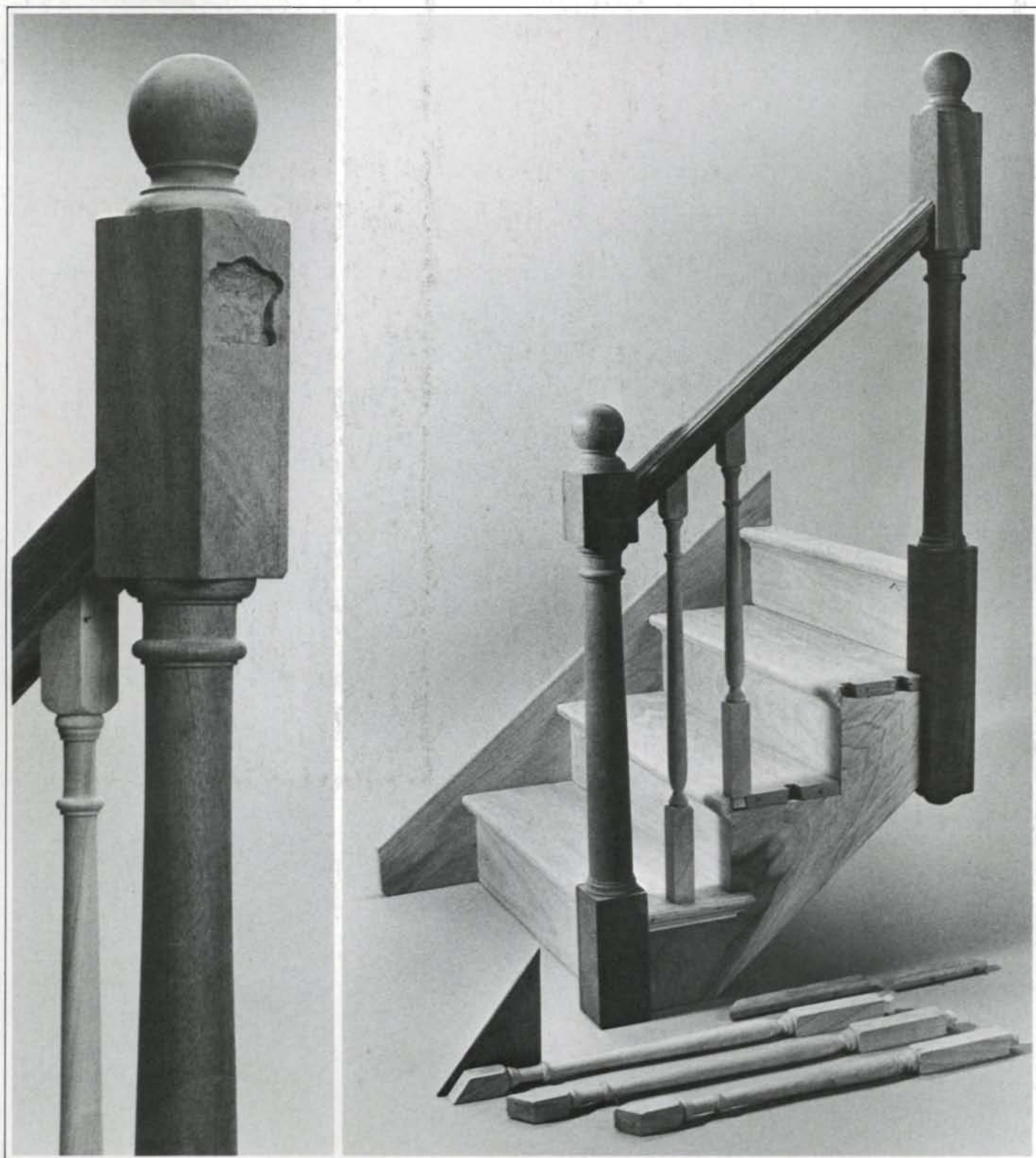


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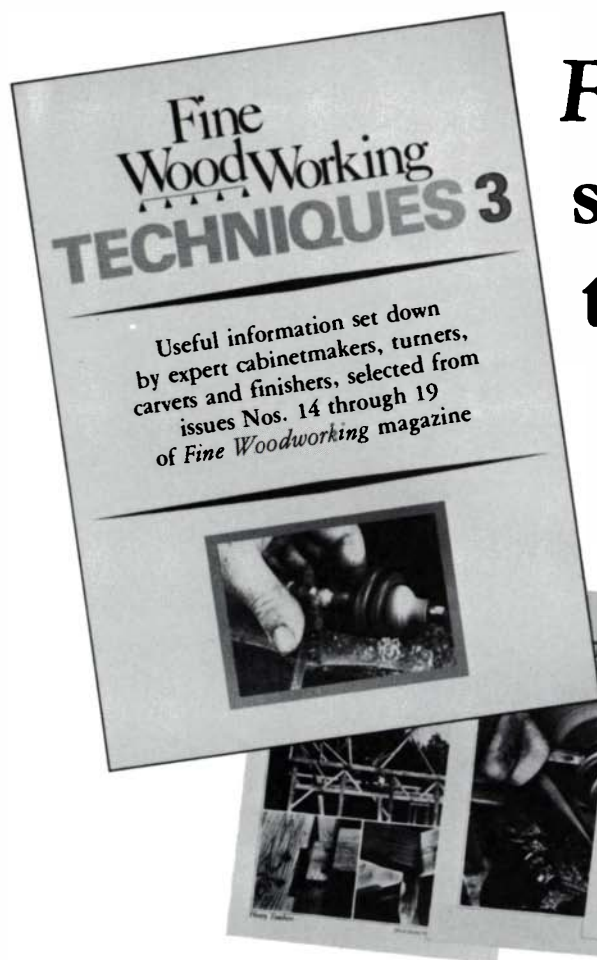
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Building Stairs





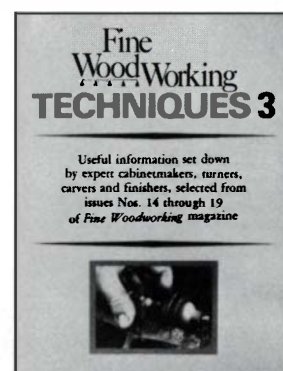
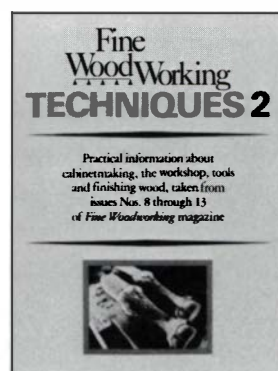
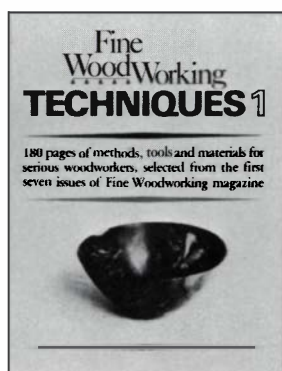
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To order *Techniques 3* or either of the previous *Techniques* books (covering issues 1-13 of *Fine Woodworking*), just use the order form opposite. Or send \$17 per copy to The Taunton Press, 52 Church Hill Rd., Box 355, Newtown, CT 06470.



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Cover: Half-scale model and detail of an open staircase, made by Harry Waldemar, of Ardsley, N. Y. Waldemar uses such knock-down models to teach; he was 40 years a stair-builder before retiring. Above, he demonstrates how to chop the housing in a closed stringer. For how he builds an open staircase, see page 48.

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Letters

On the back cover of issue #29, July '81, you carry a photo of John Brombaugh and a pipe organ he has built. I'm writing to question the phrase, "one of the few small, relatively new firms in this country." The organ-building world has undergone a significant revolution in the past 25 years. Relative to other businesses, there may seem to be only a few, but our organization, the American Institute of Organbuilders, has 150 member firms and will hold its eighth annual convention in Cleveland this fall. For those interested, AIO's address is P.O. Box 3132, Elida, Ohio 45807.

Yes, the pipe organ is a major form of woodworking. In fact, I had the privilege of restoring the oldest organ in America, built in 1770 by David Tennenberg. Some of the parts had been destroyed and I had to reproduce them. I gained great respect for the skill and craftsmanship of that builder. In fact, certain parts, which fortunately did not need replacement, were almost baffling as to how, even with modern machinery, I would have gone about making replacements.

—Joseph Chapline, Philadelphia, Pa.

I am getting slightly tired of those who denigrate all modern pipe organs, and claim that electric-action organs fall apart in 10 years, while trackers will last for hundreds. It just ain't true, alas. The pipes and casework are alike in both, will last about the same length of time, and pipes and cases are often re-used in rebuilds of old organs. The fragile part of the electric organ is the action-pneumatics, made of leather, which is admittedly perishable, but there are newer types of electric action containing no leather.

There is much faking on the whole subject; I know people who have visited Leipzig, and claim to have heard old

Johann Sebastian Bach's own organ at St. Thomas's Church. Well, they just haven't. The history of that organ is well documented, and in highly condensed form, is as follows: First built in 1356 by Joachim Schund. Rebuilt 1489, 1498, replaced by new organ from Antoniermonche in 1525, repaired 1538/39, 1580 and 1585. By the end of the century, the organ was "falling apart," to use the historian's words, and was rebuilt in 1590. In 1619/20, the organ was rebuilt again, and enlarged. In 1657 minor repairs, 1670 large-scale repair. In 1721/22, a major rebuild by Johann Scheibe. More repairs and rebuilding in 1739, 1740 and 1747. In 1755, new Positiv division, new pedal division. Further repairs and rebuilding in 1769, 1772, 1773. In 1889, the entire organ was broken up and replaced by a new one by Wilhelm Sauer; additions were made by Sauer in 1907.

So much for tracker organs lasting for centuries.

—John S. Carroll, Emlenton, Pa.

Andy Marlow has a nice homebuilt stroke sander (July '81). But I must take exception to the business of crowning the main drums. Approximately 15 years ago, I built a 4-in. wide two-drum stroke sander. At the time of construction, I had the pleasure of meeting Dick Merrill of Woodcraft Supply, the innovator of their Mark II sharpening system. His advice was, "use only one crowned pulley, and the longer the belt, the better." I built my sander with a flat driver and a slightly crowned "cocking" pulley. It worked flawlessly. Since then, I have seen more problems associated with multiple-crowned pulleys in a drive. With more than one crowned pulley, it is virtually impossible to align the imaginary centers of the pulleys to each other. As a result, the various crowns fight each

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Bart Butell
Lake Oswego, OR

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Anthony A. Seminaro
Hoffman Est. IL

A nice letter, yours of the first of May. Sorry, you can't have my blade back. We are into miniature furniture, where tolerances are critical. When I can slice Cuban Mahogany thinner than Arby's can slice roast beef, I couldn't be happier.

Carl A. Anderson, M.D.
Ft. Thomas, KY

After using the dado blades on my first large cabinet project, I found them to be an exceptionally good tool and for the price I recommend it to anyone.

Michael Manant
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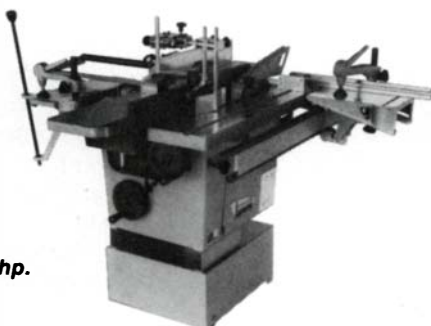
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other, causing erratic side-to-side belt motion. Observe the commercial sanders. The driving pulley is flat, the idler pulley crowned. Incidentally, too much crown will break the back of the belt, so don't crown over $\frac{1}{8}$ in. per foot each side of center. For optimum traction, lag the driving pulley with rubber. Crosswise strips glued on are almost as good as a solid sheet, particularly if you can't grind the surface flat. There are several graphite composites available to apply to the stroker to reduce heat and increase belt life. Also, design your drive to run the belt faster than 1500 surface feet per minute for optimum belt life.

—W.B. Newbold, Milford, N.H.

I recently purchased a used Delta Milwaukee 6-in. jointer. However, the fence was warped so that it was difficult, if not impossible, to obtain a square edge. The local machine shop said it would be very costly to grind flat because there were no flat reference points to set up from. Then I got the bright idea to have the automotive shop grind it on their head grinder, which requires virtually no set up. After grinding the fence, it was touch-sanded with a belt sander, which produced a very acceptable finish. This method may not produce as true a surface as another grinding procedure, but it improved my problem considerably, and for the nominal cost of \$10.

—Carl Holkeboer, Holland, Mich.

EDITOR'S NOTE: For more on machinery in general and warped jointer fences in particular, see pp. 68-74.

The handling of single-phase to three-phase power conversion (*FWW* #24, Sept. '80, and #26, Jan. '81) left a great deal to be desired. The only time that the use of a single to three-phase converter is justified is when a piece of machinery has a

three-phase motor whose stationary parts are an integral part of the machine itself and thus cannot be replaced. If the three-phase motor can be replaced by a single-phase motor (given that one cannot change the number of phases in the service), then one should do so. Efficiency improvements of single to three-phase conversion are just not there; the phase balancer just introduces additional losses. The quick reversal argument, although true, is a specious attempt to justify a bad call, since the time you might spend waiting for a motor to stop is significant only in mass-production situations. The quaint description of "three times as many pulses" in the three-phase case is as wrong as it is quaint.

—M.G. Rekoff Jr., Chattanooga, Tenn.

Kenneth Rower says in his article on single beds (*FWW* #28, May '81) that he can find no practical way to have matching bunk beds while "preserving the interesting difference in height between headposts and footposts." Has he thought of turning one unit upside down and placing it on top of the other? He would only have to add a second rabbet to the long rails so the pine slats could be dropped in from the other side. The posts could be located by short pieces of 1-in. dowel. I use horizontal bars dropped into slots in the posts to provide a foothold for small feet.

—Simon A. Watts, Putney, Vt.

With reference to the discussion of gunstock finishing in the July issue: For furniture, the dull surface left by pure tung oil responds beautifully to extra-fine steel wool and a coat of hard wax. Should be a good finish for stocks, in my opinion, although it requires maintenance.

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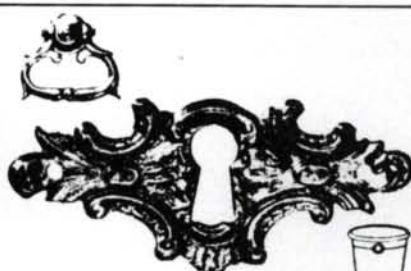
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Recently I rubbed the stuff, with my fingertips, into the walnut stock and forearm of a new rifle with good results. The factory stain finish didn't become much glossier, but the improvement in depth was really striking.

—John A. Chambers, Huntsville, Ala.

The article on particleboard-and-staple construction (July '81) has no more place in your magazine than a front-page feature on a lemonade stand would have in the Wall Street Journal. In this day of energy shortage I can think of no better use for wood waste than the production of Presto logs...

I would like to compliment you on your "Woodworking in Mendocino" article. Its description of the craftsman and designer fits me and most of the better woodworkers that I know. I'm self-employed, making custom furniture frames for upholsterers, bandsaw boxes with hinged tops, inlays, carved signs and other commissioned pieces.

—R. John Urbas, Randle, Wash.

I have been interested in the running battle of the bowl-bottom cleaners. It was a problem for me until I worked out a process that beats any I've seen in this current feud.

I turn my bowls by gluing the block to a piece of scrap

fastened to the faceplate. This way I can turn all the inside and the outside down to the scrap block. Complete the sanding and then knock the bowl off the block. Line up all the bowls that you are turning in this batch, with the smallest-diameter bowl at one end and the largest one at the other. Now put a new scrap of wood on the faceplate, about 1 in. larger than the largest bowl. Cut a hole in the center about 1/2 in. deep and just the size of the smallest bowl. Press that bowl into the recess so that the bottom faces outward. Pull up the tailstock, when possible using a ball-bearing chuck and smooth pad for contact. Turn off the glue and any excess wood. This gives you a chance to sculpt the bowl bottom with a neat ring that greatly enhances its appearance. For each successively larger bowl, turn the hole in the scrap block a little larger.

Samuel H. Lamb, Santa Fe, N.M.

I was very impressed by the way Galen Winchip built his wooden jointer (FWW #28, May '81). I once saw a jointer that was built almost the same way Winchip's is, by the grandfather of one of my friends, about 35 years ago. It was still working fine after all those years, although it seemed to me slightly out of true. Anyway, it still does a fine job. Before I saw it, I didn't believe such a precise machine could be homemade. I would like to ask Winchip if it's safe to build a larger jointer, the same way he did (let's say 10 in. or 12 in. or even 16 in.).

—Michel Chevannelle, Quebec, Canada

EDITOR'S NOTE: Winchip doesn't advise building a wooden jointer wider than 8 in. Larger tables would be too difficult to keep true.

Regarding Jerry Clancy's question (July) about using fir instead of pine for sash, trim and millwork: No doubt about

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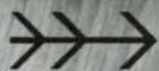
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the quality of pine for such, but the price comes close to that of walnut. I have made several doors and many window sash using poplar lumber with excellent results. No. 1 common poplar, 6/4 thick, cost me \$.70 a ft., while 6/4 pine last year was something like \$2.60. —Tom Ricci, Bradfordsville, Ky.

I think you were irresponsible to publish Jerry Matusik's letter in *FWW* #29 (July '81). He obviously has some preconceived notions of what constitutes "plans" for a moisture-content meter that prevent him from even trying out John Pray's ideas. It hardly seems fair for you to help condemn something neither Matusik nor the editors of *FWW* evidently have tried. I, too, sent for his plans and was pleased (and yes, a bit dismayed) at the simplicity of his idea. So, for the \$70 Matusik mentioned, and only two hours of my time, I now have a moisture-content meter whose probe pins are easily driven in-to and removed from 1 in. deep in hard maple, with a top-of-the-line multimeter thrown in to boot. Seems like a bargain to me. —Peter Cass, Nottingham, N.H.

Readers might like to know of a climax forest about three miles south of Paoli, Ind., on Route 37, known as the Pioneer Mother's Forest, that contains walnut trees of great height and 12 ft. in circumference. There hasn't been an ax in that timber since 1821. There is also a 500-year-old oak tree, topped out by lightning. If a tree falls across a path, the path is opened by chainsaw, the chunk is laid aside, but nothing is ever removed from the land. —Richard Camp, Paoli, Ind.

Tell Larry Green (Letters, July '81) not to feel so bad about the waste involved in woodworking. In no way can you affect

cosmic entropy. Sooner or later all wood will become dust or even less. The 85% that we waste was doomed to rot anyway. The 15% that we preserve has been snatched from the jaws of forest bugs. If we work well, then this 15% will be with us for generations. But alas, eventually it too will become dust. We are not the wasters, but the short-term preservers.

—G. Theodore Odom, Augleton, Tex.

When we got issue #27 (March '81) at the shop, we took a long lunch hour and gave it a going over. As we talked about Ian Kirby's article, "Chisels, and How to Pare," we discovered that many of us had developed special techniques that helped us get the most out of our hand tools in some tricky situations. So, we got a roll of film and took these snapshots.

—Jim Fawcett, Watertown, Mass.



Sometimes it's helpful to have a more experienced friend help you learn a new technique, left. It's amazing how a knowing hand can guide you. It's also important to use your head in your work and to become familiar with your tools, right.

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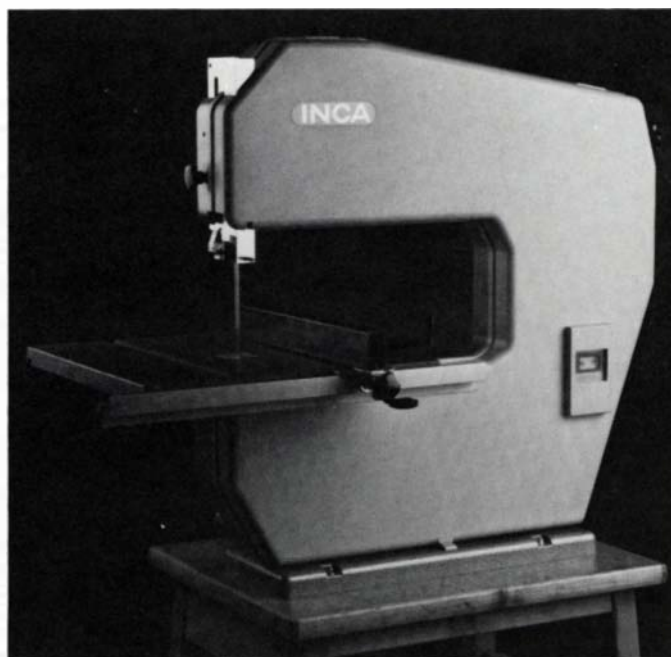
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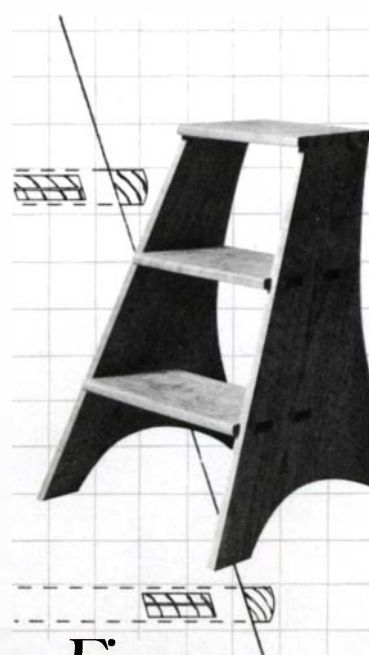
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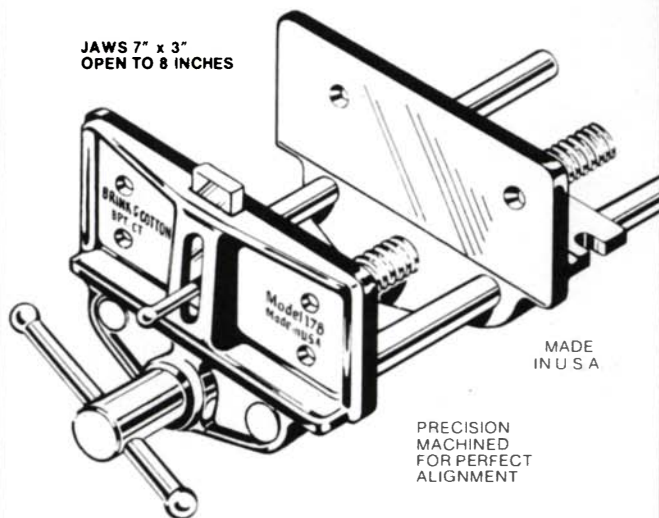
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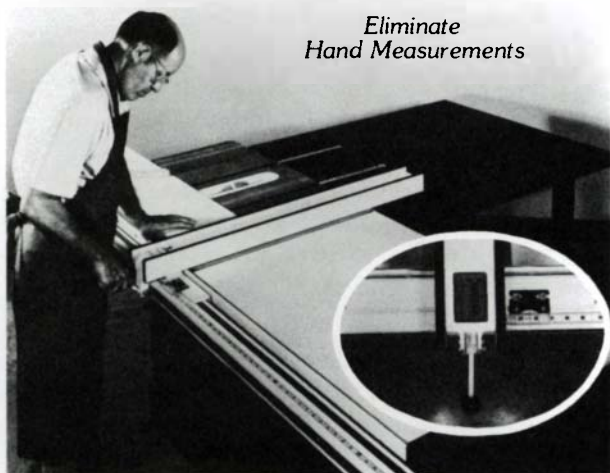
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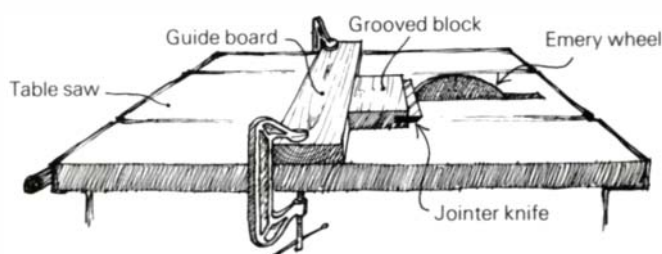
Methods of Work

Sharpening jointer knives—two ways

Here's how I sharpen jointer or thickness-planer knives on the table saw. Mount a 6-in. medium-grit emery wheel on the saw's arbor. Then clamp a straight-edged guide board across the table in front of the wheel. Fit the knife in a block that has been grooved along one edge. Be sure the groove is uniformly deep and parallel to the opposite edge of the block, and that the knife is firmly seated at the bottom of the groove.

Adjust the height of the emery wheel to touch the center of the knife's bevel. Keeping the block flat against the table, pass the knife slowly back and forth across the wheel. Take the lightest of cuts. Duplicate this on the other knives. Slowly raise the wheel until each knife is ground to a feather edge. Honing the knives on an oilstone completes the sharpening.

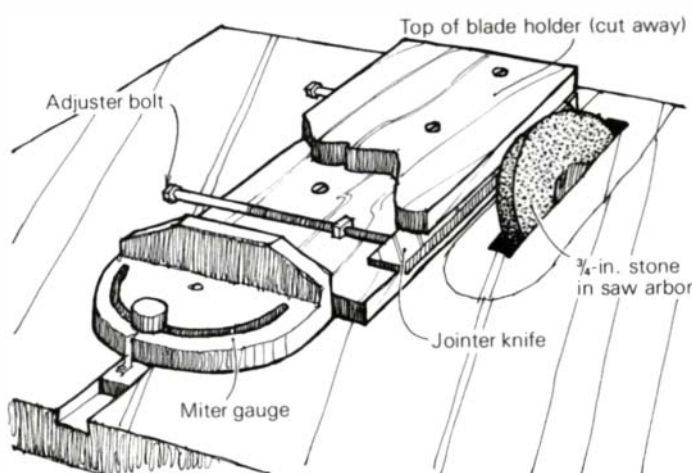
—Charlie K. Thorne, San Luis Obispo, Calif.



I sharpen jointer and planer knives on the table saw using the miter gauge. The approach offers several advantages: The knife edges are stronger (because they're straight-ground rather than hollow-ground), the grinding angle adjusts easily and the fixture handles long knives (up to 24 in.).

To make the fixture, drill and tap two holes in the slide of your miter gauge and fasten the plywood base of the fixture to the slide with machine screws. Now screw the top part of the fixture to the base so that the blade is sandwiched and clamped snugly in place. Install two adjuster bolts from the back edge of the fixture into nuts that have been mortised and epoxied into the base. Turn these bolts to adjust the first knife into perfect position. The bolts provide a reference for the last two knives so they will be ground exactly like the first.

—Jack Down, Maseru, Lesotho



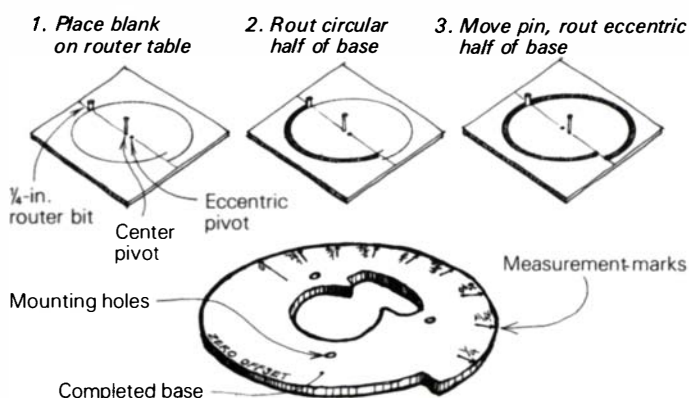
Eccentric router base

This router subbase allows me to rout an "in-between" size groove (for various stock thicknesses) without moving the guide fence or changing the setup. Because the subbase is eccentric to the router bit you can change the diameter of the base simply by changing the point of the base that rides against the guide fence.

To make the base, choose plywood, plastic or a 4-ply stack of

plastic laminate for the material. You can cut the eccentric shape on a bandsaw or jigsaw, but for a smoother, more accurate base use a router table to machine the base. First drill a 1/16-in. pivot hole at the center of the blank for the base and another 1/16-in. pivot hole offset from the center. The offset determines the eccentricity of the base. I used an offset of 1/8 in. which allows me to cut grooves of up to 1/2 in. with a 1/4-in. bit. On a line through these holes drill a 1/4-in. hole at a radius slightly larger than the radius of your router base. Before proceeding, it's a good idea to locate and drill the mounting holes in the subbase.

To cut the circumference of the base, mount the blank on the router table with the 1/4-in. hole over a 1/4-in. router bit. Drill 1/16-in. holes into the router table through both the center pivot and offset pivot. Put a pin in the center hole, turn on the router and rotate the subbase 180°. Return the blank to its starting position, put the pin in the offset hole and rotate the base 180° in the other direction. You will have to finish the "step" area with a file. Before routing out the center of the subbase, you should pivot the base on the center hole and scribe measurement lines on the base for every 1/32 in. of diameter change. Use a fine-tip waterproof pen.



To use the base to cut a 1/16-in. groove, for example, clamp a guide fence in place on the work and rout a 1/4-in. groove. Keep the zero-offset part of the subbase against the fence. Now rotate the base until the 1/16-in. scribe line touches the fence. Keep the 1/16-in. mark touching the fence and make another pass, taking care not to twist the router. The result is a 1/16-in. groove.

—Mike Ramey, Seattle, Wash.

Plastic collars for bench dogs

This round bench-dog design is the simplest I've seen and yet provides additional benefits. Make the dog by slipping a short length of transparent plastic laboratory tubing over one end of a 1/2-in. or 3/4-in. dowel. If the tubing is the right size, it will hold tight without glue. If loose, fasten the collar to the dowel with rubber cement. The compliant plastic adjusts to non-parallel edges and firmly grips odd-shaped pieces. It won't mar even soft woods, and if damaged by an errant chisel (which emerges unnicked from the encounter), the collar is easily replaced.

—Thomas K. Dykstra, Rochester, N. Y.



Shake shingles for dollhouses

To make realistic shake shingles for dollhouses, I constructed a guillotine splitter using a plane iron attached to a wood fixture. The fixture consists of a vertical board screwed to a horizontal base. Loose round-head wood screws guide the plane iron and hold it in place. The end-grain shingle stock feeds

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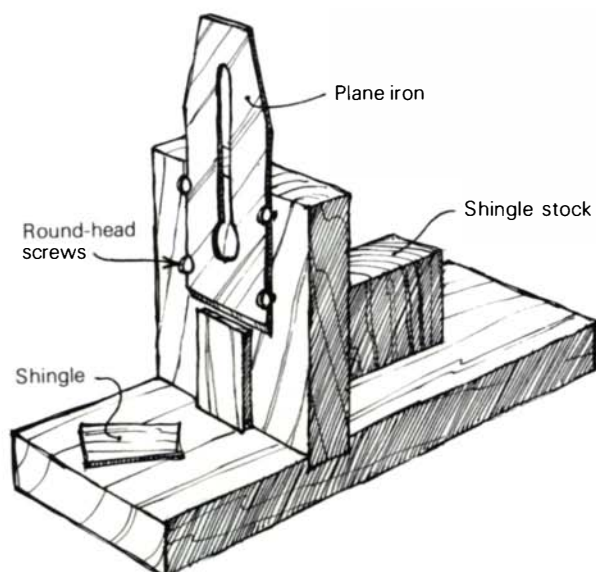
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through a notch in the vertical board. One sharp tap from a mallet will produce a perfect miniature shake shingle.

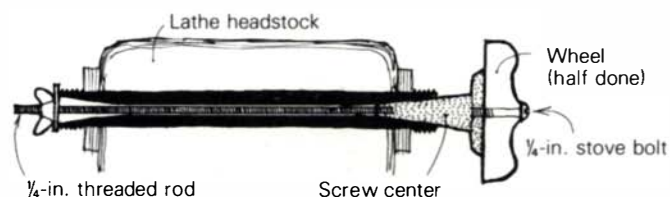
—Gene Balzer, Flagstaff, Ariz.

Making toy wheels

Hardwood wheels for toys are expensive, not well sanded and do not come in many varieties of wood. I tried making my own, but the work was prohibitively time-consuming until I came up with the modified screw center I now use. With it I can turn out a wheel every four minutes on production runs.

I started with a standard morse-taper screw center (Sears)

that I modified in two ways. First, I drilled and tapped the tail of the screw center to accept a 1/4-in. drawbolt which holds the tapered shaft tight from the back of the headstock through the spindle. The drawbolt is simply a length of threaded rod with a washer and wing nut. The second modification was to remove the screw center. This leaves a 1/4-20 threaded hole for attaching the work.



I cut the wheel blanks from scrap using a hole saw with a 1/4-in. pilot bit. Then I mount a blank on the modified center with an ordinary stove bolt. It takes about a minute to shape and sand each side. I try to completely finish one side before I turn the wheel around. While shaping, make sure the hub area is slightly thicker than the wheel rim for clearance.

For axles on the toys, I use 1/4-in. stove bolts screwed into a hidden nut mortised and epoxied in the vehicle's side. This is stronger and longer-lasting than wooden axles and allows the owner to take apart the toy and put it back together.

—George Pilling, Springville, Calif.

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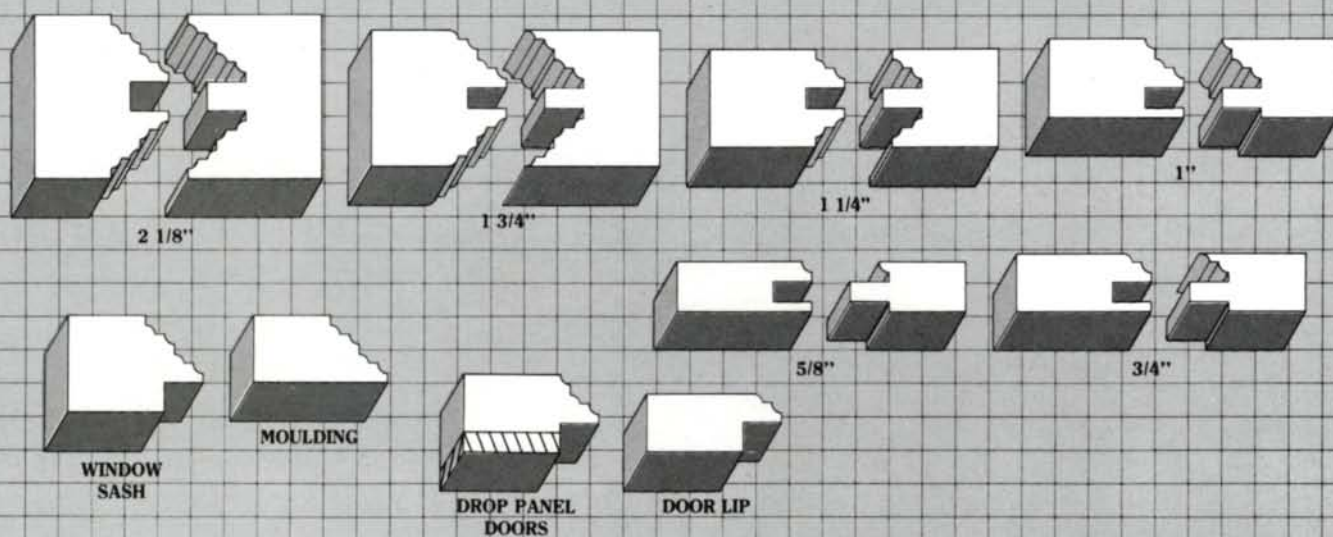
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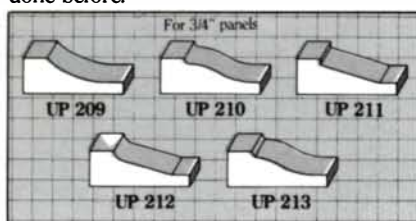


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ters: two 2-wing detail cutters, one 1/4" 4-wing grooving (or rabbet) cutter, and one 3/8" 4-wing grooving cutter. The detail cutters are reversible to cut or "stick" the mating stile and rail profiles. The 1/4" and 3/8" grooving cutters are stackable to cut a mortise of between 1/4" and 1/2" wide. Naturally they can be used without the detail cutters to dado as well as rabbet. Also included are 9 spacers to adjust the cutters to the precise thickness desired and compensate for the change in tenon thickness (or male/female fit) that occurs when the cutters are face ground. This last feature maintains the quality of fit throughout the life of the carbide. The cutters come with a 1 1/4" bore but can be bushed for any size shaper spindle down to 3/4". We'll be glad to furnish one bushing free with each set. Attached to the lid of the fitted protective case are illustrated instructions describing how to set up your shaper for the different cuts.

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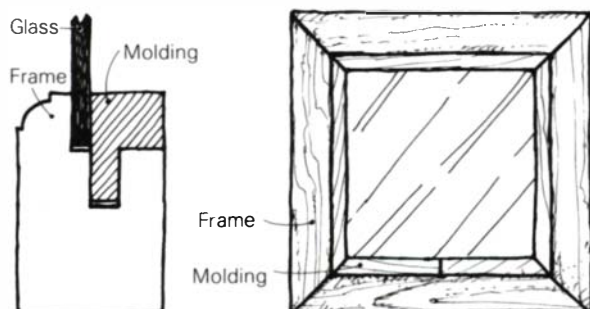
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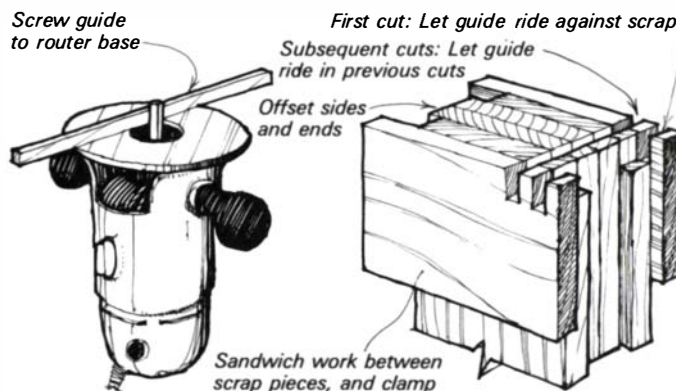
cut a rabbet in the inside edge of the frame stock. Then cut a groove in the frame stock offset from the rabbet's shoulder by the thickness of the glass. Next mill the molding with a tongue that slips into the groove with a snug fit. Assemble the frame and molding as shown in the sketch with two pieces on the bottom. If you have cut and fit the pieces carefully you won't need any brads or glue to lock the molding in place.

—Douglas L. Wahl, Washingtonville, N.Y.



Routed box joint

I enjoyed Patrick Warner's article on the box joint (*FWW* #14, Jan. '79). I like the visual results, strength and ease of assembly the joint allows. Like Warner, I use a router to cut box joints, but my technique is different. I have installed a guide block on the base of my router that acts as a jig for accurately spacing the finger cuts. The setup does not limit me in width, angle or length of project. I have made jigs to fit several common-size router bits but I usually prefer the 1/2-in. setup for most work. The sketch shows how to mount the guide block for 1/2-in. cuts. The accuracy of the joint depends on how



carefully you position the guide in relation to the bit. Drill the screw holes in the router base a little large to give yourself some adjustment room.

To use the guide, sandwich the box sides and ends between two pieces of scrap, offsetting the sides from the ends 1/2 in. and the ends from the scrap 1/2 in., as shown. Now chuck a carbide bit in the router and make the first cut with the guide sliding against the scrap pieces. For the second cut, just slide the guide in the newly cut groove. Continue the process across the ends of the boards for the rest of the cuts. It's like climbing a ladder. Wax the guide to slide easily in the grooves.

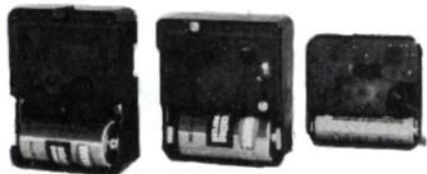
—George Persson, Star Lake, N.Y.

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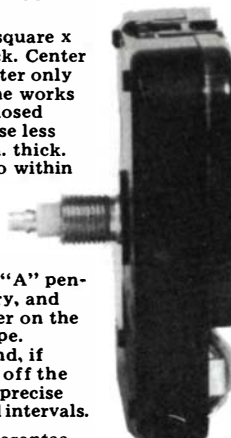
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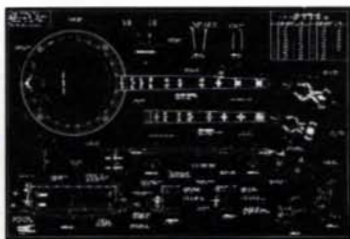
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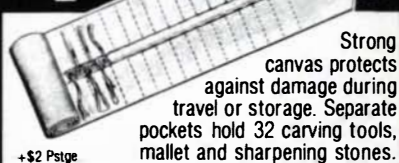


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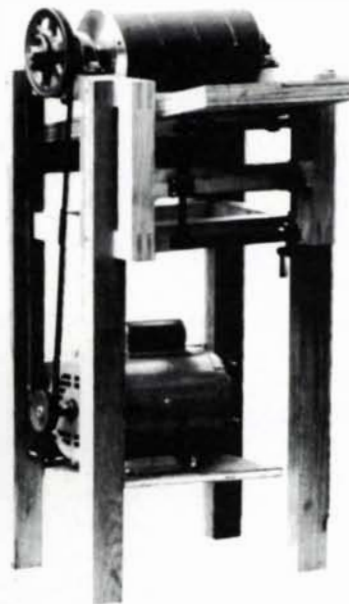
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a length of steel rod the same size as your bolt stock. Find a flat washer that just slips on the rod, saw a slot in it and twist the washer apart slightly. Weld the washer to the rod about 1 in. from one end with the lower edge of the split facing clockwise. File the pilot end of the rod for proper clearance and sharpen the cutting edge of the washer with a file.

—Carl Meinzing, Guemes Island, Wash.

Recycling old blades as scrapers

An excellent cabinet scraper can be made from a section of a 1-in. or wider bandsaw blade. Just cut the blade to 9-in. lengths, grind off the teeth and round the ends to get the shape you need. Because the blade flexes you can scrape hard-to-finish surfaces like handrails and cabriole legs.

—John E. Freimuth III, Peoria, Ill.

I recycle 12-in. power hacksaw blades as scrapers. When you grind the teeth off the blade, the resulting scalloped edge (from the wavy set) can be used for fast, rough stock removal. Reserve the other edge for finish work.

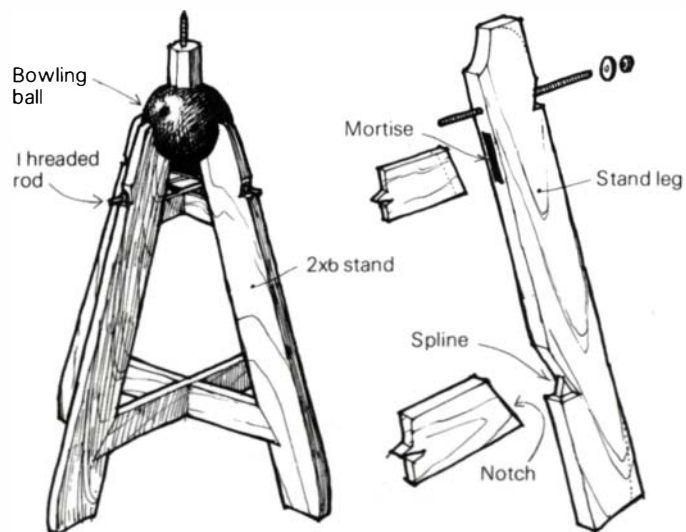
—Girvan P. Milligan, Carmel, N.Y.

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Woodcarvers will find this carver's stand useful—especially for sculpture and figures in-the-round. An old bowling ball at the heart of the stand forms what is, in essence, a universal

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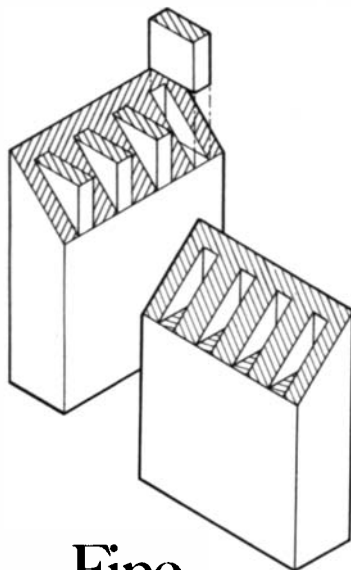
—M.B. Hansen, Huntsville, Texas



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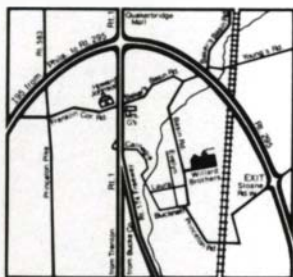
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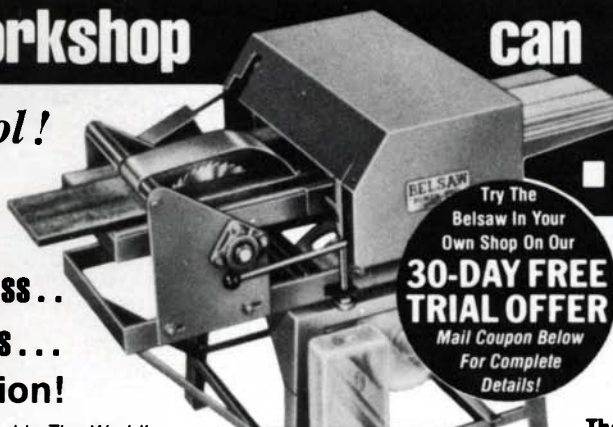
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Q & A

I'm making a dining-room table, and would like to learn of a finish that would be tough and touchable. What would you recommend? —John Millerd, Pemberton Meadows, B.C.

There are as many finishes for tabletops as there are finishers. But the one I have found to be both durable and attractive combines a prime coat of Watco Danish oil with following coats of Deft lacquer. Here's the method: Brush on a sloshing coat of Watco over the prepared surface, let it soak in and then wipe it thoroughly with a clean, absorbent lint-free cloth. Let it sit for at least 24 hours, and then rub it down with 4/0 steel wool, taking care to rub in the direction of the grain. Allow it to sit for another two to three days, depending on the humidity, until the Watco has gotten fairly hard and won't interfere with the adhesion of the Deft to come.

Now spray or brush on a thick, wet coat of Deft lacquer, as much as the surface will take without developing runs. When this coat is completely dry, sand it in the direction of the grain with 220-grit paper, using a padded block. Spray on another full coat, and when it is dry, sand with 400-grit paper. Repeat this step. The fourth coat is also a full-strength application, but it should be steel-wooled, not sanded. —Morris Sheppard

In past issues (FWW #18, Sept. '79 and #23, July '80) raised-panel doors were discussed and their construction described. But the emphasis was on rectangular panels—I'd like to make raised-panel doors with S-curved panels like the ones shown in the drawing.

—Michael Mohr, Williamsville, N.Y.

You should start by milling rails and stiles to completion, leaving enough wood on the top rails for the cyma curves. Make a plywood or hardboard pattern for these curves, mark the top rails and bandsaw them.

To get the exact outline for the panel, assemble the door frame dry and set it on top of the panel blank, which you may have to glue up from narrower boards so that it is at least 1/2 in. larger all around than the inside dimensions of the door frame. Center the frame over the panel, letting the 1/4-in. excess on each side and bottom provide wood for the tongue. Now pencil the curves on the top of the panel and add 1/4 in. to this to form the curved tongue on top.

You can form the straight bevels of the panels on the table saw in the usual way, though the curved bevels must be shaped entirely with chisels and carving tools. However, if you have access to a spindle shaper, the curved bevels can be cut with panel-raising knives and the appropriate collar, but the inside corners on the bevels must be cleaned up with hand tools because the knives will create an arc at the juncture.

The inside edges of the frame can be molded with a router, using the proper bit with a ball-bearing pilot, but you will have to form the angles of the inside corners with hand tools. If you do it this way, you'll have mason's miters (FWW #23, May '80, p. 57) where rails meet stiles. —Andy Marlow

I make jigsaw puzzles from 2-in. thick pieces of hardwood that are cut into animal shapes. To give each piece greater defini-

tion, I rout the top edges with a 1/4-in. rounding-over bit. Because the pieces are irregularly shaped, the bit encounters every kind of grain, and I get torn and ragged cuts in places. How can I get better results from routing so I don't have to do a lot of tedious sanding? —Alec R. Colvos, Tacoma, Wash.

Conventional practice calls for routing counterclockwise, as this keeps the bit from self-feeding, digging into the cut and bogging down. But there are situations when routing clockwise is desirable. Tear-out and splintering occur frequently when routing end grain; so look at the way the fibers are arranged on the end-grain edges and move the router in the direction these fibers run. This may mean that on the same end-grain you'll rout first in one direction and then in another.



Taking too deep a cut can also cause chipping. Make several shallow passes before taking a very light, final cut, especially light if you are routing clockwise. A sharp bit will leave a smoother, crisper edge. Carbide-tipped bits with ball-bearing pilots are best for your purpose.

Who has used catalpa as a cabinet wood? I have some—air-dried for seven years. Its color is close to walnut, but with dark streaks, and its grain is similar to butternut. Is this wood suitable for furniture making? —Don Crandall, Copake, N.Y.

Although catalpa is an attractive wood, it has low surface hardness. For counters, tabletops, chair parts and other pieces that get considerable wear, it dents easily. But for picture frames, cabinet and door panels, catalpa is a satisfactory choice, as it machines well. Flat-grained surfaces are difficult to sand, because the earlywood is much softer than the latewood and sanding can create an uneven surface.

Since catalpa is ring porous, it is uneven-grained, and also softer than the most ideal cabinet woods. On the other hand, it has attractive grain and color, never more than two rings of sapwood, it's highly decay-resistant and very stable. Catalpa is well suited for large sculptural carving without fine detail. It is typically straight-grained, but wood from open-grown trees tends to have more knots. —R. Bruce Hoadley

What is the best way to make a drawer-guide system? I see a lot of drawers that have grooved tracks on their bottoms, but adding these means that the drawer must be shallower than it could be without them. —John Peterson, Baton Rouge, La.

The simplest and best way to deal with drawers is to let them slide against the side of the cabinet or chest. If one or both sides of the drawer opening is a leg or face frame, you will have to fasten a strip to the inside of the case for the drawer side to ride against. This means you don't have to lose drawer depth to make room on the bottom for a grooved guide.

Cut sides, front and back to fit snugly, then dovetail and assemble the drawer. With a little sanding, it should be a perfect fit. So that it will slide easily, rub the drawer sides and bottom edges with paraffin, as well as the inside parts of the case where the drawer will touch. Never finish the drawer sides on the outside or the case on the inside. —Tage Frid

Some time ago, I bought a Sheraton dining table that had been made in Scotland about 1800. The finish was cloudy and marred by a couple of ugly burns from hot dishes, so I undertook to strip and refinish it. Unfortunately, I found that the mahogany tabletop was impregnated with wax, which I've

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SEMINAR I

Thursday, Oct. 29, 2-5 pm

Wood and its properties

Wood, what is it and how it acts
 physical & chemical proper-
 ties . . . hardwoods & softwoods
 density & grain patterns . . .
 temperature and humidity . . .
 polymerization . . . toxicity
 identification & classifications.
 Slides of rare and exotic hard-
 woods in ornamental turnery on
 an 1853 Holtzapffel lathe.

SEMINAR II

Friday, Oct. 30, 9-12 noon

Glues & woodworking joints

Cabinet and woodworking joints
 preparation of surfaces
 gluing & design . . . end & edge
 gluing . . . glues/applications
 effect of oils and resins . . . water
 & acid resistance . . . working life
 & drying times . . . glue line prob-
 lems . . . temperature & humidity
 clamping problems . . . cor-
 recting glue stains.

SEMINAR III

Saturday, Oct. 31, 9-12 noon

Finishes and finishing

Wood preparation for finishing
 abrasive papers, steel wool
 and scrapers . . . wood fillers/
 sealers . . . staining/toning
 finishes, natural & synthetic
 compatibility in re-coating
 acids, oils & waxes . . . removing
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spent hours trying to remove with lacquer thinner and steel wool, followed by soap and water in order to apply an oil and varnish finish. Is there a fast way to remove this wax or can it be neutralized in some way? Incidentally, some English friends examined the table, and told me they would refinish it with button polish. What's that? —C.B. Koester, Ottawa, Ont.

Your method of washing off the wax finish with lacquer thinner and soapy water is excellent, yet you can improve upon it by using a nylon scrub brush (with both solvents) to clean down into the pores of the wood. Another suggestion: When the wood is as clean as you can get it, apply a wash coat of thin shellac prior to the actual refinishing. This will seal the residual impurities in the pores of the wood and keep them from contaminating the finish you apply later. And this thin coat of shellac will not interfere with the finish.

Answering your second question: Shellac is marketed either in dry or liquid form. Dry shellac is sold in three forms—granulate (seedlac), flakes (in several grades, of which superfine is the best) and buttons. These buttons are about 3-in. discs, 1/8-in. thick, mostly broken. Dissolved in alcohol, they make an excellent finishing material. Most probably, "button polish" refers to such a finish, and I agree with those who recommend this finish for your table. —George Frank

Recently I built a walnut frame-style couch. I finished it with three coats of penetrating oil and followed this with two applications of paste wax. Now the sheen is fading. I have read that wax should be removed regularly and re-applied. What's the best way to remove the wax, and should I wax it again after this? —Ralph A. Bove, Jr., Asbury Park, N.J.

A paste-wax sheen fades either because the wax layer is too

heavy and turns yellow or because it's too thin and gets wiped away. It's not good to build up a thick coating of wax on wood, and I agree that it should be removed every so often. Just wet the wood with mineral spirits or paint thinner (not lacquer thinner, which will dissolve the finish) and scrub the wetted surfaces with 3/0 steel wool. Turn the pad often and rinse it in the solvent when it gets clogged with wax. It will take two or three such washings to get the surface clean.

Once you get the wax off, I advise against re-applying it. Instead, rub in by hand another coat of your penetrating oil finish, thinned down a trifle with mineral spirits. When this has dried for about 45 min., buff the surface vigorously with a lint-free wad of cotton cloth (an old bath towel) or with a lamb's-wool bonnet chucked in your electric drill. This will give you a good sheen without a shine, and will be a durable finish you won't have to renew. If you do get dull areas in the future, just repeat this process. —Don Newell

I just carved a large, free-form bowl from a locust burl. I meant for it to be a salad mixing and serving bowl, but hesitate to use it for this because I am not confident about what finish to use. Those I have tried in the past begin to develop a rancid smell with use and age. Do you know of a good oil or sealer that's odorless, colorless and safe for salad bowls?

—Ray J. Gormly, Prior Lake, Minn.

There are several good bowl finishes on the market. Clear epoxy varnish applied in successive coats (FWW #23, May '80, p. 60) makes a hard and durable finish and it will not react with food or drink or dissolve in vinegar. Some craftsmen use plain mineral oil, though this finish requires a periodic re-application of oil. My favorite treatment for bowls is Behlen's



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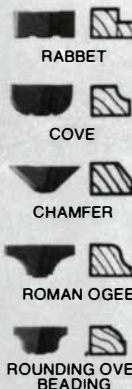
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Salad Bowl Finish (available from Woodcraft Supply, 313 Montvale Ave., Woburn, Mass. 01888). I prefer to rub in a couple of thin coats to seal the wood, though you can use the stuff more liberally if you want a built-up finish. I burnish the bowl to a soft luster. Light recoating is required from time to time, depending on the thickness of the original film. I've never had any problems with rancid smells using this finish, although I've never made salad bowls from black or honey locust, either.

—R. Bruce Hoadley

Where could I get background material and measured drawings for Greene and Greene furniture? Presently I am restoring an Eastern example of a Greene and Greene bungalow and would like to construct the furniture in the appropriate style. Where did Philip O'Leno get the necessary information to build the Greene and Greene style table shown in FWW #28, May '81?

—Jack W. Heffelfinger, Reading, Pa.

You must travel to Southern California for this information, as not much has been published, except for Alan Marks' article (FWW #12, Sept. '78, p. 40) and two books by Randell L. Makinson (available from Peregrine Smith, Inc., 1877 Gentile St., Box 667, Layton, Utah 84041). These have the most extensive bibliographies.

Dimensions and details are available only from original sources, and I suggest that you personally measure the pieces of furniture you want to build. You should contact the Gamble House (4 Westmoreland Place, Pasadena, Calif. 91103) and set up an appointment to study the construction and do some first-hand measuring. The Gamble House is open to the public, and a tour of the place is worth volumes. You will find the staff very receptive to woodworkers, architects and stu-

dents interested in knowing more about Greene and Greene. You will come away truly inspired.

Chinese furniture joints are illustrated in an appendix to Gustav Ecke's *Chinese Domestic Furniture*, published by Charles Tuttle, Rutland, Vt.

—Philip O'Leno

Follow-up:

Re Hal Halstead's request for a way to flatten and stabilize burl veneers (FWW #28, May '81, p. 24), I have another solution, one that I learned many years ago and have used successfully since. In a galvanized pan, big enough to hold the flitch, put the following: one measure powdered casein glue (white) dissolved in three measures of warm water. To this add slowly $2\frac{1}{4}$ measures of alcohol and $\frac{3}{4}$ measure of glycerine, in the above order. Soak the veneer in this solution until it chills, then lift out the veneer and hang each piece by a clothespin to drip dry. When the veneers loose their tackiness, stack them with pieces of brown wrapping paper (not newspaper) between each and clamp them up between two boards. Check after 12 hours, replace the old pieces of paper with fresh ones. Keep changing the paper every day until the veneer is dry.

You can use the solution for as long as six months, but after that, I'd make a new batch. —R.S. Hill, Ormand Beach, Fla.

Re Lyle Pelissier's search for a typewriter lift mechanism (FWW #23, July '80, p. 23): The Pfaff Sewing Machine Co. makes an elevator mechanism that is so well designed it begs additional applications. It features positive lock stops at the top, $3\frac{3}{8}$ in. down from the top and 15 in. down from the top. A spring winding device counterbalances the weight of a sewing machine or typewriter, allowing fingertip control while

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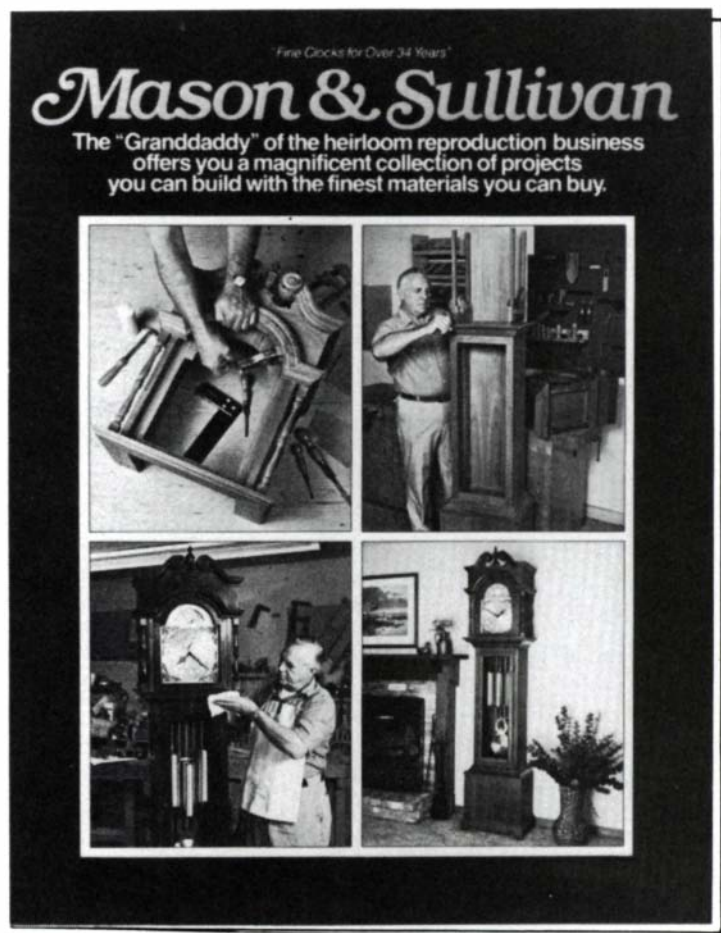
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the elevator platform moves vertically along the two tracks.

Using this mechanism would provide a normal desk-height work surface, a lower typing platform and a complete typewriter disappearing act. The one I have cost about \$100 in 1978 and was purchased from Pfaff Sewing Machine Co. of Canada, Ltd., 450 Sauve St. West, Montreal, Quebec, H3L 1Z9. You can also write to the manufacturer: Pfaff Handelsgesellschaft, für Haushaltmaschinen mbH, Subsidiary of G.M. Pfaff AG, D 7500 Karlsruhe 41, West Germany. Check with your local sewing-machine dealer first.

—Wayne Hope, St. Albert, Alta.

Dean Santner's discussion of glue-joint machining techniques (*FWW* #27, Mar. '81, p. 26) left out the crucial point—how to set the height of the cutter above the table so boards of the same thickness can be run through and flipped side to side (not end for end) for a second pass on the other edge to yield an interlocking joint, which aligns the boards' surfaces.

You must set the center of the glue-joint cutter to align with the center of the stock's thickness. The glue-joint cutter's center is midway along the center pitched line, an awkward point to gauge to. The cusps at either end of this pitched line provide much better reference points. On my cutter the vertical distance between these points is $\frac{1}{16}$ in. I set a marking gauge for half the thickness of the stock less half the pitch ($\frac{1}{32}$ in.). On the end of a short scrap I scribe two lines, one from either surface. The center of the stock is halfway between these lines, and they can be matched to the two cusps of the cutter.

I set the marked scrap on the shaper table against the infeed fence, touching the cutter, and align the two cusps of the cutter with the two scribed lines. With practice, it is possible to

do this to an accuracy of $\pm \frac{1}{64}$ in. If closer alignment than this is necessary, a trial piece must be run, and a minute adjustment made.

—John Gibbons

Readers can't find:

I need to find new or used parts for my 10-in. Boice-Crane table saw.

—John Powley, Canoga Park, Calif.

... owner's manual and parts list for a Walker Turner jigsaw. I also need the hold-downs for cutting puzzles and the blade vise.

—Nelson Davis, Sauk City, Wisc.

Readers want to know:

After three months' search I cannot find $\frac{3}{8}$ -in. wood roping for repairing wicker furniture. Does anyone know of a source for this or a method of making it?

—Kenneth E. Warling, Baltimore, Ohio

I make hardwood buttons, and would like to learn of a process for dipping 20 to 100 pieces in sealer and polyurethane that will not result in beading at the bottom of each button. Also, I'm interested in learning of a tumbling process for sanding the buttons prior to finishing and for preparing them for the final coat of varnish.

—Winston N. Colburn, Rhinebeck, N.Y.

I recently rebuilt a 12-in. jointer made by J.A. Fay and Egan Co. I don't know how to set the tables and would like to hear from someone who has had experience with this machine.

—Richard L. Volland, Emporia, Kans.

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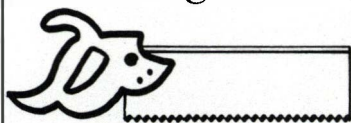
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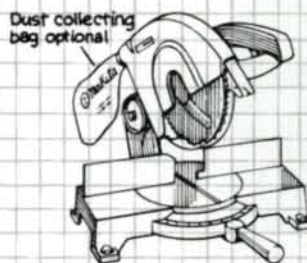


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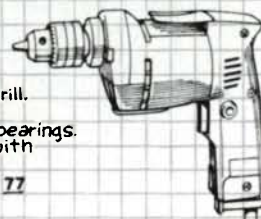
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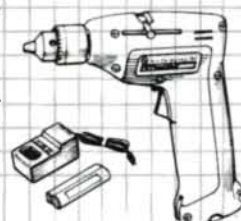


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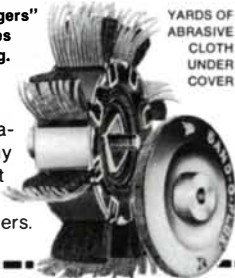
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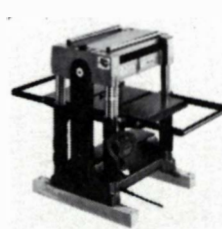
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73 MD	10"	60	5/8"	Cut Off	\$76 /\$48
84 MD	10"	50	5/8"	Rip/Cross	\$72 /\$48
71 MA	10"	18	5/8"	Rip	\$61 /\$39
72 ME	10"	40	20mm	All Purp	\$69 /\$47
73 MD	10"	60	20mm	Cut Off	\$84 /\$57
84 MD	10"	50	20mm	Rip/Cross	\$81 /\$55
Perfecta		3	3/4"	Molding	\$220/\$179
Wood Working Box		3	3/4"	Doors & Molding	\$379/\$299
Cassette 65 Plus		3	3/4"	Molding	\$428/\$360
72 MD	9"	36	5/8"	All Purp	\$62 /\$40
74 ME	10"	80	5/8"	Thin Kerf	\$96 /\$62
84 MC	10"	40	5/8"	Rip/Cross	\$68 /\$43
DADO 3	8"	18	5/8"	1/4"-1 3/16"	\$162/\$110



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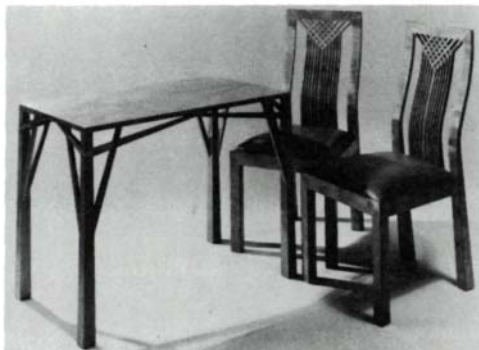
Letter from London

THE SOTHEBY AUCTION

BY ROGER HOLMES



Ashley Cartwright received £1,300 when a hammer fell on his little chest of drawers last December 10. Before you rush out to the workshop with a ball-peen, you should know that this particular hammer was wielded by an auctioneer at Sotheby's prestigious showrooms in London. One hundred seventy pieces by well-known British craftsmen went under the hammer that



Ashley Cartwright's chest of drawers in English cherry (left), 35 3/4 in. tall, sold for £1,300 (about \$2,500). Chairs in sycamore with walnut inlay, and table in satinwood with rosewood inlay (above) are by Rupert Williamson. They brought £2,450 (about \$4,600). Photos: © Sotheby's Belgravia.

night, in what Sotheby's described as the "first ever" auction of its kind.

Few of the results were as striking as Cartwright's. In fact, barely 30 of the pieces made or exceeded Sotheby's lowest estimate of their value; over half failed to reach their reserve price and were not sold. Craftsmen and Sotheby's were disappointed, but not overly; no one knew what to expect the first time around. Gallery owners were relieved, as fears that prices would reach unwarranted heights proved unfounded.

Furniture makers were slightly more successful than other craftsmen, and everyone stood to benefit in the long run from Sotheby's extensive publicity. The attempt to interest the antique-buying public in contemporary work was applauded by all. But it was not agreed that auctions are a suitable or desirable way to sell contemporary craftwork. The low prices and, despite a packed auction room, the relatively few active bidders cast doubt on the likelihood of a repeat in the near future. □

Roger Holmes is Fine Woodworking's European editor.



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HIGHPOINT AND NEOCON

More than a dozen floors of furniture and furnishings, attracting thousands of professional buyers, seemed reason enough last spring and summer to go see what the Southern Furniture Market in Highpoint, N.C. and Neocon in Chicago were like. At Highpoint I was overwhelmed. More than half of the wood furniture manufactured in this country is made within a 200-mile radius of Highpoint, and the Southern Furniture Market is, very big business. The 2 million sq. ft. of display space accommodates more than 1,300 manufacturers, and the semiannual market, in April and October, is what supplies furniture and department stores with their seasonal inventory. Competition and the proprietary veil that accompanies the introduction of new lines are thick. After two days of marching through furniture showrooms and over-hearing conversations about how brass had made a strong showing this year and how rattan had grown up and how the real high point of Highpoint was a new line of brass-and-rattan furniture, I'd had enough. The Southern Furniture Market didn't have much to do with fine woodworking.



Stacking furniture is an important part of the contract-furniture market. This "Cabaret" line from Rudd International is a takeoff on an Aalto design, but instead of the table-top or chair seat being supported from below, the legs taper into tapered mortises in the skirt.

Neocon is the exhibition of contract furniture, held each year in June. While it is only somewhat smaller than Highpoint, it is much more congenial. Contract furniture is bought and sold with an architect or interior designer acting the middleman, instead of a furniture retailer. Thus there's a more daring variety of high-end furniture, and less aiming for the mainstream of public taste; Neocon is the locus for that special piece a decorator needs to complete that special interior. It's also where furnishings for restaurants, boardrooms and offices are found. I was reminded by all the notes I saw being taken

that small shops, for whom showing at Neocon is economically and logistically unfeasible, would be wise to make local interior designers aware of their existence. The people who've come to note the latest styles are open to unusual sources for unusual work.

The Merchandise Mart, where Neocon is held, is full of interesting furniture year round, but it's not open to the public. You can tour the place Thursdays at 10 AM and 1:30 PM, or if you have \$66 and 20 people interested in viewing specific showrooms or furniture, that can also be arranged. Contact On-the-Scene Tours, 325 Wells, Chicago, Ill. 60610. —R.M.

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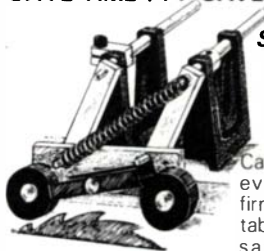
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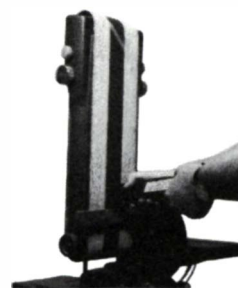
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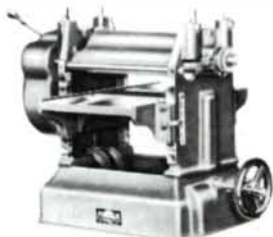
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Books

Working in Wood by Ernest Scott. *G.P. Putnam's Sons*, 200 Madison Ave., New York, N.Y. 10016, 1980. \$25, hardcover; 272 pp. Published in England by Mitchell Beazley Publishers Ltd., 87 Shaftsbury Ave., London W1V 7AD.

The Art of Making Furniture. *Sterling Publishing Company*, 2 Park Ave., New York, N.Y. 10016, 1981. \$21.95 hardcover, 192 pp. Published in England by Pan Books Ltd., Cavaye Place, London SW10 9PG.

Picking through shelves of new books about woodworking is like culling piles of mill-run lumber. Most of the pile is ordinary stuff, lots of knots and checks, useable even though overpriced. . . but hey, what's this? It's *Working in Wood* by Ernest Scott, a large and lavishly illustrated import from Britain, and an absolute jewel. It's the best book I've ever seen on the tools, methods and classical constructions used in the English furniture tradition. My bookshelves have always had a place of honor for Ernest Joyce's monumental *Encyclopedia of Furniture Making*, and Charles Hayward's *Woodwork Joints*. These now move over to make room for Scott.

The product of a team of editors, illustrators and master craftsmen, *Working in Wood* proceeds through its topics with sharp introductory text, exceedingly neat and precise line drawings (thousands of them, most traced from photographs), and concise text placed right alongside the artwork. If your brain feeds best on drawings, you can read the whole thing in drawings. If words are your meat, you'll find that the words here say exactly what the drawings show. For example, there are nine pages on the mortise and tenon, starting with layout and hand-manufacture of the basic joint, then step-

ping through the haunched, wedged, tusked and mitred variations, including that long-and-short-shouldered complexity for the corners of rabbeted frames.

The information throughout is detailed enough to guide the novice, yet it reaches far enough, and cuts fine enough, to serve the adept craftsman as an encyclopedic reference. The novice might wish for more about what to do when things go wrong, but if he follows the drawings carefully, not much will go wrong. The emphasis is hand tools and time-tested methods—there's no hint of contemporary design here, and only a whisper of electrified technology. The router, for example, gets a one-page description and never appears again. Such ancillary topics as sanding and finishing also receive short shrift, although the brief section on veneering is excellent, as is the one on carving. It shows, among other things, how to whack out egg-and-dart molding by the running foot.

I do wish the editors had not bothered to cobble together the obligatory chapter on world hardwoods, with its awful little snapshots of typical figure in each species. Although I found a few other points to quibble about, and a couple of drawings that are just plain wrong, I couldn't find any of those frustrating, baffling lapses that in most books of this type force the beginner to down tools in disgust. This is no small achievement in a work of this scope. Author Scott and the editorial group that pulled the job together—Mitchell Beazley Publishers—deserve to take a bow.

The Art of Making Furniture, another flashy British import, is quite another cup of tea, or hodge-podge. It's also the product of a talented editorial group and it was developed from a praiseworthy idea: to gather 30 or so contemporary designs by leading craftsmen, and to make them accessible in a

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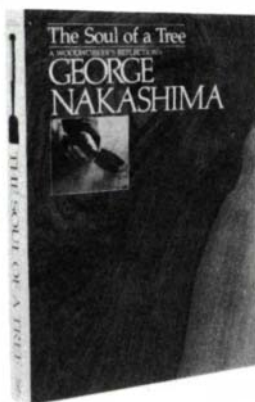
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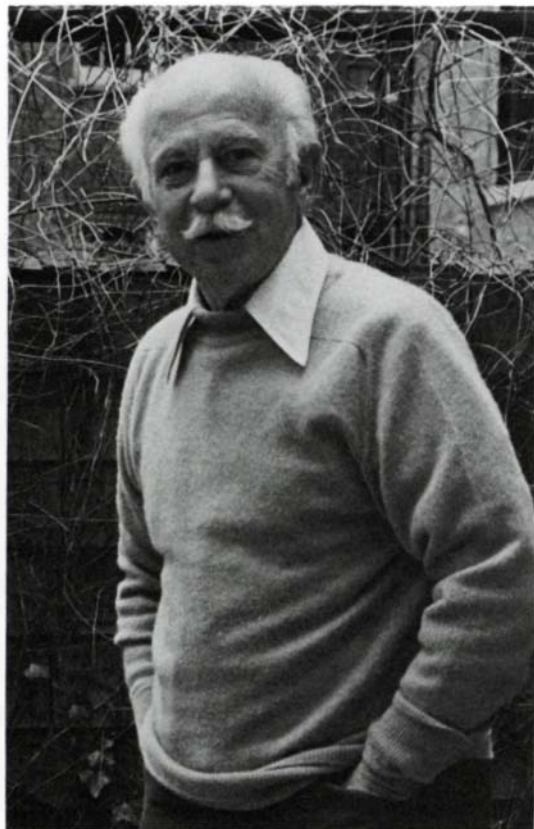


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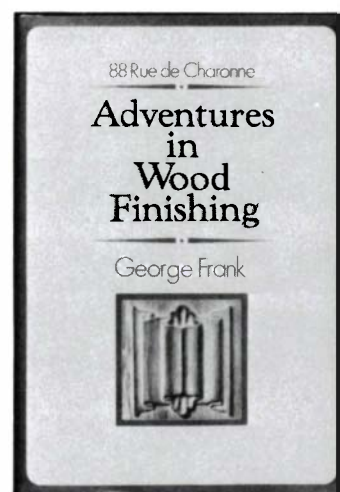
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step-by-step way to the amateur woodworker. The principal contributors are seven young Britons and two Americans (Wendell Castle and Sam Maloof), with a liberal sprinkling of inspirational quotations lifted from James Krenov's books. Each designer was given a room in the house and asked to create furniture for it, then the furniture was built for the book in the London workshops of Norman Beverton. There's a thoughtful essay by each designer, then for each piece of furniture an exploded drawing, a cutting list, numerous photographs of the finished thing, and line drawings of the work in progress with reasonably straightforward technical advice. Wrapped around the designs themselves is generalized text about tools, techniques and materials, the whole knit together with considerable graphic flair.

By now you'll be wondering what the trouble could be. Part of it is the designs themselves, the very nature of contemporary art woodworking. The best is so personal that it does not translate into sets of drawings with sequential instructions. Fred Baier's brightly painted chipboard desk is an example; there's a photo of it in *FWW* #23, July '80, p. 83. It's unusual furniture to say the least, in both construction and function, a reflection of Baier's idiosyncratic view of the world. But while many would find it intriguing to follow Baier's logic, it's difficult to imagine anybody actually wanting to build the thing. The same is true of Richard LaTrobe Bateman's kitchen furniture, standing all akimbo with lots of compound-angled tenons, and of Ashley Cartwright's elegant garden furniture, which consumes twice as much material as a conventional picnic table. It's no wonder there have not been more how-to books on contemporary work.

On the other hand, Howard Reybould's storage chest,

carved to resemble a wrapped package, is delightfully liberating and well worth emulating, even though wood movement will probably blow it apart; Sam Maloof's dining-room furniture is excellent and will appeal to many amateur craftsmen, and Wendell Castle's bedroom set, partially stack-laminated and carved to resemble draped cloth, is brilliant. This grouping by Castle manages to combine conventional construction with adroit stack-lamination, and represents the first attempt I've seen to treat stack-lamination as a copiable, step-by-step procedure.

The book's difficulties are compounded by the fact that its editors and illustrators are not themselves woodworkers. They do not seem able to tell an easy step from a difficult one. It's unacceptably glib, for example, to exhort the amateur builder of a dressing table "to obtain a clean appearance [with] mitred secret dovetail joints cut into the inner edges of both worktops," for a total 32 linear inches of mitred secret dovetail, then a few lines later to admit shyly that craftsman Beverton, when building the piece for the book, copped out and made a simple housed joint. Such quarrels become glaring in the book's pedantic chapters about tools and techniques, which are riddled with inaccurate drawings and inadequate or plain wrong advice. Woe to the amateur who tries to learn mortising from these paltry instructions, and a pox on publishers who insist that every woodworking book be a comprehensive bible for the beginner.

The sum of it is, if you want a rare peek inside the minds and methods of a few remarkably original designer-craftsmen, you'll find value in *The Art of Making Furniture*. If you want to learn traditional methods of woodworking and furniture design, get Scott's *Working in Wood*. —J. Kelsey

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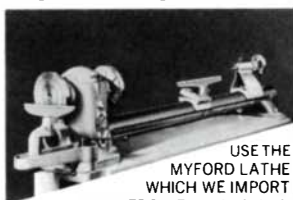
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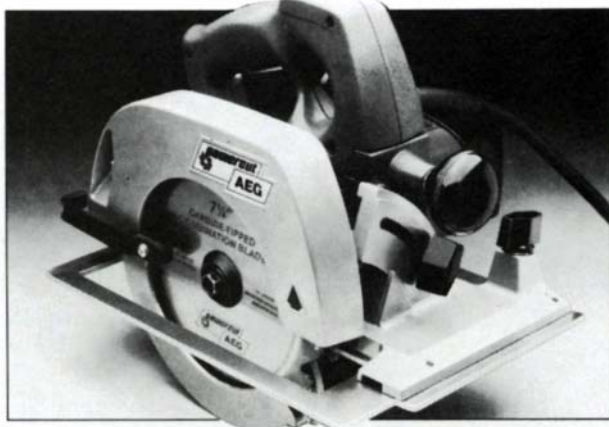
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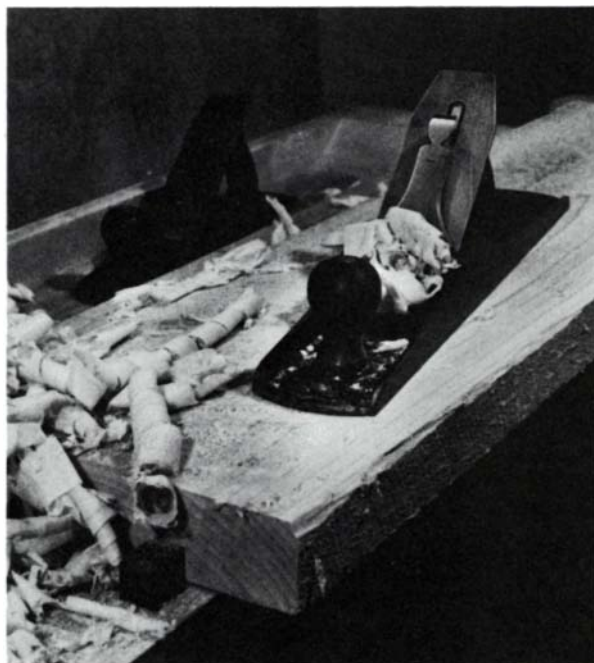
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THERE'S NOTHING LIKE AN OLD TOOL

BY HARRY MOOS

Just a few more strokes on the oilstone and the blade is finished. I look at its edge against the light and there is no reflection. I reassemble the plane and run it over a long piece of pine. The first shaving is too thick. Another adjustment, and then a paper-thin shaving curls away down the length of the board. I make another half-dozen passes before I blow away the bits of wood clinging to the blade, wipe away the fingerprints with an oily cloth, and place the plane on the shelf that I have reserved for it. This once dirty, dull and rusted piece of iron from a flea market has become a polished, sharpened beauty, ready to take its place among my other old tools. At times like this, I honestly don't know if I love the tools because they enable me to work wood, or if I work with wood because it gives me a good reason to collect these fine old tools.



I always return to this cabinet filled with hand tools: the line of planes with flaming rosewood handles, the brass-bound levels and squares, the boxwood rules, the rows of chisels and gouges. I take them from their places, test their blades against my thumb, and replace them. I find no such pleasure in turning the big table saw on and off, or in stroking the plastic surface of an electric drill. These power tools were bought new and are serviced regularly; they serve me well in the hours we spend together. But when I am not working, or perhaps while I am pondering some problem with the wood, I take a spokeshave and a scrap of wood and make a stack of shavings. It is very satisfying.

Here is an auction bill for the coming weekend that lists various carpentry tools, including planes. I have 22 working metal-bodied planes; why do I want another? There might be a Stanley No. 95, or even the elusive little No. 2. It's more likely that I'll find a common smoothing or jack plane, but even so, it may have a corrugated sole or a rosewood handle. There is always excitement in such an auction. What will I find? A few months ago it was a perfect Stanley No. 45 with all the blades still in the original box. Nothing really rare, but nice. And last year I found that beautiful old Stanley No. 72 chamfer plane.

If it is old, I can usually count on the metal being good, the balance right and the handles comfortable. Its modern counterpart will be painted to hide its rough casting, and the handle will be plastic—or, if wood, rounded only enough to delay the inevitable blisters for a few minutes longer. The trademark will not be cast into the body, but will be a decal, as though the manufacturer hopes you will forget who made

Fine Woodworking buys readers' adventures. Suitable length is 1,500 words or less—up to six typed pages, double spaced. Please include negatives with photographs.

it as soon as the decal peels off.

Here is an old 2-in. gouge with P.S. & W. Co. stamped on the blade. The handle was missing when I found it in a pile of rusted iron. Someone had beaten the socket with a hammer before discarding it. I could have bought a new one for the time I spent re-shaping the socket and turning a new handle with a leather cap. But when I notice the thickness of the metal and how well it takes an edge, I am glad that I was there to rescue it.

That explains the duplicates here. I can't bear to throw away any good tool that still has life in it. So many people will never know any tools but the bargain from the discount store. Surely someone will want my rescued tools someday, perhaps my grandchildren. So I go to auc-

tions and look for tools at flea markets. I drive around the block in heavy traffic because I see an old plane hanging in the window of a second-hand shop. All in the hope of adding something else to my cabinet of wonders.

Back in the car, I test the metal with fine steel wool to see how bad the rust is and to check the stamped markings. The rust is loose, with very little pitting. And here is the patent date. Yes, it is what I thought.

In the shop, I take the plane apart, sometimes after soaking it in a lubricant if the screws are stubborn. I carefully clean the metal with steel wool, or perhaps a buffing wheel if it will not damage the piece. I may clean threads on a fine wire wheel and blue the steel where it was so originally. If the japanned finish is damaged, I apply new enamel and put the plane body in the oven to dry. Then I clean the wooden parts, fill chips and holes, and apply a finish coat of satin varnish, or maybe just wax.

These may not be the proper steps for someone interested in preparing a tool for resale on the antique market, but I am going to use this tool, not sell it. Occasionally I have to weld some part, or replace missing parts from my box of odds and ends. Some tools have been waiting for years for this piece of brass or that kind of bolt. Finally I grind and hone the blades. Now how will it cut?

I am especially fond of planes, shaves and chisels because they make shavings. I love a good old brass backsaw, too, but it makes only dust. I used to wonder about an old neighbor who sat for hours whittling, stopping only to spit tobacco and sharpen his knife on a little stone—not making anything, just cutting big sticks into little slivers. Now I think I know what he was doing. Because when I smooth a board with a plane, I too am fascinated by the shavings that curl away in delicate spirals. □

Harry Moos, of Hill City, Kan., is a psychology teacher and counselor who makes cabinets during summer vacations.

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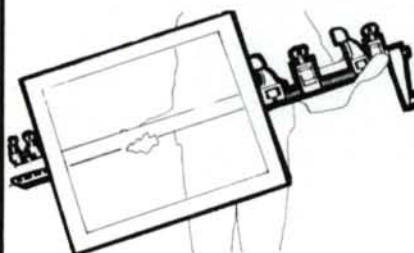
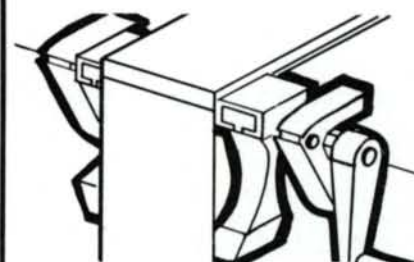
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Events

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

ALABAMA: Exhibit—work in wood by Reid Leonard & Son, Oct. 2-29. Eastern Shore Art Assoc., Fairhope.

ARKANSAS: Exhibit—Walter Anderson's wood-carving, Sept. 14 to Oct. 12. Arkansas Arts Center, MacArthur Park, Little Rock.

CALIFORNIA: Workshop with Sam Maloof, Sept. 19 and Oct. 17. The Cutting Edge, 3871 Grand View, Los Angeles, Calif. 90066.

CALIFORNIA: National Woodworking Machine and Furniture Show, September 24-27, Los Angeles Convention Center.

CONNECTICUT: Exhibit—wood, textiles, ceramics, metal, through Sept. 13; lecture by Mark Lindquist, Sept. 9. Silvermine Guild Center for the Arts, 1037 Silvermine Rd., New Canaan.

CONNECTICUT: Wood sculpture by Iain MacNeill, Sept. 25 to Nov. 13. Artists Signature Gallery, Bullards, 59 Elm St., New Haven.

DISTRICT OF COLUMBIA: Exhibit—turnings by Bob Stocksdale, Oct. 8-31. Greenwood Gallery, 2014 P. Street NW.

DISTRICT OF COLUMBIA: Turning workshop with Bob Stocksdale, Oct. 9-10, \$50. Contact Chip Bishop, 9835 Marcliff Ct., Vienna, Va. 22180

GEORGIA: Weekend Seminars—veneering, Ian Kirby, Oct. 2-4; Japanese tools, Toshio Odate, Nov. 13-15. Highland Hardware, 1034 N. Highland Ave. NE, Atlanta, Ga. 30306.

ILLINOIS: Conference, Illinois Woodworking Teachers' Assoc., Nov. 6, State University at Nor-

mal. Contact Corey B. Bloom, 1103 N. Roosevelt, Bloomington, Ill. 61701.

ILLINOIS: Seminars—carving, Sept. 26-27; turning, Oct. 3-4; boatbuilding, Oct. 10-11; joinery, Oct. 17-18. \$125 each. Contact Ron Phillips, Chicago Academy for Fine Woodworking, 1633 W. Fullerton, Chicago, Ill. 60614.

ILLINOIS: Excellence in Woodworking—trade show and gallery, Oct. 30 to Nov. 1. Hyatt Regency Hotel, Chicago.

MARYLAND: Winter Market of American Crafts, Feb. 24-28, Convention Center, Baltimore. Deadline for applications, Oct. 1. Contact American Craft Enterprises, Inc., PO Box 10, New Paltz, N.Y. 12561.

MARYLAND: Seminar—drying oak for export with Eugene Wengert, Oct. 20-21. Contact Paul Bois, National Wood Drying Associates, 5519 Lynwood Dr., Madison, Wisc. 53705.

MARYLAND: Marcel Breuer: Furniture—Baltimore Museum of Art, Oct. 13 to Nov. 22.

MASSACHUSETTS: Workshops—wood finishing, Loren Manbeck, Sept. 19; bent lamination, Jere Osgood, Oct. 17. Worcester Craft Center, 25 Sagamore Rd., Worcester, Mass. 01605.

MISSOURI: International Wood Collectors Society annual meeting, Sept. 21-23 at Point Lookout. Contact Damon Vincent, PO Box 255D, Hollister, Mo. 65672.

NEW JERSEY: Workshops—English-style wood-working, Ian Kirby, Sept. 26; Japanese joinery, Makoto Imai, Oct. 10; milling wood, Bob Sperber, Oct. 17; \$65 each. Acoustic guitar construction, Colin Butler, Nov. 1-21, \$315. Contact Sherrie Posternack, Peters Valley, Layton, N.J. 07851.

NEW JERSEY: Workshop with Tage Frid on furni-

ture design and construction, Oct. 24. Contact Gabriel Longo, Brookdale Community College, Lincroft, N.J. 07738.

NEW JERSEY: Carving and Wildlife Art Show at the Somerset County Environmental Cntr., Great Swamp, Basking Ridge. Contact R. Kurkewicz, c/o Wildlife Carvings, 317 Holyoke Ave., Beach Haven, N.J. 08008.

NEW MEXICO: Woodworker's Show—Sept. 4-8, LaFonda Hotel, Santa Fe.

NEW YORK: Furniture competition—second annual Daphne Awards; deadline for entries, Dec. 15. Write Hardwood Institute, Suite 1920, 230 Park Ave., NYC 10017.

NEW YORK: Exhibit—furniture by Jon Brooks and Howard Werner, Sept. 10 to Oct. 25; furniture by John McNaughton, Robert Trotman and Frederick Wall, Nov. 12 to Dec. 24. Workbench Gallery, 470 Park Ave. S. at 32 St., NYC.

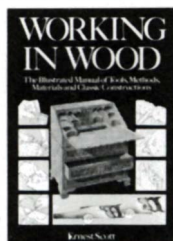
NEW YORK: Excellence in Woodworking East—trade show and gallery, Sept. 11-13, Madison Square Garden, NYC.

NEW YORK: Exhibit by 15 woodworkers, including Mark Lindquist, Robert Whitley, David Ellsworth, Sept. 18 to Oct. 17. The Craftsman's Gallery, 16 Chase Rd., Scarsdale.

NEW YORK: Convention—National Hardwood Lumber Association, Oct. 5-7, Hilton, NYC. Contact S. Carroll White, PO Box 34518, Memphis, Tenn. 38134.

NEW YORK: Furniture Exhibit—Sept. 12 to Oct. 10. The Elements, 766 Madison Ave., NYC.

NEW YORK: Courses at the Craft Students' League of the YWCA—beginning woodworking, starts Sept. 24; intermediate and advanced woodworking, starts Sept. 23; \$158 each. Demonstra-



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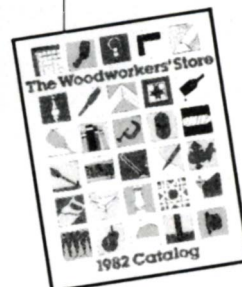
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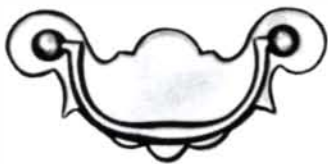
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tion on tool sharpening and planing by Maurice Fraser, Sept. 13 and Sept. 16. Contact YWCA, 610 Lexington Ave., NYC 10022.

OHIO: Marietta College Craft National, all media, Oct. 31 to Nov. 29; entry deadline, Sept. 12. Contact Arthur Howard Winer, Marietta College, Marietta, Ohio 45750.

OHIO: Artistry in Wood—competition and sale, Nov. 21-22, Dayton Convention Center. Exhibitor deadline, Nov. 1. Contact Bob Wening, 33 Watervliet Ave., Dayton 45420.

OHIO: Workshop—spray finishing technology, Sept. 14-18. Contact Dr. Richard A. Kruppa, School of Technology, Bowling Green State University, Bowling Green, Ohio 43403.

OREGON: Exhibition—furniture by John Economaki, Steve Foley and Dick Wrangle, Oct. 1-29. Contemporary Crafts Assoc., 3934 S.W. Corbett Ave., Portland, Ore. 97201.

PENNSYLVANIA: 10th Woodturning Symposium and show, with 25 instructors, Sept. 11-13. Write Albert Lecoff, Amaranth Gallery, 2500 N. Lawrence St., Philadelphia, Pa. 19133.

PENNSYLVANIA: Woodcarving and Decoy Show, Oct. 3-4, York College Gym. Contact Eldred Atkinson, Yorkcarvers, 728 Clearmount Rd., York, Pa. 17403.

TEXAS: Seminars—power tools, Ian Kirby, Oct. 17-18; bowlturning, Bob Stocksdales, Nov. 14-15. Contact Wood & Tool Store, 1936 Record Crossing, Dallas, Tex. 75235.

UTAH: Turning Symposium with Mark and Mel Lindquist, Rude Osolnik, Bruce Mitchell, Dale Nish, Oct. 8-10. Contact Dale Nish, 230 SNLB, Brigham Young University, Provo, Utah 84602.

VIRGINIA: Carving Show, sponsored by North-

ern Virginia Carvers, Nov. 28-29, Community Center, Vienna. Contact Bert Foster, 2245 No. Harrison St., Arlington, Va. 22205.

WASHINGTON: Woodworking Exhibition—Steve Barney, Todd Miller, Kate Joyce and David Eck, through Sept. 10; wood, glass, ceramics and fiber, Sept. 24 to Oct. 18; Sam Maloof, Oct. 22 to Nov. 15. Northwest Gallery of Fine Woodworking, 115 S. Jackson St., Seattle.

WASHINGTON: Exhibit and open house, Sept. 11-13. Northwest School of Wooden Boatbuilding, PO Box 401, Port Townsend, Wash. 98368.

WISCONSIN: Workshop—wood and vinyl touch-up and repair, Sept. 9-11, Holiday Inn West, Milwaukee. Workshops held throughout the U.S. Contact Mohawk Finishing Products, Amsterdam, N.Y. 12010.

WYOMING: Four-day Professional Seminar Sept. 24-27 on design, techniques, marketing. Fee \$50. Jackson Hole Arts Center, PO Box 11, Jackson, Wyo. 83001. Phone (307) 733-3462.

ENGLAND: Exhibitions—carved wooden toys, Sept. 20 to Oct. 18. Prescote Gallery, Cropredy, Banbury, Oxon OX17 1PF, Oxfordshire.

NOVA SCOTIA: Courses—advanced lathe work, Deryk Jones, begins Sept. 23, \$45; basic hand and machine techniques, making planes and wooden clamps, Richard Tyner, begins Sept. 24, \$20; one-day workshop on dovetail construction, Jeff Amos, Oct. 24, \$20; hand tools, Deryk Jones, begins Oct. 28, \$35. Contact Richard Tyner, 32 Edmonds Grounds, Halifax N.S. B3N 1M6.

ONTARIO: International Woodcarving Exhibit, through Sept. 7, Canadian National Exhibition, East Annex, Toronto, Ont. Contact R. Farr, Agriculture Mgr., Canadian National Exhibition, Toronto, Ont. M6K 3C3.

Connections

In CONNECTIONS, we'll publish membership calls for guild-style organizations, letters from authors compiling directories in which craftsmen might like to be listed, and appeals from readers with special interests looking for others who share them.

The Farmington Valley Arts Center, in Avon, Conn., is accepting applications for studio space from artists and craftspeople. Studios average 400 sq. ft. The Arts Center offers a professional class and workshop program, as well as art exhibitions. Write Melissa Meredith, Farmington Valley Arts Center, Box 220, Avon, Conn. 06001.

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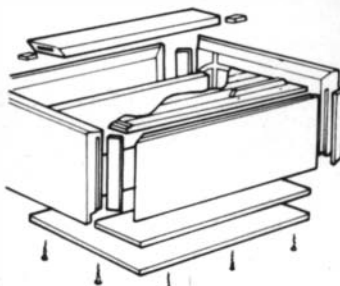
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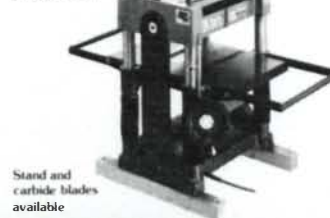
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Building Stairs

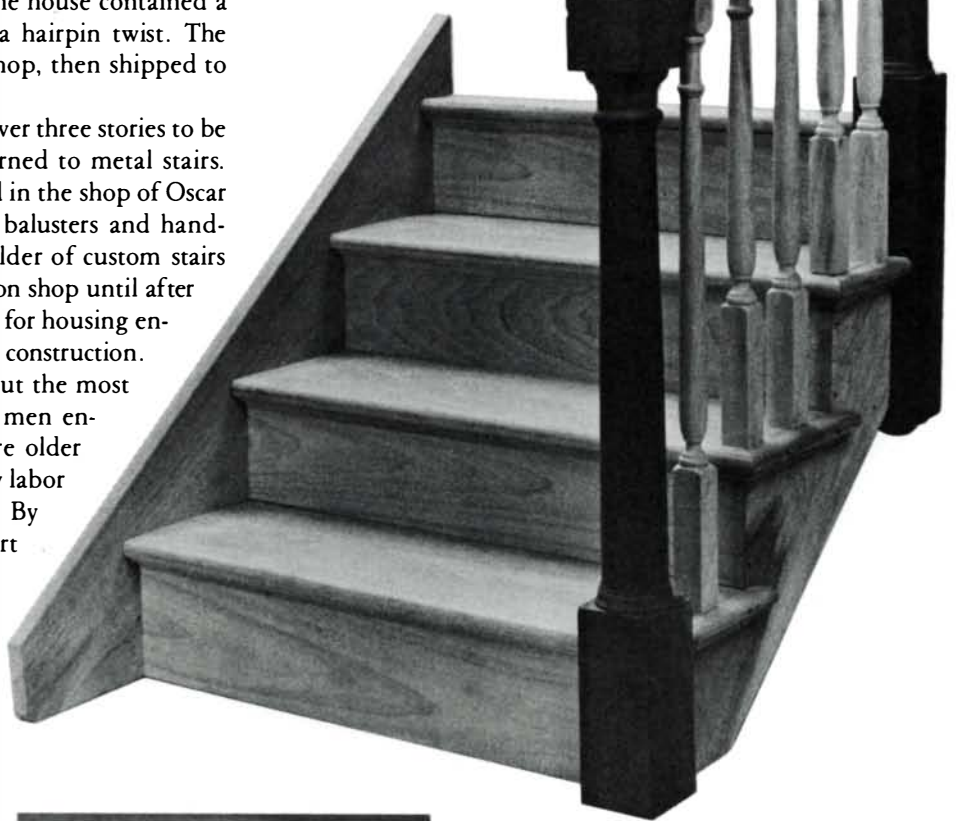
Harry Waldemar shows the old-time way to a custom job

When Harry Waldemar, of Ardsley, N.Y., began his four-year apprenticeship in 1925, the stairbuilding trade had already begun to decline. During the 19th century, New York stairbuilders were known all over the country, and were called in for the toughest jobs everywhere. This was chiefly because the typical New York brownstone house contained a difficult stair whose handrail required a hairpin twist. The stairs were built and assembled in the shop, then shipped to the site for installation.

In 1903, a new law required all stairs over three stories to be fireproof, so much new construction turned to metal stairs. Then in 1925, the year Waldemar started in the shop of Oscar Neilsen, stock parts for making treads, balusters and handrails came on the market. Still, the builder of custom stairs was able to compete against the production shop until after World War II, when the postwar demand for housing encouraged quicker techniques and cheaper construction. Production shops took the lead for all but the most complicated stairways. Fewer and fewer men entered the old trade; those who did were older than an apprentice ought to be, and new labor laws made training a man unprofitable. By the time Waldemar retired in 1976, the art of building stairs from scratch had just about died. The situation has improved a little in the last few years, with surging interest in restoring old houses and reviving traditional craft techniques. Waldemar, whose long career includes building and installing a three-story tapering spiral stairway in the Rockefeller house at Seal Harbor, Me., increasingly found himself invited to conduct workshops for young carpenters.

An uneasy lecturer, Waldemar decided to record what he knew in the form of precisely detailed knock-down models, at one-half and one-quarter scale, of the various forms a good stair can take. But no matter how tricky the stair, the basic methods and standards of the craft remain the same. Waldemar demonstrates these on the following pages using his model of an open stair, where one stringer is fastened to the wall and the other is open to view in the downstairs room. This and his other models will be on display at the New York State Museum in Albany. Waldemar is also working on a book about stairbuilding, for publication by the *Old-House Journal*. —D.F.

An open staircase. The closed stringer fits against a wall, while the open stringer on the handrail side shows in the downstairs room.

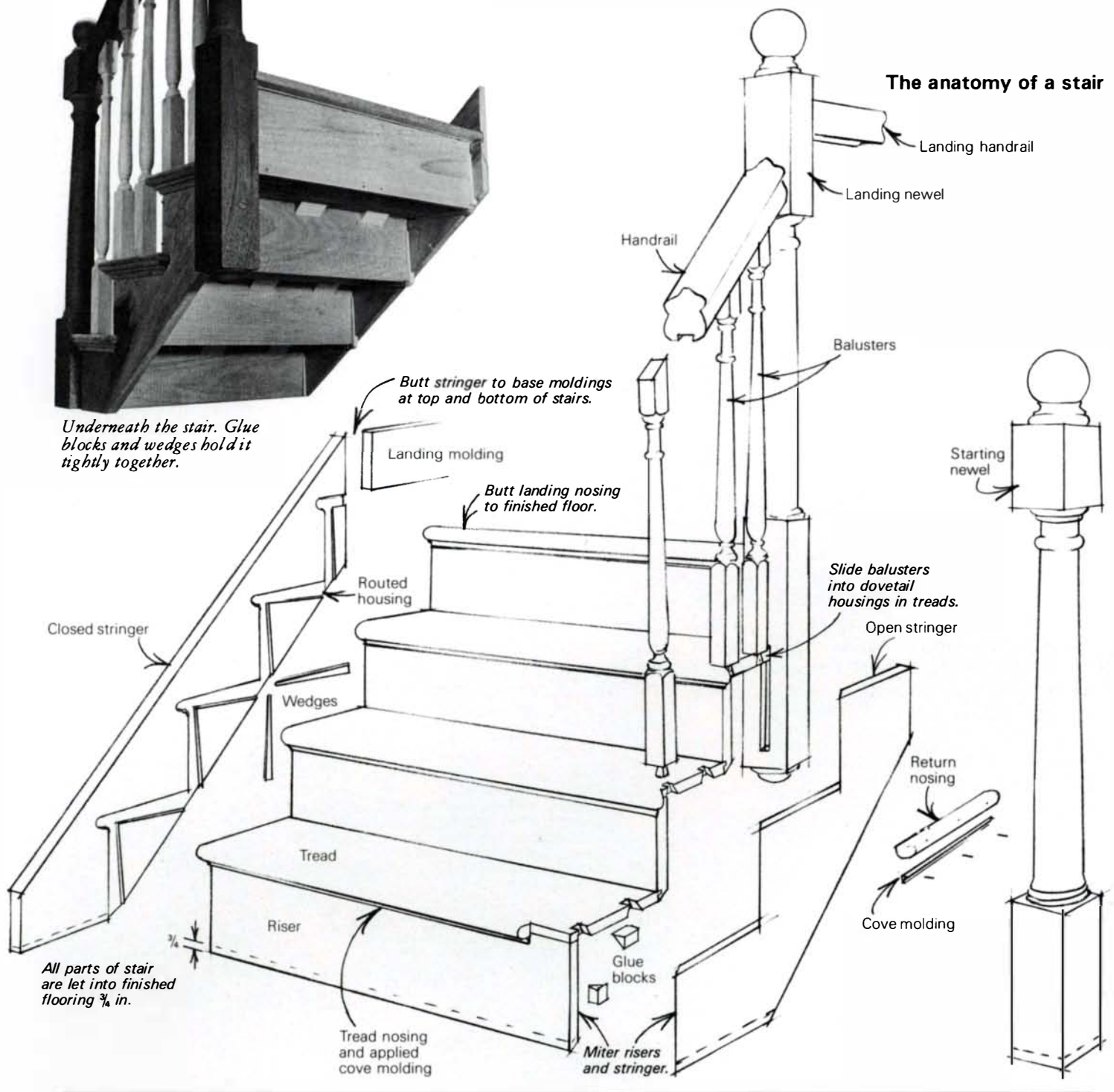


Brownstone stairs, at one-quarter scale.



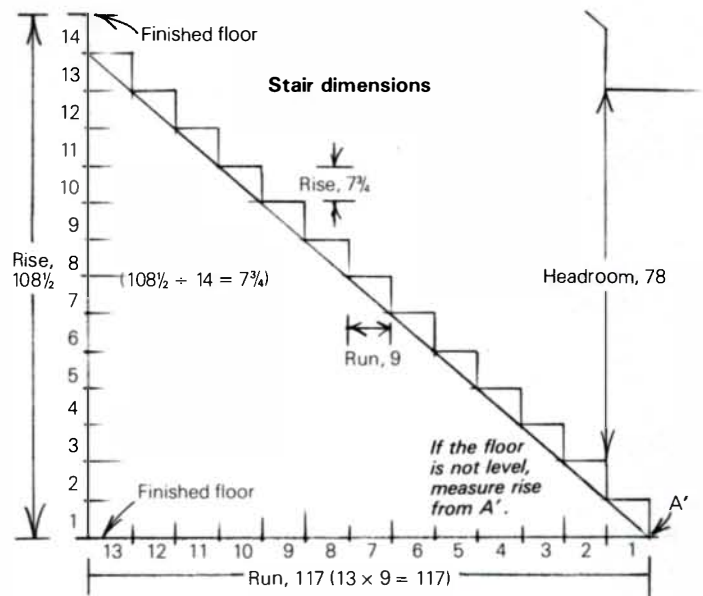
Waldemar disassembles the half-scale model.

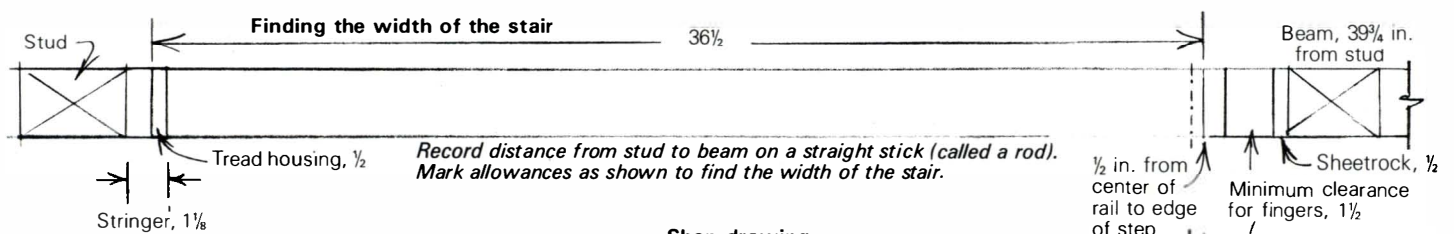
The anatomy of a stair



At the job site—A staircase consists of a stack of steps, and a step consists of one riser (the vertical board) and one tread (where you walk). The work begins by accurately measuring at the site; the drawing at right shows a typical flight, although the models that follow contain only four steps. The first measurement is the total rise from finished floor to finished floor. Always verify that the lower floor is level. If it's not, measure the variation at A' and allow for it. Since an average flight contains 14 risers, divide the rise by 14 to obtain the height of one riser. This dimension can vary from one stairway to another, but must be uniform within a flight, or else people will stumble. Risers are usually about $7\frac{3}{4}$ in. high.

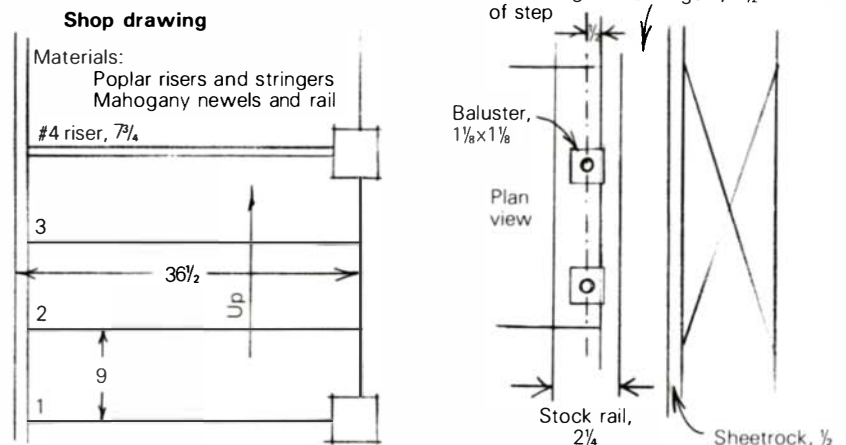
There's always one fewer tread than riser, and an average run is 9 in. Thus 13 treads times 9 in. gives the total run of the flight, providing this run will permit headroom of $6\frac{1}{2}$ ft., as drawn. Tread and riser dimensions can be adjusted, but this rule of thumb should always be observed: Two times the rise plus once the run should total between 24 in. and 25 in.





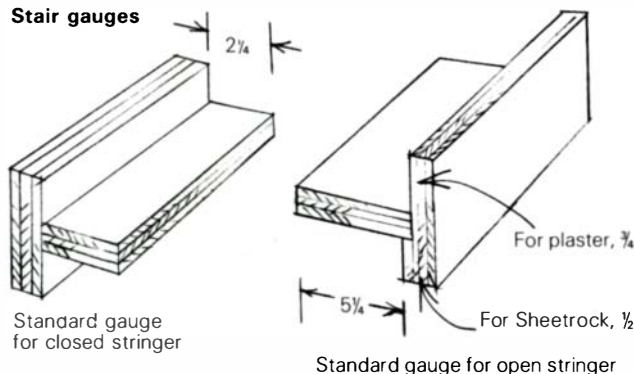
The shop drawing—While still at the site, record the width of the stairwell, including the adjacent beams and studs, on a stick of wood (called a rod). Mark on the rod allowances for Sheetrock or plaster, for the thickness of the stringers and for finger space between the handrail and the wall. You can now take the finished width of treads and risers directly from the rod—36½ in. for the stair in our example.

With the site measurements and the rod, you know enough to make a working drawing of the flight, in plan view (right). This drawing contains the information you'll need back at the shop to make and assemble all the parts of the stair.

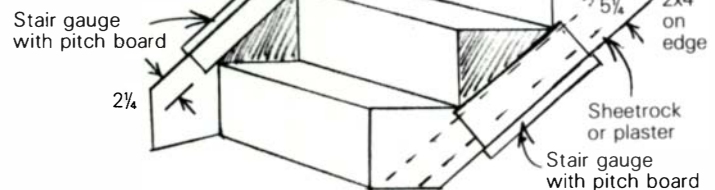


The pitch board—Back at the shop, the first things to make are a pitch board and two stair gauges. The pitch board is a right-angled triangle sawn from plywood, whose sides are the rise of one riser and the run of one tread. The stair gauges, one for the closed stringer and one for the open stringer, are used to position the pitch board when laying out the stringers, as shown below. You'll refer to the pitch board throughout the job, so make sure it's accurate.

Stair gauges

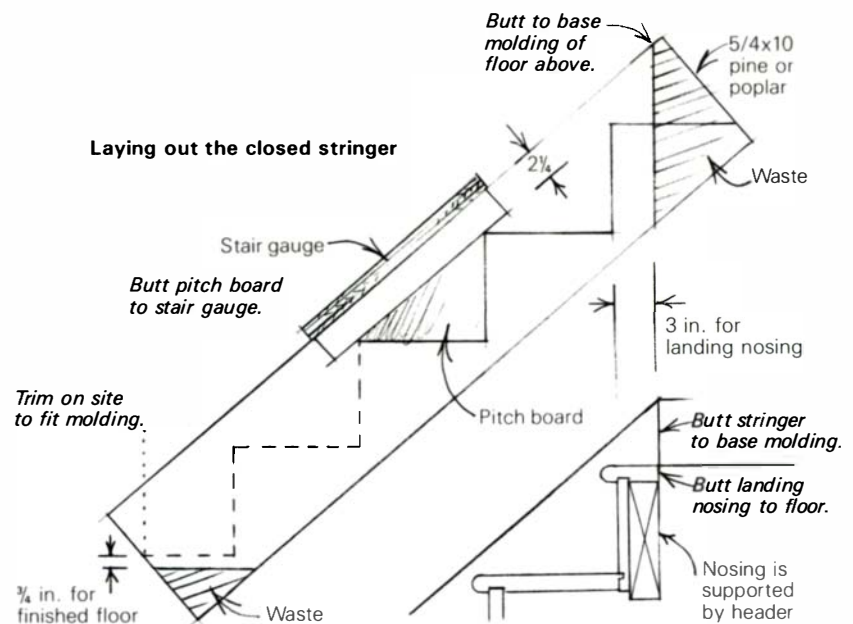


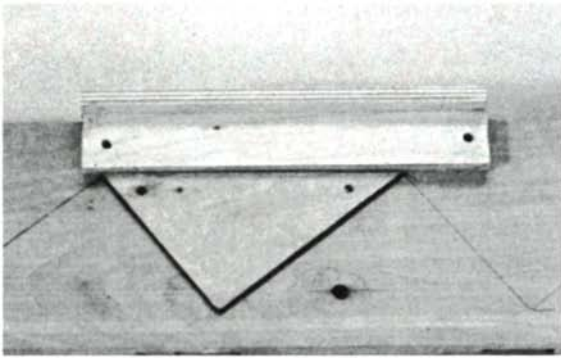
A 2¼-in. allowance permits closed stringer and base molding to meet neatly at top and bottom. A 5¼-in. allowance leaves just enough room under the stairs for a 2x4 on edge to which Sheetrock can be nailed. If the underside will be plastered, the allowance is increased.



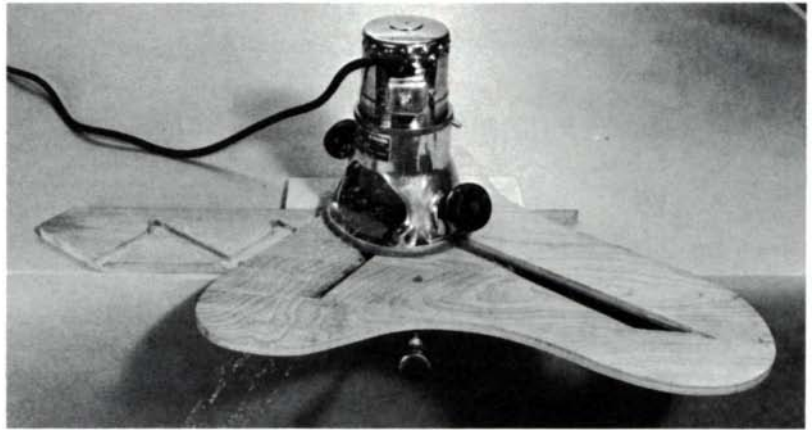
The closed stringer—The closed stringer, also called the housed stringer, anchors one side of the stair to the stairwell wall. It starts out as a 5/4x10 board (1½x9¼) of pine or poplar. To find its rough length, measure the long side of the pitch board (12 in. in our example) and multiply by the number of steps, then add a foot or two for waste. Normally, for 14 risers, you'll need a 16-ft. board.

Layout begins at the top, using the pitch board and the closed-stringer gauge to establish a line that will be the vertical end of the stringer in the finished stair. Next, shift the pitch board 3 in. to allow for the landing nosing, then trace around the pitch board to locate the outside faces of the first riser and tread. Proceed down the board. At the bottom, add the thickness of the finished floor (usually ¾ in.) to the height of the last riser. Good stairs rest on the subfloor, with the finished floor fit around the bottom step and newel post. Thus the floor holds the stairs in place. If the floor's already installed, you must chop it out to fit.

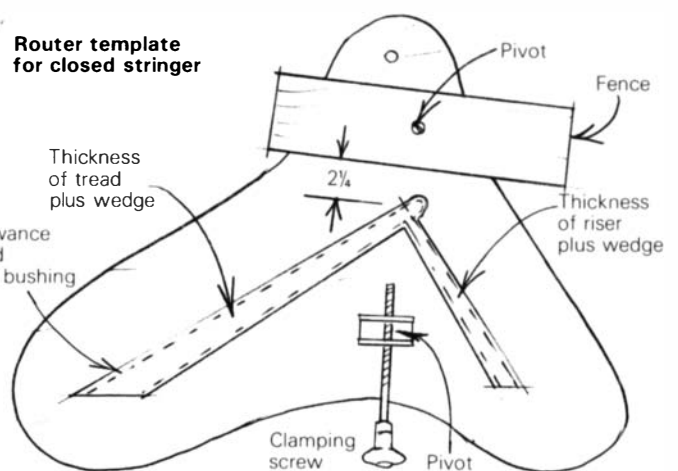
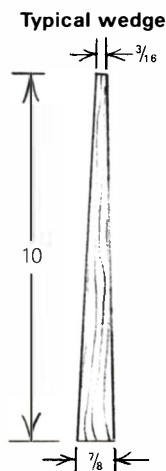




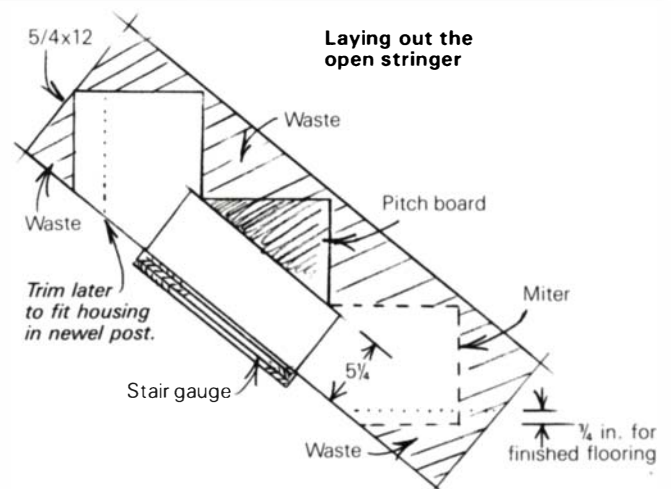
After laying out the closed stringer with pitch board and stair gauge, above, the router template, right (oversize for various size stairs), is used to rout the step housings.



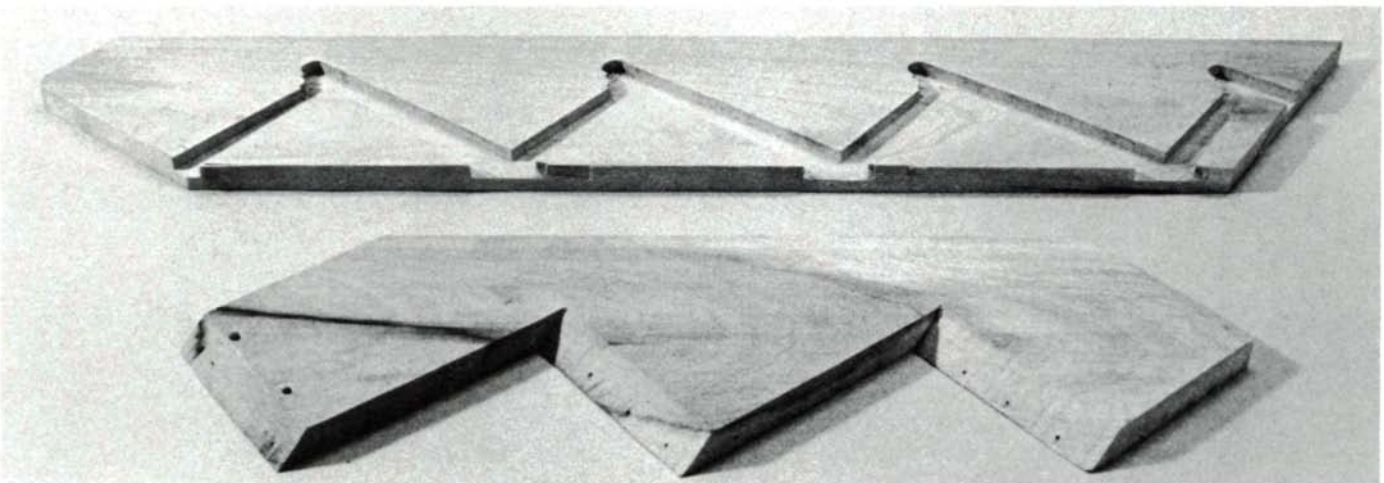
Routing the closed stringer—The zig-zag housing is routed $\frac{1}{2}$ in. deep into the closed stringer, to accept the ends of the treads and risers, plus the wedges that lock them in place. You can make a router template for use with a guide bushing (photo, top right), or you can develop the housing layout from the pitch-block lines and excavate the waste with saw, chisel and router plane. Routing done, finish up by chopping small recesses to receive the end of the cove molding that covers the joint between the tread nosing and the riser below. Production shops merely butt this molding against the stringer.



The open stringer—The open stringer supports the other side of the stair; treads rest on it and risers meet it in a neat miter. At the bottom it rests on the subfloor, at the top it is housed in the landing newel. Thus it is shorter than the housed stringer by the amount of the top riser and the 3-in. nosing allowance. It's also wider, being cut from a $5/4 \times 12$ board of pine or poplar. Use the pitch board and the $5/4$ -in. gauge to lay it out as shown, starting with a full tread at the top and allowing for the finished floor at the bottom. It can be cut out on the table saw and bandsaw, but not easily. Stairbuilders saw it by hand at the bench, using a leg vise that rises several inches above the bench surface. First make a relief cut above the line of each tread, then saw all the treads, then saw the miters for the risers. The miters should be accurate, although they can be undercut by about the thickness of a pencil line to make a neat fit certain.



The completed stringers, below.

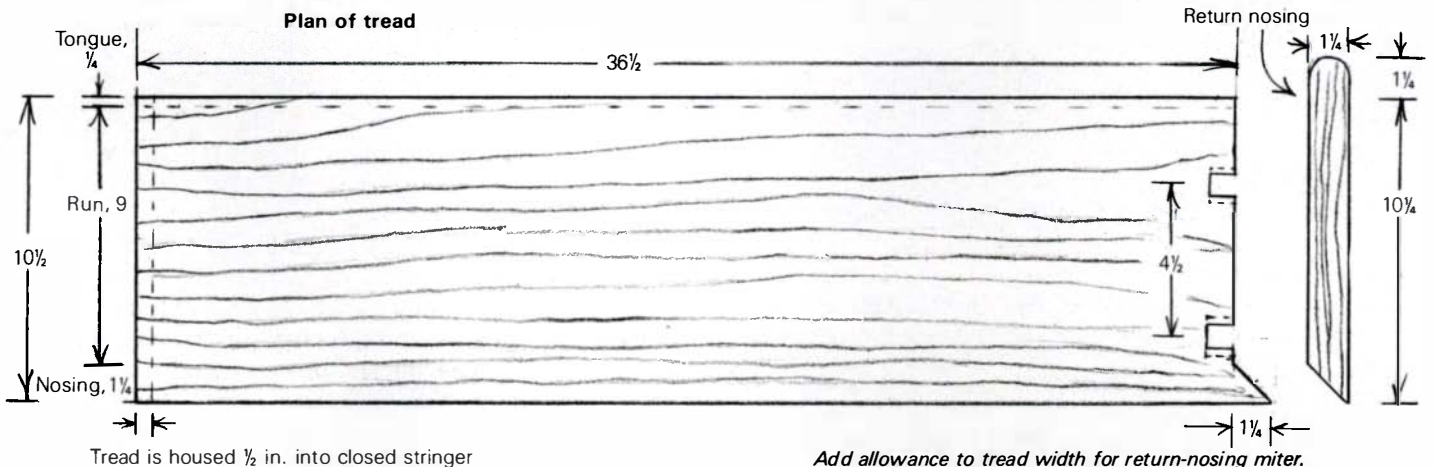
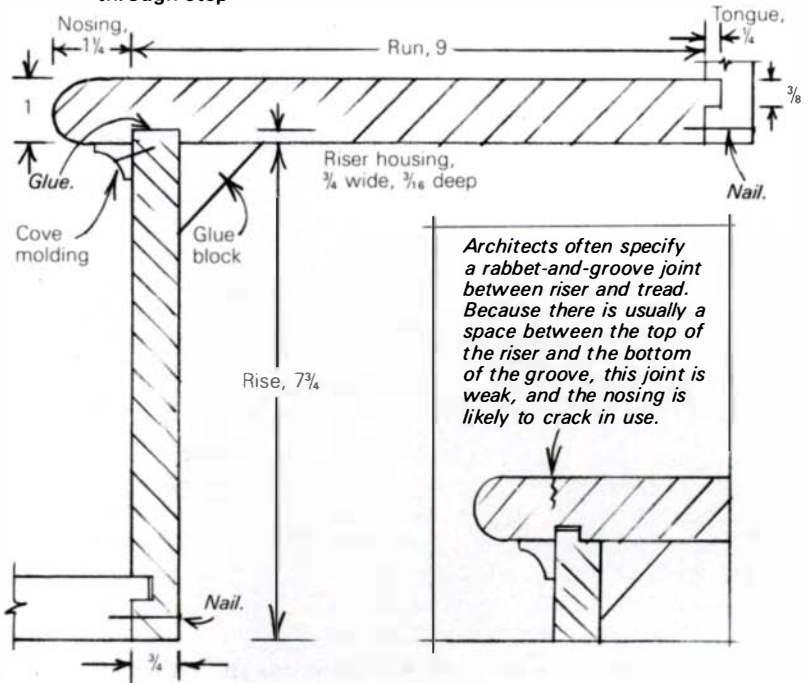


Treads—It's usual to buy pre-milled tread stock of white or red oak, 12 in. wide and 36 in. or 42 in. long, planed to 1 in. thick, with the nosing molded on one edge. The tread depth in our example is the 9-in. run, plus 1¼ in. for the nosing, plus ¼ in. for the tongue, a total of 10½ in. Rip the stock to this width.

The measuring stick gives us the length of each tread, 36½ in. This includes the half-inch that's housed inside the closed stringer, but you must still add 1¼ in. for the miter that meets the return nosing on the open side, plus ⅞ in. in order to have a place to start sawing this miter. Thus the treads must be crosscut to 37⅞ in. long; this requires purchasing 42-in. stock. Using the table saw, router or shaper, make the ¼-in. tongue on the back edge of each tread, and the ¾-in. groove on the underside where the riser fits. The spindle shaper is the right machine for these operations, and is essential in the small stair shop because it will also produce moldings, nosings and handrails.

Lay out the nosing miter. On the table saw, crosscut to within 2 in. of the miter, cut the miter itself, then remove the waste.

Section through step

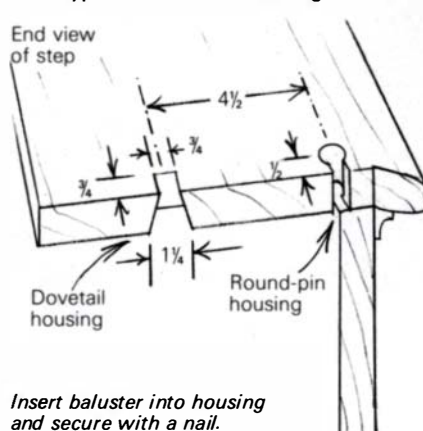


Baluster housings—If you turn your own balusters, you'll be able to make the traditional dovetail on their bottoms, which allows you to mount the balusters from the stair's open side after the handrail is in place. Besides finishing the end of the tread, the return nosing then traps the balusters. You'll need to cut a pair of dovetail housings in the open end of each tread. Position the front housing so the front edge of the baluster is directly over the face of the riser below. The housing is normally ¾ in. wide on the top surface of the tread, spreading to 1¼ in. at the bottom, and a uniform ¾ in. deep.

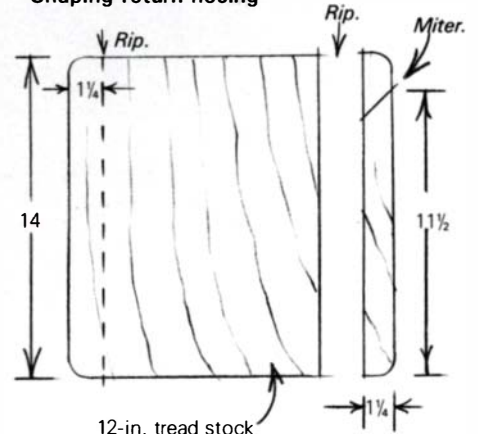
If you are buying stock balusters, they'll come with a round pin instead of a dovetail. Drill for the pin so that the shoulder of the baluster covers the joint between the tread and the return nosing by ⅛ in. Then saw a slot so the baluster can still be slipped in from the open side. Whether the pin is round or dovetailed, a single nail locks it in place.

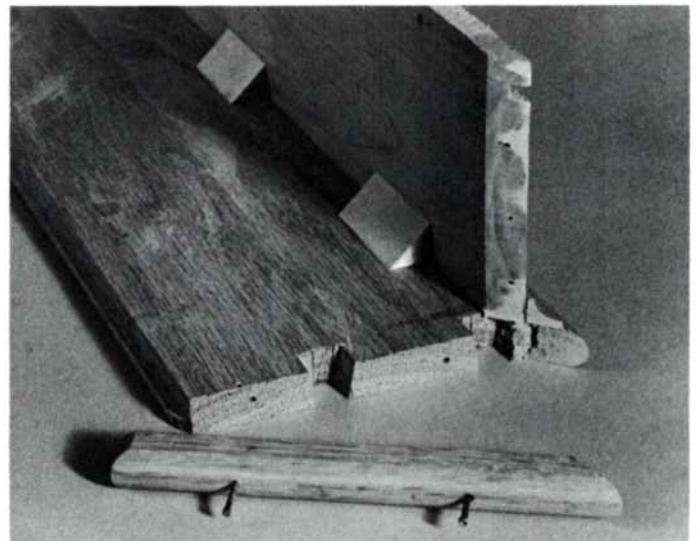
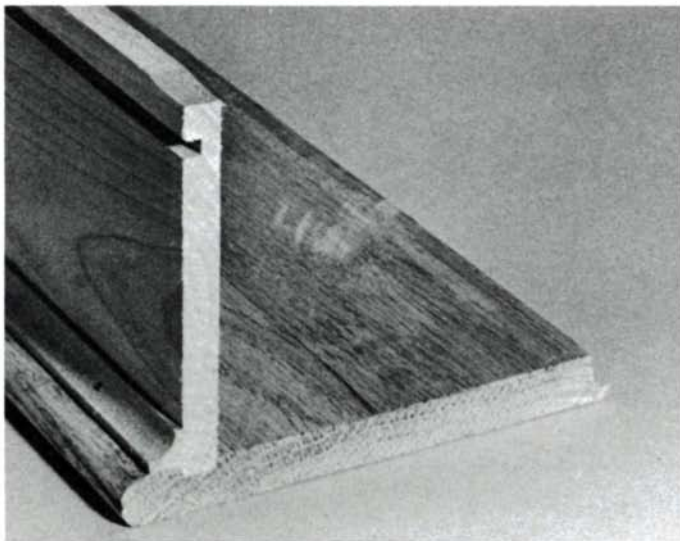
Return nosing—The return nosing completes the tread. You can buy it by the running foot, leaving you to shape the back end like the nosing profile and miter the front end to length. Or, you can shape and saw it from tread scrap, starting with pieces 12 in. wide and 14 in. or so long. The strategy is to shape all four edges of the scrap, rip a nosing 1¼ in. wide from each long edge, reshape the cut edges and rip again. Then miter each nosing to an overall length of 11½ in. —the 9-in. run plus 1¼ in. at both ends, as shown below, at right.

Two types of baluster housings



Shaping return nosing

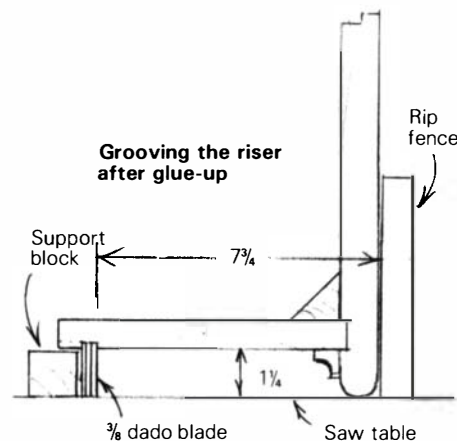




Here's how all the pieces of a finished step come together at the housed side (left) and the open-stringer side (right). You can see the fine points that make the difference between custom and production stairs. In custom stairs the riser is fully housed in the bottom of the tread, rather than being nailed or rabbeted, as in production stairs. The cove molding at this joint is let into the closed stringer in custom stairs, cut

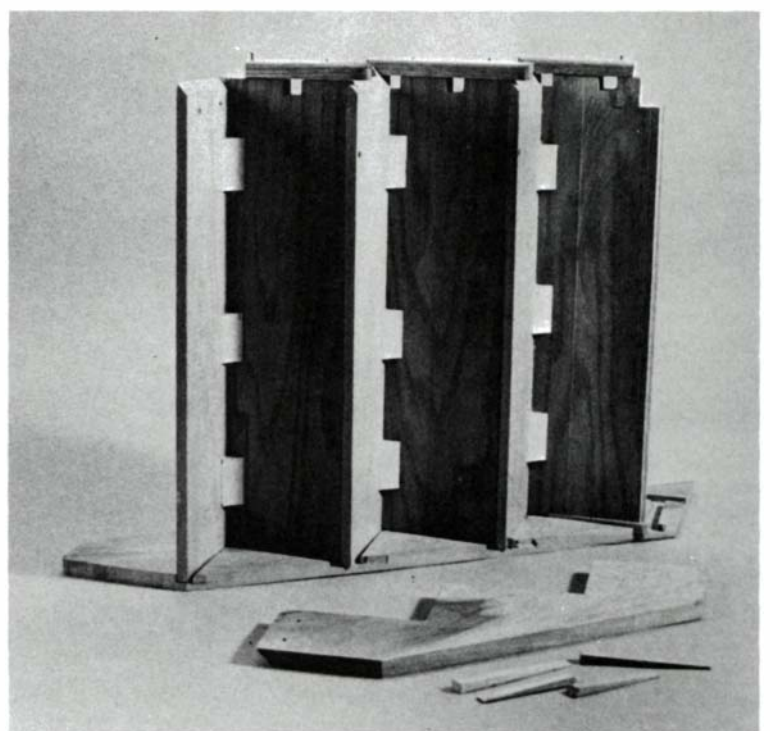
short to abutt it in production stairs. Production builders also often skip the tongue and groove at the back of the treads and lower face of the risers, relying on a few nails here instead. They usually do without glue blocks underneath too. Not much holds such stairs together, and that's why they squeak. Once the stair is installed, there's no way to get in and reinforce it, so it's best to do the job right in the first place.

Risers—Risers can be pine, but if they are to be painted, poplar is better. Buy 10-in. stock planed to $\frac{3}{4}$ in. thick, then rip it to $7\frac{1}{16}$ in. wide—that is, the rise of $7\frac{3}{4}$ in. plus $\frac{3}{16}$ in. which will be housed in the groove of the tread above. The waste ripped off can be shaped or routed into cove molding. Miter one end of the riser where it will meet the open stringer, then cut to finished length, $36\frac{1}{2}$ in. in our example, taken from the measuring rod. It's best to cut the groove near the bottom edge of each riser after gluing, or else the steps could come out crooked.



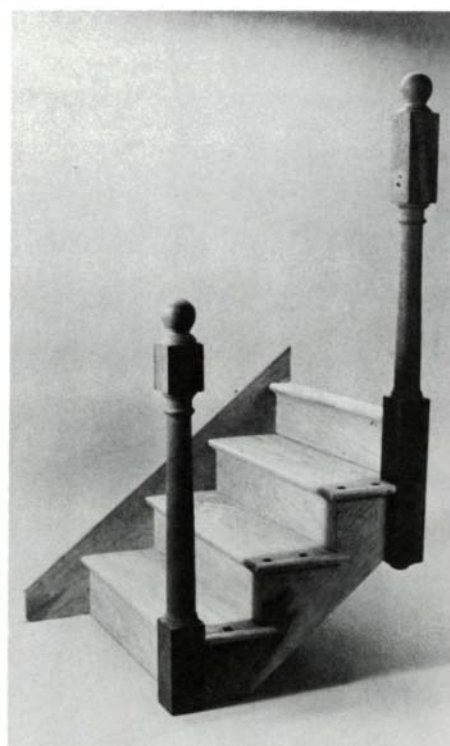
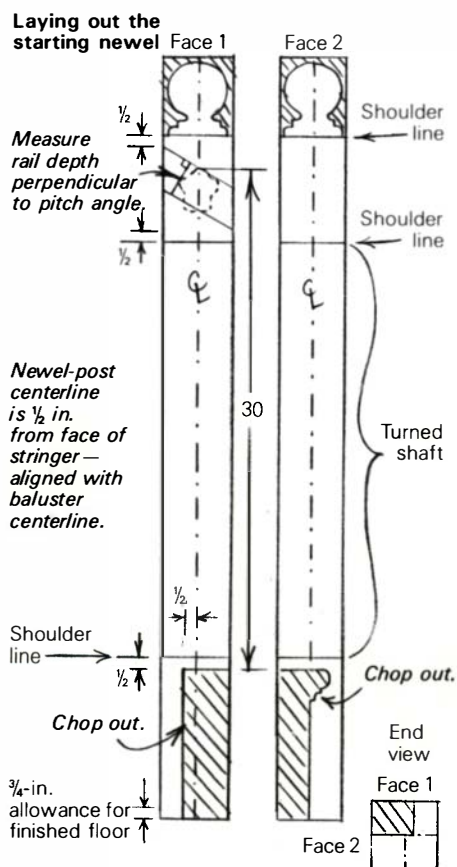
Gluing up—One step consists of a tread and the riser below it. Glue each riser into the groove milled on the bottom side of its tread, add glue blocks to the back, then glue and nail the cove molding to conceal the joint. When the glue has set, arrange the table saw as shown and cut the groove into the face of the riser $\frac{3}{8}$ in. wide and $\frac{1}{4}$ in. deep. The top of the groove will be parallel with and exactly $7\frac{3}{4}$ in. from the face of the tread. Tack the return nosing in place, using 6d finishing nails—you'll remove them later to insert the balusters. Sand the steps before assembly.

Assembling the flight—Stairs are usually assembled and glued up at the shop, then shipped to the job site in complete flights, although without handrail and balusters. Start at the top, with the first complete step (not the top riser and landing nosing). Lay the closed stringer flat on the floor, insert the step and tap in the wedges that lock it in place. Wedging the top step tight will be enough to square off the flight, so now drop the remaining steps into their housings, wedging loosely as needed. Add the open stringer, nailing through the miter into the end grain of the risers. Three nails per riser will hold it. Next, wedge the closed side, gluing in the riser wedges first and trimming them flush to allow clearance for the tread wedges to be glued in tightly. Then back-nail the bottom of the risers to the treads, spacing the nails 8 in. to 10 in. apart under the tongue. Add glue blocks to the open stringer, one block under each tread and one behind each riser. Like the wedges on the closed side of the staircase, these glue blocks will keep the stairs tight and free of squeaks. Tack the cove molding under the return nosings. Notice that nails are never driven into the face of the treads. Now you're ready to fit the newel posts, top riser and landing nosing, all of which must be done before installation because the finished floor will have to be fit and laid around them.



Open stringer will be glued and nailed to the partially assembled flight.

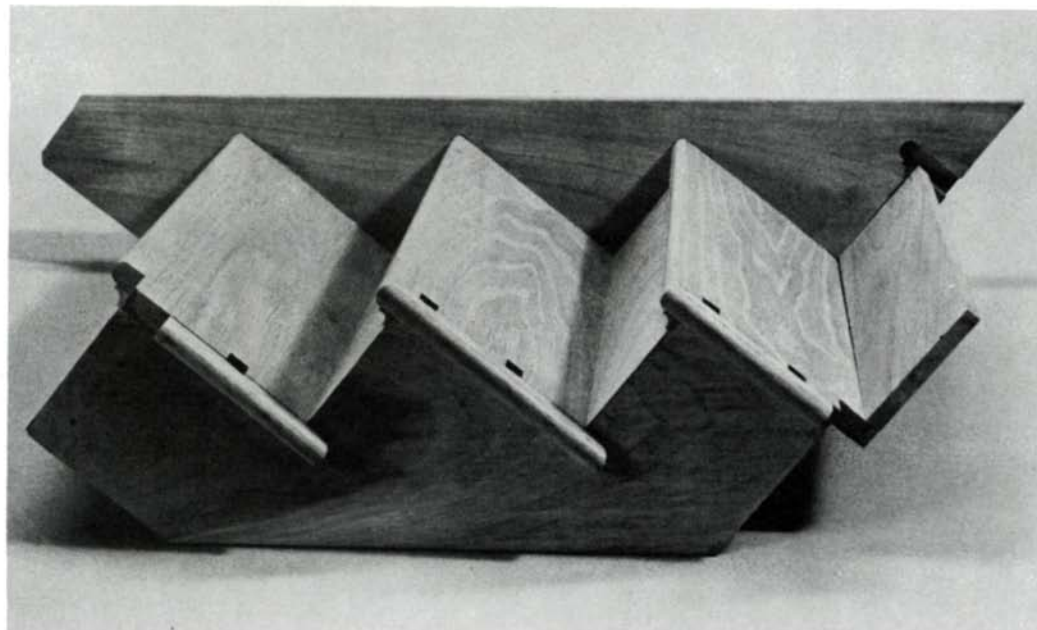
Starting newel—The starting newel, at the foot of the stair, has a large housing chopped in it to fit around the outside corner of the bottom step. The newel should be laid out before it is turned, usually from a blank 4 in. square by 4 ft. long. Start the layout by scribing a centerline on two adjacent faces of the blank, then locate the shoulders that separate the turned shaft and cap from the sections left square (right). Begin at the top of the post; the important dimension is from the crest of the handrail to the top of the first tread, 30 in. Since the handrail enters at the pitch angle, use the pitch board to establish its vertical thickness. At the foot of the post, the stringer is let in $\frac{1}{2}$ in. past the centerline, whereas the face of the bottom riser goes in right on the centerline. There's also a shallow housing for the tread nosing and its cove molding (trimmed to fit). The return nosing is cut off flush with the newel. Allow an extra $\frac{3}{4}$ -in. to be let in to the finished floor. After laying out the newel, turn it and cross-cut it to length, then saw and chisel the housings.



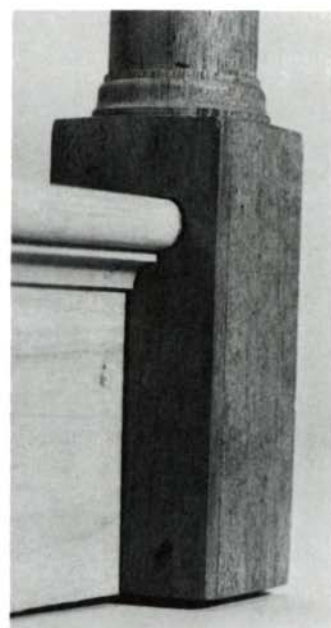
Screws from behind secure the newels. They are fitted to the flight before it's installed, so the floor can be laid around them.



The landing newel (top) and starting newel, with their housings. Note the difference in the lengths of the turned shaft and of the square sections.



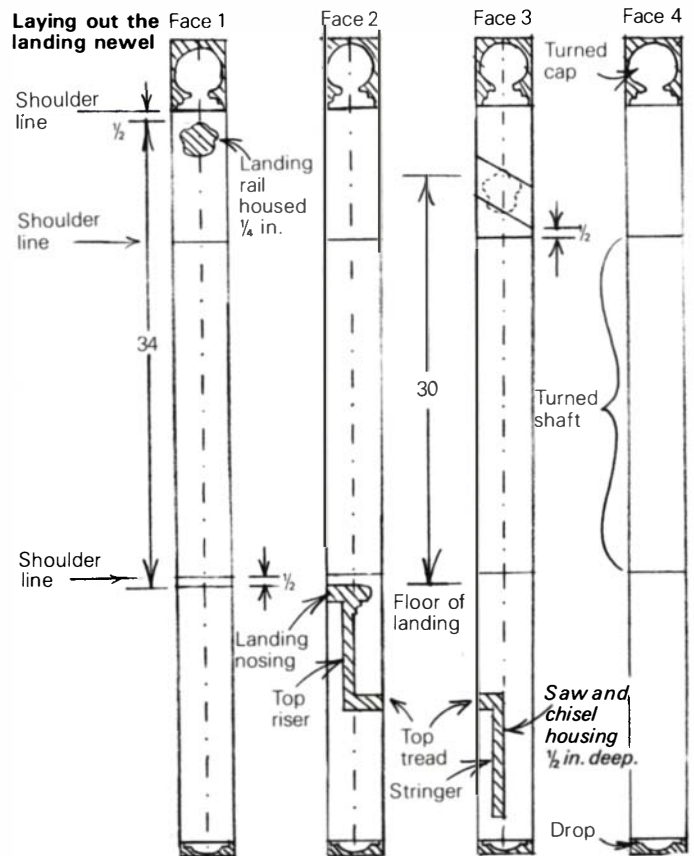
The assembled flight, with newels removed. Portions of the top and bottom treads and their moldings must be sawn away to fit the newel housings.



The starting newel houses the tread nosing and its cove molding.

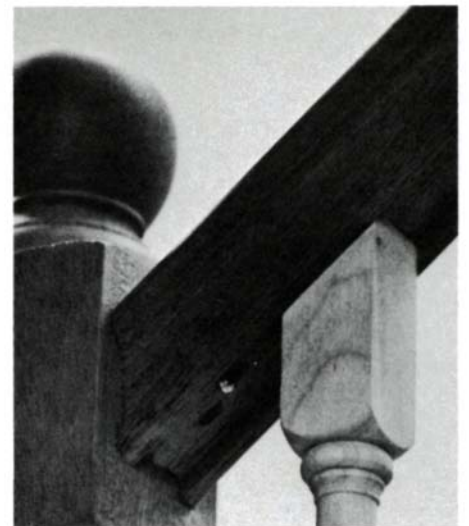
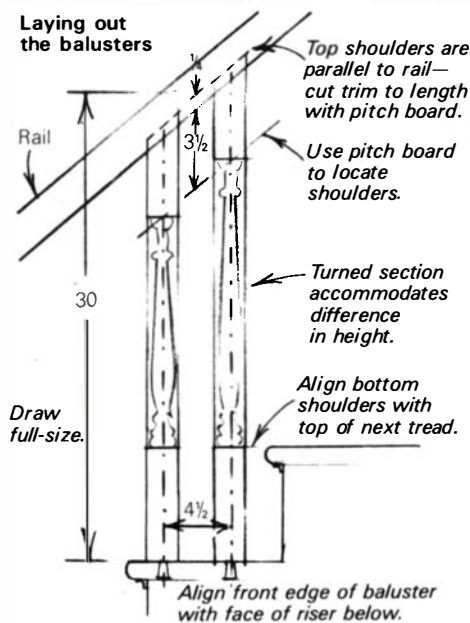
Landing newel—Because it accommodates a handrail on the landing, and also houses the top riser and the top of the open stringer, the landing newel is taller than the starting newel. A 5-ft. blank is usually long enough. The landing handrail runs straight out the back of the newel (face 1, right), so this newel must be laid out on three adjacent faces, beginning from centerlines and working down from the top. As before, the critical elevations to establish are the level of the landing itself, and of the shoulders that define the newel's turned portions. The crest of the landing rail is 34 in. above the landing nosing, and the crest of the pitched handrail is 30 in. above the landing, as it was on the starting newel. With these points established, you then scribe onto face 2 of the newel the profile of the nosing itself, of the top riser, and of the back end of the top tread, all of which should be cut back so they fit in what will be a ½-in. deep housing. The step profile and the end of the open stringer may then be scribed onto face 3. Leave ¼ in. below the stringer before laying out the drop that completes the newel. Finally, scribe the housings for the landing rail. The pitched rail need not be housed. This layout is more difficult to describe and draw than to do; its logic is apparent when you have an assembled stair or a model that you can refer to.

Screws through stringer and riser, from beneath the stair, secure this type of newel in place. Newels are usually fitted to the flight before it leaves the shop, then removed for shipping. Make sure they're plumb, then measure between the newels to find the length of rail stock you need.

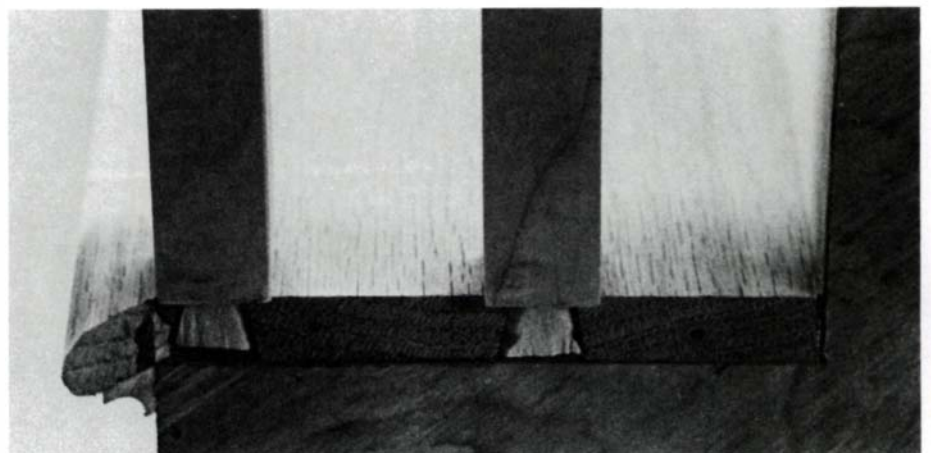


Handrailing—You can buy handrailing, or you can shape your own on the shaper. Either way, start by plowing a groove ¼ in. deep down the center of the underside of the rail, wide enough to fit the square section atop the balusters. Use the pitch board to miter the ends of the handrail, to the length you took by measuring between the newels. Butt the handrails to the newels and secure them with nails or screws.

Balusters—Each tread carries two balusters, one shorter than the other because of the handrail's pitch. They look best when the turned portion begins at the level of the top of the next tread, and ends at a uniform distance below the handrail. Thus the difference in length is accommodated in the central turning, not in the square sections at top and bottom. To lay them out, draw a full-size side elevation of one step. The turning must include stock for the dovetail pins that fit the housings in the ends of the treads. These dovetails can be sawn in the square baluster, but it's quicker to turn a cone-shape and trim it to fit. Leave the tops of the turnings overlong, and use the pitch board to trim them to length, not forgetting the extra ¼ in. that fits into the handrail. Two finishing nails into the handrail, and one through the dovetail, hold them in place. Replace the return nosing and its cove molding, gluing the mitered ends. Set the nails, drive a nail through the miter, and you're done. □



Two nails secure each baluster to the bottom of the handrail. The top of the baluster is sawn at the pitch angle.



A single nail locks the bottom of the baluster to its tread.

A Cabinetmaker's Tool Cabinet

Updating a traditional design

by David Powell

When I first started making furniture in Edward Barnsley's workshop, the tool chests used by the craftsmen there were of the traditional sort. They were simplified versions of a design that had developed over centuries, originating probably as medieval oak chests or coffers. All of them were rectangular boxes that sat directly on the floor. Their lids were hinged in the rear and locked in the front to discourage borrowing and pilfering. The underside of the lid was fitted to hold tools, and the inside of the chest contained one or two banks of drawers which faced each other and opened into a central well (see drawing below). Under the drawers there was usually a space to hold tools too large or awkward to fit into any of the drawers or to hang from the lid. These tools might fit into partitioned compartments or just be wrapped in cloth and placed into an undivided bin. At the bottom of some chests there would be a wide drawer that opened to the outside, so a person could get at its contents without having to rummage inside the main part of the chest.

By the late 18th century cabinetmaker's chests had evolved into refined pieces of furniture. Though outside they remained plain and unadorned, the interiors of these chests were often finely fitted, veneered, inlaid and otherwise decorated. Such refinements proclaimed the skill of the maker to a prospective customer or employer, and no doubt brought a sense of satisfaction to the cabinetmaker who had to live with the chest and work out of it.

When I decided to make my own tool case about 25 years ago, the chests I saw around me in Barnsley's shop were superbly straightforward and well made, but without any in-

terior inlaying, decoration or veneering. Looking at these chests, it seemed to me that their big disadvantage was that too many of the tools they held were not easily accessible. A lot of the tools were stored below the drawer cases, which could mean having to move a whole bank of four to six drawers to get the shoulder plane you wanted. And then perhaps you'd have to go to the added trouble of unwrapping it. Retrieving a tool from the bottom of the chest was about like resurrecting a mummy.

Another disadvantage with these chests was that they were low to the ground. You had to do considerable bending and crouching to fetch and replace your tools. Finally, I felt that there was much wasted space in an already confined area inside these chests, because the well between the facing drawer units had to be left clear to allow the drawers to be opened.

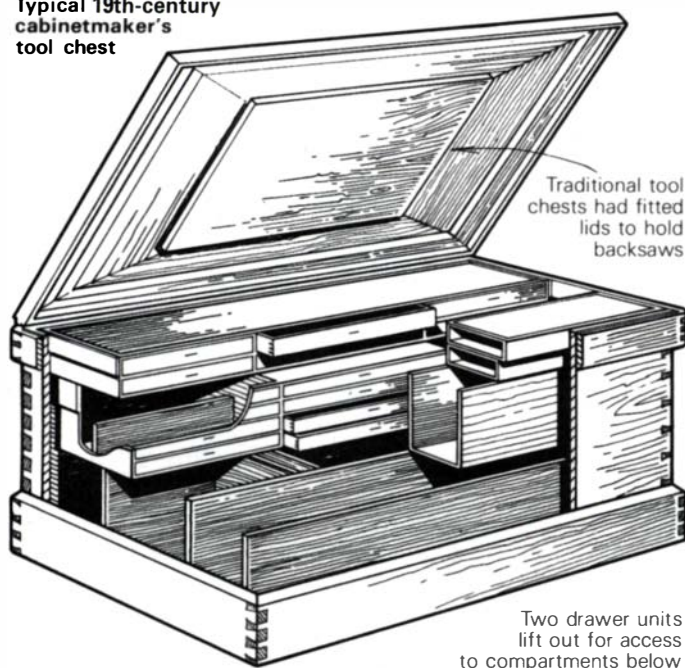
I wanted to have my tools as readily accessible as possible, while still having a case that I could close and lock. I also wanted it to be reasonably transportable, and to fit into my workplace unobtrusively. An upright tool cabinet seemed to be the answer. Sitting on a squat base, such a cabinet when fitted with a bank of drawers would hold all my tools at a comfortable height and would minimize the amount of stooping I'd have to do, and I wouldn't have to remove some tools to get at others. Having a pair of doors would give me two large surfaces on which I could mount saws. And below the drawers, I decided to build pigeonholes for my planes.

Initially, I tried to measure every tool or set of tools I owned and to assign a place in the chest or a drawer for each. This, of course, proved impossibly complex, and couldn't take into account future acquisitions. So I designed the bank of drawers to general dimensions that seemed likely to accommodate my smaller tools, and in particular to keep together sets of related tools such as squares, chisels and gauges in a single drawer, or in a group of drawers. Then I estimated what further small tools I was likely to buy and added drawers for these. This estimate has fallen sadly short of the mark, and after 25 years the drawers are overflowing with tools.

Next, I got out all my planes and lined them up, measured them and assigned each a place in the bin below the drawer case. I also made allowance in this allotment of space for planes I knew I would buy later, and have found to my pleasure that all my planes still fit neatly where I planned for them to go. Then I fell into the trap of including an open well above the drawers. At the time I conceived the design, I reasoned that this space could contain tools that didn't fit conveniently anywhere else in the cabinet, and I could use the underside of the lid for hanging more tools. Over the years this well has collected a pile of tools and dust, and has become something of a junkheap from which it is difficult to disentangle a tool I want. This is exactly the feature in the traditional tool chests that I had wanted to avoid.

Now I'm redesigning the cabinet and will make a new one

Typical 19th-century cabinetmaker's tool chest



without the well in the top. The area it would have occupied will be taken up by additional drawers. The drawers' basic dimensions won't change, and I will still provide fitted spaces for indispensable tools, but will create more in the way of flexible space for new tools.

Building a tool cabinet brings all of your joinery skills into play, and gives you the chance to make one large case and a lot of little drawers. Make the main case from 4/4 pine. If you want to omit the upper tool well and devote this space to drawers as I plan to do, then you can through-dovetail the four sides of the case together, cutting the pins on the top and bottom pieces. Groove the inner rear edges of the case to receive a 1/4-in. plywood back panel. The main horizontal divider, which separates the drawer unit from the pigeonhole section below, is through-tenoned into the case sides, with three wedged tenons on each end. This divider stiffens the sides of the case and supports the drawer unit as well.

If you are tidy, you might find the upper well useful. To make it you must let two wide rails into the sides of the case with through wedged tenons on each side as shown in the drawing on the next page. The bottom inner edges of these rails must be grooved to house the bottom panel, which is best made from 1/2-in. plywood. Also, the bottom edge of the rear rail is grooved to accept the 1/4-in. plywood back panel.

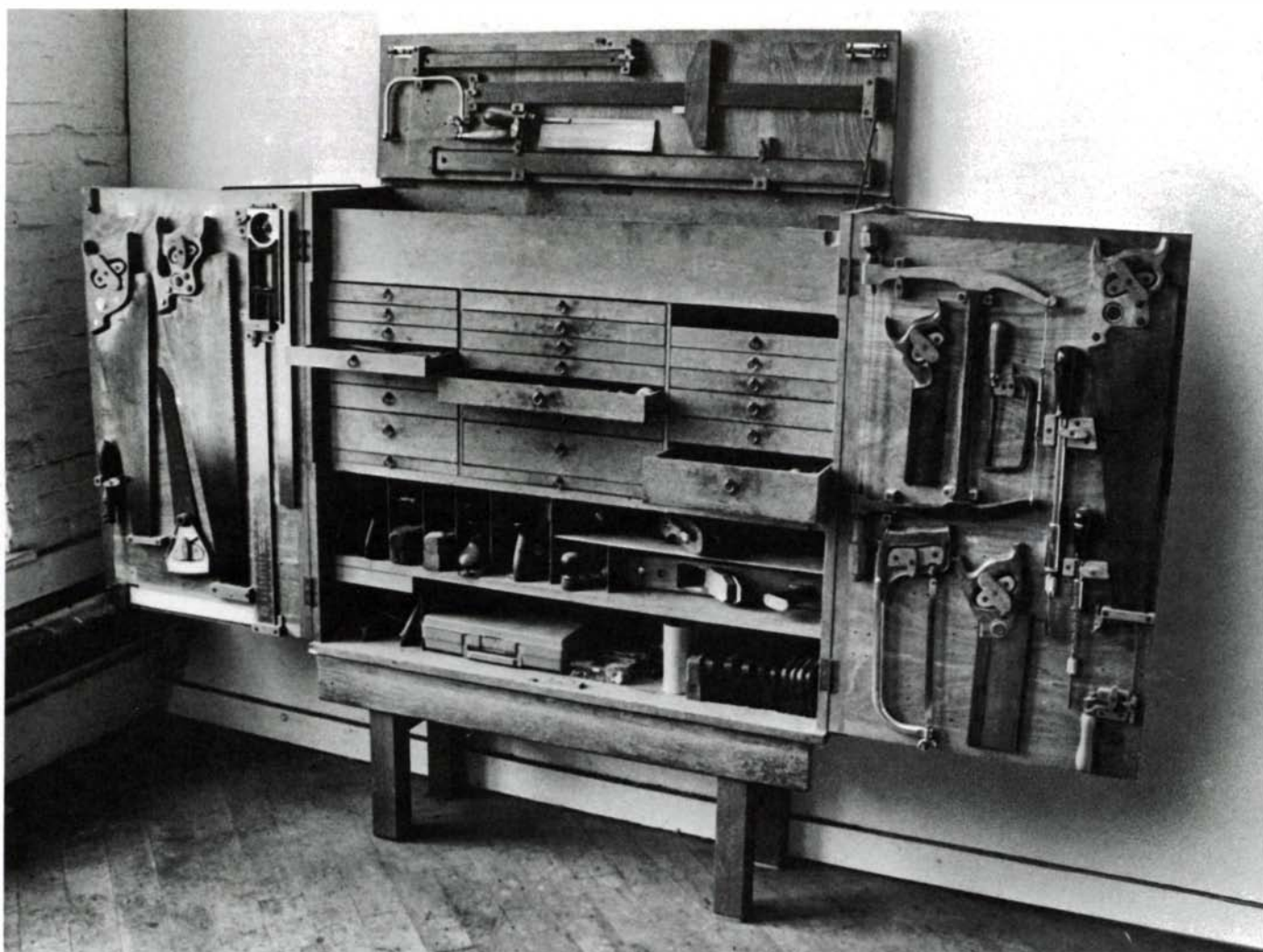
The drawer unit includes two vertical dividers which are housed at the bottom in dadoes cut across the horizontal

divider and in dadoes in the top of the case (in notches in the two rails if you build in the top well). These dividers are made from 3/4-in. thick stock, and have 1/4-in. deep, 3/4-in. wide rabbets cut along both of their front edges. These rabbets accommodate the 3/4-in. thick drawer fronts, which overlap the drawer sides 1/4 in. The side of the case must also be rabbeted in the same amount to make room for the overlapping drawer fronts at the extreme ends of the unit.

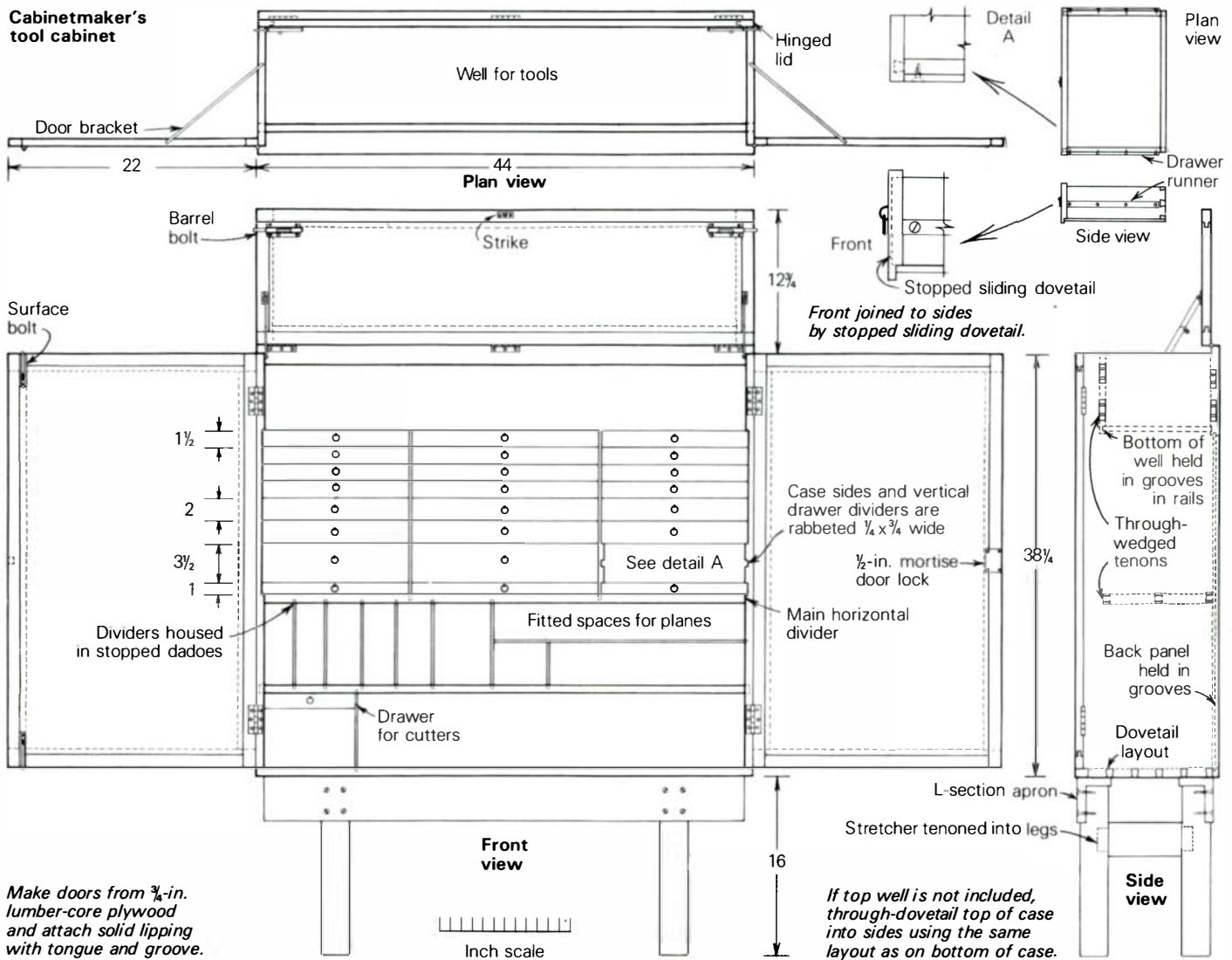
The drawers slide in 1/4-in. deep, 1/2-in. wide dadoes cut into the two vertical dividers and in the case sides. The dadoes are hidden by the overlapping drawer fronts, which also obscure the drawer runners. These are 1/4-in. thick, 1/2-in. wide strips that are screwed to the sides of the drawers. When fitting the runners in the grooves, you'll probably need to plane a shaving or two off their width to get an easy sliding fit.

The drawers themselves are joined in a straightforward way. The sides fit into vertical stopped sliding-dovetail housings in the drawer front, and the back is joined to the sides with through dovetails. The 1/4-in. plywood bottom is glued and bradded in a rabbet cut into the drawer front. The back and sides are cut narrow to ride entirely over the bottom, and therefore don't need to be rabbeted.

The three drawers across the bottom are really not drawers at all, but French-fitted trays for holding drill bits and wrenches. It's frustrating to go rummaging through a pile of wrenches when you're looking for just one, but in a fitted



To hold his cabinetmaking tools in a convenient and organized way, author built this tool cabinet, making maximum use of its interior space. Its design evolved from those chests he saw while an apprentice in Edward Barnsley's shop, and is well adapted to studio woodworking.



drawer, you can pick out the right wrench at a glance. I used 1/2-in. thick pine for the tray, and cut out the spaces for the wrenches and other items with a jigsaw. Then I applied the fitted tray over a 1/4-in. plywood bottom, and edged both sides with solid lipping to which the runners are attached. The front edge of the tray fits into a groove in the drawer front.

The pigeonhole unit has two levels, and the top one is divided into nine bins that are dimensioned to hold planes of various sizes. The shelf that separates the upper and lower sections is housed in dadoes in the sides of the case, and the vertical dividers are secured in stopped dadoes in the shelf below and in the main horizontal divider above. The bottom half of this area is left unpartitioned, except for a single pigeonhole on the left and a little drawer I built to hold cutters for my router plane and electric router. Note that the drawer fronts and pigeonhole dividers are recessed 2 in. into the case to make room for the tools that will be mounted on the inside of the cabinet doors.

I made the two doors from lumber-core plywood and edged them on all four sides with solid wood. This lipping has a tongue milled onto one edge that fits into a corresponding groove cut in the edges of the plywood. The solid lipping wears better than the raw edge of the plywood and keeps the face veneer from snagging on a shirtsleeve and tearing up. Also, it's more attractive, and will hold screws better. The doors are hung to overlap the sides of the case and are secured

with butt hinges mortised into the edges of the case and the door. If you choose to make a top well, then edge its lid with solid lipping and attach it with inlet butt hinges.

To hold the doors open so they don't flop around when you remove and replace the tools mounted on them, you can fashion brackets by bending the ends of a 3/16 in. dia. metal rod to fit into sockets in the top edge of the case and the top edge of the door, as shown in the drawing above. These brackets can be put away when the cabinet is closed. The lid for the top well is secured by a pair of barrel bolts (one on each side), and the left-hand door locks top and bottom by means of two surface bolts (the strike for the top one is screwed on the underside of the lid). A half-mortise drawer lock installed on the right-hand door secures the entire cabinet.

The base I made from pine lumber also. The side stretchers are tenoned into the legs and the L-section aprons are held with screws and glue in notches cut into the tops of the legs. You could add a shelf to the base for holding tools and other items you don't mind having exposed to the outside. The cabinet sits unattached on the base; its weight is sufficient to keep it stable and in one place. This arrangement makes it easier for me (with some help) to move the cabinet whenever the need arises. □

David Powell is a designer and cabinetmaker, and the proprietor of Leeds Design Workshops, Easthampton, Mass.

A Pair of Panel-Raising Planes

Two is more than twice as good

by Robert Bourdeau

In a recent project, a Louis XV armoire for my daughter, I used the shaper to raise the many panels for the doors and case sides. I was disappointed with the results—especially with tear-out both across and along the grain. Quite a bit of sanding was required to eliminate the pits and gouges; further, the crisp look and feel of cleanly cut wood was gone.

When it came time for me to begin work on my son's roll-top desk, and I wanted to raise its panels with double bevels, I discovered that the appropriate shaper knives would have to be custom-ground at a high cost. There had to be a better way, so I decided to make myself a pair of panel-raising

planes, a left-hand and right-hand, which would allow me to plane in the direction of the grain regardless of the side of the panel I might be working on. This meant that I could keep tear-out and splintering under control, minimizing the amount of sanding I'd have to do.

I had never made a plane before, but after studying K.D. Roberts' *Wooden Planes in 19th Century America* and reading Norman Vandal's "Paneled Doors and Walls" (*FWW* #18, Sept. '79) and Timothy Ellsworth's "Hand Planes" (*FWW* #1, Winter '75), I felt I could make the pair of panel-raising planes by laminating the bodies. I began with a full-



Tear-out from planing against the grain, always a problem when using a single panel-raising plane, is minimized by having two, a left-hand and a right-hand model. No matter how the grain runs, one plane or the other can follow it.

scale sectional drawing of the panel I wanted (figure 1); the double bevel would form a tongue on the panel's edge and make for a nicer fit in the frame grooves than would an unrelieved wedge. Using $\frac{3}{4}$ -in. stock, I divided the thickness of the panel into even thirds and decided to cut a $\frac{1}{4}$ -in. by $\frac{3}{8}$ -in. rabbet along the back edge of each panel to form the back side of the $\frac{1}{4}$ -in. tongue. When captured in the grooves, there's a resulting $\frac{1}{8}$ -in. wide gap between the vertical shoulder of this rabbet and the inner edges of the frame. This means that the panel can expand a full $\frac{1}{4}$ in. before it exerts any pressure against the frame, a sufficient allowance for most panels, unless they are exceptionally wide or made from an unstable wood. For a pleasing appearance, the back edges of the panel can be chamfered or slightly rounded over, as can the inner edges of the frame.

Since the profile of the panel's field, shoulder and bevel is the exact complement of the plane's sole, it was an easy matter to draw the plane in section atop the panel (figure 2) just as though the plane were making its final pass down the edge. By laminating the body of the plane with two sides, or cheeks, and a three-part core (a front block, an adjustable shoe and a rear block), the task of shaping the sole to the required angles was made much easier and simpler than would have been the case had I tried to make the entire body from a solid block in the traditional way. I beveled the bottom of the inside cheek at 6° off perpendicular and did the same to the outside cheek, the only difference between the two being that the outside cheek projects below the sole, while the inside cheek does not. See figure 2 for an elevation view of these parts. This arrangement determines the angle of the bevel and the final depth of cut, though these can be varied by altering the thickness of the shim, which is clamped to the bench along the edge of the panel and which stops the cut when the bottom edge of the outside cheek contacts it.

I set the two cheeks aside and turned to making the blank for the three core pieces. I laminated the blank from face-glued lengths of $\frac{1}{2}$ -in. thick maple. When the glue was dry, I dimensioned the blank 14 in. long by $2\frac{1}{4}$ in. high by $1\frac{1}{16}$ in. wide, this last dimension being final and the other two slightly oversize. Since a $\frac{1}{4}$ -in. strip along the outside edge of the sole must be beveled at 6° , I set my jointer fence at 84° and took a few light passes until the jointed surface was exactly $\frac{1}{4}$ in. wide. This is the part of the sole that conforms to the second bevel, the face side of the tongue.

I reasoned that the iron should be skewed at 30° in the body of the plane and that its cutting angle should be 35° , though 45° is common on traditional planes of this type. This meant that the face of the rear block that would support the iron would have to be cut on a compound angle as shown in figure 4— 60° in the horizontal plane, 35° in the vertical. You can make this cut by angling the miter gauge and tilting the arbor on the table saw, or by setting up the radial-arm saw for cutting a compound angle. From the toe of the angle to the rear of the blank should be about 9 in. You must orient the blank correctly when cutting; its $1\frac{1}{16}$ -in. width is a finished dimension. The height and length will be trimmed after the body is glued up. The inner face of the forward block must also be cut at a compound angle— 120° in the horizontal plane (to complement the 60° skew angle of the rear block) and 65° in the vertical plane. Since the core blank is about $\frac{3}{16}$ in. too high, you can rip off a $\frac{3}{4}$ -in. thick slice from the beveled sole to produce the adjustable shoe. Make a

smooth cut, so that the sawn surfaces will mate uniformly.

As a final step before gluing up the body, cut a $\frac{1}{2}$ -in. wide tapered dado in the inside cheek about 1 in. forward of the mouth. I also cut a $\frac{1}{2}$ -in. wide dado $\frac{3}{32}$ in. deep in the corresponding place on the side of the forward core block. When the parts were glued together these two dados formed the tapered slot for the scribing spur and its wedge. The purpose of the spur, which I made from a length of ordinary hacksaw blade, is to score the wood in advance of the cutter when planing across the grain, thus to eliminate tearing the stock.

Now the body can be glued up (with the movable shoe left out). Be sure to position the rear and forward blocks so that if the angled face of the forward block were extended, it would intersect the face of the rear block at the surface of the sole. The acute angle on the adjustable shoe will be pared back at a later time to make room for the extended iron (figure 4, detail A). And the throat opening can always be enlarged by adjusting the shoe. Be careful about positioning the cheeks in relation to the core blocks when gluing up. You may want to use pins to help locate the parts and to keep them from swimming out of alignment under clamping pressure.

When the glue has set, plane the top edges of the core blocks flush with the top surfaces of the cheeks. The movable shoe is secured by means of a $\frac{1}{4}$ -in. machine screw that passes through a slotted hole ($\frac{3}{8}$ in. by $\frac{1}{4}$ in.) in the forward block and screws into a T-nut set in a plugged counterbore in the shoe. You can make the slotted hole easily by boring two $\frac{1}{4}$ -in. dia. holes and chiseling out the waste between. The washer can either be let into the block or sit proud of the surface.

I made the handle to fit my hand and working posture. The angle between the handle and the body of the plane (and also its point of attachment) determines how efficiently your muscular energy is transmitted to the cutting edge, so it's a good idea to experiment with several angles and shapes before making a final decision on the handle design that's correct for you. The handle is attached to the body by a long $\frac{1}{4}$ -in. screw or bolt that extends through a hole bored through the full length of the handle and is screwed into a T-nut in the rear block. This T-nut, like the one in the movable shoe, is retained in a plugged counterbore.

The cutter has to be ground to conform exactly with the profile of the sole. This is critical. To ensure this conformity, I inserted the iron blank in the body and traced the profile of the sole with layout dye onto the steel and then traced again with a sharp machinist's scribe. I used a jig for grinding (see photo, next page) and I made periodic checks, re-inserting the iron into the body, to make certain the shape was being properly formed. I ground the bevel on the iron to 30° , which provided a clearance angle of 5° .

I made the chip breaker from $\frac{1}{8}$ -in. mild steel, which I first hacksawed and then filed to the final shape that is shown in figure 3. I used a small, round file to form the groove across the face of the chip breaker where it bears against the steel retaining pin. I drilled and tapped the upper part of the chip breaker to receive a $\frac{1}{4}$ -in. thumbscrew. A square, steel pressure plate, countersunk to receive the end of the thumbscrew, presses against the iron when the screw is tightened. Even greater pressure is levered against the toe of the chip breaker where it contacts the iron just above the cutting edge. You may want to use the traditional wedge here, which should exert uniform pressure along the length of the iron.

The iron should be $\frac{1}{16}$ in. narrower than the opening in

Fig. 1: Panel in section

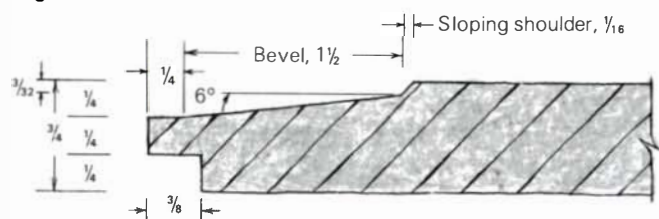


Fig. 2: Front elevation of plane and panel

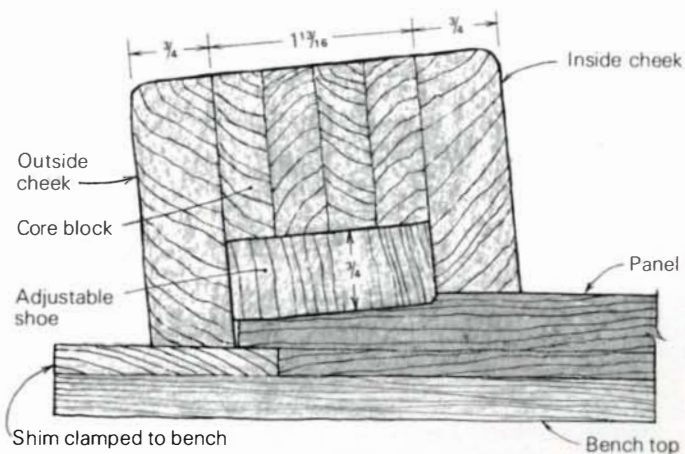


Fig. 3: Chip-breaker/cutting-iron assembly

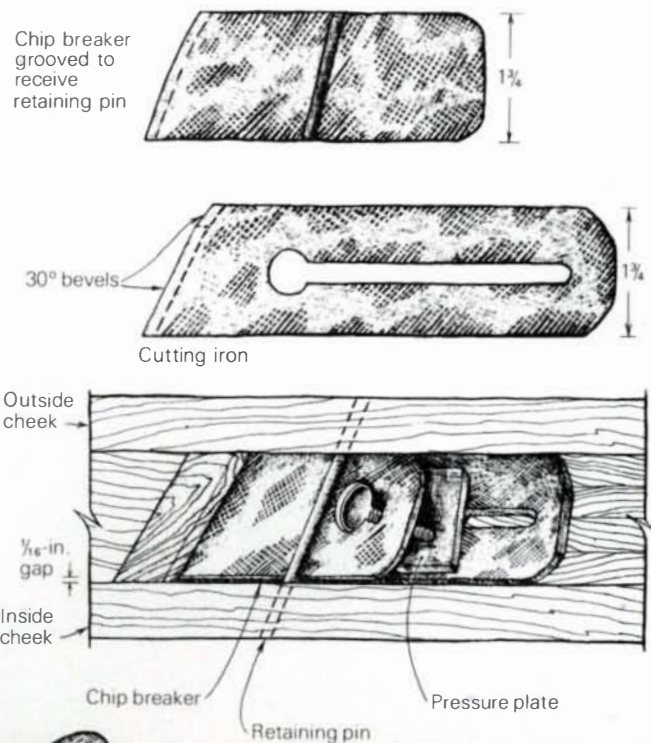
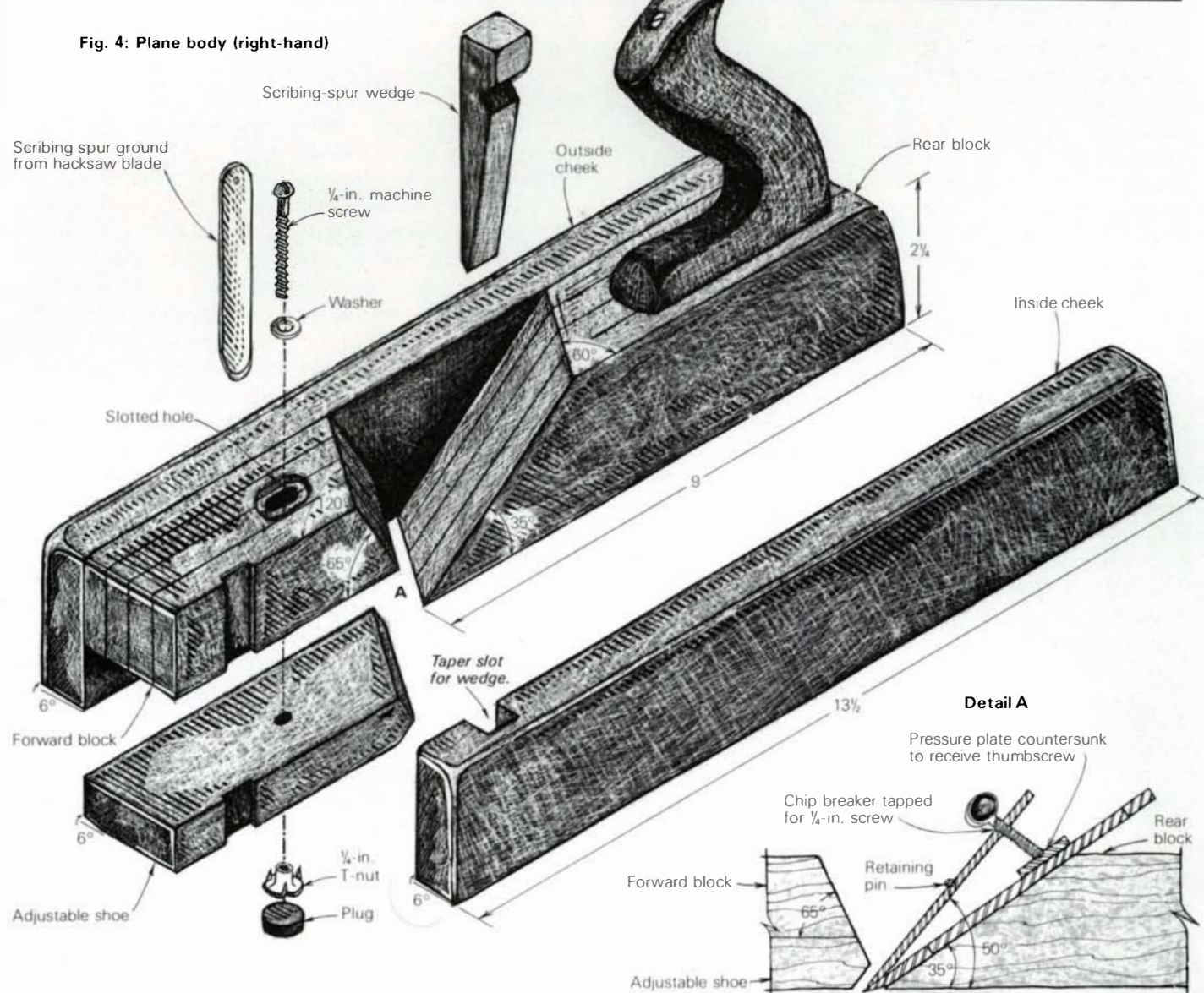
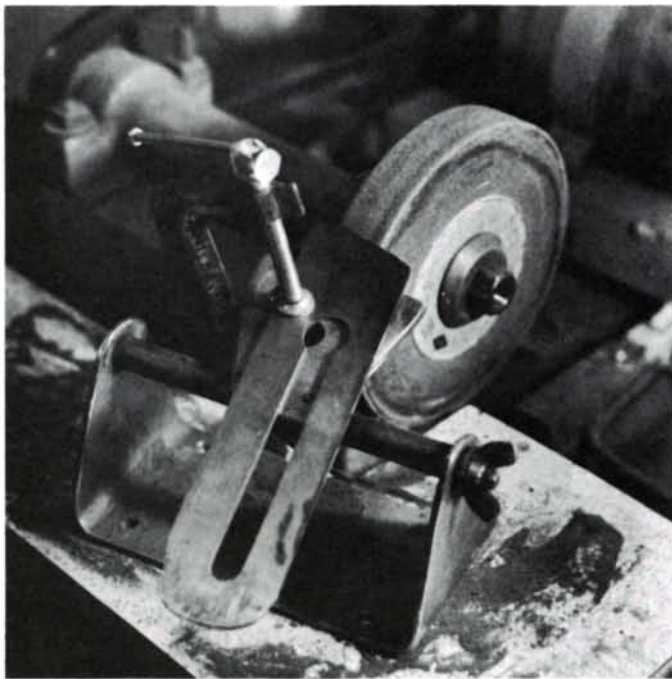
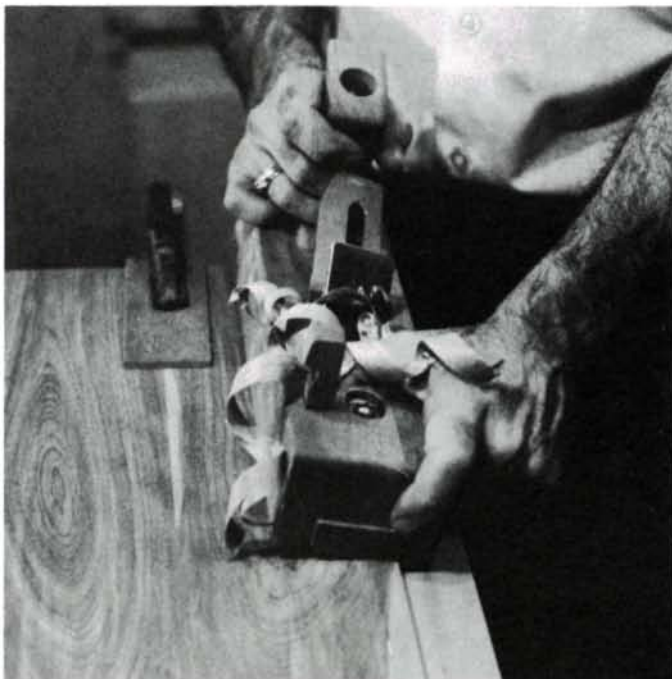


Fig. 4: Plane body (right-hand)





Author's grinding jig holds the iron at a fixed angle (top photo), yet its base is unattached, allowing the profile to be shaped freehand. In raising the panel, the plane is first canted to the outside to take several narrow shavings (center photo). Then it's canted to the inside for several passes, and then several cuts are taken down the middle of the bevel. Only when making the last two or three passes is a cut taken the full width of the iron (bottom photo). This method reduces the chance of tearing the grain and is less tiring than taking a full cut with each pass.



which it rests, and it should fit snugly against the inside of the outside cheek. This leaves a $\frac{1}{16}$ -in. gap between the iron and the inside cheek, which makes room for the sloped shoulder to be formed. Looking back at figure 2, you will see a small triangular space between the edge of the panel and the inner edge of the outside cheek. Imagine the plane just beginning to make its first pass along the flat edge of the panel. The plane's body would be oriented at 90° to the panel's surface. With each successive pass and the removal of a single shaving, the plane's body cants more and more to the outside of the panel, and with each pass the cutting toe of the iron changes its attitude and its distance from the original shoulder line. The triangular space between cheek and panel edge widens and deepens as the bevel is cut. As the plane's body cants and the iron is pulled more to the outside, the sloping shoulder is formed.

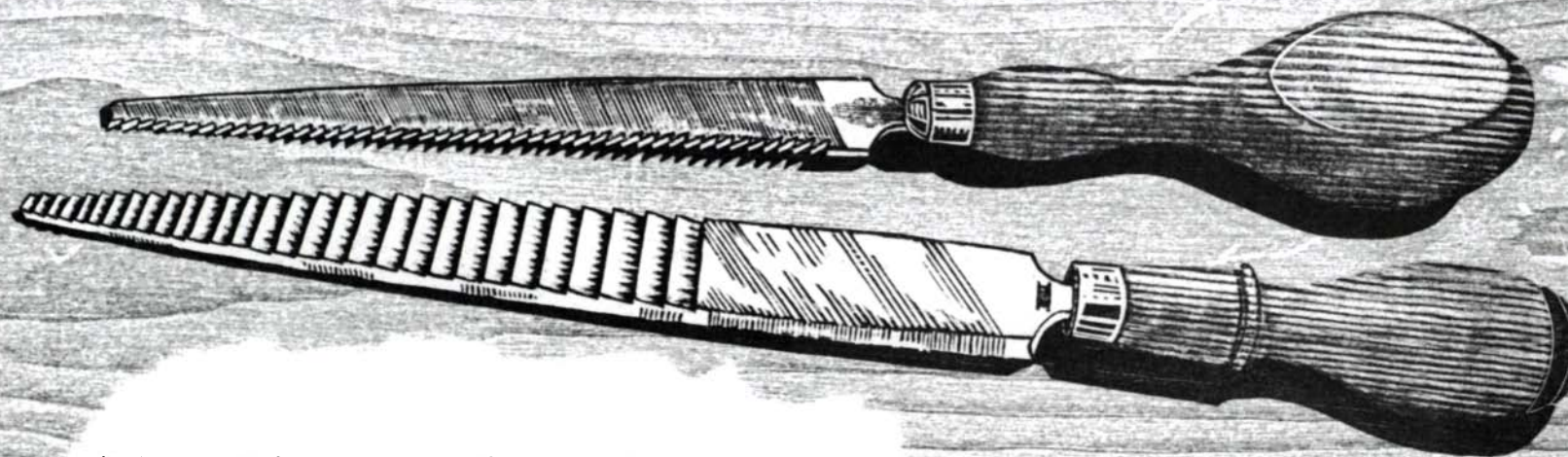
I ground the scribing spur to a round-nose shape only after experimenting with several other cutting configurations. The round-nose spur need not be inclined forward in the body as shown in the photos. Care must be taken to set the spur at the exact depth of the iron. If set even slightly deeper than the iron, it will leave ugly lines in the sloped shoulder; if set higher than the iron, it will not sever the tissue through to the depth of cut, and tear-out and splintering could result.

The left-hand plane is made exactly like the right-hand one, only everything is reversed as in a mirror. The iron, of course, must be ground to precisely the same profile as on the other plane, as you may very well be planing the same bevel with both planes, since the grain direction can reverse in the middle of a board.

In use, I have learned that long, uninterrupted strokes are best, beginning at one end and going right through to the other. The outside cheek should always be kept snug against the edge of the panel when planing. To save your strength and to proceed at a workmanlike pace, begin cutting first to the outside, removing several narrow shavings (center photo, at left). Then cant the plane to the inside for several passes; then take a couple down the middle. Don't try to take a cut across the full width of the bevel until you make the last several passes (photo, bottom left). In a dense wood it uses a lot of energy to take a cut $1\frac{1}{4}$ in. wide, and I can now understand why in the old shops two people—one pushing, another pulling—were required to manage a large plane.

I have learned quite a bit from the experience of making these two planes, enough to realize that much lies ahead, for now I've got plans to make all of my planes for molding, rabbeting, jointing and other tasks. For those woodworkers who have never tried making planes, I would add that given a reasonable amount of technical reading, careful measuring and thoughtful joining, the plane's secrets unfold like the story in a good book. □

Robert Bourdeau, 42, is an accountant and an amateur woodworker in Laval, Quebec.



The Planemaker's Float

Converting worn-out files into useful tools

by Jay Sperling and Bart Chapin

Floats are toothed, file-like tools used in making wooden planes. They were widely used when cabinetmakers built their own planes, but now this versatile tool has been almost forgotten. A float cuts faster than a file and cleaner than a rasp. It's particularly adept at removing wood from hard-to-reach spots. Though chiefly used for wooden planes, it can do various jobs requiring controlled stock removal.

Traditionally made in a variety of shapes, floats are of two basic types: edge floats and flat-sided floats. Edge floats are fairly narrow in section and have teeth on their edges. They look like fat sawblades, and can cut narrow grooves and slots in tight quarters. The planemaker would saw each side of the wedge slot and then remove the waste between the two kerfs with the flat float, which he could also use to trim the walls to fit the wedge.

Unhardened, a float is quite easy to sharpen, and one sharpening is usually sufficient for making one plane. We'll give directions for making the flat-sided float, since it's more useful than the edge float. You can make the edge float following the same methods.

Make the blank from a worn-out flat file. You will have to soften (anneal) it by heating it red-hot with a torch and letting it cool gradually. If the file overheats and sags, pound it flat.

Next, grind off the file teeth. Select one side for the new teeth and take care to keep it perfectly flat. Remove any ripples with a flat mill file. Most planemakers didn't taper the thickness of floats, but a tapered tool is easier to use in tight places. Grind away enough

metal to form a gentle taper toward the tip. The float must be stiff along its entire length, so don't taper it too thin. (Edge floats must have a uniform thickness.) Beware of hard spots in the steel.

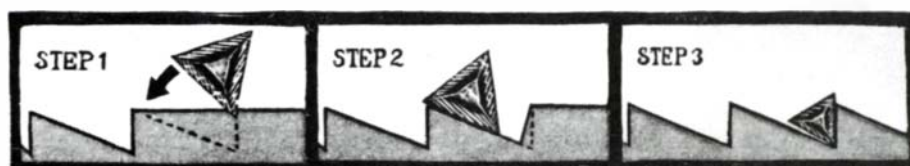
Flat-sided floats taper in plan pretty sharply toward their tips. A typical float 7 in. to 10 in. long and $\frac{3}{4}$ in. wide should taper to $\frac{1}{8}$ in. at the tip. Edge floats taper in elevation from about $\frac{1}{2}$ in. to $\frac{1}{4}$ in. at the tip. You can adjust these dimensions to suit the use of the tool. When grinding down the sides of the blank, keep the edges smooth and equal on both sides. Then fair the edges with a mill file and emery paper so they won't scratch your work. The edge float has a straight cutting edge. Grind and file it flat, referring to a straightedge regularly.

Although the teeth on traditional floats are uniformly spaced, I prefer to graduate the distances between teeth; this helps to make the tool cut more smoothly and eliminates chatter. At the tip of the tool the teeth are a little less than $\frac{1}{8}$ in. apart; this distance increases in approximately 0.005-in. increments until the teeth at the back are close to $\frac{1}{4}$ in. apart. This allows a fine starting cut and greater stock removal afterward. Laying out the teeth for the first time, you should use a rule to graduate the distance between the teeth. Using a carbide-tipped scribe, etch in the lines at right angles to the centerline of the blank. Do this by clamping the blank near the edge of a worktable (centerline parallel with the

edge) and striking off the lines with a square. Flat-sided floats are toothed for only about two-thirds of their length, while edge floats are toothed along their entire length.

To cut the teeth you will need a pair (one large, one small) of triangular files and a file card. The file card is essential as the files can clog quickly. Clamp the blank down, and beginning at the tip and working back, thicken the scribed line with a couple of strokes of the file (step 1). Then, using the larger file on all but the smallest teeth, deepen the V-groove, while forming the relief angle on the back of the previous tooth. Stop filing the gullet when the file just nicks the top of the previous tooth (step 2). If you cut further, your teeth will not be level. With your last few strokes, push the cutting corner of the file toward the back, beginning the process of forming the tooth behind. As you work up the blank and the spacing increases, cuts will become deeper and wider. Don't overcut. You can always go back and correct the tooth shapes. When done, check the level of the teeth with a straightedge.

Now take your smaller triangular file and finish filing the teeth to get a 0° rake angle on each (step 3). Continue filing until the teeth are sharp. Recheck the teeth for uniform height a last time, and you're ready to fit the handle to the tang. To resharpen, repeat the process of filing the teeth backs with the large file and filing the face of the teeth with the small one. □



Jay Sperling is a freelance writer and Bart Chapin is a cabinetmaker. Both live in Bath, Maine.

Woodcuts: E. Marino III

Carved Signs

Freehand lettering with the Murphy knife

by Roger Schroeder



Close to 200 of Paul McCarthy's signs adorn homes and proclaim businesses in the seaside town of Scituate, Mass. A 3-ft. wide carved clamshell hangs in front of a custom-framing shop; a jewelry store's sign features a wooden, in-the-round black pot overflowing with carved gems, and quarterboards with incised gold-leaf lettering are everywhere. Though originally mounted on a ship's transom beneath the quarterdeck, quarterboards have become popular on land, where they are most often applied directly to the side of a building, usually above a door. Apart from being a prolific carver (his shop produces about 40 hand-carved signs in a week), McCarthy is a teacher and conducts four classes a week, with 15 or 20 students in each.

McCarthy's lettering is done without templates or patterns, and also without a lot of carving tools. His primary tool, aside from a fishtail gouge, is the Murphy knife, named after the manufacturer in Ayer, Mass. This tool consists of a handle through which slides a high-carbon, chrome-vanadium steel blade. The blade itself ends not in a point, but a double-beveled skew. A setscrew allows for a variety of blade-length adjustments, and the cutting tip can be ground to different shapes. Whereas incised lettering has traditionally been carved using a variety of tools (*FWW* #14, Jan. '79, p. 66), including straight chisels, gouges and V-tools, McCarthy uses only this knife. "Most books tell you to get a tool that fits each curve," he points out. "Well, if I had to have a tool that fit each curve in an italic S with serifs, I'd have to use five different tools." Many other sign carvers use a router, which, McCarthy says, he can beat if you include the time spent setting up the templates. In a matter of minutes he will freehand the letters to be carved using only parallel lines and a homemade bevel (two 1x1s joined with a wing nut). He can carve an eight-letter quarterboard in 20 minutes or less, whether the letters are Roman or italic.

McCarthy cuts into the letter using the point, not the flat, of the knife. Practice is needed, he will tell you, to establish the angle and depth of the cut. Starting inside the outline of the letter, especially if more than one pass is needed, as with large letters, he draws his entire arm down, with the back of his hand resting on the board. He advises choking up on the

knife, avoiding excessive pressure on the back of the hand. To cut the opposite side of a curve or straight line, he turns his hand over and follows the same procedure. For a large letter, the first incisions will take out waste wood in the center. The serifs require no other tool, for the Murphy knife naturally follows the tightest curves.

The advantages of the knife are clear. Not only can it adapt to any kind of lettering style, but it also slices wood as opposed to crushing or splintering it. The problem with the V-parting tool, often used for cutting the channel in a letter, is that it has two cutting edges. While one may go with the grain, the other will go against it. Aware of this, McCarthy deals with wood grain as though it were the wind, and he follows it to get around curves.

As a boy, McCarthy loved whittling and he liked nautical art. All this led to his profession, which has now spanned over a decade. In that time McCarthy has taught some thousand students and has carved an estimated 16,000 pieces that include birds, quarterboards and elaborate signs. Aside from making what is probably the largest quarterboard in the country, for the U.S.S. Constitution Museum in Boston, he has carved an American eagle that stands 8 ft. high and has a wingspan of 13 ft. It is styled after the figurehead made by New England shipcarver John Bellamy in 1880 for the U.S.S. Lancaster. McCarthy's eagle lives in his shop.

Calls for his work come from all over the country, and a personalized sign that may have relief or in-the-round carving is his specialty. "I'm not a supreme artist," he says, "I want people to participate in the designs." So he is careful to get as much input from a customer as he can. First he might ask where the sign is to be hung. Then he will inquire about the kind of house the customer owns, its color, its landscaping. He will refuse a commission if he thinks a carved piece is inappropriate to its surroundings.

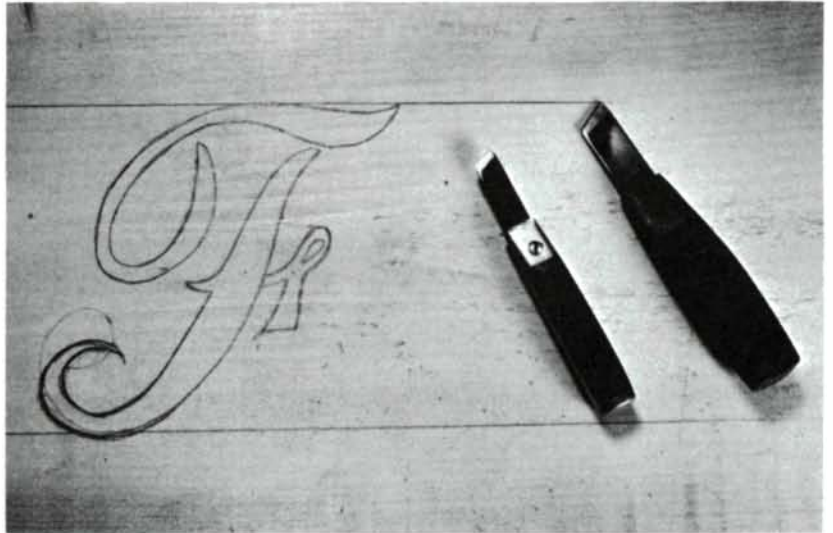
Sketching in front of a customer, McCarthy looks for what he calls a glint of satisfaction. Once found, he elaborates on the design. His interest in the customer's approval extends beyond the date of delivery, and he will repair signs that might get damaged. "It's always my sign, no matter how much a customer spends," he says. And he gets a lot of repeat business, especially from people who give his signs as gifts. Most people want quarterboards, which McCarthy believes to be "visible and in good taste, without being showy." Some

Roger Schroeder of Amityville, N.Y., is a frequent contributor to this magazine.

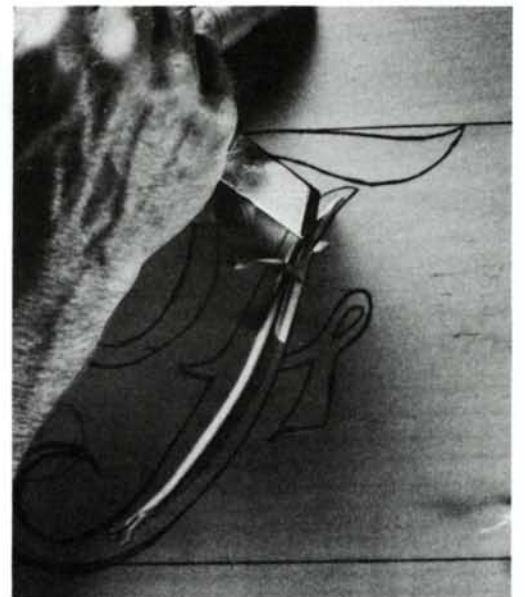


Quarterboards like this one are everywhere in Scituate.

Originally meant for ships, they now adorn buildings.



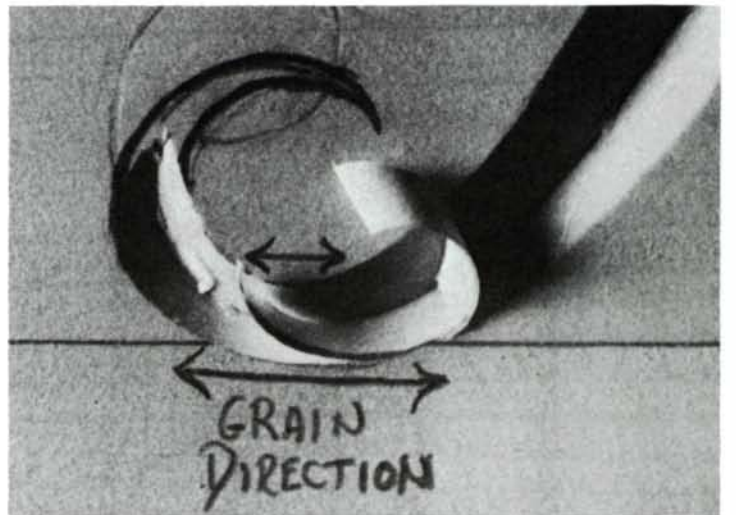
Using only these knives, above, Paul McCarthy incises sign lettering with speed and accuracy. The tips of both knives are ground to about 45° and have a bevel on both sides. The finished letter, left, shows none of the transition marks caused by using several different gouges for different parts of the curve. For results like this, the knife must be kept razor-sharp with frequent honings.

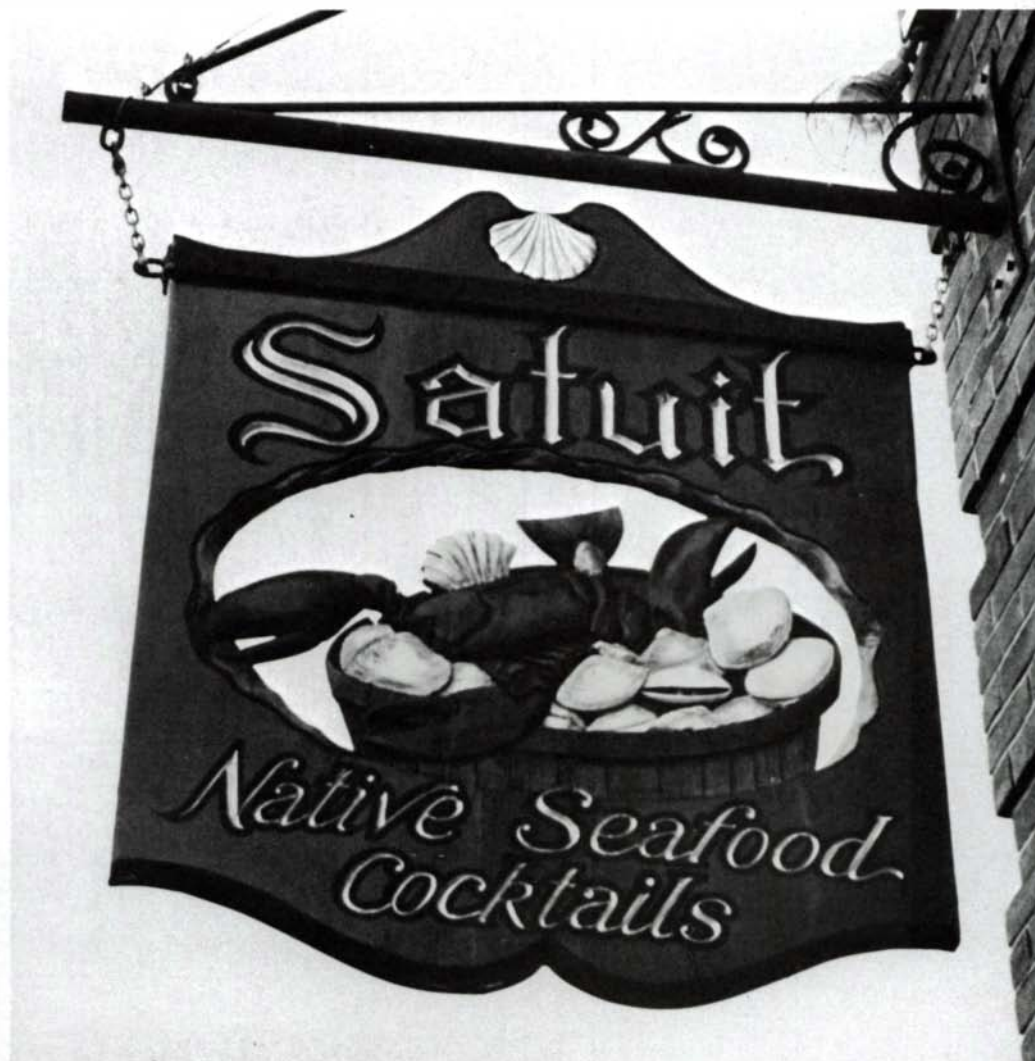


Carving begins (photo, left) by making a narrow V-trough down the stem of the letter. Back of right hand rests on work for downward strokes; thumb of left hand helps guide and power the cut. For upward strokes (photo, right), right hand is held off the work surface; thumb of left hand still provides guidance and force at the back of the blade.



The trough is gradually enlarged with successive cuts, each taking a thin shaving, to keep the knife from digging in. Above, a final cut forms the finished wall of the mid-section of the stem. In tight curves (photo, right), direction of cut must be changed often to avoid going against the grain and tearing the wood. This is what McCarthy means by "following the grain like the wind."





Made for a Scituate restaurant, sign at right sports a carved lobster and clams in-the-round. The incised lettering and little shell at top are gold-leafed. Sign at left was made for the same restaurant.

customers like double-sided signs. One he made for a liquor store in Scituate Harbor has a wine cask with the merchant's name on either side. To save a customer's money, he suggests that one side should be elaborate, the opposite side simple, perhaps with only a monogram.

Once a design is settled on, whether a simple quarterboard or a relief of a lowboy, the wood is cut to shape and assembled with resorcinol glue. His large signs are almost always made from 8/4 Eastern white pine, while quarterboards are 4/4 pine. He doesn't use rods or dowels for the big signs, which are usually steel-banded by a local blacksmith.

McCarthy's signs get two primer coats and three coats of color. He finds lead-base paints the best. "They cover well, they are durable, they don't lose their color and they stay bright," he notes. But the most outstanding aspect of his signs is his gold-leafing. Gold leaf not only gives brilliance to lettering or carving, but it also lasts some thirty years out-of-doors. A gold-leaf sizing, which is an adhesive base, is applied after the primer and color are painted onto a smooth surface. He uses a sizing that has a slow drying time, and he will wait as long as 24 hours before applying gold leaf, depending on humidity and temperature. "If the sizing is too

wet, the gold leaf will dissolve. If it's too dry, it won't stick." So he listens for a squeaky tackiness as he rubs a finger over the sizing, and then he applies a sheet of gold leaf over the area and tamps it with a sign-writer's quill.

Some of his signs are entirely gold-leafed. The shell for the custom-framing shop is done in gold leaf, as are the scales of justice he made for a local lawyer. When asked why he doesn't use gold paint, McCarthy says that even the best will tarnish out-of-doors or turn brown. The only problem with gilded signs is that they do accumulate dirt and road pitch, especially if near a highway. McCarthy suggests cleaning dirty gold leaf with muriatic acid. He warns that varnish should not be applied over gold leaf as it will, owing to the degrading effects of sunlight, lift the gold from the sign.

When not carving, McCarthy is teaching. His youngest student is eleven years old. But regardless of age, they all start with quarterboards. Given blanks, students are taught immediately to use the Murphy knife, beginning with straight lines. McCarthy says quarterboards are easy to master and don't take up much room. After quarterboards, students have their choice of projects. At one class, students were doing signs, relief carving, gunstocks, caricatures, mantelpiece ships, animals and birds.

Some of McCarthy's students have gone off to start their own sign-carving businesses. Of competition he says, "I'm not afraid of it. It's a way of keeping woodcarving going." □

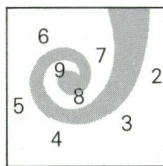
EDITOR'S NOTE: You can purchase gold leaf from well-stocked artist-supply stores or from Constantine's, 2050 Eastchester Rd., Bronx, N.Y. 10461. Murphy knives, also called general-purpose knives or mill knives, are available from most mail-order tool-supply stores.

A Carver's Tricks

Three methods from a period-furniture maker

by Eric Schramm

One of the most valuable additions to my collection of carving tools is a set of four round-nose chisels. Originally they were ordinary butt chisels, but I re-ground them to rounded profiles and hollow-ground the bevels to a length of about $\frac{3}{8}$ in., as the factory-ground bevel was too steep for carving. I use these four chisels in place of many gouges having different sweeps and widths. Used with the bevel down, the 1-in. and $\frac{3}{4}$ -in. chisels are excellent tools for wasting wood fast in relief carvings as well as roughing-in a carving in-the-round. Used with the bevel up, all four chisels work well for shaping and smoothing convex surfaces. The $\frac{1}{2}$ -in. and $\frac{3}{8}$ -in. chisels eliminate the need for a large number of gouges when setting-in a line. For example, setting-in a simple scroll can take up to eight different numbered gouges, as shown. But this scroll can be set-in using only one or two round-nose chisels.



To maintain a razor-sharp edge on my carving tools, chisels and plane irons, I made a rotary hone from a disc of $\frac{1}{4}$ -in. plywood covered with $\frac{3}{16}$ -in. thick leather which is cemented in place. I bored a hole in the center of the disc and mounted it on a work arbor (available from Sears or a well-stocked hardware store); with the arbor chucked in my drill press and the leather stropping surface charged with white rouge (available from Sears), I can hone chisels and gouges quickly, without having to interrupt my work by getting out and setting up a lot of sharpening equipment. The drill press should run at its lowest RPM. You can also use tripoli or jeweler's rouge, but neither is as effective as white rouge.

For sanding sculptured furniture parts, I devised a pinwheel sander, which I make up from worn stroke-sander belts that I get free from a local cabinet shop. I cut the belt into 8-in. dia. circles and cut a $\frac{1}{2}$ -in. hole in the center of each. Then, using a paper pat-

tern and scissors, I cut eight evenly spaced slits from the outside toward the center. These stop about $1\frac{1}{2}$ in. from the center hole. Next I fold one corner of each slit over the center and secure the pinwheel on a work arbor, whose

collars hold the folded ends in place. A little piece of double-sided tape on the folded corner will keep the pinwheel together until it's secured on the arbor. Take care that all the folds go in the right direction in relation to rotation. □



For doing the work of many carving gouges—roughing-out relieved areas and smoothing convex surfaces—Schramm made this set of round-nose chisels by re-grinding standard butt chisels. The long hollow-ground bevels are especially well suited for carving.



To make honing quick and tidy, Schramm constructed this rotary strop (above left) from plywood and leather. He mounts it in his drill press and charges the surface with white rouge, a simple arrangement for keeping a razor-edge on all his tools, without the mess made by oilstones. Pinwheel sander (above right), when chucked in lathe or drill press, is good for finishing contoured furniture parts like cabriole legs.

Eric Schramm is a professional cabinet-maker who builds reproduction furniture in Los Gatos, Calif.

Mechanical Advantage

About woodworking machines, and a visit to Rockwell and Powermatic

by John Lively

"It's a shame," he said, "that they don't make machinery like they used to." But there wasn't much sorrow in his voice, for Bob Johnson is one of the few men in the country who can claim to be a Victorian millwright. He and his wife, Mary Ellen, make their living selling exotic woods and restoring vintage machinery for such clients as the Smithsonian Institution. For the last 20 years the Johnsons' special passion has been putting together their own collection of classical machines, which are housed in several timber-frame buildings on their wooded farm in Rossville, Ga. To complete the grand scheme, they are building a railroad into the neighboring woods to fetch timber to feed a steam-powered sawmill. "This is our museum," he said as he pulled open the huge door, "but we have to work in here too. Once we've restored one of these old machines, we use it as hard and as often as we would a new one."

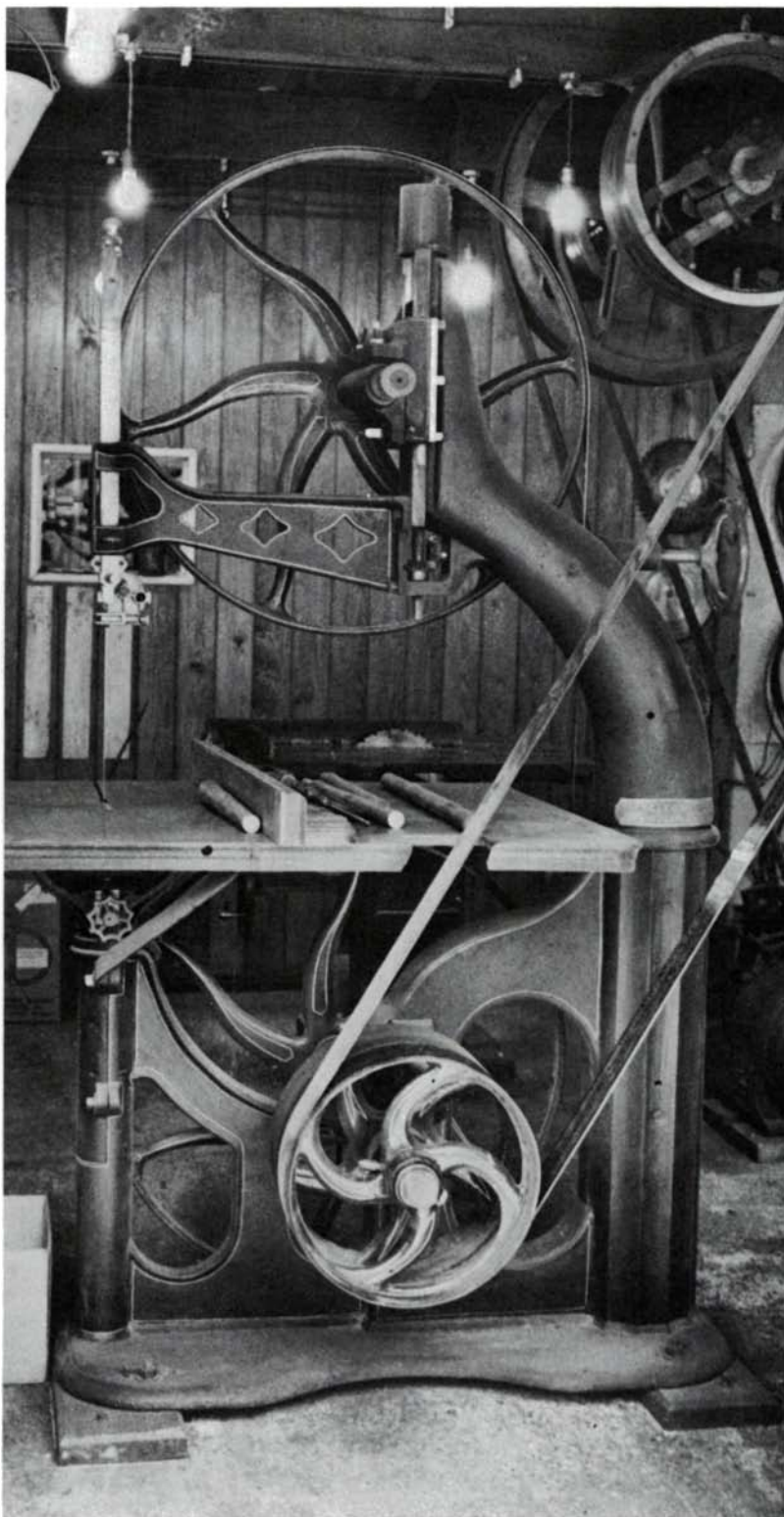
As my eyes got used to the dim light, I made out a hulking presence just beyond the doorway, but it took me a moment to recognize the thing—a leviathan jointer. Its beds were 30 in. wide and 8 ft. long, and its cutterhead so massive that three Babbitt bearings held the shaft on its axis. Built by Oliver Machinery Co. in 1905, this monster could joint an entire tabletop or door face in a single pass, or straighten structural timbers of any size. Yet its pinstriped base and thoughtful proportions made it appear lighter and friendlier than you'd expect a ton of cast iron to look.

"Everything's a mess right now," Johnson lamented, pointing to a dismantled steam engine in the next room. "I traded a 180-year-old engine for that one, and until I get it going, I'll have to run my overhead line shafts with this awful electric motor." He threw a wall switch and the whole place came to life. It was like being inside a giant wind-up toy, with big wheels turning little ones and leather drive belts slapping from one end of the shop to the other. "Look at this," he beckoned, while prodding a wide belt from its idler onto the drive pulley of his bandsaw, made in 1886 by Connell & Dengler and standing a full 8 ft. tall. It ran with a ghostly silence, without the slightest whisper of mechanical noise or vibration—just a gentle, low-pitched whoosh as its wheels fanned the air.

Johnson killed the power. All the wheels coasted to a stop, while I continued to stare at this marvelous bandsaw. With its spiral-spoked wheels, its gracefully curved main frame, fluted column and contoured base, it looked more like sculpture than like a machine for cutting wood. There could be no doubt that its makers were as much concerned with the aesthetics of its form as with the smoothness of its operation.

A few steps behind the bandsaw squatted the ugly member of the family, an 1895 American No. 1 variety saw, every bit of it, except for the arbor and worm gears, a thick and formidable piece of cast iron. Its external rack gear and obtrusive adjustment wheels made it gawky, a grim triumph of func-

This bandsaw epitomizes 19th-century woodworking-machine design and manufacture. Made in 1886 by Connell & Dengler, its graceful form and imposing stature combine with rugged mass and close-tolerance millwork to make for smooth and powerful operation.



tion over form. But it had a businesslike quality you had to admire, an unabashed utilitarian aspect.

As I proceeded to poke around, Johnson spoke affectionately about the machines, explaining that 19th-century millwrights designed these tools like works of art, often blending practicality and fair shapes into a harmony that hasn't been equaled since. Their foundrymen, he told me, were generous with cast iron, believing that a heavy machine was a good one. You won't find any fabricated steel bases on this old machinery, or any pot-metal castings or any die-stamped parts. They are all grey iron and alloy steel, with working parts precisely turned or milled and mating surfaces hand-scraped and often honed.

We walked out of the shop into the bright spring sunshine. In the yard, beneath the dogwoods and lying among the weeds, was a myriad of rusting machine parts—cogged wheels, flywheels, bushings, connecting rods and boilers, which when put back together again would become the logging train and the sawmill at the end of the line. Trying to imagine Johnson's finished fantasy, the fully operational mill and shop, the brightly painted steam engine puffing off into the North Georgia hills, pulling its train of log cars behind, I had to wonder how far we've really come from those halcyon days of big and beautiful machines. Has modern metallurgy and industrial technology made them obsolete? Has OSHA banned them from the marketplace? Or have they just become economic impossibilities, impractical in a world of mass production and costly transportation?

The truth is, such machines are obsolete. Bandsaw wheels must be enclosed, so it doesn't matter much how they look. Cast iron is expensive stuff that must be used sparingly now if a profit is to be made; cast parts are heavy, increasing the cost of transportation and handling. So today's manufacturers of trade tools use cast iron only where they must, and fabricate the remaining parts from weldments of sheet steel or die stampings. Ornament has been lost almost altogether, replaced by design notions of clean, functional shapes.

The old mechanical wonders have given way to lighter, sleeker machines, and 19th-century millwrights have been supplanted by industrial engineers and behemoth corporations, whose assembly lines turn out more machinery for more woodworkers than were ever dreamt of in the 19th century. And what every woodworker wants to know is how much quality has been sacrificed along the way. Did the good machines go out with the old ones?

Shop machinery hasn't lost its ability to do hard work. Indeed, without it most contemporary woodshops couldn't exist, and the phrase "amateur woodworker" would be a contradiction in terms. Regardless of the romantic attachment we have for our jack planes, spokeshaves and chisels, despite our skill in using these tools, the heavy gut-work in our shops gets done by the machines. Our table saws, jointers and thickness planers leave us free to hand-cut dovetails, smooth-plane tabletops and experiment with various finishes for our chests and cabinets. When we're rushed to get that job out the door, the machines do everything but prepare the surfaces for finishing, and sometimes they do even that.

Even so, woodworking machinery has frequently been an embarrassment to those who consider themselves true craftsmen. The very nature of machine production has been conceived to be at odds with the spirit of craftwork, and some heavy philosophizing has been aimed at making the crafts-

man rest easy with his machines. Gustav Stickley, whose writings early in this century popularized the Arts and Crafts Movement in America, argued persuasively that every woodworker should make full use of machinery, for it alone could relieve him of mindless toil, giving him the leisure to perfect his designs and to add those finer decorative touches that only the hand can create. Yet, Stickley believed that machine work should be limited to preparing materials for use—for sawing, planing, boring, mortising and sanding. He warned against using machines to achieve ornamental effects, as this made impossible the craftsman's only real means of self-expression, and rendered his works sterile and anonymous. Stickley's injunctions are still valid. The best of contemporary woodworking combines the sensitive and skilled use of hand tools with the intelligent and efficient use of machinery.

Such an ideal situation depends, of course, on machines behaving like good servants, and not like cantankerous flunkies. It's a satisfying experience to operate properly working, well-tuned equipment, while a malfunctioning machine is often worse than no machine at all. The bandsaw that vibrates to excess and takes a ragged cut, the cumbersome table-saw fence that's warped and won't align, the jointer whose tables droop and cut concave edges, and the thickness planer that is forever jamming up and sniping boards are just a few of the problems that bedevil woodworkers every day. Machine down-time is costly in terms of production lost and repair expense, and the frayed nerves of the woodworker are an inevitable part of the bad bargain.

The term "trade-tools" refers to medium-priced woodworking machines that are commonly used by tradesmen—carpenters, cabinetmakers and patternmakers—and in school shops. They are also designed to hold up under production-line operations in furniture factories and millworks, though often you will find heavier, more expensive machines in these situations. In the broad spectrum of machinery on the market, from the hobby-craft tools for the weekend handyman to the extra heavy-duty machine tools designed for industrial applications, trade tools occupy the middle ground in quality, performance and cost. For the average woodworker, whether a professional or a serious amateur, trade tools are the best bet.

Although there are quite a few smaller manufacturers of trade tools—Vega, General, Boice-Crane, Davis & Wells and Poitras—Rockwell and Powermatic are the largest in North America. Because these two companies are the Chevrolet and Ford of the woodworking-machinery industry, we decided to visit them to get some general impressions about their manufacturing processes, and also to ask some specific questions about their machine quality and customer service. The people at Rockwell said they would arrange for me to tour one of their plants and to interview several executives. The people at Powermatic suggested that I spend five days at one of their workshops on machinery maintenance. I accepted both offers, expecting that the experiences would be entirely different. And so they were.

The majority of Rockwell's woodworking tools are made at their factory in Tupelo, Miss. This is where the venerable Unisaw is made, along with their complete line of radial saws, the 14-in. bandsaw, the several models of shapers, the 4-in., 6-in. and 8-in. jointers, the 6-in./12-in. belt/disc sander and the 24-in. scroll saw. All of their other woodworking ma-

chines are manufactured at their plant in Bellefontaine, Ohio.

My visit to the Tupelo factory began in Bill Ramsey's office. He's plant manager and is directly responsible to Rockwell Power Tool management. Also there were Lou Brickner, marketing manager for woodworking machines, and Bernie Cox, product manager for Rockwell's Power Tool Division. "How do you know how many machines you need to make in a given month?" I asked. Ramsey explained that this is a complex calculation; output varies and is based on marketing data compiled in the home office, taking into consideration orders from distributors, sales promotions and the availability of certain parts and raw materials. "What about the person who buys one of your Unisaws and finds it's got a bad bearing or warped extension wing?" I asked. "Can he expect to get the faults corrected or the defective parts replaced?" Ramsey replied that all new machines are guaranteed against defects and that Rockwell's service system is advanced and efficient. "All the parts in all the distribution centers throughout the country are carried on a computer file," Ramsey said. "If one distributor doesn't have a particular part, he can call the home office and learn the location of the nearest service center that has it in stock, and can order it for his customer."

I listened to this with keen interest, and then recounted how several years ago I had bought a Rockwell lathe duplicator and had discovered upon opening the box that what should have been an angle-iron tool rest was just an unformed flat bar. I had taken it back to the dealer and asked for a replacement part. The dealer told me to go to an iron yard and buy a length of the stuff because ordering parts from Rockwell was like trying to get sympathy from the IRS. He said it would take months to get the piece, if I got it at all. Ramsey gave me a hard, sober look and there was a moment of quiet. "Well," he said, "That was several years ago, and mistakes do happen, and sometimes communications with distributors are not as good as they should be." He went on to say that the Rockwell people are quite aware of the fact that product quality suffered during the 1970s, but now they've made a renewed commitment to quality control.

I told Ramsey that a number of woodworkers have written to us saying that the old Delta machines were well built and reliable but that since Rockwell has been manufacturing the Delta line, there's been a decline in quality, that some parts have become tinnier and flimsier. "There's some truth to that," he replied, "but we're now reversing that trend." He offered an example. The platen for the Delta belt/disc sander was originally a cast part. Then someone decided to cut costs by making the part from a die-stamped piece of sheet metal. But they then discovered that during prolonged use the sheet-metal platen would deform from the heat of heavy sanding. So now they've gone back to using the cast-iron platen. Lou Brickner cited another example: The Unisaw rip fence, which used to be made from stamped steel, is now a hefty, ribbed-aluminum extrusion, two extrusions actually, one nested inside the other. By loosening a couple of lock screws, the lower half of the fence can be brought into contact with the table surface, a handy feature for ripping veneers and other thin materials.

I had one more question: "Suppose a customer needs a part badly or has just bought a defective machine and wants it corrected. Suppose the distributor he bought it from won't or can't get the part or fix the machine within a reasonable time. What recourse does the customer have? Is dealing with Rock-



A quality-control engineer uses mechanical and electronic gauges to see whether the milled dovetailed ways in this base for a Rockwell 8-in. jointer fall within the prescribed tolerances. The engineers select bases off the line at random during the day. A test failure stops the run until the error is corrected. Rejected parts are re-machined or scrapped.

well really a bureaucratic hassle?" Ramsey smiled. "Of course not. I've got letters right here in my desk from customers I've dealt with directly. I spent several hours on the phone just the other day trying to run down a part for a fellow, only to find out that he'd been using the wrong part number all along." He said that most customer-service problems are communication problems. In the first place a customer should get good service from his distributor; but if he can't he should write or call the nearest Rockwell service branch. If that fails to produce results, he can call or write the home office (Power Tool Division, Rockwell International, 400 Lexington Ave., Pittsburgh, Pa. 15208) or the plant in Tupelo (PO Box 1508, Tupelo, Miss. 38801). "We're serious about customer service," he said, "and will do whatever we have to, within reason, to see that problems get ironed out. The president of the Power Tool Division sits on our service committee. That's how serious we are about it."

I spent the balance of the day touring the plant, and saw how the most important shop tools are manufactured. The plant doesn't have an in-house foundry, so cast parts are jobbed out and must be inspected on arrival. Some castings, I was told, are annealed—heated to 1400°F for 30 minutes—to relieve stress. This makes the iron easier to mill and to grind, and also makes for more stable, warp-free cast parts.

Such stability is particularly important for jointers. Their tables must be perfectly flat and parallel to one another, or they won't cut a true edge on a board. If built imprecisely, they're useless. For this reason, and because jointers are made almost wholly from grey iron castings, I was especially interested in seeing how Rockwell made theirs. The 8-in. jointer begins as several castings—a trapezoidal base, infeed and outfeed tables, a fence and a number of smaller castings that make up the fence-support assembly. Dovetailed ways are



Above, at the end of a long assembly line, these workers in Rockwell's Tupelo, Miss., plant make the final checks on 14-in. bandsaws. One adjusts the blade-guide system, while the other sets the 45° positive stop on the tilting table. From here the machines go to be packaged and to await shipping.

machined into the sloping sides of the base and into corresponding inclines on the tables. The ways allow both tables to travel up and down (chiefly to adjust the depth of cut) and still remain parallel to one another. Cutting these ways precisely is so important that the operation gets checked several times during the day by a quality-control engineer, who selects a base at random and takes it to his lab. There, he clamps the base to a surface plate, and using a vernier height gauge and other measuring devices, he finds out whether the component falls within the prescribed tolerances. If it doesn't, all the pieces in the run—since the last test—are checked. If the defective components cannot be corrected by re-milling, they're scrapped.

When the base, with the cutterhead installed, and the two tables meet at a sub-assembly station, they are wedged, the gibs installed and the tables aligned and locked into place. Now the entire machine is mounted on a jig and passed several times beneath an overhead grinding wheel, which surfaces both tables at once, ensuring parallel alignment end to end. This is a sensitive operation, and the person doing it must be careful, as excessive head pressure on the grinding wheel can burn and discolor the iron or produce an uneven surface. Such errors can be eliminated by further grinding, but too much of this will yield thin table surfaces, and the jointer beds will end up as expensive pieces of scrap iron.

All the machines I saw being built were fairly old designs, most of them haven't been altered in 30 years. I asked Brickner if Rockwell was planning to bring out new machines to compete with trade tools made by such overseas companies as Makita and Injecta/Inca. He answered yes, that this summer Rockwell plans to introduce a new medium-priced thickness planer which will be made in Brazil and sold under the name Rockwell/Invicta. Then I asked whether Rockwell plans to

bring out anything else in the way of new machinery. His answer was a cagey "yes and no." Yes, they do have several things in the development stage presently; no, they don't intend to redesign any of their basic Delta machines. He said there wasn't any point in tampering with successful products that had been industry standards for so many years.

Before I left, I made a point of asking Brickner what he thought about Powermatic machinery. "They make good stuff," he admitted without hesitation. Then he added, "It's good to have good competitors."

Along with 22 others, mostly salesmen who'd been sent to Powermatic's plant in McMinnville, Tenn., by their bosses to learn about operating and maintaining woodworking machinery, I sat in a large classroom sipping coffee and waiting for the instructor to arrive. About 14 times each year, Powermatic holds these five-day workshops. The fall and winter sessions are attended by dealer salesmen and servicemen, while the six summer sessions are conducted for university industrial-arts students and teachers, who usually earn college credit for their participation.

Around 8:30 A.M. Jim Ramsey, Powermatic's product manager (no relation to Rockwell's Ramsey), walked into the room. After giving a brief history of the company, he got to the real reason we were listening. Most service problems, he told us, could be avoided if the machine operator understood his equipment thoroughly, and knew how to adjust it and how to keep it in tune. "I can't be emphatic enough," he said, clutching the podium. "You'd be surprised at how many people start turning knobs and screws without having the slightest idea what they're doing."

Before beginning the lesson on jointers, Ramsey talked at some length about the advantages of having an in-house pattern shop and foundry. Powermatic is licensed, he said, to use the Meehanite process, a patented technology for making a high-grade, close-grained grey iron that is superior for use in machinery castings. The process ensures that the molecular constitution of the cast iron is consistent from day to day and from year to year, a condition that makes milling and grinding more efficient and that contributes to product uniformity. "We can control," Ramsey added, "the aging time for our castings." He explained that the traditional method of letting cast parts sit for months uncovered in the open air is still the best means of relieving internal stresses created by the casting process. Aging gives these stresses time to resolve themselves before the part is milled and ground. "By having our own foundry," he said, "we don't have to machine green castings, and consequently we wind up with fewer warped saw tables and jointer fences."

But regardless of aging and other means of relieving stress, he continued, some castings do warp after they leave the plant. Jointer fences, he said, are the worst offenders. He walked to the rear of the classroom, where all the machines were set up for demonstration, and pointed to the fence on the 6-in. jointer. "Now, no one will want to believe this, and I've had a hard time convincing a lot of smart people, but cast iron *will* bend; you can straighten a warped fence." (See Box, on next page, to learn how.)

Over lunch I got a chance to ask Ramsey about Powermatic's customer service. The upshot of it all was that their machinery should hold up for decades of hard use, given the usual amount of maintenance and care; bearings might need

eventual replacement, but the basic cast parts should last indefinitely. They are guaranteed to be free of defects, or they'll be replaced. "We train our distributors to be able to tell whether a machine is really defective or whether it only needs adjustment or re-alignment; these guys will go into someone's shop, inspect the tool and try to fix it there." It's a rare thing, he said, when a machine has to be returned to the factory for repair or regrinding. "Since we've been conducting these workshops," he concluded, "we've minimized customer service problems." However, a customer who can't get satisfaction from his local dealer should write Customer Service, Powermatic Houdaille, McMinnville, Tenn. 37110.

The afternoon session on motors and electrical controls was conducted by Roy Baker. Though his chief function is customer service, he's intimately acquainted with the machines themselves, and serves along with Jim Ramsey as the other in-

structor in the maintenance workshops. After class he took me on a two-hour tour of the plant. Baker and I walked up and down the labyrinthine aisles, and I was a little surprised at how similar the whole operation was to Rockwell's, with the exception that Powermatic doesn't make a line of radial-arm saws, whose manufacture takes up considerable space in Rockwell's Tupelo plant. At one station along the way I reached down into a parts box and picked up a handwheel for a Model 66 table saw. "This is a pretty nice casting," I said, "but why go to all the trouble to cast such a good handwheel and then make the little center locking knob out of a plastic that can crack when the setscrews are tightened?" I once owned a Model 66 table saw and had cracked both its locking knobs while trying to tighten their setscrews. "Geez," Baker answered, "we've got to save money somewhere." (Two months later, I was told in a phone conversation with Jim

On jointer maintenance

"The most common complaint about jointers," says Jim Ramsey, chief instructor at Powermatic's machinery workshops, "is that the tables droop, or that jointed edges aren't true." To correct these problems several checks are required. First see how the operator is jointing his stock. If he concentrates his feed pressure on the infeed table, he'll probably wind up with a concave edge (a spring joint). Proper jointing calls for applying feed pressure over the infeed table only long enough to establish a straight edge about 18 in. long at the front of the board; then the feed pressure should be shifted to the outfeed table and be concentrated over the stock about 6 in. beyond the cutterhead.

Drooping tables can result from insufficient pressure on the gibs, the flat, steel bars that fit in the dovetailed ways between the bearing surfaces of the tables and the base. Their job is to compensate for wear. Ramsey demonstrated by loosening all the gib screws on the in-

feed table of the jointer in the classroom. Then he laid a straightedge across both tables, and as he had predicted, the infeed table was close to $\frac{1}{16}$ in. lower on its outboard end than at the cutterhead. As he tightened the gib screws, the table was gradually raised and finally made uniform contact with the straightedge along its full length. The gib screws must be tight enough to hold the tables parallel, but no tighter.

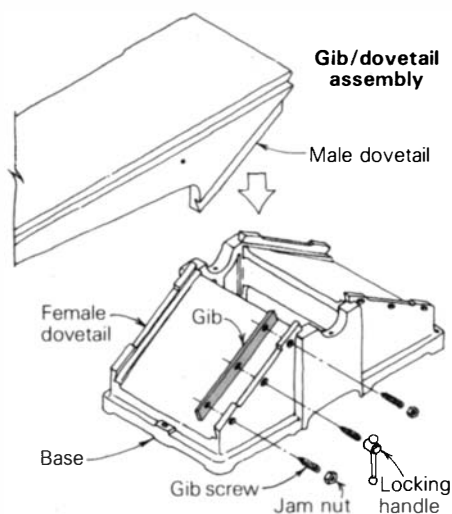
Another thing to check for is the proper alignment of the countersinks in the gibs with the tapped holes along the ways in the base (see drawing, lower left). The cone-head screws must fit into these countersinks or the beds can't be properly snugged up in their ways and the tables will sag. If a gib has to be re-aligned, loosen all the screws, position the gib (you'll need a flashlight to peer into the hole), and then lock the handle down. Next tighten the gib screws firmly and back off each a quarter turn. Finally tighten the jam nuts. Now the two tables should be perfectly parallel.

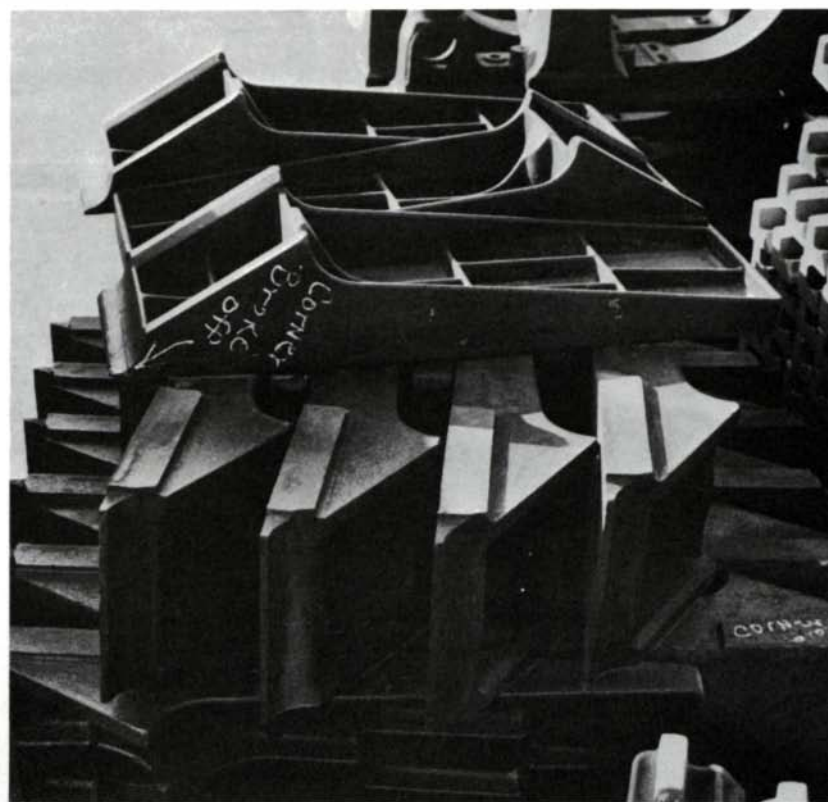
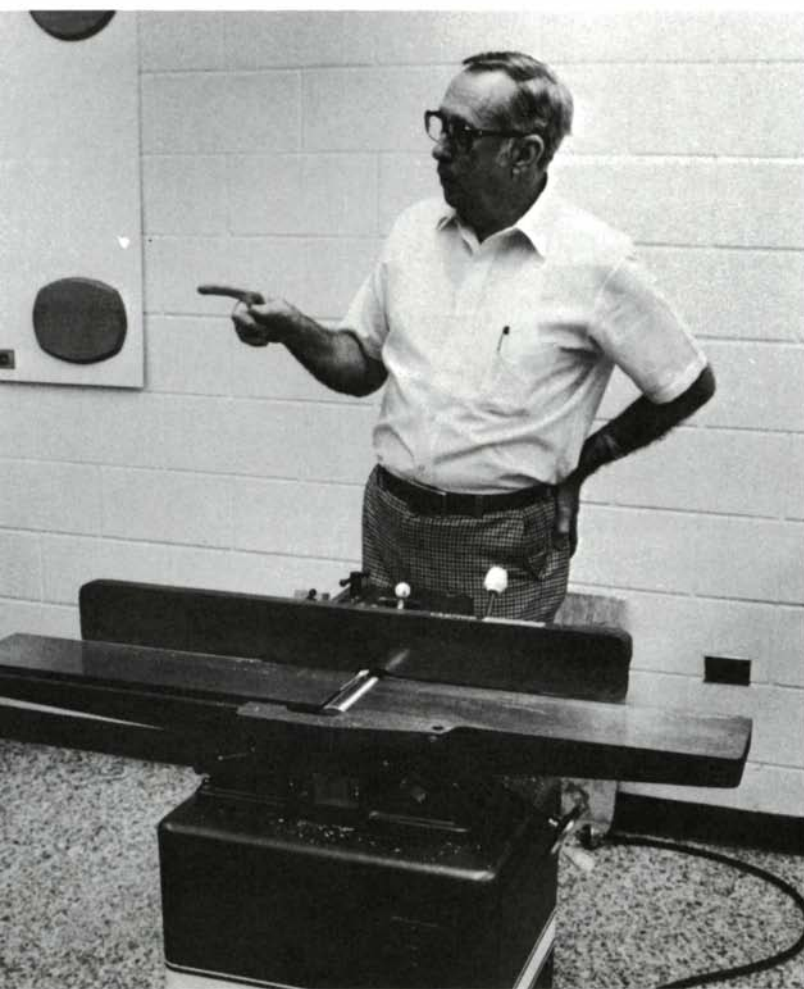
Ramsey maintains that the way you change and set the knives is critical to a jointer's performance. Never remove all the knives at once and then re-install them or replace them with a new set. Rather, remove a single knife and then replace it with a fresh one (or with the same one resharpened) and then set it. Taking out the knives all at once and replacing them one at a time can subject the cutterhead to harmful stresses and cause it to distort. If you must replace all the knives at one time, you should gradually torque the chipbreaker bolts down, going from one knife to the next, keeping the pressure equal all around the cutterhead. When tightening chip-

breaker bolts, begin in the middle and work out to the ends. Otherwise the knife can creep up or down as you apply more pressure, and you'll have an awful time trying to keep the knife at its proper height during installation.

If a jointer fence is twisted or warped or not perpendicular to the surface of the tables, your jointed edge will not be a consistent 90° to the face of the board, and you'll find you're gluing up big barrels instead of tabletops. So check the right-angularity of the fence often, and should you discover that the fence is perpendicular to the table at one point and not at another, you probably have a twisted fence. If you hold a straightedge lengthwise along the fence and detect any deviation, your fence is bowed. Ramsey says you can correct both of these problems.

If the fence is bowed, detach it from the fence-support assembly, and set it (crown up) astride two blocks on the floor. Slowly apply weight to it, usually by standing on it in the middle. At a critical point, you will feel the metal give slightly, which signals that it has returned to its original shape. It will not bend beyond this point, but will break if further pressure is applied. And, Ramsey says, it will not warp a second time, as all the wicked stresses have been exorcised by bending it again. If the fence is twisted, clamp one end in a woodworking vise and tighten a pipe clamp or bar clamp on the other end. Using the leverage from the bar, slowly apply gradually increasing pressure in the required direction. When you feel the metal give, stop. Don't try to muscle out the warp with a quick jerk, or you will break the fence. —J.L.





To reduce the chance of warping and to help relieve internal stresses, castings are seasoned. These jointer tables (above) in Powermatic's "boneyard" will lie rusting in the open air from three to six months. At left, Jim Ramsey, Powermatic's product manager and instructor for the company's oft-held maintenance workshops, tells how jointer tables will droop if the gib screws aren't properly snugged up. Loose gib screws, along with gunk and build-up along the ways are, according to Ramsey, the chief causes of sagging jointer tables.

Ramsey that Powermatic's engineers had redesigned this part. The new knobs will be cast from solid, not ribbed, plastic and will have threaded brass inserts to hold the setscrews. He assured me that the prototypes have been tested and that they will not crack.)

Then Baker took me outside for a walk through the "boneyard," the several fenced-in acres of cast-iron parts—everything from planer bases and bandsaw main frames to table-saw fences and trunnion boxes. All the castings were stacked in neat piles, some small, others mountainous. Some parts were painted green, some yellow, some blue. "Why all the colors?" I asked. He explained that each month of the year was assigned a color, that when castings came from the foundry to age in the boneyard they were painted so that their age would be apparent at a glance. "This keeps us from bringing a casting into the plant and milling it before it's had time to age for at least three months," he said.

I had been promised a tour of the foundry, so late in the afternoon on my last day there, Baker and I drove the short distance to the place. On the way I asked him what he thought about Rockwell machinery. "I used to work for Rockwell," he replied with a little grin, "and I know their line pretty well, and really can't knock it. But I think Powermatic has the best 14-in. bandsaw in the business."

At the foundry, the patternmaker and his apprentices had locked up and gone home for the day, so I didn't get a chance to talk with them or look around the patternshop. But Baker explained that all of Powermatic's machine parts begin as wooden patterns which are sent out to have aluminum working patterns made from them. The original wooden patterns

are returned and stay in the patternshop. We walked about, winding past long banks of patterns hanging from the wall, past molding and coring operations, past hot, unflashed molds, with their castings cooling inside. On we went by the quaking conveyor that shakes the sand off cold castings, until at last we arrived at the heart of the place—the twin furnaces. I mounted the steel gangway to the little booth where the operator was getting ready to charge the furnace. He was maneuvering an overhead electromagnet that clutched a load of scrap iron, including some rejected machine parts, and he stopped it just above the far furnace, whose thick, iron lid slid slowly back. Red and white light shot from the opening with palpable force. The operator lowered the magnet into the fiery pot and released its load. There was a burst of light, with sparklers flying high into the air and flames leaping up as though to consume the magnet. This is how all machines die and are born again, in the white-hot soup that turns into cold, grey iron.

Foundry practices have come a long way from the time when Bob Johnson's huge machines were made, when strength depended largely on the sectional thickness of a casting and when getting a good batch of molten iron was literally pot luck. With the introduction of the Meehanite technology in the 1950s (and subsequent, more advanced procedures), the entire casting process, from mixing the sand to pouring the metal, came under scientific control. The improved quality of the cast iron meant that sheer mass was no longer needed to achieve strength, and it also meant that the grain structure of the metal could be manipulated to suit the

kind of part being cast. Scientific control has almost eliminated hard spots in cast metal, irregularities that make a casting brittle and that can dull and sometimes break metalworking bits and cutters. So now the machining of cast-iron parts can flow at a production pace and the quality of the finished tools can remain fairly consistent.

Nineteenth-century machines were big because they had to be, and ornament could be incorporated into their structure because sectional thicknesses were so great and weight so negligible a consideration that a given part could take almost any shape the millwright fancied, so long as it did its job. The

pretty S-curved spokes of Johnson's giant bandsaw wheels were not engineered for getting maximum strength from minimum metal. Rather, they were designed for appearance and to cope with the problem of shrinkage as the castings cooled. But these days the need for lighter, more portable trade tools, along with high-speed spindle requirements, makes stress engineering preminent. Thus woodworking machines and their functional parts have to look like what they have to do. So what we have lost in mass and stature, we have gained in better machine performance and improved metal quality. Too bad we can't have both. □

On choosing machinery

If someone were to ask me whether I'd buy a Rockwell or Powermatic spindle shaper or whether I'd choose a Powermatic Model 66 10-in. table saw over a Rockwell Unisaw, I couldn't give a simple answer. But here are some general observations. Even though Rockwell jobs-out its castings, they appear a little cleaner and crisper inside and out than Powermatic's castings; on the other hand, Powermatic's castings are a little heavier and thicker in section than Rockwell's; and on the average, a Powermatic machine weighs a little more than the equivalent Rockwell model. The Powermatic 8-in. jointer, for example, is about 50 lb. heavier than the Rockwell 8-in. jointer. As far as I could tell, both manufacturers paid equally close attention to machine-finish tolerances, spindle run-out tolerances and general machine performance. Equally close in every case but one: Rockwell's tolerance for its 8-in. jointer is 0.01 in. end to end; Powermatic's tolerance for its 8-in. jointer is 0.0015 in. end to end—a significant difference. Powermatic's ground table surfaces look a little nicer than Rockwell's, but this has no effect on stock feeding or mechanical performance.

Rudolf Bass Co., in New York, sells more woodworking machines than any other distributor in the country. They handle and service both Powermatic and Rockwell lines. I phoned Richard Bass and asked him which of the two firms made the better machine, and he answered that to choose intelligently one had to check out the machines model for model, compare the features where they are different, and decide on that basis. And, he said, there's a good deal of personal preference involved. For some applications a Powermatic machine would be the right choice, for others a Rockwell model would get the job done better. "It's just not something you can generalize about," Bass

said. He then added that to make a good choice one should also take into account the kind of service the dealer can provide for each. "But when you get right down to it," Bass quipped, "Powermatic's machines are green, Rockwell's are grey."

Most distributors I spoke with agree that woodworkers would have less trouble with their machines if they would read their owner's manuals, set the machines up properly and adjust them correctly to begin with. Another mistake a lot of woodworkers make is trying to save a few bucks by skimping on the motor and electrical controls. Too often a person will spend \$1,400 on a good table saw and then get the cheapest motor he can and a simple manual switch with no overload protection. A 10-in. table saw should have at least a 3-HP motor; a 5-HP one would be even better. Motors that are underpowered for the work they do can overheat, and they consume more current as well. Having more HP than you need is best, because power consumption is reduced, along with the danger of burning out the motor or causing an electrical fire.

Several years back, when copper got scarce because of political goings-on in Chile and other places, electric-motor manufacturers introduced the T-frame motor, which is now generally sold in place of the old U-frame motors. T-frame motors have formed-steel bodies and steel end bells, whereas the U-frame motors have cast-iron bodies and bells. T-frame motors are smaller and have fewer field windings, and use 30% to 50% less copper than U-frame motors rated at the same HP. This means that T-frame motors can burn out faster and will produce less starting torque than the equivalent U-frame motors. You can still buy U-frame motors, but they're very expensive. This is another good reason for getting a motor whose HP rating is as close as you

can possibly afford to the highest rated for the particular machine.

Having said all this about buying new equipment, I'd prefer to own old machines, and if I were getting ready to outfit another shop, I'd beat the bushes to see what bargains I could scare up. Some woodworkers I know seem favored by good fortune, as they always manage to stumble on good pieces of used machinery without really looking for them. The rest of us have to haunt the auctions and pester the used-machinery dealers until at last we find what we're looking for in some dark corner of a warehouse or barn. Though the demand for used equipment is increasing as more woodworkers discover its worth, there are still plenty of old machines sitting around gathering dust all over the country. The trick is to find them, and to be able to tell how much work is needed to restore them to operating condition, something we'll be writing about in future issues.

The best table saw I ever owned was a 20-year-old Davis & Wells. Its arbor-raising mechanism was a rack-and-scroll gear, and the arbor assembly rode in gibbed dovetailed ways. When I gave the dealer my \$450, the inside of the saw was filled with gobs of pine rosin and several thick layers of compacted sawdust. He told me it had been worked hard for years in a factory that made prefabricated buildings and that for the price he couldn't guarantee anything. I loaded the monster in my pickup, took it home and then took it completely apart, cleaned off all the hardened gook, honed and polished the ways and put it back together again. I was surprised at how smoothly the arbor tilted, how easily I could crank it up and down, how accurately it did its work. Davis & Wells (now owned by Rankin Industries, 11090 S. Alameda St., Los Angeles, Calif. 90262) still makes this saw, but a new one costs \$2,250, without the motor and electrical controls. —J.L.

Two Versatile Vises

Holding the work where you want it

by Michael Stone

Probably the best vise ever made for holding irregular and odd-shaped workpieces at almost any angle or in any position was the Emmert Universal patternmaker's vise (sometimes called the roto-vise). It's a great misfortune that this vise is not made anymore, because its convenience and versatility haven't been matched by anything in current production. However, for carvers and cabinetmakers who need to hold their work in different positions to ease hand-tooling operations, there are two vises on the market that will pivot and rotate, and make the workpiece more accessible and less awkward to get at with chisel and gouge.

The Ulmia patternmaker's vise (available from most of the major mail-order tool suppliers at around \$250) can be rotated 360° on its base. Its wooden jaws also swivel independently in the horizontal plane and can thus adapt to hold tapered workpieces. This vise, made in West Germany, weighs 29 lb., and its jaws will open to 6¼ in. Its long acme-thread mounting bolt, handily equipped with a large cast-iron wing nut and pressure plate, will let you secure it to a bench top as thick as 4½ in. The chief disadvantage of this vise is that its jaws are fixed in the horizontal plane.

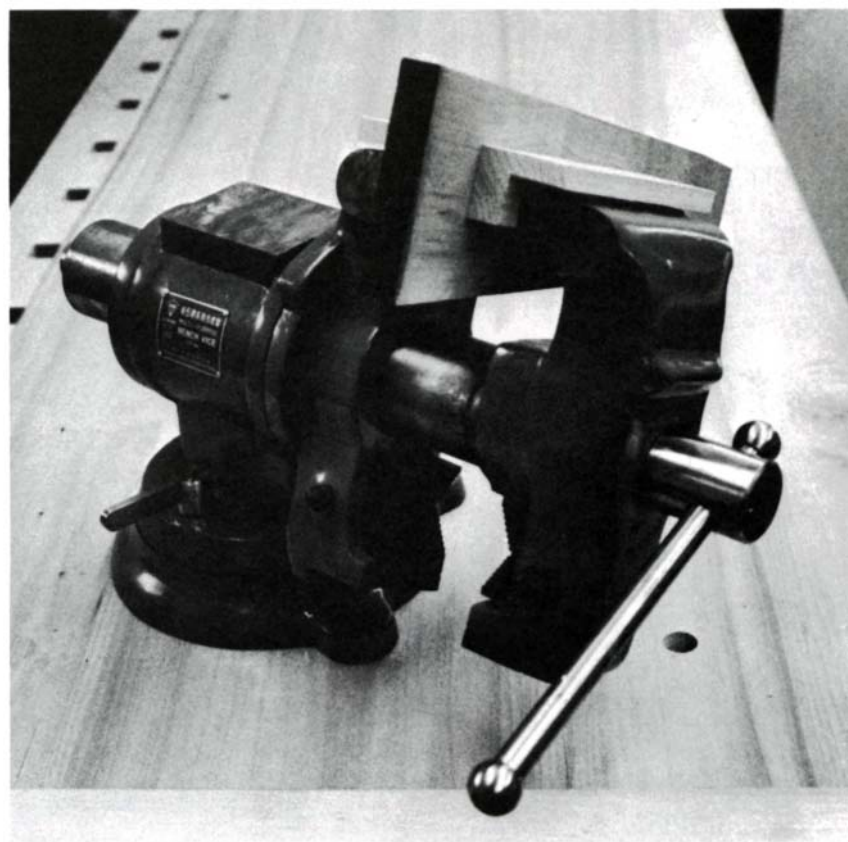
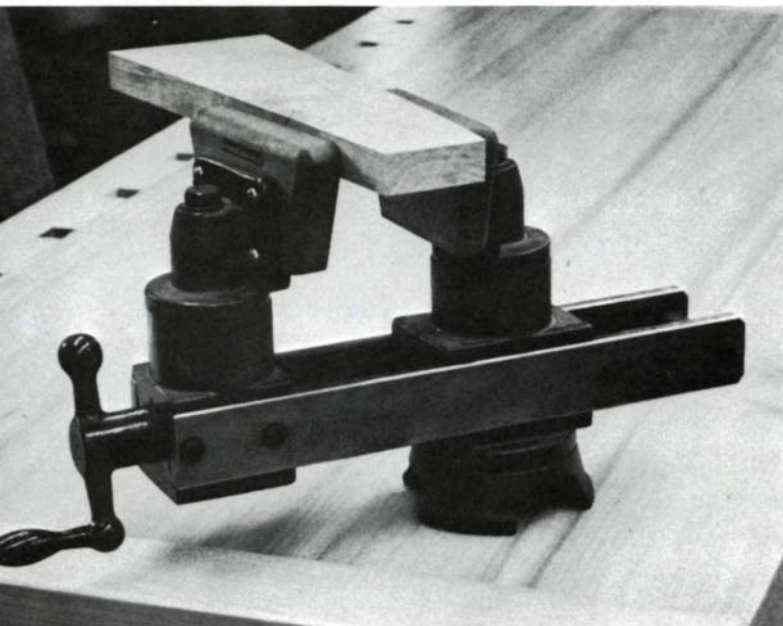
From the People's Republic of China comes a remarkable new vise of considerable versatility. Though actually a machinist's vise, its jaws can be fitted with wooden blocks,

and it will work well for holding workpieces of regular dimensions in almost any position. The entire vise will rotate full-circle on its base and the jaws will swivel 360° in the vertical plane. Both the vise body and the jaws are easily locked at any point. The vise has three pairs of jaws: The conventional jaws on top are 4¾ in. long and open to 4¾ in.; the serrated pipe jaws below the screw open to 4½ in., and the V-jaws, two plates at the bottom of the vise, open to about 5 in.

What's attractive about this vise is the high quality of its manufacture. Its cast parts are well finished and all mating surfaces are precisely milled or turned, making for very smooth operation. The acme-thread screw is enclosed, and the jaws swivel 360° and lock in any position while simultaneously clamping the workpiece. The whole thing is massive and tough, with a net weight of 88 lb. Its only disadvantage is that the jaws don't swivel independently, so it needs tapered blocks to hold tapered work. By mail order, the Chinese vise costs \$175 plus shipping from Fine Tool Shops, 20 Backus Ave., Danbury, Conn. 06810, and \$165 plus shipping from The Tool Works, 111 Eighth Ave., New York, N.Y. 10011. From either source, that's about \$2 per pound. □

Michael Stone is a freelance writer and amateur woodworker who lives in Riverdale, N.Y.

For holding regular or tapered workpieces in convenient positions, the Ulmia patternmaker's vise (below) has jaws that swivel independently. The vise also rotates a full 360° on its base and locks at any point. For woodworking and metalworking, this versatile machinist's vise from China (right) has three pairs of jaws. Shown here fitted with rabbeted wooden blocks to protect the workpiece, the vise head is canted to the right. The jaws can be swiveled 360° vertically, and rotated full-circle in the horizontal plane.



Sharpening Equipment

Our shop tests what's on the market

by Rick Mastelli

Sharpening is a problem for beginning and accomplished woodworkers alike. It's a difficult skill to learn, and early results are usually frustrating. As you come to know what you're doing, it often becomes a reluctant chore. This probably explains why there are so many sharpening gadgets and systems on the market, all advertised as taking the work, the skill, the time-consuming distraction out of sharpening tools, and leaving you with a superior edge. Does any of this equipment do the job? Early this year, the editors of this magazine set out to find out.

We borrowed from the suppliers and manufacturers sharpening equipment of all kinds. We kept this equipment arrayed on a large table in our shop, and for four months we tried it. We sharpened our tools as our woodworking required, and we found ourselves returning to some systems and avoiding others—one indication of their real speed and ease. In addition, I spent hours just wasting metal, trying to find not only the advantages and disadvantages of each system, but also the knack each requires to get the best results. Heretofore my experience with sharpening equipment had been typical: I'd used a high-speed grinder and oilstones. I was intimidated by the grinder for its having ruined by overheating about a third of the edges I'd sharpened, and repelled by the stones because of the mess my oily hands would carry to my wood. Sharpening was a bother I tried to avoid. But in working with these various systems, I learned to enjoy sharpening. The systems didn't make the difference—my concentration did. Even though I didn't get much woodworking done, I found considerable satisfaction in honing my techniques and progressing toward the perfect edge.

For some millennia tools have been sharpened by dragging them across such naturally abrasive stones as sandstone, Belgian clay and novaculite (Arkansas and Washita stones). Although we also have man-made stones today, our bench stones are basically what they've always been. Sometime, somebody got the good idea of spinning the stone, so the tool could be held in one place. He thereby invented grandfather's great treadle-powered sandstone wheel, and that led to today's hand grinder as well as to the high-speed motorized grinder found in most shops. Besides these traditional grinding methods we also have abrasive belts that travel over pulleys, fine-grained Japanese waterstones that rotate horizontally instead of vertically, and slow-speed honing plates that also rotate horizontally, like potter's wheels.

By any method, sharpening is a two-step process. First you form the bevel and shape the edge (usually straight and perpendicular to the sides of the tool), then you hone the edge, polishing and refining it until the very tip disappears. In both stages you are removing metal, and the task is to remove it quickly, accurately and coolly. Overheating the steel ruins its temper, so that the edge, no matter how sharp, won't endure more than a couple of cuts. Some of the systems we tested

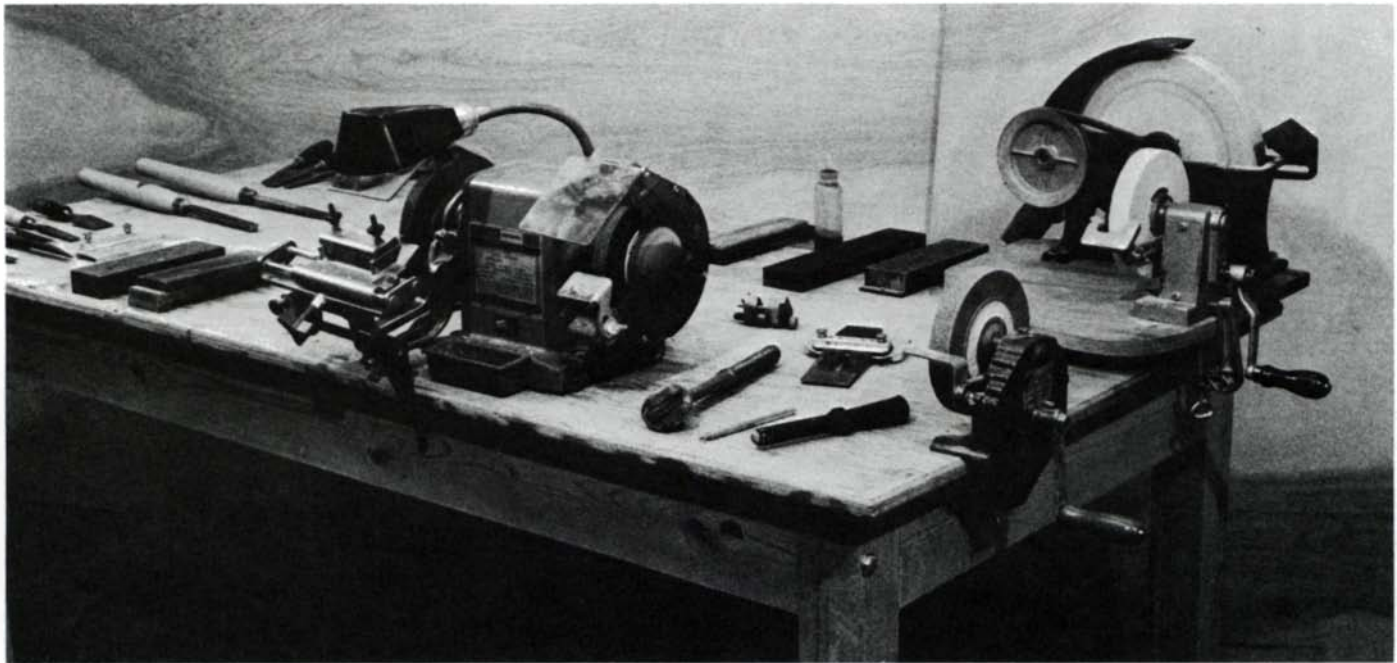
perform both operations, some only one, or only one well. What follows is a description of each system and of companion appliances, some subjective conclusions resulting from the hours I spent with them, and at the end, the views of the other two editors who worked with the equipment.

Hand grinders—A hand grinder consists of a vertical wheel powered by a crank; one hand drives the apparatus while the other guides the tool to be sharpened. The large, old-style wheels were often driven directly, while modern versions get a smaller stone up to speed by coupling the crankshaft through a gear train. The old-style wheel ran in a trough of water, to lubricate the cutting and to keep the metal cool.

We tested a 12-in. current-production sandstone wheel, bought at a flea market and jury-rigged, along with two machines that use 1-in. by 6-in. aluminum-oxide grinding wheels, one of them geared up 12-to-1 and the other geared up 22-to-1 (both are sold by Woodcraft Supply, 313 Montvale Ave., Woburn, Mass. 01888, for \$31.50 and \$64.95 respectively). The wheel of the 22-to-1 grinder clogs less, and the handle disengages to remain still when you're not cranking, but both grinders perform essentially the same. Comparing these to the sandstone wheel, we found, as we expected, that sandstone is simply not as hard as an aluminum-oxide wheel and it does not cut as fast. Also, the wheel-in-water arrangement is messy. Rotating the stone toward the tool is preferred because rotation away tends to draw the metal out, producing a larger burr and a weaker edge, and concentrates heat at the edge instead of directing it toward the tool body, which acts as a heat sink. However, a water-bathed wheel rotating toward you means the tool skims the water off the stone to run down over your hands and onto your feet. I ended up soggy straddling a basin on the floor. Sandstone in water also requires maintenance: You have to drain the trough after each grinding session, or the stone gets soft.

The smaller hand grinders don't have the water problem, and their gear-drives do generate enough speed to remove the metal, barely. If there is much metal to remove, however, and you crank them up fast, they generate more than enough heat to draw the tool's temper. With all three of these wheels, I found hand cranking awkward and tedious, and enough of a distraction to interfere with properly grinding the tool. With so many motorized systems nearby, it was hard for me to resist the temptation to flip a switch when I had grinding to do, and to leave the muscle work to history.

High-speed grinders—The grinding system that is probably most common in shops consists of a coarse and a fine aluminum-oxide wheel attached at either end of the shaft of a ½-HP, 3350-RPM motor. We tested the Sears Craftsman model 9KT 1934C (\$124.95); most tool manufacturers offer a similar machine, and a made-in-Taiwan version costs about \$50 in



Our test-table here includes hand grinders, tool holders, benchstones and a Sears high-speed grinder with rack-and-pinion grinding fixture. At the front corner of the table are three wheel dressers: a star dresser, a diamond dresser and a carbide shaft. We preferred the last.

discount houses. These grinders waste metal quickly, but generate heat at the same time. The closer you grind to the tool's edge the more gingerly you must proceed, keeping the steel cool by dipping it in water or spraying it with a plant mister, because the thinner metal heats up faster. If you see the back of the tool flash through colors from light straw to true blue, it's too late—the steel has lost its temper. You must painstakingly grind past the surface discoloration, and always at the risk of burning the metal again. If you already own a high-speed grinder, you know the risks, and maybe you've come to terms with burned edges. If you're still shopping for a grinder, consider the gentler systems on the market.

Tool rests—The tool rests that came with the hand grinders and the high-speed grinder don't work well. They're typically a sheet-metal bracket with one leg attached to the machine frame by a nut and bolt in a slotted hole. This permits adjusting the rest's angle and its distance from the wheel. But all too often the near edge of the rest, which should be a useful guide to straightness of grind, is not parallel to the wheel's axis. You have to bend the rest, shim it, or grind it parallel, with little hope of an accurate result—because it's attached at only one point, the rest flexes. Setting such a rest is tedious because there's no fine-tuning adjustment and no way to hold the rest still while tightening the nuts. You need two wrenches, one in a very tight place; at best you get a wing nut, which you can't snug enough to prevent shifting under the vibration of grinding. These rests are really maddening.

A solution is to make your own rest (*FWW* #12, Sept. '78, p. 73). Another is to use the near edge of the rest (once you've got it parallel to the wheel axis) only as a fence, never bothering about its angle (*FWW* #29, July '81, p. 66).

We also tested two devices for holding the tool at a fixed distance from the wheel while you slide it left and right. The first, from Rima Mfg. Co. (Box 99, Quaker Hill, Ct. 06375), costs \$9.95 and sandwiches the tool between two aluminum plates, the lower one of which has a fence that bears against the near edge of the machine's own rest. A similar device

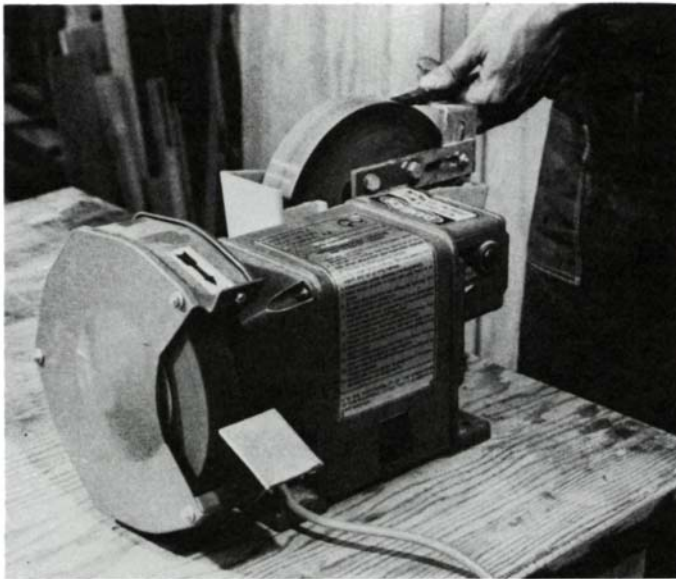
could easily be made of wood. It worked well for extensive grinding, although for touching up an edge, it was faster and easier to control the tool by hand.

The other tool-holding device we tested is a \$29.95 gadget made to fit Sears grinders. It has a fine-feed adjustment and rack-and-pinion travel, and it replaces the standard sheet-metal rest rather than jiggling off it. In use it flexed, and it was a nuisance to have to unclamp the tool to check the grind. We could never get it back in exactly the same place.

A hybrid—The Advantage model 6150 (pictured on the next page) combines a high-speed grinding wheel, for wasting metal, and a slow-speed waterstone for sharpening. Available from Advantage Machinery Co., 28 Ridge Rd., West Barnstable, Mass. 02668, it costs \$299.95. It is industrial duty, and its ¾-HP motor can be operated on 110 volts or 220 volts. The 1½x7, 60-grit aluminum-oxide wheel rotates at 3600 RPM, and the 1½x8 ceramic waterstone rotates at 144 RPM. The high-speed wheel is essentially the same as the Sears; the waterstone, on the other hand, is a pleasure to use, producing a shallow, hollow-ground bevel without burning the edge. The water and the abrasive combine to produce a slurry that makes grinding more sensitive than it is with a dry, aluminum-oxide wheel. You can press on the tool to feel the circumference of the wheel fit the hollow grind, and cutting will not be wastefully fast, nor will the speed of the wheel, which is heavily geared down, be reduced.

The tool rests are the typical sheet-metal platforms; the one for the waterstone can be mounted on either side of the water trough, for grinding toward or away from the tool's edge. The manufacturer is working on a design for a stiff brush to skim the rim of the wheel and reduce the water that ends up on the floor when grinding toward the edge.

Belt grinders—Belt grinders have several advantages over grinders that use bonded abrasive wheels. Unlike a wheel, a belt doesn't need truing or redressing; you just install a new one when the old one gets loaded and glazed. The length of



The Advantage model 6150 grinding system combines a high-speed aluminum-oxide wheel with a slow-speed waterstone. The first wastes metal quickly, the second sharpens without overheating tool steel.

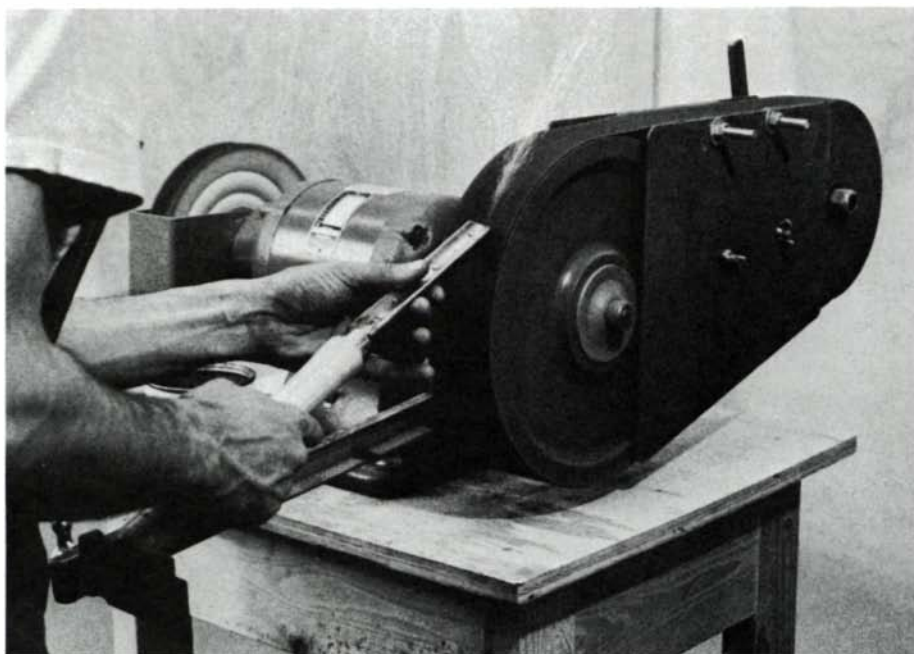
most belts is at least twice the circumference of most bonded abrasive wheels, which means more surface area to dissipate heat. And you can grind on a belt backed by either a wheel or a platen, for either a hollow or a flat grind.

We tested two belt-grinding systems (below): the Mark II from Woodcraft Supply (\$449.95) and the Rockwell model 31-325 (\$109.99, without modifications). The Mark II uses an aluminum-oxide belt, 2½ in. wide by 60 in. long, available in grits of 60, 80, 100 and 120. The finer grits clogged easily, and we got the best results from a 60-grit belt. The ½-HP, totally enclosed, 1725-RPM motor drives an 11½-in. dia. main wheel (5635 surface feet per minute) and an 8-in. muslin buffing wheel, both of them running away from the tool edge. The rim of the wheel is slightly convex and made of

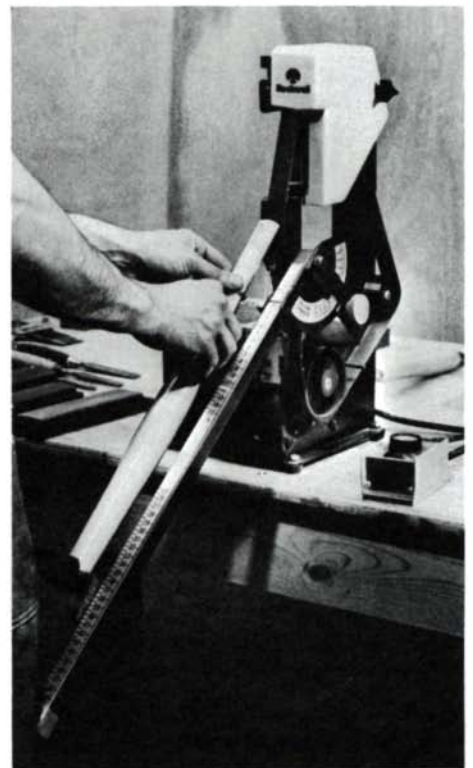
high-density polyurethane, which yields a little under pressure, affording a good, sensitive feel of the tool on the belt. It is possible to locate accurately the grinding action on a wide blade by watching where the sparks come from and adjusting the pressure across the width of the tool. Blades up to 2½ in. wide need not be slid across the width of the belt, minimizing variations in positioning and giving you a straight edge. Besides hollow-grind capability, it is easy to fabricate a flat platen of hardwood and to mount it between the main wheel and the idler using hanger bolts through holes drilled in the sheet-steel belt guard.

The Mark II's tool rest is also well designed. Though its angle is fixed, its distance from the wheel is adjustable and determines the bevel angle on the tool. It can accommodate tools up to 24 in. long, is quick and easy to set up and provides consistent, accurate jigging. The rest supports the tool at its butt end, in either a V-trough for chisel handles or in a flat-angled stop for plane-iron ends. This latter could be improved by dressing the crotch with a file to make its hold more secure. Pivoting the tool onto the wheel, rather than sliding it up into it as with a surface-contact tool rest, allows the tool to be placed and pressure to be applied more carefully. It is especially easy to sharpen gouges and other curved-edge tools. That the long belt does not glaze as quickly and dissipates heat better than a bonded abrasive wheel should not be taken to mean that the Mark II cannot overheat tools and ruin their temper; it can. But the design makes it easy to be sensitive to the process and to stop often to cool the tool in water. Repositioning the tool is no problem.

The buffing wheel removes the wire edge left from the grinding belt, polishes the surface and strops the edge. But there is too much give to the muslin. The tool sinks in and the edge is dubbed over. I replaced the muslin wheel with a rubberized abrasive wheel and a solid felt wheel charged with buffing compound. These, being firmer than the muslin, yielded a sharper edge. I came to rely on the Mark II for



The Mark II, above, from Woodcraft Supply, uses a 2½-in. wide aluminum-oxide belt backed by an 11½-in. dia. wheel for grinding and a muslin wheel for buffing. The two bolts at the top of the belt guard hold a hardwood platen we added for flat grinding. The Rockwell model 31-325, right, is fitted with Pro-Edge sharpening attachments. This butt-contact tool rest, like that on the Mark II, is ideal for sharpening curved-edge tools.



quick, accurate grinding, and of all the machines we tested, I used it most often.

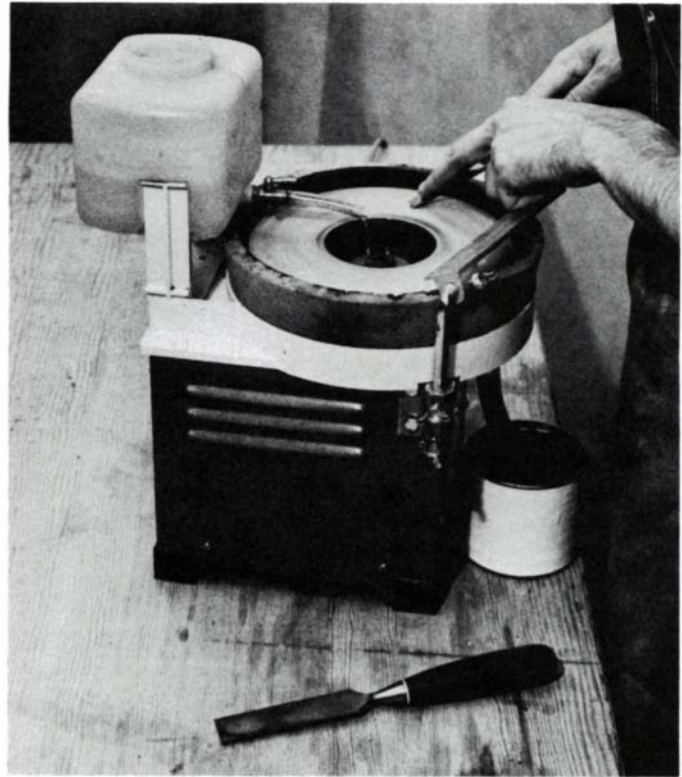
The other belt grinder, the Rockwell 31-325, is like a number of consumer-grade sander/grinders by Sears, Montgomery Ward, Belsaw and others. The 31-325 features a narrow 1x42 aluminum-oxide belt that moves at 5000 surface feet per minute over a flat platen. Its 7-in. by 8-in. table offers surface-contact tool support but no jiggling facility. It is a noisy, lightweight system, full of vibration, that can be used for sanding and grinding, but is not ideal for sharpening.

A company in the Midwest, Prakto, sells a modified 31-325 and attachments for making it more versatile, accurate and easy to use as a tool sharpener. Prakto adds a reversing switch, an improved tracking knob and sound insulation, though the system is still pretty noisy. The attachments (which fit a number of different makes of sander/grinders) are sold under the trade name Pro-Edge. They include a selection of zirconia-alumina belts (which cut faster and last longer than aluminum oxide), an auxiliary platen (which provides both hollow-grind and flat-grind capability), and a tool holder. This last supports the tool at the butt end. The bevel angle is determined by adjusting the length of the tool holder or by pivoting the entire arm assembly or both—a more complex arrangement than on the Mark II.

The Rockwell with the Prakto modifications and attachments is flimsier and more complicated than the Mark II, but both produce a good edge. The modified 31-325, available from Prakto, 6608 Cottonwood Knoll, West Bloomfield, Mich. 48033, sells for \$145. Prakto sells the Pro-Edge attachments for \$49.95, a speed controller for \$36 and a leather stropping belt for \$15. A combination of all their products, including the modified 31-325, is \$220.

Motorized Japanese waterstones—These ingenious machines are new on the American market. They consist of a box that houses a motor and gear train, atop of which spins a donut-shaped stone on a vertical axis, like a record player. You grind on the flat, horizontal face of the stone, not on its edge. The stone consists of a fine abrasive suspended in a soft cement that loosens in water. A quart-sized tank sits above the machine, with a valve that trickles water into the hole of the donut stone. Centrifugal force moves the water up the sides of the donut hole and across the stone's working surface in a uniformly thin film. As the stone dampens, and the tool and stone surfaces abrade one another, a slurry forms of stone and metal particles. It takes a while to get used to the working properties of the slurry; it tends to grab the tool and pull it along. But the cut is fast and clean and there is no danger of burning the tool. Centrifugal force continues to introduce fresh water, and to move the slurry over the surface and off the edge of the stone. A collar catches the slurry as it leaves the stone's edge, drains it into a basin, and then it drips out a rubber tube. There are no fierce sparks or harsh grinding noises, but the cool, gentle whirl is deceptive, and it takes some practice before the steel you're removing is no more than you want to remove.

We tested three such systems: the Rakuda Standard (\$275, pictured above) and Heavy Duty (\$495) from Garrett Wade, 161 Ave. of the Americas, New York, N.Y. 10013 (also available from Woodline, 1731 Clement Ave., Alameda, Calif. 94501), and the Makita model 9820-2 (\$195, pictured next page). The Rakuda comes with a 1000-grit stone, 8½ in. in di-



The Rakuda Standard motorized Japanese waterstone, from Garrett Wade and Woodline, includes a reservoir from which water drips and is spread over the surface of the stone by centrifugal force. This system removes metal quickly and coolly, leaving a polished surface.

ameter, with a working surface 2½ in. wide that rotates at 500 RPM; 100-grit and 2000-grit stones are also available. The Heavy Duty is basically the same as the Standard, except that the stone is 10 in. in diameter, it rotates at 550 RPM, and the top casing is aluminum rather than plastic. It weighs 41 lb., almost twice as much as the Standard, and would hold up well running eight hours a day. For the woodworker who sharpens tools for himself, the Standard is more than adequate. The Makita uses a 7½-in. dia. stone with a working surface 2⅞ in. wide, rotating at 560 RPM. The standard grit is 1000; 60-grit and 6000-grit stones are available.

The flat-grind produced by all three machines is significantly smoother, almost mirror-polished, compared with that produced by a high-speed grinder or by an abrasive belt. This sort of system is thus another hybrid: both grinder and whetstone. Yet it's difficult to actually hone on it, because the metal simply disappears too quickly.

The most significant difference between the two designs is in their tool rests. The Rakuda rest is merely a piece of sheet metal whose height and inclination are fixed by wing nuts. If you take the tool away from the stone to see how much you've ground, it's difficult to get it back where you had it. Finally, I developed freehand control of the tool on the stone. The skill is not so different from that required to sharpen on a stationary stone. The main difference is in the amount of metal removed—the motorized stone is awfully unforgiving of minute discrepancies in your positioning.

The Makita was designed to sharpen planer and jointer knives in addition to hand tools, and the tool rest is a long, machined-steel surface that receives a sliding knife holder and the Rima hand-tool holder (standard equipment) mentioned earlier. The rest is mounted on a pair of columns in the base; height and tilt are adjusted by thumbscrews. The columns are

adjusted independently of one another on coarse threads, and there is some play before they are locked down. It is therefore difficult to get the tool rest parallel to the surface of the stone, and to keep it parallel while adjusting height. Similarly, knife-feed adjustment consists not of one thumbscrew, but of four. Each has to be turned the same amount for feed to be even. The standard knife holder will not accommodate planer or jointer knives narrower than 1 in., but a modification is available (at no extra charge, when you purchase the machine) from one Makita dealer: Highland Hardware, 1034 N. Highland Ave. N.E., Atlanta, Ga. 30306. Makita may soon make this modification standard.

The Makita tool rest is larger, more solid and more useful than the one on the Rakuda machines, though in combination with the Rima hand-tool holder they all produce good results, even if they're tedious to adjust. But the Makita, which is noisier and has a plastic water valve and a plastic collar where the Rakuda has brass and foam rubber, is less enjoyable to use. On the other hand, the Makita is cheaper and more versatile than the Rakuda machines.

Slow-speed hones—Honing removes the wire edge produced in grinding and refines the two surfaces that form the cutting edge. Proponents of hollow grinding hone only a narrow flat, or secondary bevel, at the edge. The Japanese, on the other hand, hone the whole bevel flat and mirror-smooth. In either case, metal is scratched away, just as in grinding, except that the scratches are invisibly small. Traditionally, fine stones have been used for honing; in fact, the Old English word *hān*, from which our word *hone* is derived, means *stone*. After honing, an edge can be kept sharp by stropping, and various materials have been used, including cloth, leather and paper, either alone or charged with abra-

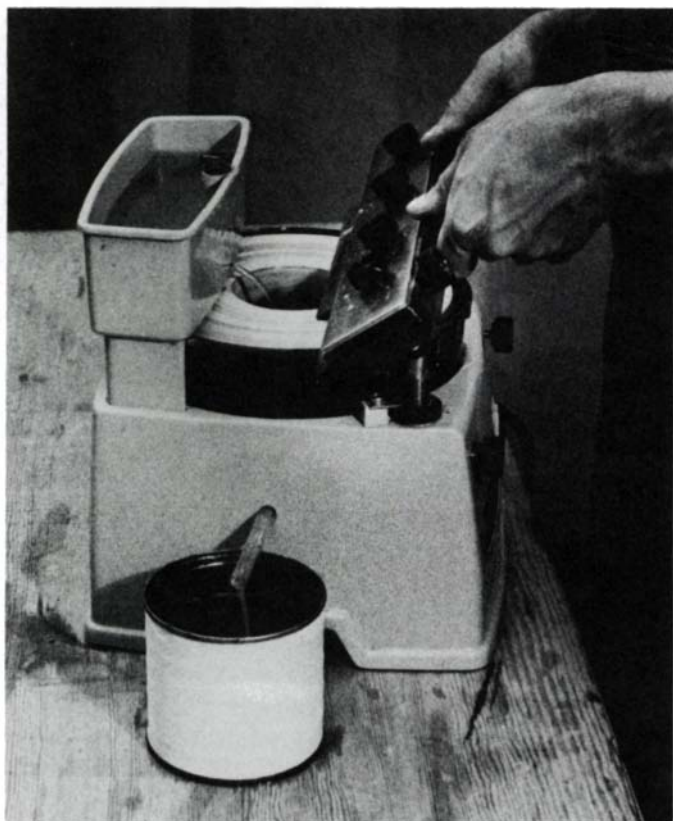
sive powder, and even the palm of the hand. Stropping or honing is the sort of thing you could well do between every few cuts, if it were convenient—consider how often a barber strops his razor. We tested two systems that claim to make honing faster, easier and more effective. Both (pictured on the facing page) employ a horizontal disc that rotates slowly, but neither is actually a hone: One is a motorized strop, the other a slow-speed grinder.

The Xenix Hone is available for \$250 from Superior Finishes Inc., 7777 Wall St., Cleveland, Ohio 44125. It uses a 9-in. dia. wheel of reconstituted leather mixed with rouge in a polyethylene matrix. The wheel rotates at 77 RPM. It is hard, but not unyielding, and so alternately pressing the bevel and the flat of a tool onto its surface slightly dubs over, and thus strengthens, the edge. I found that this machine consistently produced the sharpest, longest lasting edge of any of the systems I tested, except the simple benchstone. It is easy to use, the slow speed is not intimidating, and it requires no tool rest. It is intended to be used often while working, and is available with a foot-operated on/off switch. The beveled surface of the wheel provides clearance for tools like drawknives and its rounded perimeter can be used for stropping the inside of all but the smallest gouges. Rouge added to the leather surface will make it last longer, but the composite itself is abrasive, and as it wears, new abrasive particles are exposed. When the wheel becomes glazed over with metal particles, it can be cleaned with mineral spirits, or you can use mineral spirits to lubricate the wheel as you work. The absorbent surface and slow speed allow no spray off the edge.

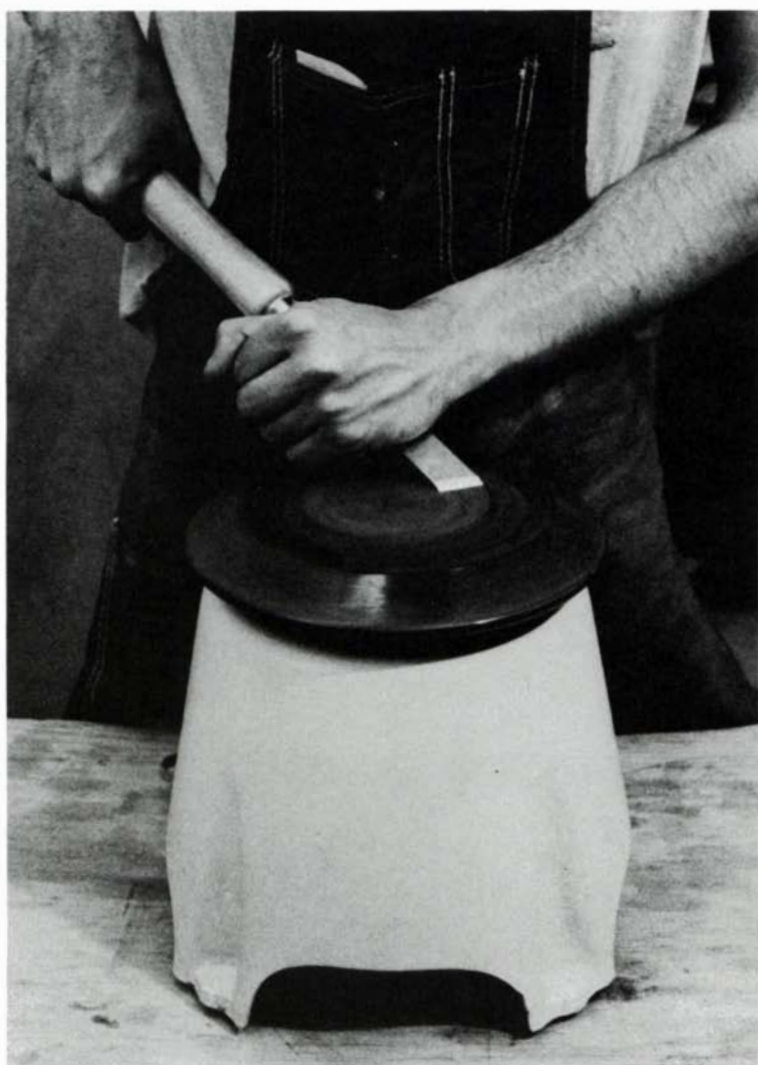
The Belsaw Power Hone, model 1019-8, sells for \$225 from Belsaw Machinery Co., Equitable Rd., Kansas City, Mo. 64141. Its 8-in. dia. plate is surfaced with 600-grit diamond dust and rotates at 120 RPM. Although this could be a good combination of grit and speed, diamond cuts much faster than other abrasives, and the machine removes metal more quickly than is appropriate for honing. Also, the surface it leaves is visibly scratched rather than polished. On the other hand, to flatten a mis-ground tool back, the plate presents a flatter surface than a stone. The Belsaw is better suited to slow-speed grinding than honing. It will not overheat the tool, though you have to acquire the knack of applying the bare minimum of lubricating fluid because there is no spray shield. The neater procedure is to wipe the spinning plate occasionally with a rag dampened in the lubricant. If the plate gets clogged, it can be cleaned with soap and water.

Benchstones—A benchstone is the most basic of sharpening equipment. I've left these for last not only because a number of the other systems ought to be used in conjunction with benchstones, but also because after all my testing, if I had to choose one and only one system to keep my tools sharp, it would be a good set of benchstones. You can remove metal with benchstones in the quantity a nicked chisel requires, admittedly with the investment of considerable time and effort. But after all, how often do you nick a chisel? In a production shop, where time is a weightier consideration, I would use a grinder, and I would choose the Mark II, but it would supplement my stones, not replace them, and most of my sharpening, especially the final edge, would be done on a stone.

I tested benchstones of four basic kinds: a combination Crystolon/India stone, a Diamond Whetstone, a Washita and hard-Arkansas, and finally a coarse and fine Japanese water-



The Makita 9820-2 is a motorized Japanese waterstone whose tool holder accommodates jointer and planer knives.



The Xenix Hone, left, is a motorized strop, using a slowly rotating plate composed of reconstituted leather mixed with rouge. The plate of the Belsaw Power Hone, above, is studded with 600-grit diamond dust.

stone. The Crystolon/India is made by Norton and sells in most hardware stores for about \$15. Both substances are made by fusing an abrasive in a ceramic matrix using an electric furnace; Crystolon is made from silicon carbide, India from aluminum oxide. The particular stone I used combined 100-grit Crystolon with 320-grit India. The Diamond Whetstone (from Diamond Machining Technology, 34 Tower St., Hudson, Mass. 01749) is also man-made though it is not really a stone. It's a perforated steel plate coated with industrial diamond dust and mounted on a plastic block. It comes in grit sizes of 325 and 600, and costs \$60 for an 8-in. by 2½-in. surface, \$34 for a 6-in. by 2-in. surface. Both the Crystolon and the Diamond Whetstone can be used for coarse shaping, as a substitute for grinding; they remove metal quickly enough. For extensive stoning of this sort I found it helpful to use a tool holder; the Eclipse honing guide available from Woodcraft Supply for \$11.15 worked well. But it did not make final honing any easier because this process involves sensitively positioning and repositioning the blade alternately on the bevel and flat side. For gross metal removal, diamond is far harder than any other substance, and so it cuts fastest. The Diamond Whetstone also has the advantage of remaining perfectly flat; it will not wear like a stone. In fact, it works very well for flattening worn conventional stones. But even with the fine-grit surface, the diamond cuts so sharply that the scratches are visible, and I could not produce a polished bevel or a very fine edge. The India produced a smoother sur-

face, but this also did not yield the best sharpened edge.

The best edges came from the Arkansas oilstones and the Japanese waterstones. My Washita and hard Arkansas cost \$20 and \$27 respectively. As is traditional, I lubricate them with a light machine oil cut with various proportions of kerosene, all of which work well. But the most effective lubricant I discovered is a product called Sharp 'N Aid (available from Cannon Valley Mfg., Rt. 1, Cashton, Wisc. 54619 for \$2.65 a bottle). It did the best job of keeping the stone from becoming clogged with metal particles. The Washita is a medium-grade hone, and yields an edge equivalent to that produced by the fine India. The hard Arkansas produces a razor-sharp edge that holds up well while cutting.

Japanese waterstones have become my favorite sharpening equipment. The ones I used are from Woodline, though they're also available from Garrett Wade. The coarse (800-grit) stone uses an aluminum-oxide abrasive and costs \$11.95; the fine (4000-grit) stone supposedly uses cerium oxide, a fine powder usually used to polish lenses, and costs \$12.95. The bonding matrix in each is a soft sort of cement that loosens in water allowing the abrasive particles to move around and re-orient themselves in relation to the tool as it moves over the stone. This action is different from that of a Western stone, where the abrasive particles are held fixed in a denser matrix. Japanese stones polish the metal as well as sharpen the edge. Also, new abrasive particles are continually being freed, so the stone cuts fast and doesn't clog. In addi-

tion to the shiny surface they produce, I prefer the touch of waterstones over oilstones. The black hard Arkansas with oil on it is slick and glassy, and you have to restrain your own movements, there's so little friction. The Japanese waterstones, although of finer grit, are more porous, and thus they feel coarser and offer a stabilizing resistance to the movement of the tool. Also, the consistency of the slurry that's formed as the tool and the stone surfaces abrade one another is controlled by the amount of water you add. At first you splash on a lot of water, and the clean stone cuts fast. As you work, you let the surface dry somewhat, and the slurry becomes a fine paste that produces a high polish. Finally you can hear the

edge getting sharp. Maybe you can hear it on an oilstone too, but it's not as distinct. The grating sound starts off dull and low and gradually rises in frequency right off the audible scale, and then you know your edge is sharp.

The other reason I like waterstones is that even if I don't thoroughly wipe my hands before returning to my work, I don't bring oily fingers to the wood. □

Rick Mastelli is associate editor of this magazine. For more on sharpening equipment and technique, see FWW #1, Winter '75, pp. 47-48; FWW #2, Spring '76, p. 54; FWW #12, Sept. '78, pp. 68-73, and FWW #29, July '81, pp. 66-73.

Two other views

I used to look wistfully at the motorized sharpening systems in tool catalogs and think that if I could afford one of these, I could sharpen my tools in less time, with less mess and bother.

The motorized Japanese waterstones seemed most attractive, as they were supposed to yield a finished edge. So I spent several hours trying to hone my chisels. These stones cut so quietly that it was hard to judge how much metal was being removed in only a few seconds. I ended up with a lot of out-of-square edges and multi-faceted bevels.

I was annoyed also by the tendency of the rotating stone to grab the tool. Maybe this was caused by minute changes in the angle of the tool on the stone, whose wet surface would grab when momentary contact was made with the full face of the bevel. But I attributed the grabbing to deposits of ground metal on the stone's surface. I tried wiping them off with a cloth which only soaked up the water and left the gunk behind. I tried wiping the stone with my fingers. This left a nice, clean surface and felt pleasantly like playing in cool mud. The cleaner stone grabbed less; when the deposits would form, I'd wipe them away with my fingers. After an hour, I felt sharp pains in my fingers and noticed blood on the tool. I was horrified to see that I'd ground off several layers of skin, down to the quick flesh. The cool abrasive slush had had an anesthetizing effect, and the damage was done before I knew it. I wore band-aids on my fingertips for several days afterward.

The motorized Japanese waterstones aren't less messy than oilstones, and are more trouble to clean up after use. Their surfaces wear fast and can easily be gouged and grooved by narrow tools. If you're used to moving your body over a stationary stone to sharpen

chisels and plane irons, you might find it awkward and difficult to hold the tool in a fixed position while the stone moves underneath it. With practice, however, you can get a nicely honed bevel, but there will be an attenuated burr at the edge, and you won't be able to remove it or to back off the tool properly on the rotating hone. I was always going back to my hard Arkansas stone to touch up the bevel, back-off the tool and remove the wire edge. Of all the sharpening systems that supposedly produced a final edge, the two from Garrett Wade worked the best, but I wouldn't trade my three oilstones for either of them.

Here's why I prefer oilstones: For every series of strokes, I first position the bevel flat on the stone, something that takes a little feeling around to do. You can't feel for this sort of thing on motorized stones, because at the moment the steel touches the abrasive surface, metal starts disappearing. In gaining speed, you sacrifice control, and the adroit touches that make the difference between sharp and razor-sharp.

—John Lively

By the end of our tests, I was satisfied that all of the machines sold as grinders will do that job, once you learn each machine's nuances and quirks. Any of them will shape a satisfactory bevel. Choosing which one to buy thus becomes a matter of pocketbook and of personal taste.

Although I've always used an ordinary high-speed grinder, I liked the motorized Japanese waterstones better because they won't burn the steel, and the abrasive-belt systems best. But at these prices I wouldn't buy either one.

Honing the bevel is another matter. I prefer to grind rarely, but to add a secondary bevel with a medium India benchstone, then to hone that secondary bevel often on a hard Arkansas oilstone. Such an edge is obtained quickly

and maintained easily, and it will pare the hair off your arm.

Only two of the test systems—the muslin buff on the Woodcraft Mark II and the Xenix Hone's leather plate—could make a ground edge sharp enough for shaving. But as we worked, I began to suspect that these buffed edges were not as durable as the secondary bevel produced by a fine oilstone. I tested my suspicion by paring a quarter-inch of wood off the ends of 1-by-2 sticks of hard maple, poplar and cherry. I used the same $\frac{3}{4}$ -in. Marples bench chisel, but I ground and rehoned it on different equipment after each bout of paring. Only the oilstoned edge remained sharp enough to continue work after paring all three sticks of wood. Neither buffed edge could complete one stick of wood before requiring a touch-up.

Squinting through a hand lens revealed why. Although buffing polishes the metal, it does not remove the scratches left by the grinder. The buffed edge is fragile, quickly becoming ragged. After a few buffs, you're back at the grinder, taking off another increment of expensive tool steel. The oilstone, on the other hand, takes all the scratches and grooves out for the whole length of the secondary bevel.

Next, I tried preparing the secondary bevel on my oilstone, then maintaining it by buffing. This time, both buffed edges lasted as long as the oilstoned edge. So the buffing wheel has a place: It's best for touching up an edge that's been ground and stoned in the old-fashioned way.

The Xenix Hone produced the sharpest edge of all, but one no more durable than the Mark II. Used in conjunction with oilstones it's a very handy strop. For a carver who must strop his gouges often, the Xenix would be ideal. But as for me, I'll stick to my cheap Sears grinder and my trusty oilstones.

—John Kelsey

Slow-Speed Sharpening

Lessening the chance of burning your tools

by Mark White

To reduce the risk of friction-caused heat drawing the temper of my tools, I designed a simple-to-make sharpening system that incorporates a vertical shaft turning slower than 300 RPM. The horizontal wheel, which allows flat grinding rather than hollow, may be a conventional grindstone or a flat wooden plate covered with an abrasive disc. For stropping, I use a crowned wooden disc covered with leather and charged with an abrasive compound.

The heart of the system, shown below left, is a laminated disc bolted to a standard pipe flange, which is in turn screwed to a short length of 1¼-in. pipe. The pipe turns in two bearings made of 4-in. by 4-in. by 9-in. chunks of hickory. I bored the holes for the bearings with an adjustable bit set to bore about ⅛ in. larger than the pipe's diameter, to compensate for swelling of the block and tightening of the hole when oiled. If you drill oversize and experience wobble in the shaft, you can cant the blocks until they bear upon the shaft. The hole in the upper block should pass entirely through it. The lower block should be drilled 1 in. short of going through, so that the shaft has a full inch of wood to rest on as it turns.

To make the pulley, I bandsawed two 14-in. discs and one 12-in. disc from

⅝-in. plywood. I marked and drilled the centers of these discs to take a ⅜-in. bolt and used these center holes to position the discs during glue-up, sandwiching the smaller disc between the two larger ones.

Next I lag-bolted the bearing blocks to the front edge of my workbench, lubricated them with chainsaw oil and inserted the pipe with pipe flange. I positioned the laminated pulley on top of the flange, and marked, drilled and bolted it in place.

The vertical-shaft motor I took from a junked washing machine. I mounted the motor on the workbench, hooked it up to the pulley and let it run for about 30 minutes in order to wear in the hickory bearings. The face of the flange did not run perpendicular to the axis of rotation, but a bit of fiddling with a couple of cardboard shims between the pulley and the flange leveled the disc.

A conventional grindstone could be mounted right on the pulley, but I chose to use my system for stropping. I stacked and glued a few more plywood discs to the top of the pulley, switched on the motor and turned the head with a sharp gouge to a rounded, conical shape. (Leather yields under pressure, and if the leather were applied to a flat surface, a tool pressed to the leather

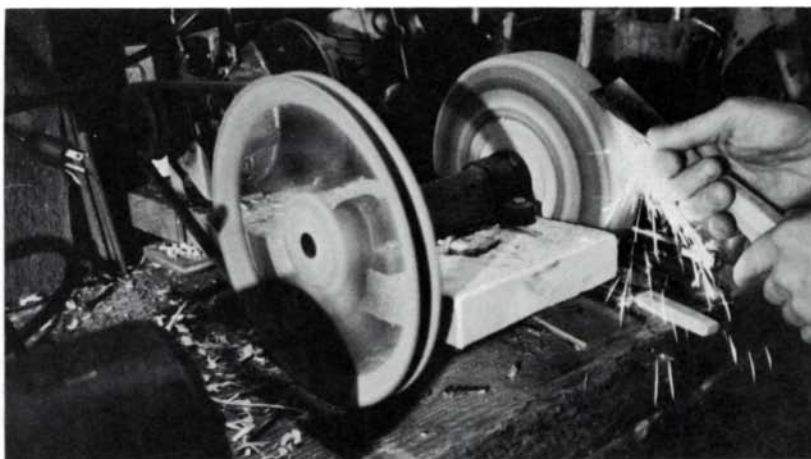
would sink in and the tool bevel would become convex.) Sanding completed the shaping of the head, and a heavy coat of paint sealed the wood. From a local leather shop I picked up a piece of ⅜-in. thick shoe-sole leather, soaked it in hot water and molded it in place over the head. A nut and washer hold the leather in the center, and a ring of aluminum tacks holds down the perimeter. The leather can be charged with various grits of aluminum-oxide buffing compound; the distance you hold the tool from the center of the disc also affects the speed of the sharpening action. Because the head is crowned slightly, wide-edge tools are easier to sharpen. Attention can be concentrated on a small section of the edge, while the ends clear the perimeter and hub of the wheel. Always hold the tool on the plate so the rotation is away from the cutting edge; otherwise the tool can grab and cut the leather.

The system can be varied to incorporate a large flexible sanding disc which, if run at 800 RPM would be useful for sharpening axes, adzes and drawknives. A reversible motor would be useful for knives and other two-edge tools. □

Mark White teaches woodworking in Kodiak, Alaska.



White's horizontal sharpening system, which rotates at only 300 RPM, can be fit with a grindstone, an abrasive disc or a leather-covered stropping wheel. An old washing-machine motor provides power.



Another of White's slow-speed sharpening arrangements has a 2-in. by 9-in. aluminum-oxide wheel on a ¾-in. mandrel powered by a 1,725-RPM motor. A 3-in. pulley at the motor and a 10-in. pulley at the mandrel yield a grindstone speed of about 500 RPM, fast enough to remove metal with reduced risk of burning the tool.

Fixtures for Steambending

Adjustable end-stop and versatile table control breakage, springback

by Michael C. Fortune

Steambending allows me to work with simply curved pieces of wood that I can shape and blend together. Most of the curves I bend happen in one plane and are not exercises in pushing the limits of the process; most of my jobs are multiples, like sets of dining chairs. The trouble with steambending is the inconsistent and unpredictable results—breakage during the bending and springback afterward.

Since I cannot afford to cut extra blanks in anticipation of rejects, I've had to devise techniques that will ensure uniform results. I also required a high degree of design flexibility, a reasonable rate of productivity, quick set-up time and easy operation by one person, and low capital investment. The system I'll describe is based upon an adjustable end-stop that's attached to the usual steel back-up strap, and a special clamping table to which I can bolt a variety of bending forms.

When I've worked out a design, an integral part of my sequence for building the object is making a complete technical drawing. For steambending, this provides the length of the blanks to be bent, their cross-sectional dimensions so that I am sure of having enough material to shape and carve around joints, the joinery details and index points for the machine jigs I use, and the size and shape of the bending form itself. The way I work, it is not practical to guess about springback, nor to accommodate each part individually, nor to discard parts that do not match. In some cases, the grain in a bending blank is part of a visual composition and could not be substituted without sacrificing other components as well.

Immersing a straight piece of wood in hot steam plasticizes its fibers. When the steamed wood is bent, the fibers on the inside of the curve are compressed while those on the outside must stretch. Since the wood is much stronger in compression than in tension, a steel back-up strap with fixed end-stops is commonly used to restrain the length of the blank, thus shifting most of the stress into compression. If the strap is too loose, tension failure is the likely result—the wood fibers on the convex side of the bend stretch until they break. If the strap is too tight, the fibers on the inside of the curve may wrinkle and buckle, called compression failure.

In my early experiments, using fixed end-stops on the back-up strap, I got a few pieces of furniture and a large pile of rejected parts. Although I had machined all the blanks to the same length, some of the rejects failed in compression, while others failed in tension. I attributed these inconsistent results to the strap's having stretched during repeated use, and to my having used kiln-dried wood, which could have had such baked-in defects as casehardening or surface checking. The steaming time was also marginally inconsistent, since I put several pieces into the steam box at once, then used them one at a time. Eccentricities that grow into most

pieces of wood also contributed to these inconsistent results.

To control these variables, I discarded the fixed end-stops for an adjustable end-fixture that could respond to each blank as the bend progressed. Also, I now use only air-dried wood, which in Ontario ranges in moisture content from 12% to 20% out-of-doors. Since severe bends may require more moisture, say 25% M.C., I may pre-steam the blank for an hour and let it sit in the steam box for a day before bending. I've successfully bent white oak, black walnut, cherry, ash and red oak, but the bending stock must be high quality, straight and free of defects.

Adjustable end-stop—The end-stops on the steel strap are subjected to considerable force as they compress the wood fibers around the bend. The end-stop must accommodate this force. The ones I am now using are shown in figure 1, on the next page, and an earlier version of the adjustable end-stop is shown in the photo. The principal material in both is $\frac{1}{4}$ -in. and $\frac{3}{8}$ -in. by 2-in. bars of hot-rolled mild steel. My current version is welded from three thicknesses of bar. The adjustable end-stop fixture is not welded to the strap, but is detachable, so it can be mounted on straps that range from 1 in. to 6 in. wide according to the stock to be bent. The bottom of the fixture includes a 45° step that interlocks with a 45° step on the bending strap. A machine screw holds the fixture in place but does not receive any lateral force; if it did, it would quickly shear off. The adjusting thread is $\frac{3}{8}$ -11 N.C. running through a coupling nut about 2 in. long. The end-stop itself is made of $\frac{1}{4}$ -in. or $\frac{3}{8}$ -in. angle iron with a short length of black iron pipe welded onto it. The pipe both locates the stop on the threaded rod and reinforces the angle iron. I generally make the stop 2 in. wide, but I add a steel reinforcing plate to the working face of the angle to make it larger than the end of the stock I am bending.

The strap is $\frac{1}{16}$ -in. steel, wide or wider than the stock, and able to take a bend without kinking. Holes are drilled $\frac{3}{8}$ in. or $\frac{1}{2}$ in. in diameter on 4-in. centers down the length of the strap, so its overall length can be grossly adjusted by the location of the fixed, hardwood end-stop, which is bolted on. Two holes are drilled through the end-stop for this purpose, with about 1½ in. overhanging on the end that faces the stock and 3 in. on the other end.

Bending table—I used to bend steamed wood around a form clamped to my workbench. To gain mechanical advantage, I attached levers to the end-stop and back-up strap assembly. My body weight was the main force, plus anyone willing to hang on for 15 minutes until the bent part could be removed and clamped to a drying jig. I needed a better way.

The versatile cast-iron table with square holes that welders use seemed appropriate. With this in mind, I fabricated a plywood table 4 ft. by 5 ft. by 3 in. thick to which I could

Michael Fortune, 29, designs and makes furniture in Toronto, Ont. He has also taught at Sheridan College.

Fig. 1: Steambending fixture

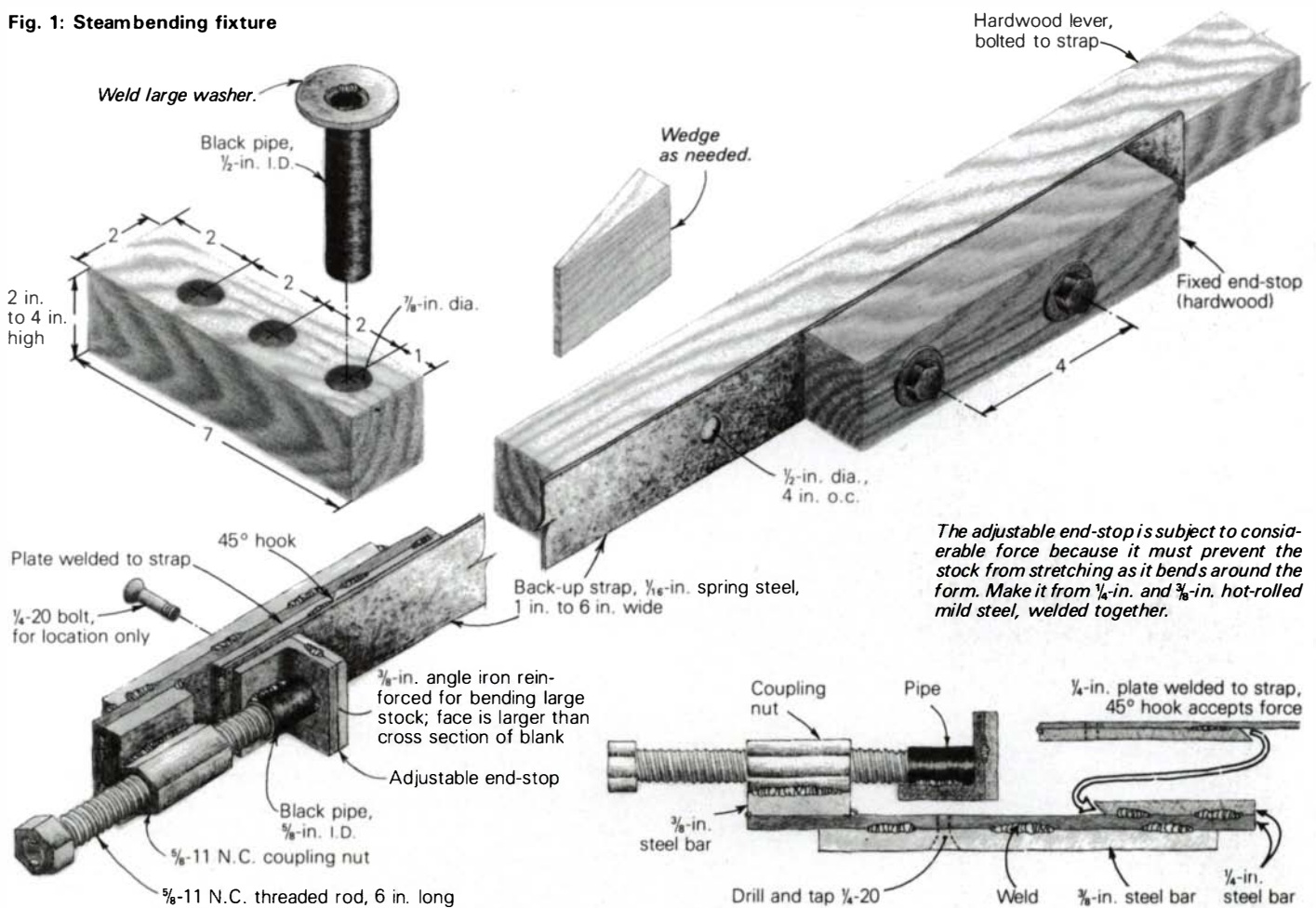
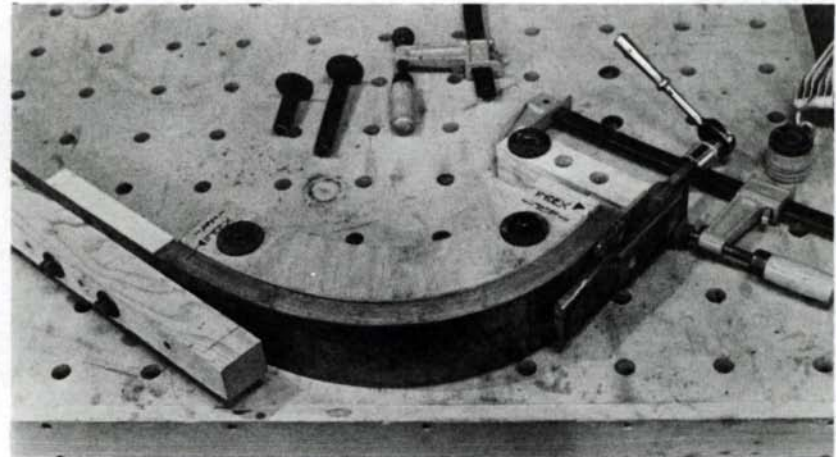
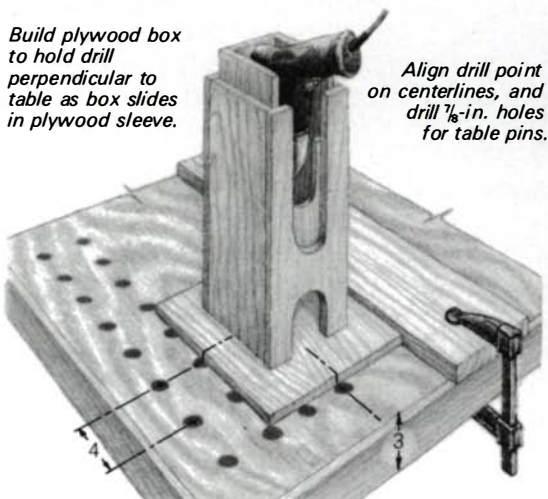


Fig. 2: Drilling jig



Bend has been levered from fixed-stop end, left, by block and tackle (not visible); adjustable end-stop is clamped to block at right, which is attached to the table by one pin. Strap and stops pivot away from the form for easy insertion and removal of stock.

fasten bending forms. My table was laminated from four sheets of 3/4-in. plywood, hardwood ply for the faces and floor sheathing for the core. Not having a veneer press, I laminated the sheets one at a time, using wood screws to provide clamping pressure. I removed the screws before adding the next layer, so I could drill holes anywhere in the table without hitting embedded hardware. For design flexibility, I drilled a regular pattern of 7/8-in. holes through the table, and holes in my bending forms and adjustable end-stop fixture. These accommodate short lengths of iron pipe, 1/2-in. I.D., which act as locating pins. They can handle the substantial shear forces of the bending process and have a large washer welded to the top for easy insertion and removal. Half-inch bolts pass

through the table pins to secure the bending forms and adjustable end-stop fixture to the table.

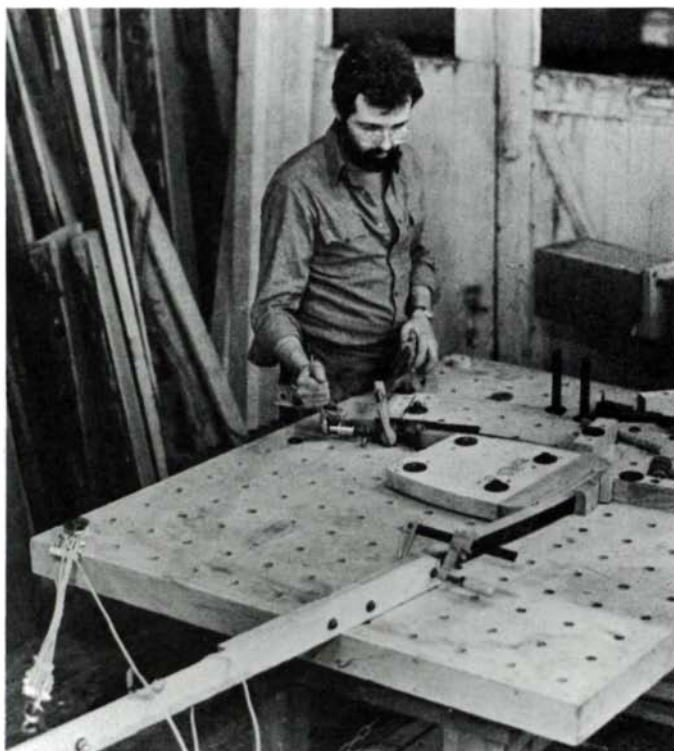
To drill perfectly perpendicular 7/8-in. holes through the large table, I constructed a tight-fitting box around a 1/2-in. hand drill. It slips into a sleeve mounted on a square of plywood, as shown in figure 2.

The pattern of holes eliminates the need for large, reinforced bending forms, because most forms can be bolted to the table at several points. I prefer plywood forms, as the less dense core of particleboard will crush after repeated use. I cut the inside shape of the form parallel to its face so that clamps can be applied wherever they might be required.

The photo, above, shows how I mount the assembly. Note



Above, Fortune begins to pull in the block and tackle for the first bend of a chair seat. The stock is first steamed in the plywood box in the background; steam is generated by a salvaged boiler containing a 4.5-kilowatt immersion heater. Below, with the first corner turned, Fortune slackens off the adjustable end-stop before levering the wood around the second bend.



Walnut dining chair, one of a set of eight with dining table, has steambent arms and rear legs, laminated back slats.

David Allen

that the adjustable end-stop is at the starting point of the bend, and the fixed stop is at the free end of the blank. The adjustable end-stop is clamped to a wooden block, which in turn is located on the table by a table pin and a bolt. This arrangement allows the strap with both end-stops to pivot away from the form for quick installation of the heated blank, and easy removal of the bent piece. Index marks can be made on the form and transferred to the bent piece for later reference when machining joints. A dozen wooden clamping blocks, drilled with $\frac{7}{8}$ -in. holes, will come in handy, as they can be bolted down anywhere and wedged against the bent blank.

The final piece of the assembly is a lever bolted to the back of the bending strap at the wooden fixed-stop end. It provides mechanical advantage and supports the blank, which otherwise might compress locally or overturn off the strap. The lever reaches several inches beyond the stop toward the blank (see figure 1). It can be clamped to the blank here if trouble starts to develop, then the clamp removed when the blank is bent close to the form. A block and tackle can be attached to the lever at its far end, for additional leverage. This can be tied off in mid-bend, freeing the operator to adjust the end-fixture or to place clamps. A marine hardware spring-loaded cinch would be useful here too.

The bending process—Before bending, make sure that all forms, fixtures and clamps are in place. Set the steamed blank (steam an hour for every 1 in. of thickness) in the strap, making sure it's in line with the strap and with both end-stops. Tighten the threaded rod on the adjustable end-fixture. I use a ratchet, tightening until it's secure, then giving it another half-turn. This should flatten any kinks out of the strap.

The photos at left show a U-shaped bend around a chair-seat form. The first curve and first corner can be bent without backing off the adjustable fixture. However, upon approaching the second corner, the straight portion of the blank will start to arch away from the strap or to deform in an S-shape. I loosen the fixture just enough to relieve the excessive compression forces that have built up. The second bend can then be made.

I've found that springback can be minimized by leaving the bent part to cool on the form for 15 minutes, bathed in a slow stream of compressed air. Then it's quickly transferred to a setting jig of the same shape as the form before it has time to spring back. It is clamped there, and left for a week or preferably two weeks. The setting jig should be wide enough to accommodate all the parts being bent; clamps spanning the bend will maintain the distance between the ends of the blanks but do not help to maintain the shape. I accommodate the setting time by proceeding with other parts of the job according to my drawings.

It's important to allow the bent fibers to relax, and the wood to reach moisture equilibrium with the atmosphere. Since pieces may come out of the strap at 20% moisture content or higher (for severe bends), they must dry slowly, else they'll check. This problem is acute when bending red and white oak. I cover the setting jig with a blanket to restrict air flow for a few days, and this seems to control the problem. □

Further Reading

"Steam Bending," W.A. Keyser, *FWW* #8, Fall '77, pp. 40-45.
 "Michael Thonet," John Dunnigan, *FWW* #21, Jan. '80, pp. 38-45.
Wood Bending Handbook, W.C. Stevens and N. Turner. Woodcraft Supply, 313 Montvale Ave., Woburn, Mass. 01888, \$9.35, 110 pp.

Bending with Ammonia

by Bill Keenan

Consider the possibilities if wood were as pliable as leather. Form could be added to the beauty of wood without having to use subtractive methods of shaping. With this in mind, Huff Wesler, at the University of Wisconsin's Art Department, has experimented with wood that is plasticized by immersion in gaseous anhydrous ammonia. After exposure to the ammonia, wood can readily be coaxed into fantastic forms.

The underlying principle of this process is not hard to understand. A solvent applied to the wood diffuses into the cell-wall structure. The bonds that clamp the wood's microscopic components together are disassembled. The wood becomes flexible, and when bending force is applied the components are physically displaced. As the solvent diffuses out of the wood, these microscopic cell components bond together in their new positions. The piece regains its rigidity in the new shape, like hair after a permanent-wave treatment.

Steam has traditionally been used to soften wood, but ammonia plasticizes the fibers more quickly and more completely; yet ammonia is not so strong that it will dissolve cell tissue as might a stronger solvent. Only the cell components are separated, allowing movement with minimal bending stresses.

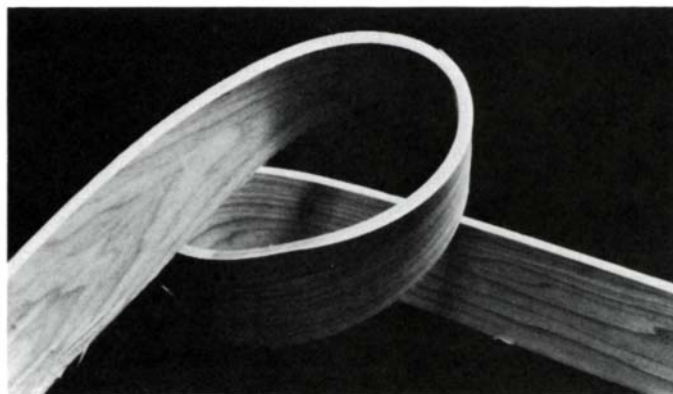
The process Wesler uses derives from research conducted over the past 15 years at Syracuse University, and commercial applications of it are covered by a number of U.S. patents. It's important to note that anhydrous ammonia (anhydrous means without water) is chemically pure NH_3 , whereas household ammonia is a dilute solution of ammonia gas in water. Experiments with household ammonia will not bend wood.

Ammonia vapors are extremely dangerous to the eyes and lungs, and this process releases quantities of these noxious fumes. A fume hood and goggles are essential parts of the apparatus. The original Syracuse experiments were conducted atop a tall building, where strong winds carried the fumes away. Despite the awful vapors, Wesler believes the process holds real potential for the craftsman and sculptor.

He built a treatment chamber (see drawing at right) for introducing ammonia into wood; using parts acquired from ordinary plumbing suppliers and stainless-steel fittings from dairy suppliers, he spent under \$1,000. The unit was welded together to withstand a pressure of 800 PSI as a safety measure. Pure, anhydrous ammonia at room temperature and at approximately 130 PSI pressure is used in the chamber.

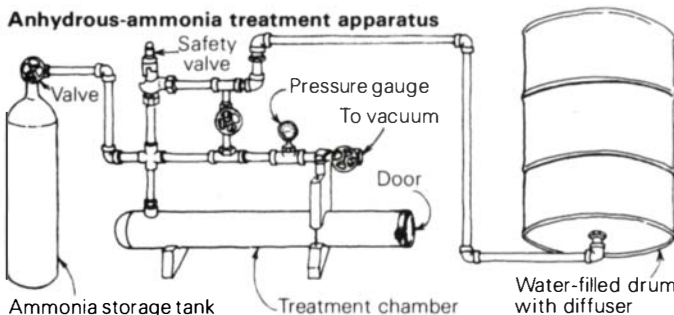
The first step in treatment is selecting the right piece of wood. In general, woods good for steambending are also good for ammonia bending. Certain species work better than others; oak works well whereas maple does not. Bending stock should be straight-grained and flatsawn. Surface irregularities and such defects as knots should be avoided, because they tend to concentrate stress. Moisture content of the wood is also important. Wesler prepares his bending stock in a plastic enclosure into which moist heat is fed, like a steam room. The stock stays there for about a month, until its moisture content is raised to an optimal 20%.

The rest is simple. In a demonstration, Wesler places a $\frac{1}{4}$ -in. thick hickory board in the treatment chamber and exposes it to the gaseous ammonia for about 45 minutes. Exposure time varies according to thickness and species of wood. Generally, an hour per $\frac{1}{4}$ -in. thickness is adequate. When he



Bill Keenan

After plasticizing in anhydrous ammonia, the $\frac{1}{4}$ -in. stock above was easily bent into a pretzel shape.



removes the piece, it's soft and ready to be shaped. Watching the piece being twisted into a pretzel shape reminds me of the delight I got as a child from watching a chicken bone that had been rubberized in a pressure cooker and was being flexed back and forth.

The bending rate can mean the difference between success and failure. If the piece crumples or kinks along its concave face, bending should be halted for about 30 seconds to allow the wood to flow. But there is also a time constraint, as the wood will begin to stiffen in about 15 minutes.

Ammonia-treated wood requires significantly less force to bend than steam-treated wood. Pieces $\frac{1}{4}$ in. thick can be bent by hand and then restrained by taping or clamping. There are other methods of bending, such as form bending, for which a mold is required. A pipe makes an excellent form for a helix or circle. Thicker pieces require a bending strap.

Once the bending is completed, the piece is dried until it reaches equilibrium with surrounding humidity conditions. A temperature and humidity-controlled drying room is best, but air-drying works well too. Warping and distortion can be controlled by leaving restraints on the piece until it is dry. This may take from hours to weeks, depending on the size and type of wood, and on the drying conditions.

Following exposure to ammonia, wood is changed in several ways. It is often denser and harder than before, a condition you can augment by compressing the wood while it is still soft. The color of the wood usually darkens slightly, but this can be an asset, as some plain woods come to life. Color change can be prevented with a sulfur-dioxide pretreatment.

There are a lot of variables involved in plasticizing wood, but the results are worth the trouble. The ease with which ammonia-treated wood can be bent, molded, embossed, densified or any combination of these processes offers a new horizon for the wood craftsman.

Bill Keenan is a woodworker and forester in Milwaukee, Wisc.

Round-Top Table

A piece that's subtle and direct

by Kenneth Rower

Here is a table capable of extensive variation in the shape of the legs, treatment of rails and outline of the top. It is straightforwardly built since all the joints are the same and the parts of the square frame are in two groups of four copies each. By altering the length of two rails, it is readily adaptable to rectangular or oval forms, and a rectangular section could be used for the legs. The top is quickly detachable via a locking system of dovetail pins cut on the leg tops and housings cut into the underside of the top.

The example shown here is in Georgia pine, with tapered, chamfered legs, chamfered rails and a 48-in. dia. top. The marriage of round top and square frame is not entirely serene, the difficulty being to make the frame large enough to seem right when viewed straight on, yet small enough not to seem bulky when viewed from a corner. The ideal stock for legs and rails is rift-cut, so that the grain is the same on all faces. A certain amount of heart figure can be included near the upper edges of the rails where it will be obscured by the overhang of the top. But do take the legs from near the edges of a flatsawn plank where the end grain shows the rings at about 45° to the face of the piece.

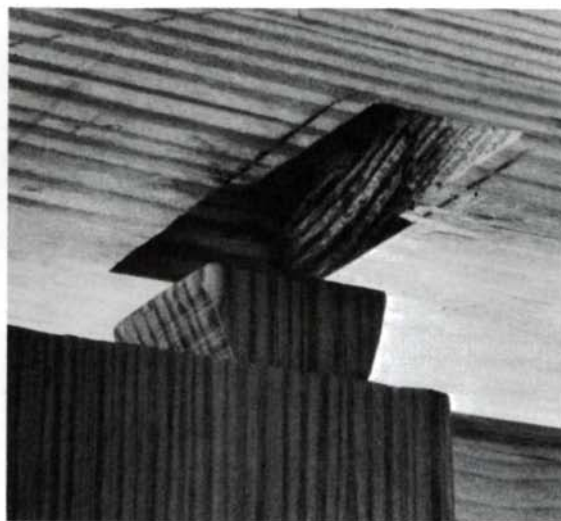
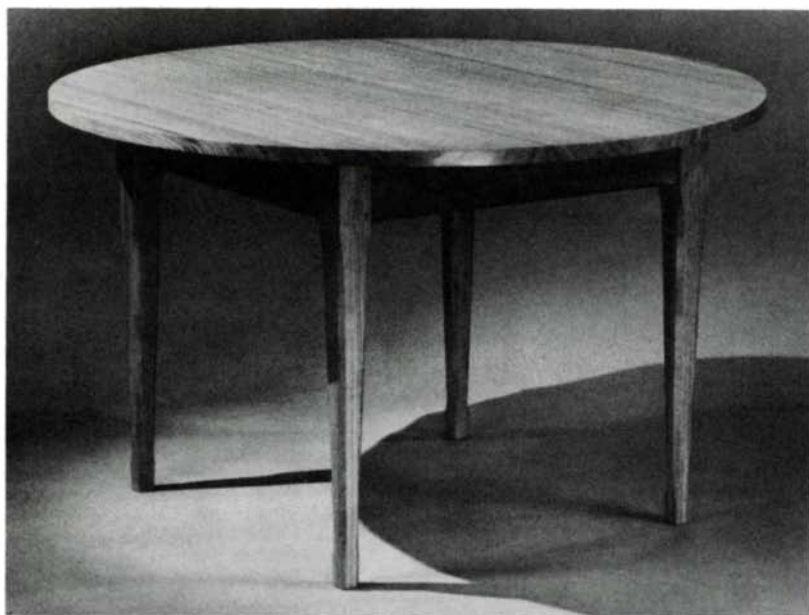
The thickness of the top should be less than half the thickness of the legs, but somewhere above two-fifths. Many arrangements are possible for the boards in the top. One good plan is to start with a long, thick plank and resaw all the pieces required, and then arrange them in a balanced pattern. Another approach is to use a fairly wide, flatsawn piece in the middle and build out to the edges with rift-sawn and quarter-sawn pieces. Given random stock, it is best to order the pieces to minimize discontinuities at the joints. There is normally no purpose in alternating heart and bark faces of the

boards except to gain a flowing appearance at the ends. Once glued up, the top is likely to curl upward at the edges regardless of the way the boards are laid. What counts most in the end is the appearance of the surface.

To make a top round by hand requires a compass or other coarse handsaw, a heavy spokeshave and an adjustable circular plane. Lay out the circle with a trammel. Saw away most of the waste, then set the top on edge in a bench vise, and work to the line with spokeshave and circular plane, exercising caution on the changing grain between quadrants. The goal is to achieve a fair curve kept pretty square to the top, free of perceptible irregularities. Some tearing is likely, and the edge will need to be sanded with paper wrapped around a thin, flexible stick about 6 in. long.

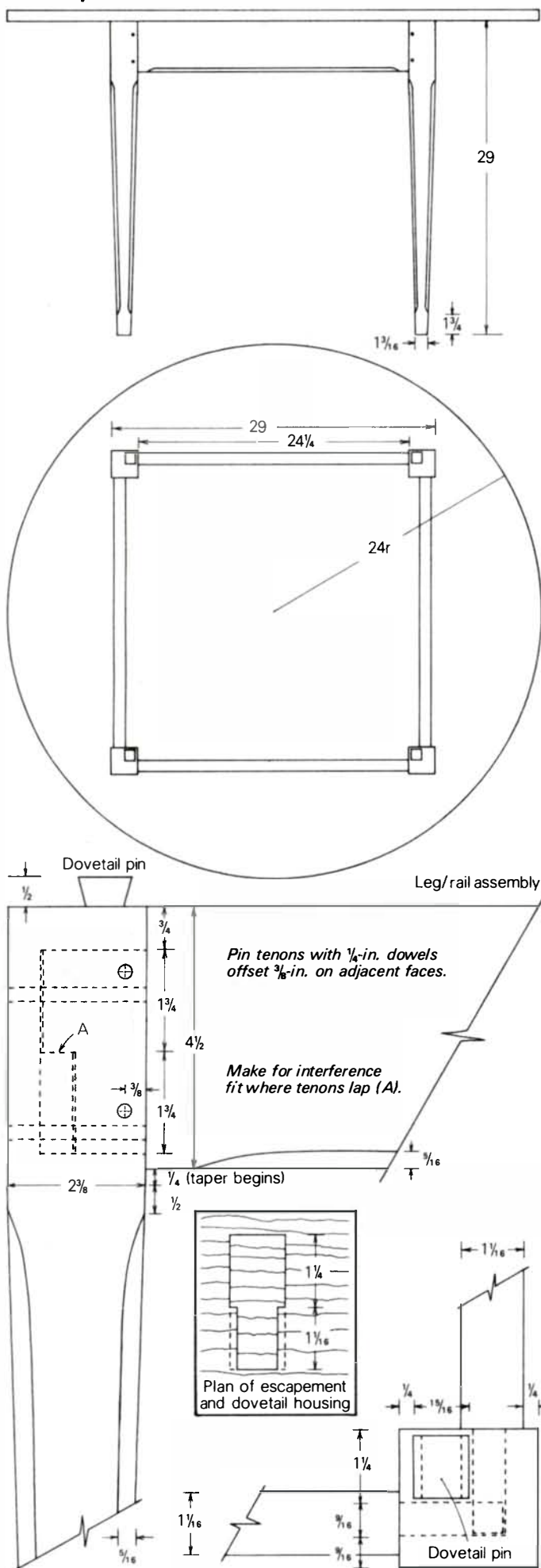
Frame size derives from the diameter of the top. A ratio of about five to eight is satisfactory if the top is round, but the frame would be somewhat larger under a square top because of the prominent overhang at the corners. Rectangular tops permit considerable variation in overhang without straining the eye. Comfortable rail depth for a table 29 in. high is about 4½ in. The leg section should be between 1¾ in. and 2½ in., assuming a thickness for the top from ¾ in. to 1¼ in.

Tenon thickness accords with leg section and the chosen system of mortising the legs. In this design, mortises are cut equal distances in from the leg faces and open into one another at the back. For tables of ordinary size the tenons should be ½ in. to ¾ in. thick. Rail thickness, in turn, depends further on the style of the frame. If the rails are to be set flush to the legs, they must be twice as thick as the tenon in order to yield an equal amount of stock in the outer wall of the mortise. But if the rails are set in ¼ in. to create a strong



Close attention to joinery, proportion and grain orientation can make the difference between success and failure in the simple design of the table at left. Removable top is secured by dovetail pins, above, which are engaged in housings.

Round-top table



shadow at the joint, they can be thinner by that amount, or the extra wood can be cut away to form an inner shoulder, certainly desirable in the absence of corner blocks. In any case, the mortises should not be cut closer than $\frac{3}{4}$ in. to the top of the leg, and it is good practice to reduce the mortise a little at the other end, allowing a small shoulder at the bottom of the tenon to conceal any bruising or shrinkage.

Tenons may be haunched or not, according to one's opinion of the relative importance of maintaining the integrity of the mortise, compared with keeping the rail flat and increasing the withdrawal resistance of the tenon. The latter is perhaps more definitely achieved by a pair of tight pins fitted across the joint close to the shoulders. But in the case of a frame with rails flush to the legs and not pinned, haunched tenons are well justified.

Taper in the legs may be scant or bold, inner faces only or all faces. The legs shown here are boldly tapered all faces, each face being reduced by half from a point a little below the joint to the bottom of the leg. This is a satisfactory proportion if the legs are to be chamfered. If they are to be left plain, it is better to use scant taper of about $\frac{1}{2}$ in. for the inner faces, or $\frac{1}{4}$ in. on all faces. It may be that tapered legs yield a more durable frame than straight legs, since tapered legs are more flexible, and strains at the feet are distributed near the leg bottoms, rather than communicated fully to the joints.

Tapers and chamfers on the legs, and chamfers on the rails, should be cut after the joints are fitted and little further handling will be required. Stop chamfers can be cut with the drawknife (bevel down), and finished with rapid, firm strokes of the spokeshave. Entrances may need to be corrected with a sharp chisel. Tearing is a frequent danger. Lay out chamfers in pencil, because scribed lines cannot be removed without broadening the chamfer.

The construction of the frame does not preclude the use of turned or specially shaved legs, as long as the inner faces of the legs are flat and square in the area of the joints.

To assemble the frame, join two legs and their rail, repeat with the other legs and their rail and then join the assemblies to each other with the remaining rails. If there is plenty of friction when the joints are tested dry, glue only the first inch or so of the tenon nearest the shoulders since any glue at the back of the mortise will cause trouble if the leg shrinks.

The fastening system between frame and top consists of four dovetail pins cut on the tops of the legs and four housings with escapements cut in the underside of the tabletop. The method for cutting these is described in *FWW* #20, Jan. '80, p. 57. When cutting out the legs, leave stock at the top ends for the pins, which should be sawn after the legs are mortised but before the frame is assembled. This fastening system will not interfere with seasonal movement of the top, but when the top shrinks or swells in width, two of the pins will remain partly engaged when the top is slid over to unlock, and you can damage the pins when removing the top. The simplest solution is to lengthen the escapements away from their housings, those on one side accounting for expansion, those on the other for contraction. This method of joining top to frame offers no advantage of strength over the customary use of screws between rails and top. But it does allow quick removal of the top, and it satisfies a certain notion of pure construction. □

Kenneth Rower makes furniture in Newbury, Vt.

Routing Mortises

A simple fixture and the right router

by Tage Frid

A mortising machine is an important piece of equipment, and in a cabinet shop with several workers one might be a good investment. Whatever kind you buy, a chain-saw or a hollow-chisel mortiser or a long-hole boring machine, you can expect to pay a lot for it, \$2,000 or more. But by building a simple fixture for holding the stock to cut the mortises with a plunge router, you can have a mortising setup that works just as well as an expensive machine. The cost is only about \$350, and you'll have acquired a heavy-duty router for general shop use.

Two makes of plunge-type routers are sold in the United States—The Stanley (models 90303 and 90105) and the Makita (model 3600 B). The Stanley plunge-base routers are production tools specifically designed for rough cut-out work, like cutting out holes in countertops for kitchen sinks or lavatories. They plunge to a set depth and lock automatically, but can't be locked at any depth in between. Stanley, by the way, has recently sold its power tool division to Bosch Power Tool Corp. (PO Box 2217, New Bern, N.C. 28560), although the tools will still be sold under the Stanley label for the next two years. The Makita router is similar in design to the Elu router, which is a popular tool in Europe but isn't sold in this country

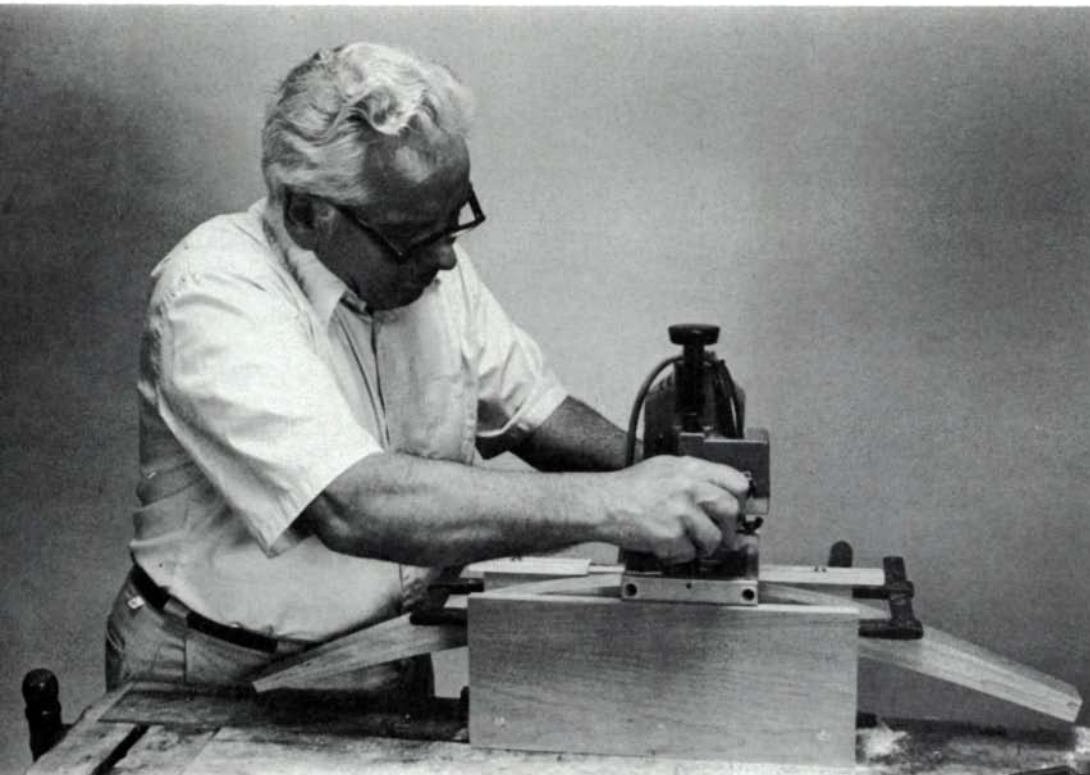
because it has a 220v, 50-Hz. motor, and would burn out if plugged into an American outlet.

Several things about the Makita model 3600 B make it a good router for mortising. It's a plunge-type router with a 2¼-HP motor. The body (motor/spindle assembly) is attached to a rectangular base by two ⅞-in. dia. steel posts. These fit into sleeves in the body, which can slide up and down on the posts (against spring tension), and be locked at any height. Plunge routing lets you begin and end a cut in the middle of a piece of stock without having to lower or lift the base from the work. With the motor running you can lower the bit into the wood by pushing down on the router's handles.

The Makita is pretty heavy (11 lb.) and well designed. The switch can be worked without having to move your hand from the handle, but it's not located right on the handle where you might turn it on accidentally when picking up the router. The body is locked on the posts by a latching lever instead of a knob, and you can reach this lever to raise or lower the bit without having to take your hand off the handle. An adjustable knob on the top stops the upward travel and also controls the depth of cut for ordinary routing.

For plunge routing there are two depth stops that let you

For cutting clean, precise mortises quickly, Frid uses a Makita plunge router with an easy-to-build fixture (below, left) for holding the stock and guiding the tool. Using appropriately sized or contoured supports, almost any piece of stock, like the curved chair back shown here, can be mortised in this fixture. At right, Frid tightens one end stop, which, along with the other, will limit the travel of the router and determine the length of the mortise.



remove stock in two passes rather than in one, and the stop rod is capable of both fast and fine adjustment. You can also control the depth of cut when plunge routing without using the stops. Just turn on the router, release the lock lever, push the bit down to the desired depth and lock it. The fence is secured with only one wing nut and is easy to set. The Makita router comes with $\frac{1}{4}$ -in. and $\frac{3}{8}$ -in. adapter sleeves for its $\frac{1}{2}$ -in. collet, so you can use different bit sizes and cut mortises of almost any width and up to $2\frac{3}{8}$ in. deep. By turning the stock over you can produce a through mortise up to $4\frac{3}{4}$ in. deep. The weight of the machine makes it stable while running and helps give you a smooth cut. You might find that the posts bind in the sleeves if you try plunging the router when the motor is not running. But when the motor is on, the vibration allows the body to move smoothly up and down on the posts.

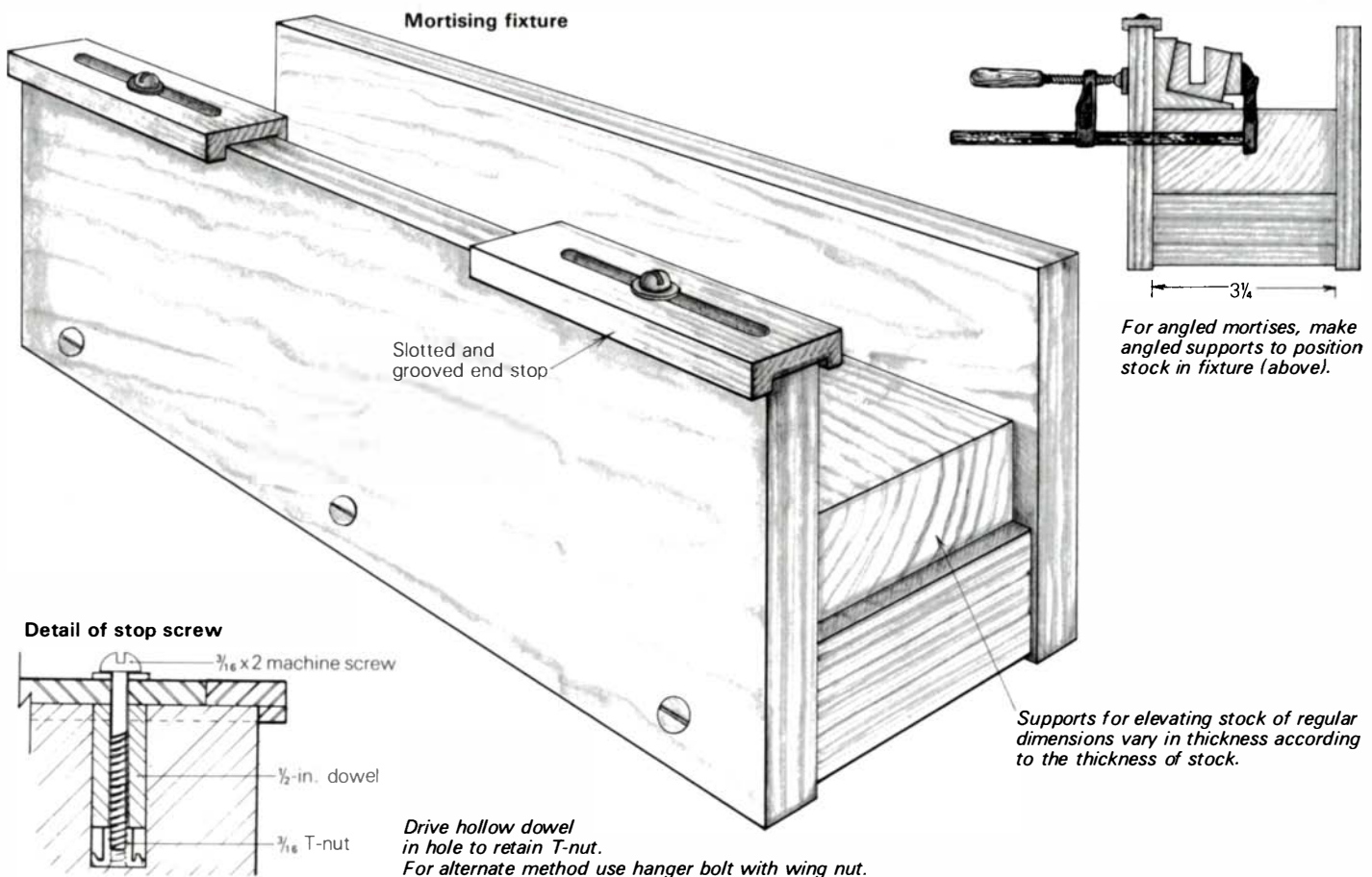
The mortising fixture I made looks like a big miter box. Its length and depth can be varied to suit your needs, but for general use it should be 20 in. to 36 in. long and about 4 in. deep. This will let you mortise everything from chair legs to bedposts. Regardless of the length, the inside width of the fixture should not be more than $3\frac{1}{4}$ in., or else the router base will not rest on both side pieces. Make the bottom of the fixture from two pieces of $\frac{3}{4}$ -in. plywood. It needs to be thick to give the sides of the box a large gluing surface and to hold them stiff with a minimum of flex. The edges of the bottom piece must be a true 90° to the face, or the sides will not be perpendicular and your mortises will be askew to the face of your stock. When gluing up, be sure the bottom edges of each side are flush with the bottom of the base. Locating pins will help hold the sides in alignment when tightening the clamps. Solid wood could warp, so you might want to make the sides from $\frac{3}{4}$ -in. plywood with solid lipping on the upper

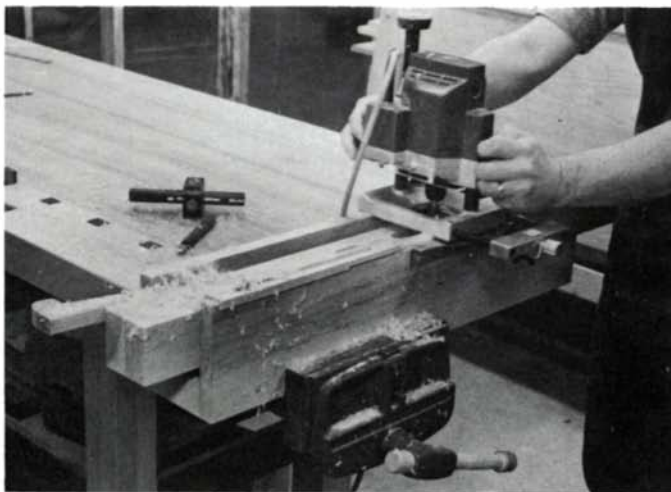
edges where the router base rubs. When the glue is dry, check the two upper edges with a square; they must be perfectly parallel. If they are not, take light passes on the jointer until the edges are square and parallel, or use a hand plane to do the same thing.

You need to install lateral end stops on the top edge of the inboard side of the fixture. The two stops are slotted strips of wood with shallow grooves on their bottoms to fit over and ride along the edge. The slot in each strip rides around a $\frac{3}{16}$ -in. stove bolt which engages a T-nut embedded in the side. A barrel nut would prove even more durable and easier to install. Also, you could drill pilot holes in the upper edge of the inboard side for hanger bolts; use wing nuts with these to tighten down on the stops.

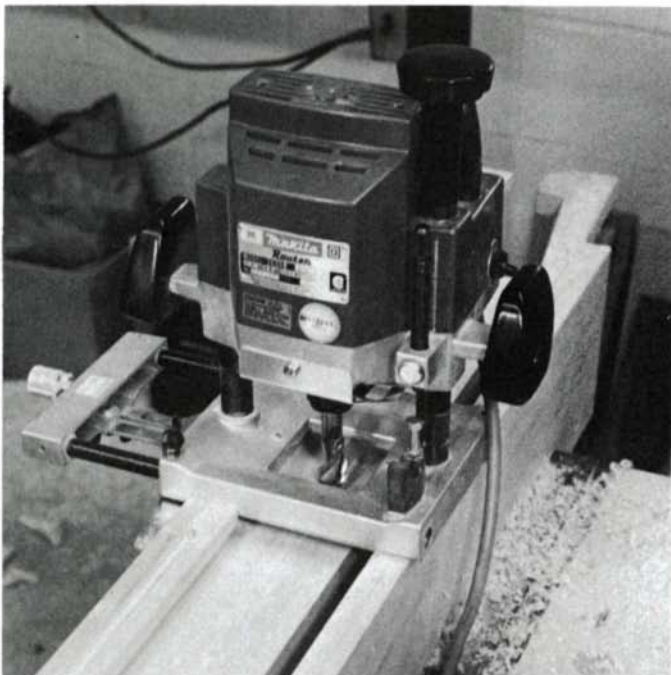
To cut the mortises in a piece of regular dimensions—a straight table leg, for example—raise the workpiece in the fixture so it's almost flush with the top edge. Center the area to be mortised in the middle of the fixture and clamp it to the inboard side. Set the stops on both ends to contact the router base so the bit can travel the full length of the mortise in one pass. With the fixture held in a vise, set the fence on the router the right distance from the bit and butt the base against the left-hand stop. Switch on the power, release the lock lever and lower the bit into the wood. For a $\frac{3}{8}$ -in. bit, a $\frac{1}{4}$ -in. depth of cut would be safe. Then pull the router to the right. Don't start at the right-hand stop and push the router to the left. By pulling the router left to right, the rotation of the bit will hold the fence against the side of the fixture, which will give you a good, straight cut.

During routing, dust and shavings can get compacted on the ends of the stops where the router base makes contact. If you don't keep this debris cleaned off, your mortise will get

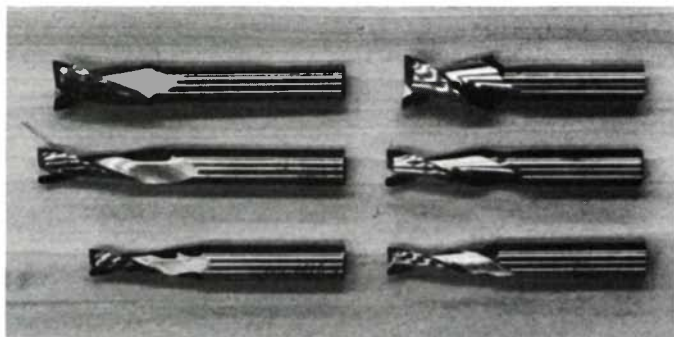




The fixture shown here was made especially long for mortising bedposts. The stock is held in place by a wedge at either end, and the lateral end stops are set to limit the length of the mortise. By making a full plunge cut at the extreme ends of the mortise and routing out the waste between with a series of shallow passes, mortising proceeds with speed and precision.



Equipped with a spiral end mill, the Makita model 3600B router is an excellent tool for mortising. But its powerful motor and square base make it also well suited for clamping upside down in the tail vise of your bench, where with the proper fence it becomes a spindle shaper.



These two-flute spiral end mills were designed especially for routing wood. Bits with cutting diameters of $\frac{1}{2}$ in. or more can cut as deep as the bit will plunge, but bits with cutting diameters smaller than $\frac{1}{2}$ in. are limited in their depths of cut by the diameter of the shank. The bits on the right in $\frac{3}{8}$ -in., $\frac{1}{2}$ -in. and $\frac{3}{4}$ -in. cutting diameters are made by Onsrud Cutter Mfg. Co. The bits on the left, in corresponding cutting diameters, are made by Ekstrom Carlson Co. Their longer shanks give them greater depth-of-cut capability.

shorter as the cut gets deeper. One way to avoid the problem is to make an initial plunge cut to full depth with the router held against the left stop and then against the right stop. Then you can rout out the waste between in several passes without having debris pack up against the stops.

The depth of each cut depends on the hardness of the wood you are cutting and on the size and kind of bit you use. Make repeated cuts, always left to right, lowering the bit between passes, until you have reached the desired depth for your mortise. All this might sound complicated, but you will be surprised at how fast it works. I have found it faster and cleaner cutting than the hollow-chisel mortiser.

To cut angled mortises in regular stock, like those in chair legs to receive tenons on stretchers and rails, make angled supports to hold the stock in the correct relation to the bit. To mortise curved pieces—a chair back, for instance—bandsaw a piece to fit the side of the curve opposite the cut and use it to support the stock when clamped in the fixture. You can place the curved support under the stock for mortising on one side. To mortise the adjoining face, support the stock from the in-board side of the fixture using the same curved piece, and a flat support on bottom.

For general mortising, I use two-flute, straight-face bits with $\frac{1}{4}$ -in. shanks. High-speed steel, straight-face bits will work, but they will get dull faster than carbide bits. For mortises $\frac{1}{2}$ in. wide or more, you can use bits with $\frac{1}{2}$ -in. shanks, which will perform better than bits with smaller shanks because they are stiffer and will chatter less. The best bits for cutting large mortises are two-flute spiral end mills with $\frac{1}{2}$ -in. shanks. They are especially designed for plunge cutting and for fast chip removal, and because of their spiral form they have a shear-cutting action. When wasting the area between the two plunge cuts, spiral bits can make passing cuts as deep as $\frac{3}{8}$ in. without protesting. But they will start to scream when you make a passing cut that's too deep, and you will find yourself forcing the bit into the work. This is not good. Spiral end mills will cut effortlessly in a straight plunge and when taking a lateral pass that's not too deep.

You can get spiral end mills made for routing wood from Onsrud Cutter Mfg. Co., 800 E. Broadway, PO Box 550, Libertyville, Ill. 60048 and from Ekstrom Carlson & Co., 1400 Railroad Ave., Rockford, Ill. 61110. Costs vary, but generally $\frac{1}{2}$ -in. dia. and $\frac{3}{8}$ -in. dia. bits are under \$10, while $\frac{3}{4}$ -in. dia. bits run about \$20. □

NOTE: The business of setting the router stops and of locating stock in the fixture can become tedious when cutting a lot of mortises. Here is a solution: First, knife a vertical line on the inside face of the fixture, near its center. This is the primary reference for subsequent measurements. Next, scribe a stop line on the top edge of the fixture, to the left of the centerline, the precise distance from the cutting edge of your mortising bit to the edge of the router base. With the left-hand stop locked at the stop line, a knife line on the stock marking the left end of the proposed mortise can be brought to the vertical centerline. Now, with the router placed against the left-hand stop, measure over on the fixture's edge, from the right side of the router base, the length of the proposed mortise minus the bit diameter. This locates the right-hand stop. To set the depth of cut, lower the adjusting knob until the cutter grazes the stock surface. Then set the depth screw to the depth of the mortise above its stop. Finally, back off on the adjusting knob so the bit will clear the stock. To make all of these measurements quick and reproducible, you can mill a set of hardwood gauge blocks. Instead of measuring, you simply insert the correct gauge block between the router base and end stop, and between the depth screw and depth stop. In addition to cutting mortises, these gauge blocks will come in handy for other setups in the shop.

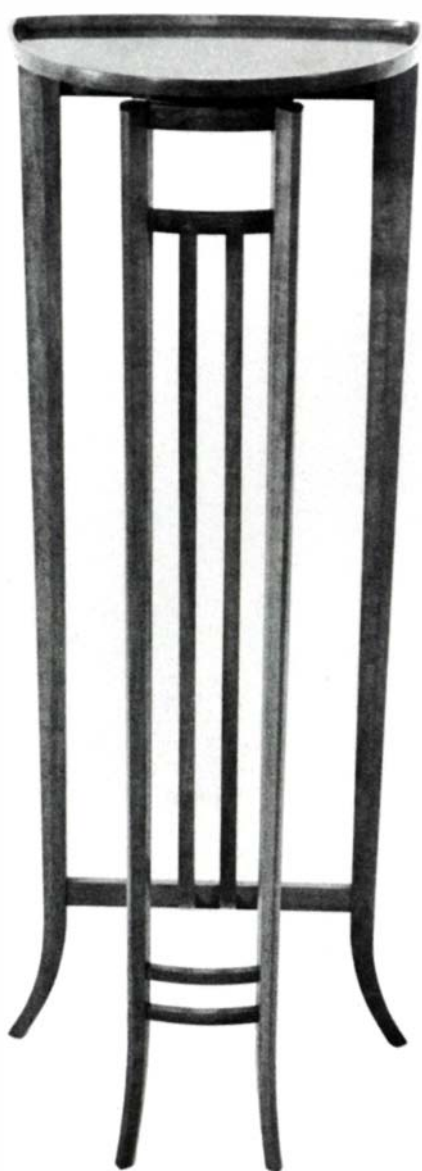
New Furniture

In search of a contemporary style



In Philadelphia . . .

Traditional forms take on contemporary shape in this chest of drawers, one of a commissioned pair, designed by Richard Kagan and built by Kagan and Frank Slesinski, both of Philadelphia. It's black walnut and measures 45 in. wide, 32 in. high, 20½ in. deep. Kagan and Slesinski achieved the traditional bombé form by gluing up walnut planks 2½ in. thick, roughing away the excess with a ball mill, then refining the shapes with Surform, gouges and curved-bottom planes. The drawer bottoms and carcase back are plywood faced both sides with walnut veneer; drawers are side-hung (detail photo at right). The finish is tung oil with a varnish topcoat. In addition to his custom furniture business, Kagan operates a gallery where contemporary studio furniture is shown and sold, at 326 South St., in Philadelphia, Pa.



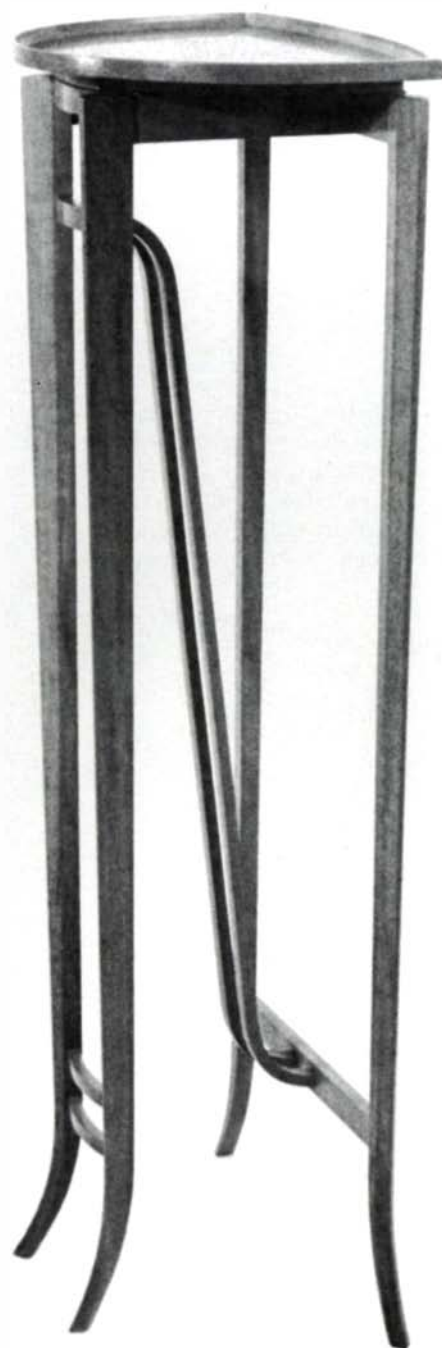
In Cambridge, Mass. . . .

Michael Hurwitz wants to make furniture that's pretty and delicate, yet alive, evoking animal images without being blatant about it. His plant stand (at left and right), of luscious pear wood, is an understated, subtle piece that shows complete attention to design and detail. The double stretcher at the front of the base reinforces its theme of parallel pairs. Even though the eccentric diagonal stretcher leaves the front legs unsupported, it's made acceptable by the lightness of the piece; the top seems to float. The whole evokes the anatomy and posture of an insect. Despite its zoomorphism the stand is somewhat stiff, probably because Hurwitz designs by drawing a lot. The stand seems to have been considered mainly from front and side views, although it succeeds from most if not all angles.

His cherry end table, below, 25 in. tall, exhibits the same clean craftsmanship and thorough detailing. Its structure is simple, with its emphasis on exposed joinery, notably the split dovetail atop the legs, and the ingenious drawer pull. So direct a design needs such detailing, whereas in the more complex plant stand it would have been distracting. This table reminds me of a scuttling crab, with a presence and personality that avoids being corny.

—Morris Sheppard

These tables were shown at the Richard Kagan Gallery in Philadelphia.



In Smithville, Tenn. . . .

Tom Hucker, 26, seeks to create furniture that influences its user in an emotional and humanistic way. He believes that crafts are filling a void left by idea-oriented fine arts; his approach is to make things "on a personal, intimate level, things made with care," that embody culture and intelligence.

This chair is the second Hucker has made of similar style. It shows tremendous skill and broad range of technique—including exposed joinery, sculptural shaping and curved, tapered laminations—the influence of his teachers at Boston University as well as of his apprenticeship with cabinetmaker Leinord Hilgner.

The chair's structure is the major element in its design statement. A dovetailed wedge locks the tapered side rail into the back leg, to provide both mechanical strength and an appealing detail. The exposed tenons at the front and atop the back, and



the absence of superfluous decorative elements, carry this theme through.

The seat plane is the focal point for a composition of linear forms. The relationships among the curved lines, in position, attitude, direction, size and shape, are harmonious and alive. From the front view, the straight lines of the legs and seat play against the swelling, lyre-like curve of the back. As you move around the chair, the echoing recurved shape of the stretchers and of the back join the graceful composition. All the parts are shaped in a muscular, naturalistic way with a pleasant degree of tension, yet with precise feeling for surface and edge. Here Hucker shows a sensibility akin to that of some sculptors he admires, notably Noguchi and Brancusi.

The chair's proportions are also pleasing, although its tall back may appear to curve too far. Sitting confirms this, for it's not entirely comfortable unless you sit straight.

— M.S.

Tom Hucker's chair was shown at the Richard Kagan Gallery in Philadelphia. Hucker teaches at the Appalachian Center for Crafts.



In Putnam, Conn. . . .

The work of Ed Zucca poses interesting questions about the relationships between art and craft, between the intellectual and visual content of a piece of furniture, and between form and imagery. The eclectic Zucca calls himself a "post modernist;" his work is diverse, ranging from practical pieces to visual puns, such as a Shaker TV set and a "wooden" table that is hollow Plexiglas filled with planer shavings. He counts among his influences Egyptian art, the Bauhaus, the Futurists, Art Deco and fantasy comic books, which he admires for their enthusiasm for the future.

Streamlined Moderne, a style of the 1930s, whose imagery can be found in the Empire State Building and in old Buck Rogers movies, receives both homage and parody in Zucca's chairs. Their back legs have a mechanical, futuristic design motif while their lightning-bolt stretchers add the comic-book/pop-art iconography. Beautifully made of maple, a lot of their appeal comes from the carving details. As a chair, the one shown sits only moderately well, the webbed seat being too level for comfort. It is also bottom-heavy, the massive legs and substructure overpowering the seat and back.

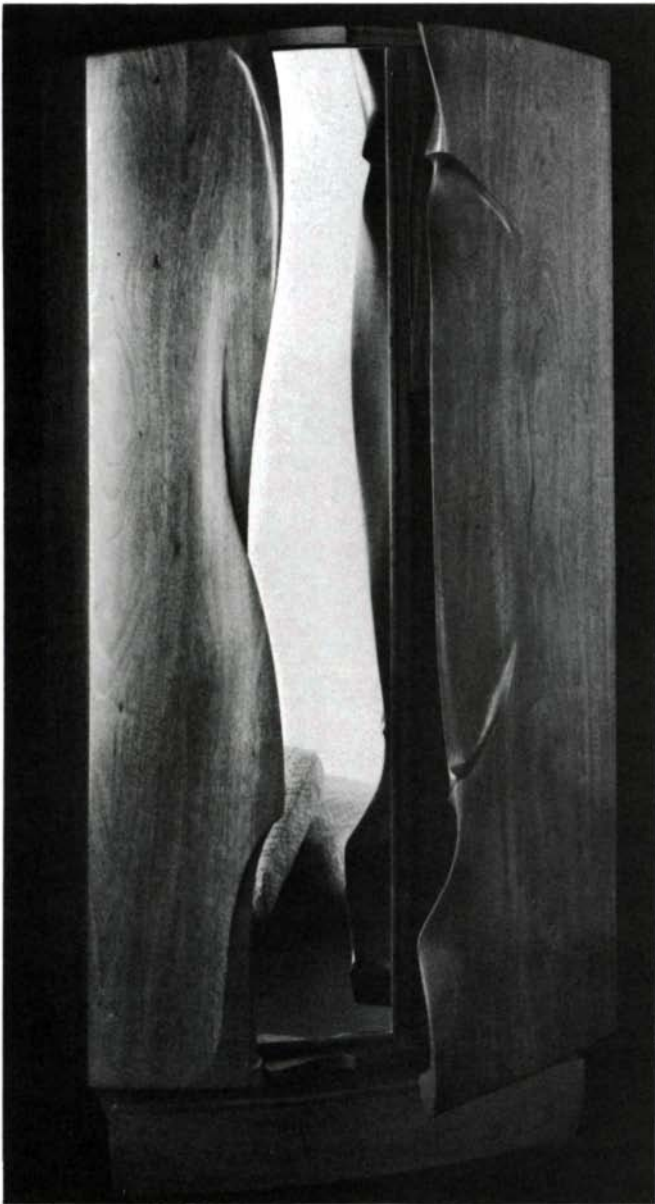
"Table of the Future" (below left), like all of Zucca's work, is flawlessly made, the details are snappy and the forms masterfully handled, showing well the artist's love for hardedge form and "nice, crisp razor edges." The wood, figured birch with cherry, is used to excellent advantage; the carving of the runners, stretcher and uprights is particularly well articulated. There is a nice balance between top and structure. The curves of the runners and the stretcher's ring harmonize with each other as well as with the top's shape, while the taper and diamond-shaped section of the stretcher and uprights add great energy. Zucca has brought diverse ideas together here, to produce a most satisfying piece of furniture.

Zucca, 32 and a graduate of the Philadelphia College of Art, likes to make furniture because "It gives me something to hold on to. If you just say 'sculpture' I'm lost." He's often trying to make a statement, and sometimes a joke, that takes his work beyond mere furniture. The important question is whether this striving enhances or distracts from the furniture itself, some of which I find quite beautiful on its own.

— M.S.

Ed Zucca's furniture and sculpture was shown last spring at the Workbench Gallery in Manhattan.





Armoire in mahogany by Steven W. Voorheis of the Primrose Center for Fine Woodworking, Missoula, Mont. Inside the carved doors there's a full-length mirror, several drawers and a storage cabinet.

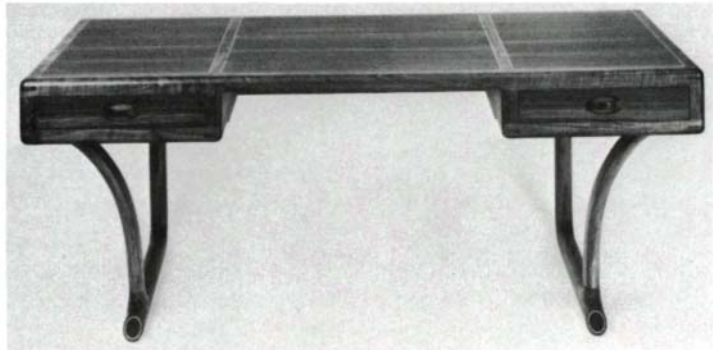
In Portland, Ore. . . .

The first annual Oregon Wood Furniture Makers Show, entitled "Handmade in the Northwest—Hardwood Furniture 1981," was held on a February weekend at the Western Forestry Center in Portland. Conceived as a cross between a gallery exhibition and a fair, the event attracted 7,000 people. Fifteen woodworkers participated; three of the pieces exhibited are shown here.



Peter Tag

Pedestal dining table (above) was made by Ken Dieringer of Eugene, Ore. Its top is of cocobolo; the base is white oak sawn 1/4 in. thick, steam-bent, then laminated on a form. Executive desk (below) was designed by Roger Hockett of Portland and built by his four-member partnership, Oregon Fine Joinery Ltd. It's made of local walnut with Mexican rosewood and brass inlay.



Rick Paulson

In Eugene, Ore.

"Plight of the Frog," by Harold Hoy of Eugene, Ore., was displayed along with 113 other sculptural and functional pieces this summer at the Renwick Gallery in Washington, D.C. The exhibition was entitled "The Animal Image: Contemporary Objects and the Beast." The rolling pin is cherry, and the frog is black walnut carved and inlaid into a maple base. □



National Museum of American Art

LOGGING WITH A HORSE

Skid logs with a horse? Nobody works with a horse anymore. Why would anyone want to? That pretty well sums up the attitude of most of us. Yet there are people who still use draft horses for a variety of chores including hauling timber. Not long ago I ran into an expert on the subject.

Rex Harral is a man of the country, born and raised in the foothills of the Arkansas Ozarks. He is slow of speech and deliberate in his movements. On first impression, he seems a romantic rustic, a figure from the past. Get to know him, however, and these preconceptions break down. In the first place, he is not a romantic at all; the term pragmatist would probably fit him better. In the second place, he is not particularly isolated, for he reads widely and voraciously, especially technical farming publications and craft journals. He is an effective small farmer who supplements his income by making and selling hardwood bowls and traditional furniture. He is also an excellent blacksmith whose woodcarving tools are recognized and sought after throughout the region for their beauty and edge-holding ability.

At sixty, Harral is well past the age when there would be any need to prove his toughness and endurance. His object is to get a job done with a minimum of fuss, so he does use a tractor for certain jobs. On the other hand, if a horse can do a job better, Rex will use a horse. He has always kept a few draft animals. They cost very little to keep, given the fact that pasture is available and that horses burn no gasoline.

Harral insists on using horse power for getting logs out of his woods, 100 acres of mixed pine and hardwood in north-central Arkansas. Harral bought the land nearly 40 years ago and has taken timber off it ever since. Depending on what was ready for the sawmill, and also on his reading of market conditions, Harral has sold from 2,000 to 6,000 bd. ft. of timber every year. This might not sound impressive to a Weyerhaeuser executive, but that timber has played a major role in paying for the land, and has often meant the difference between profit and loss at year's end. In addition, the woodlot has provided all the material for Harral's woodcraft and has heated his home for the past 37 years.

Today the woodlot is in beautiful

condition. The trees have grown tall and straight. There is a good variety in size, with roughly 5% of the timber ready for the mill each year. By careful selection and thinning, Harral has made the land far more productive than it was in the early days.

He considers draft horses important in his timber management program. Why use a horse? The photo (far right) of a log being pulled by Harral's best timber snaker, a horse known as Big John, illustrates one reason. Properly hitched together, with the singletree pulling evenly on the tug lines from the horse's shoulders, draft animal and log are hardly more than 2 ft. wide. They move between the young trees, doing them minimal damage. There will be the occasional scuffed bark or bent sapling, but that is all. Contrast this with the tractor or, worse yet, Caterpillar. In either case the woods are likely to be left a tortured mess, carved and cross-hatched with temporary roads. Harral's woodlot has only one road and it runs right through the middle. The trees are felled and limbed in place with a chain saw. When all the logs marked for harvest each year are down and ready, Big John drags the timbers out of the woods to gathering points along the road, to be picked up by the log trucks.

A second reason to use draft horses is safety. A good-sized saw log, improperly handled, can kill a man. Using long, cotton lines (roughly analogous to the riding horse's reins) Harral can walk well behind or to the side of the action while still maintaining excellent control of the horse. On a long pull where precise control is not necessary he may even drop the lines and simply control the horse by voice. Harral uses commands that go back to the dawn of western civilization. GiUp! or HiUp! gets the horse moving. Whoa! calls for a stop. Gee! means bear to the right, while Haw! moves the horse to the left. Obviously this sort of response requires training, but that's not as difficult as one might imagine. In fact, many people use large logs when training draft horses to pull. Most draft horses are not as nervous as riding horses, and a few days work with one person leading at the horse's head while another works the lines from behind will generally get things started. From there it is a matter of always accompanying the tug on the lines with



Big John and Rex Harral.

the voice commands, until they come to mean the same thing to the horse.

Harral and Big John have worked together for 16 years, since the horse was two years old. Big John is still a strapping, healthy horse with probably a good six to eight years of work left. Man and horse are a well-coordinated team, their movements and interactions honed by practice. "Back up, John," Rex calls, and John immediately takes a couple of steps backward, loosening the tug lines so that the skidding tongs (bottom photo) can be set into a log. "HiUp," comes the command and the big horse moves off at a fast walk, a 10-ft. long, 22-in. log skidding easily behind him. With tugs on the lines accompanied by Gees! and Haws! they reach the logging road. When they get to the gathering point it's "Whoa, John, back up, John." The tongs are released and then man and animal disappear into the woods to repeat the process. No one is overworked. No one appears to be hurrying. Yet at the end of the day there are three or four truckloads of logs at the loading point.

This brings up the final point in defense of horsepower. According to Harral, working in the timber with a well-trained draft horse is actually easier—and more efficient—than working by yourself with a tractor or Caterpillar. "If I used one of those things, I'd be totally wore out with climbing on it to back up a few feet, then off to set the tongs, then back on to skid, then back off to release the tongs. I swear, I don't see how folks do it," he says. As it is, Harral and Big John are tired at the end of the day, but they are not exhausted, and if necessary they can both get up and go at it again tomorrow. □

F. Jack Hurley, woodworker and history professor, lives in Memphis, Tenn. For more about using horses to drag timber, see the quarterly magazine Draft Horse Journal (\$10/year) or the Draft Horse Primer by Maurice Telleen (\$12.95, hardcover). Both are available from Draft Horse Journal, Box 670, Waverly, Iowa 50677.

Horse Logging



Above, Harral and Big John ford a stream while maneuvering a pine log away from the drop site. Here, he controls the horse with cotton lines, but sometimes he relies only on verbal commands.

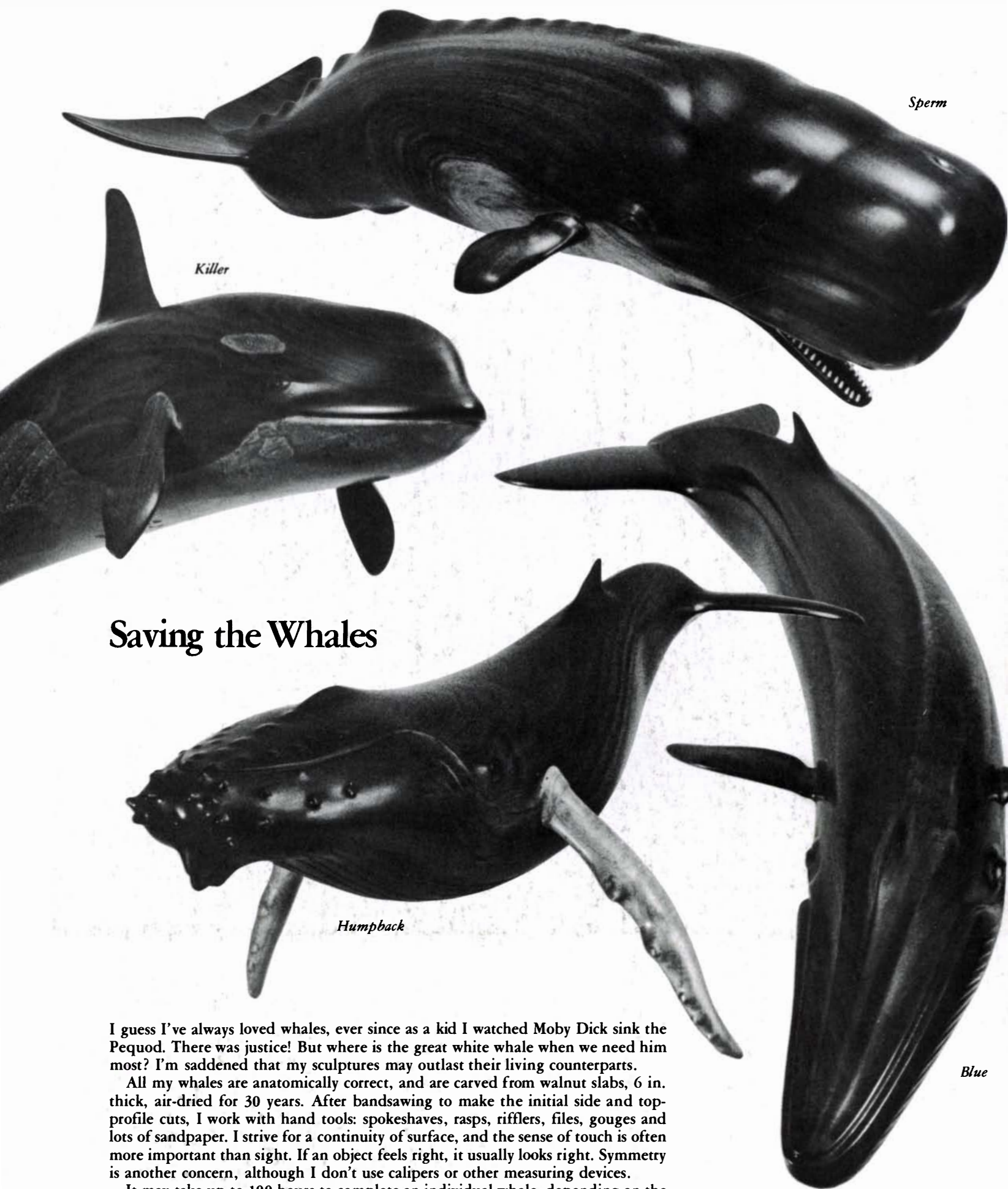


The harness for dragging timber (photo, left) consists mainly of a properly fitted collar and hames. The collar may be leather, as this one is, or cotton cloth, but leather will last much longer. Hames, which ride on top of the collar, are metal or wood, and provide a solid anchor point for the tug lines or the chains. Everything else, back bands, belly bands and rings, simply keep the chains pulling comfortably and the cotton lines from becoming tangled.

Together, horse and log are only 2 ft. wide (photo, right), which makes it easy to drag logs through tight spaces between trees.

Below, proper arrangement of log tongs is important whether you are working with a horse or a tractor. The tongs must be placed far enough forward so that the hinge point of the tongs clears the front of the log and does not ride on top. Otherwise, the tongs will be damaged and the log will dig into the ground and not pull smoothly.





Saving the Whales

I guess I've always loved whales, ever since as a kid I watched Moby Dick sink the Pequod. There was justice! But where is the great white whale when we need him most? I'm saddened that my sculptures may outlast their living counterparts.

All my whales are anatomically correct, and are carved from walnut slabs, 6 in. thick, air-dried for 30 years. After bandsawing to make the initial side and top-profile cuts, I work with hand tools: spokeshaves, rasps, rifflers, files, gouges and lots of sandpaper. I strive for a continuity of surface, and the sense of touch is often more important than sight. If an object feels right, it usually looks right. Symmetry is another concern, although I don't use calipers or other measuring devices.

It may take up to 100 hours to complete an individual whale, depending on the species. Killer and blue whales have a more hydrodynamic shape, simpler from nose to tail, whereas the sperm, with its bulbous head and ripply back, and the humpback, with its bumpy nose and ribbed body, demand more attention. Scale also varies, depending on the species. The pieces here range from 21 in. to 33 in. long.

—John C. Jackson, Chalfont, Pa.

Fine Woodworking®

INDEX 1-30

This index covers the first 30 issues of *Fine Woodworking* magazine, from Winter '75 through Sept./Oct. '81. It is a technical index, which pays particular attention to Letters, Methods of Work and Questions/Answers, as well as to the articles themselves. Photos of finished work are included among the entries.

The format for each entry is issue number, followed by a colon and page numbers. Consecutive pages are separated by a hyphen, non-consecutive pages by a comma, entries by a semicolon.

The first eleven issues of *Fine Woodworking* were published by date, without issue numbers. The issue number has appeared on the cover and contents page since No. 12, Sept. '78. The following table correlates cover date and issue number for the first eleven issues:

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