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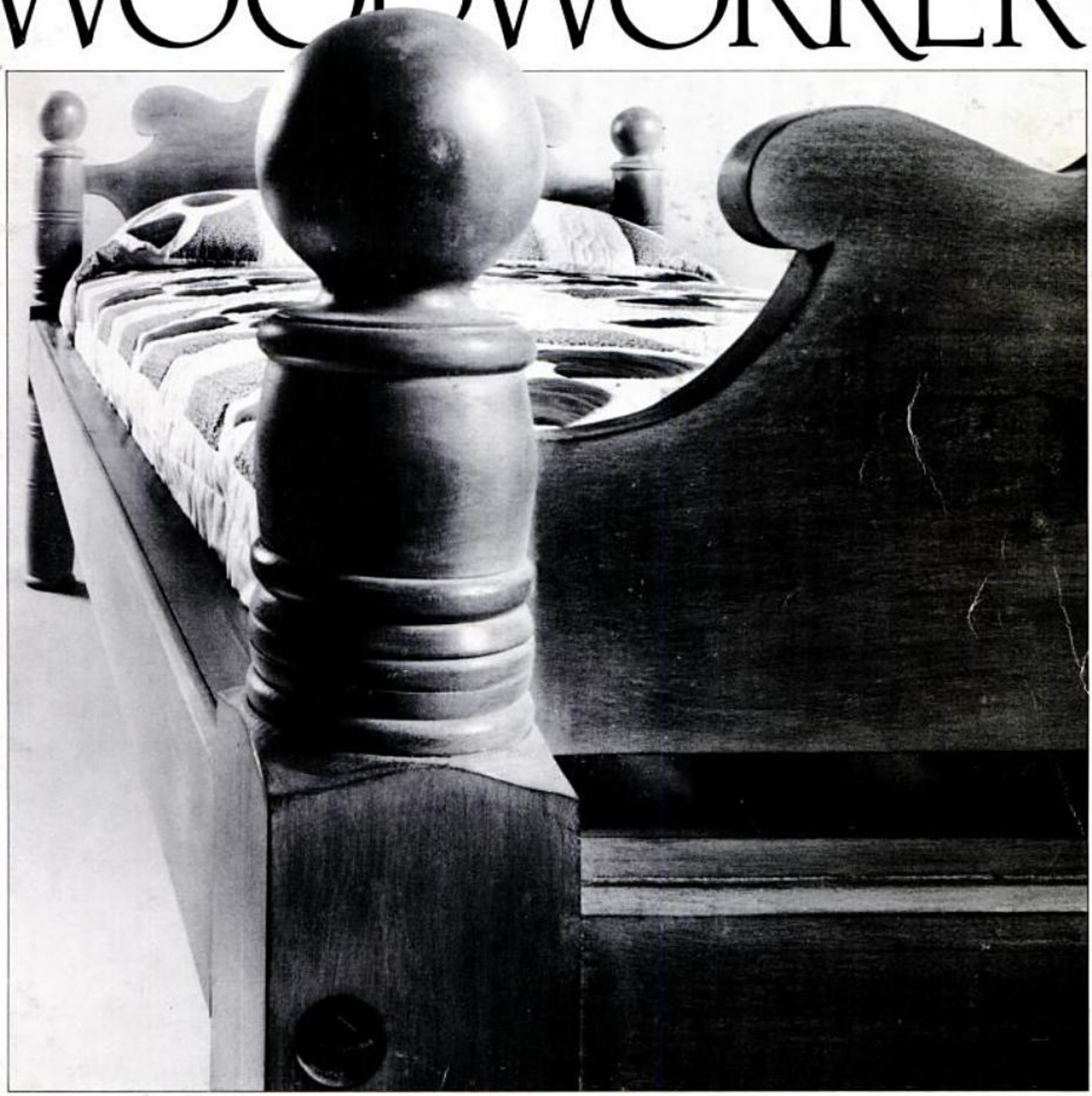
AMERICAN WOODWORKER



Build a Pennsylvania Country Bed
Cutting Tapers on the Jointer
Make a Wooden Plane
Curved-top Wall Mirror

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CONTENTS

Volume V, No. 1
January/February 1989
COVER PHOTO: Carl Doney
BED by Jeff Day
QUILT by Maggie Rice

PROJECTS AND FEATURES

16 PENNSYLVANIA LOW-POST BED
A Reproduction Built to Last a Lifetime or Longer
by Jeff Day

23 WOODEN SMOOTHING PLANE
Make a Plane That Sings in Your Hands
by Fiona Armas Wilson

30 CURVED-TOP WALL MIRROR
Splined Miters Add Strength and Beauty
by Dennis Watson

34 THE SPINDLE GOUGE
The Tool of Choice for Turning Beads and Coves on the Lathe
by Ron Roszkiewicz & Phyllis Straw

41 TABLE-TOP SKITTLES
Spin the Top to Send Pins Flying
by John A. Nelson

44 DRESSING UP THE BASIC BOX
Add Doors, Drawers or Shelves to Make Several Different Designs
by Walter J. Morrison

48 CUTTING TAPERS ON THE JOINTER
Simple Setups for Perfect Tapers
by Fred Matlack

52 DRAFTING FOR WOODWORKERS
It Pays to Know the Basics
by John A. Nelson


MITCH MANDEL

SPINDLE-GOUGE BASICS 34

DEPARTMENTS

4 LETTERS

6 Q&A

10 TECH TIPS

12 TOOLBOX

58 BOOKS AND VIDEOS

60 WOODWORKER'S CALENDAR

70 GALLERY

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A WORD FROM THE EDITOR

It's hard to believe, but the calendar says it's true. It's been a whole year since Founding Editor Jim Jennings handed over the reins of AMERICAN WOODWORKER and said, "Here, kid. It's your turn to drive." We've put together a winning team in the last twelve months—new editors, art directors, ad sales and circulation staff—the best folks we could find.

But players change on even the best of teams and there was one change this past year that saddened us all. Dennis Watson, our Contributing Editor, died last October after a long illness. Dennis joined the AMERICAN WOODWORKER staff as a Contributing Editor in September 1985. In the 9-to-5 world, Dennis made a living as an aerospace engineer designing fighter planes. His excellent articles, photos and well-designed projects have always been very popular with our readers. We will miss him.

On a happier note, Fiona Wilson began work as Assistant Editor in November and this is her very first issue. Fiona attended school in Mendocino, California, where she studied woodworking with James Krenov at The College of the Redwoods in Fort Bragg. Fiona came to woodworking by way of an interest in architecture. She designed and built some furniture while apprenticed to architect Christopher Alexander (co-author of the inspiring book, *A Pattern Language*). She's been making furniture ever since.

Jeff Day, our Senior Editor joined the AMERICAN WOODWORKER staff last March. Jeff learned the woodworking ropes at Bucks County Community College in Newtown, Pennsylvania, and paid his dues working in several production shops in the Philadelphia area including the shops of well-known woodworkers Bob Ingram and Jack Larimore.

Additions to our staff of Contributing Editors this year include Nick Engler, a woodworker and writer in West Milton, Ohio. Nick's written woodworking books for Rodale Press and Popular Science and is an old hand around the shop.

I'm very pleased to welcome noted author and craftsman Michael Dunbar as our newest Contributing Editor. Michael is known as *the* authority on American Windsor chairs. He's a master chairmaker and demonstrator as you'll discover if you find room in one of the workshops Michael gives around the country. Michael's books include two on making Windsor chairs, one on building Federal furniture, and one on buying and using old woodworking tools. He's currently wrapping up two books to be published soon by Sterling Publishing Co.

All of us here who work on AMERICAN WOODWORKER are proud of the magazine we put together and I guess it shows. In one short year we've watched our readership grow from 18,000 to well over 100,000 today. Thanks to you all—readers and staff—for making us a success.

DAVID SLOAN
Executive Editor

LETTERS

Sir:

In Tech Tips (November/December 1988 AW), you show a tip on lubricating wood screws with soap. I feel you may get a bit of mail on this as it is not a good idea. There is water in soap that will rust the screw. A better and sure-fire way is to use an old-fashioned tallow candle which is a part of many carpenters' tool boxes and the only way to go.

CHARLES H. BAUER, JR.
Philadelphia, PA

Sir:

Let me congratulate you on the format and content of AMERICAN WOODWORKER. After buying several issues on the newstand I decided it was time to take the plunge and subscribe.

ANDREW MEYERS
New York, NY

Sir:

There's one detail I'd like to add to Ernie Conover's excellent article on marking gauges (November/December 1988 AW). Sometimes you don't want to incise a gauge line on a wood surface—or possibly the wood is green and the line won't show clearly. In those cases, I find it useful to have a slotted hole for a pencil.

If you turn to page 44 of that issue you'll see that the middle marking gauge does have provision for a pencil at the left end of the beam. Using a fairly hard pencil with a chisel point leaves a clean, distinct line.

SIMON WATTS
San Francisco, CA

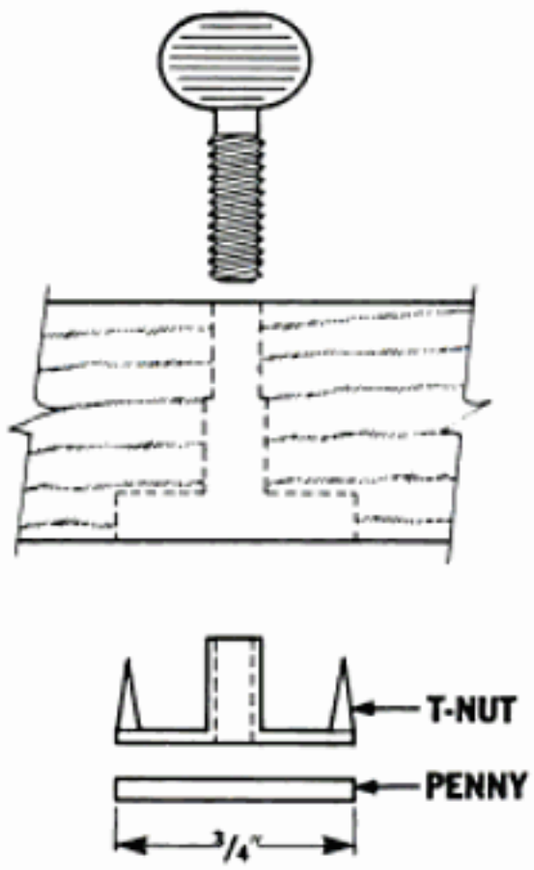
Sir:

Ernie Conover's article on marking gauges (November/December 1988 AW) was interesting for a person like myself who enjoys making his own tools. However, being less accurate than desired with a chisel, I had problems with his construction methods. I think your readers may find my suggestions a little easier.

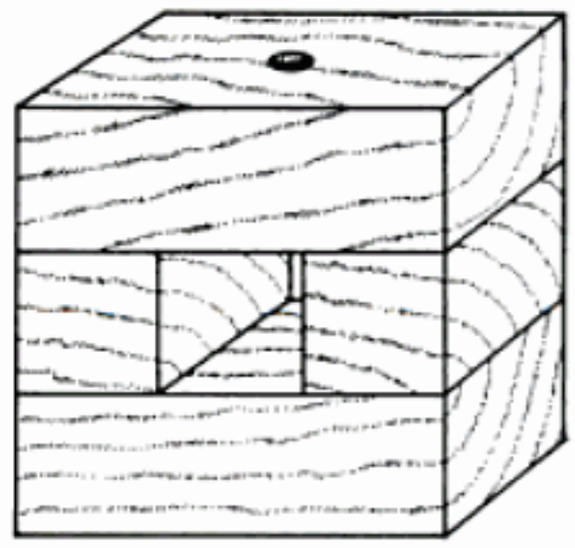
Instead of trying to chisel out the mortise in the fence for the marking gauge's beam, I form the mortise by gluing up the fence from four pieces of wood as shown in the drawing.

Lacking a thread box and wood tap, I looked for an inexpensive alternative. My solution consisted of a 1-in. long, 1/4-20 thumbscrew, a 1/4-20 T-nut and a penny (yes, as in 1/100 of a dollar). The drawing shows how it goes together. Drill the holes before gluing up the fence parts. This locking assembly does not damage the

LOCKING ASSEMBLY



MARKING GAUGE FENCE



DRAWING BY FRANK ROHRBACH

wooden beam and holds with only a gentle turn of the thumbscrew.

Besides marking gauges, this assembly can be used in other applications such as your workshop jigs.

CPT. JOSEPH V. TOMKIEL
Fort Sill, OK

Sir:

Re: Cutting Plastic Laminate (Tech Tips, September/October 1988 AW). Your idea is good, but I prefer using a piece of sheet metal bent to fit my fence. After bending the metal, I drilled holes in the top so that it fit around the adjustment bolts in the top of the fence. These holes keep the sheet metal from moving. This pre-

LETTERS

formed fence is safe, light and fast to attach to the rip fence and is foolproof.

ROGER P. ROY
Lewiston, ME

Sir:

Re: Cutting Plastic Laminate (Tech Tips, September/October 1988 AW). For years I've been using a hardwood strip, cut to match the height and length of my tablesaw's metal rip fence. To the bottom edge of this strip, at right angles to it, I glued a piece of Formica as long as the wood and about 4 in. wide. Any size laminate strips can be cut using this setup. Also, this enables me to lower the blade and raise it up through the Formica strip, cutting a minimal slot and therefore reducing the chipping of the bottom side of the laminate.

HENRY H. WEISNER
New York, NY

Sir:

AMERICAN WOODWORKER is one of a kind. I've read Nick Engler's article, "Resawing on the Bandsaw" (September/October 1988 AW) over and over.

ROBERT DADEY
Lake Mary, FL

Sir:

The November/December 1988 Tech Tips column had a tip on sanding wooden toy wheels using a file chucked in a drill press.

I, too, make wooden wheels for my toys and I've found a simple way to smooth the flange left by the circle cutter. I drive a 1/4- × 2-in. carriage bolt into the hole and chuck the threaded end into the drill press. The square part of the shank holds the wheel square and securely. After the wheel is sanded smooth I enlarge the hole with an "F" or "G" letter-size drill bit for a 1/4- in. dowel [axle]. This makes just the right fit for glueing in the axle.

ARTHUR R. NICHOLS
Woodbury, CT

Send your comments, compliments, complaints and corrections to: Editor, AMERICAN WOODWORKER, *33 E. Minor St., Emmaus, PA 18098.*

Q&A

Cleaning Paint Brushes

Q. *I stenciled some furniture with an oil-base paint recently. When I cleaned the brush in turpentine, the turps removed the paint but left the bristles sticky and gummy. What went wrong? If you can't clean your brushes in turpentine, what can you do with them? Should I have cleaned it with paint thinner instead? Have I ruined another new brush?*

GENE ZUG
Honeybrook, PA

A. While turpentine is excellent for *thinning* oil-base paints, it isn't the best thing for *removing* paint from brushes. It isn't a very strong solvent and, when it evaporates, it leaves behind the sticky residue you noticed on your brush. Although many people have success cleaning brushes with paint thinner (mineral spirits), it really only thins the paint left in the brush.

I recommend cleaning your brushes with a commercially made liquid brush cleaner instead of paint thinner or turpentine. Brush cleaners are designed to actually dissolve the remaining paint—wet or dry. A brush cleaner should work well on the brush in question.

Whether you clean a brush with mineral spirits, turpentine or brush cleaner, always wash it in mild soap and water afterward to remove any residue. To keep the bristles from curling, hang the brush out to dry.

DALE MUSSER
Chemical Coating Sales Manager
Sherwin-Williams Co.
Malvern, PA

Rattan and Tarzan

Q. *What's the difference between rattan and wicker furniture?*

DAVID RUHL
Monterey, CA

A. The truth is that rattan and wicker are actually the same thing and come from a vine called rattan. Wicker is merely processed rattan.

Rattan grows in the jungles of Asia, Southeast Asia, and Africa. Growing from the ground up to the top of the tree, it then hangs from the branches and grows back down. Tarzan knew all about rattan—it's the vine he used to swing from tree to tree.

To make rattan into furniture, the entire vine is steamed, and in some cases heated with a torch, bent over a form and allowed to cure in the desired shape like bentwood furniture.

Sometimes the husk is peeled off so that the vine can be stained. The husk itself is made into a binding that is wrapped around the joints. It also is woven into small strips to form the seats you often see on rattan and wicker furniture. In fact, Pacific Islanders often weave this type of caning around a hardwood frame to make a cot-like structure to sleep on.

Wicker, on the other hand, is made from rattan by processing the vine through a machine. It emerges as many spaghetti-like strips, which are then woven around a rattan frame to produce furniture.

Despite popular opinion, neither rattan nor wicker has anything to do with bamboo, which is hollow. Rattan *is* very porous lengthwise but that doesn't affect the strength. It certainly didn't cause Tarzan any problems.

DANIEL S. WARD
President, Oriental Imports
Daphne, AL

Oscillating Spindle Sander

Q. *I've worked with an oscillating spindle sander and find it to be a most handy tool. Unfortunately, I've never seen one for less than $900. This is way too much for someone like me who doesn't make a living from woodworking. Does any one offer a less expensive oscillating sander or possibly a kit?*

JACK SEXAUER
Plano, TX

A. An oscillating spindle sander is basically a drum sander mounted in a table, much the way a router is mounted in a router table. The drum not only rotates, it also bobs up and down as it turns. This makes for a smoother cut that is less likely to burn. Industrial machines have cast-iron tables and internal gearing that drive up the cost of the machine. Fortunately, there is an alternative. Wesley Glewwe, of West St. Paul, MN, has designed a spindle

sander that he makes from an inverted bench-top drill press. He's built over 200 of these machines and for $175 plus shipping, Glewwe will send you one of his sanders, preassembled. Except for the on-off switch, all mechanical parts are included. You'll also have to build a tabletop to support the work. Glewwe recommends plywood covered with plastic laminate. Write Glewwe at 906 Oakdale Ave., West St. Paul, MN 55118. If you want to build Glewwe's oscillating spindle sander yourself, you'll find plans in the book, *Fine Woodworking on Making and Modifying Machines* (1986, Taunton Press, Box 355, Newtown CT 06470)

JEFF DAY
Senior Editor
AMERICAN WOODWORKER

Conserving Finishes

Q. *My wife has a Hepplewhite sideboard that's been in her family for years. Unfortunately it's gotten its share of use, too. Structurally, it's fine, but there are some nicks and scratches in the finish, and there's a white ring left by someone's glass on the top. I talked with a local refinisher, who wants to strip the whole thing and start over. I'm hesitant. Part of the charm is that the finish is probably original. Isn't that part of the value, too? Is there anyway we can get this piece restored without stripping it? And if we must strip it, how do I know if we've got a refinisher we can trust?*

MICHAEL DOUGHERTY
Boston, MA

A. Your intuition is excellent. Original or old finishes are very important parts of historic furniture. The subtle brush marks and original colorants tell us much about the makers and the appearances they desired. Have the finish removed only as a last resort.

Careful testing is necessary to determine the best treatment for your sideboard. I don't advise you to do it yourself because you might damage the piece.

Instead, have the finish repaired by a competent conservator. Major museums, including the information department of the Conservation Analytical Laboratory at the Smithsonian Institution, can make referrals. The American Institute for Con-

servation of Historic and Artistic Works, 1400 16th St. NW, Suite 340, Washington, D.C. 20036 is the professional association of conservators and can provide the names of professional conservators in your area. They also have a brochure entitled "Guidelines for Selecting a Conservator" to help you in your quest. It is vitally important to keep a written record of the work you have done to the piece and place a copy inside for future generations.

While I don't recommend do-it-yourself repairs, scattered nicks, scratches and white marks can be treated without removing the original finish. Conservators usually begin by testing a small, out-of the-way section of the finish with the mildest possible solvent, usually a hydrocarbon solvent such as hexane or mineral spirits. They work up to stronger solvents till they find one that dissolves the finish. They then carefully paint that solvent into the damaged areas with an artist's brush. After the solvent evaporates, the surface damage will be unified with the surrounding finish. If this fails, the conservator can touch up the damage with very diluted shellac (e.g. ½-lb. cut).

The next option in this ascending sequence of severity is to remove the finish in the immediate area of damage with the appropriate solvent and a cotton swab. Apply a new shellac finish in the damaged areas only. The fourth option is to rapidly pad on a very slow-drying solvent, such as butyl cellosolve. Such solvents must dry for about a week before the surface can be touched.

A coat of paste wax may correct an uneven sheen. For more dramatic problems, a conservator may apply a thin coat of a new finish. The solvent should be different from that of the original finish, so the new finish can be removed in the future to reveal the original surface. Soluvar or Acryloid B-72 (both available from Conservation Materials, 1165 Marietta Way, P.O. Box 2884, Sparks, NV 89431) are appropriate finishes for this purpose.

For general information on deterioration and care of furniture, you may want to obtain a copy of the booklet "Keeping It All Together: The Preservation and Care of Historic Furniture" from the Ohio Antique Review, 12 East Stafford Ave., Worthington, OH 43085 (Price: $5.95).

MARC A. WILLIAMS
Chief Furniture Conservator
Conservation Analytical Laboratory
Smithsonian Institution
Washington, D.C.

Where To Find It

Black walnut bark, madder root and other old-time dyes and finishing materials are available from the Olde Mill Cabinet Shoppe RD 3, Box 547 A, York, PA 17402.

Wooden rabbet planes, hollowing planes and fillister planes are available from Frog Tool Co. Ltd., P.O. Box 8325, Chicago, IL 60680.

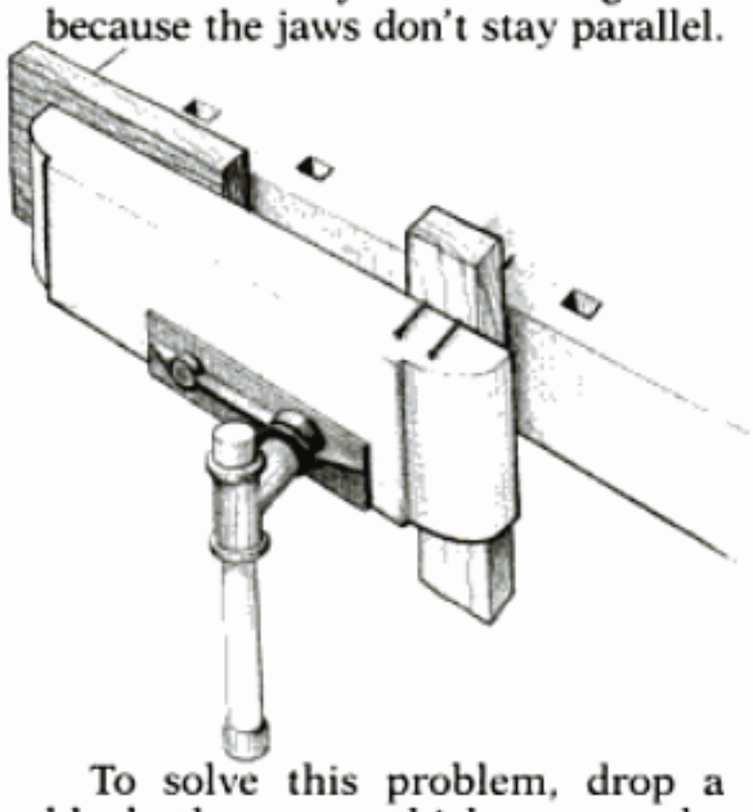
Wooden business cards the size and thickness of regular business cards are available from "Cards of Wood," P.O. Box 98, Belmont, MI 49306.

Have you got a woodworking question for the experts? Send it to Q&A, AMERICAN WOODWORKER, *33 E. Minor St., Emmaus, PA 18098.*

TECH TIPS

Vise Helper

It's hard to grip a piece of wood at one end of many woodworking vises because the jaws don't stay parallel.



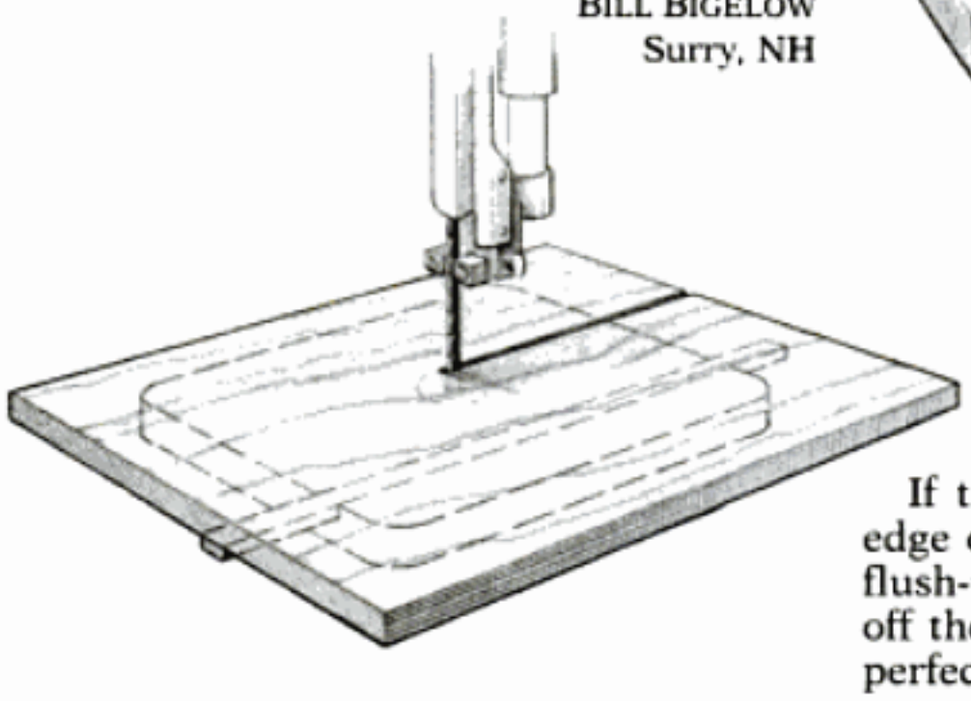
To solve this problem, drop a block the same thickness as the stock you want to grip in the other end of the vise. The vise jaws will stay parallel, and you'll get a better grip. Nails will keep the block from slipping through the vise jaws and dropping on the floor.

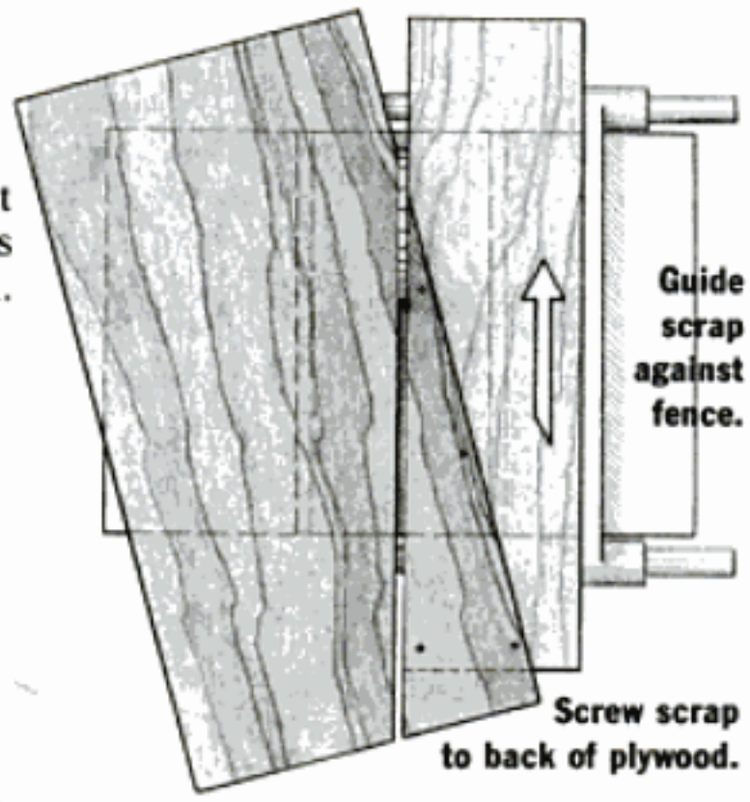
WILLIAM GUTHRIE
Pontiac, MI

Auxiliary Bandsaw Table

Make a wooden table to fit over your bandsaw table. Glue a strip of wood underneath to fit into the miter-gauge slot (if your saw has one). This "slave board," as I call it, can be aligned and clamped to the bandsaw table so that any number of jigs and fixtures can be nailed, screwed or drilled into the slave board without damaging the bandsaw table.

BILL BIGELOW
Surry, NH





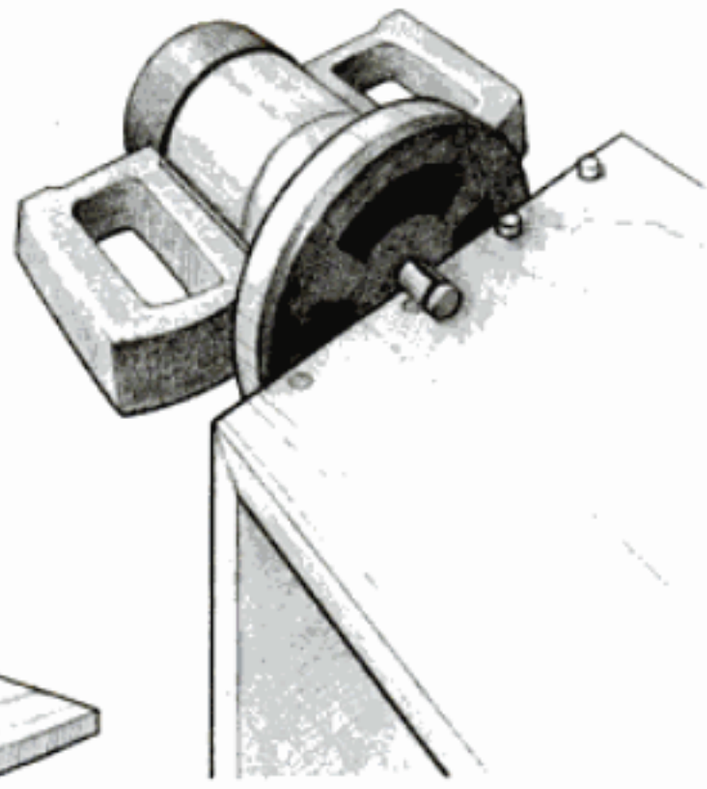
Angled Cuts on Plywood

To make angled cuts on large pieces of plywood, screw a scrap piece of ply to the back of the piece you want to cut. Guide the scrap along the tablesaw fence to make the cut.

JEFF DAY
Perkasie, PA

Trimming Dowels Flush

When wood plugs or dowels are exposed on the surface of a piece, you have to sand or file the plug or dowel flush with the surface. This often results in a slight depression around the plug or dowel because the end grain of the plug or dowel is much harder than the surrounding wood.

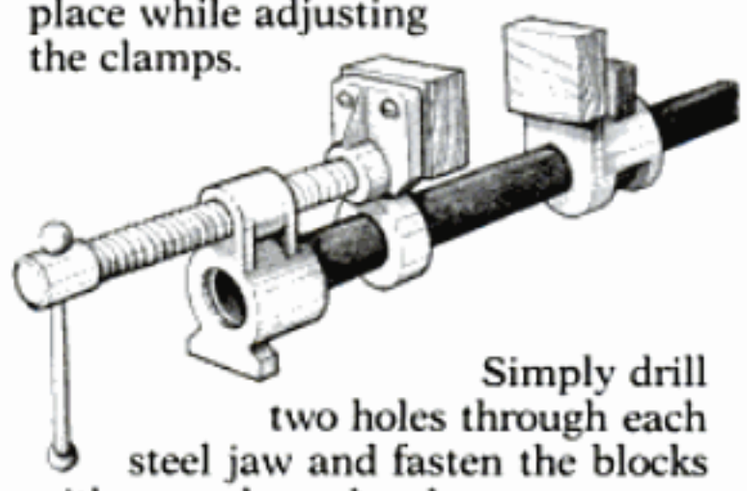


If the dowel or plug is near the edge of the piece, I use a laminate flush-trim bit in my router to trim off the end. This leaves the surface perfectly smooth and requires little or no sanding.

BOB LIPSCOMB
Concord, CA

Pipe-clamp Jaw Protectors

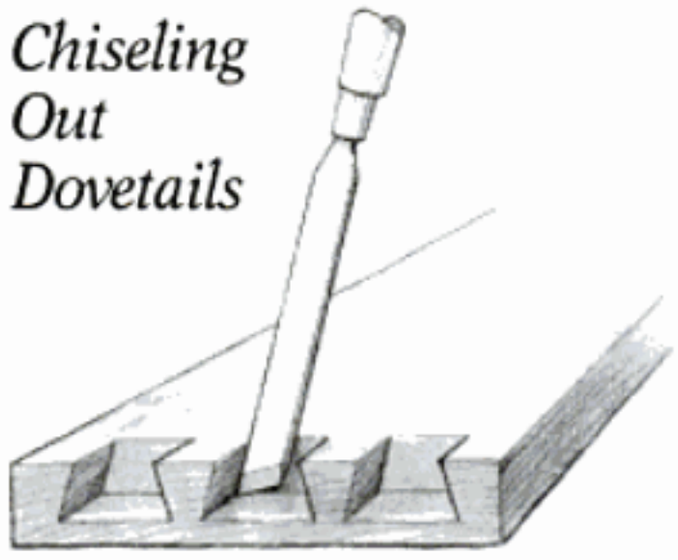
To make pipe clamps a little more manageable and to keep the steel jaws from damaging the edges of your project, fasten small softwood blocks to the jaws. This eliminates the need for that "third hand" to hold a protective scrap of wood in place while adjusting the clamps.



Simply drill two holes through each steel jaw and fasten the blocks with several pan-head screws.

DON SCARBURY
Albuquerque, NM

Chiseling Out Dovetails



When I clean out corners of half-blind and full-blind dovetails, I find a skew chisel helpful. The angled edge gets into the corners that a straight chisel can't.

GERALD R. RANDOLPH
Danbury, WI

No-clog Files

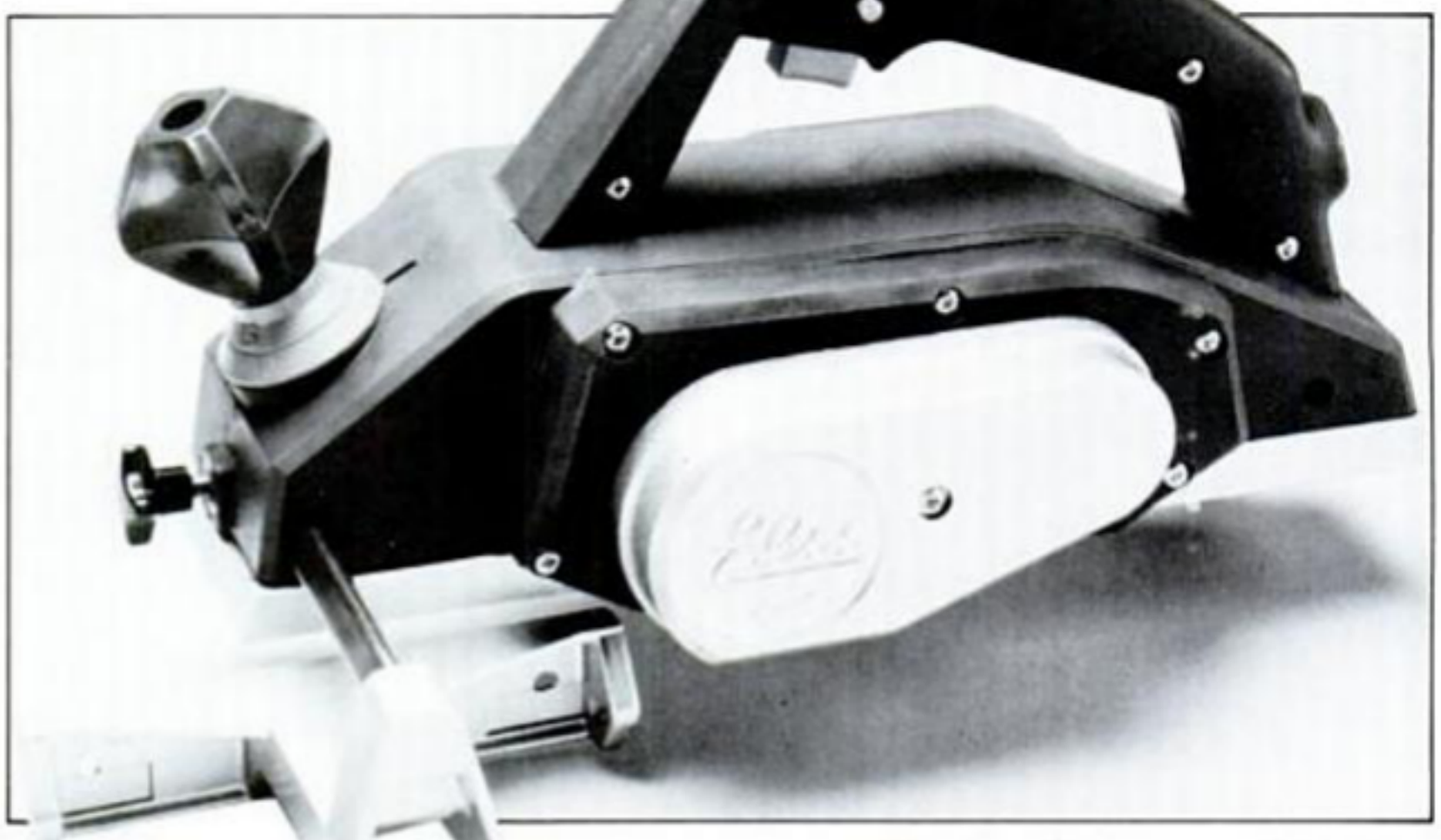
Soft, non-ferrous metals like brass and aluminum will clog a file pretty quickly. Rub your file with a piece of chalk and you'll find the file teeth won't clog nearly as fast.

LAZLO SPECTRUM
Tucson, AZ

DRAWINGS BY HEATHER BRINE LAMBERT

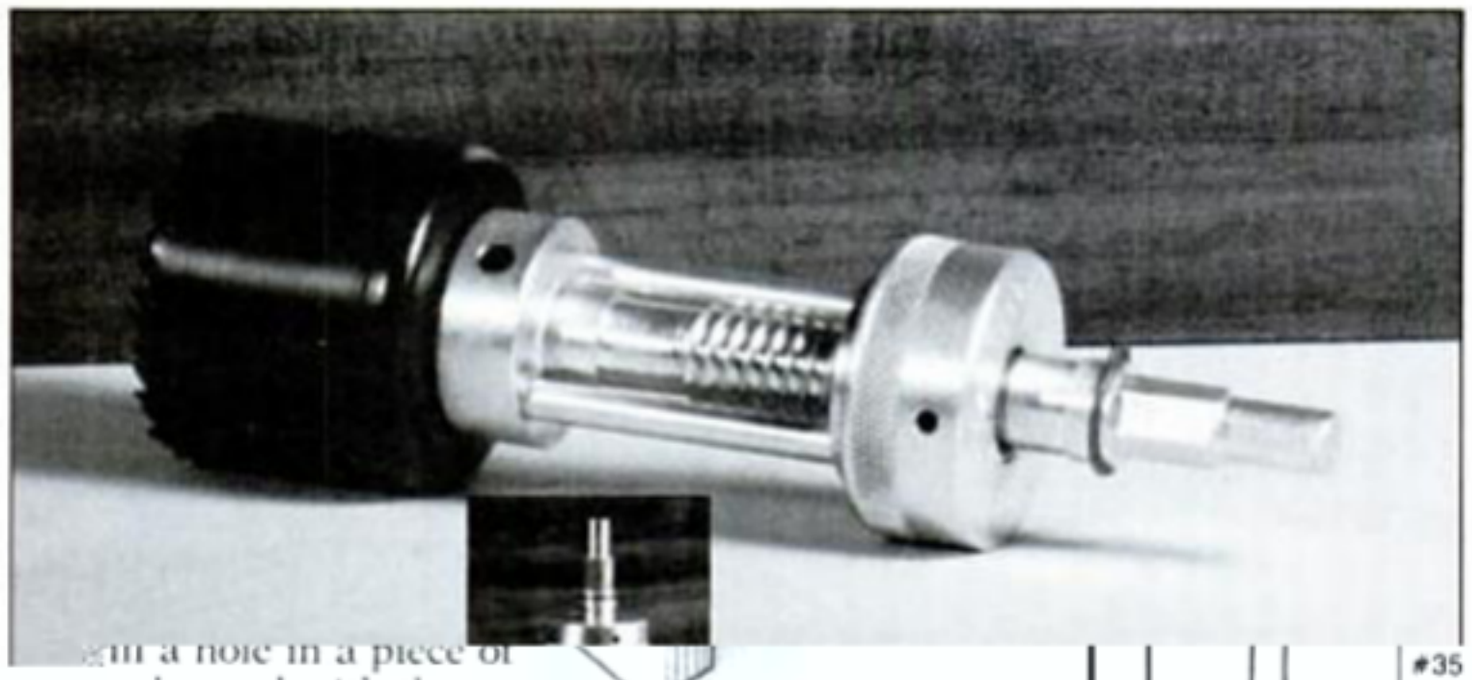
TOOLBOX

More Power to You ▶



Optimum power and maximum accuracy join forces in Elu's new 3 1/8-in. planer. Its powerful 7.2-amp motor can cut up to a depth of 3/16 in. in one pass, and the reversible, tungsten-carbide blades make for the cleanest possible cut you can get from a hand-operated planer. Elu's planer also has a large 7/8 in. rabbeting capacity. Its handles are carefully positioned to put you in full control. And, for an accurate cut, the rear and front shoes are machined as a matched set, leaving the bottom perfectly flat. With this tool, you are able to plane, chamfer, trim doors, rabbet, cut tenons and square edges quickly and efficiently. (Price: $280)

■ *Black and Decker (U.S.) Inc., Dept. AWT, P.O. Box 798, Hunt Valley, Maryland 21030*



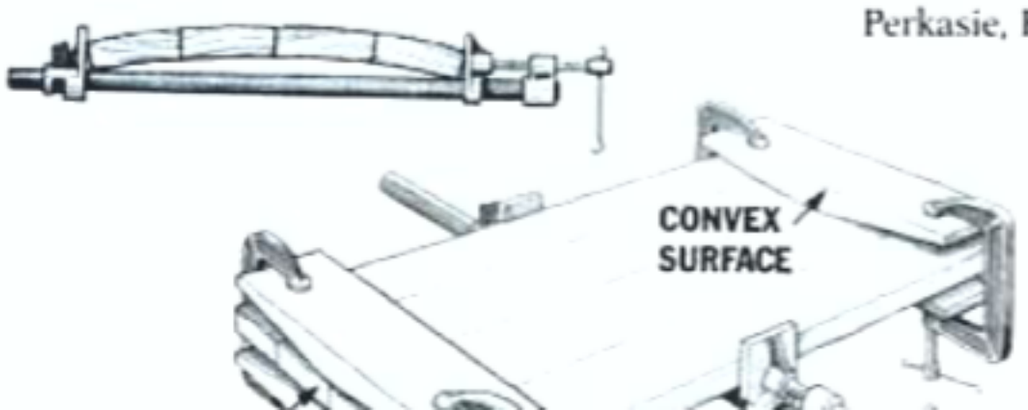
...m a hole in a piece of scrap plywood with the same bit you'll use for the mortise hole. Cut the corners off the scrap and slip it over the tail-stock center. To check the fit, slip the gauge over the tenon as you turn.

JEFF DAY
Perkasie, PA

Cauls Counter Bowing

Pressure from clamps can make a wide glued-up panel bow. Slightly convex battens top and bottom counter this pressure. Giving the cauls a coat of paste wax will keep the glue from sticking.

JEFF DAY
Perkasie, PA



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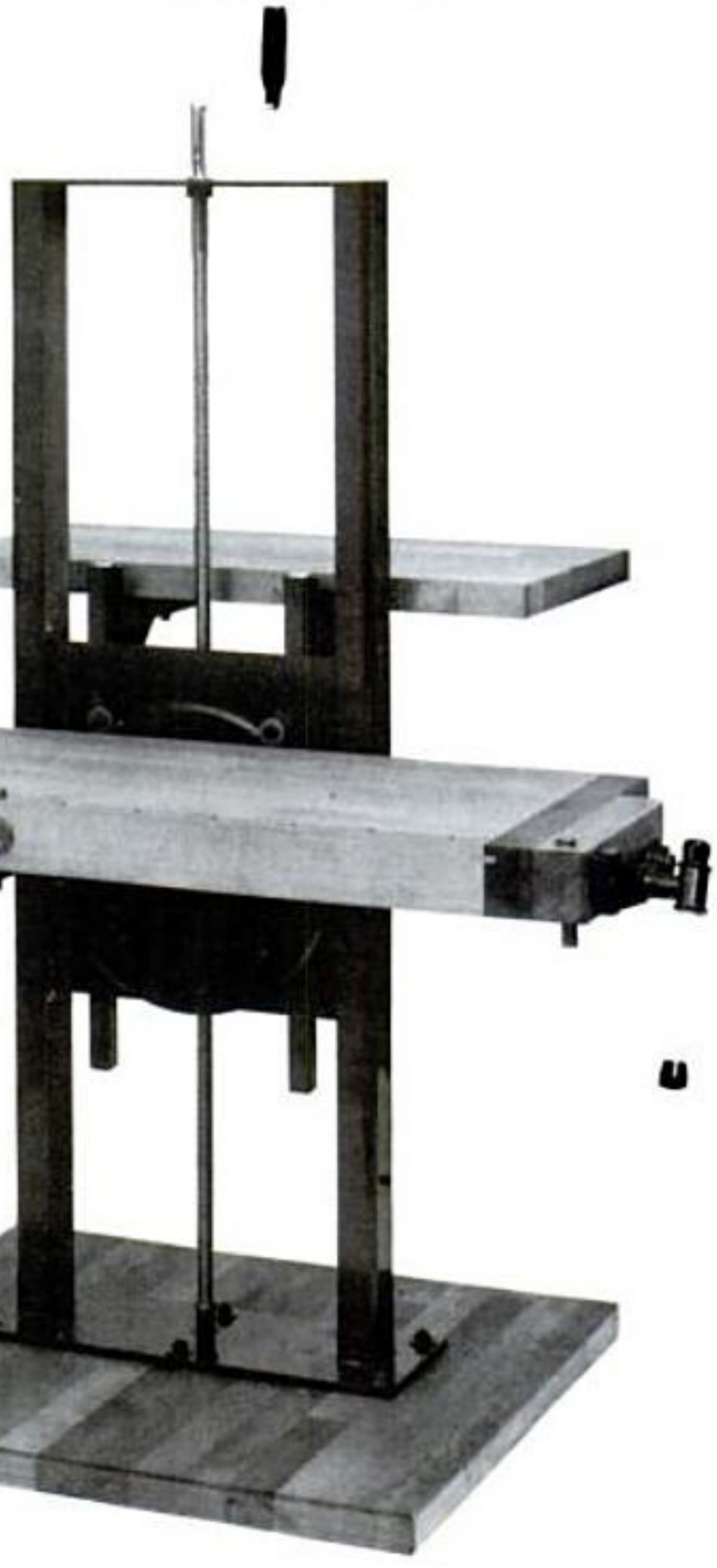
	#35	1/4" V Groove 90°	1/4"	1/4"
	#36	3/8" V Groove 90°	3/8"	3/8"
	#237	1/2" V Groove 90°	1/2"	1/2"
	#16	3/8" Dovetail 9°	3/8"	3/8"
	#80	1/2" Dovetail 8° (For Leigh Jigs)	1/2"	13/16
	#217	1/2" Dovetail 14°	1/2"	1/2"
	#218	3/4" Dovetail 14°	3/4"	7/8"
		CORE BOX (ROUND NOSE)		
	#219	3/8" Core Box 3/16"	3/8"	3/8"
	#220	1/2" Core Box 1/4"	1/2"	11/32
	#221	3/4" Core Box 3/8"	3/4"	5/8"
	#056	Tongue & Groove (FOR WOOD THICKNESS FROM 1/2" to 1")	1-5/8"	1"
	#24	1/4" Straight Bit	1/4"	3/4"
	#25	5/16" Straight Bit	5/16"	1"
	#26	3/8" Straight Bit	3/8"	1"
	#27	1/2" Straight Bit	1/2"	1"
	#28	3/4" Straight Bit	3/4"	1"
Flush Trim / Key Hole	#213	1/2" FLUSH TRIM	1/2"	1"
	#14	3/8" KEY HOLE (This Bit Only HSS)	CUTS 3/8" KEY HOLE FOR FLUSH MOUNTING PICTURE FRAMES, ETC	

Small Shop Dust Collector ◄

Don't let your love affair with wood cost you your lungs. Here's a portable dust collector made with the small shop in mind. The new Delta two-stage dust collector makes clean shop air possible for you. Operating on a ¾-HP motor, this dust collector has a unique design that captures debris at its source and culls the larger chips, leaving the blower to handle only the finer dust, so there's less wear and tear on the blower. Casters allow you to roll the collector from one machine to another. It's adaptable to most workshop machines and moves four-times more cubic feet of air per minute than most shop vacuums. And with its 35-gallon, fire resistant drum, you'll spend more time working and less time emptying. (Price: $435)

■ *Delta International Machinery Corp., Dept. AWT, 246 Alpha Drive, Pittsburgh, PA 15238*



Adjustable Workbench ►

If you have your eye out for a new workbench, consider one that can change with the requirements of your work. Willow Pond has just come out with a fully adjustable workbench ideal for those whose work requires changes in bench height or those working from a wheelchair. The bench height adjusts from 15¾ in. to 51 in. Mounted on a steel base, these workbenches not only move up and down, they also tilt 360 degrees to the right or left. Adjustments can be made manually or with an optional electric motor ($400). Each bench comes with an adjustable worktable mounted on the back side of the base, for extra work space. There are five models, and you can choose your own options, such as bench dogs, side-bench stops, front vise and end vise. You can even order one of four kinds of chemically resistant work surfaces. (Price: $2625-$2695)

■ *Willow Pond Tools, Inc., Dept. AWT, P.O. Box 544, Pembroke, NH 03275*

A Reproduction Built to Last a Lifetime or Longer

BY JEFF DAY

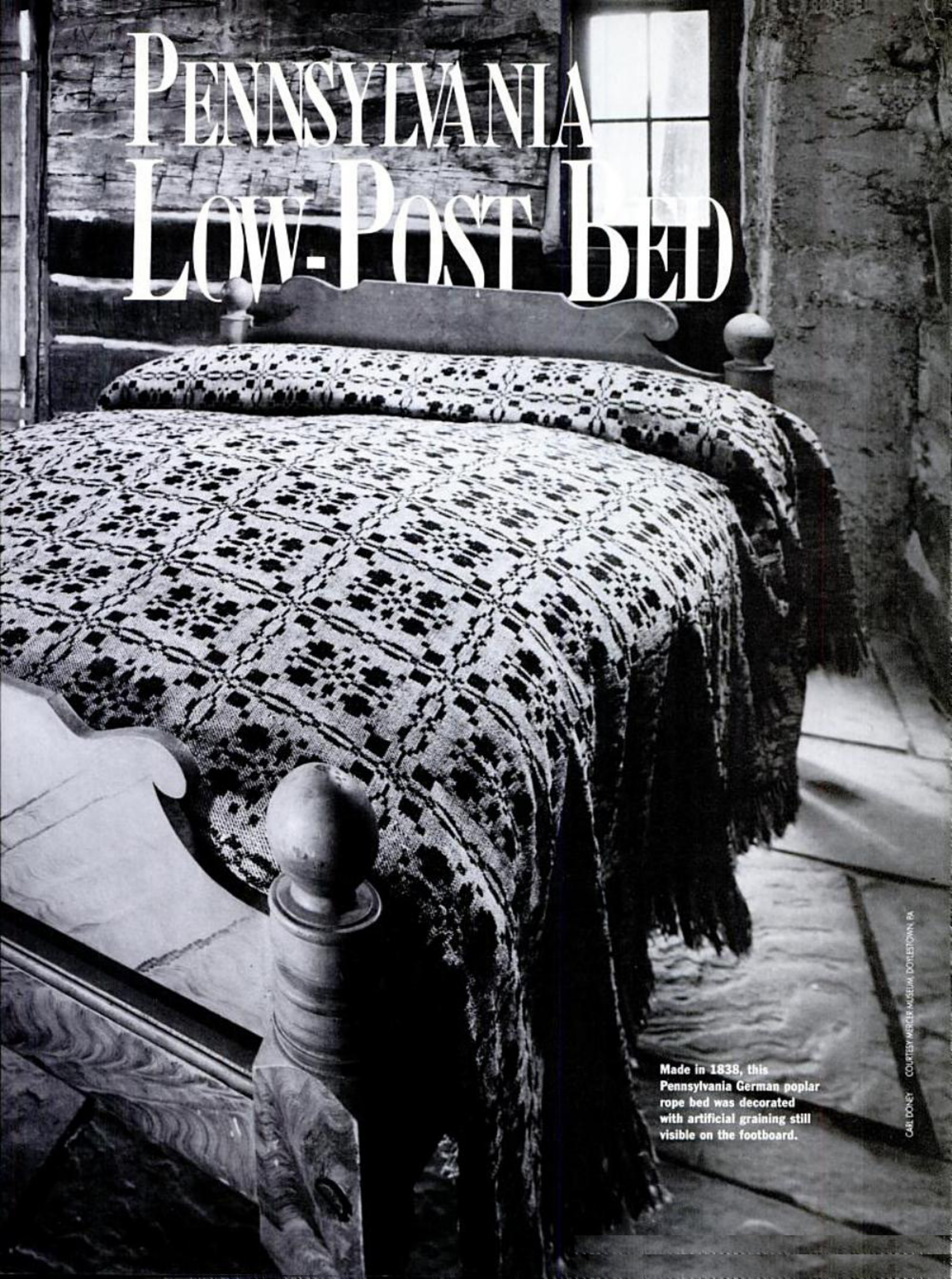
When my daughter told me she'd no longer sleep on a mattress on the floor, I knew I was in trouble. Never mind that the *reason* her mattress was on the floor was because her frequent jumping sprees had reduced her former bed to rubble. She was about to become a proper 5-year-old, and a proper 5-year-old deserves a proper bed. A proper father would just have to make one.

I decided to reproduce a 19th-century bed I'd seen in the Mercer Museum in Doylestown, PA, a fascinating museum that specializes in the tools and artifacts of pre-industrial America. I'd reproduced the bed about seven years ago to furnish a log cabin for a summer children's program at the museum. I'd wanted to build one for myself ever since.

The original bed was made by one of the area's Pennsylvania German settlers (popularly known as Pennsylvania "Dutch"). Little is known about its history, although the headboard is marked "M and C, 1838." Records show that museum founder Henry Mercer bought the bed in 1922 for $3 from Harvey Smith of Plumsteadville, a village about ten miles from Doylestown.

It's a hefty bed (a plus so far as children are concerned). The side rails are fastened to the headboard and footboard with lag screws (I used bed bolts on my reproduction), so the bed is easy to take apart for mov-

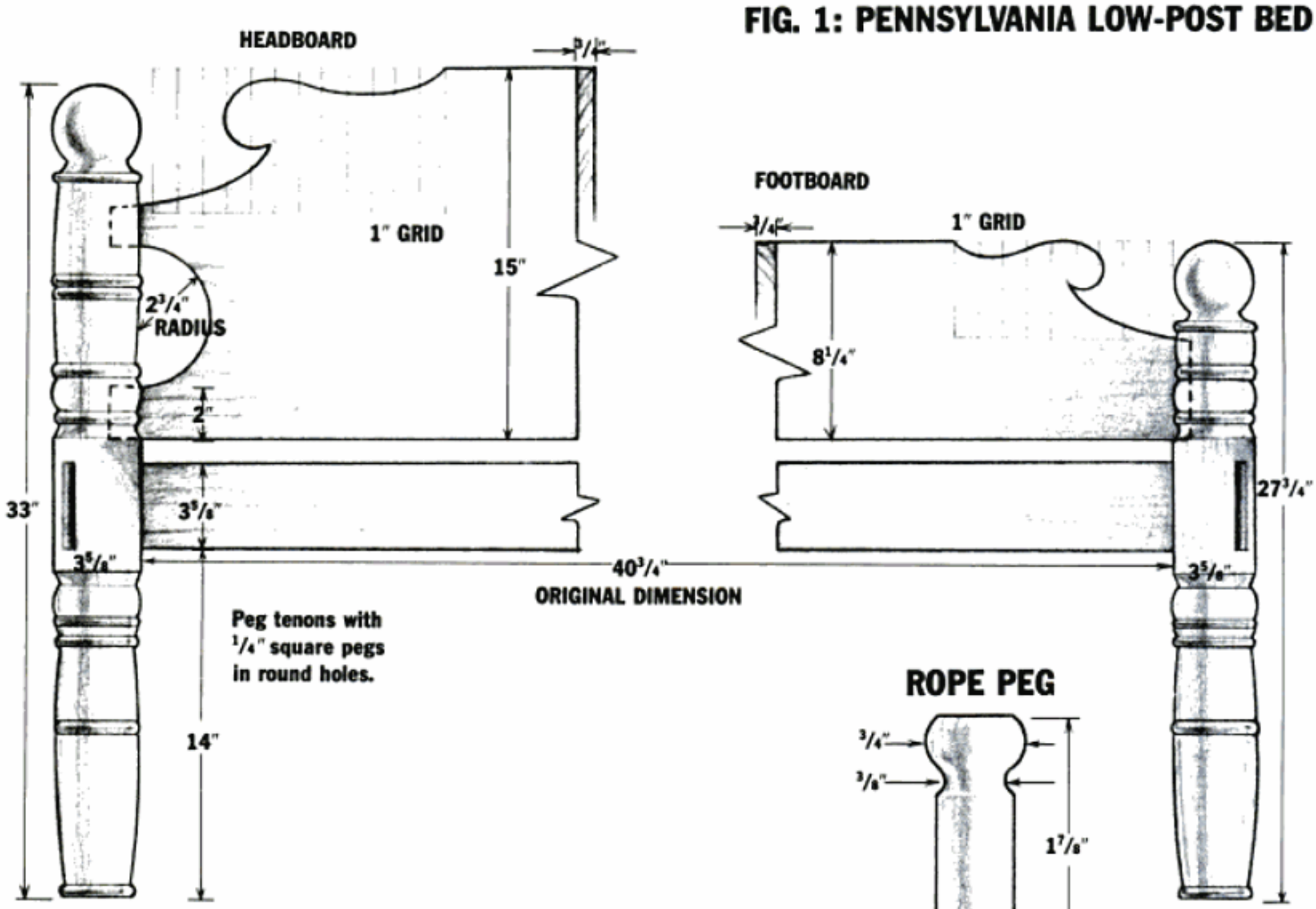
PENNSYLVANIA LOW-POST BED



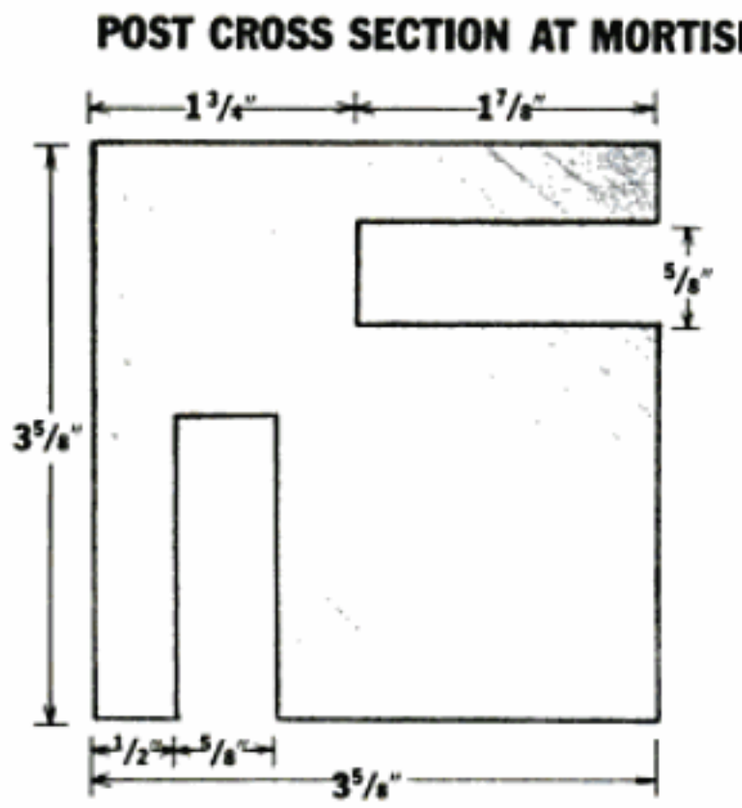
Made in 1838, this Pennsylvania German poplar rope bed was decorated with artificial graining still visible on the footboard.

CARL DONEY COURTESY MERCER MUSEUM DOYLESTOWN PA

FIG. 1: PENNSYLVANIA LOW-POST BED

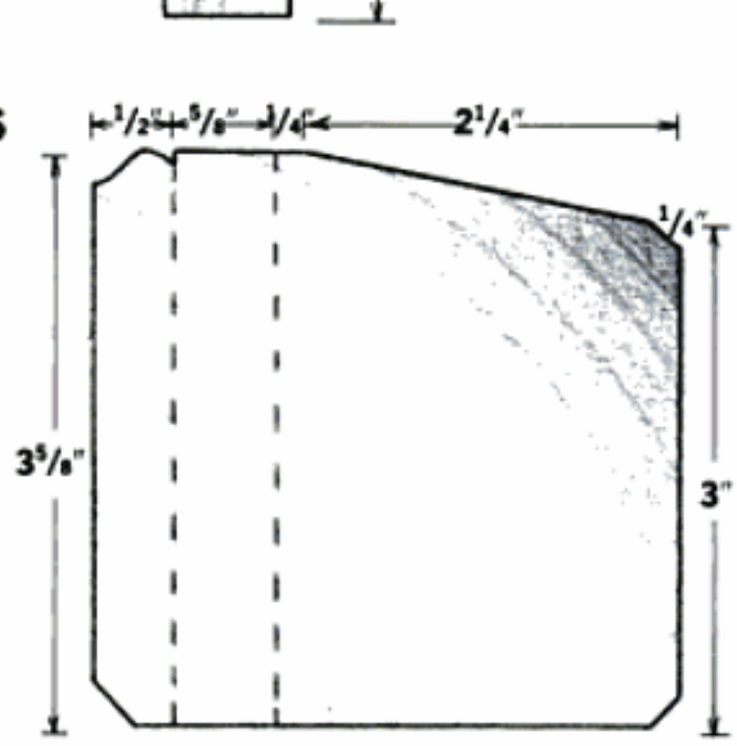


POST CROSS SECTION AT MORTISE

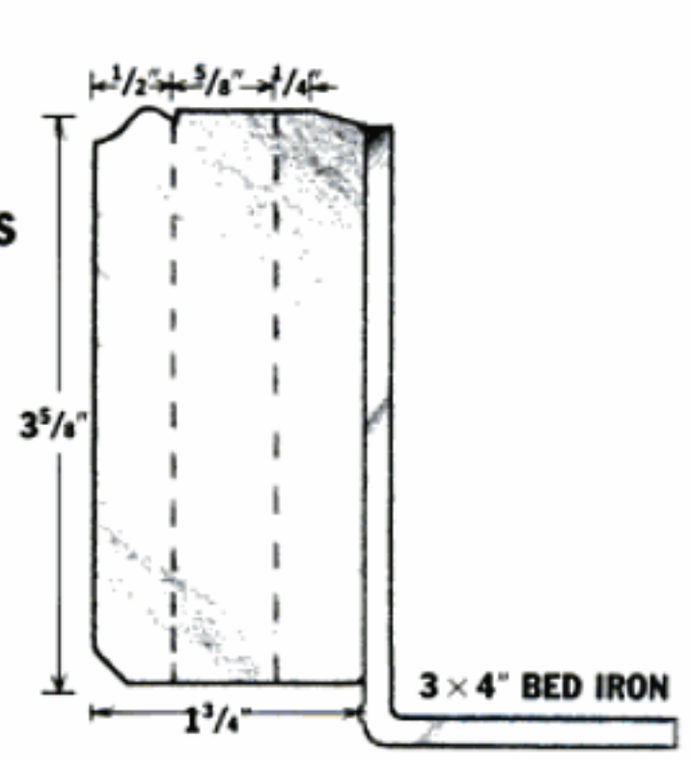


ROPE PEG

ORIGINAL RAIL CROSS SECTION



SIDE RAIL MODIFIED FOR MATTRESS



BILL OF MATERIALS

QUANTITY	DIMENSIONS	COMMENTS
4 Leg blanks	2 @ 3 5/8" × 3 1/8" × 36" 2 @ 3 5/8" × 3 1/8" × 31"	
2 Rails	3 1/8" × 3 5/8" × 40 3/4" between tenons	Original dimensions. Alter to suit mattress.
2 Side rails	3 1/8" × 3 5/8" × 68 11/16" between tenons	Original dimensions. Alter to suit.
1 Headboard	3/4" × 15" × 42 3/4"	
1 Footboard	3/4" × 8 1/4" × 42 3/4"	
40 Oak pegs	3/4" × 1 7/8"	13 equally spaced on each side rail. 7 equally spaced on head and foot rails.

DRAWINGS BY SALLY ONOFA

ing or storage. The original bed has rope "springs." A web of rope strung from pegs in the rails supports a straw-filled mattress.

Rope beds aren't all that comfortable so I modified the design of the rails, as well as the length and width of the bed to fit a modern single mattress. The drawings on page 18 show both the original rail design and several ways of modifying it for a modern mattress.

Keeping the mattress low enough in the bed so that it didn't obscure the headboard was a problem. I opted to support the mattress on a piece of ¾-in. plywood hung from the rails on 4-in. right-angle bed irons (available from Horton Brasses, P.O. Box 95, Nooks Hill Road, Cromwell, CT 06416). If you'd like a box spring as well as a mattress, 10-in. bed irons will hang the box spring below the rails and still keep the mattress low enough so the bed looks good. Add a dust ruffle to the bed clothes to hide the box spring under the rails.

The original bed is made from tulip poplar (Liriodendron tulipfera), an easy-to-work hardwood often used in Pennsylvania German furniture. Tulip poplars, named for their orange and green blossoms, have long, straight, wide trunks, and can still be found in sizes comparable to those of 200 years ago. For the legs and posts of my daughter's bed, I was able to get 16/4 planks (4 in. thick), one of them 18 in. wide, from a local wholesale lumber dealer for about $2 a board foot. If you can't get tulip poplar (also known as yellow poplar) where you live you can substitute pine or fir. If you can't find 16/4 stock you can glue up two pieces of 8/4 stock to get the 4-in. thickness you'll need for the posts.

When I built the bed for the museum's cabin, I was making furniture for a living and I ran boards through as much machinery as possible to speed things along. I no longer have to work at that pace. For that reason, and no other, I did a lot of work by hand this time, including planing much of the stock to size.

The turned posts are the heart of the bed. I laid them out from a full-size template made of ¼-in. plywood. I also cut full-size templates of the larger details in the turnings to help me gauge their shape.

On stock this big there's quite a large mass spinning between centers. For safety, keep the lathe at the slowest possible speed throughout the project. A big roughing gouge makes quick work of removing all that wood. Be sure not to get too close to the pummels—the square sections of the leg—with the roughing gouge.

Once the post is round (except for the pummels), lay out the details with the template and a pencil. Most of the turning can be done with a spindle gouge (see page 22) and a skew. You'll find, however, that the standard practice of marking the depth-of-cut with a parting tool doesn't always work here because the beads are so close together that the parting tool will cut into an adjoining detail.

As a result, I laid out the beads by cutting V-grooves with the skew. While the skew still surprises me from time to time, this particular procedure is nearly failsafe. Put the skew on the tool rest, directly in front of the layout line, with the *long point down*. Keep the skew's cutting edge vertical, and push it gently into the layout line. Raise the handle as the tool begins to cut.

The top section of the leg below the cannonball at the top of the post is barrel-shaped, with a double bead cut in it at its widest point. I turned the entire barrel first, using a template to help me get the right shape. Once I finished the barrel, I turned the beads at the widest point.

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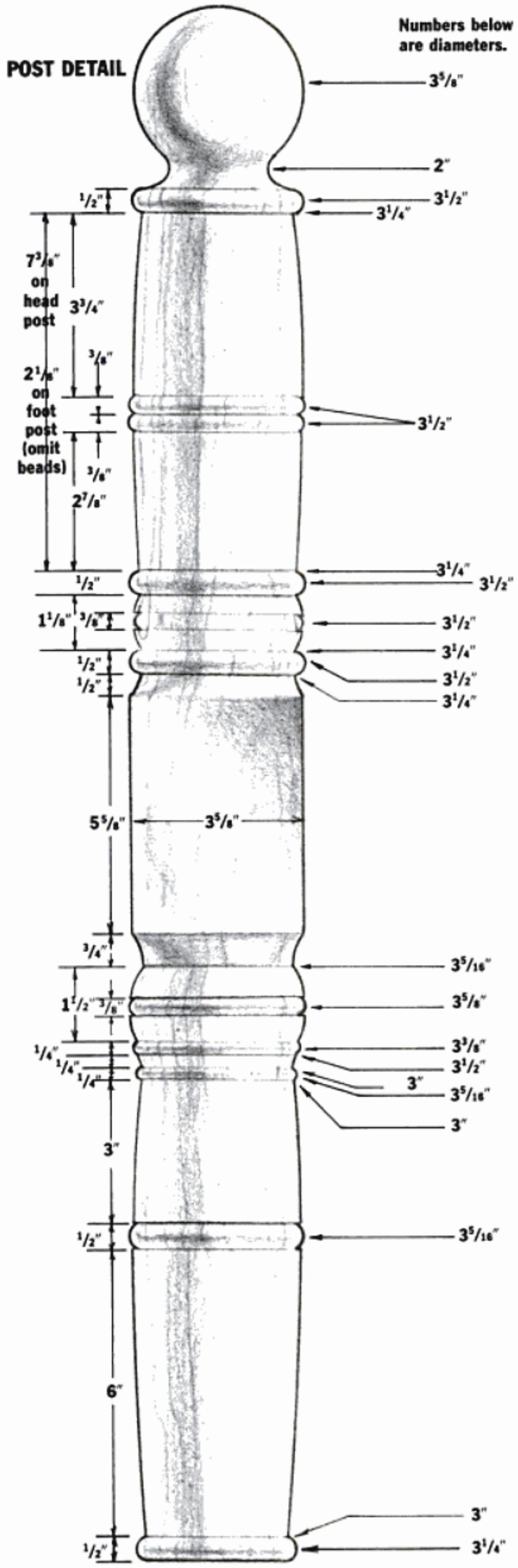
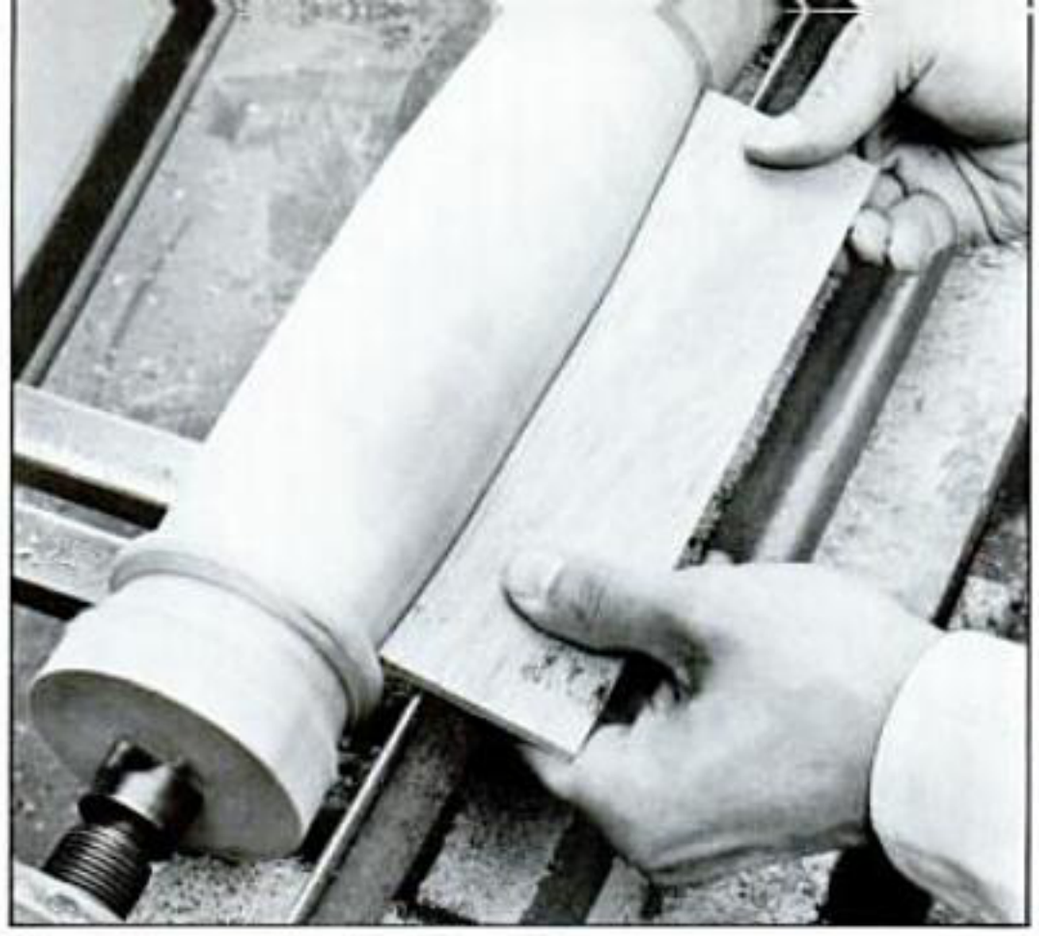
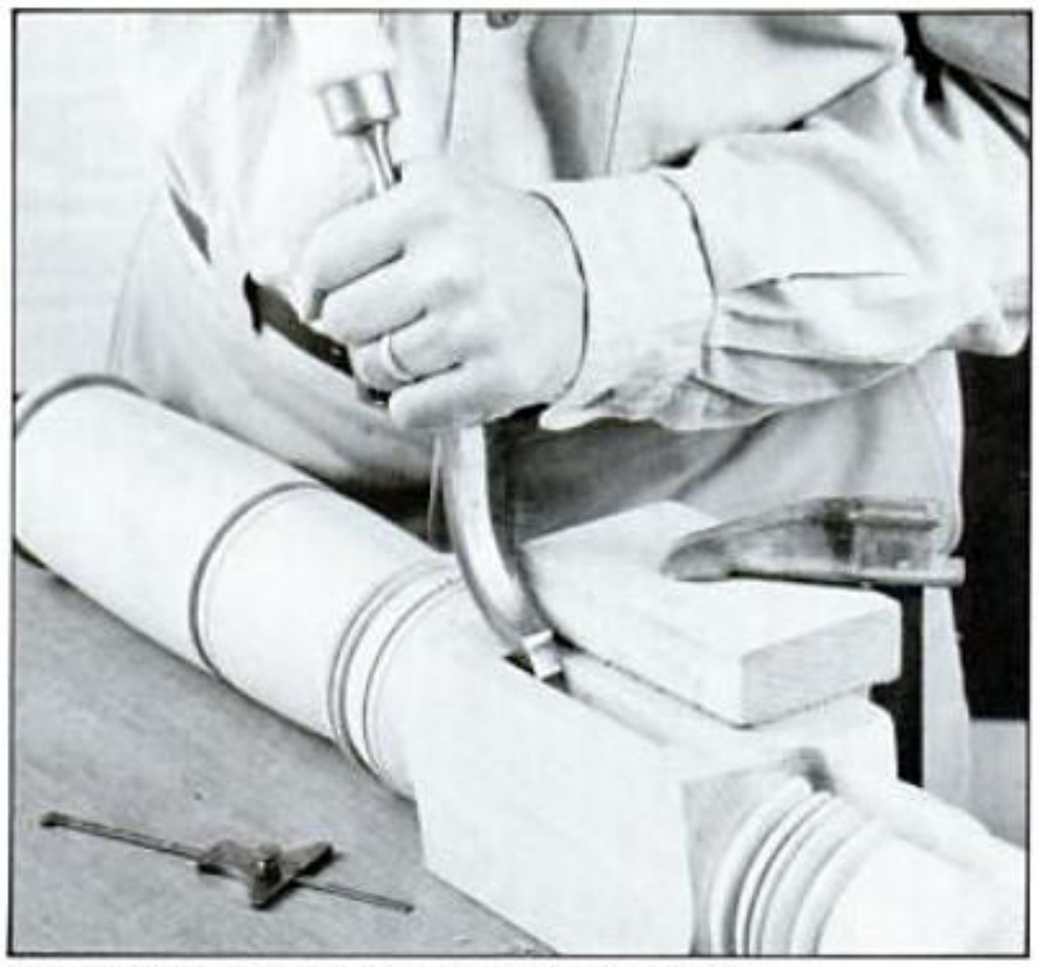




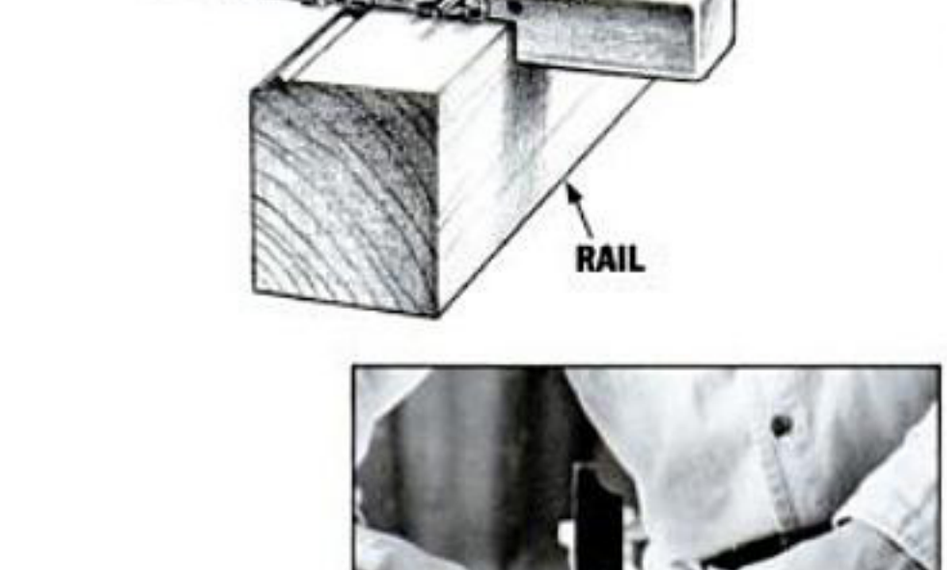
Check the leg profile with a template made from 1/4-in. plywood.

To cut the rail mortises, remove most of the waste with a drill then pare the mortise sides with a chisel.



A swan-neck chisel and a depth gauge (on bench) are handy tools for chopping deep mortises.

FIG. 2: SHOP-MADE SCRATCH STOCK



Scrape the bead on the side rails with a shop-made scratchstock.

DRAWINGS BY SALLY CINOPA

The cannonball deserves special mention. It's easy to cut a curve with a spindle gouge, but in practice, it can be hard to turn a true sphere. Cut two plywood templates to guide you. One should be a quarter of the ball's circumference at its equator; the other about a third of the circumference. Check your progress with the smaller of the templates, and once you have both hemispheres roughed out with the quarter-circle template, start checking with the larger template.

Leave a 3/4- to 1-in. dia. stem at the top of the ball so the post won't snap off as you turn. I sanded the post on the lathe, and then held a handful of shavings to the spinning post to burnish it smooth. After sanding, I cut off most of the stem with a V-cut from the skew, switched off the lathe, and cut through the stem with a backsaw. I cleaned up the top of the balls with bench chisels and sandpaper.

The next step is to mortise the posts for the rails and the headboard or footboard. Because the mortises for the headboard and footboard are cut directly into turned details instead of square sections, they present

a special problem. I suspect the original maker cut all the mortises before turning the legs, while the blank was still square. It may be because my lathe is slow and wobbly, or it may be because I am slow and wobbly, but I prefer not to turn complex shapes into areas that have already been mortised. After turning, I cut the mortises for the headboard and footboard with a plunge router. Rather than make a complicated jig, I screwed two stop blocks to the bed rails, clamped the rails against the post as shown in the photo, and guided the router against the rail. I cut the screw holes off later when I beveled the rails.

You could cut the 5/8-in. mortises for the rails in much the same way, but because they are a full 1 7/8-in. deep, and because router bits that long are hard to come by, I chiseled the rail mortises by hand.

I marked the center line of the mortise with a marking gauge and centered a 1/2-in. brad-point drill on the line to drill out most of the waste—the brad point keeps the drill from wandering. Since I don't have a drill press, I used a hand-held electric drill. After fussing around with squares and guides, I've found the easiest way to get a perpendicular hole is to throw out the guides, get directly above the hole, and eyeball the drill. Don't ask me why. It just works.

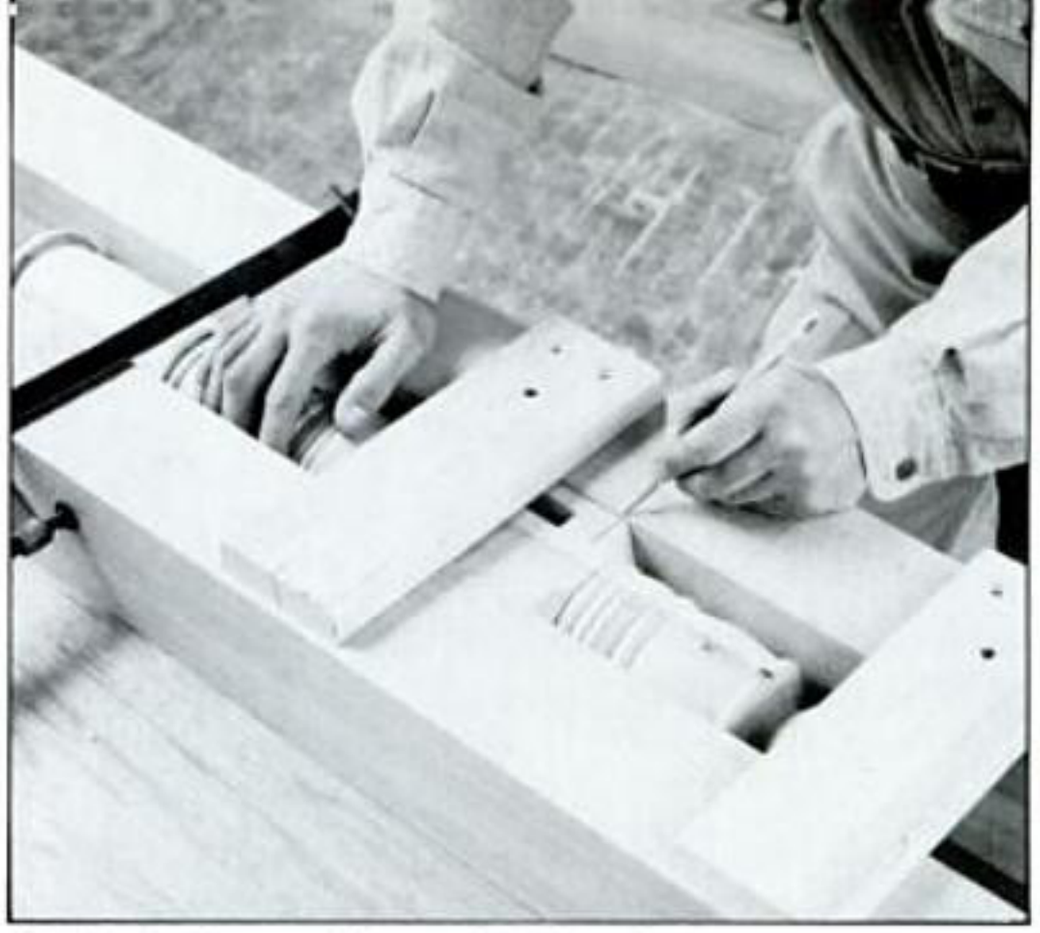
I laid out the sides of the mortise *after* I drilled the holes. This allowed me to adjust the width of the mortise should the drill inadvertently wander off course. I cut out the mortises with a 2-in. chisel, checking for square as I went with a machinist's depth gauge (available from MSC Industrial Supply Co., 1 Allwood Ave., Central Islip, NY 11722). I cleaned up the bottom of the mortises with a swan-neck mortise chisel (available from Garrett Wade Co., 161 Ave. of the Americas, New York, NY 10013).

Before you can determine the length of the rails, you need to know the size of your mattress. Be sure to add enough extra length to allow for the tenons and at least 5/8 in. more than the mattress in all directions so there's room to get your hands in between the rails and the mattress to change the sheets.

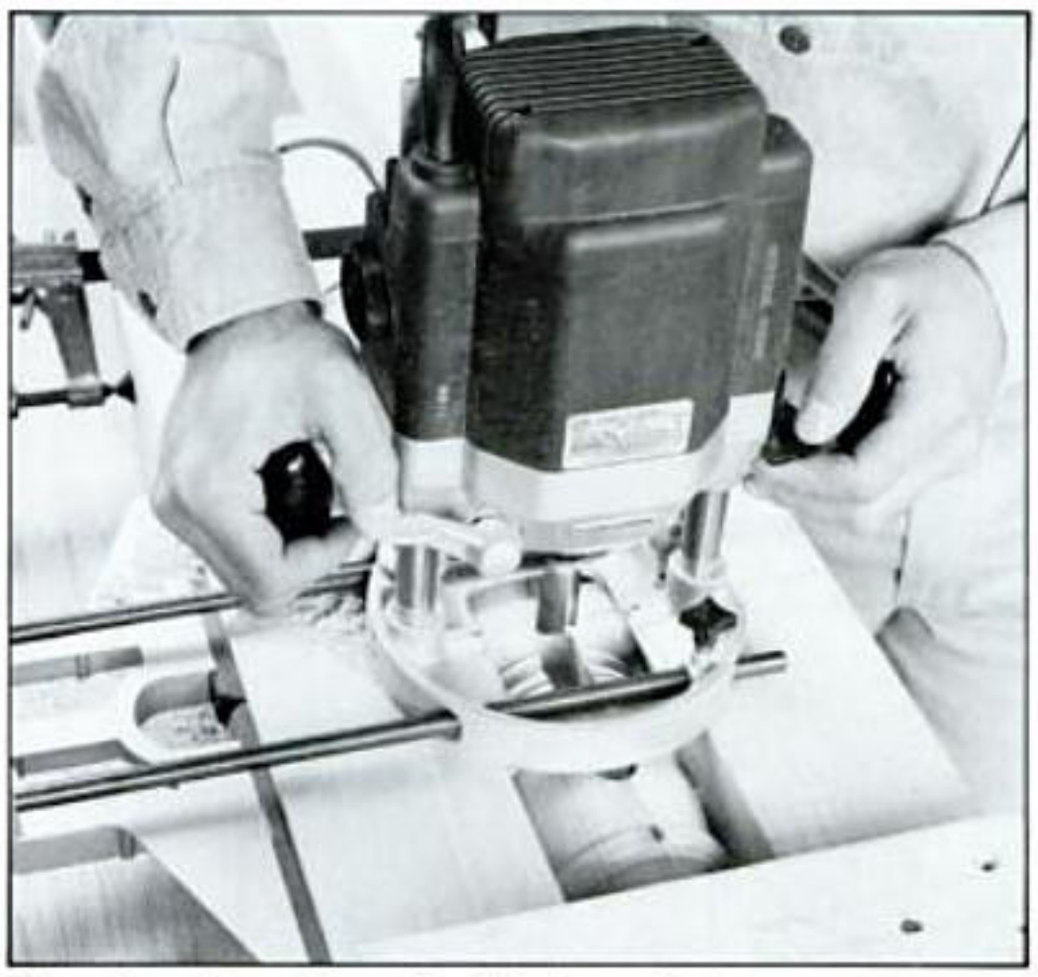
The original rails have a combination bead and chamfer on the outside edge as shown in Fig. 1. This serves both to soften the edge and to protect it from nicks and dings. Cut the bead before cutting the rail tenons. I couldn't find a router bit that cut the right profile, so I cut the bead much the way it may have been done on the original. I filed the profile into a piece of an old bandsaw blade and scraped the bead with a shop-made scratch stock as shown in Fig. 2. It's a piece of cake. The scratch stock cuts quickly, there's no tearout and the scraped surface is mirror smooth.

The next step is to cut the rail tenons. On the first bed, I cut these on the tablesaw with Delta's hefty tenoning jig. But even at the height of my machine frenzy, I decided that you really are better off cutting tenons like these by hand. The side rails are so long and unwieldy that even the best jigs bind.

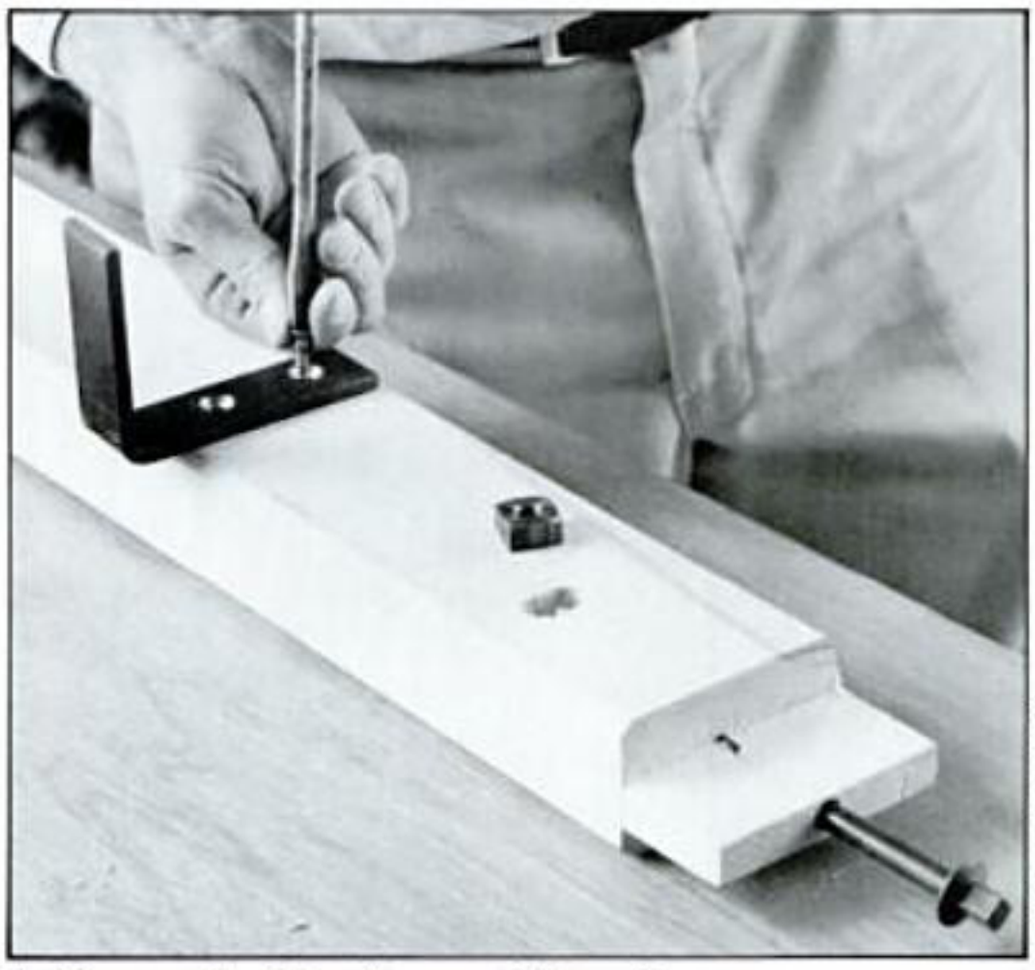
Lay out the tenon with a square and a sharp knife. If you've cut the mortises by hand they may vary a bit so it's a good idea to lay out each tenon to match a particular mortise. Make repeated cuts with the knife until the layout lines are a good 1/16 in. into the stock. Cut on the waste side of the lines with a backsaw. When you remove the waste, you'll see that the knife has left a crisp, clear line. If you need to clean up the shoulders of the tenon, the knife lines are a good guide. Once you've cut the tenons, plane or rout the 1/4-in. chamfers



Stop blocks temporarily screwed to the rails stop the router and limit the length of the mortise.



Clamp the rails on either side of the leg and rout the headboard mortises with a plunge router.



PHOTOS BY MITCH MANDEL

Bed irons on the side rails support the mattress. Bed bolts secure rails to head and footboard.

on the corners of the rails.

As I mentioned, the original bed has rope "springs" strung around pins in the rails as shown in the drawing. The top of the rail is beveled toward the inside to keep the ropes from chafing on the rail.

I cut the head and foot rails to the original profile but modified the side rails to accommodate bed irons and eliminate the rope pegs. The modified rails, shown in the drawing are narrower than the original rails but retain as much of the original profile as possible.

Next, cut out the headboard to the pattern shown and dry fit the headboard, headboard rail and posts together. When satisfied that everything fits as it should, glue them all together. Do the same for the footboard. Drill two 1/4-in. holes through each post and into the tenon as shown in the drawing. Drive a square 1/4-in. maple peg through each hole to reinforce the joint.

Bed bolts (available from Horton Brasses) fasten the side rails to the headboard and footboard. I drilled a recess wide enough and deep enough to accommodate the head of the bolt in each of the four posts, and then used the center mark left by the drill to locate a hole through the post for the shank of the bolt. I then assembled the bed, put a drill bit in the post holes, and drilled into the rails. On the inside of each rail, I mortised a hole for the nut where my measurements told me the end of the bolt should go. The next step was to put the nuts in the mortise holes and assemble the bed.

Because I worked so many of the surfaces of the bed by hand, I did as little sanding as possible—just a light once-over with 220 grit.

Few people mention paint and furniture in the same breath these days. But poplar is not a particularly pretty wood. The Pennsylvania Germans chose it because it was plentiful and easy to work. It was the plastic of its day—serviceable and cheap. The Pennsylvania Germans loved color and they painted their furniture in bright shades to cheer up poorly lighted homes. Sometimes they painted or sponged on an artificial grain to imitate more exotic woods, such as mahogany. The original bed is decorated with this artificial graining—once very bold and well pronounced but now faded with age.

Instead of reproducing the graining on the original, I painted my reproduction bed with milk paint, a concoction of milk, lime and pigment that was commonly used in the 1800s. If you want to brew your own, the sidebar (page 22) provides some original recipes. I didn't brew my own: The Old-Fashioned Milk Paint Co., P.O. Box 222, Groton, MA 01450 makes an excellent powdered milk paint based on an historical recipe. Any proper father, I suppose, would have let his 5-year-old pick the color. Mine chose blue. ▲

Jeff Day is the Senior Editor of AMERICAN WOODWORKER.

MILK PAINT

The following recipes for milk paint appeared in *Dick's Encyclopedia of Practical Receipts and Processes*, first printed in 1870, and re-issued by Funk and Wagnalls. We reprint here solely as an historical record and do not endorse these recipes or make any claims about their performance.

Painting in Milk. In consequence of the injury which has often resulted to sick and weakly persons from the smell of common paint, the following method of painting with milk has been adopted by some workmen, which, for the interior of buildings, besides being free as distemper from any offensive odor, is said to be nearly equal to oil painting in body and durability.

Take 1/2 gallon skimmed milk [see note below], 6 ounces of lime, newly slacked [slaked], 4 ounces poppy, linseed or nut oil, and 3 pounds Spanish White. Put the lime into an earthen vessel or clean bucket and having poured on it a sufficient quantity of milk to make it about the thickness of cream, add the oil in small quantities at a time, stirring the mixture with a wooden spatula. Then put in the rest of the milk, and afterwards the Spanish White. It is, in general, indifferent which of the oils above mentioned you use; but for pure white, oil of poppy is the best. The oil in this composition, being dissolved by the lime, wholly disappears; and uniting with the whole of the other ingredients, forms a kind of calcareous soap. In putting in the Spanish White, be careful that it is finely powdered and strewed gently over the surface of the mixture. It then, by degrees, imbibes the liquid and sinks to the bottom. Milk skimmed in summer is often found to be curdled; but this is of no consequence in the present preparation, as its combining with the lime soon restores it to its fluid state. But it must on no account be sour; because in that case it would by uniting with the lime, form an earthy salt, which could not resist any degree of dampness in the air.

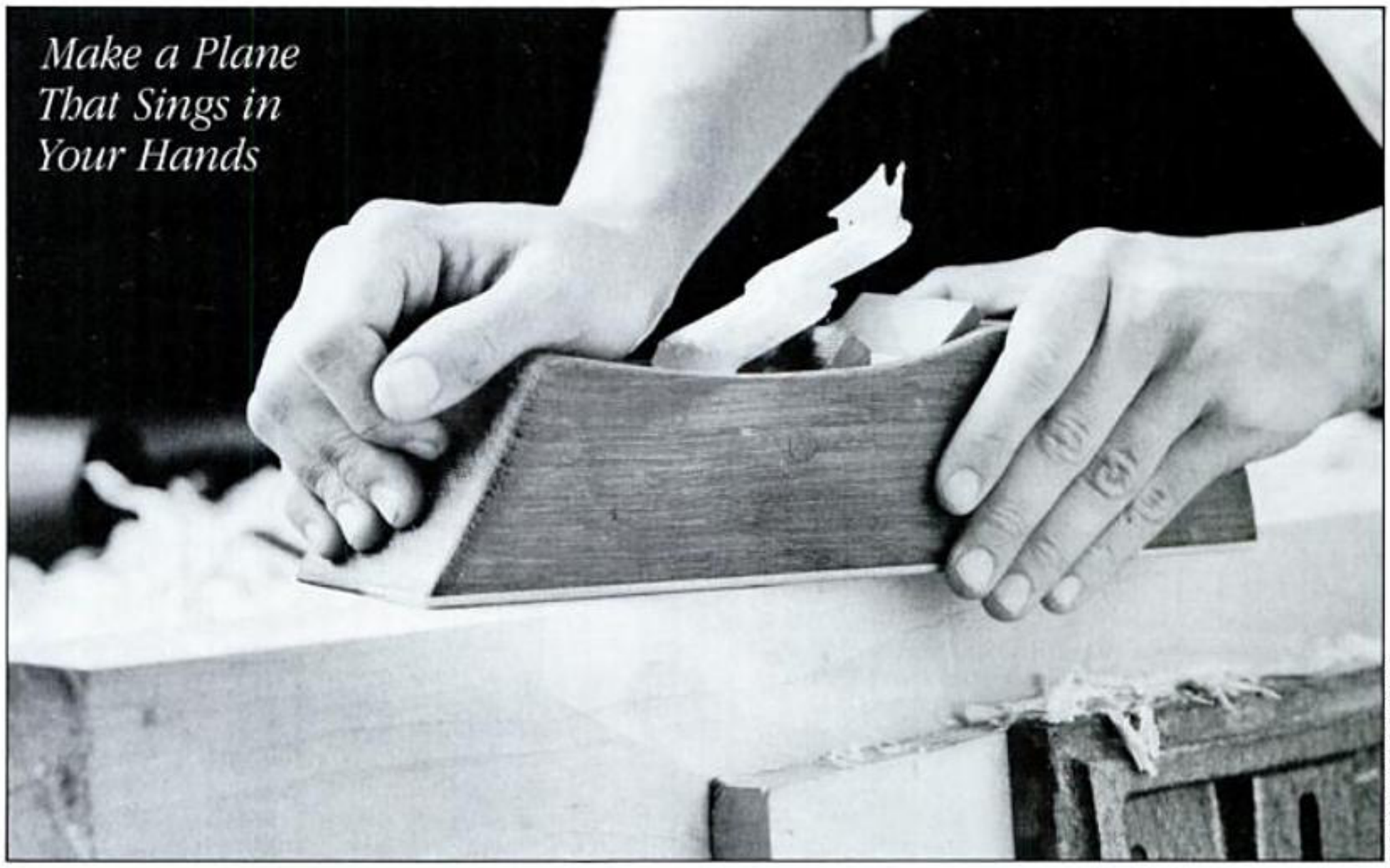
To Make Paint without Oil or Lead. [Take] Whiting 5 pounds, skimmed milk 2 quarts, fresh slacked [slaked] lime 2 ounces. Put the lime into a stone-ware vessel, pour upon it a sufficient quantity of milk to make a mixture resembling cream; the balance of the milk is then to be added; and lastly the whiting is to be crumbled upon the surface of the fluid in which it gradually sinks. At this period it must be well stirred in, or ground, as you would other paint, and it is fit for use. There may be added any coloring matter that suits the fancy, to be applied in the same manner as other paints, and in a few hours it will become perfectly dry. Another coat may then be added, and so on until the work is done. This paint is of great tenacity, bears rubbing with a coarse cloth, has little smell, even when wet, and when dry is inodorous. It also possesses the merit of cheapness, the above quantity being sufficient for 57 yards.

Editor's note: "Skimmed milk" is not the same as today's skim milk. It refers to unhomogenized whole milk from which the top layer of cream has been removed by skimming. "Spanish White" is white clay.

Reprinted from Dick's Encyclopedia of Practical Receipts and Processes or How They Did It in the 1870s *by William B. Dick. (Funk and Wagnalls, 666 Fifth Ave., New York, NY 10019)*

WOODEN SMOOTHING PLANE

BY FIONA ARMAS WILSON



PHOTOS BY ANGELO CAGGIANO

If you aren't quite satisfied with your common, hardware store metal plane perhaps the time has come to make your own. A wooden plane is very simple to make and can perform as well, if not better, than the factory-made variety.

There are many good reasons for making your own planes. Very few planes work flawlessly right out of the box. Since you must treat any plane you buy as a kit, spending hours tuning it up, why not invest this time in making your own instead? The high cost of good factory-made planes is yet another reason to make your own. A collection of store-bought metal planes can drive the woodworker on a tight budget right out of business. Versatility, too, is a point to consider. Once you know how simple it is to make a plane, you won't hesitate to make a special plane that's just the right size and shape for a particular task.

But finally, the main reason I value my wooden planes so much more than their store-bought counterparts is because they transform my relationship with my work. And, having made them myself, I understand my planes fully. This understanding makes for a dialogue between me and the wood—which is what I most want from my work. What could make work more of a delight than whisking shavings away with a plane that has sprouted forth from your own hands?

In this article I'll explain how to make a wooden smoothing plane, but the same procedure applies to larger flat-bottomed planes as well. Other types of planes—block planes, coopering planes, and rabbet planes to name a few—can also be made by hand. But, because of their differing shapes and/or blade angles the steps are somewhat different from the ones outlined in this article.

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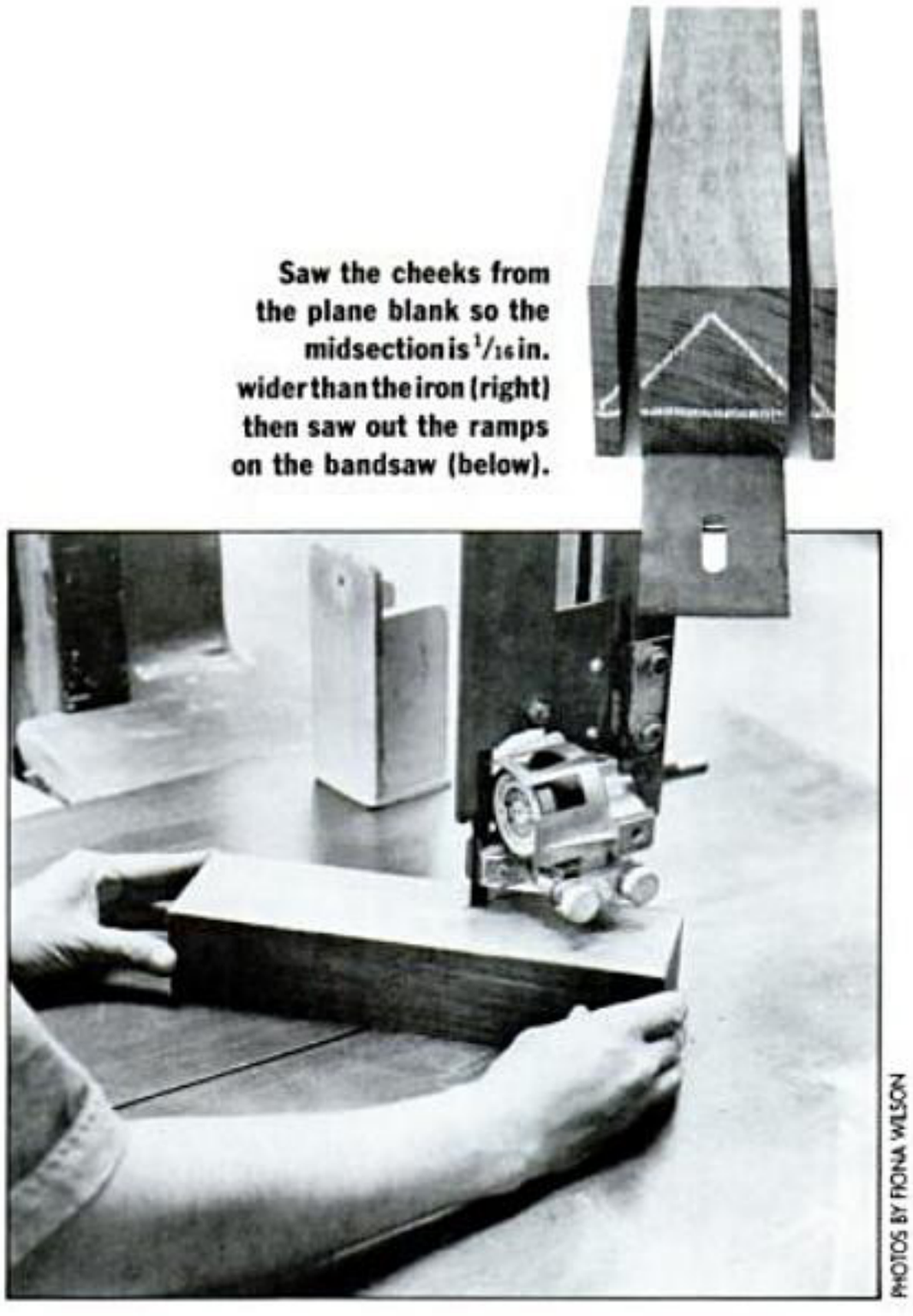


Saw the cheeks from the plane blank so the midsection is 1/16 in. wider than the iron (right) then saw out the ramps on the bandsaw (below).

PHOTOS BY FIONA WILSON

Gathering the Materials

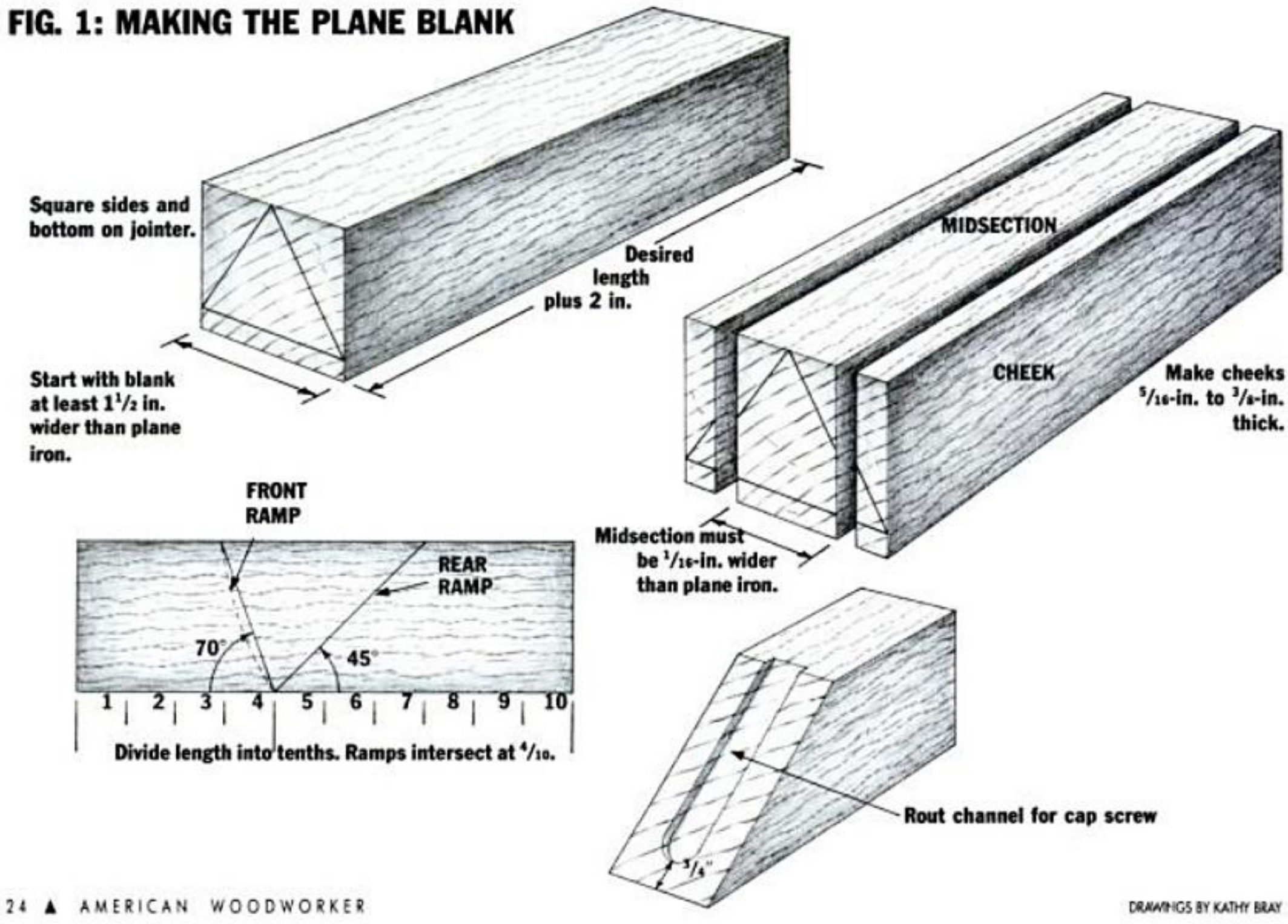
The first step in making a wooden plane is gathering the necessary supplies. You'll need the following: wood for the plane blank and sole, an iron, a chip breaker, a cap screw, wood for the pin, and ten 1/4-in. dowels.

The plane blank may be either a solid piece of wood or one glued up from several thinner pieces. The type of wood you choose is important. Dense but not brittle is the rule. Some good choices are: hornbeam, cherry, hard maple, beech, white or Japanese oak and birch. Choose one of the denser woods if you decide against gluing a sole on the bottom of the plane. Adding a sole allows you to select one of the less-dense woods for the body of the plane, making it lighter in weight. Pick a very dense wood for the sole. The two most often used woods for plane soles are lignum vitae and ironbark. These woods are naturally waxy, so they reduce much of the friction. The sole should be about 1/8-in. thick.

The main size constraint of the plane is the size of the iron you choose. Your plane blank must be *at least* 1 1/2 in. wider than the width of your iron. Wider is better than narrower because between sawing out the cheeks of the plane and jointing the midsection much of the excess width will be removed. I chose to make my smoothing plane with a 2-in. iron, so I started with a 3×4×10 in. blank with the 4-in. dimension being the width of the plane.

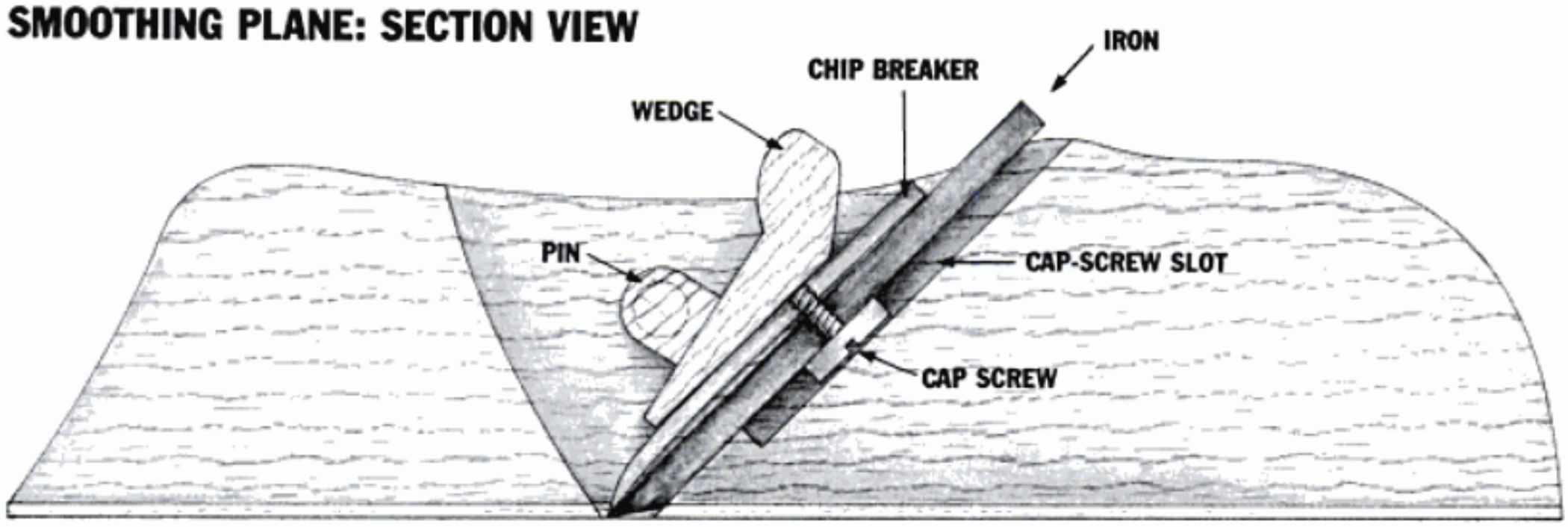
If possible, it's best to orient the end grain of the plane blank vertically to increase the plane's dimensional stability. If you're gluing up a blank from thinner stock instead of starting with a solid block, you have

FIG. 1: MAKING THE PLANE BLANK



DRAWINGS BY KATHY BRAY

SMOOTHING PLANE: SECTION VIEW



the option of alternating the grain direction from piece to piece as you glue up the blank. This adds stability.

To make the pin, you'll need a piece of straight-grained, dense wood, 3/4-in. square and about 12 in. long. You'll also need a few 1/4-in. diameter dowels.

For your first plane, a Stanley iron from the hardware store will do fine, though if you don't mind spending extra, I recommend Hock plane irons (available from Hock Handmade Knives, 16650 Mitchell Creek Dr., Fort Bragg, CA 95437) because they're thicker and, therefore, easier to hone. They also keep an edge longer since they are made of high-quality steel. Hock irons come complete with chip breaker and cap screw, but if you choose a different brand of iron, you might consider making your own breaker out of a mild-steel blank approximately half the thickness of the iron.

Building the Body

Start by squaring the blank on the jointer. The next step is to saw off the cheeks of the plane on the bandsaw as shown in the drawing (see Fig. 1). You should aim to end up with a midsection 1/16-in. wider than the width of your iron and cheeks that are 5/16-in. to 3/8-in. thick. Draw a cabinetmaker's triangle on the end of the blank so you can reassemble the pieces in their original order and proceed to resaw the cheeks of the plane. Smooth the exposed inner surfaces on the jointer or with a scraper.

Next, choose which end of the blank is to be the front of the plane and then draw ramp lines on the midsection as shown in the drawing. The back ramp, which is the bed for the iron, should be at 45° from the bottom of the plane (standard pitch) if you plan to use it primarily on softwoods and 50° for hardwoods (York pitch). The front ramp should be cut on a curve at around 70°. These two ramps intersect at the bottom and create the mouth of the plane. The mouth should be located just forward of center. If you divide the length of the blank into tenths, the opening should be 4/10 from the front as shown. Saw out the ramps on the bandsaw. You'll end up with three separate pieces: a front piece, a rear piece and the center cutout. Save the pie-shaped center piece to make the wedge.

Next, square up the rear ramp with respect to the sides of the midsection. This is where a block plane comes in handy. Be sure it's very sharp, because you will be planing end grain. The flatness of this ramp surface is crucial to the plane's performance because it's the bedding surface for the iron. Make all your adjustments to the ramp surface itself. Don't plane any wood off the sides of the midsection or you'll have problems later when you glue on the cheeks.

The next step is to rout out the groove for the cap screw. This can be done several ways; I use a router, but a chisel or gouge will work just as well. If you become enamored with making your own wooden planes, you might consider making an adjustable routing jig that guides the router to make just the right size cap-screw slot. However you choose to do it, the slot for the cap screw should be just wide enough and deep enough to accommodate the head of the cap screw. If the groove is too shallow, the screw head will touch the bottom of the groove and prevent the iron from resting flat

FIG. 2: LAYING OUT THE MOUTH

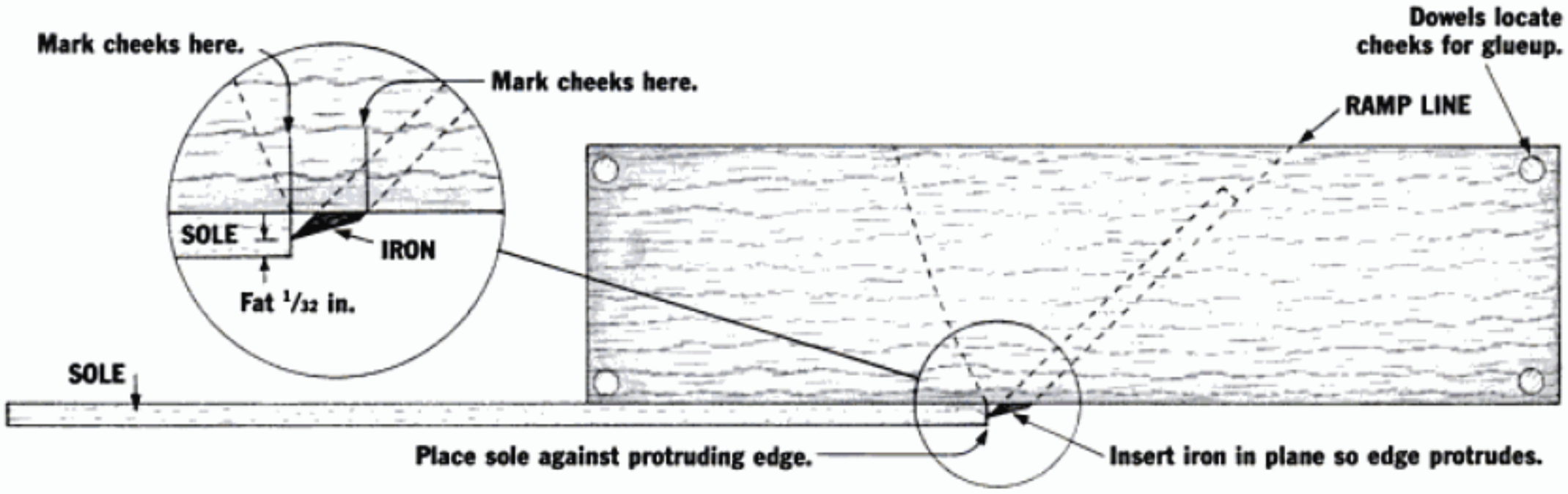
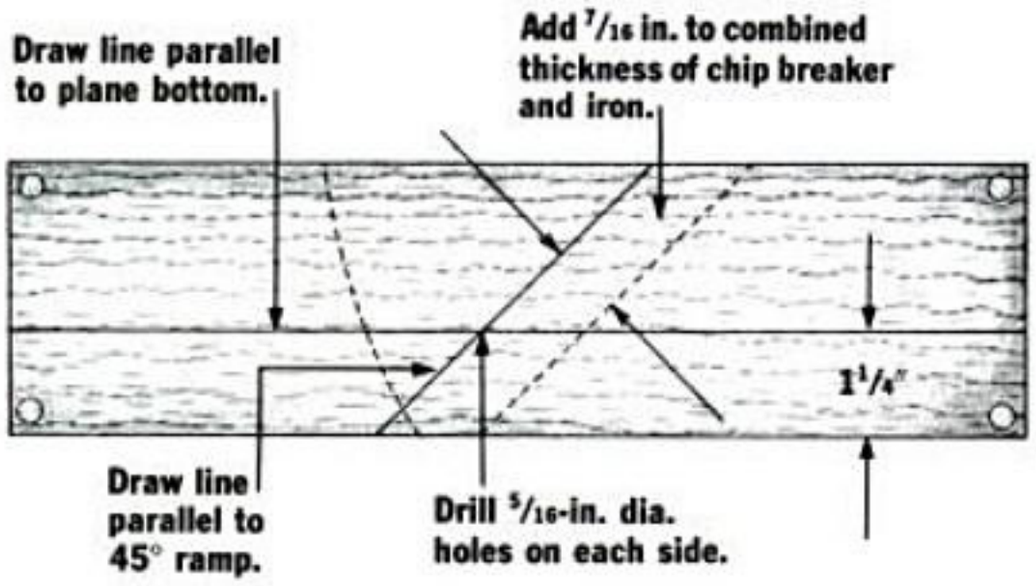
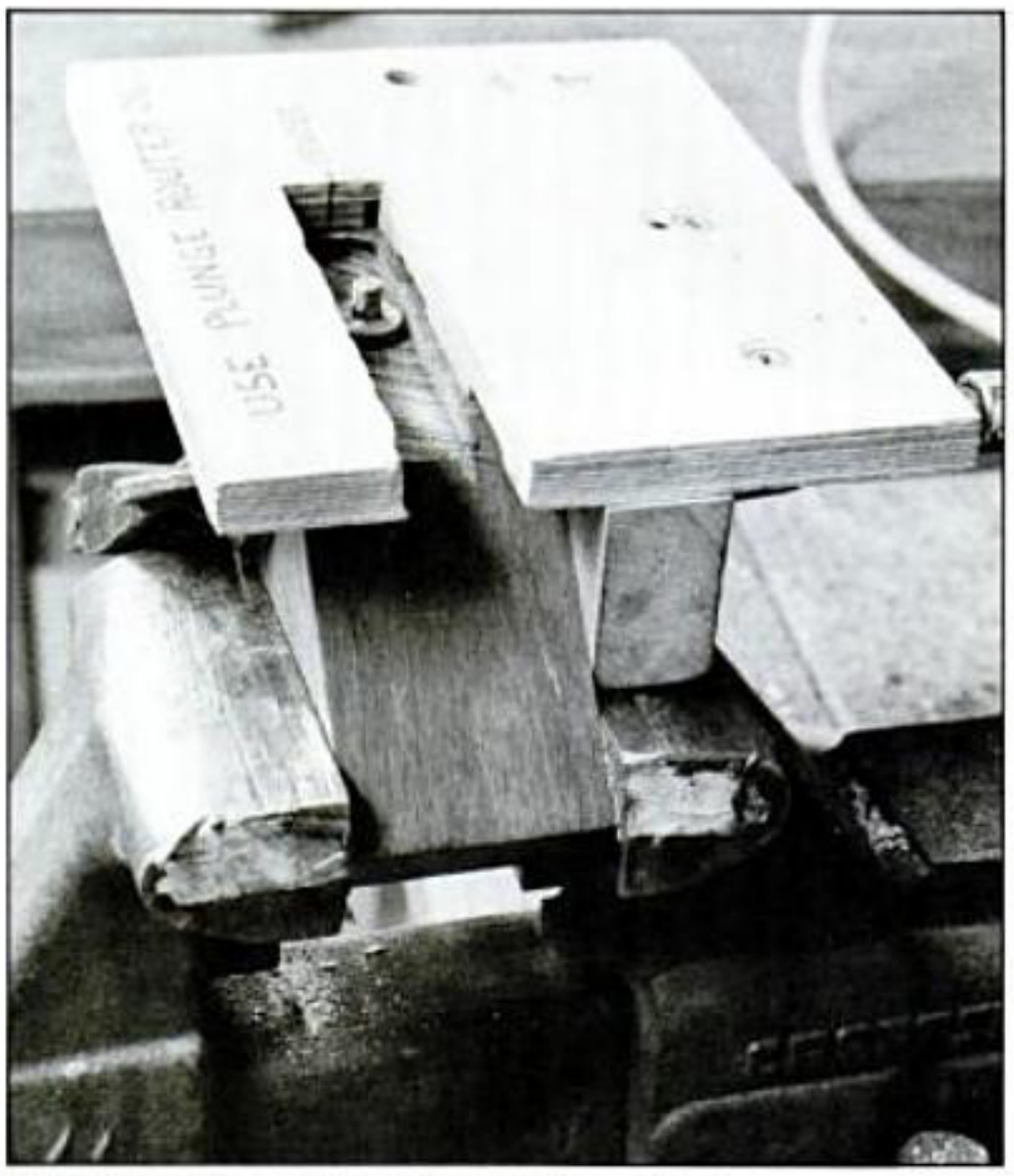
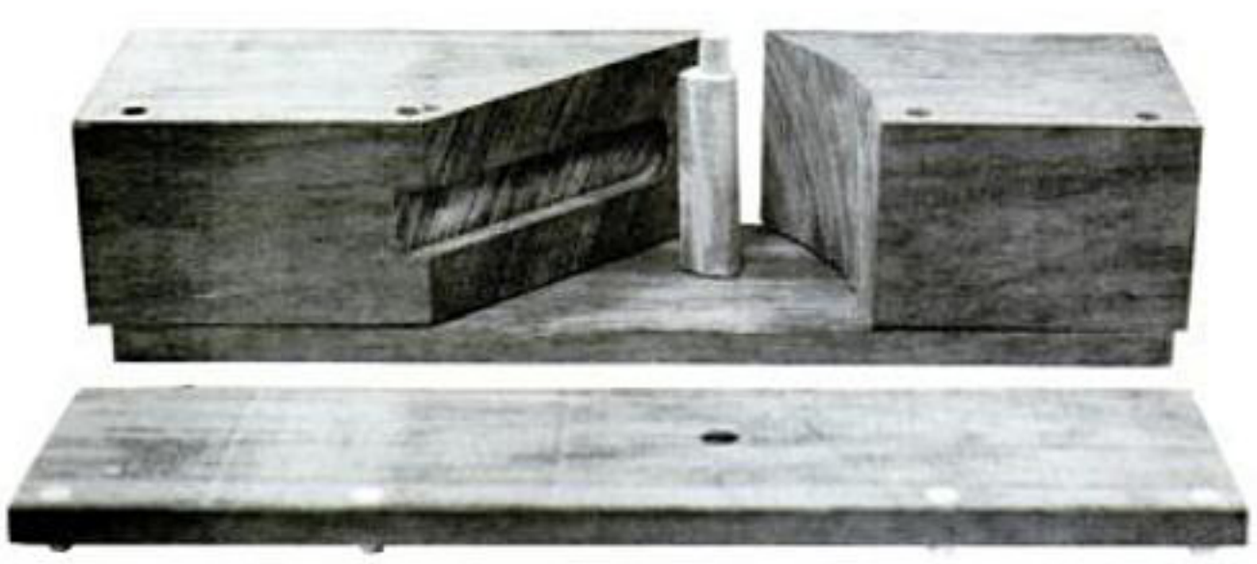


FIG. 3: LOCATING THE PIN





Routing the cap-screw groove is easy if you make a jig. A guide bushing on the router base rides inside the jig's slot.



The plane assembly ready for glueup. Dowels along the top edge position the pieces.

on the ramp. The slot should start 3/4 in. up from the bottom of the ramp and continue all the way up through the top as shown.

You're now ready to locate the cheeks of the plane in relation to the two parts of the midsection. It's important to do this step carefully because it determines the size of the plane's mouth. If you make the mouth too wide you will never fetch a fine shaving and too narrow means a much longer filing session later when you tune up the mouth. So, in order to achieve a perfect mouth, first place the midsection pieces between the two cheeks (refer to your cabinetmaker's triangle to reassemble the parts) and turn the entire plane on its side with the bottom facing toward you. Then put the iron in tight against the rear ramp and hold it so the edge just pokes through the mouth. With your free hand, hold the sole flat against the plane bottom just in front of the iron's edge. Adjust the iron so that the cutting edge of the iron touches the sole a fat 1/32 in. above the sole's bottom surface. Note: If you're making a plane without a sole, set the iron so that the edge is a fat 1/32 in. above the plane bottom.

Next, with a sharp pencil, mark on the bottom of the cheeks where the front end of the sole (the end that's touching the iron) registers. Make another mark on the cheeks at the bottom edge of the 45° ramp. These two marks indicate where to set the edges of each midsection to form the proper mouth size. Once you've marked these points, refer to them as location marks for the midsections and clamp the cheeks to the midsections, and drill four 1/4-in. holes about 1/2-in. deep on each side of the plane across the top edge of the cheeks in the corners as shown. Tap dowels in these shallow holes and cut them off flush so they won't interfere when you clamp up the plane. In the end, these dowels will not show because you'll cut them off later when you bandsaw the final shape of the plane.

Put the plane aside and work on the iron and chipbreaker. For those of you making your own chip breaker, your blank should be the same width as the iron but a bit shorter than the iron in length. As shown in the drawing, the chip breaker should have a gradual curve. Clamp the bottom quarter of the chip-breaker blank in a vise and apply an even-pressure tug. This is best done with a 2-in. × 2-in. × 6-in. block of wood with a slot cut out in one end about the width of the breaker (see photo). This will produce a soft curve that will function to hold the bottom edge of the chip breaker tight against the iron.

Whether you make a chip breaker or buy one, you'll need to grind and hone the breaker's slope. In the end, your breaker should have a gentle slope that sends the shavings up the face of the chip breaker and out the top of the plane. A steep slope will hinder the passage of shavings and clog the mouth. The underside edge of the breaker should also be honed to create a seal between the iron and breaker at the very tip once the breaker is screwed tight against the iron. Once you've polished up the breaker's curve and the underside edge, assemble the iron and chip breaker.

If you're making your own chip breaker, you'll have to drill and tap the cap-screw hole in the breaker. To do this, place the chip breaker against the iron and trace the iron's cap-screw slot onto the breaker. In the center of the traced slot, make a mark with a centerpunch, drill a hole and tap threads for the cap screw using the correct size tap and a bit of oil. Thread the cap screw into the hole and assemble the iron and chip breaker.

At this point, you may wish to grind and hone the iron, too, but this step isn't really necessary until the end.

The next step is to locate and drill the holes for the cross pin. Start by drawing a line indicating the exact position of the rear ramp on one side of the plane. Then, measure 1¼ in. from the bottom of the plane at two points (do not include the sole in this measurement) and draw a line parallel to the bottom of the plane as shown in Fig. 3. Assemble the iron and chip breaker and measure their combined thickness at the widest point. Add 7/16 in. to this measurement and

WORKING WITH A WOODEN PLANE

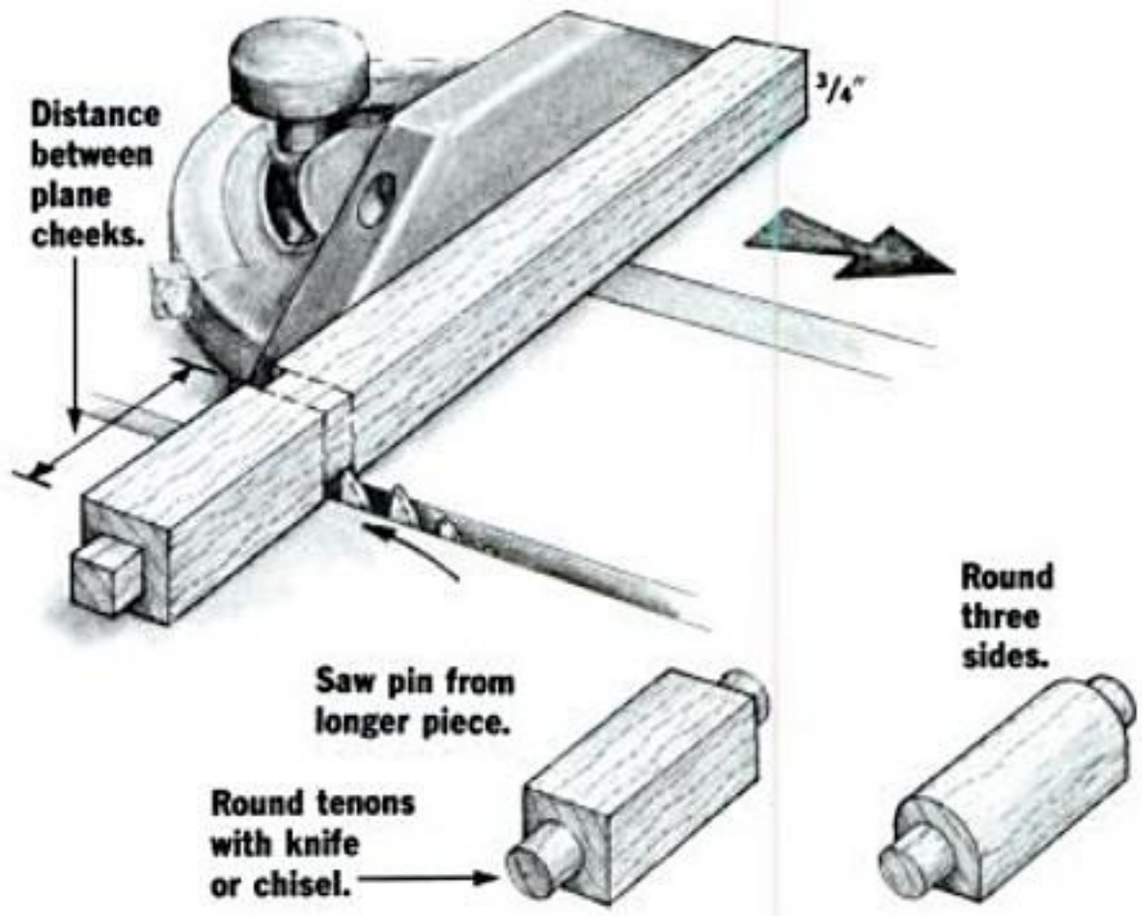
Adjusting wooden planes is an art in itself, it takes patience and practice. The iron, of course, must be sharp and the edge of the chip breaker should be set about 1/32 in. behind the iron's edge. Begin by setting the iron so that it is not yet through the mouth and tapping the wedge firm. Then turn the plane upside down and sight down the length of the bottom from the back end. Gently tap the end of the iron with a small hammer until just a glint of it pokes through the mouth. With your eye or your finger, check that the iron projects evenly. Give the wedge a good tap to hold the iron in this position.

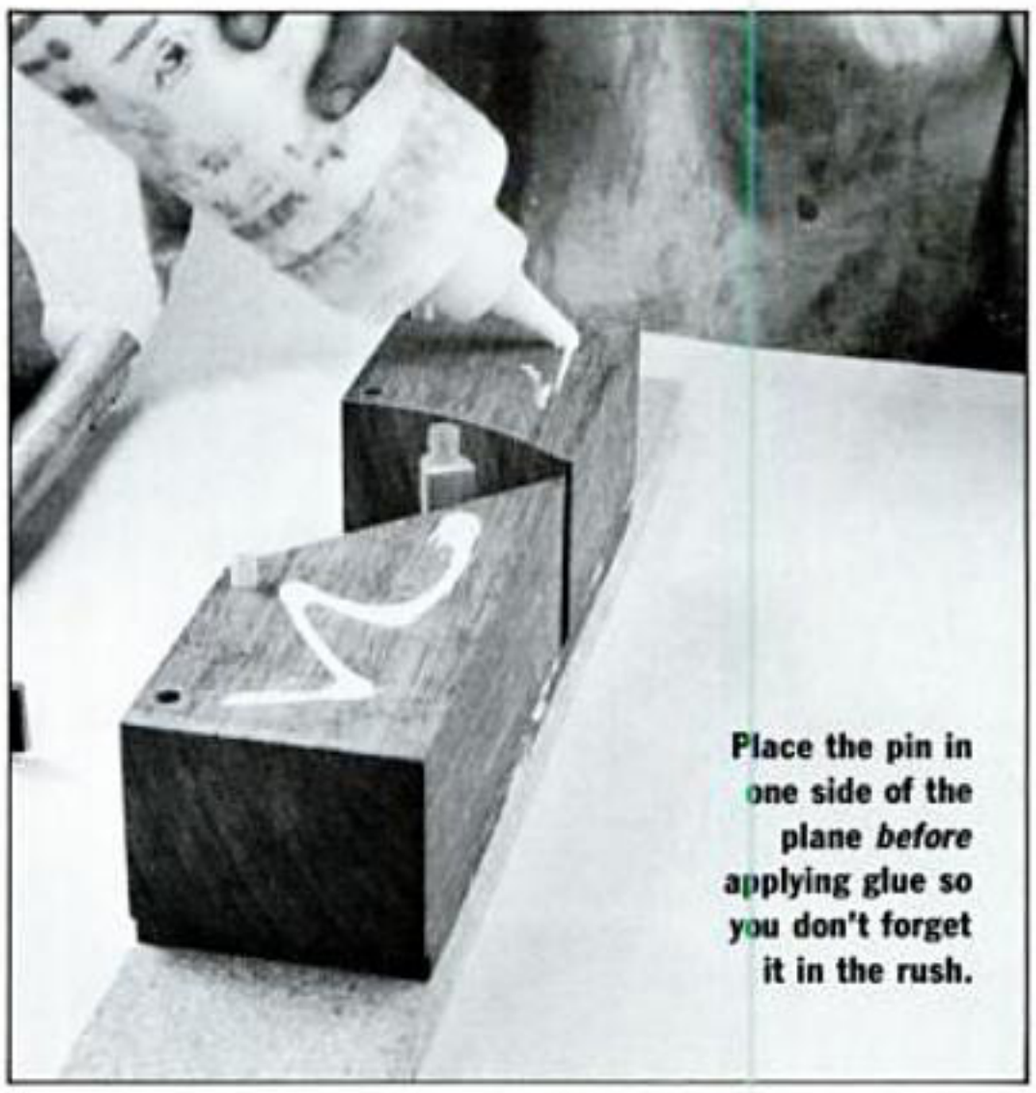
Test the plane on a scrap of wood. If you get an even, thin shaving from the center of the blade, the iron is ready to go. Often it takes a few tries to achieve this.

If the shaving is broken lengthwise, your iron is either slanted to one side or it has a nick in it. If the plane chatters, you may have the iron sticking out too far. To retract it, turn the plane upside down again and tap the back end of the plane—gravity will act to pull in the blade. You'll need to tap the wedge again.

Chatter may also be resolved by hollowing out the underside of the wedge to increase the pressure on the iron. Your stroke, too, will affect the shaving you get. Keep the motion continuous, shifting your weight from the front of the plane at the beginning of the stroke to the back of the plane at the end of the stroke. If you allow your body to enter into the stroke, you also will avoid fatigue in the arms. Holding the plane at a slight diagonal to the direction of your stroke helps you keep the stroke smooth. In time, you will be able to make the adjustments very rapidly, and the movement will become as graceful as a dance.—*F.W.*

FIG. 4: MAKING THE PIN





Place the pin in one side of the plane *before* applying glue so you don't forget it in the rush.

TIM COLEMAN

Rout the mouth opening in the sole with a guide-bushing equipped router and a template.

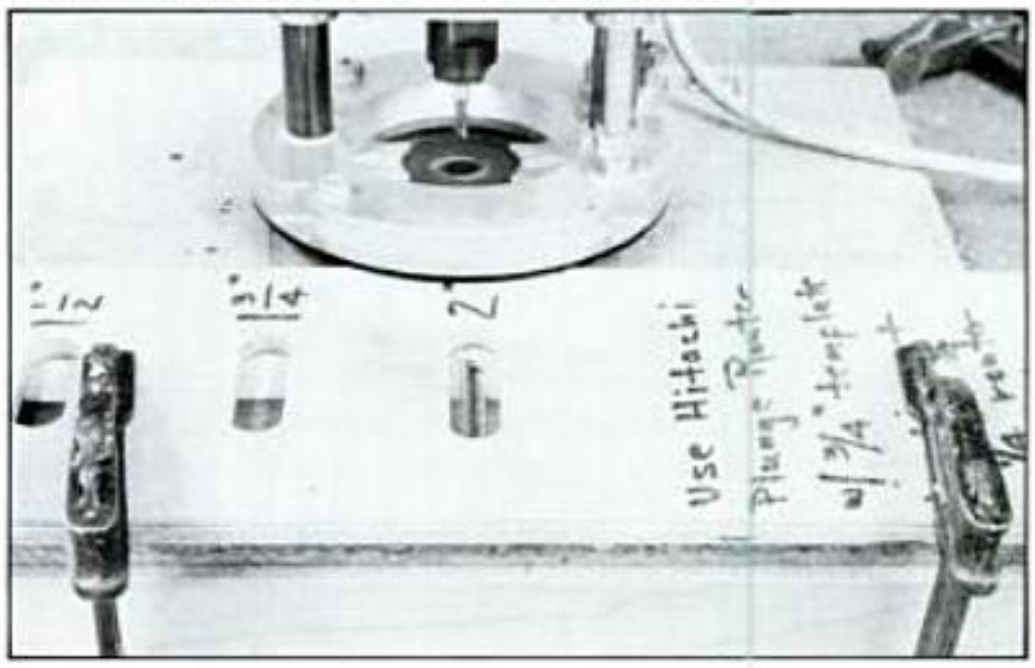
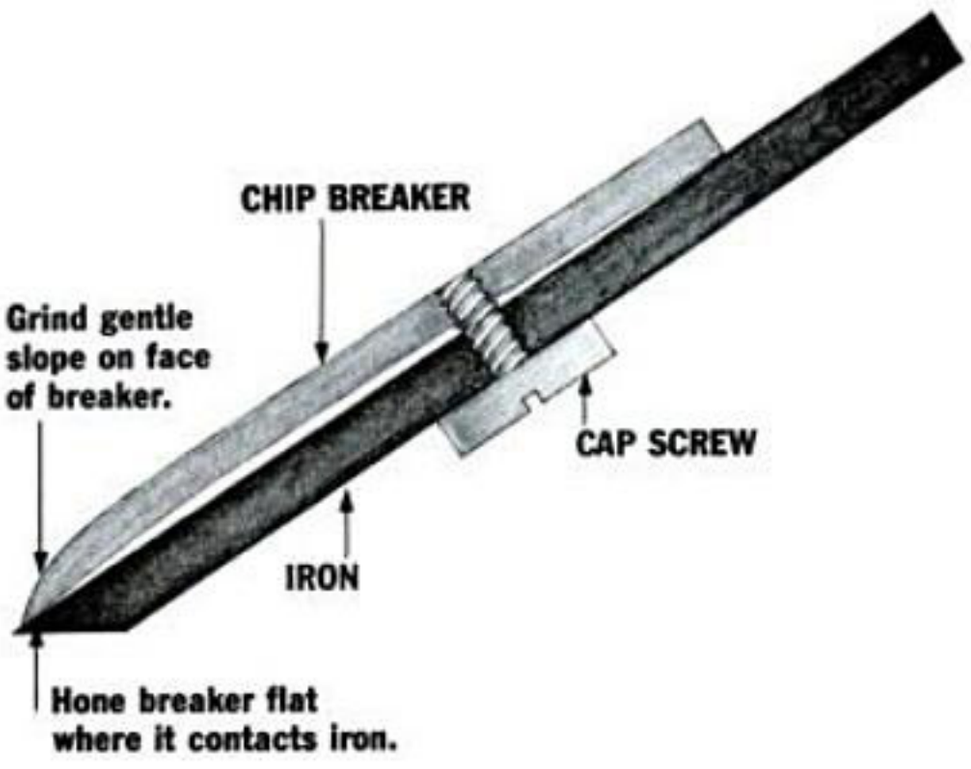
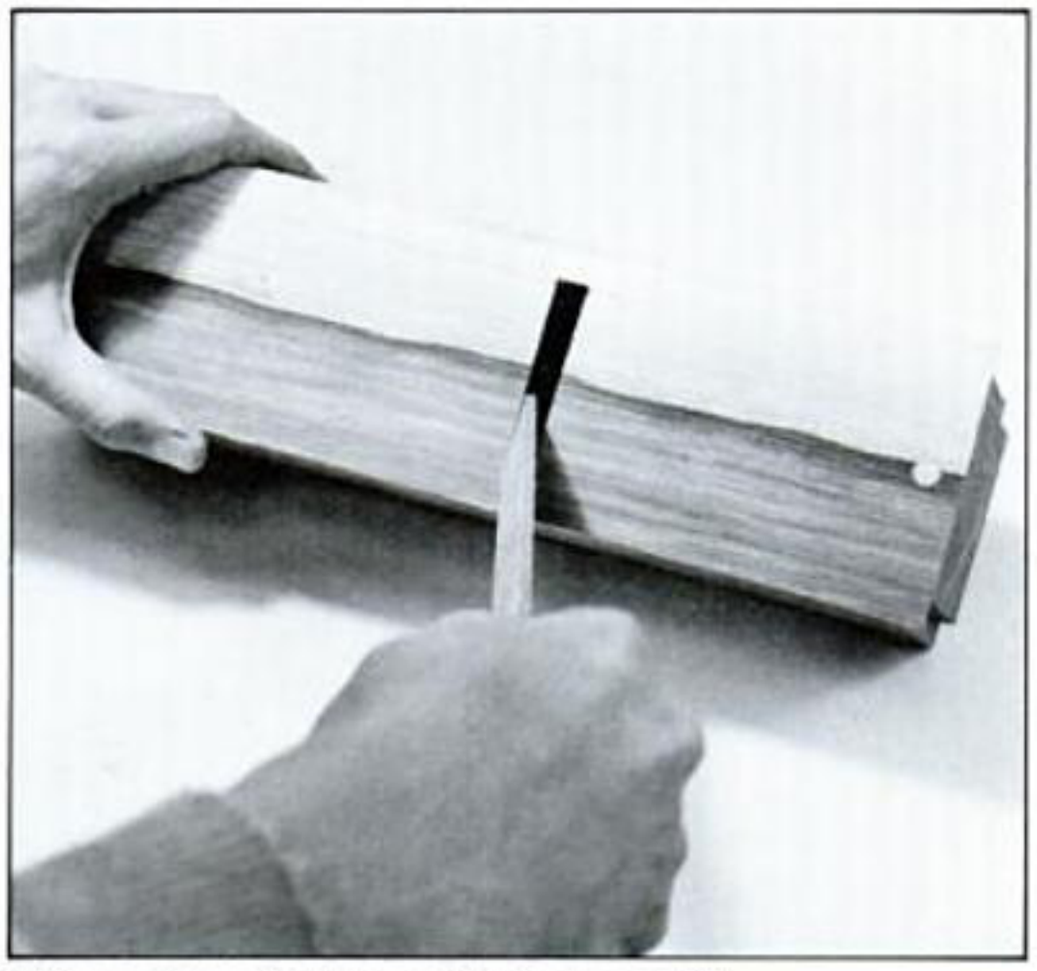


FIG. 5: TUNING THE IRON AND CHIP BREAKER





With your file angled in toward the front ramp, file the front of the mouth to reveal the iron.

The chip breaker has a gentle curve and a sloping face that allows the shaving to pass up the face of the breaker.

measuring perpendicular to the ramp—draw a line parallel to the rear ramp as shown in the drawing. Drill a 5/16-in. dia. hole at the point where this line intersects the line you drew parallel to the bottom of the plane. This is best done with a drill press or boring machine, since accuracy is important. Place the pie-shaped block you cut out of the midsection back in temporarily to prevent wood blow-out when the drill breaks through the cheeks. Repeat the entire procedure to mark and drill the other side.

The cross pin itself comes next. You need to cut a 5/16-in. dia. round tenon on either end of the pin. I roughed out a square tenon by making a series of crosscuts on the tablesaw then rounded the tenon with a knife. Draw a cross on one end of your 12-in. length of 3/4-in. square pin stock to find the center. This point becomes the center point for the tenons. Cut a 5/16-in. square tenon at one end by making a series of crosscut passes on the tablesaw. Measure from the inside of one cheek to the other and mark off that distance on the pin stock to locate the second tenon. The length of pin between the two tenons should be slightly less than the distance between the cheeks of the plane. You don't want it too tight—the pin should be able to turn in its holes.

After you've sawn both tenons, cut the pin off from the 12-in. piece of stock, round the tenons to fit the holes, and shape the pin so that it's flat on one side (the side that will contact the iron) and round on all the others as shown in Fig. 4. Fit the pin in its holes and make sure that it can turn. Then, holding the plane sections tightly together, saw the pin's tenons off flush with the outside of the cheeks.

Now you're ready to glue the plane together. You'll need two scrap pieces of wood the same height and length as the plane, and several clamps. Insert the cross pin in one of the cheeks while you spread the glue—many a plane has been glued together with this critical pin left out. Don't make this mistake! The dowels will provide you with the proper placement of the cheeks. Place the protective pieces of wood over them and then the clamps, crowding them on as evenly as possible (approximately at 2-in. intervals). Allow the glue to dry overnight.

Once the glue dries, make the wedge from the pie-shaped piece you cut out of the midsection. Draw a wedge on the flat side of this piece with the grain running the length of the wedge. The wedge angle should be cut at approximately 10° so that it holds well. Saw out the wedge on the bandsaw, and, with files, round the edges and smooth the bandsaw marks on the angled face.

With the iron, chip breaker and wedge in the plane, the wedge should contact the pin fully across its width. A wedge that is not properly fitted will sometimes produce a hollow sound when you tap the back of the plane. If this happens, try making the underside of the wedge slightly concave, and make sure the wedge has full contact with the pin. If the wedge slides out when you tap the plane, the angle of the taper is too steep.

You can now glue on the sole. Begin by passing the bottom of the plane *lightly* over the jointer to clean up the surface. Take as light a cut as possible. Set the plane on top of the sole, making sure that the grain direction of the sole is oriented so that any run-out goes downhill toward the back of the plane or you'll have chip-out and extra friction. Trace the mouth opening onto the sole and cut out this slot with a chisel, coping saw or a router. The back edge of the sole opening must

be chopped at a 45° angle—an extension of the ramp above it. Sight down the flat of the ramp, and shave or file this opening until it is exactly even. Do this with care because the iron must lie perfectly flat on the ramp. Even a slight error means a poorly positioned iron. Note that even after you have cut this slot, the iron should not yet protrude from the mouth—this result comes later with a bit of filing.

Next, clamp the sole in place and locate the sole with 1/4-in. dowels as you did with the cheeks. Drill and install one dowel at each end and saw the dowels off flush. Glue on the sole using scrap pieces to protect the sole from the clamps. Allow this to dry overnight.

Now you're in the final stretch. Flattening the sole is the next step. Replace the iron and chip breaker assembly with a piece of wood the same size and thickness as the iron and breaker pair and tap the wedge down on it. This assures that the plane is set at its usual pressure yet, when you pass the plane over the jointer there is no hazard of the iron falling down into the cutter. First joint one side of the plane, taking care not to remove much wood. Next, pass the bottom of the plane once over the jointer in the proper direction taking *as light a cut as possible* keeping the side you just jointed against the fence. If you remove too much wood, you'll open the mouth too far and ruin the sole. Finally, joint the other side of the plane.

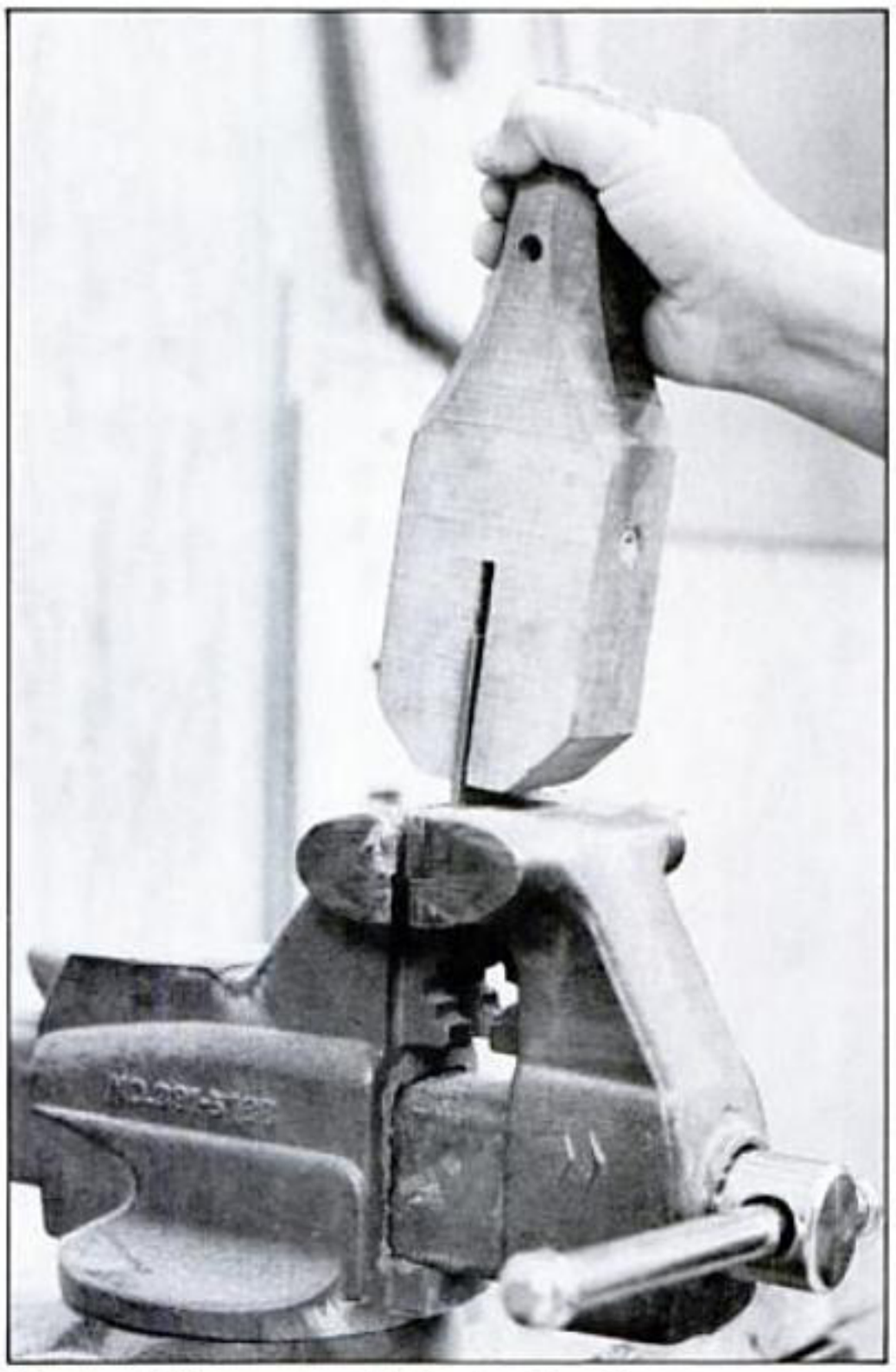
Set up a long piece of sandpaper on a flat surface, such as a piece of glass or the tablesaw top. Rub the bottom of the plane back and forth over the sandpaper until you have a flat surface square to the cheeks. Again, the iron should not be poking through yet.

Opening the mouth is the next step. With a thin file, slowly file the front edge of the mouth until the edge of the iron just pokes through, making sure the mouth opening is even across the plane. This front edge should angle forward toward the curved ramp so the shaving can exit properly. Also, file a small chamfer on the back edge of the mouth to prevent chip-out.

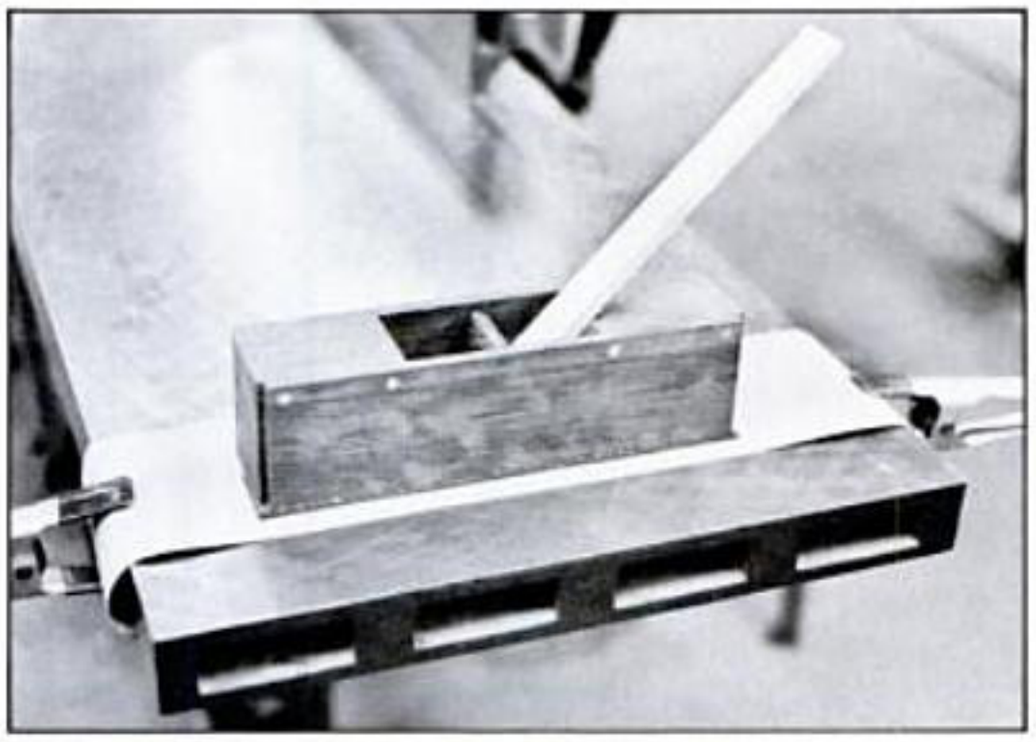
At last, you are ready to give the plane its final shape. The options are numerous, and the only parameters you have to meet are comfort, accessibility to the iron and wedge, and a flat area on the back end of the plane to allow for adjustments of the iron (done by tapping on the back end with a small hammer.) The bandsaw is the best machine for cutting the initial shape, you can then refine this with spokeshaves, files and carving tools. Sometimes crosshatching on the sides, where the fingers clutch the plane, provides extra control. Also, indentations for the fingers are a possibility, though if these recesses are too large they may reduce the stability of the plane.

Once you've finished your plane, the main work is completed, but you will occasionally need to check the flatness of the plane bottom. Wooden planes have a tendency to acquire hollows just in front of the iron and bulges just behind, but check the entire length and width of the bottom with an accurate straightedge and flatten the bottom, if necessary with either a scraper or sandpaper on a flat surface. The iron's edge, too, will need frequent attention—don't expect a quality shaving from a dull iron. ▲

Fiona Wilson learned about planemaking in the Fine Woodworking Program at the College of the Redwoods in Fort Bragg, CA. She is grateful to the program's staff for its help with this article. She is Assistant Editor of AMERICAN WOODWORKER.



If you're making your own chip breaker, form the curve by bending gently with a shopmade lever.



Flatten the bottom of the plane by sanding. Replace the iron and breaker with a piece of wood to tension the plane.

CURVED-TOP WALL MIRROR

Splined Miters Add Strength and Beauty

BY DENNIS WATSON

When my son turned 13, we suddenly had need for another mirror. The boy we could never get clean suddenly took an interest in his looks. I designed and built this red oak mirror to hang over his dresser.

The curved top is glued up from four separate pieces joined with 22½° miters. I reinforced the miters with walnut splines which contrast nicely with the oak.

You may be tempted to order the glass for the mirror before you've built the frame. Instead of trying to build a frame to match a pre-cut mirror, I think it's better to order the mirror after you've cut the mirror rabbet in the back of the frame. Make a cardboard template that fits the opening, and let the glass company cut a mirror to match your opening.

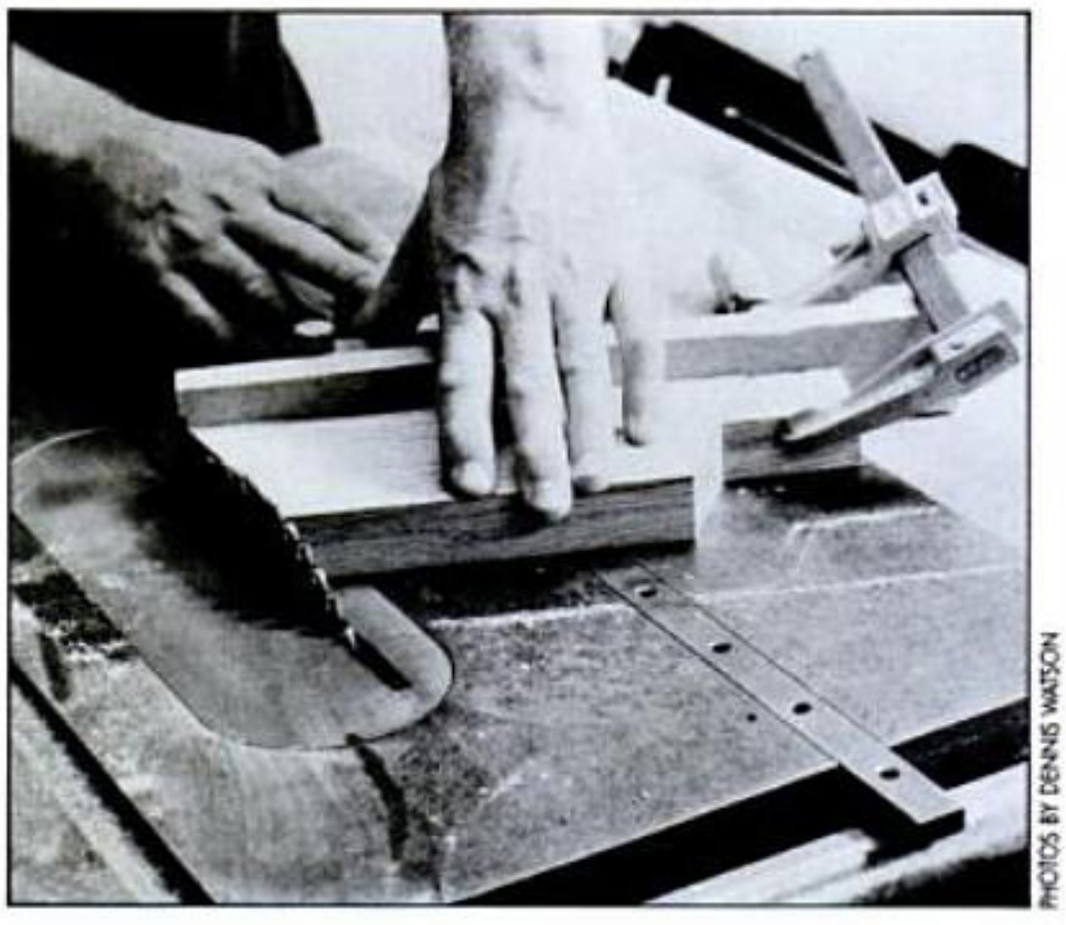
Begin construction by cutting the parts from ¾-in. stock. Rip the sides, bottom, and top pieces to the widths shown in the Bill of Materials, but leave them at least ½-in. longer than the given length so that you don't have to cut miters on the very end of the board.

The next step is to cut the 22½° miters that join the four top pieces. I've found the best way to get the precise setting on a saw is by trial and measure. The measurement scales on most machines are notoriously bad—trust them to get you close, then cut a test joint on two scrap pieces of wood. Hold the boards together to form a trial 45° joint, and check it against your 45° square. If the joint isn't perfect, adjust the saw slightly and try again. When the sample joint is perfect, miter the four top pieces. Putting a stop on the miter gauge, as shown in the photo, ensures that each piece is exactly the same length.

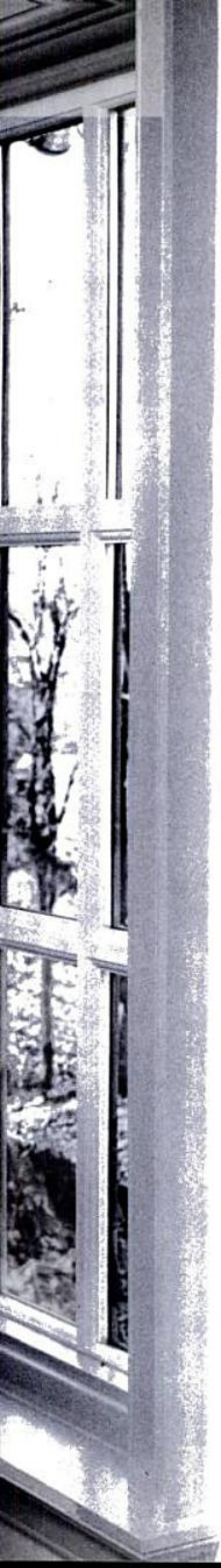
Even a well-cut miter isn't very strong, because most of the glue surface is end grain, making for a weak joint. I strengthened each joint by inserting an exposed walnut spline. To do this, cut a ¼- × 1-in. groove for the spline on the tablesaw or with a ¼-in. slot cutter on a router table. If you saw the spline groove on the tablesaw, don't try to make the cuts freehand. Clamp the frame parts in a tenoning jig to keep your fingers safely away from the blade.

Make the miter splines from walnut. Start by ripping a 2-in. wide strip from a ¾-in. walnut board. Resaw the strip on the tablesaw or bandsaw into two 5/16-in. thick strips and either hand plane the strips to final thickness or run them through the planer. Check the fit as you go or you're likely to end up with splines that are too thin for the groove. Once the thickness is right,

A stop block keeps the length of the four top pieces uniform.

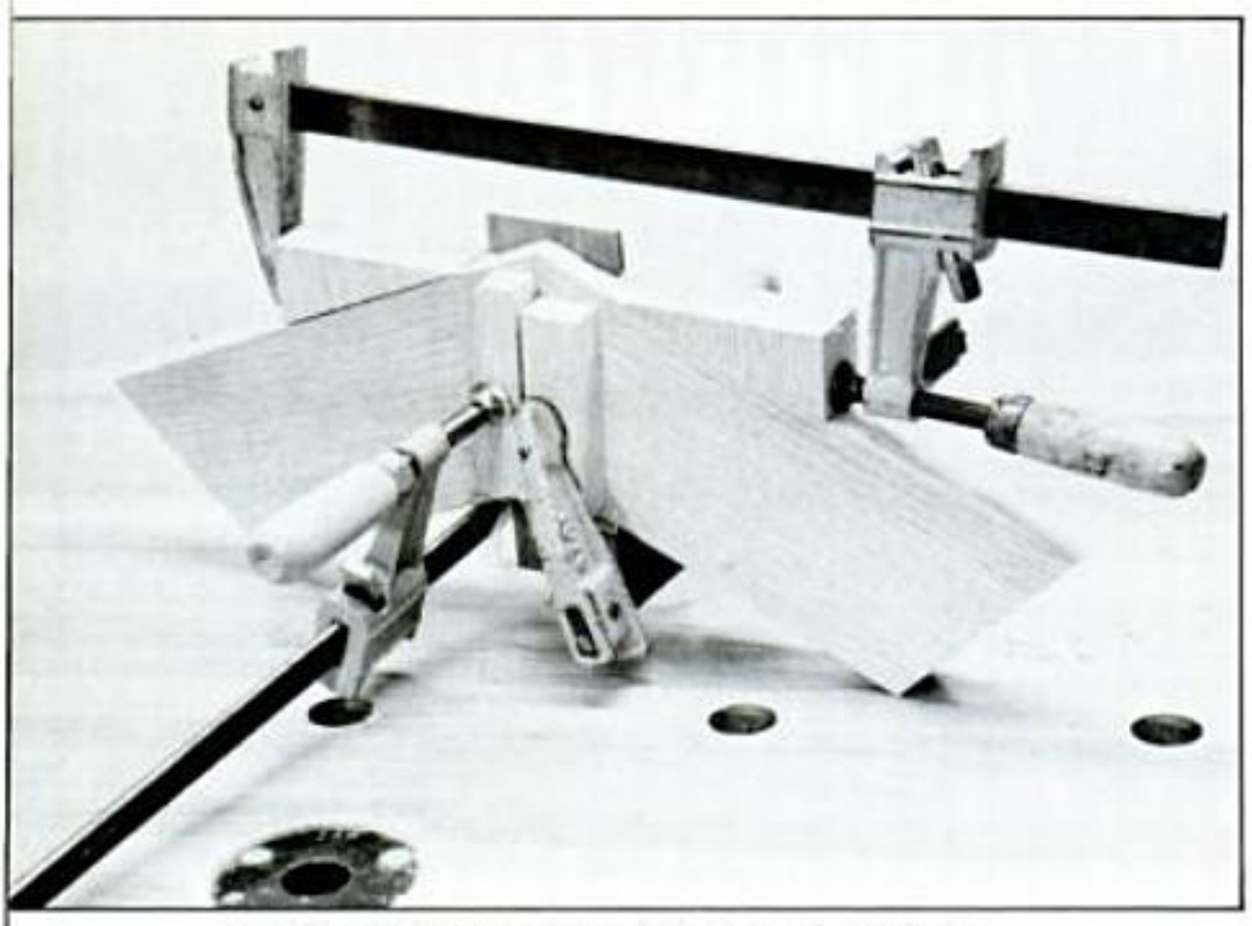


PHOTOS BY DENNIS WATSON



This mirror's good enough to look at. It's made of red oak and joined with walnut-splined miters for strength as well as looks.

MITCH MANDEL



Don't try to glue up the entire top at once—glue it up in two sections. The scrap left from mitering the ends provides a clamping surface.

cut the strip into 1-in. wide splines.

Before gluing, dry fit the top pieces together to make sure the joints pull up tight. Miters tend to slip under pressure from clamps, so I glue clamping blocks to the frame as shown. Glue both surfaces as you normally would but put a piece of heavy paper between the blocks and the frame. Let the glue dry before you clamp up the miters. When the time comes, you can remove the blocks by tapping sharply with a hammer. A scraper will remove the paper and glue.

I glue the top of the frame in two sections. First I glue up two pieces to form one half of the curve as shown in the photo, and then I glue up the other two pieces to make the other half. Clamp across the face of the joint as shown, to keep the frame tight against the spline. When both sections are dry, I glue the pair together to form the entire arch.

Now miter the joints for the bottom. Set up the 45° miter with the technique you used earlier, but check the sample joint against a 90° square. Cut the top ends of the mirror sides at 90°.

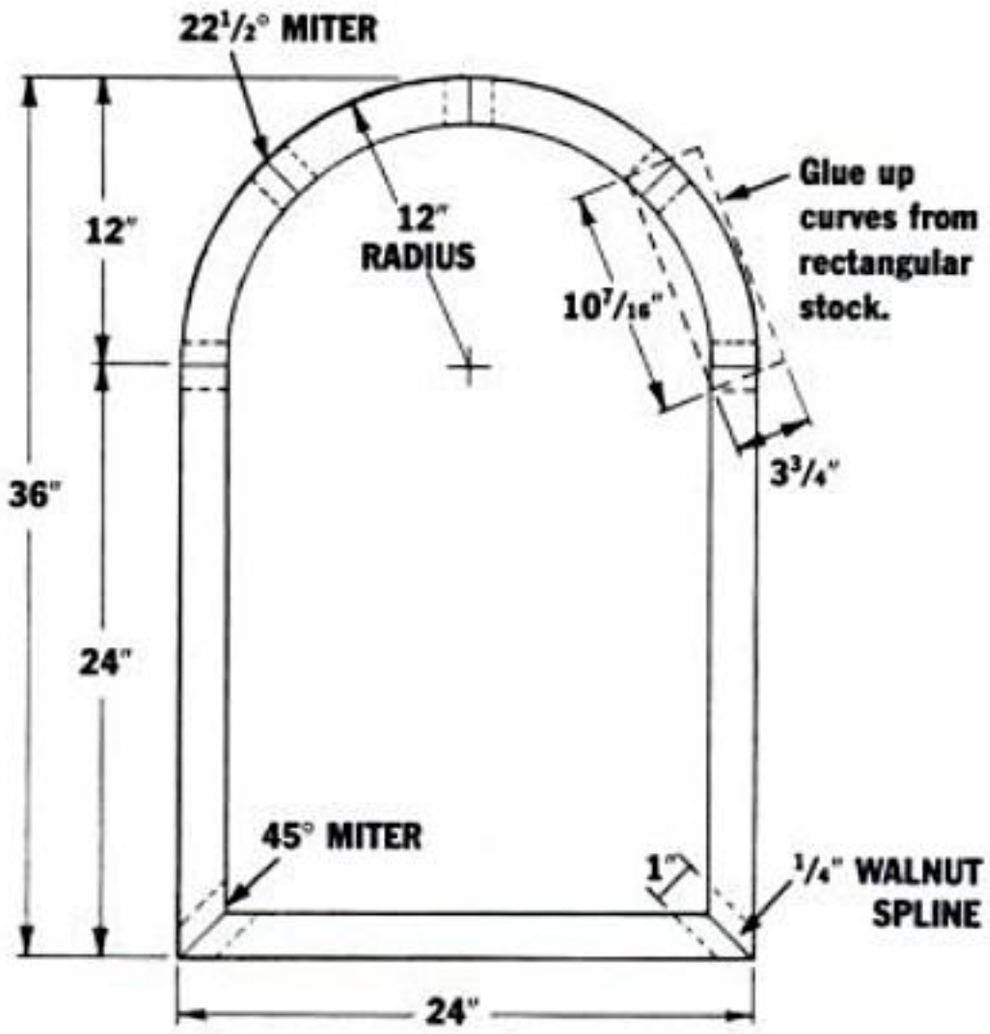
Before you glue the top to the sides, lay out the curve with trammel points, and bandsaw the inside curve of the top. Once the frame is assembled, you can't get inside with a bandsaw to make the cut. After sawing, I smoothed the inside of the curve with a drum sander in my hand drill.

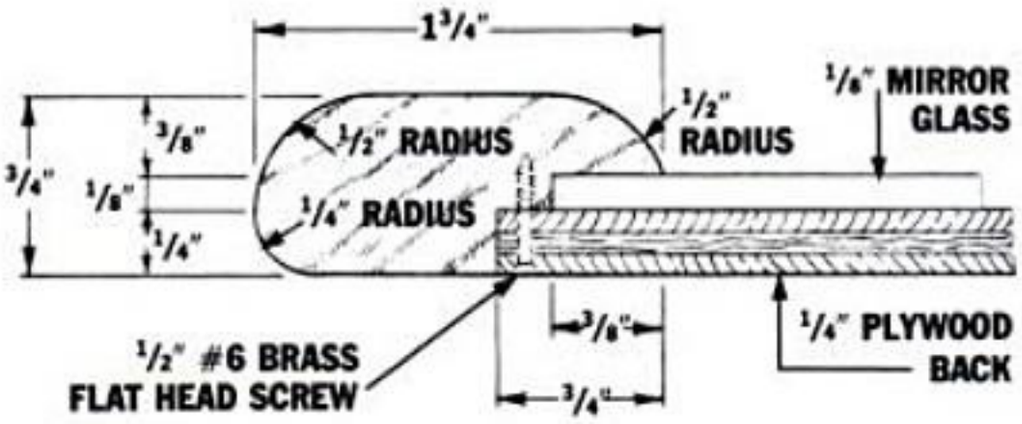
Glue the assembled top, the sides and the bottom together. Clamp across the lower miters, using clamping blocks as explained above. After the glue has dried, bandsaw the outer curve of the top and clean up the curve with a spokeshave.

Round over the front edges of the frame with a router and a 1/2-in. round-over bit with a ball-bearing guide as shown in the drawing. Ball-bearing guides are much better than stationary bearings, which tend to burn the wood. Round over the outer edge on the back of the frame with a 1/4-in. round-over bit.

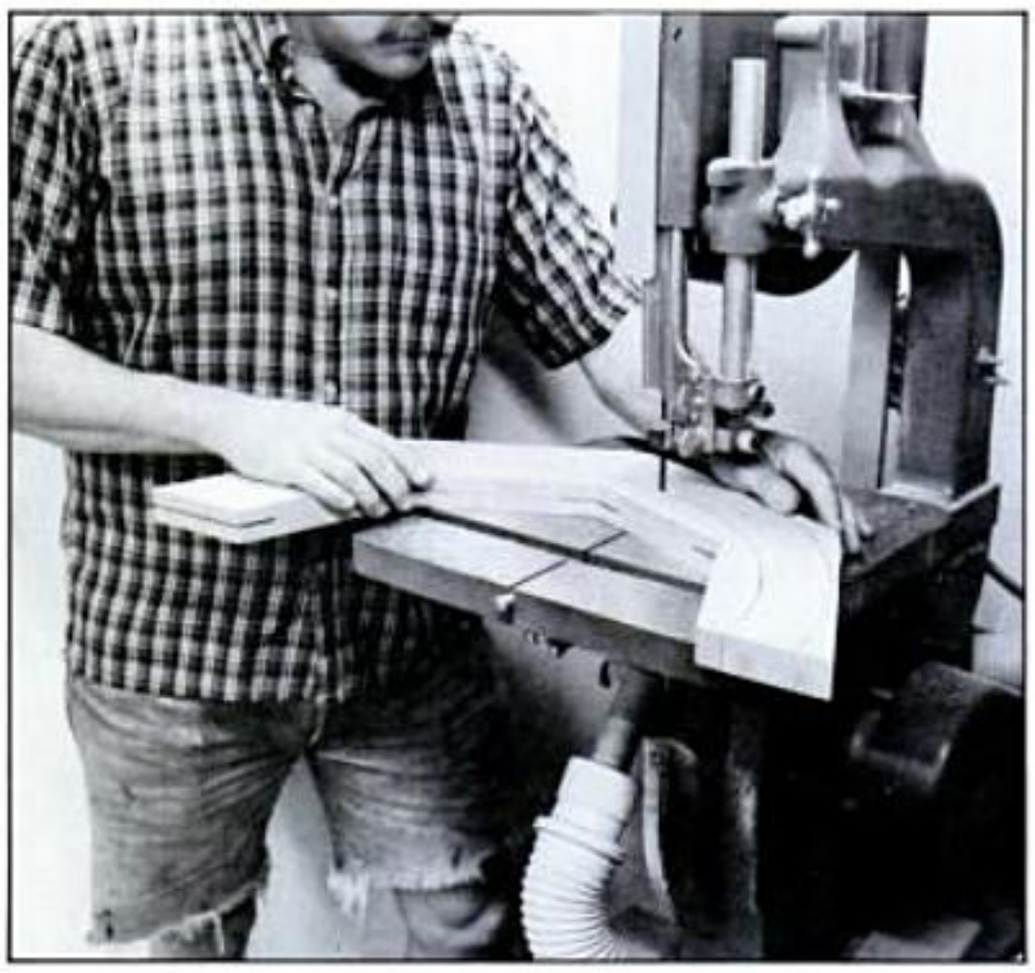
The mirror glass and the plywood back are housed in separate rabbets cut in the back of the frame as shown in the drawing. Cut the rabbet for the mirror glass with a router and rabbeting bit. Unfortunately, you can't cut the rabbet for the back with a rabbeting

FIG. 1: WALL MIRROR





Bandsaw the inside curve before gluing the top to the rest of the frame.



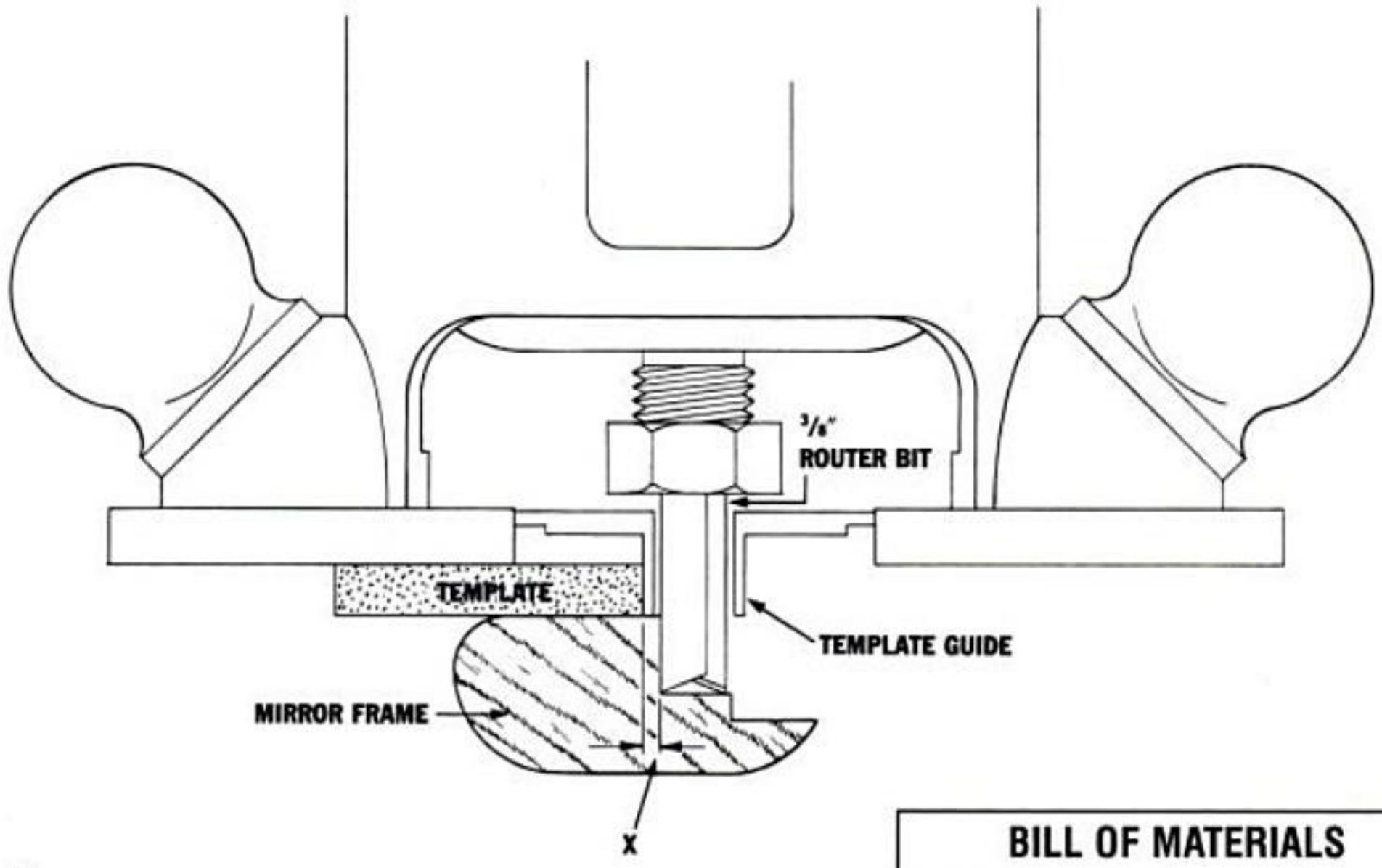
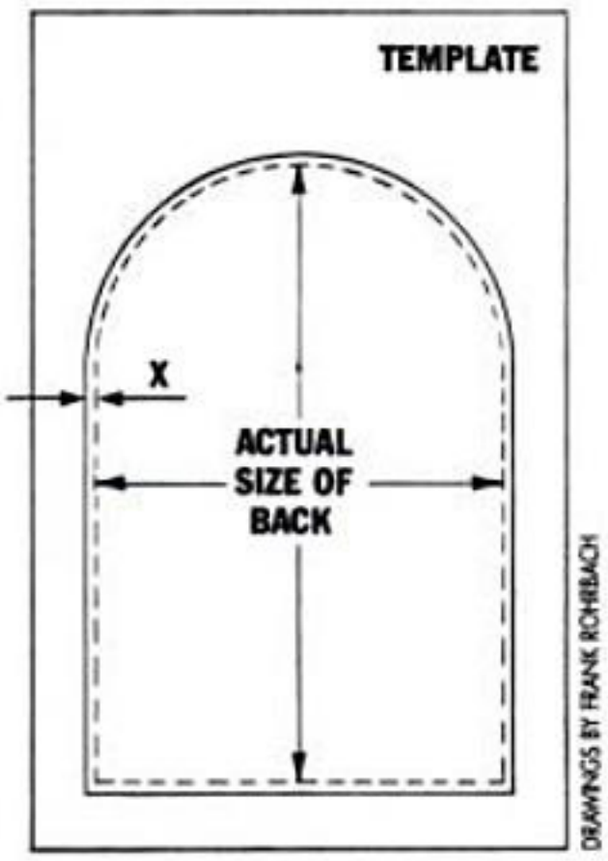


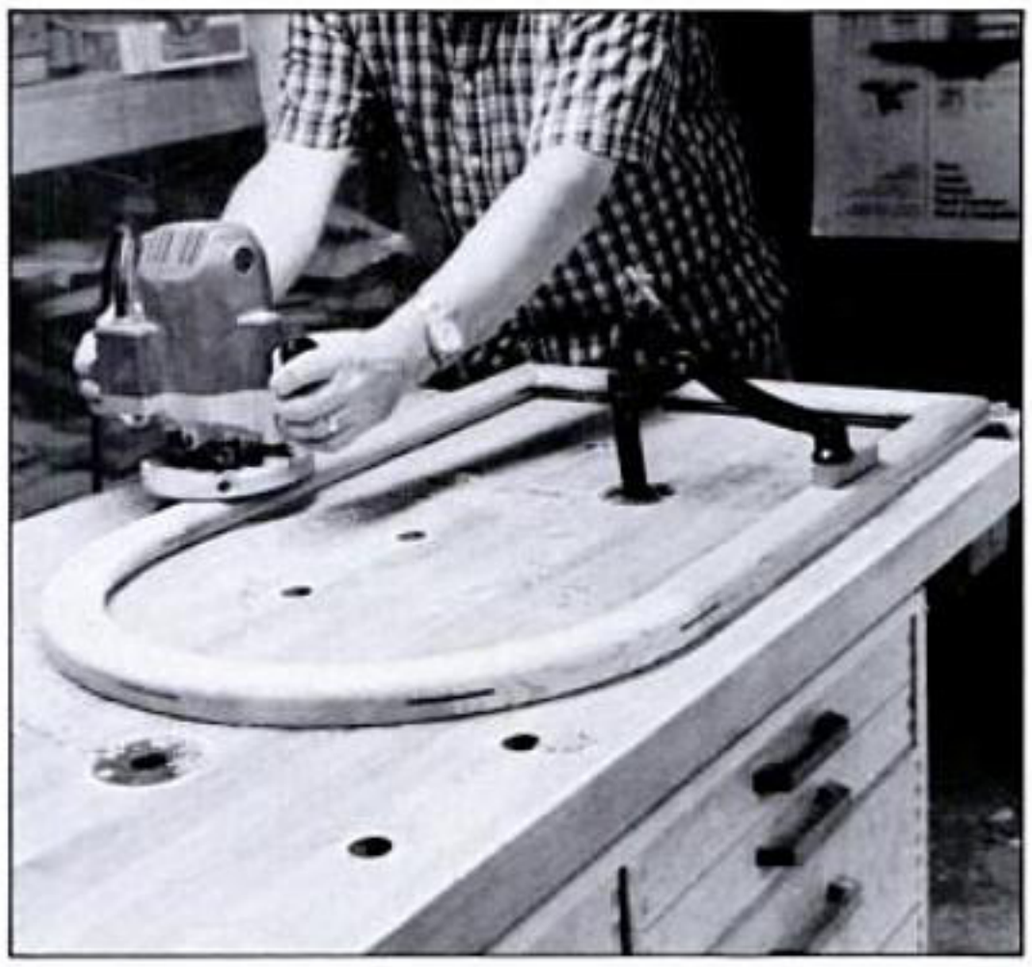
FIG. 2: ROUTING THE BACK RABBET

Make template opening larger than mirror back by distance "X" in drawing above.



DRAWINGS BY FRANK ROHRBACH

Clamp the frame securely to the bench and round over the edges with a router.



BILL OF MATERIALS

QUANTITY	DIMENSIONS	DESCRIPTION
2	3/4" × 1 3/4" × 24"	Sides
1	3/4" × 1 3/4" × 24"	Bottom
4	3/4" × 3 3/4" × 10 7/16"	Top
1	1/8" × 21 1/4" × 33 1/4"	Mirror glass
1	1/4" × 22" × 34"	Plywood back

bit—there isn't any place for the pilot bearing to ride. I routed the rabbet for the back by outfitting my router with a guide-bushing and guiding the bushing against a hardboard template.

If you haven't done this type of pattern routing before, it isn't hard. The template guide, which looks like a little top hat through which the bit projects, screws to the base of your router. The outside edge of the guide-bushing rides against a hardboard template to guide the cut as shown in the drawing.

Make the template as shown, out of 1/4-in. hardboard. The opening should be the shape of the back, but *larger in all directions* by the difference between the outer diameter of the guide and the diameter of the bit as shown in Fig. 2.

Saw the curve in the template with a saber saw, and smooth it with a half-round file. Cut the straight edges with a router and fence. Tack the template in place on the back of the mirror (make sure it's centered) and set the router for a 1/4-in. deep cut. Make the cut, keeping the guide-bushing snug against the template. When the rabbet is finished, square up the bottom corners with a chisel and cut the plywood back to fit.

To hang the mirror, I cut two keyhole slots in each side of the frame with a special keyhole bit (available from MLCS, P.O. Box 4053A, Rydal, PA 19046). Or, you could attach screw eyes to each side and hang the mirror on picture wire.

Finish the frame as desired. I applied two coats of Watco Natural Danish Oil. I wet-sanded the second coat with 600 wet-dry paper and then gave the frame a good coat of paste wax.

Clean the mirror glass with any glass cleaner and put it in place. Install the plywood back with 1/2-in., #6 brass, flat head screws to complete the project. ▲

Dennis Watson is a contributing editor of AMERICAN WOODWORKER.

The Tool of Choice for Turning Beads and Coves on the Lathe

THE SPINDLE GOUGE

BY RON ROSZKIEWICZ & PHYLLIS STRAW

Roughly half of the students who come to my woodturning workshops don't really understand how to use a spindle gouge. "Yeah, I know how to get a hollow shape with a spindle gouge. You just push it into the wood and wiggle it,right? But I can't figure out how to make a bead. Don't I need a different tool?"

No you don't. The spindle gouge is the most efficient and practical tool for turning coves, beads and balls on the lathe. Unfortunately, this isn't obvious from the look of the tool. The spindle gouge's fingernail-shaped edge misleads lots of beginners into using the tool like a round-nosed scraper to scrape a hollow, or cove, the same shape as the end of the gouge. It *is* possible to make a cove by pushing into the wood and scraping

The spindle gouge is the tool of choice for turning coves and beads on the lathe.

away, but this isn't the best way to use the tool. In fact, it doesn't use the correct part of the cutting edge at all. The spindle gouge is designed to cut like a jackknife, not scrape. If you *scrape* coves with the push-and-wiggle method you need a different size spindle gouge for different size coves. If you *cut* with the gouge, rubbing the bevel to guide and control your cut, you can make a wide range of cove sizes with a single spindle gouge, and you'll produce a smooth surface free of fuzzily scraped end grain.

In this article, I'll show what the spindle gouge can *really* do and explain how to turn coves and beads—the two basic cuts. I'll also explain how to make half-coves and half-beads—variations on the basic cuts.

What's Happening at the Edge

The key to understanding the spindle gouge (and turning in general) is to understand what's happening where the cutting edge meets the wood.

Unlike a roughing gouge, which is ground straight across, the spindle gouge has a fingernail-shaped end with a long bevel and no corners to dig into the work. This curved edge functions like a knife, arcing into the long grain and shearing through end grain to produce thin, curled shavings. Instead of jabbing the gouge straight into the wood, roll the gouge to the left or the right to make a cut. The right side of the cutting edge cuts to the right, the left side cuts to the left.

There are two points to remember when using the spindle gouge: The bevel of the tool must rub on the wood during the cut and the tool must always cut from the larger diameter to the smaller diameter. If you try to cut "uphill," the edge will catch in the wood.

Selecting a Spindle Gouge

Spindle gouges come in widths ranging from 1/8 in. to 2 in., with 1/4, 3/8, 1/2 and 3/4 in. being the easiest widths to find. If your tool kit includes 1/4-in., 1/2-in., and 3/4-in. wide spindle gouges, you will be able to handle most projects in the middle-size range but if you can buy only one gouge, pick the 1/2-in. size.

There is some size relationship between the width of the gouge and the length of the cove (or bead). A rule of thumb to follow in deciding what size spindle gouge to use is that the width of the gouge should be approximately half the length of the bead or cove. If the tool is too wide, the unused side of the cutting edge is likely to catch in adjacent wood. If the tool is too small, it is difficult to use the bevel effectively to control the shape. But it's okay to use a small gouge to do minor rounding over on a larger shape such as a shoulder.

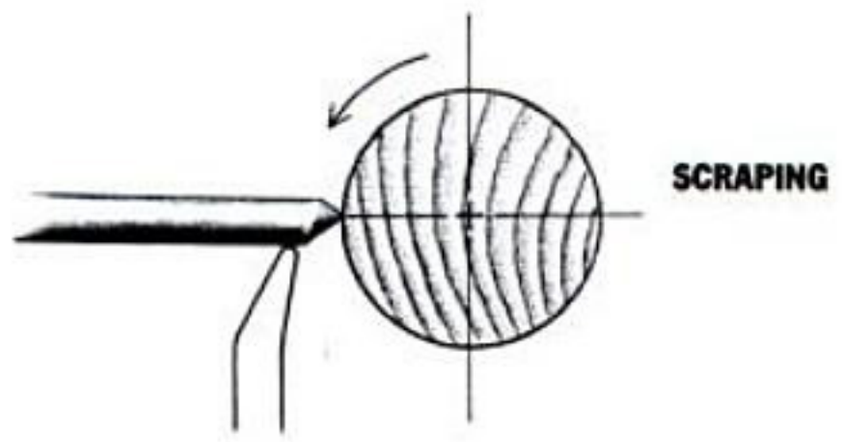
At one time, spindle gouges were made only of carbon steel, but today you have a choice between carbon-steel gouges and gouges made from high-speed steel. The major advantage of high-speed steel is its high resistance to heat. When a spindle gouge is used properly, the bevel rubs the wood throughout the cut creating extreme friction and heat. A carbon-steel edge just doesn't hold up under this stress as well as a high-speed steel edge, and you have to resharpen it more often. It's also easier to overheat the edge of a carbon-steel tool and ruin the temper when you grind. For these reasons, it's just not worth it, in my view, to buy anything but high-speed steel.

The first thing I check when I'm buying a spindle gouge is the position of the groove down the middle known as the channel or the flute. Looking down the shaft of the tool from the cutting edge, I want to see symmetrical curves on either side of the channel and no high spots or flats—especially on the bottom of the gouge where it contacts the tool rest. I look for a long channel because the longer the channel, the more times it can be sharpened before it gets too short to use. This is especially important with carbon-steel tools because they must be reground more frequently. The shaft of the tool also should be straight and properly aligned in the handle.

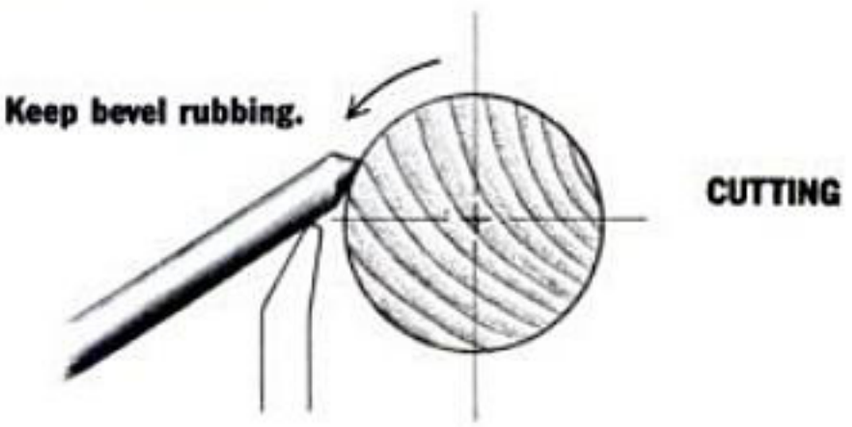
For proper balance, the relationship between the length of the blade and the length of the handle is important. The length of the tool varies among manufacturers but the standard industry ratio of 2:3 for blade-to-handle length produces a pretty well-balanced tool. As you gain experience with different tools you start to get particular about what you like. On a 1/2-in. spindle gouge, for example, a 9 1/2-in. handle with a 6 1/2-in. blade for a total length of 16 in. works just right for me. I like my 1/4-in. and 1/8-in. gouges to be shorter—about 12 in. overall. Because this short length isn't readily available, I usually turn my own handles.

Don't be put off by a poorly ground bevel if the rest of the tool is right. The shape of the factory-ground bevel will probably need to be refined in the sharpening process anyway. The sidebar on page 40 shows how to grind a bevel. CONTINUED

FIG. 1: SCRAPING VS. CUTTING



The spindle gouge is designed to cut, not scrape. Scraping produces a torn, fuzzy surface that requires lots of sanding.



Cutting produces a smooth shearing cut that requires little if any sanding.

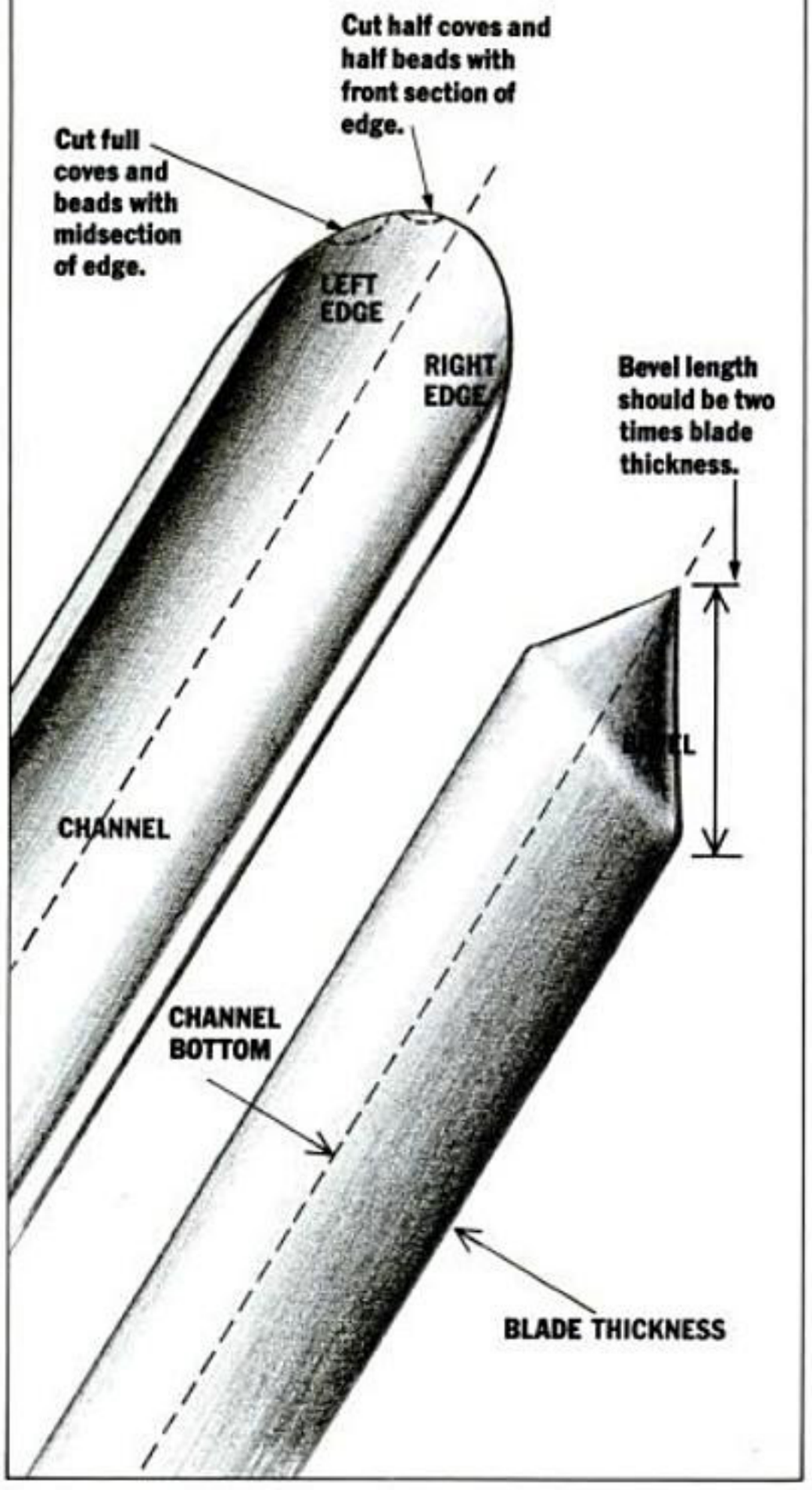
DRAWINGS BY GEORGE RETSECK

Ron Roszkiewicz and Phyllis Straw are co-authors of the books, The Woodturner's Companion *(1984, Sterling Publishing Co., Inc., Two Park Ave., New York, NY 10016) and* The Woodturner's Art *(1986, Macmillan Publishing Co., 866 Third Ave., New York, NY 10022).*

SALLY SHENK ULLMAN

To try these cuts you'll need to turn a rough cylinder. I recommend poplar because it's inexpensive and easy to turn. Mount a blank 10 in. long and 2 in. square between centers. Adjust the tool rest so that the straightedge of the rest is in line with the axis of the cylinder, and round the blank into a cylinder with a roughing gouge.

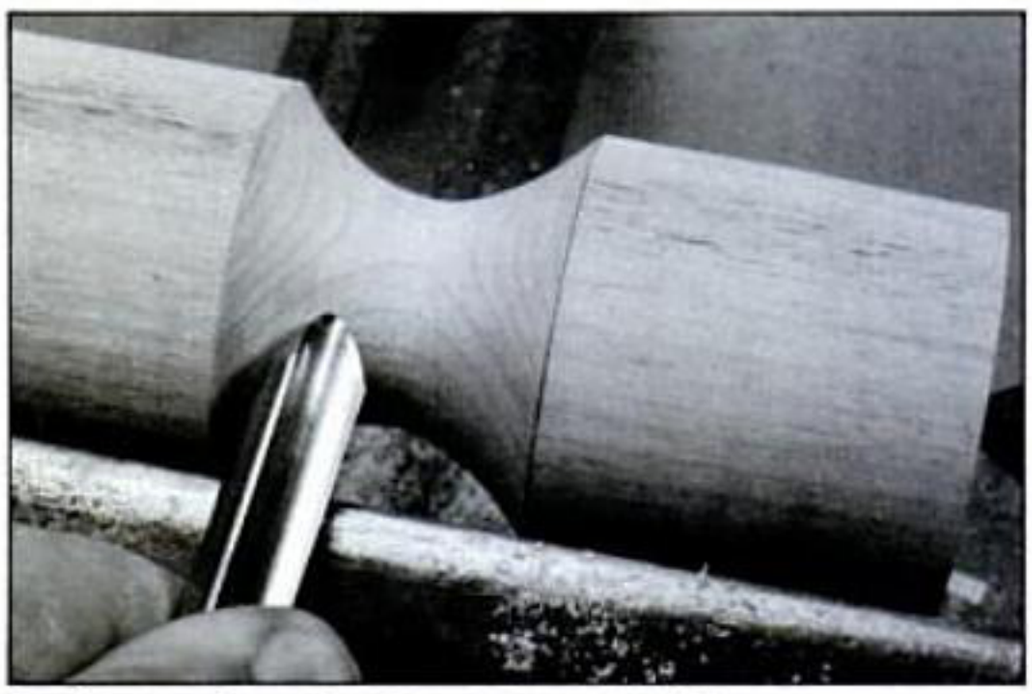
FIG. 2:
ANATOMY OF A SPINDLE GOUGE



TURNING A COVE

Tools Required

- ½-in. spindle gouge
- Parting tool
- Calipers
- Ruler
- Pencil

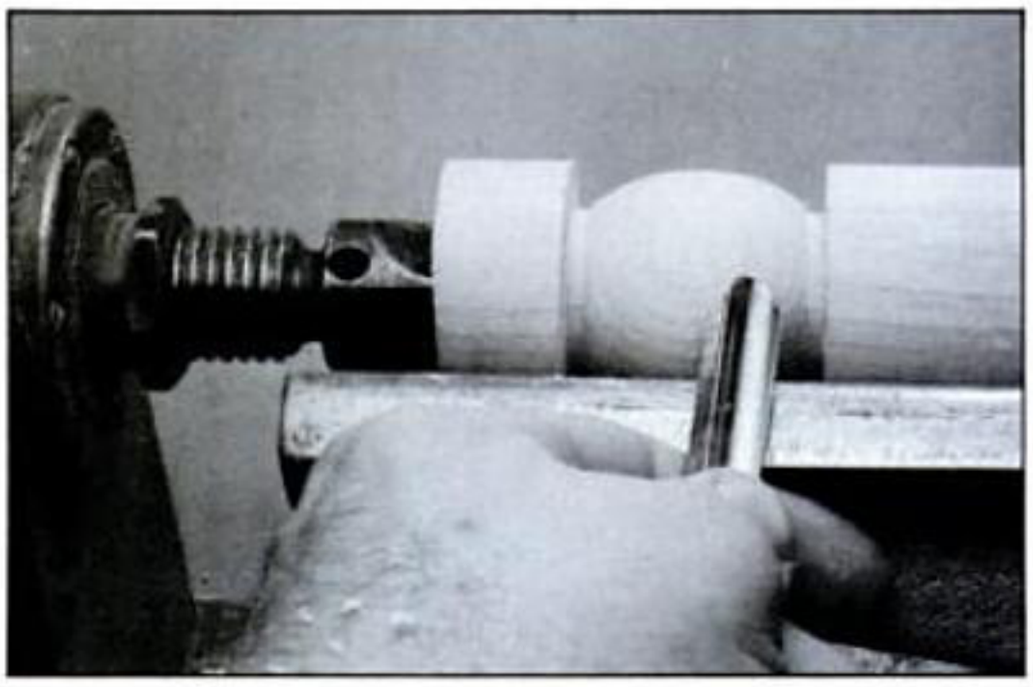


Turning a cove is a series of two-cut sequences that hollows out the cove—a cut from right to center followed by a cut from left to center.

TURNING A BEAD

Tools Required

- ½-in. spindle gouge
- Parting tool
- Calipers
- Ruler
- Pencil



Turning a bead uses a two-cut sequence to round the bead—alternate cuts to each side of center cutting "downhill" from larger to smaller diameter.

Cutting a cove is done in a series of two-cut sequences that hollows out the cove—a cut from right to center followed by a cut from left to center. Each cut goes downhill, from larger to smaller diameter until you reach the final shape and diameter of the cove.

To turn a cove, draw pencil lines on the cylinder to mark the cove length and the center of the cove as shown. Make the cove 1½ in. long and locate the end of the cove about 1 in. from the end of the cylinder.

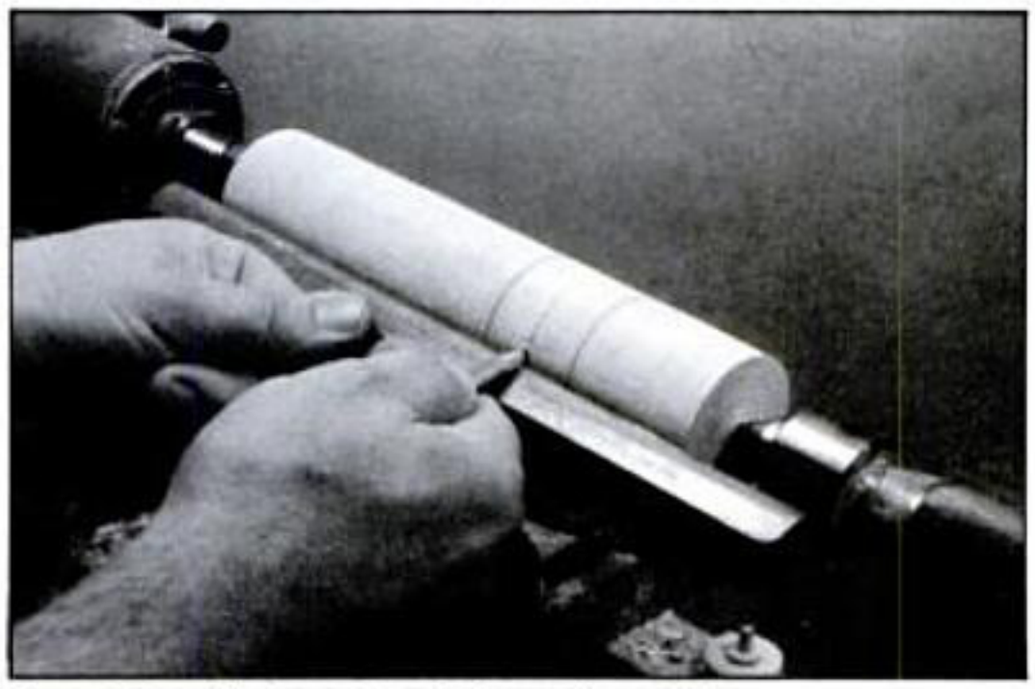
Next, make a cut on the center line with a parting tool. (I prefer the diamond-shaped variety.) This depth cut is a guide for the smallest diameter of the cove but it also creates a relief for clearing out chips and keeping the edge of the gouge from catching on the opposite side of the cove at the end of each cut.

Set your calipers for a diameter of 1¼ in. With your left hand (if you're right handed) hold the calipers so that the ends are rubbing the spinning wood and with your right hand hold the parting tool firmly against the tool rest. Then make a cut with the parting tool until the caliper's ends are no longer rubbing the wood.

Place the ½-in. spindle gouge on the tool rest with your right hand in the middle of the handle (if you're right handed) and your left hand on top of the blade just behind the tool rest.

Roll the tool on its left side, just to the right of the depth cut so that the channel faces the depth cut as shown in the drawing. With the handle held low, position the edge just to the right of the depth cut so you can envision slicing off only the right corner formed by the depth cut. With your right hand, pivot the handle upward until the edge and the bevel contact the wood, give the handle a clockwise twist, rolling the tool to make a piercing, scooping cut. It's a fluid motion that starts with the gouge on its left side and ends with the gouge channel facing up. Only the hands move; your body stays still during the cut. If the tool won't cut, roll the tool a bit more to the left and try again.

I find it helpful to divide the edge visually into two sections on either side of center as shown in Fig. 2. Use



Turn a 2-in. cylinder and mark the center and the ends of the cove with a pencil.

To turn a bead, draw pencil lines on the cylinder to mark both the edges of the bead and the center of the bead as shown. Make the bead 1½ in. long and locate the end at least 1 in. from the end of the cylinder.

Adjust the tool rest so that it is slightly below the axis of the cylinder and from ⅛ to ¼ in. away from the wood. Set the lathe speed to approximately 1500 to 1700 RPM for a block this size.

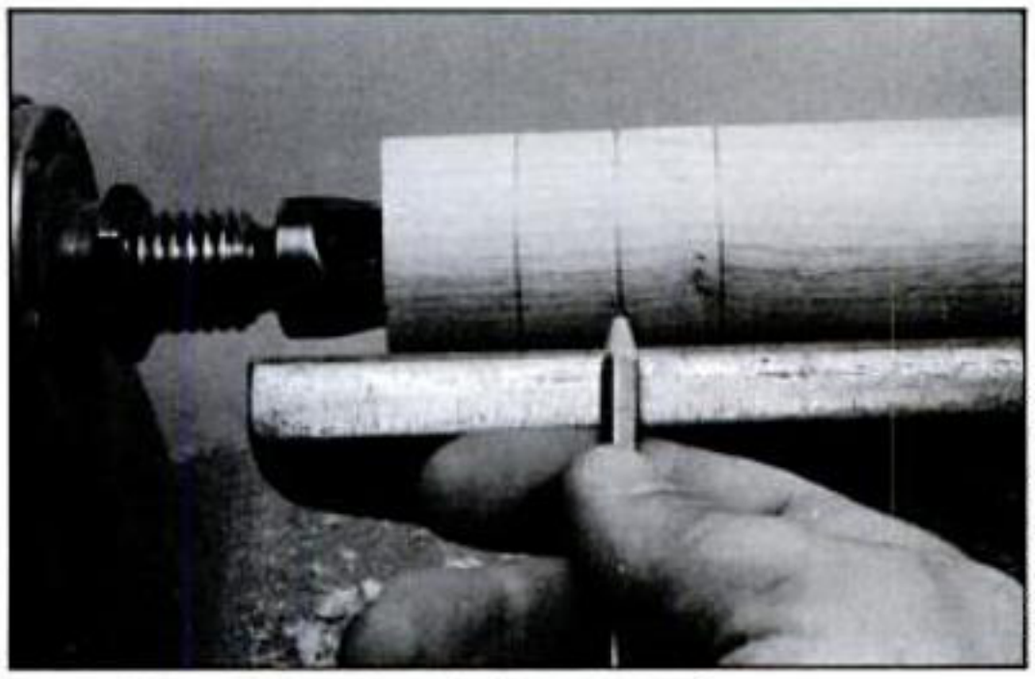
Next, make a depth cut with a parting tool on all three pencil lines. The center cut defines the largest diameter of the bead and the other two cuts define the smallest diameter. Set your calipers for 1¼-in. dia. for the outer cuts and 1⅞-in. dia. for the center cut. Make the outer cuts at least ¼-in. wide, making two parting-tool cuts side-by-side if necessary. You need this extra room so that the unsupported edge of the gouge won't catch in adjacent wood at the end of the cut.

Place the gouge on the tool rest with your right hand in the middle of the handle (if you're right handed) and your left hand on top of the blade near the tool rest.

Your first cut will take off the right-hand corner of the bead as shown in the drawing. Hold the tool handle low with the gouge channel facing up. Allow the right side of the bevel to rub the wood near the corner so that you can envision nipping that corner off. Roll the handle clockwise until the right-hand edge starts to cut. When the gouge starts to cut, keep the bevel against the wood, lift the handle up slightly, and roll the tool clockwise to the right, shearing off the corner. At the end of the cut, the gouge channel should be facing down. It's a smooth, fluid motion with the hands.

Repeat the above steps on the left side of the bead, rolling the tool counterclockwise to make the cut. When you get close to the bottom of the depth cuts, rehone the gouge and make light finishing cuts until you've reached the bottom of the depth cuts.

To get a symmetrical bead, you should alternate cuts on either side of the bead, cutting the same amount from each side. The quality of the bead shape depends entirely on the control you exercise over the tool. While



PHOTOS BY RON ROSZKIEWICZ

Turn a 2-in. cylinder and mark the center and edges of the bead with a pencil.

TURNING A COVE

the middle section of the left side cutting edge.

Stop at the depth cut. Don't try to cut uphill on the left side of the depth cut. If you do catch the unsupported left edge of the gouge on the uphill side of the cove, it will dig in, slam the tool down on the rest, and leave a nasty-looking furrow in the wood. If this happens, you can usually clean up the dig when you repeat the cut on the left side of the cove.

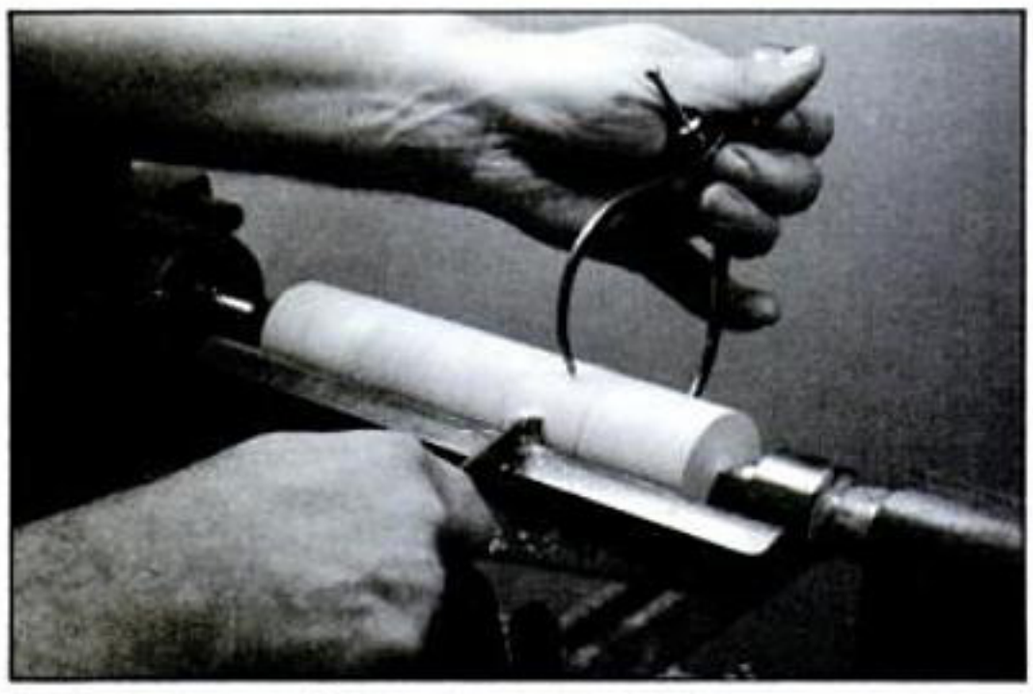
To cut the left side of the cove, repeat the above steps on the left side of the depth cut, starting with the gouge on its right side and rolling the tool counterclockwise. Alternate the cuts—first right, then left—until you reach the bottom of the depth cut.

Once you've got the shape you want, re-hone the cutting edge, set your calipers for the final 1⅛-in. dia. at the center of the cove, and clean up the cove with a couple of light finishing cuts. Use the same technique for finishing cuts but go slower and try to remove any ridges.

Half Coves

For a half cove, you only need to make one reference mark for the length of the cove since the depth cut is the marker for the other end of the decorative element. Mark out and make your depth cut with a parting tool in the manner described above.

There is a real risk, when making a half cove, of catching the unsupported edge in the wall of wood at the end of the cut. A slightly altered technique is required to avoid this. The cutting action is the same as for a full cove but the gouge channel should only be turned about ⅔ toward the depth cut at the start of the cut instead of fully facing it. Cut with the upper section of the cutting edge closer to the tip. The handle should be raised higher at the end of the cut and the channel should face the wood wall. If you do catch the edge, the dig can be cleaned up with a skew chisel cut.



Set the calipers for 1¼-in. dia. and make a depth cut with a parting tool.

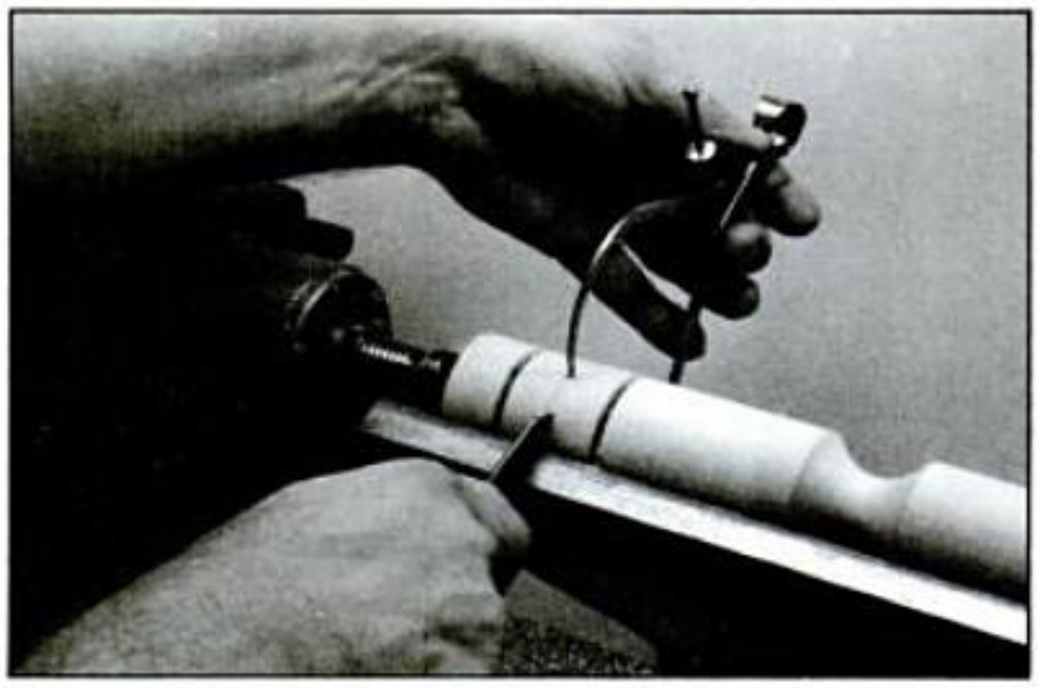
TURNING A BEAD

you raise the handle and at the same time roll the tool, the left hand is gently nudging the tool in the direction you're cutting. If you hold the tool too firmly it will be hard to maintain a fluid movement through the cut and the curve of the bead will be bumpy.

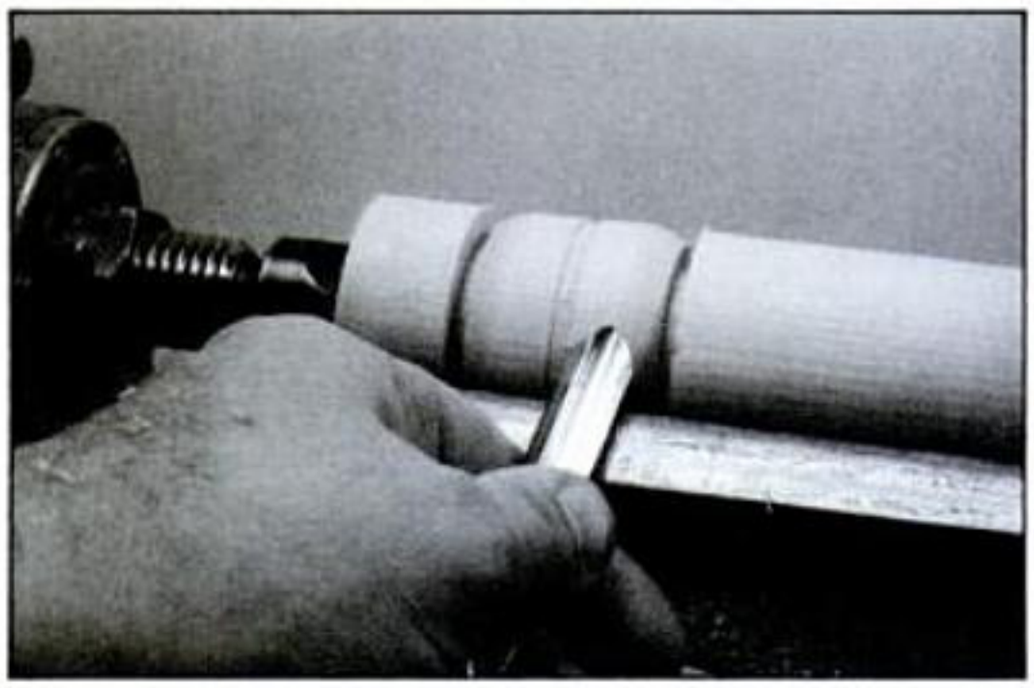
On many spindle turnings, beads butt up against larger-diameter elements and if you aren't careful, you can catch the shoulder of the large element with the edge of the gouge. In this case, you need to cut with the upper section of the cutting edge, close to the tip, and raise the handle much higher at the end of the cut.

Half Beads

To make a half bead, you can use the same techniques described for turning a bead. If the larger diameter of the half bead butts against a larger element, you may not be able to fit the gouge in the space next to the larger element. The solution is to clean up this bit of waste with a parting-tool cut.

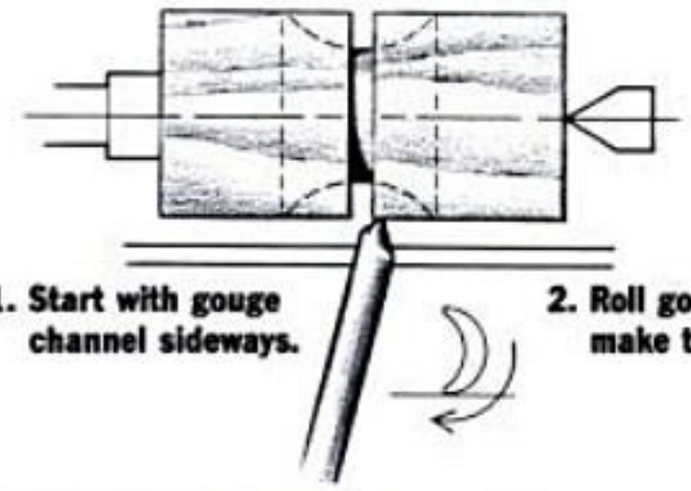


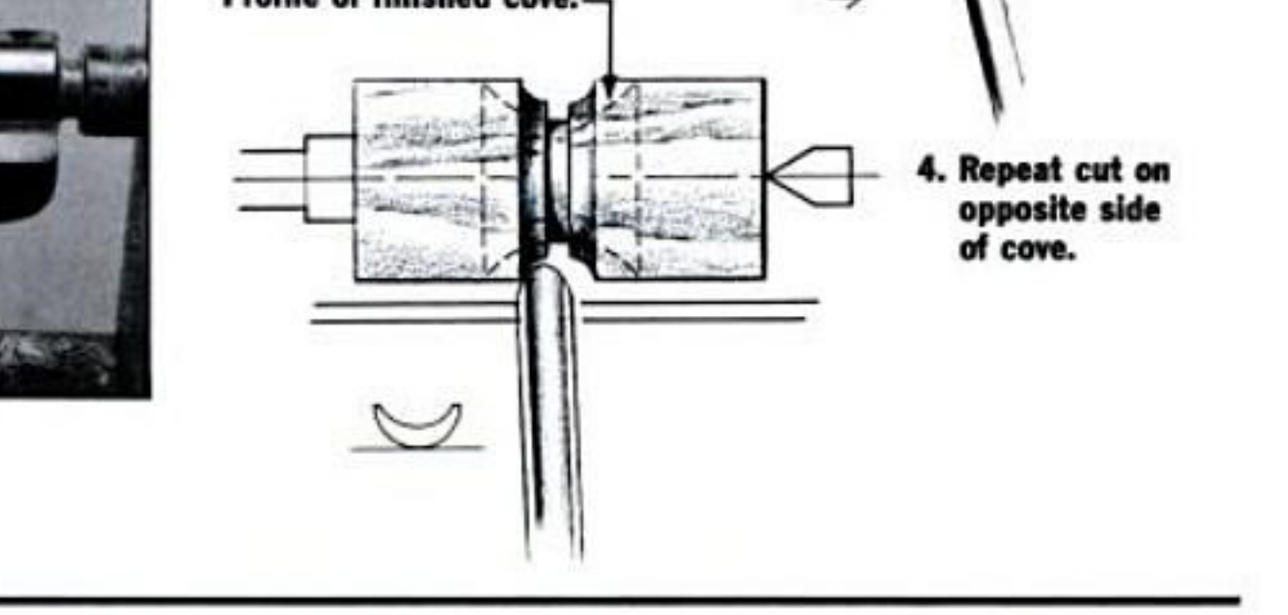
Define the large and small diameters of the bead with a parting tool.

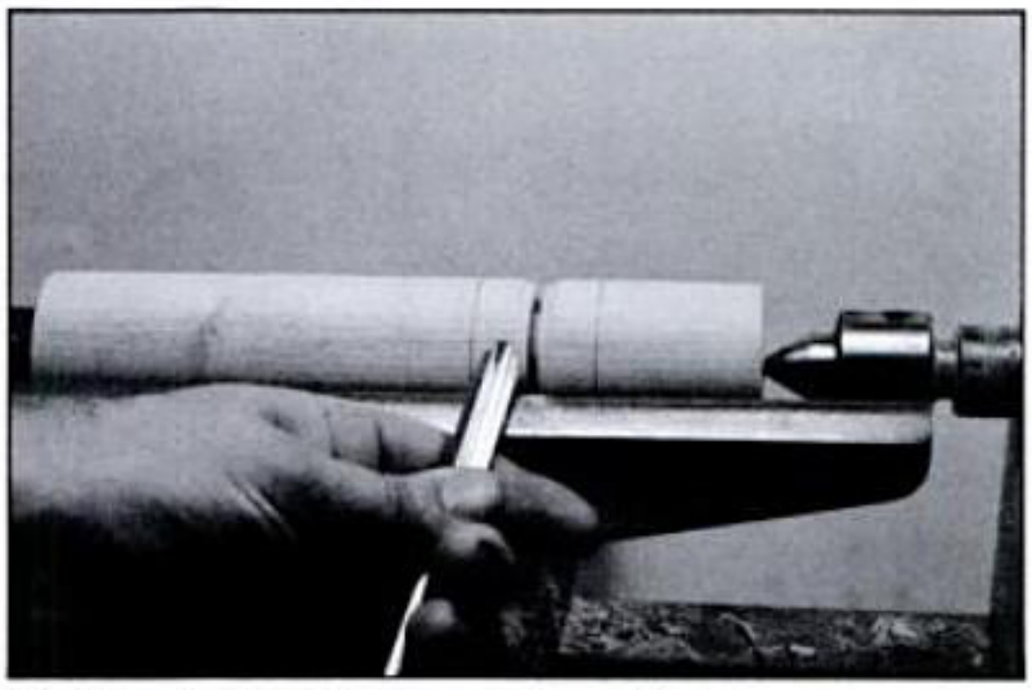


The first cuts slice off the outer corners of the bead, cutting downhill, away from center.

FIG. 3: TURNING A COVE

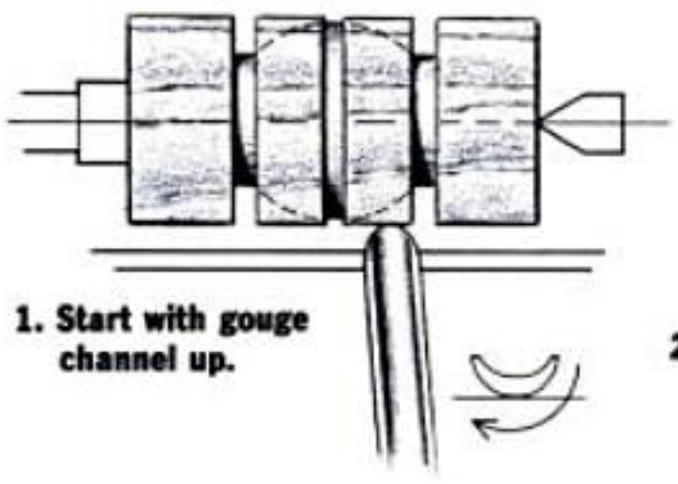


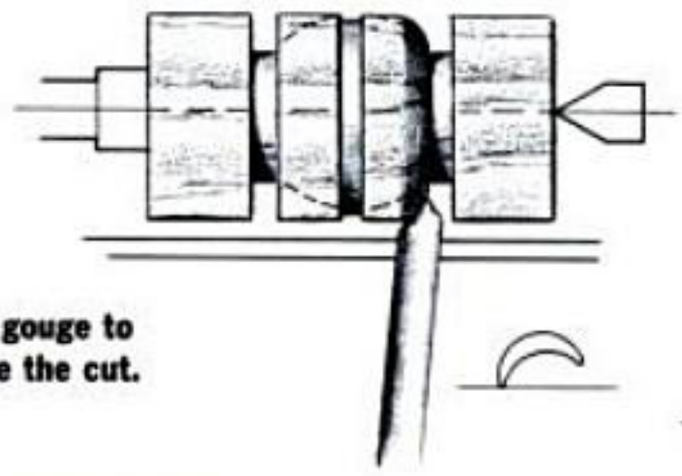


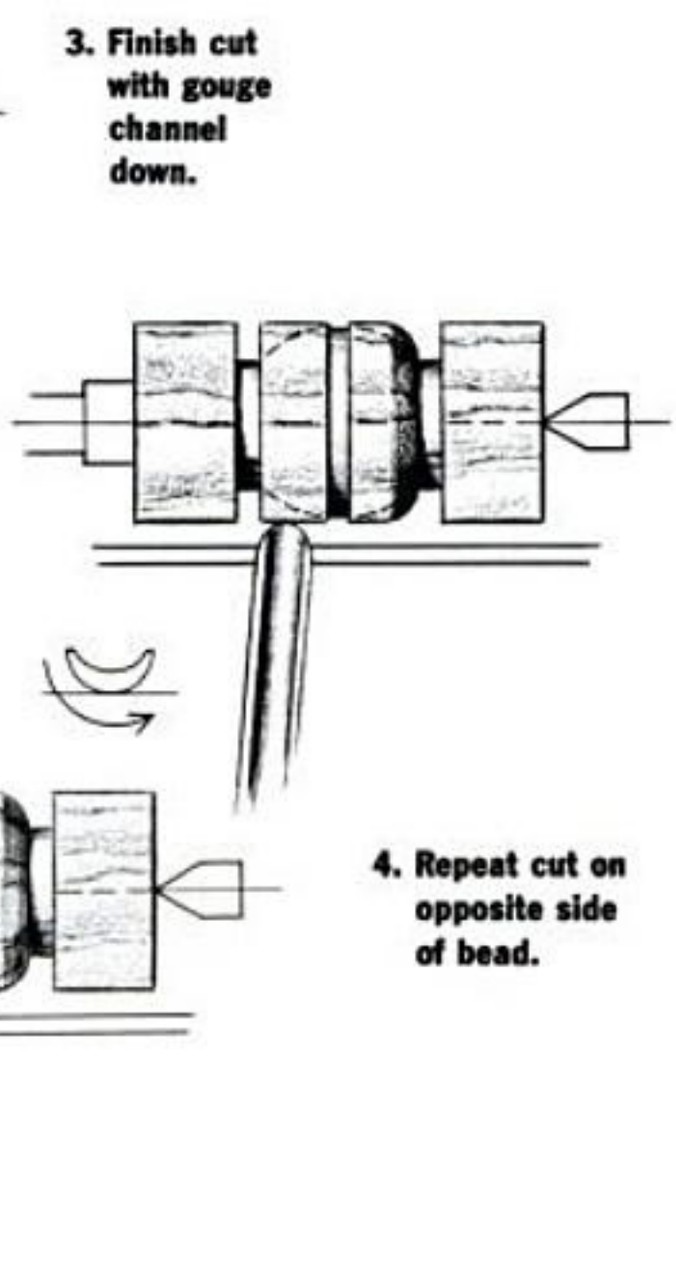


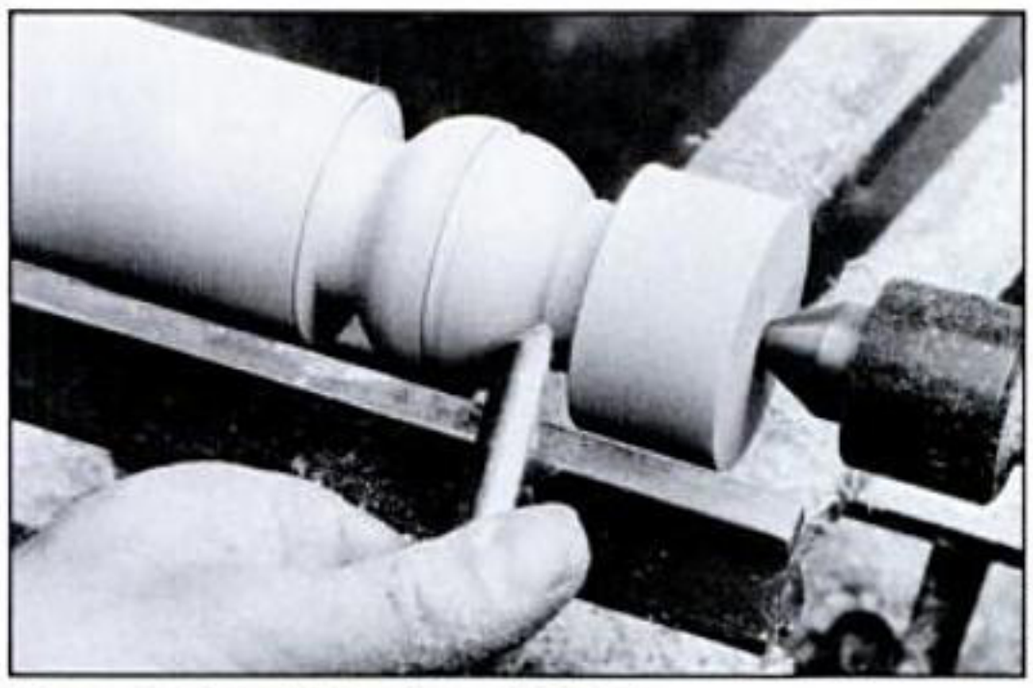
The first cuts slice off the corners formed by the depth cut.

FIG. 4: TURNING A BEAD









MITCH MANDEL

The gouge channel faces down at the end of the cut.

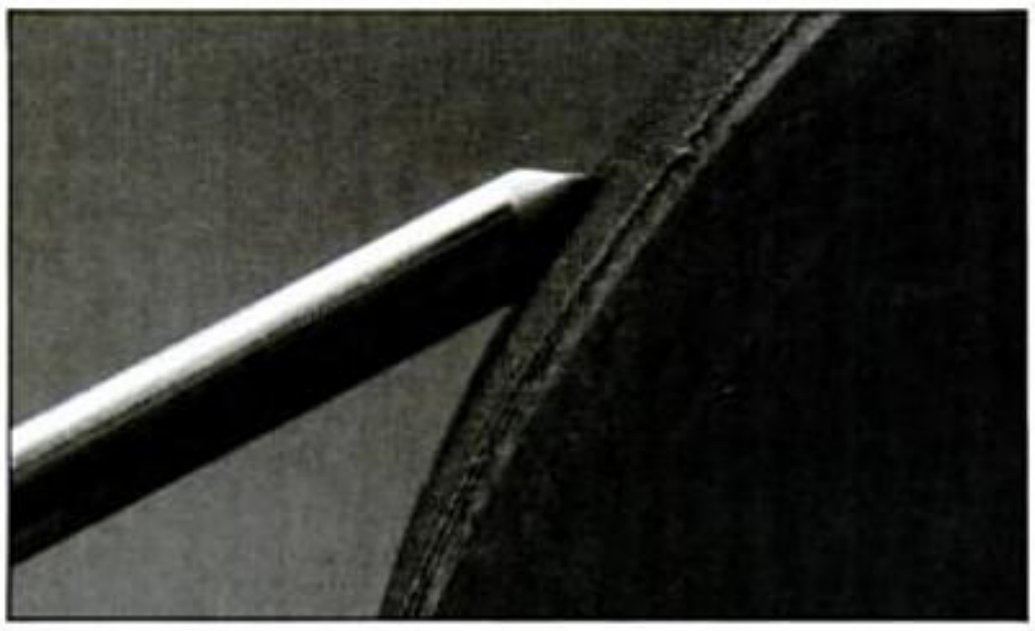
SHARPENING KNOW HOW

Sharpening a spindle gouge is a three-step process: grinding, honing and buffing.

Grinding establishes the shape of the edge and the length of the bevel. The method for grinding the bevel is the same whether you have a belt grinder or a wheel. I suggest using a fine-grit belt or wheel for all grinding to save time honing later. It may take a little longer to shape a bevel with a fine abrasive, but it is far easier than honing out coarse grinding marks on the curved bevel surface by hand.

The length of the bevel should be about twice as long as the thickness of the blade. Set the angle of the tool rest to determine the angle of the bevel. If the existing bevel is too short, adjust the tool rest so that only the bevel heel rests against the abrasive to grind a longer bevel. If the bevel is too long, adjust the tool rest so that only the nose of the bevel is resting on the abrasive to grind a shorter bevel. If the bevel is the right length to begin with, adjust the rest so that the bevel lies flat on the abrasive.

Once you've established the right angle for the tool rest, roll the gouge to the right and left to grind the finger-shaped edge. There should be no shoulders to catch on the work.

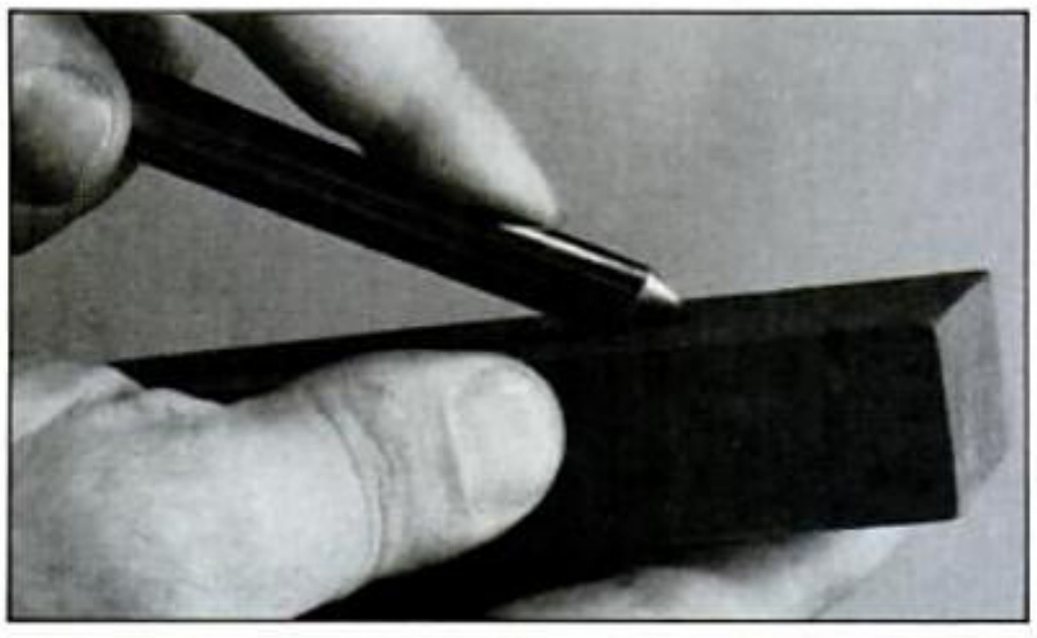


Grinding, the first step in the sharpening process, establishes the shape of the edge and the length of the bevel.

After grinding, hone the edge on a fine India stone or soft Arkansas stone to remove any grinding marks and create a razor-sharp edge. It's easier if you hold the blade of the gouge in one hand and rub the stone against the bevel, checking where contact is being made between bevel and abrasive. Rub the stone in a circular motion, covering the entire bevel surface. The grinding process will leave a hollow-ground bevel so your honing will create two flat surfaces, one next to the cutting edge and the other just above the heel of the bevel. If you see light shining on the edge, the gouge is still dull.

Polishing the edge on a felt buffing wheel or leather strop removes the burr left by the stone and makes the edge stronger and smoother cutting. If you choose to buff, use a light touch on the wheel or you'll round over and dull the edge. Hold the tool the same way as for honing, and rub the strop against the bevel pushing forward from the heel of the bevel to the edge. I charge the wheel with a stick of gray, emery buffing compound (available from Woodcraft, 41 Atlantic Ave., P.O. Box 4000, Woburn, MA 01888.)

I always re-hone and re-buff the edge of a spindle gouge before making finishing cuts.—*R.R.*



After grinding, hone the edge on a bench stone to remove grinding marks and create a sharp edge.

Spin the Top to Send Pins Flying

TABLE-TOP SKITTLES

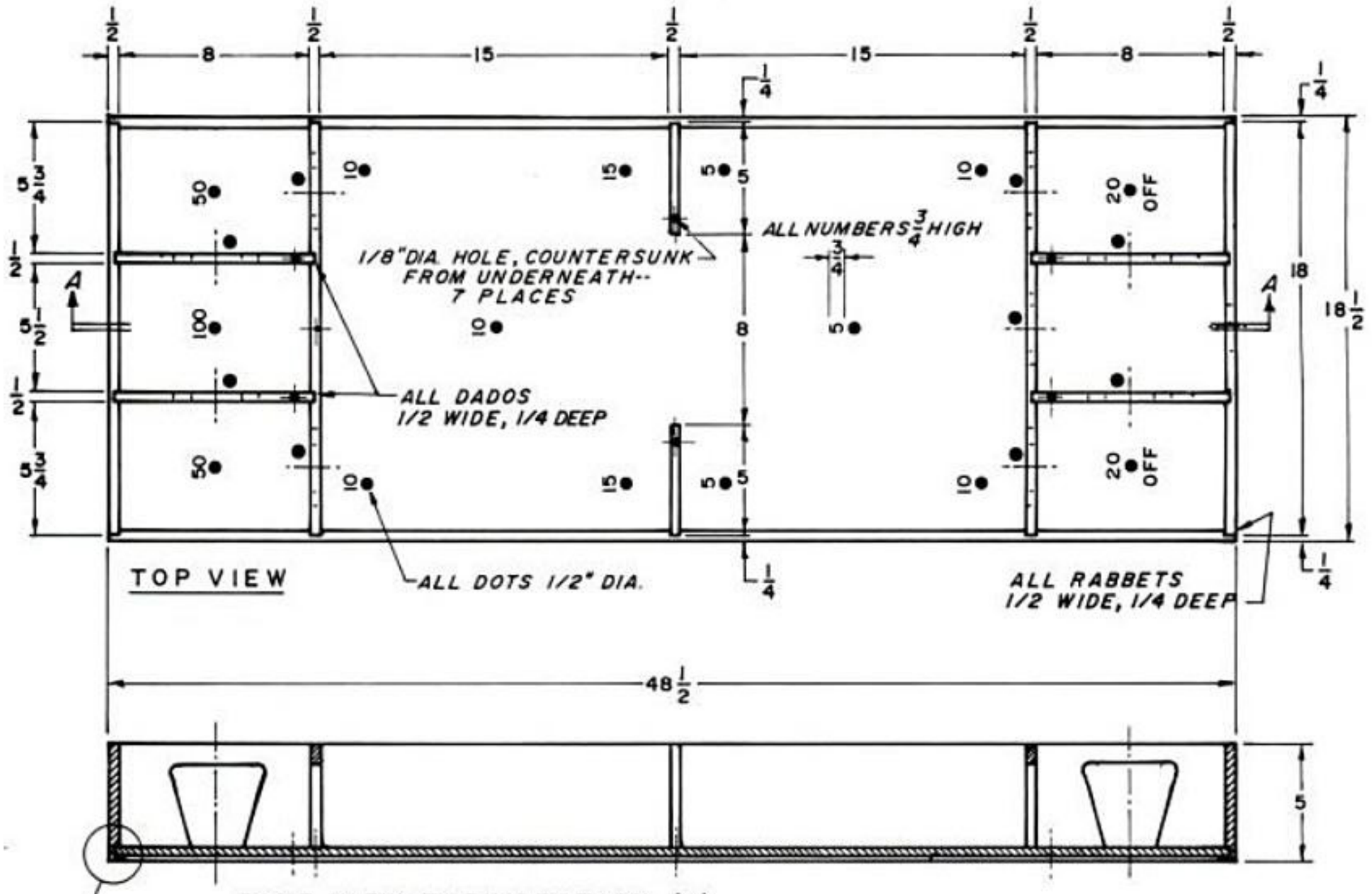
Table-top skittles is an action game that will keep your kids happy for hours. Launch a spinning top through the slot and the top wanders from room to room knocking down any pins in its path.

PHOTOS BY MITCH MANDEL

BY JOHN A. NELSON

Here's an action game that you and your kids will enjoy for many years to come. It's simple to play. Just launch a wooden top through a slot at one end of the playing field. The gyrating top roams from room to room, knocking over wooden pins known as "skittles." The object of the game is to knock down as many skittles as possible to get the most points.

The playing field is a box made from 1/2-in. birch plywood with a 1/4-in. hardboard bottom. There's nothing fancy about the joinery—rabbets and dadoes fastened with nails and glue. The most time-consuming part of the entire project is turning the game's pieces. You'll



TOP VIEW

SIDE VIEW THRU SECTION *A-A*

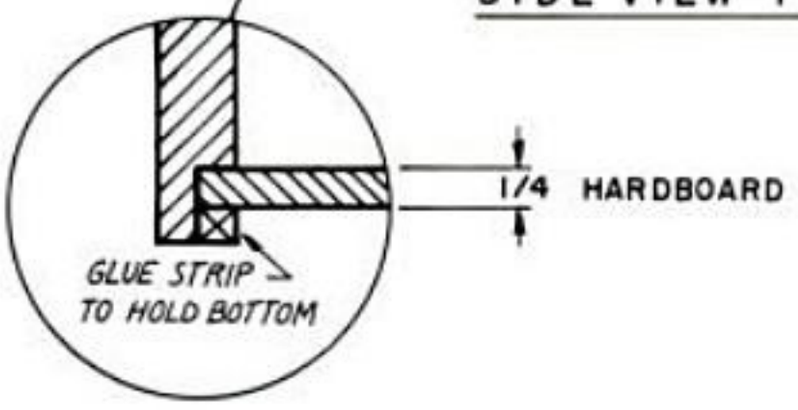
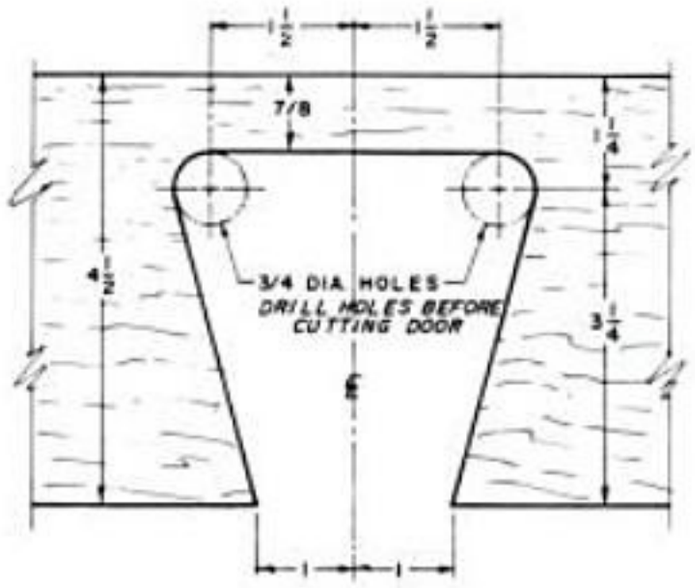
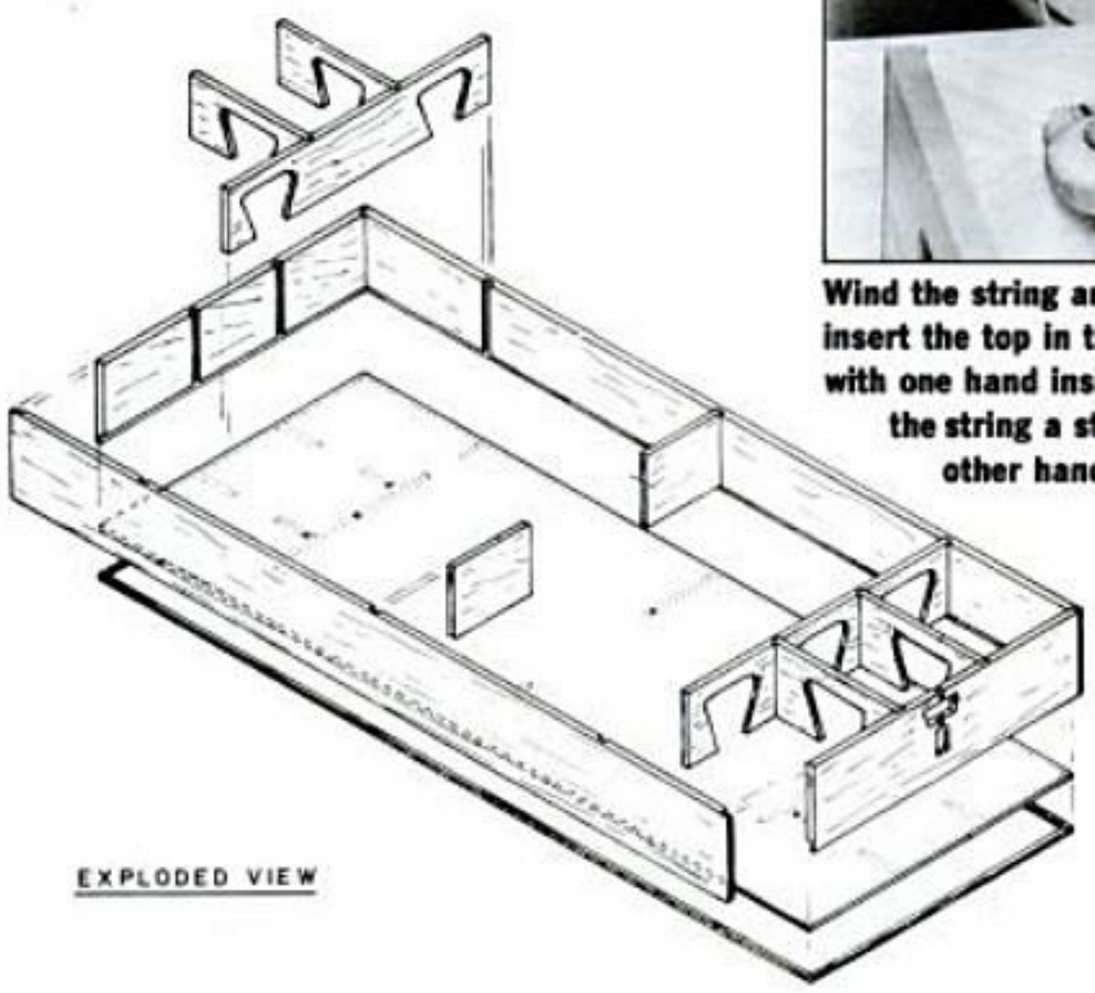


TABLE-TOP SKITTLES

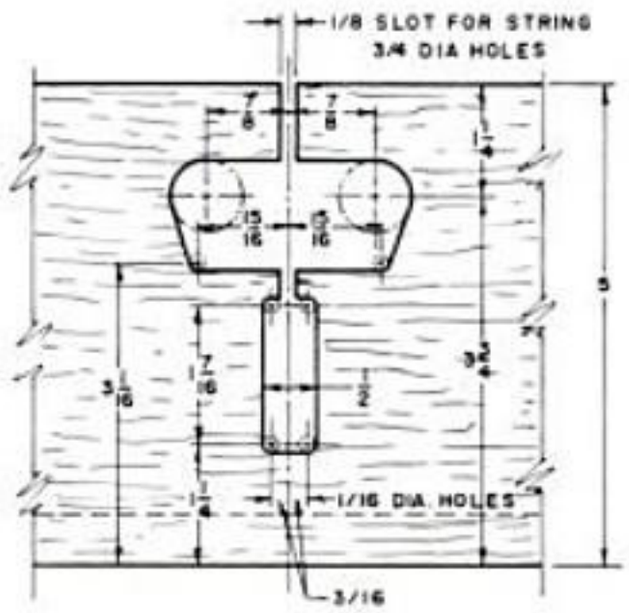
Wind the string around the top and insert the top in the slot. Support it with one hand inside the box and give the string a steady pull with the other hand.



DETAIL OF DOOR CUT-OUT



EXPLODED VIEW



CUT-OUT FOR STARTING TOP

DRAWINGS BY JOHN A. NELSON

need to turn the top, 15 skittles and a handle for the top's string.

Before you start cutting, read the instructions once or twice and study the drawings so you'll know how things go together.

Cut all the plywood parts to the dimensions shown in the drawing. Cut the dadoes with a dado head on the radial arm saw or tablesaw or with a ½-in. straight bit in a router. Cut the rabbet that runs around the bottom on either the tablesaw or with a router.

The next step is to saw out the door openings and the top cutout in one end of the box. Mark center points as shown in the drawing and drill on these centers to form the radiused corners of the openings. You may want to stack the four small dividers and drill and cut them all at one time. After drilling the holes, cut out the openings with a coping saw, bandsaw or saber saw. Sand all the plywood parts before assembly.

Assemble the box, except for the bottom and the strips that secure the bottom in place, with glue and small finishing nails. Be sure to keep everything square.

Fit the bottom board into the rabbet in the bottom of the box. With the bottom in place, mark the location of all the walls. Remove the bottom and drill and countersink pilot holes for flat head wood screws to fasten the bottom to the walls.

Stain or paint the walls of the game board and paint the bottom board white. Apply two coats of white paint, sanding lightly between coats. Rub the final coat lightly with 0000 steel wool and paint the 15 pin markers and score numbers on the bottom. I used a drawing pen with india ink but black enamel would work fine. Note that the numbers are all positioned so they can be read from the playing end of the board.

After painting the circles and numbers, put a coat of varnish over the entire bottom board and rub it lightly with 0000 steel wool when dry. Apply a coat of paste wax and screw the bottom to the box. Glue in the strips that secure the bottom in its rabbet.

Turn the top, the 15 pins, and the top-string handle between centers on the lathe from an easy-to-turn hardwood like poplar, cherry or maple. You may want to paint the pins and top—it's up to you. Tie a 15-in. long string to the handle, and you're ready to play.

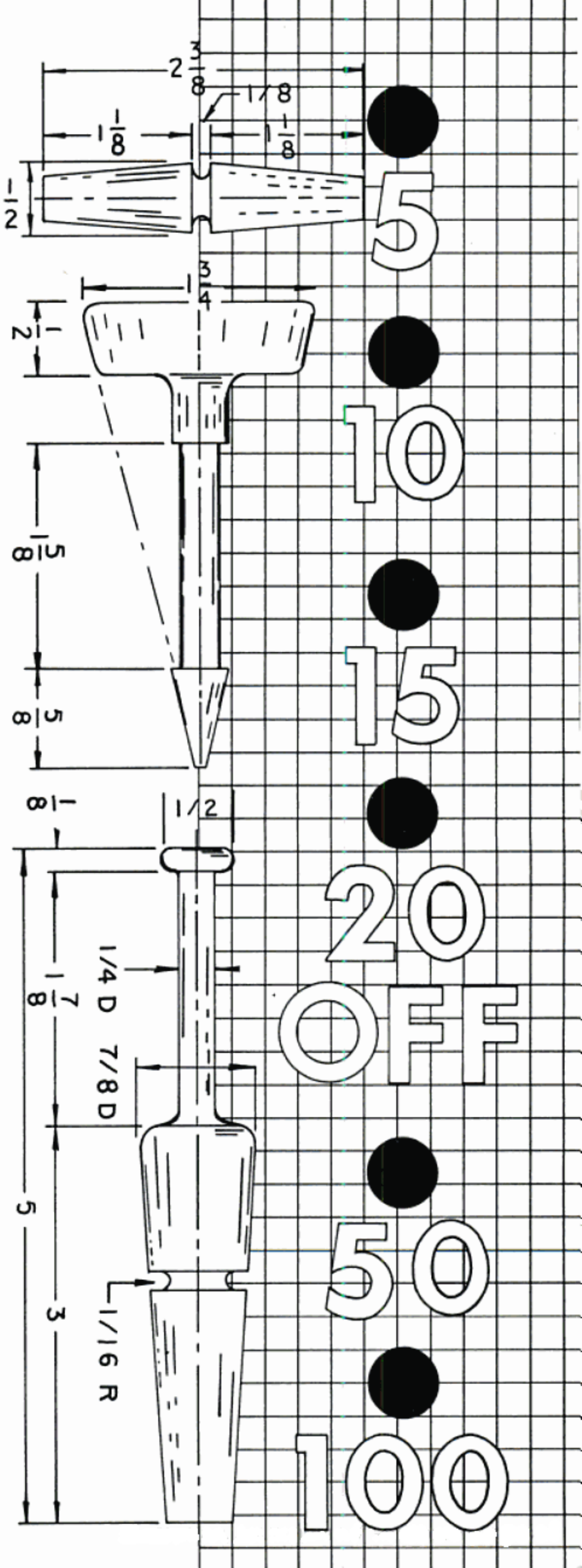
Playing the Game

Place the game on a flat surface and set the skittles on their spots. Wind the string around the top and insert the top in the slot at the end of the board. Support the top with one hand inside the box and give the string a steady pull with the other hand. The top will spin around, knocking over any skittles in its path. For a faster game, raise the end of the game board ½ in. or so to incline the playing field slightly.

You can play the game one of two ways—until one player reaches a predetermined number of points, such as 100, or until each player takes a predetermined number of turns with the top. In the latter, the player with the highest number of points at the last turn is the winner.

If the top tends to stay in one spot instead of moving around the board, try flattening the point of the top a bit more with a file or a piece of sandpaper. This makes the top less stable and more inclined to wander. ▲

John A. Nelson is a high school drafting teacher and a contributing editor of AMERICAN WOODWORKER.



DRESSING UP THE BASIC BOX

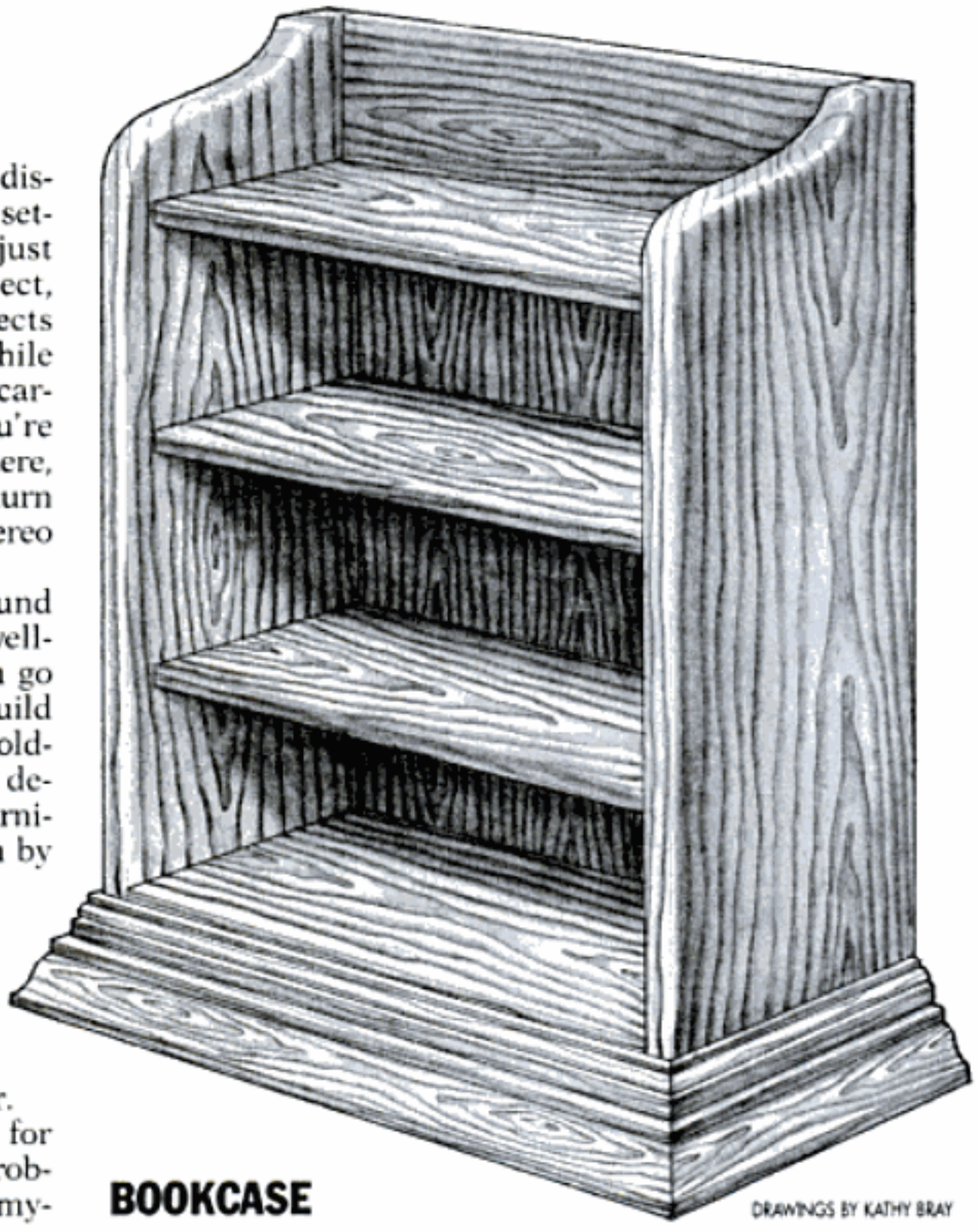
Add Doors, Drawers or Shelves to Make Several Different Designs

BY WALTER J. MORRISON

Those of you who share my disdain for spending hours setting up a tool to make just *one* cut for just *one* project, take heart. You can make lots of different projects based on the same basic box. This means that while you're set up for it, you can cut out parts for several carcases at once and stockpile the pieces until you're ready to build another project. By adding a door here, a drawer there or a shelf someplace else, you can turn this basic box into a bookcase, a wall cabinet, a stereo cabinet—all sorts of different pieces.

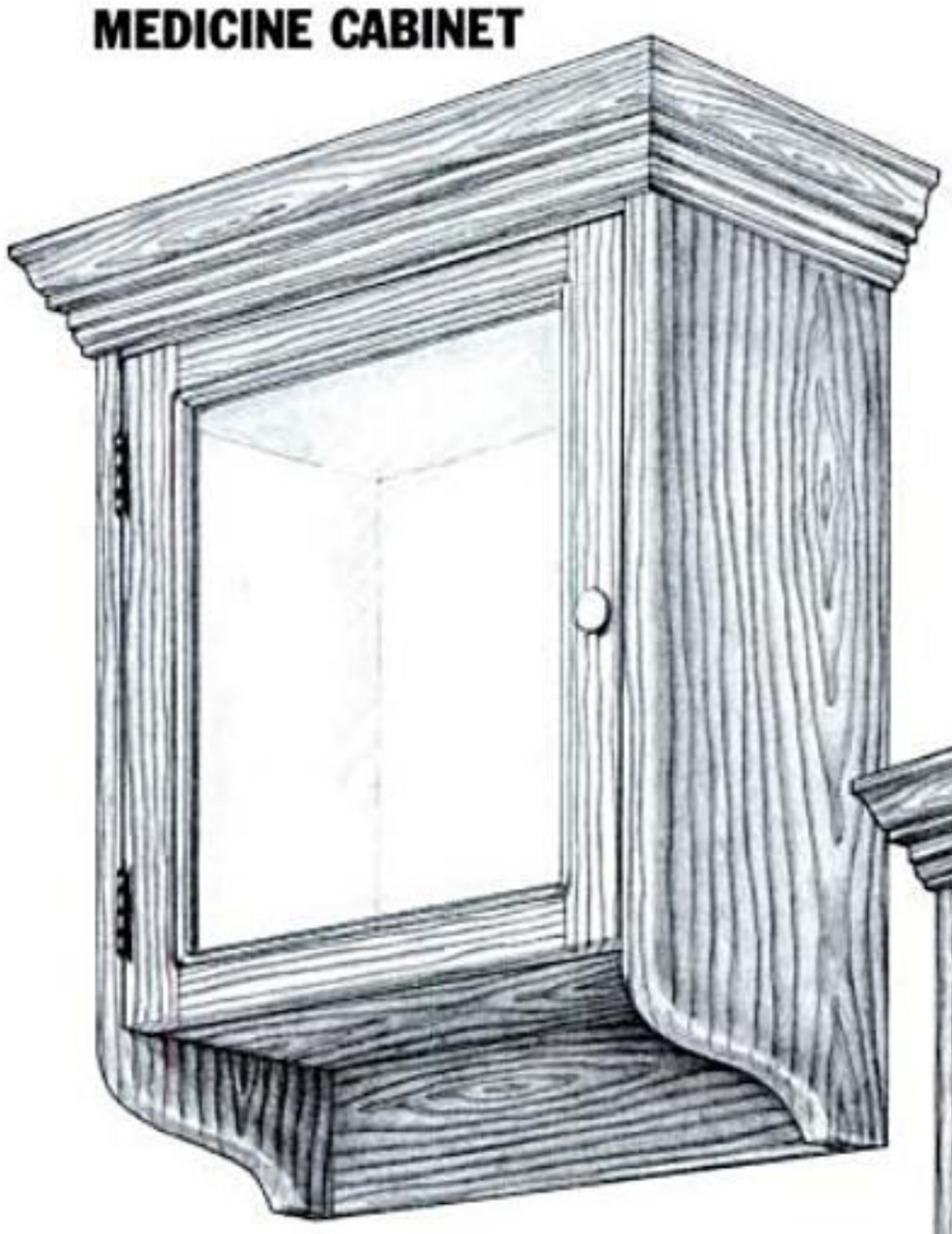
This technique of designing several pieces around one box—I call it the "universal carcase"—is well-known to professional cabinetmakers. Rather than go through a costly setup for just one cabinet, they build several at a time, embellishing the basic box with moldings, doors, shelves, etc., to make several different designs. While this technique is widely used in the furniture industry, I came across the idea pretty much by accident. I made three wall shelves like the one shown here. One sold quickly, while the other two hung upside down in my shop for a couple of years. I'd look at them occasionally as I went by, and one day I realized those wall shelves might make a good bookcase and might even make a good cupboard, if I added a door.

In fact, that carcase has been the foundation for about half-a-dozen cabinet designs so far and will probably yield half-a-dozen more before I start repeating my-

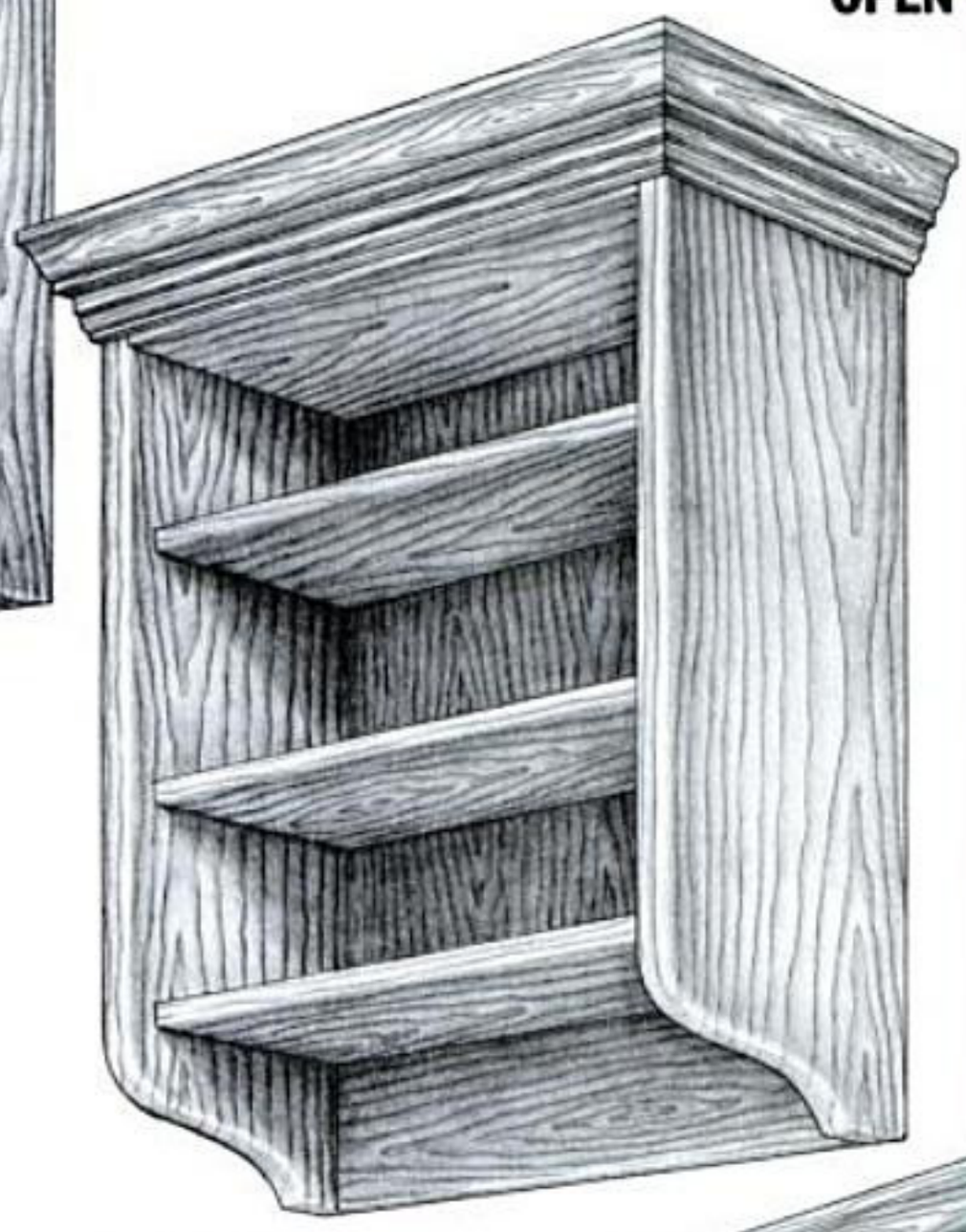


BOOKCASE

DRAWINGS BY KATHY BRAY

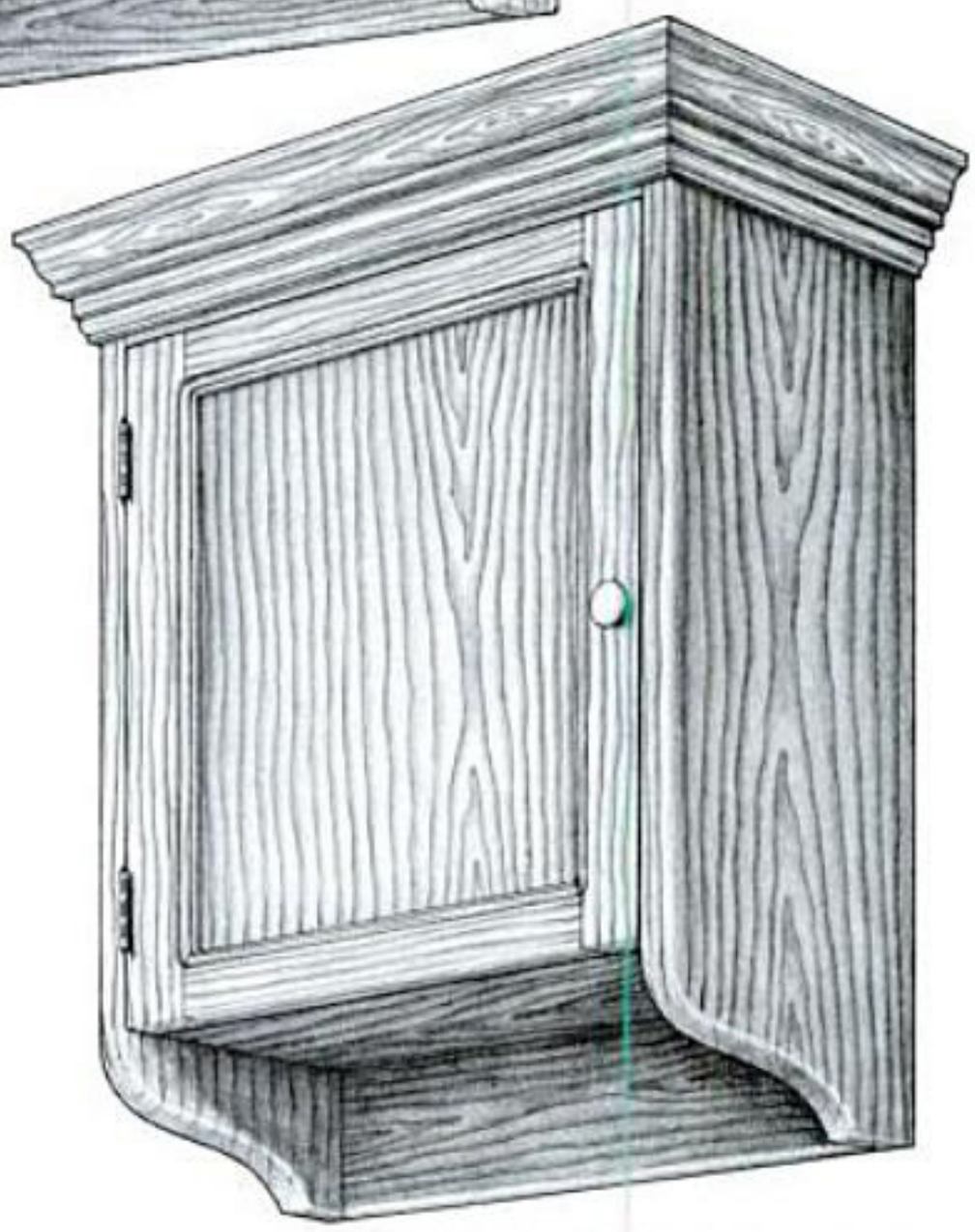


MEDICINE CABINET



OPEN WALL SHELF

All the designs shown here are based on the simple wall-shelf carcase at right.



COLONIAL WALL CABINET

self. I've built some of the designs shown here and some of the sketches are just ideas that I plan to build.

Take a good look at the drawings: The carcase for every piece is exactly the same (see sidebar page 47). The wall shelf, for example, is made by flipping the bookcase upside down. Substitute glass shelves and add a mirrored back and a recessed light to make a curio cabinet. Add a mirrored door to the wall-shelf design to turn it into a medicine cabinet, and so on.

Variations on a Theme

Design is a process of exploring variations on a theme. In this case, the theme is a basic box. You can change the look and feel of the box by adding or subtracting different elements such as moldings, handles, shelves or doors of different sizes, designs and materials. You can turn the box sideways or upside down; stand it on the floor or hang it from the wall. Paint it, laminate it, carve it, stencil it, even mount it on cast-

ers—anything's a possibility.

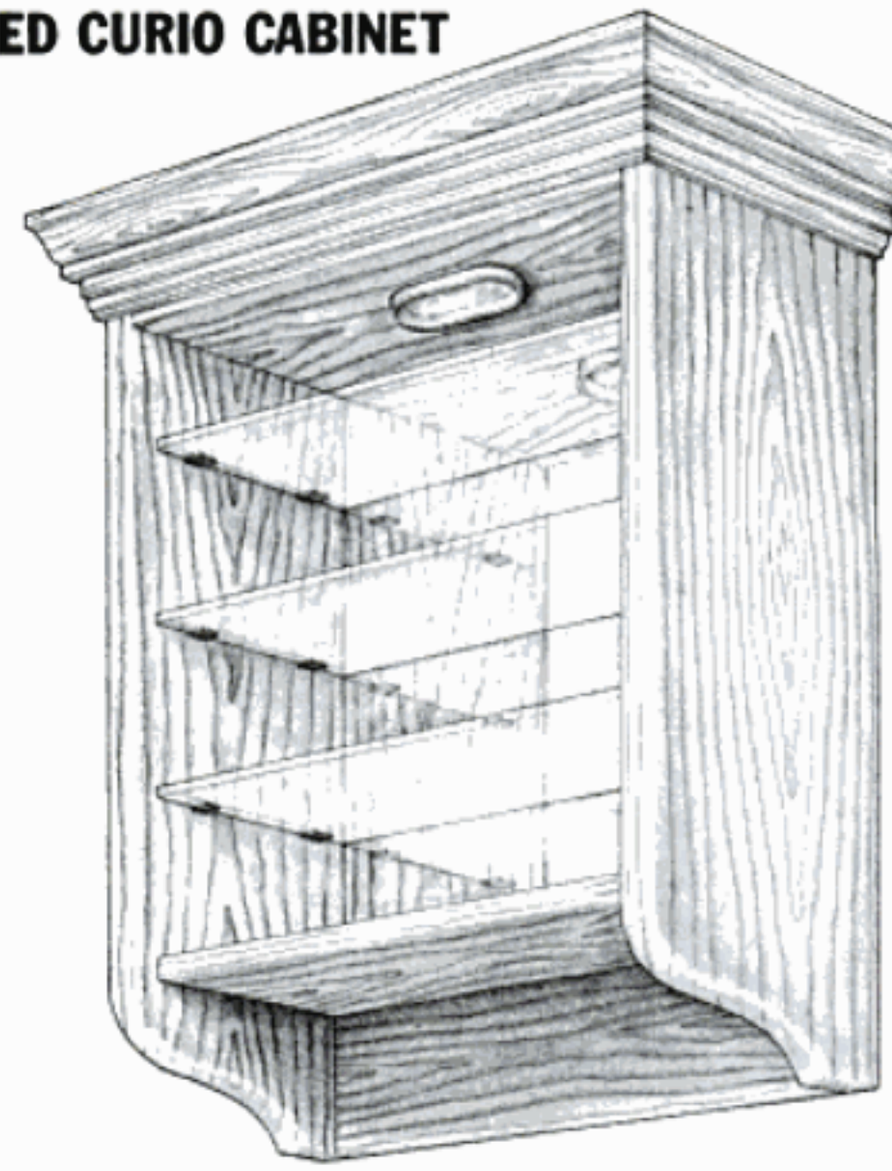
The box you choose for your "universal carcase" doesn't have to be the same one I used for the projects shown here. It doesn't have to be hard to build either. I've been known to nail and glue a cabinet together. But a universal carcase of some sort provides the theme and teaches you the skill of looking at an object and seeing several options.

Consider doors. Solid doors, frame-and-panel doors, glass doors—each type has its own personality. If you've got six different doors on six identical carcases, you've got six different cabinets.

I apply the "universal" approach to doors as well as carcases. The door frame shown in the drawings is designed for panels of glass, wood, a mirror or a wire grill. The panel is held in place with removable clips, and can be taken off—or even changed—long after the piece is complete.

Drawers add more design possibilities as shown. Replace the drawer with a hinged, drop-down panel to form a writing surface for a kitchen wall desk. A magnetic catch holds the drop-down panel closed.

Cabinet lights and glass panels really change the feel of a piece. How about a lighted curio cabinet with a mirrored back panel instead of plywood? The carcase design I used has a space behind the crown molding for installation of a 3½-in. dia. can light (available from Constantine's, 2050 Eastchester Road, Bronx, NY 10461). Be sure to cut ventilation holes in the top so the light doesn't overheat.

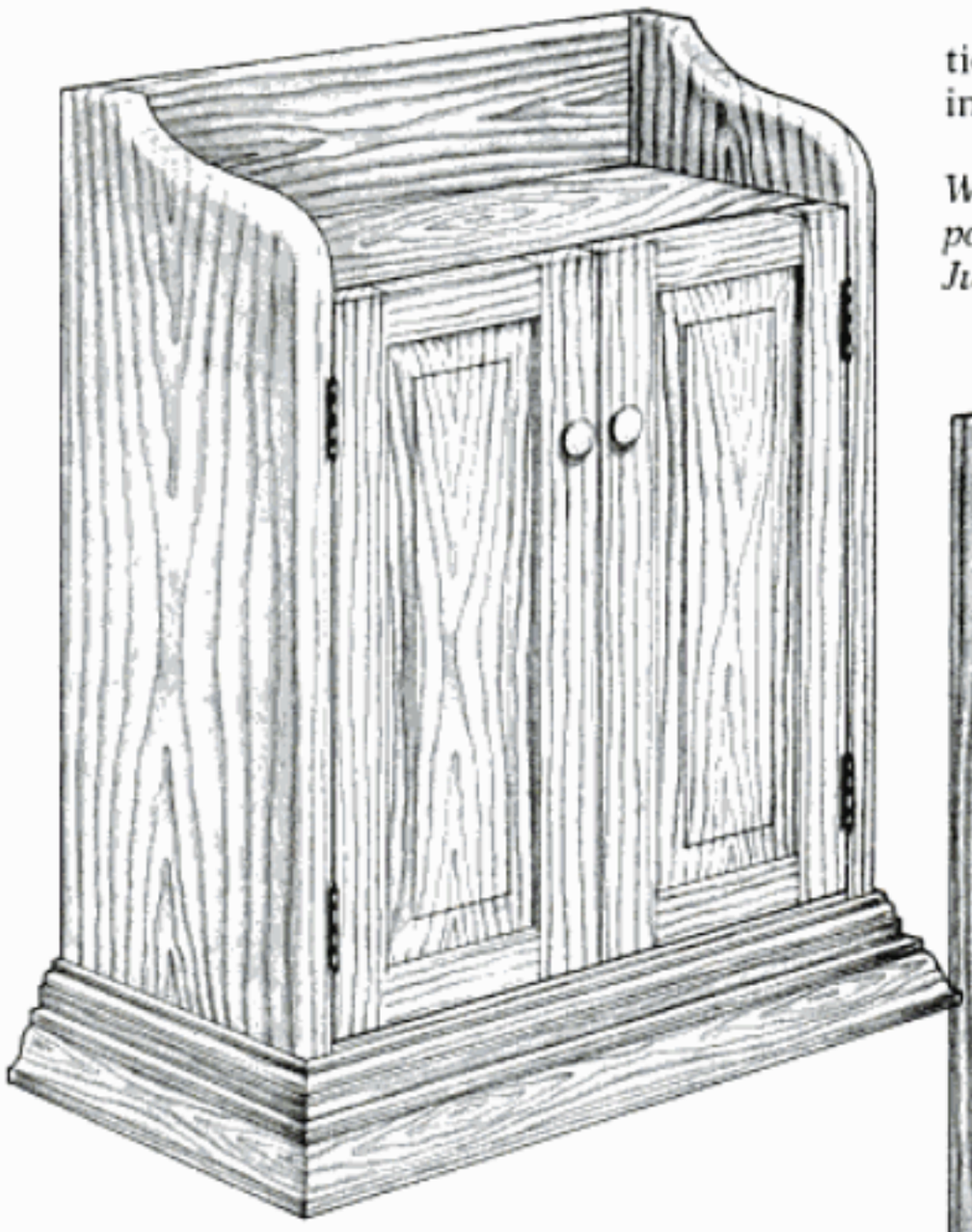


LIGHTED CURIO CABINET

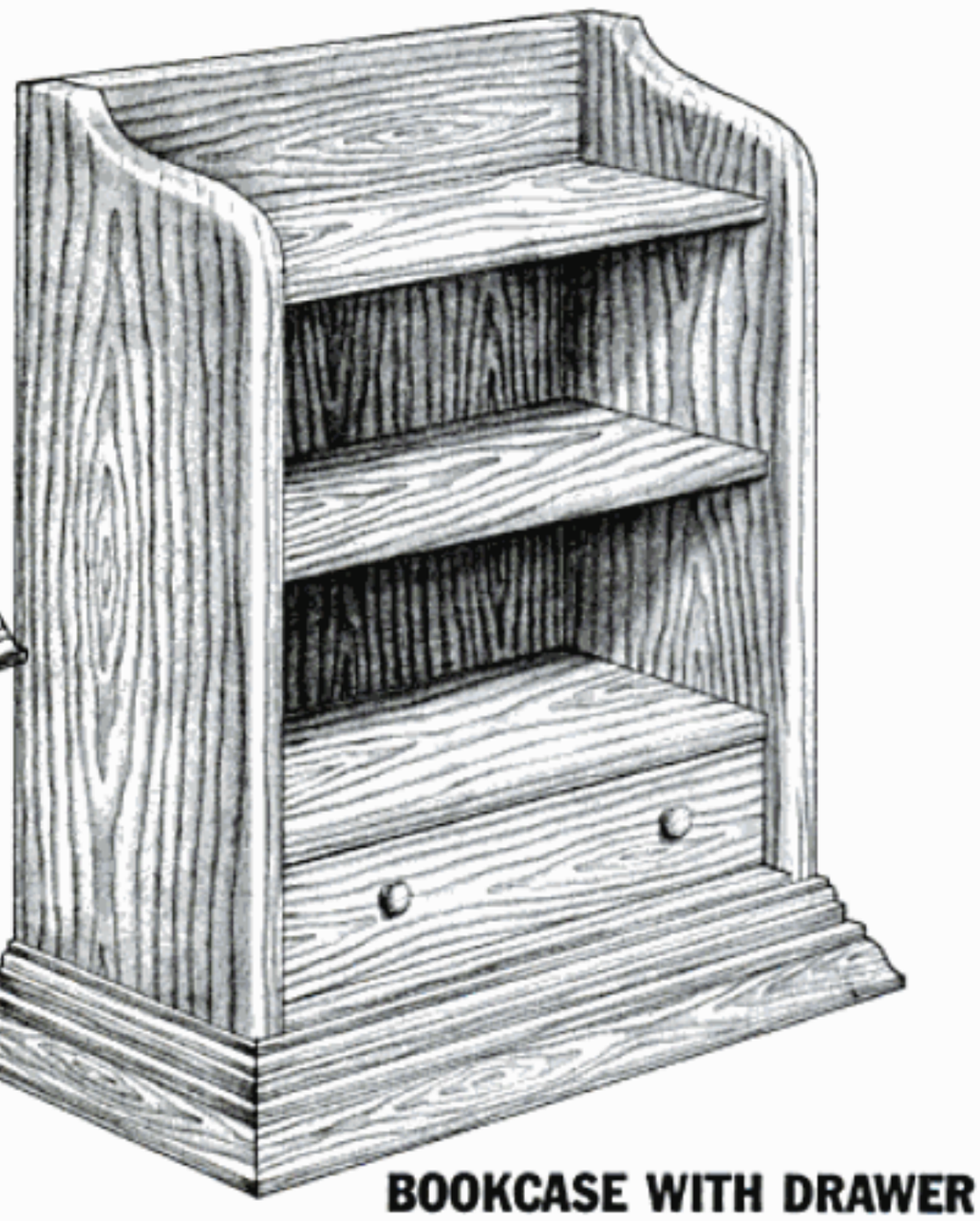
Why not make the shelves out of ¼-in. glass? If you order glass shelves cut to size, specify a seamed and polished edge—seaming removes the sharp edges, and polishing gives the edge a smooth look.

The old design-school adage goes, "form follows function." That may be so, but form is *limited* only by your imagination. ▲

Walter Morrison is an engineer and woodworker in Northport, NY. He wrote about building a mantel shelf in the July/August 1988 AMERICAN WOODWORKER.

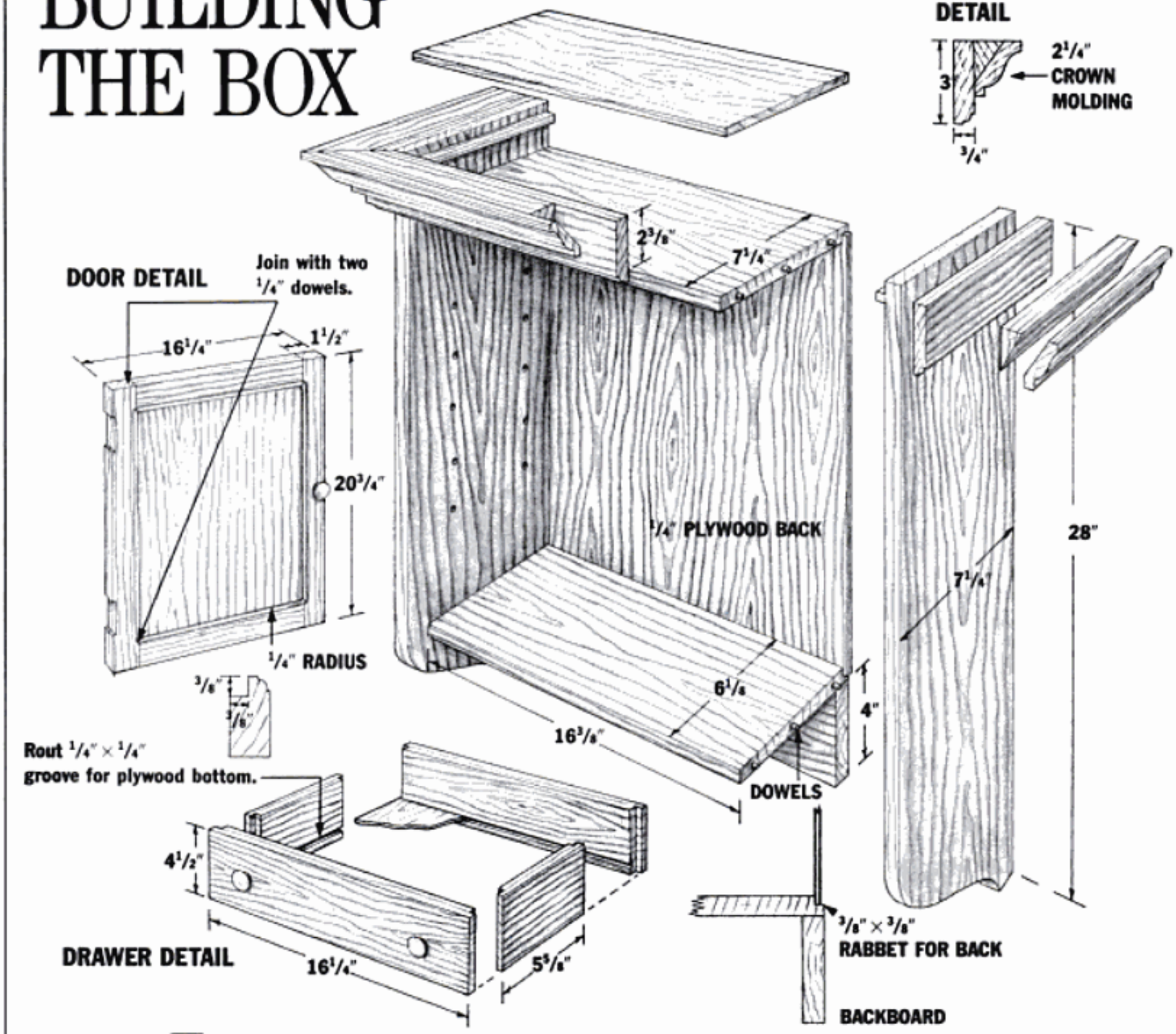


RAISED-PANEL FLOOR CABINET



BOOKCASE WITH DRAWER

BUILDING THE BOX



The carcase shown here is the one that has become my "universal carcase," but it started out as a design for a wall shelf. The curves and molding give it a colonial feel that makes it a good basis for furniture with a "country" look. All the designs in this article were based on this carcase.

To build it, start with the cabinet sides. Cut them to size, and lay out the curves on the end of each piece. Cut the two fixed shelves to length and drill the dowel holes that join these shelves to the sides. I cut the adjustable shelves later, and hang them from metal shelf pins (available from Constantine's). Lay out and drill the shelf-pin holes—remember that the right side will be a mirror image of the left side. Don't lay out holes on what will be the outside of the cabinet.

Cut the curves on the sides with a coping saw, saber saw or bandsaw and clean up the kerf marks with a fine drum sander.

Before assembling the carcase, I rout a detail on the outer edge of the sides with a 3/8-in. radius round-over bit to the profile shown in the Edge Detail. I guide the bit's pilot bearing against the edge of the cabinet sides and rout the same detail on the edge of the backboard and the flat piece of the molding assembly.

Sand the sides and fixed shelves before assembling the carcase. When gluing, I tack a scrap piece of wood diagonally across the cabinet back to keep the assembly square until the glue sets. After the glue dries, I rout a 3/8- × 3/8-in. rabbet for the cabinet back. Square up the cuts at the corners with a chisel or utility knife. Screw the back in place so that you can remove it later if you want to add a mirrored back.

Glue and nail the backboard in place, and install the crown molding. The molding is built up from three pieces—a flat board, a piece of 2 1/4- × 3/4-in. crown molding and a triangular infill piece. Glue the infill and crown molding together before cutting the miters. Nail the flat board to the carcase and nail the crown molding over it.—*W.M.*

CUTTING TAPERS ON THE JOINTER

Simple Setups for Perfect Tapers

BY FRED MATLACK

Most people think the jointer is good only for straight surfaces, but when I want a nice, crisp tapered leg, the jointer is the machine I choose. A well-tuned jointer turns out tapers that are crisp, true, and nearly ready to finish. And unlike the bandsaw or the tablesaw, the jointer cuts tapers without elaborate jigs that just clutter up your shop.

There are several types of tapers: full tapers, partial tapers, short tapers and stop tapers. Each type requires a slightly different setup but the principle is the same: Begin the cut with the board spanning both tables. What will be the wide end of the taper rests on the *outfeed* table and what will be the narrow end of the taper rests on the *infeed* table. The jointer will cut wood from the trailing end of the board only, creating a taper.

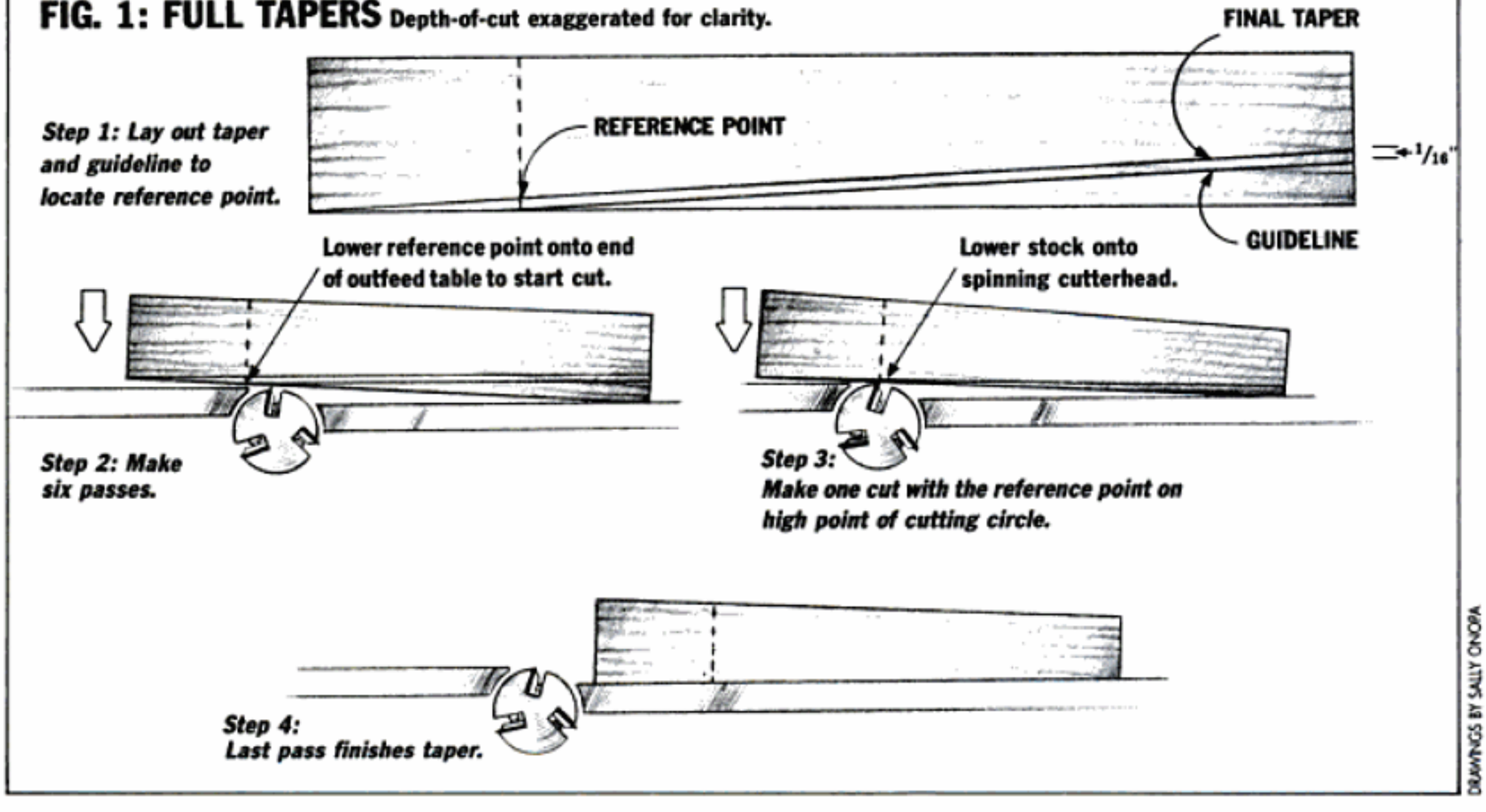
Full Tapers

Let's start by cutting a full taper. Fig. 1 shows the procedure step-by-step. But, before you start cutting, you need to establish some reference points so you know where to position the stock on the jointer table. First, locate the top of the cutting arc, and mark it on the fence with a felt-tip marker. Make a second mark on the fence marking the end of the outfeed table nearest the cutterhead.

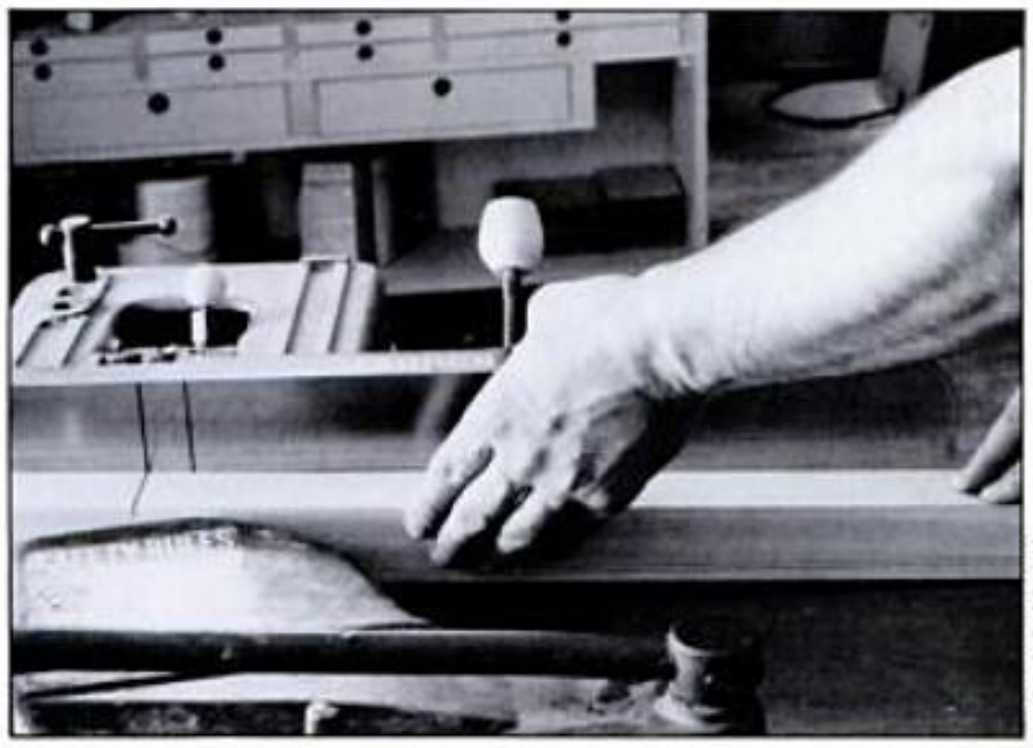
With that done, cut a full taper on a board 2 in. × 2 in. × 24 in. We'll leave the wide end at 2 in., but taper the narrow end down to 1½ in. Since the jointer works best making light cuts, we'll lower the infeed table to remove 1/16 in., and cut the taper in eight passes.

The first step to jointing a taper is to draw it on the actual stock as shown in Fig. 1, Step 1. Draw the taper, and then draw a guideline parallel to it as shown. The distance between the two lines is equal to the depth-of-cut—in this case 1/16 in. Mark the point where the guideline runs off the edge of the board with a third line as

FIG. 1: FULL TAPERS Depth-of-cut exaggerated for clarity.



DRAWINGS BY SALLY ONOPA



ANGELO CAGGIANO

Begin the cut when the reference line on the board is directly over the end of the outfeed table. Mark the fence to indicate this point.

shown in Fig. 1, Step 1. This third line provides an important reference point for starting the cut.

Now you're ready to go. Switch on the jointer, position the reference point over the end of the outfeed table nearest the cutterhead (you've already drawn a line on the fence to mark this point) and lower the board onto the spinning cutterhead as shown in Fig. 1, Step 2. To do this safely, begin with the entire board resting on the infeed table. Hold the board snugly against the fence. Lift the wide end up off the infeed table slightly. Keep the narrow end of the taper resting solidly on the infeed table and slide the board along the fence until the front end nudges the guard aside as shown in the photo. Try this maneuver several times with the power off to get the hang of it.

After six such passes, the board will have a taper but it will also have a slight flat, and a slight snipe near the wide end as shown in Fig. 1, Step 2. To remove both the flat and the snipe you need to make a seventh pass that's slightly different from the first six. Instead of lowering the reference point onto the end of the outfeed table, begin the cut by lowering the reference point directly over the top of the cutting circle as shown in Fig. 1, Step 3. Move the board across the cutterhead as you normally would.

The eighth and final pass is a cut along the entire length of the board as if you were jointing a straight edge as shown in Fig. 1, Step 4.

Partial Tapers

In many cases, you'll want to start a taper several inches from one end of the stock. Table legs, for example, often have a taper that starts just below the apron, a few inches from the top of the leg. The technique is the same as the full-taper technique explained above.

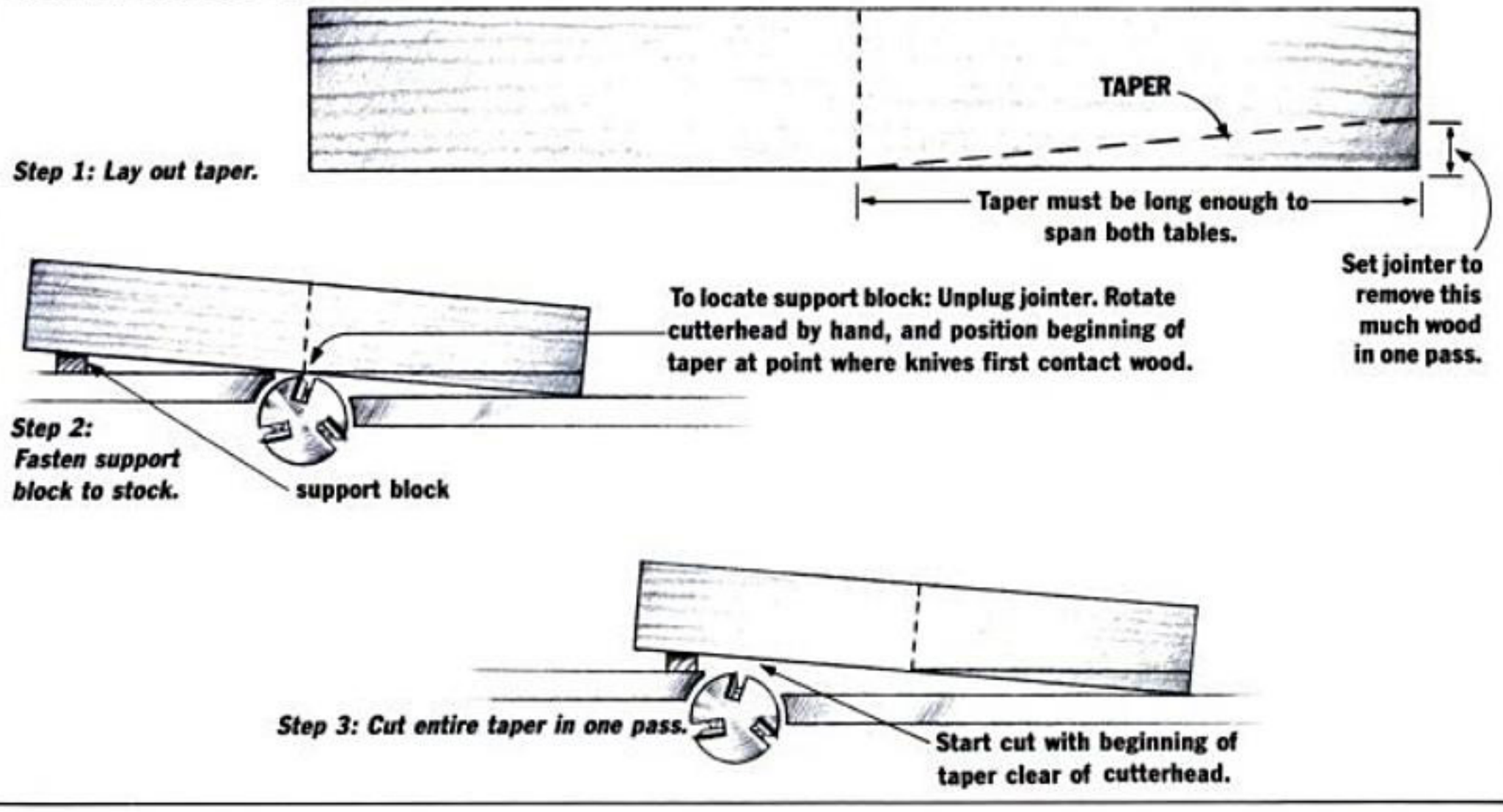
Mark the jointer table as explained for a full taper. On the side of the stock, lay out the taper and the guideline parallel to it and mark the reference point. Make all eight cuts as shown in Fig. 1. The untapered section at the top of the leg simply goes along for the ride. It touches neither the blade nor the outfeed table.

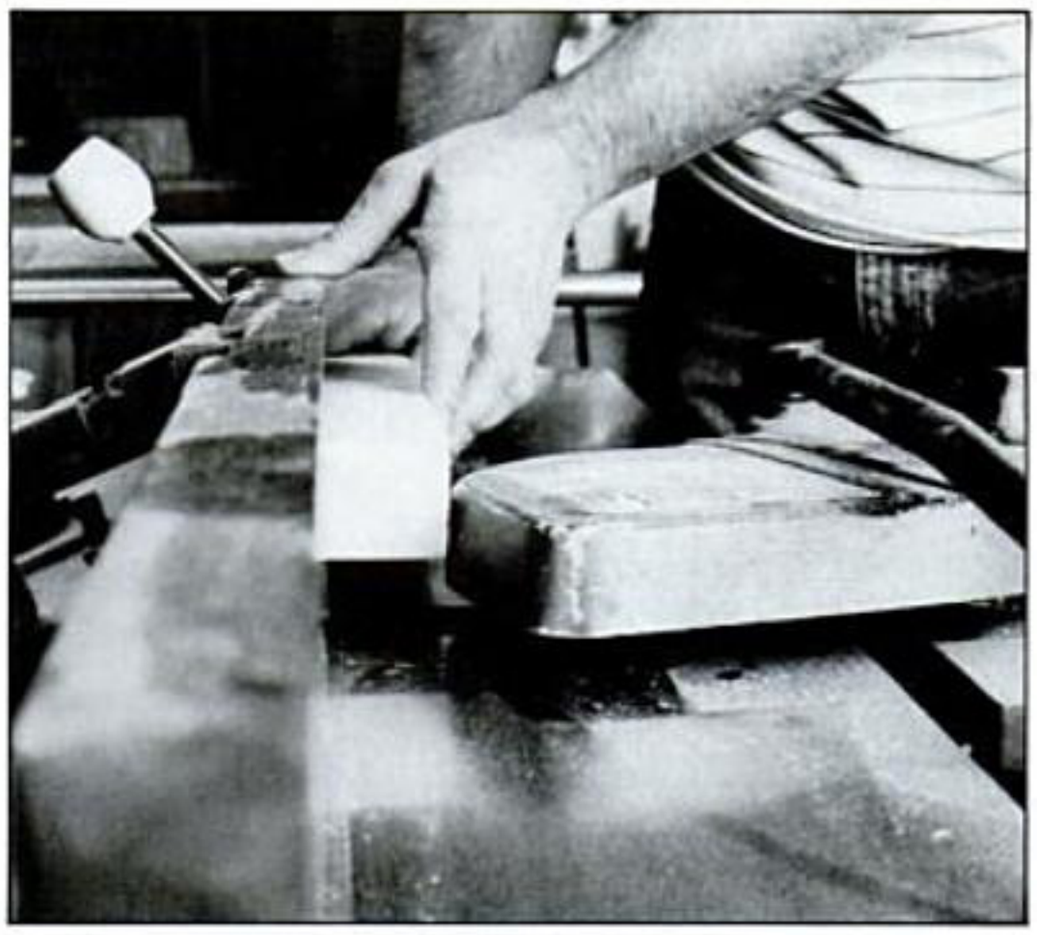
Short Tapers

Short tapers on the end of a long piece present a special problem. The taper must be long enough to span both tables. If the taper is too short, the stock can drop into the cutterhead—an extremely dangerous situation. Make sure the taper you plan to joint is longer than the gap between the infeed and outfeed tables. If you want a taper that's shorter than the gap between the tables, begin with a leg that is a little long; joint a taper that's a little longer than desired, then trim the leg (and the taper) to the desired length.

Unlike full or partial tapers, short tapers are cut in a single pass. Your layout line determines the depth-of-cut. Begin by drawing the taper on the stock as shown in Fig. 2, Step 1. At the narrow end of the stock, mea-

FIG. 2: SHORT TAPERS





Position the board by lifting its front end off the infeed table and nudging the safety guard aside. Keeping hands away from the blade.

sure the distance between the layout line and the bottom face of the board as shown in Fig. 2, Step 1. Lower the infeed table to remove that amount.

With the jointer turned *off* and unplugged, position the board with the narrow end of the stock resting on the infeed table as shown in Fig. 2, Step 2. The start of the taper is over the cutterhead at the point where the knives first contact the wood and the untapered section is up off the outfeed table as shown. With the stock in this position, slide a small scrap block under the uplifted end until it wedges tight. This block will support the uplifted end of the stock as you cut the taper. Mark its location and temporarily fasten it to the stock with tape, tacks or hot-melt glue. Make sure it is securely attached.

Remove the stock from the table and turn on the jointer. Begin the cut by nudging the guard out of the way with the end of the board, and advance the stock until you can lower the scrap block onto the outfeed table. Slide the board forward; the block automatically determines where the jointer begins cutting.

I believe that it is safest to stand in front of the jointer and to pull the board through as shown in the photo. You might prefer to push the stock from behind with a push stick. Do whichever you find most comfortable. Feed the stock slowly and be sure to keep the narrow end of the taper and the support block firmly against the tables at all times.

The length of a short taper is limited by the gap between the infeed and outfeed tables. On most 4-in. jointers, the shortest taper you can cut is about 2 in.

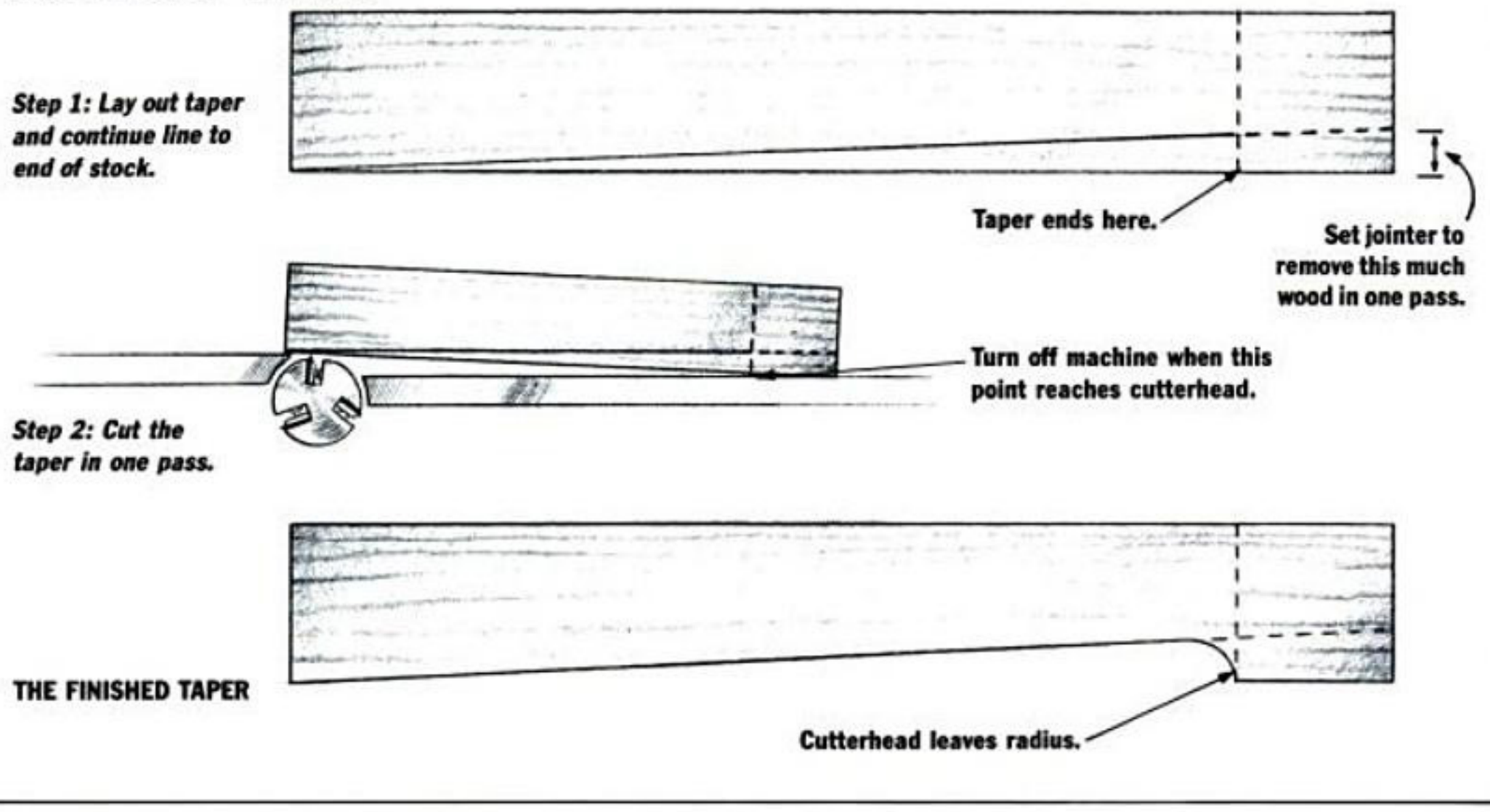
Stop Tapers

In some cases, you may want the *narrow* end of the taper to stop before it runs off the end of the board as shown in Fig. 3, Step 1. The technique is much like that used for a full taper, except that the entire cut is made in one pass and stop the cut before it reaches the end of the stock.

Start by laying out the taper. Continue the line all the way off the narrow end of the stock as shown in Fig. 3, Step 1, even though you're not going to cut that far. Now, measure the distance between the layout line and the bottom face of the board at the end as shown. Lower the infeed table to remove this amount. Even though the jointer may be set to remove as much as ½ in., you'll stop the cut before you actually cut off this much wood.

Switch on the jointer and lower the wide end of the stock onto the end of the outfeed table, (see Fig. 3, Step 2) nudging the guard aside as explained above for full tapers. Joint until the cutterhead contacts the section that is to remain square, then turn off the machine and wait for the cutterhead to come to a complete halt be-

FIG. 3: STOP TAPERS



fore removing the wood from the table. The cutterhead will leave a radius at the end of the cut; either clean it up by hand, or incorporate it into your design.

If you want a stop taper with a flat at the wide end as shown in Fig. 4, you'll need to support the wide end with a scrap block as explained above for a short taper.

First, you'll need to position the scrap block. Draw the taper on the stock as shown in Fig. 4, Step 1. Then, with the jointer unplugged, position the board with the starting point of the taper (at the wide end) over the cutterhead at the point where the knives first contact the wood. This setup is shown in Fig. 4, Step 2. Support the uplifted wide end of the stock with a block as shown in Fig. 4, Step 2.

Remove the stock from the table and start up the jointer. Nudge the guard aside with the end of the stock and lower the scrap block onto the outfeed table as shown in Fig. 4, Step 3. Make the cut in one pass. If you've positioned the support block correctly, the jointer will start cutting at the beginning of the taper. Stop when you reach the section that is to remain square and switch off the jointer.

Stop tapers are particularly useful for making spade feet, common on Hepplewhite furniture. To do this, make a stop taper on all four sides of the leg, allowing the end of the cut to be the top of the foot. For the foot itself, cut a short taper on all four sides or taper the foot by hand with a plane.

Cutting Multiple Tapers

When cutting identical tapers on several pieces, or tapering four sides of the same piece, you can save a lot of time by laying out the starting point of the cut on the jointer itself, instead of drawing the taper on each piece of wood.

Draw the taper, guideline and reference point on one piece of stock. With the jointer switched off, position the reference point over the end of the outfeed table as you would for your first cut. With a marker or a piece of tape, mark the infeed table at the narrow end of the stock. Begin each new taper with the narrow end lined up on this mark.

For full or partial tapers you'll need to make a second mark on the infeed table to mark the start of the seventh cut—where the reference point is over the top of the cutting circle as shown in Fig. 1, Step 3.

For stop tapers, you'll need to make an additional mark on the outfeed table to locate the end of the cut. For stop tapers, I recommend marking the start and end of the cut with stop blocks clamped to the jointer instead of a pen line or a piece of tape.

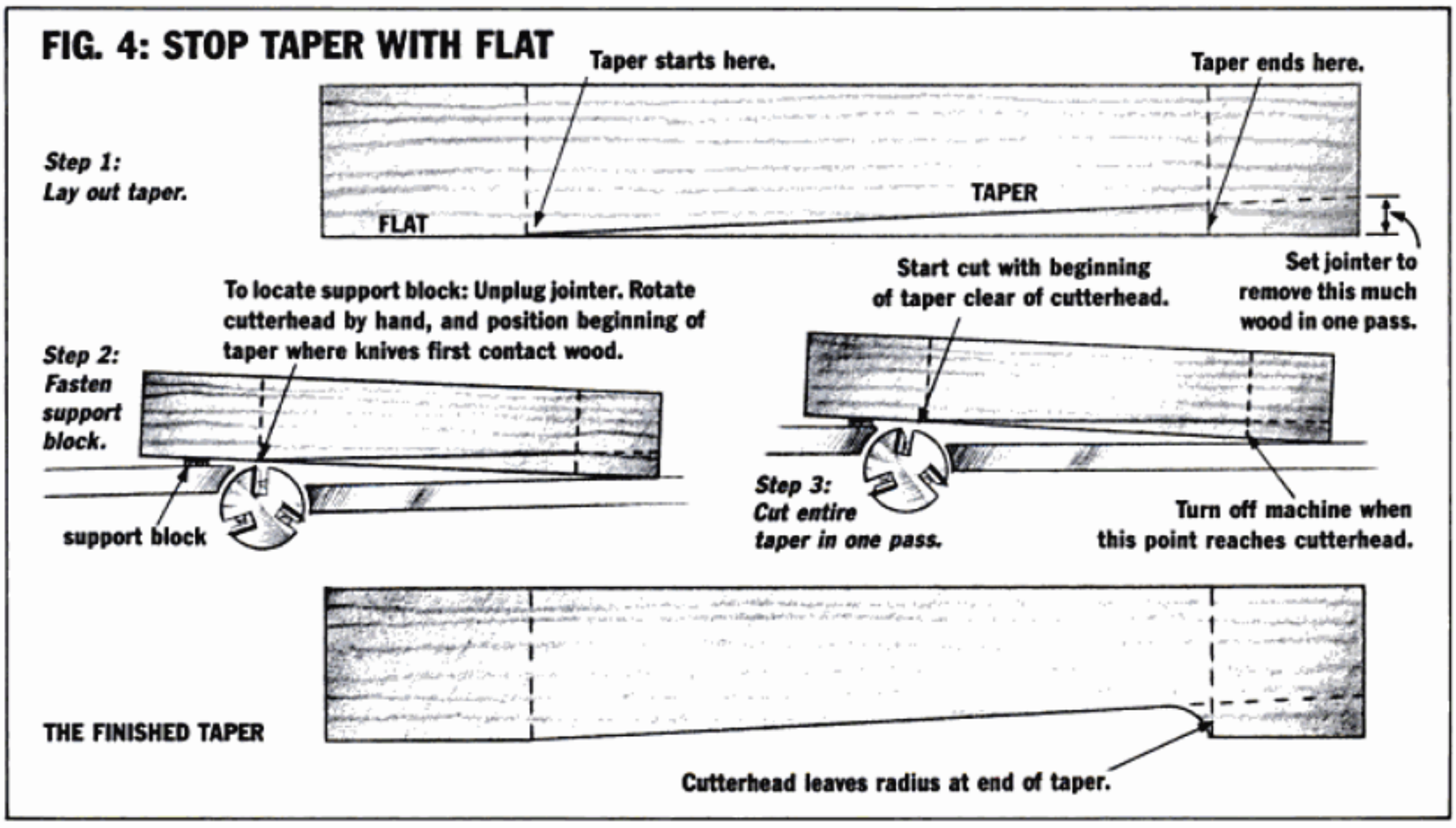
Use these marks (or stop blocks) to start your cuts and all the tapers will be exactly the same. Not only do you save time measuring, you'll also avoid having to remove layout lines from the finished pieces. ▲

Fred Matlack heads the Rodale Design Department.

PLAY IT SAFE

The jointer is a potentially dangerous machine that can severely injure your hands if you're careless. While you should always be cautious around the jointer, cutting tapers requires you to perform some operations that need extra caution. *Unplug* the jointer when setting up a cut and think the operation through before doing it. Know *exactly* where your hands are going to be and keep them well away from the cutterhead. Always use push sticks and safety guards when making a cut and protect your eyes with safety glasses. Never joint stock shorter than 10 in.

FIG. 4: STOP TAPER WITH FLAT



DRAFTING FOR

Whether You Design From Scratch or Work From Plans It Pays to Know the Basics

BY JOHN A. NELSON

Drafting. The very word sends shivers down the backs of countless woodworkers. Masters of their machines, they are terrified by the pencil. But drafting is actually a second cousin to woodworking. Most woodworkers are naturals at it because they already have a good feel for size and proportion.

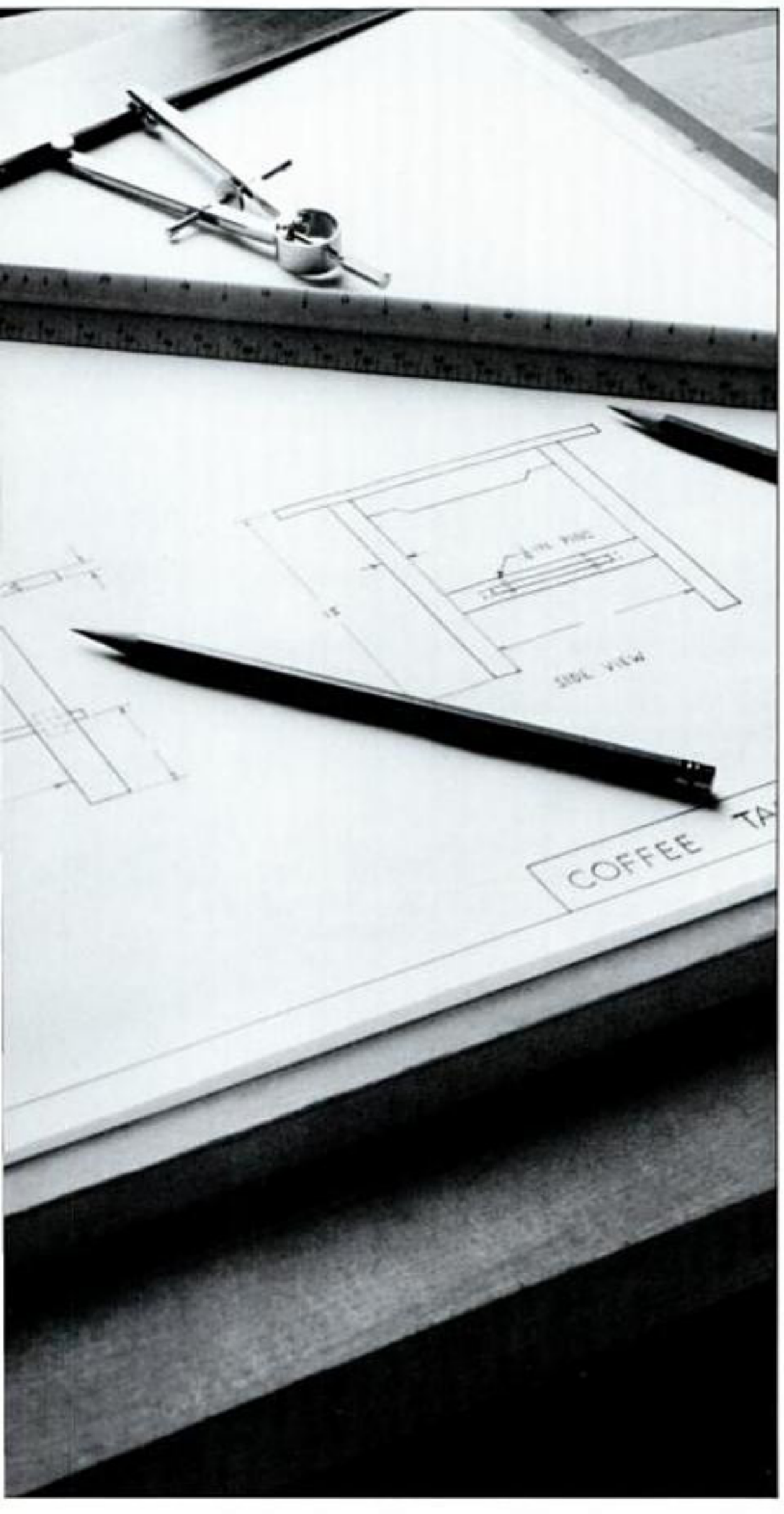
There are some very good reasons why every woodworker should know the basics of drafting. It pays to lay out a project on paper before it's built. You can anticipate construction problems, work out joinery details and get a better idea of what that great design of yours is really going to look like. By laying out a project on paper, you can also plan a cutting list to make the most efficient use of expensive wood. Even if you never design a thing in your life, you can't read a plan or a blueprint without some knowledge of drafting.

Think of drafting as a "graphic language." Like any language, the fine points can get complex but the heart of drafting is simple, even if its name, the "multiview projection system," doesn't sound simple. In multiview projection, the draftsman shows multiple views of an object at the same time—front view, top view, side view, etc. The different views work together to provide information about the object to the person who reads the drawing.

Multiple Views Tell the Story

A simple box is shown in Fig. 1. Imagine being small enough to take a stroll around it. From the front you see the length and height of the box, but not the depth.

WOODWORKERS



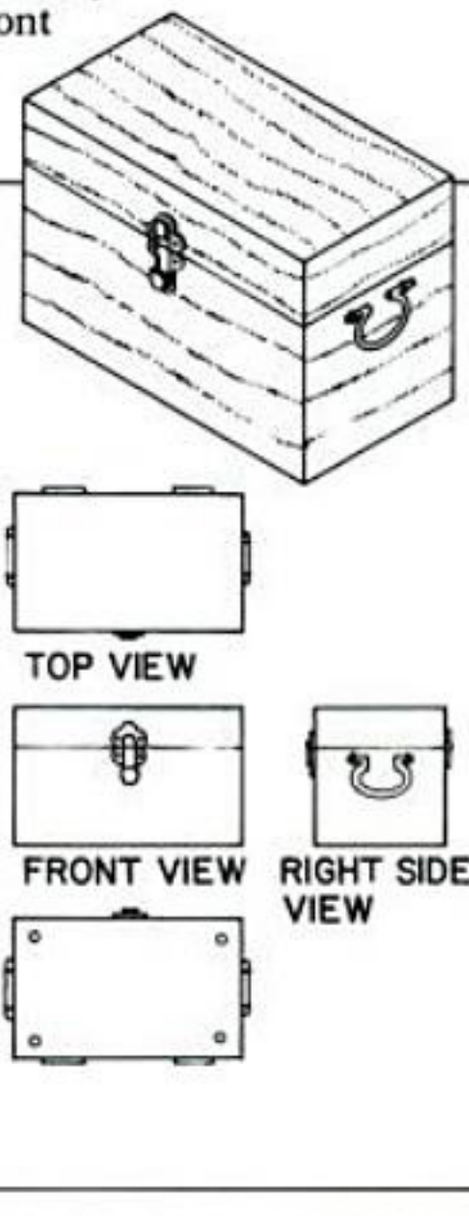
SALLY SHENK ULLMAN

You can see the latch, but you can't see the hinges or handles. As you walk around the box, these details soon become clear, but no single view of the box—front, side or back—illustrates it completely. To get the whole story you need to see several views at once. A multiview projection of our walk is also shown in Fig. 1. For a simple project like the box, however, the complete multiview actually tells us more than we need to know. Most woodworking projects can be illustrated with two or three views—the front view, top view and/or the right-side view. The drawing can be either full-size, or to scale (¼ in. = 1 in., for example).

For practice, get out your drawing equipment (see sidebar) and we'll work through a multiview projection of a simple box as shown in Fig. 2 and 3.

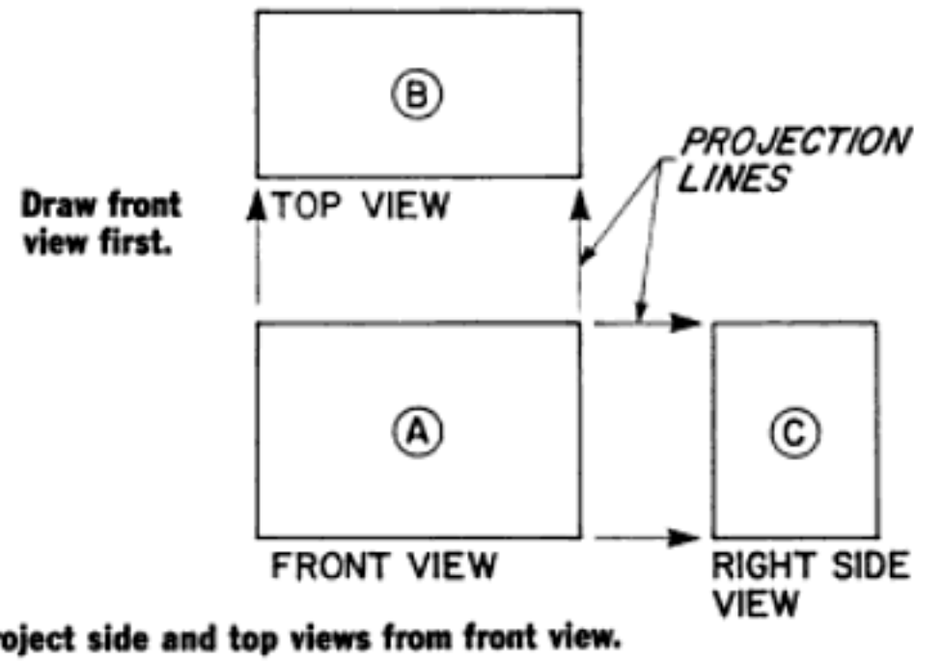
The front view is always the most important view and is the starting point of every multiview drawing. The front view is the first view to draw. CONTINUED

FIG. 1: MULTIVIEW PROJECTION



DRAWINGS BY JOHN NELSON

FIG. 2: PROJECTING FROM FRONT VIEW



Project side and top views from front view.

Draw the front view in *object lines* (see Fig. 5). Object lines are thick lines, while all other lines on a drawing are somewhat thinner. Draw the horizontal lines with the T-square as a guide. Draw the vertical lines with a triangle resting on the square.

After drawing the front view, the right-side view is next. The right-side view is always directly to the right of the front view. Rather than re-measure the height, position your T-square along the bottom edge of the front view, and "project" a line off to the right, as shown in Fig. 2, to locate the bottom of the box in the right-side view. Project a second line from the front view to locate the top of the box in the right-side view. These projection lines should be very light layout lines that are barely visible.

The width of the box can't be determined from anything already shown in the front view. If you had a real box in front of you, you'd simply measure the original and draw two lines that distance apart to show the width of the box on the side view. If this were a box you were designing, this would be a chance to try out various widths on paper to get the desired proportions. Since this is only an exercise, pick any dimension for the width and complete the side view in object lines.

The top view comes next, and is always located directly above the front view. Project the sides of the box upward from the front view. To lay out the width of the top, you have to project the width from the right-side view, with a 45° projection line as shown in Fig. 3. Draw the line with a 45° triangle, resting on the T-square as a guide.

These three views—front, right side and top—reveal all there is to know about our rectangular box. More complex projects may require additional views to show all the views. A bottom view, if needed, would be projected below the front view in the same way. A left-side view would be projected to the left of the front view.

Features such as hinges, handles and locks, also are projected from one view to another. Always project a feature from one view to another rather than re-measure the same feature over and over again.

Showing Hidden Details

Sometimes an object has details that can't be seen from the outside. Details that you can't see from the outside are shown as dashed lines called *hidden lines.* The dashes are usually about 1/8-in. long with a 1/32-in. space between dashes as shown in the drawing.

Sometimes, on complex objects, there are so many hidden lines in a regular view that it's difficult to understand what they all actually mean. When any one of the regular views becomes confusing because of too many hidden lines, you can convert it into a section view as shown in Fig. 4. A section view shows what an object would look like if you sliced it with an imaginary saw blade to reveal its interior. Section views require two new kinds of lines: a thick, *cutting-plane line,* and a thinner *section line.* The *cutting-plane line* (line A-A in Fig. 4) shows where the imaginary slice was made. Two arrows point from what will be the front of the cross-section view to the back. *Section lines* are thin, diagonal lines (slanted 45°) about 1/8 in. apart that shade the surface cut by our imaginary saw blade.

Fig. 4 shows an object cut in half. The top view in Fig. 4 has a cutting-plane line "A-A" where we took an imaginary saw cut. The front view shows the cut-open box and is labeled "Section A-A." The interior details now can be shown as object lines instead of dashed hidden lines as shown in the right-side view.

Dimensioning

Proper dimensioning is as important to drawing as proper measurement is in the shop. You'll save yourself trouble during construction if you draw only those di-

FIG. 3: PROJECTING FROM SIDE VIEW

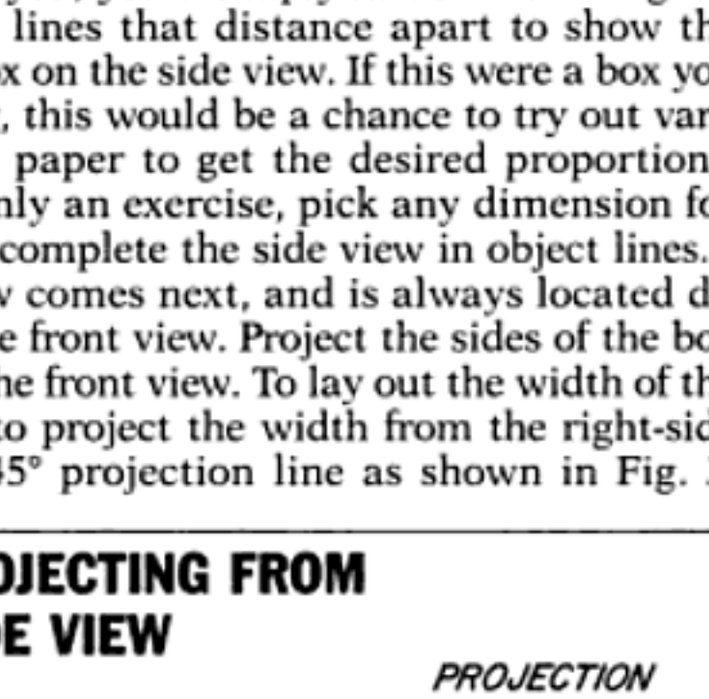
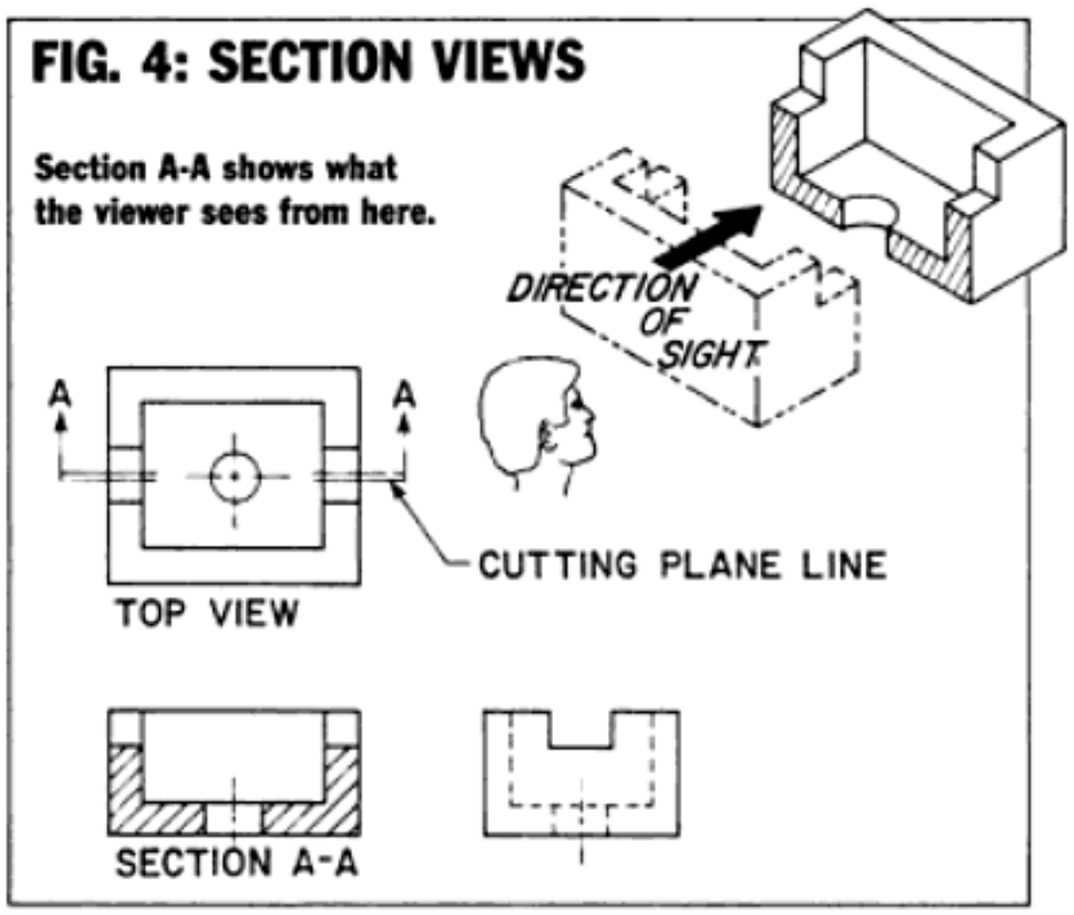
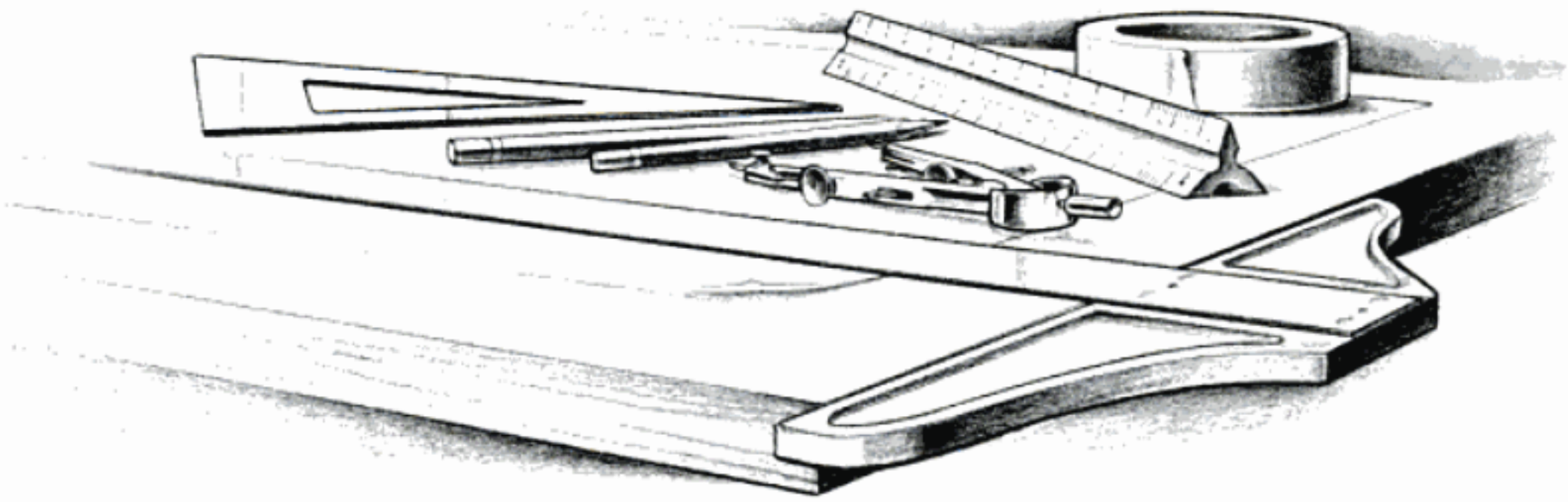


FIG. 4: SECTION VIEWS



TOOLS FOR DRAFTING



You don't have to spend a fortune on fancy equipment to produce perfectly acceptable shop drawings. All you really need are the following basic tools. Drafting equipment can be purchased locally at any good art supply store.

DRAWING BOARD—The drawing board should be as large as possible—24×36 in. is a good size for most woodworking projects. It should have a smooth, flat surface. Metal edges are nice, but not necessary.

T-SQUARE—The T-square is a guide for drawing all horizontal lines. It should be the same length as the length of the drawing board. T-squares with plastic edges are best because you can see through the edge to line up on a line or a point below.

TRIANGLES—You'll need three kinds of triangles: a 45° triangle, a 30/60° triangle and an adjustable triangle. The 45° triangle has two 45° angles and a 90° angle. The 30/60° triangle has a 30°, a 60° and a 90° angle. The adjustable triangle, as its name implies, can be adjusted to any angle. Triangles are made of see-through plastic and range in size from 2 to 24 in. An 8-in. triangle is probably best for most woodworking drawings.

COMPASS—The compass is a tool that draws radii, arcs and circles. It has two legs with a point at the tip of one leg and a pointed lead on the other leg. Compasses come in all sizes and styles, but I recommend a 6-inch compass with a center-wheel adjustment. The center wheel locks the arms in place. Keep the lead very sharp and extended out from the compass leg a minimum of 3/8 in. A 2-H lead works best; sharpen it with sandpaper to a chisel-shaped edge with the bevel facing away from the center point.

SCALE—A scale is the draftsman's ruler. Because not all drawings are actual size—some projects are too large to fit on a regular sheet of paper—the drawings must be scaled down. A drafting scale is triangular, and each face has measurements drawn to a given scale. With a scale, you can measure directly without having to make any mathematical calculations. A scale with full-scale (1), half-scale (1/2), quarter-scale (1/4) and one-eighth scale (1/8) is a good one to buy.

PENCILS—To produce professional drawings you need a high-quality drafting pencil, not a common old #2 pencil with an eraser. Lead varies in hardness from soft HB lead to very hard 9-H lead. A 4-H lead is good for light layout lines and a 2-H lead works well for all finish lines. For high quality, professional drawings, keep the lead very sharp at all times.

LEAD POINTER—The lead pointer is a one-handed version of a regular pencil sharpener and puts a sharp, tapered tip on the end of the lead. Unless you do a lot of drawing, purchase an inexpensive lead pointer.

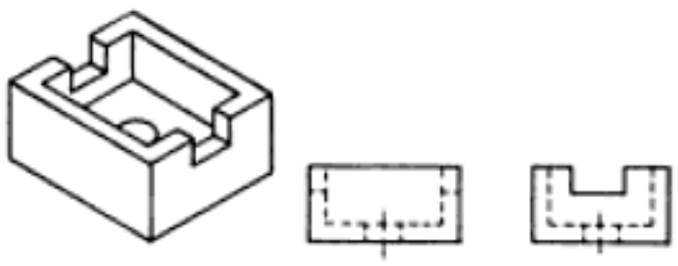
IRREGULAR OR FRENCH CURVES—No line on a drawing is made freehand. While straight lines are drawn with a T-square or triangle, and circles are drawn with a compass, all other curved lines are drawn with an irregular or French-curve template. Irregular-curve templates come in all shapes and sizes. It is best to have two or three different irregular-curve templates on hand so you can draw almost any kind of a curved line. Draw an irregular curve a section at a time. First draw the part of the curve that matches a section of your template and then move the template to match the required curve. I usually draw curves lightly freehand and darken them with the irregular curve.

PAPER—The best inexpensive drawing paper is called vellum. It is translucent and can therefore be used to make blueprints should you ever want to make inexpensive copies of your drawings. It also erases easily if necessary and comes in standard sizes: 8 1/2×11 in.; 11×17 in.; and 17×22 in. and larger. The 17-×22-in. size is good for most woodworking projects.

DRAFTING TAPE—Drafting tape holds the vellum paper on the drawing board. Line up the bottom edge of the vellum with the T-square and tape the four corners of the vellum with 3/4-in. long pieces of tape. I recommend tape 3/4-in. wide for general use. A roll of drafting tape will last you a very long time.—*J.N.*

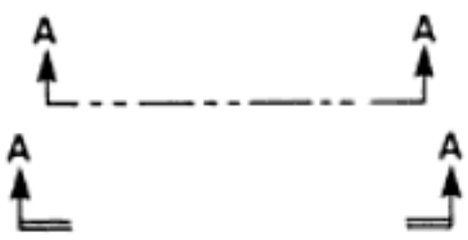
DRAWING BY SALLY ONOPA

FIG. 5: A PICTURE BOOK OF LINES



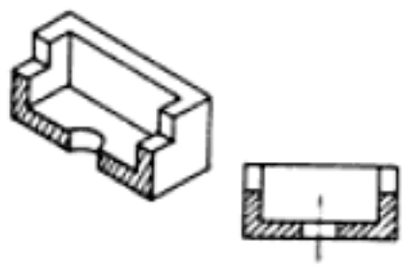
OBJECT LINES
Object lines show the outline of an object.

HIDDEN LINES
Hidden lines provide an X-ray view of details inside an object.



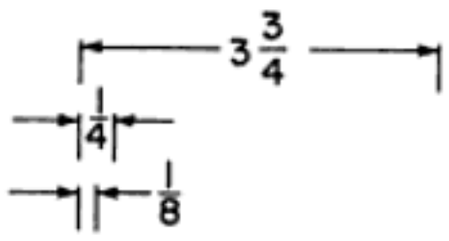
CUTTING-PLANE LINE
Cutting-plane lines show where an imaginary cut is made through an object to reveal details on the inside.

SECTION LINES
Section lines show the surfaces that have been cut.

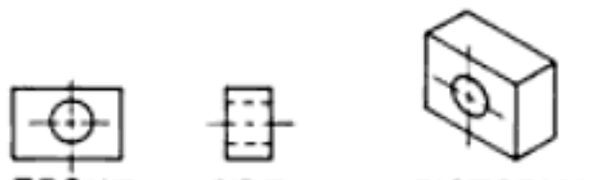


DIMENSION LINES
Dimension lines indicate the size of the piece.

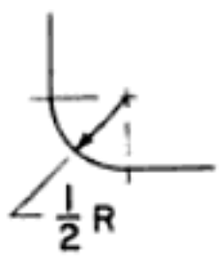
EXTENSION LINES
Extension lines extend from the edges to show a measurement.



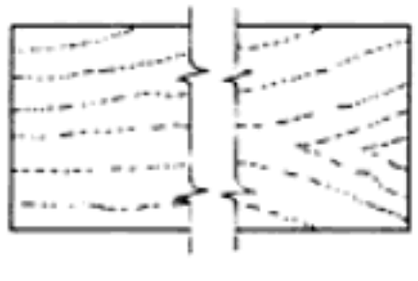
CENTER LINES
Center lines mark the center of holes and cylinders.



LEADER LINES
Leader lines direct the eye to a dimension which will not fit in the available space.



BREAK LINES
Break lines show that the center of the object has been removed to save space on the drawing.



mensions you need to make the object. Always try to dimension the profile of an object: Dimension a hole in the view that it appears as a circle and a notch in the view that it appears as a notch.

Dimensions are indicated with two kinds of lines, *extension lines* and *dimension lines.* Both are thin black lines. As their name implies, *extension lines* are lines that extend from the edge being measured as shown in Fig. 5. They don't actually touch the object but start about 1/32 in. away from it. *Dimension lines* have arrowheads at each end and are drawn parallel to the edge being measured. The dimension line is broken in the middle to allow the dimensions to be placed inside the break. Arrowheads should be drawn 1/8-in. long.

Sometimes there isn't enough room to put either the dimension or the arrows between the extension lines. If this happens, draw the arrowheads outside the extension lines, as shown in Fig. 5.

Sometimes it's necessary to mark the center of an object to show that it's really a hole or a cylinder when it looks flat on the drawing. A *center line* is a line that alternates 3/4-in. long dashes and 1/8-in. long dashes with 1/32-in. spaces in between.

Dimensioning holes, round-overs and radii presents special problems. For holes, think like you would when building: Locate the center of the hole first, and then note the size you will actually drill the hole—1/2-in. dia., for example.

You dimension the hole with a line through the diameter that ends in arrowheads at the circumference of the circle. If the diameter is large enough, you can write the dimension inside the actual circle. If the diameter is too small for all this to fit inside the circle, add the dimension outside the circle with a *leader line.*

Curves, coves and round-overs are dimensioned according to the radius of the arc that forms them. The line showing the length of the radius is an arrow that begins at the swing point of the arc, and ends at the arc. If space allows, add the dimension inside the arc. If not, add the dimension outside the arc with a leader line.

Today, all dimensions are usually placed so they can be read from the bottom of the drawing paper without turning the drawing to read a dimension. On old drawings, the horizontal dimensions were usually placed to read from the bottom of the paper and the vertical dimensions were placed to read from the right side.

If a project you want to draw is too large or long to fit on a sheet of paper, you can cut out the midsection with *break lines*. Break lines show that the center of the object has been removed. Although the part has been drawn shorter than it really is, the correct dimension is always given. A break line is a thin, black line with thin freehand "Z"s drawn along it as illustrated. Note also the thin break lines are drawn out past the object.

When you write dimensions or labels on a drawing, use a simple block letter, 1/8-in. high. Two tricks will help you when writing labels for your drawing. Draw your letters between two light guidelines 1/8-in. apart, making the letters with strokes that go from top to bottom. Good lettering takes practice but makes a drawing look professional. If you have trouble writing legibly, you might consider purchasing a lettering template. These templates will help you make perfect lettering every time. ▲

John Nelson is author of Basic Drafting for Design *(1987, Delmar Publishing Company, Albany, NY) and a contributing editor of* AMERICAN WOODWORKER.

BOOKS & VIDEOS

BOOKS

Woodworker Guide to Woodturning

by Michael O'Donnell
(1988, Cupress, 20 Torbay Rd., Markham, Ontario L3R 1G6, Canada) Softcover; 122 pp; US $21.95

Michael O'Donnell's new book, *Woodworker Guide to Woodturning*, is a welcome addition to my rapidly growing collection of books and video tapes on the subject. O'Donnell approaches the subject with a lot of enthusiasm and is very knowledgeable and thorough in his descriptions. These descriptions are enhanced by the abundant, clear diagrams.

The book focuses on the proper use of lathe tools as well as sharpening, approaching the lathe, cutting techniques and turning exercises. O'Donnell covers these areas very thoroughly—for both center work and faceplate turning. This book, however, does not include information on finishing, chucks or taking a piece of wood from start to finished project.

Perhaps a small point but, I feel, a very important one, is that although there is a section on safety, eye protection is not mentioned. In fact, in a number of photographs of O'Donnell turning, he is wearing no safety shield or safety glasses. O'Donnell is cavalier in this serious deletion.

MARK SFIRRI

Toys Wooden

by J. James Hasenau
(1985, Holland House Press, Box 42, Northville, MI 48167) Softcover; 104 pp; $9.95

Wooden toys have an almost universal appeal. In *Toys Wooden*, James Hasenau has done a fine job providing an introduction to the making of such toys. What is especially inviting about the book is the simplicity of its instructions. *Toys Wooden* would be an excellent gift for any budding woodworker.

Projects range from small blocks decorated with postage stamps and hung to make mobiles, to a shadow box, to the ubiquitous wooden train. The instructions are well written and clear as are the full-size patterns. Recommendations for tools, materials and methods are given in an appendix. A list of sources for materials is also provided. Instructions are given for making many simple tools including a drill for balsa made from a paper clip.

One beef: the back cover states that the book instructs in methods for multiple production when only two pages of appendix do so. In all, however, *Toys Wooden* is an excellent primer for making toys that are both simple and charming.

DENNIS R. MITTON

BOOKS & VIDEOS

Relief Carving and Lettering

by Ian Norbury
(1988, Linden Publishing Co., 3845 N. Blackstone, Fresno, CA 93726) Softcover; 157 pp; $15.95

Novices and experienced woodcarvers alike will find Ian Norbury's *Relief Woodcarving and Lettering* instructional and inspiring. This book lures its readers into improving their skills by making the carving techniques in each chapter a bit more advanced than those in the previous chapter. Black and white photos of Norbury's wonderful carvings stand as beautiful and intriguing examples of what can be accomplished by following the instructions. The writing is very clear, though it often helps to have tools and wood in front of you, as some of the points he covers are best learned through experience.

Norbury begins with a basic discussion of tools and carving techniques. Low-relief and high-relief carving each take up a chapter followed by a chapter on the many sculptural possibilities relief carving offers. He wraps up the book with a discussion of lettering, including a catalogue of alphabets.

This book is a highly readable text with a fine balance of photos and drawings that help illustrate the numerous carving secrets Norbury offers. It's a must-read for any carver or would-be carver.

FIONA WILSON

VIDEOS

Shopsmith, Inc. Hands-On Series Outdoor Projects

with Avian Rogers and Les Cizek
(1986, Shopsmith Inc., 3931 Image Drive, Dayton, OH 45414) Length: 30 min.; VHS and Beta; $24.95

This how-to video tells how to make two projects: an hexagonal picnic table and a planter box. The redwood picnic table is made of two hexagonal "wheels," one for the top and one for the seat, connected by six angled, bolt-on legs. The instructors stress patience and accuracy as they lead the viewer through cutting and assembly. A pamphlet of detailed drawings, material lists, and step-by-step instructions is included as a companion to the video.

Basic miter and bevel cuts are demonstrated using a portable circular saw or a tablesaw. Use of simple jigs for clamping and stop blocks for repetitive cuts are shown as well.

The planter is a simple box with holes in the bottom for drainage. A top frame around the box is doweled together at mitered corners. The viewer is shown how to make these joints with either a doweling jig or the Shopsmith as a horizontal boring machine.

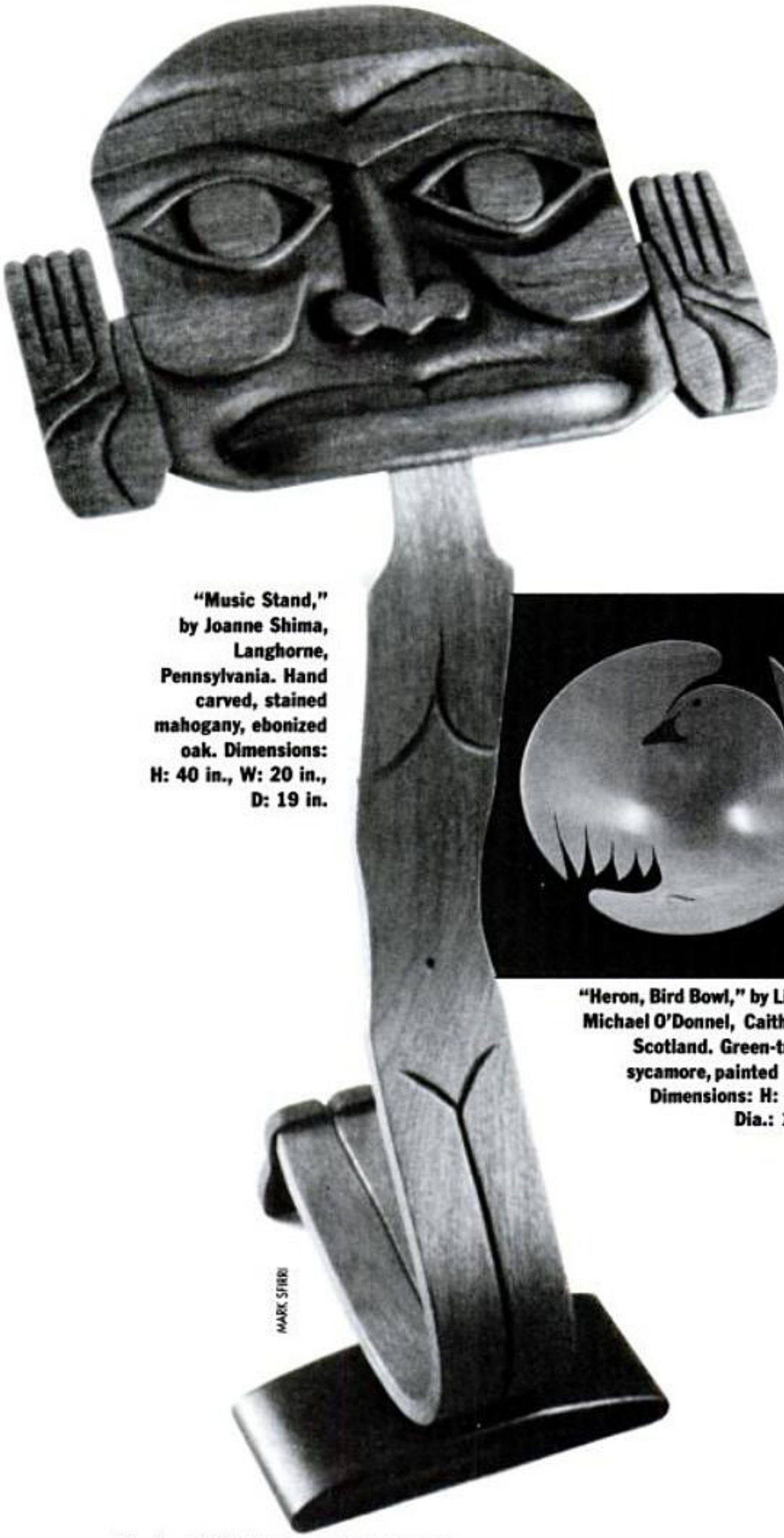
A separate section covers some basic shop tips and safety. This includes a demonstration of push sticks and feather boards for ripping stock on the tablesaw.

DAVE SELLERS

GALLERY

CURRENT WORK BY OUR READERS

Traditional furniture has its place, but woodworkers like to follow flights of fancy, too, unleashing their imaginations to explore wilder horizons. Often the elements that emerge in such fanciful works are animal forms: birds, serpents and humans are just a few that appear here. Other imaginative flights produce more spacial or geometric forms or play with illusion. Though some of these pieces aren't functional in the traditional sense, they do fulfill a function nonetheless. They satisfy a fundamental human desire for mystery and delight.



"Music Stand," by Joanne Shima, Langhorne, Pennsylvania. Hand carved, stained mahogany, ebonized oak. Dimensions: H: 40 in., W: 20 in., D: 19 in.

MARK SFIRRI

DAVID SLOAN

"Heron, Bird Bowl," by Liz and Michael O'Donnel, Caithness, Scotland. Green-turned sycamore, painted head. Dimensions: H: 4 in., Dia.: 11 in.

MARK SFIRRI

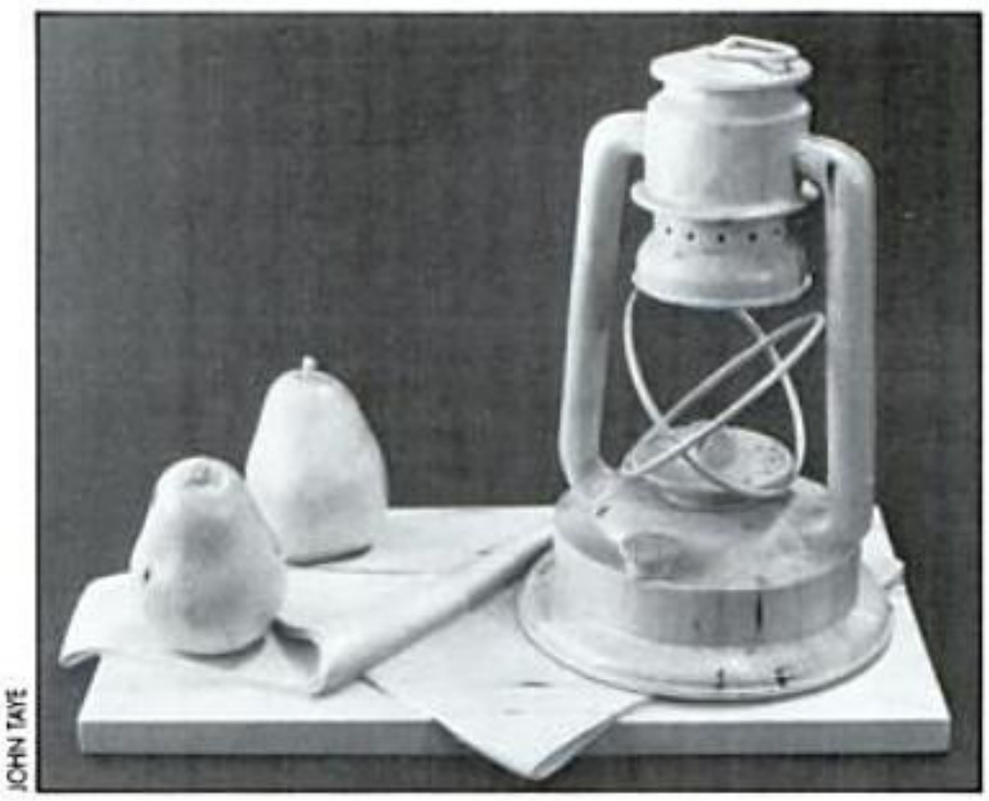
"Stool," by Joanne Shima, Langhorne, Pennsylvania. Mahogany, wenge, milk paint, suede and gold leaf. Dimensions: H: 36 in., W: 17 in., D: 17 in.

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 (4×5 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.*

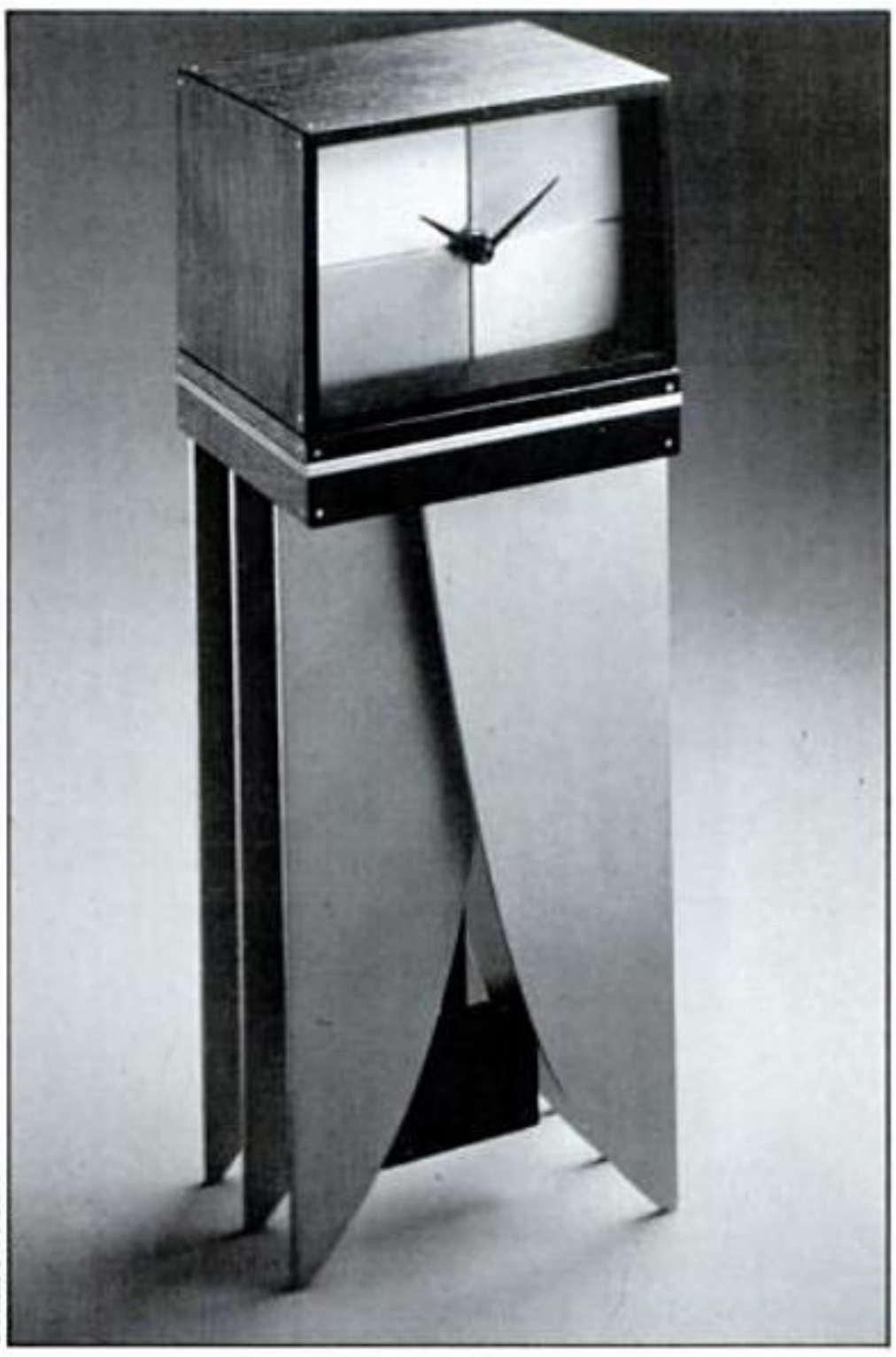
GALLERY

CURRENT WORK BY OUR READERS

**"Lantern and Pears,"
by John Taye, Boise, Idaho.
Basswood. Dimensions:
H: 12¾ in., L: 17 in.**



JOHN TAYE



CHARLES SWANSON

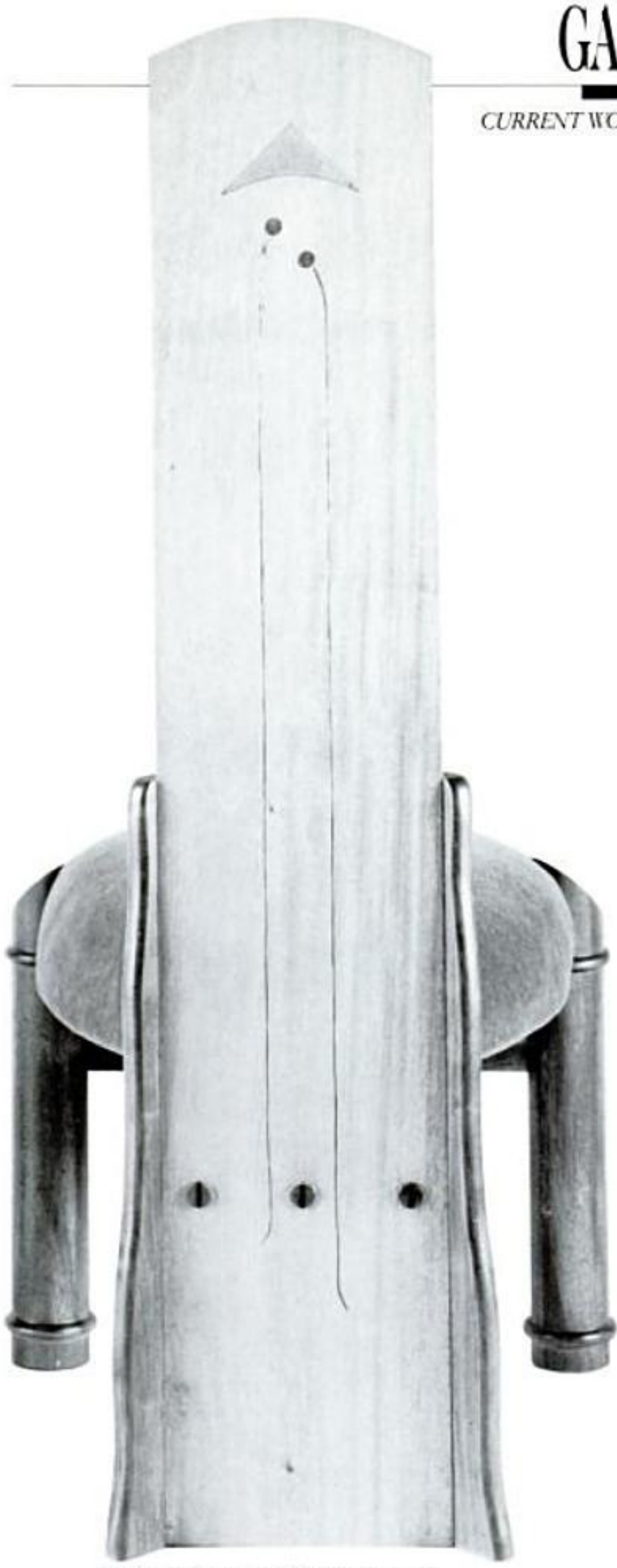
**"What a Swinging Clock!,"
by Charles Swanson,
Providence, Rhode Island.
Ebonized mahogany,
aluminum. Dimensions:
H: 11 in., W: 4 in., D: 3 in.**

RICK ECHELMEYER

**"Sperm Chair," by Jack Larimore
Associates, Philadelphia, Pennsylvania.
Mahogany, purple heart, painted detail,
inlaid plastic dots, mohair. Dimensions:
H: 48 in., W: 20 in., D: 20 in.**

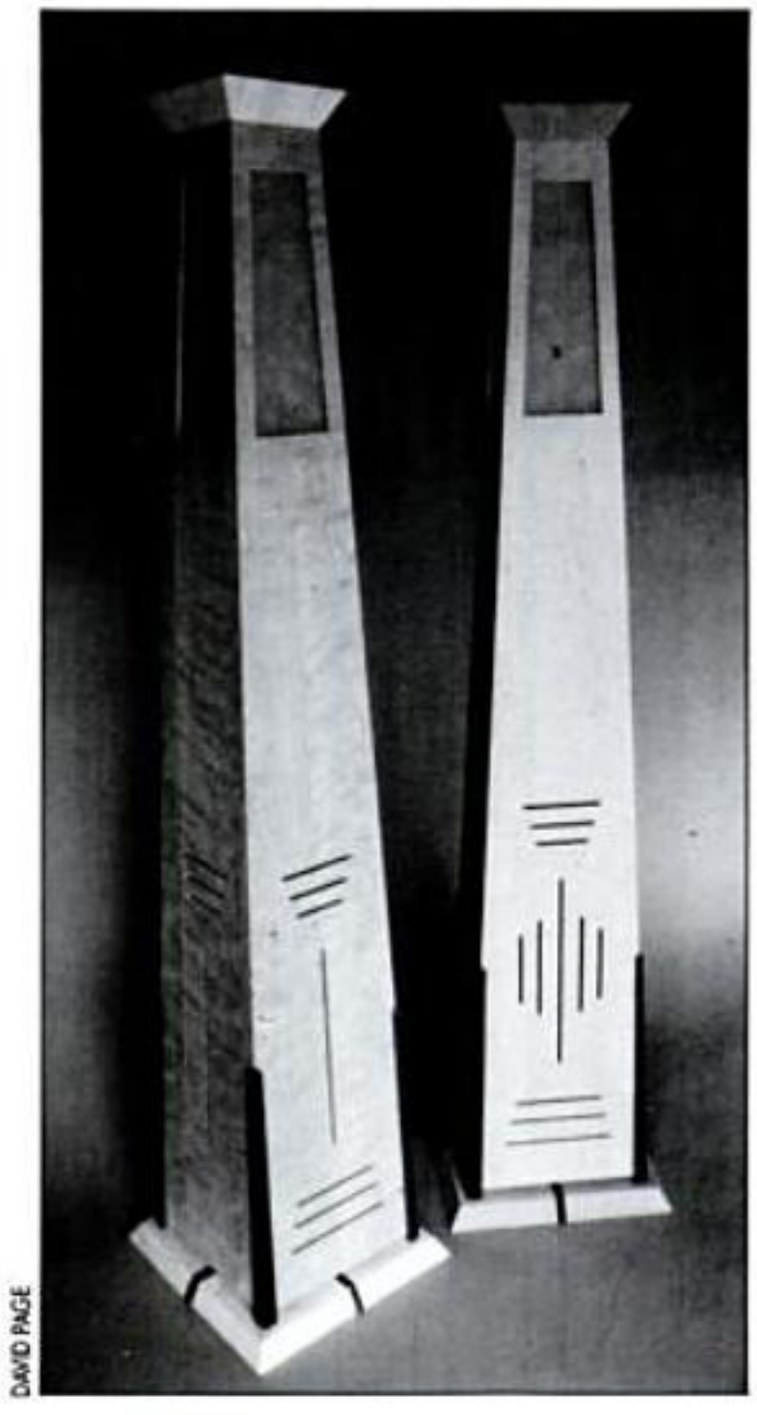
GALLERY

CURRENT WORK BY OUR READERS



"Sperm Chair," back view, by Jack Larimore Associates.

"Serpentine Rocker," by David Page, Swarthmore, Pennsylvania. Ash, ebony, leather. Dimensions: H: 58 in., W: 28 in., D: 50 in.



"Standing Lamps," by David Page, Swarthmore, Pennsylvania. Ebony, pear, curly maple, curly cherry, glass. Dimensions: H: 60 in.