

AMERICAN WOODWORKER

April 1991, Issue No. 19



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Issue No. 19

March/April, 1991

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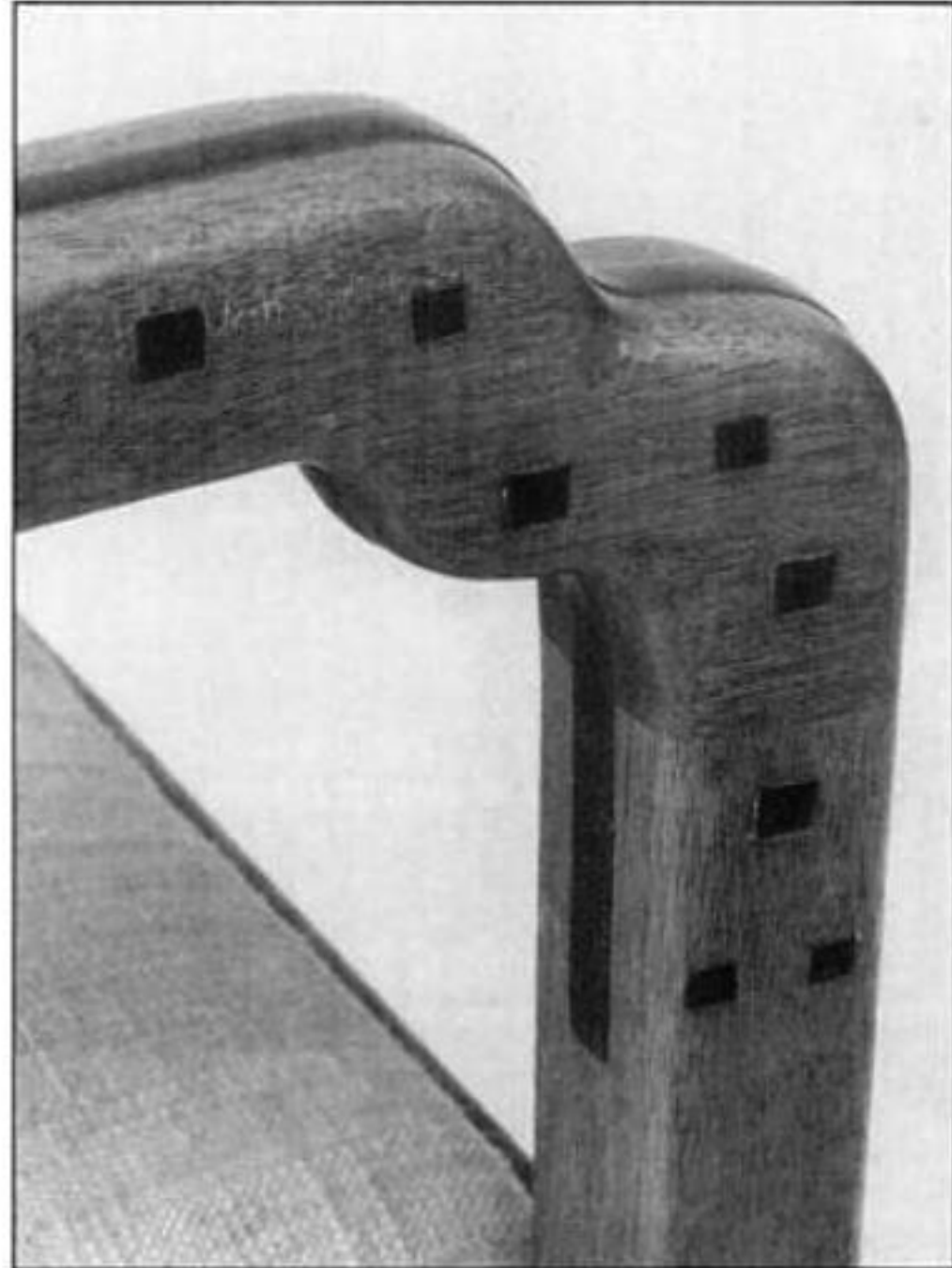


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A WORD FROM THE EDITOR

WINGING IT



We got a letter recently from a frustrated reader who criticized us for publishing furniture projects that called for tools and machinery he didn't own and couldn't afford to buy. "I don't have a machine shop full of specialty tools," was the way he put it. I know how he feels.

I remember a time when my workshop consisted of a box full of hand tools and a door thrown

across a couple of oil drums in the roach-infested basement of a New York City brownstone. Urban woodworkers develop a keen eye for scrounging, and I was always on the lookout for choice bits of wood that someone had put out with the trash. One day, I hit the jackpot—a broken chest of drawers with curly maple drawer fronts. I loaded up all the pieces I could carry.

A friend was about to be married that week, and at the eleventh hour, I decided to make her a dovetailed candlebox with a sliding lid. The maple drawer fronts beckoned. The problem was that the 1/2-in. thick candlebox sides were somewhere in the middle of those 3/4-in. thick drawer fronts, and all I had were hand tools. I had to get that box built fast, so I grabbed a marking gauge and a plane and went to work. I got a few blisters and it took me a while, but I shaved that stock down to the thickness I wanted. As I grunted and pushed, I kept thinking, "Back before power tools everybody worked

this way." Good for the soul.

Then there was the time I was visiting my brother, who lives outside London. Innocently, I volunteered to repair his rickety antique kitchen table that wiggled and wobbled whenever you looked at it. I found out too late that my brother is one of those guys whose tool collection consists of a hammer, a drill and some rusty old screwdrivers. I saw no sense in spending money on tools he'd never use again (and I didn't want to carry on the plane), so I decided to wing it.

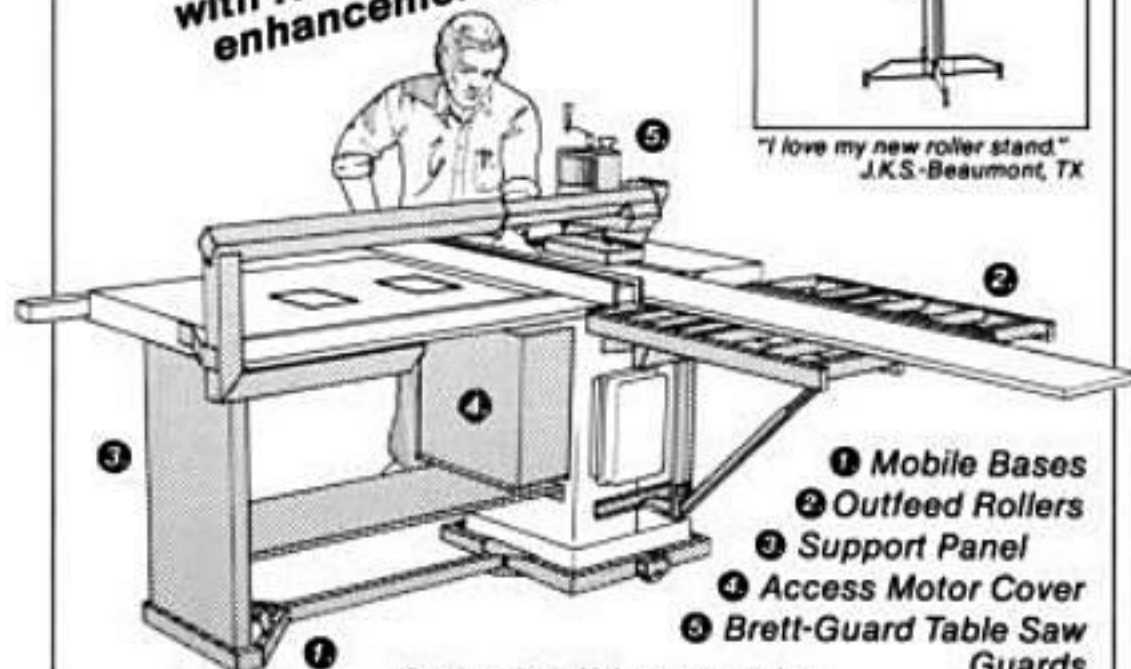
I borrowed an old smooth plane, sharpened it on a piece of sandpaper and managed to disassemble the table, clean up the joints and put it together, ready for glue. Big problem. No bar clamps to glue up the top. I made a loop out of rope, stuck in a stick and twisted it tight like a tourniquet, then I climbed on that table and pulled the joints tight with my hands while the glue set. I must have looked silly. It wasn't the strongest glue joint I ever made, but the table was fixed.

The point I'm trying to make is this. Nobody—repeat, *nobody*—has every tool and machine we talk about in *AMERICAN WOODWORKER*. If you don't have a tool that's mentioned in an article, you can nearly always find an alternative if you only stop and think about it. Whether you call it "winging it" or good ol' Yankee ingenuity, it's a trait that we woodworkers need to cultivate. It's good mental exercise and it sure beats giving up.

DAVID SLOAN, Editor

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Not A Weekend Warrior

I've been reading *AW* for about two years, and I compliment you on a fine publication. I would also add my voice to those who have encouraged you to feature articles on quality woodworking. There are already too many publications treating the "weekend" or "one evening" project.

M. KEITH UMBREIT
Fallston, MD

One Man's Meat...

As an enthusiastic novice who purchases every magazine or project book advertising the "Easy to Build ... One Weekend Only ..." projects, I would like to congratulate Roger Holmes on his "Mortise & Tenon" and "Trestle Table" articles (*AW* #18). I found Roger's articles concise, explicit and readable, even for a novice like me. This is rare!

I hope you will feature more authors and articles of this caliber in the future. I enjoyed the January issue of your magazine and look forward to many more in 1991.

DONALD GREEN
Wanaque, NJ

...Is Another Man's Poison

I find that most of your articles are pleasant narratives—but without the meat to the story. I for one, am not a graduate of some exotic design school, have not apprenticed with the grand guru of cabinetry, and don't have a full machine shop backed by hundreds of specialty tools and planes. Perhaps you are aiming to a different audience and if so, fine. But I am frustrated by being tempted by your projects only to find an incomplete or inaccurate description using tools I don't have.

For example, the "Mortise & Tenon" article in *AW* #18. Two photos illustrating the techniques show the operation of power tools without the use of safety glasses or eye protection—a very bad message for you to be sending. In the illustration of the trestle table (on page 25) there is a sloppy drawing depicting an off-center tenon when in fact, if you dig out the dimensions and do the arithmetic, it is centered.

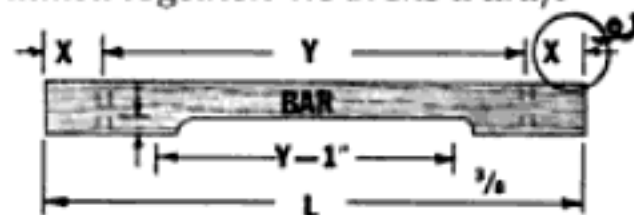
ROBERT J. KUTELLA
Mt. Prospect, IL

Safety glasses are like seat belts—some people wear them, some people won't. We editors always wear glasses when we operate machinery, and we urge all woodworkers to follow suit. But you're right. Those photos set a bad example, and we should have caught it.

The drawing of the trestle table on page 25 shows the tenon on the trestle table leg slightly off center. This is incorrect. The dimensions, however, are correct and show that both the tenon and the corresponding mortise in the foot of the table are centered.

Xylophone Correction

If you tried to add up the bar dimensions in the Xylophone article (*AW* #17), you probably had a big surprise. The dimensions are correct (but for one typo—the Y dimension on the E bar should read $5\frac{9}{16}$ not $5\frac{19}{16}$). They just aren't meant to be added together. We broke a draft-



ing convention when we put two X dimensions on the xylophone bar. We should have used only one X. Ideally, you would cut the bars to their listed lengths, then, measuring from one end, mark out the first hole to the given X measurement. Next, measuring from that first hole mark, you would mark out the second hole using the Y measurement. The end measurement then "floats." Its dimension is not critical.

Well, Doggone!

In the December 1990 issue (*AW* #17) you published plans for "Fritz, the Wonder Dog." A neat puzzle. But more than just a puzzle, it provides the vehicle for the presentation of a special present. I had some walnut scraps left over from a chair. I looked at "Fritz" and I looked at the scraps. Wow! The belly of "Fritz" could be hollowed out and used as a semi-secure repository for some small valuable item. Further, it could be used to present a small, unique present such as jewelry. I scaled up the

drawing about $2\frac{1}{3}$ times to take advantage of the wood I had available. The hole in "Fritz's" belly was lined with velvet and the present that I will give to a friend of mine at Christmas will be something extra special due to the presentation. I thank Allan Boardman for his article. Keep them coming.

ROBERT L. CARSON
White Rock, NM

I was really attracted by the dog puzzle in *AW* #17 so I made six of them—four of them for my four grandsons, one for my sister and one for myself. No money in the world could have bought the great feeling I had watching the boys on Christmas day. Believe me, their eyes were shining like bulbs in a Christmas tree.

Please congratulate Allan Boardman for so fine a toy. Keep up the good work.

ANDRE DESROSIERS
St. Pierre Les Becquets, Quebec

Kudos from a College Shop

I've been receiving and enjoying *AW* now for a couple of years. I am an assistant professor at a two-year college teaching carpentry and cabinet-making. We use your magazine for information and ideas for the students as they design, plan and build a personal project in a semester's time. We have had a number of students copy some of your pieces with excellent results.

PETER KRUPPENBACHER
S.U.N.Y. College of Technology
Delhi, NY

On Wooden Lights

I've designed and built at least a dozen wooden light fixtures over the last 20 years, but I still learned a lot from Charles Linn's great article on wooden lights (*AW* #17). I also enjoyed seeing the designs of other woodworkers. I got a lot of ideas.

One technical point that doesn't make sense to me is Linn's suggestion that, for safety reasons, all wiring must run through metal tubing or wireway. Metal conducts electric-

CONTINUED

ity—wood doesn't. So it seems to me that if the insulation wore off and exposed a bare wire somewhere inside the lamp, you'd be safer if that bare wire touched wood. If it touched metal, the entire piece of metal—and probably all the metal parts of the lamp—could become a shock hazard. Am I missing the point? If the wire shorts out inside the metal wireway would it simply trip the circuit breaker?

LARRY MONTMARK
Espanola, NM

Charles Linn responds: *This is a good question. It is certainly true that broken conductor insulation inside a metal wireway can cause a hazardous condition, especially if the wireway is not grounded. But metal wireways are all around us, in light fixtures, in buildings and outdoors. The only way to ensure that they don't present a hazard is to be sure that the wiring inside them is properly installed. After installation, they rarely present a hazard. By the*

way Mr. Montmark, an exposed hot conductor inside a metal wireway would not necessarily trip your circuit breaker, so be careful.

I recommend installing a metal wireway because of what can happen to a light fixture after it leaves the workshop. Someone gets ahold of a lamp that was designed for some soft, ambient lighting, and replaces its three, 40-watt bulbs with three 300-watt bulbs. As the wiring heats up, the insulation melts away, allowing the hot and neutral conductors to join in a short circuit, and suddenly a miniature arc-welding exhibition is taking place deep inside that wooden lamp base. The idea is that the metal wireway will keep the sparks and molten copper wire separated from the wood so that the lamp does not burst into flames. Such a fire may be embarrassing if it occurs spontaneously during a dinner party or romantic interlude.

The most difficult part of designing an object so that it is safe is anticipating the infinite variety of means that

people have of rendering the object unsafe. Installing the metal wireway may be inconvenient at times, but I recommend it.

I enjoyed the article on wooden lights (AW #17). I need a source of supply for light parts. Can you help?

DWAINE SCHNEIDER
Ankeny, IA

If a local electrical-supply company doesn't have what you need, parts for lamps and light fixtures are available by mail from: Paxton Hardware, 7818 Bradshaw Rd., Upper Falls, MD 21156, (301) 592-8505.

Tell us what you think. Send your comments, compliments, complaints and corrections to: Editor, AMERICAN WOODWORKER, 33 E. Minor St., Emmaus, PA 18098.

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Clear Finishes

Q. I want a clear finish on my furniture, but I'm not set up for spraying. I've tried varnish, polyurethane, shellac and oils. They're all slightly yellow—none of them is really clear. Is there a clear lacquer that brushes on? Is there anything else that would do?

TIM GALLAGHER
Denver, CO

A. The clarity of a finish is determined by the color of the resin used to form the film. The solvents in the finishes you mentioned are all clear as water. Nitrocellulose lacquers are clear, but lacquers modified with alkyd resins can be as amber as varnish.

One commonly available clear brushing lacquer that would meet your needs is Deft Clear Woodfinish (available at many hardware stores). Apply it with a fine, natural-bristle brush loaded for a wet coat, and move a bit faster than usual, as brushing lacquers dry quickly. Follow the directions on the can, and it should do the trick. Deft also comes in aerosol cans, which are fine for smaller areas or for your last coat, to keep brush marks to a minimum. Adequate ventilation and an organic vapor respirator will keep fumes from giving you a headache.

To avoid solvent fumes, try a water-base clear finish such as Deft Wood Armor, or Flecto Varathane Elite Diamond Finish (available at hardware and paint stores).

Minwax's Helmsman Spar Urethane is another possibility. It's not crystal clear, but it's one of the clearest varnishes I've used and beats many standard lacquers for clarity.

The catch with clear finishes is that they often yellow over time. Direct sunlight will hasten the process in any finish. I recently repaired a chair that I had lacquered five years ago. The lacquer was clear when I sprayed it, but it had gradually yellowed to the color of an oil finish. Sometimes the best thing to do is accept fate; combined with maturing of the wood color, a bit of yellowing can complement the piece.

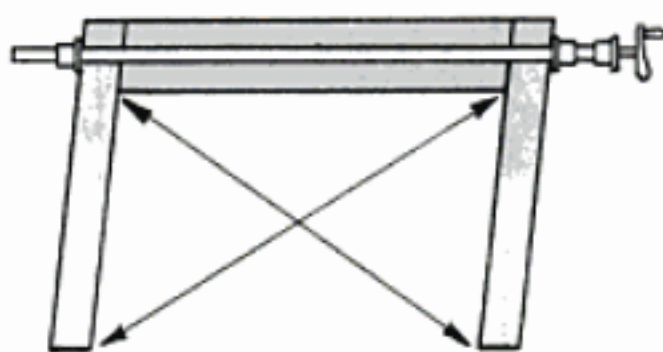
NANCY LINDQUIST
Woodworker and finish consultant
Kansas City, MO

Even Table Legs

Q. When I make a table, I take great care to cut all four legs exactly the same length. But no matter how careful I am, the table always rocks a little and I need to shorten one of the legs by $\frac{1}{32}$ in. or so to eliminate the rock. Is there a way to avoid this?

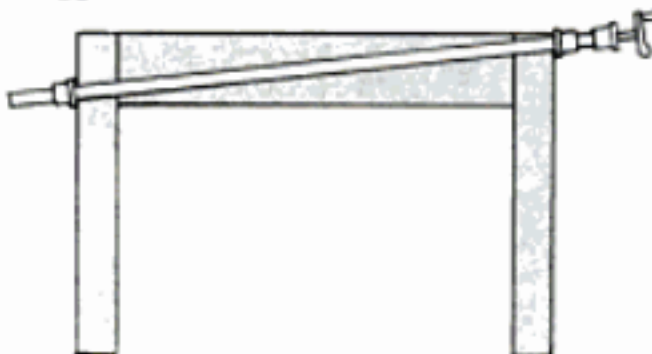
JACK MAHONEY
Paris, TX

SQUARING TABLE LEGS



DRAWINGS BY FRANK ROEBACH

Unequal diagonals indicate out-of-square. (Exaggerated)



Reposition clamp and retighten to square up legs; recheck diagonals.

A. There are lots of chances for error when making a table. First, address the obvious concerns—cutting parts to correct length and making ends perfectly square. Make sure your saw blade and miter gauge are square. Pay particular attention to the mortise-and-tenon joints of the rails and legs, as error here will be compounded eight times over in the final piece.

Glue up the table in stages instead of all at once. Glue one rail and the two corresponding legs together, and then the opposite rail and its two corresponding legs. It's much easier to deal with two mortise-and-tenon joints at one time rather than all eight at once, and there won't be as many clamps to get in the way. Immediately after clamping up each of these subassemblies, before the

glue has begun to set, measure the diagonals to check for square. If one measures even $\frac{1}{8}$ in. longer than the other, the legs are not square. (See drawing.) This can usually be corrected by angling the clamp slightly and retightening it.

After the glue sets on the subassemblies, glue and clamp them together with the remaining rails to complete the whole table base. Move the whole base with clamps to the flattest spot in the shop—the table-saw is your best bet—and check for any rocking. If you find some unevenness, a slight clamp adjustment, as before, will force the raised leg down, and the table base will sit flat. Make the adjustments before the glue sets, otherwise you'll fracture the joint.

MARK SFIRRI
Cabinetmaker/woodworker
New Hope, PA

Smoothing Planes

Q. I have trouble getting a smooth surface with a hand plane without leaving little gouges on the wood. I wonder if there's any difference between an ordinary bench plane and a smoothing plane. If so, would a smoothing plane help me to get a better surface?

ARTHUR GUILMETTE SR.
Westport, MA

A. Bench planes are simply planes that are used at the bench for surfacing and jointing boards. The three most common bench planes are the long jointer plane, the mid-length jack plane and the shorter (about 9 in.) smoothing plane.

First, do the rough planing and flattening with the jack plane, then start working with the smoothing plane, taking very thin cuts. To avoid gouges, round off the corners on the blade of the smoothing plane just a bit. Do this by rubbing the corners lightly on a fine sharpening stone after you've made the last pass on the stone to hone the bevel. I like to take this approach even further by grinding and honing a very slight convex curve along the edge of the blade from side to side.

For the final planing on the wood,

adjust the blade so it's evenly exposed only a few thousandths of an inch, then take the last strokes just "kissing" off the high spots. Some people think the subtle ridges left by a hand plane lend a "handmade" character to a piece of furniture. But if you like, you can remove these ridges with a hand scraper.

MIKE DUNBAR
Contributing editor
Portsmouth, NH

Stain on Kerf-Bent Plywood

Q. Recently I made some speaker stands with 1/4-in. birch plywood. The plywood was kerf bent to a 4-in. radius to wrap around an interior frame. When I stained the stands, I got a "print through" of each kerf on the outside of the plywood. I was careful not to cut the face veneer, and I sealed

the outside before I stained. Where did I go wrong?

RICHARD STONE
Middletown, OH

A. Kerf bending stretches the outer layer of veneer unevenly—the areas still backed by the full thickness of the plywood remain largely unstretched, while the areas over the kerf cuts stretch the most. This changes the way the grain of the face veneer accepts stain in the different areas.

To reuse the stands as they are, you could veneer over the entire unit and refinish. You could glue the veneer directly to the stands, but you'll have to work carefully to avoid irregularities or glue-starved bulges that can telegraph through the thin veneer alone.

A better way is to glue the veneer onto thin, bending ply with the grain going in the same direction as the bending ply, and then glue the bending ply to your stands. Bending ply is

simply thin, (1/8 in. or less) three-ply plywood. You can glue the veneer to the bending ply flat. When bent, the bending ply will adhere better to the stands than the veneer alone. If the radius of the curve is very tight (1 1/2 in. or less), use special bending ply that has the grain of all three plies going in the same direction. Bending ply is available at any good plywood supplier, especially one who deals with the kitchen-cabinet trade.

JOSH MARKEL
Furniture designer and maker
Philadelphia, PA

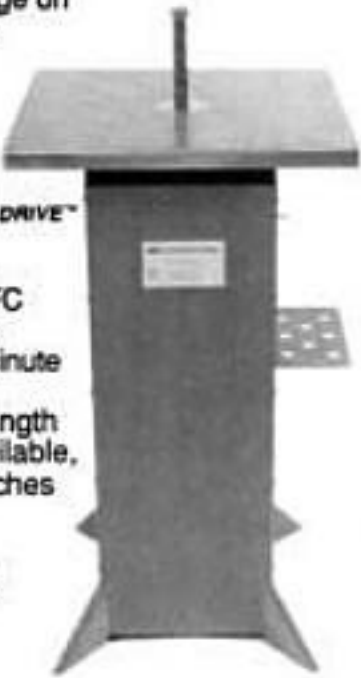
Drying Wood

Q. At age 85, I've accumulated a lot of woodworking tools, but what I need is a way to dry my wood. I salvaged the controls, heaters and blowers from an old clothes dryer, and I wonder if I could make a small wood dryer from these parts that

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would hold about 200 board ft. of wood. Any suggestions?

ED FRY
Versailles, MO

A. Yes, you probably could, but I wouldn't recommend it for a number of reasons. Fresh-cut wood typically has about 75% moisture content. For furniture making it should be dried to about 7% moisture content. The first stage of drying—down to about 25% moisture—is very critical. The temperature and humidity in the dryer must be carefully controlled during this stage. If it dries too fast, cracking will occur; too slow and staining (from enzymes in the wood) is likely. If the wood is dried "green" from the saw it may have residual drying stresses that could cause pinched saw blades or immediate warping when worked with machines. It's doubtful the clothes dryer parts could be set up to provide the kind of fine-tuned control

necessary to avoid these problems.

You'd also have to rig a safety control that will cut off the heat if the thermostat fails. And since the heating elements are exposed to air and wood develops fine dust as it dries, there's a real fire hazard. That means you'd have to design a dual-chamber heating system like those in hot-air home-heating furnaces.

I'd recommend a solar lumber dryer as an alternative. For 200 board ft. you'd need a small, insulated kiln with 20 sq. ft. of clear corrugated fiberglass sheet in the roof to let the sun's heat in. Drying time is about eight weeks in good weather, and the quality of the dried wood is excellent. For a set of free plans for a larger solar dryer, send a S.A.S.E to: Forest Products Center, Virginia Tech, Blacksburg, VA 24061. You can scale the plans down to the size you need.

DR. GENE WENGERT
Professor, wood technology
Blacksburg, VA

Where To Find It

Beveled glass mirrors in circles, ovals, rectangles and other shapes, and various sizes for hand mirrors and jewelry boxes are available from Floral Glass & Mirror, Inc., 895 Motor Pkwy., Hauppauge, NY 11788.

Tagua nuts, a vegetable alternative to ivory for small turnings, inlays, and scrimshaw are available from Hiltary Agricultural Products, 7117 3rd Ave., Scottsdale, AZ 85251.

Specialty files, rifflers and rasps in unusual shapes and sizes are available from T.B. Hagstoz & Son, Inc., 709 Sansom St., Philadelphia, PA 19106.

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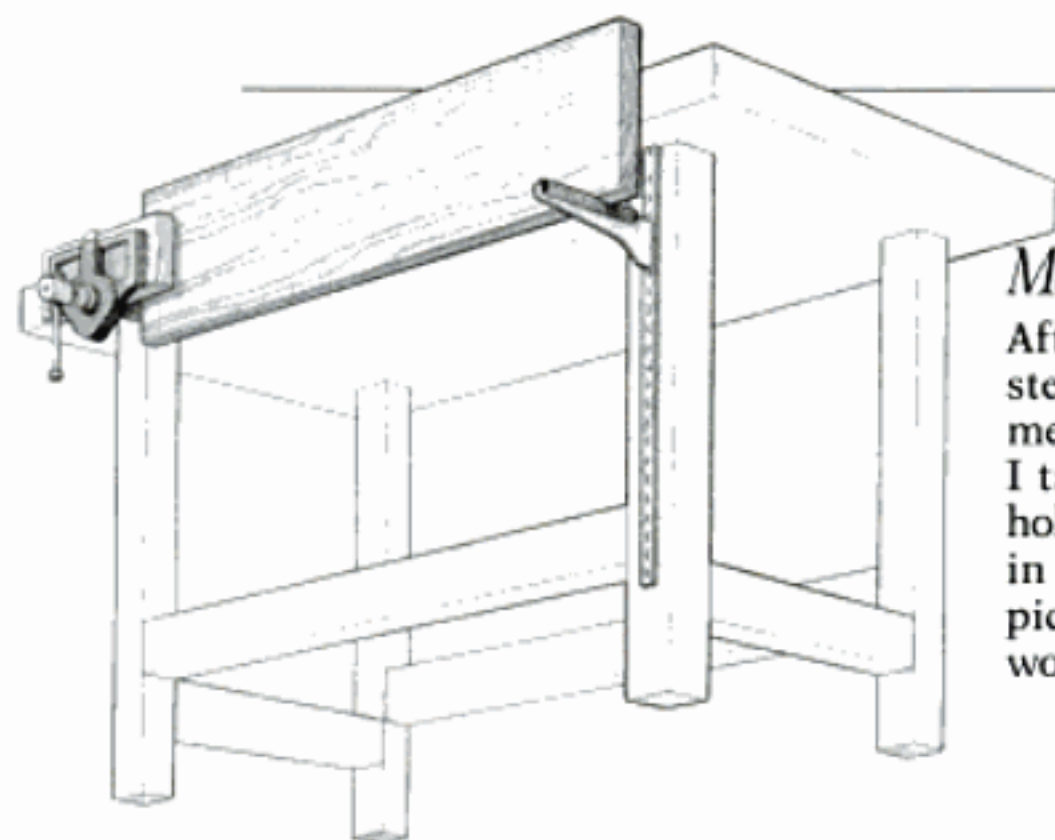
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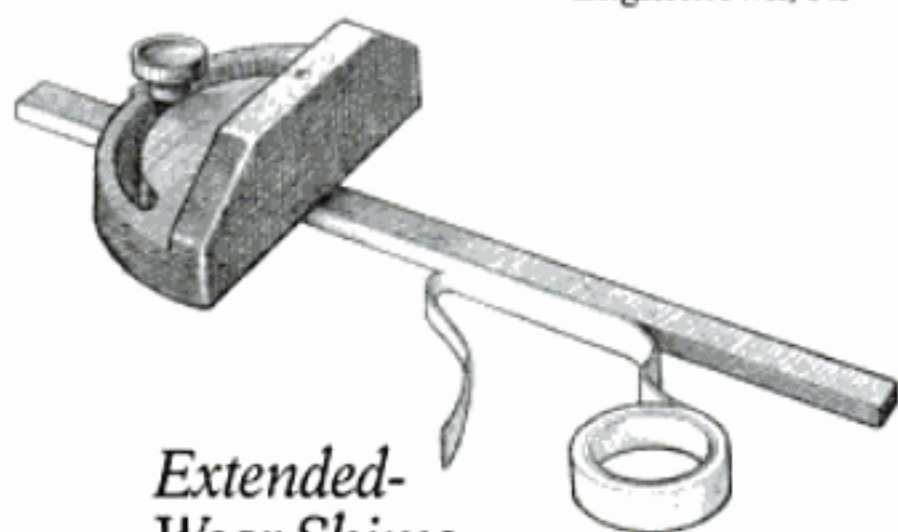
TECH TIPS



Long-Board Support

Woodworkers have contrived a great many devices to hold up the end of a long board clamped in a vise, but few are as simple and reliable as this one. Screw an ordinary metal shelf standard to a leg of the workbench. Fit it with a shelf bracket and a piece of split tubing or hose for cushioning.

JOHN McDONALD
Englishtown, NJ



Extended-Wear Shims

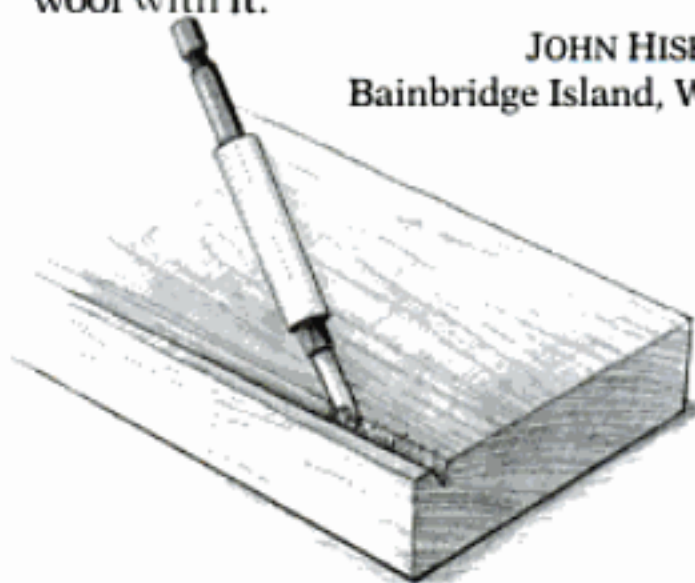
I use adhesive-backed metal tape from home centers or building-supply stores as a durable shim that withstands wear. It's great for correcting a sloppy fit between a miter-gauge bar and a table slot.

RICHARD CANDY
Cinnaminson, NJ

Magnetic Fuzz Buster

After rubbing down a finish with steel wool, I want to get rid of the metal strands left behind. To do this, I take a magnetic screwdriver bit holder, fit it with a bit that will get in the crevices of my project, and pick up the small particles of steel wool with it.

JOHN HISEY
Bainbridge Island, WA



Stop the Rattle

To keep my tablesaw insert from vibrating and rattling, I put little dabs of Shoe Goo on the sides near the corners. Next I trimmed it to fit with a



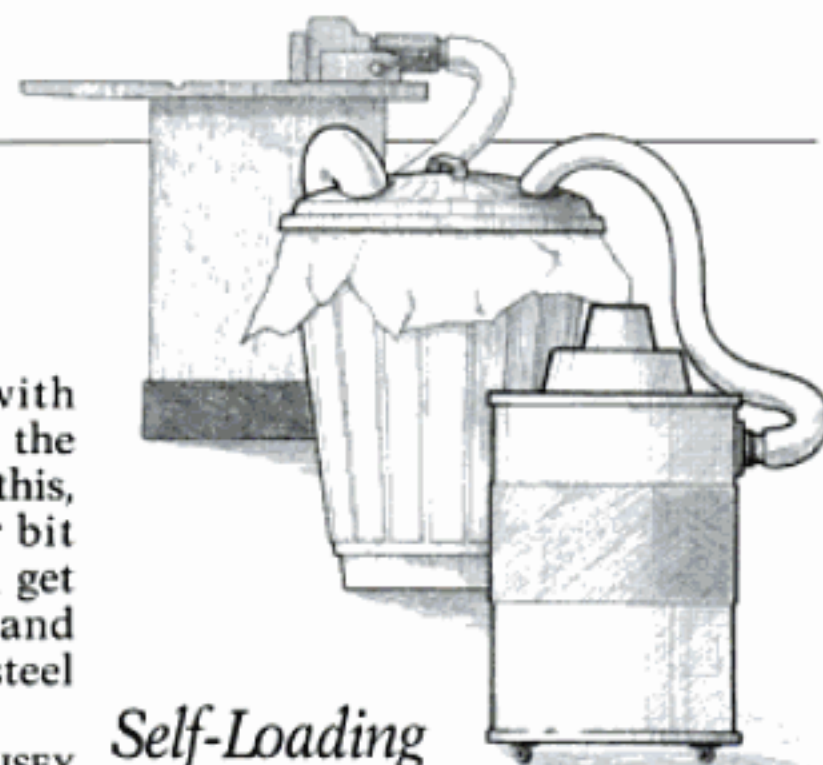
sharp knife after it has hardened. Shoe Goo is a soft plastic that comes in a tube. Runners use it to patch worn areas on the soles of running shoes. Athletic-wear stores carry it.

BRIAN HONEY
Barrie, Ontario

Self-Loading Trash Bags

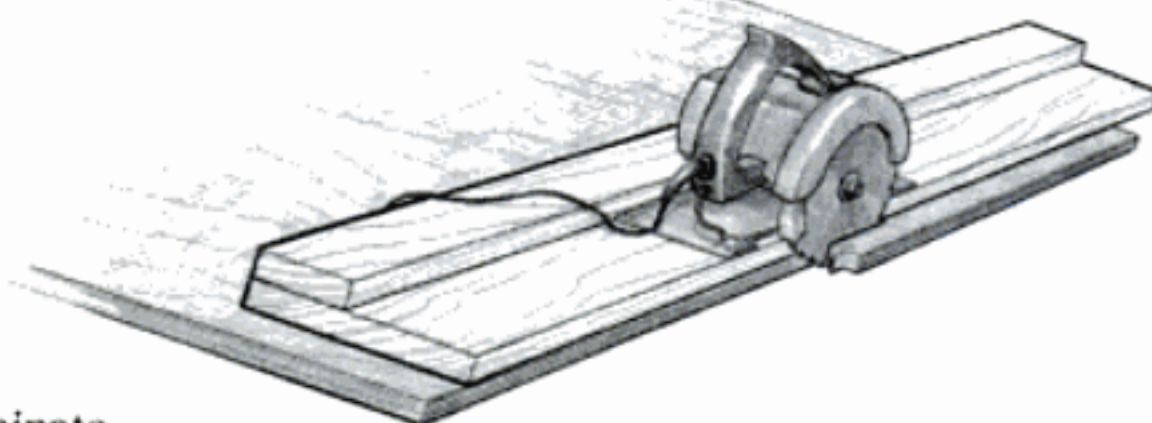
I found myself knee-deep in chips and shavings after buying a shaper, but had neither the funds nor the space for a full-scale dust-collecting system. To solve the problem, I connected my shop vacuum to a plastic garbage can lined with a trash bag, and connected the garbage can to the shaper with metal dryer vent hose, as shown in the drawing. The chips drop out in the garbage can and only the dust goes to the vacuum. The secret is to keep all the connections, including the lid, airtight. You'll have to figure out how to attach the hoses to your particular garbage can lid. Duct tape is a big help.

JOHN O. CRENSHAW
Mission Viejo, CA



Splinter-Free Plywood Cuts

The tendency of portable circular saws to splinter the top side of plywood can be minimized with the saw guide shown in the drawing. Make it out of two pieces of wood. The edge of the upper narrow piece must be



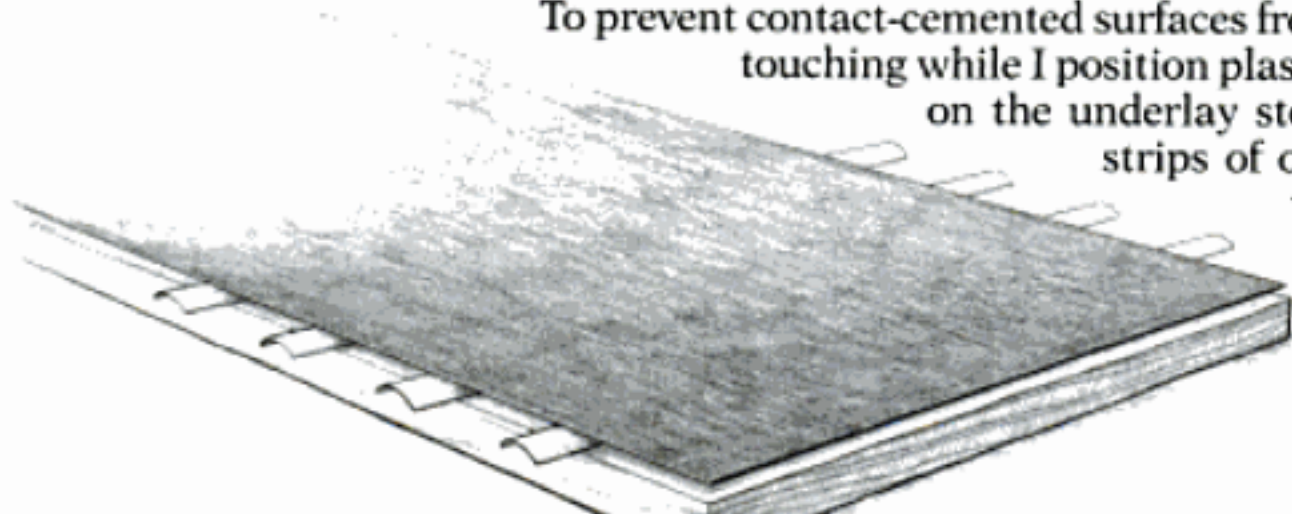
dead straight. Fasten it to the lower piece, revealing a bit more than the width of the shoe of the portable saw so that the saw can be used to trim the piece to exactly the right width. The lower piece holds down the wood fibers, preventing splintering.

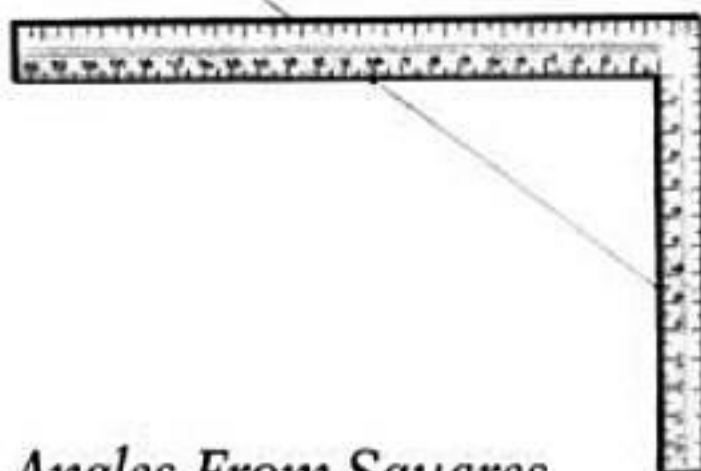
ROLAND FILION
Manville, RI

Blinds Separate Laminates

To prevent contact-cemented surfaces from touching while I position plastic laminate on the underlay stock, I place individual strips of old venetian blinds between them. They pull out easily, dropping the laminate onto the surface.

J. A. WILSON
Lexington, MA





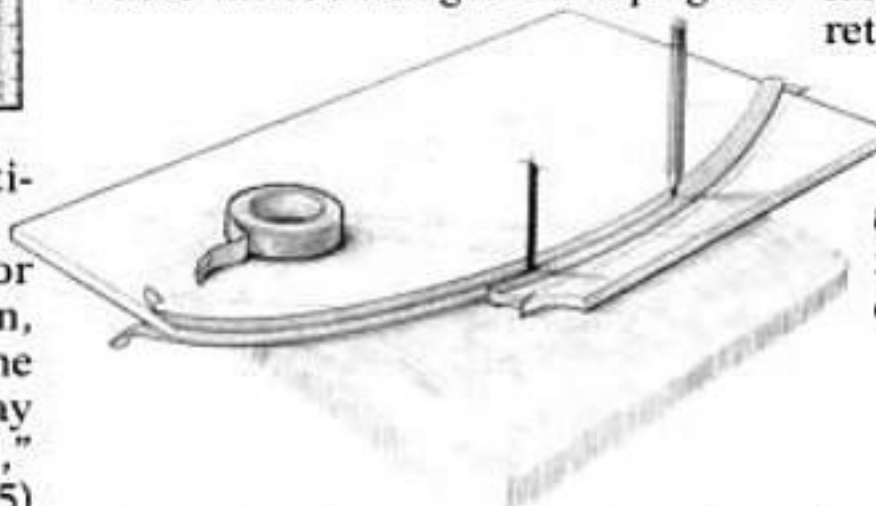
Angles From Squares

You don't need to be a mathematician to lay out accurate angles in the shop. If you have a calculator with trig functions (sin, cos, tan, etc.), here's how to do it. Enter the angle that you want to lay out (say 37°), hit the button labeled "tan," read the value (in this case 0.75355) and move the decimal point over one place to the right (in this case to 7.5355). Now find 10 in. on one leg of your framing square and 7.5355 in. (7 1/2 in., or 7 17/32 in. to be more precise) on the other leg of the square, and you have the angle as shown.

TREBOR NAROM
Onaled, NM

Sawing Plexiglass

When sawing Plexiglass or similar thin plastics, I control chipping and shattering by applying masking tape to both sides of the plastic right over where the cut will go. The tape gives



me a surface for marking the cut line and prevents chipping during the cut. It's been helpful with a circular saw, a bandsaw and a scroll saw. It also helps to use a fine-toothed blade and to hold the plastic sheet to prevent vibration.

RUSSELL G. CLAUSING
Overland Park, KS

Stop Dust Migration

My wife used to complain about dust from my basement shop appearing all over the house. I finally figured out how it got there; via the furnace, from the basement cold-air return ducts. To stop the dust, I got some felt from the local fabric store and taped it over the basement cold-air return grills. No more complaints! Apparently the furnace filter just wasn't fine enough.

JIM TURBYVILLE
Westland, MI

Know a better way of doing something? Designed a clever jig? Send your woodworking tips, along with a sketch or a snapshot to: Tech Tips, AMERICAN WOODWORKER, 33 E. Minor St., Emmaus, PA 18098. We'll pay you \$35 if we publish your tip.

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Bronze Scraping Plane

This new scraping plane from Lie-Nielsen Toolworks is ideally suited to many finishing jobs. It will take off a shaving of infinitesimal thickness, and produce a smooth surface. It's patterned after the very rare Stanley #212 plane. The scraping plane's adjustable blade is $\frac{1}{8}$ in.

thick and beveled at 60°. The body is made of manganese-bronze alloy, and the tool has a cherry wood handle. Tooothing blades for preparing surfaces for veneering and for working exceptionally difficult grains are available in 18 and 25 teeth per inch. (Price: \$115)

■ Lie-Nielsen Toolworks, Inc., Dept. AWT, Rt. 1, Warren, ME 04864, (207) 273-2520.

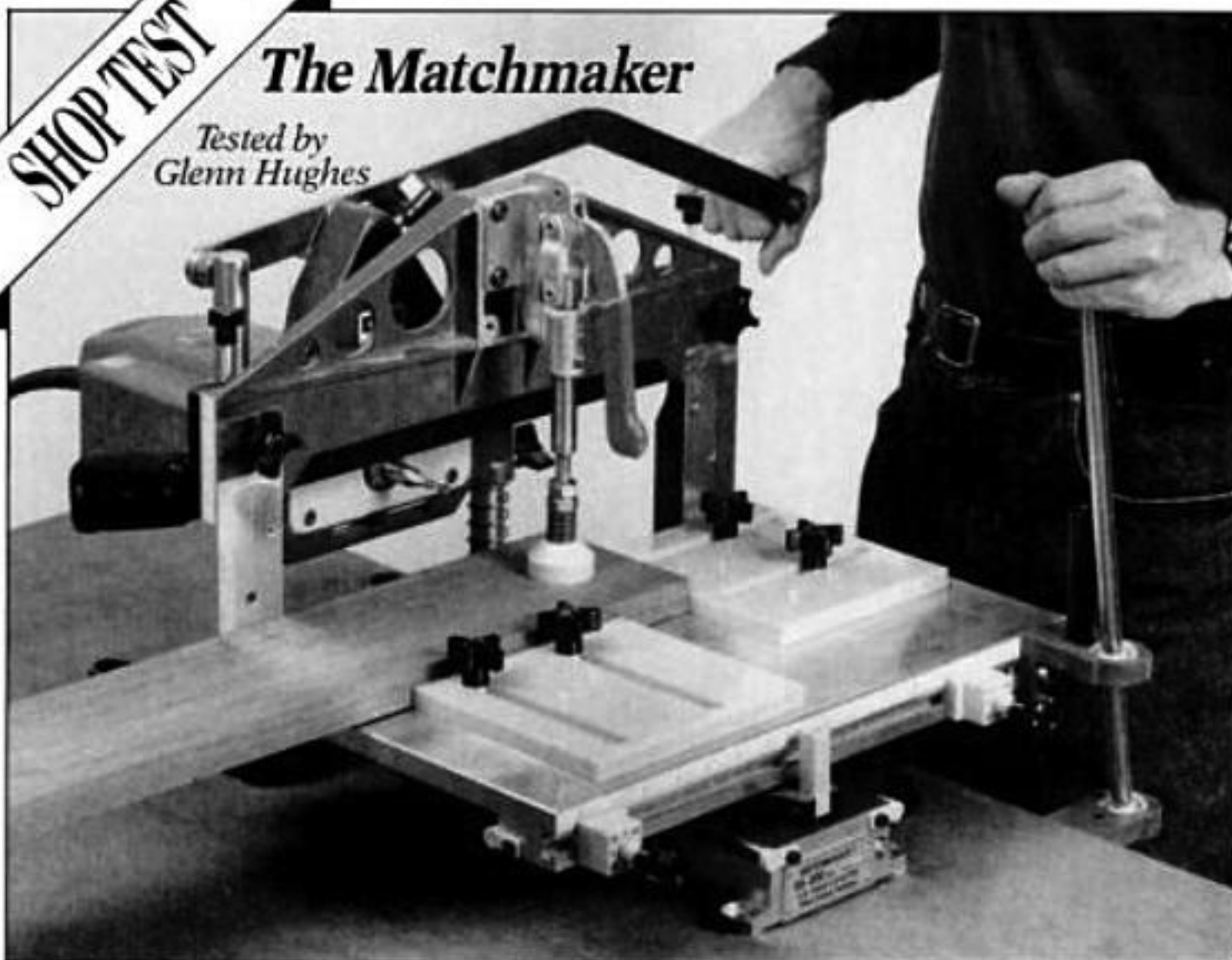
CIRCLE NO. 23 ON PRODUCT LITERATURE CARD



SHOP TEST

The Matchmaker

Tested by
Glenn Hughes



The Matchmaker is a multi-purpose woodworking machine for cutting mortises, tenons, dovetails and box joints easily and quickly. The machine works like a slot mortiser or boring machine, but it has the added ability to duplicate shapes from templates, making it more versatile. It's powered by a big, 3-HP plunge router, which you buy separately. The entire unit can be mounted on the end of a bench or stand and fitted with dust collection.

The Matchmaker has a beefy aluminum frame, which holds the router, and a horizontal aluminum table, which holds the workpiece. The table can move in two horizontal directions on precision linear-motion bearings. The router is mounted horizontally on a part of the frame that moves up and down on two posts. Depth-of-cut can be adjusted with the router's own plung-

ing mechanism or stops on the table. All these parts working together allow the bit to make accurate, easily controlled movements in three planes—up and down, left or right, and in and out.

For template work, the operator guides a stylus around a template while the cutter duplicates that shape on the workpiece. Plastic templates are available for making tenons, mortises for shutter louvers, dovetails and box joints in a variety of shapes. You can also make your own templates for custom shapes.

There are different models of the Matchmaker designed to fit the major brands of routers. The model we tested was designed for a Freud FT 2000 plunge router. To mount the router, I had to remove its base and the plunge guide posts, then slide it onto the guide posts of the Matchmaker. With a little practice, it took

only a minute to mount the router. Other than that, the Matchmaker came practically ready to use and was quite simple to set up. Be sure to get the router oriented correctly so its switch is easy to reach.

Mortises are very simple to set up and cut, and the ergonomic design of the Matchmaker makes it easy to use. The table moves smoothly and the adjustable stops make repetitive cuts a breeze. A joystick allows you to move the table in both directions with one-hand control. I discovered that the clamping pad lacks sufficient purchase on narrow stock to hold the workpiece tight when making aggressive cuts. This is easily remedied with an auxiliary C-clamp on the free end of the stock.

Tenons are equally easy to set up and cut, but you must pay attention to feed direction to avoid tear-out. At first, I wasn't able to get as tight a fit with the tenons as I'd like, but shimming the stylus with Scotch Tape fixed that. As with any woodworking procedure, I'd recommend doing test cuts first. I found that I got the cleanest cuts from high-speed steel spiral-flute router bits.

All in all, I believe the Matchmaker is a worthwhile tool in any workshop, and I especially appreciated its versatility. I'd recommend it for any woodworker who cuts a lot of mortises or does limited production runs. The machine is sturdily built with rugged moving parts, and a nice finish on the metal frame and table—it looks like it came out of a custom machine shop. (Price: \$549.00; router and templates not included)

■ Woodworker's Supply, Dept. AWT, 5604 Alameda Place, N.E., Albuquerque, NM 87113. (505) 821-0500.

GARDEN BENCH

*Designed for the Chicago Botanic Garden, This Bench
Will Make Any Backyard Look Like an Estate*

BY CHARLES SHACKLETON

When the people at The Chicago Botanic Garden called me in 1987, they were looking for a garden bench well within the English garden-bench tradition but distinctive in appearance, comfortable, durable, and handmade in America. The folks at the botanic garden and I worked together for nearly a year, refining a design. Two trips to Chicago and three prototypes later, we arrived at the design shown here.

A lot of careful thought went into the bench. That thought was directed primarily toward aesthetic and structural excellence. Price and shipping considerations were secondary. I'm quite happy with the results. The Chicago Botanic Garden must be pleased too; the folks there have ordered more than 80 benches through the years.

Teak

The traditional English garden bench is teak. For outdoor furniture, teak is a very practical choice. It's extremely stable and durable and as strong as oak. While the silica in the cells does tend to dull cutting tools rather quickly, teak is reasonably easy to work with either hand or power tools. And it's quite attractive, whether oiled or left to weather to a silver gray.

Unfortunately, teak is good for so many purposes,

and demand is so high that loggers have destroyed entire forests for the profits. Unlike many woods, however, teak flourishes in single-species plantations. The Dutch began planting teak in Java more than 100 years ago. The teak in the Chicago bench comes from these plantations. If you decide to build your bench out of teak, do get it from a supplier who can certify that it's plantation grown. If you'd rather build with a rot-resistant domestic wood with adequate strength, consider white oak, black cherry or black walnut.

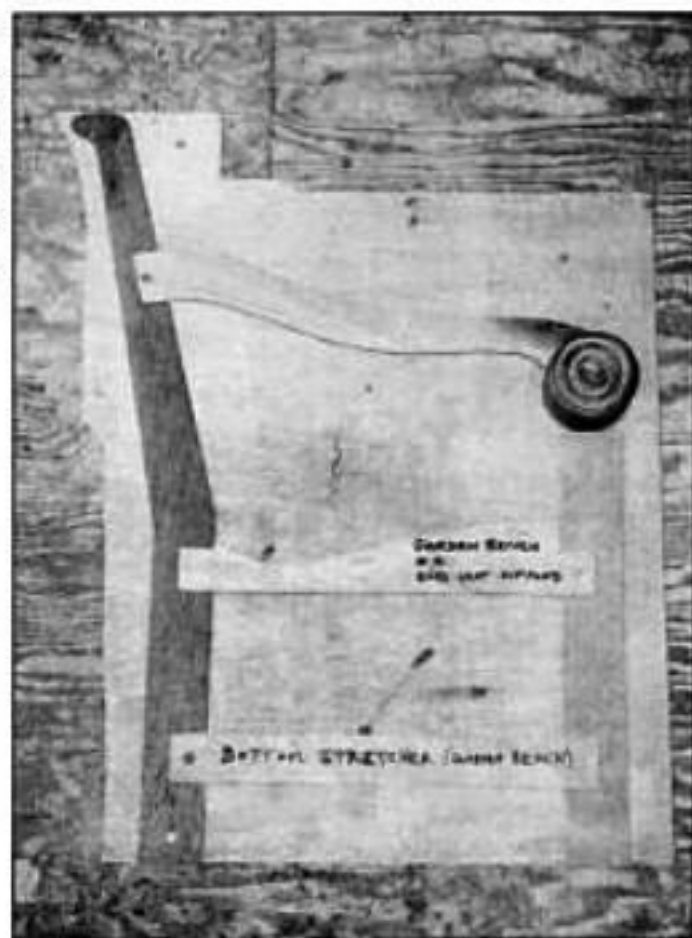
The Bench Parts

Most of the construction of the bench is conventional joinery and should present few problems for the average woodworker who's careful and accurate. Just a few aspects of the bench construction deserve comment.

Adhesives for year-round outdoor exposure must be waterproof. Ordinary white or yellow wood glues are out. In my furniture shop we use WEST System epoxy formulated for building wooden boats, and the slow hardener with it for maximum assembly time.

Each end assembly has six parts, all of which must come together accurately if the joints are to be tight and gap free. Since the rear leg piece has a bend and the arm has curves, you'll never get it perfect just by measuring. We make up full-size patterns out of 1/4-in. plywood and trim them until they fit each other pre-

Lay out full-size plywood patterns for the bench end assembly to ensure a gap-free fit before cutting expensive teak.



Turn the decorative "balls" for the arm-leg assembly between centers. Reverse the ball in the lathe to turn the second side.

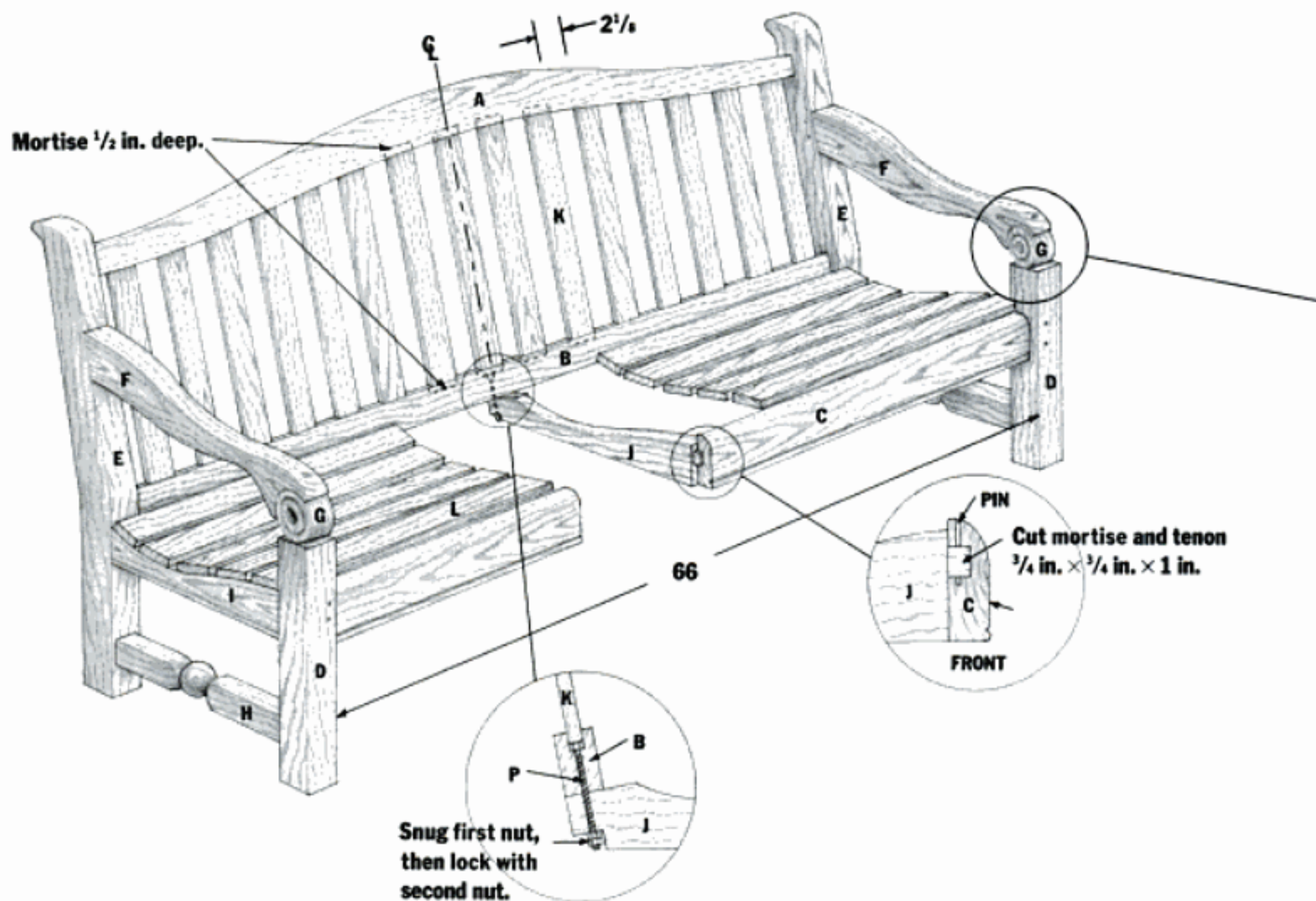
This garden bench will bring a touch of class to your patio or yard. It's traditional yet distinctive and solidly designed to last for generations.

PHOTOS BY BOB MORAN

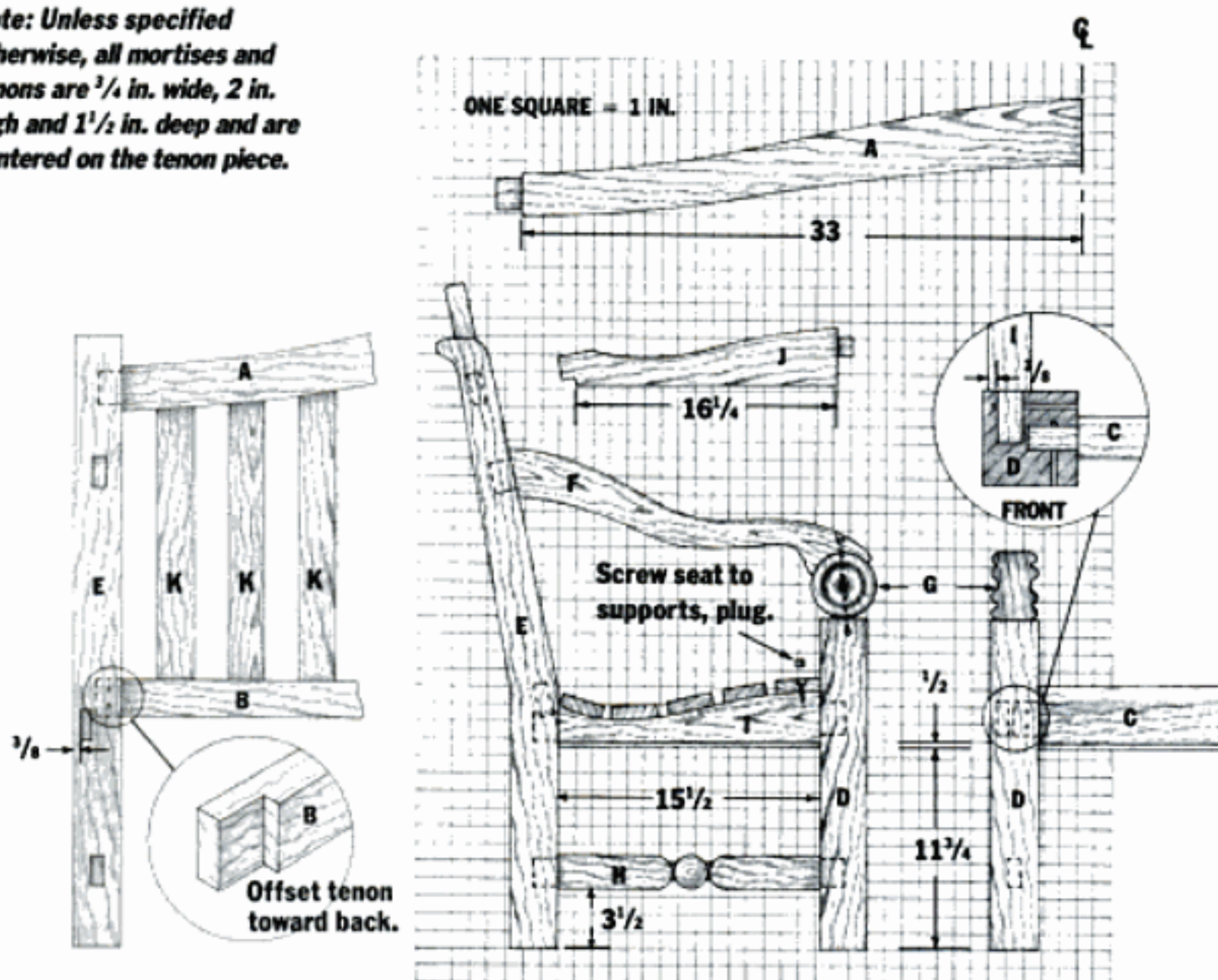
ROGER MATTINGLY

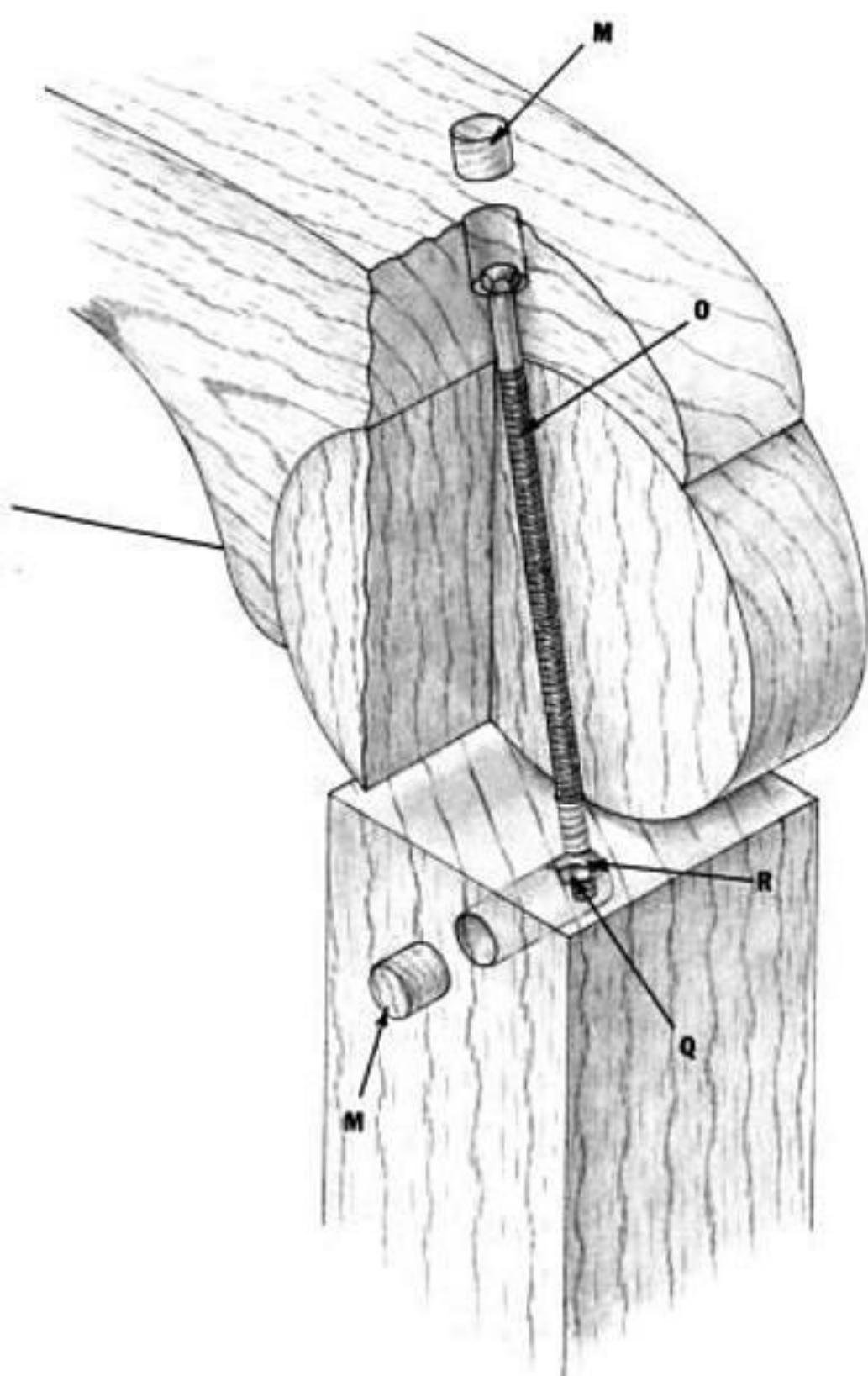


CHICAGO GARDEN BENCH



Note: Unless specified otherwise, all mortises and tenons are $\frac{3}{4}$ in. wide, 2 in. high and $1\frac{1}{2}$ in. deep and are centered on the tenon piece.





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KEY	PART	QTY.	DIMENSIONS
A	Upper back rail	1	1 1/4" x 7" x 69"
B	Lower back rail	1	1 1/4" x 2" x 69"
C	Front seat rail	1	1 1/4" x 3 1/2" x 69"
D	Front leg	2	2 3/4" x 2 3/4" x 19 1/2"
E	Rear leg	2	2 3/4" x 5" x 36"
F	Arm	2	2 3/4" x 3 1/2" x 22"
G	Ball	2	2 3/4" x 3 7/8" dia.
H	Stretcher	2	2 1/8" x 2 1/8" x 18 1/2"
I	End seat support	2	1 1/4" x 3 1/2" x 18 1/2"
J	Mid seat support	1	1 1/4" x 3 1/2" x 18 1/2"
K	Back slats	15	1/2" x 2 1/8" x 20"
L	Seat slats	5	3/4" x 2 1/2" x 71 1/4"
M	Plugs	4	3/8" dia.
N	Plugs	15	3/8" dia.

HARDWARE

O	2	3/16"-18 x 6" stainless steel cap screw
P	1	3/16"-18 x 3" stainless steel cap screw
Q	4	3/16"-18 stainless steel hex nut
R	6	3/16" stainless steel flat washer
S	15	1 1/4" #8 flat head brass wood screws

WEST System epoxy, stainless steel bolts, washers, nuts, brass screws, 1/4-in. dia. teak bungs (plugs): JAMESTOWN DISTRIBUTORS, 28 Narragansett Ave., P.O. Box 348, Jamestown, RI 02835, (800) 423-0030.



After turning, remove the lathe center marks on the balls with a 1-in. spade bit ground to cut a shallow dish shape.

cisely, then cut the bench parts to match the patterns. I strongly recommend that you do the same.

The "balls" (actually cylinders) that fit between the armrests and the front legs are turned on both faces. I've turned them two different ways, both of which worked well. You can choose between these approaches depending on what equipment you have. The first approach is to turn the balls between centers, as shown in the photo on page 21. Turn one face and half of the circumference, ignoring the very center of the face, then reverse the ball in the lathe and turn the other face and half of the circumference. After turning, dish the very centers of the faces on a drill press with a wide spade bit modified to cut like a rosette cutter, as shown in the photo on page 23.

The alternative approach for shaping the balls is to saw the circumference with a circle-cutting jig on the bandsaw, then chuck the round blanks in a large three-jaw chuck to turn the faces. Whichever way you turn them, be sure to make both balls to exact diameter.

The armrests have a concave surface at the front that fits over the balls. We first bandsaw this curve, then sand it to fit the ball with a wooden sanding drum turned on the lathe. The diameter of this drum after gluing on 60X or 80X abrasive paper should be the same as the ball's diameter. The drum is powered by the lathe and sands the end of the arm to a perfect fit.

The other curved surfaces, including the rest of the arm surfaces, the rear legs, the seat supports, and the top of the back, are bandsawn and sanded smooth. We shape the front seat rail by roughing it out with bevel cuts on the tablesaw, then finishing with hand planes.

We round over the edges of all the parts with a router in a router table. Before doing so, however, it's important to mark where parts join. Skip rounding



A turned wooden sanding drum covered with 80X abrasive paper or cloth grinds the front end of the bench arm to match the diameter of the balls.

over the joint areas until after assembly, and then work up to the joint by hand.

Assembling the Bench

The balls between the arms and front legs make it tricky to assemble the bench. It's easiest to fit the ball in place after assembling the rest of the end section. Begin by fitting the seat support and turned stretcher to the front and back legs and pinning them permanently. Next, fit the arm to the rear leg and pin the joint with holes offset about $\frac{1}{8}$ in., and no more. This technique is known as draw boring. There is no con-



To drill the bolt hole in the bench's end assembly, aim a long bit carefully down a sight line at the center of the nut hole. Extend the sight line with a steel ruler if it helps you to aim accurately.

venient way to clamp this joint, and draw boring pulls it up tight.

The ball should then slip nicely between the arm and the front leg. With the end section flat on a benchtop, inner surface uppermost, orient the ball so the grain runs up and down from the arm to the leg. Hold it there by clamping from the top of the arm to the seat support, as shown in the photos on page 24.

Now clamp the entire end section to the benchtop to prevent movement as you drill the holes for the 6-in. stainless steel bolt that holds it all together. The drawing shows where the bolt, washers and nut must

TEAK: THINK BEFORE YOU BUY

BY TED TUESCHER

Can a conscientious woodworker use teak and still sleep at night? Depending on where the teak grew, buying it may indeed encourage further destructive harvesting of tropical forests.

Teak is native to Southeast Asia, specifically India, Burma, Thailand and Laos. Most of the original stands of teak are gone. The largest remaining teak forests are in Burma, which has one of the fastest rates of forest depletion in the world. The ruling military government in Burma is cutting teak with little regard for the future. According to The World Resources Institute, few proceeds from these sales of teak benefit the forests or forest-dwelling communities of Burma. (The U. S. is considering a ban on importing Burmese teak because of human-rights violations.)

But Burma is not the only source of teak. Unlike many other tropical hardwoods, teak grows extremely well in plantations. More than 40 countries now have teak farms. Java, an island in Indonesia, has been growing high-quality teak for more than a century. Little natural forest re-

mains on this densely populated island, but carefully managed tree farms ensure an adequate future supply. Seed orchards and bud-grafting sites help develop a healthy and well-formed crop. Rock terracing protects slopes from soil erosion. Cover crops between the rows of trees protect the soil from monsoon rains. In an effort to help consumers locate responsibly produced tropical wood products, the Rainforest Alliance in New York has certified teak from Java as being "well-managed."

To use teak responsibly, ask your supplier for verification that it comes only from plantations. While we don't want to encourage countries to clear more forest to create plantations, using plantation-grown teak will help ensure that the few remaining natural stands will not be cut. Finally, encourage your supplier to participate in the Smart Wood certification program (see *Final Pass*, page 80) initiated by the Rainforest Alliance. If you'd like more information, write the Rainforest Alliance, 270 Lafayette St., Suite 512, New York, NY 10012.



Detailing, shaping, and finishing by hand produce the subtle variations that make a project friendly and inviting.

go to securely hold the assembly. Notice that the bolt angles forward from the arm to the leg. You'll need a $\frac{5}{8}$ -in. bit with a good sharp spur to drill the bolt counterbore in the arm and the nut hole in the leg. You'll need a $\frac{3}{8}$ -in. bit with a long center pilot, like a Stanley Powerbore, to start the bolt hole accurately in the center of the bottom of the counterbore. Finally, you'll need a $\frac{3}{8}$ -in. bell-hanger bit to finish the long bolt hole.

To begin, draw the line of the bolt on the inner surface of the arm and the leg. Then, using a square, transfer the line to the outer surface of the arm and leg. In Barnard, Vermont.



Mark the backrest slats for length by fitting them in their mortises at one end and marking the other end while the bench is temporarily assembled.

rule along the line to serve as a longer sight line, as shown in the photo on page 24.

First, bore the $\frac{5}{8}$ -in. counterbore and nut hole. Then start the bolt hole with the $\frac{3}{8}$ -in. Powerbore. You can now drill the remainder of the hole with an extra-long twist drill or bell-hanger bit, as shown in the photo. Aim carefully down the sight line so the bolt hole comes out in the center of the nut hole.

Bend the washer that fits inside the



Hand-cut inlays? Guess again. The graceful vines and leaves on the drawer front of this table were cut with a router.

*Delicate Designs
with a Router
and Template*

STRING INLAY

BY FRED MATLACK

For centuries craftsmen have decorated panels, tabletops, drawer fronts and the like by carefully carving delicate grooves and patterns with a scratch stock or knives, chisels and router planes, and filling the recesses with inlays of contrasting wood. Inlaid lines, especially curved lines, are traditionally called "string inlay" or stringing. Today, you can create very impressive designs easily by cutting the grooves and shapes with a router guided by a template, and then tapping contrasting strips into the recesses. In this article I'll explain how to design the inlay to simplify cutting and fitting the pieces, how to make reusable templates out of plywood or hardboard, how to cut the inlay pieces and how to fit them into the grooves.

Designing Inlays

Design your inlay from the start, so you can cut the grooves with a router, and so the inlay wood doesn't have to bend too much during installation. Narrow inlays have a delicate appearance and look difficult to do. But, since the narrowest router bit you'll find is a $\frac{1}{16}$ -in. dia. single flute high-speed steel bit (Bosch #85091, for example), I suggest that you design your inlay for $\frac{1}{16}$ -in. wide lines.

A template guides the router for smooth, flowing curves and truly straight lines. Since it takes time to make the template, try to include repeated or mirror-image curves in your design. That way, you can use the template several times, or at least flip it over to produce a mirror image. The example in the photo and in Fig. 2 has a mirror-image pattern on the front of a

drawer.

Bear in mind that you have to fit wood into the grooves that you rout. You can miter the inlay pieces at sharp corners and bend the wood into reasonable curves, but it's difficult to bend most $\frac{1}{16}$ -in. thick strips any tighter than a $\frac{1}{2}$ -in. radius. Avoid the frustration of broken inlay pieces by designing the curves no tighter than you can bend the inlay wood. Also, try to limit solid areas, such as inlaid leaves, to easily reproduced shapes that you can "mass produce," as explained below.

I'd suggest that you try the whole process on some scrap wood following the pattern in Fig. 2 before designing your own inlay. That way, you'll have a better feel for what the wood can do.

Templates

A router fitted with a template guide is the best tool for cutting grooves for slender lines. A template guide is a router attachment that fits onto the router base. The business end of it is a collar that projects below the router base, right around the router bit, as shown in Fig. 1. To use a template, clamp it to the workpiece and rest the router on the template with the template guide hanging over the edge. Guide the router so the template guide follows the edge of the template while the bit cuts a groove in the workpiece.

The bit cuts the groove a fraction of an inch away from the edge of the template, as shown in Fig. 1. This offset is not a problem on a straight line as long as the template is correctly positioned, but when the template curves, the offset changes the radius of the curve. Fig. 1 shows how the radius of the groove will be

You will need to prebend the inlay strips to fit around tight curves. Dry heat from a soldering iron makes the wood pliable enough to bend.



Glue the inlay strip into the groove beginning at one end and working toward the other end. Cut away extra length just before the last end goes into the groove.

smaller than the radius of the template on an inside curve, while on an outside curve the radius of the groove will be larger than the radius of the template. You must cut the template to a shape that compensates for this difference.

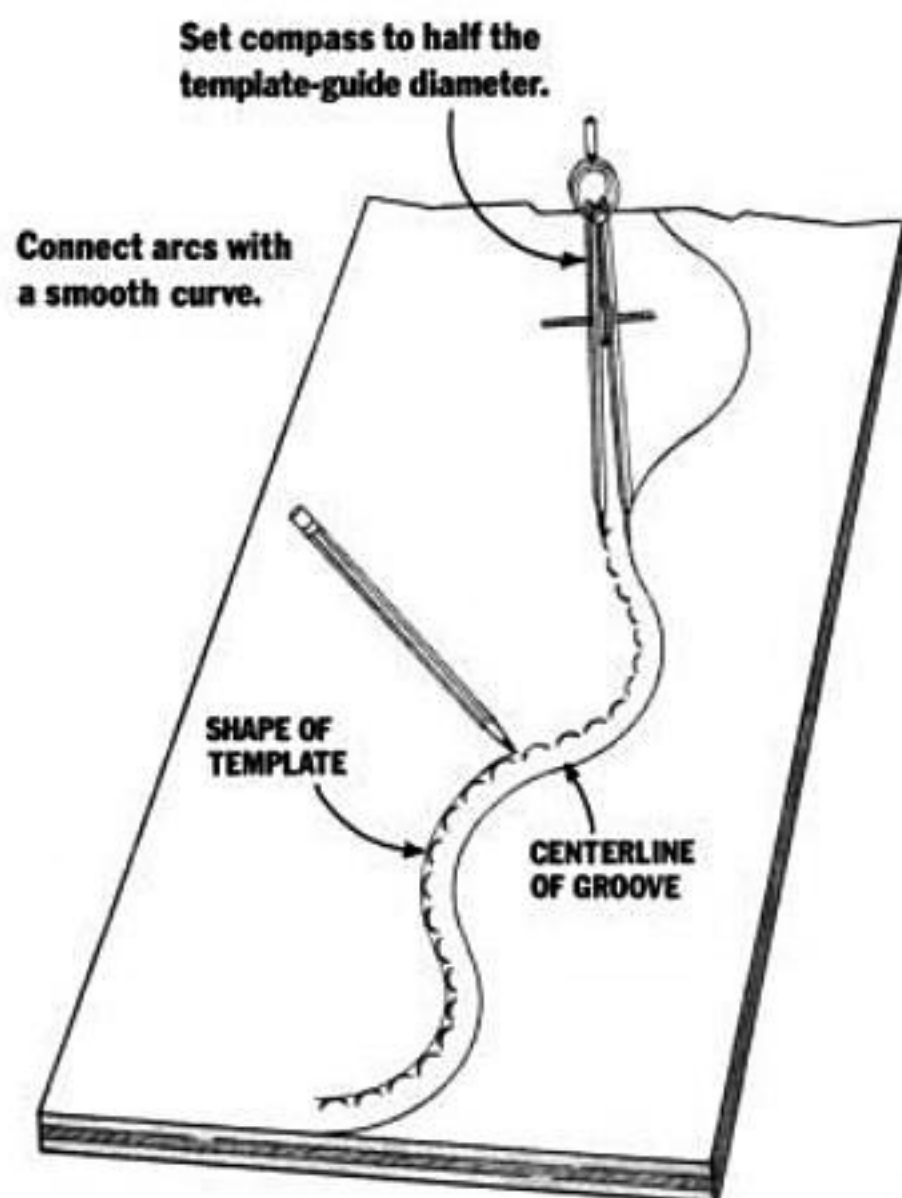
The distance from the centerline of the groove to the edge of the template will always be half the diameter of the template guide. You'll simplify making the template if you design your inlay by drawing a line for the centerline of the groove instead of drawing two lines for the two edges of the groove.

To make the template, first trace the inlay design onto the template stock. Hardwood plywood and hardboard make good templates. Choose a thickness

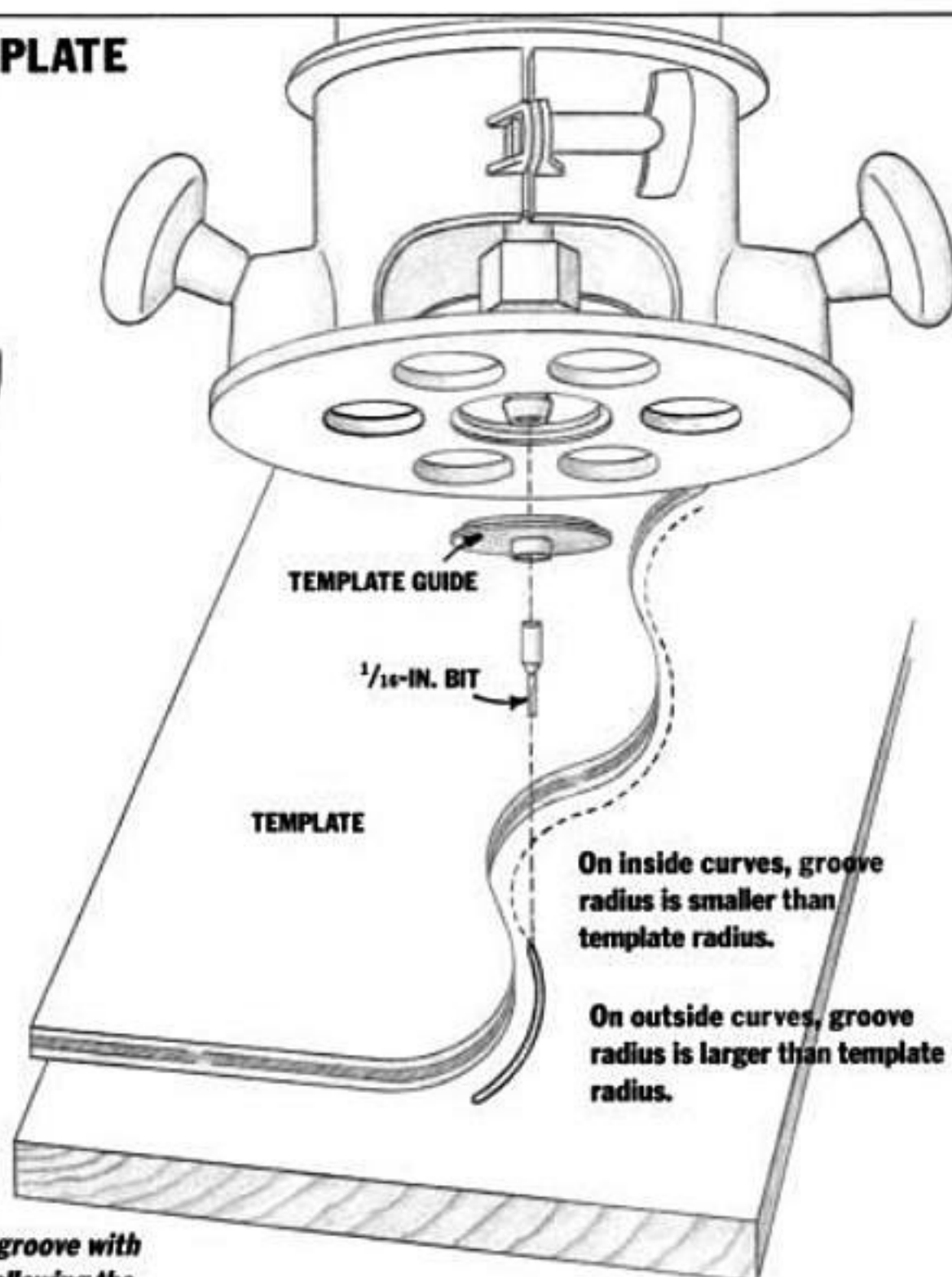
slightly greater than the length of the collar on your template guide. Trace the pattern in Fig. 2 if you don't want to design your own inlay just yet. Set a compass to half the diameter of your template guide and strike a series of arcs on the template side of the line (not the waste side), as shown in Fig. 1. Draw a smooth curve connecting the high points of the arcs and saw out the template. Sand the edge to assure smooth, even curves.

To try out the template, clamp it in place on a scrap piece of wood, adjust the router to cut about $\frac{1}{8}$ in. deep in the scrap and cut the groove. Keep the template guide tight against the template as you cut. Clean out the grooves and sand them lightly to get rid

FIG. 1: ROUTING INLAYS WITH A TEMPLATE



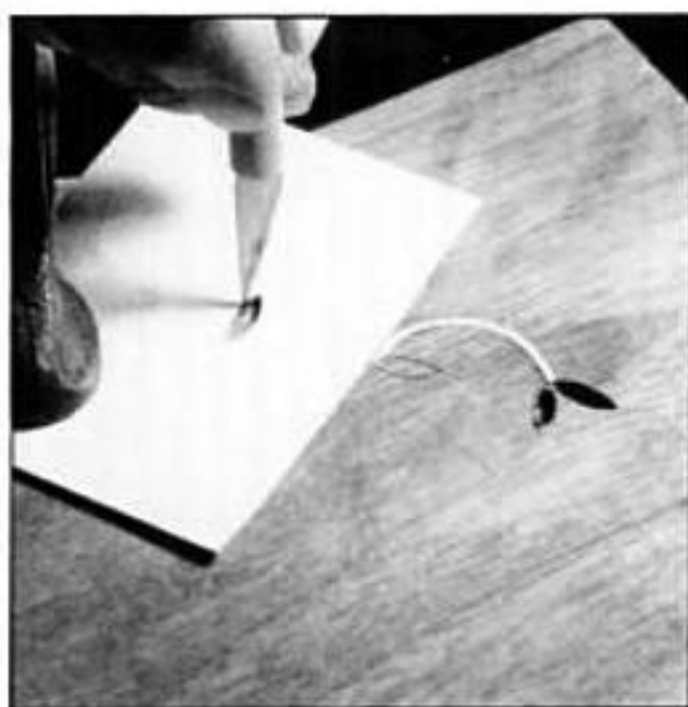
STEP 1: Cut the template to a line offset from the line of the design.



STEP 2: Rout the groove with a template guide following the template.

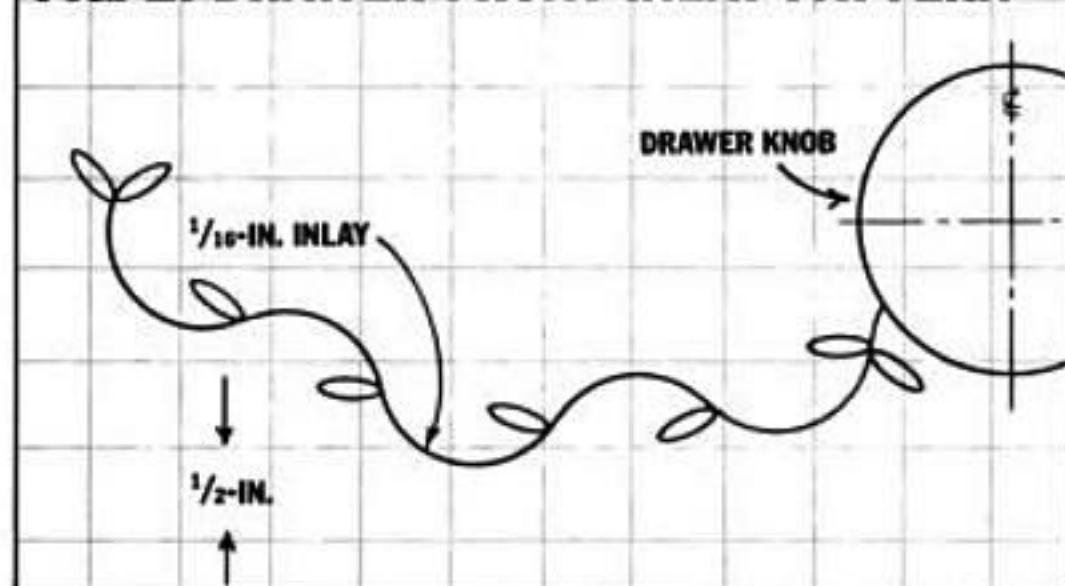
DRAWINGS BY FRANK ROEBACH

Incise the outline of leaves or similar shapes by tracing around a plastic laminate pattern with an X-acto knife. Rout out the bulk of the area and clean up the corners with the X-acto knife.



Saw off a glued-in leaf with a veneer saw or other fine-toothed flush-cutting saw, then glue the remainder of the plug in the next recess.

FIG. 2: DRAWER-FRONT INLAY PATTERN



of any whiskers raised by the cutter. Now check that the groove matches the pattern.

Cutting and Fitting Inlay Strips

The next step is to cut inlay strips for the grooves. Choose an inlay wood with tight, straight grain (I used maple for the drawer shown on page 26 and cut several $\frac{1}{16}$ -in. $\times$ $\frac{3}{16}$ -in. strips several inches longer than the groove. If your saw leaves deep saw marks, cut the strips a bit thicker than $\frac{1}{16}$ in. so you can sand out the saw marks and still produce a good fit in the grooves.

If you've designed an inlay with very easy curves, you may be able to fit the strips in the grooves without prebending, but with most designs, including the one in Fig. 2, you must prebend the strips to the shape of the design. The easiest way to bend the strips is with heat. You can bend them over the round body of an electric soldering iron, as shown in the photo on page 27. Lay a strip of wood across the hot iron and press lightly to bend the strip around it. When the wood is hot enough it will bend easily. If not hot enough, the wood will crack and if too hot it will scorch. You may waste a few strips until you get the hang of it. Start at one end of the design, bending the strip to match, and work your way from curve to curve, checking the bent strip against the design as you go. Try to be accurate with the bends. You'll be able to spring the strip a little, but the closer it is to the proper shape, the easier it will be to install. Leave the strip a bit longer than the groove.

When the strip matches the groove fairly closely place a small amount of glue in the groove and press the strip in, starting at one end, as shown in the photo on page 27. Trim the strip to length before pressing the last end into place, then set a block of wood over the strip and tap it with a hammer to seat the strip

firmly into the groove.

Let the glue dry, and then sand the strip down flush with the surrounding surface. Be careful not to split the strip while you are sanding it down. A split could easily run down below the surface and show in the finished job. That's it. You've inlaid delicate curved lines.

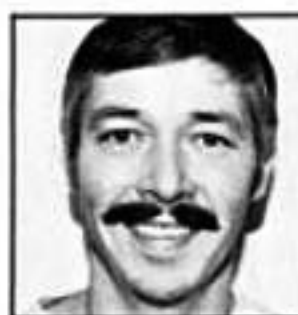
Inlaying Larger Shapes

Most inlay patterns include broad areas like leaves or shells, in addition to slender lines. I've found it easiest to inlay these shapes by incising the outline in the background stock with an X-acto knife and freehand routing the recess. I make a pattern of the actual shape and size of the design element and use it for both outlining the recess and cutting the inlay wood. Because I trace around the pattern with a knife, I make the pattern out of plastic laminate; it's hard enough to resist knife cuts, thin enough to easily trace around, and just workable enough that I can cut out the shape with a jigsaw and smooth it with needle files.

If you're practicing with the design in Fig. 2, make a pattern of the leaf, place it on the stock where the design calls for a leaf, and outline the leaf with a sharp X-acto knife, as shown in the photo above, left. Incise the outline of all of the leaves in this manner, and then rout the recesses freehand, $\frac{1}{8}$ in. deep and just shy of the outline. Hand-trim the edges to the incised line with the X-acto knife to finish the recesses.

With the same pattern, mark the leaf shape on a piece of $\frac{3}{4}$ -in. to $\frac{5}{4}$ -in. thick inlay wood. Saw out the leaf with a jigsaw or bandsaw to produce a plug that will fit closely in the leaf recess. (You'll slice this plug into many inlay pieces.) You can adjust the shape a little with sandpaper or files, but if you miss the shape by too much, cut another plug to get one that fits well.

When you've got a plug that fits the recesses nicely, put a small amount of glue in a recess and tap the plug firmly into it. Let the glue set, then cut the plug off just above the surface with a veneer saw or Japanese saw with a flexible blade, as shown in the photo above, right. Repeat for each recess. If you use up the plug, cut another one and continue until you've filled all of the recesses. Sand the leaves flush, and you're ready for your choice of finish. ▲



Fred Matlack heads the Rodale Design Group where he practices woodworking, metal working and almost every other craft you can name. His passion is restoring and using antique, pedal-powered woodworking machines.



Tables like this one were commonly found in Early American inns. Today, it looks right at home in a dining room.

TAVERN TABLE

BY CRAIG W. BENTZLEY



ENGRAVING COURTESY THE BETTMANN ARCHIVES

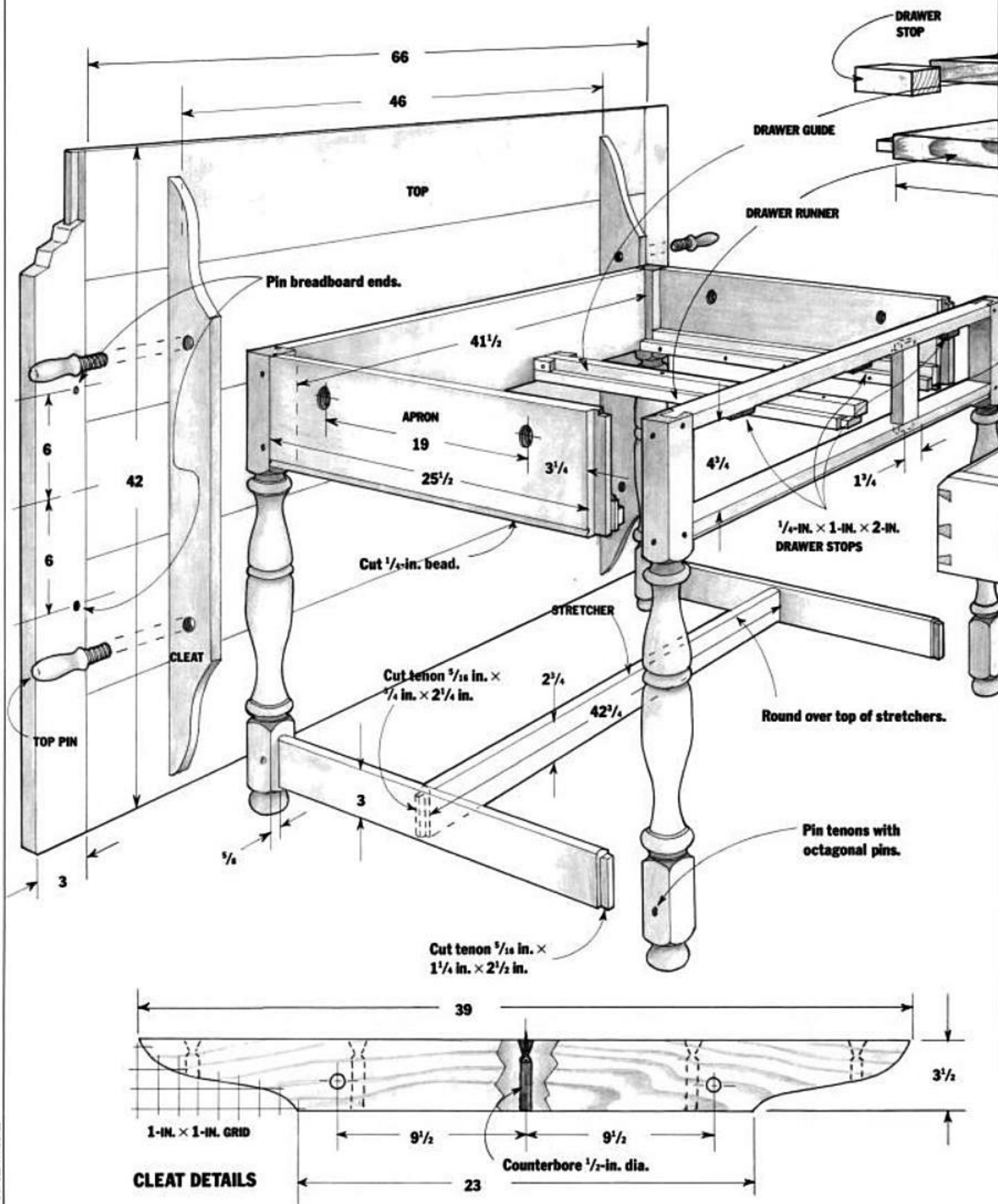
In the 1750s, tables like this were common in the taverns of the American colonies. These tables were made in many different sizes and variations, but they had some distinctive features in common—turned legs, stretcher base and a removable pinned top with “breadboard” ends.

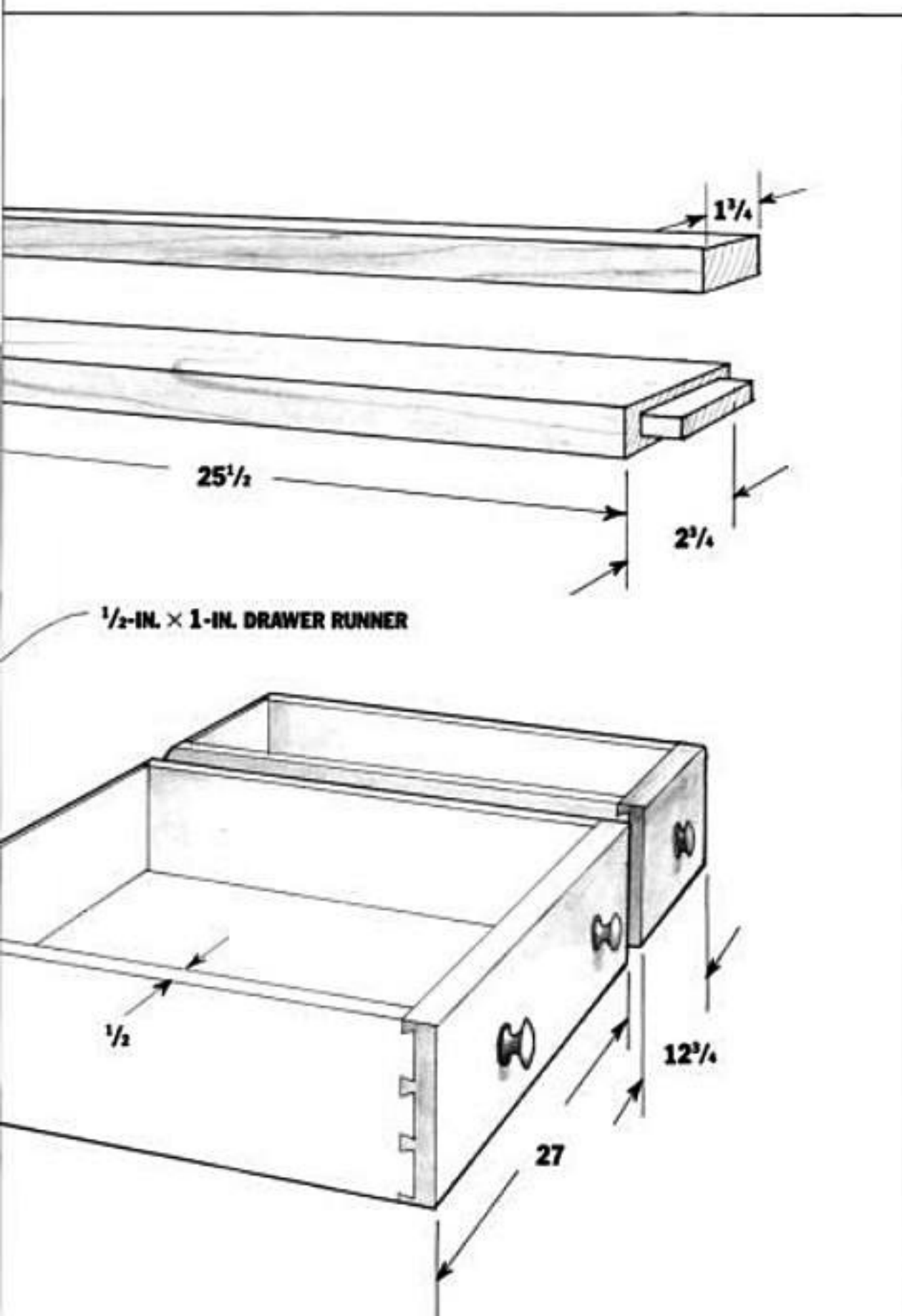
I designed and built the table for a customer who wanted a dining table to match her other Early American furniture. My reference books give many different names for this type of table. But by any name, it has a character that will make it at home in a dining room, a library, a work room ... or even a tavern.

The different-size drawers in the table aren't an ac-

PHOTOS BY MITCH MANDEL

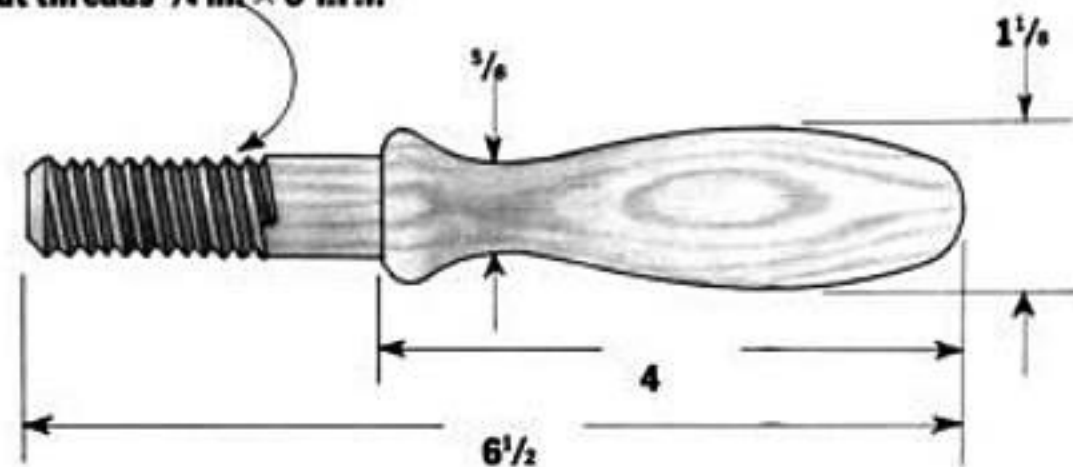
FIG. 1: TAVERN TABLE





NOTE: ALL STOCK 1-IN. THICK UNLESS OTHERWISE NOTED

Cut threads $\frac{3}{4}$ in. $\times$ 6 T.P.I.



TOP PIN
(4 REQUIRED)



An old Stanley #45 plane works great to put a bead on the bottom edge of the aprons and lower drawer rail.



Use the dove-tailed ends of the top drawer rail to lay out the dove-tail mortise on the top of the legs. Then saw to the line and chop out the waste with a chisel to make the dovetail sockets.

cident. (See Fig. 1.) They were a standard feature on these tables. A good innkeeper provided many amenities for his guests including pipes, tobacco, playing cards, candles, eating utensils and reading material, so the drawers were handy for storing these items.

According to one theory, these tables had removable tops because early tavern patrons were so rowdy the tops frequently needed repair or replacement. Aside from historical authenticity, the removable top makes moving the table much easier. The turned pins that hold the top add an interesting visual detail. The breadboard ends helped to prevent the cupping that was almost certain to occur when wide boards were used to make the top. Cupping was common because early cabinetmakers rarely finished the undersides of tabletops, causing the boards to dry out unevenly.

I prize historical accuracy in the furniture I build, and I like to use hand tools to get an authentic hand-made appearance. The subtle markings from hand-planed surfaces and edges contribute to the authenticity of the table. While I took care to design the table to be historically accurate, my customer specified dimensions I had to meet. The top was to be 72 in. x 42 in. (a bit larger than usual). The table had to have a center stretcher to allow chairs to slide under, and the side overhang had to be generous enough to accommodate guests at the table's ends. It can seat up to eight.

I made most of the table from pine, but decided on poplar for the legs to support the weight of the top and



Glue the breadboard ends to the top at their center only. Peg the ends 6 in. on either side of the centerline for reinforcement.

FIG. 2: JOINERY DETAIL AT TOP OF LEG

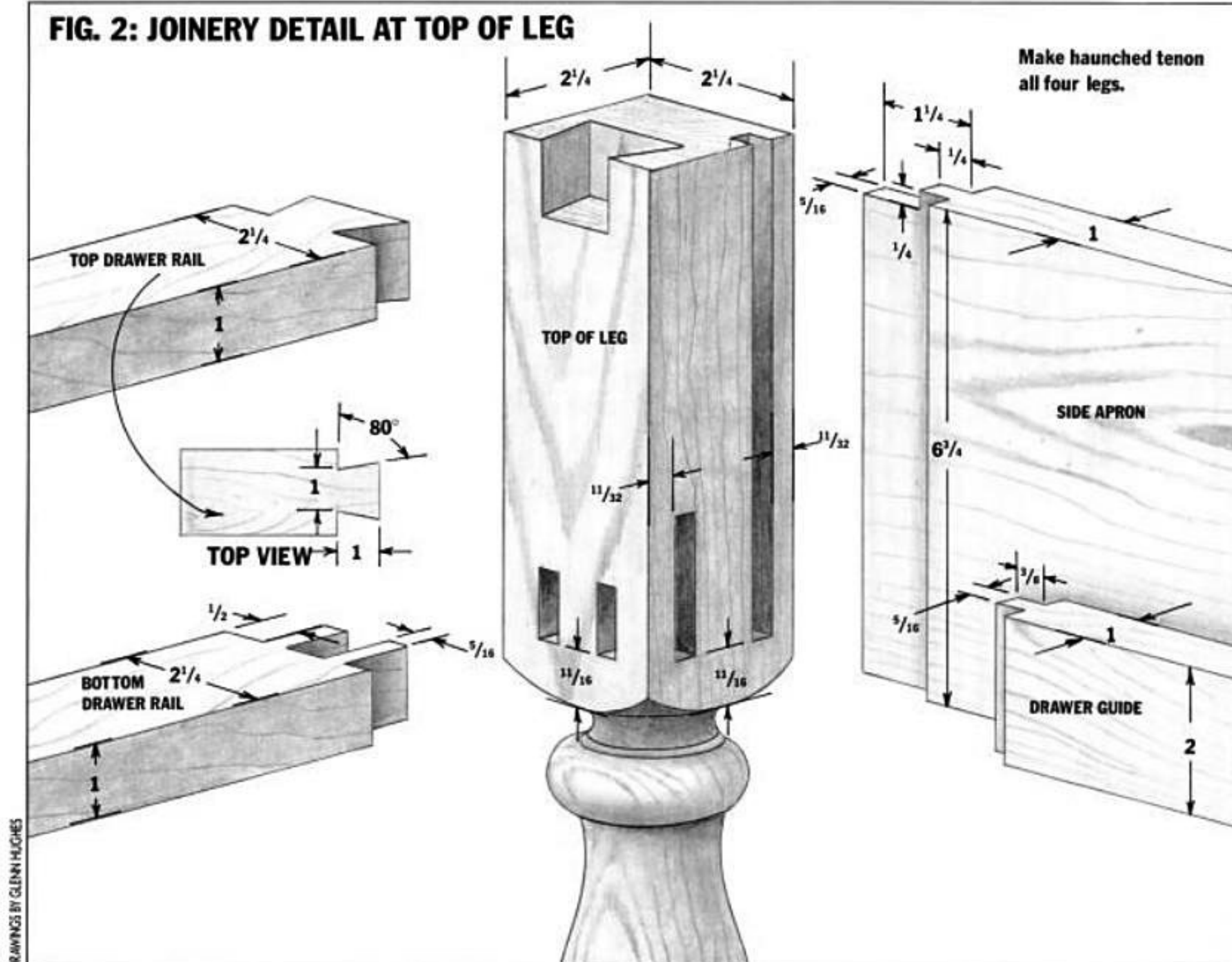
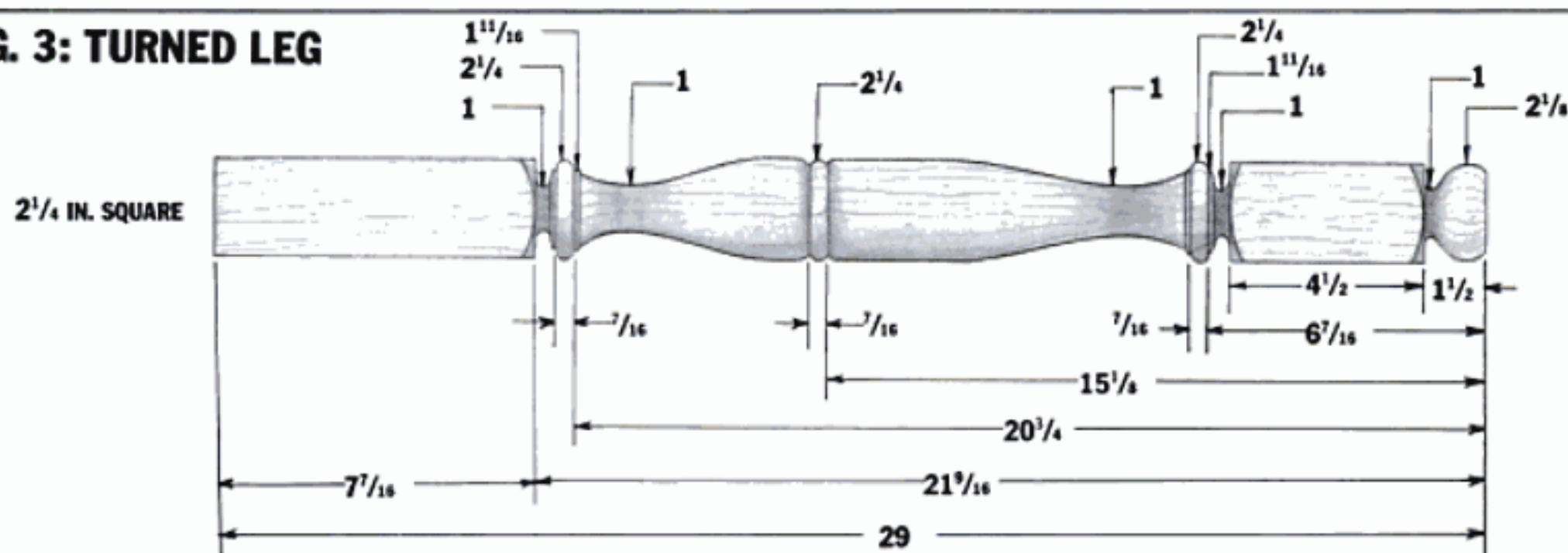


FIG. 3: TURNED LEG

to help withstand any sideways racking. Also, I could turn the shape of the legs more crisply with poplar than with pine. I used maple for the drawer knobs and the turned pins that hold the top to the base.

Building the Table

Begin with the base. Prepare the 2 1/4-in. leg stock, making sure it is perfectly square. I leave an extra inch of material at the top of the leg to eliminate break out when I'm cutting the mortises. This is sawn off after mortising. Turn the legs to the dimensions given in Fig. 3, and then arrange the legs so the grain patterns match up closely when viewed from any side.

Once the arrangement is determined, I mark the tops of the legs so they won't get mixed up during layout of the mortises for the aprons and stretchers. Lay out the mortises with a knife and a mortise marking gauge. (See Fig. 2.) These scribe lines won't rub off, and if they extend beyond the mortise they'll show slightly on the finished table. Such marks are almost always found on period pieces, so I let them remain. Just don't overdo it. I cut the mortises on my drill press with a hollow chisel mortising attachment.

The next step is to prepare stock for the aprons, drawer fronts, stretchers and drawer rails. I begin by ripping the material to rough width on the tablesaw and then bring it to finished width with a hand jointer plane. I cross cut to length (including tenons) on the tablesaw. The white pine I use runs about 1 1/16 in. to 1 3/32 in. thick, which is a bit heavy for this piece. I set a marking gauge to 1 in. and mark the stock to remove the extra material from the face side. I use a jack plane with the iron ground very slightly convex so that it has about a 1/32 in. crown in the center. I plane down to the line in a pattern parallel to the edges of the stock. This leaves the surface with a nice hand-planed look when observed in a raking light. Again, the key is to not overdo it. Early cabinetmakers didn't make their face surfaces look like washboards, and neither should you.

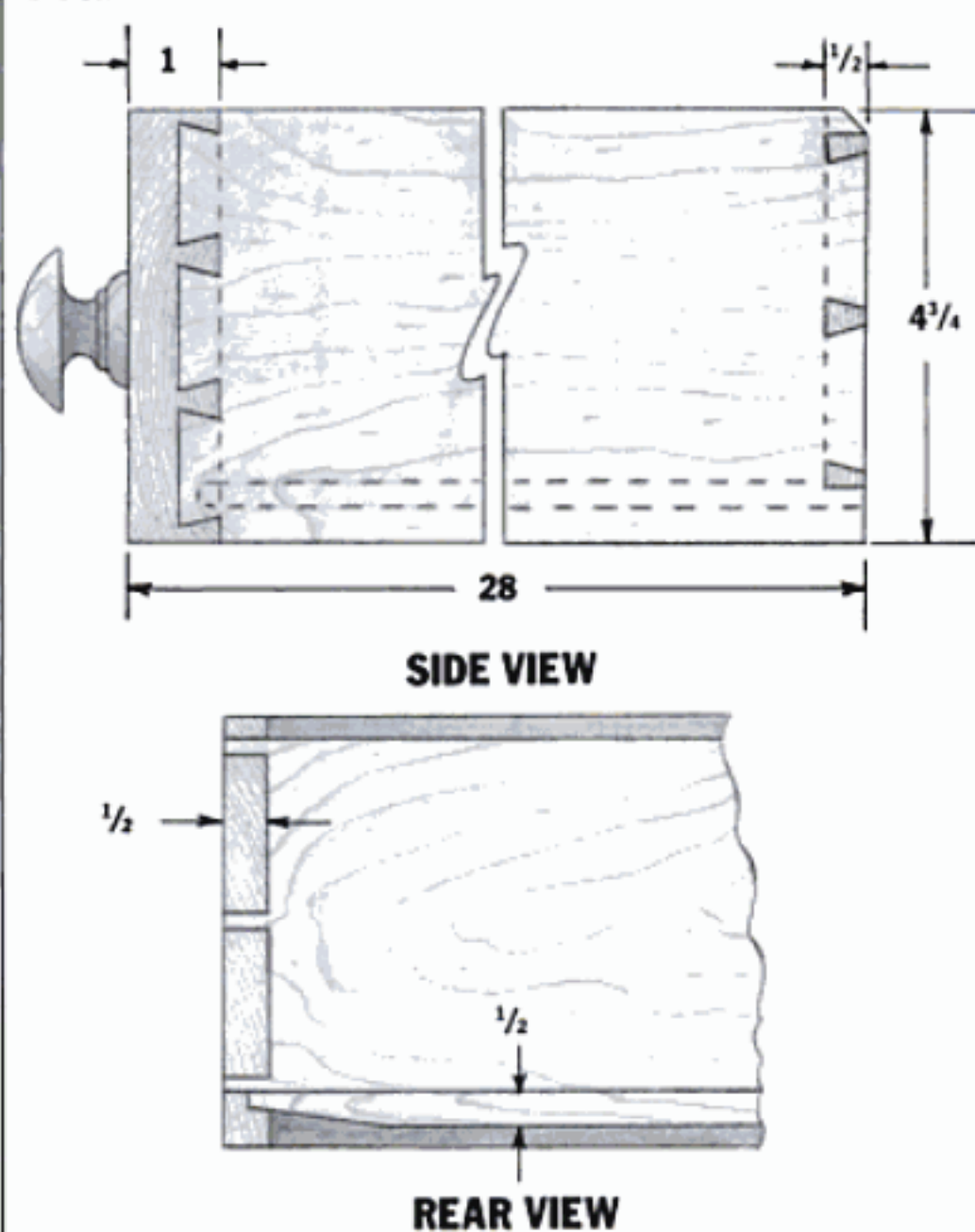
At this point, I put a 1/4-in. bead on the bottom edge of the apron and lower drawer rail with a Stanley #45 plane, as shown in the photo on page 31. The bead serves two purposes. First, it adds visual interest to an otherwise plain surface, and second, it's not as prone to damage as a sharp edge. Lay out the mortises and tenons on the aprons, rails, drawer guides and stretcher stock. (See Fig. 1 and 2.) I cut the tenons on my tablesaw using a tenoning jig. The lower drawer rail has double tenons, which I cut by hand. The upper drawer rail is dovetailed into the tops of the front legs. Cut the dovetail on the rail first, then use it to mark

the legs. The waste can be removed from the dovetail socket on the legs by sawing to the lines and then chopping out with a chisel. (See photo page 31.)

Before cutting the tenons on the stretcher stock, I round over the top edges of the stretcher. I use a home-made scratch stock (see page 62), but a router would work well here. Note that the long center stretcher is not quite as wide as the end stretchers.

I recommend a dry-assembly run before gluing up the parts of the base to avoid any unpleasant surprises. First, assemble the sides (complete with the side drawer guides). The rear apron, lower drawer rail, center drawer runner, and center stretcher go in next. The center drawer divider and top drawer rail go in last. I use liquid hide glue for complex assemblies because its slow set gives me plenty of time for alignment and squaring up. Even so, it wouldn't hurt to have a helper during glueup.

To reinforce the mortise-and-tenon joints, I make

FIG. 4: DRAWER CONSTRUCTION

small octagonal pegs with a simple jig and a modified block plane. (See sidebar.) Once the glue has cured, remove the clamps and lay out the peg locations on the legs and drawer rails with an awl. Use a $\frac{1}{4}$ -in. brad-point bit to drill the peg holes. Drill about $\frac{3}{4}$ in. deeper than the far tenon cheek. I use octagonal pegs that I make by hand with the jig described in the sidebar. I chose walnut for the pegs because the contrast is attractive and walnut is nice to work with. Tap the pegs in without glue until they're slightly proud of the surface. They can be sanded or trimmed flush, or left to protrude slightly, which adds an authentic period look.

Now cut the side drawer runner strips and the cen-

ter drawer guide, plane to dimension, and attach with hide glue and cut nails.

Prepare the drawer fronts in the same fashion as the aprons. The drawer sides, backs and bottoms are made from $\frac{1}{2}$ -in. pine. Cut the dovetails and bottom grooves (see Fig. 4) and glue up the drawers, checking for square. Glue up the stock for the drawer bottoms and cut to size so the grain runs sideways in the drawers.

Bevel the underside of the drawer bottoms on the front and sides with a block plane. The bevel is about $1\frac{1}{2}$ in. wide and tapers to slightly less than $\frac{1}{4}$ in. thick at the edge. Test the fit of the edge in the groove. When it's snug, but not tight, secure the bottom to the drawer



MAKING OCTAGONAL PEGS



(Far left)
The author's jig for making octagonal pins is as simple as it gets—and it works great.

(Left)
A little manual pencil sharpener chamfers the end of the pins in a jiffy.

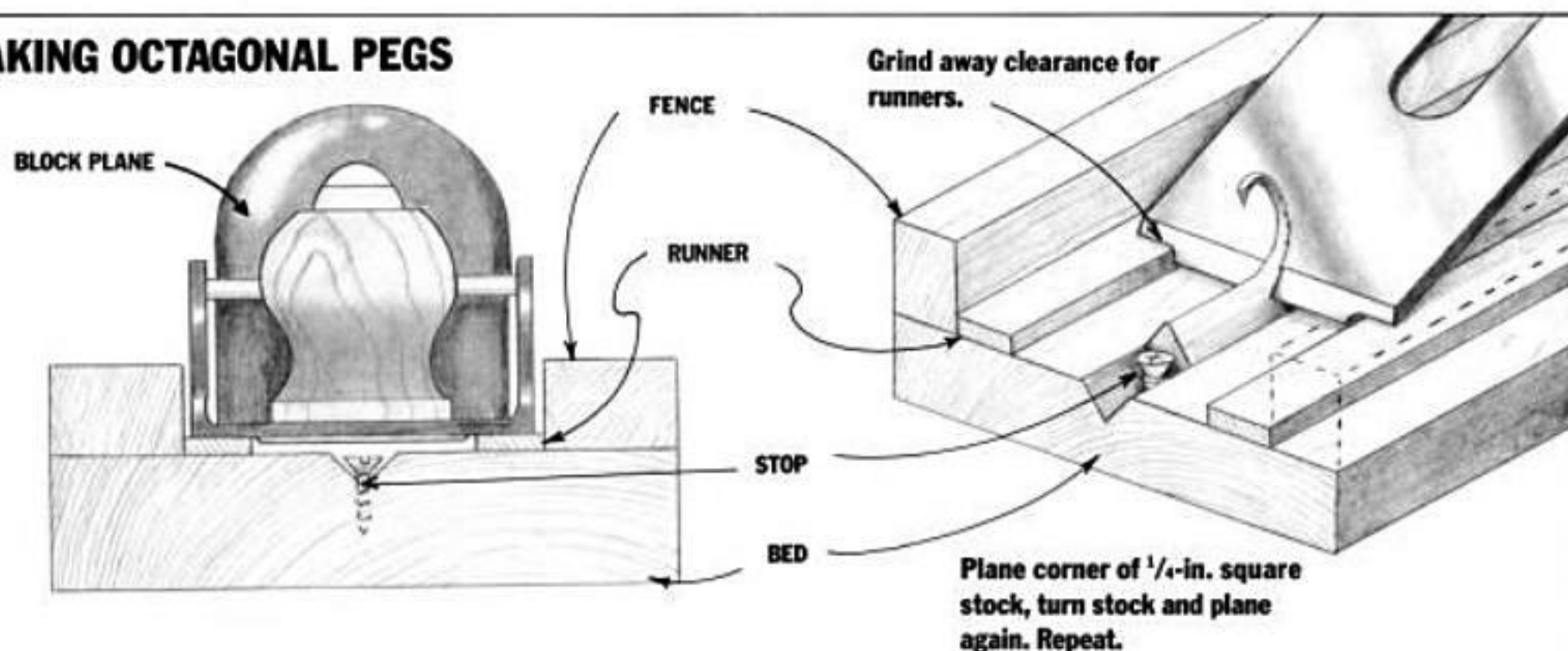
When I started restoring antique furniture I discovered that almost all quality period furniture had tapered pegs, roughly octagonal in cross section. I started making these pegs for my reproductions in the traditional fashion—riving them from solid stock and whittling each one to shape—which makes them very strong. This took a lot of time, and I decided there had to be an easier way.

So I developed this low-tech block-plane jig to make octagonal pegs. (See drawing.) I use a cheap Stanley "Handyman" block plane, which I bought at a yard sale for 50 cents. Make the jig from scrap stock, as shown. The dimensions

aren't critical. My jig is about 15 in. long. On a tablesaw, rip a V-groove $\frac{3}{16}$ in. deep down the center, and add a "fence" on either side. A small brass flat head wood screw centered in one end of the V-groove acts as a stop for the peg stock. Size the thickness of the runners by trial and error. The plane's depth-of-cut can be adjusted somewhat to make up for discrepancies.

To make a batch of pegs, I rip out $\frac{1}{4}$ -in. $\times$ $\frac{1}{4}$ -in. stock on the tablesaw using a fine-toothed blade. I lay the strips in the V-groove of the jig to plane off the corners to make the octagonal shape. Next, I chamfer one end of the pegs for easy starting with a small hand-held pencil sharpener.—CB

MAKING OCTAGONAL PEGS



back with three cut nails. Don't glue the bottom in place. These drawers are quite long from front to back, so the bottoms must be free to expand and contract. If the humidity is low when you build the drawer, it's a good idea to allow some space between the front edge of the drawer bottom and the bottom of the groove in the drawer front.

Now check the drawers for smooth operation in the base, and install the 1/4-in. thick drawer stops on the underside of the upper drawer rail. I turned the drawer knobs on a screw chuck and fastened them to the drawer fronts with flat head wood screws. (See Fig. 4.) A more authentic method would be to turn tenons on the ends of the knobs and fasten them with wedges from inside the drawers.

Original tavern tables were usually a bit smaller than this one, with the tops often made of a single board, and rarely more than two boards. On this table, I glued up the bottom from five boards and alternated the growth rings. Not too authentic, but it's practical. Carefully lay out your stock for the top, selecting the best grain patterns and being sure to alternate the growth rings. Joint the edges of the top boards, glue them up, and cut the top to length.

Next, make the breadboard ends. I cut the tongues for the breadboard ends in the top with an old Stanley No. 289 skew rabbet plane, but a router works well, also. (See Fig. 1.) After the tongues are cut, I hand plane the long edges of the top to the final width. This removes any chipping or breakout that occurred during the tonguing operation. I cut the grooves in the breadboard ends with a dado blade on the tablesaw and then cut the breadboard ends to length.

At this time, it's a good idea to put some stain on the ends of the tongues and inside the ends of the grooves. The top will move with changes in humidity and nothing looks worse than "white" wood peeking out at you from the edge of a breadboard. The breadboards should be glued to the top at their center only to allow for this movement. I put glue on the tongue about 6 in. on either side of the centerline. For added reinforcement I also install a peg at 6 in. on either side of the centerline, from the bottom. The pegs aren't visible from the top. The top can now be cleaned up and planed. Use a light touch and finish off with a sharp hand scraper.

The top is attached to the base with two cleats that fit parallel to the side aprons. On most period pieces, the cleats were housed in sliding dovetail joints in the top. To save time and to avoid the open dovetail cavities on the edges of the top, I attached the cleats with wood screws. I used five screws on each cleat, installing the screws in counterbored pilot holes from the cleat bottom. (See Fig. 1.) I elongated the outer holes with a small rasp so the screws can move with the movement of the top. After cutting the curved profile on the ends of the cleats, drill the 3/4-in. holes for the top attachment pins. Screw, but don't glue, the cleats in place. Fill the counterbored holes with wood plugs.

On period tables, the pins that hold the top to the base are a slip fit, which means the top might rattle a bit because it won't be tightly attached to the base. It's also very easy for the pins to fall out. I remedied this problem by threading the ends of the pins and the holes in the aprons, as shown in Fig. 1. I don't recommend threading pine, but these pins aren't removed very often and the screw-in pins have proven to be far superior to loose pins. If you don't have a screwbox

and tap to cut threads, make the pins a loose friction fit.

Before drilling the pin holes in the apron, set the top on the base and check the overhang. When everything is aligned, mark the center of the holes. Drill the holes, and then tap the threads. I put a couple of coats of thin shellac in the tapped holes to help stiffen up the soft pine threads. This completes the construction, and the table should be ready for finishing.

Finishing the Table

If all of your tools were sharp and you were careful during glueup, sanding should be easy. I hand sand lightly with 220-grit paper without a planing block so I don't obliterate the marks from hand planing. You can "distress" the table to give it an aged appearance. Again, I think the key is to go easy.

On this piece, I lightly rounded sharp edges and mildly distressed the top, aprons, and stretchers by striking them with a handful of keys on a ring. Next, I gave it a very light once-over with 220-grit paper.

I made my own stain by mixing japan colors (3 Tbls. burnt umber, 2 Tbls. burnt sienna, 1 Tbl. raw sienna) into about one quart of Sherwin Williams oil stain #113-9039 Clear Base and Sealer (available at Sherwin Williams stores). This handles like a regular oil stain. Be sure to wipe off the excess once the stain begins to set up. You can increase the intensity by increasing the amounts of japan color or by applying a second coat after 24 hours. The end result was a mellow, aged appearance that doesn't look like it came "out of a can."

Once the stain coat dried, I brushed on a coat of Stulb's Old Village #1232 Graining Liquid (available from the Stulb Co., P.O. Box 597, Allentown, PA 18105, 215-433-4273 for nearest dealer). This is a thick, translucent oil stain. I wiped most of this off, allowing it to remain only in crevices, dents, and areas where dirt might naturally build up. The effect is to enhance the "aged" appearance.

After this dried, I sealed the surface of the piece with a wash coat of 1-lb. cut of shellac. I used butonlac, which is a grade of shellac that imparts a slightly darker tint to the wood. The wash coat was rubbed down with a fine 3M "Scotch-Brite" pad and cleaned off with a tack cloth. Don't forget to finish the underside of the top. I used the Sherwin Williams Clear Base and Sealer (as mentioned above) without pigment on the bare wood of the drawers to seal them and to give the bare pine some color.

To give some character to the top, I created several water rings, like those caused by flower pots or glasses, by applying burnt umber acrylic artist color (available in art supply stores) to the rim of various-size round plastic containers and setting them on the top at random locations. I softened the hard edges of the rings with a dry bristle brush and a soft cloth. If you try this, use moderation—three or four strategically placed rings can be very effective.

Finally, I applied two thin coats of Pratt & Lambert #38 Clear Satin Finish alkyd varnish (available in paint stores and hardware stores), sanding lightly between coats. Steel wool the final coat and apply a coat of paste wax. ▲



Craig Bentzley practices antique-furniture conservation and restoration and also builds period reproductions.

TURNING PEPPER

ANGELO CAGGIANO



Spice up your life with a turned pepper mill. As author Dale Nish's mills demonstrate so gracefully, the shape can suit your fancy.

Want to add a little spice to your life? Try turning a pepper mill. Pepper mills are fun to turn and they make great gifts for friends or family. Who can resist the aroma and taste of fresh-ground pepper?

The heart of the pepper mill is a grinding mechanism (available from Craft Supplies USA, 1287 E. 1120 S., Provo, UT 84601, (801) 373-0917). These mechanisms come in three different sizes to make pepper mills of three heights—5 in., 7 in., or 10 in. high.

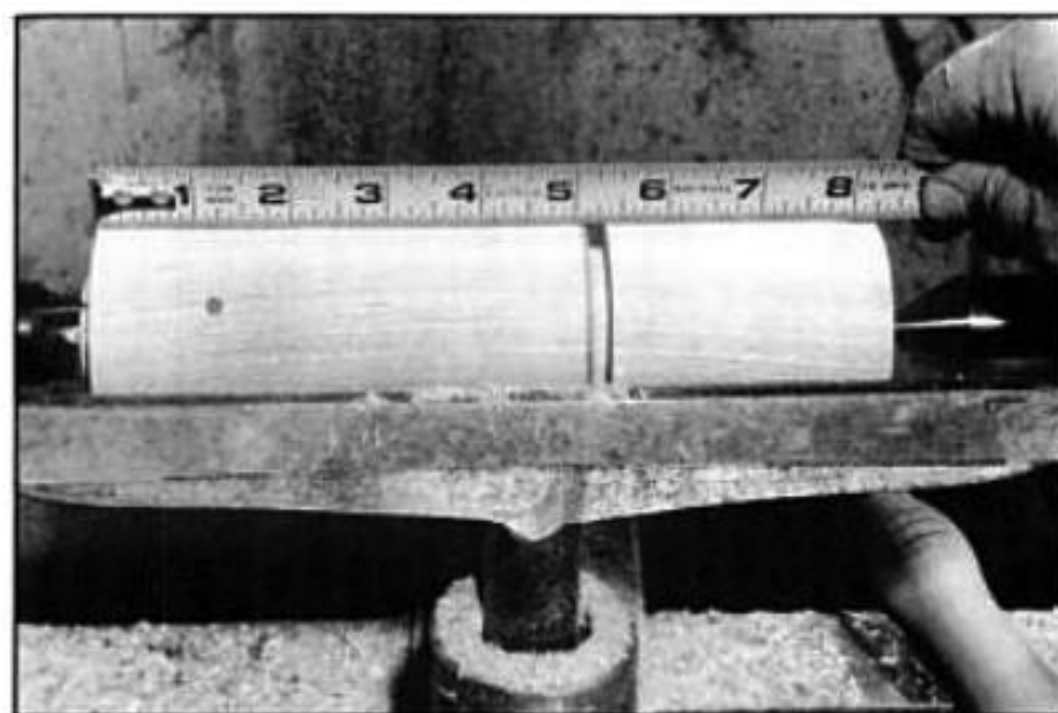
First decide what size pepper mill you want to make and order the appropriate-size grinding mechanism. Once you have the mechanism, select a block of wood approximately $2\frac{3}{4}$ in. sq., and at least 1 in. longer than the length of the grinding mechanism you've purchased. For example, a 7-in. mechanism requires a block about $2\frac{3}{4}$ in. $\times$ $2\frac{3}{4}$ in. $\times$ 8 in. long. Most any hardwood will work well, but highly figured wood or spalted wood will look more dramatic.



The heart of the pepper mill is a grinding mechanism (bottom) available in three sizes for 5-in., 7-in. and 10-in. mills. The top and body of the mill are turned from a single piece of wood.

Turning the Mill

STEP 1. Mount the block between centers on a lathe and rough-turn to a cylinder about $2\frac{1}{2}$ in. in diameter. Try to make the surface straight and even. Square the ends of the cylinder with a parting tool by making a clean cut on each end of the cylinder as deep as you can go before hitting the drive center or cone center.



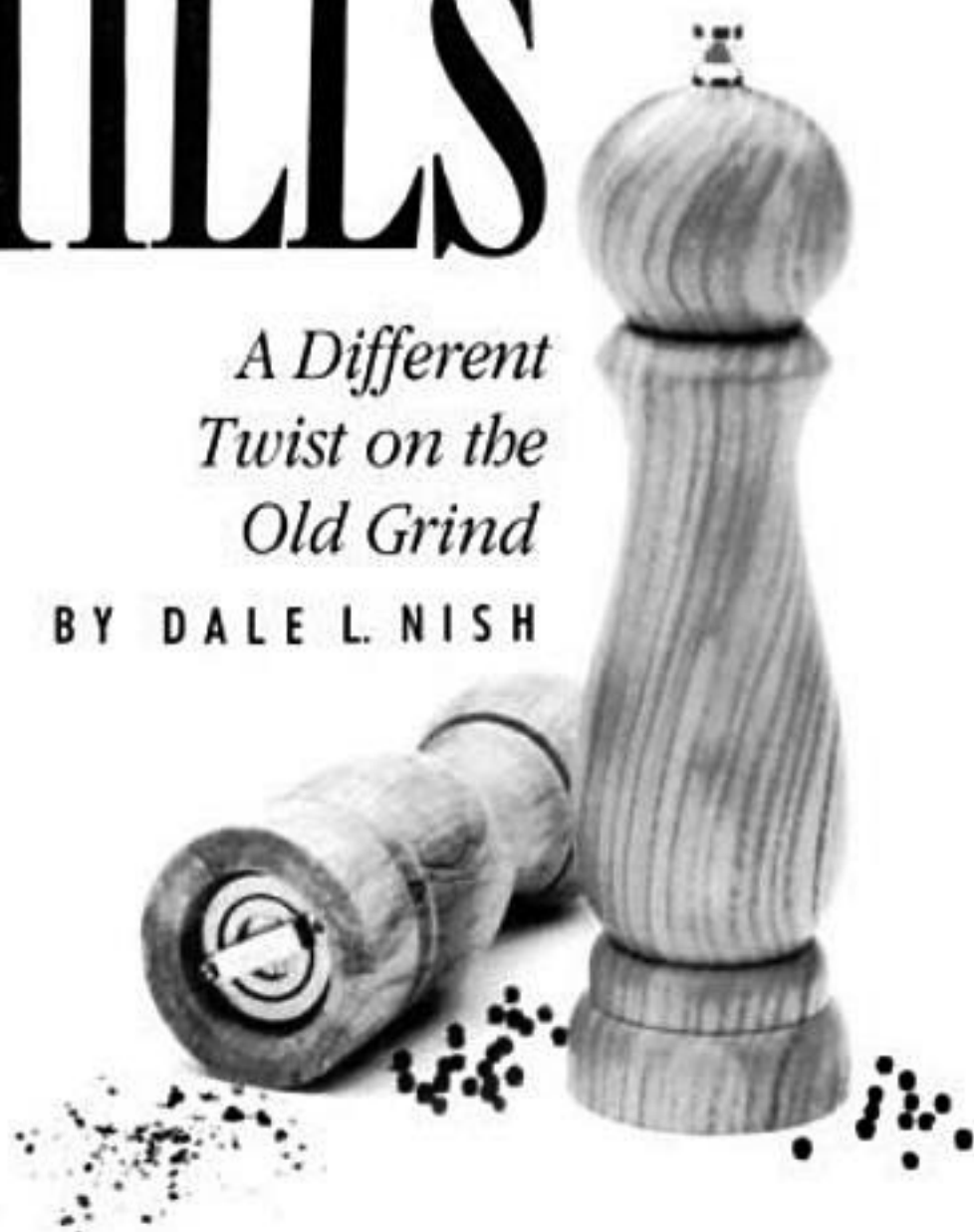
Rough out a cylinder for the pepper-mill body, then lay out the top and body of the mill. Allow an extra inch on the top for a spigot.

STEP 2. Lay out the body and top of the pepper mill on the cylinder. For a 7-in. mill, a good proportion is a 5-in. long base and a 2-in. long top piece. Lay out the top an inch longer than its finished height to allow for a "spigot" (a short, round tenon) you'll need to turn later on one end of the top. (See Fig. 1.) Draw a pencil line to separate the body from the top.

MILLS

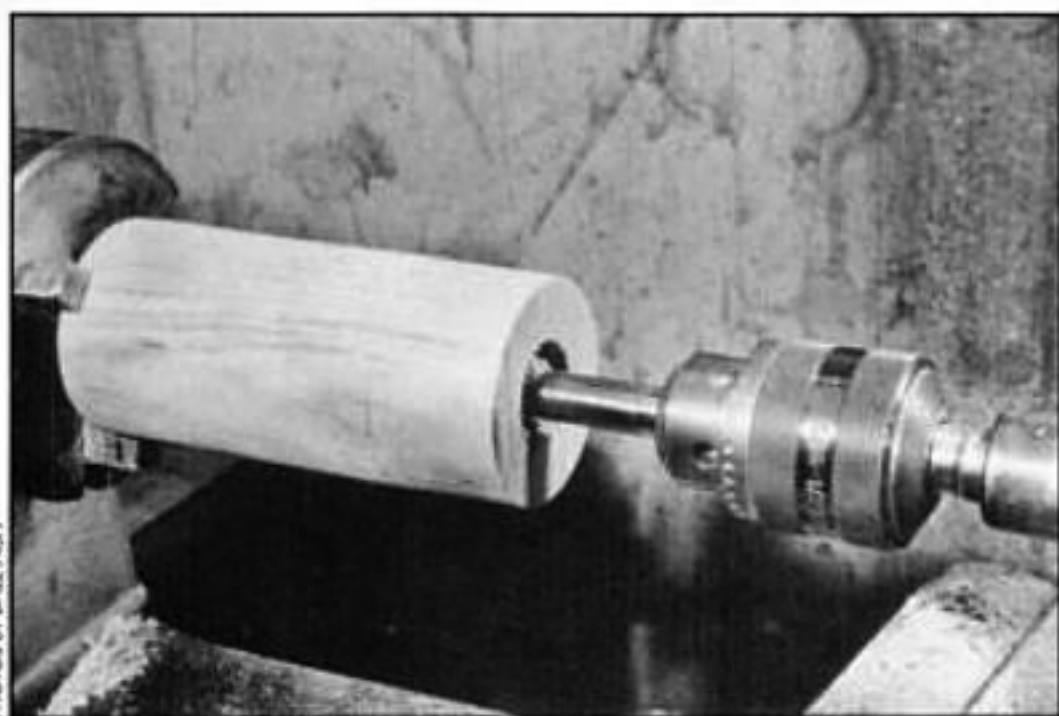
*A Different
Twist on the
Old Grind*

BY DALE L. NISH



Author Dale Nish fine tunes the shape of a pepper mill. The mill is chucked on a spigot chuck.

STEP 3. Part off the top with a parting tool. Cut down the pencil line with a parting tool, stopping when about $\frac{3}{4}$ in. of wood is left. Stop the lathe, and finish the cut with a hand saw, to separate the top from the body.

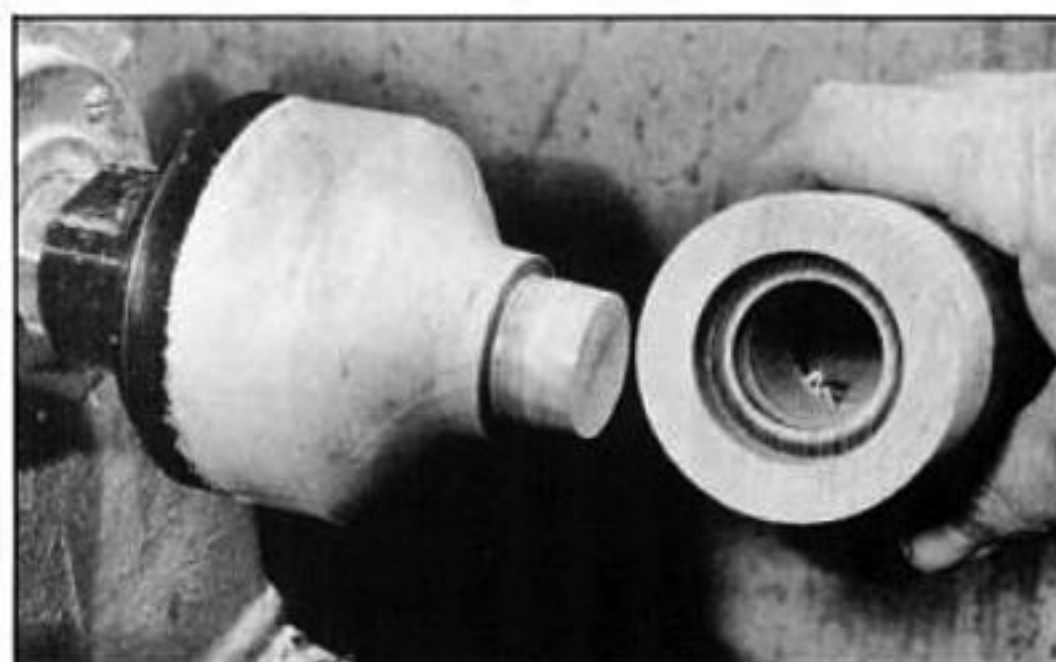


Mount the mill body in a chuck, drill a $1\frac{1}{2}$ -in. counterbore in the bottom, then drill a 1-in. hole all the way through.

STEP 4. Mount the pepper mill body in a chuck (either a 3- or 4-jaw chuck or a multi-purpose chuck like the Raffan Chuck, or the Nova 4-Jaw Chuck). If you don't have a chuck, make a jam chuck to hold the stock. (To make a jam chuck, screw a $1\frac{1}{2}$ -in. to 2-in. thick waste block to a faceplate. Turn a hole in the block to fit the end of the pepper-mill body. Jam the body cylinder in the hole and tap it with a mallet to get a very tight fit. Tap the other end of the cylinder one way or the other until it runs true. Glue if necessary.)

STEP 5. Drill the holes for the grinding mechanism. Mount a drill chuck in the tail stock and install a $1\frac{1}{2}$ -in. dia. bit (a Multispur or spade bit works fine). Drill a $\frac{3}{8}$ -in. deep hole in the bottom end of the pepper-mill body. This is a counterbore hole to hold the grinding-mechanism base. (See Fig. 1.)

Next, put a 1-in. bit in the drill chuck and drill a hole all the way through the body, centered on the counterbore hole. If your mill body is longer than 5 in. it may be necessary to drill the hole halfway, then reverse the mill body in the chuck and drill in from the other end to meet the first hole. It's OK if the holes don't match up perfectly, as this hole provides the storage space for peppercorns.



Turn a spigot chuck from scrap with a "spigot" (a short tenon) on one end that fits the hole in the mill body.

STEP 6. Turn a spigot chuck to hold the base, as shown in the photo. (A 1-in. dia. pin chuck will also work if you have one.) The spigot chuck is just a block

of wood with a short tenon (the "spigot") on the end, which fits into the 1-in. dia. hole you drilled in the pepper-mill base. To make a spigot chuck, screw a 2-in. or 3-in. thick block of hardwood to a faceplate, and turn it to the shape shown in the photo. The spigot should be about $\frac{3}{4}$ in. to 1 in. long and fit tightly into the 1-in. dia. hole in the bottom of the mill body. The shoulder above the spigot prevents the spigot from going too far into the mill, yet allows access to the bottom of the mill for sanding and finishing.



Mount the body on the spigot chuck and turn the body to the desired shape.

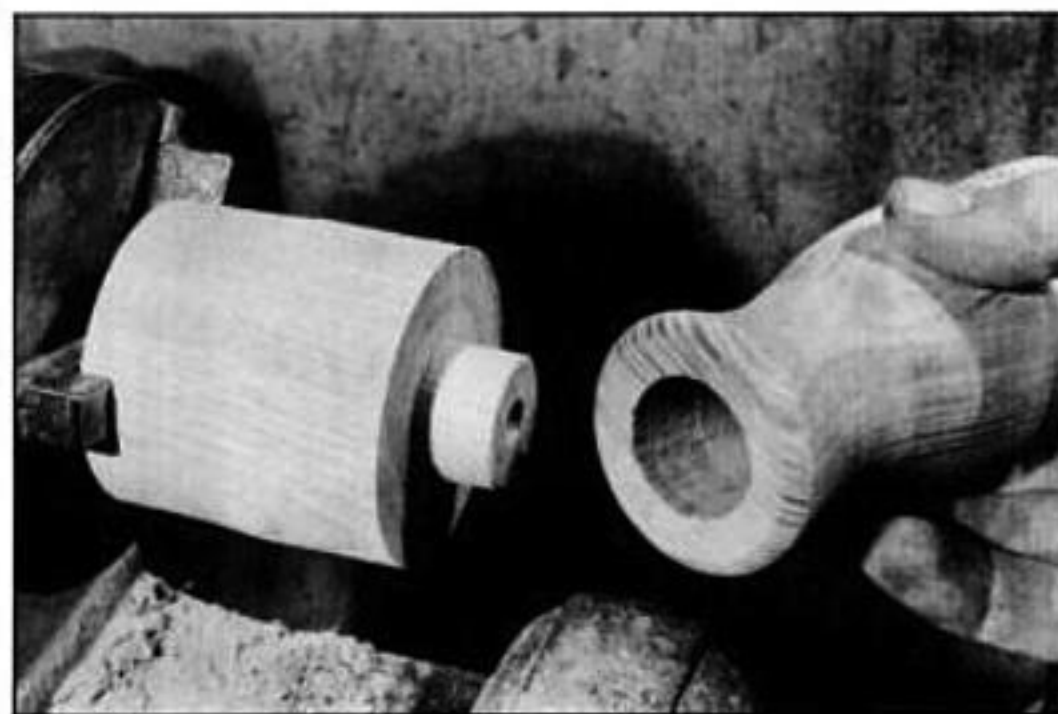
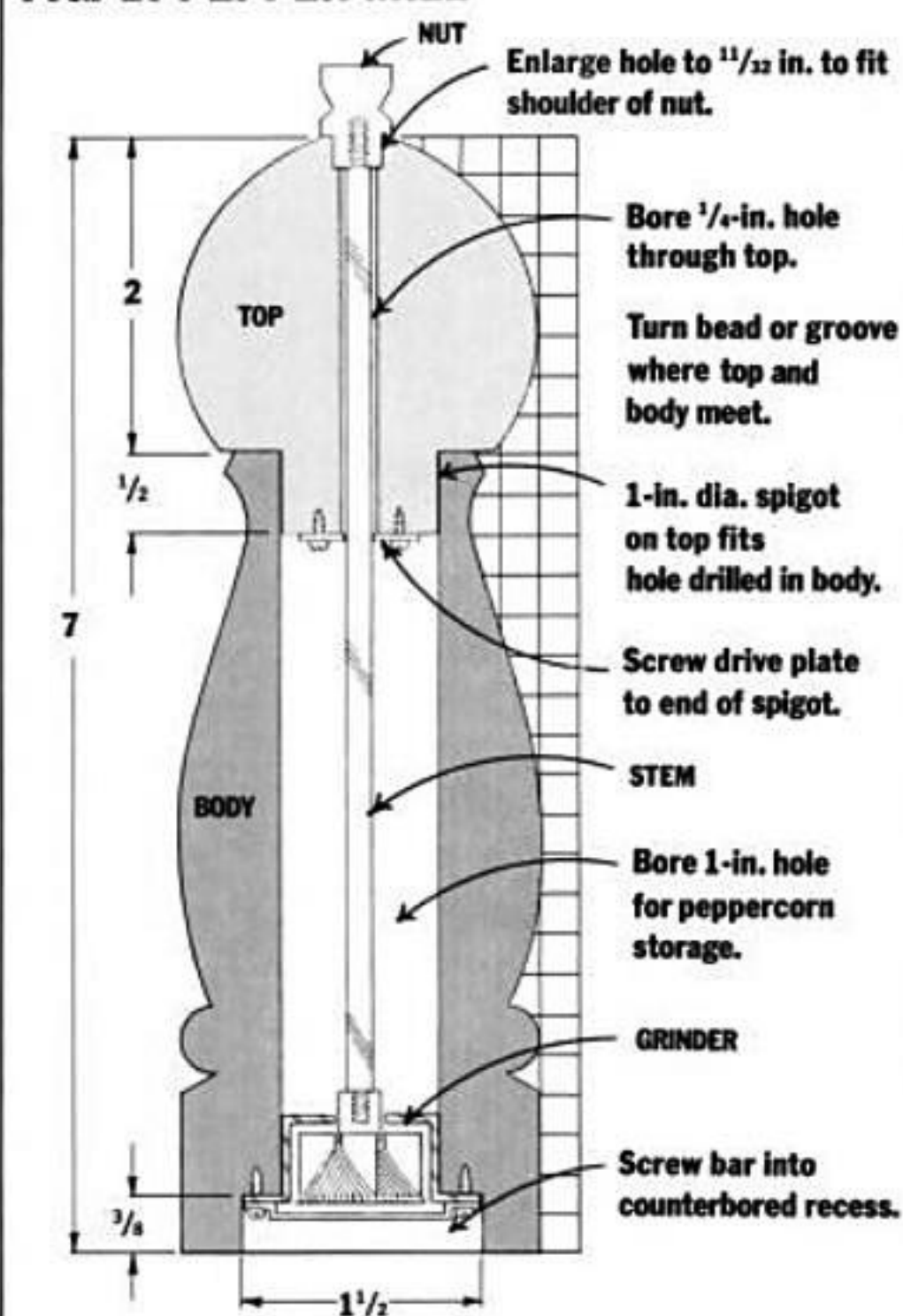
STEP 7. Rough turn the mill body. Mount the body on the spigot chuck and support the other end with a cone center in the 1-in. hole. If you don't have a large cone center, turn a wood cone to fit over your existing center. Turn the body to the shape you want, keeping in mind that some final shaping cuts can be made after the top is in place.



Mount the top in a chuck and drill a $\frac{1}{4}$ -in. hole halfway through. Reverse the top and finish the hole from the opposite side.

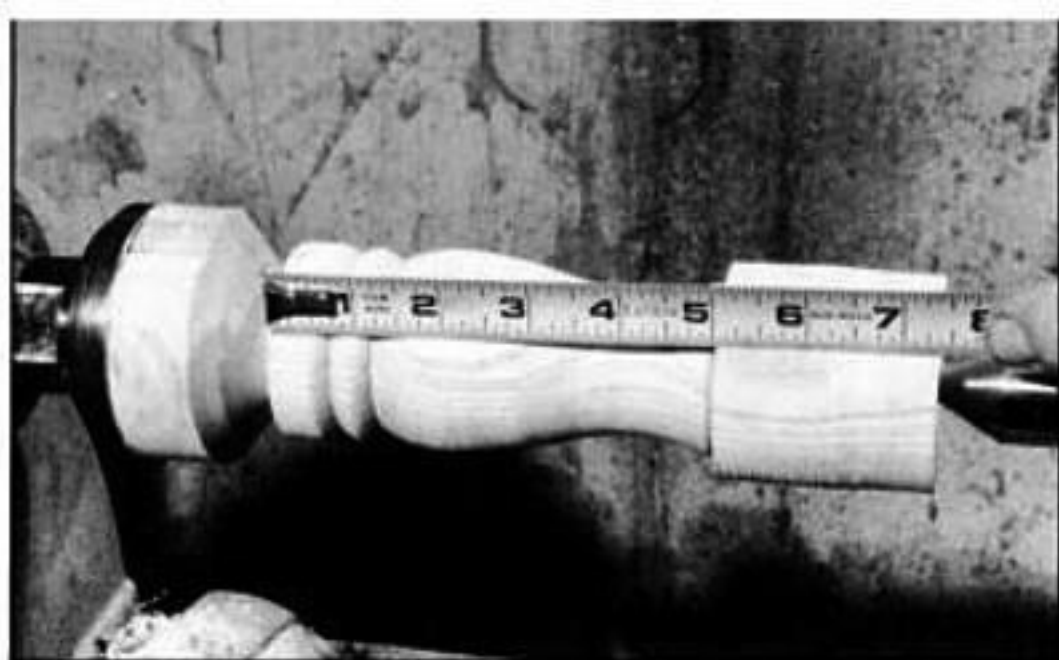
STEP 8. Mount the mill top in the chuck and drill a $\frac{1}{4}$ -in. hole about halfway through. Reverse the top in the chuck and drill in from the other end until the two holes meet. If you drill only from one end, the bit may wander off center.

FIG. 1: PEPPER MILL



Turn a spigot on the end of the top to fit into the mill body.

STEP 9. Turn a spigot on the end of the top that fits the mill body. This spigot fits into the mill body when the pepper mill is assembled. The mill will look best if the grain matches between the top and body. Check the top for grain pattern and mount the top in the chuck. Bring up the cone center in the $\frac{1}{4}$ -in. hole. This will secure the stock as well as guarantee that the hole will be in the center of the spigot. Turn a 1-in. dia. spigot, $\frac{1}{2}$ in. to $\frac{3}{4}$ in. long on the end of the top. Check the fit to the hole in the body. Make the fit snug, but not tight.



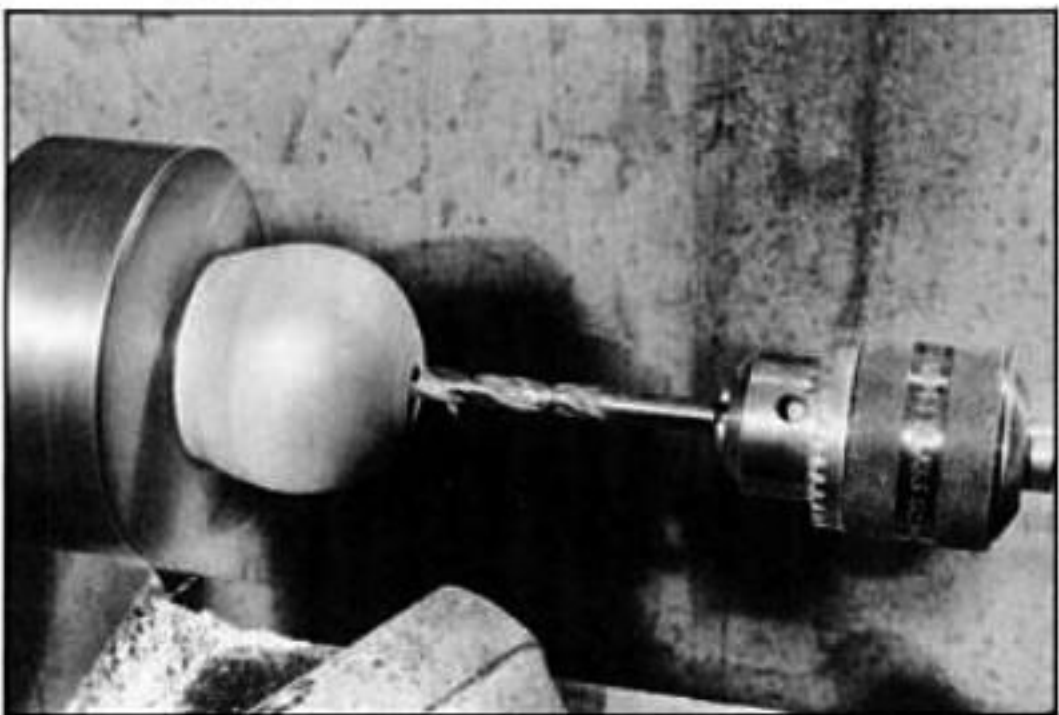
Assemble the top to the body and mark the overall length of the mill. Shorten the length, if necessary, by removing wood from the top.

STEP 10. Assemble the top to the base and mount the base on the spigot chuck. Bring the cone center into position in the $\frac{1}{4}$ -in. hole in the mill top. Measure and mark the finished length of the mill. This finished length is the same as the length of the mechanism *provided the counterbored recess in the body is $\frac{3}{16}$ in. deep.* (The photo shows a mill that will measure 7 in.).



Turn the top of the mill to shape, and finish up any shaping of the body.

STEP 11. Turn the mill top to shape. If necessary, remove any extra length from the top to make the overall length of the mill correct. At this time, do any additional shaping to the body of the mill.



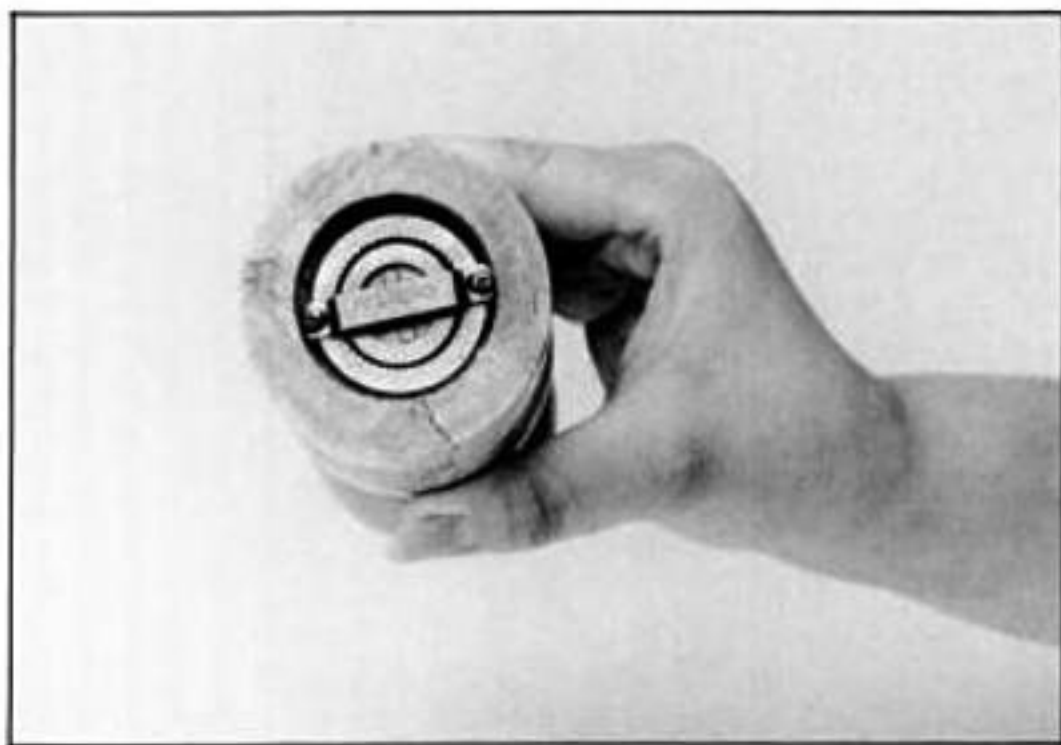
Counterbore the top hole to accept the stem nut on the grinding mechanism.

STEP 12. Counterbore the hole in the top. Remove the mill top and fit its spigot in the chuck. With a $\frac{11}{32}$ -in. drill bit, enlarge the $\frac{1}{4}$ -in. hole in the top to a depth of about $\frac{3}{16}$ in. This allows the nut on the mechanism to

fit down into the hole with the shoulder of the nut supported by the edge of the hole. (See Fig. 1.) You could also use a small skew chisel in the scraping position to enlarge the hole, but be careful not to get it too large.

STEP 13. Sand and finish the mill on the lathe. Start with 80-grit, if necessary, and finish with 220-grit paper. Next, stop the lathe and hand sand with 220-grit paper following the grain direction to remove any cross-grain scratches.

I like to seal the wood with a lacquer sealer, such as Deft. Apply a wet coat with a brush, let the sealer soak in for a few minutes, then wipe dry with a paper towel or cloth. Turn the lathe on and buff the surface dry. Apply a light coat of paste wax or wax stick and buff dry with a cloth.



Install the mechanism. A drive plate screws to the top's spigot, and the grinder fastens inside the counterbored bottom with a bar held by screws.

STEP 14. Install the mechanism. Center the driving plate on the spigot end of the top, drill two pilot holes for the screws, and attach the plate with screws. (See Fig. 1.) Insert the mill stem and grinder into the bottom of the mill body. Place the bar across the grinder in the recess, drill pilot holes and fasten with screws.

Place the mill stem into the square hole in the driving plate and slide the top down into position. If the spigot is a little tight, remove the top and sand the inside of the hole to make a looser fit. A little wax around the hole may make the assembly rotate easier.

Fill the cavity in the base with peppercorns, replace the top, and finger-tighten the nut on the top of the stem. The mechanism is spring-loaded so the more you tighten the nut, the finer the pepper grind. If you want a coarser grind, loosen the nut. ▲



Dale L. Nish is a professor of Industrial Education at Brigham Young University. He is author of the books, *Creative Woodturning*, *Artistic Woodturning*, and *Master Woodturners* (available from Craft Supplies, 1287 E. 1120 S., Provo, UT 84601).



HENRY MATHER GREENE

THE FURN GREENE AND

Two Brothers Who Made

In the early years of this century, when furniture design innovations tended to originate in the East and Mid-

west, two brothers were breaking new ground in the small, Southern California town of Pasadena. Architects Charles S. Greene and Henry M. Greene were best known for taking the humble bungalow to its ultimate artistic heights; but they also designed numerous pieces of highly original furnishings for these bungalows. Their careers stretched from 1894 to the 1940s, but they made the majority of their furniture between 1904 and 1913. Today, their furniture is well respected as a major force in the Arts and Crafts movement. The furniture from this movement, popular from 1890 to 1920, stressed craftsmanship and the relation of form, function and materials.

As was typical of architects during the Arts and Crafts movement, the Greenses involved themselves in all levels of design. As Randell Makinson—director and curator of the Gamble House in Pasadena, a living tribute to the Greenses—explains, “It was impossible for them to think of one element of the design and not all the others.” That included the street-scape, landscape, building, furnishings and even decorative arts, such as carpets, lighting, hardware and so on. Early sketches of rooms included furniture design and placement. As they designed their interiors, they could not separate one part from the whole.

The early furniture of Greene and Greene is highly reminiscent of pieces designed by Gustav Stickley, an



The Greenses participated in all levels of design, from houses to interior furnishings. In a Greene and Greene house was one uninterrupted fabric.

BY DAVID

ITURE OF GREENE

Their Mark on the Craft



CHARLES SUMNER GREENE

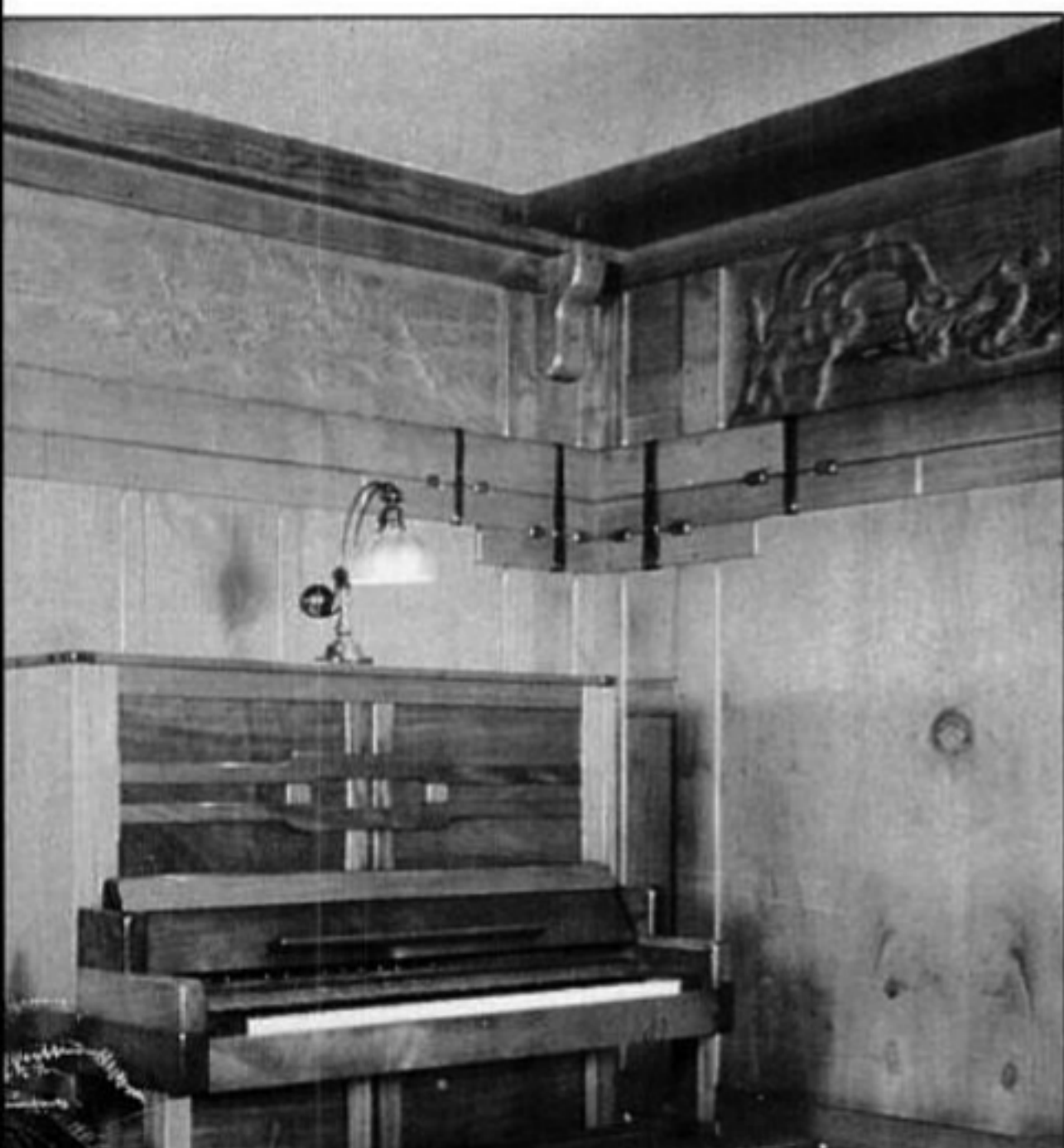


PHOTO BY MARVIN RAND, COURTESY GAMBLE HOUSE, USC GREENE & GREENE LIBRARY

early leader in the Arts and Crafts movement who advocated simplicity. Later, the Greenes developed their own design vocabulary—a strong Oriental influence graced with carvings and inlay. Their inlay included semi-precious stones and mother-of-pearl, as well as wood. As their talents matured, their materials expanded to include Honduras mahogany, Burma teak, ebony, walnut, grey maple, cedar, lignum vitae and other exotic species.

The rounded treatment of the edges and corners of their furniture stands in contrast to the furniture of Stickley and others. The Greenes' work looks sensitive and pliable when compared to the rather spare, straight-lined work of their contemporaries.

A Oneness of Spirit

Unlike many other architects who have designed furniture, Charles and Henry Greene had

could trust John to ca

ARCHIVE PHOTO, COURTESY OF GAMBLE HOUSE, USC GREENE & GREENE LIBRARY

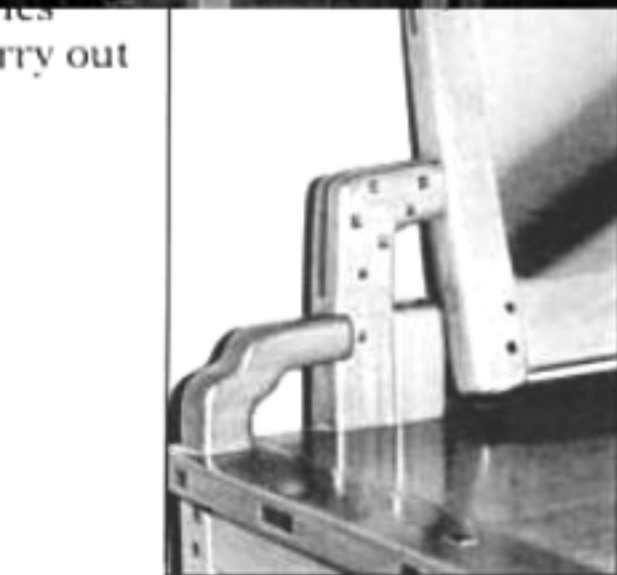


PHOTO BY



TO BY DAVID DONNELLY



explained later to Makinson, Wright was referring to Charles Greene's ability to get craftsmen to produce work the way he wanted it. Wright apparently had never been able to achieve that type of harmonious relationship.

The Furniture of the Gamble House

The Gamble House was built in 1908 for David and Mary Gamble and later bequeathed to the City of Pasadena in a joint agreement with the University of Southern California. When looking at the furniture on display in the house, one is immediately struck by a

number of remarkable features.

The entire house is a matching set, even down to the leaded glass windows, door knobs, lamps and pottery. Straight-line tables, desks, chairs and chests reveal a cornucopia of intricate detail. Tenons are exposed and pegged with square-shaped ebony pegs. Exposed ebony splines grace table and chair corners. Subtle, Oriental, floral inlay patterns highlight selected doors and sides of casework. Hand-carved drawer pulls rise up in layers. Box joints with contrasting ebony pegs defy the tradition of dovetails on drawers and chests. (See photo page 42.) Shallow sweeps on chair backs



PHOTO BY DAVID DONNELLY



PHOTO BY MARVIN RAND, COURTESY OF GAMBLE HOUSE, USC GREENE & GREENE LIBRARY

This dresser appears in the same master bedroom in the Gamble house as the chiffonier on the opposite page. The Greens commonly designed each room of furniture as an ensemble.



PHOTO BY MARVIN RAND, COURTESY OF GAMBLE HOUSE, USC GREENE & GREENE LIBRARY

PHOTO BY DAVID DONNELLY



This rocker, from the living room of the Gamble house, is a fine example of the "cloud lift" motif. (See crest rail, top, left.) Contrasting stays ornament the back splat of the rocker (bottom, right).



PHOTO BY MARVIN RAND, COURTESY OF GAMBLE HOUSE, USC GREENE & GREENE LIBRARY

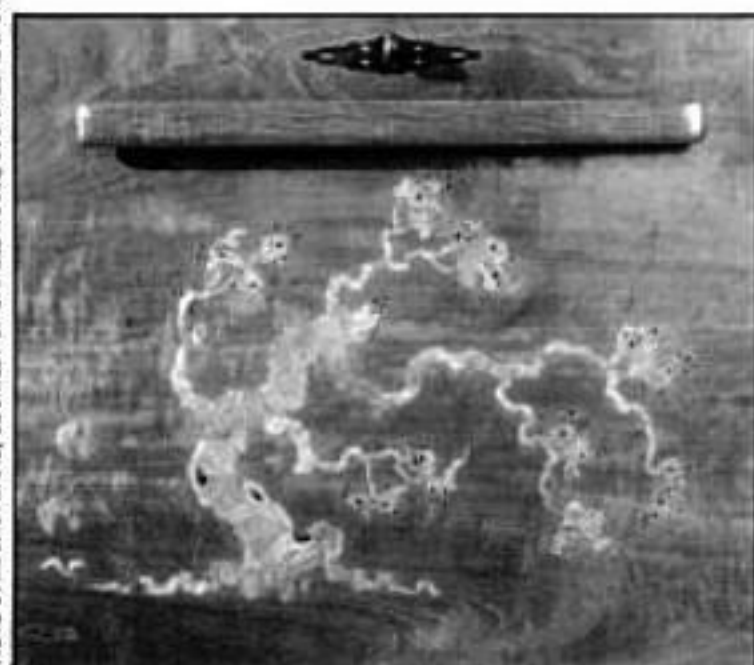
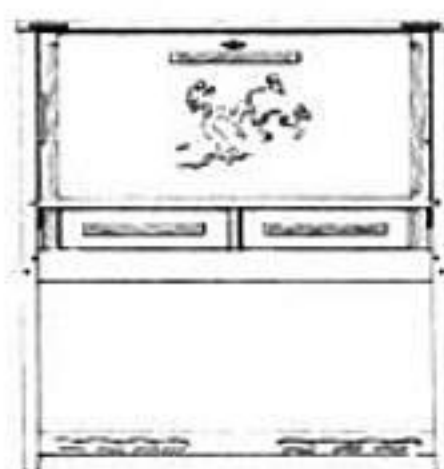
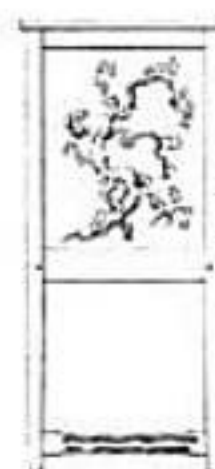


PHOTO BY MARVIN RAND, COURTESY OF GAMBLE HOUSE, USC GREENE & GREENE LIBRARY

From the William R. Thorsen house, this sideboard shows the kind of delicate inlay that ornamented the Greenes' furniture. The inlay incorporates both mother-of-pearl and fruitwoods.



FRONT CLOSED.



SIDE.



FRONT OPEN.

DESK.
SCALE 1/4" = 1'-0".
OVER. WIRE INLAY ON PANELS.
PREPARATIONS ON LOWER RAIL.

FOR MORE INFORMATION

For more information on Greene and Greene:

The Gamble House, 4 Westmoreland Place, Pasadena, CA 91103, built by the Greenes in 1908, is now open to the public as a tribute to the Greenes' work. For information call (818) 793-3334.

The Henry E. Huntington Library, Art Gallery and Botanical Garden, 1151 Oxford Rd., San Marino, CA 91108, has a permanent exhibition of Greene and Greene furniture from the Gamble House, USC Greene and Greene collection. For information call (818) 793-3334.

Greene & Greene—Furniture and Related Designs, by Randell L. Makinson (1979, Peregrine Smith Books, P.O. Box 667, Layton, UT 84041). This book can be purchased through most bookstores and from the Gamble House bookstore. (See above address.)

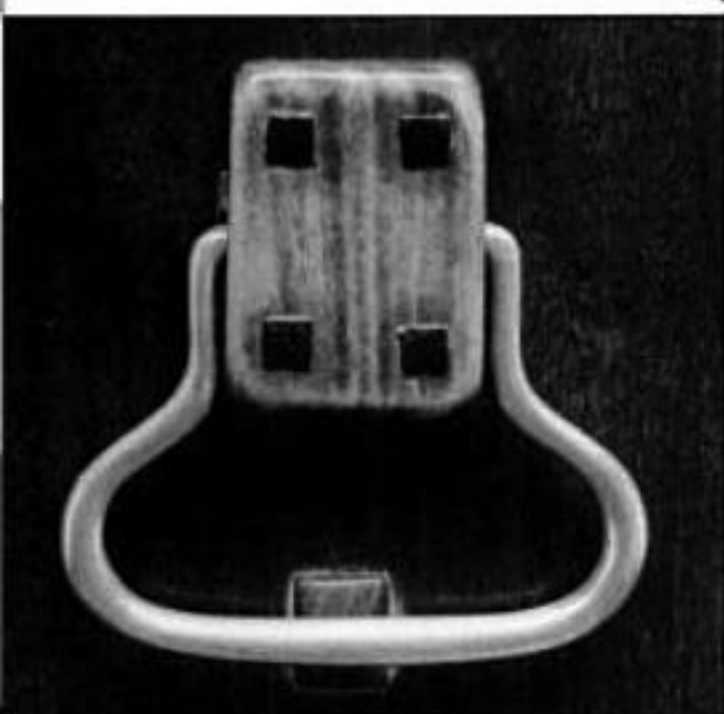
The Oriental influence that is obvious in much of the Greenes' furniture can be seen in the fruitwood-tree inlay in this desk from the Pratt house. The inlay (middle left) can be seen on both front and side, as the Greenes' illustration shows.



ARCHIVE PHOTO, COURTESY OF GAMBLE HOUSE, USC GREENE & GREENE LIBRARY



Light fixtures designed by the Greens show a rich combination of wood and iridescent glass. This ceiling light is from the living room of the Freeman A. Ford house.



Ebony pegs decorate the handle of a letter case from the Gamble house guest bedroom.

MARVIN RAND, COURTESY OF GAMBLE HOUSE, USC GREENE & GREENE LIBRARY



The twist of the armrest in this dining host chair from the William R. Thorsen house was a common element in the Greenses' chair designs.

reveal the Oriental influence. Lap joints on end tables catch the eye by accenting and rounding over every component of the joint, rather than blending the pieces together as one. Double L-shaped brackets offer more than support to a chest mirror. (See photo on page 42.) And an interlocking maze of intricate detail on a stair landing reveals why Peter Hall had a reputation as the best stair builder on the West Coast.

A common thread through the furniture and architectural woodwork of the Gamble House is a design motif called the "cloud lift." It is most evident on a chair back, where the crest rail rises in a stairstep pattern toward the middle. (See photo on page 43.) Once identified, you can see it on table corner braces, dressing-table mirror brackets, ends of bookcases, and even modest carvings on end tables. In fact, if you look carefully, there are few pieces in the Gamble House that don't have some hint of the cloud lift.

The Greene's exposed, elaborate joinery could be criticized as pretentious, but Makinson thinks otherwise. When he sees exposed splines and pegs throughout, he interprets it as an honest expression—coping with the very nature of pieces that tend to twist, warp, and separate. Breadboard ends on large tabletops, for example, are designed to allow expansion and contraction without letting joints open or close.

Bridging Past and Present

Along with his interest in furniture, Charles Greene had a personal fascination with carving and inlay. Landscapes and floral arrangements appear on both architectural pieces and furniture. For example, one sideboard has an inlay pattern on the end doors that is banded in ebony, giving the impression of being framed like a painting. (See photo on page 44.) Makinson reminds us that clients who could afford a house and furnishings designed by the Greenses generally were not young. Having grown up in the Victorian era, these clients had a different sense of style from the Arts and Crafts period in which the Greenses worked. So the simple decorative touches the Greenses added to their furniture were an attempt to connect the eras—to pay homage and respect to the more ornate styles of the past while keeping their pieces contemporary and progressive.

Robert Ashbee was a major figure in the Arts and Crafts movement in England, writing and commenting on the philosophy of the movement. When he visited America, he was fascinated with the variety of product styles seen in different parts of the country. He saw in the work of the Greenses a design that came from a total understanding of the medium, because they were craftsmen as well as designers.

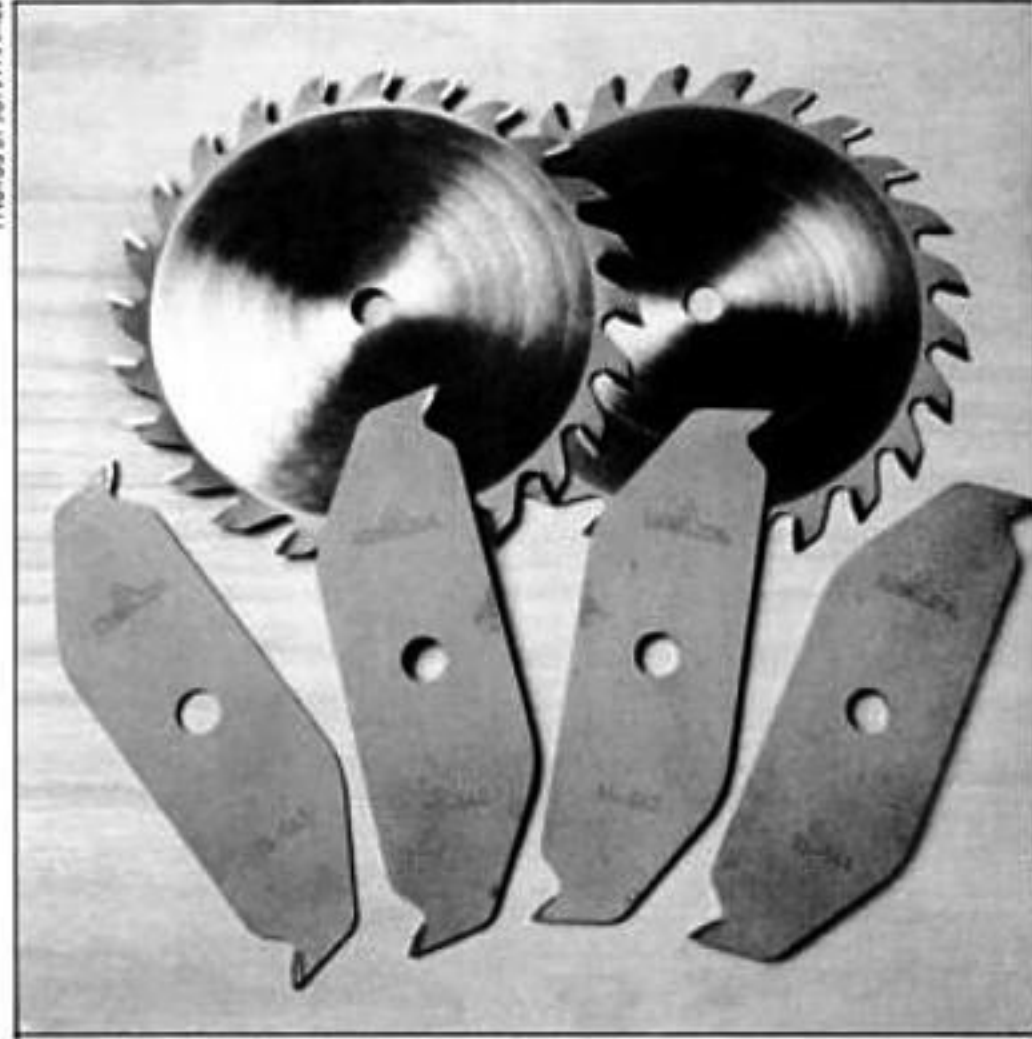
After a visit to the Greenses, Ashbee said (as quoted in Makinson's book—see Information Box, facing page) "He [Charles Greene] took us to see his workshops where they were making, without exception, the best and most characteristic furniture I have seen in this country. There were beautiful cabinets and chairs of walnut and lignum vitae, exquisite doweling and pegging, and in all a supreme feeling for the material.... Here things were really alive ..."



David Donnelly is an amateur woodworker and a regular contributor to *AMERICAN WOODWORKER*.

STACK DADO

PHOTOS BY JOHN HAMMILL



A stack dado set contains two outer blades, as many as five chippers, and may include several paper shims of varying thickness. Delta dado set shown.

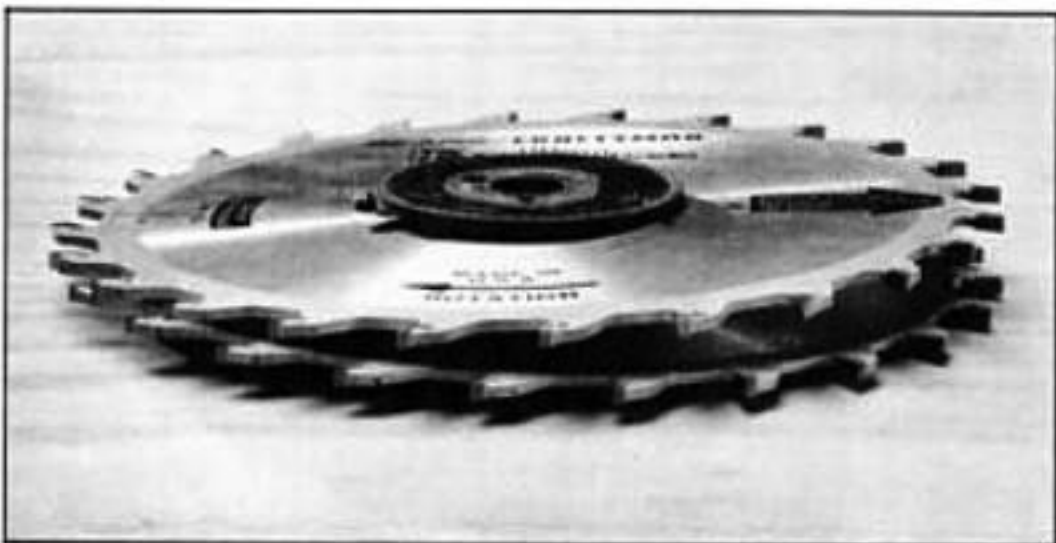
DADO

The traditional dado head consists of a stack of chippers sandwiched between two saw blades. It's still a popular choice, but no longer the only choice. Systimatic dado set shown.

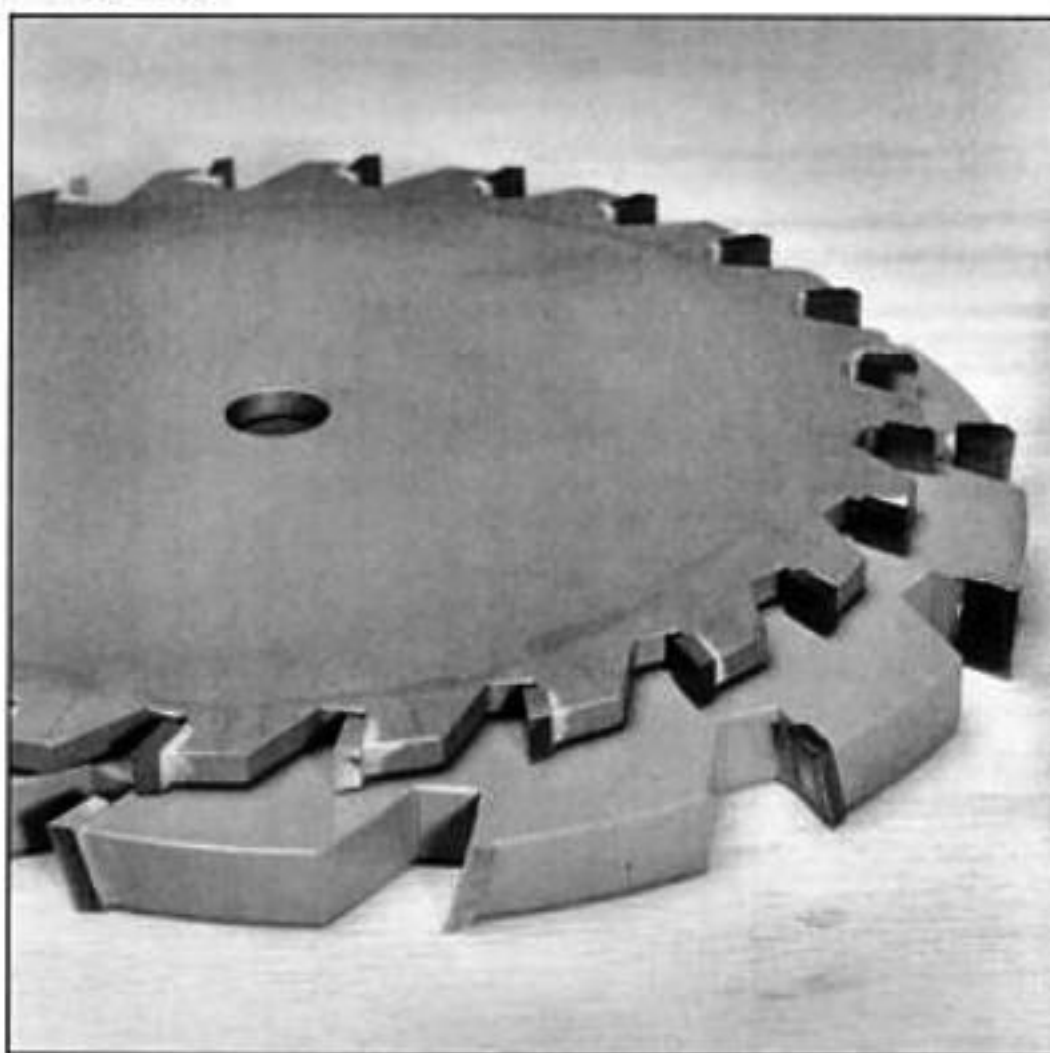
WOBBLE DADOS



Wobble dados are available in both single-blade (above) and double-blade (below) versions. Two Craftsman models are shown.



GROOVERS



Fixed-width groovers come in diameters from 6 in. on up, in widths from 1/4 in. on up, with six to 24 teeth, and a choice of straight-face or alternate shear-face teeth. Freeborn groovers are shown.

HEADS

We Took a Look at Some Popular Groove Cutters

BY BOB MORAN AND DAVE SELLERS

Dado heads are groove cutters that fit like a saw blade on the arbor of a tablesaw or radial arm saw. They cut grooves across the grain or with the grain, narrow or wide, near the center of a board or along the edge. Nothing beats a dado head for the combination of speed, ease, accuracy and consistency. If your wood-working includes cutting a lot of grooves, like fitting drawer bottoms to drawer sides or joining shelves to cabinet partitions, you'll save yourself a lot of time and produce better results with a dado head.

To get a real in-the-shop feel for today's dado heads we tried several different kinds on a variety of materials. We found some of them a lot easier to use than others; and some of them cut a lot better than others. Our report should help you decide if a dado head is for you, and which kind would suit you best.

Three Types of Dado Head

There are three basic types of dado head; the stack dado, the wobble dado and the fixed-width groover. The stack dado consists of two outer blades that re-

semble regular saw blades and a set of "chippers" that are sandwiched in between, as shown in the photos on the preceding page. You can change the width of the groove that it cuts by changing the number of chippers between the two outer blades.

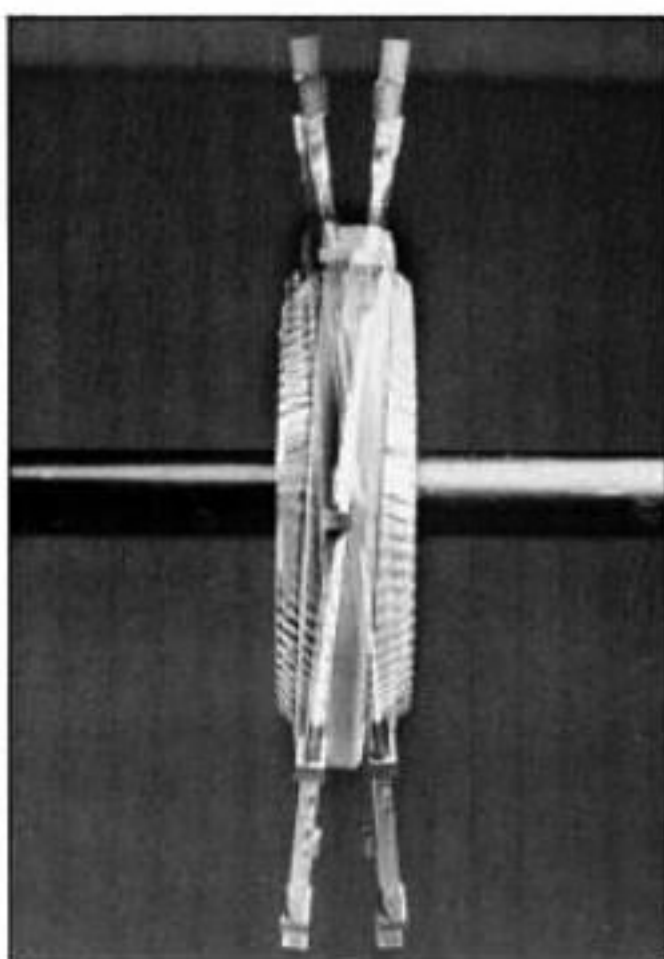
The second type of dado head, the wobble dado shown in the photos above, consists of one or two blades mounted between wedge-shaped collars that make the blade wobble as the arbor turns. When spinning on the saw, the teeth trace out a wider swath than just the thickness of the blades, making a wide kerf or groove. (See photo page 48.) You can adjust the amount of wobble to change the width of the groove.

The third type, the fixed-width groover, looks like a massively wide saw blade, as shown in the photo on page 47. It's not adjustable for width. All three types of dado head can be used on either a tablesaw or a radial arm saw.

Dado heads are available in a wide range of sizes, quality, and price. Makers usually recommend a dado head 2 in. smaller in diameter than the saw's maximum-diameter saw blade. That is, a 10-in. saw should not swing a dado head larger than 8 in. Stack dados

As a wobble dado rotates, it cuts a groove as wide as the amount of wobble.

Like saw blades, the outer blades of a stack dado are available with different tooth configurations. You'll pay more for more teeth but get a smoother cut and less chipout. Systimatic outer blades shown.



PHOTOS BY JOHN HAMEL



MITCH MANDEL

Shear teeth like this one (on an outside blade of a General stack dado set) cut cleanly on the side of the groove. The dado set includes a left blade and a right blade for the left side and right side of the groove.



and fixed-width groovers come in diameters from 6 in. on up, 6-in. and 8-in. being the most common.

Stack Dados

To many old-timers, stack dados are the only "real" dado heads. They are sold as a set of two outer saw blades that cut the edges of the groove (more about them in a bit) and a series of chippers to remove the material in the middle of the groove.

The chippers usually have two wings, (two teeth) but better sets sometimes have chippers with four or even six wings. Most common stack dados contain two $\frac{1}{8}$ -in. thick outer blades, four $\frac{1}{8}$ -in. chippers and one $\frac{1}{16}$ -in. chipper, allowing you to cut grooves from $\frac{1}{4}$ in. wide to $\frac{13}{16}$ in. wide in $\frac{1}{16}$ -in. increments. Some makers substitute a single $\frac{1}{4}$ -in. chipper for two of the $\frac{1}{8}$ -in. chippers.

The outer blades of a stack dado set are like saw blades that are exactly the same diameter as the chippers. Some makers grind the teeth on these outer blades so that one blade makes the finest possible cut on one side of the groove while the other blade makes its finest cut on the other side. (See photo.) For example, we found this kind of asymmetrical "shear tooth" configuration on more expensive sets from Systimatic, DML, Delta and others. With this kind of a dado set, you must be sure to stack the blades correctly—they're marked so you get the right sides facing out.

Other makers produce special tooth geometries for specific purposes. For example, General Saw's Scriber Tooth Dado Set has an extreme top bevel and the Forrest Dado King has a negative hook angle on the teeth, so they work well on veneers and brittle materials like plastic laminates.

The 8-in. carbide-tooth stack dados that we looked at ranged in price from about \$200 to \$365. More money buys more teeth, more sophisticated tooth grinds, and beefier chippers. The 6-in. stack dados cost less. Some sets with high-speed steel teeth, instead of carbide, cost as little as \$30.

Setting up a stack dado can take time, especially if you need a precise width. To begin with, when any blade is mounted on a saw arbor the flanges should be clean and free of wood chips, and the blade must be wiped clean so it doesn't wobble. When setting up a stack dado, you may have as many as five chippers and two blades to keep clean as you stack them on the arbor. You should spread the chipper teeth out evenly around the circumference of the cutting edge and make sure the teeth of the outer chippers fall in a gullet between teeth in the outside blades.

To get a precise width, you'll need to make test cuts and adjust the thickness of the stack with shims. That's what takes time; you have to take the whole stack off and reassemble it with paper or brass shims (see Sources), keeping the shims, as well as the cutters, free of sawdust. But with careful shimming you can get a delicious fit between your groove and any oddball thickness of material. To repeat a setup with a stack dado, note which shims and chippers you used.

Wobble Dados

The wobbly blade approach to cutting a groove has been around for quite a while. In addition to the single blade wobble, we looked at a variation that uses two blades instead of just one (Sears Craftsman and DML). It cut cleaner but cost more than single-blade wobble dados.

Wobble dados have two things going for them: they're quicker to adjust than stack dados, and you can wobble on a lower budget than you can stack. But they tend to chip out the edge of the groove, and they produce a rounded or irregular bottom in the groove.

You can adjust a wobble dado in your hands, but it will be easier if you put it on the saw's arbor first. Run the nut down loosely (there won't be room for the outer flange), then hold the collar so it won't turn while you rotate the cutter until the index marks on the collar line up for the width of groove you want. Lining up the marks puts you in the right ball park; it seldom gives you a groove of precisely the indicated width. Since you can't measure the amount of wobble directly on the dado head, you'll have to cut test grooves and adjust the width by trial and error.

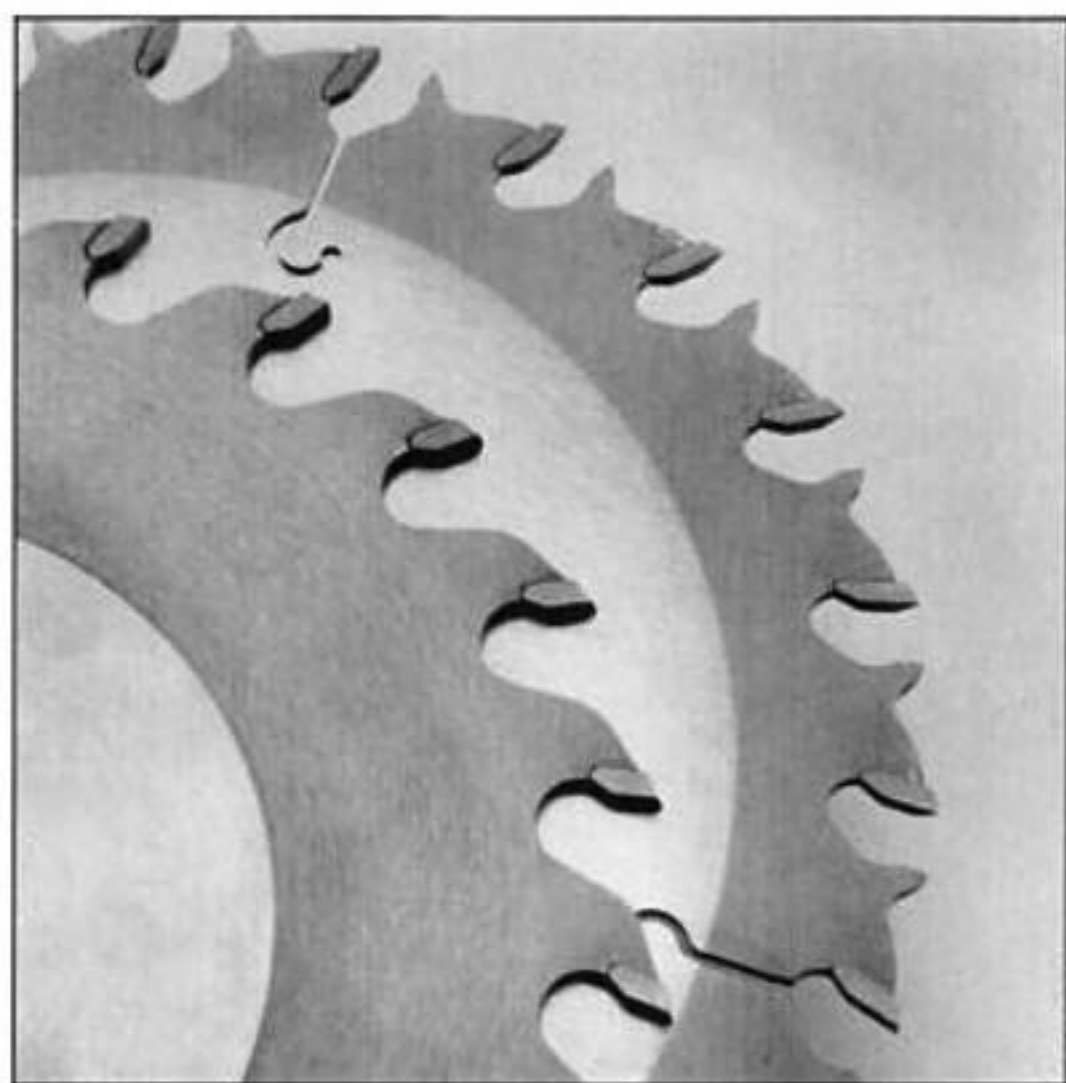
It's fairly easy to adjust a wobble dado on a radial arm saw since the index marks are usually on the face of the collar where you can see them and know which direction to adjust. It's more of a challenge on a table-saw where the marks are difficult to see and the collars are less accessible. That's why we appreciated the marks that the Irwin dado provides on the edge of the collar, where they can be seen from above. But even in the worst-case scenario—no visible marks, on a table-saw, in poor light, with bifocals—adjusting a wobble dado is still faster than disassembling a stack dado and reassembling with shims.

To repeat a setup, most wobble dados require that you go through the same trial-and-error routine again. We liked the Irwin wobble dado, which provides two screws that lock the collars, allowing you to remove the unit without losing the adjustment.

Getting the groove where you want it is not quite as easy with a wobble dado as it is with a stack dado or groover. Only a few of the teeth on a wobble dado actually cut the edges of the groove. You have to identify these teeth to position the stock for cutting the groove where you want it. On some wobble dados, like the twin blade Sears, these "outside" teeth are marked with a big arrow, which is a plus. With others, you have to rotate the dado head to find which teeth cut the widest part of the groove.

Groovers

Non-adjustable fixed-width groovers, seen most often in production shops, have one big advantage over the other types of dado head; of all the dado heads we tried out, the fixed-width groover was the simplest to set up and use. You just mount it on the saw like any other blade and cut grooves of exactly the same width every time. That saves a lot of horsing



Freud's Safety Dado (rear) features a high shoulder in front of each tooth to limit its bite and prevent overfeeding and jamming on a radial arm saw. It works. A conventional dado blade (front) is better suited to a tablesaw.

around and test cutting.

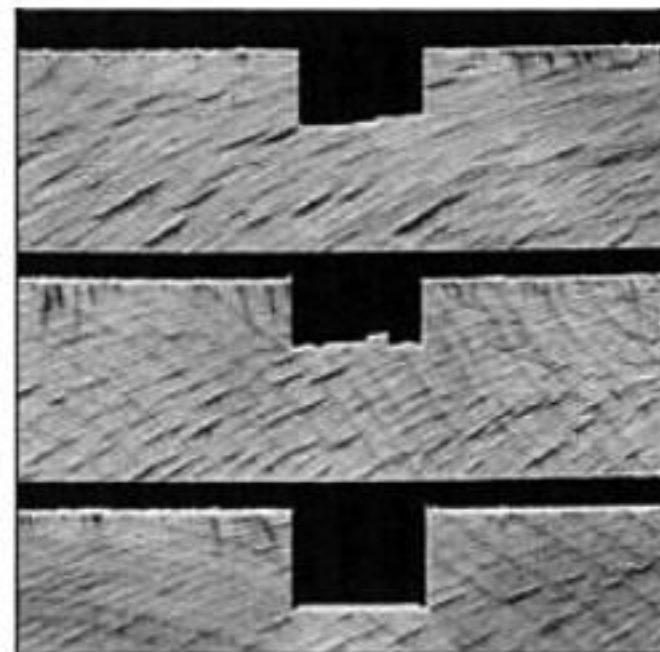
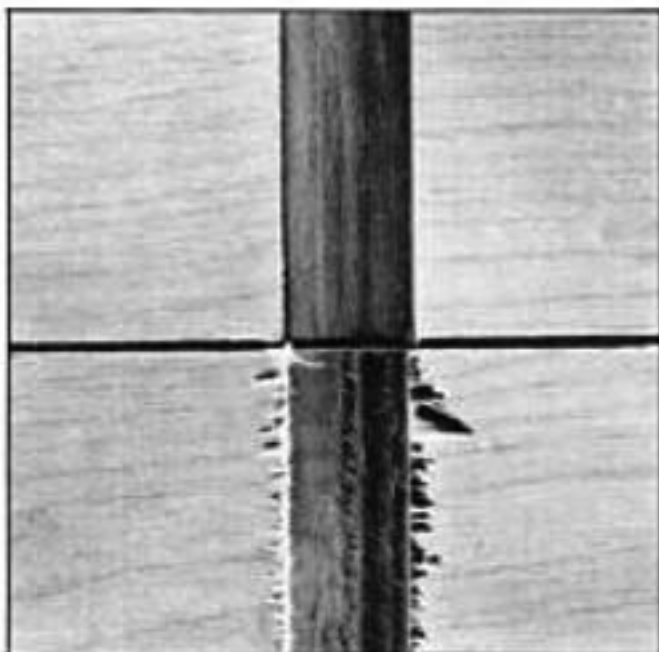
We tried a Freeborn 1/2-in. wide, 8-in. dia., 12-tooth fixed-width groover with alternate shear faces. It's a massive brute, well balanced, that ran smoothly and quietly. It took a fraction of a second longer than lighter dado heads to reach full speed, but it cut without a hint of vibration. Freeborn makes these groovers in 6-in. to 10-in. diameters, with six to 24 teeth, with either straight-face or alternate shear-face tooth configurations. List prices range from \$128 to \$234.

Remember that the reasons for cutting grooves with a dado head are speed, ease, accuracy and consistency. The fixed-width groover is at the top of the heap in all these categories. If most of your groove cutting is at the same width, say, grooving for drawer bottoms, you might consider giving up adjustability in favor of the simplicity of the fixed-width groover. You can always cut the occasional groove of a different width with a router or multiple saw kerfs.

Quality of Cut

The type of saw that you use for cutting dados makes a difference. You probably know that it pays to

Crosscuts on birch plywood show the big difference between the clean cut of a top-of-the-line stack dado (top), and the ragged cut of an inexpensive wobble dado (bottom).



A wobble dado may cut an irregular or curved groove bottom (top sample). A cheap stack dado may leave ridges (center sample). A good stack dado or groover cuts a square groove bottom (bottom sample).

PHOTOS BY JOHN HANDEL



Less expensive 6-in. all-steel stack dados offer a choice of economy machine-set teeth (front) or higher-quality hollow-ground blades (rear). Delta dado sets shown.

SOURCES

**DELTA
INTERNATIONAL
MACHINERY CORP.**
246 Alpha Dr.
Pittsburgh, PA 15238
(800) 438-2486
(for nearest dealer)
(stack and wobble dados)

DML INC.
1350 S. 15th St.
Louisville, KY 40210
(800) 233-7297
(stack and double
blade wobble dados)

**FORREST
MANUFACTURING CO.**
461 River Rd.
Clifton, NJ 07014
(800) 733-7111
(stack dados)

**FREEBORN
TOOL CO., INC.**
E. 3355 Trent Ave.
Spokane, WA 99202
(800) 523-8988
(solid groovers)

FREUD
218 Feld Ave.
High Point, NC 27264
(800) 334-4107
(stack dados)

GENERAL SAW CORP.
20 Wood Ave.
Secaucus, NJ 07096
(201) 867-5330
(stack dados)

THE IRWIN CO.
92 Grant St.
Wilmington, OH 45177
(513) 382-3811
(wobble dados)

SEARS ROEBUCK & CO.
Sears Tower
Chicago, IL 60684
Call your nearest store
(stack and wobble dados)

SYSTIMATIC
12530 135th Ave., NE
Kirkland, WA 98034
(800) 426-0000
(stack dados)

**WOODWORKER'S
SUPPLY**
5604 Alameda Place, NE
Albuquerque, NM 87113
(800) 645-9292
(dado shim set)

have the good side of the stock facing up when using a tablesaw, because most of the chipping occurs where the saw teeth exit the wood on the down side. But since a dado head on a tablesaw cuts a groove *only* on the down side, it tends to chip.

Radial arm saws have a distinct advantage when crosscutting dados; their climb-cut manner of crosscutting produces less chipping. Every dado head we tried gave smoother results when crosscutting on the radial arm saw. Crosscutting dados on a radial arm saw can be dangerous because of the strong tendency to overfeed, so keep firm control of the saw carriage, holding it back as necessary, and take multiple shallow cuts to keep the blades from climbing up the stock and jamming. The Freud Safety Dado has a shoulder in front of each tooth that helps minimize this tendency to overfeed. When we tried taking an extra-deep cut, the Freud dado set made it through with no trouble, while other dado sets climbed and jammed.

Whatever type of dado head you choose, the goal is clean, crisp, chip-free grooves. We found a wide range in the quality of the cut from the dado heads we tried. We cut grooves both with the grain and across the grain in birch plywood, melamine-faced lauan plywood and hard maple. The most difficult material to cut cleanly turned out to be the birch plywood. The edges of the grooves tended to chip badly. Only the \$365 Systimatic Super Fine 42 carbide-tooth set with six tooth chippers gave truly excellent results crosscutting the plywood on a tablesaw.

While crosscutting birch plywood was a difficult test, grooving with the grain in hard maple was a piece of cake. The vast majority of the dado heads, including some of the least expensive, gave clean, crisp edges on the grooves. Some of them produced a pretty irregular bottom in the groove and the wobble dados made bottoms that were out of square, but that doesn't always matter. If you're cutting grooves for drawer bottoms in solid lumber, you probably don't need to spend a lot for a dado head to get a good job.

To sum up, we found that more costly carbide-tipped stack dado sets produced the best results in the widest variety of cuts and materials. Inexpensive stack dados made cleaner cuts for us than wobble dados, and a material as common as birch plywood proved to be a real challenge for dado heads. Wobble dados took less time to adjust than stack dados, but fixed-width groovers were the quickest and cut grooves with an exceptionally smooth bottom.

Our advice? First, decide what qualities you want in the grooves you'll be cutting, whether you need adjustability, and what materials you'll be cutting. There's no need to mortgage the farm to pay for capabilities that you don't need. Ask yourself if quality of cut is more important than ease of adjustment before deciding between a stack or wobble dado. Think router for occasional cross-grain dado cutting in hardwood plywood, or use a radial arm saw. And finally, get the advice of a local dealer who specializes in blades and cutters for the woodworking industry (perhaps a professional sharpening service) if you need a dado set for difficult materials like plastic laminates or brittle veneers. ▲

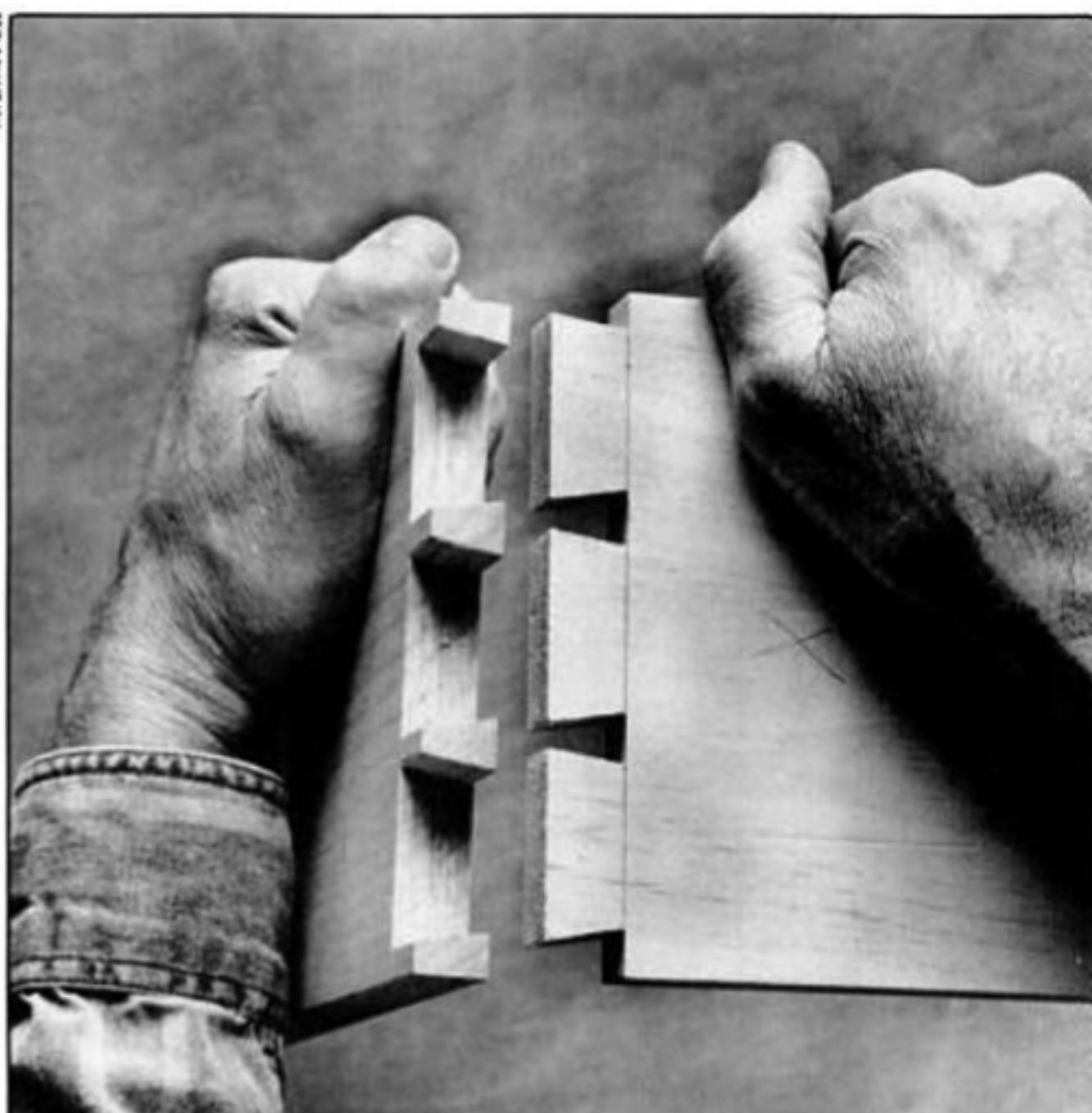
Robert Moran and Dave Sellers are assistant editors of AMERICAN WOODWORKER.

HAND-CUT DOVETAILS

*A Little Practice Makes
a Perfect Fit*

BY WALKER T. WHEELER

MITCH MANDEL



NG ANGLE

angle for a dovetail is a
also. It must be steep
ot "pull through" the pins
weaken the short grain
ime has shown 80° to be
e. The drawing shows a
80° angle to set your slid-
n the edge of my bench.

and the steps are just a map; the real route to cutting dovetails is practice.

You can produce excellent dovetails with just a few basic hand tools. In addition to a bench vise and a clamp, you will need a marking gauge, a small square or try-square, a sliding bevel, a scribe or scratch awl, a dovetail saw, a wooden mallet and assorted chisels ranging from 1 in. down to 1/8 in. wide. The marking gauge and the chisels should be sharp to prevent tearing the cross grain.

3

Measure and
mark the narrow
side of each pin.

2

Set the
bevel for
the dovetail.

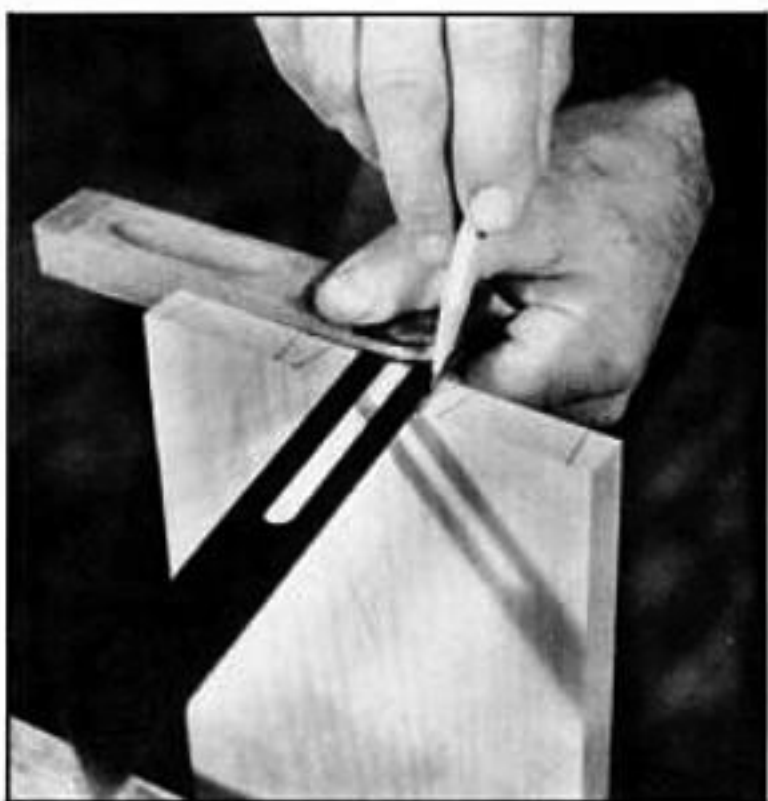
Interlocking
pins give
dovetails
extra strength.

GETTING THE A

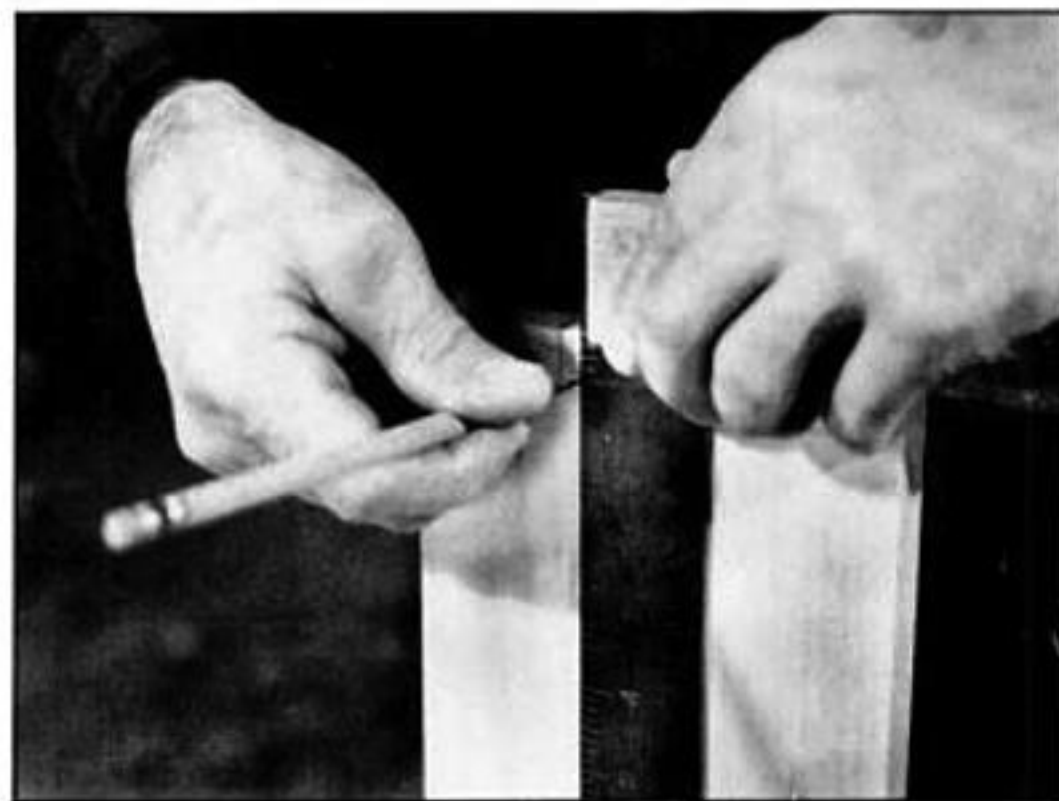
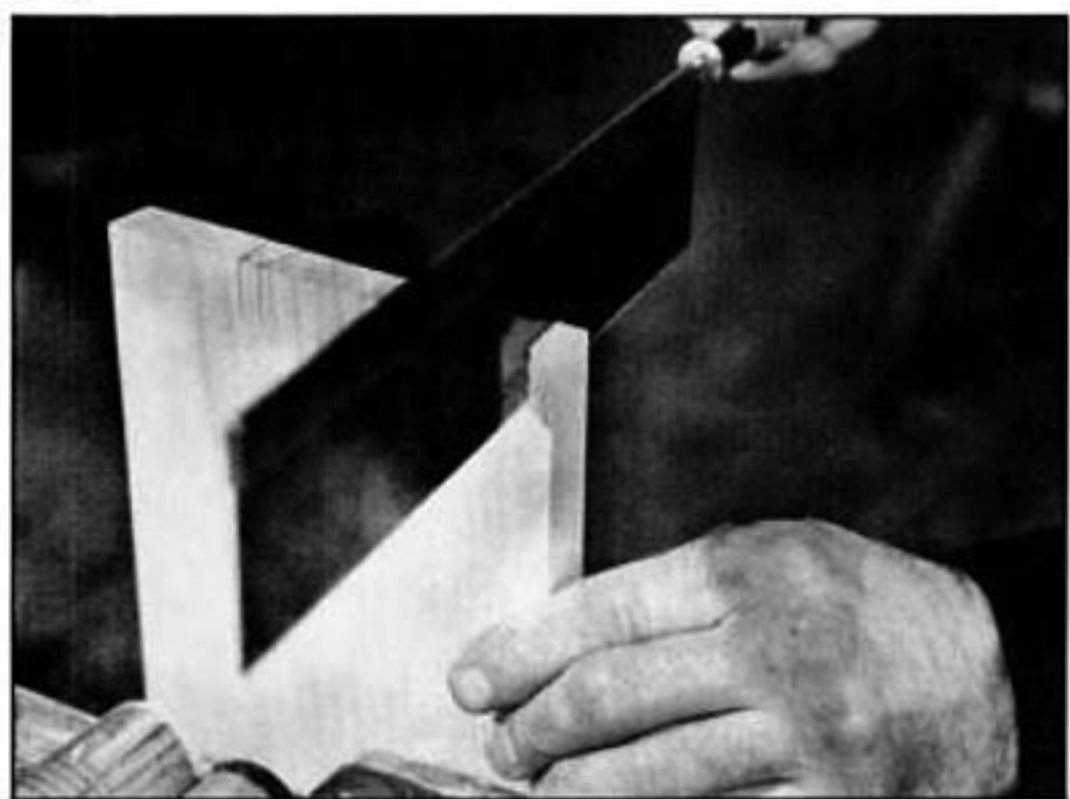
The best compromise is steep enough so the tails do not pull out, but not steep enough to tear the wood at the end of the tails. I use an excellent compromise: a sliding bevel. I do it right

4

Lay out the end of each pin at 80°.



Saw on the waste side of the vertical lines.

6**5**

Square down from the pin ends to the baseline.



Cut the baseline deeper along the waste sections.

7

mine the length of the pins and tails; the extra $\frac{1}{32}$ in. ensures that when the joint is assembled you can sand the ends of the pins and tails flush with the faces of the boards instead of having to sand the faces of the boards down to the ends of the pins and tails. **2** Holding the fence of the marking gauge tight against the squared ends of the boards, scribe a line across both sides at the end of both pieces.

Next, select one face of each piece as the outside face of the assembled joint and mark it with an X. Choose a piece for the pin piece, and place it in the vise with the end grain up.

A dovetail joint should have a half pin on each end. (Half pins are angled on only one side.) Pins should be centered about $1\frac{1}{2}$ in. to $2\frac{1}{2}$ in. apart on $\frac{1}{2}$ -in. to $\frac{3}{4}$ -in. thick stock. When first learning to hand cut dovetails the narrow side of the pins should be about $\frac{1}{4}$ in. wide. You can achieve a more delicate look by making the pins narrower, but it makes cutting the tails more difficult. Always use at least three pins, including the half pins, for a complete joint.

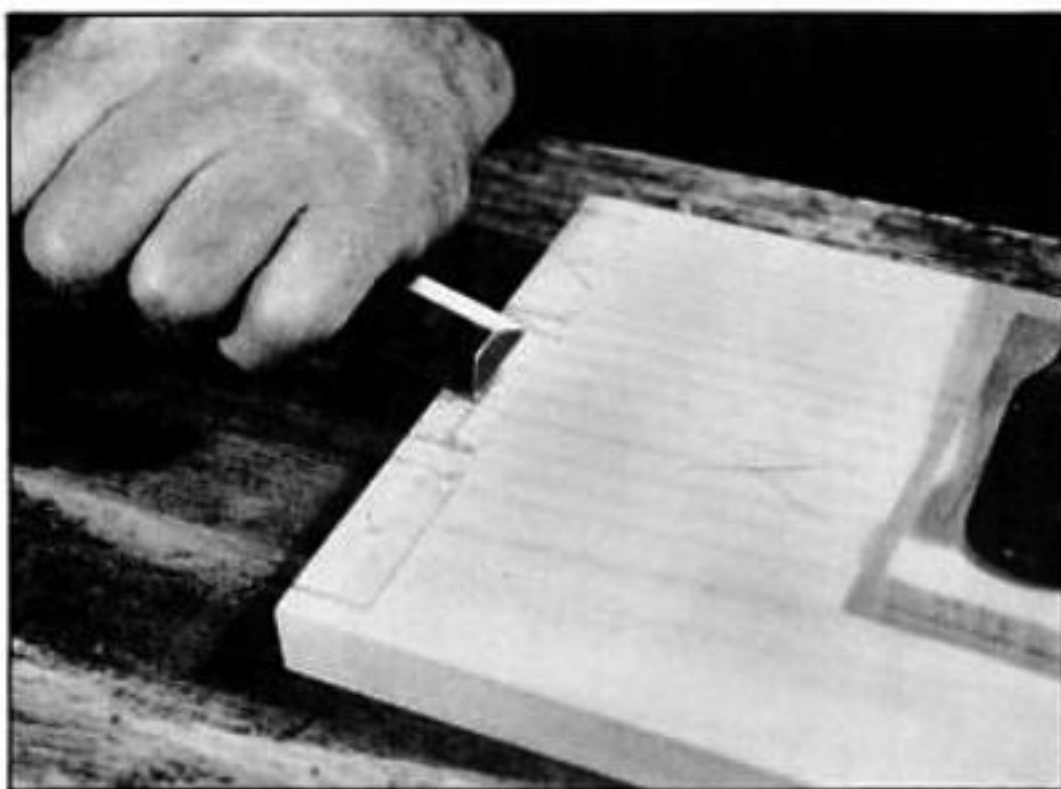
3 Lay out the narrow side of each pin on the outside edge of the end grain, spacing the pins equally. **4** Use the sliding bevel set at 80° to complete the layout of the pins on the end grain, and **5** use the square to

drop perpendiculars on the faces to the line made earlier with the marking gauge. Mark the portions to be removed with Xs to prevent confusion when cutting them out.

Cutting the Pins

6 With the pin piece still in the vise, make the vertical cuts with the dovetail saw, keeping the saw kerf on the waste side of the line. Guide the saw with your thumb, and use light downward pressure on the saw when starting each cut. Be careful not to saw below the baseline scribed by the marking gauge, because a cut below the line will show when the joint is together.

To prepare for chiseling out the waste, clamp the board flat on the bench with the outside face up and the pins pointing toward you. When using chisels to remove waste, always place the chisel with the bevel side toward the waste. **7** Begin by using a wide chisel, like a knife to deepen the scribe line along the waste sections. **8** Then gently push the chisel in from the waste side to remove enough wood to create a shallow V-cut at the back of each dovetail section. This is a critical step in assuring a tight-fitting joint, because any variation from the marking-gauge line will show when the joint is assembled.



8

Gently chisel out a V-groove.



Chip out the waste.

10

9 On the next pass, tap lightly on the chisel with a mallet to further deepen the cut along the marking-gauge line. Undercut the back of each waste section by tilting the chisel very slightly toward you to ensure that the joint will close tight to the marking-gauge line when assembled. 10 Then chip out a thin piece of waste by tapping the chisel in from the end grain.

Continue to remove thin pieces from between all the pins until you are halfway through the board. Turn it over and work from the other side, again undercutting slightly. When removing waste with the narrow side of the waste section facing up, be careful not to damage the sharp edges of the pins by forcing wide chips up through the narrower opening between pins. With a narrow chisel, remove a chip from the center of the waste first, then remove chips from the sides. 11 When all the waste has been removed, clean out the corners with a chisel.

Cutting the Tails

Use the completed pins as a pattern for scribing the tails. Though many experts recommend an awl for scribing the tails, I prefer a finely sharpened No. 2 pencil. A pencil has two advantages. First, it creates no pressure on the pins, which must not shift during

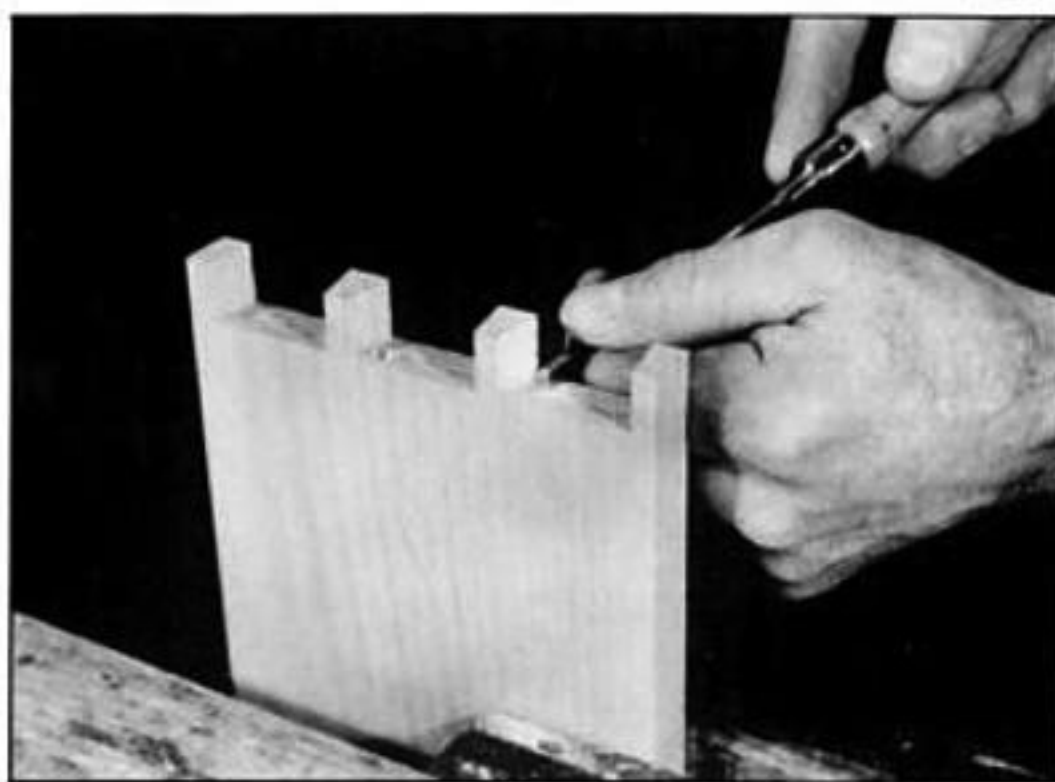


9

Chop the baseline, undercutting slightly.

Clean out the corners.

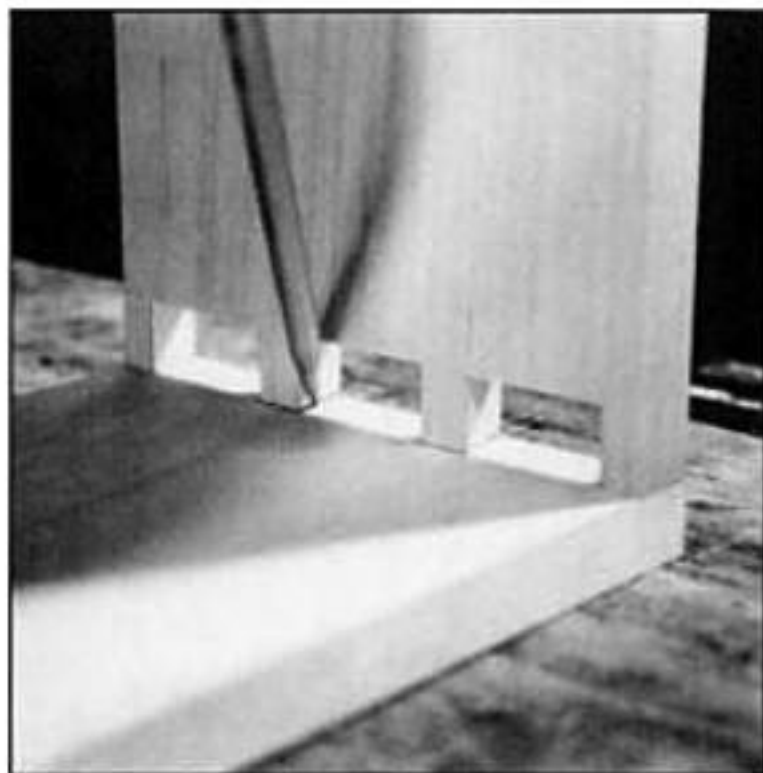
11



the tracing, and second, the resulting lines are dark and easy to see. Just keep the pencil point sharp!

12 Put the tail piece on the bench, outside face down, and stand the pin piece on it in the position that the joint will go together. With the widths of the boards aligned and with the wide edge of the pins on the marking-gauge line on the tail piece, you are ready to transfer the profile of the pins onto the tail piece. Trace from the inside corner of the joint rather than the outside so you can see that the face of the pins remains on the scribed line. Then remove the pin piece and mark the waste portions with Xs. 13 With a square, draw pencil lines across the end grain from the ends of the traced lines.

Now saw and chisel out the waste between the tails the same way you did the pin piece. Try to split the line with the saw cut, paying attention to which side of the line is waste. Learning where to saw in relation to the line, so the tails fit easily but snugly, comes with practice. It is one key to successful dovetail construction. Undercut the back of the waste section as you did between the pins. An important exception to this undercutting is on the ends where the half pins will be located. This waste should be sawn out with the dovetail saw and pared off flat with a chisel if necessary,

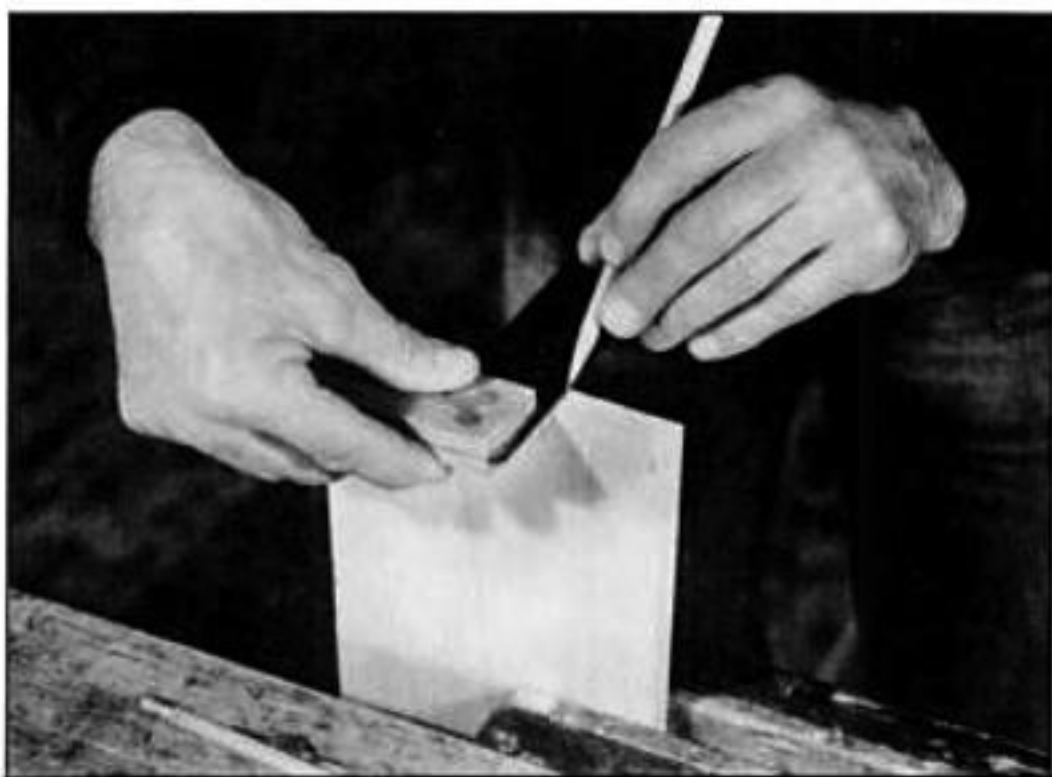


12

Trace the pins onto the tail piece.

Square across the end grain.

13



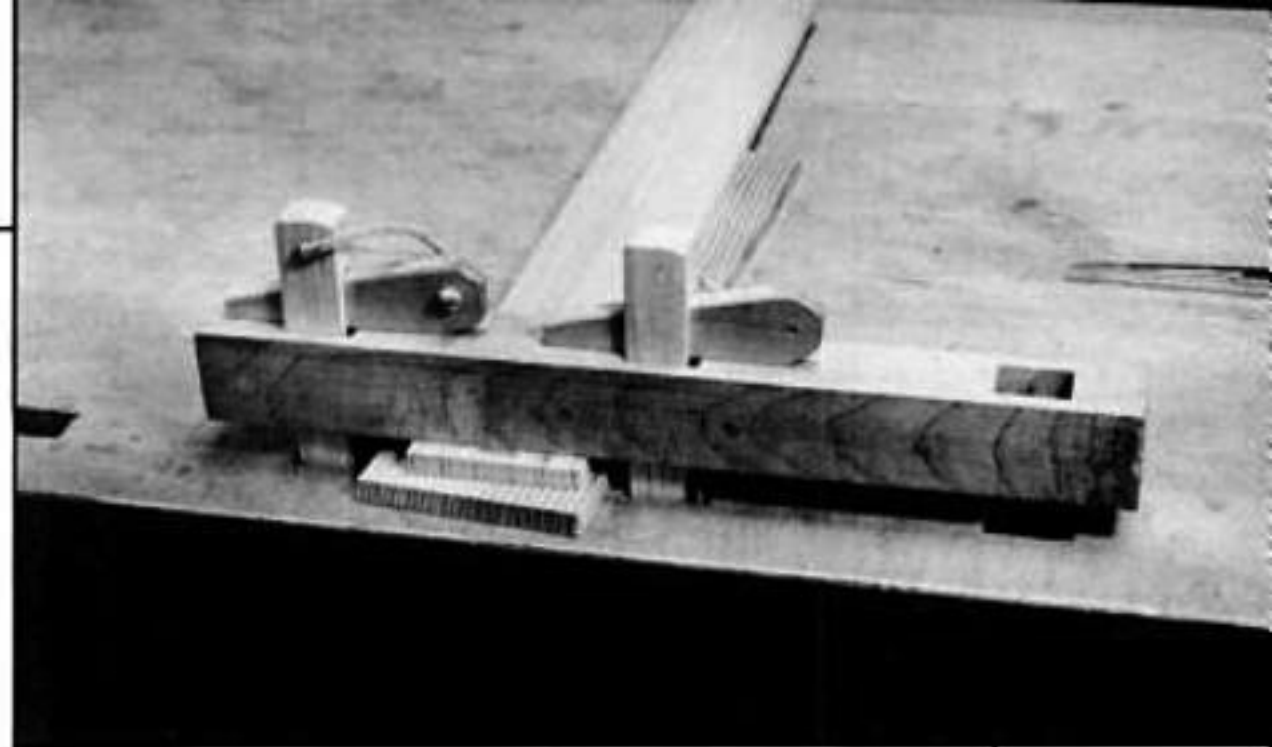
because it will show in the finished joint.

Test the joint for fit by lightly tapping the tails onto the pins to get them started. I usually spank the joint together with the palm of my hand. Use a mallet if you need to, but protect the wood. You should be able to feel if the fit is a good one right away. As you practice cutting dovetails, aim to get a good fit by precisely cutting to accurately laid-out lines. If you try to trim the joint to fit, and pare the wrong side of an interface that is too tight, you will only make matters worse.

The key to successful hand dovetailing is practice, practice, practice, until it becomes second nature. Once this occurs, both your speed and the quality of the finished joints will improve dramatically. The lasting reward is the satisfying knowledge that you have incorporated the very best of old-world quality into your work. ▲



Walker T. Weed III is a second-generation woodworker and a juried member of the League of New Hampshire Craftsmen. He designs and produces a wide range of furniture from his shop in Vermont.

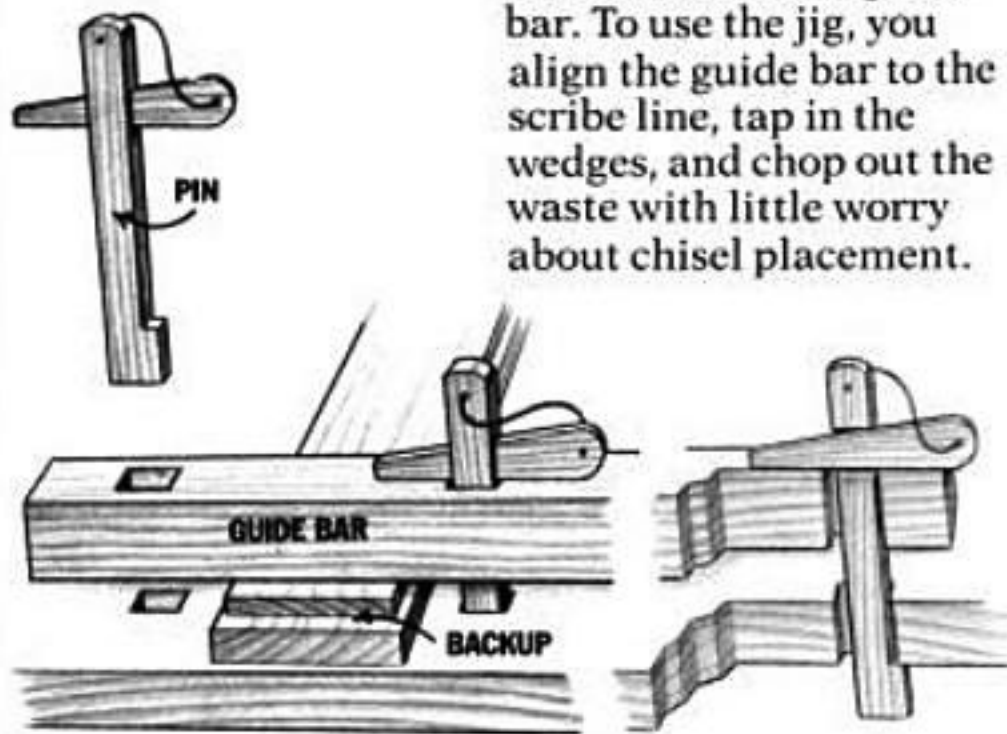


DOVETAIL CHOPPING JIG

BY DAVID WELTER

Gaps in a joint are about as ugly as woodworking gets. In dovetail joints, gaps happen when your chisel strays from the scribed baseline as you chop out waste. A chopping jig puts the chisel *on* the line, dead on, every time. And it does it while clamping the stock to the bench, quickly and securely, saving you from juggling separate clamps.

The jig has two pins that hook to the bench through the bench dog holes. Wedges that pass through the tops of the pins clamp a guide bar down tightly, sandwiching the workpiece and a backup board between the bench and the guide bar. To use the jig, you align the guide bar to the scribe line, tap in the wedges, and chop out the waste with little worry about chisel placement.



Most of the jig's dimensions are dictated by your bench dog hole dimensions, as shown in the drawing. Since the dog holes are at a slight angle and the jig pins need to be vertical, the dog hole angle determines many of the pin dimensions.

A leather shoe string tethers the wedges to the pins so they don't get lost. Glue a strip of sandpaper to the underside of the bar for a good grip. Now quit fiddling with the jig, and cut some dovetails.



As captain of the world champion U.S. Boomerang Team, Barnaby Ruhe lives and breathes boomerangs.



The author makes a two hand "clap catch," and some other professional moves.



AMERICAN WOODWORKER editors and photographers play hookey to get a few boomerang lessons from the master.

BOOMERANG

It'll Come Back to You, It Really Will

BY BARNABY RUHE

Making a boomerang is closer to carving or sculpting than it is to ordinary woodworking. A boomerang is all gentle curves and flowing lines, as if its arcing flight path is foreshadowed by its shape. As an artist, I became fascinated with boomerangs when I realized they're a pure free-form work of art. I've never seen a better example of the idea that "form follows function." When I'm filing the wing contour on a boomerang, I can't help thinking that I'm cutting the "shape of the wind" right into the wood.

The returning boomerang I'll discuss in this article is a sports boomerang, a distant cousin of the non-returning hunting boomerang made by Australian Aborigines. Eventually, they evolved a returning boomerang, which was probably used to hunt migrating birds. But today, the principle function of the return-

ing boomerang is for sheer joy. There's something magical about testing the wind, tossing and watching that piece of wood you carved circle right back to your hand—defying logic. If you make and toss one yourself, you'll encounter sufficient delight, bordering on delirium, to prove my point. Guaranteed.

A boomerang flies because its arms or "wings" have a cross-sectional shape like an airplane wing or airfoil. (See Fig. 1.) The leading edges of the arms are rounded, while the trailing edges are thin and tapered. The arms' top faces are curved and bottom faces are flat. The boomerang's throwing arm—the one you grip in your hand—is the arm with the leading edge facing out. The other arm has the trailing edge facing out and is called the "dingle arm." When you throw a boomerang, a snap of the wrist as it leaves your hand gives it a spin so the wing shape creates lift.

Boomerangs are made in an endless variety of shapes and sizes, including circles, triangles and all the letters of the alphabet. A V-shape (an angle of about 105° is ideal) is most common. But as long as you make it with two (or more) wings with an airfoil cross section there's a good chance you'll get it to fly. What's more, you'll discover that different shapes and wing contours create different flight paths and effects.

To make a boomerang, you can use natural elbows of trees, solid hardwood or other materials like plastic or fiberglass. But most boomerangs are made from marine-grade plywood, usually 1/4 in., 5-ply Finnish or Baltic birch (available from Anderson International Trading Co., 1011 W. Barkley Ave., Orange, CA 92668, 714-771-6270). A 5 mm (about 13/64 in.), 10-ply Finnish birch plywood (also sold by Anderson) is popular for making very light, strong boomerangs. Your local lumberyard or hobby shop may carry it too.

Making the Boomerang

Making a boomerang can be as simple or as elaborate as you want. That's part of the fun! It's best to start out with a basic plywood boomerang like the one described here. Later, you can make fancy boomerangs with laminated hardwood and inlays, if you like.

To make your first boomerang you'll need a jigsaw or bandsaw for cutting out the shape from a sheet of thin plywood, and a power sander of some kind with coarse sandpaper. You'll also need that handy woodworker's tool, a four-in-hand rasp (a common half-round rasp with four different cutting surfaces, also called a shoe rasp).

Draw the pattern shown in Fig. 1 onto your sheet of birch plywood, and cut out the blank. If there is any warp in the plywood, the upcurved, concave side of the plywood sheet should be the topside of the boo-

EDITOR'S NOTE: If you've never seen a boomerang fly or thrown one yourself, chances are you might not understand the attraction. Boomerangs, it turns out, are one of those things you have to "experience." That's why we're out here in a big, open lawn on a bright, crisp December morning with Barnaby Ruhe, captain of the U.S. Boomerang Team. He's got a canvas bag and two old suitcases full of boomerangs—there must be a 100 of them in all shapes, sizes and colors, from all over the world. Barnaby's out here now, twirling his arms, stretching and getting in a few practice tosses to warm up. There's a feeling in the air...

Experiencing boomerangs with Barnaby Ruhe is like playing catch with Jose Canseco or hoops with Michael Jordan. His enthusiasm is infectious. From the first throw with its high arcing flight, doubling back overhead, hovering, then softly spiraling down into his waiting hands, our eyes are bugging out with a chorus of "wows" all around.

Barnaby's a dynamo of excitement as he winds up to throw the boomerang with the focused intensity of a Kung Fu master. As the day wears on, he catches the 'rang behind his back, under the leg, and with his feet, sometimes throwing two at once. Soon we're all throwing, and swooping boomerangs fill the sky. We're hooked.

We wanted to let you know what a great time we had, because we want you to try it yourself. The cost is small, and the woodworking is easy—this article will show you how to do it. And one thing's for sure—you'll never have so much fun with such a little stick of wood. Catch the fever.



The author's bag is filled with boomerangs of every shape and size.

merang's wings. The grain needn't favor either wing, so I set the grain of the surface plies at 45° to each wing.

Now shape the leading and trailing edges of the boomerang blank, as shown in Fig. 1. Don't worry too much about getting this shape exactly right because there is no one correct way—different shapes create different flight effects. Just make sure the curves are on the top, and the bottom remains flat. You can also make a little indentation in the trailing edge of the throwing arm to serve as a finger grip. Note that Fig. 1 shows a "right-handed" boomerang—if you're a lefty, just reverse the positions of the leading and trailing edges.

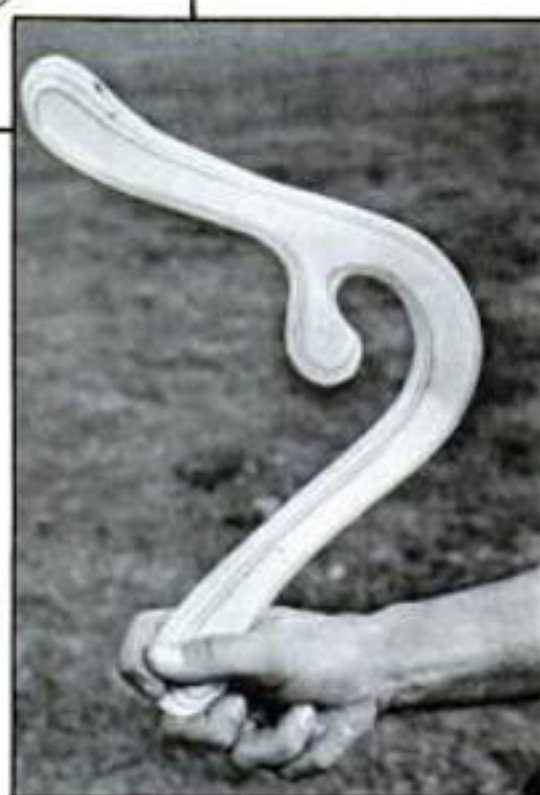
Remove the excess wood with your four-in-hand rasp, or opt for speedier shaping with a power sander. I use a simple disc-sanding attachment on my drill. A rough grit for the disc works fastest. As you sand, the glue lines between plies create contour lines to guide the shaping process. Notice how the lines exposed on the trailing edge of each wing are farther apart than the lines on the leading edge. Make the shape so the trailing lines go all the way around each wing tip. At the "elbow" where the two wings join, the leading and trailing edges switch places from one wing to the other. A smooth transition across this area ensures the most brilliant flight.

I like to shape the two wings rapidly with the sander, then take the rough boomerang and my rasp out to an open field for testing, tossing and filing, tossing and filing, fine tuning the evolution of the flight form as I go. The four-in-hand rasp allows intimate contact

THROWING THE BOOMERANG



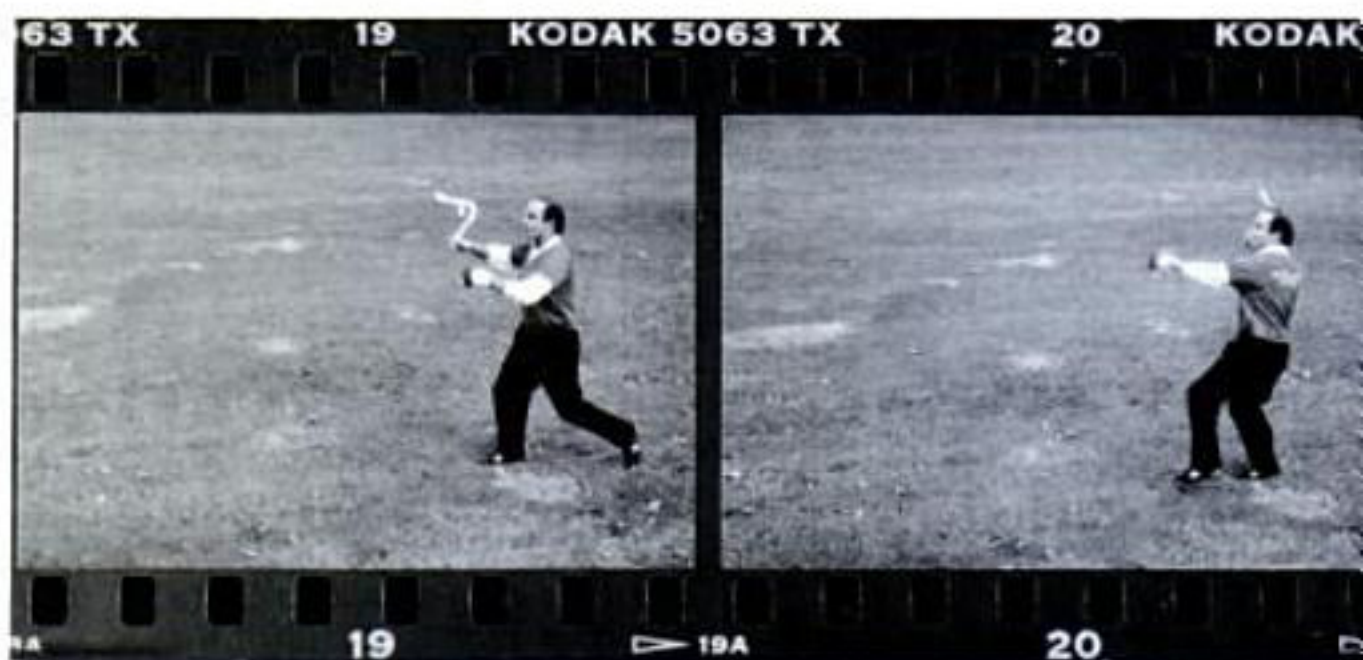
Check the wind direction, then throw the boomerang at 2 o'clock to the right of the wind.



Grip the boomerang by wrapping one finger around the tip of the throwing arm, with the flat side away from you.

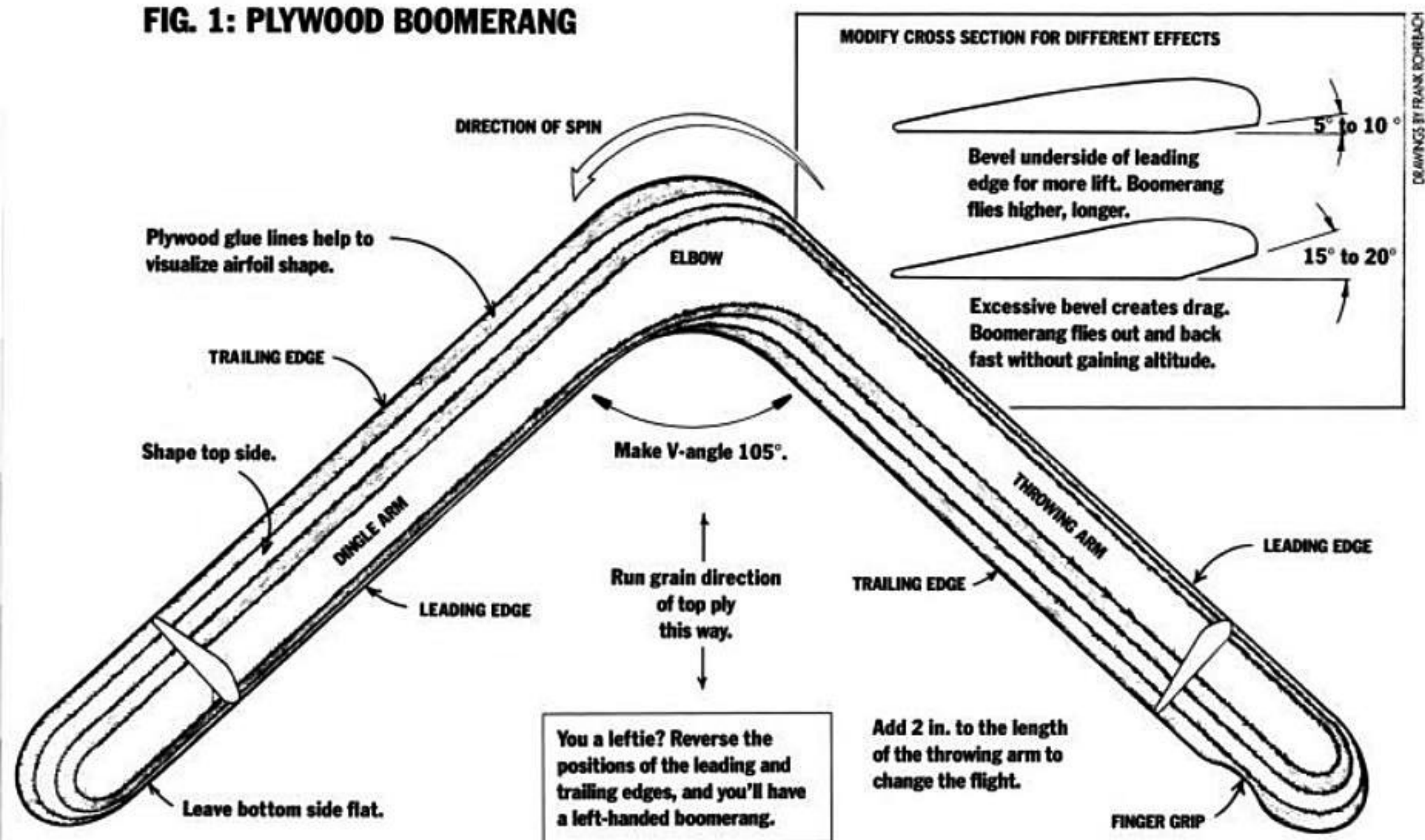
Your boomerang will return! I guarantee it, providing you learn to throw it correctly. But don't worry, it's easy.

Pick a big, open field and a day with a mild breeze—about 5 MPH or less. At higher wind speeds throwing gets tricky, and 10 MPH to 15 MPH is too much. Throw from the center of the field so there are no obstructions. Trees have a habit of snagging boomerangs as if trying to reclaim their wooden origins.



With the boomerang held vertically, toss it with an overhand motion (like throwing a baseball).

FIG. 1: PLYWOOD BOOMERANG



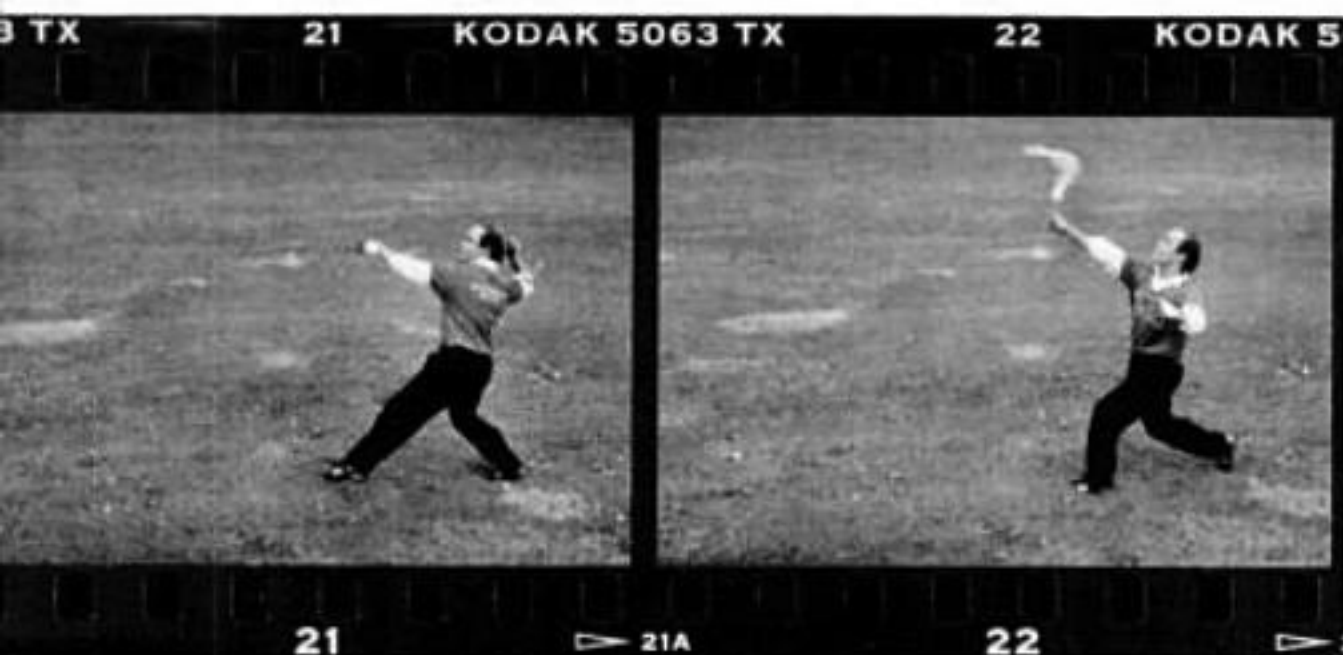
Grasp one arm of the boomerang so the flat side is against your palm, facing away from you. A single finger wrapped around the tip of the boomerang's throwing arm is all you need.

Face the wind and imagine it's coming at you from the 12 o'clock noon position, then turn slightly to the right, and toss the boomerang at the 2 o'clock position. (For lefties, turn to the left and toss at 10 o'clock.) Toss with an overhand motion, like a baseball, with the boomerang nearly vertical, straight up and down (never side-arm). Give the boomerang an extra spin with a snap of your wrist just as it leaves your hand. Aim for the horizon. The boomerang will fly straight out for some distance, suddenly veer skyward, and then begin to curve

back toward you, sometimes doing an extra loop until it settles back to earth. You throw the boomerang vertically, and it comes back horizontally. The effect is amazing.

If the boomerang lands to your right, aim a little bit more to the left. If it lands in front of you, throw a bit lower. Behind you, throw a bit higher. You can increase the range of your boomerang by taping a penny to the tip of the leading arm or both arms. Moving the penny along the arms makes for drastically different flight patterns. If you especially enjoy one placement, you might drill a hole at the spot and inlay a small weight made of lead or brass. Try to catch the boomerang with a clap catch, trapping it between your hands as you bring them

together, palms horizontal, keeping your fingers away from the spinning blades.
—B.R.



all). Aim for the horizon and give it a spin with a snap of your wrist as it leaves your hand.



Snare the boomerang with a "clap catch," trapping it between your hands as you bring them together. Keep fingers away from the spinning wings.



Draw the pattern of a boomerang on a sheet of thin plywood and cut out the blank with a saber saw.



A disc-sanding attachment on your drill is good to rough out the airfoil shape on the wings of the boomerang.

Take the boomerang out to an open field to fine tune the shape with a four-in-hand rasp—tossing and filing as you go.



with your emerging boomerang, and to me this part of the work is more of a meditation than a labor.

Beveling the underside of the leading edge produces more lift, while excessive beveling (past 15° of slant) creates drag. (See Fig. 1.) A crude airfoil-shaped cross section on the arms might be sufficient to make a boomerang fly in a strong sea breeze, whereas a perfectly curved cross section might generate too much lift and the boomerang would get blown downwind. Every subtle change in shape and wing contour gives a boomerang a different personality in flight.

Remember, don't lay these fledgeling boomerangs on the grass, or they'll warp. Stacking your raw boomerangs together with rubber bands ensures they remain flat.

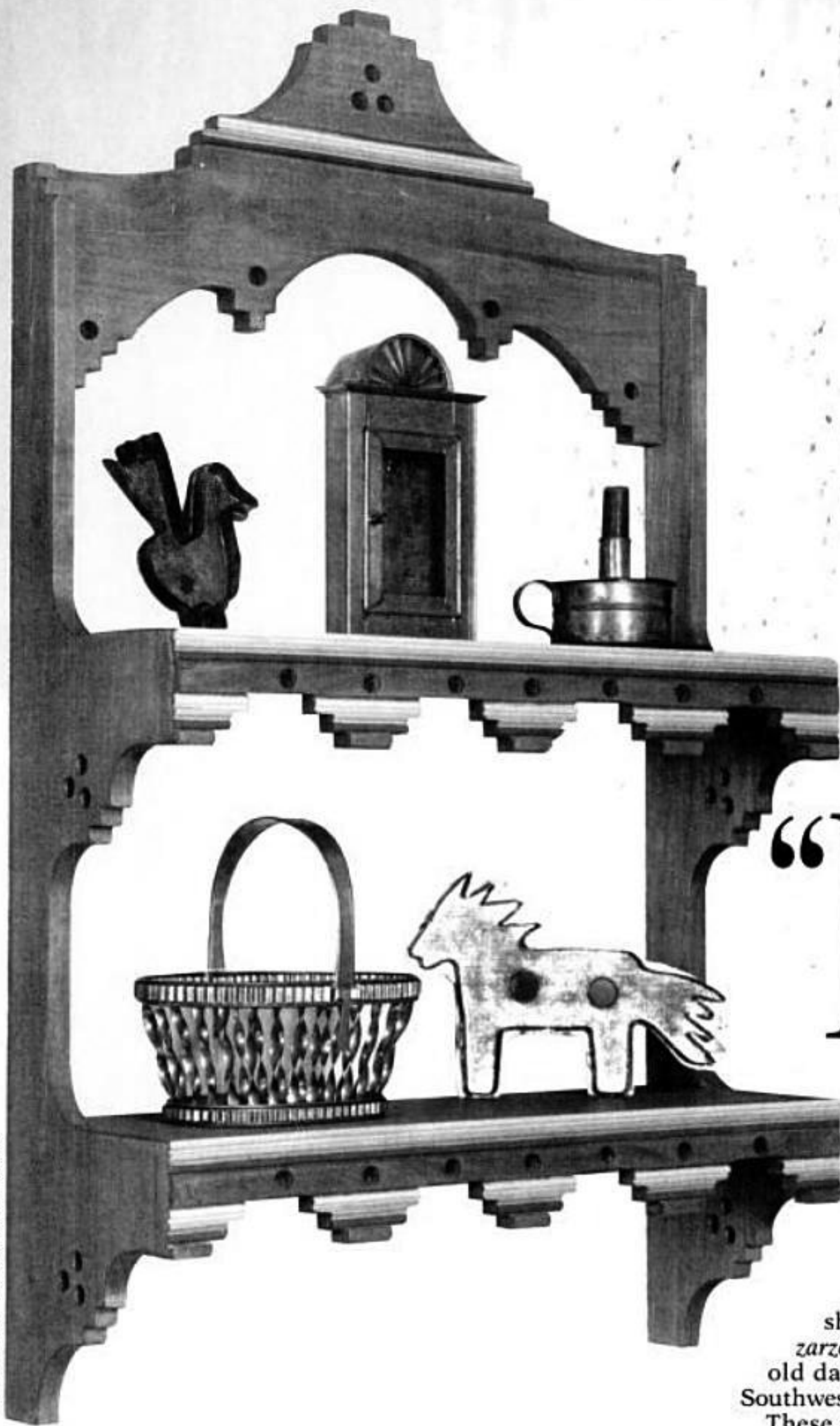
It's marvelous how just a few strokes of the rasp (don't overdo it) on the tip of a wing can achieve more spin or lift or drag or drop. Part of the fun is finding out for yourself just what a little shape-shifting can do to the flight. For example, suppose I want to make a "fast catch" boomerang—one that goes out and back in a quick, tight, horizontal circle without gaining any altitude. To do this, I need a wing that doesn't generate much lift, so I shape excessive bevels to the underside of each leading edge. (See Fig. 1.) This "bad wing theory" creates a boomerang that screams around a tight circle and comes back at you fast, without loitering skyward. On the other hand, a wing profile with an nice curve on top and a flat bottom will more likely have your boomerang hovering breathtakingly over your head.

Once you've made your peace with the tuning and retuning of your new boomerang through flight testing, you can apply a finish. A few coats of enamel paint (sanding between applications) with a final clear polyurethane coat will produce a durable finish. Purists simply finish their boomerangs with linseed oil, to contemplate the grain of the wood. I use day-glo paints to make my boomerangs more visible for competition throwing, and I apply the paint with a brush instead of an aerosol can (aerosols help widen the "ozone hole"). But really, anything goes when it comes to decorating your boomerang. You can make stripes, dots, inlays, drawings—anything to get you in the mood and celebrate the magic of flight.

The same goes for throwing the boomerang. (See sidebar.) I urge you to indulge in the Aborigine legacy of communion with nature: smell out the wind currents and thermals of the day, toss like some savvy sailor, and dance a Lambada with the capricious wind as your partner. Your boomerang circles about the border of a field, soaring above trees and streams, past delighted spectators, and back to you to complete the circle. The boomerang personifies just being there in the immediacy of your toss and flight. To throw one is to have a ritual with your local surroundings. The boomerang effect is a great lesson in karma: you get back as much or more than you throw out. ▲

Barnaby Ruhe is captain of the U.S. Boomerang Team, which won the World Team Cup in 1989. He'll be traveling to Perth, Australia in April to defend the title. He has been making his own boomerangs for competition since 1976. Ruhe works as an artist in New York City.





“REPISA”

BY NICK ENGLER

Several distinct forms of furniture have evolved out of the Southwest furniture tradition.

Among them were decorated hanging shelves called *repisas* in New Mexico, or *zarzos* in the rest of Hispanic America. In the old days, it was common for each room in a Southwestern home to have a *repisa* on its wall.

These shelving units were usually of modest size, having only one or two shelves each. They were used to hold candles, pottery, personal articles and other small items. If a *repisa* hung in a kitchen or near an entrance, the aprons or the front edges of the shelves were often fitted with pegs to hold dried chilies, cooking utensils, hats, wraps, or lariats. Some *repisas* were tiny shrines displaying *santos*, painted or carved images of saints.

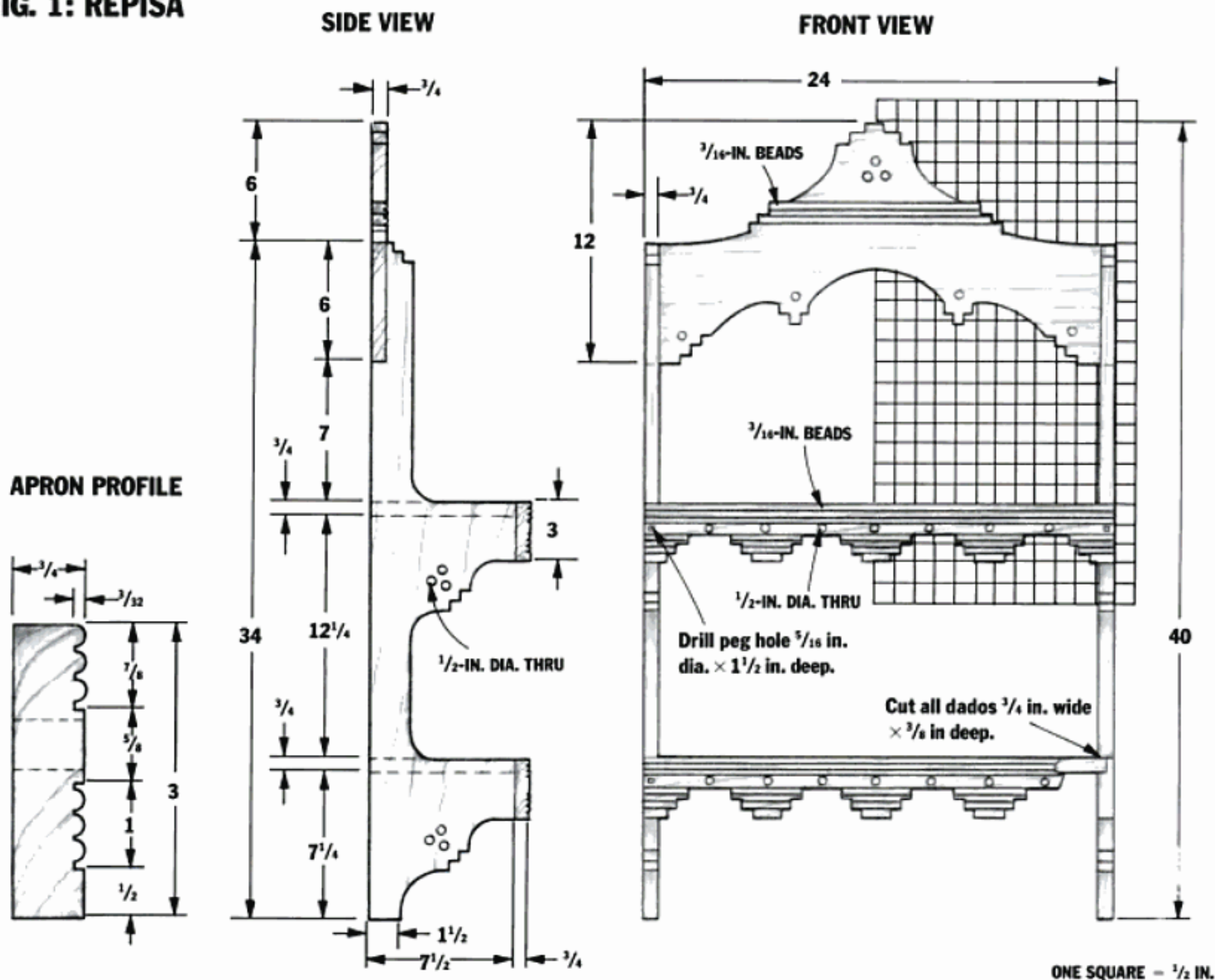
The *repisa* shown here is built in the traditional Southwest style, copied from historical *mestizo* (Hispanic/Indian) forms. The arched backboard shows Spanish influence, while the rectangular shapes are stylized Pueblo “cloud steps”—a common Southwest Indian motif. Like most folk furniture, the construction is simple. The shelves rest in dados in the up-

A Decorative Shelf in the Southwestern Tradition

This bright and playful wall shelf will serve as an attractive setting for your small treasures.

FIG. 1: REPISA

DRAWINGS BY MARY JANE FAVORITE

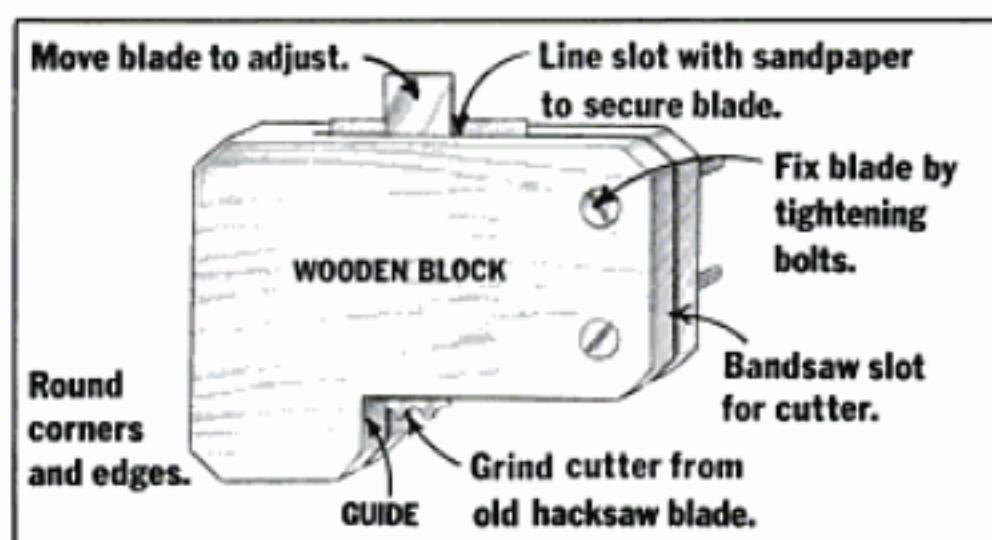


MAKING A SCRATCH STOCK

Before the advent of power routers and shapers, craftsmen devised simple hand tools like the scratch stock for forming decorative shapes. The scratch stock consisted of a scraper blade (ground to a desired profile) mounted vertically in a block of wood. By scratching this tool back and forth across a wooden surface, a decorative shape emerged.

A scratch stock remains useful today. In many cases, it will do a better job of cutting a small shape than a power tool does, particularly in hardwood. Because it scrapes rather than cuts, it doesn't lift the grain. Figured wood won't chip or splinter. And because it burnishes the surface as it scrapes, the completed shape requires little or no sanding.

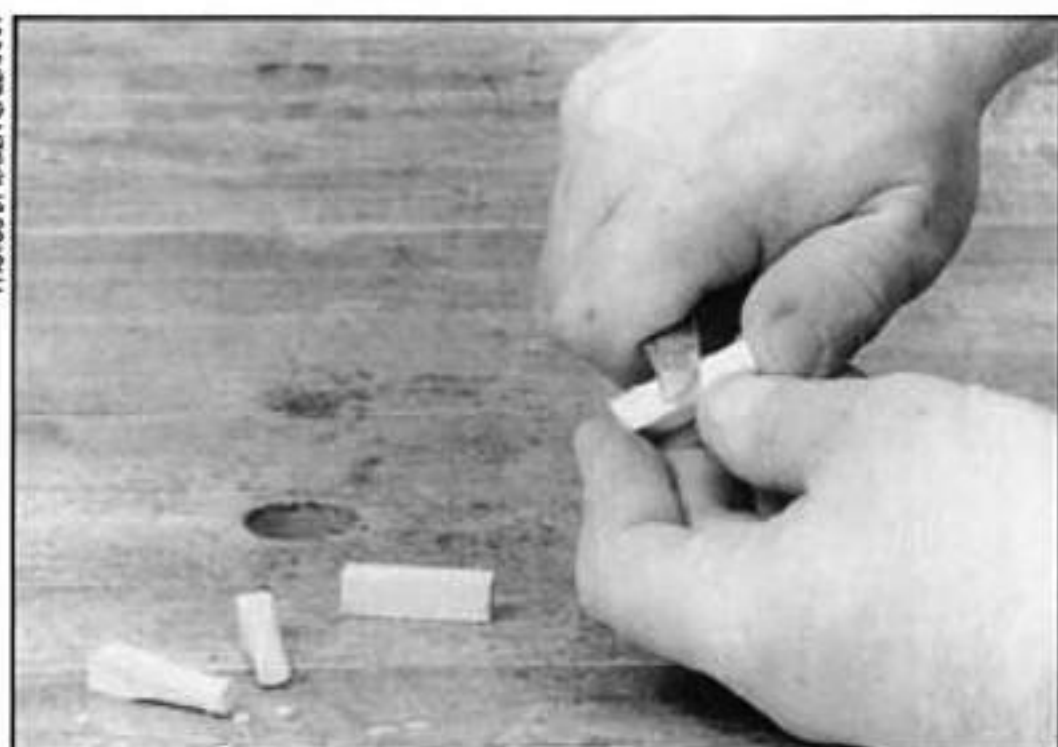
You can make your own scratch stock from a block of hardwood and an old hacksaw blade. The simple scratch stock you see here can be modified to suit different tasks. You could even add handles to increase the comfort during longer tasks. If you don't want to go to the trouble of making your own scratch stock, you can buy a metal one (under



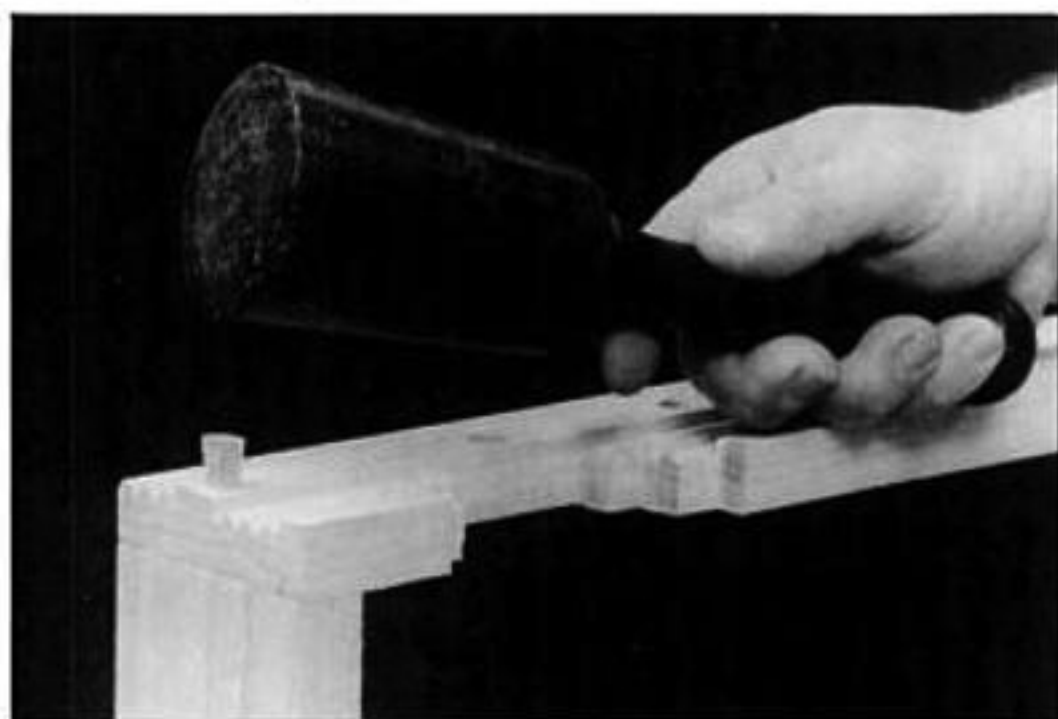
DRAWING BY SALLY ONOPKA

"beading tools," available from Garrett Wade, 161 Ave. of the Americas, New York, NY 10013 or Lie-Nielsen Toolworks, Rt. 1, Warren, ME 04864).

To use the scratch stock, draw it over the surface of the wood several dozen times, pressing down firmly. Lean the blade in the same direction that you draw the tool, like a cabinet scraper. With each pass, the scratch stock will scrape away a small amount of wood until the shape is complete. The lower edge of the scratch stock acts as a guide.



Old-time craftsmen often pegged their furniture together with square pegs driven into round holes. This arrangement prevented the pegs from working loose. Cut peg blanks from a very hard wood. Whittle the bottom ends of the pegs round.

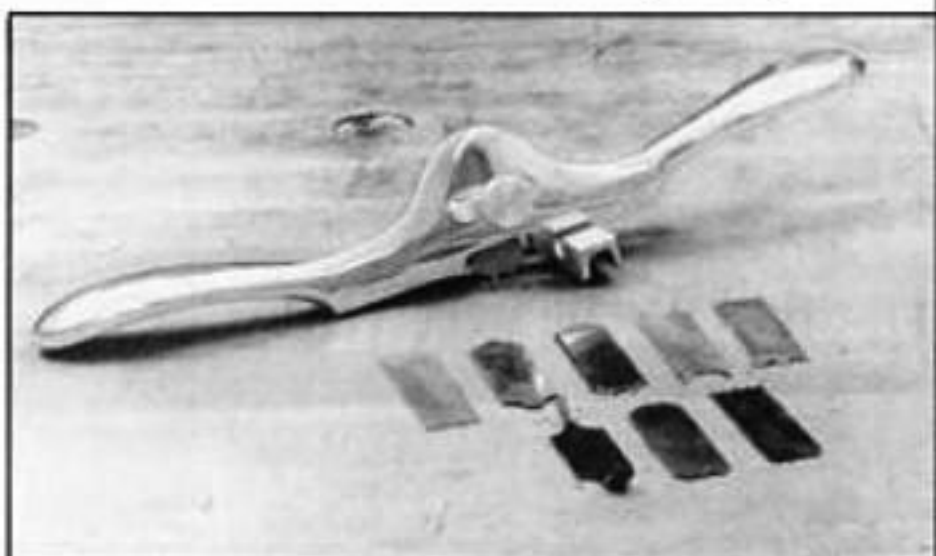


The front apron on this shelf is pegged to the uprights. To install the pegs, wipe a little glue on the peg, then drive it into the hole with a wooden mallet or rawhide hammer.



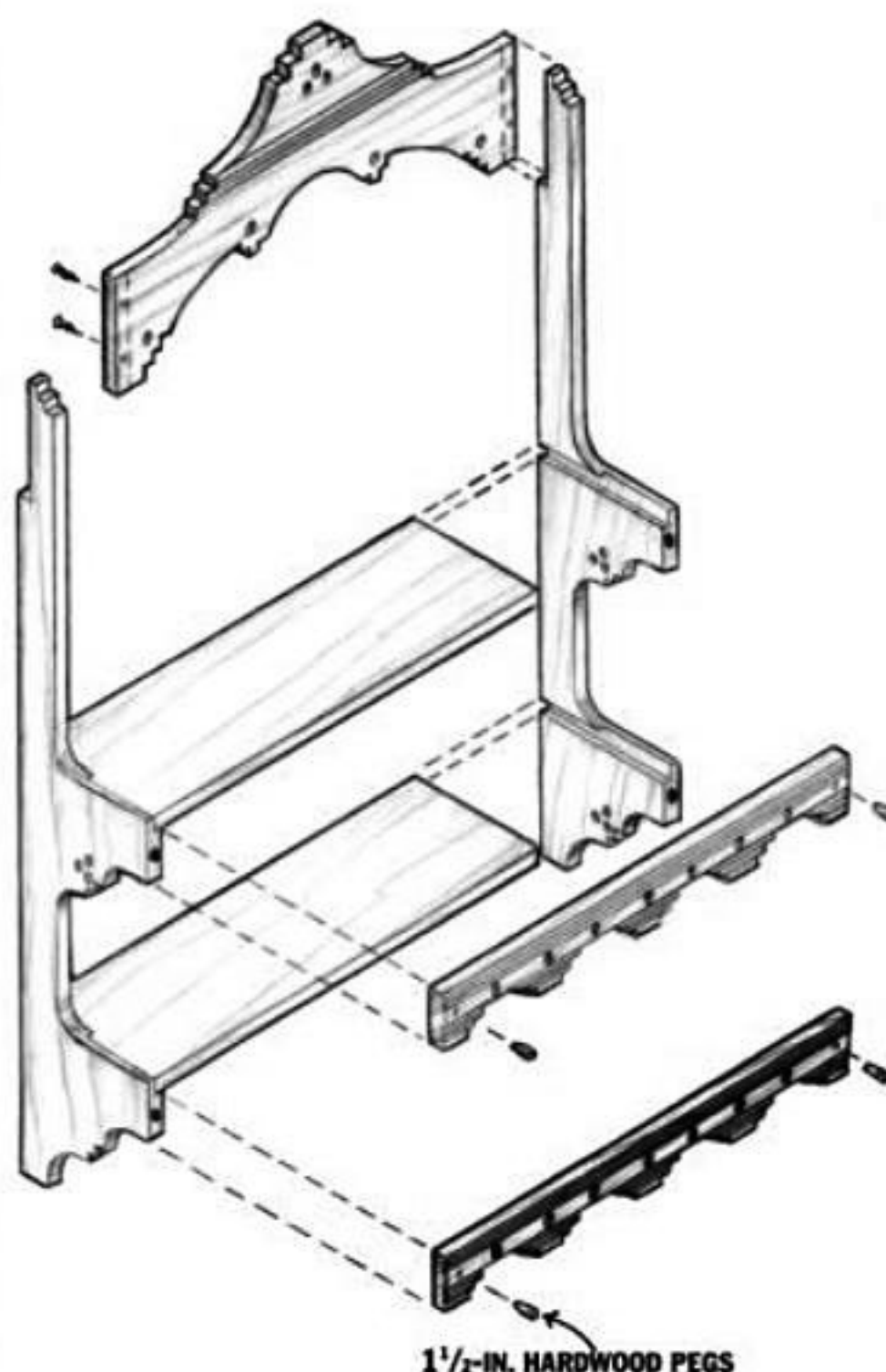
To use a scratch stock, draw it along the wood with the blade leaning in the same direction that the tool is moving. Make multiple passes until the shape is complete.

This store-bought scratch stock (see facing page for source) may look like a spokeshave but it works more like a cabinet scraper. It comes with a set of shaped scraping cutters.



BEADING TOOL COURTESY LIE-NELSEN TOOLS

FIG. 2: EXPLODED VIEW OF REPISA



rights, the backboard is screwed on, and the remaining parts are assembled with butt joints reinforced with square pegs. (See photo.)

Small bands of beading called "reeds" embellish the backboard and aprons. (See Fig. 1.) These reeds were another popular decorative motif in traditional Southwest furniture, possibly because they were so easy to make. Old-time craftsmen cut them with a "scratch stock"—a tool that scraped a shape in the wood. It's easy to make your own scratch stock. (See sidebar.) You could just as well cut the reeds with a molding plane, a shaper, or a tablesaw molding head with a set of three-bead knives.

We've painted this *repisa* with artist's acrylic paint in solid pastel colors. Many *repisas* were carved or painted with intricate designs. Feel free to experiment. ▲



Nick Engler is a contributing editor of AW. He's an author and a wood-working instructor at the University of Cincinnati.



This ancient tool caters to the modern craving to get things done quickly. The enxó is a convenient, one-handed tool used to rough stock down to size with speed and accuracy.

A Stone-Age
Survivor

ENXÓ

BY SIMON WATTS

The enxó (pronounced en-shaw) is a type of hand adze widely used in Portugal. Carpenters, boatbuilders, millwrights, anyone working with wood is sure to have one in his toolbox. No one knows how old the enxó is, but the hand adze in its general form dates back to the Stone Age—many have been found with flint cutting edges. In Portugal, miniature stone enxós occasionally show up with other grave goods in burial grounds.

Primarily used for roughing stock close to its finished size, an enxó can remove large quantities of wood quickly. In skilled hands, however, the enxó can produce shavings, and the work then requires only a few passes with a plane for a finished surface. An enxó can cut inside curves—a chair seat, for example—and it's especially useful for overhead work and getting into tight places.

The enxó is a simple tool that has changed little over the centuries. The three enxós shown in the photo span 100 years.

The one in back is a century-old enxó that came from Guimaraes in northern Portugal. The blade is quite flat, has a projecting tang attached to the wooden handle and a cast-iron strap. The blade is held in place by a wedge of hardwood.

The second enxó, shown on the left, is more recent. It has a curved blade, which, too, is attached to the

handle by a strap.

The third and most modern version has the blade attached with a pressed-steel bracket. However, the handle is still notched as if for the iron strap—a rare glimpse into the evolution of an ancient tool.

Old blades vary in size, but the newer ones I've come across are 4½ in. wide and about 5 in. long. The front of the blade is slightly curved and ground to a 25° bevel. The handles are made of eucalyptus, orange wood, or local oak, and there is a sideways extension under the right side of the grip to protect knuckles from splinters.

I've used an enxó in many aspects of rough carpentry for quite a few years. I have found it a handy, versatile tool much easier to learn to use than its two long-handled cousins, the lipped adze and the railroad adze. If you measure the radius of curvature on the enxó blade, you'll find it close to the length of your own arm from the hand to the elbow. This is why, after only a few hours of practice, you'll feel quite comfortable using it. Another advantage of the enxó is that it only requires one hand, leaving the other hand free to hold the work.

The enxó works best on softwoods and green or partially dry hardwoods. I use one frequently in Nova

ANGELO CAGLIANO

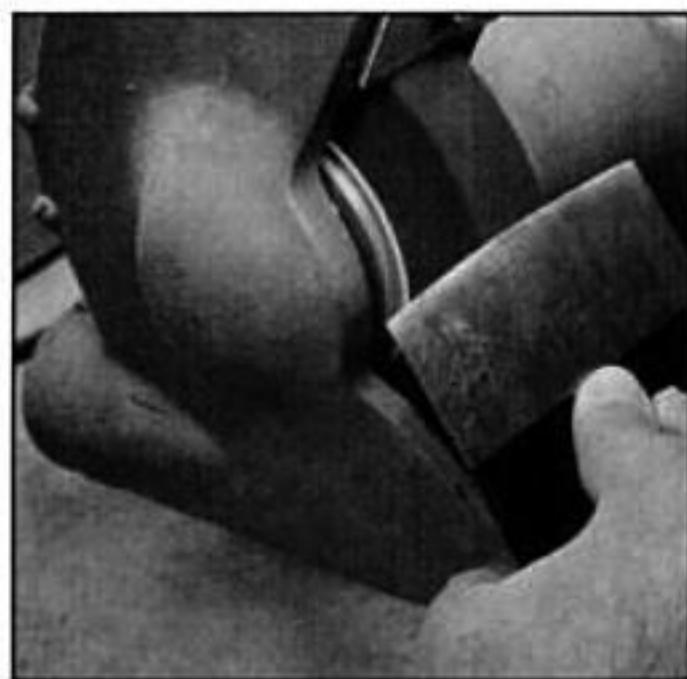


The three enxós shown here span a century—the oldest one in back to the newest one in front.

Scotia where I have a home with no electricity. I find it handy for building and repairing docks, making log cribs and all manner of rough carpentry including shingling. An enxó is also useful when it's not feasible to use a bandsaw either because the work is too heavy or because it is already built into a larger structure. Bevelling the frames of a boat is a good example. The men that repair and build boats in Portugal seldom have portable power equipment available. A tool that rapidly dimensions lumber on the job is especially useful.

Other uses are to strip bark off trees, shape masts and flag poles and put up temporary scaffolding and concrete formwork. I've even seen enxós put to use cleaning the cement off used formwork. As one Portuguese carpenter said of the enxó: "It's not a toy. It's for real business—you can even cut through nails with it."

In Portugal, choosing an enxó is easy. There is only one manufacturer, "Jaguar," a firm known for quality



The modern way to sharpen an enxó is with an electric grinding wheel.

Using a small sharpening stone, hone the bevel and the back side to eliminate the wire edge left by grinding.



tools. A Portuguese, when buying one, detaches the blade and "rings" it, choosing the one that "makes the best music." A dull chink might indicate a crack in the forging.

There is another version of the enxó made in Spain, the "Bellota," but nobody I'd met ever tried one. This may have been because Portuguese tend to take a dim view of things Spanish and are fond of quoting the proverb: "From Spain come only bad winds and bad marriages."

Sharpening the Enxó

With older enxós you can touch up the edge with a file. The steel in the new ones is so hard that it can barely be scratched, so you must use a grinder when sharpening. When sharpening a new blade, I first remove the enxó's handle and set the tool rest of a dry grinder to conform to the factory-ground angle—about 25°. Grind the bevel maintaining the same curve on the front edge.

After you feel a burr on the upper surface, use a small oilstone (a soft Arkansas works well), to gently hone both edges until the burr disappears as shown. As the edge dulls with use, hone it again with an oilstone. If you hit a nail or otherwise damage the edge, you'll have to go back to the grinder and repeat the process. When working with used lumber with the risk of hitting old nails, a secondary bevel of 5° would give a stronger edge.

In Portugal, workers mostly use a whetstone with water—the same kind farmers used for sharpening scythes and sickles. These carborundum stones are cheap and portable but leave a rough edge. As someone explained to me: "For delicate work an enxó must be sharp. For rough work it can be quite dull."

After sharpening the tool, make a blade guard of wood or leather before doing anything else. Your other tools can jostle the exotic newcomer and damage the edge—or vice-versa.

When learning to use an enxó, practice first on the edge of a piece of 1-in. stock. Draw a line, and try hewing as close to it as you can get. Be alert about the grain slope, and if the wood seems to be tearing up, reverse the direction of cut. Next, try drawing a line with a gentle concavity and hewing to that. Pivot the tool from the wrist as you would swing a short-handled hammer.

When you've mastered edge trimming, take a more solid chunk of wood such as a log, and try flattening one side. You'll find it often works best to cut in a herringbone pattern so you are slicing through the grain fibers obliquely.

Once you get started, I know you'll enjoy this ancient tool and appreciate its versatility. The enxó is not sold in this country nor in Canada, so I've arranged to import a limited quantity for those who want to try one. The cost, including air freight is \$50.00. Allow six weeks for delivery. Write to: Simon Watts, 720 Bay Street, San Francisco, CA 94109. ▲



Simon Watts is a journalist and teaches wooden boatbuilding in California and around the country.

DECO DESK CLOCK

*A '30s-Style
Timepiece
for Turners*

BY FIONA WILSON



MITCHMANDEL

I have this thing about clocks—I don't like them. No matter what time I think it is, the clock always mocks me with a later hour. Clocks love to have the last laugh. Like stealing the hours of my life is some kind of joke! Well, I don't see the humor. So I've designed a clock that will give me a big head start—about 60 years. This clock—inspired by the 1930's Art Deco tradition—is a friendly, future-meets-past type of timepiece. A cross-breed between Buck Rogers and the front grill of a 1953 buick. Best of all, it's a humble clock—to read it you have to look *down* on it. I have no doubt my clock will know from its very first tick just who's boss. Then it's sure to keep the correct time ... my time.

This is a stone-simple project. It starts as a turning. After you turn a laminated blank to the profile shown

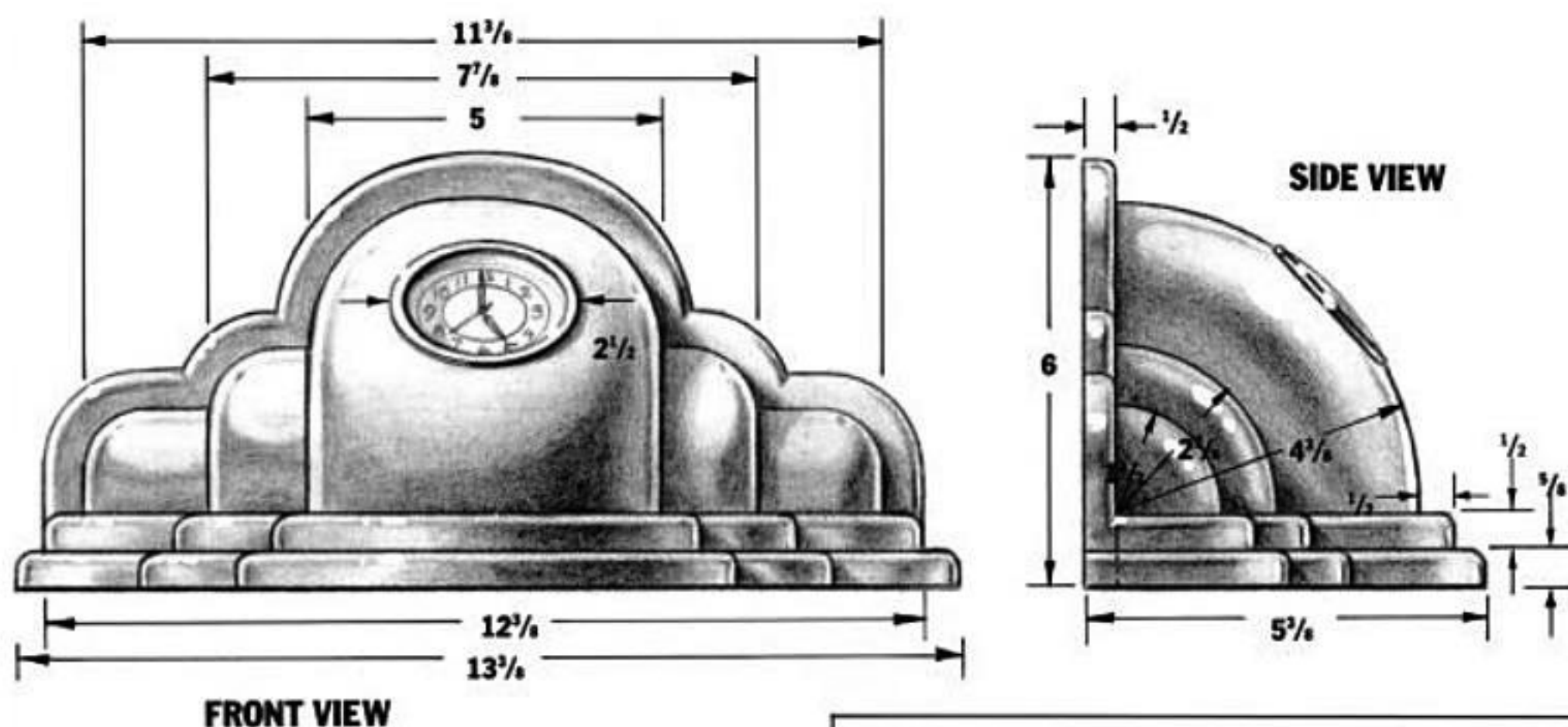
in Fig. 1, you'll saw it in half, then in quarters. By doing this, you'll end up with four clock bodies. This makes it an ideal project for a small production run. So you can either make four clocks, or use three as trial runs to get a fourth that actually works, as I did (but then, you won't need to do this, since I've worked out the bugs for you).

In Fig. 2 you'll find plans for a V-jig that will make this project a smooth operation. This jig will hold the odd-shaped clock body secure while you perform all the necessary woodworking magic. You'll use this jig several times during the course of the project.

Turning the Clock Body

Start by gluing up a block 9 in. square by 12 $\frac{1}{4}$ in. long. Cut the corners off on a bandsaw so you have something that approximates a cylinder. Mount this on your lathe between centers. It's a hefty piece, so be

FIG. 1: ART DECO CLOCK



DRAWINGS BY SALLY ONORA

PHOTOS BY GLENN HUGHES

Turn the clock body from a 9-in. sq. x 12 1/4-in. long block. Shape the block with a gouge or skew to the profile shown in Fig. 1.



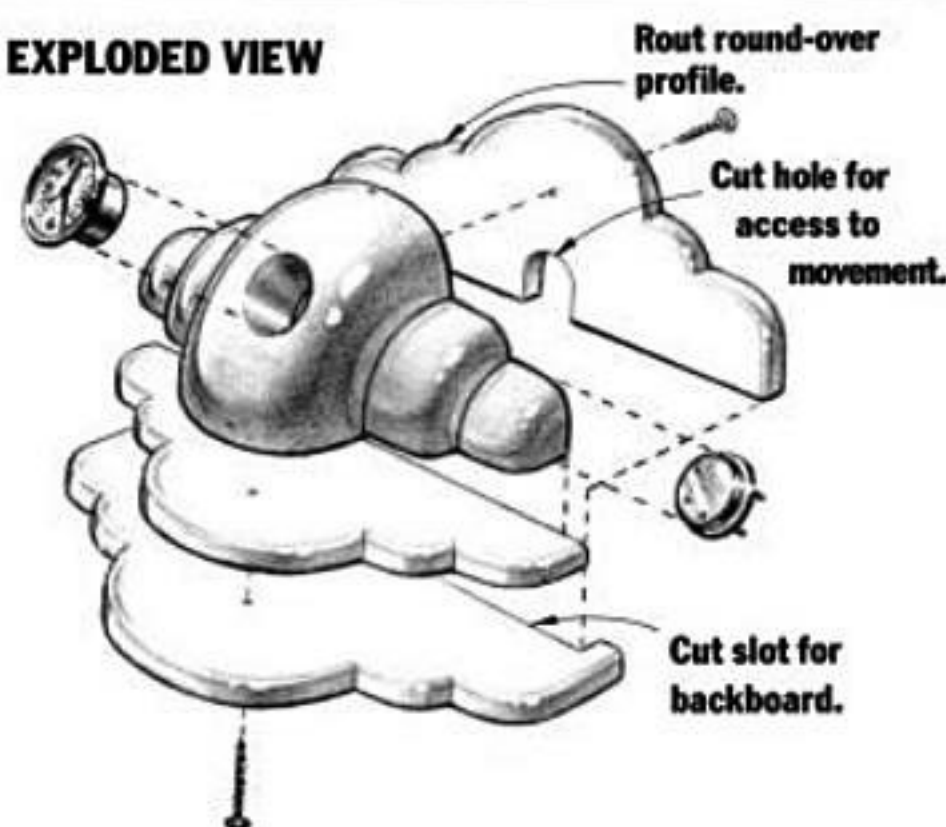
Rip the turned form in half on the bandsaw by supporting the form in a V-jig. Pass the form through the blade slowly to keep the cut straight.



sure the spur center is *securely embedded*, then fasten the tail stock tight.

Set the lathe for the slowest speed, and with a gouge, rough the block into a cylinder. Then, turn the form to the general shape shown in the front and side view in Fig. 1. Feel free to vary the shape according to what you like, but bear in mind that if you make the central portion a tighter arc than shown, you'll have extra work later to fit the clock bezel flush. Finish the surface up with a skew or gouge and sandpaper. (See photo.) When you're done with the turning, you may want to apply a finish to the form while it's still on the

EXPLODED VIEW



lathe. Since I intended to paint the clock afterward, I simply sprayed on a sealer coat of Deft Clear Wood Finish (available from Constantine's, 2050 Eastchester Rd., Bronx, NY 10461).

Cutting the Turned Form into Quarters

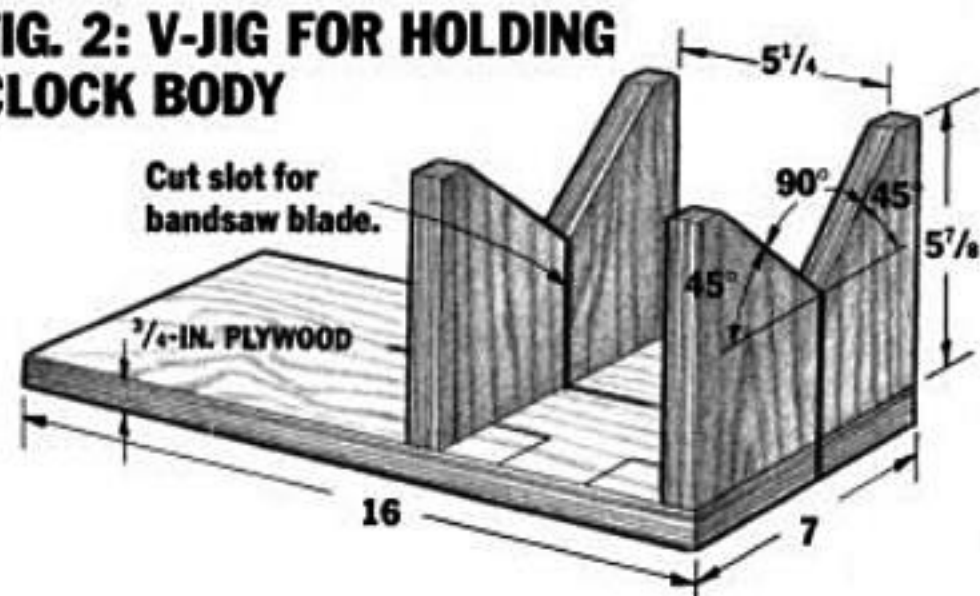
While the finish is drying, make a jig like the one you see in Fig. 2. This V-jig will hold the turned form steady while you cut it in half. I did it on a bandsaw. To do this you'll need a bandsaw with a 12-in. depth-of-cut (on Delta bandsaws you can extend the depth-of-cut from 6 1/4 in. to 12 1/2 in. with a height extension (available as "Riser Block Set" from Trend-lines, 375 Beacham St., Chelsea, MA 02150). You could also saw the form in half with a hand saw.

To saw the form on a bandsaw, simply lay the form in the jig, securing it to the jig with a strip of duct tape on the end closest to you. Set up a fence to guide the jig, and saw the turning in two. (See photo.) Even with a well-tuned bandsaw and the V-jig running against a fence, the blade may wander off center. A slightly off-center cut is okay—you'll true the quarters up on the jointer, anyway. The main idea is to cut slowly. I used a 1/4-in. wide blade, but I recommend you use a 1/2-in. wide blade and put a little extra tension on it. (See Re-

To drill the hole for the clock movement, mount the clock body in the V-jig face up, and begin by drilling a pilot hole all the way through.



FIG. 2: V-JIG FOR HOLDING CLOCK BODY



sawing on the Bandsaw, September/October, 1988 AW.) Once you've cut the block in half, secure each half (one at a time) in the V-jig and cut each of these in half. You'll end up with four quarters. True up the bottoms and backs of each quarter on the jointer.

Drilling for the Movement

Next step is drilling a hole through the clock body for the movement. I recommend you use the same battery-operated quartz movement that I did. (Quartz Insert Movement with Arabic Numerals, \$16.50, #P-812 available from Merritt's Antiques, Inc., R.D. #2, Douglassville, PA 19518, 1-800-345-4101.) This mechanism comes as a complete package—movement, hands, bezel and all (except the size N battery, available at your local market). This movement matches the clock style nicely.

To drill for this movement, you'll need to use two different-diameter Milwaukee-brand hole saws. The front portion of the hole needs to be 2 1/4 in. in diameter to fit the body of the clock movement. The back portion of the hole needs to be 2 3/4 in. in diameter to accommodate the back mounting plate of the mechanism. Start by marking the center point of your clock body on the face. With the clock body securely supported face up in the cradle of the V-jig, drill a pilot hole all the way through the clock body. (See photo.) To do this, you'll need a long bit that's the same diameter as the pilot drills in the arbors of your hole saws. (I used a 5-in. long, 1/4-in. dia. spade bit.) The bit should exit the clock body at the back bottom corner.

Next, replace the pilot drills in your hole saws with metal bar stock of the same diameter as the drills (also the same diameter as the pilot hole). This will prevent the hole saws from drilling off center of the original pilot hole. Chuck the 2 1/4-in. dia. hole saw in your drill press, and centering the bar stock in the pilot hole on



Next, drill down through the face of the clock with a 2 1/4-in. hole saw (top). Drill as far as the hole saw will allow. Finish up the hole from the back side. First, drill as far as you can with a 2 3/4-in. dia. hole saw. On a bandsaw, cut away the waste in back so you can drill deeper with the 2 3/4-in. dia. saw. Make the final cut with a 2 1/4-in. hole saw, and drill in as far as possible (bottom). Knock the waste away with a hammer.



the front side of the clock body, drill down as far as the hole saw allows. (See photo.) Turn the clock body over in the jig, and with the 2 3/4-in. dia. hole saw, drill in from the back side as far as the hole saw allows. Then, so that you can drill a bit deeper, knock out some of the back waste on the bandsaw or with a chisel. Finally, finish up the hole with the 2 1/4-in. dia. hole saw on the back side. (See photo.) The cylinder you've drilled likely won't come right out, but a few good wacks on the front side of the waste should be enough coaxing. If you've done everything according to plan, the movement should fit in the hole, and the bezel will sit flush against the front face of the clock body.

Making the Back and Bottom Assembly

Cut out the back and bottom boards on the bandsaw. It's easy to get a uniform profile by riding a compass, open approximately 1/2 in., along the top and bottom profile of the clock body. For the lower of the two baseboards, cut the profile on the upper base board first, then use it as a template for your compass while you draw the shape of the lower baseboard. Note that the backboard fits within a notch in the lower base board, and be sure to cut a mousehole-shaped door in the backboard for access to the movement's time-adjustment knob. (See Fig. 1.) Smooth the boards up with a sander or file, and rout a round-over profile on the inner front/top edges of each board. Glue the base together, then screw the clock body down, and screw the back onto the clock body and base. (This allows access to the mechanism for battery changes or removal.) Protect the clock with a clear finish, or a coat of paint. As you might have guessed, mine is painted racer red. ▲

Fiona Wilson is associate editor of AMERICAN WOODWORKER.



American Country Furniture: Projects from the Workshop of David T. Smith

by Nick Engler and Mary Jane Favorite
(1990, Rodale Press, Emmaus, PA)

..... 1,900 projects featured is accompanied by a photograph, standard, an exploded view and plenty of details. I appreciate the fact that it does not specifically prescribe

AMERICAN WOODWORKER

what tools to use for construction. This forces cabinetmakers to think out the job and select tools they have on hand. When an unusual technique is required, a special "know-how" section supplements the project, providing information that would otherwise have to be looked up elsewhere.

The final chapter is on finishing and is very informative, providing tips on replicating old finishes, particularly painted finishes.

A terrific color-photo section ties everything together and brings the talents and craftsmanship of David T. Smith to life.

If you appreciate a book that not

through the construction process. Rather than whizz past every detail, it focuses on how a project flows through an efficient one-man shop, as an idea becomes a design and a design becomes reality.

It begins in Mehler's studio where he explains how he develops a design and adapts it to various tables. Then it moves to his wood storage area where he shows how stacking wood in the order it was sliced from the log is an important first step in creating a harmonious piece. He illustrates his thinking as he marks up the boards for rough cuts that will maximize each board's potential. This is a theme that remains strong throughout the video; each step of the way, Mehler points out how he is cutting and orienting stock to achieve the best final result. This is exactly the kind of information best conveyed in moving pictures.

Shaker Table. It's much more valuable for the logic and techniques that go into a woodworking project. This glimpse at how a pro does it is well worth the price.

DAVID SCHIFF

..... the panoramic view of the he d

70

Joining a woodworking guild can take the loneliness out of an otherwise solitary craft. The work you see here is a collection of pieces from three Texas guilds: the Central Texas Woodturners Association, the Central Texas Woodcarvers, and the Central Texas Woodworkers. If you've been yearning for company, check out your local woodworking guilds. If you're already part of a guild, send us photos of guild members' work. We'd like to see what you're up to.

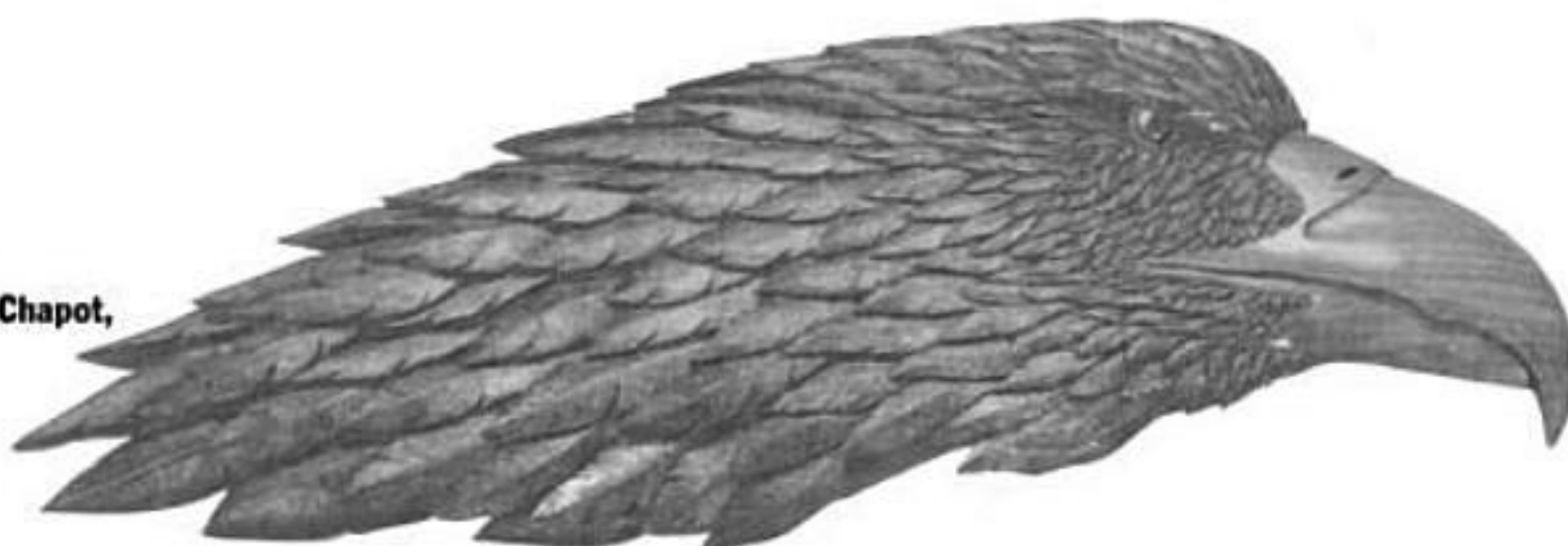


Moose, by Cruz Rendon, Austin, Texas.
Basswood. Dimensions: H: 8 in., L: 13½ in.



Lidded Box, by S. Gary Roberts, Austin, Texas. Mesquite. Dimensions: H: 4 in., D: 5 in.

Eagle Head, by Charles Chapot, Austin, Texas. Walnut. Dimensions: H: 10 in., L: 24 in.



Chip-Carved Plate, by John Duffy, Austin, Texas. Basswood. Dimensions: W: ¾ in., Dia: 9½ in.



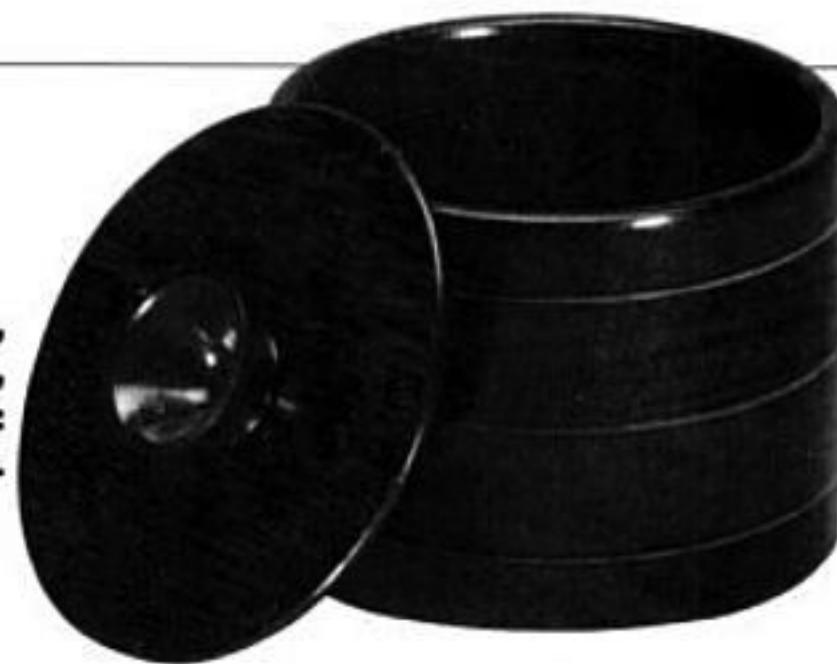
Bowl, by James Poppell, Belton, Texas. Walnut. Dimensions: H: 8 in., Dia: 11½ in.

GALLERY



Armadillo,
by Donny Griffith,
Austin, Texas. Basswood.
Dimensions: H: 9 in., W: 4 in.

Lidded Box, by Jim Berry,
Austin, Texas. Rosewood,
pecan. Dimensions:
H: 3½ in., D: 3 in.



Cowboy Hat, by Rod Johnson,
Austin Texas.
Basswood.
Dimensions:
Full Size.



Want to see your work in Gallery? Send photographs and a description of the piece to: AMERICAN WOODWORKER, 33 E. Minor St., Emmaus, PA 18098. Only black-and-white prints (4 in. x 5 in. or larger) or color slides will be accepted. Please do not send color prints or snapshots. Enclose a self-addressed envelope for return of photos.



Carved Table, by Tem SayThongKham, Pflugerville,
Texas. Mahogany. Dimensions: H: 18 in., W: 21 in., L: 48 in.



Carved Table (close-up)

PHOTOS BY JAMES POPPEL



New Frontiers in Bed Design

April 1 1991
Special to *Slumber News Digest*
By H.V. Schlapen

Here's good news for the more than two million Americans identified in a recent survey by S.N.D. as "heavy sleepers." It has long been recognized by sleep therapists that heavy sleepers need heavy beds.

The new Workman bed was designed by the late Dr. Ty Moroni—himself a "heavy sleeper." In fact, it was during the assembly and testing of the first Workman prototype bed that Dr. Moroni suffered the unfor-

tunate accident that eventually claimed his life. (See "Martyred Sleep Professor Gave Life for Research" in last month's *Slumber News Digest*.)

Today's heavy sleepers can rest assured that the new Workman bed not only looks heavy but *is* heavy—about 3½ tons. Each bed is carved out of a solid cube of laminated red oak by automated, computer-controlled laser routers. Fastenings are high-tensile, heat-treated moly-codded steel, Coast Guard approved, ground to zero tolerance and capable of resisting full torque at maxi-

mum elevation.

Each bed is given a 48-hour "torture test" by a specially trained team of heavy sleepers. Rated 4-ZZZZ by the American Sleep Institute, all Workman beds are guaranteed for the life of the original purchaser.

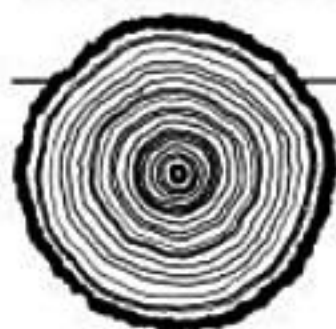
The public response has been most gratifying, says Mr. Caballo de Noche, vice president of marketing. He reports that one young newlywed wrote: "My mother-in-law went to sleep on a Workman bed and slept so well she never woke up."

A retired taxidermist writes from Duluth, "Our pet cow likes to climb on beds and broke several of them. We finally got her a Workman Vaca-Bed, and she just loves it. In fact, we now have quite a time getting her out of bed for morning milking."

Hotels are finding they can charge extra after installing Workman beds. One downtown Cincinnati hotel suffered a partial collapse with the extra weight, and a motel owner in Amarillo Texas writes, "A family of seven came for the night and slept so well they stayed for their entire two-week vacation—thanks to our new Workman beds." Another in Schmucksville, Illinois, had to take down its sign because it was always full—nobody would leave.

On the drawing board is the new Mega-Bed—it sleeps millions. Also Pet-A-Beds for your furry, feathered or scaly friends. Address all inquiries to *Slumber News Digest*, Buena Suena Boulevard, Dozeman, Montana.

SIMON WATTS



SMART WOOD™
A PROGRAM OF THE
RAINFOREST ALLIANCE

Smart Wood

Exotic woods have gotten a good deal of press lately. "To buy or to boycott?" has been the common question. Some people insist on a boycott of all exotics. Others argue that a boycott undervalues exotic wood and ultimately promotes deforestation—that it's better to buy exotics, but to buy them selectively. That's where Smart Wood comes in.

To aid the woodworker in buying lumber from better sources, the Rainforest Alliance—an environmental organization—has created the Smart Wood certification program. This program aims at identifying and promoting the use of tropical timbers from carefully harvested sources.

The Rainforest Alliance has chosen the following criteria for evaluating tropical timber sources:

- 1) Maintenance of environmental functions, including watershed stability and erosion control
- 2) Sustained-yield production
- 3) Positive impact on local communities

Any source that meets these criteria will be classified as a "sustainable source" if it is in strict adherence to the above criteria. Sources that show at least a strong operational commitment to these criteria will be classified as "well-managed."

Companies that then verify that they are selling this approved lumber will be granted the right to use the Smart Wood name and logo for marketing purposes, and will be included in the Rainforest Alliance's Smart Wood list.

For more information write: The Rainforest Alliance, 270 Lafayette Street, Suite 512, New York, NY 10012, or call (212) 941-1900.