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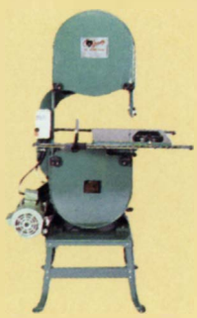

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Fine WoodWorking® January/February 1987

Spray finishing is basic to the professional shop, but can also be a boon for the amateur. To learn how it's done, turn to p. 67.

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DEPARTMENTS

ARTICLES

Postmaster: Send address changes to The Taunton Press, Inc., PO Box 355, Newtown, CT 06470.

Thank you for publishing an article on furniture with its design based solidly on function and grace. I refer to Scott Dickerson's article about his couch (*FWW* #61). When the appearance and details of a piece flow from the necessities of use and construction (given a certain amount of sensitivity to line and proportion), it is my firm opinion that the furniture is well made. Heaven preserve me from "sculptural statements." Similarly, wit is refreshing on first sight, but not on 50th.

My vote goes for more articles like this one, where real people make real use of fine wooden custom work.

—Hilde Orloff, Highland Park, Ill.

I bought a Makita B04510 sander several years ago and have been very disappointed with the clamping method. I have had several large orbital sanders over the years (I have a Porter-Cable 505 now) and their clamping systems have always worked fine. The Makita sander, on the other hand, was a nightmare. The little arms that swing out to give leverage to the clamps for paper changing are so stiff my fingers would almost bleed after a day of pulling on them, but the most annoying aspect is that the teeth on the clamp would wear the sandpaper. This caused the paper to wiggle all over the pad and clamps, until it finally came off altogether. I made new teeth with a file (they were almost completely gone) and this worked for a month or two, but then the problem returned worse than ever. Finally, in a fit of anger, I threw the machine in the trash. I plan on replacing it with a Porter-Cable 330 if I find the extra cash. I guess you get what you pay for.

—Ben Erickson, Eutaw, Ala.

A technique using aniline dyes mixed with plaster of paris described in David Shaw's article on filling the grain (*FWW* #60) involves working the dye with one's fingertips. Use of aniline dyes presents a potential health risk in that chronic industrial exposure to aniline derivatives has been associated with an increased risk of bladder cancer. The use of gloves for the described procedure, or application of dye by brush over uncolored plaster, would avoid absorption of aniline through the skin and should be the preferred method of work. When it comes to one's health, avoiding contact with aniline is not "squeamish," it's smart.

—Dr. Timothy Woodlock, Rochester, N.Y.

Regarding the comments in *FWW* #58 and #60 about paying for shrinkage as a result of kiln drying. In 1975, the U.S. Department of Commerce's Bureau of Standards challenged the National Hardwood Lumber Association's (NHLA) measurement rules on the grounds that federal law required the seller to deliver the quantity charged for on the invoice; i.e. 100 ft. invoiced, 100 ft. delivered. The Association chose to fight instead of acceding to the government requirement.

In an open forum before the National Conference on Weights and Measures in Washington, D.C., the Frank Paxton Lumber Company's corporate president, Frank Paxton Jr., debated NHLA representatives on this issue. As a result of this debate, the NHLA group volunteered to change its measurement rules to conform with federal regulations.

If a seller charges a customer for more lumber than he received because of kiln shrinkage, he is not adhering to the NHLA's measurement requirements.

—Brad Newcomer, Cincinnati, Ohio

As a finisher/restorer who has used all of the sanders except the Ryobi reviewed in *FWW* #60, I have reached some different conclusions about the merits of the various machines.

First, although the Porter-Cable Speed-Bloc is considered to be ruggedly built, it's the only one of mine that has broken down—the screws that hold the plastic cover to the metal housing stripped out. While the two-part housing may reduce vibrations, I think the design is vulnerable here. I've only used my Speed-Bloc for horizontal production work because it's too tall for work in small spaces. Also, because it's relatively heavy and the grip is far from the center of gravity, it's harder to control and awkward to use inside cabinets and in any position other than horizontal. When you're holding a machine out at the end of your reach, every ounce counts.

I prefer the Hitachi. Contrary to the article's conclusions, I've never had any problems with the paper-holding springs. Mine still hold fine after two years. The article expressed concern that the ventilating slots might be easily covered during use, leading to overheating. I've used mine upside down in jigs with about 30% of the ventilation slots covered with no problem. I do agree with Robert Vaughan that the switch is a little hard to use.

The Black & Decker is the only sander I've noticed overheating. It slows down noticeably with very little pressure and will even stall on those jobs where you're trying to remove a lot of material in a hurry. The plate is very thin and the pad is so thin and hard that, contrary to the article's suggestion, it is *not* ideal for sanding lacquer sealer. It will cut through spots even infinitesimally higher than the surrounding area. This is a drawback in a wiggly world with very few absolutely dead-flat boards. With extra padding it will work okay, but that defeats the dust-collection system. Speaking of which, after using the sander for a while, the vibrations loosen the bag, which falls off with a big puff of all the dust you're trying to contain.

While I think the kind of disassembly analysis represented by this article is useful, perhaps it would be better if *FWW* spent the money necessary to really test products in the field or do some surveys among its readers, instead of spending it on big color pictures of the products. It reminds me too much of those "independent" car magazines.

—Peter Eastman, Berkeley, Calif.

Regarding Eugene Landon's fine article, "Making the Chippendale Chair" (*FWW* #60). I would like to offer several alternative methods. First, when joining frame members at an angle, as chair construction normally requires, I have found that cutting tenons at an angle and mortises straight (i.e. at 90° to the piece to be mortised) facilitates the operation and produces neater, more accurate, and, in some instances, stronger joints than doing the reverse. A minor benefit of this procedure is that it will not be necessary to spring the rails during the normal assembly sequence. Remember that tenon lengths (and overall rail length) will have to be adjusted so that adjacent tenon ends nearly touch when the joint is assembled.

Secondly, I prefer to chop mortises by hand. I find the results cleaner, more accurate, and probably just as quickly accomplished. Besides, I find hand mortising to be one of the true joys in woodworking, though I would consider using my hollow-chisel mortiser for a run of chairs.

Lastly, when possible and stylistically appropriate, draw-bore and pin all structurally important mortise-and-tenon joints for a truly tight and beautiful joint. The advantages of this become evident when one considers the unique stresses to which chairs are subjected.

—Tom Johnston, Warrenville, Ill.

In *FWW* #60, you had a story of an ex-schoolteacher (Thomas Moser) turned furnituremaker. I can just visualize him standing up in front of his class at test time, admonishing his students to do their own work and not cheat. In my estimation, he flunked his own test, and it's this kind of thing that makes the public skeptical of hand-crafted items. His hand-made

chairs, individually signed, are about as believable as a Hillshire Farms ad telling the public they are a quaint country butcher shop with a little old man bending over a butcher block hand-trimming meat for their sausage. The next thing you know G.M. and Ford are going to hand-build cars. After all, people do stand on the assembly line and help put them together with their hands. 'Nuff said?

—Mark A. Knudsen, Des Moines, Iowa

Tom Murphy's article "Designing furniture for the disabled" (*FWW* #60) was a cogent presentation of the needs disabled individuals have for special postural and positioning aids, and of the combined skills of craftsmen and therapists in producing special equipment. Murphy would be interested in the post-graduate program offered by the London College of Furniture (41-71 Commercial Rd., London E1, England) called DEMAND, an acronym for "Design and Manufacture for Disability." The director of the program, Brian Boothby, hopes that some day adaptive furniture will be as available as prescription eyeglasses.

Design problems are dictated by the needs of each disabled client, but individual solutions are extended and adapted to help others, as the following examples of chair design at the college indicate: A little boy with cerebral palsy had such poor muscular control that he was unable to sit or keep his head steady; crippling scoliosis, a spinal deformity, made sitting painful for a young woman; and an elderly woman with bone disease, who stood and walked with difficulty, was faced with the prospect of entering a nursing home because once seated, she could not get up and she risked falling.

With advice from a physiotherapist, students positioned each client comfortably in a bean-bag type seat. The plastic bags filled with polystyrene balls were molded to provide comfortable support. Through a special procedure, the polystyrene balls were vacuumed out and the rigid plastic shell was filled with plaster of paris, producing a cast of the client's contours.

Each result was aesthetically pleasing—anyone working with the disabled will be familiar with complaints of "ugly" equipment and prostheses. The little boy's chair was backed with curved plywood, inner seating sections were a bright, soft, washable red vinyl. For the scoliosis patient, the solution was a chair with concave and convex areas shaped to her body contours. Pressure areas were assessed carefully so the seating would minimize the risk of pressure sores. The result was a chair with the airy lightness of the best of modern sculpture. For the older woman, the difficulty in rising from a chair was solved through arm rests of slightly different angles, each fitted with a raised area that she could grasp easily. At her request, the chair was styled to blend with her own furniture. Four years later, she was living independently in her own home. The cost of the chair was a fraction of a week's stay in a nursing home.

—Dr. Hope C. Solomons, Iowa City, Iowa

I've been using polyurethane to finish furniture and cabinets for some time now and I don't agree with Otto Heuer that foam brushes are the tool to use. They're fine on flat surfaces, such as tabletops, but lousy everywhere else. It's very hard to prevent buildup along inside edges, as when doing raised-panel doors, because you tend to squeeze the sponge. A good China bristle varnish brush allows you to control the flow much better. *—Patrick O'Shaughnessy, Wolfeboro Falls, N.H.*

I thought the articles on wood screws (*FWW* #60) were quite well done. I recoiled, however, when I read the first paragraph of Paul Bertorelli's insights on drywall screws: "...I'll stoop to any method of fastening wood, so long as it gets the job done in a hurry." I guess I should appreciate his candor, but I couldn't help feeling indignant that he should be allowed to make such a statement in your usually authoritative publication. How could anyone, an editor no less, be permitted to make such a rash remark when you have such a receptive audience that's seeking answers and methods of doing quality work? Doing something in a hurry is almost never the best way of getting work done.

At a time when all American products are suspect—from cars to clothes to computers, even woodworking machinery—perhaps we should work harder to keep our craft pure. A statement like Mr. Bertorelli's can do great harm. I hope no reader takes it to heart.

Obviously, I'm disappointed. I've been a reader since issue #3 and I'll continue to read. But, I'll read Mr. Bertorelli's writings much closer from here on in. *—Tom Potter, Tulsa, Okla.*

On reading of Tom Dewey's success in "aging" cherry using sodium hydroxide (*FWW* #61), I was reminded of a (primitive) technique I have used in antique restoration work when necessity called for adding new wood to old.

I simply go to my woodstove and scoop up a jar full of wood ash, add enough water to make a super saturate, then let it steep overnight. What I've made, of course, is a crude lye which, when applied to cherry (and some other woods), has the same effects as those described by Mr. Dewey.

—Robert E. Wright, Center Sandwich, N.H.

Bruce McQuilkin, a fine craftsman and mainstay of the Baulines Guild died of a cerebral hemorrhage on July 20, 1986. A graduate of San Francisco State's Creative Arts woodworking program, Bruce was also a highly decorated Vietnam veteran who spent little time dwelling on the past and much time charging into the future.

In addition to being an accomplished furnituremaker, Bruce taught woodworking through the Guild and University of California extension services. For years he was a major participant in the development, design and production of shows for the Guild. The Guild is establishing a trust fund in his honor to benefit students in Guild programs. To contribute, write Baulines Crafts Guild, McQuilkin Trust Fund, P.O. Box 305, Bolinas, Calif. 94924. *—Patty Rose, San Anselmo, Calif.*

Steve Cook's thickness sander (*FWW* #58) sounded like the answer to a prayer, and indeed it was. I'm retired and enjoy woodworking in my own small shop, building furniture for the house and some gifts.

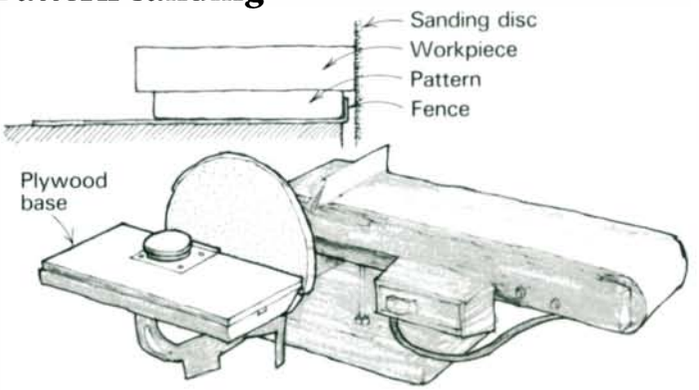
In most respects I followed Cook's plan, but since I don't have a machinist friend, I made my sanding drum from a 24-in. piece of schedule 40 six-inch PVC pipe. With PVC, the lips to receive the end pieces can be milled with a router and the whole drum can be turned true with a woodturning skew used as a scraper.

I made the drum ends from ¼-in. acrylic, sandwiching them at each end with 1½-in. squares of acrylic to make a ¾ in. thickness for the holes for the ¾-in. shaft. I used PVC glue for the plastic and metal-filled epoxy to glue the drum to the shaft. I left a 1-in. hole in each end to apply epoxy to the inside of the shaft and also to apply 18-in.-long pieces of ¼-in. copper tubing with epoxy to balance the drum. (I taped them to the outside first to get the balance and then glued them inside.)

The disadvantage of the PVC route is that I'm afraid to increase the torque on the epoxy shaft-drum bond so that I'm getting somewhat less than 1/64-in. depth of cut with 36-grit paper. But, I'm not in production, so I can make a few more passes. If the bond fails, I'll go Steve Cook's route. I have only $6 invested in the plastic. *—Robert W. Kolb, Hamilton, Ga.*

edited and drawn by Jim Richey

Pattern sanding



When I needed to reproduce 100 small ovals from ¼-in.-thick wood, I experimented first with several router methods, which proved either defect-prone or dangerous. I solved the problem by pattern sanding the ovals on a 12-in. disc sander. I suspect the same technique could be adapted to a belt sander with equally good results.

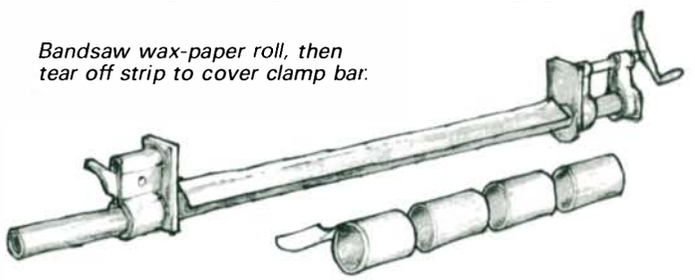
Only two parts are necessary, a pattern and a guide fence. I made the pattern from ¼-in.-thick Plexiglas, which I shaped and smoothed on the disc sander. Because the pattern rubs against the guide fence, it must be sized about ⅛ in. smaller than the dimensions of the finished work and should be chamfered on its bottom edge for dust clearance. The guide fence is simply a 4-in. square of sheet metal with one edge bent up to a 3/16-in. lip. Attach the guide fence to a plywood base with countersunk screws so that the lip overhangs one edge of the plywood slightly. Now clamp the plywood to the disc sander table with the guide fence next to, but not touching the disc.

To use the device, fix the slightly oversize workpiece to the Plexiglas pattern. To keep the workpiece from slipping, use sandpaper, double-sided tape or protruding brad points. I've found that a sheet of sandpaper glued to the top of the pattern provides enough friction for most situations. Push the pattern against the sheet-metal fence and rotate it to grind the workpiece to shape. With 100-grit sandpaper, the whole operation takes about 30 seconds for a small, uncomplicated shape. The fixture shown may be used to form straight or convex shapes only. However, concave shapes could be easily cut using a similar device that incorporated a curved guide fence and small drum sander. *—Don Herman, Brecksville, Ohio*

Quick tip: To cut sandpaper discs to size I keep a pair of dividers with one leg sharpened to a knife edge. I just scribe the exact size needed on the back of the sheet and cut the disc free with one or two passes. The dividers also excel at scribing wood. *—Carl Meinzinger, Guenes Island, Wash.*

Preventing clamp stains during glue-up

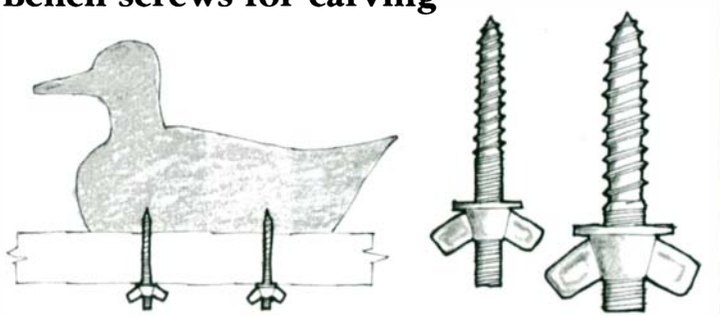
Bandsaw wax-paper roll, then tear off strip to cover clamp bar.



Here's a simple solution to stains caused by wet glue reacting with metal clamps. Bandsaw a roll of ordinary wax paper into 2-in. mini-rolls. Tear off what you need, fold into a tent shape and lay the wax paper on the clamp as shown.

—Dustin P. Davis, Frostburg, Md.

Bench screws for carving



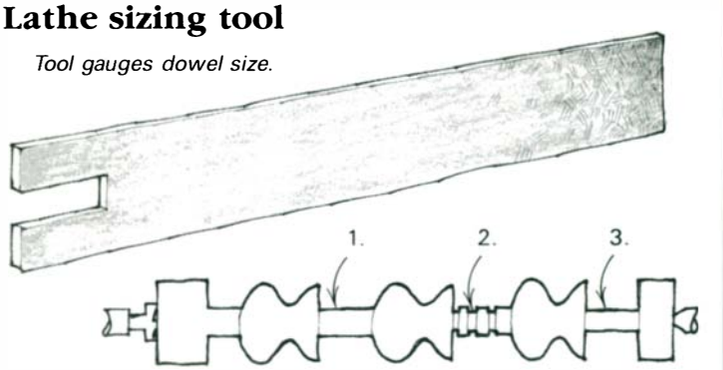
Except for their expense, bench screws are the ideal solution for fixing carving blanks to the workbench. Fortunately, you can duplicate their function for mere pennies. Ask at your local hardware store for hanger bolts. These bolts, which are available in a variety of smaller sizes and lengths, have a wood screw on one end and a machine screw on the other. Replace the nuts that come with the bolts with wing nuts and you have virtually duplicated a $20 benchscrew.

The hanger bolts will be more than adequate for holding smaller carvings. But larger carving blanks call for a heftier bench screw. To make one, hacksaw the head off a lag screw as big as you need and thread the shank with a standard die. Fit the screw with washers and a wing nut and you have a monster bench screw. *—Ford Green, San Antonio, Tex.*

Quick tip: You don't need two hands to adjust a C-clamp. Try this: grab the end of the T-handle and let your arm and the clamp hang down toward the floor. Move your hand as if stirring paint, and you'll find that the clamp body will rotate around the screw. *—John McDermott, Rexton, N.B.*

Lathe sizing tool

Tool gauges dowel size.



I turn many wooden knobs in multiples of four, and I needed a quick and accurate procedure to put ½-in. dowel stems on each knob. This easy-to-make sizing tool does the job beautifully. Start with a 12-in. length of ⅛-in.-thick steel. Square the end and cut a ½-in.-wide slot 1 in. or so deep into the end of the bar. File the slot to exact size. You may wish to bevel the tool's cutting edges above and below the slot, so they have a shape similar to the cutting edge of a parting tool. However, I found that the sizing tool will function perfectly well with sharp, square corners. To use the tool, first turn the knobs to shape with their stems slightly oversize (1). Plunge the sizing tool down on the stems at ¼ in. intervals to produce bands of the true dowel size (2). Then bring the remainder of the dowel down to size with a parting tool or chisel (3).

—J.C. Collier, Upper Hutt, New Zealand

Layout procedure for routing dadoes

Here's my pet method for routing dadoes in plywood. First locate and mark out the dado on the workpiece and score the veneer with a sharp knife. Set a compass to the distance from the edge of your router base to the bit. For example, if your

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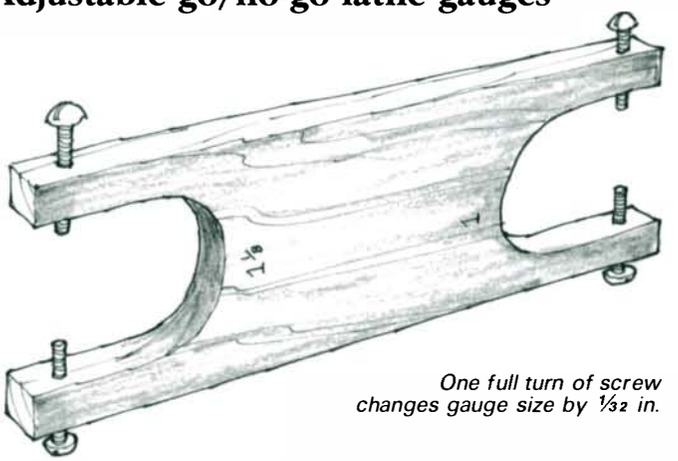
router base is 6 in. across and you're using a ¾-in. bit, set the compass to 2⅝ in. With the compass point on one edge of the dado, swing two arcs—one at each end of the dado. Now clamp a straightedge tangent to the arcs to serve as a fence and you're ready to rout. *—Chuck Anderson, Porterville, Calif.*

Adjustable go/no-go lathe gauges



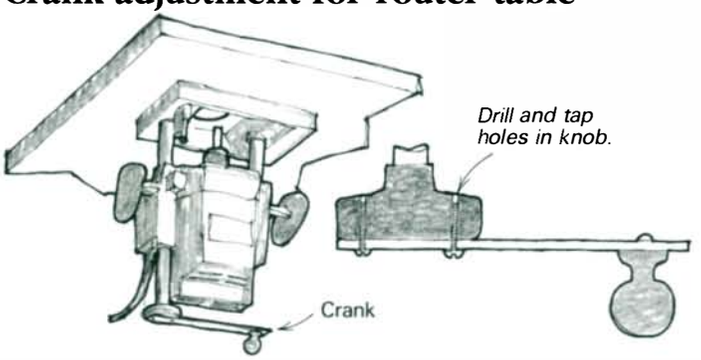
One full turn of screw changes gauge size by 1/32 in.

A set of these shopmade gauges will make measuring diameters easy and precise. Start with a length of ⅜-in.-thick, close-grained hardwood. Cut U-shaped recesses in each end slightly larger than the diameter to be measured and trim the piece so that the "arms" of the gauge end up about ⅜ in. square. Next, using a 9/64-in. bit, drill holes for the adjustment screws in each arm as illustrated. These holes should be ¼ in. from the ends, square and centered.

Now install four 1-in.-long, size 8-32 machine screws in the holes. Turn the screws right into the holes—no tapping is necessary. In fact, the self-cut threads will make lock nuts unnecessary. Round over and smooth the ends of the screws to increase accuracy. Now you're ready to set the gauge to the required dimension with an inside caliper or any convenient standard. One full turn of the screw makes a 1/32-in. change in the gauge dimension. *—R.H. Taylor, Southport, Conn.*

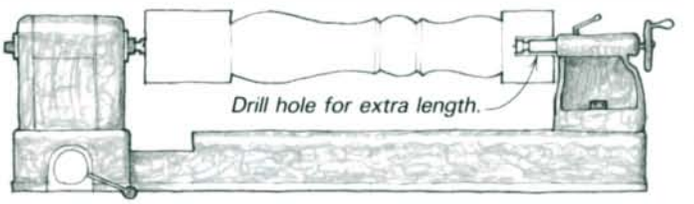
Quick tip: Everybody has seen adjustable shelf systems consisting of a vertical standard screwed to the wall and a shelf support that locks into slots at various heights. I mounted such a standard to a leg on my workbench and now I can adjust the "shelf support" to help position long work held in my bench vise. *—Ben Terlecki, Oshawa, Ont.*

Crank adjustment for router table



The Makita plunge router I have installed in my router table works beautifully. But adjusting the depth of the bit with the adjustment knob was awkward and tedious. I solved this problem by removing the pre-load springs from the router support tubes. Then I fashioned a simple crank handle that screws to the existing knob. Now I can adjust the router quickly to whatever depth I need. *—Robert T. Combs, Carpinteria, Calif.*

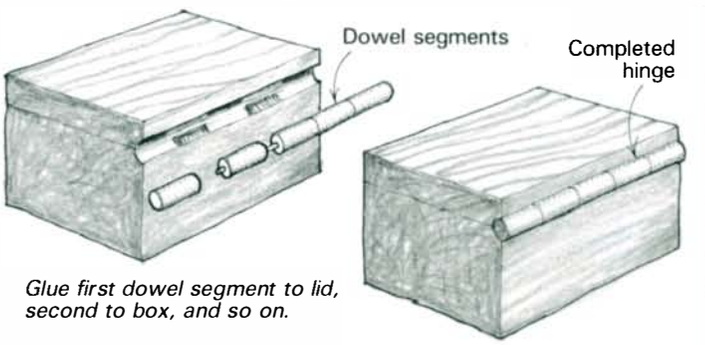
Gaining length on a lathe



When I wanted to turn a set of fancy 6x6 Victorian newel posts, I found my lathe's capacity was 2 in. short of the required length. Finally I discovered the method illustrated here, which gave me the extra 2 in. and paid a safety bonus as well. I drilled a hole, the same diameter as the tailstock, 2 in. deep in the center of one end, dropped the tailstock into the hole and mounted the work on the lathe. After the workpiece is in place for turning, it's impossible for it to fly off the lathe.

—Dan Miller, Elgin, Ill.

Wooden box hinge



Glue first dowel segment to lid, second to box, and so on.

This wooden hinge is tricky to make. But because it's distinctive, attractive and functional as well, perhaps the extra trouble is justified.

To make the hinge you'll need a ½-in. or ⅜-in. dowel, preferably from the same wood as your box, a brazing rod pin as long as the back of the box and a core-box router bit to rout a round-bottomed slot the same diameter as your dowel.

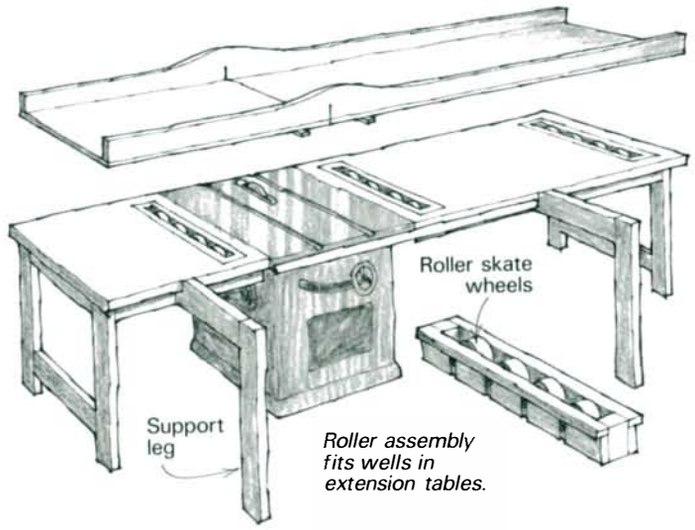
Start by determining the number of hinge segments you wish to have. There should be an odd number, and each segment should be no longer than 1½ in. or so. Divide the length of the box back by the number you have chosen to get the length of each dowel segment. Now carefully slice up the dowel taking care that each segment's end is a perfect 90°. The next step is to drill a hinge-pin hole through each of the interior segments and halfway through both of the end segments. The pin hole must be perfectly centered in each segment. I've seen several ideas in the Methods of Work column to accomplish this operation. The easiest, I think, is to clamp a 2x4 to the drill-press table and drill a registration hole the same diameter as the dowel about ¾ in. deep into the 2x4. Without moving the drill-press table, chuck the bit you intend to use for the pin holes into the drill press. When you place a dowel segment in the registration hole, the pin bit will be centered right over it.

Now you're ready to rout a round-bottomed channel centered over the seam where the top of the box meets the back. You can rout this channel by clamping the top to the box and using a core-box bit or, alternatively, you can rout the top and back separately with a piloted cove bit. Either technique will work.

When you have completed the hinge channel, you're ready for the tricky part—gluing the hinge in place. First string the dowel segments on the pin wire like beads with an end segment on each end. Lay the hinge in the channel between back and top and mark the location of each segment. Carefully smear dabs of glue in the channel, alternating between top and

back so that half of the segments will be glued to the top and half to the back. Don't use too much glue, because any squeeze out will lock up the hinge. I've experimented with several types of glue and have had the best luck with epoxy, even though I normally avoid it. Place the hinge into the channel and clamp lightly to minimize squeeze out. When the glue sets, remove the clamp, cross your fingers and try the hinge action. If all has gone well, you will have a smooth-working, good-looking hinge. *—Jeris Chamey, Ponca City, Okla.*

Sliding tablesaw carriage



If you've ever attempted to crosscut a 6-ft.-long, 2-ft.-wide panel on the tablesaw, you know the operation is awkward, error-prone and even scary. By contrast, when you add the sliding carriage described here, tablesaw crosscutting is made more accurate, faster and safer. The fixture is straightforward with two main components: an auxiliary bed fitted with rollers made from skate wheels, and a sliding carriage that rolls atop the bed, using the miter gauge slots as a track.

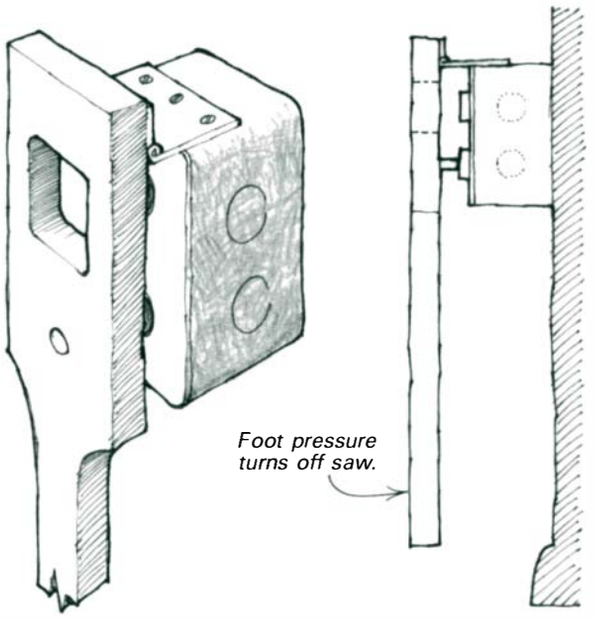
The auxiliary bed fitted with rollers is really the key to the fixture. Without the rollers the heavy sliding carriage would stick and bind. To make the auxiliary bed, first construct two outrigger tables to bolt up to the saw as shown. The size of the tables is discretionary, of course, but I recommend that the tables-plus-saw add up to at least 8 ft. long. The rollers are made up in three box frames, each containing four nylon roller skate wheels mounted on ¼-in. threaded-rod axles. The roller boxes drop into wells in the top of each outrigger table as shown. The boxes pop out when they are not in use and can be replaced by plain plywood inserts. It is a good idea to design in some sort of height adjustment for the rollers in case they are too low or too high in use.

The sliding carriage is nothing more than a large panel of plywood with fences fixed to the front and the back edges. Waxed maple runners screwed to the bottom of the carriage slide in the miter gauge slots and ensure the table tracks at right angles to the blade. I bolted the fences to the panel using slotted holes so that I could adjust the fences for a perfectly square cut.

Because the sliding table is heavy, another necessary component of the fixture is a support stand to hold the table when it's pulled back toward the operator before the cut. You may chose to incorporate this support into the design of the auxiliary bed. In my case I made up a couple of removable legs I can fasten in place whenever I use the sliding table.

One side-benefit of the fixture is that you may use the roller feature without the sliding carriage. The rollers make ripping a full sheet of plywood a breeze. *—Bill Amaya, Hailey, Ind.*

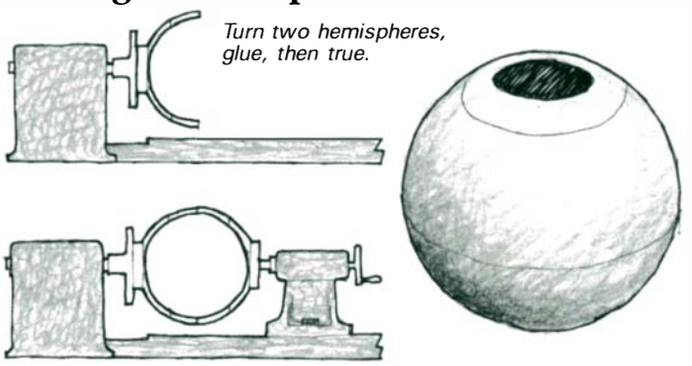
Foot switch for tablesaw



This foot switch is for those of us who, with both hands critically occupied on top of the saw table, have wished for a third hand to reach under the table and turn off the saw. I added the switch to my saw primarily for safety reasons but now find its convenience indispensable. The foot switch is simply a hinged paddle that hangs down over the saw's push-button switchbox. I can turn off the saw by bumping the paddle with knee or foot—a short dowel located at just the right spot pushes the off button. A hole through the top part allows normal finger access to the on button and, in fact, offers some protection against the button being pushed accidentally.

—Eric Eschen, Chico, Calif.

Turning hollow spheres



For those of us who have neither the tools nor the skill to hollow out a solid sphere on the lathe, here is an alternative. First glue up two blanks using truncated wedge segments and solid wood caps (see "Segmented Turning," *FWW* #54). Turn two hemispheres, as shown in the sketch above, and glue them together after they have been hollowed to the desired wall thickness, leaving some extra thickness to allow for truing later. To glue the hemispheres together I leave one hemisphere attached to its faceplate in the lathe and use the tailstock to apply pressure while the glue sets. It is a good idea to leave the tailstock in place for extra support while you true the sphere to its final shape. *—Al Brotzman, Madison, Ohio*

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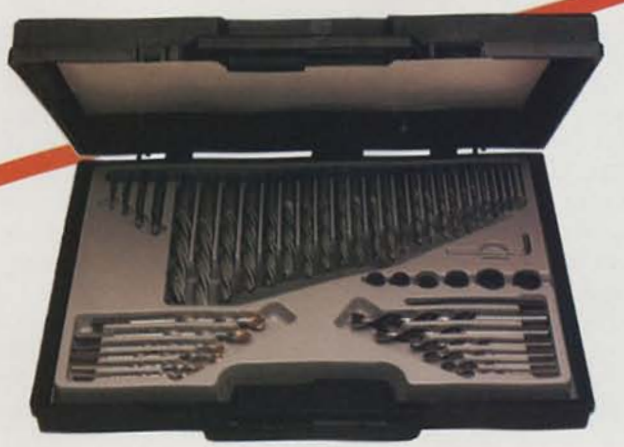

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Freud's new 50 piece drill bit set comes with a heavy duty carrying case for ease of storage and protection. This set consists of: A) 25 high speed steel bits (1/16 - ½ in 1/16 increments) B) 4 high speed steel bits for use in sheet metal (¼, 3/16, ⅛, 3/32) C) 6 chrome vanadium steel brad point bits for use in wood (⅛, 5/32, 3/16, ¼, 5/16, ⅜) D) 6 carbide tipped masonry bits with hex shanks (5/32, 3/16, 7/32, ¼, 5/16, ⅜ E) 1 center punch, 2 Allen keys and 6 depth stops to set bits at pre-determined depths.

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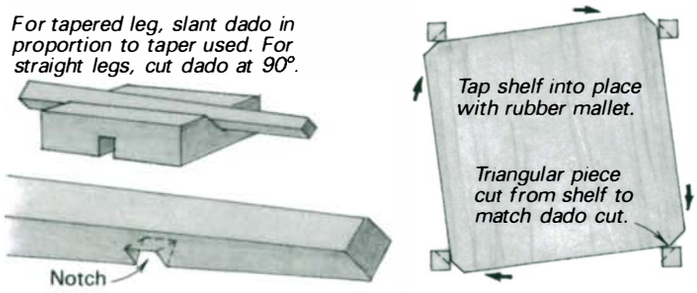
Fixing shelves to table legs

I need a method for attaching the bottom shelf of a coffee table or end table to both square-leg and tapered-leg designs.
—Louis Welch, Sudbury, Mass.

Carlyle Lynch replies: One good way to attach these shelves is to notch the legs, then glue the shelf into the notches. You can do this with either hand tools or by machine.



For straight legs, cut a dado across the two inner sides of each leg at the desired height of the shelf. To make it easier to hold the leg and prevent splintering, mount the leg in a wooden trough, as shown. Fasten the trough to the miter gauge and pass the whole assembly over the dado cutter, or make repeated passes over a regular blade. The dado should be as wide as the shelf is thick, and cut through slightly less than half the leg. You can also cut the dado sides with a handsaw and chisel out the waste.

The method for tapered legs is similar, except cut the notch at an angle. Set the leg so that its tapered sides rest in the trough. Then slant the dado cut toward the small end of the leg enough to compenstate for the taper, so the shelf will be parallel to the floor when mounted in the legs. You have to work out the dado setting for each taper, but for most small tables I'd suggest you start with a 1½° to 2° tilt on the dado cutter.

To assemble, cut triangular pieces from the corners of the shelf, as shown. Spread glue on the mating surfaces, hold the shelf diagonally between the legs of the assembled table, and start it into the notches before tapping it home with a mallet.
[Carlyle Lynch is a designer, draftsman and retired teacher in Broadway, Va.]

Lubricating bronze bushings

I'm building a powered device to buff, grind and wire brush tools. Basically, it involves pillow blocks supporting a rotating arbor. The blocks are bronze bushings inside of a casting. The casting has an ⅛-in.-dia. hole for oil, but I can't find any similar hole through the bushing. How can lubricant get to the inside surfaces where the friction is? Should I drill out the bushing? ***—R.F. Itnyre, Washington, D.C.***

Rich Preiss replies: Refrain from drilling any holes through the bronze bushings in your stationary pillow blocks. Although metals such as bronze and cast iron appear hard and impenetrable, the opposite is closer to the truth. Oil is able to penetrate the porous metal and provide all the necessary lubrication, but you must keep up with your maintenance to ensure that the bushings never run dry. To ensure best penetration, use a light-to-medium viscosity oil, such as 20-weight, or a specialty lubricant, such as sewing machine oil, which is more highly refined. I'm not familiar with any formula to choose RPM based on diameter and lubricant, so I'd base my RPM setting on functional requirements, then stay on the low side to accommodate the bronze bushings. For your operations, I'd recommend a range of 1,700 to 2,850 RPM.
[Rich Preiss is the head of the wood program at the University of North Carolina at Charlotte.]

Refinishing a classic Jaguar

I'd like some advice on refinishing the woodwork on my 1965 3.8 S Jaguar. I've finished one small part—the door ledge—with varnish. So far, it seems okay, but the main question is what to do with the dashboard, which has been subjected to the sun's rays and heat and has developed fine cracks. Is there a finish that will resist such torture?
—George P. Calderwood, Long Beach, Calif.

Donald Steinert replies: I'm quite familiar with the cracks you describe on your dashboard. I don't know of a clear wood finish that will hold up forever when it is subjected to extremes of heat, cold and moisture endured by a dashboard beneath an auto windshield. It took a few decades, but manufacturers of prestige cars finally got the message in the early 1970s and stopped putting woodwork in this area.

You can restore the woodwork, but then the best thing to do to preserve the finish is to keep the car out of the sun as much as possible. A clear finish is analogous to a fair-skinned person, who has very little pigment in the skin to block out harmful rays of the sun. Both will burn in the sun. One of those folding cardboard windshield shades sold by auto dealers may be the best investment you can make to protect the woodwork.

Here's what I would suggest for refinishing. Products formulated for furniture will not hold up well in a car. Forget lacquer. It will craze badly in a year or so. Polyurethane, even exterior grade, does not hold up much better. Marine varnish is probably your best choice. Spraying is probably the best method for applying the varnish. It takes a long time to dry and consequently will collect dust, so you will have to rub out the finish once it's dry. But the finish on your automobile should be rubbed out anyway to be authentic. Once you've built the varnish up to the thickness you desire, leave it in a warm, dry place for several weeks before the final rubout.

Another possibility is McCloskey's Bar Top, a durable phenolic resin-based varnish (available from McCloskey Varnish Co., 7600-T State Road, Philadelphia, Penn. 19136, and from its local distributors). It usually dries dust-free in about an hour, can be recoated in a matter of hours and rubbed out after two or three days. I refinished the woodwork in a Rolls-Royce with McCloskey's about 10 years ago and it still looks great. It's a show car, however, and doesn't regularly sit out in the sun. For my own restoration work, I spray catalyzed polyester resin, but it's very tricky to use, hazardous to your health and expensive (about $50 per gallon). I don't recommend it for anyone except trained professionals.
[Donald Steinert specializes in restoring woodwork on antique automobiles. His shop is in Grants Pass, Ore.]

Stripping bark off ironwood

I have a slab of extremely hard ironwood lumber that was harvested in northern Wisconsin about 10 years ago. Every time I try to remove the bark, I end up badly scratching the smooth wood underneath. Should I steam the wood first?
—William R. Schumaker, Milwaukee, Wisc.

Jon Arno replies: A good thorough steaming is the most promising approach if you want to peel the bark from the wood at the cambium layer. The problem is that once wood dries, the bark shrinks around it and the sap tends to harden like glue. Fortunately, even though the gums, resins and lignin (the cement that bonds wood cells together) are not highly water soluble, they are thermoplastic and will soften with heat. With wood as old as yours, however, you'll probably need a double-barreled approach to remove the bark. I would thoroughly remoisten the wood with steam, then vigorously pound the bark with a dull object while it's still warm, to help separate the layers.

Incidentally, the name ironwood can lead to some confusion since it's used to describe totally unrelated woods around the world. Just about any species hard enough to cause an ax to bounce will pick up this name. In Wisconsin, the name usu-

ally refers to hop hornbeam, *Ostrya virginiana*, a member of the birch family. Given a sharp chainsaw, hornbeam makes fine firewood—long burning with extremely hot coals. I mention this just in case your bark proves to be as difficult to remove as I suspect it will. Another option is to saw the bark off and use the boards in the shop, but the creamy-yellow wood is rather bland. Its greatest claim to fame is as the preferred wood for mallet heads, splitting wedges and other rugged purposes, where it's a cheap, organic substitute for iron or stone. [Jon Arno is an amateur wood technologist and woodworker in Brookfield, Wisc.]

Making deluxe wooden tackle boxes

About 30 years ago I made several Philippine mahogany tackle boxes. Mine still serves me well, and owners of fine tackle shops want me to make more for presentation gifts. Now that I'm semi-retired I'm in a position to do it, but what wood would be best for a box where weight, water resistance and durability are essential. The boxes are 8 in. by 9 in. by 18 in. I'd like to work with ⅝-in. stock.

—John C. Bair, Atlanta, Ga.

Michael Podmaniczky replies: You have couple of options in picking wood for your deluxe tackle boxes. Varnished and oiled teak is *de riguer* for many people when it comes to luxury boat equipment, but I think teak is an overused, as well as misused wood. First of all, gluing teak is a tricky job at best. Teak's real strength is its ability to withstand incredible punishment from man and the elements without any kind of protective finish. It's ideal deck planking; left alone it bleaches to a lovely silver contrast to the varnished wood on a boat. Unfortunately, most workers can't resist spending a lot of time and money to prevent this weathering. It would be one thing if teak were relatively inexpensive and highly figured, but it's neither. And, if you're looking for a lightweight timber, teak is definitely not the right choice. The next logical choice would be Honduras mahogany, which is lighter than teak, very durable and stable, and reasonably priced. Honduras finishes well and it often comes nicely figured. It still may be heavier than you want. A bit lighter, butternut is a wood that old timers used a lot around boats.

I think the best choice is the one you made for your first box—Philippine mahogany. In some circles, it has an unfortunate reputation because it isn't as dense as Honduras mahogany, and it's also hard to work because it commonly contains "ribbon" figure. But this ribbon figure is exactly what you need to dress up your tackle boxes. The ribbon figure will usually be throughout the board, so you'll have minimal waste. Buy the lowest grade of Philippine mahogany, and you'll have the lightest as well as the cheapest. Philippine mahogany is plenty strong enough to make ⅜-in. box sides, but be sure to use strong joints. This means dovetails, which also add to the looks and the sale price of the piece.

To finish the boxes, I'd recommend you apply a pigmented liquid grain filler, available from larger paint supply stores and mail-order outlets, then finish with at least three coats of natural-resin spar varnish, rubbing down between coats. Check the label to make sure the brand you pick contains ultraviolet inhibitors, since the box will be regularly exposed to sunlight. For the inside of the box, I'd recommend you go to local marine supply dealer and buy a common boat oil, such as Matthews boat oil or Deks Ole #1. Tung oil would also do the trick. While we're discussing the inside, you might also consider using butternut for the dividers. The sun won't be able to bleach out the delicate color in there and they'll look great.

[Michael Podmaniczky is a furniture conservator at the Henry Francis du Pont Winterthur Museum, Winterthur, Del.]

Wobble on radial-arm saw

I'm having a problem with a Sears 10-in. radial-arm saw. The bearings on which the carriage slides along the arm apparently became worn enough to develop play. This causes the carriage to sway side-to-side and make a wobbled cut. I replaced the bearings once, but the new set soon developed the same type of play. I tried changing blades and checking all the other adjustments, but nothing cured the problem. Any suggestions?

—John Jordan, El Campo, Tex.

Curtis Erpelding replies: I think the problem developed because you haven't adjusted the bearings tight to the ground ways of the arm. On my saw there are four bearings, two on each side of the arm. Pay particular attention to the bearings on the left side facing the saw. These are tightened down by eccentric bolts which when loosened can be turned to bring the bearings tight up into the ways. If you adjust the bearings this way, I think your problem will go away. The bearings themselves would not wear out as quickly as you describe.

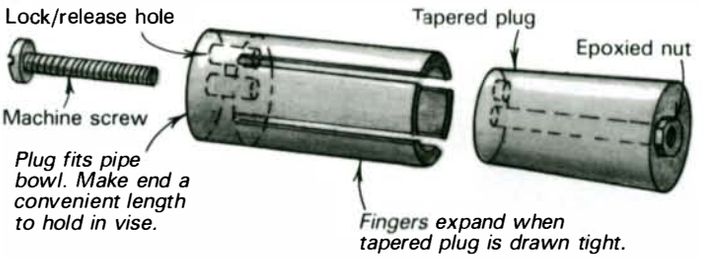
[Curtis Erpelding is a professional woodworker in Seattle, Wash. He's featured in the video "Radial-Arm-Saw Joinery," available from Taunton Press.]

Carver's pipe clamp

I hand carve smoking pipes. The tobacco hole is usually ¾ in. to ⅞ in. in diameter and 1 in. to 2 in. deep. I usually shape a dowel to fit snugly into the bowl, secure the other end of the dowel in a vise, then shape the outside of the pipe with a rasp. Invariably, the dowel loosens and the blank falls off. Can you suggest a better holding system?

—Raymond L. Ludwick, Santa Ana, Calif.

Jim Cummins replies: The jig shown in the drawing should solve your holding problem. It's an adaptation of a chuck that woodturners use on the lathe.



I'm not sure what woodworking tools and machines you have, so I can't tell you the best way to go about making the holder. If you have a drill press, lathe and bandsaw, it should be self-evident. If you have nothing but an electric drill, you should be able to manage one way or another. The hardest part of the job, drilling the main hole through the dowel, could be solved by going about it another way, such as gluing Popsicle sticks to a plug to imitate the chucks's fingers. Depending on the wood's tendency to split, you might need some sort of ferrule around the bottom. This could be wrapped wire, a radiator hose clamp or a section of copper or steel pipe. For a better grip inside the bowl, wrap some rubber bands loosely around the chuck before inserting it. The lock-release hole shown in the drawing serves both to keep the tapered plug from turning (insert an Allen wrench), and as an access hole to tap the tapered plug loose when you're done.

[Jim Cummins is an associate editor of *Fine Woodworking*.]

New life for antique plane

I am restoring an antique wooden plane, which I believe was made about 1860. My problem is sharpening the iron. Each time I approach a good edge, nicks appear. I've flattened the back, ground the edge to 20°, then sharpened it from 26° to 28°. I've tried finer stones, heavier honing oil, more swearing

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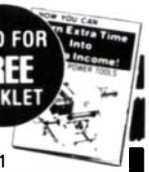

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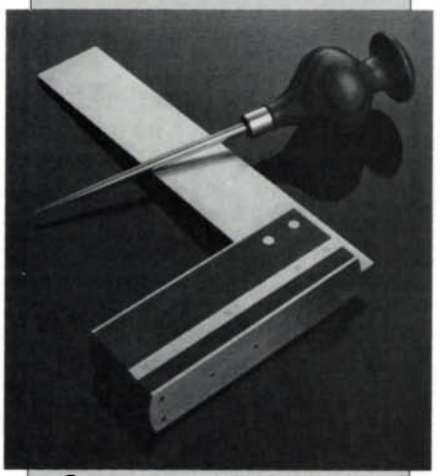

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and drawing the iron sideways along the stone, but still get nicks. The steel doesn't seem to be excessively hard or brittle. The plane has a wonderful balance and is generally too nice to be relegated to the mantelpiece. Any suggestions?

—Mark W. Riffe, Williamsburg, Va.

Jerry Glaser replies: A plane iron that is at least 125 years old must have rusted at one time or another. Such intergranular corrosion could weaken the bonds of the metal's crystalline structure enough to allow small particles of steel to break off at the thin edge during sharpening. Without seeing the iron, the only thing I could suggest is grinding away the first 1/16 in. to 1/8 in. of the cutting edge and the top 0.010 in. to 0.029 in. of the surfaces of the iron. This might remove the metal weakened by corrosion or damaged by improper sharpening and leave structurally sound metal. If that doesn't work, no amount of honing or Anglo-Saxon invective is likely to save your plane from the mantelpiece, unless you are willing to make a new iron for it. If you're really set on saving the iron, however, you could have it analyzed by a metallurgist, who might know another remedy.

One other possibility. Everyone has come across tools that are difficult to sharpen or don't hold an edge. These are relegated to the back of a drawer and left there for posterity. This may account for your iron—it was a dog to begin with.

[Jerry Glaser is a manufacturing engineer who lives in Playa del Rey, Calif.]

Dry glue rising from joints

My problem is glue rising out of joints anywhere from a week to a month after I complete a project. I use Elmer's Carpenters yellow glue, which I think is excellent, and Watco Danish oil. I suspect the problem could be due to Alaska's high summer humidity, or to the fact that I store my lumber in a shed outside of my shop. What do you think?

—Dean Snook, Chugiak, Alaska

Bruce Hoadley replies: I also suspect moisture is the culprit, although it's difficult to give an exact answer without seeing the joint seepage. I assume you're having problems with the edge-to-edge joints. Your shed-stored lumber is probably drying down to only 12% to 15% (the percentage may even be higher in the summer). After the lumber is converted to furniture, it will re-equalize down to 7% to 10% moisture in an indoor environment. The resulting dimensional change could be causing a shift at the glueline.

If there were a moisture gradient in the lumber (that is the wood is dryer at the surface than through the mid-thickness), subsequent drying of the wood could pinch the glueline near the surface, and actually cause the glue to be squeezed out as a bead or bump along the glueline. This is likely since PVA-type glues, such as Elmer's, are not totally rigid when dry.

Before moving your lumber supply indoors, I suggest you try some simple experiments to prove if moisture is the problem. First, cut some boards in half. Leave half of the boards stored in your lumber shed and bring the other half into a heated living area for a couple of months. Next, glue up two panels, one using only lumber stored outside and one with wood stored inside. Make sure you mark the boards and panels clearly so you don't get mixed up. Surface and finish the panels in a similar manner. Observe them for period of time, at least as long as it took for the problems to develop in your other work, and see if the panels of air-dried stock react differently than those of room-dried stock.

[Bruce Hoadley is professor of wood technology at the University of Massachusetts at Amherst.]

Warped rosewood tabletop

I'm having problems with some East Indian rosewood warping after it was planed. The rough-cut 4/4 stock was fairly straight when I got it, but it bowed considerably as soon as I put it through the planer. Since I wanted to make a tabletop with the 6-in.- to 8-in.-wide boards, I doweled them together with 1/2-in. pins. When I released the top from the clamps, it was considerably bowed, so I set weight on it for a few weeks. This reduced the bow slightly, but didn't eliminate it, so I put oak cleats around the inside of the table apron and screwed the top to the cleats. Will the top eventually pull the screws out?

—Joel Agranowitz, Long Beach, Calif.

Simon Watts replies: Wood will often move slightly when sawn or planed. If you can afford the wait, it's usually best to rough cut the pieces to within 1/4 in. of their finished size, then set the pieces aside for several months so they can adjust to the prevailing humidity levels in your workshop. Incidentally, to ensure a flat surface, always flatten one side of the board with a jointer or a jack plane before thickness planing.

You may not prevent all the wood movement, but you can minimize it by taking the same amount of wood off each side of the board. For example, if you want to reduce 4/4 stock to 3/4 in., don't take 3/16 in. off one side and only 1/16 in. off the other. Try instead to take 1/8 in. off each side.

There is nothing wrong with your cleat idea, as long as you make sure the shank of the screw is loose in its cleat hole. This will allow some movement of the wood. My own preference is for Z-shaped tabletop fasteners (available from Paxton/Patterson, 5719 W. 65th St., Chicago, Ill. 60638). These clips engage in a groove, usually a sawcut around the inside top edge of the apron. They hold the top securely to the base, but still permit enough movement to allow for seasonal changes. If you like the idea of this type of attachment, but prefer a more traditional approach, you might try wooden buttons (see p. 58).

[Simon Watts is a cabinetmaker, teacher and boatbuilder in San Francisco and Nova Scotia.]

Jim Cummins replies: I don't think your wood movement is caused by moisture problems, but by residual stresses left in the wood when it was dried. For example, a board can be perfectly flat when the stresses within it are in balance, but if resawn, the balance is lost. Such warping and cupping happens immediately as the board is cut, whereas moisture related warping takes days or weeks.

As Simon Watts said above, it is best to remove material equally from both sides of a board when planing much off. Additional advice is to use the jointer to get the wood close to the final size, before light thickness planing to get rid of any taper that the jointer might have left. The jointer will give you flat surfaces, correcting any cupping with each new pass; the pressure rollers on a planer will flatten a cupped board as it goes through, but it will spring back cupped again as it comes out the other side.

If a tabletop is cupped much, I wouldn't rely on screws to hold it flat; it would be under constant strain, and sooner or later I would expect something to give.

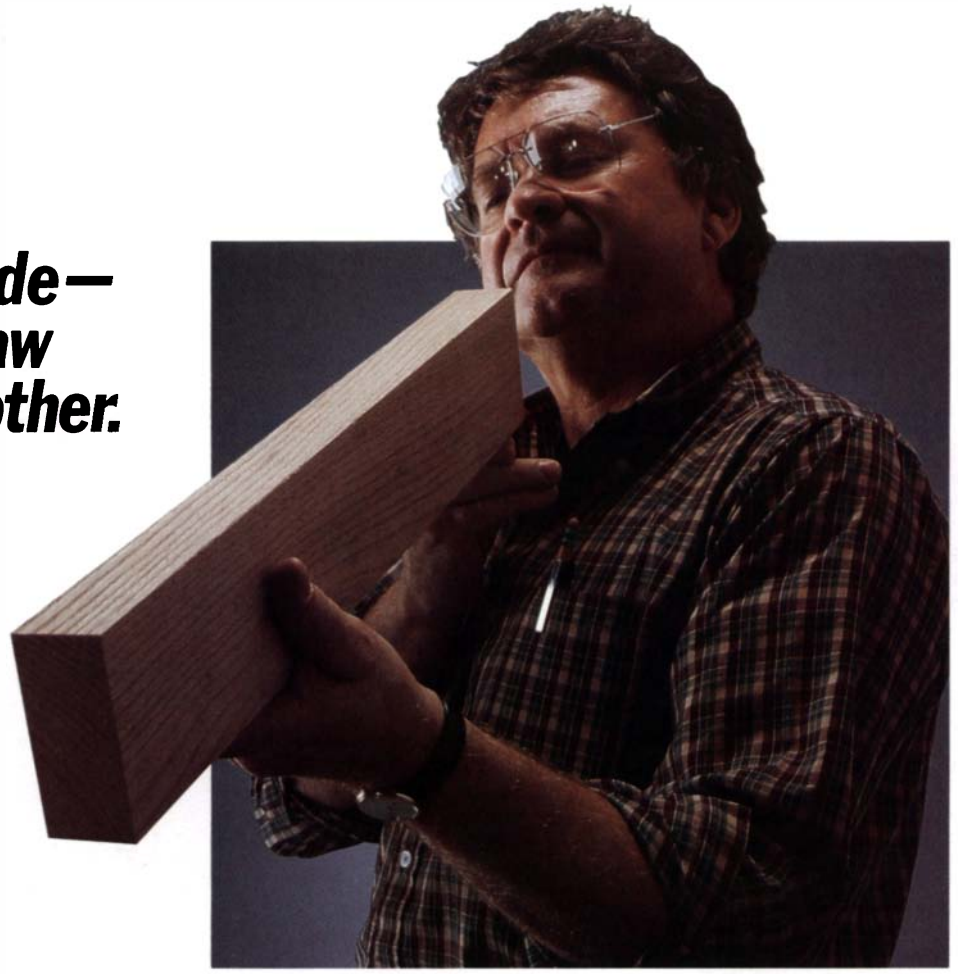
[Jim Cummins is an associate editor of *Fine Woodworking*.]

Readers exchange

I need information about the Great Wheel woodturning lathe. After researching the Dominy Collection at the Winterthur Museum, Winterthur, Del., a friend and I built a similar lathe for the Joynter's Shop At Pennsbury Manor, William Penn's reconstructed home in Morrisville, Penn. If you know of any existing Great Wheel lathes, or have any information or photographs that will help our research on these lathes, please contact Palmer Sharpless, 192 Durhams Rd., Newtown, Penn. 18940.

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

The Systi Matic blade—how and why one saw really can cut smoother.



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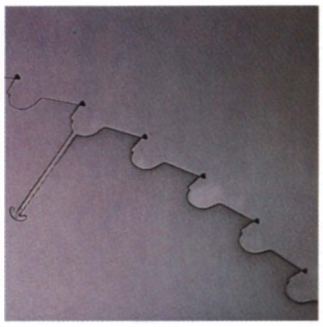

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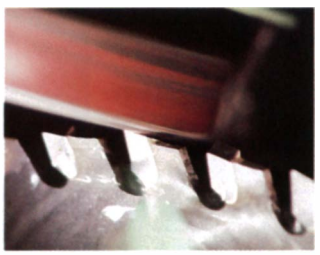

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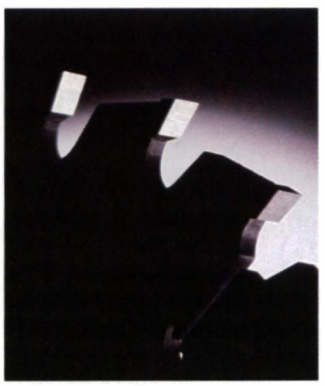

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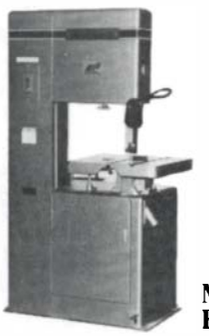

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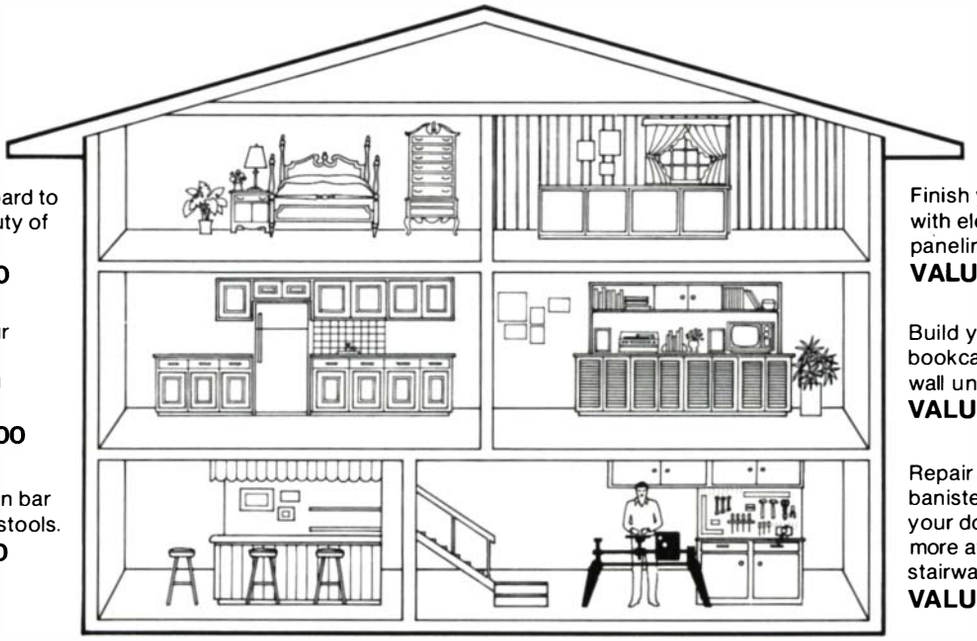

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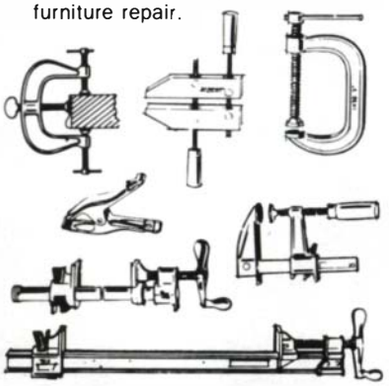

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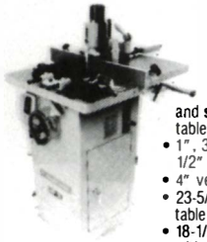

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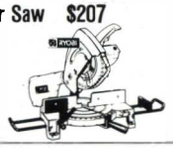

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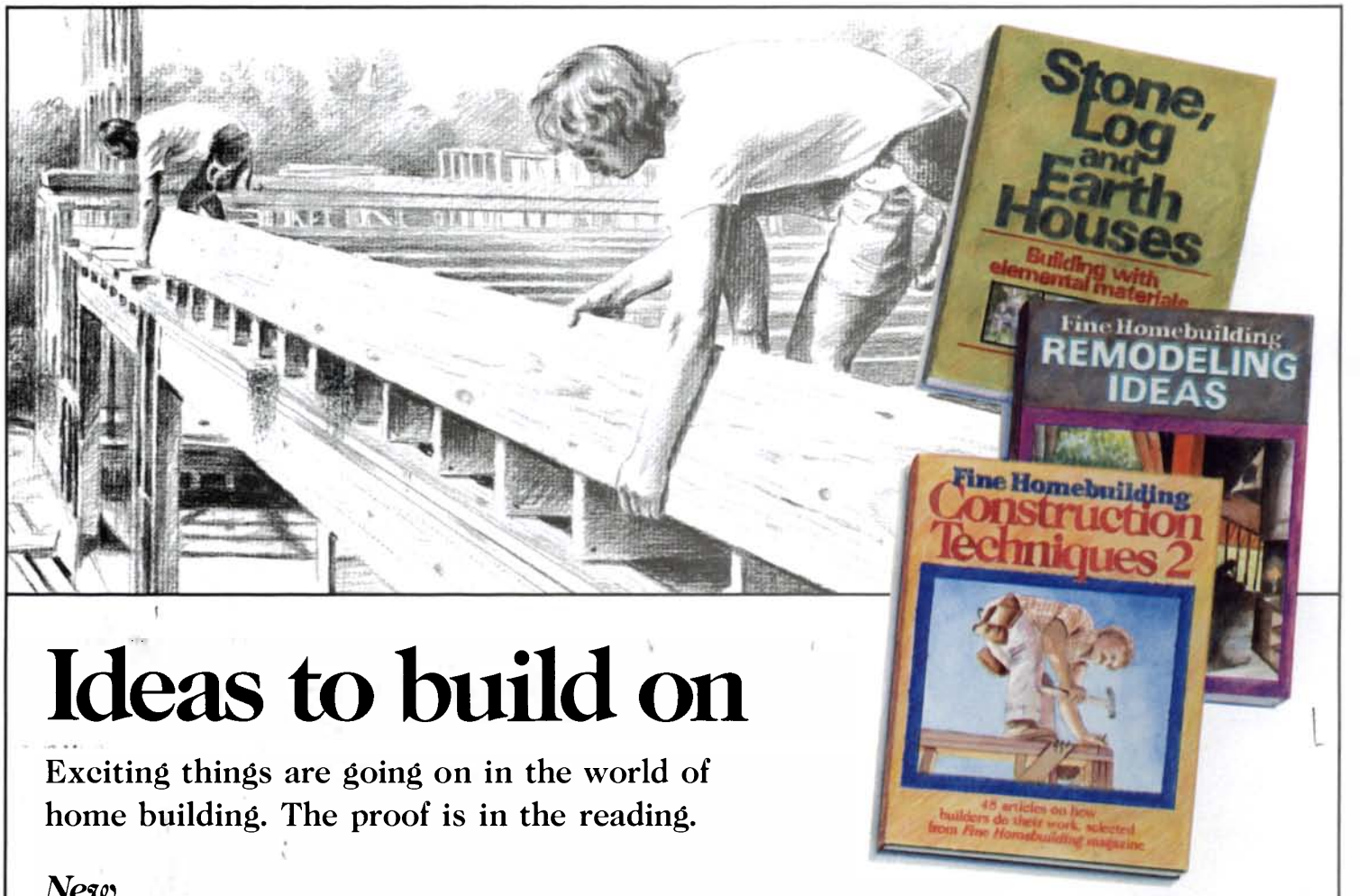

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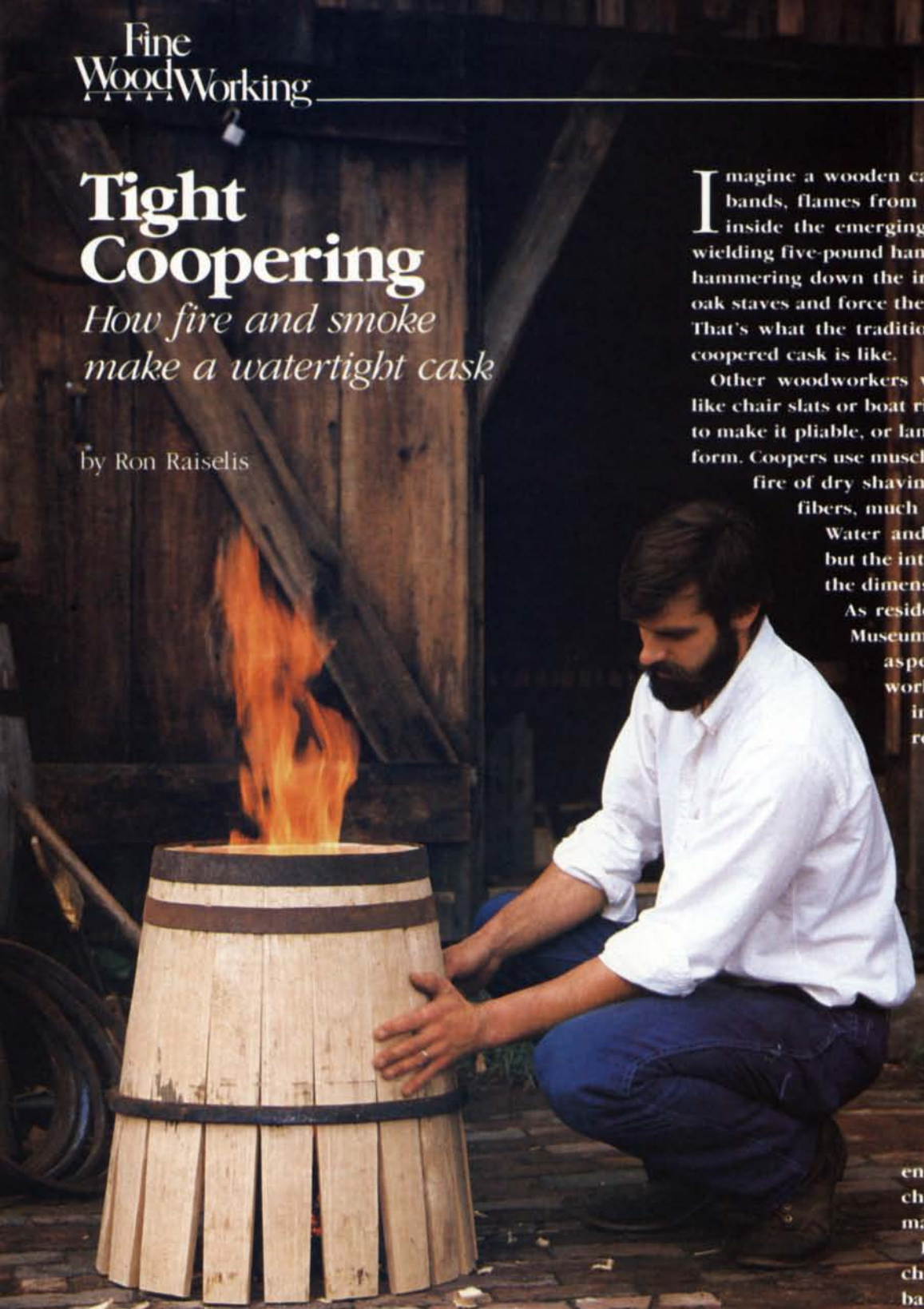
Fine Woodworking
January/February 1987

Tight Coopering

How fire and smoke make a watertight cask

by Ron Raiselis



Imagine a wooden cask, its staves held loosely by iron bands, flames from a scrap-wood fire licking up from inside the emerging barrel as you and your partner, wielding five-pound hammers, quick-step around the barrel hammering down the iron hoops that bend the 1-in.-thick oak staves and force them into the traditional barrel shape. That's what the traditional firing and trussing of a hand-coopered cask is like.

Other woodworkers who bend wood for curved parts, like chair slats or boat ribs, usually steam or soak the wood to make it pliable, or laminate thin strips of wood around a form. Coopers use muscle power and the heat from an open fire of dry shavings. This dry heat relaxes the wood fibers, much like a heating pad relaxes muscles. Water and steam would do the same thing, but the introduction of moisture might distort the dimensions of the staves and create leaks. As resident cooper at the Strawbery Banke Museum in Portsmouth, N.H., I practice all aspects of the cooper's trade: tight work, the most exacting and demanding skill of making watertight barrels like the one in the photos; white work, making straight-sided buckets and containers, usually with soft woods; and dry or slack work, making barrels for flour, apples and other solids. A barrel is a size or capacity of container, one holding 31 gallons. Other sizes range from the giant hogshead to half-barrel (15½ gal., about 100-lb. dry measure) to a firkin, or ¼-barrel, about 8 gal. I make and sell all sizes, usually to museums and historic restorations, though some amateur wine and beer makers order custom kegs. Most wooden barrels sold today are made by machines, whose untiring speed helped make hand coopering redundant.

In the days before stave-cutting machines and metal beer kegs, wooden barrels were the best containers for shipping and storage, and coopers zealously guarded the secrets of their trade. Apprentices were sworn never to reveal how wood was bent into the familiar broad-bellied containers that arched from end-to-end. Since Biblical times, that shape had proven rugged enough to be rolled down the gangplank of a ship or to be banged around in the back of a wagon, and to withstand great force from the weight of flour, apples or fish, or the fermentation of beer. The greater the belly of the barrel, the more internal pressure it can withstand. Nail kegs and other light-duty containers have nearly straight sides when compared to the broad bends of the staves in a beer barrel.

I became a cooper, even though the trade's been virtually dead in this country since the turn of the century, because I was intrigued by the cooper's unusual techniques and reli-

Raiselis twists his froe through a quartered block of green oak to split out stave blanks, left, then tapers and bevels each piece with a side axe. After shaping the outside of the stave with a straight drawknife, he uses a hollow shave, above, to scoop out the inside face so the stave can be more easily bent. The long butt joints on the staves are jointed and beveled on a coopers' jointer, which looks like an oversized, upside-down cabinetmakers' plane, right. The plane can be finely set, making it better than a power jointer for this operation.

Fig. 1: Parts of a barrel

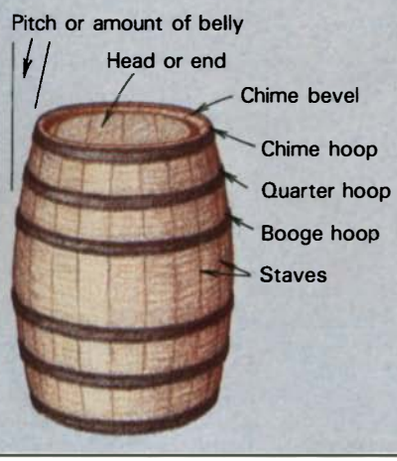
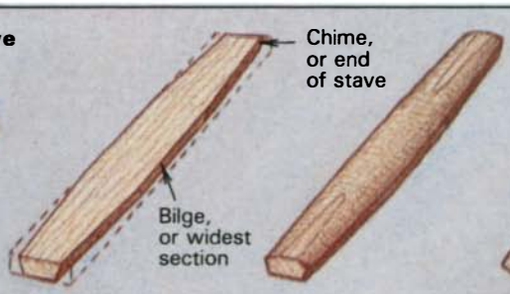


Fig. 2: Shaping a stave

Hewing

The cooper quarters the logs with wedges and sledgehammer, then splits sections into quarter-grained slabs, 3 in to 4 in. wide.

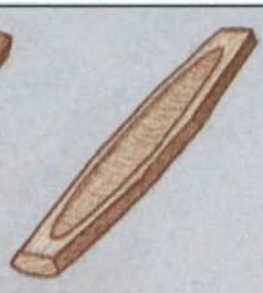


Listing

The long edges of each 1-in.-thick stave are tapered and beveled with side axe. All the shaping operations are done entirely by eye, without any type of gauge or template.

Backing

Working on a shavehorse, the cooper drawknifes the outside of stave to match the outer radius of barrel.



Hollowing

A curved drawknife is used to hollow the inside of the stave, to make it easier to bend.

ance on traditional woodworking skills and tools. My tools are the ones used by my predecessors—adzes, drawknives, spokeshaves and curved planes rescued from flea markets and antique auctions. My great-grandfather Benedict was a cooper, but I knew little about his work or coopering until 10 years ago when I went to Old Sturbridge Village, in Massachusetts, to learn traditional cabinetmaking and coopering. By studying the historical collection at Sturbridge and visiting other museums and coopers in the U.S. and England, I taught myself the trade.

The cask shown here is made of air-dried, riven white oak. Riven oak is easier to work than sawn wood because it's split along the fibers and is, therefore, very straight-grained and works easily in either direction. Virtually all watertight barrels are seasoned white oak. It's strong, durable, non-porous, bends well, and won't taint beer, spirits, and oils. Coopers also used many other woods, including red oak, ash, chestnut and hemlock for barrels to store dry goods, and pine for fish barrels and nail kegs.

I begin construction by sawing an oak trunk into bolts slightly longer than the height of the container I expect to make—about 24 in. for a half-barrel to about 34 in. for a barrel; a large cask may require staves nearly 5 ft. long. After quartering the log with metal wedges and sledgehammer, I split the sections again, using a froe, into quarter-grained staves 3 in. to 4 in. wide and about 1 in. thick.

The wood air dries for about a year before being shaped into staves, as shown in the photos above. Each stave is laid across the block and a side axe is used to taper and bevel the long edges. A side axe has a single bevel and a long, offset blade that lets you cut accurately down the stave. After clamping the staves in my shaving horse, I drawknife each to a uniform thickness, remove any wind or twist, and shape the outside and inside surfaces, as shown in figure 2. The mystery here, and a major reason why people didn't make their own barrels, is that all this shaping is done by eye. Unlike some European coopers (*FWW* #40), American and British coopers always worked without templates or gauges.

The most demanding part of stock preparation is jointing the staves to true the long edges and refine the bevels. The work is done on a cooper's jointer (above, right), a giant stationary wooden plane up to 6 ft. long that's mounted upside down on a stand. The stock is handheld and run over the jointer iron, similar to the way you'd pass stock over a power jointer. The trick is to cut all the staves exactly alike, a skill that only comes with experience, so they'll fit together perfectly and bend to create a barrel with the

Flames dart from within the circle of staves as cooper Ron Raiselis waits for the scrap-wood fire to warm the wood. Heat relaxes wood fibers so the staves can be bent into the traditional barrel shape.

Photos: Brian Gulick; drawings: Lee Hov

Staves are 'raised up' in an iron hoop that sets the barrel diameter. Raiselis steadies the staves with his left forearm as he adds more staves with his right hand.

Quick-stepping around the barrel, Raiselis and Jonathan Davol simultaneously hammer down the metal hoops that bend the warm staves to shape.

Cocking a hoop draws the staves together enough to reduce the diameter of the barrel so the next size hoop can be forced on.

correct pitch, or belly. The finished staves average 3 in. to 3½ in. wide. Before he can assemble the barrel, the cooper needs enough staves to fill the hoop that sets the diameter of the barrel, usually one stave for each inch in the diameter of the vessel.

After jointing, the staves are "raised up" in an iron hoop to create a frustrum, a truncated cone shape as shown above. Raising-up hoops for barrels are about 18 in. in diameter; one for a half-barrel would be about 15 in. in diameter. To raise the barrel, I hold the first stave against the inside of the hoop, add a second stave and grasp them both with my left hand. As I add a third stave, I grip the first two with my hand and support the new one with my forearm. After that, it's a matter of adding one stave at a time until the hoop is full. Once all staves are in the hoop, the frustrum will stand by itself until the first bending or truss hoop, called an overrunner, is put in place. This large metal hoop slides about two-thirds down the barrel. A blacksmith friend made my truss hoops from strong and durable ½-in. by 1-in. iron bar stock, but riveted ash or hickory hoops were often used by traditional coopers.

The cask is now ready to fire. Dry white oak shavings are packed into a cresset, a basket made from old iron hoop stock. The cresset is placed into the barrel and lit from the top to ensure a slow, even fire that heats the staves hot to the touch along their entire length. If you tap a warm stave with a hammer, it makes a dull thud, rather than the sharper resonance you get on cold wood. Normally the staves will be hot enough to bend in 10 to 20 minutes.

Usually it takes two men to hammer down the truss hoops evenly. We begin by driving the overrunner to the ground. Next, a truss hoop the same diameter as the bilge or belly (point of greatest diameter) is driven past the center of the staves to the bottom. When the second runner has been driven down, the staves are essentially the same diameter at the ends as at the bilge. A smaller hoop won't pass down from the top, but can be forced on by inverting the cask and cocking the last hoop, as shown in the top right photo, making the diameter at the end somewhat smaller. Like all other hoop stock, truss hoops have a taper to the inside surface, allowing them to draw the staves together more efficiently. Smaller hoops are driven on in succession, as the hammers strike simultaneously and a hoop is kept snug about the bilge to keep the outside fibers from fracturing. As each truss hoop is driven home, the staves draw closer together, and contain the heat better. The fire must be kept burning in the cresset during the whole process, and sometimes the staves begin to burn and must be swabbed with water. Deep charring is not a desirable effect.

The last truss hoop is driven down below the chime so an iron band can be hammered flush with the chime. This band is the same diameter as the raising-up hoop. Once this band is seated,

Inside a modern cooperage

by Sandor Nagyszalanczy

Stepping into the Demptos cooperage is like being transported back to the early days of the Industrial Revolution: craftsmen wielding hammers, adzes and handscrapers, work side-by-side with men operating power saws and lathe-like machinery in a shop redolent with the smell of fresh shavings and thick with woodsmoke. Although the Demptos family began practicing the art of the *tonnellier* (French for cooper) in France during the early 1800s, their California cooperage isn't bound by the methods of the past. They run a modern and efficient business, and augment the traditional hand-coopering techniques with the speed and muscle-sparing labor of modern machinery.

Demptos manufactures and supplies wine barrels to some of the finest wineries in the world. Their customers include some of the legendary chateaus of France, as well as Demptos' neighbors in the Napa Valley, the heart of America's most renowned grape-growing and wine-making region, and other acclaimed West Coast wineries. Even as plastic and metal containers threaten to inundate us, wooden barrels are essential for winemaking. The wood subtly interacts with the young wine, flavoring it as it ages, allowing it to develop its own particular body, acidity, finesse and flavor.

Oak imported from France is by far the most popular wood for wine barrels, due to its strength and superior flavoring properties, which vary with the region where the oak grew. Demptos prefers oaks from Limousin, Nevers, Troncais, Allier, Vosges, and Borgogne areas of France. Regardless of the oak's origins, the interior of each barrel must be scorched or toasted before it can properly flavor the wine. Toast levels vary from light, which just tans the oak, to very heavy, which actually chars it. The winery's enologist (winemaster) must consider all these factors—the oak's origins, the charring level and the type of wine to be made—before placing a barrel order.

Rather than hand shape each of the staves as traditional coopers did (see accompanying article), Demptos has its oak cut and shaped into staves in France. Machines automatically cut the perfect bevel and taper on each stave, regardless of its width, thereby eliminating one of the most tedious and demanding aspects of the old coopering trade. Once the staves arrive in California, they are raised up in the traditional way within an iron hoop and heated over an open fire until the staves are pliable enough to bend. The only modern innovation is a power winch and cable that tightens around the lower end of the barrel, pulling the staves into shape. After the temporary metal hoops

Fires burn in iron cressets as a cooper wraps a power winch cable around the hot staves. The cooper in the foreground is fitting a hoop on a 3-ft. tall barrel.

are hammered into place, the barrel is doused with water, placed over the burning cresset and sealed with a wooden lid to bake. This sets the staves in their bent form, as well as toasts the inside to the desired degree.

Next, the barrel is chucked on a large lathe-like machine that rotates the barrel ends against a whirring pair of saw blades and molding head cutters that trim the edges and cut the chime bevel and croze groove, all in about a minute. The bung hole is bored in the middle of the widest stave by a large drill press, then heat-scorched so it will make a better seal with the softwood plug. Hoops are fitted next: six per standard 60-gallon Bordeaux-style barrel; eight on the Burgundy type. Each metal hoop is measured, riveted, and fitted individually.

The barrel heads are also oak. Several narrow boards are held together by small steel pins instead of dowels. Before the head is cut to size, each individual barrel must be measured by walking a divider six times around the inside circumference of the croze groove to determine the exact diameter. This measurement is used to set the automatic head-cutting machine (undoubtedly the most sophisticated piece of machinery at Demptos). It rotates the blank past an unusual, conical-shaped rotary saw blade and cutter that create a perfectly sized disc with a sharp lip (called the bezel) designed to fit snugly into the croze.

After the heads are set into place and cleaned up with a bit of hand scraping and sanding, the barrel is tested for leaks. Rather than fill the barrel, the coopers pour a small amount of water into the barrel, then pressurize it with compressed air before rolling it about to check for defects. Open pores or insect holes that could dribble precious wine are plugged with small, sharpened oak pegs. Staves that leak badly are replaced.

With the middle hoops removed, the entire outside of the barrel is cleaned up by a power scraping machine, which has a large piston-like arm that forces a heavy blade up and down as the operator rotates the barrel and adjusts the depth of cut. The wide, thick, scroll-like shavings are collected and sold to winemakers who give their inexpensive product an aged flavor in much the same way as water is flavored with a teabag. Then, all the hoops are set by an enormous multiple-arm press. Like a trained octopus, it pushes each hoop down from all sides at once to ensure it's properly positioned and aligned. Finally, the ends of the staves are varnished to prevent wine from seeping through the porous oak, and the barrels are fumigated with sulfur gas to retard the growth of mold during storage and shipping.

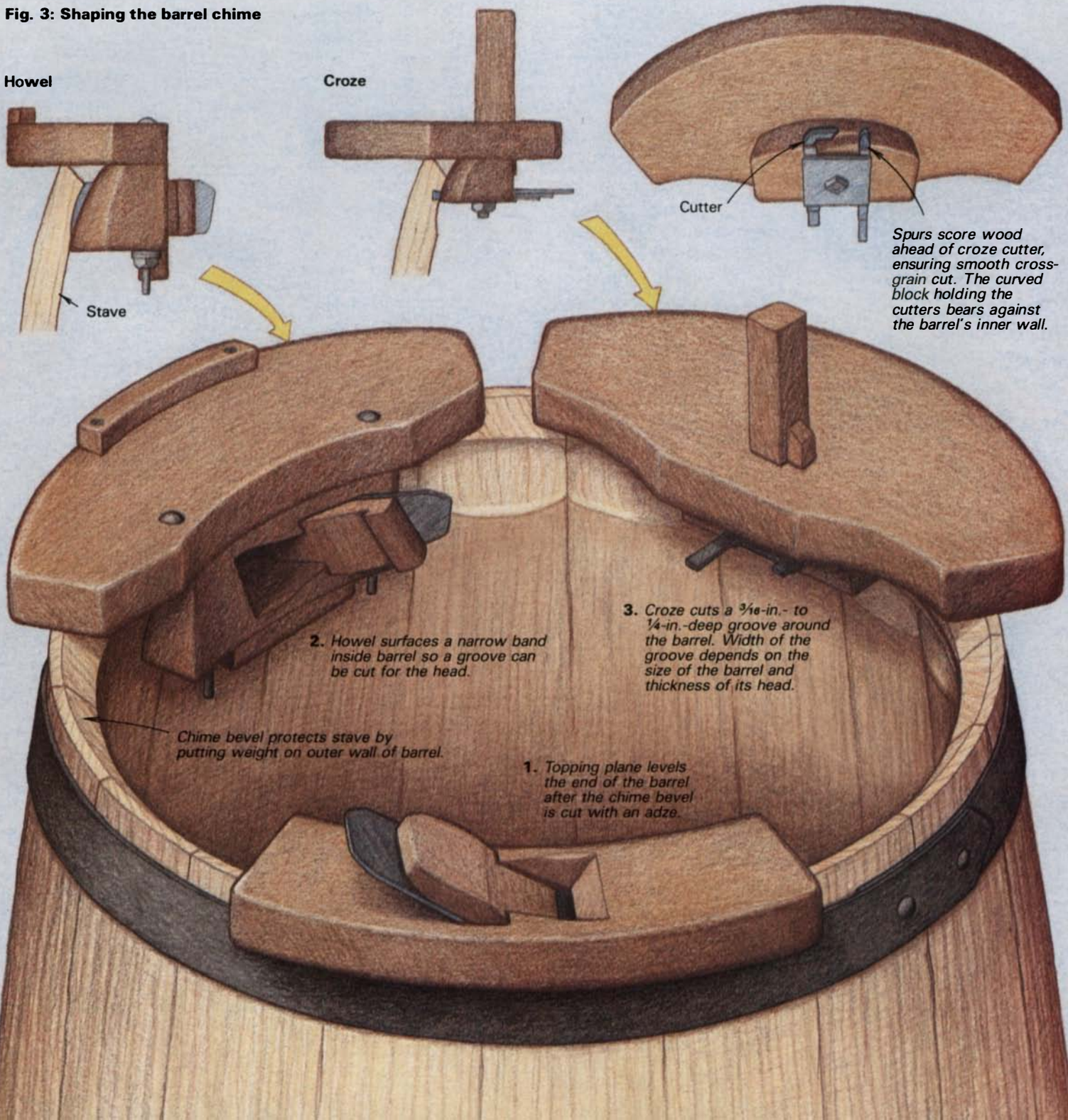
Despite the mechanization at Demptos, barrel-making is still fairly slow and highly hand-labor intensive—the seven-man crew at Demptos produces only about 15 barrels a day. But this seems perfectly appropriate when you consider the amount of time it takes to create a Grand Cru Classe Chateau Margaux. □

Sandor Nagyszalanczy is an assistant editor of Fine Wooodworking.

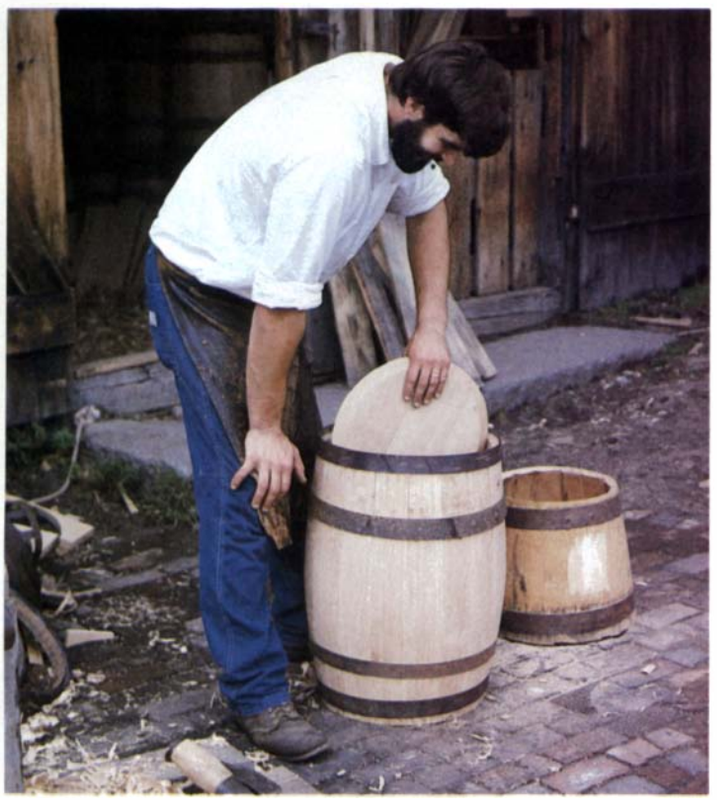
Warm wood cuts easier than cold, so Raiselis bevels the barrel rim with an adze as soon as the cresset's removed. The bevel keeps weight on the outer walls and off the grooved inner section.

Raiselis temporarily removes each metal hoop while he spokeshaves the barrel to remove irregularities between staves.

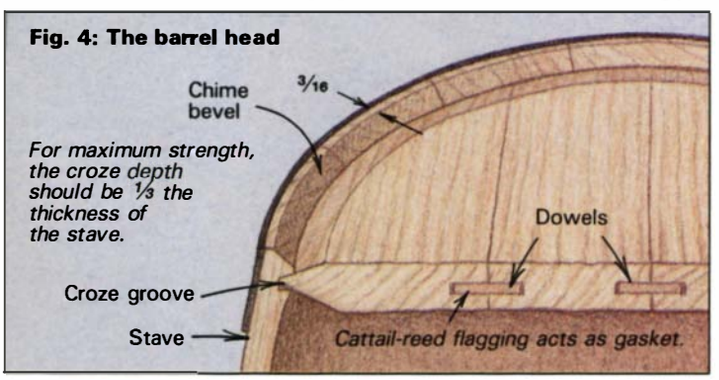
Fig. 3: Shaping the barrel chime



The bevel around the circular head, or end, of the barrel is roughly shaped with a side axe and finished with a heading knife.



Before snapping the head into the croze, Raiselis refines the bevels with a heading knife, which is curved for cutting endgrain.



photo, p. 42, the truss hoops can be struck off and iron bands driven on to support the bilge and quarter. With the joints tight, the cask makes a neat circle, but must be reheated again to "set" the staves in their bent positions. The cresset is re-filled, re-lit and put back into the barrel, which is sealed for 20 to 30 minutes with a cover of old stave stock.

When the cask comes off the fire, an adze is used to cut the chime (or bevel at the end), shown on the facing page, far left. The tough, white oak endgrain is easier to cut when it's hot. The chime bevel's important because it protects the weak, short grain above the croze, or groove, that will be cut into the barrel to receive the top and bottom panels, called heads. Once the bevel's cut, the barrel's weight rests on the staves' outer walls, rather than on the more fragile inner walls. Next, special planes are used to smooth the barrel's rims so it can be fitted with heads. First, the top of the chime bevel is leveled with a topping or leveling plane. The rim must be level because the fences of the planes used to smooth the inside ride on this surface. Next the howel is run round-and-round the inside of the rim to eliminate irregularities between staves and create a smooth band just below the chime. This surface is grooved with a croze, a curved plane with a pair of spurs to score the cross-grain and a narrow iron to cut the groove, also called a croze. The rest of the inside is usually left rough. Finally, the outside of the keg is smoothed with a spokeshave.

The barrel heads, which are fit into the croze, are also oak. Usually it takes three or four boards to make a panel slightly larger than the barrel opening. As a rule, the top and bottom are 1½ times the thickness of the staves. The pieces are jointed by hand on the cooper's jointer, then doweled together with round or square pegs. Before tapping the pieces together, a single strip of flagging, dried cattail reed, is placed along each joint. The flagging acts like a gasket to keep the joint tight when the barrel is filled with liquid. The pegs between the joints merely hold the pieces together until the head is fit into the croze; then the pressure of the hoops and staves keeps them tight. The assembled panels are flattened with a swift, a large spokeshave shaped something like a chimney swift in flight.

The head must be beveled to fit into the croze. After sawing out the circle with a frame saw, I roughly bevel the head's edges with an axe, then finish the bevels with a heading knife, a large, heavy knife with a slightly curved blade to facilitate cutting on endgrain. Before the head can be fit into the barrel, the hoops must be slacked off enough to spring the staves apart. After the head's beveled edges are snapped into the croze, the hoops are pounded tight again.

Finally, the bending hoops are knocked off and replaced with permanent metal ones—mild steel for most barrels, brass for more ornate models and for some 19th-century naval work. Barrels for dry storage traditionally were hooped with bands of ash, oak, hickory or other saplings, split and notched to lock together around the barrel. The wooden staves are usually left unfinished.

It takes me about a day to make a watertight barrel like this, but an experienced brewery cooper could probably do two a day. Time isn't that important to me, though. What matters is preserving the coopering trade, its tools and traditions. I think it's good for people to realize the amount of work and skill that went into the most commonplace objects, and to see how really elegant a simple, functional handmade cask can be. □

Ron Raiselis operates the cooper's shop at Strawbery Banke Museum in Portsmouth, N.H. For information about the Museum, call (603) 433-1100 or write to P.O. Box 300, Portsmouth, N.H. 03801.

The two semicircular ends of this 10½-ft.-long dining table can be used as pier tables against a wall, or fastened together to make a separate round table. The top is maple veneer on particleboard, with banding, aprons and legs of solid purpleheart with ebony inlay.

Solid Banding on Round Tabletops

A three-section racetrack table

by Graham Blackburn

The commission was for a large, maple-veneered dining table with a broad, solid banding of purpleheart, and inlaid with ebony—a very striking color scheme. Eventually I'll make a set of chairs to match, but that's in the future, as my shop is too cramped for space to tackle both projects at once.

The initial problem was how to design a table that would be big enough for the occasional dinner party of 12 without dwarfing the three or four people who would use it the rest of the time. A table that expanded and contracted by means of leaves was out of the question because in its contracted state it would look far too small for the room it was to occupy.

The solution was a large table with removable ends that, when not required for the maximum number of diners, might stand as pier tables against a wall. This would leave a smaller center section to seat three or four more intimately, and still leave the room filled comfortably. The full table is a form known as a "racetrack" table—that is, an oval table with straight sides. Besides maintaining comfortable spatial relationships between the room and the table, this arrangement also makes possible a variety of seating opportunities, as shown in figure 1.

I made up the veneered sections using a large press belonging to a friend. Not only does veneer make the construction of a large flat surface easier than using solid wood, it also allows the use of patterned figure, and avoids problems of expansion and contraction that would otherwise destroy the solid-wood banding.

Using a standard-density particleboard, I laid up fiddleback-maple in the pattern shown in figure 2. This pattern ensures that the two end sections join the center section and each other with a book-match that's balanced from the very center of the whole table. The underside was simply slip-matched with plain maple. As shown in the drawing, I faced the joining edges of the sections with ½-in. maple. The alternative would have been to veneer these edges later, after the panel had been veneered and trimmed. This is not a bad practice, but it does leave an extra line of veneer showing.

It's worth noting that, for a table this size, ¾-in. particleboard

Photo: Woody Packard

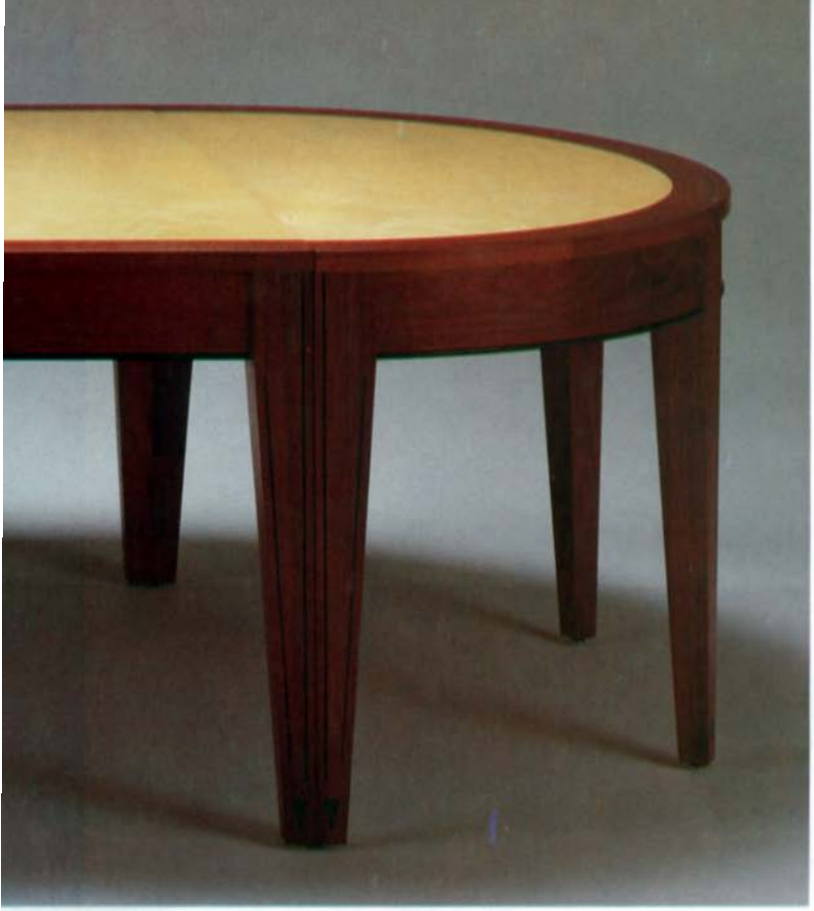


Fig. 1: Seating possibilities

Repositioning the table's three elements allows varied and comfortable seating. A table with leaves, another possible design choice, would have folded up too small for the scale of the room.

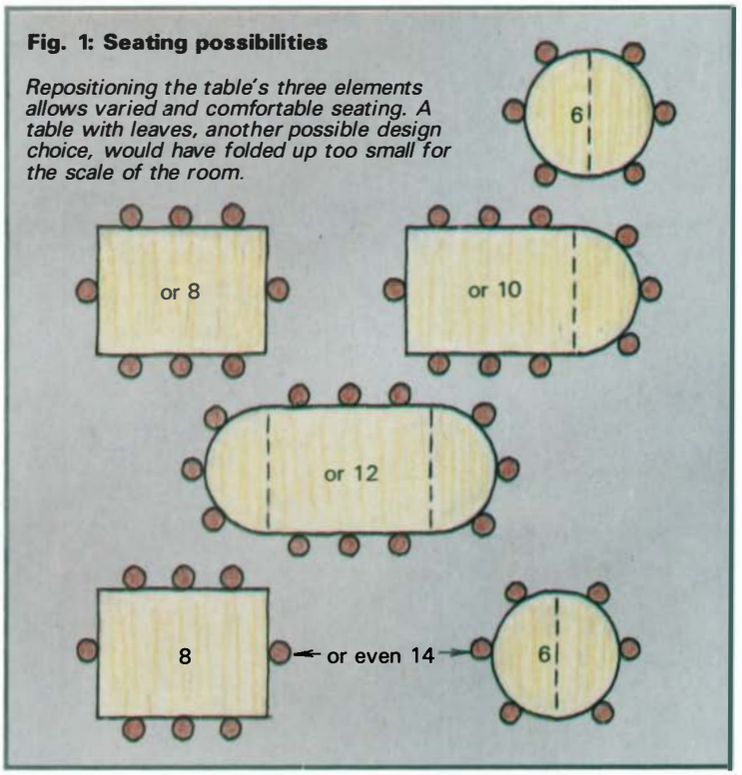
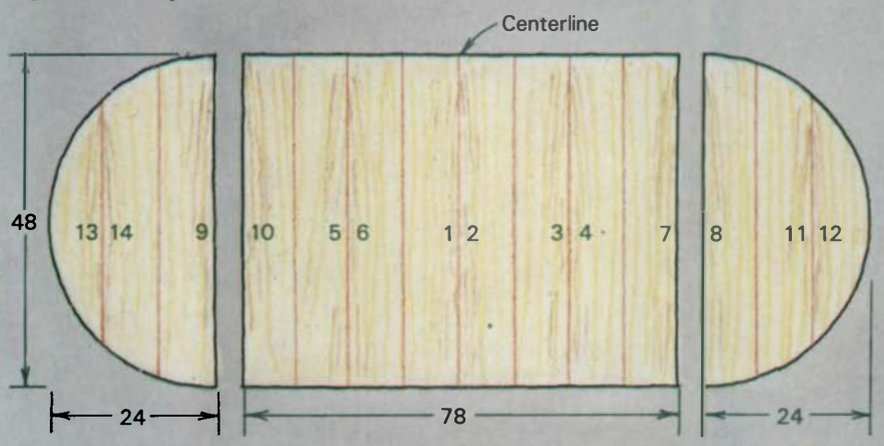
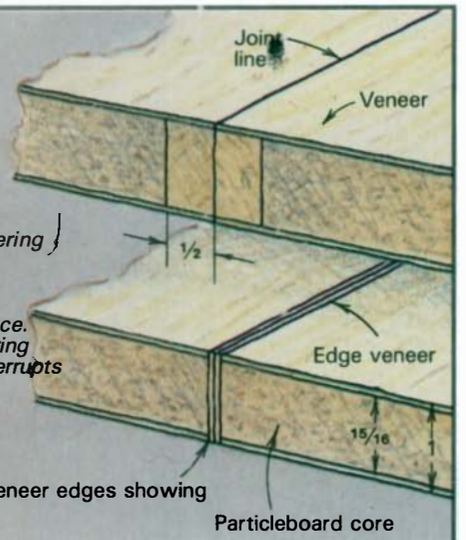


Fig. 2: Veneer pattern



Numbers indicate position of each leaf in the flitch. This layout averages differences from leaf to leaf, and also creates a match when the two ends are combined into a round table.

Lipping core before veneering (top) results in a visually continuous veneer surface. Edge-veneering (bottom) interrupts surface.



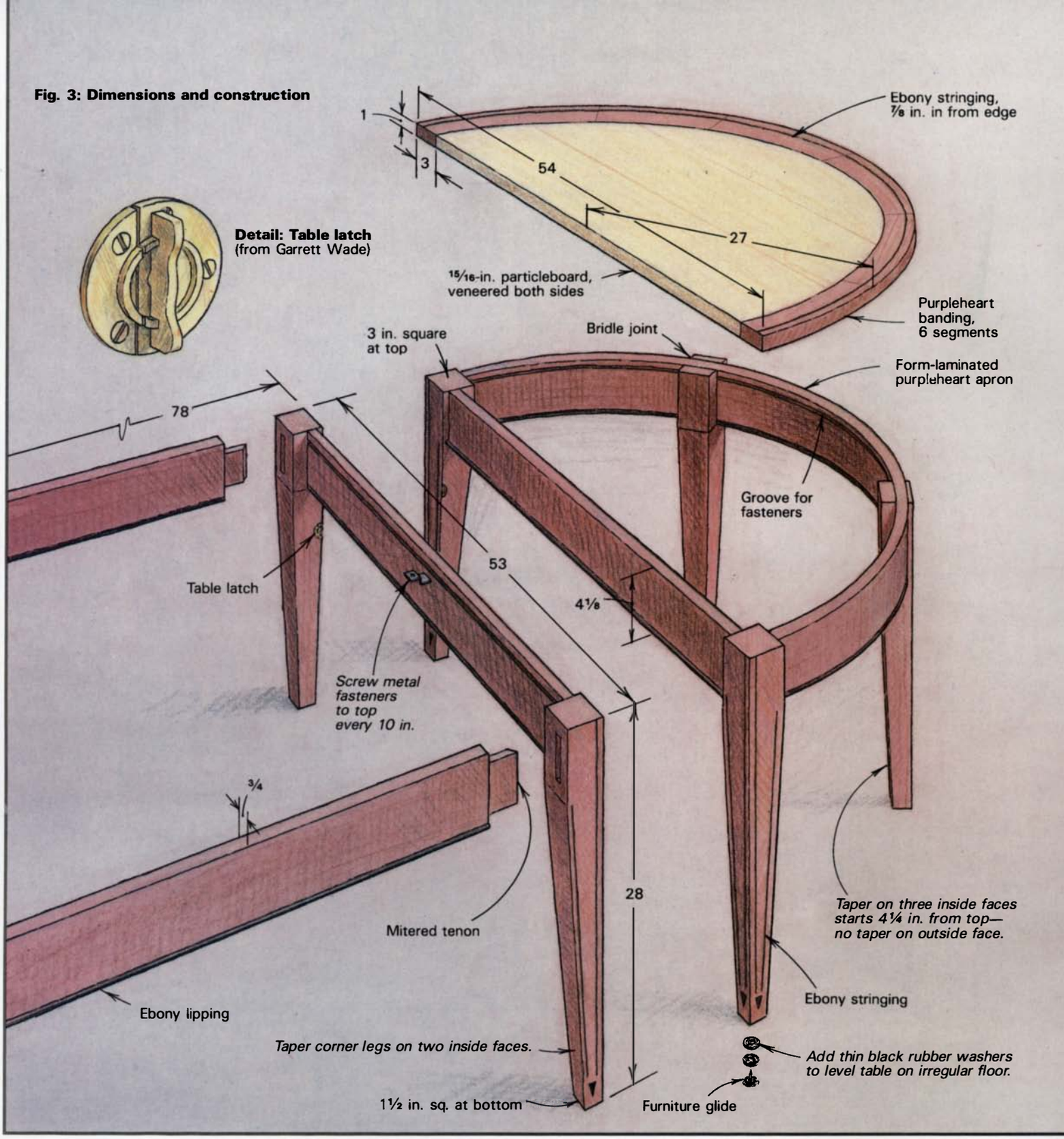
would have looked too thin. I custom-ordered a sheet of particleboard, thicknessed to 15/16 in., from the Eagle Door and Plywood Co. (450 Oaktree Ave., South Plainfield, N.J. 07080), so that when the top was veneered on both sides it would be a full inch thick.

Banding is frequently veneered cross-grain on solid or veneered stock. This has its advantages—the grain is always perpendicular to the edge, there's little waste, and the pieces are often small enough to minimize any problems related to wood movement. However, solid banding has advantages, too—the edge doesn't have to be separately veneered or previously faced, and it's easier to work any desired molding in a solid edge than in a veneered or composite edge.

To cut the ends to shape, a router was mounted in the circle-cutting jig shown in figure 4 (p. 49) and the jig carefully positioned on the panel at the center mark. With a ½-in. double-flute helical bit, I took four increasingly deep passes to cut out the semicircle. As a precautionary measure, I had first drawn the outline on the panel with a pair of trammel points (with pencil attachment), and set the circle-cutting jig to cut ⅛ in. outside this line. Then, when the semicircle had been cut out, a light finishing cut, running the router the "wrong" way, clockwise, brought the panel to size and left a perfectly square edge.

There's always the question, when making a jig, of how refined it should be. If I know I will be using a jig over and over, I rarely resist the temptation to make it a visual and tactile pleasure—I am very fond of varnished mahogany and polished brass. But for a one-off job, I usually settle for a jig that will simply get the job done. This attitude sometimes makes me feel I'm a cog in a Rube Goldberg cartoon, but it has the advantage that when the job is done I can dispose of the contraption without remorse. If I'd saved every jig I've ever made, I wouldn't be able to walk through my shop.

The number of segments making up the edgebanding is a matter of choice, depending partly on how well you can match the grain, but for a two-part circular top the number must be even. I chose 12—six a side—since I would be able to get all the seg-



ments sequentially out of one length of purpleheart I had on hand. Figure 5 shows the general arrangement of the banding and also how to work out the angles for the banding segments. The width of the banding is a matter of choice, in this case I thought 3 in. looked nice. If you have a board somewhat longer than the circumference you intend to band, then all the segments can be marked on it in a straight line and numbered so the grain can later be matched.

Having done this before, I had a template on hand that I used to indicate the segments on the chosen board; you can make a template exact enough for this purpose by marking the position of the six segments around one of the semicircles—the distance between marks will give you the inside measurement of the segment and you trace the inside curve directly from the panel.

I used a protractor and a straightedge to produce the lines to the circumference. Even though I did this as carefully as possible, measuring between each point on the circumference gave me 12 slightly different lengths. So, I averaged out the distances and marked and measured again (and again) until each segment measured exactly the same.

Thickness the banding stock to a dimension $\frac{1}{16}$ in. thicker than the veneered panels; I'll discuss the reason for this a little later. Then, using the template as a guide, carefully cut the stock into lengths and rip the pieces to uniform width. Next, cut the miters

Fig. 4: Jig details

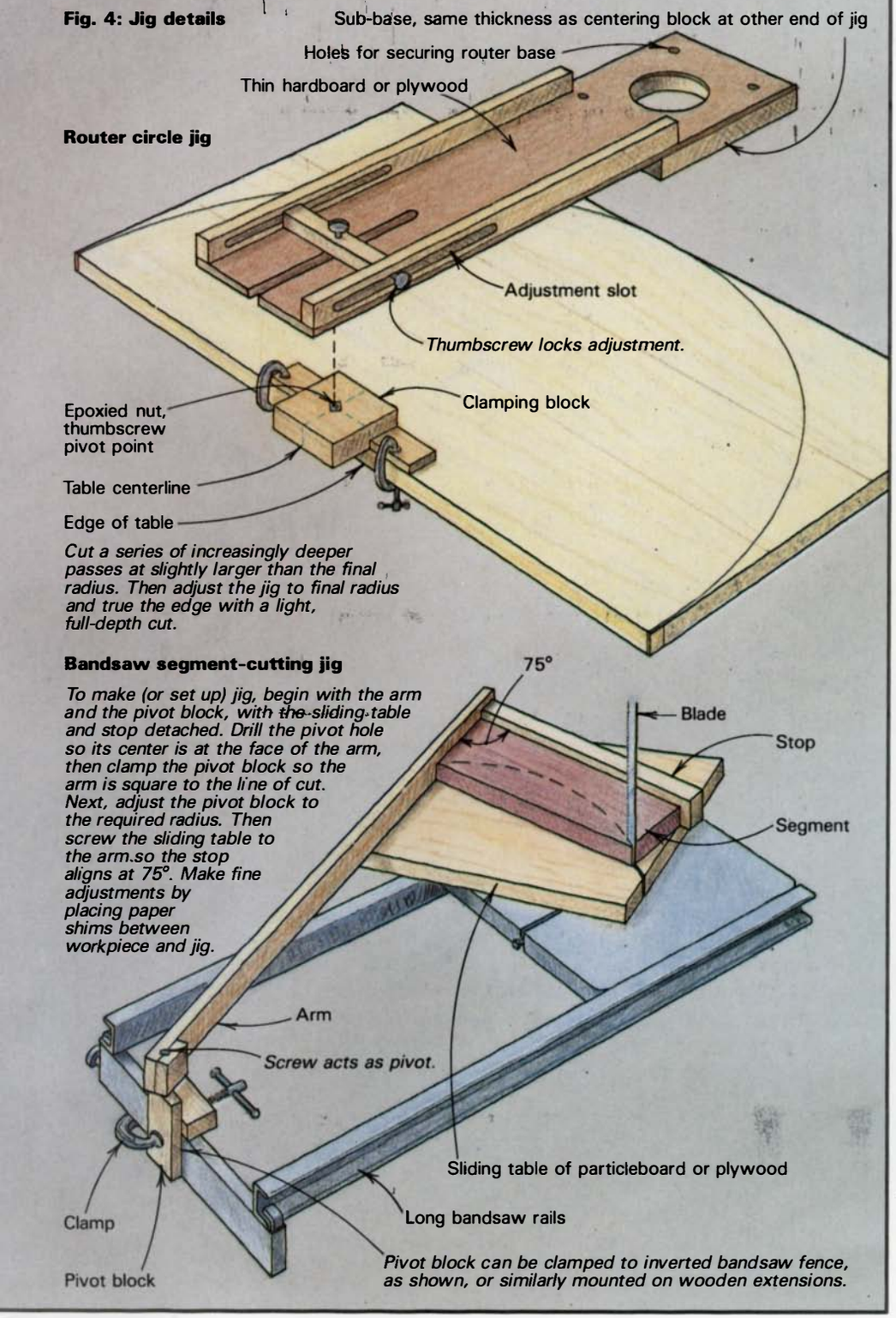
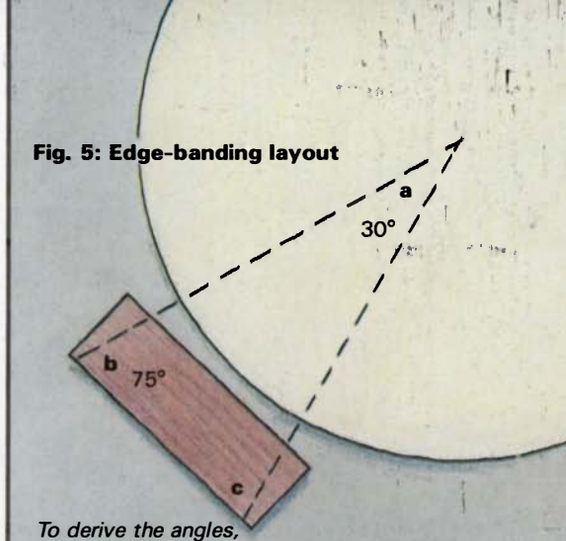
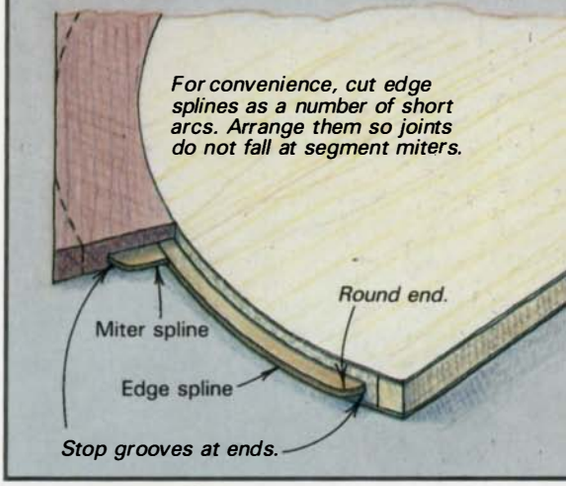
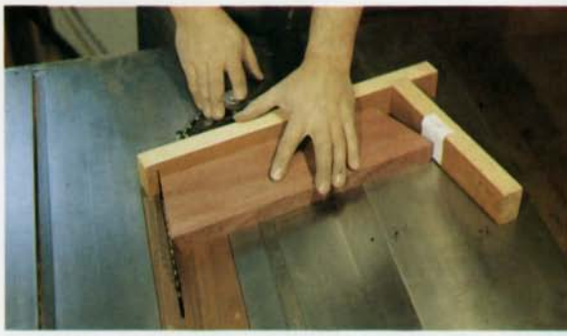


Fig. 5: Edge-banding layout



*To derive the angles, divide the number of degrees in a circle, 360, by the number of segments, 12. This gives the inner angle, **a**, 30°. Then, since every triangle contains 180°, angles **b** and **c** must be 75°. Cut a template accordingly and use it to lay out the rough segments on the stock.*





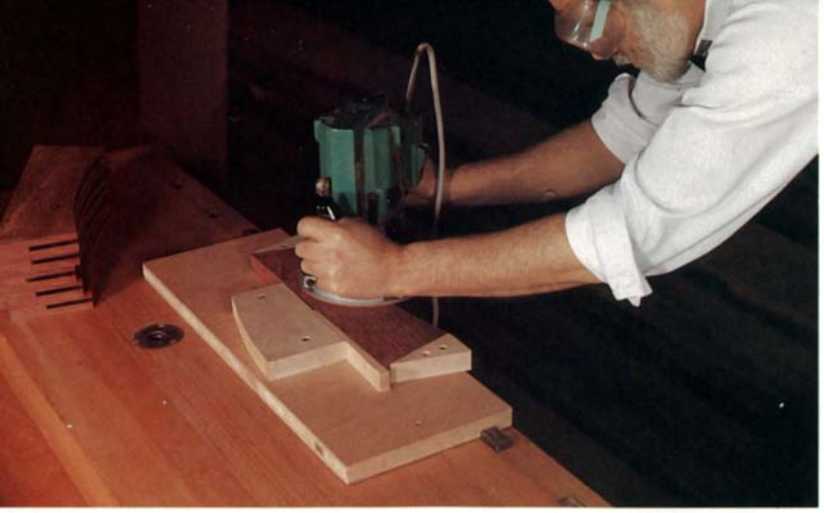
Segments of banding are precisely cut to length and end angle using this L-shaped jig attached to the miter gauge. Photo shows second end being cut, and the paper shims that allow fine adjustment.

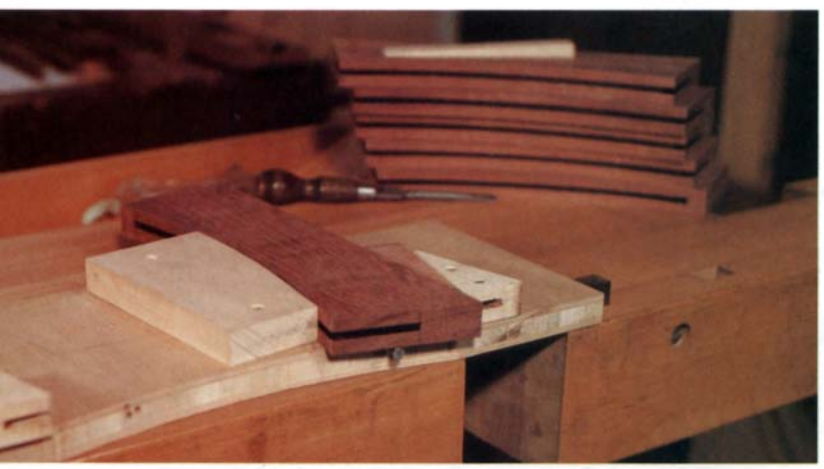
on the tablesaw using a stopped fence attached to the saw's miter gauge, as shown in the photo on this page.

When making this jig, position the stop so that the first miter is cut a hair oversize. When the workpiece is turned to cut the miter on the other end, paper shims stapled to the stop can be folded down to bring the second miter to exactly the right place. Adjust the number of paper shims until the distance on the short side is ***exactly*** the same as the distance between the segment-length marks on the rim of the semicircle. This is absolutely critical if all segments are to join perfectly and completely encircle the top. So make as many trial cuts as necessary to ensure that the angle and dimensions are correct.

The next step is to cut the inside curve on the segments so that they fit against the edge of the semicircles. I accomplished this with the help of a shopmade jig for the bandsaw. The basic construction and the important pivot and adjustment details are shown in figure 4.

Here are a few less obvious points to bear in mind. First, make sure that the table, the jig, and the segment are all perfectly perpendicular to the blade, or the segments will tilt when butted up to the tabletop. Second, for a perfect arc to be cut, the leading edge of the blade's teeth must be exactly perpendicular to the *very center* of the jig's pivot point. And third, the distance between the center of the pivot point and the inside edge of the





Blackburn routs slots for splines with a slotting cutter whose pilot bearing rides along the work's edge (top photo). The clamping jig holds the work securely by means of wedges and movable blocks that can be screwed down where needed. When slotting the miters (lower photo) the screw shown acts as a length stop.

blade must be the same as the radius of the tabletop. Having set everything up to these specifications, increase the radius by 1/32 in. and, once again with the use of paper shims, make a trial cut on a piece of scrap (cut to the same size as the segments) to ensure that the blade enters and leaves the segment exactly at the corners. With a perfectly sharp bandsaw blade, it's possible to make a finish cut good enough to glue onto the table edge, but I prefer to make the cut 1/32 in. larger, then individually fit each segment at the proper place on the circumference using a compass plane. If you don't have a compass plane, you could true the curve by adapting the router setup used to cut the semicircles, or by using a shaped sanding block.

At this point you can lay out the segments around the two semicircular tops, arranged as one circle, to check for correct miters, closeness of fit, and overall length.

Cutting the grooves for the splines that attach the segments to the tabletop and each other is the next operation. This used to be done with a hand router with a curved sole, but is now more easily accomplished with an electric router, a slotting bit and a small holding jig, as shown in the photos above. The reason for having cut the segments 1/16 in. thicker than the tabletop now becomes clear—to ensure that the segments, when attached, will be a little proud of the table's surfaces (both top and bottom). This makes planing and cleaning up the banding easier and safer than dealing with a surface that could possibly be lower than the central veneer. The easy way to achieve this fit is to cut the groove in the tabletop first, and then lower the bit 1/32 in. before cutting the grooves in the segments.

Splines may be made from Masonite or plywood—just choose a slotting cutter of the same thickness. For a 3-in.-wide banding, a 1-in.-wide spline is adequate. You can lay out the curved strips with trammel points and cut them on the bandsaw. Be sure to check that the spline is not too wide anywhere—it would be disastrous to discover this in the middle of gluing up.

The assembly order is as follows: First glue the edge spline into one of the halves, then glue the first end segment and attach. Glue and insert the miter spline and then attach the next segment, and so on. When both halves are banded, clamp them together with a band clamp around the whole circle, pulling opposite pairs of segments into position, where necessary, with a long bar clamp. To ensure that the end segments on both halves line up with the ends of the halves, insert a strip of batten between the two halves. Wax the batten so the glue doesn't stick to it.

Gluing-up a top of this size is quite a lot of work, and white glue might give you a little more time than yellow glue, but even so you'll have to work fast and carefully. Position each segment exactly, for it will not want to move much horizontally when all of its neighbors are in place. As soon as you have made sure that all the segments are tight against the veneered panels, and all the miters are closed, make one more circuit before the final tightening of the band clamp, to check that the top surface of each segment is flush with its neighbor. Any discrepancy here can be rectified with a smaller clamp directly over the joint.

To cut the outer circumference, separate the two halves and reattach the router circle-cutting jig as explained earlier, but this time increase the radius by 3 in. (or by whatever width banding you have decided on). Slowly, in small increments to avoid tearout, trim the outside edge to a semicircle. This is a critical step since you have invested so much time by now. You might even first cut close to the line with the bandsaw, or even a saber saw, and then merely trim to the finished size with the router.

Final treatment of the edge can be achieved in various ways. I prefer a few light passes with the compass plane, but this must be set very finely and be very sharp because of the alternating grain direction on each segment. Another choice would be to make a curved sanding block from scrap.

The top and bottom surfaces of the banding can now be planed flush with the veneer and then the whole surface gone over with the scraper.

The other construction details are shown in figure 3. When making my table, I edgebanded the center section with two straight pieces cut to the same width as the curved banding.

Legs were cut and mortised to receive the aprons, which, for the semicircular ends, were form-laminated (*FWW* #54). The two central legs at each end were attached with bridle joints, all others with mortise-and-tenon joints.

Before the legs and skirts were glued up, the legs were tapered, and the skirts slotted at the top of the inside to receive the metal fasteners that hold the top down.

Finally, the tabletop and legs were inlaid with ebony stringing. I had left the inlay design to the end, as a sort of insurance policy, thinking that if any of the joints in the banding did not fully close up, I could position the stringing to cover the gaps. I am pleased to report, however, that this consideration did not materialize. In fact, the glue lines were all so clean, I decided they should be left to be seen. When the fates are kind, why not go with the flow? □

Graham Blackburn is a furniture designer and maker in Woodstock, N.Y., and author of numerous books on woodworking.

Dennis Young shapes a Windsor chair back with a drawknife.

Profile: Dennis Young

Californian builds on six years of apprenticeship in Japan and England

by David Sloan

Few Westerners know, firsthand, the rigors of a traditional Japanese apprenticeship. Dennis Young is one who does. In 1972, Young left his native California to begin a four-year apprenticeship at Matsumoto Mingei Kagu, a furniture workshop in Central Japan. Here, he hoped, he would get the traditional hand-tool training he was unable to find at home.

"It was a disciplined, severe environment," remembers Young. "I had no privacy, no time for myself." Young worked ten hour days, six days a week and half a day on Sunday. (He spent his "free" Sunday afternoons working in the company fields.) For months he performed routine tasks around the shop. The work was extremely repetitive, and he hungered for the chance to make furniture. "At the end of six months I was really fighting the routine. One day the factory manager deposited me with an older craftsman who was to be my teacher." Young was given a floor-level workbench and a mat. He sat there for two days before his taciturn teacher acknowledged him. "At that point, I didn't speak Japanese well enough for us to communicate and I don't think my teacher knew how to respond to me, a Westerner." says Young. The demands of his teacher were stringent. He spent several months just learning to sharpen. Finally he was taught to make a chair. "I felt tremendous pressure to work to a degree of tolerance that I found exhausting on a daily basis." After a year, Young's work was thought good enough to go out the door with the regular factory production.

"Everyone referred to learning as 'stealing' techniques. Your teacher would show you the basics of a thing but you were expected to learn the fine points by observing." Apprentices would sometimes resort to sneaking a look at the master's tools after hours to learn how to tune their own.

Matsumoto makes both Asian and Western-style furniture, and Young found himself making Windsor chairs in the middle of Japan. Although parts were roughed out with the help of machines, finished surfaces were always produced with handtools. "There wasn't much allowance for individual interpretation at Matsumoto and this was a way for the craftsman to impart his own personality into the work."

After four years, the isolation and lack of free time proved too much and Young decided it was time to leave. "I never really enjoyed it there—the lack of privacy, the rigors. . .but the level of skill was so high. I just had this burning desire to be a craftsman."

Young's desire to learn took him next to England where he hooked up with Stewart Linford, a chairmaker in High Wycombe, a town west of London once known as the chairmaking capital of the Western world. From Linford, Young learned the traditional method of making English Windsor chairs—a nearly extinct trade. He mothballed most of his Japanese tools and learned to use arcane English tools such as spoon bits, and a tool called a travisher, a sort of bent spokeshave for finishing dished seats.

After a year and a half, he went on to another shop for six months where he learned to make what were called "best" chairs, mostly in the Chippendale and Hepplewhite style. Here Young worked with his Japanese tools, much to the amusement of his mates. "'Airplane propellors,' was what one elderly chairmaker called my Japanese saws," recalls Young. "Not one person I worked with expressed more than a fleeting interest in my tools." Frustrated with the low wages and England's notoriously un-sunny

Photos: Schopplein Studio

Not surprisingly, some of Young's designs show a strong Oriental influence. The bookcase above, made of purpleheart with ebony drawer pulls, is 30 in. tall and 6 ft. long. The room divider on the facing page is patterned after a traditional Japanese *tsi tatte*. The frame is padauk, the fabric by Myung Jin Fabrics. The Honduras mahogany and rosewood bookcase next to the divider shows a strong Korean influence. The padauk table is similar to the low tables used in Japan; its mortise-and-tenon joints are cut with sloping shoulders. A ¼-in.-round strip of wenge is glued into a slot cut around the perimeter of the top. (Young was assisted by Mineo Tsutomu on the table and cabinet.) Chairs are the bread and butter of Young's shop. He makes all sorts, from the traditional Queen Anne side chair (below right) to the contemporary Windsor (left).

skies, Young returned to California in 1978. In borrowed shop space in Bolinas, he started making chairs and low-slung Japanese dining tables. Today, chairs are 50% of Young's furnituremaking business in Petaluma. He isn't tied into one particular style, but makes everything from traditional Queen Anne sidechairs to Windsoresque rockers of his own design. Young's cabinet and table designs betray more than a hint of Oriental influence.

Young still relies heavily on handtools, switching easily from Japanese tools to Western. "The English tools are great for removing material quickly, but the Japanese tools are more sensitive and leave a better finished surface." He still works at his low bench—Japanese style—for certain planing tasks.

Young feels that the most valuable legacy of his apprenticeship was the influence it had on his attitude toward work. "The sheer repetition taught me discipline and gave me the stamina to do hard work. I saw older craftsmen in Japan who could do monotonous, repetitive tasks and apply themselves in a very workmanlike manner. When I compare craftsmen in the U.S. to those in Japan, craftsmen here tend to be more self-indulgent and not so willing to do repetitive tasks. I believe repetitive shaping to be instrumental in developing a feeling for form. Although I don't think I've completely overcome laziness or self-indulgence, my training has helped me to confront repetitive work and do it skillfully."

It may soon be impossible to duplicate Young's experience. Even in Japan, traditional apprenticeships are pretty much a thing of the past. Most young people in Japan don't want to put themselves in that sort of rigorous situation. When asked if he would do it all over again, Young replied, "Perhaps. My experience in Japan was very painful. I'm happy to have achieved my level of ability, but I paid a high price for it." □

David Sloan is a former associate editor of Fine Woodworking.

Chucks for Woodturning

How many ways can a wood chuck chuck?

by David Sloan

I was taught that you had two choices when mounting work on the lathe—a spur center for long stuff and a faceplate for flat stuff. I can still hear my junior-high shop teacher extolling the virtues of these two implements as he held them aloft. He taught us to glue pretty green felt on the bottoms of our candlesticks and platters to hide the screw holes and spur-center marks. If you wanted another way to mount work on the lathe, you usually had to figure it out and make it yourself. Yes indeed, those were the Dark Ages of woodturning.

Today's turner has other options. There are some clever multifunction chucks being made today that can hold work in ways my shop teacher never dreamed of. Each chuck has limitations of its own, but adding one or two to your collection of faceplates and centers will make your lathe more versatile.

Some of the chucks being made today have features based on old designs that professional turners have been making out of wood for years. Screw chucks, cup chucks and "spigot" chucks (British turners call a round tenon a spigot), for example, are among those described in John Jacob Holtzapffel's 1881 book, *Hand or Simple Turning: Principles and Practice* (reprinted by Dover Publications, Inc., 180 Varick St., New York, N.Y. 10014).

England is the spawning ground for many of today's combination chucks. The first was the Myford 3-in-1. Designed by Edward Barrs in the mid 1950s, it combined faceplate, screw chuck and collar chuck. The Coil Grip Chuck, designed by Roy and Peter Child, expanded on the features of the 3-in-1 by adding a way to grip the work by compression. The 6-in-1 chuck, designed by Nick Davidson, was the first chuck with jaws that expand outward and lock into a recess turned in the bottom of a bowl.

From the ten or so combination chucks in production worldwide, I tried three that met the following criteria: The chuck had to be available from dealers in the U.S. or Canada and come in thread sizes to fit several different lathes. I also tried an inexpensive 3-jaw machinists' chuck. Some interesting chucks that didn't meet my criteria are listed on p. 57.

The chuck you choose depends on the sort of turning you do. If I could have only one chuck, I'd opt for maximum versatility. But, one chuck just doesn't do it all. I like to work with a screw chuck, a 3-jaw and a combination chuck. I've never found a better screw chuck than the Glaser, and I'd choose the Precision or Multistar over the Delta Super Chuck because they're more versatile.

David Sloan is a former associate editor of Fine Woodworking.

The Glaser Screw Chuck has a stainless steel screw with a thin thread that displaces very little wood, and a removable, reversible collar to support larger stock.

Glaser Screw Chuck

The Glaser chuck has the distinction of being the only American-made chuck I could find. It's an efficient, well-made tool and I wonder how I got along without it.

A hardened stainless-steel screw with a special thin thread protrudes from the center of the 1½-in.-dia. anodized aluminum body. The screw has no taper and the thin thread is designed to penetrate the wood with minimum damage. A reversible and removable collar screws over the chuck body to provide extra support (2½ and 3½ in. dia.) for large stock.

For facework or centerwork, you drill a ¼-in.-dia. hole in the stock and thread it on the chuck. The screw grips tenaciously, even in endgrain—something most screws won't do. Mounting and removing work is fast, which explains the popularity of screw chucks with production turners. Work removed from the lathe can be remounted accurately without much fuss. A screw chuck is also ideal for quick mounting of jam chucks and other homemade wooden chucks and faceplates.

The Glaser Screw Chuck, $69.50, is available from Jerry Glaser, 8341 Delgany Ave., Playa del Rey, Calif. 90293. Please specify type of lathe.

The Precision Combination Chuck comes with the accessories shown above, except for the optional spigot chuck at center right. The dovetail collets expand to grip a recess turned in the bottom of a bowl, top right. The pin chuck fits into a 1-in. hole, center left. When the bowl is rotated, it locks in place. The optional spigot chuck accessory is ideal for turning boxes. The Precision requires two C wrenches to change accessories.

Precision Combination Chuck

Designed by Nick Davidson and made in England, the Precision chuck is the updated version of his earlier 6-in-1 chuck. It is available in both right-hand and left-hand threads for a wide variety of lathes.

The Precision is a complex piece of machining, very nicely executed on computerized machinery. In its basic form it combines five functions. Two for face work: 3½-in.-dia. expanding dovetail collets and a 1-in.-dia. pin chuck, as well as three for center work: a 2⅛-in.-dia. cup chuck, a collar chuck, and a 3-way split ring. Optional accessories include smaller expanding collets, several sizes of screw chuck, a 2-in. spigot chuck, several sizes of collet-chucks and faceplate rings.

Can a chuck that does so many things do them all well? From my experience with the tool I would say yes, although changing from one function to another takes some time. Are all the functions equally useful? There were some that suited my style of working and some that didn't. Other turners I spoke with preferred different functions. I prefer the cup chuck and optional spigot chuck functions for turning end-grain boxes because they require less preliminary stock preparation than the collar chuck and split ring do and they don't waste as much wood. The collar chuck and split ring also impose some restrictions on design because the collar must slide over the stock. It's usually not practical to use them on stock that's more than 2½ in. in diameter.

To use the expanding dovetail collets, you mount the work on a faceplate, screw chuck or pin chuck, mark out a 3½-in. circle and turn a 5/16-in.-deep recess with dovetail sides. The cast pot-metal jaws expand inside the recess. They grip well, although I'm not wild about the concept of forcing the wood apart instead of gripping it by compression. Turn away too much of the supporting wood around the jaws and the wood may split when a tool catches.

The dovetail recess left in the bottom of the bowl is preferable to screw holes, and some may choose to leave it, although I prefer to turn away all signs of mounting. A nice feature of the expanding collet is that work can be removed and remounted without loss of center. In my opinion, the expanding collets really come into their own in conjunction with the optional faceplate rings, which screw to the work and have a dovetail recess that fits over the collet jaws. With this system, work can be mounted and removed very quickly,

and the rings also cost much less than conventional faceplates.

The pin chuck works well for gripping the uneven bark face of a block to turn a natural edge bowl, where you don't have a flat surface to attach a faceplate or screw chuck. The 1-in.-dia. pin can hold a heavy block of wood securely. With the blank on the pin, you turn the outside and turn a tenon for a spigot chuck or a recess for the expanding collet chuck.

To sum up, the Precision is a chuck that I'll always find a use for, even if there are some functions I don't really use. The nice thing about the Precision is that you can choose from so many optional accessories to suit the type and scale of your work. I haven't tried every accessory, but I find the chuck more useful with the 2-in. spigot chuck for boxes and a smaller 2-in.-dia. set of expanding dovetail collet jaws (the standard 3½-in. jaws are just too big for most of my bowls).

The Precision Combination Chuck is available from Cryder Creek, Box 19, Whitesville, N.Y. 14897, or Craft Supplies USA, 1644 S. State St., Provo, Utah 84601; $99.95.

Delta's Super Chuck Kit comes with two expanding collets, two wing cutters to cut the collet recesses, and a screw chuck. The backing plate doubles as a small faceplate. The split ring expands outward to lock into a recess cut in the bowl bottom.

Delta Super Chuck

Designed by Bruce Leadbeatter of Belmore, Australia, the Super Chuck is manufactured Down Under and imported by Delta.

The Super Chuck comes with two expanding collets (2 in. and 3 in. dia.), a screw chuck and backing plate that doubles as a small faceplate. Two wing cutters are included for drilling the recess into which the collet expands. The instructions recommend clamping the bowl stock to a drill-press table for this operation. A sharp ridge around the collet perimeter bites into the sides of the recess.

The chuck is simple and works well. The machined-aluminium jaws are contained by a spring, so they don't flop around and fall out as you insert them into the recess. As you twist the chuck, a cone-shaped boss draws against the backing plate, spreading the three collet jaws apart—simple and effective. Unlike the Precision, no wrenches are required to expand the jaws.

The collets are designed to keep you from turning away too much of the supporting wood around the jaws. This cuts down on the number of flying bowls, but limits how small you can turn the base with work mounted on the chuck—3¾ in. with the 3-in. collet and 3 in. with the 2-in. collet.

Centerwork can be mounted on the screw chuck, but the short screw doesn't grip as well in endgrain as the carefully machined thread of the Glaser chuck.

Delta Super Chuck is available from Woodworker's Supply of New Mexico, 5604 Alameda N.E., Albuquerque, N. Mex. 87113, and other Delta dealers; $120.

Grizzly 3-jaw chuck

I have always wanted a big 3-jaw chuck but balked at spending $200 to $300 for one. Sorely tempted by the bargain-basement price, I ordered a 6-in., Taiwanese 3-jaw from Grizzly. The Grizzly chuck has reversible self-centering jaws and it works. What more could you want?

Three-jaw chucks are dangerous. They don't grip as securely as the chucks designed specifically for woodturning, so a catch invariably sends the work flying. ***Always wear a face shield.*** Don't use one until you are so proficient with tools that a catch is a rarity. In addition, you can't see the protruding jaws when the chuck is spinning, and you'll get hurt if you touch them. If you paint the ends of the jaws with Day-Glo orange paint, you can see where they are.

The 3-jaw chuck is available from Grizzly Imports, P.O. Box 2069, Bellingham, Wash. 98227; $55.50.

The Grizzly 6-in., 3-jaw chuck sports reversible, self-centering jaws.

More chucks

Multistar Duplex Chuck System (£63.82, about $90, from Multistar Machine and Tool Ltd., Ashton House, Wheatfield Rd., Stanway, Colchester C03 5YA, England). A versatile combination chuck that grips by expansion or compression. Five jaw sizes available. Optional accessories include pin chuck, screw chuck and indexing device.

Myford 4-in-1 ($75.75 from Frog Tool Co., 700 W. Jackson Blvd., Chicago, Ill. 60606). A 3-in.-dia. faceplate, screw chuck, collet and screw-grip chuck. Available only with 1 in. by 12 right-hand thread for the Myford lathe.

Precision Collet Chuck (£46, about $65, from Craft Supplies Ltd., The Mill, Millers Dale, Buxton, Derbys. SK17 8SN, England). This one combines features of the existing Handy Collet Chuck and the Precision Spigot Chuck. □

Mode's wooden chuck allows him to turn shallow-domed lids or lids with irregular projections. The holes allow him to gauge the lid thickness. A wooden collet chuck can be made with a piece of springy hardwood and a hose clamp (shown below).

Do-it-yourself chucks

Professional turners often need to make special chucks for special jobs. Michael Mode, of Zionsville, Pa., came up with this ungainly-looking chuck, enabling him to turn thin, shallow box lids and lids with irregular projections, that would be awkward to chuck by any other means. The holes in the sides of the chuck allow him to feel both sides of the lid to gauge thickness.

The lid chuck starts as a block with two holes, mounted on a screw chuck and turned into a hollow cylinder with a shoulder at one end, as shown. Mode roughs the exterior of the lid on a faceplate, then trims the chuck to fit. He taps the lid into the wooden chuck to hollow the inside. When he's cut away too much of the shoulder, he glues an insert into the end of the chuck. —*D.S.*

Fastening Tabletops

How to cope with wood movement

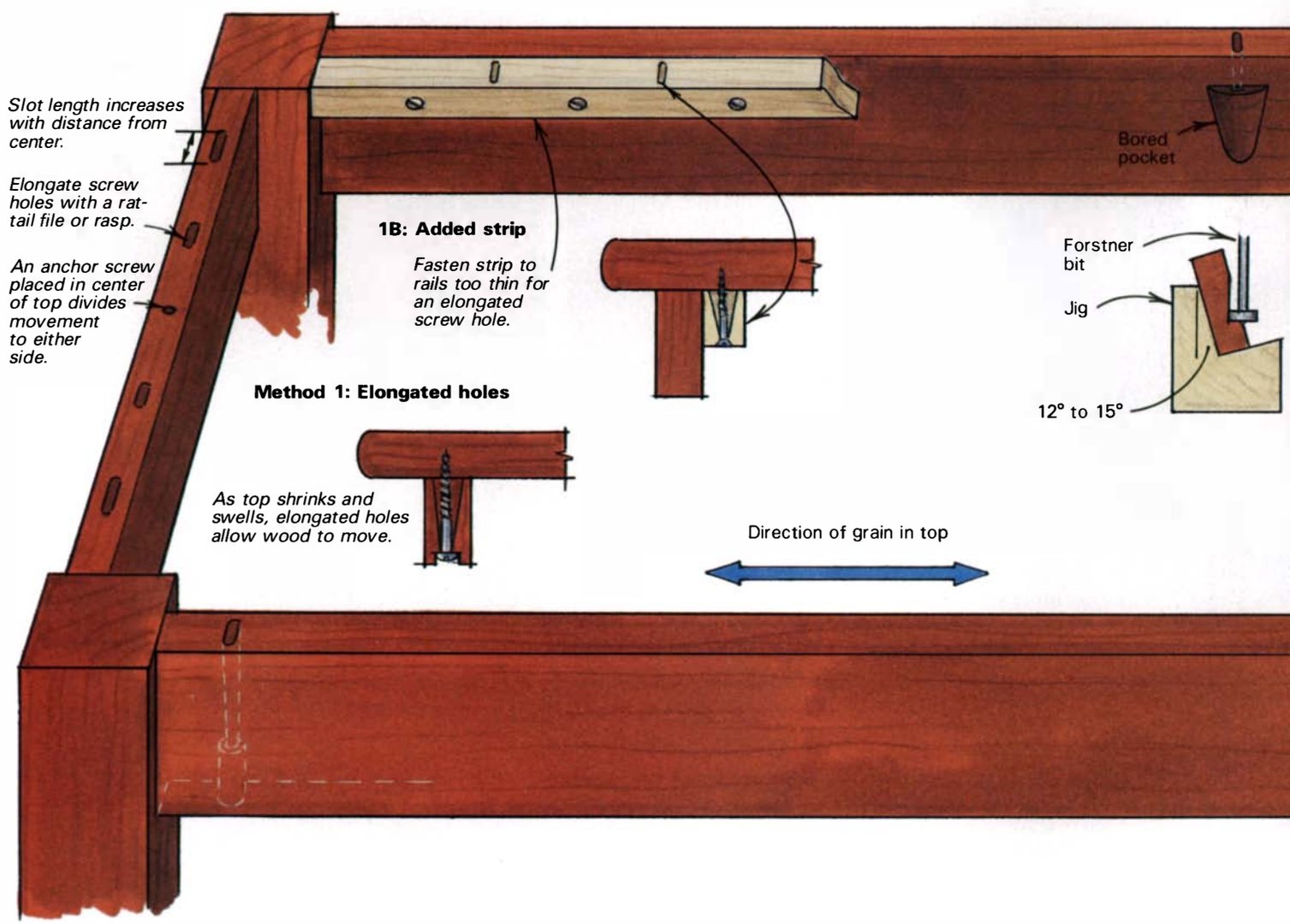
by Christian Becksvoort

I remember the first table I built in the junior high school wood shop: Philippine mahogany, carefully mortised and tenoned. When it came time to attach the top, I went whole hog; glue all around and black, round-head screws. I took the table home, put some plants on it and parked it directly over a hot-air outlet. Needless to say, the top did not survive the winter. It bowed and cracked. Thus ended round one in a continuing battle of wits between wood movement and my efforts to cope with it.

What it comes down to is this: When relative humidity goes up or down, so does the moisture content of wood, and it expands and contracts in width, across the grain. It doesn't change in length (actually it does, but so little that it can safely be ignored). The problem is how to attach a solid-wood tabletop that shrinks and expands across the grain to rails that don't change in length.

When designing a table, there are ways to minimize wood movement. In general, let the grain of the top run in the longest dimension. For example, a 3-ft. by 7-ft. tabletop should be glued up from 7-ft. boards, so there's only the movement of the 3-ft. width to contend with. On a round or square top, glue up the top from quartersawn stock, if possible, because it's likely to move about half as much as plainsawn stock.

Even using quartersawn stock won't eliminate wood movement problems, so I use one of the four methods shown in the drawing to accommodate movement. All of these require screws in some form or another. No matter which method I use, I anchor the tabletop at each end with a screw through each rail, skirt, brace, or support where it intersects the centerline of the



top. This screw divides potential wood movement into halves, 50% to the left of center and 50% to the right.

Method 1, the one I use most often, is simply screws through the table rails into the top. Except for the anchor-screw hole at each end, the holes are slotted or "ovalized" in the direction of potential movement with a rat-tail file or rasp. In the end rails that run across the grain of the top, the farther these holes are from the center, the longer the slots. In the side rails that parallel the grain of the top, the slots are all the same length. Use an awl to mark the actual location of the screw in the slot. To ease the actual movement I sometimes use round-head screws and washers.

On a table with relatively thin rails, the slots would break through the side rails. In this case, I glue or screw strips to the inside edges of the side rails, as shown in drawing 1B.

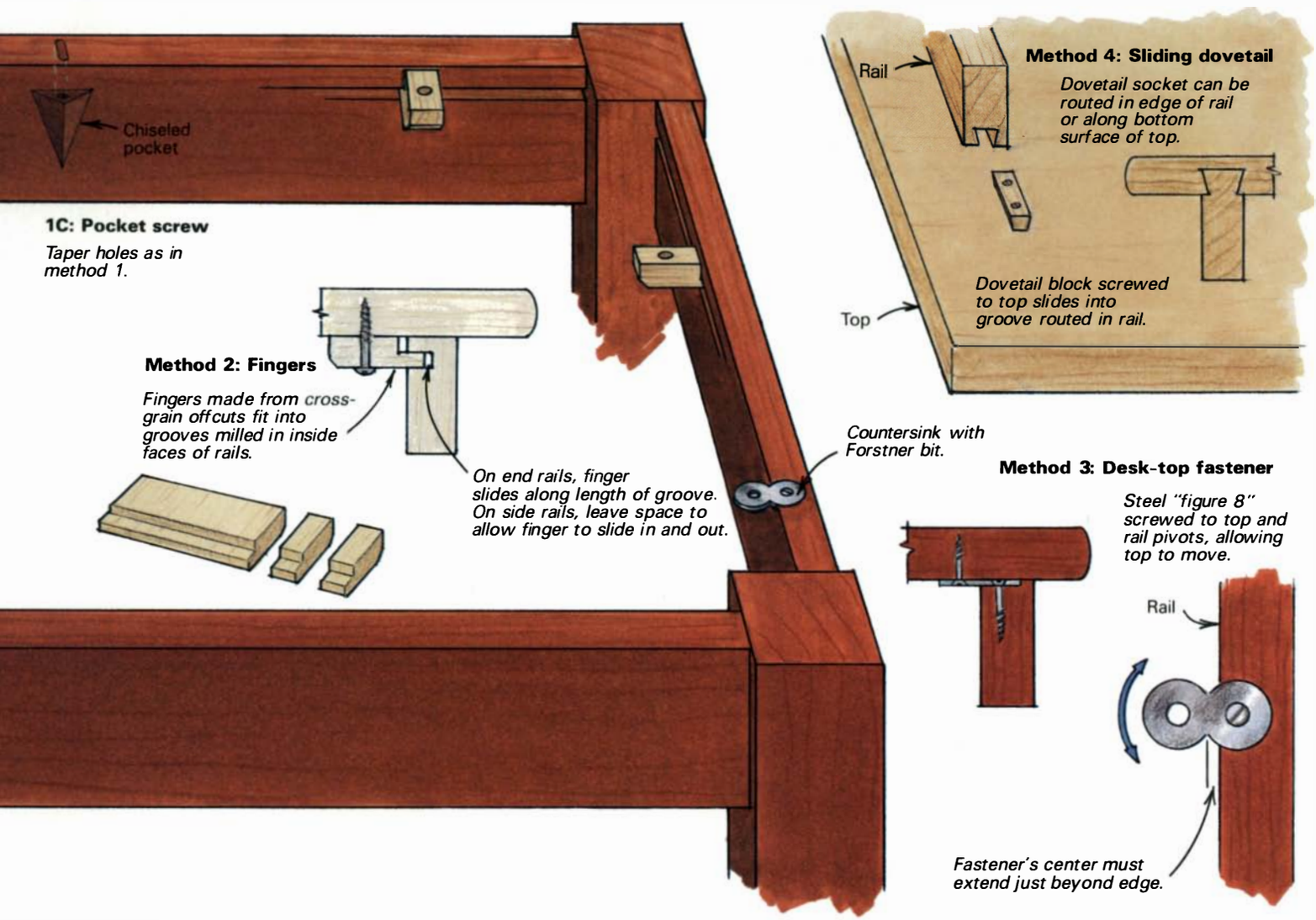
Drawing 1C shows a variation of the slotted hole technique which allows screw access through pocket holes on the inside surfaces of the rails. On antique tables these pockets were three-sided holes chiseled into the rail. A faster alternative is to use a Forstner bit in a drill press. Make a jig, as shown, with a 90° rabbet tilted about 12° to 15°. Rails can be set into the jig, drilled with the Forstner bit, then re-drilled with a ¼-in. bit for the screw shank.

Method 2 involves grooves and fingers (sometimes called buttons). Before assembling the table base, run grooves along the inside upper face of the rails, then cut wooden fingers to fit the grooves. These are best cut in quantity from wide endgrain cutoffs, such as the trimmed end of the tabletop. An alternative is to use metal fingers (available from Craftsman Wood Service Co., 1735 West Cortland Ct., Addison, Ill. 60101).

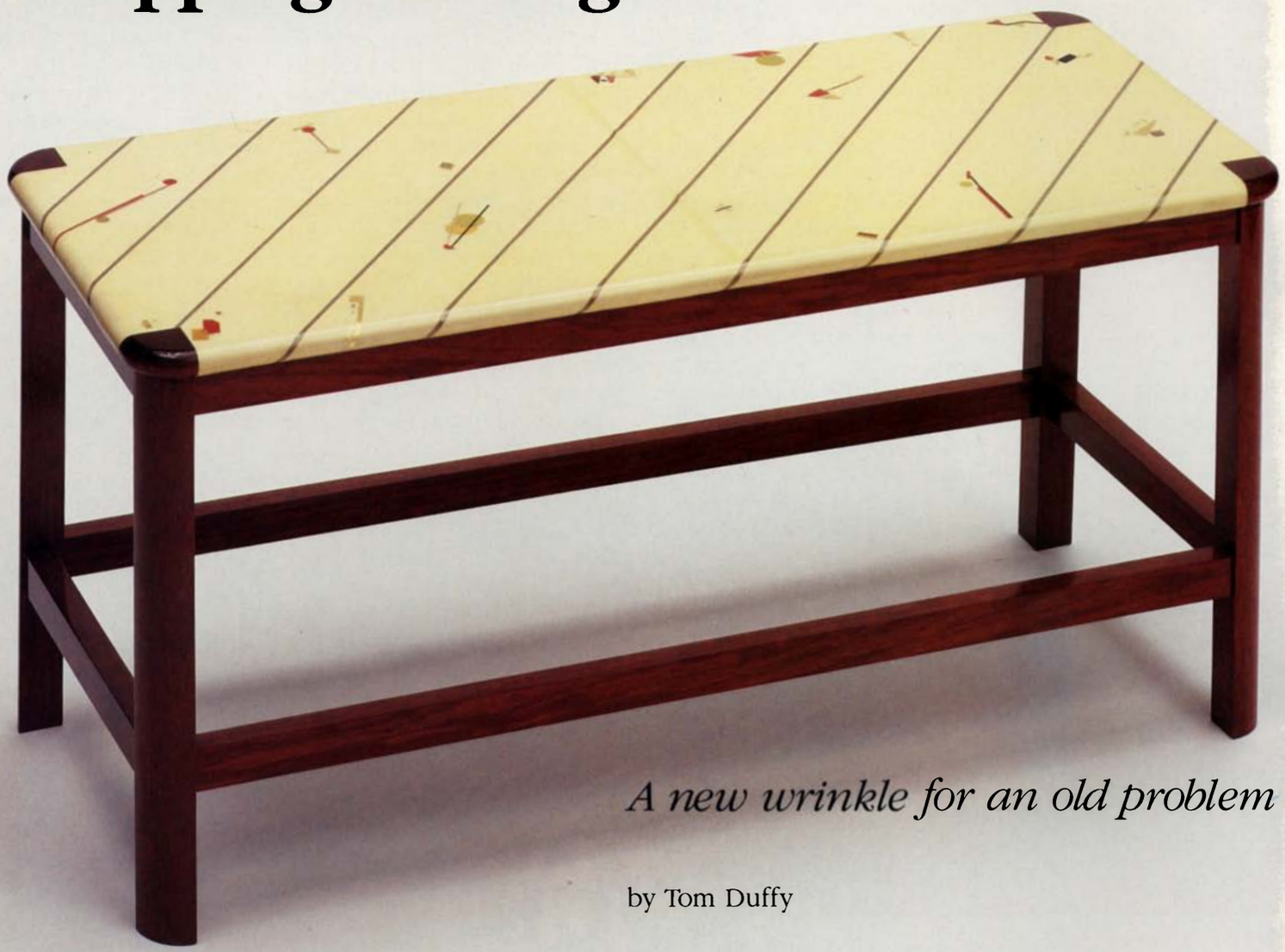
Method 3 uses the "figure 8" or desk-top fastener (the best are Knape and Vogt #1547, but less expensive ones are available from The Woodworkers' Store, 21801 Industrial Blvd., Rogers, Minn. 55374). The fasteners are installed in shallow, blind holes flush with the tops of the rails. This method is ideal for fastening rails or cleats running across the top grain because the fastener pivots as the wood moves. If set in slightly oversize holes and positioned at a 45° angle to the rails that parallel the grain, a desk-top fastener will allow a bit of movement, though not as much as a finger will.

I use the sliding dovetail shown in method 4 as a last resort for extreme amounts of movement or for a testle tabletop, where there are no long-grain rails. For example, I recently completed a 4-ft. by 24-ft. conference table made in three 8-ft. sections. The architect specified that the grain run in the 4-ft. direction, so each section had 8 ft. of moving wood to contend with. In this case, I routed a dovetail groove along the length of each 2-in.-thick rail running across the top grain (stopping just short of one end). I fastened 20 2-in.-long dovetail blocks along each long side of the top with a dab of glue and two screws. I waxed the dovetail grooves and slid a rail over each line of dovetail blocks. I put a heavy screw through the rail at the centerline of the top to anchor the two firmly and divide potential movement in two. □

Chris Becksvoort, a professional furnituremaker in New Gloucester, Maine, is the author of In Harmony With Wood *(Van Nostrand Reinhold Co., 1983).*



Wrapping the Edges



A new wrinkle for an old problem

by Tom Duffy

Tom Duffy's solution to the problem of edge treatment on a veneered panel was to bend the veneer around a bullnosed edge. Positioning the holly veneer strips diagonally allowed him to treat all four edges the same.

Fig. 1: Veneer Layout

Leaves in a veneer flitch are kept in the order in which they were sliced or sawn.

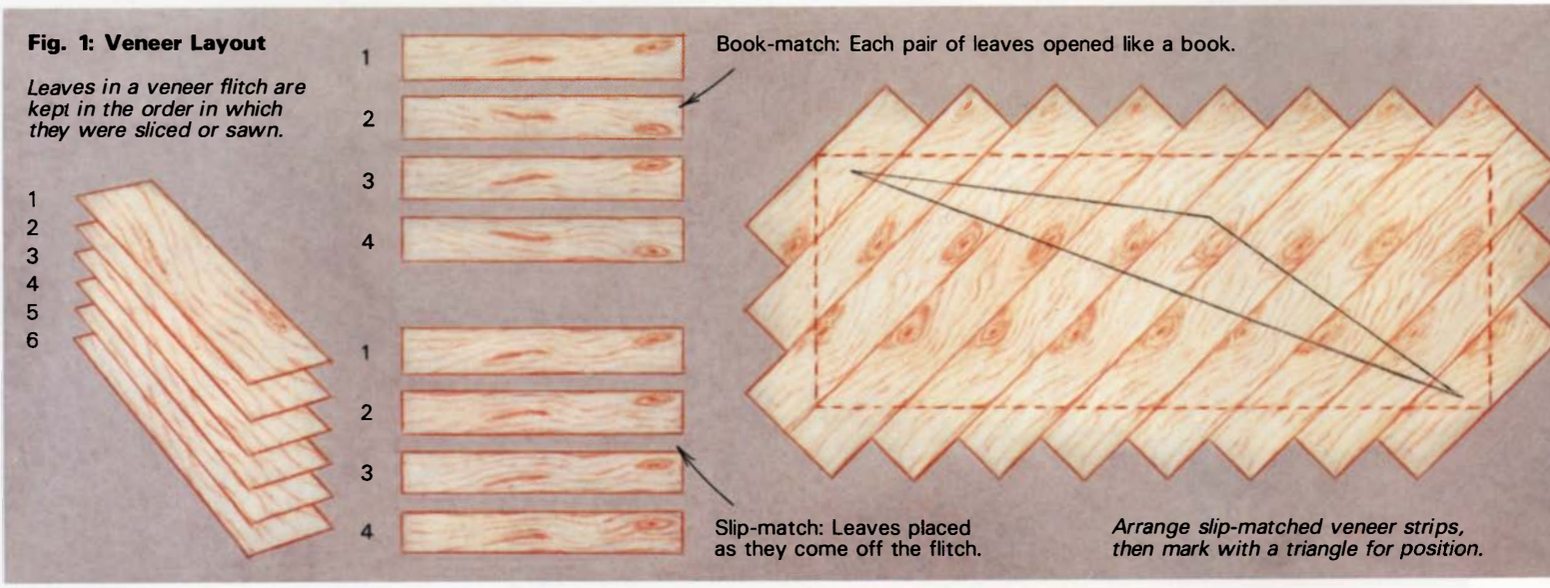


Photo this page: Courtesy Museum of Fine Arts, Boston; drawings: Lee Hov

My unstudied opinion of veneered work was that it was somehow "cheap." Veneer was covering something and so was participating in some fundamental lie. It wasn't until I was struck by the notion that veneer was ***thin*** wood that I came to see it in a new light. Removing the idea of veneer as a mask and seeing it as thin wood cleared the way for a deeper understanding of the nature of wood. In its solid form, wood shows itself mainly as structural, a post or beam, for example. Veneer on the other hand is, in fact, a fabric—it can bend and bunch and can be saturated with dye.

Recently, I've been using veneer's fabric-like capacity to bend to solve one of the design problems associated with veneered panels: edge treatment. I don't like the look of solid-wood or veneer strips glued on the edges of the panel substrate; in addition, a glueline might fail or a solid lipping shrink and telegraph through the face veneer. I decided to bend the veneer around the curved edge of a piece to produce a seamless transition from top to bottom. I explored the technique first on a bed design, then used it on the bench shown on the facing page, commissioned by the Museum of Fine Arts in Boston, Mass.

The benchtop is veneered with strips of holly applied diagonally so that each of the four edges is an identical veneered bullnose. Although I chose holly to provide a uniform, light-colored background for the dyed inlays, the wood's shimmering grain also adds life to the surface. I'm keenly interested in this light-reflective quality, called chatoyance, which is a changeable, lustrous, undulating surface appearance. Good examples of chatoyance are seen in figured mahogany, the lightly rippled surface of a stream or the alternating light and dark strips of a newly mowed putting green. Either the eye or the object must move to fully appreciate chatoyance.

The layout of the benchtop involved three related factors: the size of the top, the width of the strips, and their angle across the top. After washing about with these three elements for a time, trying paper strips of different widths across a mock benchtop, they finally assumed their proper place and relationship.

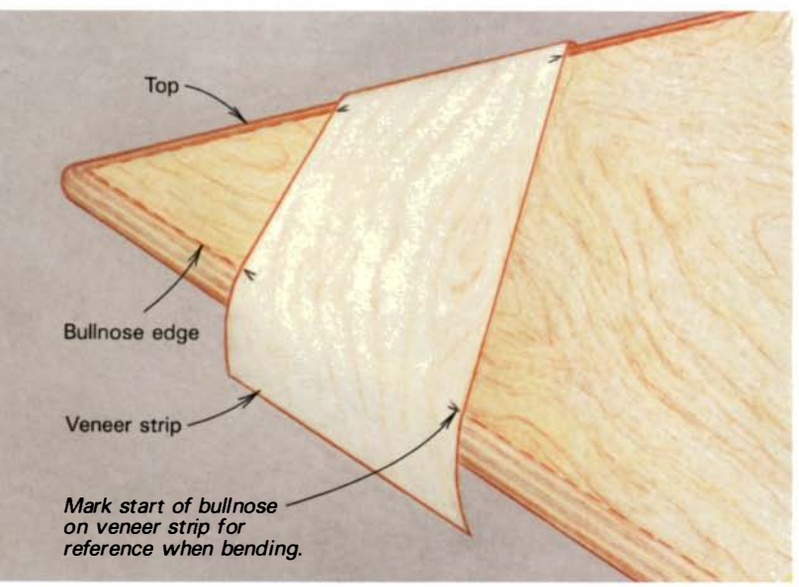
There are a number of ways to match veneer on a panel; two of the most common are book-match and slip-match. To book-match veneer, each successive pair of veneer leaves is opened like a book, producing a pattern symmetrical about a centerline, as shown in figure 1. Slip-matching, the technique I chose, arranges each sheet as it comes off the flitch, creating a pattern of individual, repeating elements. It's critical that the veneer "sisters" are marked for sequence and side-up orientation as they come from the flitch. An inadvertently flipped leaf can reflect light very differently from its right-side-up sisters. With wood as plain as holly this error may not be obvious until the finish is applied.

Slip-matching veneer on a diagonal requires only that you pick a repeating feature—a grain swirl or pin knot, for example—and keep them in line. Once arranged, I marked the sisters with a triangle, as shown in the drawing. Note that each leaf has two lines of the triangle on it. It is quite difficult to flip or get the sisters out of sequence with this method, and it leaves a minimum of pencil marks to be removed later.

For the substrate, I used ¾-in. Baltic birch plywood, cutting a bullnose edge around the entire perimeter with a ⅜-in.-radius router bit worked from both faces of the panel. As this was to be a bench seating two, I decided to suggest this by gluing a very slight fillet to the core. The fillet is triangular in section, with concave faces rising to a peak less than ⅛-in. high.

With the layout arranged and the core prepared, the next step was bending the veneer. I arrived at the bending method by trial and error. I tried hot pipe bending, but couldn't avoid scorching the wood. An elaborate mandrel setup on my lathe proved workable but unnecessarily cumbersome. I found that the best method was a relatively simple combination of moisture and heat. Starting from the middle of the benchtop, I laid a veneer strip in place at the correct angle and put two marks, one at each edge of the strip, where each bullnose started. Then I clamped the veneer on another panel with an edge bullnosed the same as the one for the bench, aligning a pair of marks with the bullnose. Wetting both sides of the veneer in the vicinity of the bend, I waved a 650-watt heat gun across the surface and slowly bent the veneer over the bullnose. (If you don't have a heat gun, pouring boiling water on the veneer should work to bend it.) A block of wood coved to match the bullnose helped ease the bend evenly. Once bent, I removed the strip from the form, held the bend with the coved piece while I thoroughly dried it with the heat gun.

After bending the other end, I glued the strip to the core. For each strip, I made a caul that covered the entire strip up to the bends. A split section of aluminum tubing secured the bends over the bullnose. The veneer past the bend on the underside is also supported with clamped cauls. For the holly strips that crossed the central fillet, I scored the underside of the veneer with a razor



Allen Burns

Duffy bends dampened veneer around a bullnose former. The bend is then fixed with a heat gun.

Veneered columns

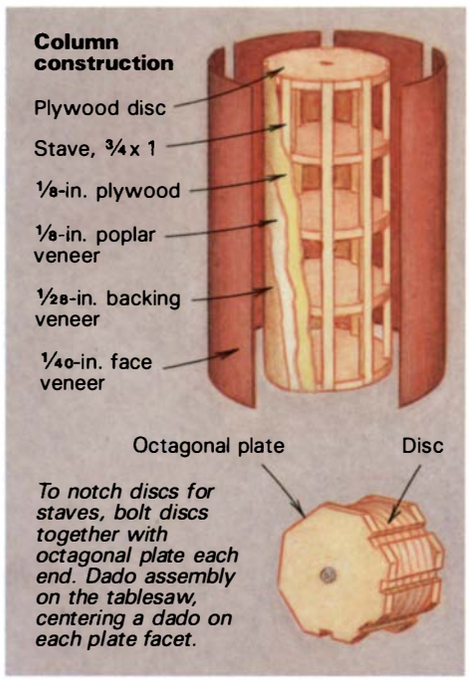
by Thomas J. Fannon

I recently completed the altar shown here, commissioned for a 100-year-old chapel at the Catholic University in Washington, D.C. The piece reflects the Romanesque surroundings of the intimate chapel, embellished with touches of the Byzantine, in reference to the nearby National Shrine. Historically, the transition from round column to square beam or arch was handled by a capital of one of the classical orders. The height of the altar wouldn't allow this approach, however, so I drew concentric arches springing from points spaced equally around the tops of the columns. The result was fascinating, reminiscent of the receding arches in the entrances to the classical cathedrals. I flared these arches outward on all sides toward the perimeter of the table. It was a satisfying drawing; building it looked tough.

The mahogany base, or plinth, was straightforward. A router, guided by an air-clamped jig, cut the many archways. A shallow sawkerf housed the tiny boxwood capitals. A shaper and a bit of handwork finished the moldings. If only the ancient temple builders had had it so easy.

Each column consists of five bandsawn discs, attached at equal intervals to eight thin vertical staves. A layer of $\frac{1}{8}$-in. bending ply and a layer of $\frac{1}{8}$-in. poplar veneer encircles the cage-like framework. Figured mahogany face veneer, with backing veneer, completes the column. I bandsawed the discs then notched them to house the staves. Octagonal plates fixed each end of a stack of discs, bolted together through their centers, made a simple jig for dadoing equally spaced notches on a tablesaw, as shown in the drawing. I notched the $\frac{3}{4}$-in. by 1-in. staves to form lap joints with the disc dadoes and assembled the frameworks. Light planing faired the staves to the curve.

The plywood layer was carefully cut to the column circumference, then stapled and glued to the frame. After setting the staples and dressing the surface lightly with a sanding block, the poplar was added. A sheet of stiff (18 gauge or better) galvanized metal serves as a caul, drawn around the drum with web clamps aligned with the internal discs—tightened over the staves, the pressure would distort or break them. Two $\frac{1}{2}$-in.-square strips along the caul's edges lift the metal bodies of the clamps above the column to avoid damage. I glued the poplar in two halves, and the result is remarkably strong.



After matching and taping the face veneer (four leaves per column), I glued it to a backing veneer using the metal cauls and column as a former, half a column at a time. Removed from the column, these skins are stiff and curved enough to allow exact trimming for perfect lengthwise joints. (I use a hinged printers' knife, 42 in. long, for a veneer trimmer.) Front and back skins were glued to the column one at a time, then the column ends were trimmed flush.

The arch is built up of layers of curved plywood panels, veneered on two forms, one for the front and back, one for the ends. The veneer was an interstellar cloudburst, carefully cut and positioned so the combined layers would create a perfectly flowing pattern. The altar top, like the base, is made of solid mahogany.

I was as pleased with this piece as any I've ever made. But perfection? Maybe never: During the final stages of coloring, I used a felt-tip marker to add accents, then shot the final coats of lacquer and went home for the night. The next morning I was appalled to find that a chemical reaction had turned all the marker accents iridescent green. Yikes! Both columns were completely stripped and refinished in time to keep an appointment with the photographer. □

Thomas Fannon is a woodworker in Alexandria, Va.

Allen Burns

Aluminum tube, split lengthwise, serves as a caul for gluing the bend. Wooden cauls distribute pressure on the flat surfaces.

knife precisely where it crossed the fillet, and shaped the caul with a chisel to correspond to the fillet's concave shape. After dry-clamping the setup, to make sure everything fit, I applied glue to the core and clamped-up as shown at left. When the glue was dry, I removed the clamps, scraped away the excess glue and repeated the whole process for the next strip. I made no attempt at perfect seams since these would be covered by narrow harewood strips (harewood is most often sycamore or maple dyed silver-gray with ferrous sulphate). I didn't worry about the corners, which would be cut away for purpleheart legs.

Once all the holly was laid, I trimmed the excess on the underside and vacuum-pressed purpleheart veneer onto that surface (run the veneer at the opposite diagonal to the holly for structural balance). No special attention was paid to the joint between the holly and the purpleheart because these edges would be covered by the base skirt rail. (The base is straightforward mortise-and-tenon construction. I turned all the legs at once by gluing four pieces together with paper between the pieces so I could separate them after turning.)

Next, I cut the grooves for the harewood stripes in the top

Ken Wyner

The columns of Tom Fannon's altar are veneered in figured mahogany wrapped around a plywood-covered frame. Thin marble slabs separate the columns from the solid-mahogany top and plinth.

surface, running a Dremel router against a wooden fence clamped to the benchtop. I cut the stripes to match the groove width with an Ulmia double-knife inlay cutter (available from Lee Valley Tools, P.O. Box 6295, Station J, Ottawa, Ontario K2A 1T4, Canada). Inserting the harewood dry into the groove, I held it in place with cellophane tape, pulling it around the bullnose with the tape for support. (The narrow stripes bent around the curve without wetting or heat.) After scribing along the stripe for the grooves on the curves, I removed the stripe, cleaned out the groove with a narrow chisel and glued the stripe in place. A wooden caul distributed pressure on the top, a short length of split aluminum tube secured the bend.

During the course of making the top I cut inlays that I intended to use and assembled them on double-faced tape. When I position inlay, I think of jazz and of the way strangers assume their separate places on a bus. The backdrop supplied a sublime field for the constellations of inlays and gold leaf—I have never seen black look so black as when it is let into holly.

The actual inlay techniques are rather simple. I scribed around the inlay with an X-Acto knife, lifted the inlay and the excess tape, deepened the scribe line and excavated with a Dremel router or a small gooseneck chisel. After checking the fit, I glued the inlay in place with 5-minute epoxy, covering the whole assembly with clear tape until dry. A sharp scraper quickly leveled and cleaned the inlay.

The completed top required considerable sanding. I used a broad piece of very dense plastic as a block to hold a full sheet of sandpaper to better level the entire surface. Because of the heavy use the bench would receive in the museum, I chose a catalyzed lacquer finish for its durability. It took three days to spray and sand enough coats to build up a good, heavy film, which was given a final rubout with auto-body rubbing compound before applying the gold leaf. Gold leaf contributed a different "frequency" to the chatoyance of the piece—wood grain has a mellifluous chatoyance while the gold "blinks." Ten to fifteen dust coats of lacquer completed the finishing, applied carefully so that no further rubbing was needed, which might have upset the gold. □

Tom Duffy makes architectural woodwork and furniture in Ogdensburg, N.Y.

Wooden Combs

Pattern routing builds the blank

by Ric Carpenter

When my customers tell me how they like my wooden combs, I usually hear the word "love" in the first sentence. Using a wooden comb is a revelation to someone whose hair has always been tortured by plastic combs and brushes. Plastic causes static electricity and split ends—plastic is the reason for all the hair-repair shampoos! Wood, on the other hand, is organic and similar to hair in its molecular structure. Just leisurely combing your hair for a few moments a day not only treats your hair right, it releases a great deal of stress from both mind and body.

I've chosen to be a combwright as the way of making my livelihood. I left white-collar work 10 years ago, when I was 33, and first tried making bandsawn burl boxes. The reality of the craft circuit, however, is that no matter how beautiful the work, nobody buys except at Christmas time. After three years of horrendous effort, I realized that, if I wanted to continue expressing my creativity and, at the same time, add to the reservoir of positiveness in the world, what I needed was a unique item that could be sold year-round by mail.

In the days before plastic and rubber, wooden combs were once common—millions are still made each year in China. The Chinese combs are made from one piece of wood with the grain running with the teeth. This means there's weak cross-grain along the spine of the comb. Sooner or later, the comb will break. I've eliminated that cross-grain problem by making my combs from two pieces of wood glued together, as shown in the photo above.

I work with 16 different woods, from oak to ebony, allowing many combinations. I'll explain the production methods I use, but it's possible to make a couple of combs with little more than a bandsaw (or a scroll saw) and a belt sander (see box, p. 66).

My standard combs are just under 3 in. wide and range in length from 4¼ in. to 9¾ in. I prepare the ½-in.-thick by 10-in.-long by 3-in.-wide handle blanks in advance. I can get one large comb or two small combs from one of these blanks. The tooth blanks are also cut from ½-in. stock.

I pattern rout both the tooth blank and the corresponding opening in the handle blank, as shown in the drawing and photos on the facing page. Before routing, I bandsaw the work slightly oversize so the router doesn't have to remove much wood. My router is mounted on the column of my drill press with a homemade mounting bracket made from steel plate and a piece of 3½-in.-dia. steel pipe. (I call this a poor man's pin router.)

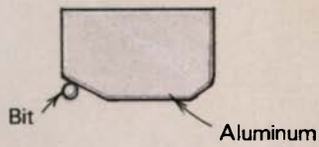
The tooth blank is bonded into its cut-out in the handle with fast-setting epoxy, tinted black with a little graphite. The resulting dark black glueline fills any gaps and looks like purposeful decoration. I prefer West System epoxy resin #105 and hardener #205, sold by Gougeon Brothers, 706 Martin St., Bay City, Mich. 48706. I prepare the surfaces for gluing by scuffing with 50-grit sandpaper and wiping each surface with alcohol. I apply a first coat of epoxy to both surfaces and allow it to soak into the wood. After 20 minutes, I apply another coat and clamp the two pieces together with rubber bands.

The next step is to cut the teeth. The teeth and the slots in between are ⅛ in. wide. I've made a gang saw that cuts all the slots in one pass, either 11, 16, or 23, depending on the size of the comb. As you can see in the photo at right, the blades are graduated in diameter, a job that any saw-sharpening shop should be able to handle. The cross-cut fence that holds the comb blank and feeds it into the blades is designed to stop exactly above the center of the saw arbor. At this point, I switch off the saw and remove the comb. Feeding the comb farther will

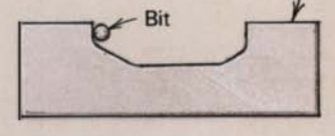
Fig 1: Routing the tooth blank and handle cutout

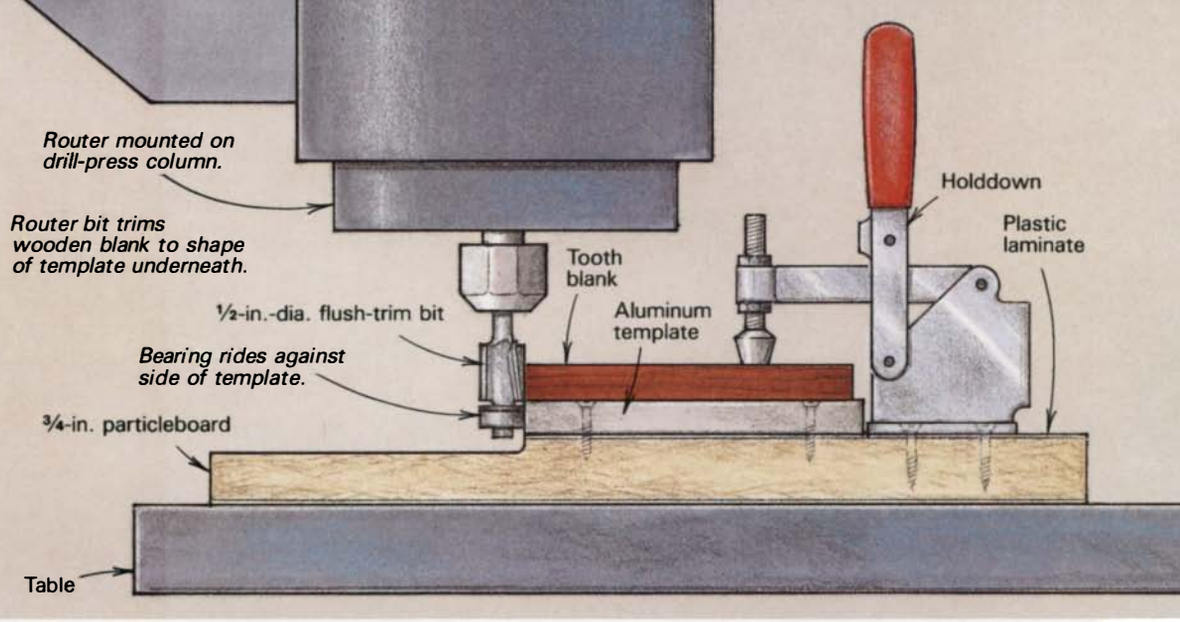
Each size comb requires two templates.

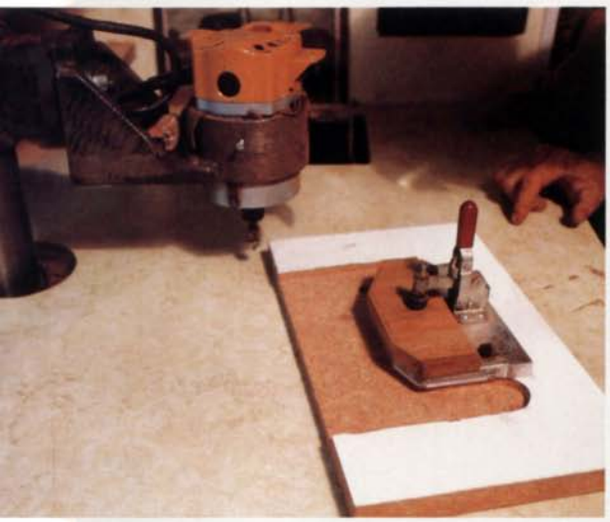
Male template cuts tooth blank.

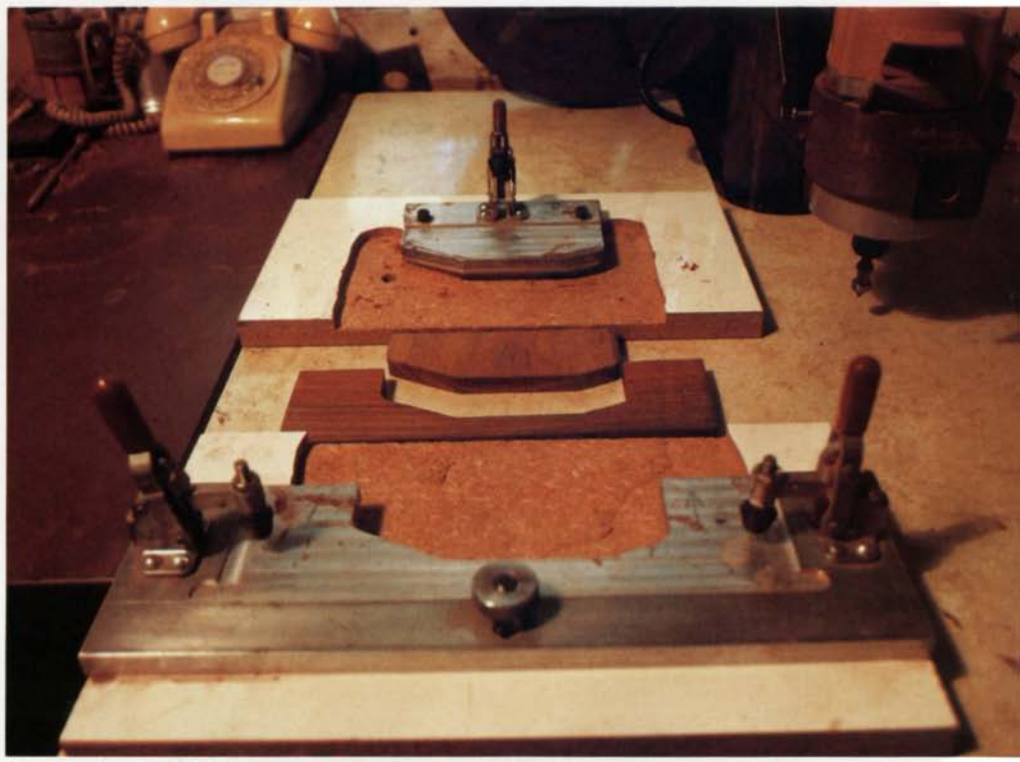


Female template cuts tooth cutout in handle.









A bracket welded from steel plate and a section of 3½-in.-dia. steel pipe mounts a router on the drill-press column (above)—the jig cuts the tooth inlay blank for a large comb. Each comb requires two templates (right). The male jig (top) cuts the tooth blank and the female jig (bottom) cuts the corresponding cutout in the handle. The router pilot bit rides against the edge of the template to trim the stock on top.

A gangsaw (above) cuts all the teeth in one pass. The cross-cut fence that holds the comb is designed to stop over the center of the arbor. At this point, the saw is switched off and the comb removed. Carpenter's sanding machine (right) consists of six ¼-HP motors mounted on a lazy Susan. Each padded sanding disc sports a different grit paper.

Photos this page: William B. Ivy

William B. Ivy

After cutting the teeth, the top of each groove is relieved with a carbide cutter in a Foredom flexible-shaft handpiece.

result in shattered teeth. After cutting the teeth, I saw out the handle profile on the bandsaw.

For contouring and finish sanding, I made a sanding machine from six ¼-HP sealed 1,725-RPM motors mounted on a lazy Susan. A 9-in.-dia. aluminum sanding disc from Sears is mounted on each arbor. I glued 1-in.-thick foam rubber to each disc with contact cement, then covered the foam with two drawstring cloth bonnets. I glue sandpaper to the outer bonnet with contact cement. Each disc gets a different grit (50, 120, 220, 320, 400 and 600).

Starting on the 50-grit disc, I grind the initial contours. The comb is shaped so that it tapers in section from about ⅜ in. at the spine to a point at the business end of the teeth. The 120-grit paper removes any lumps and bumps and finishes the taper. I sand between the teeth with a 1-in. narrow-belt sander. It's important to remove any rough spots that may grab the hair.

Next, the comb is put in a vise and, using a carbide cutter (Dremel #1009) in a Foredom flexible-shaft handpiece, I relieve the gaps between teeth at the spine. I bevel each tooth edge and round the points by hand with 120-grit paper.

The combs are finished with Howard Feed-N-Wax (made by Howard Products, Inc., 411 W. Maple, Monrovia, Calif. 91016), an aromatic mix of beeswax, carnauba and orange-oil. □

Ric Carpenter can be reached at Sierra Legacy, P.O. Box 563, Lotus, Calif. 95651.

Making combs the hard way

by David Sloan

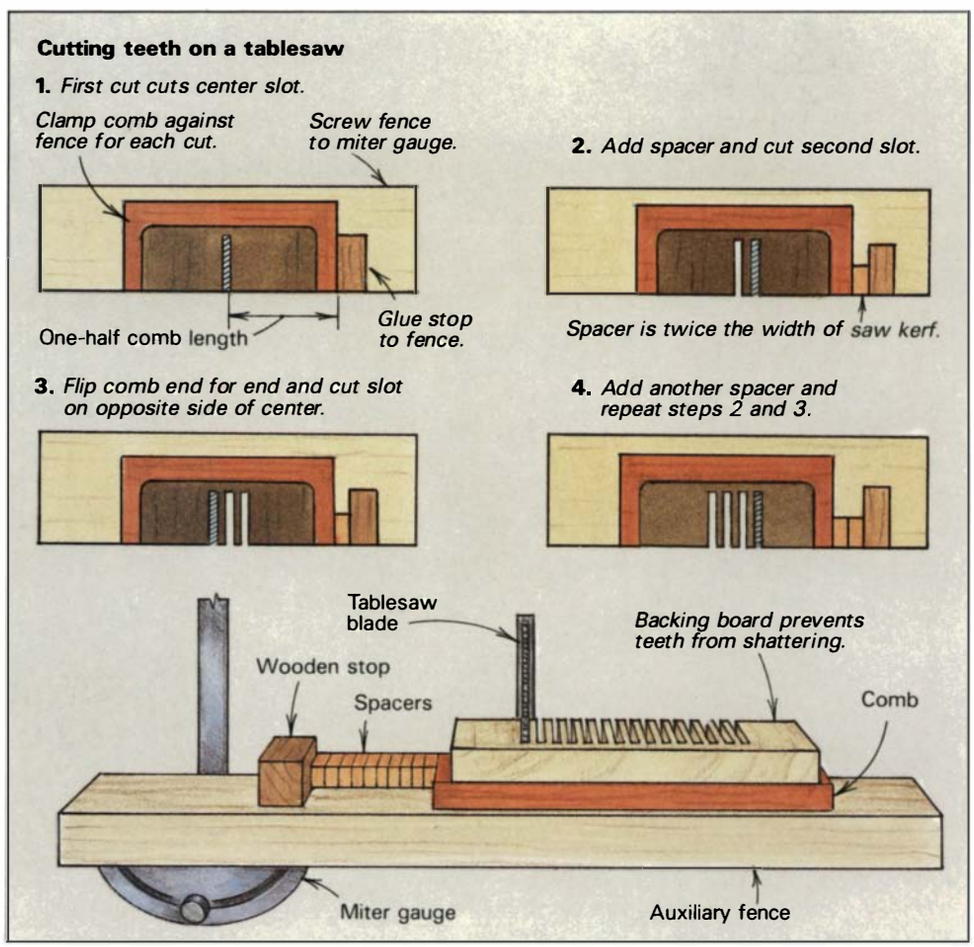
You don't need special equipment if you only want to make a couple of wooden combs. I made one with a bandsaw, tablesaw, belt sander and thin rat-tail file. It took me about 4 hours from start to finish, but that included lots of head scratching and some scrounging around for materials.

First, I bandsawed the tooth blank to the shape I wanted. Then, I traced the tooth blank shape on the handle blank and bandsawed the opening in the handle, staying inside the pencil line. I had to sand and file a little, but I got the two pieces to fit pretty well. I smeared 5-minute epoxy on both pieces and clamped them with thick rubber bands.

I cut the teeth on the tablesaw, but the bandsaw would be safer. The setup I used to space the teeth works on either machine. First, cut into some scrap and measure the width of the kerf. You will need some spacers twice as wide as the kerf so the teeth and the spaces between them will be equal. I rummaged through some drawers and found some nuts that were ¼ in. thick—twice the thickness of my ⅛-in. kerf. The drawing shows how I used the nuts to space the teeth.

Finally, I sanded the comb to shape on an upside-down belt sander, sanded between the teeth by hand (whew!) and relieved the gaps between the teeth with a rat-tail file. □

David Sloan is a former associate editor of Fine Woodworking.



Spray Finishing

Mastering clear lacquer

by Gregory Johnson

Sprayed nitrocellulose lacquer, though more involved to apply than a padded oil or brushed varnish, is worth the extra effort. As author Johnson explains, it's among the most workable and practical of finishes for small-shop furnituremakers.

I once heard a story about an old man in a brass foundry who had been tirelessly polishing a huge brass door for hours on end. Another man, having watched him work for awhile, finally spoke up. "That door is just beautiful. How do you know when it's done?" Still polishing, the old man answered, "It's never done. They just come and take it away."

You could say the same thing about a hand-rubbed lacquer furniture finish. The more you rub, the better it gets. But long before they come to take it away, you'll have achieved a splendid finish that protects wood against abrasion, heat, alcohol, dirt and water much better than an oil finish. True, a sprayed lacquer finish is more difficult to apply than oil or brushed varnish, but it's among the most workable, practical finishes for the small shop. It's fast drying and you can see results quickly. Lacquer alone brings out the beauty of natural wood in its lightest tone. Most problems in a lacquer finish are evident within five minutes after spraying. If it doesn't blister, pinhole, craze or look like a lunar landscape within that time, chances are very good that it won't fail later on. And if, for some reason, you don't like the results, you can usually strip it off with thinner and start again.

In this article, I'll describe spray lacquer basics using a desk made by my nephew, Paul Johnson, as an example. The desk presents most of the problems you'll face in lacquering a piece of furniture, including spraying inside corners and finishing both sides of a flat panel that will be exposed to heavy wear. Since the desk is made of maple and purpleheart, two nicely contrasting woods, no masking or staining was required, making this a straightforward, clear lacquer job. It's possible to mix stains and glazes with lacquers or to color wood by spraying opaque lacquers, but these techniques are the subject of another article.

Getting started—Before going into the specifics of spraying, I should say a bit about safety. Spraying lacquer is extremely haz-

A good lacquer finish begins with a meticulously prepared surface. Above, Johnson repairs a minute flaw with a hot knife and a burn-in stick. Patches will later be matched with blending-powder stains.

ardous. The fumes are toxic and explosive and the lacquer itself highly flammable, as is the overspray. Consequently, I do all of my spraying inside a commercial-quality spray booth equipped with a high-volume fan that rapidly clears fumes and removes overspray from the exhausted air with a series of paper filters. The fan itself and the lighting fixtures inside the booth are wired with explosion-proof fixtures.

Obviously not everyone has access to a spray booth, but I strongly recommend that you buy one used or new or build your own, using the explosion-proof hardware available from wholesale electrical supply houses. On warm, windless days, it may be possible to spray small jobs outdoors in a sheltered area, but if you plan to do a lot of lacquering, a booth is a must. Before buying or building a booth, check with the local fire department to find out if zoning or safety laws prohibit spraying in your neighborhood. In California, where air-quality laws are strict, you should check with environmental authorities before setting up. Whether you spray inside a booth or outdoors, *always* wear a respirator designed to protect against vapors from organic solvents.

Before finishing can begin, the furniture must be completely assembled with everything fitted to perfection. There's nothing worse than rushing a piece through finishing only to discover that a door or drawer still needs a pass with a plane to achieve a perfect fit. It's sometimes difficult to know how much of a piece should be assembled before finishing. You might assume, for example, that the pigeonholes in the desk should be left in pieces, then assembled after finishing. In fact, it's not difficult to angle the spray pattern into each compartment. If finished as small parts, they'd be blown all over the place, take twice as long to spray and be bothersome to handle. Follow this general rule: assemble glued-up parts before finishing, but disassemble parts fastened with screws, hinges or bolts after they've been fitted and spray them separately.

I begin by meticulously sanding the wood with 100-grit garnet paper followed by 220 grit, keeping a close eye for imperfections and fixing them as I go. Sanding can be done by hand or with a pneumatic or electric orbital sander. Jumping from 100 grit to 220 grit may sound like heresy, but it works fine as long as the final sanding is thorough enough to remove any scratches left by the 100 grit. As I sand, I blow off the dust with compressed air to reveal any imperfections. Dents can be steamed out by placing a moist towel over the blemish and heating it with a household iron. If the ding remains, fill it with clear burn-in stick or five-minute epoxy mixed with a little sawdust. Later, the patch will need to be blended in.

Tight-grained woods, like the maple and purpleheart in the desk, don't need to be filled before sealing, but open-pored woods should be filled with paste filler. I use Star paste wood filler (available from Star Chemical Co., 360 Shore Drive, Hinsdale, Ill. 60521), which comes in pre-mixed colors and natural. To keep the filler from darkening the wood too much, spray a light coat of lacquer sanding sealer, then sand with 320-grit wet-or-dry paper before filling. After the filler has cured overnight, scuff-sand it with 320 grit before applying any more coats. At this point, you can begin thinking about a spray schedule.

Lacquer is a very versatile material and, depending on how you apply it, a tremendous number of finishing effects are possible, ranging from a subdued, low-gloss film hardly distinguishable from oil to a hard, mirror-like gloss. In any case, applying lacquer is a multi-step process that takes place over a few days or a week. I usually plan the schedule in my mind but it's helpful to note it on paper, especially for a beginner.

It's sometimes difficult to decide what degree of gloss a piece of furniture ought to have. I've found that in most cases, a dark piece looks good with a higher gloss. A satin finish on dark mahogany, for example, sometimes appears muddy, but a higher sheen brings out the depth. In most cases, any sheen looks good on light-colored pieces, but they're usually best treated with a satin or semi-gloss.

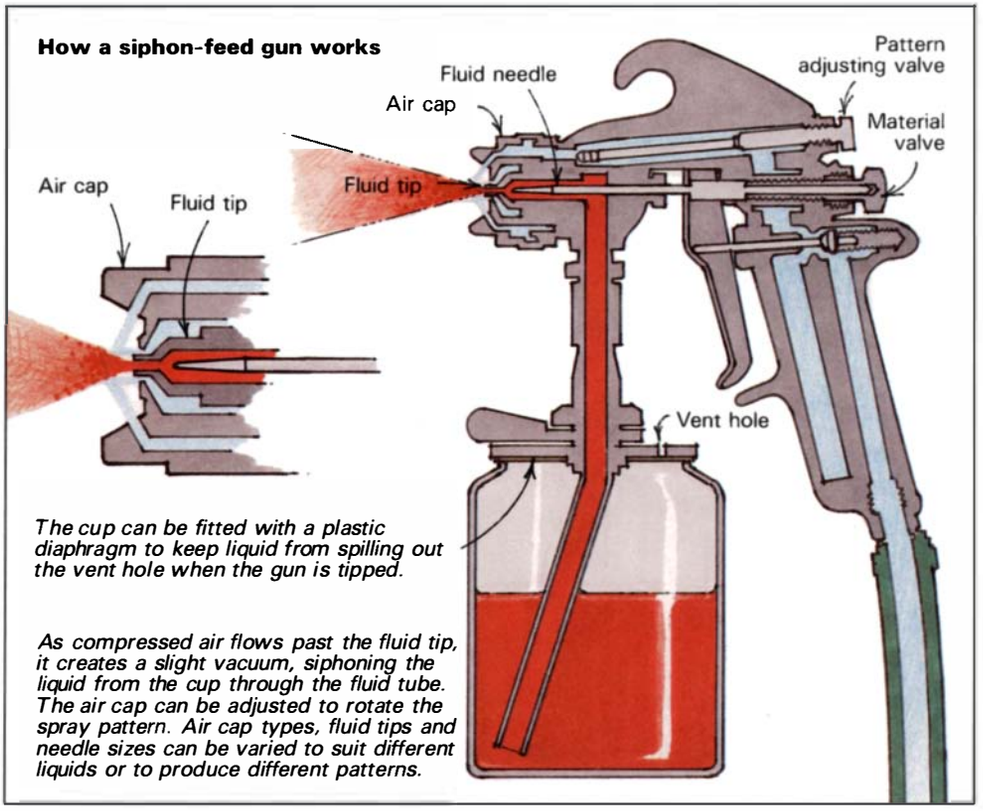
Lacquer manufacturers sell a range of glosses typically going from flat, satin, semi-gloss to gloss. To keep things simple, you can simply buy a gloss lacquer then add a flatting agent if you want a flatter sheen. Just mix up an experimental batch and spray it on a test piece.

The main disadvantage of flatting agents (and flat lacquers) is that they produce a softer, less resilient film. For vertical surfaces or unexposed areas that won't get much wear, this isn't a problem. Table and desk tops, however, need the added protection of a gloss. If glossy doesn't suit your tabletop, you can flatten the sheen, without giving up hardness, by rubbing with steel wool or pumice. It's perfectly acceptable, and often desirable, to use different gloss ranges on the same piece. Regardless of the final sheen I want, I use gloss for the base lacquer coats because it shows up defects that need fixing before applying the final coats.

Here's the spray schedule I came up with for the desk: Two coats of sealer, sand well with 320 grit; one coat gloss, touch-up any light colored patches; two coats gloss, do burn-ins, check for any remaining touch-ups; two coats gloss, sand well with 220 grit; two coats semi-gloss on base, drawer, knobs, bottom side of writing lid, sides and bottom of pigeonholes; two coats gloss on top of writing surface and top of pigeonholes. Allowing for drying times and rub out and assembly, this finish was accomplished over seven working days.

Counting the two sealer coats, there are nine coats of lacquer altogether. That may sound like a lot of finish, but lacquer has a relatively low solids content. After thinning the lacquer for spraying, it contains only about 10% solids. So, 90% of what you spray evaporates. Most lacquers are thinned 50/50 for spraying

Selecting spray equipment



The type of spray equipment you choose depends on how your shop is equipped and how much money you want to spend. If you already own an air compressor, you'll need to begin with a spray gun. These are available in two types: pressure feed and siphon or suction feed. In a pressure-feed gun, the fluid is forced through the spray nozzle by pressure introduced into a large container holding the finish. This type of gun is best suited for viscous finishes or production spray schedules. Siphon-feed guns work by drawing the material out of a small cup via a slight vacuum created by compressed air streaming through an orifice in the air cap. Siphon feeds are usually the best choice for small jobs involving light-bodied lacquers.

I like the DeVilbiss model JGA-502, a siphon-feed cup gun that costs about $120. Other manufacturers make similar guns, so you may want to shop around. The JGA-502 gun can be fitted with any number of needle, nozzle and air cap combinations, depending on the type of material being sprayed. For lacquer work, the Ex .070 fluid tip with a #80 cap seems to work best. A different cap and tip combination may be required for heavier or lighter liquids or in instances where compressor air output is limited.

In our shop, we have a 5-HP compressor that's more than capable of operating a spray gun and an air tool or two, all at the same time. Some people insist that you need a big compressor to run a spray gun but I disagree. Before we got the big compressor, I managed pretty well with a 1½-HP Sears Craftsman compressor. As long as your compressor is able to deliver about 5 to 7 cubic feet per minute at 30 to 38 psi, any siphon-feed gun should work fine. I operate my gun at 38 psi with the material-adjusting screw wide open (unscrew until you see the first thread) and the fan pattern adjusted to its full extent. This will give you a 6-in.-wide spray pattern at about 6 in. to 8 in. away, ideal for furniture.

Whatever the compressor, you need clean, dry air. Water in the air supply is bad news. If there's enough, it can cause the lacquer to cloud over or blush. Oil blown past the compressor's pistons is equally troublesome. To avoid problems, pipe the compressor's output through traps designed to remove oil and water, and drain these traps regularly. We pipe air around our shop through ½-in. galvanized pipes. We've installed a trap right at the compressor's output and also at each air station in the shop. If you have only one trap, install it as far away from the compressor as possible to allow the air to cool and the water to condense. The compressor should be downhill from the air outlets so condensed water will run back into the compressor's tank where it can be drained. Our air system is charged at 120 psi. Regulators at each outlet adjust pressure downward, as required.

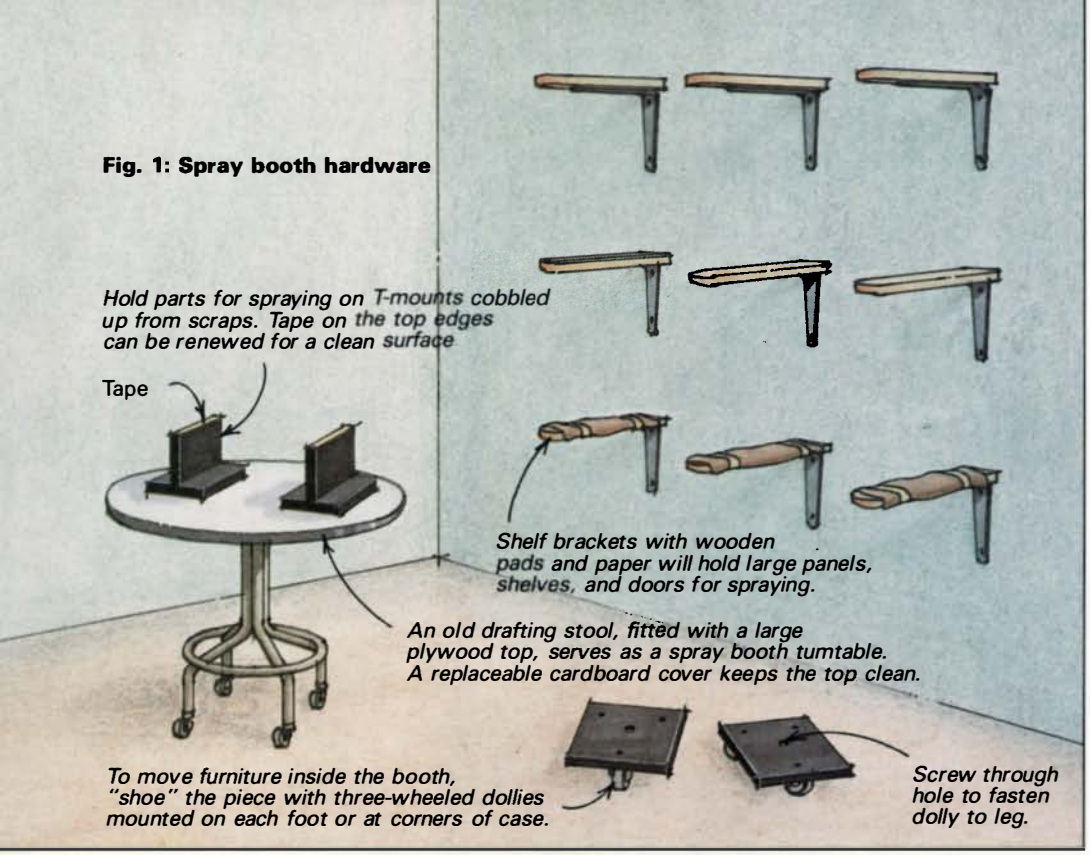
Recently, I discovered another type of gun that operates on low-pressure air delivered at high volume by a turbine pump instead of a compressor. These guns have been popular in Europe for about 20 years but are just catching on in this country. The system I use is made by Apollo Sprayers International Inc., but similar set-ups, all of which operate on the same principle, are available from several other manufacturers (see p. 72 for more). Where a conventional gun atomizes the material at about 35 to 50 psi at 5 to 7 cubic feet per minute of air flow, a low-pressure gun atomizes at 3 to 5 psi at 45 cfm. As a result, the gun doesn't blast the lacquer onto the surface but lays it down more gently, allowing more control with much less overspray and, ultimately, less waste. With less overspray, I can operate the booth fan at half-speed, which cuts noise and reduces my winter fuel bills. While these guns aren't cheap, they're less expensive and involved than buying and setting up a compressor system. —*G.J.*

unless stated otherwise by the manufacturer. I've learned to thin lacquer pretty much by eye, but if you want to be more scientific about it, you can buy a device called a viscosity cup. By timing how long it takes your thinned lacquer to drain through the cup, you can measure viscosity accurately. Cups come in different sizes but most lacquer manufacturers quote times for the No. 2 Zahn cup. The proper viscosity is important since it affects how well the lacquer sprays. If the lacquer is too thick it won't atomize properly, resulting in a spotty surface. If it's too thin, it's likely to run or be over atomized and produce a rough, gritty surface.

Much of the sealer and lacquer I use comes from a local company, Eastern Chem-lac (1080 Eastern Ave., Malden, Mass. 02148). For tabletops I use a higher-quality, more expensive sealer and lacquer from Mohawk (Perth Rd., Amsterdam, N.Y. 12010).

Setting up the booth—With the desk sanded and ready, I moved it into the spray booth, planning in my mind the most efficient way to spray it. I placed the pigeonhole assemblies on drying racks along the wall. A pair of sawhorses, bridged by two 8-ft. 2x4s, supported the writing lid, drawer and drawer bottom. For the writing lid, which must be finished extra carefully on both sides, I taped clean drawing paper around the 2x4s for padding. The drawer pulls were mounted on a stick so they could be

Drawings: Joel Katzowitz



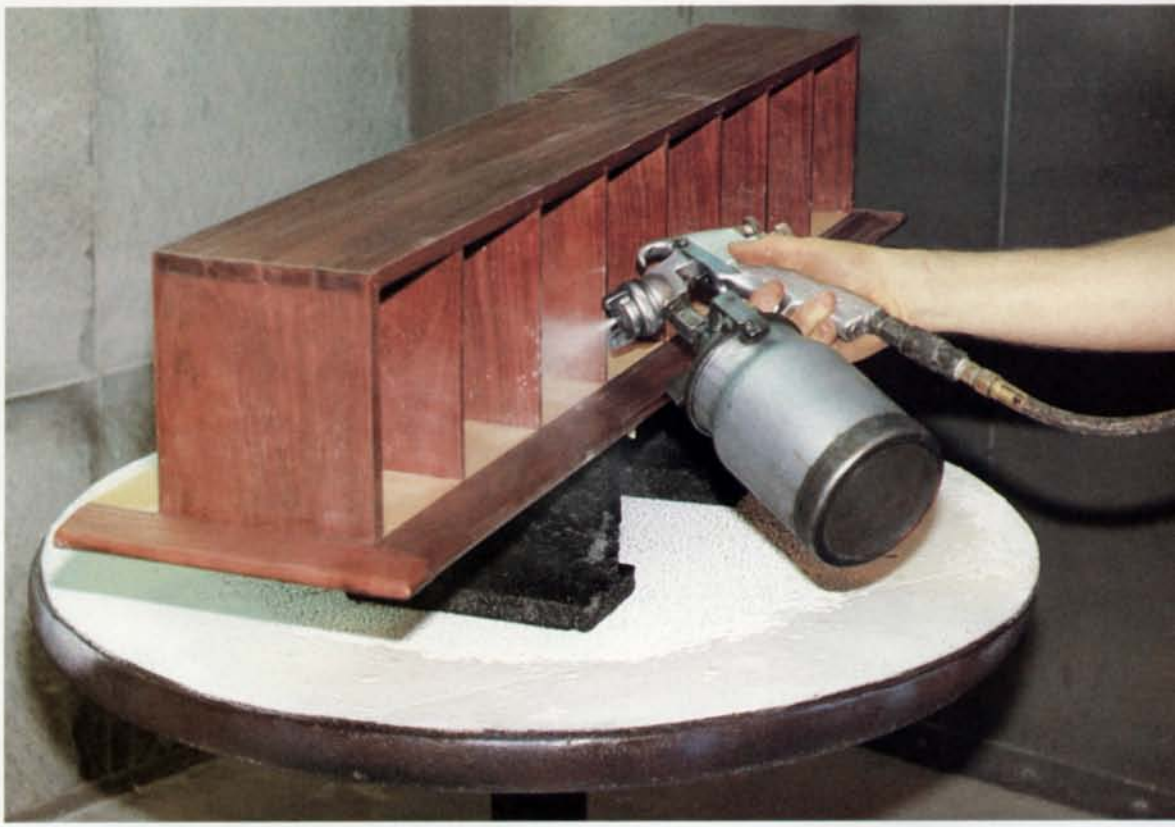
Spraying techniques

Parts to be sprayed are first positioned conveniently in the booth using fixtures shown in the drawing above. Small items like drawer pulls (upper right) are mounted on a scrap and sprayed separately.

With short, tight bursts and quick sweeps, it's possible to spray inside pigeonholes without getting a face full of overspray (right).

The gun's distance and rate of movement control the fullness of each coat, a technique best learned on horizontal surfaces.

Johnson sprays the insides of enclosed structures, like the drawer shown at lower right, before moving to the outside surfaces. The drawer bottom is propped up on T-mounts and sprayed separately.



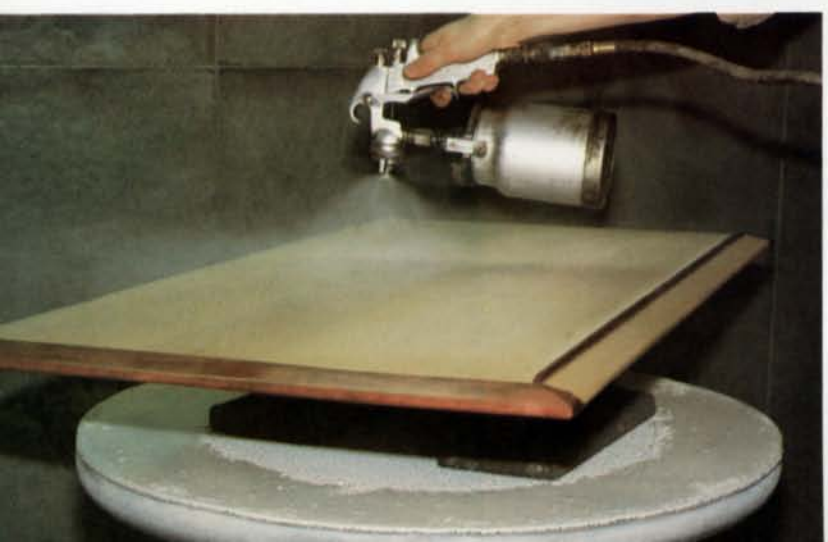
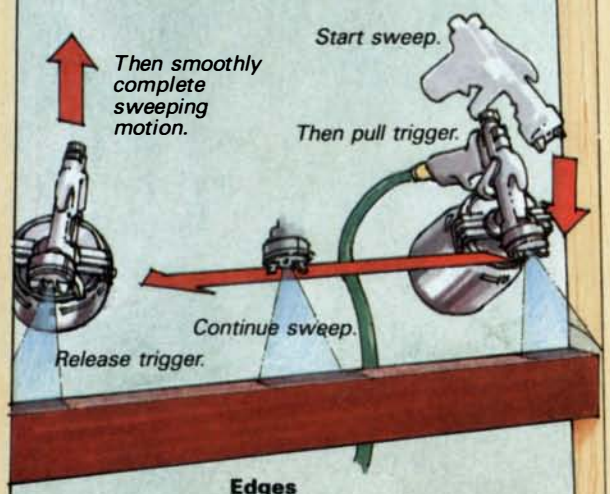


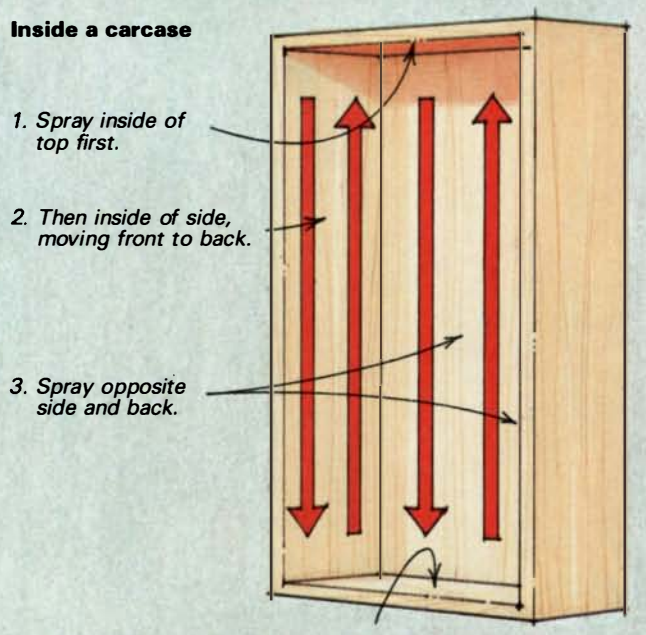
Fig. 2: Aiming the spray pattern

Inside corners

Spray inside corners with a continuous sweeping motion, keeping the gun at a constant distance from the surface.



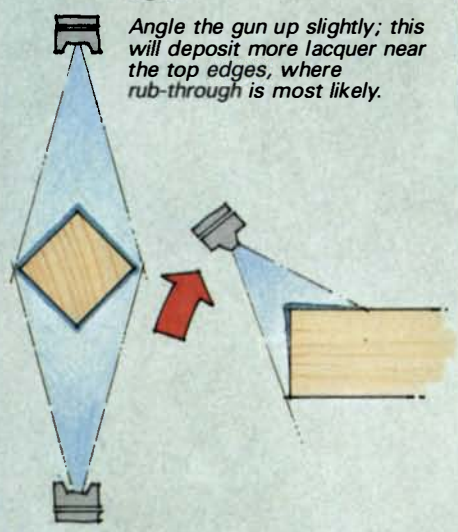
Inside a carcase



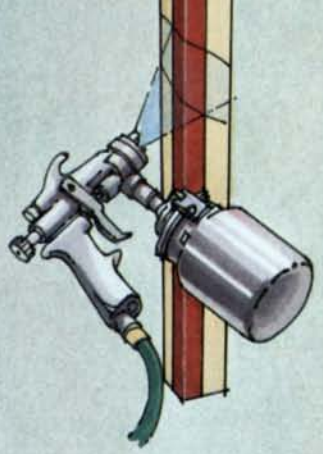
4. Since bottom of case will be most visible, spray it last before moving to outside surfaces.

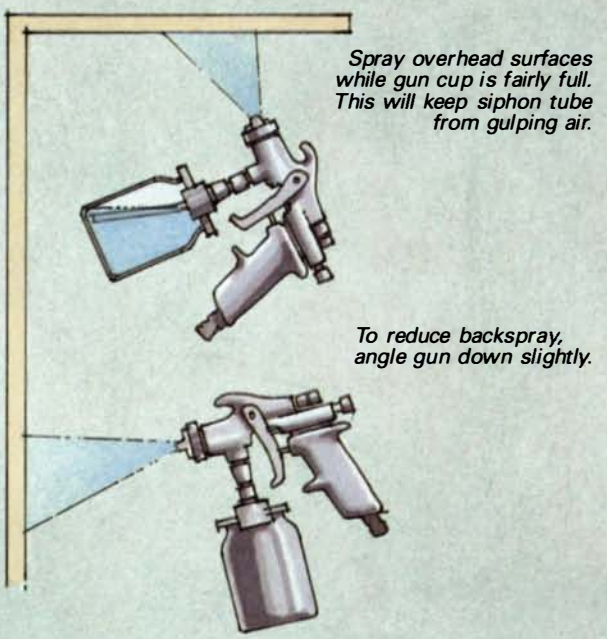
Edges

Angle the gun up slightly; this will deposit more lacquer near the top edges, where rub-through is most likely.



Spray narrow parts such as legs and stretchers in two passes by angling the gun to coat two surfaces at once.





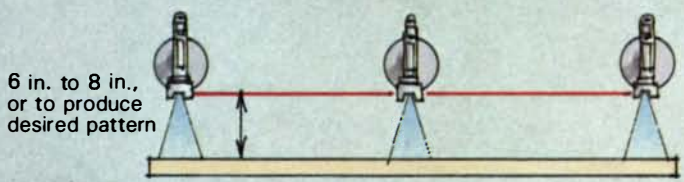
Spray overhead surfaces while gun cup is fairly full. This will keep siphon tube from gulping air.

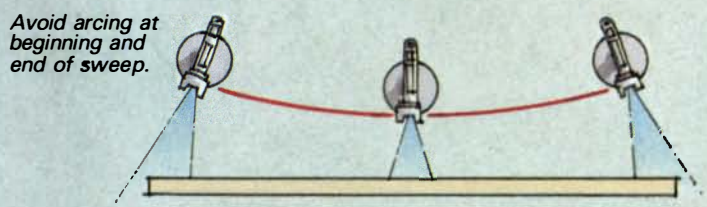
To reduce backspray, angle gun down slightly.

Panels

On flat surfaces, keep the gun parallel to surface and about 6 in. away. For a tighter pattern, work closer but move the gun faster to avoid puddling.

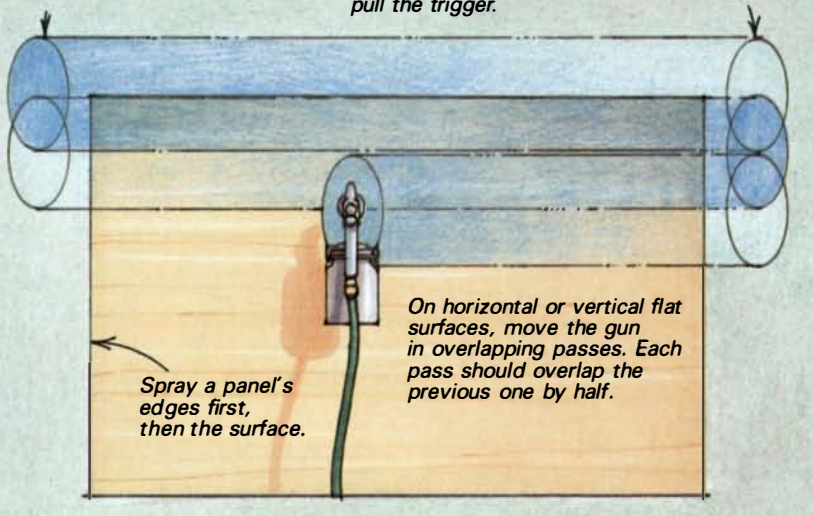
Keep gun at constant distance from work.





Stop spraying just past the edge.

Begin gun movement first, then, just before the nozzle encounters the edge, pull the trigger.



Improvising a spray booth

by David Shaw

While it's preferable to spray lacquer within the cozy confines of a commercial spray booth, many of us have neither the space nor the money for one. With a little ingenuity, however, and minimum expenditure, it's possible to reasonably duplicate spray booth conditions so you can spray small jobs safely inside your shop.

The three main things you need to do are to ventilate your spray area, isolate it from spark sources and exhaust the noxious and inflammable fumes. Since I can't afford a separate booth, I do all of my spraying inside my 14-ft. by 22-ft. shop. For ventilation, I installed an explosion-proof fan (mine's a Dayton 9M717) in one wall of the shop, at an opposite corner from an air vent. To keep overspray from being pumped outdoors, I installed a filter on the exhaust side of the fan, between the fan and a set of louvers that automatically open when the fan's turned on. The filters, called paint arrestors, are available from local finish supply houses. If practical, it's better to install the filter in front of the fan so overspray won't gunk up the blades.

The size of the fan (quoted in cubic feet per minute) depends on the size of the room in which you're spraying. Not too surprisingly, there are government regulations on fan size. The Occupational Safety and Health Administration recommends a minimum air flow of 100 feet per minute over the object being sprayed. To arrive at a fan size needed to move this much air, multiply the width of your spray area times the height by 100. My fan's not nearly big enough to move that much air, but by spraying as close to the fan as I can, I get good enough ventilation for short spraying sessions and also keep the overspray from settling on my tools and on other pieces.

Good lighting is critical in spray finishing. I've managed to make do with the standard fluorescent tubes in my shop, but the safest light sources are the explosion-proof fixtures enclosed in glass and wired through metal conduit to a switch outside the spray area. Similarly, the compressor should be located outside the room and preferably at a level well below the spray gun, so moisture in the air will have plenty of time to condense and gravity will pull the water back into the air tank where it can be drained.

Finally, and perhaps most important, you have to contain the buildup of fumes that will occur in your shop. Lacquer fumes are insidious and persistent and will work their way through the tiniest cracks and holes. My solution was to staple a plastic vapor barrier to the spray area walls, furr-out the wall and nail a layer of fire-code drywall over that. The combination of air pocket and vapor barrier seems to keep the fumes from wandering. Floors should have the barrier and drywall installed on the ceiling below.

Don't entirely discount spraying outside, if weather permits. This can be a pleasure or a disaster, depending on the wind, number of birds and how many flies in your neighborhood enjoy doing headers into fresh lacquer. In any case, don't forget to wear your respirator. Despite what you think, that gentle breeze will not waft away those harmful fumes. □

David Shaw is a professional wood finisher in Kelly Corners, N.Y.

In this western Massachusetts furniture shop, a corner of the old fabric mill the shop is housed in has been converted into a spray booth. The explosion-proof fan (Dayton 6K734M, ¼ HP) is mounted in a frame fitted with a sliding door so the booth can be sealed up during cold weather. Incandescent lamps are enclosed in explosion-proof fixtures and wired through metal conduit. Furnace filters installed in the double doors leading into the booth filter dust from incoming air, allowing spraying while normal shop operations are underway. A fire extinguisher and a combustible-waste can are located just outside the booth doors. The hardware shown here is available through local industrial supply houses or from McKilligan Industrial and Supply Corp., 435 Main St., Johnson City, N.Y. 13790.

held up with one hand and sprayed from all angles. Each leg of the desk was screwed to a three-wheeled dolly, making it easy for one person to move it around.

Sometimes, if a piece seems particularly complicated to spray, I'll run through the motions of spraying without pulling the trigger. My objective is to formulate a pattern so I can coat the piece evenly without forgetting where I've already sprayed. It's important to learn to see the lacquer going on. This is best learned on flat, horizontal surfaces because it's easier to position yourself at the proper angle to a light source. I move the gun at a distance and speed that puts the lacquer down in one full, wet coat, producing a shiny, evenly wet film. Moving the gun too fast will leave a spotty, thin coat. Go too slow and you risk runs and sags, especially on vertical surfaces. Always start moving the gun before you start spraying, otherwise the lacquer will puddle.

I began the desk-spraying schedule by applying the first coat of sealer. Sanding sealer is a high-solids-content lacquer loaded with stearates which give it a dense, milky appearance. Sanding sealer serves several purposes. It contains additives that raise the grain slightly, creating a firm bond and good adhesion. The high solids content of the sealer helps fill the small pores and the stearates make it very easy to sand.

In spraying, the order of events is less important than gun position. The drawing on p. 71 gives some tips on how to position the gun. As a general rule, though, I begin with the more difficult, small surfaces and work toward the larger, flat surfaces. I try to do the vertical surfaces first, then the horizontal and if the piece has inside corners—a drawer, for example—I start there first, progressing toward the outside.

Closed structures, like the desk's pigeonholes or the inside of a cabinet, present special problems because the atomized spray tends to rebound, creating a blinding fog. To avoid this, I spray a quick burst with a slight sweeping motion in each compartment. With the inside coated, I work my way around to the outside taking care not to get too much lacquer on the front edges, which were partially coated when I sprayed the inside.

With double-sided pieces, like the desk lid, spray all four edges and then the top. Once the film has dried to the touch, flip the lid over and spray the back side. Be sure to spray both sides on the same day, otherwise you risk the wood warping from uneven moisture exchange. Spray the last coat on the surface that will show in the finished piece. Usually, applying two coats of sealer is sufficient.

Allow each coat of sealer to dry no less than an hour before spraying the next coat. On unimportant surfaces like backs and bottoms, you can "speed dry" the sealer by blowing it with air from the gun and second coating right away. An hour after spraying the second sealer coat, I sand the wood with 220-grit dry silicon-carbide finishing paper. If the sealer coat brings out an area that should have been sanded better, sand down to the bare wood, then spot spray the area with sealer. I blow the white powder left from sanding off with compressed air. Don't worry if a small amount of the powder remains, it will melt into the next coat.

After you've sanded the second coat of sealer, you can spray the first coat of lacquer, employing the same routine as for the sealer. I let the first lacquer coat cure overnight then tackle touch-ups the next morning. The first coat of lacquer will show up any light patches in the wood. These can be touched-up with blending-powder stains mixed in a paper cup with 2-lb.-cut shellac and padded or brushed on. Blending-powder stains are made especially for spot touch-ups and come in a very wide range of colors. I have a small touch-up kit from Mohawk that contains 21 one-ounce jars of blending powders. It has black, white, red, yellow and blue with many other assorted wood tones that can be mixed to match any tone I need.

With all the touching-up done and only clear lacquer to spray, I keep an eye out for any surface defects I missed. Everything gets two good coats of clear gloss lacquer, with at least an hour drying time between and no sanding. Burn-ins are done at this point, then two more coats. When this last coat is dry, about an hour, I do any burn-ins I missed earlier. With three coats of gloss on the surface, I feel safe leveling a burn-in without sanding through to the wood. Then the sixth and seventh coats are sprayed on and allowed to dry overnight before sanding everything with 220-grit wet-or-dry finishing paper. Sanding can be done by hand or with an electric or pneumatic orbital sander. After a quick dusting, the piece is ready for the final coats. By the time you spray the final coats, you will have acquired some experience with your gun (and the piece) so these coats should be your best.

In spraying the final coats, and perhaps even the base coats, you may encounter some problems. One of the most common is orange peel, a finished surface that looks slightly bumpy with the surface texture of an orange. Orange peel occurs when the lacquer is too thick or if it dries too fast, before it has a chance to flow out. To prevent it, make sure the previous coats are sanded well so the surface is level, then make sure the next coat is a full, wet one. If orange peel is severe, adding a drying retarder to the lacquer will slow the drying time and help the lacquer to flow out. On humid days, retarder will also allow moisture from the atmosphere or your compressor to escape before the finish dries, preventing a milky film called blushing, another common lacquer problem.

If you are refinishing an old piece of furniture, the lacquer may form small craters called fish eyes. Fish eyes are usually caused when traces of silicone from old furniture polish prevent the lacquer from adhering to the wood. Tools that have been sprayed with a silicone lubricant can transfer the stuff to new wood with the same miserable results. A few drops of an additive called fish-eye preventer usually clears up the problem. Once fish eyes have occurred, the best way to seal in the silicone is to mist on three very light coats of lacquer, followed by regular wet coats again.

Rubbing out the film—Once the final coat has dried overnight, you can begin rubbing out the finish. I first sand everything (except high-wear surfaces, which are treated differently) lightly with 600-grit wet-or-dry paper lubricated with water to which a small amount of dishwashing soap has been added. The purpose of this sanding is to level off any dust specks that may be caught in the lacquer. But if the surface feels smooth already, I go directly to rubbing with 4/0 steel wool lubricated with water and steel-wool lubricant. Mohawk calls its steel-wool lubricant Flat Lube, while Star sells one called Steel Wol-Wax. To use either type, dip the wool in the can, getting a small amount of lubricant on the pad. Squirt some water on the pad and start rubbing the surface in broad, long strokes with the grain. I start out rubbing lightly on an area, wiping the surface dry now and then to see how it looks. Usually, brisk medium pressure is all that's needed. If there's a small amount of orange peel in the lacquer, the rubbing will smooth it over. After rubbing, wipe everything down with a rag and clean water, then

A careful rubdown with wet-or-dry sandpaper, lubricated with soapy water, dislodges dust nits and levels the lacquer film. Johnson completes the job with 4/0 steel wool lubricated with a commercial steel wool lubricant.

Even a multi-coat lacquer finish is only a few thousandths of an an inch thick so rub-throughs are inevitable. They're repaired by spot touch-ups with aerosol lacquer. Johnson has masked the desk's pencil trap (middle) and he uses thin cardboard to mask the aerosol's spray pattern (above).

immediately dry the surface with clean, soft rags.

The tops of tables, desks and chests require more attention because their surfaces are closely scrutinized. I sand these with 400-grit wet-or-dry finishing paper on a pneumatic straight-line sander lubricated with soapy water. Don't try this with an electric orbital sander, the shock hazard is too great. Hand sanding is fine. In either case, the final sanding with 400 grit should be done by hand. With the top sanded to my satisfaction, I dry it off with a rag and start rubbing with dry 4/0 steel wool. The beauty of dry 4/0 wool is that you can see exactly what's happening so you can achieve a nice even pattern. I rub the entire surface briskly, concentrating a few short strokes on the edge and then continuing the long strokes, always in one direction. The dry-wooling has brought the sheen up considerably from the 400-grit sanding, but it still appears a bit hazy. Satisfied that the sheen looks even, I add wool wax to a new piece of 4/0 steel wool, along with water, and continue with brisk rubbing.

This step goes very quickly. I check the sheen now and then by brushing some of the sudsy rubbing sludge aside with my thumb. When the sheen looks right, clean it up with water and clean, dry rags. A semi-gloss sheen is produced by thousands of minute scratches in the surface, so if you want a higher gloss you have to keep rubbing, making ever-finer scratches. Sometimes on dark woods, I rub the lacquer with rottenstone and water on a rag, bringing up a higher gloss. It's important to remember that if you didn't get an even scratch pattern with one of the coarser abrasives earlier, it will show up more as the gloss increases. For super-glossy finishes, I sand with 1,200 grit or finer instead of 400 grit, following up with automotive buffing compound.

When I had completed rubbing the desk, I noticed that I'd rubbed through the lacquer around the pencil trap on the lid. To fix this, I taped off the surrounding area then sprayed the trap with semi-gloss from an aerosol can. It's important to pull off the masking while the new lacquer is fresh, otherwise you risk tearing the film later. I also found minor rub-throughs near a couple of edges and touched them up by masking the aerosol spray pattern with a piece of thin cardboard. After the touch-ups had dried for an hour, I rubbed them lightly with steel wool and Flat Lube to blend them in. Rub-throughs that are too difficult to spray can be fixed with thinned lacquer applied with the side of a small touch-up brush or a small piece of dense felt.

One last dusting with a soft rag and the piece looks beautiful. Ship it. □

Greg Johnson is a professional finisher and woodworker. He lives in Newton, Mass. Photos by author.

Sources of supply

Lacquers, sealers, thinners:

Grand Rapids Wood Finishing Co., 61 Grandville Ave. S.W., Grand Rapids, MI 49503.

Randolph Products Co., Park Place East, Carlstadt, NJ 07072.

H. Behlen & Bros., Inc., Route 30 North, Amsterdam, NY 12010.

Lee Valley Tools, Ltd., P.O. Box 6295, Station J, Ottawa, Ontario K2A 1T4.

Spray guns and pneumatic equipment (write for the location of the nearest distributor):

Binks Mfg. Co., 9201 W. Belmont Ave., Franklin Park, IL 60131.

The DeVilbiss Co., P.O. Box 913, Toledo, OH 43692.

W.W. Grainger, Inc., 5959 W. Howard St., Chicago, IL 60648.

Building Bookcases

Ideas for shelving life's clutter

by Dick Burrows

Coping with the hundreds of books, records, and assorted knick-knacks of the typical household can be a festering nuisance. Never having enough shelves, homeowners and apartment dwellers struggle many a weekend with assorted boards and nails. Even though professional woodworkers might not like to admit it, bookcases of all sorts are a major bread-and-butter item for many small shops. And, designers and interior decorators spend hundreds of dollars to make storage units into elegant and beautiful room dividers and built-ins with hand-carved moldings and leaded glass fronts.

Whether you're making a simple pine bookcase or a $2,000 room divider, the principles, and problems, are basically the same. The shelves must be spaced to accommodate specific objects; fit within the structural restrictions of a particular room; be strong enough to support the objects without sagging, racking or resembling a wooden bridge; and be attractive and blend well with the existing decor. If you're only storing old paint cans in the basement, looks aren't crucial, but in most living areas a badly designed bookcase can be a real eyesore.

If you are designing your first shelving unit, don't be intimidated by your lack of technical knowledge about spans and strengths of materials. Common sense may be the most important design factor, says David Stenstrom, shop foreman for Woodward Thomsen Co., a custom cabinetshop and millhouse in Portland, Me., that regularly builds shelving units for new and renovated homes and offices. Stenstrom outlined the basics, shown in figure 1, p. 76, as he showed me a typical custom case being built in the company shop.

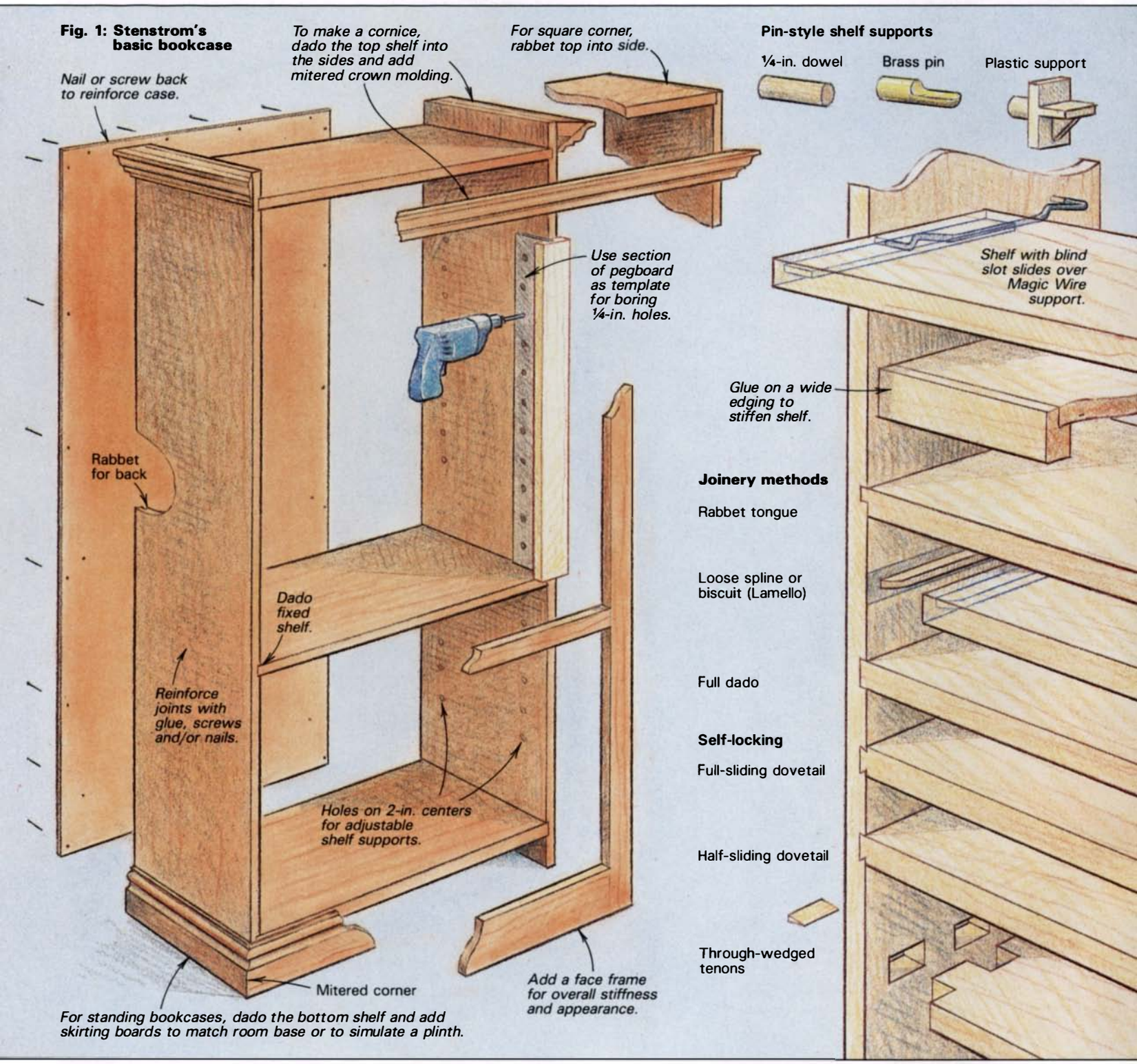
Most people align their books flush with the front of the shelves and dislike having the books pushed to the rear. Generally, this means that you seldom need a bookcase that is more than 8 in. to 10 in. deep. Records fit well on a 12-in.-wide shelf, and overhang just enough for easy browsing. The span of ¾-in.-thick shelves should not exceed 2½ ft. to 3 ft., and that could be stretching it for some artbooks and records. If you want wider spans, use thicker shelves or reinforce them with hardwood edging, screw or nail the shelves to the case back or add vertical supports under the shelves. For exceptionally heavy loads, you might consider torsion-box construction (*FWW* #32). If you have any doubt about shelf strength, set different-size shelves on blocks and see how they react to a full load.

The best way to handle questions about shelf heights is to make most of the shelves adjustable. If the top, bottom and

middle shelf are fixed, the case will be more than strong enough to support floating shelves in between, especially if you install a rigid back. Stenstrom supports shelves on brass pins (shown below), which are fairly unobtrusive and easy to fit in holes bored in the case sides. Short pegs made of ¼-in. dowel work, too. A section of pegboard makes a handy drilling guide for shelf pegs. Magic Wire supports (available from The Woodworkers' Store, 21801 Industrial Blvd., Rogers, Minn. 55374) also fit into holes in the carcase sides. The wire fits into a sawkerf on the shelf end, leaving no visible means of support. If you are fixing the shelves permanently, shelves for records should be spaced 12 in. or 13 in. apart. Most bookshelves can be 8 in. or 10 in. apart, with more clearance needed for oversize books, art books or law books.

Stenstrom has developed some guidelines for shelving. Plywood is the best material. It's fairly economical, readily available and, as an added bonus, you don't have to worry about wood movement and other problems associated with solid wood. If the piece is to be painted, ¾-in. birch veneer-core plywood is ideal; for natural finishes, use cherry, mahogany or other hardwood-veneer plywood edged with solid wood. For shelves, the ¾-in. plywood can, in effect, be thickened by gluing 1¼-in. to 1½-in.-wide hardwood strips to the plywood edges. Joinery seldom need be more exotic than it has to be. In plywood, routed ⅜-in.-

Fig. 1: Stenstrom's basic bookcase



Steve Shafer's shelves and cupboard (at left and above) are built of oak plywood, without glue. Each carcase top and bottom is nailed to the uprights, then a plywood back is nailed on to hold the case rigid. Gravity holds the shelves onto the lower cupboard, so it's easy to move and rearrange the units. A reinforcement strip is nailed beneath the lower shelf.

Exotic hardwoods can dress up a simple design. For this leaning bookcase (right), Jerry Nelson handcarved the sides of the padauk standards to accent the lines of the piece and take advantage of the wood's grain patterns.

Jerry Nelson

deep dadoes reinforced with glue and 1½-in. drywall screws hidden by plugs are more than strong enough to withstand the downward sheer of the heaviest book load. Dovetails and other fancier joinery might be used on solid-wood cases (see article, p. 80). A ¼-in. plywood back rabbeted and tacked to the case is perhaps the most important structural feature. It helps square up the case initially and once it's nailed or screwed in place, it keeps the piece square and resistant to racking. The rest is all decoration: a mortised-and-tenoned face frame or molding to hide the joints and improve the lines of the piece, a plinth to lift the case off the floor and help it blend in with the baseboard and other decor, crown molding for the top, doors for cabinets, decorative hardware and a carefully applied finish. These touches make the case attractive and create the impression that it is a lot more complex than it really is.

As I visited other woodworkers who frequently make shelves, I found Stenstrom's guidelines to be pretty reliable, and a good basis for all sorts of individual design interpretations. One of the most practical shelving systems I saw is by Steve Shafer, a cabinetmaker in Arlington, Va. During the past few years, he has fine-tuned his production techniques enough to be able to turn out attractive bookcases, like the one shown at left above, at prices that are competitive with commercially available, mass-produced furniture.

Shafer builds the cases of fir-core, rotary-cut oak plywood, attractive, strong and available for about $30 a sheet. The top shelf unit and the bottom cupboard are separate pieces, as shown above, center. Gravity holds them together. By sanding and finishing the panels before they're cut, standardizing part sizes so the whole case can be cut from one or two 4x8 sheets, and by building with nails and easy-to-install piano hinges, Shafer has cut construction time to eight hours, making it possible to price the finished unit as low as $200.

The first step is to cover the 4x8 plywood sheets with a coat of varnish or clear Minwax Antique Oil. When the first coat dries, the entire sheet is sanded with a belt sander and 120-grit paper. Then, another coat of finish is applied. Next, Shafer cuts out the pieces on his tablesaw. All of his standard designs make maximum use of each sheet. The cupboard shown here, for example, is 30 in. high and 16 in. deep, so he can saw three strips of this width from a 48 in. piece of plywood. His shelves are all 8 in. deep and 32 in. wide. Odd-size cases mean higher prices because of increased waste.

To strengthen the plywood, and to make the case components look like solid wood, Shafer tongue-and-grooves solid oak edging onto the plywood. He plows the groove in the plywood edges, then mills the tongue on the ½-in. to ¾-in.-wide strips of dressed oak. Shafer finds the shaper is the fastest way to cut the joint, but it can be done on a tablesaw or with a router. He applies ⅞-in.-thick edging to the ¾-in.-thick plywood, so he doesn't have to mess around with aligning everything perfectly when he glues the banding on. After the glue dries, he uses the shaper to cut the edging flush with the plywood and to round the edges.

One reason Shafer turns out bookcases so quickly is that he avoids time-consuming cleanup problems by not using any glue to hold the case together—it's just nailed with 1½-in. (4d) finishing nails. Since the back is the case's main structural support, he says that gluing in the shelves doesn't significantly strengthen the piece. The back is nailed to a fixed shelf in the middle and in rabbets cut into the case sides and top, which makes the case rigid and keeps it from racking out of square. Hanging the doors on piano hinges also saves time because they are easier to install than butt hinges and can be quickly and invisibly shimmed with wood strips if the frame-and-panel doors need adjustment.

The bookcases by Stenstrom and Shafer are generally fairly large, elaborate constructions, but a clever idea and good workmanship can turn a small quantity of wood into a functional piece of furniture, such as the leaning bookcase shown above, right. Jerry Nelson, a furnituremaker and boat builder in Wheaton, Md., built the 48-in.-high case with padauk left over from another project. He cut the stock into seven manageable pieces, arranged them so they'd lean at a 10° to 15½° angle, then cut mortises to accept shouldered stub tenons on the shelves. The mortises are cut so the top shelf is level when the case is lean-

David Scherrer

Movable oak shelf brackets by Ted Scherrer hook directly onto uprights fastened to the wall. Dowel pins in the brackets on the left fit into holes in the shelf standards. Wedges on the brackets at right fit into slots, as shown in the drawing below.

Lake Union's bracket-shelving system, shown above and in fig. 4 below, incorporates sliding bookends that fold down when not in use.

Fig. 3: Scherrer's wooden brackets

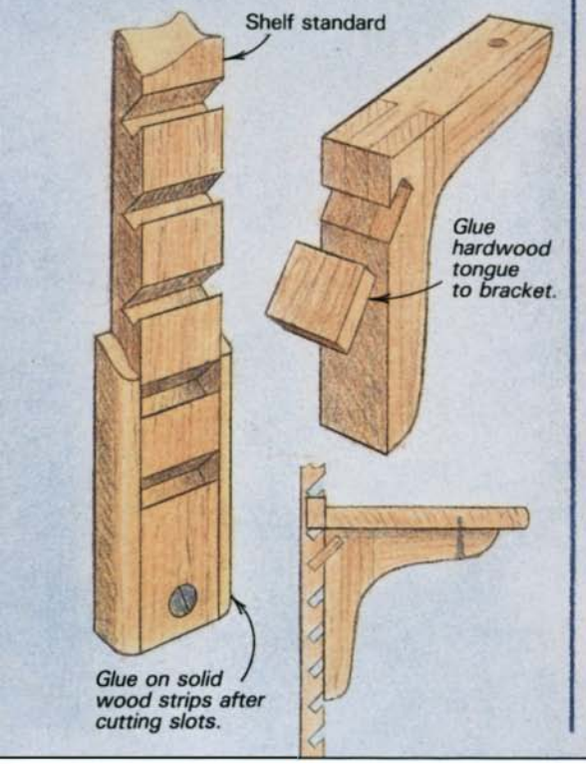


Fig. 4: Lake Union's fold-away bookends

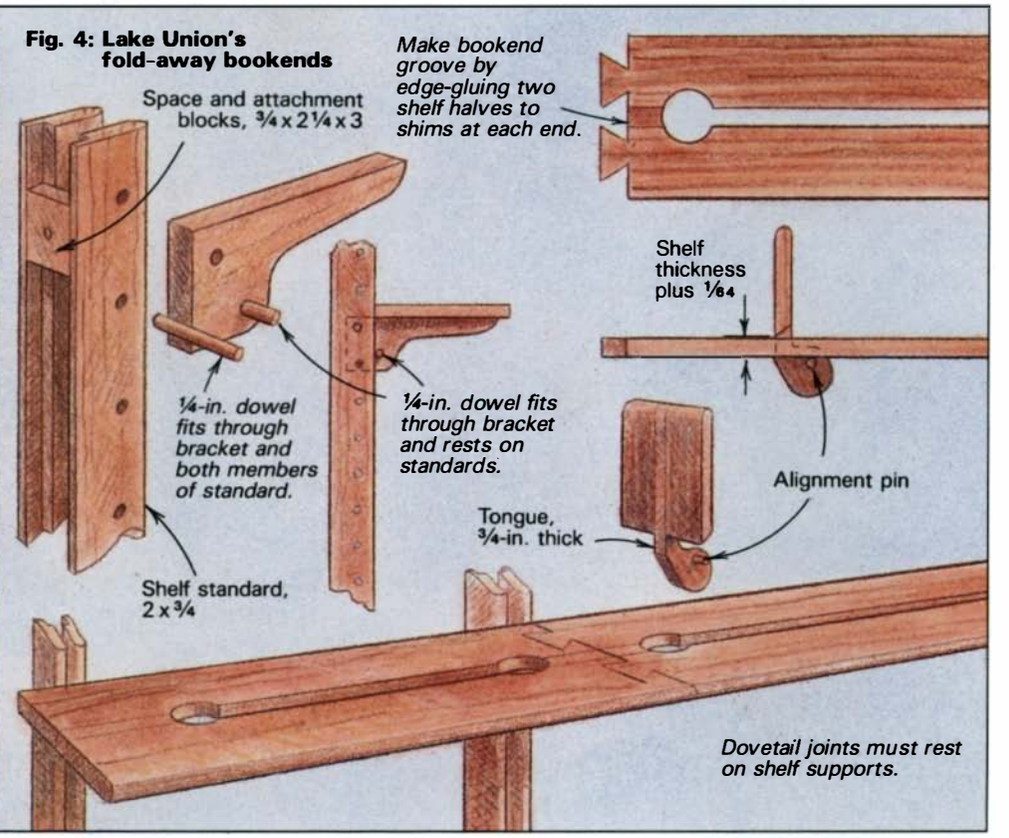
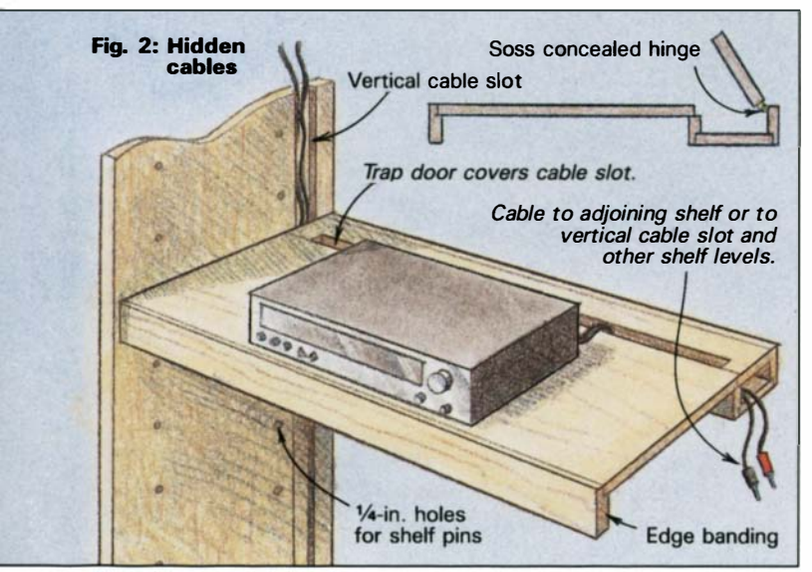


Fig. 2: Hidden cables



ing against the wall. The other shelves lean slightly to the rear. Strips fixed behind the shelves keep the books from tumbling out of the case, and also help prevent racking. As a decorative touch, he bandsawed each of the upright standards in a teardrop shape and accented the lines of the piece by carving an undulating curve on the outside surfaces. He did all the carving with hand gouges, then sanded the piece smooth before finishing with several coats of clear Danish oil.

In today's age of electronics, shelves are commonly needed for personal computers, TV and VCR, and a wide range of stereo equipment. Even the best designed shelving units can be ruined by the tangle of wires that power all this equipment. Joel Katzowitz, a designer with Design South, an Atlanta, Ga., firm which designs and builds displays for exhibitions and trade shows, has a solution for hiding the clutter—movable shelves with a wire run hidden by a small trapdoor. The shelf, shown in figure 2 rests on support pins and can be moved up or down to fit the equipment. A vertical groove plowed in the case

Ron Christensen's shelves ostensibly fail the basic role of shelving, as they appear to be breaking apart, dumping books on the floor. They're actually torsion boxes fixed to the wall with metal angle brackets.

sides makes it easy to run wires from shelf to shelf.

Nelson's leaning shelves are a step away from doing away with the case altogether, and fastening the shelves directly to the wall. As the variety of commercially made bracket systems indicates, open shelving is very popular, particularly in uncluttered, modern interiors. Ted Scherrer, who operates Fairhaven Woodworks Co. in Bellingham, Wash., builds open shelving systems with all-wood brackets, shown on the facing page, that are strong and graceful. The bracket is made from two pieces of hardwood mortised and tenoned together at right angles to each other (figure 3), then shaped to a smooth, flowing radius with a drum sander. Scherrer makes two types of wall-mounted standards to go with the brackets. One has ½-in.-wide angled slots cut across the standards, which are covered with solid-wood strips glued along both edges. The other has ½-in. holes bored on 2-in. centers along its length. To fit the slots, he glues a hardwood tongue on the back of the brackets. The tongue locks into the standard with a wedging action. For the ½-in. holes, Scherrer uses a standard dowel pin.

Lake Union Woodwork in Seattle, Wash., also makes bracket shelving. The movable wooden bracket shown in figure 4 fits between vertical standards fastened to the walls. Company manager Keith McCauley said the standards are drilled on 3-in. centers for a ¼-in. dowel that reaches through the holes and the bracket as a height-adjustment pin. A second dowel, the support pin, is inserted through the front of the bracket and rests on the front edge of the standards, holding the top of the bracket perpendicular to the standards. The standards are screwed to the walls through three blocks fixed in rabbets on the back edge of each vertical member. For the system to work efficiently, the standards must be plumb and aligned on the same plane with each other. The blocks can be shimmed out with metal washers to do this.

The shelves are made up of boards joined end-to-end with jigsaw puzzle-like dovetails, which allow you to make long shelves from short, easily handled boards. Sliding bookends run in a ¾-in.-wide slot that extends nearly the length of each shelf. A tongue on the end of the bookend drops through 2-in. holes bored at each end of the slot. The bookends are fairly simple to make, but it's important that the dowel pin be located to tilt the bookend slightly toward the books it is supporting. The angle makes the bookend automatically lock itself in place with a pinching action. To move the bookend, you simply press its top toward the books, and, because the bottom edge is beveled at 45°, it will release.

Bookcases can be a challenging project for any woodworker. The case can be as elaborate as your energy and pocketbook allow, and there are numerous opportunities for you to show off your joinery and design skills. You can have a little fun, too, and throw in an unexpected twist as did Ron Christensen, a custom furnituremaker in Atlanta, Ga. His shelves are a sight gag—they appear to be broken, the books on them tumbling. The stepped shelves are actually a series of torsion boxes covered with ¼-in.-thick veneer. Despite their appearance, the shelves work fine, in addition to being a delightful eye-catcher. □

Dick Burrows is an associate editor of Fine Woodworking.

Photo: Ron Christensen

Sliding Dovetails

Routed joint eases carcase assembly

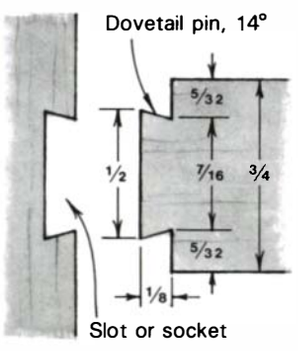
by Mac Campbell

I have a physical limitation that handicaps me in some shop operations, particularly the assembly of large, complex carcases: I have only two hands. On carcases assembled with dowels or mortise-and-tenon joints, juggling clamps, cauls, glue and panels at the same time is a major problem. In the past, my solution was to assemble parts of the carcase separately, then put these together until the whole assembly was finally completed. This was unsatisfactory because it required large amounts of time and space, and made perfectly square assembly more difficult. Since I do a large amount of carcase work, this problem screamed for a solution, and eventually I found one: the sliding dovetail.

The sliding dovetail is a wonderful joint. Used throughout a carcase, it virtually guarantees that the piece will square itself. Slightly cupped or bowed panels will be pulled flat, and stay flat. The joint can be blind or left exposed; it allows one-piece-at-a-time assembly, requires no clamps, and can allow for cross-grain movement. Its only drawback is that because the joint's male pin must fit tightly into the tail, or female slot, it's devilish to cut accurately.

If the joint is cut with a 14° dovetail bit, which yields about a 1:4 ratio, cutting the male portion of the joint 0.010 in. too narrow allows a gap of 0.040 in., or just under 1/16 in., between the two panels. Cutting it 0.010 in. too wide produces a joint that can't be assembled. Actually, it's worse than that. The joint can be partially assembled until it jams so tightly you can neither drive it home nor get it apart for another try. A joint that's too tight is a greater disaster than one too loose. The trick is to cut the joint accurately and quickly. There are machines that do this (*FWW* #54), but they're expensive. My system works and costs about a half-day to set up, plus a trip to the scrap pile for materials.

The female part of the joint, called the slot or socket, is fairly straightforward (**1**). Lay out centerlines for all joints, marking them clearly; also mark where the joints are to be stopped if they're not to be cut clear through. I use the hinged plywood fence shown and explained on the facing page. With the guide clamped in place, set the router to the desired depth. While I've cut a number of joints with 1/4 in. penetration, I use 1/8 in. as a standard. It's more than strong enough, and if two panels are to be joined to opposite sides of a 3/4-in. central panel, it leaves more strength in the central piece. Another advantage is that if the joint's a bit too snug, 1/8 in. of wood is easier to crush into place than 1/4 in.



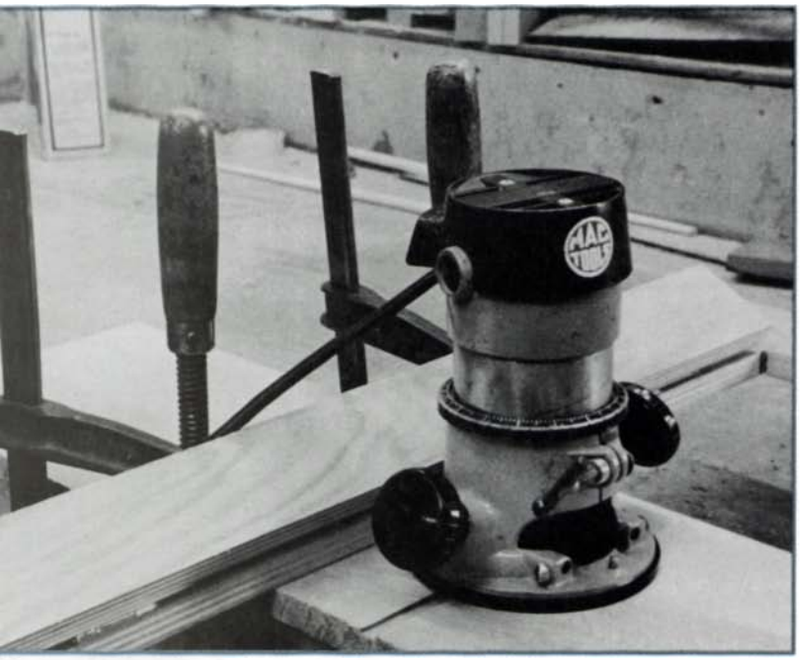
The trick to making a sliding dovetail joint work is cutting the male (dovetail pin) portion of the joint. Ideally, it would be cut by two dovetail bits opposite one another, cutting both sides of the pin at the same time. Since this is hard to set up, most methods I've seen cut the pin's two sides one at a time, and here the problems begin. The usual procedure is to cut one side, flip the workpiece and cut the other side. This depends on the piece being *absolutely* even in thickness across its width; any small deviation results in a large discrepancy in the joint. If the piece isn't perfectly flat, the situation gets worse, since on one pass it can rock, and on the other it can be lifted off the reference table by the bow.

The heart of my system lies in using an existing flat surface as a reference table and using the same side of the workpiece to reference *both* sides of the joint. I use the infeed table of a 15-in. jointer, but a tablesaw table or good bench would work as well. Photo **2** shows the general setup, with the router mounted on a pivoting subbase/fence. Photos **3** and **4** show the two sides of the pin being cut.

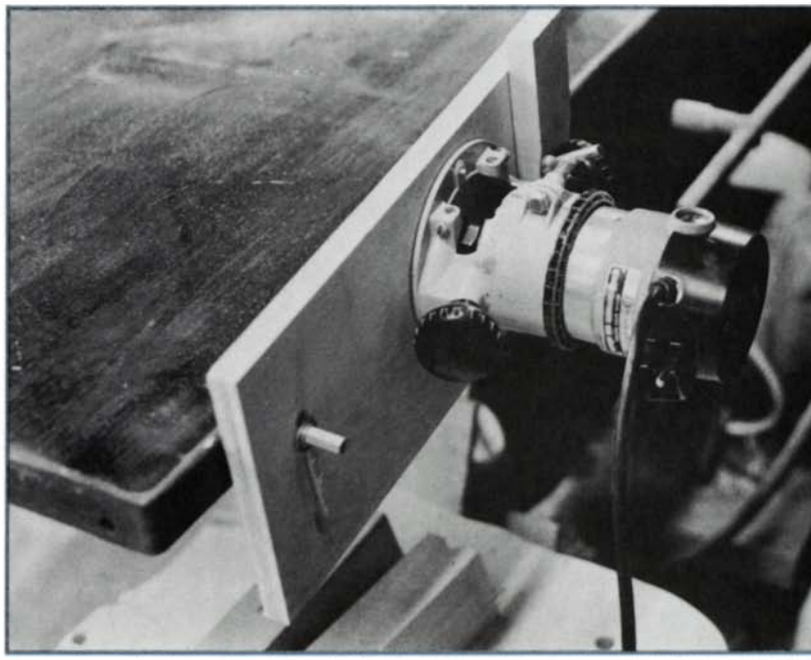
Assembling cabinets by yourself with this type of joinery is a relaxed process. I like to work on the floor so I can use my weight to slide panels into place. I usually start the joint together to see just how tight the fit really is. If it's too tight, I'll take it apart and take a discreet pass with a dovetail plane. If it's fairly tight, I'll partially assemble the joint and apply glue to the exposed parts of the joint in both panels. If the fit feels "just right," I'll apply glue just after the assembly is started, and if it's a little slack, I'll apply the glue to both halves of the joint, then wait for a few minutes before assembling to allow some swelling to take place. Usually, the panels slide smoothly into place, one after the other, and the swelling caused by the moisture in the glue locks the panels securely within a minute or two. If the joint involves cross-grain construction, apply glue to only one end of the joint just before it's completely assembled. Panels that seem loose can be clamped until the glue dries, but it's rarely necessary if care is taken in cutting the joint. It takes very little glue to lock the joint securely. If a joint binds and it's too late to disassemble it, it can be drawn into place using a pipe clamp with the faces rotated 90° around the pipe to engage each panel.

The sliding dovetail has become my standard joint for virtually all carcase construction in which panels meet in a T- or cross-configuration. It's quick, reliable, strong, and comfortable for an individual working by himself to use. The only drawback is that the joint requires considerable care and accuracy to cut, but that's really what cabinetmaking is all about. □

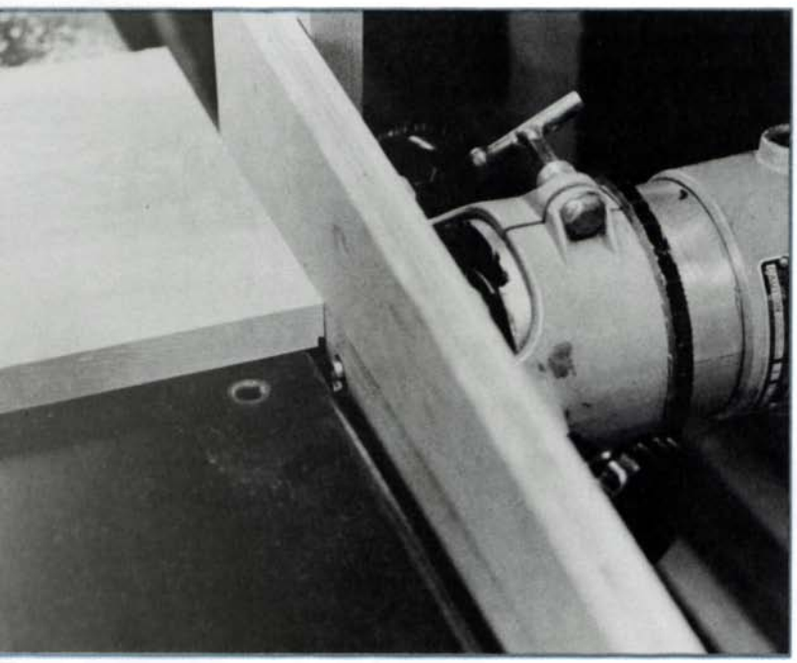
Mac Campbell runs Custom Woodworking in Harvey Station, New Brunswick, Canada. Photos by the author.



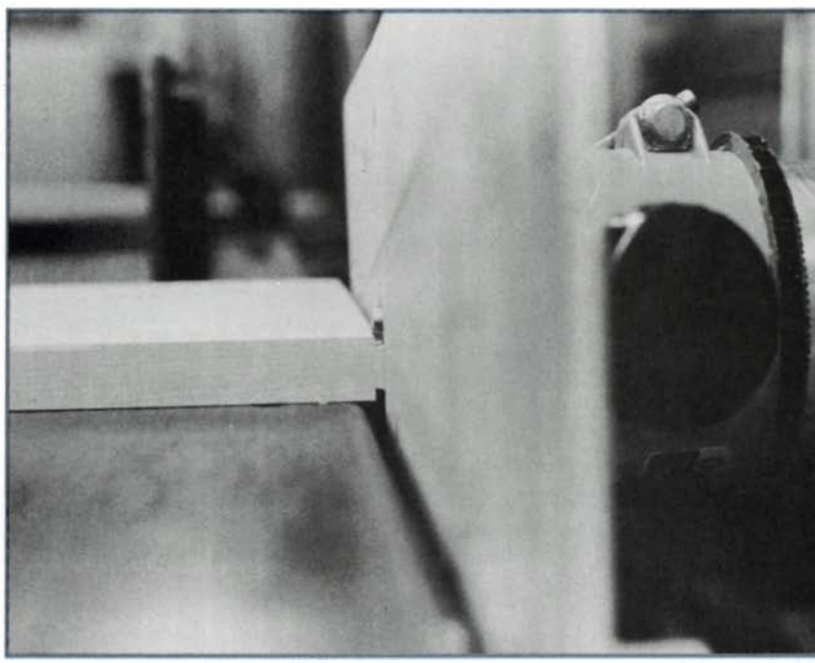
1: I rout the slot or socket about ⅛ in. deep, using the shop-made fence shown in the photo above. The fence's hinged lip makes alignment easier: The hinged part is exactly half as wide as the router base, so that when the lip is flipped down, its edge marks the centerline of where the router bit will be. The first step is to draw the centerline of the slot on the work and align the flipped-down fence with it. After the fence is clamped in place, I flip the lip up out of the way for routing. The L-shaped extension on the end of the fence acts as a built-in stop when routing stopped dovetails.



2: Rout the male, or pin, part of the dovetail using a plywood subbase/fence attached at right angles to a reliably flat surface. I drilled and tapped holes in my jointer table to accept the jig, which adjusts by pivoting on one bolt (concealed by the router in the photo), and locking via the bolt and slot in the foreground. The hole for the dovetail bit should be just large enough for the bit, though it can be counterbored to allow clearance for the collet nut, if necessary. When mounting the jig, shim the subbase far enough away from the edge of the table so the bit can be lowered completely below the work surface (see photo 3).



3: All cuts are made with the same reference side of the board down. Set the router to cut one side of the joint and cut that side on all pieces. Try to feed the work with a uniform, comfortable speed and pressure; when you cut the second side of the joint, your goal will be to match that speed and pressure. I prefer making the cut with the bit climb-cutting (feeding with the bit's rotation), since this eliminates chipping. Otherwise, score the cutting line first with a cutting gauge to prevent tearout. Before changing the router setting, cut the joint on several pieces of scrap for testing the second cut.



4: When all the cuts of the first side of the joint have been made, re-set the router to cut the opposite side. Run the first of your scraps through, then test it in one of the female cuts made earlier, and adjust the router if necessary. (I have never had one fit on the first try, but I keep hoping.) Continue this adjustment process until you get the fit you want. Because of the built-in geometry of the joint, the slight swelling caused by the moisture in the glue can be enough to jam things up, so err on the side of looseness, but only slightly. Once you're satisfied with the fit, cut all the joints.

Making Split-Bark Seats

Weaving a durable bottom from hickory

by Jeff Shriver

From the last half of the 19th century until just after World War II, almost every Appalachian homestead had several simple, but well-constructed woven-bottom chairs. Most were variations on a theme: two bent back slats, with bent and splayed back posts, flattened on one side from the seat to the top of the post. Ash, hickory and hard maple made the posts, white oak was frequently used for the rungs.

Chair bottoms were woven of any number of materials, usually gotten from indigenous plant sources. Cattail leaves, corn husks and broom sage provided what's commonly referred to as "rush," but more often white oak splits or strips cut from the inner bark of the hickory tree were used. Hickory bark was the most durable, easily woven and inherently beautiful. Fresh from the living tree or after soaking in water, it's extremely soft and pliable. But when dried, it's nearly as hard as hickory wood itself and will withstand a lifetime of daily use.

Such old chairs are often available at flea markets, and renewing the bottoms of these worthy derelicts offers a rewarding and fascinating opportunity to learn a forgotten craft, increases the value of the chair, and most important, provides

you with a place to "set a spell." Of course, the methods I'll describe in this article can also be used to outfit a new chair. Since seat weaving is a down-home green woodworking technique, you don't need much in the way of special tools, just a drawknife, a good pocket or utility knife and a bark spud. A shaving horse is optional.

To begin with, you'll need to familiarize yourself with the various hickories that provide the raw materials. Hickories are divided into two distinct groups: the pecan hickories and the true. The true hickories, shagbark *(Carya ovata)*, shellbark *(C. laciniosa)* and pignut *(C. glabra)*, indigenous to most of the United States and Canada, are eligible candidates for stripping. Shagbark and shellbark, as the names imply, have loose, shaggy gray scales or plates curling up at the loose end. Due to the variable degree of scaliness, it may be difficult to positively distinguish between the two without inspecting the leaves and comparing your observations to the hickory entries in a good tree identification book. In either case, they both work equally well. The pignut lacks the scales completely and is more similar in appearance to the bitternut *(C. cordiformis)* and the mockernut *(C. tomentosa)*, which are among the pecan hickories. Their deeply furrowed bark clings tightly to the tree and is light gray in color.

If you've access to a forest, you may want to locate and cut a live, standing tree. You'll know that the tree is healthy and freshly cut and there's a certain intangible pleasure of knowing from whence it came, and of being involved in every stage of the process. If you don't have access to any standing hickory and have no use for the wood inside the bark (in this instance it's a waste product), you may want to explore a more ecologically sound alternative; go to a sawmill and peel trees already cut. Due to its extreme hardness and difficulty in drying, hickory is accorded low status in the lumber industry. Tool-handle manufacturers buy most of it, almost always in the log form. It may take a month of calling or visiting sawmills to find any. Then, when you've succeeded, you may have to hasten to the mill and start working immediately, before the logs are sawn into small blocks.

One important factor to consider when looking for logs is the time of year when they were felled. This is crucial. Trees cut during the winter months, late summer or fall are virtually impossible to peel. Trees felled in late April, May and June will relinquish their bark with a minimum of effort. As the season advances, separation of the bark from the tree becomes increasingly difficult, and typically by late July, a pleasant occupation can become an arduous struggle resulting in cut and smashed fingers and shins, with little bark to show for your efforts.

After locating some usable logs, your next concern is handling these long, awkward timbers. At 64 lb. per cubic foot, hickory is one of the heaviest woods. To get strips long enough to wrap once around the chair bottom and a little excess, they'll need to be at least 4 ft. long. In other words, you've got some very heavy objects to wrestle around. The ideal tool is a peavey or cant hook, but in lieu of that, a spud bar will work, or any long, stout pole capable of offering some leverage. If you're at a sawmill and the logs are stacked in a pile, you'll have to roll them off to the ground where they can be rolled over a few times. You may want to seek the aid of whatever power log-handling equipment is available at the mill. The operators usually don't mind helping, just be certain to show your appreciation. In any case, the log needs to be lying on some reasonably flat surface, where it can be rolled over once completely.

An alternative to stripping whole logs is to peel the waste slabs left over after the cant has been initially squared. They're small,

1. To remove the inner bark of a hickory log, Shriver first kerfs the length of the bole with a chainsaw. A trenching shovel slipped between the wood and the bark loosens the slab enough to be peeled by hand.

manageable pieces, and they already have an edge you can get under to pry up the bark. You may have to make prior arrangements with the sawyer to leave the slabs whole, as most mills routinely cut this waste material into firewood.

Before you strip the bark, it's a good idea to calculate the amount you'll need. To estimate this, find the area of the seat (disregarding the splay) in square inches and multiply by five. Why five? The warp must cover the top and the bottom in one direction, that's twice the area. Then the woof, which runs at 90° to the warp, covers the top and bottom one time each. That's four times. The other 20% accounts for the splay and waste.

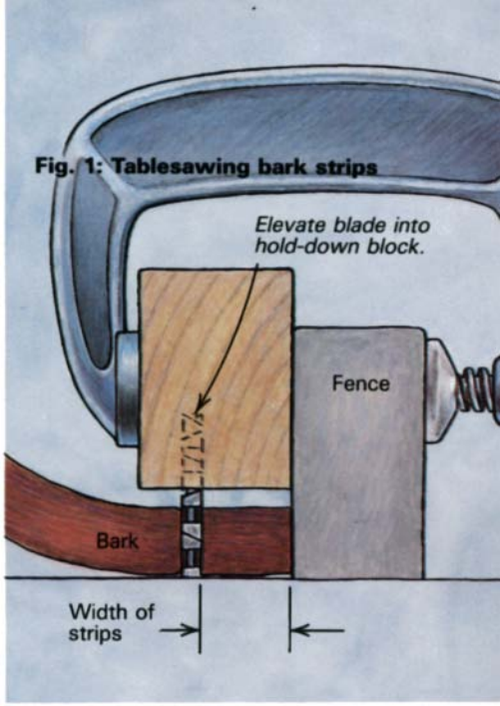
Estimating how much bark a given tree will yield, although fundamentally simple, is subject to a considerable degree of error. Using the formula for finding the surface area of a cylinder, π times diameter times length (in inches) and multiplying by two will give a ballpark figure. The actual yield will depend on log quality, incidence of knots, buckshot and fence-wire wounds, log taper and the thickness of the bark. You multiply by two because before you're through, you'll split all the material in half, doubling the amount (at least).

Just as there's more than one way to skin a cat, so, too, with skinning a log. For seat weaving purposes, you're interested in only the inner bark. To get it, you have to peel off both the rough, outer bark and the inner bark, separating the outer bark later. For a log 10 in. in diameter or larger, a particularly effective technique is to cut a longitudinal kerf through the bark down to the wood, in sections approximately 8 to 10 in. in width. A chainsaw is most effective at this task, but a hand axe will yield equivalent, if slower, results. If you're peeling a sapling, another method is to shave it off with a drawknife. Being thinner and more flexible, the inner and outer bark on these youths is much easier to peel. However, it's thin and can't be split as can the thick bark of old patriarchs.

At any rate, assuming you've chosen a large tree, start at the end of the log, slip a bark spud between the bark and the wood, and pry up. If you don't have a bark spud, a trenching shovel, spud bar, or anything that's thin enough to slip between the wood and

2. After soaking the peeled slabs for a day, the author removes the rough outer bark with a drawknife.

3. The debarked slab is cut into strips with a stout knife or ripped on the tablesaw. The hold-down shown at right makes for safe tablesawing.



bark, and long enough to offer some leverage, will suffice. Keep prying up and moving forward. You can usually pull it off with your hands when there's enough pulled up to grip.

I've found that this process is eased somewhat by leaving the logs out in the sun for a week after they've been cut. The idea is, the wood looses moisture, shrinks and begins to separate from the bark. A word of caution though: after two weeks, the bark begins to dry out, starts adhering to the wood, and becomes as brittle as a corn chip.

After stripping the logs, immerse the bark slabs in water for at least 24 hours. This softens the hard, dry outer bark, the ends of the slabs that may have dried out, and removes any mud left clinging to the outer surface. The best technique is to tie all the slabs in a bundle and soak them in a pond or stream. Weight the bundle with rocks and secure it to the bank. A moving body of water is preferable to a still or stagnant pond. If left two or three days in a pond, the bark will develop an unsavory, acrid odor. However, if you choose a stream or river to soak the bundle in, you run the risk of it washing away. Just be certain the bundle is bound tightly and well-secured on shore. If no large body of water is available, anything large enough to submerge the material is adequate.

Next you're ready to shave off the outer bark. Two tools are required; a drawknife and a shaving horse. Inexperienced people often complain that drawknives aren't controllable, and can do little more than claw and scrape the wood. You may have to experiment with several kinds until you find one you like. Try turning the knife over, using it bevel side down (my favorite knife can be used only in this fashion). Be patient. It takes time to develop good control, but it will come.

The other tool, the shaving horse, provides a way to secure the bark while you shave. If you don't have access to one, you might consider constructing your own, using the plans shown in *FWW* #43. For rendering material for three or four chairs, you may not want to bother with building a shaving horse. Two C-clamps and a 2-ft.-long 2x6 clamped to a bench will suffice for a short run, although it's a little clumsy.

In either case, the idea is to place the bark on some support, secure it, and shave off the outer bark. If you're using shagbark or shellbark, the large plates will more or less break off, revealing a very thin, gray-green layer beneath. The external bark on the smooth-bark hickories is more tenacious and removed with more difficulty and care. What you're looking for is a greenish-yellow, soft material with a highly visible, reticulose character. It's not hard to see. Keep shaving the outer bark, being careful to remove as little of the inner bark as possible. Keep working at it until all of the outer bark has been removed.

Finish shaving the rest of the slabs, then stack them in a weighted pile to keep them as flat as possible while they dry overnight. Cutting the slabs into strips can be accomplished in several ways. Using a sharp knife with a thin, stout blade and a straightedge as a guide, score a line in the center, the entire length of the slab. Then fold it in half along the score line and finish the cut, working from the inside of the fold. All the cuts are made using this cut-and-fold technique. It's best to keep the strips ⅜ in. to ¾ in. wide. Anything wider makes splitting the strips too difficult.

If you are preparing a large quantity of strips, using a tablesaw will expedite the process tremendously. Also, strips cut on the tablesaw have smooth, straight edges and are much easier to split than knife-cut strips. To get the initial straight edge to run along the fence, either cut the slab in half using the knife, or guide it freehand through the saw. This is not as dangerous as it sounds, just be certain to guide the slab through slowly and in a straight line (striking a chalkline is helpful). If it begins to catch on the back side of the blade, you're not guiding it straight. To minimize this problem, set the blade at a nominal projection above the table. To tablesaw the slabs into strips, use the method shown in figure 1.

By now, the strips are probably too dry and stiff to manipulate easily, so they'll need to be soaked in water for several hours until they are once again soft and pliable. When they can be wrapped tightly around your finger, they're ready for splitting.

Using a sharp knife, start the split at one end of each strip, being careful to start the cut as close to the center as possible. Now grab each strip between your thumb and index finger and pull them apart, being careful to keep the split running down the center. This is the key to the success of this splitting process; keeping the split in the center of the strip. If it starts to run to one side, pull on the opposite, thicker side until the split is again centered. Keep a close eye on both sides; it may be perfectly centered on one side and grossly off-center on the other. This can be corrected by carefully manipulating the strip in a twisting fashion, keeping in mind to pull on the thick side until the split is once again centered. If you find the split has gotten too thin on one side to effectively center it again, you

Drawings: Michael Janos

4. Bark from old trees is usually thick enough to be split three or four times, yielding weavable strips ⅝ in. to ¾ in. wide and about ⅛ in. thick. With a knife, start a split in the end of each strip then coax the bark apart by hand, maintaining uniform thickness as you go.

5. Before splitting, Shriver soaks his strips until they're supple enough to bend easily around his fingers.

6. Shriver begins the warp by tacking a strip inside the front rung. The strip is carried under, around and over the side rungs.

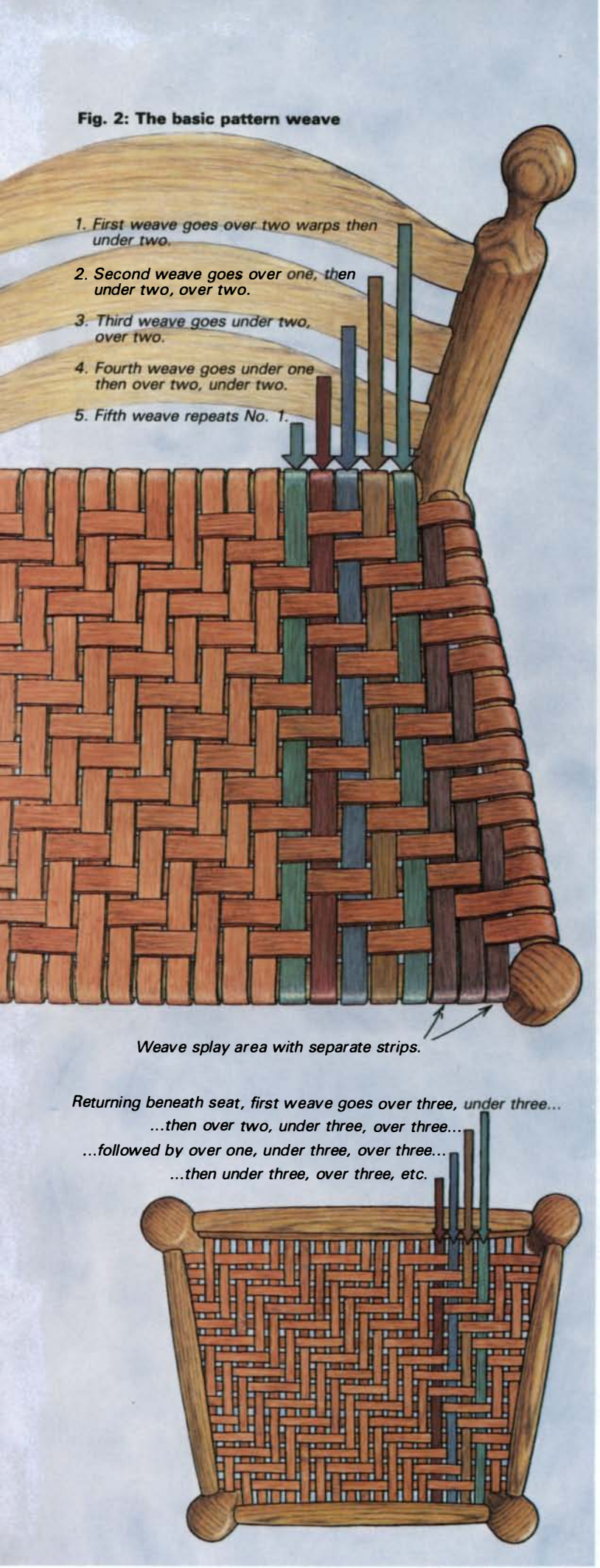
can cheat a little by using a knife to cut it back in. This may leave a "hangnail" that makes weaving more difficult, but it's better than wasting an entire strip.

Depending on the age and species you're working with, you may be able to split the strips more than once, possibly several times. The finished splits should be approximately ⅛ in. in thickness. After splitting, roll the splits in a coil and leave them to dry for later use. To prepare splits for weaving, soak them in water for at least 24 hours (less time is needed if the water is warm), until they can be folded without breaking or splitting out. I usually steep them for a few days, waiting for the water to darken to the color of strong tea. This effectively stains the splits to a uniform, rich dark brown.

Weaving a chair bottom is fundamentally a simple task learned in a few hours. The pattern described here is a traditional design found in most old, and many new split-bottomed chairs. The one key factor to keep in mind is uniformity of tension in the splits. Individually the splits are thin, frail members. When woven as an integral unit, they can withstand enormous stress. If one or two splits are more taut than the rest, they'll bear more than their share of the weight, and, of course, will be the first to break. Aesthetically, the only important considerations are keeping the splits running straight and the weave tight.

A brief vocabulary will be helpful. The warp is the material that is initially wrapped around the seat in one direction. The woof, or weave, is that material which runs at 90° to the warp and is actually woven in, over and under. The cardinal points of left and right are expressed assuming the individual is looking at the chair from the front.

To begin the warp, nail a split to the lower inside of the front rung with a carpet tack. It's best to attach it to the right of center so there will be sufficient length to be woven into the pattern later on. Run the split first under the left rung then up and around on to the top, over to the right rung, around and under. Continue this process until the end of the split is reached, at



7. As more warp length is needed, bark strips are spliced on by tying them with thread let into notches cut about 4 in. from the end of each strip.

which point you'll splice on another split to continue the warp.

The splice should always be done on the bottom, so some of the split may have to be cut off and discarded. This can be a painful procedure, considering the amount of effort put into making them, but alas, it must be done. Also, all the splices should be done as close to the center as possible. This ensures that both ends of the splits will, when the weaving is complete, become an integral part of the whole. The splice is simple; overlap the two splits (the fresh one and the ending one) about 4 or 5 in. With a sharp knife, cut two notches, one on each edge of the overlapped splits, then wrap several layers of heavy thread in the notches, and tie it off. The notches should be at least 4 in. from the ends of the splits, otherwise you may tear the notches out and pull a splice apart later on.

After splicing, proceed as before, keeping equal tension on all the splits. Also, don't pull them too tight or weaving in the woof will be a brutal task. To test for the proper tension, press down on the splits with the palm of your hand. The top layer should almost, but not quite, touch the bottom layer.

The transition from warp to woof goes like this: When you've reached the back of the seat, the last split on the top travels, as before, up and over the left rung, across the top of the seat, around the right rung to the bottom. But, instead of going across the bottom, the split is wrapped one-quarter of the way around the right rear post and around the back rung, up and over to the top of the seat. If you have made the transition properly, you should be at the right rear of the seat, and the split should be traveling at 90° to the warp. At this point weaving commences.

First, begin by going over two splits, then under two, then over two, and so forth until the front rung is reached. Then turn the

8. Warp to weave (woof) transition is made by wrapping up and over left rung, across the top of the seat, down and around the right rung to the rear rung.

9. The first weave moves toward the front of the chair, passing first over two strips, then under two strips, and so on.

10. As the seat progresses, a butter knife acts as a ramp to ease insertion of the weavers. The chair's splay forms an unwoven section that will be filled in with separate pieces.

chair over, wrap the split around the rung and this time go over three, under three, over three, and so forth to the rear rung. On the bottom, the three sequence is used to save time; the looser the weave the easier it is to weave, therefore, faster. Proceed around the rear rung, turn the chair back over, and instead of going over two, go over only one split initially, then follow the same sequence of under two, over two, etc. to the front rung. Turn the chair over and on the bottom go over only two this time, then, as before, resume under-three over-three weaving to the rear rung. On top again, the split will go under two this time but on the next run it will go under one, then you're back to the original over two and the sequence begins again. Underneath, from the beginning you start with over three, over two, over one, under three, under two and under one. At the end of this sequence, you start again with over three.

As in the warp, all splices are made on the bottom, however, tying is unnecessary. Simply weave the ending split as usual, until it ends, preferably near the center of the seat. Then begin weaving the fresh split from the front rung, being careful to maintain the pattern. This is most easily done by looking at the pattern, counting over to the front rung following the sequence of over three, under three, etc. Weave in the fresh split accordingly and overlap it 6 or 7 in., hiding the loose end under an "under three" portion. Proceed with weaving the top and the bottom, keeping the splits running straight and snug. At this point, don't worry about the unwoven portions formed by the chair's splay.

As completion nears, the weave tends to tighten and the weaving becomes increasingly difficult (particularly if you've wrapped the warp too tightly). At this point, an un-serrated butter knife will help in weaving the final stages. Use the knife to enlarge the gap where the weave is to enter and slip it in. Remove the knife and do the same thing where the split will exit, using the knife as a ramp to guide the weaver out.

The final weaver (i.e. the rear rung is filled with woof) is simply woven in as before and tucked in underneath an under three sequence on the bottom. To fill in the splay, cut several strips 12 to 14 in. long. Often the ends cut off during weaving can be used. Then weaving from the front, and on the top, continue the pattern as before. Since the side rungs run at an angle relative to the front, each successive split will be slightly shorter than the last. I usually fill in both sides on top, then flip the chair over and finish the bottom. The ends on top and bottom are again tucked under.

Completing your first seat may be a slow, exasperating experience, particularly if you don't pay close attention to the proper beginning sequence. If you make mistakes, pull the woof out and start over. Your fingers may cry out for relief after four or five hours. If you must temporarily abandon the task, douse the seat on both sides with water (preferably warm) and cover with a wet towel. Repeat the dousing when you return. If you are absent longer and the seat dries out completely, repeated drenching with hot water will renew the suppleness.

When dry, the seat should be tight and elastic. A quick pass with 100-grit sandpaper on an orbital sander, followed by a propane torch, will eliminate any wisps that remain. Lastly, I usually brush on a liberal coat of thin linseed oil, but this is optional. □

When he wrote this article, Jeffrey Shriver lived in West Virginia. He has since moved to Tucson, Ariz., where, in addition to chairmaking, he's exploring the architecture and furniture of the Southwest.

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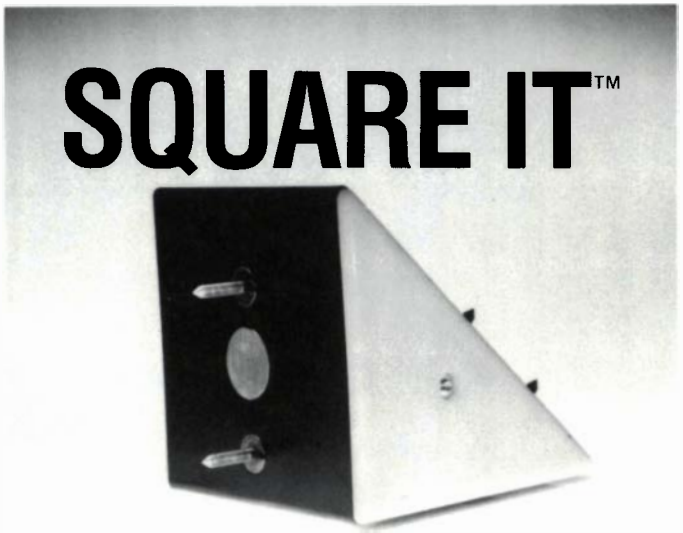

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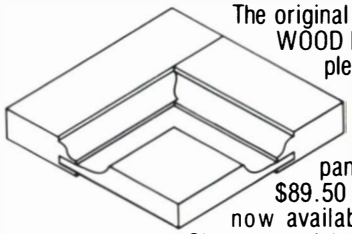

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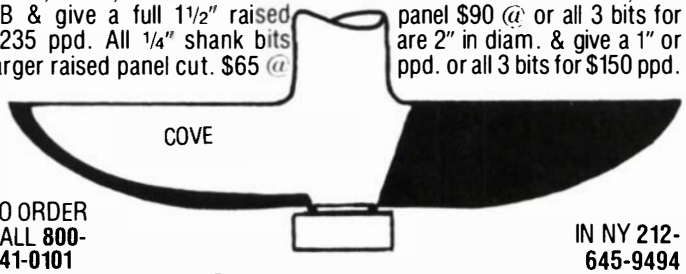

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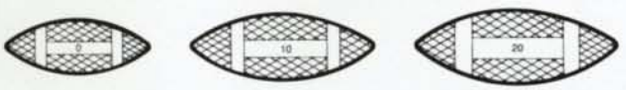

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Antique woodworking tools for sale. $1 for list. Rick Rubin, W. 1421 16th, Spokane, WA 99203. (509) 624-9354.

Stanley # 55, good condition, all cutters and parts, asking $300. Call (214) 674-4925,

Spalted turning blocks--exotic, reasonable. $1 for samples. D. Bush, 412 Central, Half Moon Bay, CA 94019. (415) 726-9153.

Hitachi FA 700 Super Surfacer, good condition, $950. Hitachi Grinder/Honer, $250. Brett Fanney, (413) 637-3280.

Kiln-dried red oak. 4/4 FAS $1.38/bd. ft., #1 $1.03/bd. ft. Good lengths, widths, color and texture. For S2S add 15¢/bd. ft. 100 bd. ft. minimum. G. White, 317 S. Main, Beebe, AR. (501) 882-5946.

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Walker Turner 10-in. tablesaw 1PH, excellent condition. $450. G. Hanson, 1515 Laurel Ct., Dundee, IL 60118.

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Wanted: 16-in. wheel for Wallace bandsaw. Peach Englund, 1208 Roundhill Rd., Baltimore, MD 21218. (301) 235-6536,

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Listings of gallery shows, major craft fairs, lectures, workshops and exhibitions are free, but restricted to happenings of direct interest to woodworkers. We'll list events (including entry deadlines for future juried shows) that are current with the months printed on the cover of the magazine, with a little overlap when space permits. We go to press two months before the issue date of the magazine and must be notified well in advance. For example, the deadline for events to be held in March or April is January 1; for July and August, it's May 1, and so on.

CALIFORNIA: **Workshops**—Woodworking for women, beginners and advanced, traditional furnituremaking, focus on handtools. Contact Debey Zito, 103 Wool St., San Francisco, 94110. (415) 648-6861.
Show—6th annual Woodline-East Bay woodcrafters, Mar. 7–8, 1731 Clement Ave., Alameda. Contact Dick Compton, 4351 Whittle Ave., Oakland, 94602, (415) 531-6455, or Nancy Horowitz, Woodline, The Japan Woodworker, 1731 Clement Ave., Alameda, 94501. (415) 521-1810.
Classes—Marquetry, furniture repair and veneering, woodfinishing and refinishing, Allan Fitchett, Feb. 3–5. Many other classes. Constantine's Wood Products, Inc., 5318 W. 144th St., Lawndale, 90260. (213) 643-9484.

COLORADO: **Workshop**—Wood, its properties, peculiarities & predictabilities for furniture and cabinets, Bruce Hoadley, Feb. 7–8. Contact Ray Scott, Woodworking Weekends in Colorado, 12922 W. Montana Ave., Lakewood, 80228. (303) 986-9102.

CONNECTICUT: **Exhibition**—30th annual crafts exposition, July 16–18. Application deadline Feb. 21. 30th Annual Guilford Handcrafts Expo, Box 221, 411 Church St., Guilford, 06437. For more information contact Fernn Hubbard or Joyce Wright, (203) 453-5947, 453-6237.

DELAWARE: **Auction**—Antique tools, Apr. 11. Contact Bates & Brown, Inc., Rte. 3, Box 159G, Hockessin, 19707.

FLORIDA: **Workshop**—36th annual Florida Craftsmen conference and exhibition; workshop in wood, Mark Lindquist, Jan. 31. Valencia Community College, Orlando. Contact Ellen Patton, Florida Craftsmen Conference, 1601 Orlando Ave., Longwood, 32750.
Classes—Woodfinishing, veneering, furniture repair, Allan Fitchett, Feb. 26–28. Many other classes. Constantines Wood Center of Florida, Inc., 1040 E. Oakland Park Blvd., Ft. Lauderdale, 33334. (305) 561-1716.
Exhibition—24th annual Coconut Grove arts, Feb. 14–16. Sponsored by Coconut Grove Association, Inc. Contact Suzanne Kores, Asst. Dir., Coconut Grove Arts Festival, Box 757, Coconut Grove, 33233. (305) 447-0401.

ILLINOIS: **Juried show**—8th annual Fountain Square arts festival, June 27–28; outdoor show. Application deadline Apr. 10. Contact Evanston Chamber of Commerce, 807 Davis St., Evanston, 60201. (312) 328-1500.
Seminars—Routers, Jan. 16–17; plastic laminates, Mar. 13–14. Write Coordinator of Program Registration, College of Continuing Education, Adams Hall, Rm. 131, Northern Illinois Univ., DeKalb, 60115.

LOUISIANA: **Exhibition**—25th anniversary exhibition, Louisiana Crafts Council, Jan. 10–Feb. 26, Southdown Plantation/Terrebonne Museum, Box 2095, Houma, 70361. Contact Sheri Watkins (504) 868-4926; Mar. 8–Apr. 4, Bolton Library, Louisiana State Univ. at Alexandria, Alexandria, 71032. (318) 473-6438.
Workshops/seminars/juried show—Wood, David Ellsworth, Jan. 30–Feb. 1. Contact Lynda Katz, 450 W. Bennett Rd., Independence, 70443. (504) 878-6441. Made in the Shade, 19th Annual Louisiana Crafts Council, Jan. 30–Feb. 20. American Crafts Council Southeast Conference, Louisiana State Univ., Baton Rouge.

MARYLAND: **Juried shows**—12th annual spring arts and crafts, Apr. 10–22, Montgomery County Fairgrounds, Gaithersburg. 10th annual spring crafts festival, May 1–3, Maryland State Fairgrounds, Timonium. For information, send three stamps (66¢) for postage to Deann Verdier, Dir., Sugarloaf Mountain Works, Inc., 20251 Century Blvd., Germantown, 20874. (301) 540-0900.

MASSACHUSETTS: **Workshop**—8th annual wood identification, R. Bruce Hoadley, Jan. 20–23. Contact Antoinette E. Tomasik, Program Coordinator, Div. of Continuing Education, Goodell Bldg., Room 608, Univ. of Mass., Amherst 01003. (413) 545-2484.
Exhibitions—Sam Maloof, Feb. 5–Apr. 5; Worcester Craft Center's 17th annual craft fair, May 15–17. Application deadline Feb. 14. Contact Craft Fair Registrar, Worcester Craft Center, 25 Sagamore Rd., Worcester, 01605. (617) 753-8183.
Workshops/seminars—Numerous events. Contact The Woodworkers' Store, 2154 Massachusetts Ave., Cambridge. (617) 497-1136.

MICHIGAN: **Juried show**—28th annual national fine arts and crafts fair, July 22–25. Slide application deadline Feb. 15. For application write the Ann Arbor Street Art Fair, Box 1352, Ann Arbor, 48106.

MINNESOTA: **Workshops/seminars**—Numerous events. The Woodworkers' Store, 3025 Lyndale Ave. S., Minneapolis. (612) 822-3338.

NEW JERSEY: **Juried exhibition**—New Jersey arts annual, fiber, metal and wood, through Jan. 11. New Jersey State Museum, 205 West State St., Trenton, 08625. (609) 292-5420.

NEW MEXICO: **Show**—New Mexico Woodworkers sponsored by Albuquerque Woodworkers Association. Feb. 6–15. Fine Arts Gallery, New Mexico State Fair Grounds, Albuquerque.

NEW YORK: **Workshops**—Small projects, Japanese hand tools. The Luthierie, 2449 West Saugerties Rd., Saugerties, 12477. (914) 246-5207.
Exhibition—Ornamental turnings of Frank M. Knox, through Feb. The Art & Frame Gallery, 23 Main St., Mt. Kisco, 10549. (914) 666-2938.
Exhibition—11th annual American crafts festival, July 4, 5, 11, 12. Lincoln Center for the Performing Arts, New York City. Application deadline Jan. 30. Contact Brenda Brigham, American Concern for Artistry and Craftsmanship, Box 650, Montclair, NJ, 07042.
Exhibition—MFA Sculpture Exhibition, Feb. 18–Mar. 13. Parsons Gallery, 2 West 13th St., New York, 10011. (212) 741-7572.
Classes—Beginning to advanced woodworking, Maurice Fraser, Feb. 1 through May 30; $170 per course, registration Feb. 1. Free dovetail demonstration Jan. 26, 6 P.M. YWCA Craft Student League, 610 Lexington Ave. (corner of 53rd), Manhattan. (212) 755-4500.

NORTH CAROLINA: **Juried exhibition**—Showcase of woodcarvings, Feb. 28–Mar. 1, deadline Feb. 12, no mail-ins. Park Center Auditorium, 310 North Kings Dr., Charlotte, 28204. Contact Showcase of Woodcarvings, 1418 Armory Dr., Charlotte, 28204, or Bonita Heffner (704) 336-2584.
Juried show—8th annual Winterfest art & craft show, Feb. 12–14. Asheville Mall. Contact Betty Kdan, High Country Crafters, 29 Haywood St., Asheville, 28801. (704) 254-0072.

OKLAHOMA: **Seminars**—Bowl turning, Alan Lacer, Feb. 21, 9 A.M. to 4 P.M.; between center turning, Alan Lacer, Feb. 28, 9 A.M. to 4 P.M. Registration fee $30 (each seminar). Moore-Norman Vo-Tech School, 4701 12th Ave. NW, Norman, 73069. Contact Deanna, (405) 364-5763.

OREGON: **Exhibitions**—Numerous shows, exhibitions. The Gallery, World Forestry Center, 4033 SW Canyon Rd., Portland, 97221. (503) 228-1367.
Workshops/seminars—Know your router, Jan. 10; joinery, Jan. 17 & 24; Japanese tools and joinery with Jay VanArsdale, Feb.; tablesaw jigs and fixtures, Mar. 28; woodworkers on film, weekly showings Jan. 12–Mar. 13. Contact The Wood Workshop, 1108 NW 21st, Portland, 97209. (503) 242-1849.

PENNSYLVANIA: **Seminars/demonstrations**—Power tool joinery, Jan. 17. Olde Mill Cabinet Shoppe, RD 3, Box 547-A, York, 17402. (717) 755-8884.
Juried show—9th annual Long's Park art and craft festival, Sept. 5–7. First jury deadline Feb. 15; final jury deadline June 1. Entry fee $10. For application send #10 SASE to Dick Faulkner, Long's Park Arts and Craft Festival, Box 5153, Lancaster, 17601.
Seminar/demonstration—Something new, woodturning with O'Neill, Stirt, Sharpless, Ellsworth, Stone, and more, Mar. 20–22. Contact Jon Alley, Fine Arts Dept., Bucks County Community College, Swamp Rd., Newtown, 18940.
Exhibition—Wharton Esherick, sculpture, furniture, utensils, daily. The Wharton Esherick Museum, Box 595, Paoli, 19301. (215) 644-5822.

TENNESSEE: **Juried exhibition/workshops**—Space: New Form, New Function, mixed media, through Jan. 24. Spring 1987 assistantships, Mar. 9–Apr. 3, application deadline Jan. 17. Arrowmont School of Arts and Crafts, Box 567, Gatlinburg, 37738. (615) 436-5860.
Juried show—Master furnituremakers show, Apr. 24–26. Application deadline Jan. 15. Sponsored by Dogwood Arts Festival, 203 Fort Hill Bldg., Knoxville, 37915. Contact Carol Evans (615) 637-4561.

TEXAS: **Exhibition**—Vessels and Forms, lathe-turned wooden pieces, Mar. 6–May 1; sponsored by The Houston Festival. 1600 Smith Building, Houston, 77002. Slide deadline Jan. 9. Contact Peter J. Hutchinson, Curator, Vessels and Forms Exhibit, 13818 St. Mary's Lane, Houston, 77079.
Exhibition—Crafts and arts exposition, 1987 Houston festival, Mar. 19-29. Contact Barbara Metyko, Production Dir., The Houston Festival, 1964 West Gray, Suite 227, Houston, 77019. (713) 521-0993.

WASHINGTON: **Workshop**—Lofting, Eric Hvalsoe, Jan. 28–Feb. 1. The Center for Wooden Boats, 1010 Valley St., Seattle, 98109. (206) 382-BOAT.
Workshops/demonstrations—Tools-In-Action series, free, every Saturday, 10 A.M. Boatbuilding, woodcarving, sharpening, other woodworking topics. The Wooden Boat Shop, 1007 NE Boat St., Seattle, 98105. (206) 634-3600.

WISCONSIN: **Juried show**—15th annual festival of the arts, Mar. 29. College of Fine Arts, University of Wisconsin, Stevens Point campus. For information, write 15th Annual Festival of Arts, Box 872, Stevens Point, 54481.

ONTARIO: **Show**—Machinery and Supply Expo (WMS '87), Mar. 28–30; daily seminars. Automotive building at the Canadian Exposition. For information, contact Joan Landis (203) 964-0000 or Alex di Meo (514) 937-5383.

Hough's Encyclopaedia of American Woods by Ellwood S. Harrar and Fred M. White. *Robert Speller & Sons Publishers, Inc., P.O. Box 825, Madison Square Station, New York, N.Y. 10010; 16 two-part volumes. Part I, $50 per vol., ring binder, 25 species; Part II, $25 per vol., clothbound; 200 pp.*

This encyclopedia comprises 16 volumes in all, each volume covering 25 species. Part I contains specimens of the woods. Mounted in windows on the page for each species are a transverse, radial and tangential slice of wood. Each is cut cleanly enough to observe cellular arrangement with a hand lens to aid in identification work, and each can be used to check for fluorescent response to ultraviolet light.

Part II, the text discussion of each species, is divided into three sections: general information (i.e. historical notes, companion species, etc.); a description of the tree, including size and form, geographic range (with accompanying range maps); and, finally, the wood is described in terms of gross diagnostic features and microscopic anatomy. A glossary of terms and an extensive bibliography are also included in Part II.

The background of this work is somewhat legendary, having begun a century ago with the original work of Romeyn Beck Hough. Hough began cutting sections in 1883 and published the first volume in 1888, with successive volumes published until his death in 1924. Four years later a 14th and final volume was released, the text prepared by Hough's daughter, Marjorie G. Hough. A huge stock of original wood sections still remained and were made available for preparation of the current edition of *American Woods*, begun in 1957.

Of the current limited edition of 1,000 sets, between 800 and 900 subscriptions have been sold, but all volumes published to date are still available. At approximately $1,200 for the entire set, it doesn't seem like a routine addition for the individual woodworker's library. However, most sets are located at major public libraries and institutional and college libraries throughout the country. Because of its value as a source for wood properties and identification, or simply because of its uniqueness and overall accomplishment, every woodworker might find it profitable and pleasurable to get acquainted with *Hough's Encyclopaedia of American Woods.* ***—R. Bruce Hoadley***

Woodworkers Buyer's Guide to Power Tools by Frank M. Pittman. *JM Publications, 13 Walton Mall, P.O. Box 1408, Hendersonville, Tenn. 37077; 1986. $12.95, paperback; 206 pp.*

If I were in the market for a power tool, I'd surely be even more interested in this large-format volume, for it appears to accomplish its stated aim. That is, it gives an excellent overview of the business of purchasing tools. Not only are the major U.S. manufacturers covered, but so are many imported products. Notably absent, however, is the entire Inca line.

In his preliminary comments, Pittman makes useful observations about buying used equipment. He suggests checking for cracked and/or warped castings which more or less automatically render the machine unfit for service; further, running the machine with a nickel standing on edge will tell you a great deal about the machine's balance and general "tune." He also deals with Asian machines. Since many are copies of older U.S. models, repair parts for many an old machine may be available from the "right" import dealer. Apparently the quality of Asian machines is incredibly uneven; Pittman cautions us to examine the machine we are planning to buy—not just one with the same model number—so that we know what we're getting.

Most of us know more about what our machines do than we know about the motors that run them. Thanks to the short chapter about motors, I think I may now really understand the differences between single-phase and three-phase motors, and the differences between the kinds of switches. In motors, as in nearly all aspects of tool buying, the cheapest "up front" price may not be the least expensive over the tool's expected life.

The tools are sorted by type, and treated more or less the same. The section about tablesaws, for example, advises us to choose our tablesaws as much on the basis of what we'll do with them as on the basis of price or brand name. We're cautioned to pay special attention to table inserts, rip fences and miter gauges, the most used and complained about parts of the saw, and to use first-quality saw blades and keep them in good condition. Pittman hasn't tested these tools (or others in the book) and doesn't compare their performance one against the other. While the chapter emphatically doesn't say "you should buy a Brand X," it lays out specifications in such a way that choosing the right saw for your needs should be considerably simplified.

After tablesaws come shapers, radial-arm saws, wood lathes, drill presses, stationary sanders, jointers, bandsaws, scroll saws, planers, miter saws, routers, hand drills, sabersaws, belt and orbital sanders, grinders, spray equipment, dust collectors and "miscellaneous." With the exception of miscellaneous, each category gets thorough and factual treatment.

The miscellaneous section contains 37 tools ranging from lathe duplicating systems through flexible-shaft machines, dovetail templates, miter trimmers (arm powered!), moisture meters, overarm routers, slot mortisers, boardmakers for chain saws, to safety devices. As a 15-year veteran of shop work, I have quite a collection of prejudices about which tool brands are best, and have tried to fill my shop with the best. Since I don't need any new tools, it's about these miscellaneous tools that I am most interested to know more, and there's really not much about them here. But then, most of these items aren't comparable to, well, anything. Since the book appears a likely candidate for periodic revision, perhaps the next edition will have some "hands on" testing of these miscellaneous oddities.

This book is interesting, straightforward reading if you want to know more about your tools and/or the costly mistakes made when buying them, and it's *must* reading if you're in the market for a new power tool. It will surely save you many times its price—if not in cash, in aggravation. ***—Hugh Foster***

Carving Classic Regional Shorebirds by Anthony Hillman. *Dover Publications, Inc. 31 East 2nd Street, Mineola, N.Y. 11501; 1986. $5.95, paperback; 72 pp.*

Identifying American Furniture by Milo M. Naeve. *American Association for State and Local History, 1400 Eighth Ave. South, Nashville, Tenn. 37203; second printing 1982. $15, hardcover; 87 pp.*

Making Country Furniture by Richard A. Lyons. *Prentice Hall, Inc., Englewood Cliffs, N.J. 07632; 1987. $24.95, hardcover; 221 pp.*

Carving Classic Regional Shorebirds is a valuable addition to any bird carver's library. Instead of focusing on the latest high-tech carving techniques, it takes a look backward at some of the early designs for decoys—not ducks in this case, but the smaller shorebirds: sandpipers, plovers, curlews, knots and turnstones.

The designs are from the "primitive" school, and primitive these carvings may be when compared with a modern blue-ribbon winner, whose every feather line is burned in with meticulous accuracy. The highest levels of the modern school produce carvings that, to a human eye, are virtually indistinguishable from a stuffed duck. Yet the older carvings are compelling in a broader, perhaps more meaningful, sense. In the author's words, "these decoys. . .demonstrated the carver's profound under-

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BD1020R	3/8" 2-spd Cordless Drill w/free holster-Xtra special buy	148	95
TS251U	10" Mitre Box	300	169
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0228-1	3/8 drill 3.3A 0-1000 rpm	139	92
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0210-1	3/8 cordless drill — NEW — 2 speed	189	95
6539-1	cordless screwdriver — NEW — 190 RPM	99	59
1007-1	1/2" drill 4.5A D-Hdle	217	145
1107-1	1/2" drill 4.5A D-Hdle	222	145
3300-1	magnum rt angle drive kit	271	170
3102-1	Plmbrs rt angle drill kit	287	180
1676-1	HD Hole Hawg w/cse 2 sp	363	235
5395	3/8 sgle sp hammer drill kt	203	150
5397	3/8 var sp hammer drill kit	208	155
5371-1	HD mag. hammer drill 1/2"	313	207
5373	HD mag. ham. drill 3/8"	262	175
6511	2 speed Sawzall w/case	197	122
6226	port band saw 2 sp w/case	416	280
6234	TSC band saw port w/case	416	280
6405	8 1/4" circ. saw 13 amp	191	127
6460	10 1/4" " 15 amp w/case	380	245
6165	12" Chop saw 15 amp 4200 R.P.M.	311	189
6255	v/sp Jig Saw 3.8 amp	217	140
6245	sgle sp Jig Saw 3.8 amp	191	125
6012	1/3 sheet HD Orb. sander	173	110
6014	1/2 sheet HD orb. sander	184	112
5660	1 1/2 HP router 10 amp	289	175
5680	2 HP router 12 amp.	342	220

DRYWALL SHOOTERS

6753-1	3.5 amp 0-4000 rpm new	125	79
6747-1	4.5 amp 2500 rpm	157	100
6750-1	4.5 amp 0-4000 rpm	141	90

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LIST. . .149.00 SPECIAL SALE. . .85.00

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FREUD SAW BLADES

Univ. Bore — Professional Series

CARBIDE TIPPED SAWBLADES

Item No.	Description	Diam.	Teeth	List	Sale
PS203	Gen'l Purp.	7 1/2"	24	27.24	17.50
PS303	Fine cutting	7 1/4"	40	32.97	20.50

5/8" Bore — Industrial Grade

CARBIDE TIPPED SAWBLADES

Item No.	Description	Diam.	Teeth	List	Sale
LU72M010	Gen-l Purp.	10"	40	68.58	34
LU81M010	Gen-l Purp.	10"	40	69.30	35
LU73M010	Cut-Off	10"	60	79.65	36
LU82M010	Cut-Off	10"	60	86.40	44
LU84M010	Combination	10"	40	70.99	36
LU84M011	Combination	10"	50	74.51	37
LU85M010	Super Cut-Off	10"	80	110.88	62
LM72M010	Ripping	10"	24	64.85	34
OS 306	6" Dado			139.00	92
OS 308	8" Dado			170.00	105
TR 100	3 blades & Dado set			399.00	255

MAKITA CORDLESS FESTIVAL OF VALUES

Model		List	Sale
4300DW	Jig Saw	158	99
5081DW	3 3/8" Saw Kit	174	95
5600DW	6 1/4" Circular Saw	224	125
9035DW	Finishing Sander	128	73
6010DWK	3/8" Cordless Drill Kit.	152	88
6010SDW	3/8" Cordless Drill	84	45
8400DW	3/8" Hammer Drill	188	105
DA3000DW	3/8" Angle Drill	176	98
6010DL	3/8" Drill w/Flashlight	162	89
6012HDW	3/8" 2 spd Driver Drill w/Bat & Metal Case.	178	98
DK1002	3/8" Drill w/Flursnt Lt	164	90
6710DW	Cordless ScrewdrvrKit	148	84

LEIGH DOVETAIL JIGS

Model	List	Sale
TD514	149	125
TD514L	219	195
D1258-12	299	245
D1258-24	359	275

MAKITA BRAND NEW X-TRA SPECIAL

Model	List	Sale
5007NBA - 7 1/4" Saw w/Elec. Brake	186	115
5008NBA - 8 1/4" Saw w/Elec. Brake	212	130

MAKITA TOOLS

		List	Sale
BO4510	Sander	86	43
9900B	3"x 21" belt sander.	218	119
9924B	3"x 24" belt sander.	208	130
9924DB	3"x 24" b/sand. w/bag	234	130
9035	1/3 sheet finish sander	88	48
9045B	1/2 sheet finish sander	184	90
9045N	1/4 sht fin. sand. w/bag	184	105
4200N	4 3/8 circ. saw 7.5 amp	168	93
5008NB	8 1/4 circ. saw 13 amp	198	105
5201NA	10 1/4 circ. saw 12 amp	398	215
4300BV	v/sp jig saw 3.5 amp	218	120
4301BV	orbv/sp jigsaw 3.5amp	230	125
JR3000WL	2 sp recip saw w/cse	188	120
JR3000V	vs recip saw w/case	198	120

* * * MAKITA TOOLS * * *

SPECIAL PROMOTION

		List	Sale
LS1000	New 10" Mitre Box	368	198
792210-7A	Carbide Bld for above	49	31
9820-2	Blade Sharpener	268	159
741074-9	60 (coarse) Grdg Whl	33	23
741070-7	1000 (med) Grdg Whl	31	22
741071-5	6000 (fine) Grdg Whl	43	30
1900BW	3 1/4" planer w/case	178	92
1100HD	3 1/4" planer w/case	312	160
3608BK	3/4 hp rouler w/case	132	85
3601B	1 3/8 hp router	198	115
3700B	1/2 hp trimmer 28.000 rpm	148	82
BD4530	6" Round Sander	90	48
DA3000	3/8" angle drill	188	105
DP4700	1/2 v/sp w/rev" 4.8 amp	172	92
HP1030W	3/8 v.s.r. hammer drill w/case	158	98
6300LR	1/2" angle drill w/rev.	268	152
84198B-2W	1/2" s sp. hammer drill w/case.	268	150
GV5000	Disc Sander	98	53
6800DB	2500 rpm 3.5 amp	134	79
6800DBV	0-2500 rpm 3.5 amp.	144	89
6801DB	4000 rpm 3.5 amp.	134	79
6801DBV	0-4000 rpm 3.5	144	89
2030n	12" planer/jointer	2360	1475
2040	15 5/8" planer	1930	1195
1805B	6 1/8" planer kit w/case	466	265
JV1600	var. speed jig saw	162	89
JV2000	var. speed orb. jig saw	188	100
5005BA	5 1/2" circular saw 8 amp. with brake.	176	98
9207SPC	7" var/speed electronic sander/polisher	238	130
9303BH	4 1/2" sander-grinder kit	146	95
4014NV	var/speed blower	138	79

DELTA — BRAND NEW

Model		List	Sale
34-080	10" Miter Box w/rotary table	279	179

○ ○ ○ ***Repeat of a Sellout*** ○ ○ ○

DELTA — SUPER SPECIAL

40-601	18" Electronic v/sp scroll saw — complete	1117	679

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ALL SALE PRICES AT 40% OFF LIST.

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Model	STANLEY	List	Sale
33-116	PL-316 3/4" x16' Rule	15.95	7.50
33-320	PL-320 3/4 x 20C Rule	16.95	7.95
33-425	PL-425 1" x 25' Rule	18.95	8.95
33-430	PL-430 1" x 30' Rule	20.95	9.95

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LIMITED EDITION "AMERICAN CLASSIC"

7/8 H.P. Router comes with its own specially designed metal presentation case.

ONE TIME CHRISTMAS SPECIAL

$115.00

Lots of 3 — **$339.00**

SANDER SPECIALS BY PORTER-CABLE

Model 330 — Block Sander

List 87.00 - Sale 53.00

Model 505 - H.D. 1/2 Sheet Finishing Sander

List — 175.00

Sale — 104.00

BUY BOTH — 145.00

DELTA

#34-410 — 10"

CONTRACTORS SAW w/Stand & 1 1/2 H.P. Motor

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FACTORY REBATE 100.00

579.00

FREE DELIVERY TO 48 STATES

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AMERICA'S LOWEST PRICED TOOLS

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SUPER CORDLESS SPECIALS from BLACK & DECKER

Model	DRILL KITS	List	Sale
1930	3/8" rev/hi speed	165	110
1950	3/8" High Torque	165	110
5930	Reversible Hammer	179	120
1970	3/8 rev/hi torq. screwdrvr	179	120
1980	Rev/adj clutch Scrudrill	179	120

BRAND NEW! SUPER SPECIALS from MILWAUKEE

Model		List	Sale
0214-1	3/8" c/less drive/drill	189	109
8975	H.D. heat Gun, 11.6A Low 570°F - High 1000°F	81	49
5920	belt sander 3x24 w/o bag	315	199
5925	belt sander 3x24 w/bag	315	215
5930	belt sander 4x24 w/o bag	326	209
5935	belt sander 4x24 w/bag	348	214

STATIONARY TOOL SELL-A-THON

Model	from MAKITA	List	Sale
2020	8" Longbed Jointer with elec. brake 12A	1700	850
2040	15 5/8" Planer 13A	1780	1150
2030	12" Planer-Jointer	1980	1150
2030N	12 1/2" Plnr-Jntr w/elec. brake	2160	1350

RYOBI

BS50N	7" Band Saw	995	585
BS360NR	12" Band Saw	1936	1150
RA2500	10" Radial Arm Saw	536	385
AP-125	12 1/2" Planer	1680	950
AH-115	12 1/2" Planer-Jointer	2195	1245

DEWALT by BLACK & DECKER

3436	12" Dewalt Radial Arm Saw	1550	1240
7790	12" Contractors Rad. Arm Saw	1045	836
7749	10" Deluxe Radial Arm Saw	606	485
7779	10" Contractors Rad. Arm Saw	710	568
3486	8" Rip & Crosscut Panel Saw	1034	827

DELTA

		List	Sale
34-621	Contractors Saw w/o motor 9"	551	425
34-710	Super 10" Saw - 1 H.P.	621	475
15-091	15" Floor Model Drill Press	510	395
15-090	15" Bench Model Drill Press	510	395
11-072	32" Radial Drill Press	409	330
22-651	RC33-13" Planer - 2 H.P.	1729	1195
46-140	11" Lathe w/Stand w/o Motor	448	350
33-150	Sawbuck-Frame & Trim Saw	707	499
33-990	Deluxe - 10" Radial Saw	630	475
33-890	12" Rad. Saw w/1 1/2 H.P. Mtr	1422	950
28-283	14" Band Saw comp/ 3/4 H.P. Motor & enc. std.	970	670
28-243	14" Band Saw w/open steel std less motor	621	475
28-560	16" Motorized Band Saw comp. w/stand	467	349

★ *X-TRA SPECIALS* ★

MAKITA TOOLS

		List	Sale
6010DL	C/less Drill w/flashlight-charger & case	174	90
OP3720	3/8 drill Rev. 0-1800 rpm	98	47
6510LVR	3/8 drill Rev. 0-1500 rpm	136	67
6013BR	1/2" Drill rev. 6 amp.	198	100
5402A	16" Circular Saw-12 amp	518	315
2414	14" Cut Off Saw-13 amp	308	169
3612BR	3 HP Plunge Router	318	175
9401	4x24 belt Sander w/bag	268	160

BOSCH TOOLS

		List	Sale
1581VS	Top Handle Jig Saw	225	126
1582VS	Barrel Grip Jig Saw	126	118
1604	1 3/4 H.P. Router	199	118
1942	Heat Gun 650°-900°	99	85
1272	3x24" Belt Sander	259	159
1272D	3x24" Belt Sander w/bag	274	169
1273	4x24" Belt Sander	274	169
1273D	4x24 Belt Sander w/bag	289	179

★ NEW LOW PRICES ★

PONY CLAMP FIXTURES

Model		List	Sale	Lots of 12
#50	for 3/4" Black Pipe	11.23	7.15	79.00
#52	for 1/2" Black Pipe	9.36	6.10	67.50

JORGENSEN HAND SCREWS

Model	Jaw Length	Open Cap.	List	Sale	Box of 6
#5/0	4"	2"	11.59	7.25	39.15
#4/0	5"	2 1/2"	12.45	8.10	43.75
#3 0	6"	3"	13.36	8.50	45.95
#2/0	7"	3 1/2"	14.36	8.95	48.35
#0	8"	4 1/2"	15.97	9.95	53.75
#1	10"	6"	18.25	11.35	61.25
#2	12"	8 1/2"	20.94	13.60	72.95
#3	14"	10"	26.56	16.75	91.35
#4	16"	12"	34.55	23.75	128.25

JORGENSEN BAR CLAMPS

STYLE 37 — 2 1/2" Throat 1/4" x 3/4"

Model	Jaw Length	List	Sale	Lots of 6
3#3706	6"	7.88	5.50	29.70
#3712	12"	8.73	5.95	32.13
#3718	18"	9.64	6.95	37.53
#3724	24"	10.54	7.35	39.69
#3730	30"	11.76	8.25	44.55
#3736	36"	12.85	8.95	48.33

Who Has The Saws That Cut It Across The Board?

BLACK & DECKER of course!!!

Model	WORM DRIVE SAWS	List	Sale
3050	6 1/2" 12 amp - 4600 rpm	247	169
3051	7 1/4" 13 amp - 4300 rpm	232	149
3052	8 1/4" 13 amp - 4300 rpm	247	169
	SUPER SAWCATS		
3047-09	7 1/4" w/brake - 12.5 amp	226	149
3048-09	8 1/4" w/brake - 13 amp	240	155
	BUILDERS SAW CAT		
3030	7 1/4" 13 amp - 5800 rpm	155	100
3035	8 1/4" 13 amp - 5800 rpm	175	125
3034	7 1/4" 13 amp - 5800 rpm	162	115
3033	6 1/2" 13 amp - 5800 rpm	162	115
	JIG SAWS		
3157-10	var/sp orb action d/hdl	174	115
3153-10	var speed 4.5A 0-3100	158	105
3159-10	2 sp orb action barrel grip	178	120
	CUT SAW KITS		
3103	2 sp 6 amp-2400 strokes	163	100
3105	v/sp 6 amp-2300 strokes	170	110
3107	v/sporb 6A 0-2300 strokes	183	119
4300	Drill Bit Sharpener.	289	205
1321	1/2" drill 450 rpm 6 amp	175	115
4010	Palm Sander	80	48
4015	1/2 Sheet Finish Sander	160	105
	DRYWALL GUNS		
2034	v.s.r. 0-4000 rpm	121	79
2037	v.s.r. 0-4000 rpm	139	89

"Door Openers" from MAKITA

9501B	4" Grinder Kit	119	55
2708	8 1/4" Table Saw	348	199
5007NB	7 1/4" Circ. Saw	158	94

MILWAUKEE BUY OF THE YEAR

Model 6365 — 7 1/4" Circular Saw

List $169.00 Sale $99.00

Lots of 3 — $289.00

MORE MAKITA TOOLS

Model		List	Sale
6070DW	3/8" Cordless V/Sp. Drill	98	59
3705	Offset Base Trimmer	198	125
DA3000R	3/8" V/Sp. Angle Drill	192	110
HP2010N	Hamr Drl. 2 Sp., V/Sp.	224	145
HR1821	1 1/16" Rotary Hammer	440	295
HR2511	1" Rotary Hammer	490	325
HR3851	1 1/2" Rotary Hammer	680	419
HM1301	Demolition Hammer	780	495
HK1800	Power Scraper	348	245
PC1100	Concrete Planer	438	319
4110B	12" Angle Cutter	418	295

FREUD WOOD CHISEL SETS

WC-104	4 pc- 1"-3/4"-1/2"-1/4"	29.90	17
WC-106	6 pc- 1"-3/4"-5/8"-1/2"-3/8"-1/4"	39.90	26
WC-110	10 pc- 1/4" to 1 1/2"	66.90	46
CS-106	6 pc- Carving Set	74.90	54
CS-112	10 pc Carving Set	139.90	95
TT108	8 pc Turning Set	67.90	45

All of the above come in beautiful wood cases.

CM100	Carvers Mallet	9.90	7.50

AEG POWER TOOLS

Model		List	Sale
EZ 501	C/less Scrwdrvr **Brand New**	59	35
EZ 502	C/less Scrwdrvr-190 rpm	98	52
EZ 505	C/less Drill/Driver	139	79
EZ 506	C/less Electronic Drl/Drvr	159	94
EZ 581	C/less Caulk Gun var/sp	179	106
SCR1E	Drywall Screwgun 0-2000	125	74
SCR11E	Drywalll Screwgun 0-4000	125	74
BE8RL	3/8" var/sp drill 3.8 amp rev	86	51
BE10RL	3/8" var/sp drill 5 amp rev	125	74
SBE401 RL	3/8" Ham Drill v/sp h.d.	88	52
SE2E13RL	1/2" Ham Drill 2 sp h.d.	169	101
TC25E	Tech Driver v/sp 5 amp	150	89
PC70	7 1/4" Circular Saw 12 amp	157	93
VS130	Orb Sndr 20,000 OPM 1/3 sh	75	48
VS260	Orb Sndr 25,000 OPM 1/2sh	156	88
VSS260	OrbSndr25,000OPM w/bag	189	118
Hbse75S	Belt Sander v/sp 3" x 21"	199	118
BSPE60	JigSaw Orb v/sp 4.6 A w/case	214	127
RSK600	Recip Orb Saw 10 amp	229	136

ROTARY HAMMERS

PHE 16RL	3.8 amp 5/8" capacity in concrete	269	175
PH 210	5.2 amp 3/4" capacity in concrete	398	260
PHE 20	Same as above — except var/sp 0-750	418	270
PHD 26	6.3 amp 1" capacity in concrete	495	320
PH 38	7.5 amp 1 1/2" capacity in concrete	549	355

All above complete with cases

SKIL TOOLS

		List	Sale
551	5 1/2" Circ. saw 6.5A	99	73
77	7 1/4" Worm Saw	240	135
367	6 1/2" Worm Saw	239	135
825	8 1/4" Worm Saw	270	165
807	7 1/4" Skilsaw 13A-Super	153	100
808	8 1/4" Skilsaw 13A-Super	172	110
2016-02	3/8" Cordls Drl complete w/charger, case & 2 batteries	199	95

standing of the way birds perceived other birds." Like the birds they were meant to lure, we humans react to these carvings on a sub-intellectual level. To anyone who knows birds, there is a sudden shock of rightness about them. This rightness, surpassing mere likeness, is the basis of great folk art the world around.

There is minimal how-to text. The bulk of the book is 16 full-size patterns printed on heavy stock. For production runs, the author recommends gluing the pages to plywood for permanency, but there's no reason the pages can't be used just as they are to make a full set of these birds.

Identifying American Furniture bills itself as "a pictorial guide to styles and terms, Colonial to Contemporary." Its format is to have, for each of 32 different styles, a single page of photos facing a single page of keys and text, accompanied by an index and an extensive bibliography.

I'd say the author does an excellent job of homing in on what's truly distinctive about each period. Judging by the introduction, the author would be the last person to claim that the discussion of what constitutes a particular style ends with this book. It is, rather, a beginning—and a good one. Whereas, in the past, seeing something lurking in the corners of an antiques shop, I might have mumbled, "Good grief, that's ugly!" Now I can speak right up in clear tones: "Look! What a fine example of Renaissance Revival. . . ."

Containing 50 projects, *Making Country Furniture* ranges in complexity from a very easy pipe box to an ambitious slant-top desk. The author presupposes that you have some knowledge of woodworking, so directions tend to be of the "now cut the dovetails" type, rather than detailed how-to.

At about 50 cents per project, I think you get your money's worth. My only warning about the book is that a careful study of the murky photographs reveals that the author has changed sizes and details of many of the antiques. Building exactly according to his drawings may leave you with something that does not quite capture the original. *—Jim Cummins*

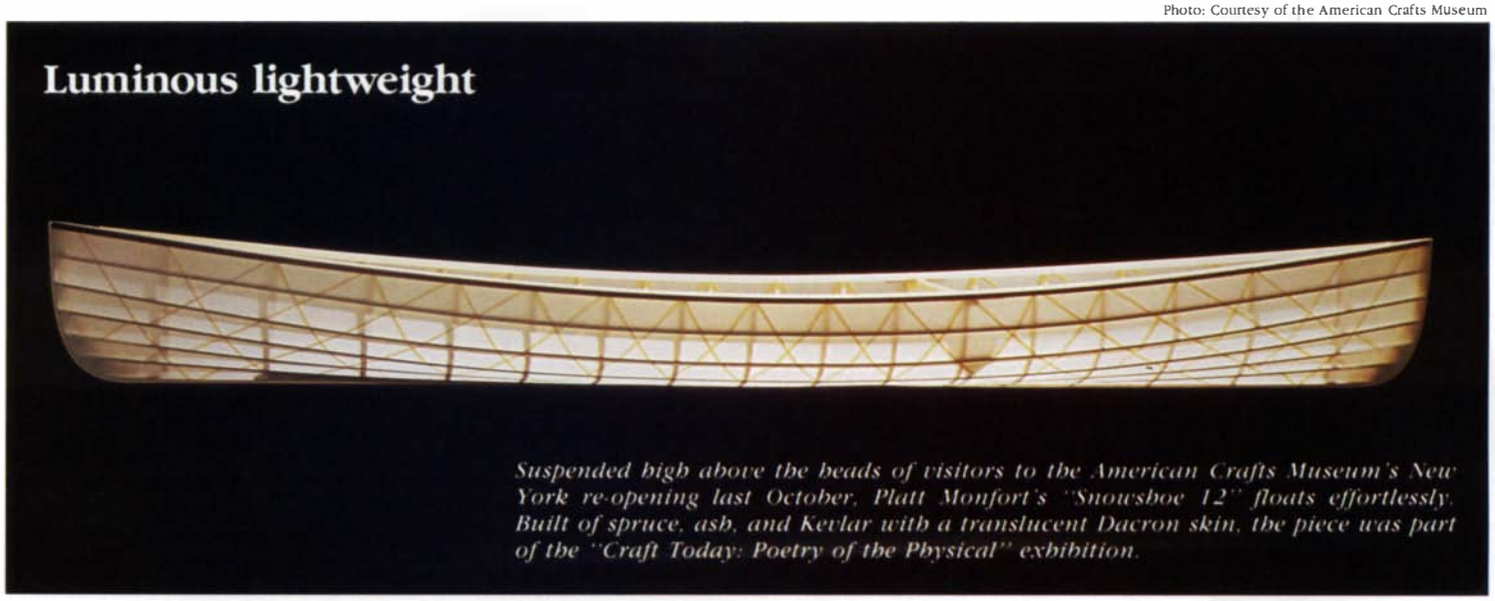
Contemporary American Woodworkers by Michael A. Stone. *Gibbs M. Smith, Inc., Peregrine Smith Books, P.O. Box 667, Layton, Utah 84041; 1986. $29.95, hardbound; 165 pp.*

"Talent will out," goes an old truism. In every field, there are those whose exceptional talents elevate them to the status of folk heroes among their peers, with tales of their exploits handed down verbally in the best folklore tradition. In *Contemporary American Woodworkers*, Stone looks at the careers, philosophies and furniture of some legendary figures on the American woodworking scene.

Stone selected ten craftsmen he felt have made "profoundly significant contributions" to the craft: Wharton Esherick, George Nakashima, Arthur Espenet Carpenter, Bob Stocksdale, Tage Frid, Sam Maloof, James Krenov, Garry Knox Bennett, Jere Osgood and Wendell Castle. A more disparate bunch would be hard to find, but extremes—from a gnarled redwood slab that Nakashima gently coaxed into a table to a hard-edged ultra-modern Colorcore and aluminum desk by Bennett—are what make this book exciting. If the "why" of woodworking interests you as much as the "how," beg, borrow or buy this book. *—David Sloan*

R. Bruce Hoadley is professor of wood science at the University of Mass., Amherst. Hugh Foster is an English teacher at Lincoln High School in Manitowoc, Wisc. David Sloan is a former associate editor of FWW. *Jim Cummins is an associate editor of* FWW.

Photo: Courtesy of the American Crafts Museum



Suspended high above the heads of visitors to the American Crafts Museum's New York re-opening last October, Platt Monfort's "Snowshoe 12" floats effortlessly. Built of spruce, ash, and Kevlar with a translucent Dacron skin, the piece was part of the "Craft Today: Poetry of the Physical" exhibition.

Reflections on apprenticeship

I hadn't planned to hire an apprentice at all. I had worked with an apprentice for a three month period six years previously, and it had been a financial disaster from which I recovered very slowly and painfully. Still, when John came knocking on my door asking about working for me, I did listen and the more I listened, the more I saw this as quite an opportunity for both of us.

John (not his real name) was a single man in his early twenties who had just completed a 42-week course in cabinetmaking offered at a community college in the province. Because I have sat for the last five years on the committee that oversees this course, I was well aware of its strengths and weaknesses. Strong in the areas of shop procedure, production work and wood technology, its weaknesses included too much orientation to "safe" construction procedures ("no piece of wood in a laminated panel should be wider than 2 inches . . ."), little or no training in hand-cutting and fitting joints, and weak training in finishing procedures. Still, the course was probably the best training around for the type of work I do, and I assumed that anyone who would start and finish a 42-week course must have a fair degree of commitment.

John impressed me personally; he seemed quite serious about his work, and was explicit about not wanting to move around and switch jobs frequently, although he did admit that he didn't have a clear goal in mind of what he wanted in woodworking. He seemed more interested in the work than the money, and, in fact, we didn't even discuss wages until the second interview, when we agreed to a starting wage of $6 per hour, for a 37½-hour week.

Timing seemed almost ideal. The Province of New Brunswick had just instituted a "Jobs In Business" program, designed to encourage private industry to create new jobs by subsidizing wages for new employees. For John's employment, the province agreed to reimburse me $2.75 for every hour John worked for the first 12 weeks of his employment. After an eight-week grace period (during which I would pay the entire wage), they would offer the same subsidy for an additional 14 weeks.

There was only one more hesitation on my part; I wanted to actually see John at work, and find out if we could co-exist peacefully in a relatively small (1,200 sq. ft.) shop day after day. We therefore worked out an arrangement whereby I would supply all wood, hardware, and plans for two European-style workbenches, and he would build them. One would belong to the shop, and the other would be his, to use while he worked for me and to take with him if and when he left. No money would change hands. This worked to everyone's satisfaction, and on July 9 John began work for Custom Woodworking.

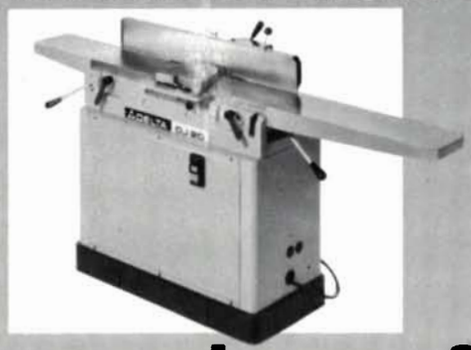
Things seemed to go well. I found John pleasant (and mercifully quiet) to work with. He was very quick to learn, and possessed the wonderful gift of being able to apply what he learned in a particular situation to new applications. I rarely had to tell him something twice. In those areas where he had already developed the necessary skill, such as cutting mortise-and-tenon joints, I had only to show him the process I used for that particular job and he was off and running.

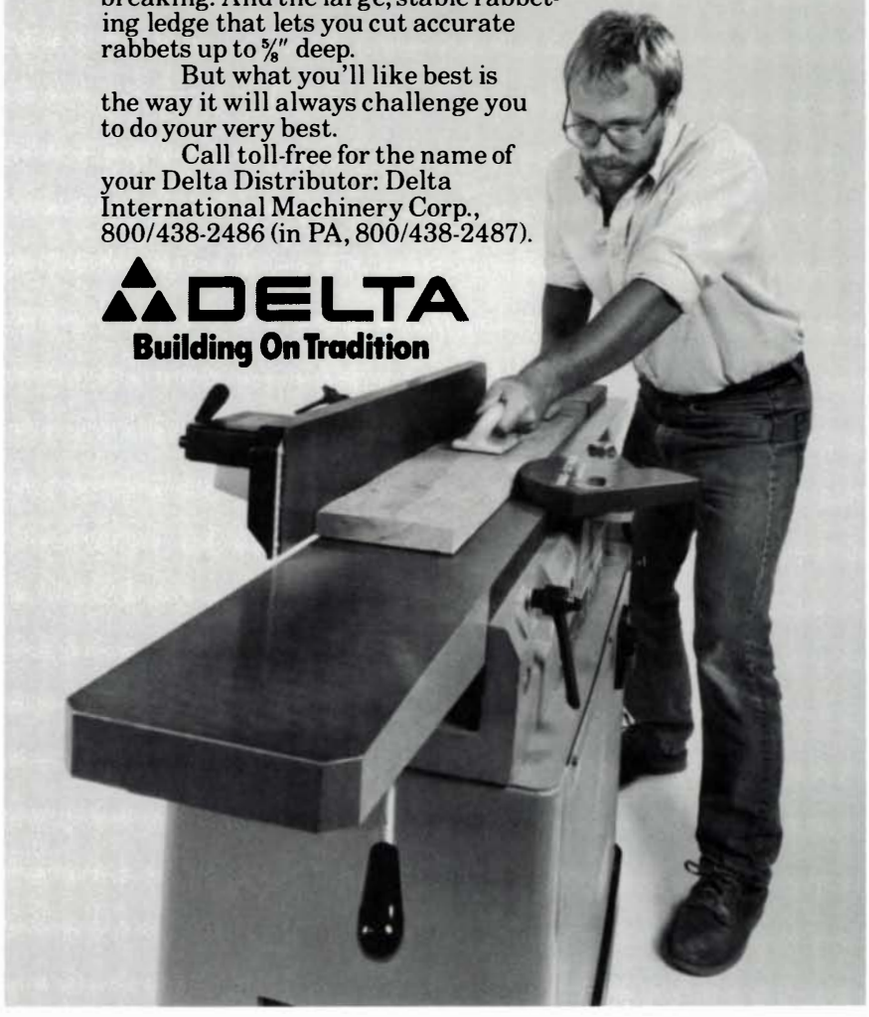
I soon realized, however, that there would be a problem in those areas where he had not developed the necessary skills. I could, for instance, very easily show him how to cut a dovetail (it is, after all, basically a matter of sawing to a line), but that is only the process. Developing the skill to use that process takes time and practice, and it was difficult to see my way clear to signing a paycheck for him to practice these skills, wage subsidy or no. Still, I was willing to try to work out the difficulties because I saw real potential in John as a cabinetmaker, and a real potential for his employment to become profitable for my business.

It is not, I quickly discovered, easy to be an employer. Having an apprentice did indeed generate a sort of master-slave relationship, but I was not the master. I found that I had to devote every spare minute to planning two work flows in the shop, to generating new business (and developing a whole new line of business more suited to his skills), and, generally, to keeping everything flowing smoothly. A heart attack a year and a half ago has made me very conscious of stress, both physical and psychological, and I was painfully aware that my stress level during John's employment, even when things were going well, was extremely high. Still, I foresaw (or hoped) that things would change as time went on, and saw it as an investment in the future of my company.

On September 17, John quit. He told me that "his heart just wasn't in this kind of work," and he wanted to leave. I left the amount of notice to him, and he was gone within an hour. I was, to put it mildly, thunderstruck. I had no inkling that this was in the wind. As the shock wore off over the next couple of days, I realized that my investment of time, energy, and stress had been made worthless; the future return I had been banking on was wiped out for good.

Financially, the picture was no better. Deducting subsidy from wages, my average monthly wage bill came to $561. Dur-





ing the period John worked for me, the average monthly sales for the shop were only $34 higher than during the previous four months. John's employment, therefore, resulted in a net loss averaging $529 per month. Indirect costs—increased wood spoilage, increased use of shop supplies, increased advertising and telephone costs, etc.—are more difficult to measure, but they were certainly there. The bottom line is that I invested heart, soul, and wallet in a potential future that will never come to pass.

I once said, "I will *never* leave this house and this land; this is where my roots are." That was almost 20 years and 3,600 miles ago. It taught me a lot about the word never. So now I'll just say that the hinges of Hell will freeze solid before I pay another apprentice for the privilege of teaching him woodworking. I have never been paid to learn cabinetmaking, only to do it; the learning has always been my responsibility, on my own time. It is, I think, the only way. This is not to say that I will always work alone. I still can see a time when I would like to have someone else in the shop, to allow me to take on more custom office furniture, for example. The overhead would presumably increase relatively little, while there would be at least twice the man-hours to carry it. Equally important, it is difficult to work creatively in a vacuum. I would enjoy hearing someone else's thoughts and ideas about woodworking, and bouncing my ideas off him.

The question is how to reach this goal without suffering another disaster like the one with John. My thinking now is that the apprenticeship program must be set up differently, blending elements of employment, school and traditional apprenticeship practices. I'd arrange it so the apprentice would work for the shop in the morning, doing whatever needs to be done. Some training would take place during this time, but the primary goal would be to get more work out of the shop faster, even if this means the apprentice spends a great deal of time sanding and rubbing finishes. Four afternoons a week, the apprentice would have free use of the shop tools and equipment, to practice new skills and to work on his (or her) own projects. The fifth afternoon would be given over to straight teaching of cabinetmaking; the "curriculum" for the weekly session would depend on the skill level and aptitude of the apprentice. The program would be strictly limited in duration, probably to 90 days, after which there would be no obligation on the apprentice or me. We could renew the contract for another 90 days, modify it by mutual agreement, or go our separate ways. For this program, the apprentice would pay a fee, probably on the order of $400 per month.

I don't know if this program would appeal to anyone; certainly it would place a real financial hardship on the apprentice. Yet it seems to me that learning woodworking, sooner or later, involves a financial hardship. I, as a shop owner and a reasonably skilled cabinetmaker, am unwilling to carry that hardship for someone else, having already carried it for myself. I will invest my time, energy and such abilities as I have to help someone else learn the profession. I am simply asking that person to make an investment of his own.

—Mac Campbell
Harvey Station, New Brunswick

Formaldehyde fu es: your nose knows

Formaldehyde vapors are dangerous to breathe and you don't have to cut up frogs to get a lungful. Chances are you breathe the stuff every day. The vapors make the eyes burn and irritate the mucous membranes and respiratory tract. At worst, long-term exposure may cause cancer.

Urea-formaldehyde glue is the main culprit. Also called plastic resin, this glue gives off formaldehyde as it cures, and long afterward. "Never work with the stuff," you say. No matter. Anything made with urea-formaldehyde resin—plywood, particleboard and foam insulation—also gives off the gas. Even your living room may not be safe. With the increased use of insulation and weatherstripping, today's houses are so airtight that the formaldehyde given off by the building materials can't escape. The emissions diminish in time, but it may take years.

If you want to find out how much formaldehyde you're breathing, you need a formaldehyde dosimeter. Two types are available from the Dosimeter Corporation, 11286 Grooms Rd., Cincinnati, Ohio 45242. The Model F-3 kit ($75) gives you ten on-the-spot readings. The Model F-1 kit ($49.50) contains two dosimeters that must be returned to the lab for analysis after they are exposed to the air. For the company's "Formaldehyde Dosimeter Bulletin," call 1-800-322-8258.

South seas wood wanderer

Here I am, a sea-gypsy woodworker with a box of hand tools, at the bottom of the world after four years of wandering.... What's that strange urge that can sometimes force people out of established comfort into what seems to be insecurity and danger? Is it an urge that should be heeded or suppressed? Well, we heeded it.

Along with my wife and two small children, I bought a yacht and sailed off from Europe. We had sold our house and my workshop. I left behind a good reputation as an "artist-craftsman" that I was just establishing in England. We had absolutely no idea of what lay ahead. Just about all of our money went into buying a 45-ft. steel yacht, meaning that work somewhere would be necessary fairly soon.

At the time, our reasons seemed simple. We were still relatively young, but could see life cozily stretching off down through middle-age ahead of us. It was the thought of looking back on this from old-age, full of regret at all the things that we could have done, that moved us out. Also, we wanted to see some of the different cultures of the world.

An indication of what I expected upon leaving was that I left behind all my books on furniture. I brought only those on boatbuilding, plus a carefully chosen box of hand tools and a precious portfolio of photographs. As it turned out, virtually all my work has been in furniture, and I've no doubt that I have developed far more in this line than if I had stayed in the United Kingdom. Some might use words like destiny or "inner course."

This development was mostly a result of working in entirely new environments. In England, I had made individual pieces of furniture for particular settings. There the house is a bastion against the elements—a strongly marked barrier between inside and outside. In the tropics, life moves with ease back and forth between the two. The living environment is less precious, and not so unrelated to the exterior. In England I had only worked with local hardwoods. But now, in the strong colors of the tropics, I felt at home with more exotic timbers. These new experiences added to my feel for wood, and the conversion of it into furniture.

First of all we worked in the Caribbean. I was lucky enough to meet a wealthy doctor who had just bought a new house. It was quite empty, and over the next 18 months I worked from room to room building all the free-standing and fitted furniture. Most of the time I worked in the house itself. This was a rewarding experience in design and continuity, much less likely to occur in the more formalized society of Europe.

What was also new and demanding was the lack of woodworking facilities. I have always believed that small-shop woodworkers can't compete with big, machine-oriented companies. We should only do things that they can't. My work has always

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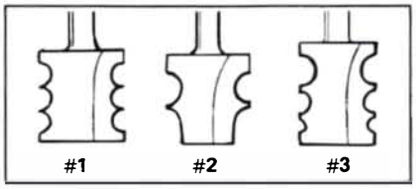

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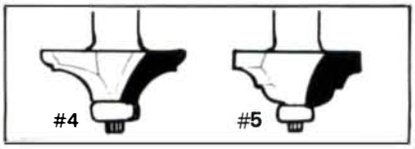

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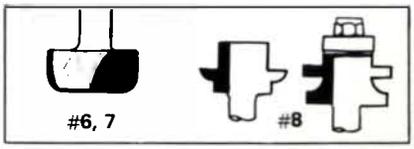

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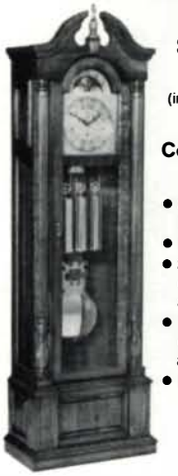

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contained a lot of handwork, so this new problem wasn't too large. For much of the work, the only non-portable machine I had was a radial-arm saw. Occasionally I bought time on machines in a local joinery shop, but wherever possible, I designed around these limitations. I had no vise or bench—only a light Black & Decker "work center." However, this became a liberating experience for me, and I was certainly much happier.

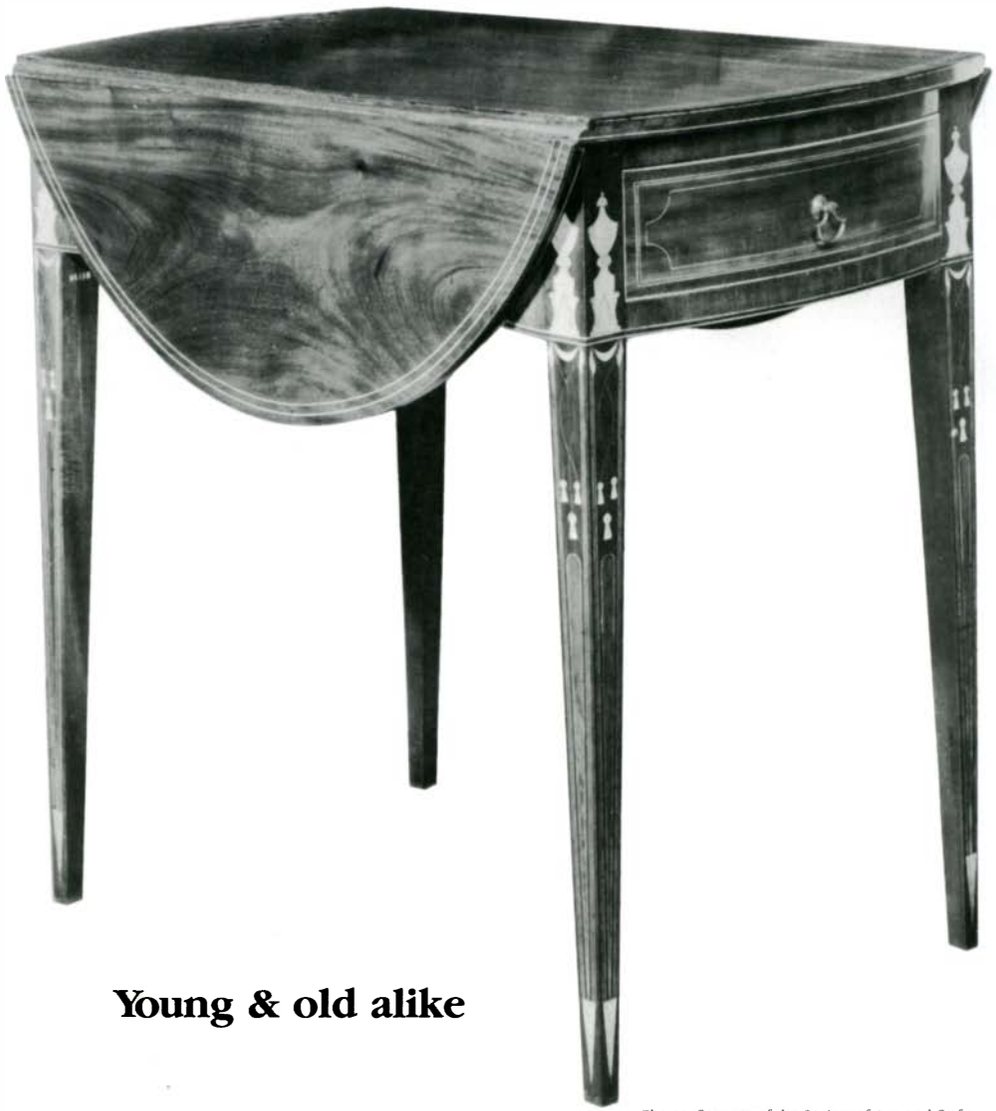
Next we sailed to Tahiti, for what must be the most wonderful year of our lives. Once again I found work in a new private house. The owners were an extremely sensitive and generous retired couple who allowed full scope for my creativity. That, combined with the powerfully dramatic landscape and a host of exciting new woods, provided a truly unique opportunity. It convinced me that the richer our lives are, the richer our creations will be.

The Tahitian hardwoods were a revelation. Because they're not available in quantities large enough to export, these woods are little known outside the islands. But I found local woods at least as good as rosewood and walnut. Once again I thrived on the limited facilities, though this time I had the luxury of a bandsaw and a wobbly old tablesaw—both run off a diesel generator. A visiting Frenchman quite missed the point. Indicating a finished chair and my corner of the garage (among paint pots and lawn mowers) he said, "'E made dees . . . in dere!"

I was also greatly influenced by the Polynesians. Over the last few centuries they have produced some stunningly elegant woodwork. The designs evolve slowly, products of their society and lifestyle, which is so intuitively related to the pure, uncluttered nature around them. And slowly, too, we began to realize how much better we felt without all the trappings that we had left behind. The wide open spaces of ocean washed out many of the blindly inherited traditions. With a free uninhibited perspective, we are free to select that with which we have most empathy. The very close relationship with nature that living on a sailing boat entails, plus the lack of so many pressures, set the creativity sparkling in both of us. Wood, like nature, is not something to be dominated. In order to create works of simple harmony, it is essential to live a simple, harmonious life.

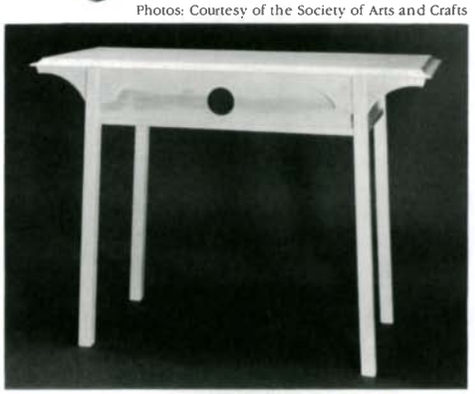
We are now in New Zealand, which is a return to much that we left behind. We hope to go on cruising for a few more years. There are many more islands to explore and woods to discover. I long to have the time to explore more of the Polynesian forms in free-flowing sculpture.

—David Trubridge, Bay of Islands, New Zealand



Young & old alike

Photos: Courtesy of the Society of Arts and Crafts



Last October's Society of Arts and Crafts show in Boston featured the work of past and present generations, with pieces like the mahogany Pembroke table (above) from the late-18th century juxtaposed with contemporary work such as Wendy Stayman's table (right) made of bleached curly maple and holly, with accents of sterling silver and slate. The exhibit, titled "American Furniture: Past and Present" featured contemporary pieces by 17 artists, as well as antique furniture on loan from various public collections.

The free estimate

Tell me, are you still giving it away free? Your time, that is. Are you still running out at the public's beck and call, giving free estimates even though you know many of those estimates will never amount to anything?

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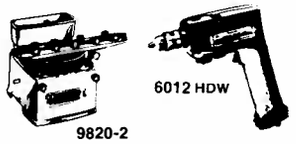

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1604	1¾ hp Router	115.00
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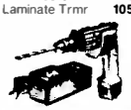
90086	¾ hp Laminate Trmr	105.00



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never going to hear from the caller again and this "free estimate" has evaporated into a total waste of time and money. Furthermore, there's a good chance that the person you gave the estimate to made careful notes and turned your ideas over to someone even hungrier than you, who got the job by bidding it cheaper. Insult on top of injury.

As you might have guessed, I have a few suggestions on how to reduce or eliminate all that colossal waste: you simply refine it, re-label it, and get paid for it.

If making an estimate or bid requires that you leave your shop, spend more than 15 minutes with someone or produce sketches, drawings, and written lists of materials, you can inform the possible client that you *do not* give free estimates. But you *do* offer a comprehensive feasibility, design and cost analysis in writing, complete with sketches or drawings and material samples. Then, inform them that the fee for this professional service is $75 per hour plus $35 for each visit to the site. It would do well to show a sample package of what they'll receive.

If this kind of priced estimation is done in a professional manner by enough people in the arts and crafts, it may be possible that the public will eventually lose its expectation of receiving the time and talents of skilled people for nothing. —*Peter Good*

Peter Good, a woodworker in Oakland, Calif., is editor of the Bay Area Woodworker's Newsletter from which this article is adapted.

Closed forms

a way of seeing marriage:

watch: these vases on pedestals in a gallery,
how they open with small holes at the top
into swollen interiors,
how the smooth oiled wood wraps around
the empty space.
turn, and look at them from various angles—
delicate sides, the color of spalting,
the widening shape—
that tiny spot of darkness
giving out freedom, structure, mystery;
giving out a prize,
taking it back,
giving it again.

—*Carol Cox, Tougaloo, Miss.*

Low-pressure spray finishing systems, such as the Apollo 500 shown here, are an alternative to conventional compressed-air systems.

Product review

Apollospray, *low-pressure spray finishing system, Apollo Sprayers International Inc., 11577 Slater Ave., Unit H, Fountain Valley, Calif. 92708.*

Everyone should try out new equipment, just to get a feel for it and to perhaps learn how advances in tools and materials might improve the speed and quality of his work. So last summer, when I was offered a chance to shop test a new spray finishing system (new to me, at least), I was ready to give it a whirl.

The equipment I tested is the Apollo 500, one of several low-pressure, high-volume spray finishing systems to be aggresively marketed in the U.S. in recent years. Apollo makes nine different models. The one I tested is their smallest and retails for $495. The idea behind low-pressure systems is just the reverse of the conventional compressed-air systems.

In a conventional system, a compressor supplies high-pressure air (35 to 40 lb. per square inch) at low volume (7 cu. ft. per minute) to a siphon-feed cup gun or a pressurized pot and gun. Low-pressure sprayers like the Apollo use 2 to 5 psi air at 50 to 70 cfm, supplied by a turbine-type compressor that delivers warm, dry air to the gun. The manufacturers claim that the low pressure creates far less overspray, limits blushing and saves material.

I have to admit that, compared to my Binks 69 cup gun, the Apollo seems like a pretty strange bird. The turbine compressor unit is about the size of a gallon jar, weighs around 12 lb. and is connected to the gun by a hose about three times as thick as a regular air hose. The turbine is a small, high RPM universal motor that spins a fan blade which, in turn, pushes air into the gun. The Apollo has a bleeder-style gun, which means that the trigger doesn't regulate the air flow but only the introduction of material from the lightly pressurized cup. As long as the turbine is running, air flows constantly through the gun. In any spray gun, the finish is atomized by air passing through the fluid nozzle and air cap. The goal is to have just enough air pressure to produce particles small enough to flow out on the surface but no so small and light as to be wafted away in a cloud of overspray. With conventional guns, the finest-quality finishes are produced by fine atomization. Unfortunately, half of the finishing material ends up on the floor, in the air and in the booth filters, wasting material (and the energy to propel it) and adding to cleanup costs. Low-pressure sprayers aim for the same fine finish but without over atomizing.

The Apollo has no air-pressure gauge to fuss with, and no oil or moisture sludge to creep from the compressor tank to the gun and contaminate the work. You just screw open the material knob until the gun delivers the amount you want. If the material's too thick, the gun sputters, telling you to thin it some more. If the pat-

tern's too large for what you are spraying, you can change to a smaller fluid nozzle and needle assembly provided by Apollo.

I used the Apollo in my shop for two weeks, spraying the pieces I'd normally do with the Binks. While I was spraying the inside of a large wardrobe with black lacquer, I was amazed to actually *see* the surface I was spraying. Normally, I'd be in the dark, blinded by a cloud of overspray. Overall, however, I found the Apollo more awkward to use. To get equivalent coverage, I found I had to move the gun slower or make more passes. For a smooth finish, I found I needed to thin the material more than with my Binks gun. I noticed that the warm air traveling through the gun handle heated up the handle. On a drizzly, 85° day, the handle became uncomfortable to hold within 15 minutes.

Although there's clearly less overspray, I have reservations about Apollo's claim of material savings. Frankly, I hadn't noticed a difference in the shop so I asked Bob Becker, the technical director of Earl Campbell Industrial Finishes, a local lacquer manufacturer, to help. In their laboratory, we attempted to duplicate the test methods Apollo used to arrive at their impressive efficiency claims. We conducted three transfer efficency tests on each of three guns: the Apollo; the Croix CX-7 low-pressure system; and my Binks gun. Using lacquer, we found no substantial differences in efficiency.

The CX-7, by the way, is the equivalent of Apollo's more expensive model 700, a spray rig intended for commercial use. The CX-7 sells for $625. It's available from Croix Air Products, 520 Airport Rd., Fleming Field, South St. Paul, Minn. 55075. Although I didn't use it as much as the Apollo, the Croix gun is probably the better choice for the experienced sprayer. It allows greater control of the atomization and has a pinch valve at the base of the handle to regulate the air or turn it off when the gun's not in use.

The biggest benefit of low-pressure systems is for field jobs—they're light and portable. For the homeshop duty for which it's intended, the Apollo 500 might be a good choice because it would allow an inexperienced person to get results without facing the bewildering choices in setting up a conventional gun. But, in my opinion, low-pressure systems don't lend themselves well to the kind of production work I do. At prices ranging from $500 to $700 for the small models, they're priced comparably with conventional equipment. But, in our shop, an air compressor performs multiple duties, providing all sorts of pneumatic conveniences. Maintained properly, compressors last a lifetime.

—Nancy Lindquist, Kansas City, Mo.

Simon Watts

Richard Elderton's desk was part of the first Barnsley Trust Exhibition.

Barnsley Trust

For over half a century, Edward Barnsley and the cabinetmakers in his Hampshire, England, workshops have turned out furniture of exceptional quality. During that time, Barnsley developed the style and maintained the ideals of his father, Sydney Barnsley, and Ernest Gimson, two of the first and most influential of the English Arts and Crafts woodworkers. No less impressive than his furniture has been Barnsley's ability to keep the workshops solvent through the periodic waxing and waning of interest in fine craftwork, to say nothing of depressions, recessions and war.

Six years ago, when both Barnsley and the century turned 80, his family and a group of friends set up the Edward Barnsley Educational Trust to ensure the survival of the workshops and the apprenticeship system long practiced there. In June, the first exhibition of work produced by the Trust workshops was shown at the Pennybank Gallery in London.

The workshop is run by Edward Barnsley's son, Jon, and staffed by three or four trained cabinetmakers and an equal number of apprentices. The shop continues to operate as a business, reproducing Edward Barnsley's designs and new designs by his son, sometimes done in collaboration with an apprentice. As Jon Barnsley puts it, "We're making furniture using the kit of parts that Dad developed." The Trust endowment covers some or all of the high cost of training and maintaining apprentices. Even with this help the whole operation does little better than break even.

George Taylor, who started as an apprentice with Barnsley in 1936 and retired this summer, has seen many changes over the years, from the introduction of machinery in the early 1950s, to the Trust apprentices. "We don't press the students to hurry," he told me. "We show them what to do and let them get on with it. Very different from when I started here."

It is this sense of continuity, of being part of a tradition going straight back to William Morris, that has such appeal for many. There are more applications for apprenticeships than positions available. So Edward Barnsley's influence continues, his designs are made, young people have a chance to learn in the Arts and Crafts tradition. Jon Barnsley, who is also a practicing architect, may, in time, put his own mark on the shop, but for the moment it is a living memorial to his father, a place comfortably out of synch with the world around it.

For information about the workshop and the Barnsley Trust, write Contessa Karin Antonini, The Bee House, Froxfield, Petersfield, Hants. GU32 1BB, England.

—Simon Watts, San Francisco, Calif.

Short takes

Even garage-size crafts businesses must comply with the same consumer safety regulations that affect giant manufacturers. Federal rules govern everything from the smallest permissible size of toy parts to the largest allowable percentages of lead in finishing products. For a full rundown, write to the Consumer Product Safety Commission, Division of Regulatory Management, Directorate for Compliance and Administrative Litigation, Washington, D.C. 20207.

■ The latest theory to surface about "Nessie" the Loch Ness monster says that she's really a tree—a Scots pine to be exact. Scientists claim that logs from the ice-age-old *Pinus sylvestris* which have slipped to the icy depths of the loch undergo an internal decomposition. Supposedly, gases pro-

INDEX TO ADVERTISERS

Joe Mctyre

Making its grisly point in a big way, this billboard in Smyrna, Georgia, advertises emergency room services that any woodworker in his right mind should hope he'll never need.

duced by this decay process eventually raise the log to the surface where pressure-blisters on its corky bark burst (hissing and frothing demonically, of course) and once again send the log under—leaving behind only the occasional wide-eyed witness.

■ *The Craft Report* newsmonthly is currently creating a chair that's not made of wood—it's a chair in crafts marketing research and education at a soon-to-be selected university. The goal of their new non-profit group (whose advisory board includes Sam Maloof and Joan Mondale) is to explore the business end of crafts marketing and to supply that information to artist/craftsmen. Send requests for information to: Robert Gray, Executive Director, Crafts Report Educational Fund Project, 17 Botany Ct., Asheville, N.C. 28805.

■ According to a major manufacturer cited in the *Toronto Star,* many beginning woodworkers are afraid of their routers. In fact, more than 75% of all the routers purchased or given as gifts are hardly used at all. Not surprising, when you consider what the sensation of holding a screaming, chip-hurling gyroscope must feel like to a neophyte. It's just a shame to think of such a useful tool ending up in the attic.

■ Turning afficionado Albert LeCoff recently received a $5,000 grant to create a non-profit museum and center for woodturning. Based in Philadelphia, the WTC will be a permanent facility housing a collection of over 100 turned objects, as well as slides and reference materials. Besides creative research, the center will provide turners with special exhibits and educational events. For information contact Albert LeCoff, Director, Woodturning Center, 42 W. Washington Lane, Philadelphia, Penn. 19144. 215-844-0151.

■ Michael Monroe was recently announced as the new Director of the Renwick Gallery, replacing Lloyd Herman, who resigned last May. The Renwick is the crafts center of the National Museum of American Art at the Smithsonian Institution, and houses one of the most important permanent collections of arts and crafts in the country. In the past 15 years since the gallery opened, Herman has created an imaginative program of changing exhibitions including shows, lectures and conferences.

■ Minneapolis residents should welcome the opening of a new gallery in their area. The Lowry Hill Gallery, specializing in handmade furniture and accessories on consignment from local woodworkers, is located at 1775 Girard Avenue South and open by appointment only. Contact Evelyn Ahlberg at 612-374-3632.

■ Two new monthly publications have recently come on the scene: *Northeast Woodshop News* (Pratt St., Essex, Conn. 06426), at $9.97 for twelve issues, offers New England-area woodworkers articles of interest, as well as events, information, and advertising. *Tool Ads* (P.O. Box 33, Hamilton, Mont. 59840) is, as its name implies, an advertising vehicle for people selling, swapping, or searching for tools of all kinds. A one-year subscription costs $15.

Notes from the log

As I was setting up a new shop, one of my first thoughts was about acquiring raw materials for projects. I soon called a fellow who had run an ad selling a huge walnut tree—70 ft. in length and 22 in. across. Unfortunately, he forgot to mention that the tree was still standing.

With the help of a couple of friends, a chainsaw and a portable bandsaw mill, we dropped the tree and began to cut it up into lumber. While removing a freshly cut board, we discovered a pocket of body filler with a clear plastic tube that held a note saturated with walnut juice.

After drying and taping the note together, I read: "Tree set out in April, 1930. Holes made on March 28, 1962, when two clothesline hooks were taken out. Hooks had been in long enough to be nearly grown over; someone will be glad when tree is sawed up that hooks were taken out. Leon R. Ward. May 9, 1962. Hard frost last night." □

—Mike Miconi, Batavia, N.Y.

Notes and Comment

What's new in woodworking in your area? Notes and Comment buys brief articles about interesting events, shows and people and welcomes all manner of commentary. Send manuscript, if possible with color slides or black-and-white photos (preferably with negatives), to Notes and Comment, Fine Woodworking, ***Box 355, Newtown, Conn. 06470.***

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Comin' in on a bean and a prayer

Ron Koehler says his present work is "an extension of a decade devoted to the creation of movable sculpture." An Assistant Professor of Art at Delta State University in Cleveland, Miss., Koehler has shown at more than 75 exhibitions, and has gathered a dozen or more awards for his work in wood, metal, ceramics and paper.

"Garden City Special," shown here, is an outgrowth of two of Koehler's favorite attention spenders—his son and his garden. It was recently on display at the Contemporary Works in Wood show at the Dairy Barn in Athens, Ohio. As a straight sculpture, the veggie-plane is bound to inspire at least a chuckle. As a pull-toy, it wiggles along on eccentric wheels, and a cam in the corncob causes the caterpillar to bob up and down in the slipstream.

Now that it has passed muster in a national exhibition, the winged vegetable machine must face its true test. Will young Mr. Koehler pull it? Or try to eat it? Or both?