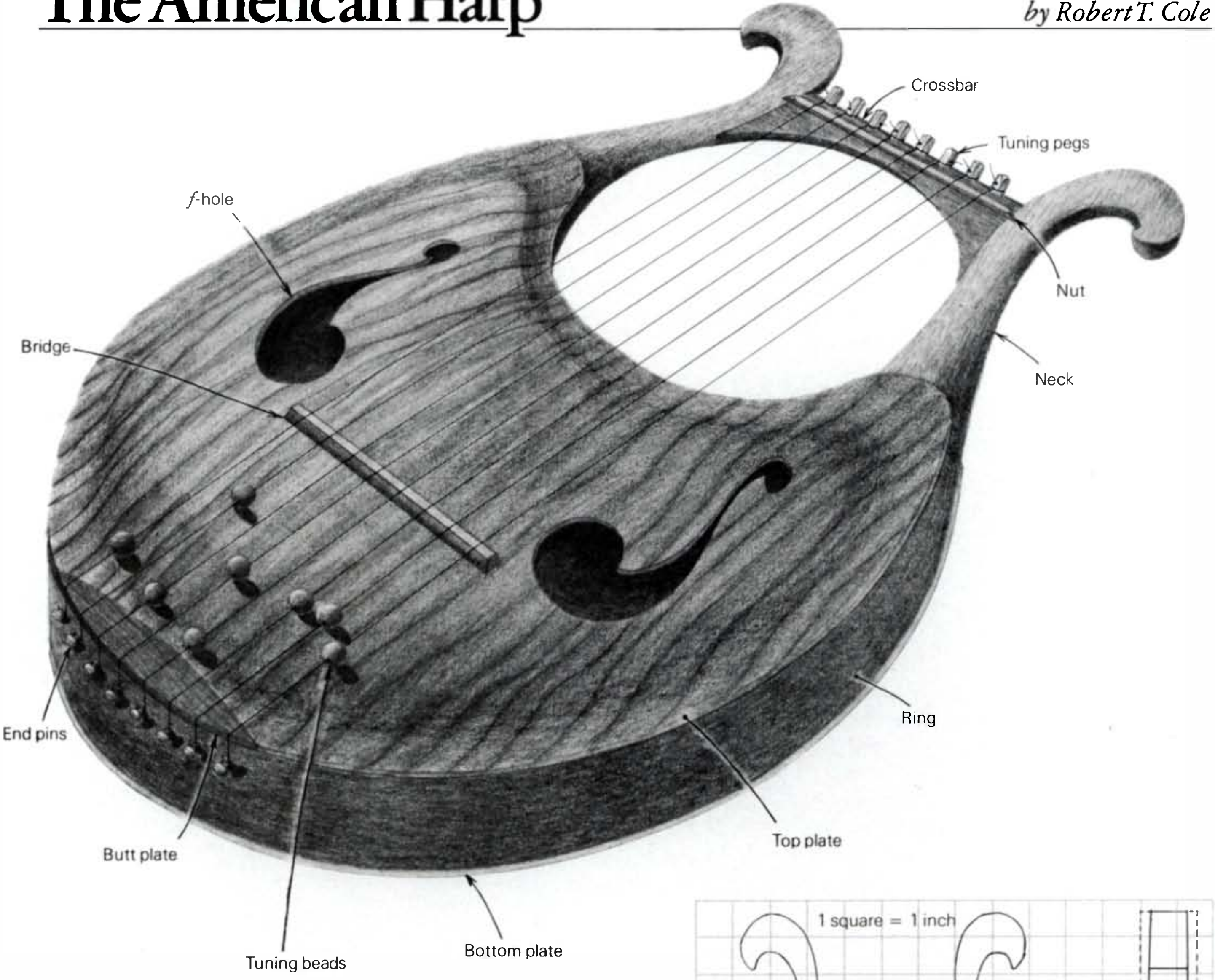



**Fig. 5: Cutting groove on table saw**



# The American Harp

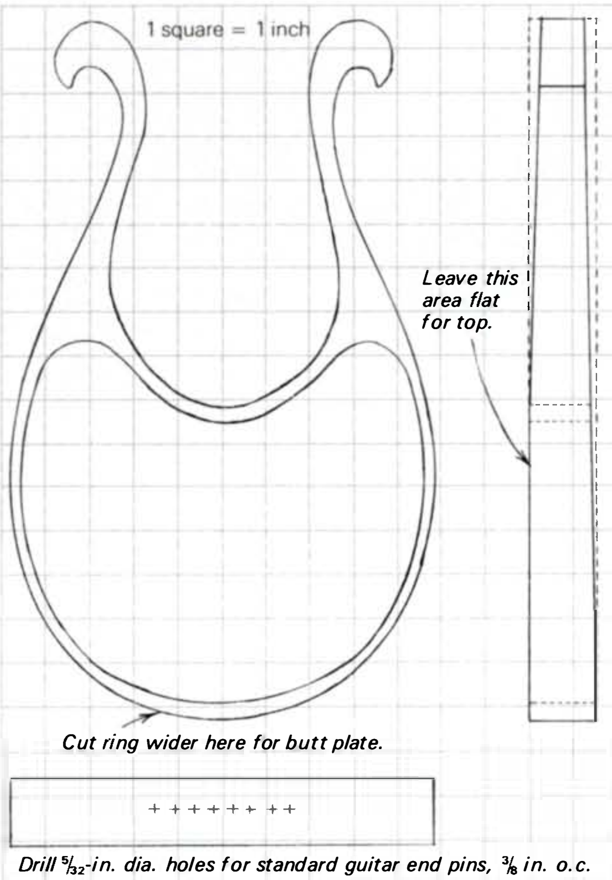
*by Robert T. Cole*




The lyre form of the harp is the most ancient of stringed instruments, and it has evolved into a variety of forms. I designed the instrument here to be used with high-tension steel strings; it is strong and stable, and it includes carved front and back plates. No other lyres have been built like this, so I call this the American harp. Regardless of the name, its function, as usual, is to encourage music at home and singing in particular. It can be tuned to many scales, so there's enough complexity to occupy the player for years.

**Materials**
- 1½ x 10 x 16 Philippine or Honduras mahogany
- ¾ x 10 x 20 Philippine or Honduras mahogany
- 1½ x 2 x 5 hardwood crossbar
- Hardwood strips for nut, bridge and butt plate
- ¼-in. dowel, 10 in. long
- Wooden beads (8)
- Piano-tuner's pegs (8)
- Guitar strings (8)
- Guitar end pins (8)—you can make your own

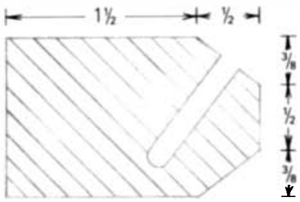
The ring, shown in the drawing at right, forms the sides and necks of the harp. It may be cut out on a bandsaw or with a coping saw. It is then cleaned up using both a disc sander and a drum sander. The overall width of the harp may vary between 9½ in. and 10 in., and the thickness of the wall ranges from ¼ in. on the sides to ⅝ in. where the end pins will be drilled. Do not round any edges until the harp is glued up.

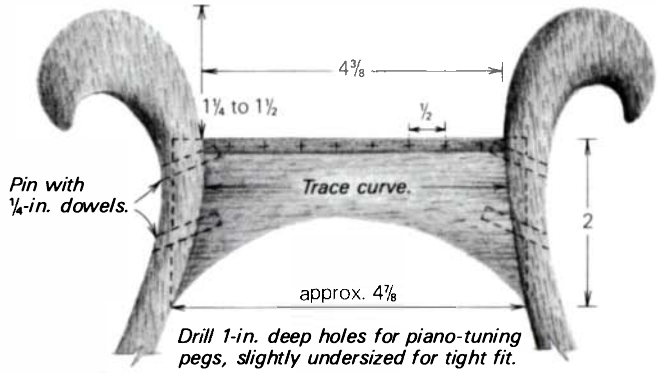


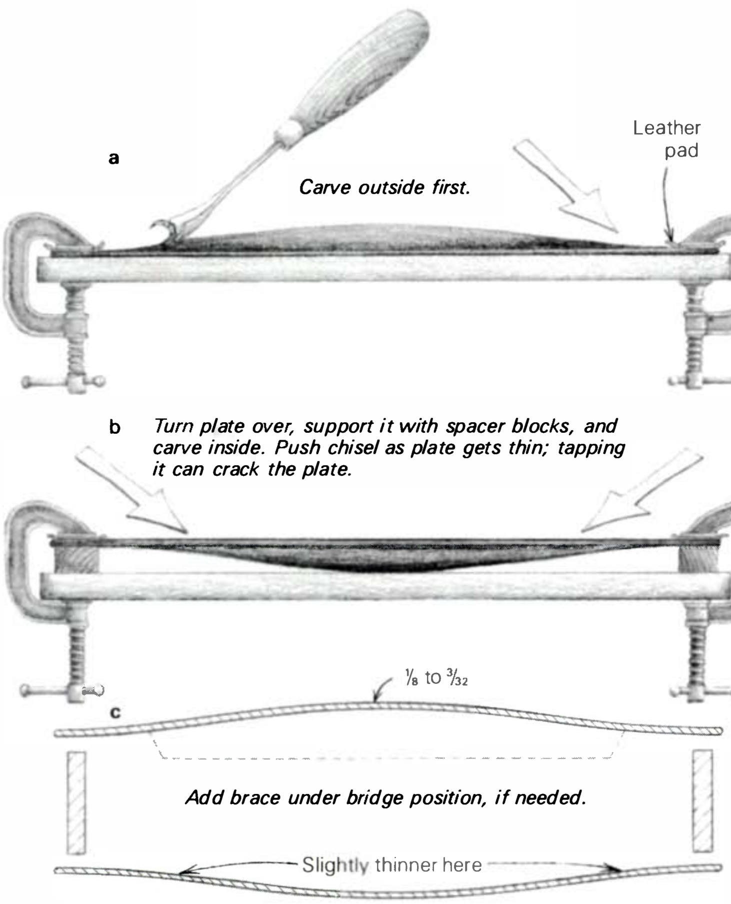



Drawings: E. Marino III

The crossbar should be made from a strong hardwood, like maple, oak or koa. Trace the inside curve of the necks onto the crossbar blank, then cut and shape it to fit. Bevel its two faces, and drill holes for the tuning pegs slightly smaller than the pegs. Tuning pegs can be had from a piano supply house, and a tap-wrench handle works well to adjust them. Glue in the crossbar, and when dry, drill and pin it with four ¼-in. dowels.

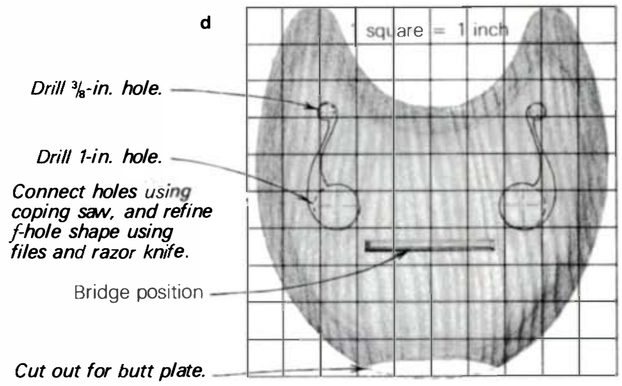


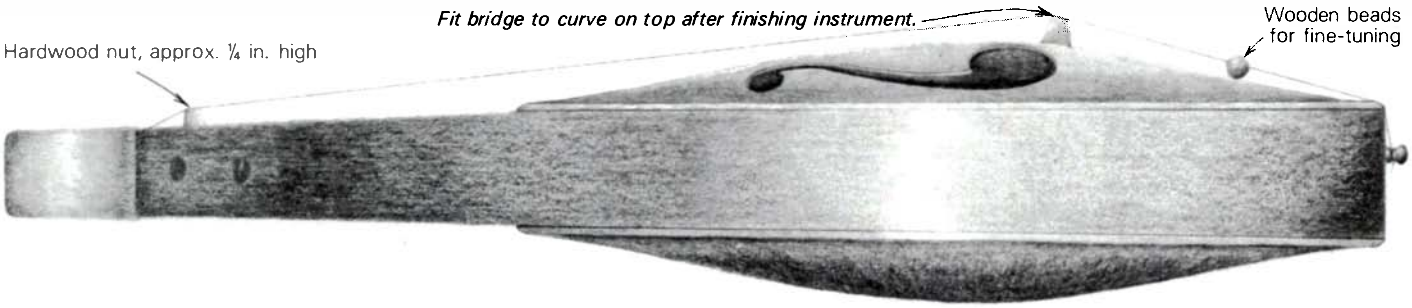




Now you can carve the plates. First saw the outline from the ¾-in. thick mahogany blank, leaving ⅛-in. trim. Clamp the blank to the bench, outside up, and fair the edges with a wide gouge (a). Turn the blank over, clamp it to the bench using spacer blocks, and begin carving the inside face (b). As the plate gets thin, push the chisel rather than tap it (or use a disk grinder), or you risk splitting the wood. Quite often you must unclamp and feel its thickness. It should approach 3/32 in. near where it will be glued. If it deflects more than 1/16 in. under moderate pressure, you should add a brace under where the bridge will be (c). If you carve the plate too thin at any spot, glue on a wood patch.

Smooth the inside with sandpaper and refine the contour, Then cut the *f*-holes in the top plate—carefully, as it is easy to split the thin wood (d). Next cut out the space for the butt plate. This is where the strings will lay over the end, and they would cut through the softer mahogany.




Glue up one plate at a time, back, then front, checking first to see that the surfaces make good contact. I use aliphatic resin (yellow) glue and clamp with C-clamps every couple of inches, protecting the wood with leather pads. When the front plate is dry, glue on the butt plate and drill the end-pin holes. Round all the edges and finish-sand.

Make the hardwood nut about ¼ in. high and glue it to the crossbar. I finish the harp now using a brushing lacquer—three coats, sanding between coats and rubbing with steel wool at the end. Now fit the bridge to the curve of the top and slot it for the strings: Use regular guitar strings, as shown:

| String | Tuning |
|---|---|
| 0.046 wound | Bass C |
| 0.036 wound | G |
| 0.026 wound | C′ |
| 0.020 wound | E |
| 0.016 plain | G′ |
| 0.012 plain | C″ |
| 0.010 plain | E′ |
| 0.008 plain | G″ |

Other tunings are possible. Bring all the strings up to tension, then fine-tune using the wooden beads between the end pins and the bridge. The first tuning takes patience because the instrument needs to adjust to the tension.

The harp can be played by plucking, or with hammer-dulcimer sticks made of felt, to produce the effect of a steel-string lyrical drum. □

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*Robert Cole, of Santa Barbara, Calif., is a luthier.*

# A Spindle Cradle

*by Dick Webber*

The imminent arrival of our first grandchild recently forced me to put aside other projects and turn my attention to the design and construction of a cradle. An adequate supply of air-dried cherry, purchased eight yeas ago from a country sawmill, seemed an ideal choice of wood. My problem was the design. I wanted it to be practical, of a style that blended traditional lines, and of a construction that omitted metal parts yet allowed the cradle both to rock and to be removed from its stand. Too, it should be sturdy enough to last several generations. I am an amateur turner, and I got some assistance in designing the spindles for this cradle from a long-time turner, Walker Justice, of Vermilion Bay, Ont. He improved the spindle forms by suggesting more pronounced curves, perfectly semicircular beads and right-angled shoulders, exactly the sort of crispness that is usually missing from a beginner's turnings.

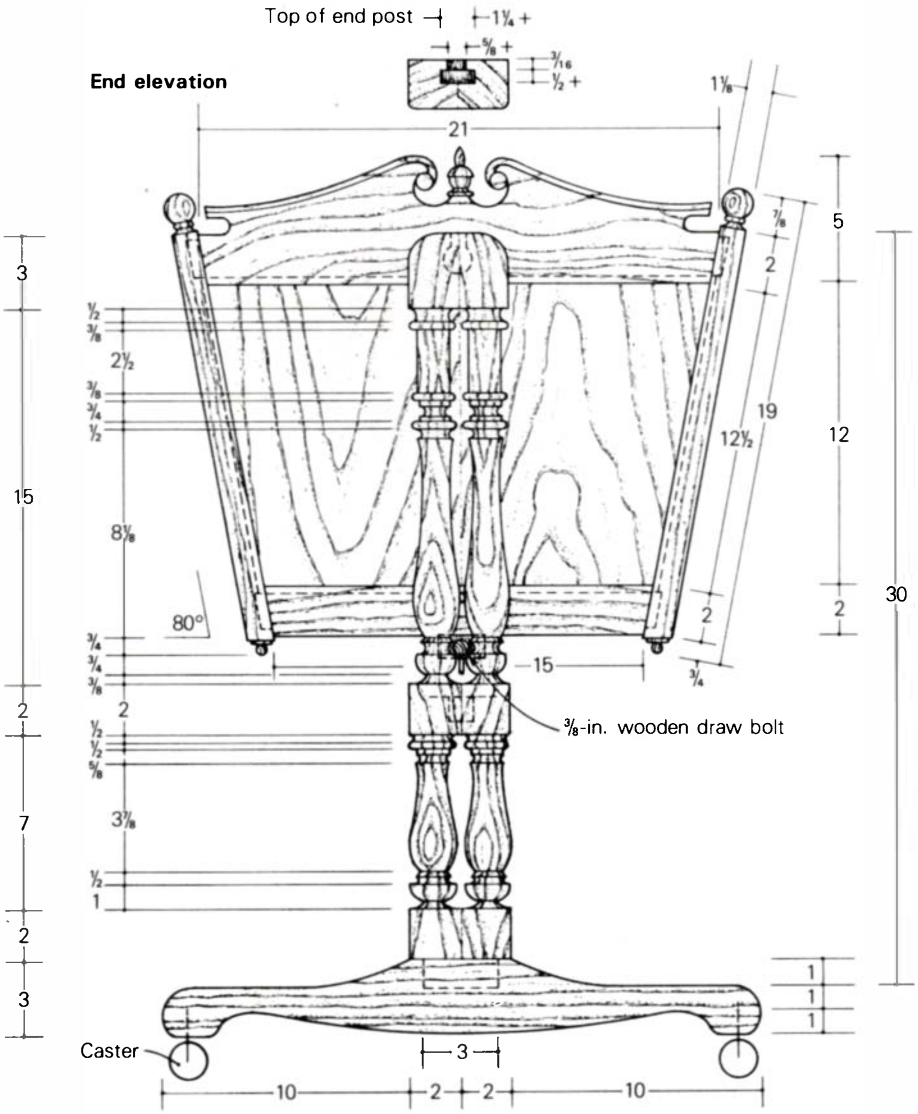
**The stand**—I wanted the effect of a single-post end support, but needed good lateral strength to withstand the racking stress of a rocking cradle. I decided to fasten two 8/4 turnings together, and left three parts of the turnings square for later gluing. The lower two receive the square tenons of the turned stretchers. The upper one receives the cradle-support pin (of oak, for strength), and is slotted accordingly. The bottom of the larger and smaller diameters of this T-shaped slot must conform to the size and shape of the pin. I started the cut by drilling a hole the size of the small diameter of the support pin into the face of the post where pin meets post. Then I chiseled down into the top the exact width of the diameters of the pin, making sure to position the mortise properly for clearance between post and cradle, and stopping at the centerline of the previously drilled hole. The last task here is to cut out the rounded part of the slot that receives the large diameter of the pin. I roughed out the space with a ¼-in. chisel, and finished by making a slightly smaller copy of the support pin, gluing sandpaper around the large end and turning my sandpaper peg in the slot with an electric drill. Once the cradle was built, I drilled a hole in each end and glued in the support pins, waxing them with paraffin where they fit the T-slot for smooth, quiet operation.

I bandsawed the feet of the stand from 2x3 stock, then mortised for the posts and drilled for caster posts before rasping and sanding the feet to a pleasing rounded shape. Casters are optional, but I figured them in my overall height, so omitting them would necessitate adjusting the length of the posts or the shape of the feet.

**The cradle**—The construction of the cradle is post and rail, using mortise-and-tenon joints with framed panels at both ends. One-inch dia. spindles with ½-in. round tenons connect the top and bottom rails before they are joined to the corner posts. I laid out the corner posts, then turned the ball at the top and the button at the bottom. I then mortised the posts for rails, and grooved them for the end panels. I joined the rails ⅛ in. from the outside of the posts in order to allow more depth for the tenons and to keep them from meeting.

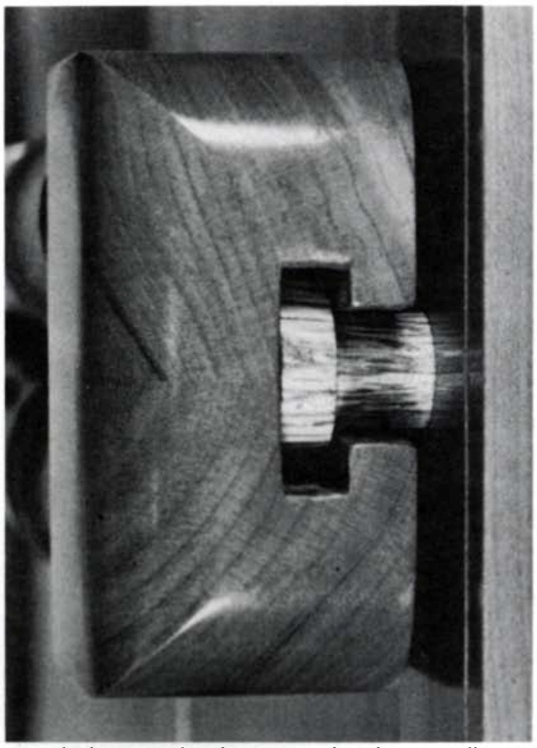
Instead of molding them, I grooved the outside face of the top side rails and the top of the end rails using a ¼-in. core-box router bit. I sanded the edges of the grooves and rounded over the tops of the side rails to produce a section like that of a handrail.

I made the bottom of the cradle from ½-in. stock, notched to fit around the posts. The bottom rests on ⅜-in. by ½-in. cleats screwed to the inside of the

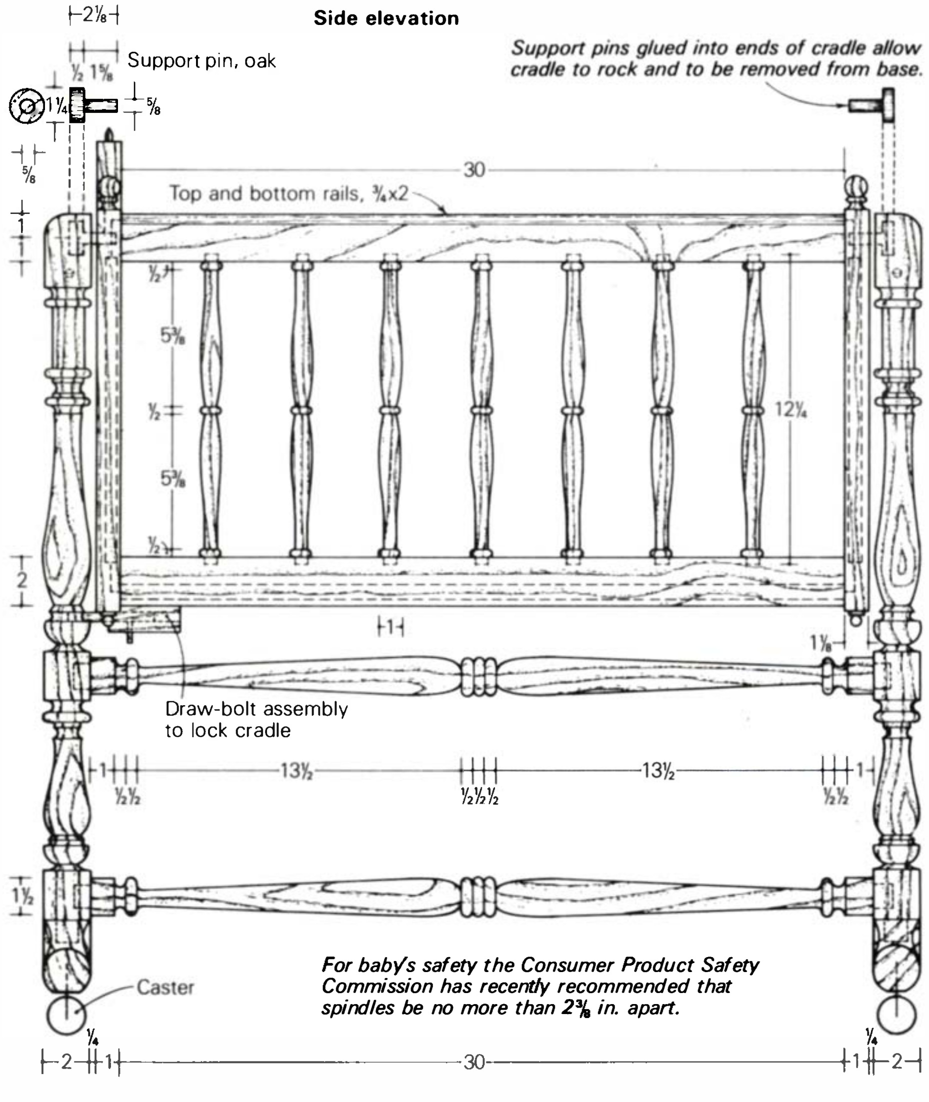





Photos: Mike Hill; author's plans redrawn by Karen Pease



*An ideal project for the turner, this cherry cradle uses twin 8/4 spindles for strong, stable posts. Instead of using metal hardware, the cradle pivots on an oak pin in a T-shaped slot, above, cut at the top of the posts. The cradle can thus be lifted easily from its stand.*




cradle, flush with the bottom of the rails. I chose not to fasten the bottom to the cradle thinking that, given the habits of infants, it might be handy to be able to remove it. A standard-size mattress fits into the bottom of the cradle.

To keep the cradle from rocking when the baby is left unattended, I made a wooden version of a draw bolt and fastened it to the bottom of the cradle. When extended, the bolt slips between the two turnings of the end post.

**Finishing**—Because so much of this project involved turnings, I finished the parts before assembly. I use Qualasole hand-rubbing lacquer (available from Woodcraft Supply, 313 Montvale Ave., Woburn, Mass. 01888). I begin by applying a generous amount with a cloth pad, making sure to saturate corners and crevices. As the finish builds, I apply lighter coats, increasing the pressure on the pad as the finish dries. When finishing on the lathe, I stop the lathe occasionally and rub longitudinally to prevent ridges from developing. The final coat should be a light application of Qualasole mixed 50/50 with thinner and rubbed vigorously until dry. □

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*Dick Webber is a real estate developer in Oklahoma City, Okla.*

# A Wooden Mechanism for Dropside Cribs

*by Kenneth Rower*

Cribs are often designed so the sides can be slid down to get the baby in and out. The proper metal parts might be hard to come by, and even then unsatisfying to see and use. But the whole mechanism—pins and grooves that allow the gates to slide and to be removed when the child outgrows the need for them, bolts that stop the gates in several positions, and springs that activate the bolts—all can be wood.

Fit upper and lower guide pins at each end of the gate to run in grooves cut in opposite posts. At the bottom of each groove, cut an escapement for the lower guide pin, to allow the gate to be swung outward. Once in this position, the gate can be removed entirely by tilting it, thus freeing the upper guide pins from the grooves.

Near the top of each leg, deepen the groove into a notch that will receive the spring-loaded bolt. Two such bolts, each passing through a bar and a stile of the gate, support the gate when up. A single-leaf wooden spring, housed in its own groove in the gate and retained at its lower end, presses the bolt outward into the notch. Drill a finger hole in the end of each bolt to make the bolts easier to retract.

Lower down in each groove, cut a notch to hold the gate off the floor. Slope the grooves for a short distance above these lower notches to allow the gate to be raised without having to retract the bolts. Cover the seats of the notches with thin cork to absorb shock.

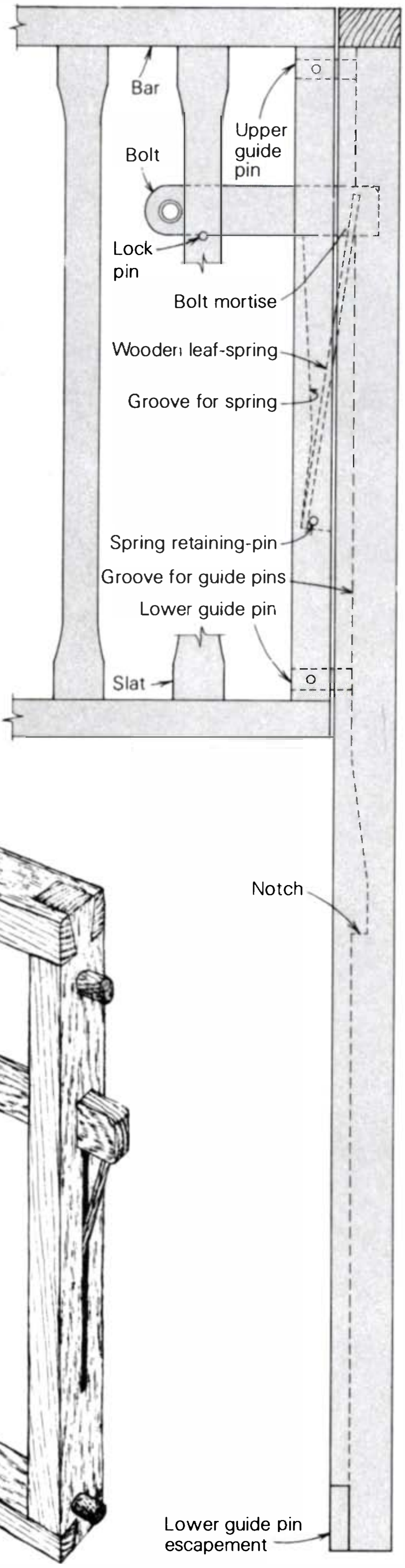
To prevent a child from withdrawing the bolts, first at one end then the other, and bringing the gate down with resounding effect, fit locks across the bolts where they pass through the bars of the gate. These locks are simply dowel pins notched part way through for the thickness of the bolt, and shaped where they protrude on the outside of the bar to offer a finger-and-thumb grip. In one position the pin allows the bolt to move freely, but if rotated one-quarter to one-half turn, it locks the bolt in the mortise.

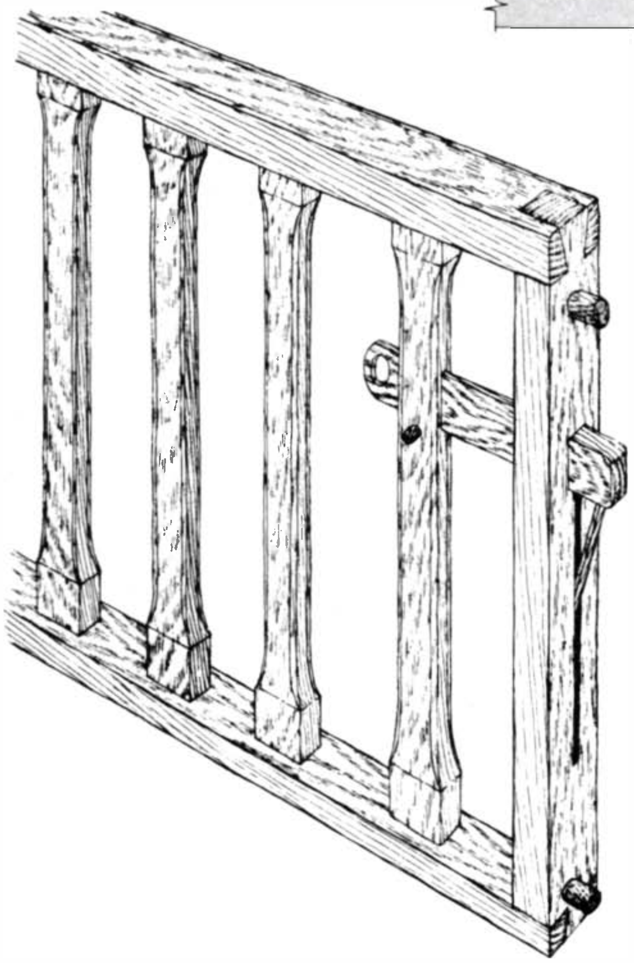
While there are no special pitfalls to the construction, groove and notch depth, bolt travel and bar centers in the gate must be carefully planned. The guide pins on the prototype are through-fitted dry, and thus adjustable as to projection, but you can cross-pin them once they are properly located in their grooves. Make the bolts and springs of straight-grained stock, and cut the mortise in the bolt for the spring deep enough so the spring can be pulled up past its retaining pin when installing or removing the mechanism. Mortises in the bars should be cut before the bars are shaped, and the whole system tested before gluing up the gate. The holes for the lock pins can be bored once everything else is in place. Locate them to put about less than half the diameter of the pin in the path of the bolt.

In order for the system to work smoothly the legs of the crib must be stout enough to resist spreading; otherwise the gate can jam. □

*Kenneth Rower is a woodworker in Newbury Village, Vt.*

Side view



# Turning for Figure
## Some design considerations when making bowls

*by Wendell Smith*

Recent articles about woodturning emphasize the techniques of turning. Discussions of grain and figure are generally found in books about wood or timber. The purpose of this article is to bring these two subjects together and to discuss some aesthetic aspects of bowl turning which depend upon grain and figure in wood. You can predict and control the figure that will appear in a completed piece by considering how your proposed bowl shape relates to the original orientation of the blank in the tree. The same blank can yield several types of figure, depending on how you orient it on the lathe and the radius of curvature you choose for the turning.

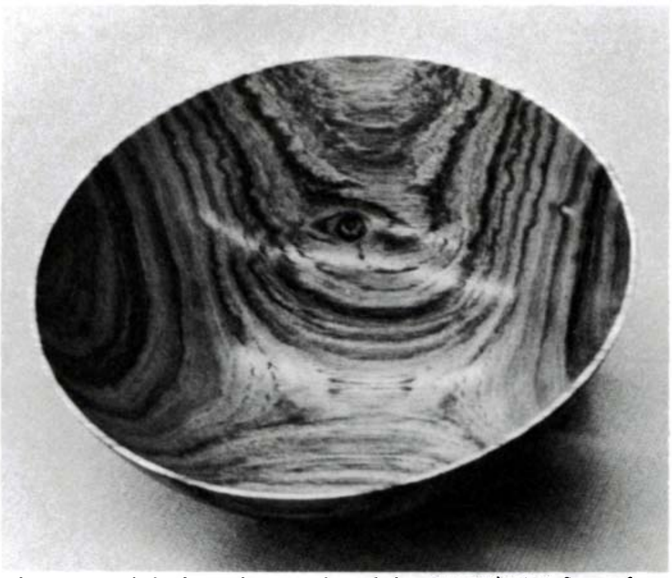
In this discussion, the words grain and figure will be used in the technical sense. Grain refers to the orientation of wood cells with respect to the axis of the tree. Authorities generally distinguish six types: straight, wavy, interlocked, irregular, spiral and diagonal. The first four are the most common. Figure is the surface appearance of the wood's anatomical features, including grain, which results from cutting or machining. In the same turning blank, tangential, radial and transverse surfaces display different figure, as shown on p. 76.

*Wendell Smith, who lives in Fairport, N.Y., is a research scientist and woodturner.*

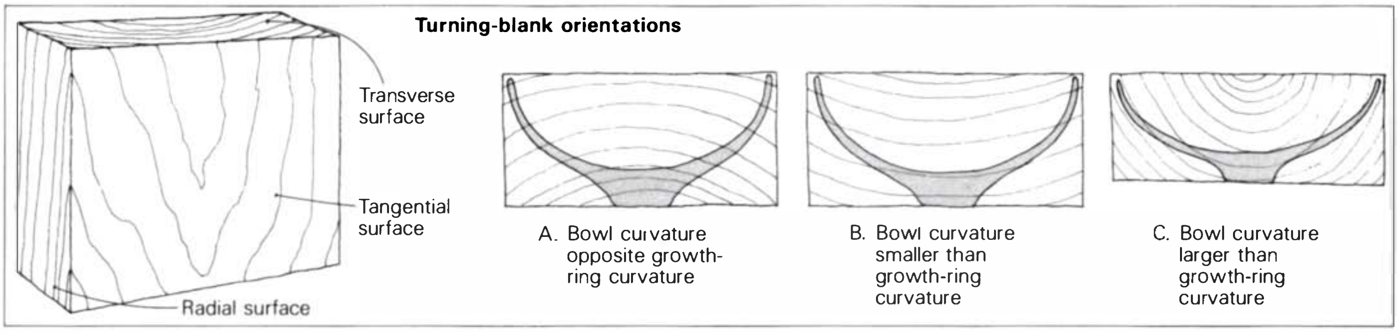
You can obtain many interesting effects using straight-grained wood by varying the orientation of the growth rings. Bowls can be turned with the growth rings "concave up" (the ring curvature running in the same direction as the bowl curvature) or with the growth rings "concave down" (with the ring curvature running opposite the bowl curvature). Some people find these relationships easier to visualize in terms of the bark side and the heart side of the wood. A bowl turned with the growth rings concave up opens toward what was the center of the tree, while one turned with the rings concave down opens toward what was the tree's bark.

Whether you turn with the rings concave up or concave down changes the appearance of a bowl or tray. I turned two cherry trays from blanks cut from adjacent segments of a single board, but I flipped one blank over before turning. A predictable pattern of concentric ellipses was produced on the tray blank oriented with the rings concave down (photo above left), while a hyperbolic pattern resulted when the rings were oriented concave up (photo below left). A striking example of hyperbolic figure is shown in the tulipwood bowl below. Turning concave up or concave down is a matter of personal preference, although I think that the former emphasizes flat-

Photos: Wendell Smith



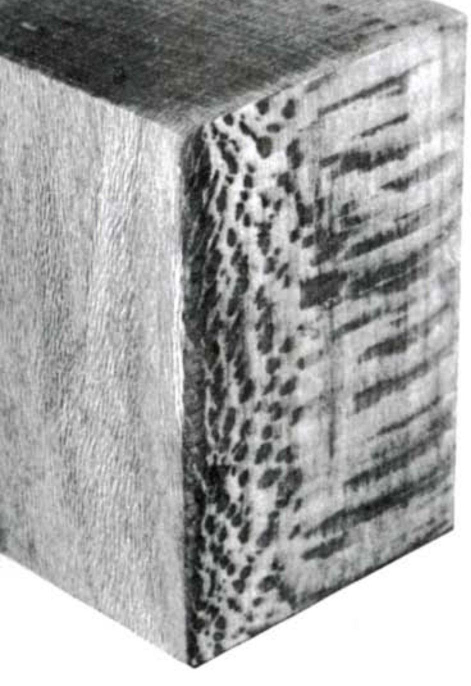
*Cherry trays, left, from the same board show growth-ring figure from turning concave down (top) and concave up (bottom). Above, hyperbolic figure on tulipwood bowl by Brian Lee.*




ness, while the latter accentuates roundness and depth.

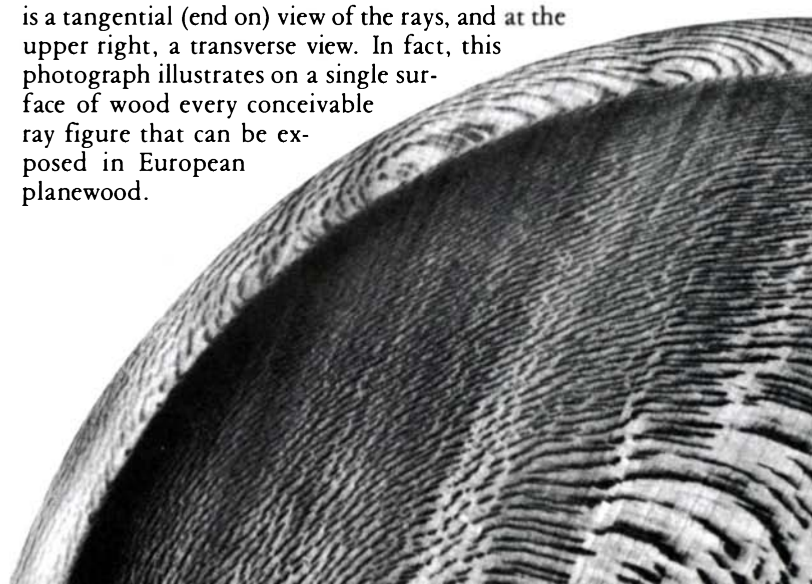
These examples of growth-ring figure are really special cases of a more general rule. If the radius of curvature of a bowl is opposite to (A, above) or smaller than (B) the radius of curvature of the growth rings, a pattern of concentric circles or ellipses will result. If the radius of curvature of a bowl is greater than the radius of curvature of the growth rings (C), a hyperbolic and/or parabolic figure will result. Thus, under certain circumstances turning with the rings concave up can lead to either figure, as shown at right and below, on the butternut bowl. The base of the bowl has a greater radius of curvature than the rings, while the sides of the bowl have a smaller radius of curvature. Therefore, what begins as a hyperbolic pattern in the bowl bottom becomes a concentric pattern at the sides. The result is a set of rings that progresses across the bowl, a figure enhanced, in the case of butternut, by the characteristically scalloped annual rings of the species.

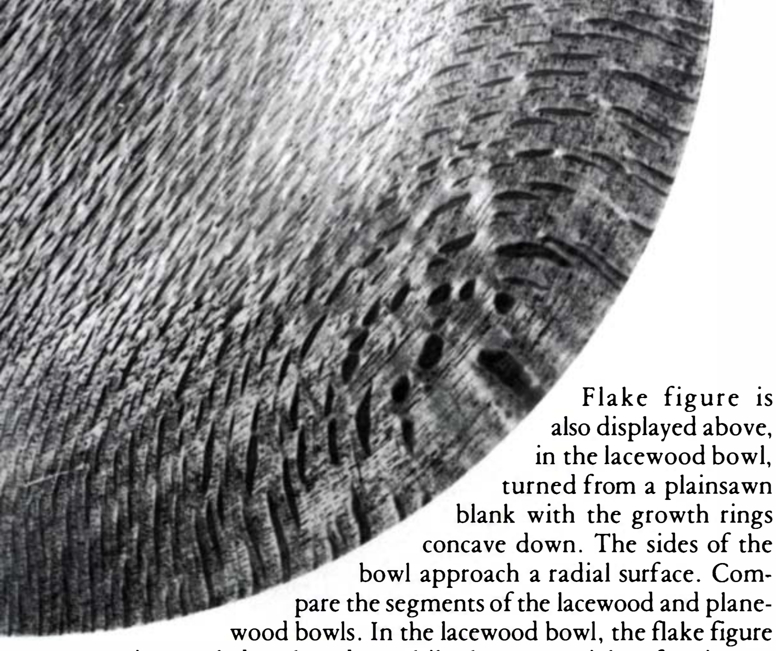
Many of the bowls shown here I purposely turned for symmetry. If symmetry is eliminated, the relationships discussed will still apply. Thus trial and error, and careful observation, can lead to turnings that fully reveal the beauty of the wood.



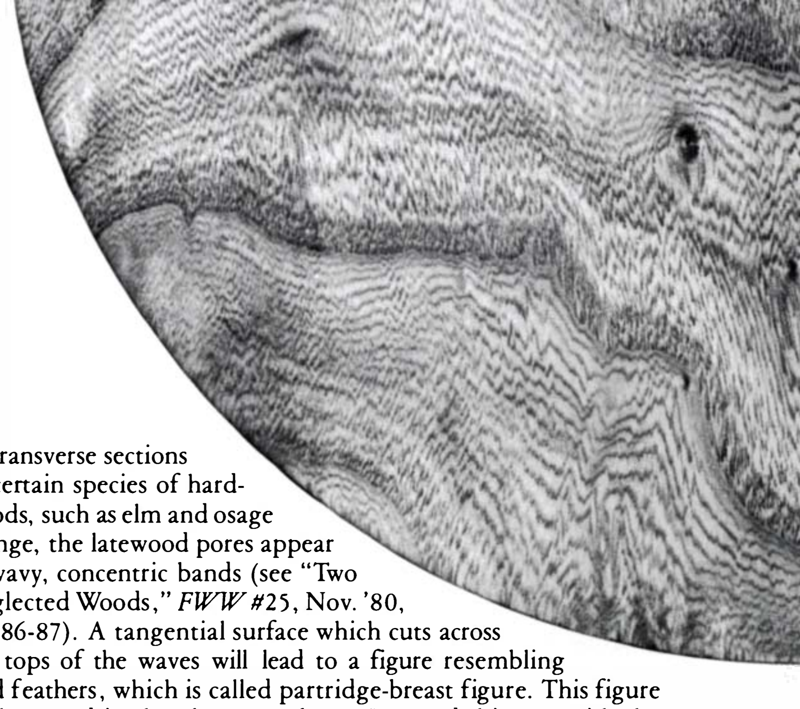
Two anatomical elements which are present to different degrees in all hardwoods are vessels and rays. Broad rays are characteristic of woods such as oak, beech, planewood and lacewood, regardless of the presence or absence of fancy grain. When rays are exposed on a radial surface, flake (or ray-fleck) figure results, which can be an interesting design element. Rays can be seen in radial and tangential section in the block of European planewood, left.

The planewood bowl, below, was turned from a quartersawn board. Because of this, the flake figure is revealed in the center of the bowl, but is lost toward the sides. At the lower left is a tangential (end on) view of the rays, and at the upper right, a transverse view. In fact, this photograph illustrates on a single surface of wood every conceivable ray figure that can be exposed in European planewood.





Flake figure is also displayed above, in the lacewood bowl, turned from a plainsawn blank with the growth rings concave down. The sides of the bowl approach a radial surface. Compare the segments of the lacewood and planewood bowls. In the lacewood bowl, the flake figure is revealed at the edge, while the tangential surface is now toward the center—just the opposite of the planewood bowl. As with the planewood bowl, the lacewood segment displays every conceivable ray figure. Button figure, which is characteristic of riftsawn lacewood, can be seen as the eye proceeds slightly away from the full flake figure.



In transverse sections of certain species of hardwoods, such as elm and osage orange, the latewood pores appear as wavy, concentric bands (see "Two Neglected Woods," *FWW* #25, Nov. '80, pp. 86-87). A tangential surface which cuts across the tops of the waves will lead to a figure resembling bird feathers, which is called partridge-breast figure. This figure is illustrated in the elm tray, above. I turned this tray with the rings concave up because the surface of the tray would be very close to tangential. In a perfectly tangential cut the figure is rather diffuse.

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Orientation is also important with woods having a fancy grain, such as wavy or interlocked. Wavy grain leads to a figure known as curl, which is best displayed on a radial surface. The curly maple bowl, left, was turned with the rings concave down. Consequently, the figure is slightly more pronounced at the sides of the bowl (radial cut) than at the base (tangential cut).

The same considerations apply to turning woods with an interlocked grain as apply to those with wavy grain. Interlocked grain, which is typical of many tropical woods, occurs when fibers of successive growth layers spiral in opposite directions. This results in a figure on quartersawn surfaces known as ribbon, or stripe, of which striped African mahogany is probably the classic example. To display this figure in a plainsawn board it is best to turn with the rings concave down. Alternatively, the combination of a quartersawn board with maximum radius of bowl curvature would also lead to maximum stripe figure. The combination of interlocked with wavy grain can lead to several other figures, many of which are better displayed on a radial surface.

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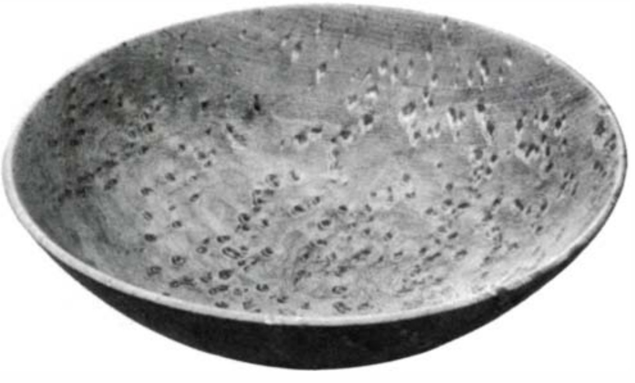


Irregular grain is the fourth type considered here. One example, caused by localized swirls in the grain, is bird's-eye. Because bird's eyes develop radially within the tree, a tangential cut best reveals the ends of the eyes. Thus, turning concave up may be preferred, as in the bird's-eye maple bowl at left (turned by Al Stirt). On the other hand, bird's eyes can also be attractive in cross section, which calls for cuts that expose a radial surface.

The most frequently encountered irregular grain occurs in the vicinity of crotches. Boards which at first sight might be rejected because of unwanted knots can be used to turn beautiful objects. A blank removed from a board by sawing close to but not including a knot will usually lead to a figure with chatoyant swirls. The ultimate in crotch figure is generally taken to be a full-feather crotch, shown at left. To obtain this figure, however, bowl design really must begin when the log is cut. For more on cutting wood for figure, see "Harvesting Green Wood" by Dale Nish, *FWW* #16, May '79. □

# A Shop-Made Bowl Lathe

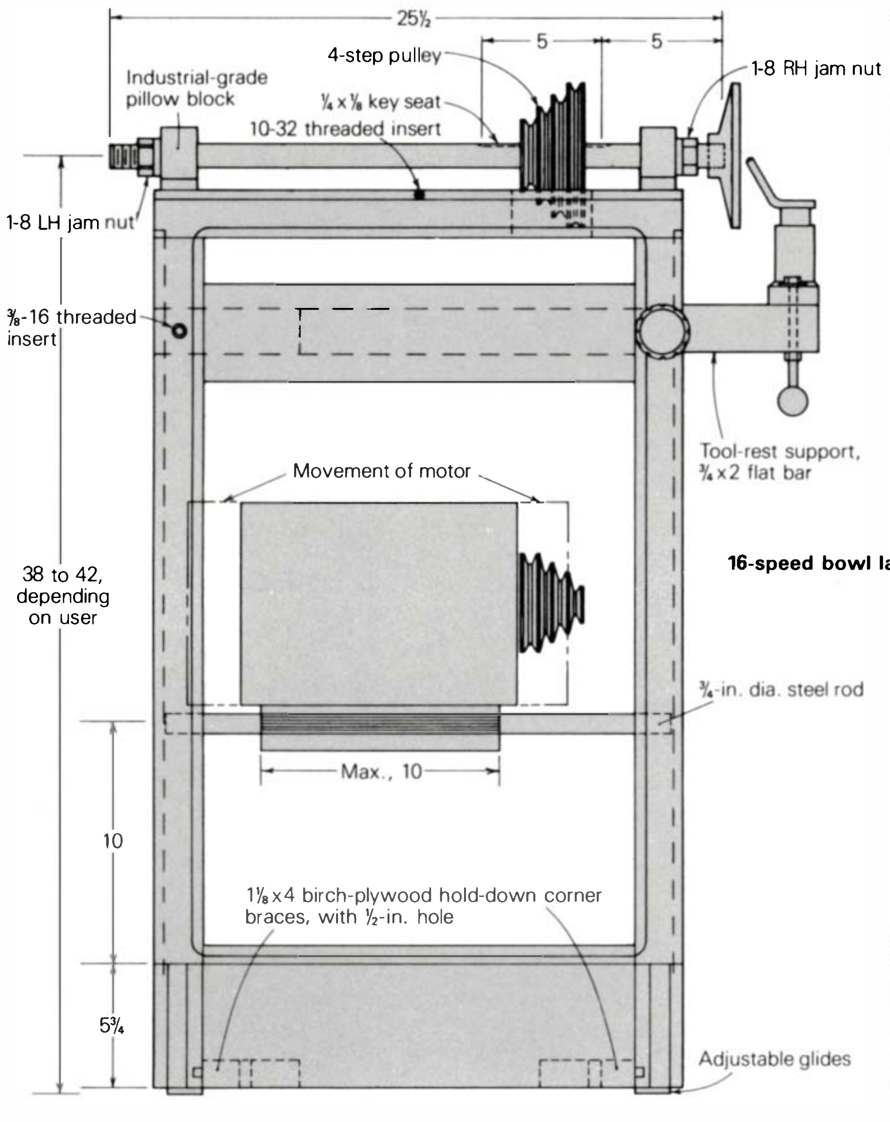
## You can add ways for spindle turning

*by Donald C. Bjorkman*

After building my disc sander *(FWW* #23, July '80) and getting so much use out of it, I decided to build a lathe I've wanted for a long time but have been unable to afford. As most of my turnings are bowls and I do not have room in my shop to keep a full lathe, I designed a large bowl lathe that can be expanded into a bed lathe. It has a 17-in. swing inboard, a 74-in. swing outboard and a 48-in. span between centers. As with the disc sander, the motor is positioned low, contributing to the stability of the machine, and it is enclosed in a cabinet to protect it from shavings and dust. A door allows access for easy speed changes, and the cabinet can be used to store tools or hold sandbags for ballast. The motor platform slides back and forth on the shaft that supports it, so that by using two four-step pulleys, 16 speeds are possible. For this system to work, the machine must be level, or the motor will creep on the support shaft. With the size pulleys chosen, the speeds range from approximately 500 RPM to 2,300 RPM. Although I have turned a piece containing 50 bd. ft. on a pattern lathe, I doubt that I will ever gamble with a 74-in. dia. item, as the outer edge at 500 RPM will be traveling at almost 10,000 FPM. Maybe I'll work up to it.

The frame is constructed of hard maple and all the joints are open mortise and tenon. The stress panels are ⅜-in. Baltic birch plywood, and the shaft and pulley cover is vacuum-formed plywood, the equipment and technique for which is discussed in *FWW* #16, May '79, pp. 52-57. The stress panels are glued into rabbets in the frame, except for the front panel which is screwed in place to allow complete access to the interior. The floor of the machine can also be removed so the corner braces can be bolted to the floor.

The sloping sides and perpendicular base of the machine require that the slot mortises in the base be cut on an angle. I




**16-speed bowl lathe**

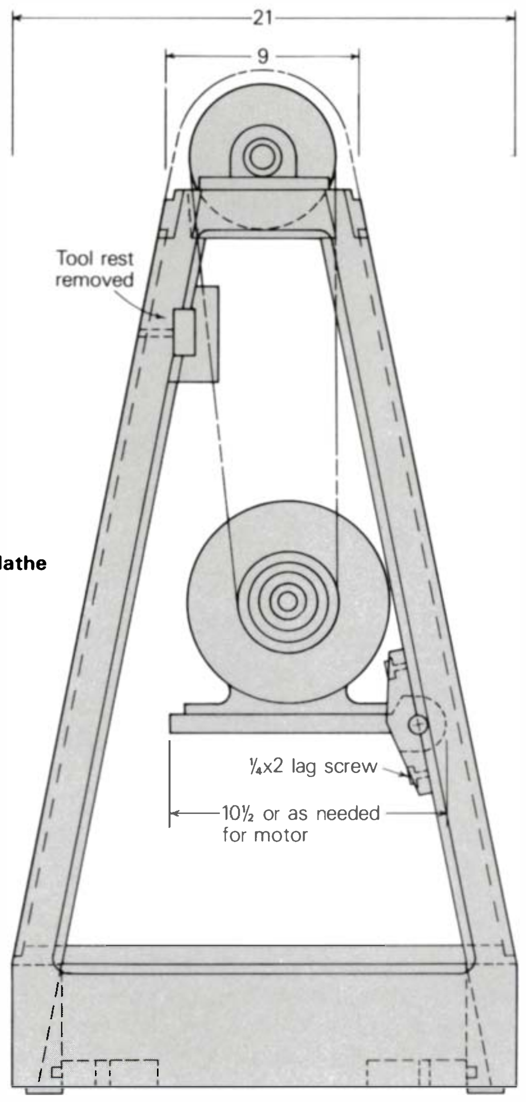
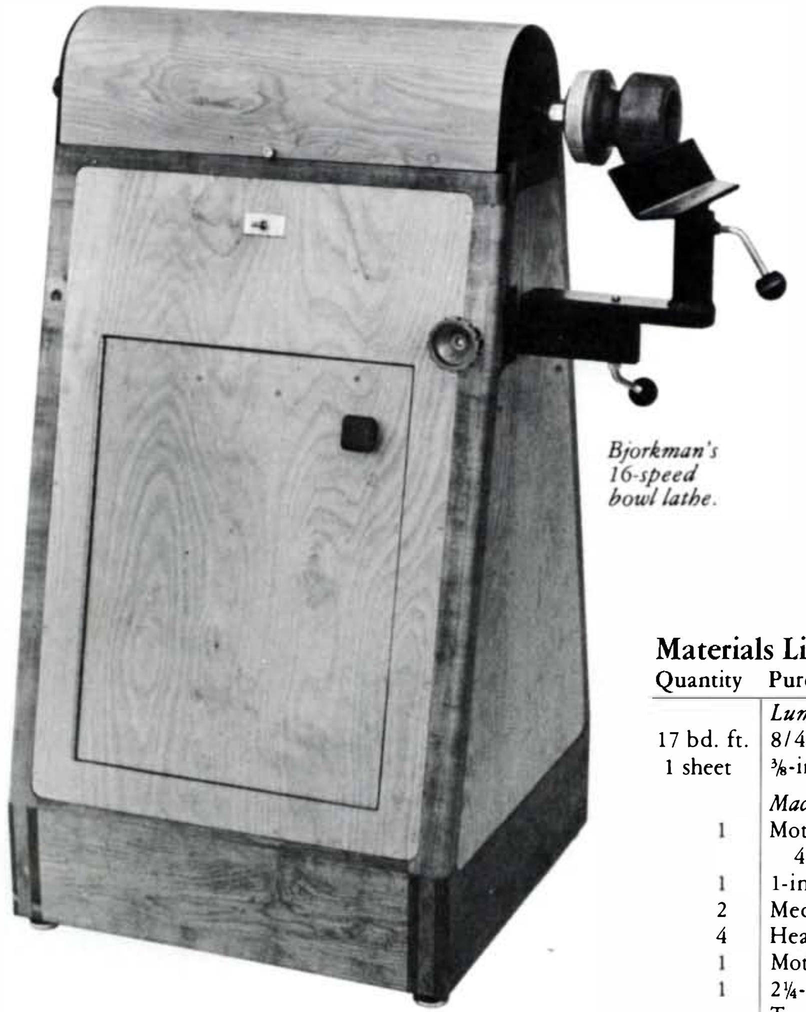


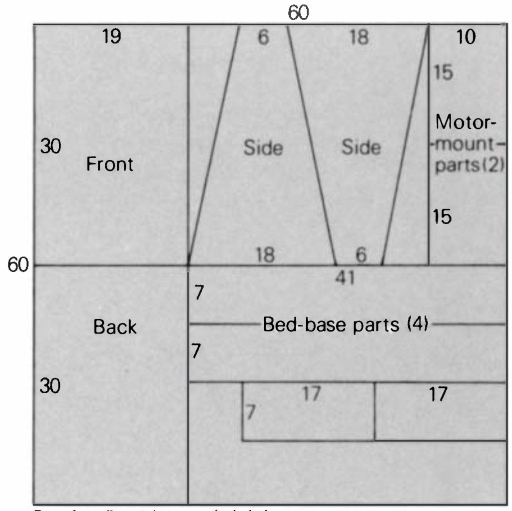



Photo and drawings: Donald C. Bjorkman



*Bjorkman's 16-speed bowl lathe.*

**Layout of parts from sheet of ⅜-in. Baltic birch plywood**

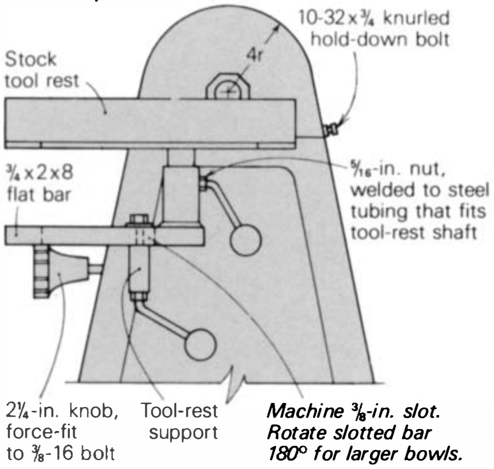



*Parts for tailstock base not included*

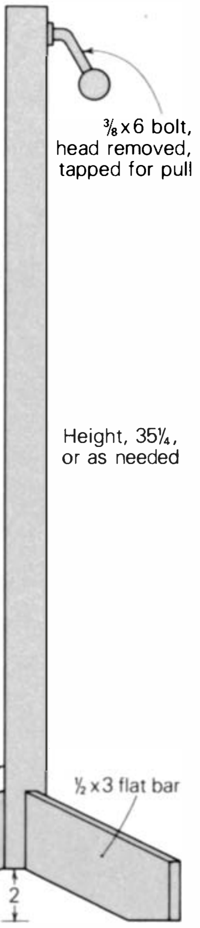
## Materials List

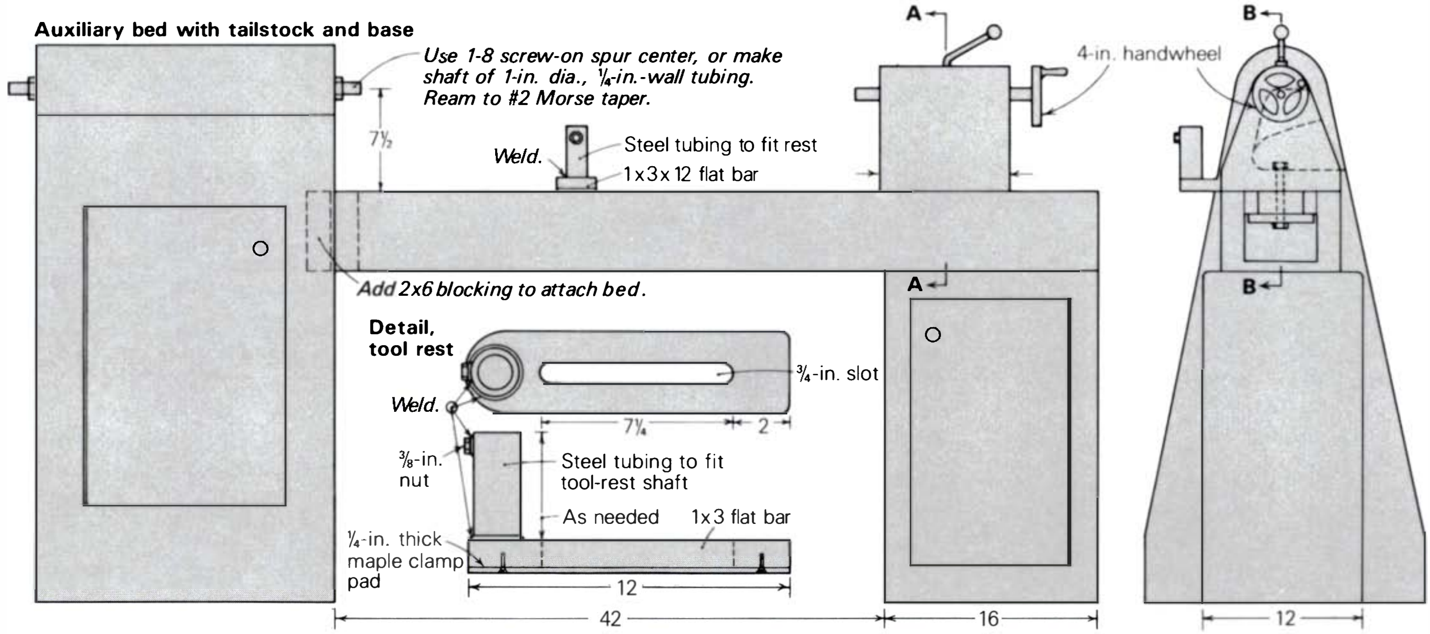
| Quantity | Purchased parts | Approx. cost (Fall, 1980) |
|---|---|---|
| | *Lumberyard* | |
| 17 bd. ft. | 8/4 maple, 5 in. by 20 ft. | $ 35.00 |
| 1 sheet | ⅜-in. by 60-in. by 60-in. Baltic birch plywood | 28.00 |
| | *Machinery supplier* | |
| 1 | Motor-shaft pulley, 1¾-in., 2⅝-in., 3⅜-in., 4-in. dia. | 9.50 |
| 1 | 1-in. shaft pulley, 3-in., 4-in., 5-in., 6-in. dia. | 16.00 |
| 2 | Medium-duty self-aligning pillow blocks | 45.50 |
| 4 | Heavy-duty adjustable nut glides | 4.00 |
| 1 | Motor switch | 9.00 |
| 1 | 2¼-in. locking knob | 1.50 |
| | Tool rest and faceplates as needed | |
| | *Steel supplier* | |
| 25½ in. | 1-in. dia. cold-rolled rod | 2.50 |
| 20½ in. | ¾-in. dia. hot-rolled rod | 1.00 |
| 2 | ¾-in. by 2-in. hot-rolled flat bar, 8 in. & 24 in. | 4.00 |
| 4 in. | Tubing sized to tool rest | .50 |
| 1 | 1-8 RH jam nut | 1.00 |
| 1 | 1-8 LH jam nut | 1.50 |
| | Welding of tool rest | 5.00 |
| | Machining of shaft | 15.00 |
| | *Hardware store* | |
| 2 | 10-32 threaded inserts | |
| 2 | ⅜-16 threaded inserts | |
| 8 ft. | 14/3 SJ electric cord | |
| 1 | 220 V electric plug | |
| 1 | ⁵⁄₁₆-18 by 4-in. hex bolt | |
| 1 | ⅜-16 by 6-in. hex bolt | |
| 4 | ⁵⁄₁₆-18 by 1¼-in. hex bolts | |
| 4 | ⁵⁄₁₆-in. hex nuts | |
| 4 | ⁵⁄₁₆-in. lock washers | |
| 8 | ⁵⁄₁₆-in. flat washers | |
| 4 | ¼-in. by 2-in. lag screws | |
| 1 | ⅜-16 by 3½-in. hex bolt | |
| 4 | ½-13 by 3-in. hex bolt for pillow blocks | |
| 4 | ½-13 hex nut | |
| 4 | ½-in. flat washers | |
| 3 | Ball-shaped wooden drawer pulls | |
| 1 | 1⁷⁄₁₆-in. by 24-in. continuous hinge | |
| 1 | ¼-in. by ¼-in. by 2-in. key for pulley | |
| 1 | ½-in. by 50-in. V-belt | |
| 2 | 10-32 by ¾-in. knurled finger bolts | |
| 6 | 1¼x8 FH wood screws (Phillips) | |
| 18 | ¾x6 FH wood screws (Phillips) | |
| 1 | Cabinet door catch | |
| | Total, miscellaneous hardware | 24.50 |
| | Total cost | $203.50 |

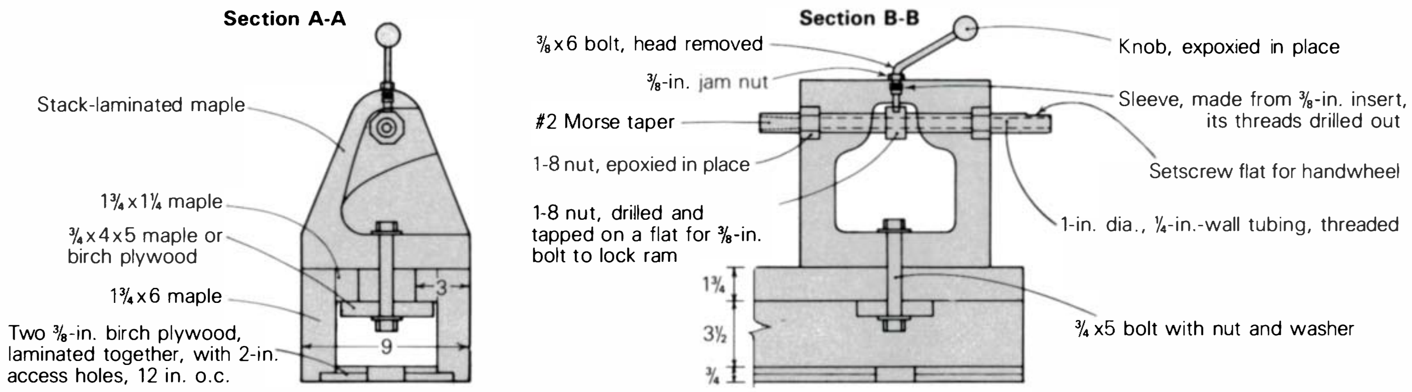
**Tool-rest assembly**




**Three-legged tool-rest stand**






used the table saw and a simple tapered jig. When the frame is fully assembled, a ⅜-in. rabbeting bit and router cut the rabbets for the plywood panels to fit into.

The guide through which the tool-rest support slides consists of two 1½-in. by 4-in. pieces of maple that span the uprights of the frame. To form the ¾-in. by 2-in. channel in the guide, I grooved each piece and glued them together. To align the groove I wrapped the steel bar in wax paper and positioned it in the groove during glue-up. Then I cut the angle on the guide's face to match the slope of the sides of the machine. A 2¼-in. knob on a ⅜-in. bolt through a threaded insert in the machine frame locks the sliding section of the tool-rest support in place. The pivoting section of the support consists of an 8-in. length of flat bar steel welded to a 4-in. length of steel tubing. A ⅜-in. slot is machined in the flat bar for the ⅜-in. hold-down bolt to slide in.

You can make ways for spindle turning on this lathe from two pieces of 1¾-in. by 6-in. maple, 58 in. or however long you desire. Laminate a 1¾-in. by 1¼-in. piece of maple along the length of the top edge of each way to create the lip that the tailstock and tool rest clamp to. Reinforce the bed along its lower side with a double thickness of ⅜-in. birch plywood, rabbeted into the inside edge of each way. As you will not have plywood pieces long enough to extend the length of the ways, stagger the joints for strength. Drill 2-in. holes on 12-in. centers along the length of this plywood for access to the hold-down bolts on the tailstock and tool-rest support. By epoxying and/or flush-screwing a thin piece of maple to the bottom surface of the tool rest, you can prevent a metal-to-wood sliding contact, thus forestalling damage to the wooden ways. Secure the tail end of the bed to the tailstock pedestal by bolting through the plywood along the bottom of the bed. The tailstock itself is stack-laminated maple. When the 1-8 nuts that hold the ram are epoxied into the tailstock, be sure to have the ram screwed in place so that the nuts are indexed to each other. The same is true when drilling the hole into the flat of the nut that locks the ram. With the tailstock in place bolt the ways to the headstock through two maple attaching blocks, one between the ways, the other between the frames under the spindle. It is important that both the longitudinal and horizontal planes of the bed are parallel to the centerline of the spindle; if not, you could end up with tapered turnings. Sight through the headstock spindle and move the tailstock until it is aligned. Shim where the headstock attaches to the bed as needed. You can also adjust the mounting of the pillow blocks.

The dimensions given are for my lathe and may be modified, but if the machine is built much larger, one piece of plywood will not be enough for all the stress panels. Also note that the spindle size and tool-rest holder were chosen to accept manufacturer's stock units. When buying steel, consider purchasing enough to build an outboard tool-rest stand. The materials list includes parts for the bowl lathe only. As motor prices vary considerably, I have not figured the price of one in the costs, but a ¾-HP to 1-HP motor is recommended. □

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*Donald Bjorkman is professor of interior design at Northern Arizona University in Flagstaff.*

# Pillar-and-Claw Table

## Designs and methods for a period piece

*by John Rodd*

There is always a demand for small tables to put beside an easy chair or in a bare corner. One of the handiest types of these has been traditionally known as the pillar-and-claw table. The name is confusing, because the term claw refers to the whole leg and not to the foot, which may or may not be an actual claw of the sort that most of us are accustomed to seeing. So to avoid confusion hereafter, the claw will be called the leg. Before describing how to make one of these step by step, let's consider some of the historical variations on the three principal elements of the basic design—the legs, the pillar and the top.

The earliest and most common form of this table is the Queen Anne version shown in figure 1A. Fashionable from about 1700 to 1760, it's never entirely gone out of favor. Most of these were made of walnut and often had a shell carved on the knee. Instead of plain pads, the feet might be ball and claw as in figure 1B. Occasionally, tables with pad feet were "improved" by craftsmen who glued cheeks on the feet and then recarved them in the ball-and-claw style. This left the foot wider than the leg at the pillar and the result was horrible. Later, when mahogany became popular, paw-and-scroll feet were introduced.

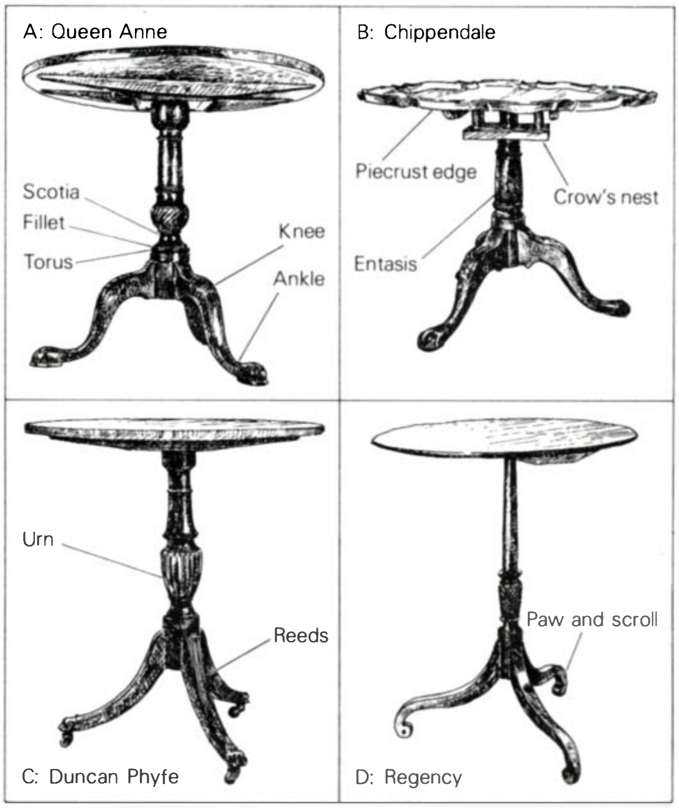
Tables shown in Sheraton's drawing book have legs with continuous concave curves that sweep from pillar to foot. Examples of these often end in a brass paw carrying a caster (figure 1C). In America this form was perfected by Duncan Phyfe, whose designs combine beauty with stength in a most satisfactory way and should be studied by anyone who plans to work in the style. If you choose to make one of these, you may have difficulty trying to cut the reeds on the legs so they taper in the same proportion that the leg tapers. See the box on p. 85 for my method of doing this. The table shown in figure 1D is typical of those fashionable during the Regency (1811-1820). The legs are tapered, rectangular in section and terminate with involuted scrolls.

The lower end of the pillar is always a cylinder to which the legs are attached, usually with sliding dovetails, but sometimes with dowels instead. Above this there is usually a shoulder, next a waisted section and then an urn, which may be decorated with reeds, carved leaves or other ornament. The member between the urn and the top should be the longest part of the pillar, and spread to the maximum diameter at the top to give adequate support. It is often fluted and, in Victorian tables, worked with a tapered twist, a rather attractive detail that's fun to make. Examples of that period also may include a boss and pendant at the base, covering the dovetails and showing a bead at its junction with the pillar.

A common weakness in pillars of this type is that the waist section below the urn has been turned too narrow. Not only is there danger of its breaking across the grain, but also any strain on the legs can cause splitting along the sides of the dovetail housings. These housings should be supported by a substantial amount of wood on either side and at the top. The fat pillar shown in figure 1B is less common, but in some respects to be preferred for its strength. Also, it shows classical details, as does the pillar for the table whose construction is described on the following pages (figure 2). The base of the pillar, like an Ionic column, consists of two beads with a hollow between, or as it was called, an upper and lower torus with a scotia between. The base of the shaft, in classical fashion, curves outward to meet the fillet above the torus. Turning a perfectly tapered shaft is more difficult than turning beads and coves. I once asked an old turner whether a pillar should have an entasis (a slight bulging in the shaft), thinking this was a feature that belonged only on a large architectural column *(FWW* #29, May'81, p.78). I was surprised when he answered that to be correct it should, and that explaining the entasis made a good excuse if the customer complained that the shaft was barrel-shaped.

Unlike a classical column with its 20 or 24 flutes, table pillars have only 12, but the ratio of one part land or fillet to three parts flute is correct. However, having repaired so many

**Fig. 1: Four basic table designs**




*John Rodd's book,* Restoring and Repairing Antique Furniture, *is available from the Van Nostrand Reinhold Co., 450 W. 33rd St., New York, N.Y. 10001.*

Drawings: Christopher Clapp

*Author's version of a Queen Anne pillar-and-claw table has a piecrust top, a carved pineapple on the pillar and delicately pointed pad feet.*

**Fig. 2: Patterns for Queen Anne table**

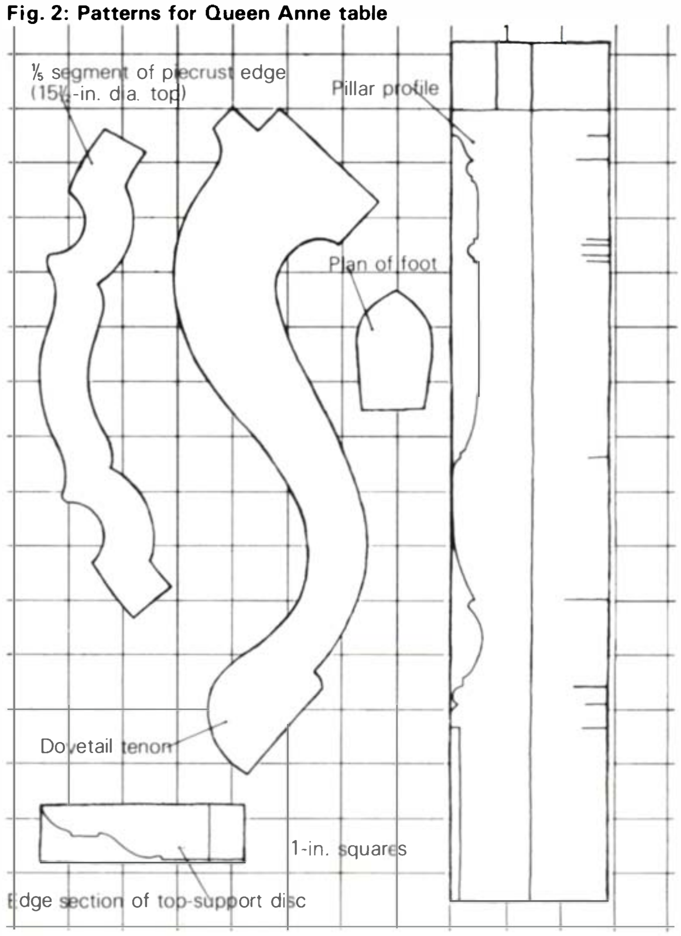
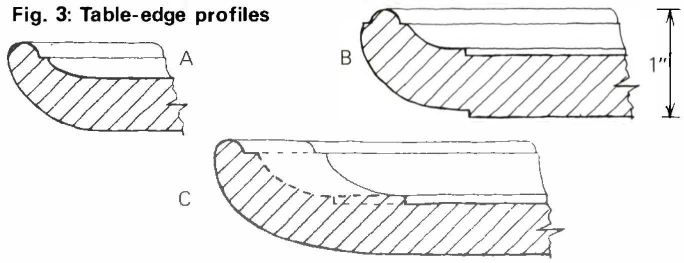



**Fig. 3: Table-edge profiles**




thin fillets where they have been chipped out, I usually make them more substantial, sometimes as much as one part fillet to two parts flute.

A plain top with a slightly rounded edge is quite satisfactory, or with a double or triple bead around the edge. Dished tops (figure 3) are nicer, but should be turned from stock at least ⅞ in. thick, unless they are quite small; then the edge is usually like the one in figure 3C. The best of all, in my opinion, is the piecrust edge, about which I'll say more later. A top that is not intended to tilt should be supported by a turned disc that could be as much as half the diameter of the top. The disc will reduce the tendency of the top to warp and strengthen its attachment to the pillar. It's best to make the disc of the same wood as the top, and to orient its grain in the same direction. Tilting tops have a crow's nest, as in figure 1B.

**Making a table**—The style I like best is the Queen Anne table with pad feet and a piecrust top. Figure 2 shows the patterns for the legs, pillar, top-support disc, the foot and a one-fifth segment of the piecrust edge. Cut the patterns from ¼-in. plywood, hardboard or solid wood. Take care to fair and smooth all the curved edges, and make sure that the bottom of the foot is square to the back of the leg (what will become the dovetail tenon). Next prepare the stock for the parts, using the dimensions given in figure 2. The top is 1 in. thick, the legs 1⅜ in. thick, and the pillar 3 in. in diameter. Bandsaw the top and the top-support disc to rough circles, ignoring the shape of the piecrust edge at this stage.

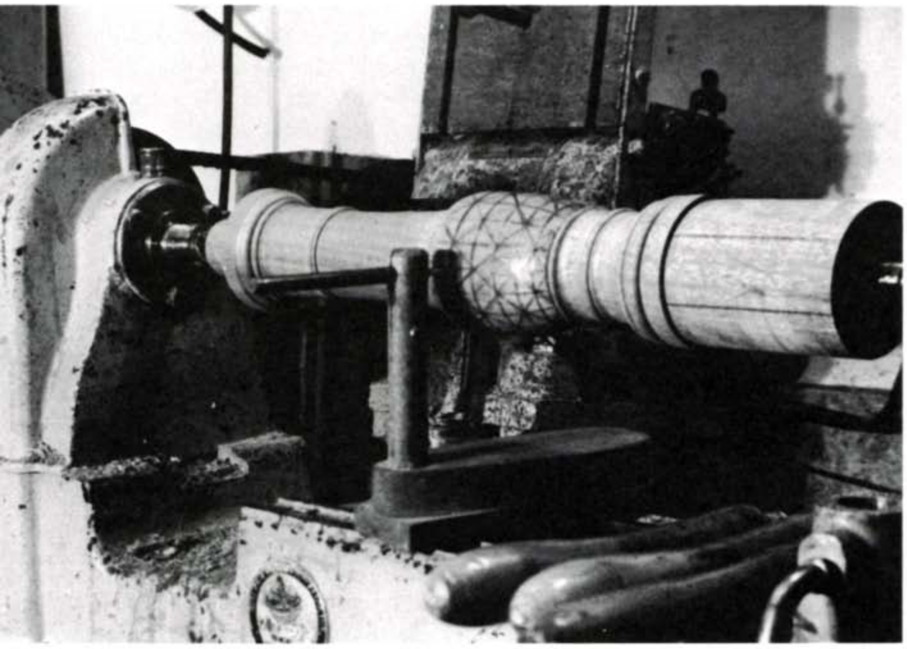
**The legs**—Now cut the three legs, having made sure that the grain in each runs at about a 45° angle from the foot to the back where it will join the pillar. Stack the three legs one atop another, align them carefully and clamp them together in a vise. Then plane the rear edges flat and flush. These surfaces will become the backs of the dovetail tenons, and the shoulders are gauged from them, so having all three in the same plane ensures that the legs will be square to the pillar when the dovetails are seated in their housings.

Gauge in from the backs ½ in. and score a line on all four sides of each leg to mark the shoulder lines of the joint. Then lay out the dovetail tenons. The accepted slope is 1:7, and they should be no narrower than ½ in. where they meet the shoulders. Saw right to the lines to minimize cleaning up of the cheeks with a chisel, but you must pare the end grain carefully to form the shoulders of the joint. Cut the top of the dovetail tenon back about ⅝ in., as shown on the pattern



Photos: John Rodd

*With the leg secured to the bench with a holdfast, author, above, spokeshaves the leg in a gentle curve to form one side of the ankle. The penciled line on the leg marks the limit of cut. The other side (down) has already been shaved to the line. At right, holding the leg in one hand, a wide-sweep gouge in the other, Rodd pares the foot to bring it to a point. Note how the butt of the gouge is seated in the hollow of his shoulder and how his arm is locked in position, so the cutting force comes from the body rather than from the arm.*



*Author uses this marking jig, left, on his lathe to lay out complex patterns for carving and for turning, like this stylized pineapple. The jig consists of a base which sits flat on the ways, plus a post for holding a pencil. Attached to the outboard mandrel is the wooden indexing wheel and pin stop. At right, having set the diamond pattern for the pineapple, Rodd uses a shallow gouge to form the pyramid-shaped elements. The horizontal lines on the base of the pillar delineate the areas to be later flattened and mortised for dovetail housings which will receive the dovetail tenons on the legs.*

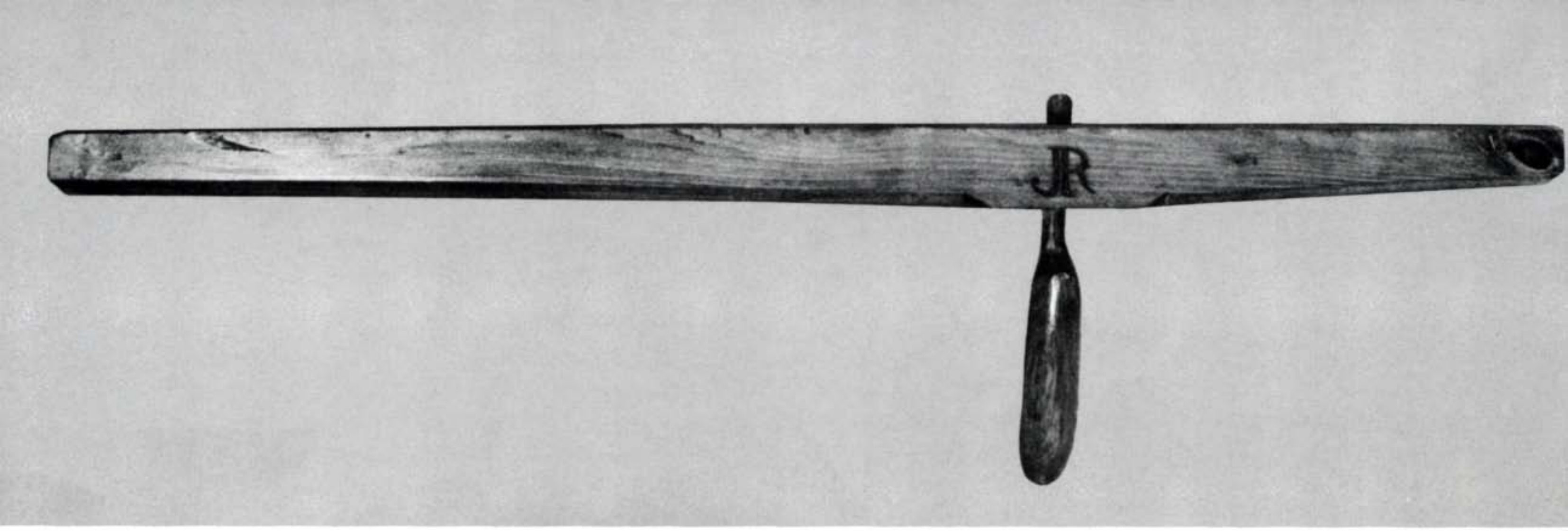
above. This will make the housing stronger by leaving more wood at the top of the joint.

Now begin shaping the legs by fairing and smoothing the sweep of the curves top and bottom with a spokeshave. To make the ankle area about two-thirds to three-fourths the thickness of the foot and upper leg, pencil in a line from each side to mark the depth of cut. Hold the leg to the bench with a holdfast, and spokeshave it in a curve down to the line (top left photo). The curve should begin about midway between the shoulder and the foot and continue onto the foot itself. The ankle gets fully rounded, while the sides of the leg remain flat. The top surface of the knee is rounded, leaving a distinct corner at the top which fades about one-third of the way down. The spokeshave does most of the final shaping, though rifflers and large half-round files are useful in small, concave surfaces.

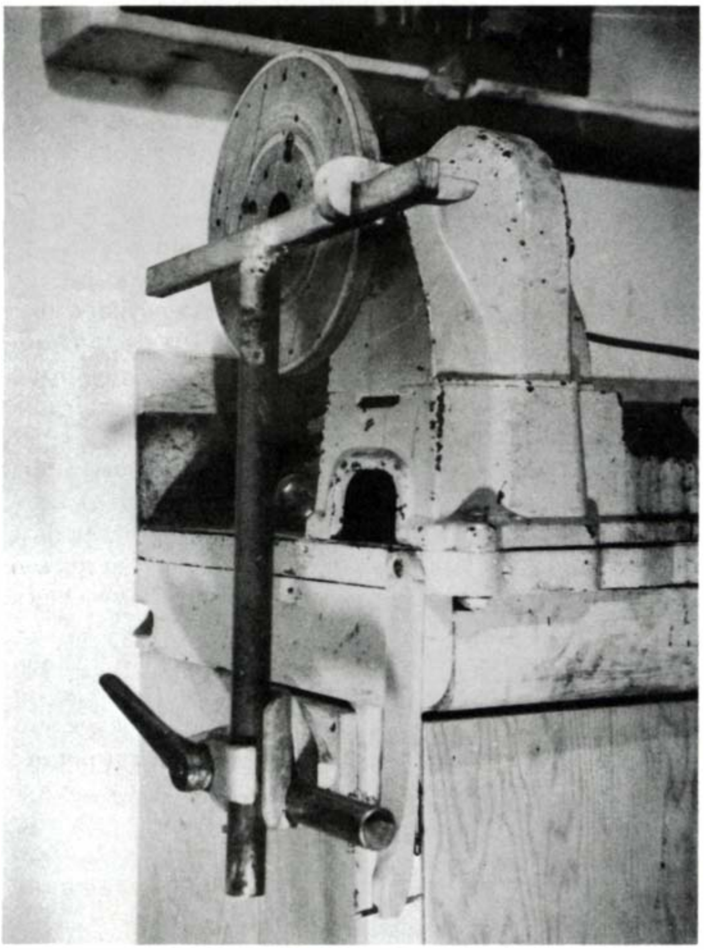
The pointed toe is roughed out with a large gouge (photo, top right). You can do this by eye or use the pattern provided and lay out the shape on the bottom of the foot. Note that the sharp ridge from the pointed toe dies out on top of the foot. Complete the shaping of the foot by carving a groove around the bottom with a V-parting tool and rounding the sides of the toe into it.

**The pillar**—Except for decorating the urn, turning the column is pretty straightforward and needs no comment. Urns were commonly ornamented with reeds, but I chose to carve a pineapple instead, and I'll describe how it's done. If your lathe is not equipped with an indexing wheel, make one out of wood, along with a pin stop. The wheel should fit friction tight on the outboard end of the mandrel. Laying out the pineapple calls for 18 equally spaced horizontal lines along the circumference of the urn, so bore a ring of 18 holes (each 20° apart) in the indexing wheel. To mark the 18 horizontals, make the simple jig shown above, at left. It consists of a base which sits on the lathe bed and a vertical post which holds a pencil, whose point is aligned precisely with the turning axis.

The next step is to mark the spiral lines on the urn. First draw on a single spiral line using a short length of flexible metal tape to guide the pencil. At each point where this initial spiral intersects the horizontal lines (there are five intersections in the example shown) you will draw a circle around the circumference of the urn, using the marking jig and rotating the stock into the pencil. Now you have a framework on which you can accurately mark out the rest of the spiral lines in both directions. Once this is done, you will have a grid of uniform diamond-shaped elements, and you can to set them



*Used for cutting dished-out tops to final depth, after most of the stock has been wasted with a gouge, this depth cutter, above, is basically a hefty stick with a hole in it, through which protrudes a ½-in. gouge. The stick rides against the raised rim of the revolving top while the tool cuts the relieved area to a uniform depth. Below, for turning round tabletops, author made this tool rest from steel bar stock. It can travel laterally on the horizontal bar below, and is provided with an auxiliary rest for getting at the rim of the rotating stock.*



in, cutting grooves along the spiral lines with a V-parting tool.

When these cuts are finished in both directions, start shaping the individual diamonds. With a fairly flat gouge, pare away the wood on the four sides of the center point to form a pyramid. Cut close but not quite to the bottoms of the grooves, and try to leave the intersections of the spirals plainly visible. Once the gouge work is finished, you should clean up the grooves with a small parting tool.

While the stock is still on the lathe, you will need to lay out the base of the pillar to receive the legs. This involves cutting three flat areas and the dovetail housings. First mark out the boundaries for the flats; these are 1⅜ in. wide and as long as the shoulder on the legs. Use the indexing wheel to find the centerline for each land, and measure over 11/16 in. on either side to establish the shoulder lines. Cut the flats by sawing a series of kerfs almost to the shoulder lines, then remove the waste between with a chisel. Finally, pare to the lines with a wide chisel or rabbet plane, and check for flatness using a piece of glass with crayon smeared over its surface. The color will rub off on the high spots, and you can level them.

To cut the dovetail housing, first bore a ⅝-in. hole on the centerline so the top edge of the hole is ⅝ in. below the top of the land. This area is not mortised because the dovetail tenon has been cut back ⅝ in. from the top. Position the end of the dovetail tenon as though it were going to enter the pillar, and trace around it with a sharp pencil or scriber. Carry the marks up across the face of the flat to the outer edges of the holes. With a dovetail saw or tenon saw, cut down the walls of the housing, finishing the cuts with the point of the saw. The hole at the upper end makes this job easier. Chisel out the waste between the cuts, making sure that the bottom of the housing is cut to full depth and is absolutely flat. Slightly bevel the two outside corners, then try the fit by inserting the tenon to about two-thirds its length and moving it in and out a couple of times. Check the walls of the housing for shiny spots to pare down. Repeat this until the leg can be driven home with a few light blows. The fit should be snug, and the shoulders should pull up tight.

At this point I find it convenient to glue the rough-sawn top-support disc to the pillar (you can reinforce the joint with a dowel), and turn it as part of the spindle, rather than as a separate faceplate turning. Then I sand the finished turning, taking care to avoid the urn. You'll ruin its appearance if you sand the points off the pyramids.

**The top**—The roughsawn blank for the top should be 1 in. thick and 15½ in. in diameter. The dished area will be ½ in. below the carved rim. Screw the top to a faceplate and mount it on the outboard side of the lathe. You will need a wide tool rest like the one shown at left, which you can fabricate from steel bar stock, or simply make out of wood for an occasional turning. To dish out the top I first remove most of the wood with a ½-in. gouge; then I use the depth cutter shown above, which I made myself. It consists of a long bar about 1½ in. square and three times as long as the radius of the largest top to be turned. The ½-in. dia. hole for the cutting tool, an ordinary ½-in. turning gouge, is bored about one-third the way from the one end, and the back of the bar should taper slightly from this area to the ends. The cutter (wedged in place) projects through the hole in the amount you want to dish out the top. In use, the bar is tilted back for the initial cuts and slid back and forth across the rim. Finally, the face of the bar rides flat against the rotating rim.

Before removing the top from the lathe, prepare a wooden straightedge of suitable length, cover it with crayon and hold it against the top as it revolves. High spots will show up as rings. The center portion can be leveled with a finely set block plane, and the outer part can be smoothed with a flat 1½-in. wide gouge which has been ground to an angle of 65° and honed absolutely sharp.

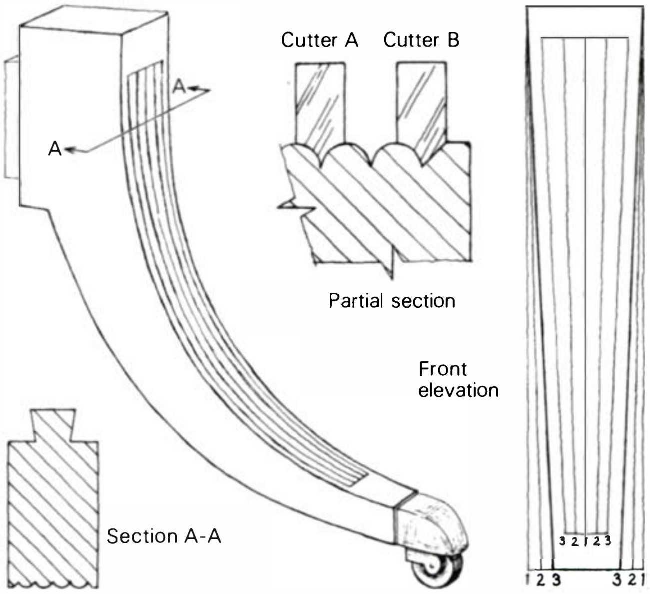
Next comes the piecrust edge. With a compass, describe a circle 15 in. in diameter and use it to register the pattern for the outside scalloped edge, which is marked out and cut with a bandsaw. Next fair all the curves with a large half-round file. This outer edge serves as a guide for making two more such edges, one within the other—the line to mark the upper edge of the cove, and the one to mark the lower edge of the cove. The curves and proportions of the piecrust pattern change as you move inward, and some freehand drawing is necessary to get things right. Once you do, make a cardboard template for these inner edges.

With the two inner edges marked out, begin setting in and grounding the cove, taking care to cut it to no more than half its final depth, and observing how the grain responds to your direction of attack. This is followed by a second setting in, using an almost flat 1¼-in. gouge, until the cove has been fully grounded. Both care and control are needed to avoid tearing the wood during final grounding, so remember how the grain behaved during the first stage of carving and adjust your direction of cut if necessary. Next cut the inside corners of the rim with a parting tool, using an easy sweep from top to bottom; then complete the cove, cutting into the corners with the flat gouge.

Use a small parting tool to set in and ground the little fillet that separates the cove from the bead which forms the top edge of the rim. Work the intersections (inside corners) with a spade firmer chisel. Finally round the bead with the concave side of a ¼-in. carving gouge, whose sweep should conform to the curve. These cuts are made from both directions with a rolling motion. This is particulary good exercise in handling carving tools because the angle of the grain is constantly changing, and cuts to both the left and the right are necessary. In doing this you will appreciate the small inner bevel you get if you sharpen your gouges properly.

Little now remains to be done. The underside of the outer edges must be rounded, the inner curve being started with a large gouge and finished with file and spokeshave. Lastly, the grounded areas of the top are smoothed with a cabinet scraper, and then the entire top is sanded before attaching the top-support disc with woodscrews. □

# Cutting tapered reeds




Tapered table legs, whether curved or straight, are often decorated with reeds, which for a correct appearance must also be tapered in the same degree as the leg. Reeds can be tapered freehand with carving tools, but getting accurate and uniform results is tedious and difficult. The only specialized tool involved is a scratch stock, which you will find useful for other molding jobs. Mine is similar to the one described in *FWW* #11, Summer '78, p. 60, but has an adjustable fence, like a marking gauge, instead of a fixed fence. The adjustable fence isn't necessary; on a conventional scratch stock, you simply move the cutter in its slot and tighten the setscrews to reset the distance between the cutter and the fixed fence.

Two cutters are needed. One is ground to cut the vein between two reeds and half the profile of each (cutter A, shown at right). The other is ground to cut only the outside half of the outer reeds and the relieved area between it and the border on the leg (cutter B). You can make these from bits of hacksaw blade or other thin, suitable steel.

I'll describe how to cut four tapered reeds on a curved tapered leg; the principles can be adapted to handle other legs or furniture parts and more or fewer reeds. First dimension the leg blank, bandsaw it to its proper profile and fair the curve, leaving the sides yet untapered. With a flexible metal tape, lay out the lines of the finished taper on the face of the stock. Now look at the wedge of wood on either side that will become waste; at the bottom of the leg divide the wide part of both wedges in two. Draw a line from this midpoint to the top of the leg, bisecting the wedge of waste. Do this on both sides of the leg.

Install cutter A to take a cut down the center of the leg. Hold the fence against the side of the leg and cut in the middle vein and the two inner halves of the two middle reeds. Then handplane the taper on both sides to the first line. You now have a new edge on which to register the scratch-stock fence. Reset the fence to cut the veins between the two outer reeds and the two inner ones. When done you will have formed two tapered central reeds and the inner halves of the two outer reeds. Now plane the leg to its finished taper, install cutter B and form the outer halves of the outer reeds.

Cutting more reeds means tapering the leg in more increments. Cutting an odd number of reeds requires tapering the center reed by planing first to half the depth of the first taper line on both sides. To stop reeds, square off the ends of the veins with a parting tool. —*J.R.*

# Gluing Up

## How to get a strong, square assembly

*by Ian J. Kirby*

Gluing up is unique among woodworking operations. It's an irreversible, one-shot deal and has to be got right. You may have done accurate work up to this point, only to find that a small error in assembling or clamping has produced all sorts of inaccuracies that will be difficult, perhaps impossible, to fix. A common lament in woodworking is that "everything went perfectly until glue-up, then everything went wrong." When you think about it, this is not surprising. How often do we systematically consider gluing up, and how much time do we give to dry clamping? Usually very little, and then halfheartedly.

To get the best results, we should bring a studied method to this operation and practice it more. We ought to have a table especially prepared for this purpose, its top surface flat, clear of debris and well waxed to resist glue penetration. A piece of varnished plywood over your benchtop will do, but a sturdy table, 36 in. high with a Formica surface, is better.

Before gluing up, you should dry-clamp each assembly exactly as you would clamp a glued assembly. This means positioning and tightening all the clamps, with correct glue blocks, and checking the whole assembly for accuracy. Gluing should proceed calmly, in an atmosphere of preparedness, with the glue and necessary applicators ready, clamps standing by, and you and your assistant decided on the order of events. The time of day you glue up is important. Most woodworkers like to glue up in the evening and let the glue set overnight. To meet this goal, a lot of work often gets rushed, dry clamping gets short-circuited and we have all the necessary ingredients for a disastrous glue-up—fatigue, unpreparedness and anxiety. The only reason to proceed under such conditions lies in the spurious notion that glue cures only while the moon is out.

Consider the alternative. Leave the work dry-clamped overnight. The next morning, check the clamping to see if everything is still properly aligned. Then collect all the tools and materials you need and begin to glue up. The light is better, your mind is fresh, the pressure to complete the job is gone. If you can't leave the work dry-clamped overnight, at least let it sit for an hour while you attend to other things.

Gluing up actually begins with a decision about what to glue together and in what order. The more subassemblies you can get together, the easier the total operation will be, especially the final glue-up. But before gluing any parts, always clean and prefinish surfaces that cannot be reached later with a plane. It's much easier to work on a piece of wood while its entire surface is exposed and accessible than to try to remove mill marks and other blemishes once other parts are permanently in the way.

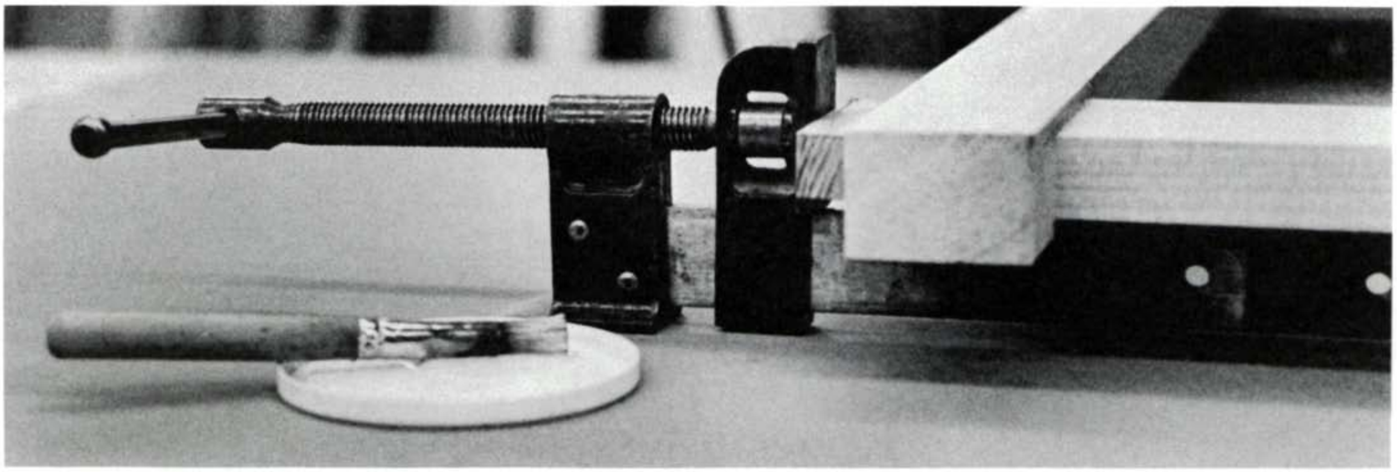
You must also weigh the inconvenience of having three or four finishing sessions as the job proceeds against one grand and difficult cleanup after final assembly. Prefinished surfaces will resist glue penetration from squeeze-out. When the excess glue is dry, simply lift it off with a sharp chisel. When finishing prior to gluing up, take care to keep the finishing material off joint interfaces.

**Bar clamps**—The type of bar clamp you use has considerable bearing on the ease and accuracy of the glue-up. For general cabinetmaking applications, quick-action bar clamps with a circular pad at the screw end are no substitute for a standard bar clamp. A good clamp should sit on a glue table without falling over at the slightest touch. The bars should be identical in section, and the heads should move easily, but not flop around. When pressure is applied, the face of the head should be at 90° to the bar—this way we know exactly where pressure is transferred. A collection of clamps is an investment no matter which you choose, but it is a long-term investment you can make by purchasing one or two clamps at a time. The combined value in the end may equal that of two major machines. The best choice in the main is between Jorgenson, Wetzler and Record clamps. I prefer the last.

**Applying the glue**—The amount of glue squeeze-out is an important signal. Since it is waste, it is best to have as little as possible, but we still want assurance that there is sufficient glue in the joint. The smallest bit of squeeze-out is enough. This results from getting the glue in the right place in the right amount. For different jobs you will need different applicators. White glue (polyvinyl acetate) and yellow glue (aliphatic resin) can be stored in and dispensed from a squeeze bottle. But a squeeze bottle is not a good applicator, and won't guarantee that the surfaces being joined are completely wetted by the glue. There is no reliable adhesion if joining surfaces don't get completely wetted.

Since the future of the piece depends on the quality of its joints, we need to take a close look at the business of applying the glue. Manufacturers try to lower the surface tension of the glue so it will spread easily. Nevertheless, the glue should be rubbed or rolled on, not merely squeezed out onto the surface. A set of stiff-bristle brushes of different sizes (I use plumber's flux brushes) will suffice in most instances. If you use white or yellow glue, brushes can be stored in a jar of water, but it is just as easy to wash them out and begin next time with a dry brush. If you use urea-formaldehyde glue or resorcinol, you must clean the brush after each use, for these will set hard even in water.

When edge joining boards, white or yellow glue can be squeezed from a plastic bottle onto one surface. If the boards are clamped or rubbed together and the clamps are removed immediately and the joint broken, chances are you will find that the glue has covered both surfaces uniformly. That this happens in edge joining does not mean that it will happen in other joining situations. In fact, it's not a good method for edge joining either. A better way would be to run a very light



*The size and position of the clamping block can make the difference between success and failure when gluing up. The block should be the same dimensions as the section of the rail, and placed directly opposite the shoulder area, centering the clamping pressure on the joint.*

bead on each surface, and then with a 1-in. wide paint roller, spread the glue thinly. Now we know that the surfaces are evenly wetted and that when the joint is clamped we won't have gobs of the stuff dripping on the floor, the table and the clamps. Spreading glue with your fingers is a bad practice. You need fingers for other things, and the grease and dirt you add to the glue won't help adhesion. If you insist on using your fingers, wash your hands first.

**Edge gluing**—When gluing up several narrow boards to make a case side, tabletop or framed panel, there are four important considerations: the position of each board in the composite piece, the grain direction of each, the number of clamps to be used and the means for aligning and registering the boards to keep them from swimming about when pressure is applied. Assuming that all of the boards are dimensionally stable and free of defects, the first thing to decide is how to arrange them to get the best appearance. This involves shuffling the pieces around to achieve visual harmony and continuity in the figure. Remember that after gluing up you will have to clean up the surfaces with a smoothing plane, so try to decide on an arrangement that permits the grain of all the boards to run in the same direction. If this is not possible, then you will have to plane in both directions and carefully avoid tearing the grain on an adjacent board.

Having decided on their arrangement, mark the boards so their order can be recalled when they are put in the clamps. Dry clamping will determine the number of clamps you need and where to put them. As shown in figure 1 on the next page, clamping pressure is diffused in a fan of about 90° from the clamp head. You will need enough clamps to ensure that the lines of diffusion overlap at the first edge joint. The number of clamps then is a function of the length of the boards and of the widths of the two outer boards. Since the boards themselves transmit and spread the pressure, clamping blocks are unnecessary in edge gluing. Plan to joint and rip the composite piece to width after glue-up. This will remove any depressions the clamps leave.

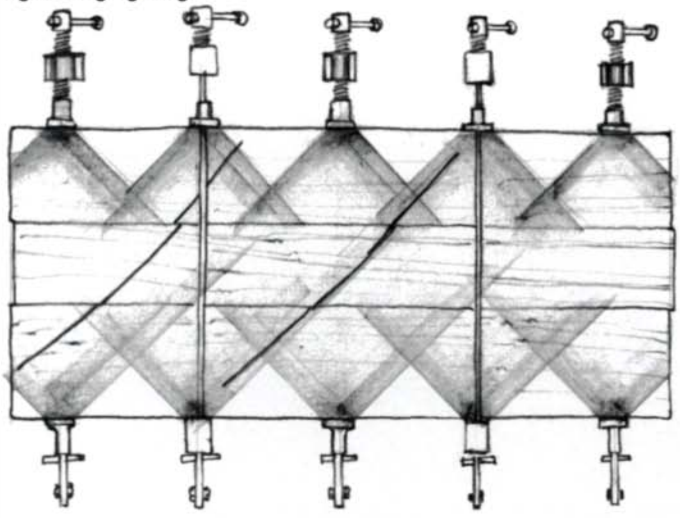
When you know how many clamps the job calls for, put half the number (half plus one if the total number is odd) on the table, evenly spaced. If the bars are not bent or damaged, they will register the boards in the horizontal plane. Coat each edge to be joined with glue, wetting all the surfaces thoroughly and uniformly. When the boards have been put into the clamps and slight pressure applied, place the remaining clamps over the top of the panel and begin to tighten all the clamps. Having an equal number of clamps top and bottom prevents the panel from bowing under pressure.

Ideally you should be able to edge-glue boards without having to rely on any mechanical means of holding them flush. But when the boards are even slightly warped this isn't possible. It is common to use dowels for aligning and registering boards; if you're going to do this, use a doweling jig to align the holes. Another method for registering edge-glued boards is the Lamello joining plate (*FWW* #29, July'81, pp. 79-80); the machine that cuts the slots is expensive, but worth the investment for the professional woodworker. The quickest solution is to lightly clamp battens across the width of the panel. Don't overtighten the bar clamps. This can squeeze out most of the glue and starve the joint. Moderate pressure is all that is needed when edge gluing.

**Gluing up mortise-and-tenon joints**—Mortise-and-tenon joints usually get little attention when gluing—most woodworkers want to assemble them as fast as they can. But the pace ought to be less hurried; ideally there should be two people at a glue-up, one to direct the order of events and to tighten the clamps, the other to manage the shoe end of the clamps. Both apply the glue. One coats the tenons thoroughly while the other puts glue in the mortises. Because the mortise and tenon goes together in a sliding fit you can't expect to apply glue to the tenon alone and still have enough in the joint. You will have to spread glue in the mortise as well. Don't just squirt in some glue and push it around with a stick or pencil, because the excess glue can impede fitting the joint. Visualize the glue as a fluid pad of considerable thickness. The pressure exerted by an excess on one side of a tenon can misalign the members. So apply glue thinly and evenly to all surfaces. Better than squeezing lots of glue into the mortise and stirring it with a stick is using a stiff-bristle brush.

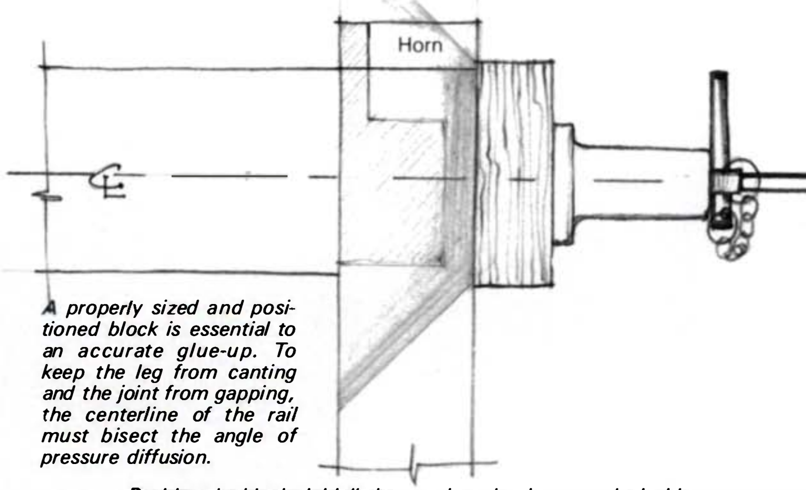
During dry clamping pay close attention to dimensioning and positioning the clamping blocks. Their purpose is not so much to protect the stock as to transfer the pressure from the clamp to the workpiece in exactly the area required. The fact that the clamp heads can lean away from a right angle under pressure, that they may have been put onto the work slightly askew and that the workpiece may not have edges perpendicular to its face, are all things you must consider when direct-

**Fig. 1: Edge gluing**



*Shaded areas show diffusion of clamping pressure. Use enough clamps to ensure that lines of pressure overlap at the two outer joints. An equal number of clamps above and below the panel prevents bowing.*

**Fig. 2a: Gluing leg/rail assemblies — Plan view**




*A properly sized and positioned block is essential to an accurate glue-up. To keep the leg from canting and the joint from gapping, the centerline of the rail must bisect the angle of pressure diffusion.*

*Position the blocks initially by eye, but check across the inside surface of both legs with a straightedge to make fine adjustments in their final placement.*

**Fig. 2b: Side elevation**

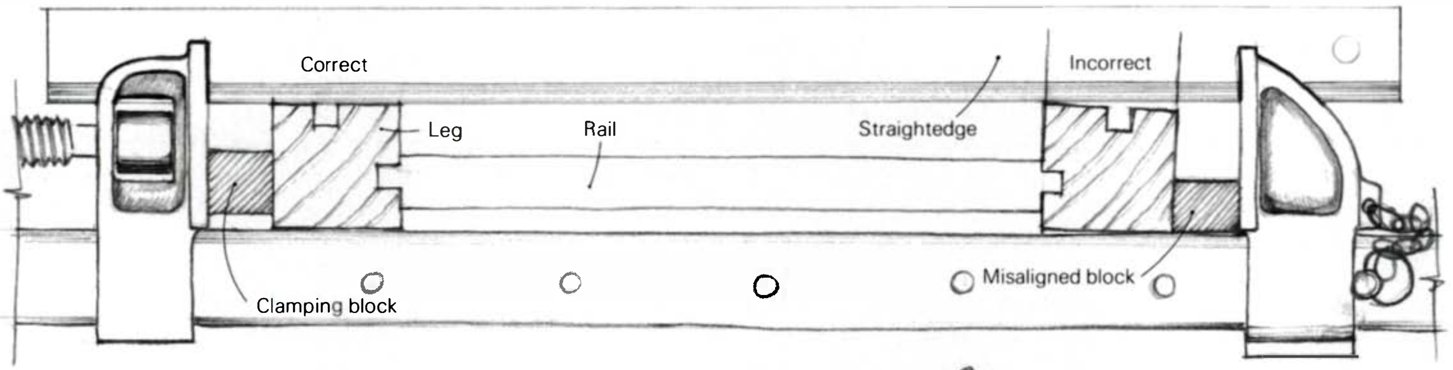
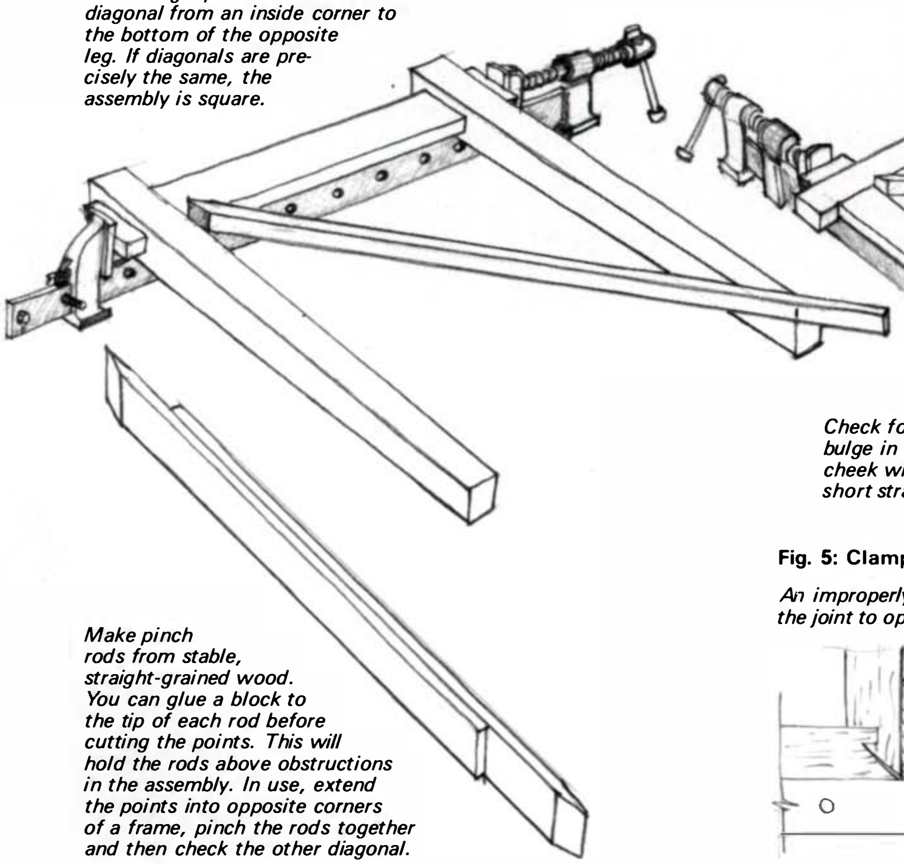


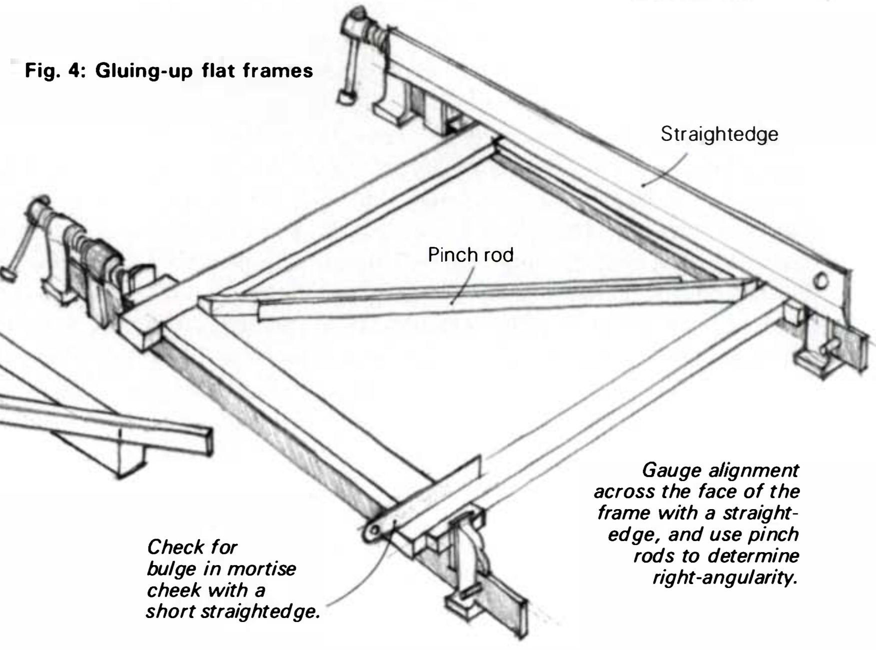

**Fig. 3: Checking for alignment**

*Use a single pinch rod to measure the diagonal from an inside corner to the bottom of the opposite leg. If diagonals are precisely the same, the assembly is square.*



*Make pinch rods from stable, straight-grained wood. You can glue a block to the tip of each rod before cutting the points. This will hold the rods above obstructions in the assembly. In use, extend the points into opposite corners of a frame, pinch the rods together and then check the other diagonal.*

**Fig. 4: Gluing-up flat frames**

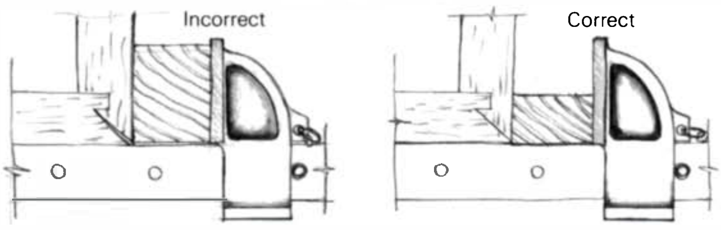



*Check for bulge in mortise cheek with a short straightedge.*

*Gauge alignment across the face of the frame with a straightedge, and use pinch rods to determine right-angularity.*

**Fig. 5: Clamping blocks in carcase glue-ups**

*An improperly sized or positioned block can bow a carcase side and cause the joint to open, below left. The example below right is correct.*



ing clamping pressure. Putting a piece of plywood between the workpiece and the clamp shoe or head isn't enough.

In gluing up leg/rail or rail/stile assemblies, the size of the glue block that distributes the pressure to the shoulder line of the joint is important. Providing that the grain of the block runs lengthwise and it is thick enough not to distort under pressure, the block should be about as long as the rail is wide, and about as wide as the rail is thick, as shown in figures 2a and 2b. With the right clamping block, pressure can be placed where you need it by moving the block slightly to one side or another or up or down the legs. If you attempt to glue up without clamping blocks, there's little chance of directing pressure where it is required.

The parts of a correctly glued-up assembly or subassembly should not twist or wind in relation to one another. They should be aligned and at right angles to one another. Joint lines should close up tightly. When assembling two legs and a rail, as in a table frame, cut the legs ¾ in. longer than the finished length. This excess, called the horn, is left at the top of the leg, where it can reinforce the mortise and help keep the end grain from splitting during dry clamping and gluing up. The horns are cut off later when the glue has cured. On rail/stile assemblies, where you have mortises at both ends of the vertical members, add 1½ in. to the length of the stile, making a ¾-in. horn at each end. When laying out the joints on legs, measure from the bottom to the top, not from top to bottom. This way you won't have to cut the legs to final length after assembly. When laying out the joints on stiles, clamp the two members side by side and lay out the final cut to length at the top (striking across both at once); then measure down from these to lay out the finished length at the bottom. Use a try square and a layout knife for the best results. Then you can accurately check the work when gluing up.

**Checking for alignment**—The legs should be sighted with winding strips to make sure they are in the same plane. Don't try to sight tapered legs on the tapered side. To correct twist or wind in the assembly, one person holds it down tightly on the clamp bed and slackens off the clamping pressure. The second person, holding one leg in each hand, moves the legs into proper alignment. Then the clamps are retightened.

Right-angularity between legs and rail is frequently overlooked. This is best checked by laying a straightedge across both legs as shown in figure 2b. To correct misalignment, the clamping block must be raised or lowered to redirect clamping pressure. If this isn't done, the rails will go off at odd angles at the next glue-up when the subassemblies are joined by two more rails. Then the finished piece will be under constant tension and the rails may bow. Using the straightedge as a reference, shift the clamping blocks in the appropriate direction. Here dry clamping will tell you ahead of time where to position each block. Remember to dimension each block carefully, as improperly sized blocks are difficult to position and can misalign an accurate joint by putting pressure in the wrong place.

Next check for overall squareness in plan. A try square is hardly adequate for checking this sort of right-angularity. On assemblies with long legs and rails, it can gauge only a fraction of the lengths involved, and if the legs are curved or tapered, or if the rails aren't straight across their bottom edges, a try square won't work at all.

Squareness is best determined by taking diagonal measurements from the top inside corners to the inside bottom corners of the legs. If the diagonals are equal, the assembly is square. You can make these measurements with a long rule, though take care to place the rule at the same depth in the two corners. A flexible metal tape can also be used, but this requires two people for accurate results. One holds the one-inch mark in precise alignment with the corner, while the other pulls the tape taut to measure the distance to the bottom inside of the leg.

Traditionally, diagonal measurements are taken with pinch rods. Shown in figures 3 and 4, these are similar to the two sticks described in *FWW* #6, Spring '77, p. 46, only their ends are pointed to fit into corners, and stepped so they can span obstructions like center stiles and stretchers. Considering their high degree of accuracy and the small amount of effort needed to make them, there's little reason to use anything else to measure internal diagonal distances. We should find the diagonals equal if the clamp holding the assembly together is in line with the rail member. If they are not equal, reorient the clamp and the blocks in such a way that the members will creep into square with one another.

**Assembling frames**—When gluing up a flat frame, as for a door, employ the same checking procedures and assembly methods as you would for a leg/rail assembly. But because a frame is closed on four sides and relatively thin in section, it calls for some special attentions. The flatness of the gluing table is particularly important. If we are using identical clamps and we press the frame down onto the clamp bars, we will get a twisted frame if the table we are working on has a twisted top. Usually the cheeks of a mortise in a frame are fairly thin, and the glue in the joint migrates to the center where it can cause them to bulge outward. Avoid this by clamping across the cheeks with a C-clamp and properly sized blocks.

**Gluing up carcases**—A situation where improperly dimensioned clamping blocks can be dramatically counterproductive is in gluing up carcases. Too large a block, as shown in figure 5, can misapply the pressure, cause the sides to bow like crazy and open the joint on its outer edge. For clamping case sides tightly against an internal shelf or other member, we have little choice other than to use cambered cauls *(FWW #23*, July '80, p. 12).

Gluing dovetails is totally different from gluing mortises and tenons. If the dovetail has been made so that the end grain of the pins and tails is below the surface on the adjacent boards *(FWW #21*, March '80, p. 75), then all that is required to glue a large carcase together is one clamp and two people. After the glue has been applied and the joint put together, the dovetails are clamped home individually. They will not spring back if correctly made, because there is considerable friction in the glue interfaces between the pins and tails. When the glue has been uniformly brushed on the long grain of the pins and tails, each part swells, making the close fit even tighter. Don't delay assembly after applying the glue, and don't try to hammer the parts home, as you quite properly did during the dry test assembly. Clamping is the proper means once the glue is applied, and it is sweet and easy to clamp each tail one after the other and see the glue come squeezing out at the bed of each pin. □

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*Ian Kirby writes frequently for this magazine.*

# Lacquer Finishing
## How to spray a mirror finish

*by George Morris*

High-gloss lacquer finishing is time-consuming and rigorous. It requires meticulous surface preparation, special equipment if you're going to do much of it, and a carefully followed schedule of application with constant inspection and correction along the way. The reward is a stunning, jewel-like surface that offers a high degree of protection. A good lacquer finish has the quality of a mirror, and if improperly prepared, it will unforgivingly reveal every irregularity in the surface. By the time a surface defect manifests itself in the lacquer film, it's usually too late to correct it. Thus it's especially important to learn how to judge the quality of the wood surface before you apply any finish.

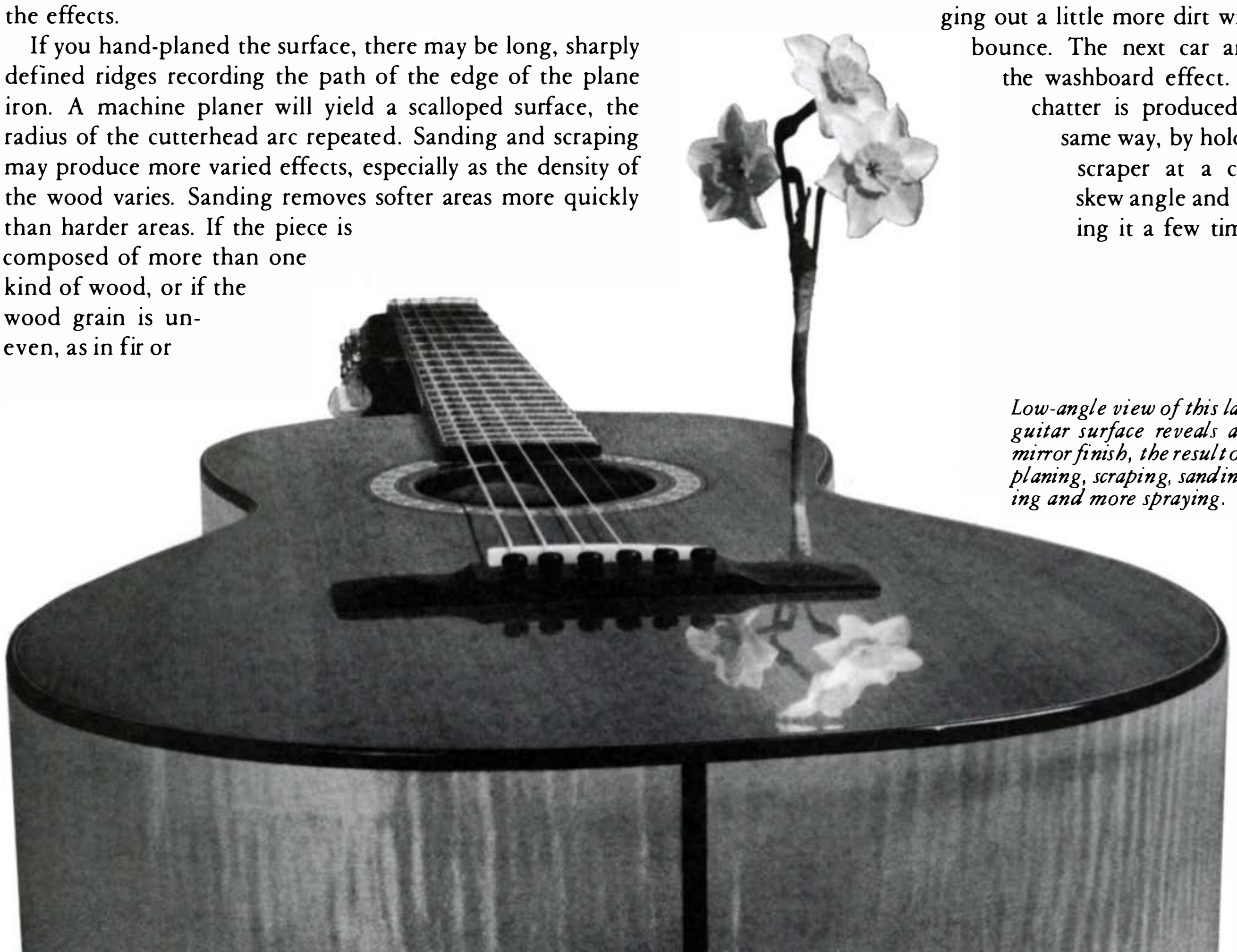
**Preparing the surface**—Looking straight into a surface you can pick out obvious flaws like scratches, nicks and holes, but if that is all you do, you miss most of what will become painfully obvious later. To find less pronounced defects you will need to position a light source and your eye so that shadows are created and observable. Imagine a landscape at the moment the sun is setting. Even the subtlest of features casts a shadow. The surface you are preparing is analogous to the landscape; a light bulb is the sun, and your eye is opposite the bulb. You are now in a position to observe the topography, but what is it you are looking for? The answer is found in recalling what you did to the surface and in anticipating the effects.

If you hand-planed the surface, there may be long, sharply defined ridges recording the path of the edge of the plane iron. A machine planer will yield a scalloped surface, the radius of the cutterhead arc repeated. Sanding and scraping may produce more varied effects, especially as the density of the wood varies. Sanding removes softer areas more quickly than harder areas. If the piece is composed of more than one kind of wood, or if the wood grain is uneven, as in fir or oak, you can expect the surface to be uneven although you have taken care to work consistently. Relatively dense areas in the wood will stand proud of the surface and, from our sunset perspective, will be revealed as shadows following the figure.

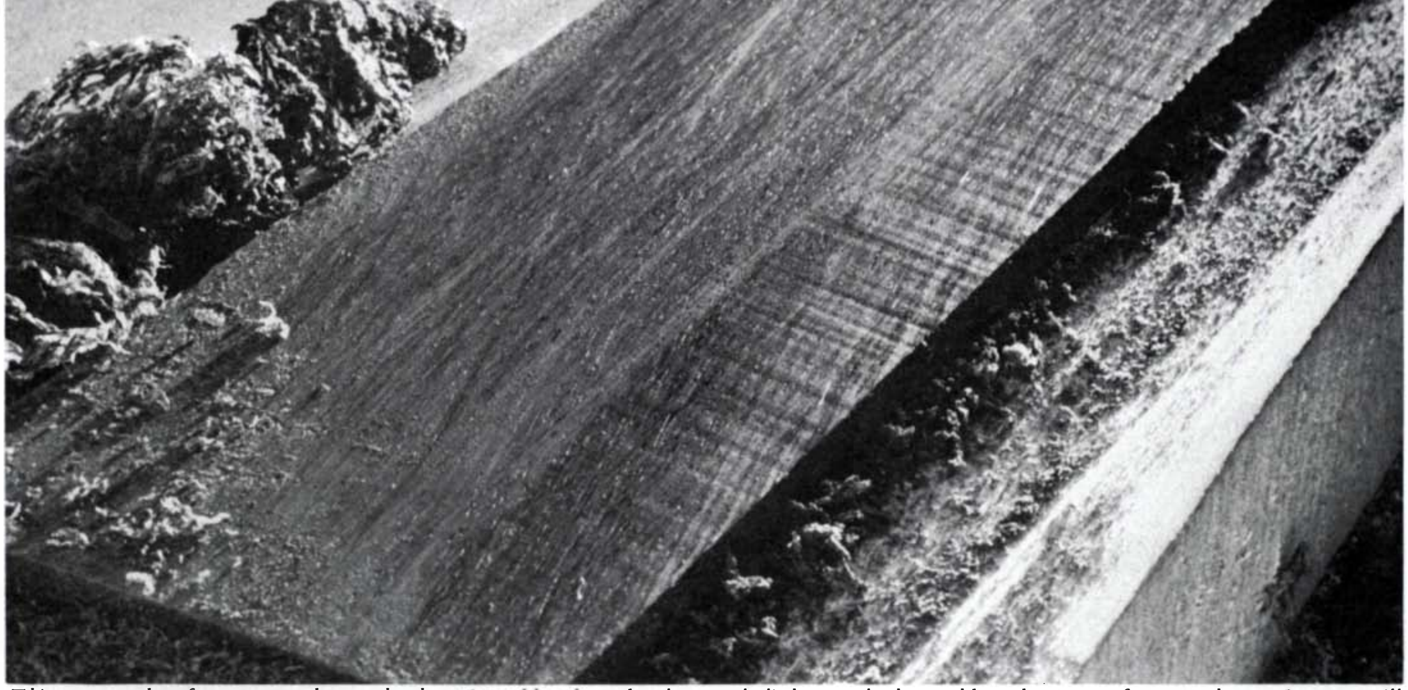
When sanding, back up the abrasive paper with some hard material—wood, hard felt or rubber blocks. For contoured surfaces, back up the paper with posterboard or a bit of flexible plastic, or at least fold the paper in half and glue it to itself with rubber cement. Your paper must not be able to conform to the irregularities you are trying to remove. Take care also to sand in line with the figure, and to release pressure from the paper at the end of each stroke, to avoid swirl marks.

Avoiding the pitfalls of scraping requires more skill. Scrapers work most efficiently on dense wood; softer materials compress under the cutting edge instead of standing up stiffly to be cut down. Thus the scraper's effect on the landscape is opposite that of sandpaper. The softer areas spring back after the scraper has passed, leaving them higher than the denser areas and producing a ribbed surface that on some woods looks like a neatly plowed cornfield at dusk. The fix is a quick follow-up sanding with a hard backup block.

Another effect of poor scraper technique is chatter, analogous in our landscape metaphor to a washboard section in a dirt road. Along a dirt road a car bounces rhythmically in response to some small irregularity in the surface, its tires digging out a little more dirt with each bounce. The next car amplifies the washboard effect. Scraper chatter is produced in the same way, by holding the scraper at a constant skew angle and by passing it a few times over



*Low-angle view of this lacquered guitar surface reveals a perfect mirror finish, the result of careful planing, scraping, sanding, spraying and more spraying.*



*This rosewood surface appeared smooth when viewed head-on, but low-angle light reveals the washboard pattern of scraper chatter. Lacquer will make such flaws painfully obvious, when it's too late to correct them without removing the entire finish. Take a good look at the surface in the correct light before you start to spray.*

the same spot. To avoid chatter you must repeatedly change the angle of approach or the skew of the blade, or both.

Other trouble areas surround the designed-in features of a surface: round holes, slots, inside corners and the like. Scrapers and sandpaper tend to fall into slots and holes, producing general depressions around them or, in the case of scrapers, troughs radiating out from them. Only hard sanding blocks can save you. Inside corners require planning and perhaps a specialized tool. If the surfaces adjacent to the corner have their grain running parallel to the crease, it's not hard to sand the corner smooth. But if the grain of one or both surfaces runs perpendicular to the crease, you can clean up using a tool I call a chisel-scraper, simply a chisel sharpened as usual but with a burr added by drawing the edge over a flat steel surface. An ordinary scraper has some thickness, which keeps the cutting edge from reaching into the corner. But a chisel-scraper's edge is thin. An inexpensive ½-in. chisel with its corners removed (for safety) is ideal. However, the best precaution when finishing inside corners is to surface them completely before gluing, and to remove all squeeze-out before it dries. The hidden danger of working around any problem area is that it encourages special attention, resulting in a local surface that's inconsistent with the rest of the object.

Lacquer is a low-wetting finish, which means it does not appreciably penetrate the wood, but lies on it as a film. The surface tension of this film will draw it away from any sharp edge, leaving precious little there and making it easy to sand through later when leveling between coats. Therefore, as part of your pre-finishing surface preparation, soften, if not actually round, all edges of the work to be sure they will remain adequately coated. The slight falling off of a surface as it nears the perimeter has another advantage. It compensates for the tendency in leveling between coats to do extra work near the edges, which makes it more likely you will sand through the film there. This relieving the surface near the edge prevents time-consuming spot repairs later.

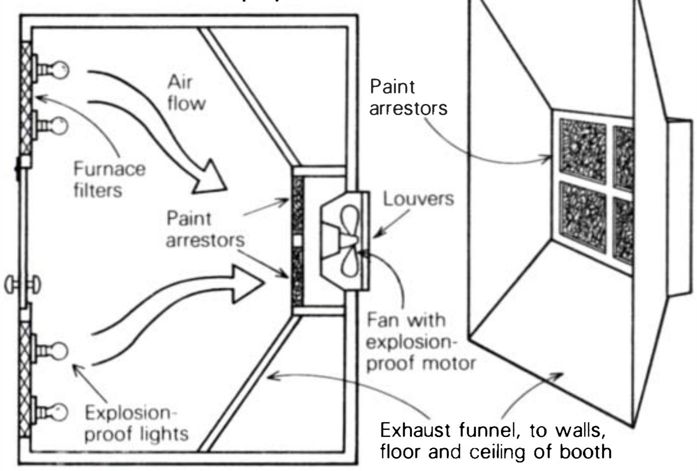
Having removed all surface irregularities and prepared all the edges, you can begin final sanding with fine papers backed by hard-felt or rubber sanding blocks. Hardwood blocks with coarse abrasives are good for dimensional leveling, but fine papers on hardwood blocks tend to glaze and will streak the surface with burnish marks. There's little value in finish-sanding beyond 320 grit. You will see some improvement of the surface past this point, but once lacquered the surface will return to what it looked like at 320 grit. Also, grits finer than 320 do little more than burnish the wood, making it more difficult for the lacquer to stick without blistering.

**Equipment**—Lacquers can be applied by brush, pad or spray, and in most cases the quality of the finished product will be the same. But because some of the exotic hardwoods, rosewood for instance, contain resins that are dissolved by lacquer thinner, the finish can get muddy and can stain adjacent lighter woods when it's dragged around with a brush or pad. Otherwise, small objects such as jewelry boxes can be finished without investing in any more than some good brushes. The steps in the finishing process are the same for brushing or spraying, the only differences being in the speed of application and the time involved in leveling the finish.

The decision to spray may depend upon where you live. All cities and most towns have restrictive codes regulating the design and use of spray facilities, because of the extremely volatile, poisonous and potentially explosive nature of the material. Some codes are stricter than others and require explosion-proof rooms, water curtains, sprinkler systems and asbestos blankets, not to mention outrageously expensive insurance. Spraying is usually illegal in an urban environment, unless you make a substantial investment in equipment. Short of setting up a clandestine operation, you could rent access to a spray booth from a school or body shop. Nitrocellulose lacquer, the type most commonly used for wood finishing, is composed of nitrocellulose (an ingredient in gun powder), various ketones, acetates, toluol, plus other nasty stuff. Codes or no codes, you owe it to yourself and anyone close to you to take adequate precaution against the dangers. You should wear a good-quality chemically filtered respirator, even if you spray outside—an inexpensive alternative to further investment if the environment and weather permit.

If building a booth is possible, the simplest one would need an enclosed space, entry and exit filters, explosion-proof lights, and an exhaust fan with an explosion-proof motor. The fan, mounted in an exterior wall, would necessitate some kind of weather shield—louvers, for instance. Such an assembly can be bought ready to install from most auto-body-shop

Plan view of a basic spray booth




suppliers. In front of the exhaust fan you need a filter wall perhaps 3 ft. square. The filters themselves are called paint arrestors and are also an auto-body-shop supply. For best vapor evacuation, a funnel should be built from the filter wall to the complete height and width of the booth, which should be as small as is comfortable to work in. Clean conditions require that the entry air be filtered, and here furnace-type filters covering an area a few times larger than the exhaust area, directly opposite the fan, will work. The door should provide a tight seal and should open outward, to maximize the usable space inside. The light source should be located behind you, so you can see reflections on the surface of the work as you spray.

Spray outfits are of various types, the simplest being the self-contained "airless" type for which you don't need a compressor. These guns are electromagnetic piston-drive mechanisms that run off standard house current. A small amount of fluid is siphoned up and propelled out the nozzle at 60 cycles a second. Although that might seem pretty quick, it doesn't compare with the force of an air-powered gun. Airless guns also clog easily and have a bad habit of spitting at the work. Nevertheless, they will get the job done faster and more evenly than brushes or pads, and may be all you need.

If time is important, or if you already have a compressor, an air gun is a better choice for its faster rate of application and finer atomization. The size of the gun should match the scale of the work. Most lacquering is done on relatively small objects, so a modest gun with perhaps a pint capacity is sufficient. Whatever the size, don't buy a cheap gun; you will curse that decision from day one.

To power your air gun you need a steady supply of compressed air at between 30 PSI to 40 PSI, the steadier the better. For steady flow and complete control of the pressure, a compressor with a holding tank and an air regulator is superior to cheaper direct-feed, continuous-drive systems.

**Application**—Lacquering consists of three stages: filling, leveling and polishing. Throughout, you should be inspecting the surface for defects and correcting them, as explained in the box on p.94. There are probably as many ways of getting the job done as there are people doing it, so what follows should be seen simply as one good method among many.

The question most frequently asked by the novice is "How many coats of lacquer do I put on?" This question can't be answered as it can for painting; painting is accomplished when the surface is opaquely covered. Lacquering is not simply a covering job, for lacquer is not clear paint. On bad lacquer jobs you can actually see two surfaces, a thick layer of clear plastic and under that the surface of the wood. Done properly, however, you see one surface of polished wood. It is gotten that way not by the mere addition of clear stuff, but by a cyclic process of adding material and sanding it off until the surface being treated is truly flat, at least to the degree that the eye no longer distinguishes any texture. Only enough material must be left on the surface to enable you to polish it without breaking through to the wood. So the answer to the question "How many coats?" must be left at "Enough," that is, however many coats it takes to complete the job of leveling and polishing.

Effective spray technique is largely a matter of speed and consistency, graceful motion and thoroughness. You are trying as quickly as possible to coat a surface evenly and completely, with no unblended areas. In effect, you want to have the entire object wet at once. To do this the gun must be supplying its maximum amount of fluid, and you must move quickly from surface to surface in a preconceived pattern that will ensure thoroughness, with tightly spaced strokes that overlap each other and the object's edges.

The process begins with the application of a sanding sealer diluted with an equal amount of lacquer thinner. Sanding sealer is a kind of lacquer specially formulated to raise the grain of the wood, to provide a base for better adhesion and to be easily sandable. It gives you a preview of the finished surface, allowing you to locate and repair any imperfections.

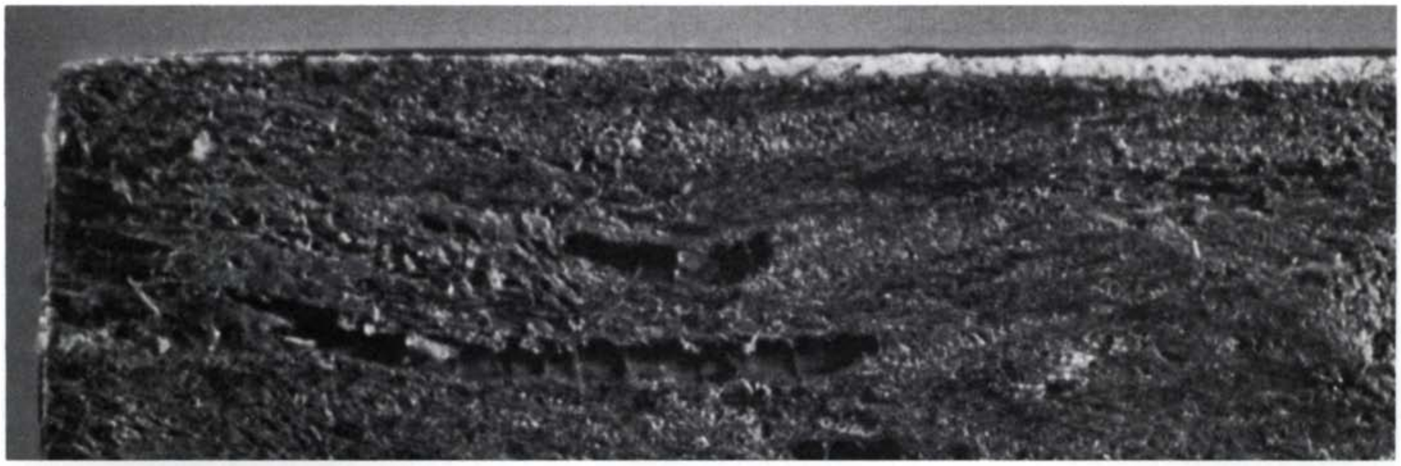
After perhaps an hour's drying time a wood filler can be used on open-pored woods. Most wood fillers consist of chalk, plus a touch of clay and pigment, carried in a mineral spirit or naphtha vehicle. The pigmented chalk is left in the pores of open-grained woods, where it fills most of the space. Buy neutral filler and color it yourself with dry poster paint, toning it down with lampblack to suit whatever wood you are filling. This will save your having to buy endlessly different colors. Thin the filler about 25% with naphtha and apply it with a rag, working the surface constantly while the filler is drying. It will soon begin to collect on the rag. Now wipe the surface across the grain to clean off all excess filler. For large-pored woods, like oak, a second application may be necessary after three hours' drying time. Eight to twelve hours later, sand the surface clean with 320-grit paper to remove filler residue and raised grain. You will sand through the sealer coat in places, making an awful mess, but the next coat of sealer, applied just like the first, will blend perfectly.

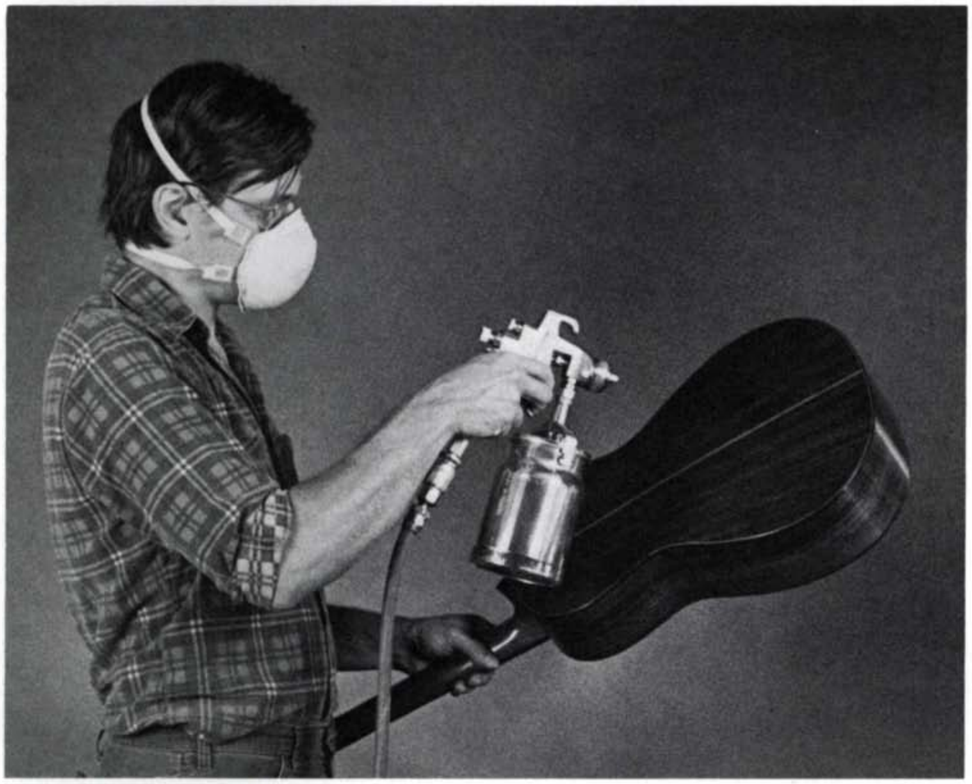
The surface will now appear improved but not yet truly flat, and it will take the remaining sealer coats, applied heavily but sanded almost completely off, along with subsequent lacquer coats, to complete the leveling process. These will be spread out over a period of days, with no more than four coats applied per day. On the first day I stay with the sealer, applying three wet coats one to two hours apart. A wet coat means that the solution is applied so heavily that it floods the surface, leveling itself to a mirror gloss just one taste short of drooling. This welds the material to the previous coat and ensures adequate film thickness. As the lacquer coats build, a

Editor's note: You can buy most lacquer-spraying equipment and supplies from auto-body-shop suppliers and from Sears. Major manufacturers of spray units include DeVilbiss Co., Box 913, Toledo, Ohio 43692 and Binks, 9205 West Belmont Ave., Franklin Park, Ill. 60131.



Drawing: Lynn McVicker





*Morris demonstrates the proper relative distance from and angle to the surface being sprayed. Handholding the guitar allows more sensitive positioning in relation to the light. He's using a full-size DeVilbiss type JGA gun, siphon-fed from a quart cup, which is suitable for spraying large objects without the need for frequent refills. DeVilbiss type EGA gun, top right, is right for objects the size of a guitar and smaller. Its cup can be replaced with a small mayonnaise jar, permitting quick color changes. The Binks model 18 gun, right, has a pressure-fed hose instead of a cup. The hose supplies lacquer under 10 PSI from a 2-gal. holding tank. Such a system is light, versatile (it can even be used upside down) and good for production work. At top, an edge-grain section of a piece of lacquered rosewood at X28 magnification shows its enormous pores and the filler (white at upper right) under the finish. The lacquer film tapers in thickness toward the corner because the film shrinks as it dries.*

thoroughly wet application is necessary or a layered structure will result, which is prone to blistering and ghosting. Also, because of the low solids content of lacquer you need the thick coat just to have anything left after the thinner has evaporated. Straight from the can, the solids content is about 20%, and when mixed with equal amounts of thinner it is 10%. Compared to varnish, which is about 50% solids, this is like mixing one quart of varnish with one gallon of thinner.

Perhaps the most important thing to understand about this low solids content is the fact that while the thinner is evaporating, the lacquer film is shrinking. Only one-tenth of what you spray will remain as a film on the wood. The rate of evaporation and shrinkage is extremely fast at first, so the surface can be touched within minutes of being drenched. But the evaporation rate decreases rapidly, and enough thinner is trapped within the film so that shrinkage is still perceptible after a week of drying. It is bad practice to apply more than three, at most four, coats of lacquer without allowing an overnight dry to let most of the trapped thinner escape. Otherwise, the thinner will be buried under so much lacquer that it will take weeks to evaporate completely.

After the first three coats of sealer dry overnight, sand the surface thoroughly with 320-grit paper on a block. This dulls the shiny surface, but the low spots will still shine. The goal is a uniformly matte surface with no shiny spots, but you may sand through to the wood in places. When this happens spray more sealer and sand again, until there are no shiny spots anywhere. Now spray one last coat of sealer to coat any wood that's been sanded bare, and begin spraying the first lacquer coats. Lacquer is usually diluted with an equal volume of thinner, and it's sprayed at the same rate as sealer, a coat every hour or two, no more than three coats per day. Let dry overnight and sand with 320-grit paper the next day. Repeat this cycle until you can level-sand the entire surface without sanding through to the wood anywhere. Then apply the final three coats and allow the surface to stabilize and harden for about five days, before final leveling and polishing.

Final sanding can be done with either 500-grit stearated paper dry (available from auto-body-equipment suppliers), or with 600-grit paper wet—there's no difference in the final result. As water can mar the wood if you sand through, I recommend the dry 500-grit paper, used with a felt sanding block behind it and with a reciprocating, in-line motion to prevent build-up of dry lacquer dust on the paper. The surface and paper must be constantly wiped clean, for this white powder clogs the paper and mars the surface.

When free of all telltale shiny spots, wipe the surface clean and continue this abrasive action with the first of two polishing compounds, coarse and fine, which will produce the mirror finish. I use Meguiar's brand compounds, Mirror Glaze I for the coarse and Mirror Glaze III for the fine. (For the name of your local distributor, write to Meguiar's, 17275 Daimler, Irvine, Calif. 92714.) Both can be used on a lamb's-wool pad, rubbed by hand or with a buffer. They are best kept in covered plastic squeeze bottles and should be applied to the pad, not to the surface, to guard against dirt scratching the finish. Use buffing compound sparingly and wet it frequently with water to create a slurry that helps to float the surface clean and keep the abrasive cutting. I usually buff in line with the figure when using the coarse compound, and in a circular pattern when using the fine.

The quality of the finished surface depends completely upon the success of each step, from the preparation of the wood to its final polish. Critical inspection will reveal when a flaw is created. Once you start spraying, it is too late to repair the earlier stages, but if you need to respray once you've begun polishing, first wash the surface with alcohol and water, 50/50, to remove polishing residue. The surface may be rebuffed at any time in the future with the fine compound to restore its original luster. □

*George Morris makes guitars in Post Mills, Vt.*

## Troubleshooting the spray schedule

**Drools and sags:** The gun is too close to the surface, or you are moving it too slowly, or you have passed over a spot too many times. If caught right away, simply hold the surface horizontal and give no direction for the excess fluid to run, or smear the drool flat with your hand. A flat smear will dry and be sanded out much more quickly than a thick drool. But do not break a drool that has scabbed over.

**Overspray:** Lacquer not absorbed by the surface because it is dry upon contact. Either the spray gun is being held too far from the surface, or air pressure is too high.

**Ghosts:** Cloudy, amorphous apparitions, the result of having trapped overspray within the finish. Ghosts are usually discovered while polishing, since the interlayer phenomenon is porous and does not polish. It must be remelted either by some careful work with the polishing wheel, to warm and soften the surface, or by the use of a pulling rubber. Pulling redissolves the surface using a diluted thinner (cut 50% with alcohol). The fluid is applied sparingly to chamois leather wrapped around an egg-sized cotton wad. Stroke the puller quickly and firmly across the surface a few times until the ghost dissolves.

**Bubbles:** Air trapped by spray turbulence, most common when spraying straight into a corner. To minimize, direct spray in line with the corner.

**Blisters:** A local adhesion problem encouraged by the surface's being banged. Blisters are more likely if the wooden surface was burnished or coated with something incompatible with the lacquer. Before taking the finish off completely and repreparing the surface, try puncturing the blister with a blade and adding a drop of thinner to act as a glue between film and surface.

**Fish-eye:** Small circular features, sometimes iridescent, from either oil or silicone on the surface. Remove oil with naphtha, and remove silicone with a lacquer additive designed to eliminate the effect.

**Checking:** Random fissures in the hardened film caused by uneven shrinkage across the thickness of the film itself. It could be the result of extreme temperature change whereby the film cracks as does glass when quickly passed from boiling to freezing temperatures. Shrinkage can also be uneven if the surface of the film dries before the thinner within the film has a chance to escape. The hardened surface will pull itself apart when the thinner trapped beneath it eventually evaporates, as does a mud pond drying in the sun. The effect is minimized by keeping the film thickness as thin as possible. Trapped thinner is the result of insufficient drying time between coats, or more than a few coats applied in one day.

**Crazing:** Subtle, small cracks in the film, caused by spraying fresh lacquer over old finish. A close cousin to checking, it is avoided by sanding the old finish very thin before respraying.

**Pits:** Unfilled pores or gaps in joints. If these are found before spraying begins, it's simply a patching problem to be fixed with wood splints, a sawdust-and-glue mixture or shellac stick melted into the pit and sanded smooth. If pits are found during the spray schedule (they'll appear white when filled with powdered lacquer) lacquer putty will do the trick. Lacquer putty is undiluted lacquer that has been left to evaporate until it's the consistency of thick honey. It must be applied between coats with a small, flat stick, allowed to dry overnight and sanded level the next day before spraying is continued.

**Sand-through:** If you sand through the lacquer to the wood in the middle of a surface, either respray the entire surface to the edges, masking everything else with newspaper to avoid overspray, or respray through a cardboard mask with a small hole cut in it to minimize overspray. Beware of ghosts. I have had success respraying minor repairs using acrylic lacquer on top of the nitrocellulose finish to prevent these visitations.

**Dull spots:** If, regardless of how thoroughly a surface is polished, it still does not gloss, you are probably polishing sealer, which will never gloss. The cure is to spray on more lacquer. —*G.M.*

# New Furniture

## A gallery opens on Long Island

*by Rick Mastelli*

Pritam and Eames, a new gallery devoted to one-of-a-kind and limited-edition furniture, opened last spring in Easthampton, N.Y., on the moneyed tip of Long Island. Owners Warren and Bebe Johnson spent about a year finding and visiting craftsmen, learning what was important in gallery operations and building confidence in their venture. Their legwork brought them furniture by craftsmen who don't ordinarily show in galleries, plus showpieces by such long-established woodworkers as Wendell Castle and George Nakashima. The Johnsons also encouraged several younger craftsmen by commissioning and buying work outright—most galleries accept work on consignment only. Finally, they carefully promoted their wares among the wealthy arts patrons of the Hamptons, and as a result have broken even during their first months of operation. At their opening, I heard nothing but praise about the relationships the new gallery had established. "This place has everything going for it," said one woodworker. "If a furniture gallery is going to make it, it's going to be here."

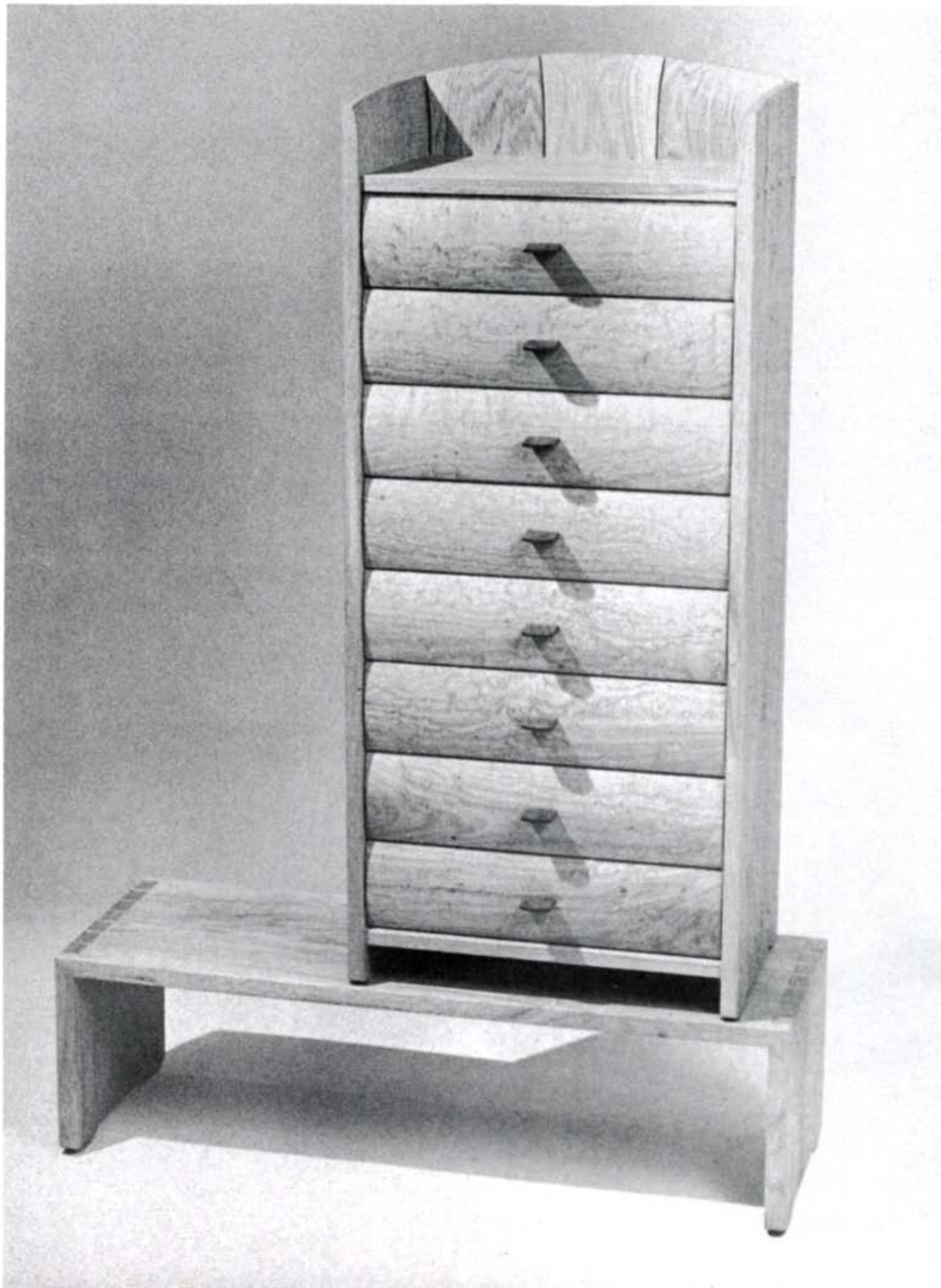
The opening show of 60 pieces of furniture brought together some of the best art woodworkers in the Northeast. When you first see a collection of this quality, you are overwhelmed; it all looks so good. But the more time you spend with the furniture, the more the individual pieces distinguish themselves. Some are so highly refined, even smug, that they shut you out. Others draw you closer, inviting you to sit, to open a drawer, to run your hand over their surfaces. The photos here represent the pieces that attracted me. The better I got to know them, the more interesting they became.

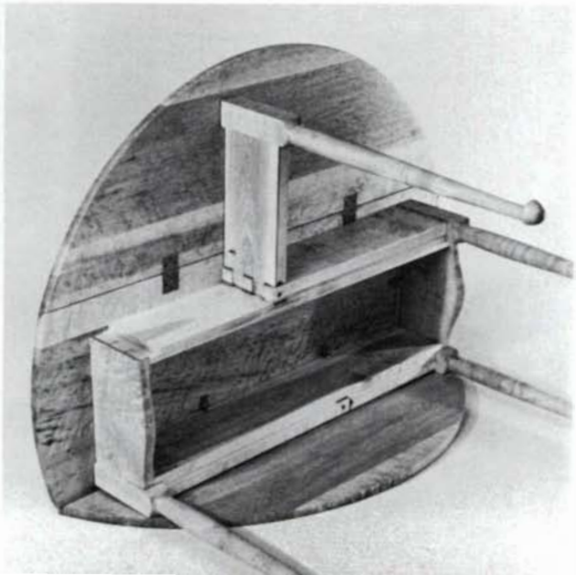
Pritam & Eames is at 29 Race Lane, Easthampton, N.Y. 11937. The Johnsons are looking for new craftsmen to represent, and invite woodworkers to send their portfolios for review, or just to stop in and see what's on display.

### In Lincoln, R.I. . . .

Hank Gilpin's chest-on-stand is among the friendliest pieces of furniture I've met. It's made of plain, wormy and blistered oak, with bubinga pulls, and two things make it so attractive. First is its size: 50 in. high on its stand, with the chest itself 39 in. high, 17½ in. wide and 11½ in. deep. There's something ingenuous about a chest of drawers that has to stand on a bench to meet you; it wants so badly to be helpful you can't help but like it. The other attraction is the texture and quality of its surface, not sanded smooth, filled and polished hard, but oak left faceted by the hand plane that shaped it, then rubbed with oil. The curved drawer fronts, each with a tiny bead at top and bottom, deepen the softness of the piece, drawing you into it. The sides and gently flaring back cradle whatever you choose to place on top, while the stand calls out for a plant.

Gilpin says his design was determined by available time and materials and by function, not by abstract ideas: "With speculative pieces like this, I give myself a time limit of two weeks. I want to end up with something affordable. I have lots of little things around the house, always in the way, I think everybody does, so I decided to make lots of drawers to hold them. And I had enough blistered oak for eight drawer fronts, so I made eight drawers. When I was done I wanted somehow to present the chest, to make the lower drawers easier to reach, and to keep the piece from being overshadowed by whatever might be put next to it. So I made the stand, and it's also the size of the plank that I had. The important thing is that the piece be useful. I've never made anything that wasn't useful. But as far as design goes, if everything were made out of one-inch thick white oak with some exposed joinery and chamfered edges, I'd be happy."





## In Brookhaven, N.Y. . . .

With this gateleg table with ladder-back chairs, David Ebner departs from his usual sculptural style to interpret traditional forms in a personal, contemporary way—he calls them "classical impressions." This suite is production furniture (four prototypes and 20 jigs preceded Ebner's first run of 20 chairs) that nevertheless has a handcrafted feel. Ebner started from a simple Vermont gateleg made around 1790 that had four legs instead of the usual six with innumerable stretchers. The table's chunky skirt is what allows the legs to be delicate and without stretchers. The pad feet, which remind Ebner of clamshells, root the table in its tradition yet add a whimsical note. The bird's-eye figure that plays over the whole surface is also traditional, the old-time country maker's way of imitating fancy veneers from city shops.

The chairs are similarly rooted in tradition, but liberated from busy understructure by the modern alternative: corner blocks splined to stout rails and held by long screws. The sculpted curve that unites seat rail and table apron is another contemporary touch; such a detail is not economical in production without using electrical sanding equipment. Although the pad foot makes the chair's front legs seem to toe in awkwardly, there's certainly nothing awkward about the way the chair sits—it's very comfortable.

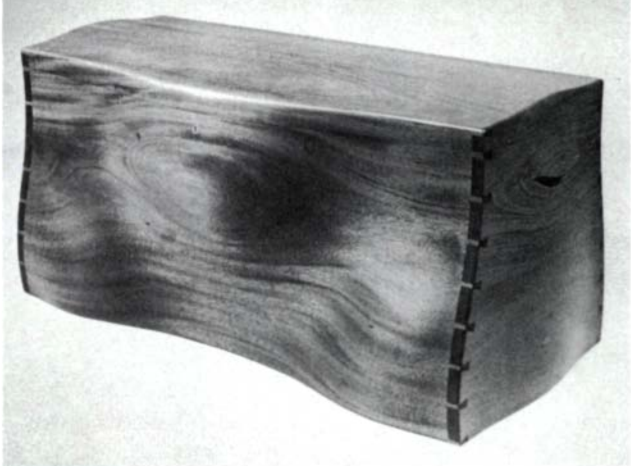
## In West Kingston, R.I. . . .

These two chairs made by John Dunnigan are not meant to be a pair, but placing them together does show the range of designs that can be derived from one tasteful starting point—in this case, the scimitar curve of their legs. The armchair's frame is walnut, with two-tone peach velvet upholstery; the shape of its legs is echoed by its padded arms and back. The sidechair, in Honduras mahogany with blue polished-cotton seat, is simpler though no less elegant, its similar curves creating a sense of poise and propriety. Where the armchair would fit the privacy of a luxurious bedroom, the sidechair belongs in a formal dining room.

Dunnigan explains that he strives to control how his furniture will be seen, and that this simple curve is the easiest to direct and to follow. He dislikes the S-curve "because it distracts the viewer, compounding movement in the piece. My pieces move from the floor up or from the wall out or from the center out." This preference for centered mass and directed line is classical, reminiscent of Sheraton and Hepplewhite, as is Dunnigan's taste for largish chair seats. When you look at the dining chair from eye level its proportions are classical too: the sizes of the space below the seat, of the seat itself, of the space above it and of the backrest all progress regularly, from larger to smaller. The armchair is more romantic, but it's still a classically centered composition, controlled by the simple curves of its base. Both of these chairs are entirely comfortable.

## In Rochester, N.Y. . . .

Richard Newman's blanket chest is another traditional exploration. But instead of projecting a contemporary rendition of an older form, Newman is speculating on the sources of the tradition, in this case the part of the human form that inspired the bombé chest. "It's a very abdominal piece," he says, jokingly referring to the finished thing as "mom." It's certainly the kind of furniture you want to get close to, its shimmering mahogany surface almost requiring you to touch. When you raise the lid, you discover that the chest's front was carved from one solid piece of mahogany, 42 in. long and 19 in. wide, originally a 14/4 roughsawn plank, but now reduced to a consistent ⅞-in. thickness. If it weren't for the dovetails, it might seem hollowed from a log—as some chests were in medieval times. Newman found the curving dovetails a challenge to his ingenuity. He made them by standing the thick planks on end, then with templates routing what would be the inside and outside contours. Then he routed the dovetails into the wood that remained, before carving the rest of the bellying plank. From its carved handles to the keyhole at its navel, Newman's chest is consummate workmanship. It's also fun. □



# Portfolio: Michele Zaccheo

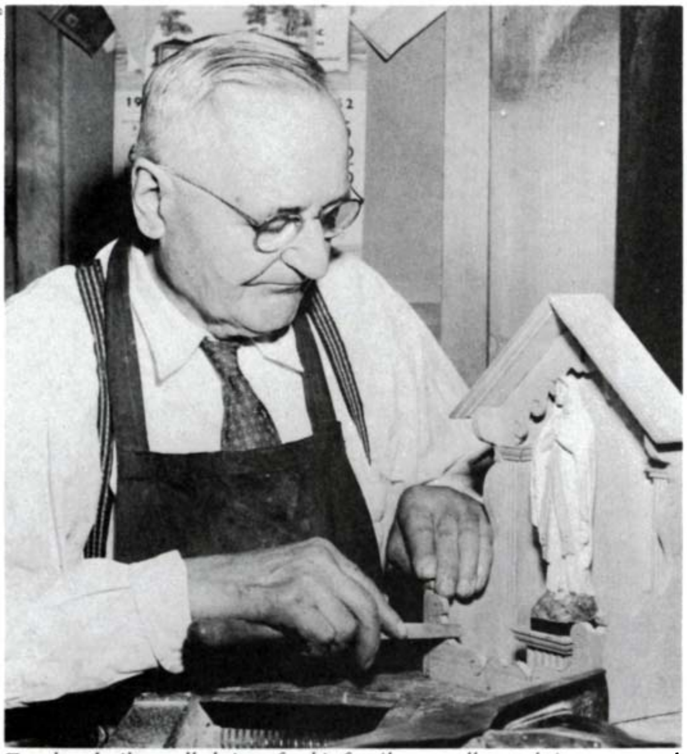
*by Neil G. Larson*

Michele Zaccheo was seventy when he turned to furniture design full-time. Using a lifetime of skills and ideas he had acquired as a woodworker, Zaccheo produced about 400 wooden pieces in his Torrington, Conn. home. Since making furniture was an avocation for him, albeit an obsessive one, his personal taste and wit find free expression in his output, which includes basket-weave chairs, cabinets adorned with marquetry, and even veneered canes. He built a personal museum to contain the cache of objects. From time to time local newspapers stumbled upon this gold mine crammed with unlikely furniture, yet when Zaccheo died in 1973 at age 93, his accomplishments were unrecognized. It was not until Zaccheo's heirs gave some of his furniture to the Torrington Historical Society that his unique designs came to light.

Zaccheo was born in Luino, Italy. At age twelve, he was apprenticed to a wheelwright and two years later he was hired by a woodworking firm to make doors. Following a brief stint in the army, Zaccheo returned to Luino and remodeled the small church there. He did everything, he said—doors, windows, altar furniture and pews.

In 1911 he emigrated to America, settling in Salisbury, Conn. He worked in the surrounding towns as a carpenter and cabinetmaker for 36 years. In a newspaper interview in 1955, Zaccheo said he had built more than 200 houses and repaired many more. He spent two years remodeling houses, churches and banks in Falls Village, he built the altar furniture for the Congregational Church in Salisbury, and he worked on the Hotchkiss School in Lakeville. "Go any place around here," he said, "and ask whether Michele Zaccheo has worked in any village. They'll tell you yes."

Walter H. King



*Zaccheo built small shrines for his family, as well as pulpits, pews and altar furniture for churches in Italy and Connecticut. He usually signed his work in English spelled according to Italian phonetics: "Med Bai Michele Zaccheo, Eg 84, Torrington, Conn. USA."*

The work didn't stop when he retired. "For a while I thought I would go crazy with nothing to do," he related in the same interview, "so I built my own house in Torrington. My son helped me, then we built one for him. Soon after that we built one for one of my two daughters, then we remodeled my other daughter's house. When I stopped doing this big work in 1951, I began my fancy work. . . . This stuff takes a lot of time. I often work until midnight, but I love it."

The "fancy work" included tables and chairs. They are playfully eclectic in style, with definite roots in antique furniture, though modified by ethnic and contemporary features. Many of the chairs incorporate basket-weave surfaces with bentwood members, which are like wrought-iron work that Zaccheo had seen in Italy. Not surprisingly, Zaccheo was also influenced by Connecticut's historical traditions. Some chairs resemble the Hitchcock chair made nearby, especially in their turnings. In fact, his museum contained some very accurate Hitchcock reproductions, complete with their characteristic painted decoration.

Tables were Zaccheo's favorite form. They feature tilting tops, revolving bases, leaves that spring up at a touch, and surfaces that slide away to reveal interior compartments. Zaccheo produced round-topped stands by the dozens, in styles ranging from antique to modern, each displaying his skills of turning and veneering.

Veneering was a Zaccheo perfection. Most of his tabletops were fancifully detailed with inlay of contrasting colors and shapes. His most ambitious designs are found on his case pieces, primarily corner cupboards and dower chests, where thousands of pieces of wood combine to create a visual delight. Smaller objects received equally painstaking attention. He made veneered urns to commemorate special events, friendships and patriotic themes; one large, elaborate urn he created expressly to hold paired American and Italian flags.

Much of his material was salvage from cabinet jobs that his son, then a woodworker in his own right, saved for him. He also scavenged old furniture, especially television cabinets, for which he held little esteem save for their mahogany. A sideboard in his home was constructed around carved panels from a Victorian bedstead.

The cornucopia of forms and decoration of his furniture appear eccentric curiosities by themselves, yet are part of a clear development in the Zaccheo museum. There are innumerable odds and ends that show his creativity: pots and pans, coffee pots and toasters sculpted in wood, mechanical gizmos both by themselves or incorporated into furniture to make leaves secretly drop or legs retract, puppets, wagons and anything needing to be made or wanting expression. Zaccheo did not adhere to classicist conventions, but toyed in wood with skill and imagination. □

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*Neil G. Larson, of Kinderhook, N.Y., is a decorative-arts specialist. Some of Zaccheo's work can be seen at the Torrington Historical Society, 192 Main St., Torrington, Conn.*

## The Work of Michele Zaccheo

*At left, slant-top desk, bentwood rocking chair and Hitchcock-style bench, made between 1954 and 1960, are mahogany-stained maple with basket-weave panels. The panels are of 1/16-in. slats, ripped from the same stock Zaccheo used for veneers, woven on a warp of wood or copper strips. Center left, veneered tables, made between 1955 and 1968, exemplify Zaccheo's playful use of unusual forms and materials. Low drop-leaf table, front left, is pine veneer on fir plywood. Bottom left, writing table and chair, of cherry, is an early design. Traditional forms are reinterpreted, culminating in extraordinary feet. Below, with his labor measured as "three winter's work," Zaccheo created his most monumental piece, a corner cupboard with intricate, geometric designs. Two other cupboards exist, each with a shell-carved tympanum.*

# ROYAL SUITE

Photos: © 1981 Steven Sloman

While becoming famous for stack-laminated furniture of adventurous form *(FWW #5)* Wendell Castle has become uneasy about the ambiguity of his work: Is it furniture or is it sculpture? Now Castle declares that along with visual form, workmanship itself is art. He's turned to furniture that looks like furniture, and to the extremes of workmanship—and price—that characterize fine antiques. His writing desk with two chairs is made of English sycamore, solid and veneer, with amaranth drawers, ebony accents and 8,500 inlaid ebony dots. Within weeks of its summer debut at the Milliken Gallery in Manhattan, a Swiss investor bought the suite for a princely $75,000.

Castle says that this is the best cabinetmaking he's ever done, that it picks up where Emile Ruhlmann, the last of the great ébénistes, left off. Is the design and workmanship of Castle's suite really as good as that of royal antiques? You can decide for yourself—the pieces are on display through Nov. 25 at the Pratt Institute Gallery in Brooklyn, N.Y.