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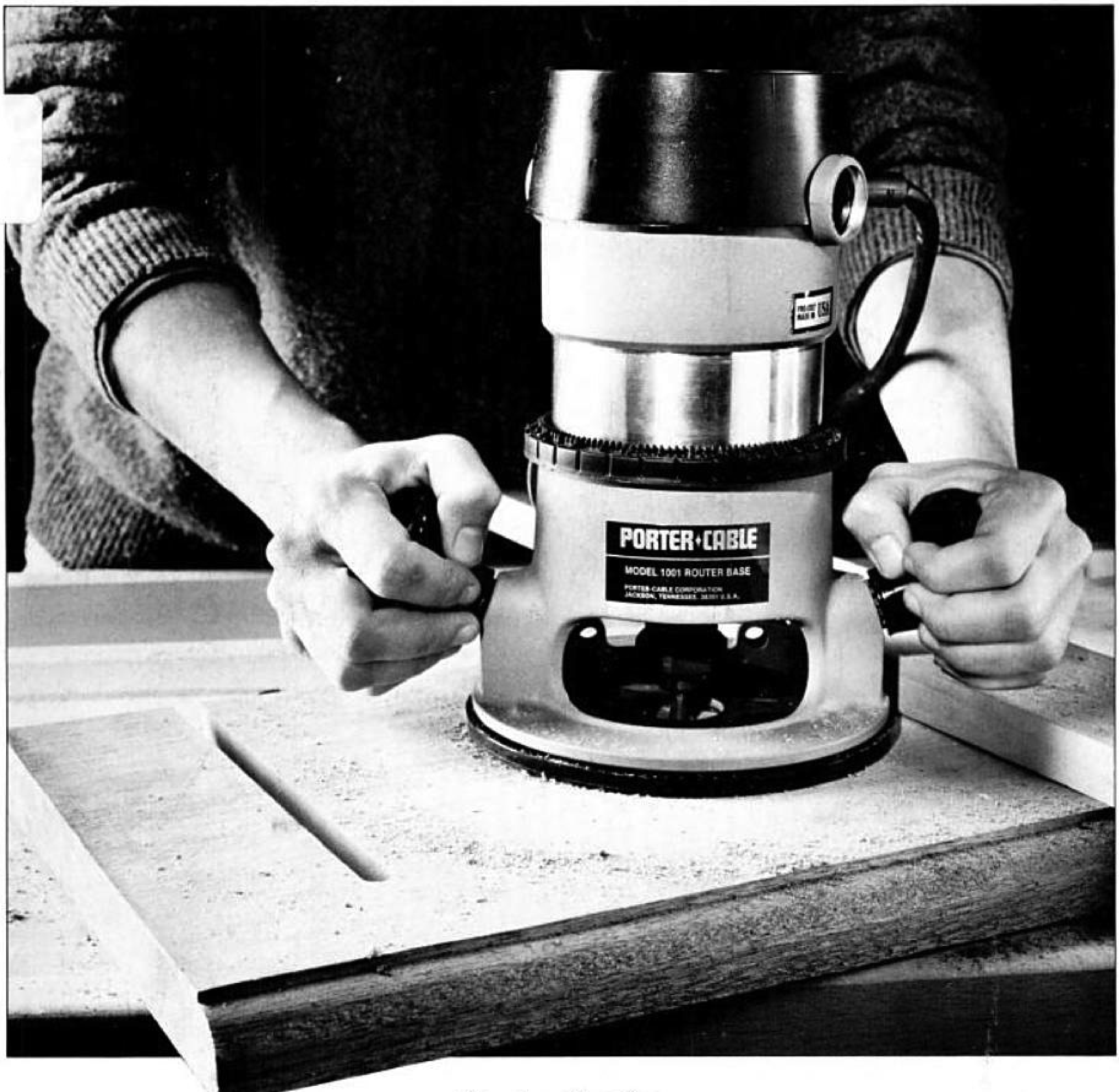
February 1990, Issue No. 12

AMERICAN WOODWORKER



Router Basics

Parsons Table Plans

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Wooden Moulding Planes

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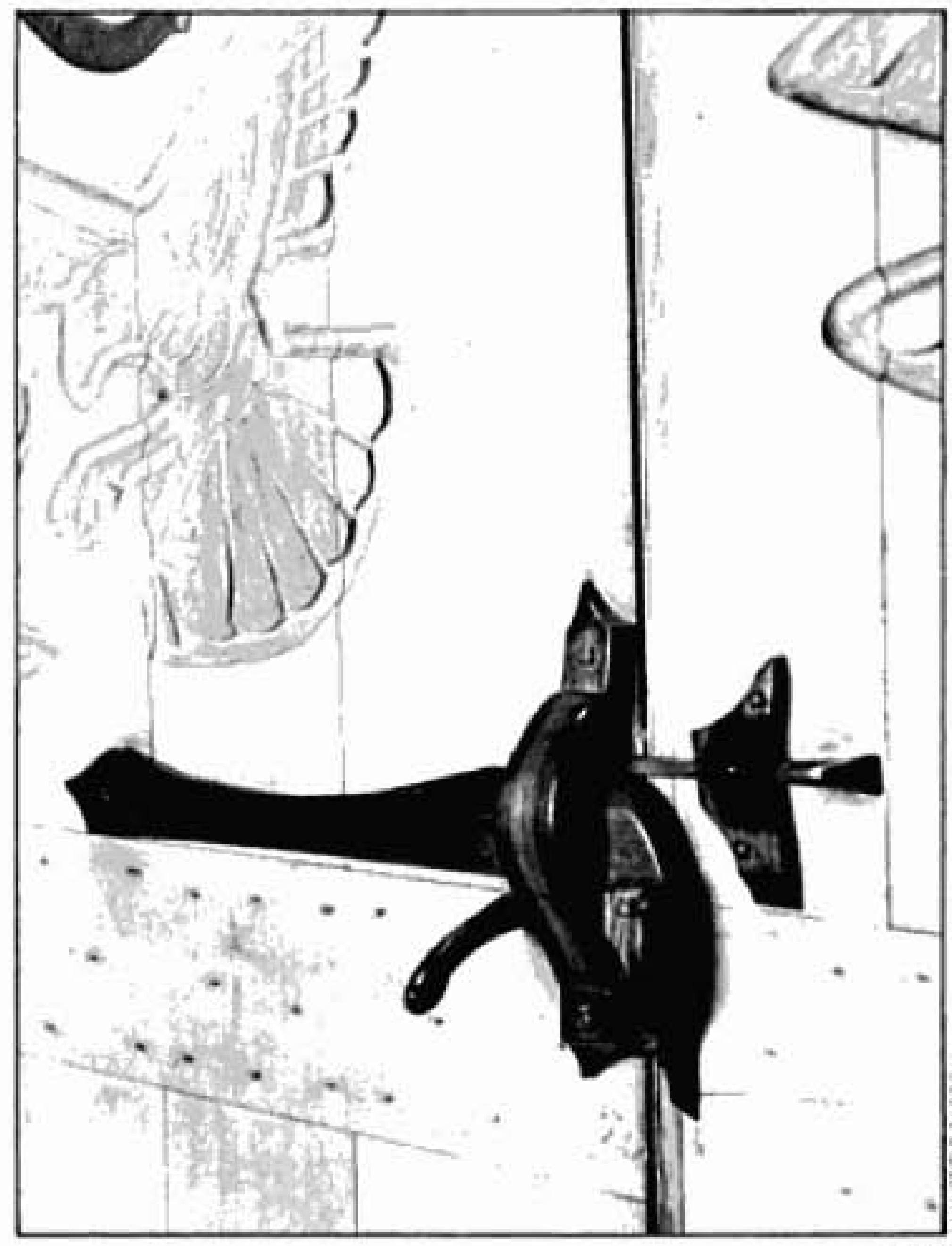

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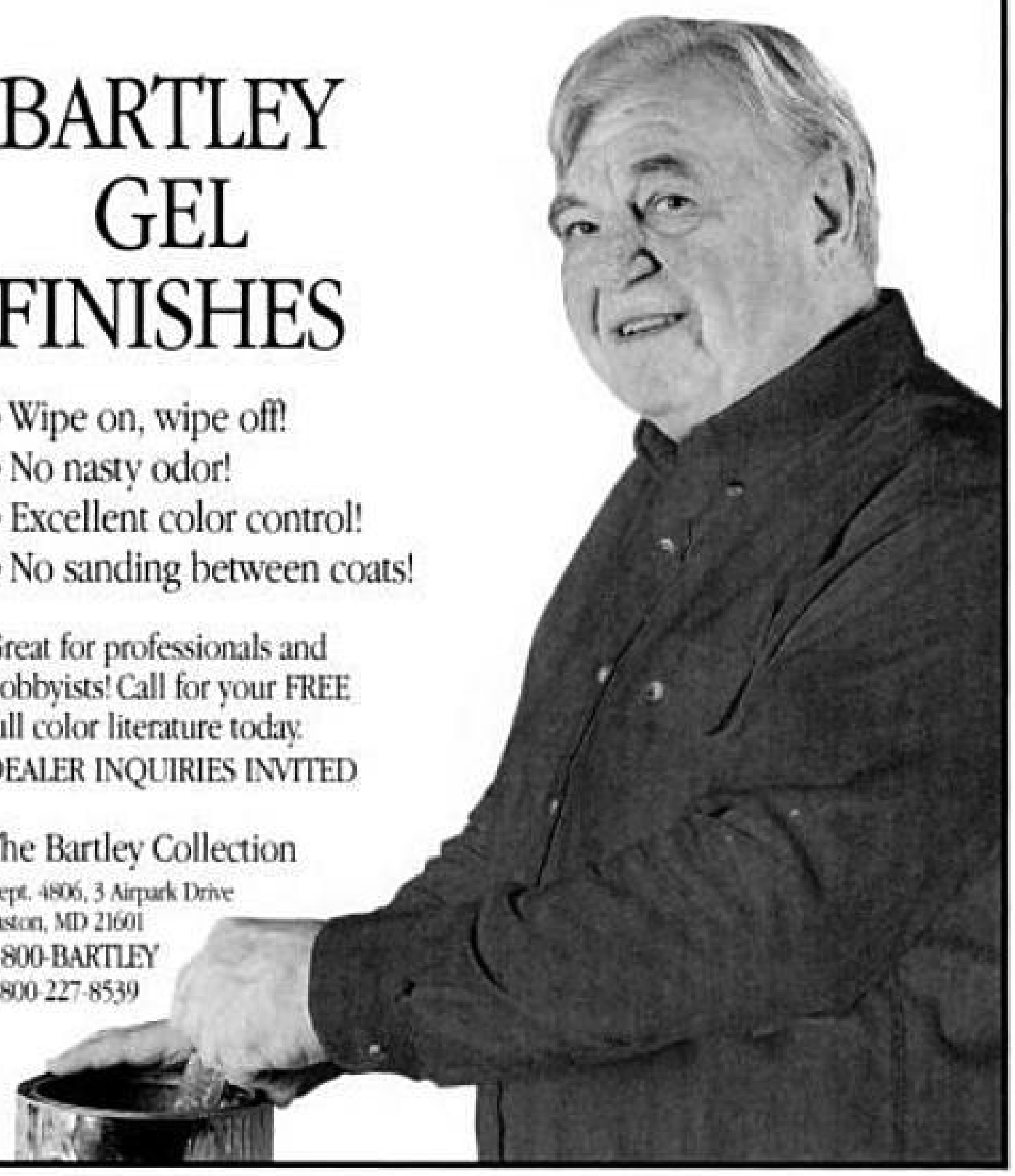

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A WORD FROM THE EDITOR

MAKING DO

The Theory of the Three Ps:
"Perfectionism leads to Procrastination.
Procrastination leads to Paralysis."

I'll bet you think the editor of a woodworking magazine owns the ultimate dream shop, packed with the latest, fanciest, high-tech woodworking equipment on the market, right? Well, why don't you join me for an arm-chair tour of my personal workshop, situated in the basement of my house.

Careful on the stairs, I've been meaning to move those pieces of wood. Watch your head. I raised most of the hot-air ducts to get more headroom, but that one's still pretty low.

Over there's my funky old bandsaw—a 1950 vintage Sears 12-incher I got from my Uncle Jack. That upper guide broke years ago, but it still runs fine on the replacement guide Jack made for it. I resaw on it all the time. The radial arm saw, grinder, and that old drill press, I bought secondhand. I splurged a few years back and bought that Delta Contractor's saw brand new. Last year, I went wild with a new 6-in. jointer. Up till then, I hand planed everything I made at home. I still use my planes a lot, but it's nice to have an alternative.

My workbench? I left it behind last time I moved. It was too big to bring along. Right now, I make do with my "WorkMate" portable bench and that heavy, wooden table with the machinist's vise. I also work on my tablesaw sometimes. I've got a new Record vise over there on the floor, and some 5-in. square oak for the legs of my next workbench, when I find the time to build it.

Tool cabinet? Never owned one. I keep my hand tools, chisels, and carving tools neatly arranged on those wooden shelves. My turning tools are still packed away in boxes, since I sold my old lathe. Maybe next year I'll spring for a new one.

The lighting is a bit spotty, but I fill in with clamp lamps when I need more light. I'm planning to install two separate circuits—one for the lights and one for my equipment. In the meantime, I make do with what I have.

That's the point. Make do with what you have. Like you, I dream of the day when I'll have the time and the money to build the workshop I've planned in my head. At the rate I'm going, I may never *complete* my personal dream shop, but I'm building it piece by piece as I go along, adding tools, machinery and improvements as the years go by. In the meantime, I don't let less-than-ideal surroundings prevent me from working.

If you put off woodworking until you have the perfect workshop, you'll never make anything. Paralysis. Get going with what you have. You'll find that your shop will grow and evolve with time.

DAVID SLOAN, Editor

HOW WOULD YOU MAKE THESE WITHOUT Incra Jig™

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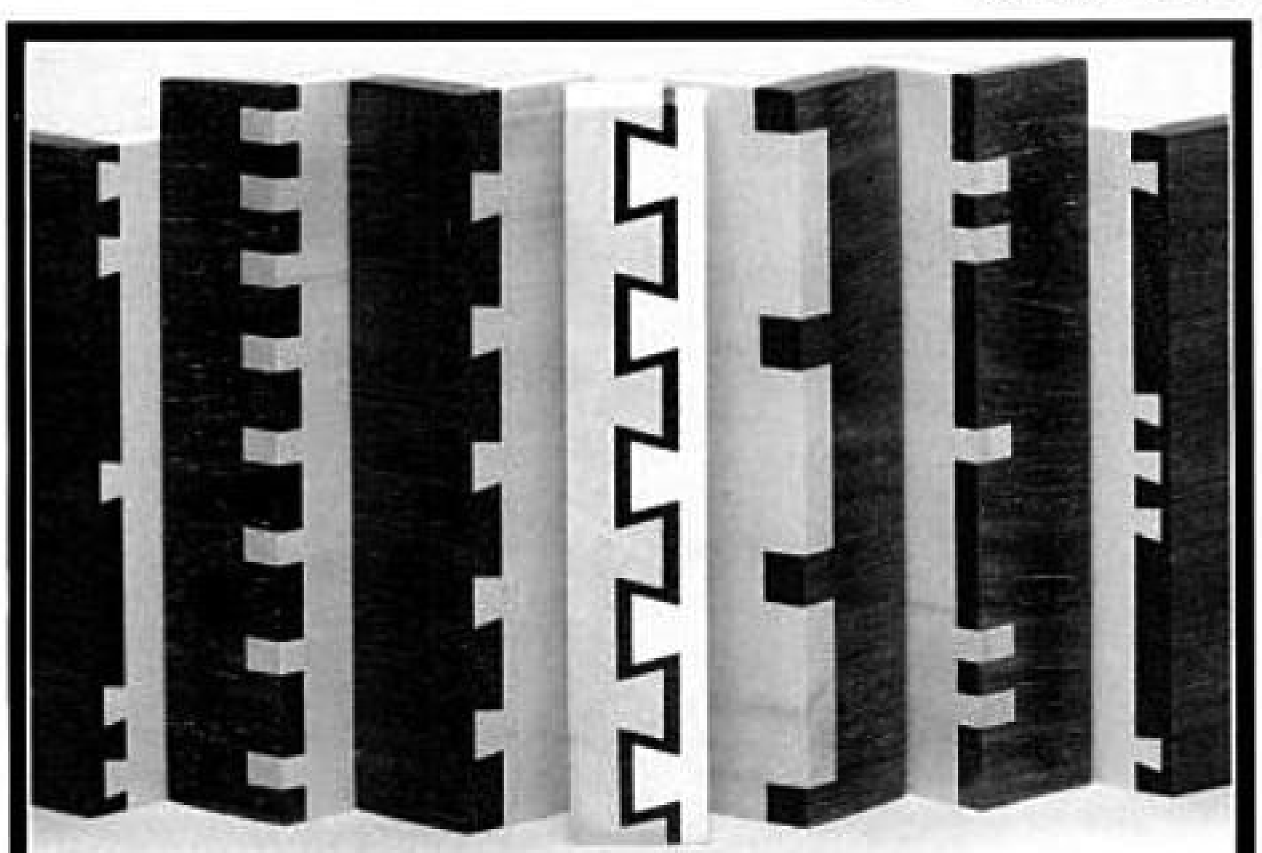

These joints were made using the new ***Incra Templates****, with* ***Incra Jig*** *on the router table.*

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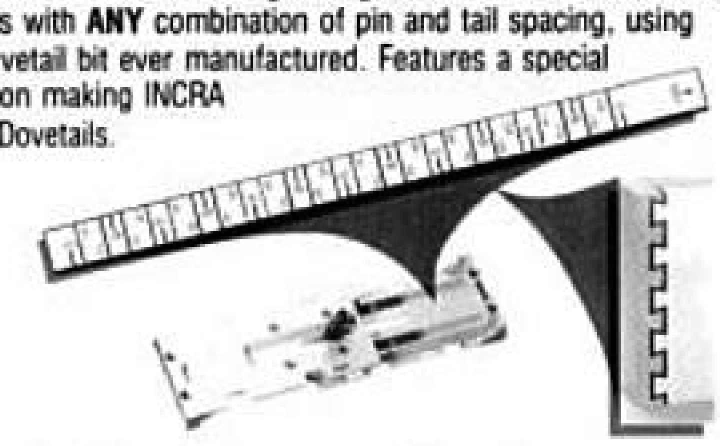

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INCRA Templates with included handbook are sold separately from INCRA JIG.

LETTERS

Sir:

Congrats are due you—and many "thank yous" to the author, Curtis Johnson—for the woodworking glues article in your September/October issue. This article is *must* reading for anyone who glues up a job.

WILLARD G. RUBLIN
Shelton, WA

Sir:

If there was a magazine being printed that was better than yours I would buy it in a minute. But, I don't believe I'll be buying any subscriptions to magazines, other than yours, for quite some time. If we woodworkers maintain, in our work, the quality you maintain in your publication, we'll be doing alright.

JOHN LOVE
Crown City, OH

Sir:

Just finished reading [Ray Levy's] article on wooden mechanisms (September/October, 1989 *AW*). Thanks. What an interesting article and clever idea. I'm an industrial engineer and amateur woodworker, so I really appreciate how these mechanisms illustrate different motions.

TOM KECK
Decatur, IL

Sir:

Your magazine is really great and I probably will continue subscribing to it for a long time. There are at least ten publishers trying their best to please the public, and except for non-colored photos, I would still rate *AMERICAN WOODWORKER* at the top of the ten magazines. Keep up the good work. Your photos and line drawings are without flaw and easy to read.

DONALD F. KINNAMAN
Phoenix, AZ

Sir:

While browsing through the magazine rack at the local bookstore, I noticed, for the first time, behind battered and bent copies of men-shaped women weight lifters, a copy of the July/August, *AW*. The Pachyderm Puzzle caught my eye. I purchased the magazine.

A few moments later at a competitor's bookstore (would you believe we have two in the same shopping mall) I noticed a copy of the September/October, *AW*. I immediately seized the opportunity to peruse your just-found treasure of woodworking info, but alas, on opening the magazine, what did I find? My pachyderm! Dead on page 4.

As I sit here at my desk, I'm looking at the "Enigma for the Young at Heart" and thinking—this could be an enigma for the builder. Find the mistaken measurements! Just imagine ... a project with incorrect measurements! It would be like a crossword, a cryptogram; find the hidden mistake. But wait, time is of the essence and must be remembered, so floating back into reality, why not request the correct measurements? So I guess I will.

JOHN N. MOLES
Del City, OK

EDITOR REPLIES: *John, we got a lot of mail on our elephant puzzle goof, but your letter takes the cake. Thanks for the laugh.*

Sir:

Thank you for letting me wrack my brains over that elephant puzzle. It was good exercise. Let's hope the corrected plans work.

BARBARA N. SHEPARD
Surry, ME

Sir:

I bit into that bandsaw article with great anticipation from the bait of the article's title and subtitle (Buyer's Guide to Bandsaws, September/October, 1989 *AW*). I got a mouthful of shaving cream when I was expecting steak! I expected for the writer to write a little about each machine and pass on some comparative information to help the reader make an informed buying decision. What we got to see was a chart made up from looking over catalog specs, and catalog specs are next to useless in deriving comparative information within a group category.

I expected to see a chart showing how much each wheel showed to be out of round, or maybe how the tires were attached to the wheels. Which wheels were crowned and which ones were flat? Were the threaded knobs and adjustments well-fitted or sloppy? How much downward deflection did the upper wheels have when each saw was tightened down on a 1/4-in. blade?

What text there was seemed good enough for a very basic wash-over on bandsaw technology, but it did not follow the line of the title.

I'm paying premium prices for this magazine and expect premium technical journalism, and instead got average. I feel you have arrogantly treated your reader's intelligence with casual contempt.

ROBERT M. VAUGHAN
Roanoke, VA

EDITOR REPLIES: *You're right to emphasize the importance of wheel deflection, guide adjustments, and the other technical points you mentioned in your letter (which we edited for publication). All of these things affect bandsaw performance and convenience, as our article pointed out. Unfortunately, we lacked the manpower to measure, and the page space to print, every technical specification for each of the 38 bandsaws we included in our chart. We listed the specs we thought most important.*

Our "Buyer's Guides" are meant to provide the information you'll need to make an informed choice when you purchase tools or equipment. We think the "Buyer's Guide to Bandsaws" will help most readers select a machine that fits their needs and budget.

Sir:

Thoroughly enjoy each issue of *AW*. The quality of the entire publication is exemplary. Without exception, each issue has provided a myriad of ideas, which I've been able to put to use in my woodshop. The entire staff is to be commended.

H.R. BALDWIN
Canton, OH

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

Shop Wiring

Q. *After years of running machinery with extension cords, I've decided to rewire my shop. I have a jointer, a tablesaw and a bandsaw. Most of the motors on my machinery can be wired to operate at either 115 or 230 volts. It will cost a couple of extra bucks to wire for 230, but I'm wondering if it's worth it. Can I get more power out of my motors? Will they operate better? Cheaper?*

BRUCE SANDT
St. Louis, MO

A. Let's start by dispelling a myth. The cost of operating a motor is the same whether it runs on 115 or 230. Roughly speaking, the operating cost of the motor can be determined by multiplying amps (on the motor's nameplate) times voltage to get watts. On a given motor, operating at 230 volts doubles the voltage drawn, but it also halves the amps. The wattage—and therefore the cost of operation—stays the same. You pay for the number of watts the motor draws, regardless of the voltage at which it operates.

The reason 230-volt motors are made is because resistance causes voltage to drop, or dissipate, as it travels through a wire. In its simplest terms, if the voltage drops 11.5 volts between the panel and your saw, you've lost 10% of your power on a 115-volt motor. If it drops 11.5 volts on a 230-volt motor, you've only lost 5%. The further you drop from the motor's rated voltage, the less power you have for a heavy cut.

Generally speaking, running a motor at 230 volts instead of 115 volts is worthwhile on motors rated 1 H.P. and larger; with smaller motors, there is no real advantage to operating at the higher voltage.

ED COWERN
Electrical engineer and woodworker
North Haven, CT

Finish for Hot Tubs

Q. *I've installed tongue-and-groove spruce boards on the walls and ceiling of our new hot-tub room. The boards are stained, but I'm confused about what finish to apply over the stain. I've been told that sun exposure from windows on three sides may damage polyurethane, and moisture can ruin varnish. Any suggestions?*

ELMER REED
Dora, New Mexico

A. The situation in your hot-tub room resembles outdoor conditions: extreme variations in humidity and destructive rays from sunlight.

There is *no* really durable unpigmented (clear) outdoor finish. You could put on a conventional film-forming finish like polyurethane or spar varnish, but either of these will begin to peel in a few years. This happens when moisture works its way behind the film and breaks the bond with the wood. If I had to choose between the two, I'd pick spar varnish over polyurethane, because it's more resistant to damage from the sun's ultraviolet rays, and it'll be easier to strip when the walls need to be refinished.

Instead of a film finish, I'd recommend a penetrating finish designed for outdoor use such as Watco Exterior Wood Finish (made by Watco/Minwax Co., 15 Mercedes Dr., Montvale, NJ 07645). This type of finish will soak into the wood without leaving a surface film, so it can't peel or crack. The harsh conditions will wear the finish, but it can be easily applied every year or so without elaborate surface preparation. Just touch up or recoat as needed. There should be many good brands to choose from at your paint-supply store.

Be sure to choose a penetrating finish with fungicides added to prevent mold and mildew growth. I'd recommend two to four coats to build a good base.

BOB FLEXNER
Refinishing consultant
Norman, OK

Bandsaw Speeds

Q. *I have an Inca bandsaw that I can run at three different speeds. I have a lot of trouble with resawing and would like some advice on choosing the correct speed.*

DAVID ST. GEORGE
Essex Falls, NY

A. The simple answer is to run the saw at the fastest speed that won't bog the motor down. But your trouble with resawing may not be caused by using the wrong speed. Several different variables can affect how a bandsaw cuts.

Blade configuration, motor torque, feed rate and blade speed must all work together in a delicate balance. Getting this just right means making the correct choice of blade and motor, and developing an intuitive sense of how fast to feed the stock.

First, select the widest blade with a hook-tooth pattern that fits your bandsaw—about six teeth per inch with a 1/2-in. blade, and four teeth per inch with a 3/4-in. blade. The coarse teeth have a bigger gullet to clear out the waste without clogging. Make sure the blade is sharp, clean and degummed.

The motor's power is what really pulls the blade through the cut, so if you have the option of different motors with your saw, always go for the bigger one. This will ensure enough power to keep the feed rate up without taxing the motor.

The secret to clean, straight resawing is feeding the stock at an optimum rate of speed—hard or thick woods will be fed slower than soft or thin woods. As a rough guide, I feed about 4 to 6 ft. per minute in 6 in. pine, and 2 to 3 ft. per minute in 6 in. maple. If you're feeding too fast (pushing too hard), the blade will buckle and wander in the cut. If the wood is scorched, you're feeding too slowly or the blade is dull.

If you can't maintain a satisfactory feed rate without bogging the motor down, switch to a slower blade speed. This acts like "shifting gears," which changes the balance of the above variables. The blade has more power at a slower speed—like a car in a lower gear going up a hill. Again, feed as fast as the motor will allow.

CHARLES HARVEY
Shaker oval box maker
Berea, KY

Got a woodworking question for the experts? Send it to Q&A,
AMERICAN WOODWORKER,
33 E. Minor St., Emmaus, PA
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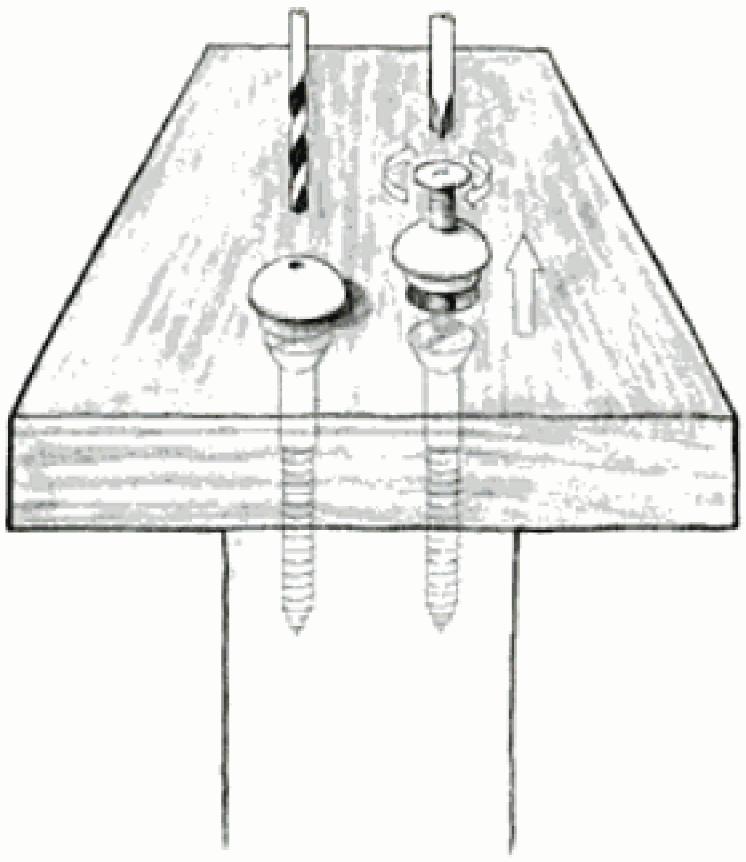
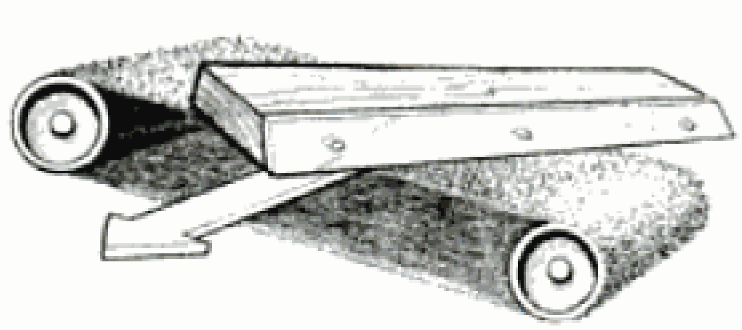


Plug Puller

Here's a sure-fire way to remove a button plug or a flush plug that covers a screw head. Drill a 1/8-in. pilot hole through the center of the plug. Then, drive a drywall screw through the center. The hardened drywall screw bottoms on the screw head and forces the plug up out of the hole.

KENT A. JOHNSON
Evansville, IN



Grinding Planer Blades

Here's a simple jig for sharpening planer and jointer blades on the belt sander.

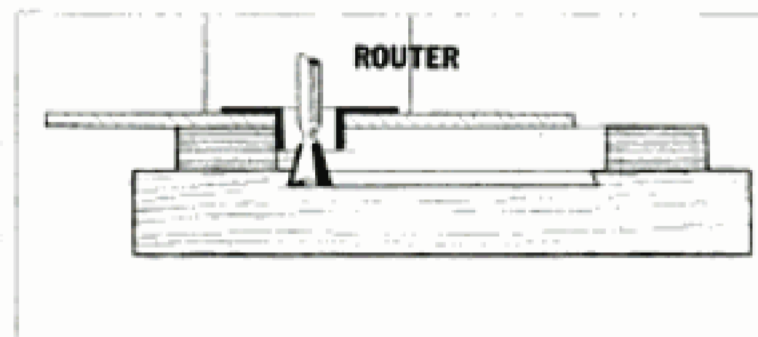
Move the block and blade back and forth across the sanding belt, concentrating pressure on the blade.

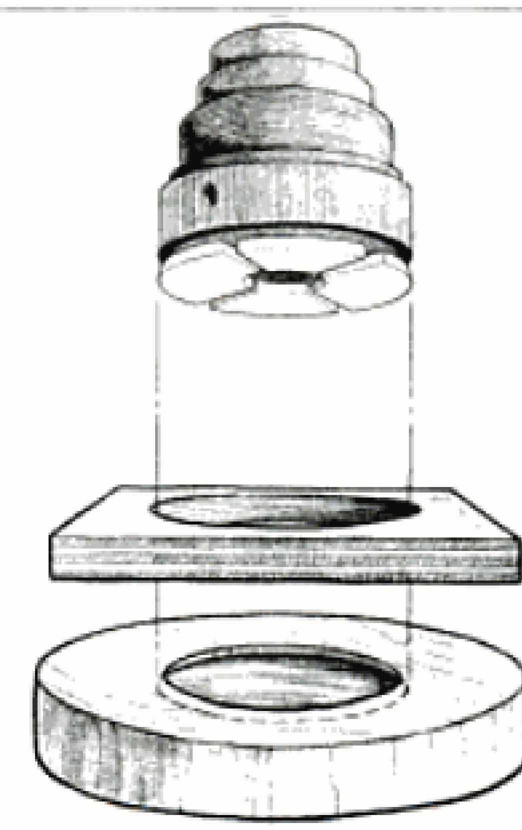
A.J. TRYBA
Benton, IL

Routing Recesses for Wooden Chucks

Whenever I make a wooden chuck for my lathe, I rout a dovetail recess on the back, so that I can mount the chuck on the expanding jaws of my Precision Combination Chuck.

Determine the size of the recess needed to fit the expanding jaws. Pick a guide bushing and a dovetail router bit. Measure the outside diameter of the bushing, and subtract the diameter of the bit from this figure. Divide the remainder by two, to give you the amount by which the radius of the template opening must exceed the radius of the desired recess.





Make the template thick enough to allow the guide bushing to move around without touching the workpiece. Cut out the template opening, and clean up the edges so the guide bushing will move smoothly around the opening. Secure the template to the back of the wooden chuck with two-sided tape. Set the bit for a depth of about 3/16 in., and rout the recess.

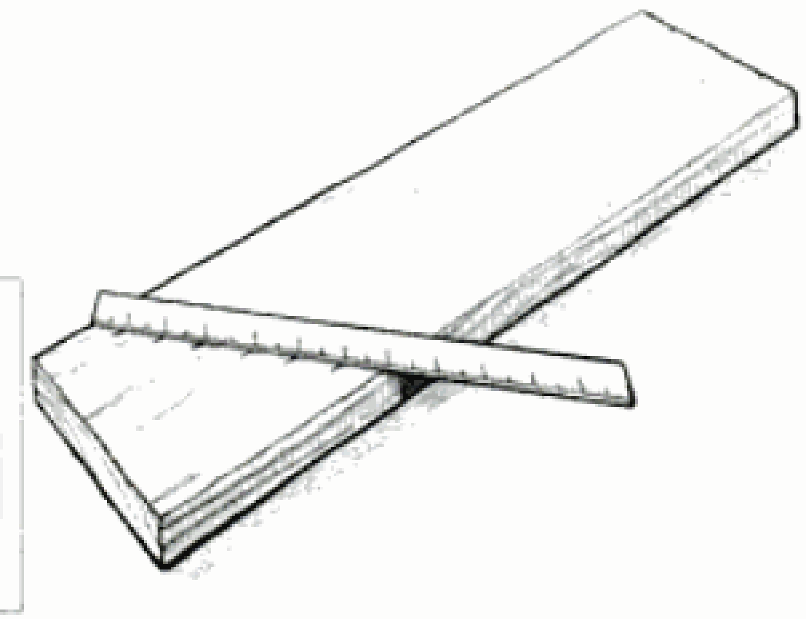
JOHN SAINSBURY
Brixham, South Devon,
England

Keep Your Finish Fresh

A thirsty crow, unable to reach the level of water in a nearly empty pitcher, dropped pebbles into the pitcher till the water rose to the brim.

Likewise, to keep the contents of a finish can from oxidizing and forming a skin, try dropping marbles into the can to raise its contents to the brim. This keeps out the air and keeps the finish fresh. When you've finished the can, just rinse the marbles with mineral spirits and use them again.

DOUG KENNEY
South Dennis, MA



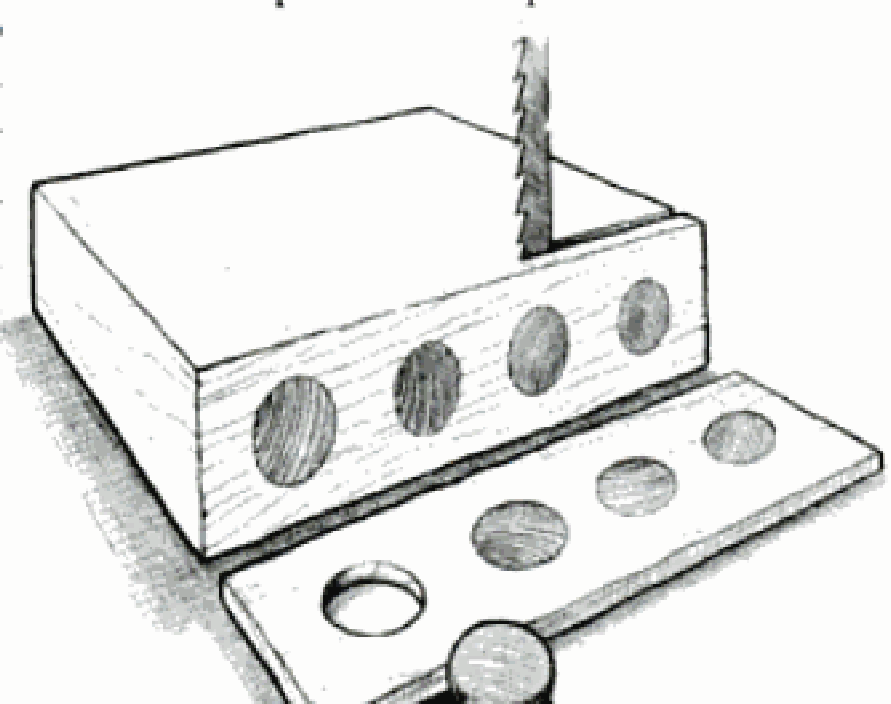
Quick Division

To quickly mark off equal divisions on a board for dovetails or other joints, place a rule diagonally across the surface so you can mark off the number of divisions in whole numbers. For example, to divide a board into 7 equal parts, place the zero mark on one edge of the board and place the 7 in. mark on the other edge. Make a pencil mark at each inch mark—1 through 6—to divide the board.

BILL BIGELOW
Surry, NH

Strip o' Wheels

Faced with the task of making 80 1/2-in. dia. wheels for some toys I was making, I came up with the following idea. I drilled some 1/2-in. dia. holes in a piece of scrap wood and



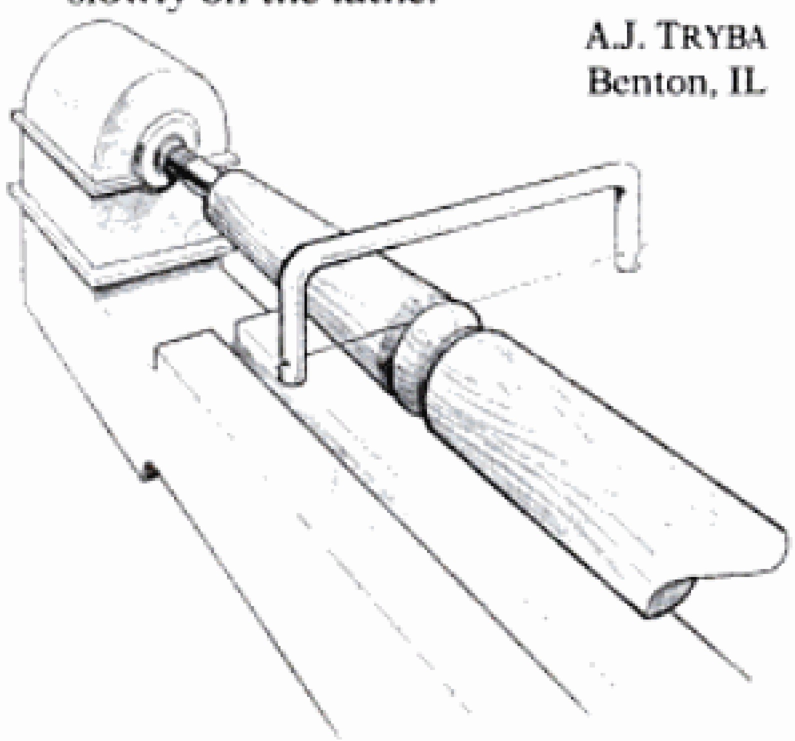
drove short pieces of 1/2-in. dowel into the holes. Then, I ripped the scrap into strips the thickness of the wheels I wanted and popped the finished wheels out of the strips. This technique makes wheels that are free of rough edges.

LAWRENCE L. LUCAS
Mount Jackson, VA

Painting Grooves

I use this simple device to accent grooves of spindle turnings with gold or silver paint. I saturate the string with spray paint and touch the string to the groove as the work turns slowly on the lathe.

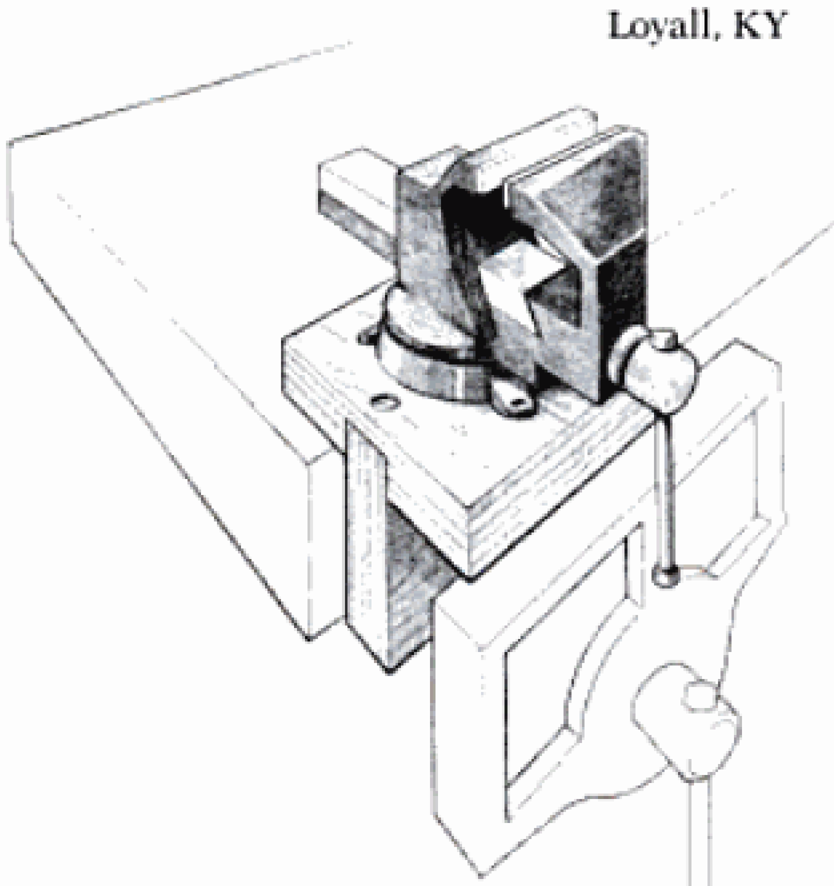
A.J. TRYBA
Benton, IL



Quick-Change Vises

I had no room to mount a machinist's vise on my workbench, so I mounted the vise on a T-shaped wooden base. When I need the vise, I clamp the base in the jaws of my woodworking vise.

CLARENCE H. FRALEY
Loyall, KY



Microwave Dowling

Dowels too tight? Three or four minutes in a microwave oven will remove moisture and make the dowels easier to insert.

ROYCE W. STAFFORD
Jefferson City, MO

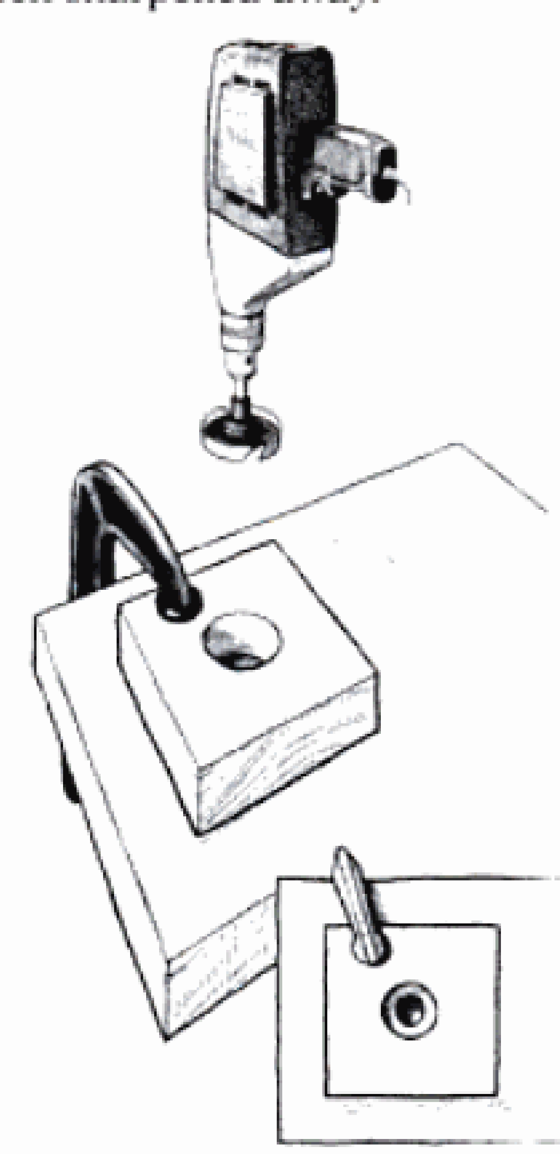
File Sandpaper Under "S"

I've found that manila file folders make a great place to store sheets of sandpaper. Before, I always had to look through a stack of sandpaper packages or a stack of different-size partial sheets. Now I put sandpaper in a folder labeled with the grit number and store the folders in the filing cabinet with my woodworking magazines and papers.

ROBERT PAULEY
Decatur, GA

Rx for Wandering Forstners

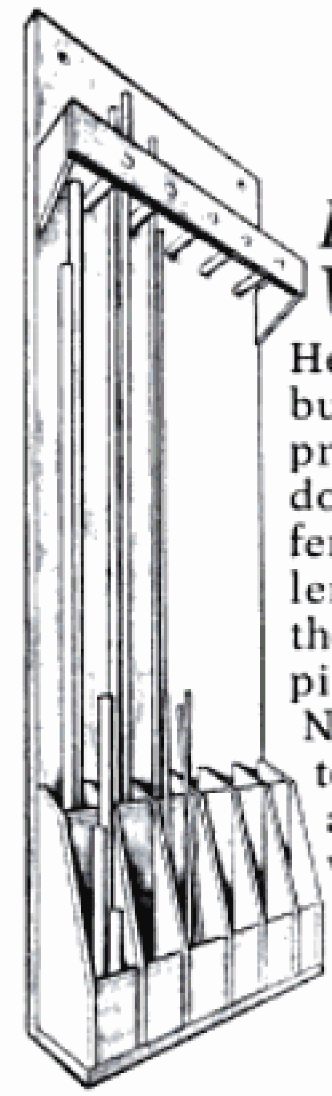
I find myself using my Forstner bits in my portable drill as often as I do in my drill press. The problem is that the bits have a tendency to wander, especially if the brad points have been sharpened away.



My solution is to drill a hole through a small block of wood using the drill press. I then clamp or screw the block to the piece I'm drilling with my portable drill.

This technique is also handy for enlarging existing holes in a piece of wood. Simply center the block over the existing hole.

GLEN C. RUBIN
St. Marys, GA



Dealing With Dowels

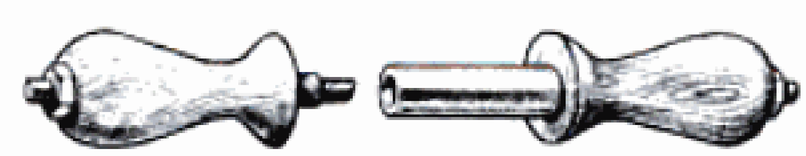
Here's a rack we've built to solve the problem of storing dowel stock of different lengths. Full-length dowels go in the back and shorter pieces go up front. Now it's easy for us to find the diameter and length of dowel we want.

ALICE & ROBERT TUPPER
Canton, S.D.

Spray Your Dust Troubles Away

When I first tried my two-bag dust collector, I noticed an unacceptable amount of fine dust escaping through the top bag. Recalling a trick I'd heard, I sprayed the inside of the upper bag with aerosol, no-stick cooking spray. This treatment stopped the finer dust with no noticeable loss of efficiency in the dust-collection system.

ROBERT BRANDT
Ft. Worth, TX



Burnisher From Wrist Pin

Wrist pins from auto engines make ideal burnishers for putting a burr on hand scrapers and cabinet scrapers. They're very hard and can be highly polished. You can find wrist pins at junk yards and engine repair shops. They come in a variety of sizes. Look for hollow wrist pins so you can add a pair of handles.

H. WESLEY PHILLIPS
Greer, SC

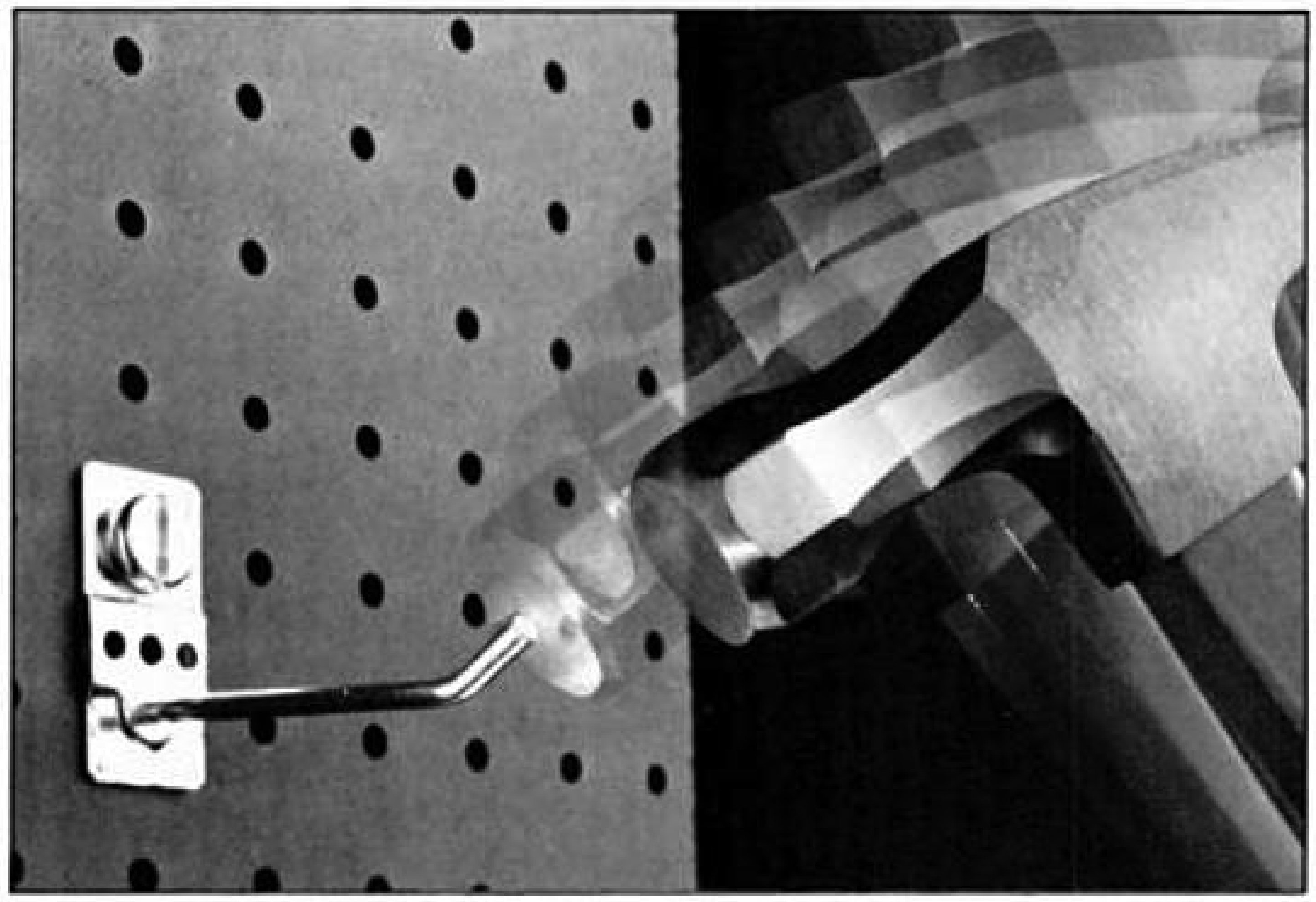
Know a better way of doing something? Designed a clever jig? Send your woodworking tips, along with a sketch or a snapshot to: Tech Tips, AMERICAN WOODWORKER, *33 E. Minor St., Emmaus, PA 18098. We'll pay you $25 if we publish your tip.*

DRAWINGS BY HEATHER BRINE LAMBERT

The Hook With Staying Power ▶

Ever notice that the hooks on your pegboard have a maddening tendency to leap off every time you fetch a tool? Sort of defeats the purpose of having a pegboard. The Forever Hook is a new kind of pegboard hook that stays put even after you retrieve your tools due to a small screw which holds the hook in place. These hooks latch right onto ordinary ¼-in. and ⅛-in. pegboard. Designed to hold twice the weight of ordinary pegboard hooks, the Forever Hooks come in 25 different models to hold all your tools. (Price: Set of 12, $4.95)

■ *Windsor Industries Inc., Dept. AWT, 86a Elinor Ave., Akron, OH 44305. (800) 678-2552.*



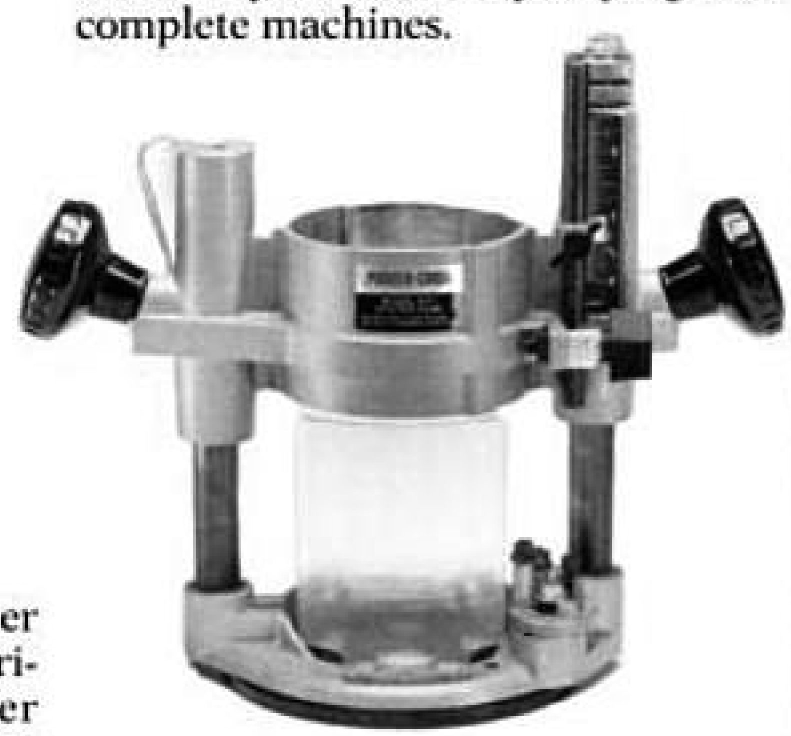
CIRCLE NO. 36 ON READER SERVICE CARD

SHOP TEST

New Kid On The Block: Porter Cable Model #693 Plunge Router and #6931 3½-in. Plunge Base

Porter Cable's #693 plunge router is, I believe, the first serious American entry into the plunge-router arena. Although I was struck by that Porter Cable feel of solid quality, I was surprised that the #693 has only a horse-and-a-half of punch behind it. All the other router biggies have fielded heavyweights that pack at least 2½ HP. But, I've learned that the #693 is to be only part of Porter Cable's plunge line. Rumblings from Porter Cable's Tennessee headquarters hint that a real muscle plunger will be stacked against the *sumos* early in 1990.

And for those of you who already own a Porter Cable fixed-base router, you now have the option of turning it into a plunge router. Porter Cable sells the plunge router *base* separately (#6931), and it's been designed to fit the motor unit from your old Porter Cable fixed-based router (fits most 3½-in. dia. motor units.) Simply pull the old motor unit out of it's fixed base, and clamp it into the new plunge base. No need to drain your wallet by buying two complete machines.



If you've worked with plunge routers, then you've come up against that stopper-pole depth regulator that no one can quite figure out. Porter Cable's Yankee ingenuity took care of this by junking the spot-welded pointer and replacing it with a sliding indicator. Drop the stopper-pole on the work. Lock the sliding indicator at zero. Raise the pole against the scale to set your plunge depth, and you're ready to go.

Other nice features include a stop screw with spring-interfaced, double locknuts that can't possibly vibrate out of position; a five-position turret stop; ¼-in. and ½-in. fingered collets instead of cheapo split-nuts; and a firm, but comfortable, plunge spring that couples an excellent plunge action with a positive return.

The #693 has its downsides. Stubby fingers may have trouble reaching the plunge-lock lever. The ON/OFF switch action is horizontal —I'd prefer having it run vertically to parallel finger motion. Bit capacity is limited by the down-sized throat hole. The 1⅛-in. opening won't take stock edging bits. You'll either have to pick up Porter Cable's sub-base or make your own. Lastly, the outboard fences and template guides that come with competition's machines are sold as options for the #693.

Final proof is in the operation. A responsive and vibration-free motor gives total power to the bit. Routing is smooth and easy. Overall, the #693 rates a "Thumbs Up." (Price: #693 complete router package, $280.00; #6931 3½-in. plunge base, $120.00)

BERNIE MAAS

■ *Porter Cable Corp., Dept. AWT, Box 2468, Jackson, TN 38302. (800) 321-9443.*

CIRCLE NO. 34 ON READER SERVICE CARD

▼ Fine Tune to the Right Height

Raising and lowering the cutter height on your plunge router to a precise level can be an exercise in exasperation—hit or miss, at best.

The cutter-height adjustment knob does away with this frustrating task. With a simple twist of the knob,you can easily set the exact cutter height you need. The knob is mounted inside an aluminum body that installs right onto your router's existing threaded rod. You don't have to alter your router. Knobs come in five types to mount on the following router models: Makita 3612B or BR, Hitachi TR12, Bosch 1611 and 1611VS, Elu 3337 and 3338. (Price: $19.99)

■ *Woodhaven, Dept. AWT, 5323 W. Kimberly, Davenport, IA 52806. (800) 344-6657.* CIRCLE NO. 49 ON READER SERVICE CARD

▲ Clearing the Air

Until recently, many woodworkers hadn't given much thought to the air quality in their shops, but news about the hazards of wood dust has woodworkers looking for ways to clear their air. The Mobile "K" Filter is a new solution to clean shop air. It's designed to remove all types of shop particulates, including sawdust, metal dust, smoke, paint sprays, oil mist, and so on. The filters mount within the unit on a roll. To change a filter, you just pull out the old section, and cut it off. The new filter is then automatically in place. There are 65 filter changes per roll. The Mobile "K" Filter is mounted on casters to make it easy to roll to critical areas in your shop. You need only a standard 110 outlet to plug it in. (Price: $296.50; replacement roll, $47.50)

■ *Tech Paper Inc., Dept. AWT, 64 Euclid Ave., Pittsfield, MA 01201. (413) 499-3351.*

CIRCLE NO. 35 ON READER SERVICE CARD

Good Vibrations ▼

Palm-grip sanders are versatile tools, but their constant vibration can soon wear you out. The new model #4011 1/4-sheet sander from Black & Decker was designed to solve this problem. It's got the highest output power in it's class, but it's among the lowest in vibration. An internal fan draws sanding dust through holes in the pad and matching holes in the sandpaper—easily made with an accessory sandpaper punch. The dust-collection system uses a wide-mouth bag that's easy to dump (no awkward zippers), or a hose connection for hooking up your shop vacuum. A 6-in. circular pad is an option. The sander has a 1.7-amp motor, a rocker switch with dust boot and plenty of clearance for flush sanding. (Price: $79.00)

■ *Black & Decker (U.S.) Inc., Dept. AWT, 10 North Park Dr., P.O. Box 798, Hunt Valley, MD 21030. (800) 235-2000.*

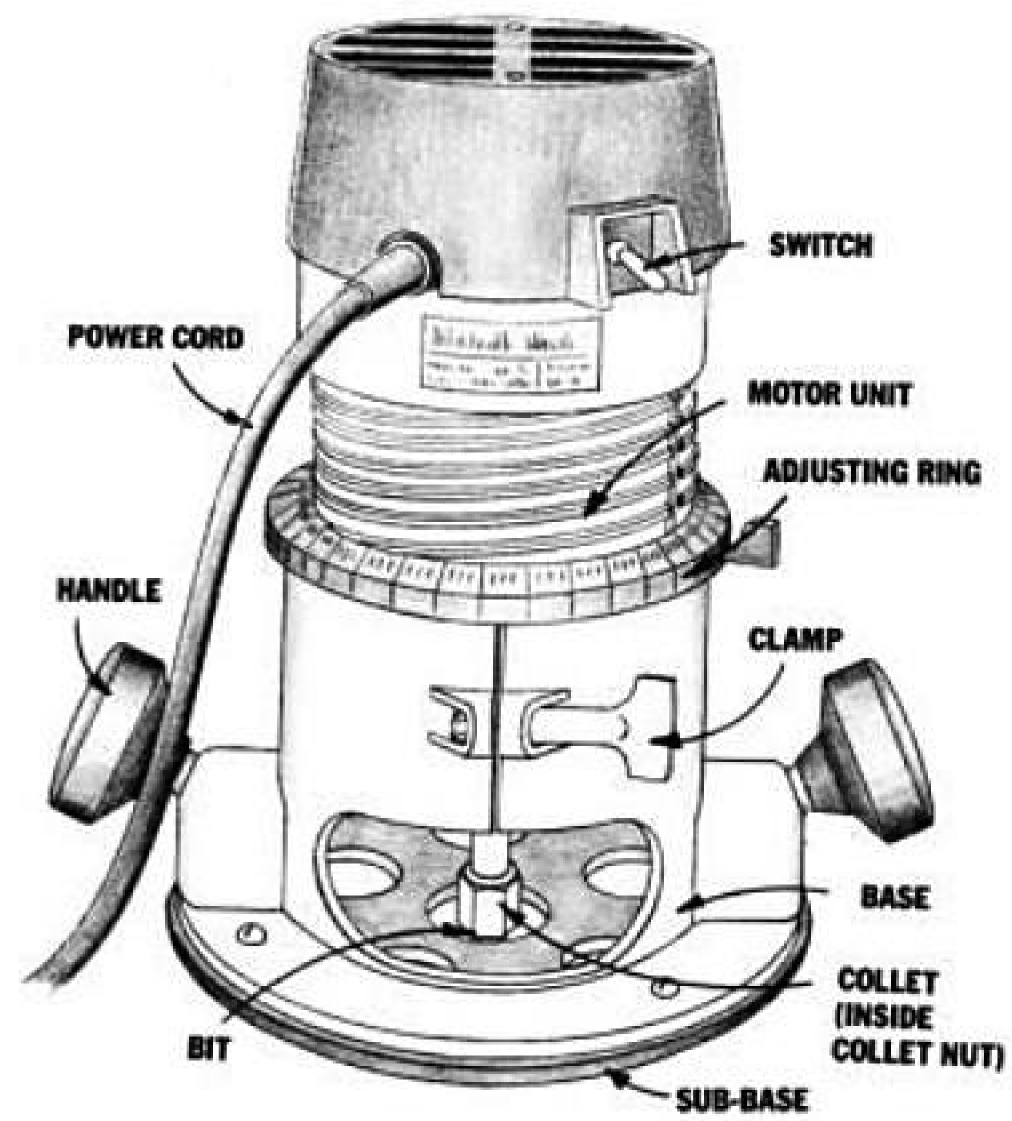
Routing decorative edges like ogees or round-overs is easy with a router and a bit with a ball-bearing pilot.

Vary Your Repertoire From Round-Overs to Rabbets

ROUTER 101
THE BASIC COURSE

BY BERNIE MAAS

FIG. 1: ROUTER NOMENCLATURE



DRAWINGS BY FRANK ROHRBACH

So the family got you a router for Christmas. Maybe you've never used one before, but you've heard about some of the things a router can do. Now you just need to learn how. Or, perhaps you've used a router in your shop for some time doing round-overs and moldings on edges. Now you'd like to try your hand at the many other operations a router can do.

Whether you're a beginner or a seasoned woodworker, you'll soon find that a router can handle many of the jobs that would ordinarily be done on stationary machines—and often safer, more efficiently, and certainly cheaper. In this article I'll show you how to expand your repertoire of router operations. I'll explain how to cut rabbets and dadoes, how to make and use fences and templates, and a few other tricks of the router trade. First, let's look at the basic router parts.

There are three main parts to a router—a motor unit, a base, and a sub-base. The router base is the framework that holds the canister-like motor and provides two handles for the operator. The *sub-base* is a thin, plastic disk screwed to the flat bottom of the base. The On/Off switch is located near the top of the motor, or sometimes on one of the handles.

At the bottom end of the motor's shaft is a collet, which is the receptacle for the router bit. Collets differ in their design for gripping the bit. Full-fingered collets use a series of finely machined "fingers" which grip the bit uniformly around its circumference. A split collet has a single, lengthwise slit. A tip to prevent bits from becoming loose in split collets: Insert the bit until it bottoms out, then draw it back about $^1/_{16}$ in. before tightening the collet nuts.

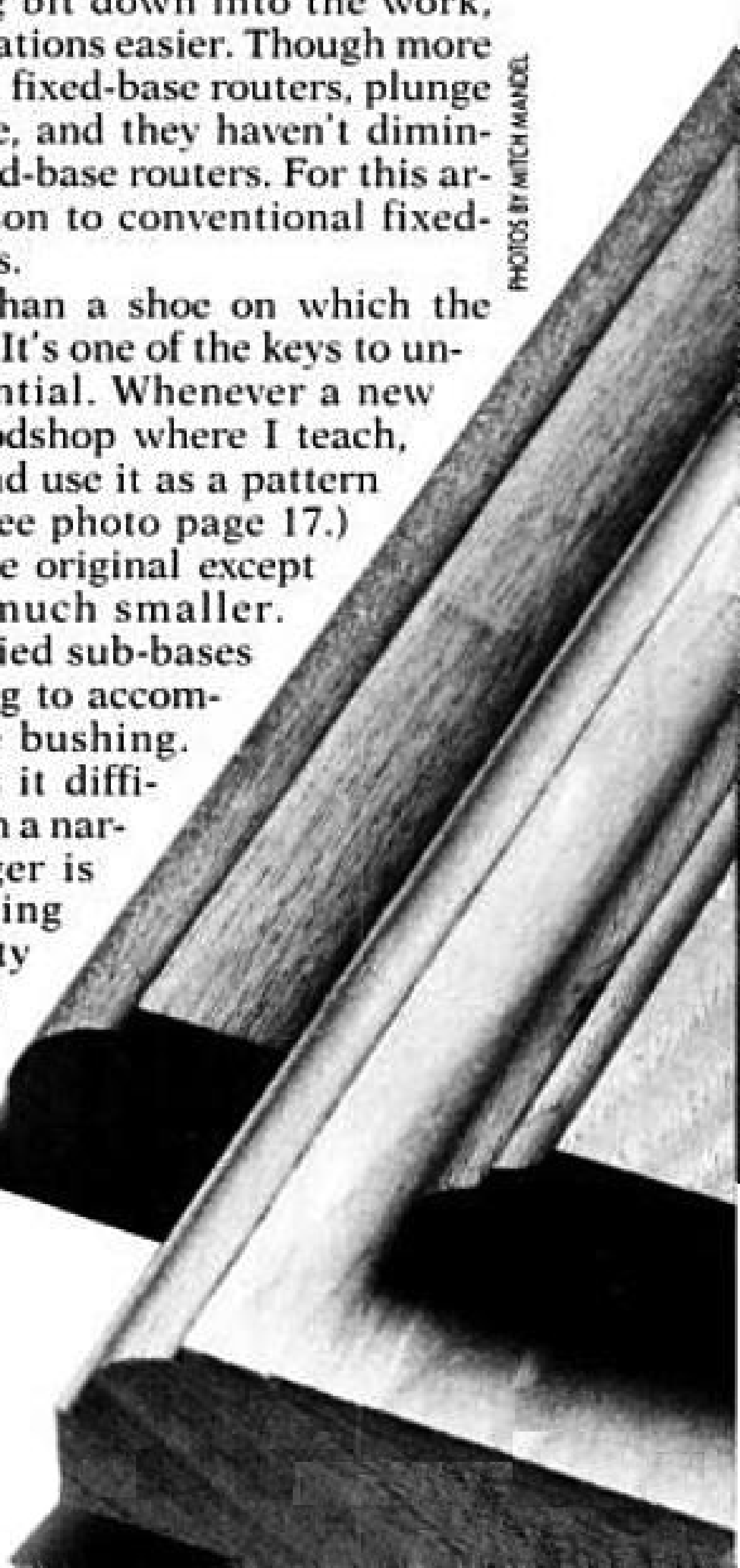
To change the depth-of-cut, router motors are designed to adjust up and down within the base. Router designers do this in one of three ways. One approach is to simply let the motor slide up and down in the base, but fine control is difficult with this system. A better method "screws" the motor in and out of the base on a spiral ramp. Unfortunately, this continually repositions the On/Off switch (with a top-mounted switch), which can confuse the operator. In the third type, a threaded and graduated "adjusting ring" raises or lowers motor depth. In my opinion, this last type of adjustment allows the best overall control.

Homemade sub-bases such as these really increase your router's versatility. One has a small throat hole for use on narrow edges. The other is great for guided cuts along a fence.

Recently, plunge routers have attracted a lot of attention. This type of router is equipped with two spring-loaded, vertical posts that allow the motor to move up and down relative to the base. The operator can "plunge" the rotating bit down into the work, making many routing operations easier. Though more versatile than conventional fixed-base routers, plunge routers are more expensive, and they haven't diminished the popularity of fixed-base routers. For this article, I'll limit my discusson to conventional fixed-base (non-plunging) routers.

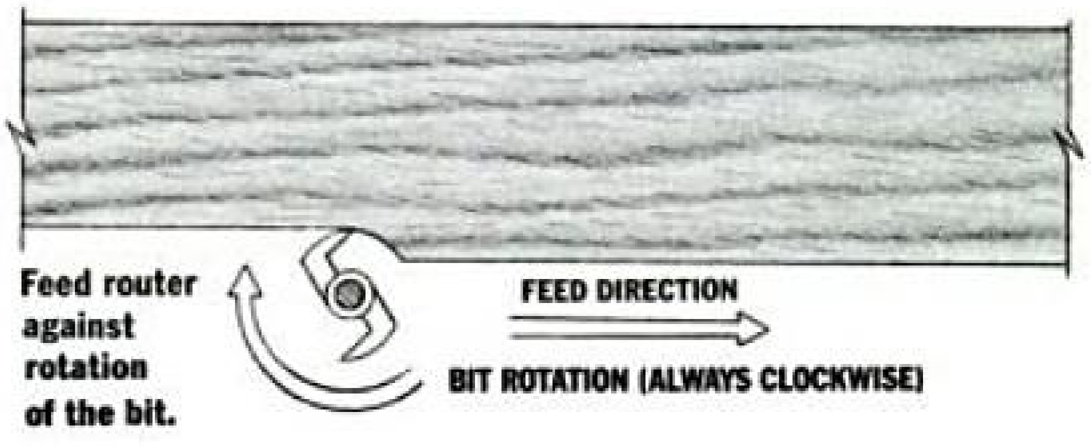
PHOTOS BY MITCH MANDEL

The sub-base is more than a shoe on which the router rides over the work. It's one of the keys to unlocking the router's potential. Whenever a new router comes into the woodshop where I teach, we take the sub-base off and use it as a pattern to make two new ones. (See photo page 17.) The first is identical to the original except that the throat hole is much smaller. Here's why: Factory supplied sub-bases have a large throat opening to accommodate a template guide bushing. This large opening makes it difficult to support the router on a narrow workpiece. The danger is the router may slip, causing the bit to gouge out a nasty snipe. On the auxiliary sub-base, the smaller throat hole works better on small or narrow stock.



The second sub-base we make is the "triangle" base, shown in the photo, a product of student ingenuity. This base has a

FIG. 2: ROUTER FEED DIRECTION

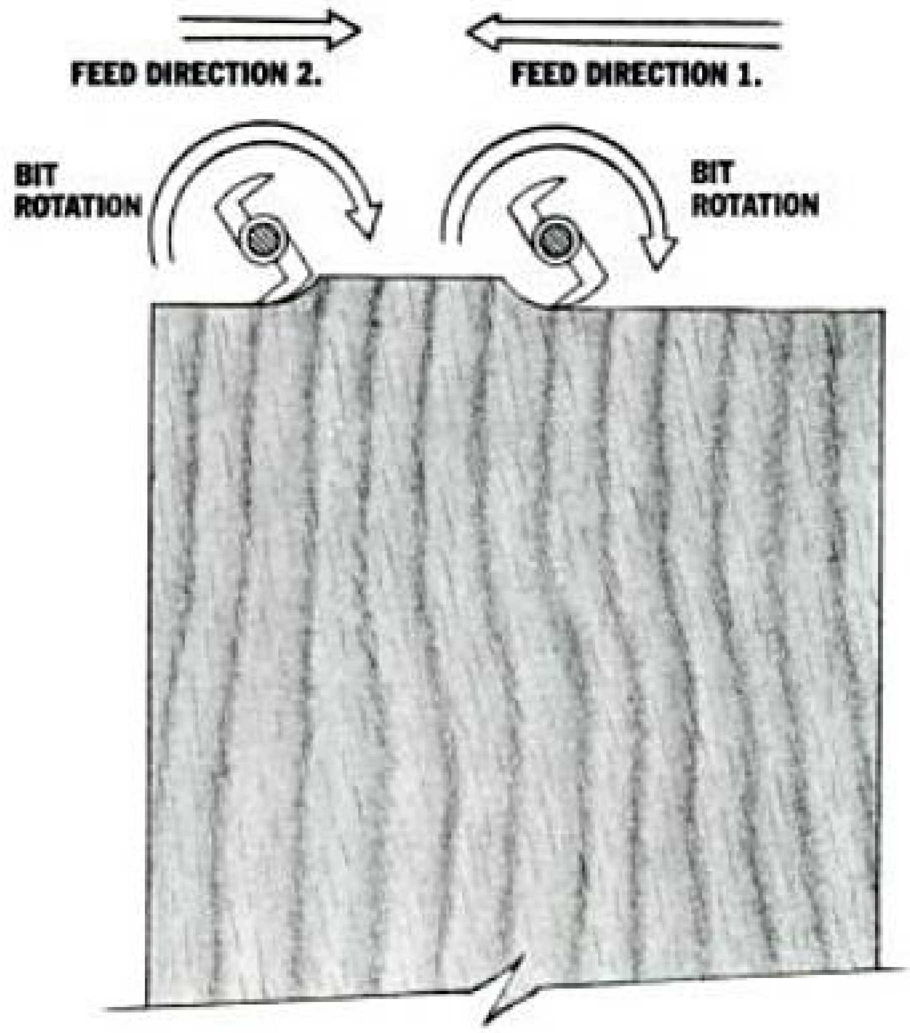


ROUTING END GRAIN

When routing end grain, follow this sequence:

1. Feed in from one edge against the rotation of the bit, and cut almost all the way across the edge.

2. Feed in from the other edge to meet the first cut.



foot-long straightedge, which makes for greater stability when guiding the router against a fence, as you would for cutting grooves and dadoes. For easy setup, we make the distance from the center of the router to the straightedge a measurement that's easy to remember.

We make our sub-bases from ¼-in. thick materials such as hardwood plywood, Dupont's Corian, or plastics such as Lexan, Plexiglas and Lucite which work and wear well. Check plastic-supply houses for discarded cut-off pieces. (You can order Lexan and Lucite from AIN Plastics, Inc., 249 E. Sandford Blvd., P.O. Box 151, Mt. Vernon, NY 10550.) Corian is a solid, synthetic material used for kitchen and bath countertops. Check with remodeling contractors for scrap pieces.

Basic Router Operations

The router performs several basic operations—edge treatments such as rounding, molding, chamfering, beading, trimming or rabbeting; grooving operations, which include dadoes, V-grooves, and dovetail grooves; and excavating operations such as cutting recesses or mortises.

Edge treatments are the easiest to learn first. With common router bits you can do treatments like softening (rounding over) square edges, stop-chamfering table legs, chamfering paneled-door frames, or rabbeting a plywood back into a carcase, to name a few.

Edge treatment bits are self-guiding thanks to a short extension of the shaft called a *pilot*, that acts as a bearing surface. The shaft end rides the edge of the board and guides the bit. Better quality bits have a ball-bearing collar fitted onto the end of the shaft. The only adjustment you need to set with this type of bit is the depth, by raising or lowering the router motor. Set the cutting depth to produce the effect you want. For example, depending on how deep you cut with a round-over bit, you can make a stepped round-over, or a round-over whose curve blends into the top face of the board.

To begin an edge cut, set the router on the workpiece with the bit well clear of the work. With a firm grip on the handles, start the machine, and let it accelerate to full speed. White knuckles aren't necessary, but you must make sure you're in control. Move the bit into the work until the pilot touches the work

WHAT ABOUT BITS?

The high-speed steel bit on the left has a simple steel pin to act as a pilot to guide the bit. The cutting edges can be resharpened easily with a grinder. The carbide bit on the right has a ball-bearing pilot, which won't burn the wood. The carbide cutting edges require a special sharpening service.

COURTESY OF VERMONT AMERICA

Starting a collection of router bits can be confusing, because there are so many different bits to choose from. While there are many different sizes and shapes available, router bits can be conveniently lumped into two broad categories: edge-treatment bits and grooving/excavating bits.

Edge-treatment bits include decorative profiles such as round-overs, beads, ogees, chamfers and coves, as well as utilitarian cutters such as rabbeting bits, flush-trimming bits and slotting cutters.

Edge-treatment bits are self-guiding—a pilot guide rides against the edge of the work. On inexpensive steel bits, the guide is simply a short extension of the shank, below the cutter. This type of steel tends to burn the edge of the work, so better-quality bits feature a ball-bearing pilot guide that eliminates this problem.

Grooving/excavating bits are used for routing grooves, dadoes, recesses and mortises anywhere on the workpiece, in addition to the edge. This category includes straight bits, V-grooving bits, dovetail bits and core-box bits. Grooving/excavating bits do not have a pilot bearing, so the

A 3/8-in. rabbeting bit, set for 1/4-in. depth-of-cut, makes a perfect recess for fitting cabinet backs. Rounded corners left by the bit can be squared up with a chisel.

If the dado or groove is close to an edge, this "outrigger" fence can guide the cut with accuracy. Add a piece of 3/4-in. square × 12-in. stock as an auxiliary fence to increase control.

firmly. Slowly feed the bit along the edge, *moving against the rotation of the bit,* as shown in Fig. 2. This tends to draw the bit toward the work. Feeding with the rotation of the bit is called "climb cutting," which tends to kick the bit away from the work.

It's best to avoid climb cutting except when dealing with end grain. You can rout against the rotation of the bit across a length of end grain, but the wood may split at the end of the cut as the bit nears the corner. The solution is to stop routing just short of the corner,

COURTESY OF MLCS LTD.

A basic collection of router bits might include: (left to right) a 3/8-in. round-over bit, a 1/2-in. round-over bit, a chamfering bit, a 3/8-in. rabbeting bit, a 1/4-in. straight bit, and a 3/4-in. straight bit.

router must be guided against a fence or the edge of a template.

Straight bits are arguably the most versatile type of grooving/excavating bit because they produce a flat-bottomed cut. Straight bits are available in several different types. Single-flute bits have one cutting edge or "flute." Double-flute bits have two cutting edges and cut more smoothly than single-flute bits. Stagger-tooth straight bits give the same smooth cut as double-flute bits, but with less friction, binding and better chip extraction. Spiral-flute bits are good for deep excavations, like mortises, because their screw action draws chips up and out of the hole.

Many bit shapes are available in both high-speed steel and carbide versions. Carbide is the professional's choice, because it stays sharp far longer than steel. Carbide can cut plywood, laminates, and particleboard—materials that quickly dull steel bits. Why doesn't everyone buy carbide bits? Because of the price. High-speed steel bits are in the $5.00 range, while identical carbides cost a few dollars more. Steel bits also can be sharpened in your shop. Carbide bits must be sent to a sharpening service, although they may not require sharpening for years. For many woodworkers, the longevity of carbide more than makes up for it's cost.

Most router bits are available with either a 1/4-in. shank or a 1/2-in. shank. Bits with 1/4-in. shanks are lighter duty and less expensive than the equivalent bit with a 1/2-in. shank. Bits with 1/2-in. shanks vibrate less and can stand up to harder use. Some large bits (like panel-raising bits) only come with 1/2-in. shanks. Routers with 1/2-in. collets usually have an adaptor that accepts 1/4-in. bits. But, if you have a 1/4-in. router, you can't use 1/2-in. bits in it.

So what bits should you buy if you're just starting out? A lot depends on the work you plan to do, but for a basic starter set I'd recommend the following bits: two round-over bits—a 3/8-in. radius and a 1/2-in. radius; a chamfering bit; a 3/8-in. rabbeting bit; and two straight bits—1/4-in. and 3/4-in. That's a bare-bones set that will get you through a lot of woodworking operations. You can always expand your set as the scope of your woodworking increases.

Good quality bits are expensive. Keep bits in their pouches or in a rack to protect their edges. Dull bits cut poorly, burn edges, and can be dangerous, so keep bits clean and sharp.—*B.M.*

then start a new cut feeding in from that corner to meet the already completed part of the cut, even if it means climb cutting.

Instead of trying to remove lots of stock with one heavy cut, it's better to take several light cuts. The surface will be smoother, and the router motor won't bog down. The final pass should be solid, smooth, with an even feed—too fast and you'll get a choppy, rough finish—too slow and you'll get burn marks on the routed edge. With practice, you'll get a feel for the right rate of feed.

Decorative edge moldings are the most obvious use for edge-treatment bits, but there are many other possibilities. With a rabbeting bit, you can rout the rabbet for a plywood cabinet back after the carcase has been assembled. In this case, you have to guide the router on the edges of the boards. This can be shaky, because there isn't much support for the router base. Clamp a piece of jointed scrap to the work to widen the surface and give the router base more support. Square up the corners of the rabbet with a chisel.

By combining several different router-bit profiles, you can make your own moldings. Choose from a variety of bits to create different contours. I cut the stock a few inches longer than needed, clamp one end and rout as far as possible, then shift clamps and finish routing.

Edge-trimming bits have a pilot bearing the same diameter as the cutter. This type of bit will trim an overhanging edge flush with the surface on which the pilot bearing rides. It's very useful for flush trimming plastic laminate, veneer, or wooden lipping on the edge of shelves.

Grooves and Dadoes

One of the greatest features of the router is its ability to do real "meat-and-potatoes" joinery such as dadoes, half-laps, grooves and rabbets. The router has a real advantage in this kind of cutting when working with warped or curved boards. With its small base, a router can ride over a slightly curved surface and produce a uniform cut conforming to the contour of the warp. Later, assembly will flatten out the warp and your joints will be perfect. Compare that to wrestling warped boards through a radial arm saw or tablesaw, producing grooves and dadoes of varying depth.

Grooving bits don't have a pilot bearing to guide the bit, so you need to guide the router against a fence. There are two options. One option is the outrigger fence (usually plastic or metal) that's typically available as an accessory from the manufacturer. The other option is a wooden fence you make yourself.

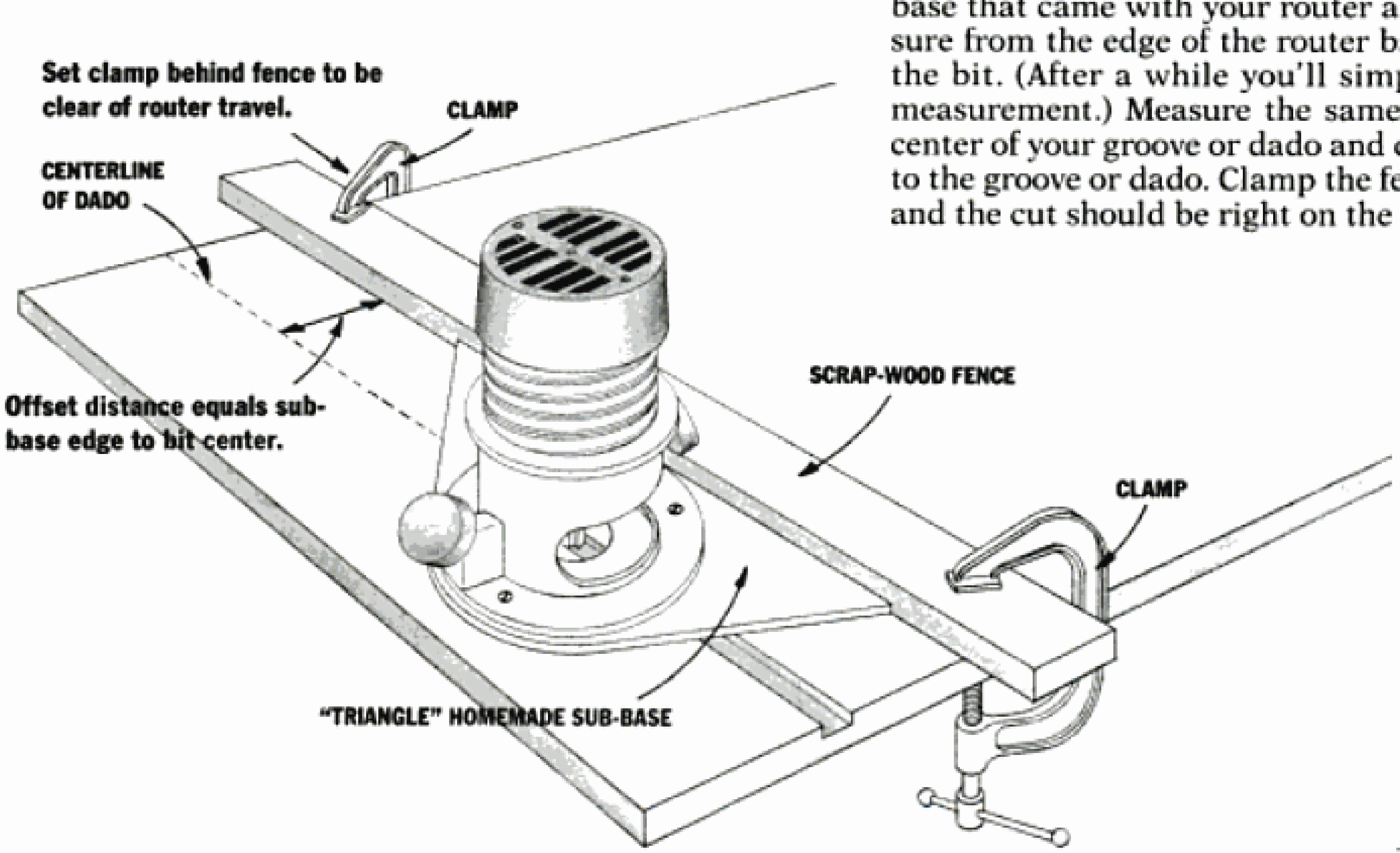
Outrigger fences ride the edge of a board. They're only useful when you're cutting close to an edge, because the length of the fence-extension bars limits the distance you can cut from the edge of the board. Some better-quality fences have a vernier adjustment for fine control. Without this adjustment knob, you'll need a very light touch to position the fence.

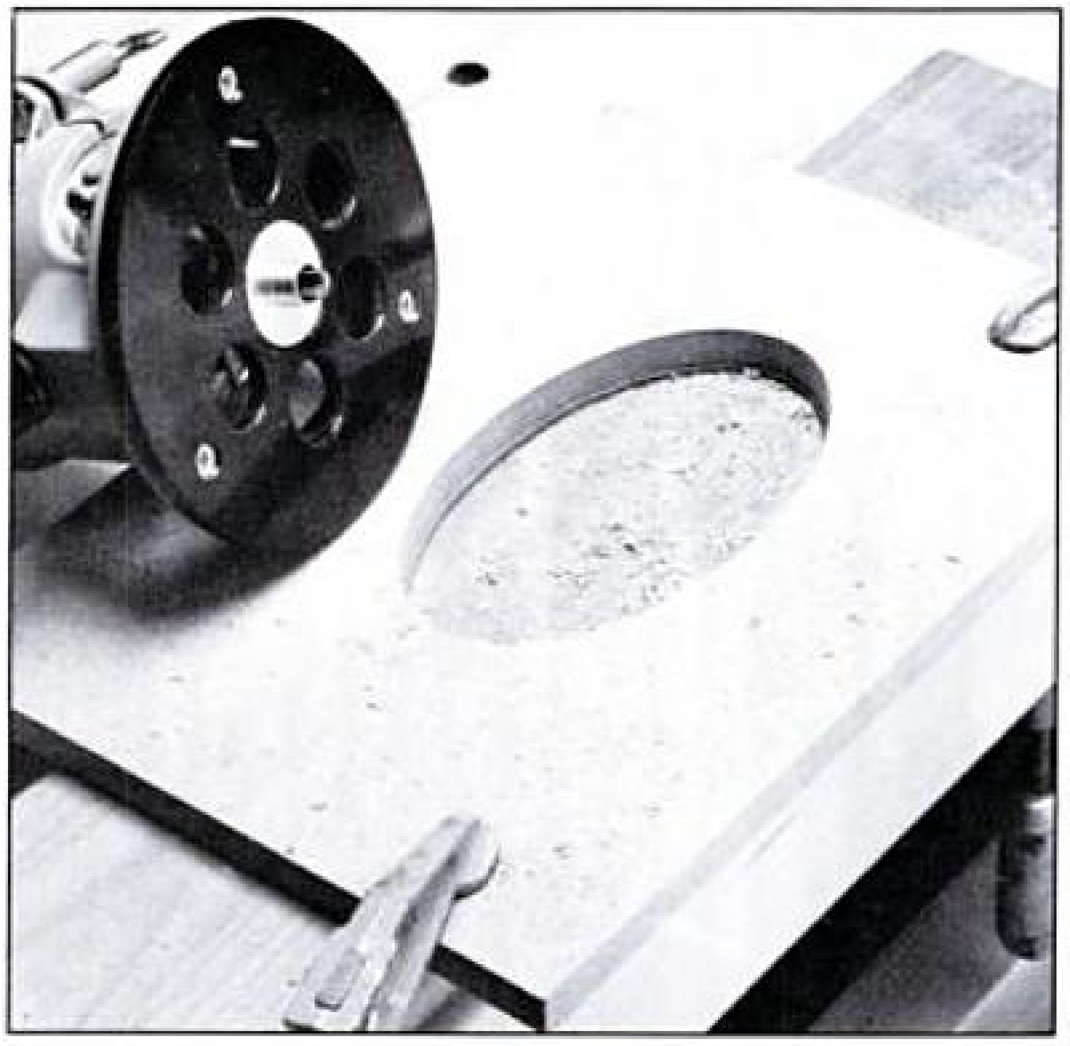
To use an outrigger fence, first lay out the groove or dado carefully, then adjust the bit so it rests flush on the surface of the work. Place the fence solidly against an edge of the board parallel to the intended cut. Slide the router on the fence extension bars until the bit is centered between your layout lines, then tighten all adjustments. Set the depth for the first pass. I like to work down to final depth in 1/8-in. increments. Place the router at an entry point where the bit can run freely before engaging the work. As before, feed against the bit's rotation.

The "make-your-own" wooden fence is just a long straight piece of wood clamped across the workpiece. For dadoes, you can build a "T-square" fence, which is just a nice piece of straight stock with a 12-in. head piece fitted at a right angle to one end, so it looks like a drafting T-square. With the head tight against the edge of the board, one clamp will hold it down.

The homemade "triangle" sub-base mentioned earlier is a natural to use with a homemade fence because it has that nice, long straightedge. The standard sub-base that came with your router also will work. Measure from the edge of the router base to the center of the bit. (After a while you'll simply remember this measurement.) Measure the same distance from the center of your groove or dado and draw a line parallel to the groove or dado. Clamp the fence along this line, and the cut should be right on the mark. (See Fig. 3.)

FIG. 3: SETTING UP A SCRAP-WOOD FENCE





Use a template guide bushing and template to rout out almost any shape imaginable. You can make your own templates for irregular shapes. The template guide bushing screws into the throat hole of the factory-supplied sub-base.

A blind groove or dado is one that stops short of an end or edge. To make a blind cut, fixed-base routers are usually lowered into the work from a tilted position to start the cut. Of course, as the spinning bit hits the wood, there's a tendency to lose control with the wrenching torque. A safer approach is to drill a hole in the line of cut slightly larger in diameter than the bit. Then, with the bit in the hole, it can't grab as the router is powered up. The slightly bigger hole may show in the finished groove, but in most cases you should be able to position it where it won't detract.

Cutting hinge mortises is another router trick. Lay out the hinge location, and make cuts along the lines with a sharp chisel. Then cut out the mortise with a small straight bit, and clean up the corners with a chisel.

Using a template guide bushing and a template expands the versatility of a router tremendously (March/April, 89 *AW*). A template is a pattern that allows you to rout out recesses with precise borders, such as curved grooves for tambour doors or the circular rabbet for the glass in a hand mirror. A template guide bushing is an accessory that fits in the throat hole of the router sub-base. The bushing protrudes from the bottom of the router, and the bit protrudes through a hole in the bushing and turns freely inside it. The theory is simple: run the guide bushing against the template and the bit follows the same path, repeating the pattern.

You can make a template out of any material that will survive. For safety, I'd avoid metal. It should be slightly thicker than the length of the guide bushing to provide clearance between the bushing and the work. The contour of the template's pattern must be smooth, as the guide bushing will follow every lump or bump in the template with a resulting irregularity in the cut.

When designing a template, no inside curve should have sharp corners or a smaller radius than the radius of your guide bushing. A small radius in an inside corner prevents the guide bushing from following your pattern. The template should be large enough to provide a stable base for the router. The router's base must always be supported.

Because the diameter of the guide bushing is larger than that of the bit, the area actually routed out will be slightly smaller than the area covered by the template opening. You can calculate the offset between the opening and the edge of the template: subtract the bit's diameter from the guide bushing's outside diameter, and divide by two. For example, I run a $^1/_2$-in. bit inside an $^{11}/_{16}$-in. O.D. guide bushing, so the diameter difference is $^3/_{16}$ in. Consequently, when making a template, the template must be $^3/_{32}$ in. larger than the opening all around.

The template must be securely fastened to the work. Clamps are best, as long as they don't interfere with the router's movement. You can use countersunk screws, but the screw holes must be in a spot on the workpiece that won't show, or in a scrap area that'll be removed. Double-sided tape or hot-melt glue are also good ways to hold a template in place.

Template cuts must often be started blind. Use the same technique as for blind dadoes: drill a hole large enough to accommodate the bit, to a depth equal to the finished excavation depth. A flat-bottom Forstner bit is ideal since it won't leave any marks in the floor of the recess.

To start a cut, place the bit in the pre-drilled hole and rest the router base firmly on the template. Switch on the router. For good control and clean results, cut the full depth in several passes, lowering the bit about $^1/_8$ in. at each pass, and only $^1/_{16}$ in. for the final pass. Keep the guide bushing against the edge of the template for the last cut along the perimeter.

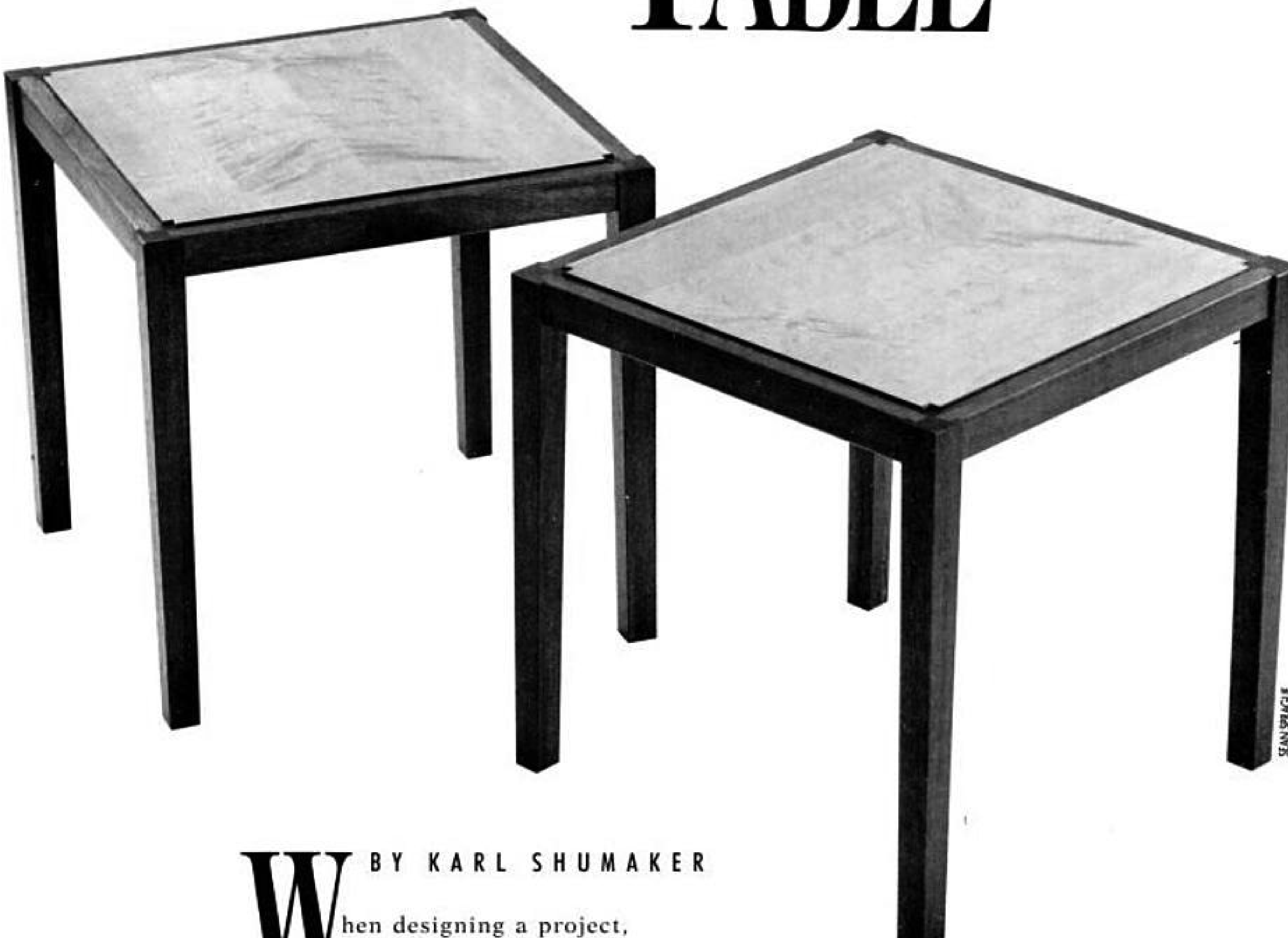
Dust is your router's worst enemy. It can damage bearings, switches, and even the motor. The remedy is to clean it with a vacuum, or compressed-air hose after each use. If you replace bearings, opt for the type that are sealed against dust. Their extra cost is worth it. Remember that collets wear out too. Replace your collet when it fails to hold bits tight. For safety's sake, wear safety glasses, ear plugs, and a dust mask when operating a router.

Conventional fixed-base routers are designed for hand-held operations. For more flexibility, consider getting a router table, which converts your router into a mini-shaper. (Don't attempt to clamp your router upside down in a vise.) There are also many commercially made jigs available for tasks like cutting dovetails (March/April, 1988 *AW*), mortises, hinge mortising, circles, lettering and other operations. There are many jigs you can make in your shop to increase the router's versatility. Circle-cutting jigs (May/June, 1988 *AW* Tech Tips), mortising jigs (May/June, 1988 *AW*) and others are fairly simple to build. If you'd like more detailed reading on routers and jigs, Patrick Spielman's books, *Router Handbook* and *Router Jigs & Techniques* (Sterling Publishing Co., Two Park Ave., New York, NY 10016) are excellent sources. ▲

Bernie Maas is an Associate Professor of Art at Edinboro University of Pennsylvania, where he teaches woodworking, engineering drawing and computer-aided design. He builds Bauhas-style furniture at home in Cambridge Springs, Pennsylvania.

PARSONS TABLE

Details Embellish a Straightforward Form

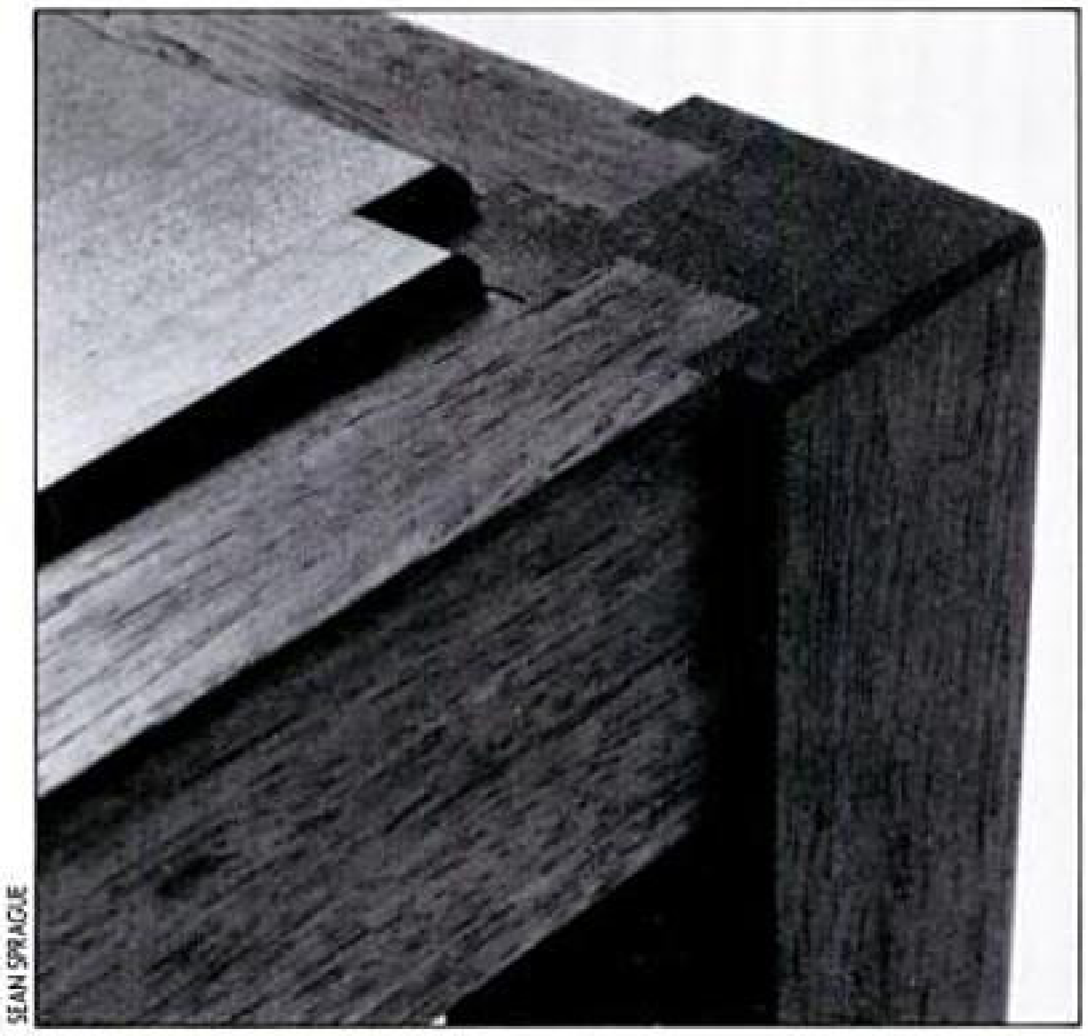


BY KARL SHUMAKER

When designing a project, sometimes technical considerations such as joinery push you around so much, that what you end up with doesn't even resemble your initial idea. On this end table, though, I got lucky. I set out to make an 18-in. cube-shaped table in the simplest possible fashion, and I ended up with decorative details for free.

The decorative pattern on the leg tops, for example, is simply the exposed haunch of the haunched tenons that join the legs and stretchers. By raising the surface of the veneered top slightly above the stretchers, the edge banding around the top appears to be raised stringing inlaid around the top.

The tabletop is enclosed by stretchers on four sides. This construction leaves no room for wood movement, so a solid-wood top is out of the question. Therefore, the top has to be a veneered panel. You have two options at this point. Either make the panel from nice-looking hardwood plywood, or veneer your own panel on a dimensionally stable material such as furniture-grade hardwood plywood, medium-density fiberboard (MDF), or lumber-core. In my case, I wanted to make a pair of tables with a book-matched veneer pattern, so I sawed my own veneers and glued them on a 3/4-in. plywood panel.

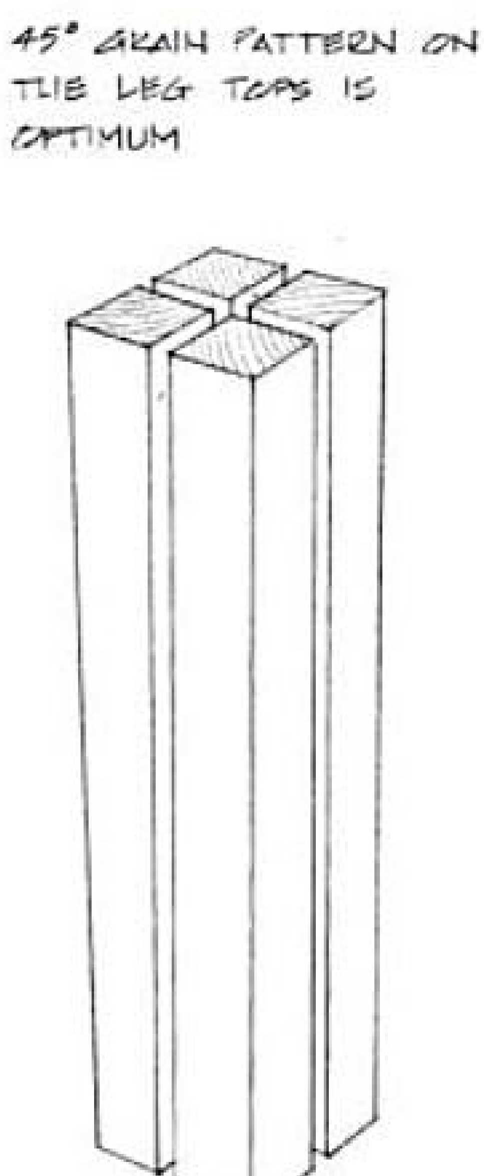


The veneered top protrudes $^3/_{32}$ in. above the table frame to reveal more of the contrasting edge banding around the top. Exposed haunches on the leg add visual interest.

Building the Table

The construction sequence begins with building the table frame, consisting of the legs and stretchers. Make the veneered top larger than necessary. When the frame is complete, you'll trim the veneered top to size, glue on the edge banding, and fit the top into the frame opening.

You'll get a better match in color and figure if you cut all the frame parts from one board. Start with approximately 4 board feet of 8/4 stock. Mark the plank with chalk to lay out four legs, four stretchers and four strips of wood to make the ledgers that support the top. Try to plan your cuts so that the growth rings on the legs run diagonally across the leg tops. This will give you the most harmonious grain pattern when viewing the piece of furniture as a whole.



Saw out the parts approximately $^3/_{16}$ in. oversize. I use the bandsaw with a rip fence to do this, for two reasons. First, a bandsaw wastes less wood because of its narrow kerf. Second, and most important, I find the bandsaw much less intimidating than a circular saw when working thick wood.

Rough out an extra leg and an extra stretcher. These can be cut from the same stock as the rest of the frame parts or some scrap. You'll use these extras later to set up for the mortise-and-tenon cuts.

Once you've roughed out your stock, square up the legs and stretchers on the jointer. First, run one face over the jointer, then run the jointed face against the jointer fence to make a second face at 90°. It's important here to check with an accurate square to see that your leg is square, otherwise you won't be able to get a tight-fitting joint or parallel legs later. Next, run the stretchers and legs through the thickness planer to the desired thickness, or plane them by hand.

Put the stretcher stock aside for now, and square one end of each leg on the tablesaw. Next, cut all the legs to a final length of 18 in. So the legs are exactly the same length, I clamp a stop on the fence of my crosscut table when cutting the legs to length.

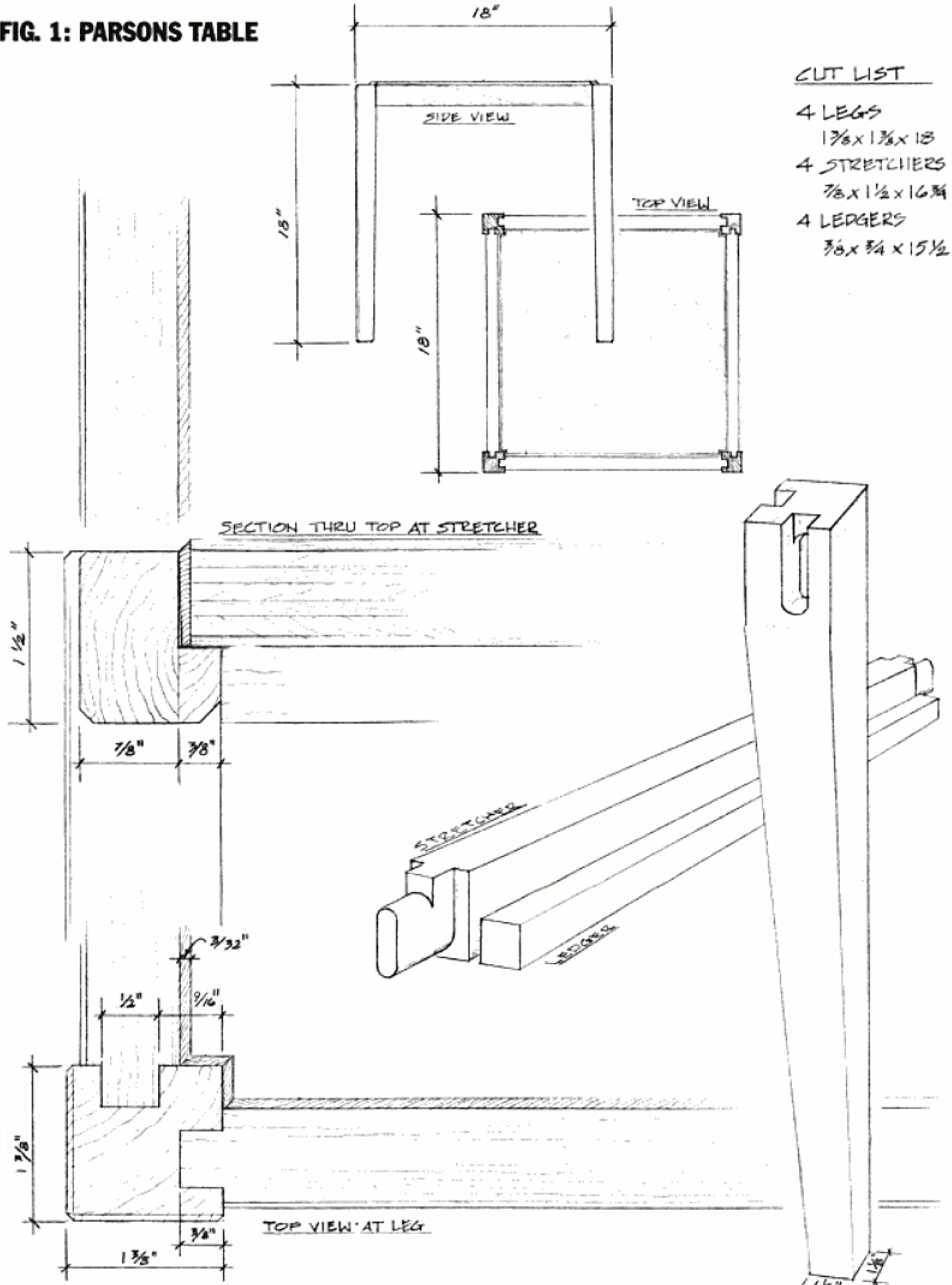
Choose the best end for the tops, and clearly mark the sides you plan to mortise. Lay out the mortises according to the dimensions in the drawing. The stretcher tenons will be $^3/_4$ in. long, so cut the mortises $^1/_{16}$ in. deeper to allow compression room for glue. When cutting the second mortise in each leg, don't be surprised if you break through into the first. You'll miter the ends of the tenons later, to allow for this intersection. Cut the deep mortises for the tenon first, then the shallow mortises for the haunches.

You'll get a better match in color and figure if you cut all the frame parts from one board.

Once you've cut the mortises, taper the two inside faces of each leg. Draw a line $^3/_8$ in. below each mortise to mark the start of the taper. The legs taper from $1^3/_8$-in. square at the top to $1^1/_8$-in. square at the bottom, as shown in the drawing. Saw the tapers on the bandsaw, then remove the bandsaw marks with a hand plane. Be careful not to plane above the line, into the flat area where the shoulders of the stretcher tenons will seat.

I cut the tenons after cutting the mortises, because I find it easier to fit a tenon to a mortise than vice versa. The proper fit on a tenon is a friction fit. A joint that rattles is no good. The other end of the spectrum, a joint that's too tight, also spells trouble. The wood will swell when glue is applied, and the joint may bind before it goes all the way home. A tight joint in the dry run has been the cause of more than one "Keystone Cops" scene during glue-up. Dashing for extra clamps and frantic pounding with mallets can be forgone if you get your joints to fit right from the start.

FIG. 1: PARSONS TABLE



DRAWINGS BY KARL SHUMAKER

Square up one end of each stretcher, then cut them all to a length of 16¾ in. Here, too, I use a stop on my crosscut table so the stretchers will be identical. From here on, use the extra stretcher to set up your cuts for the haunched tenons.

Haunched tenons are cut on the tablesaw, much like regular tenons. Saw the shoulders and the face of the haunch with a crosscut table or miter gauge. I set a stop on my crosscut table when I saw the tenon shoulders, to make sure all four stretchers are iden-

FIG. 2: MORTISE LAYOUT

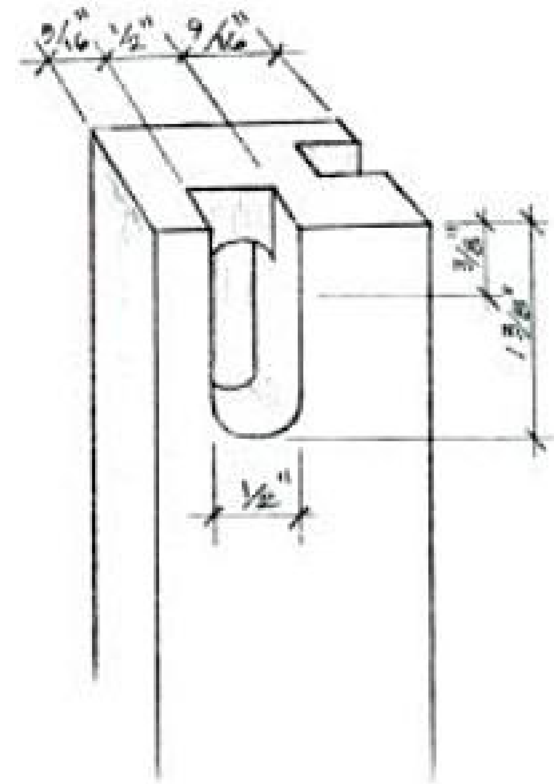
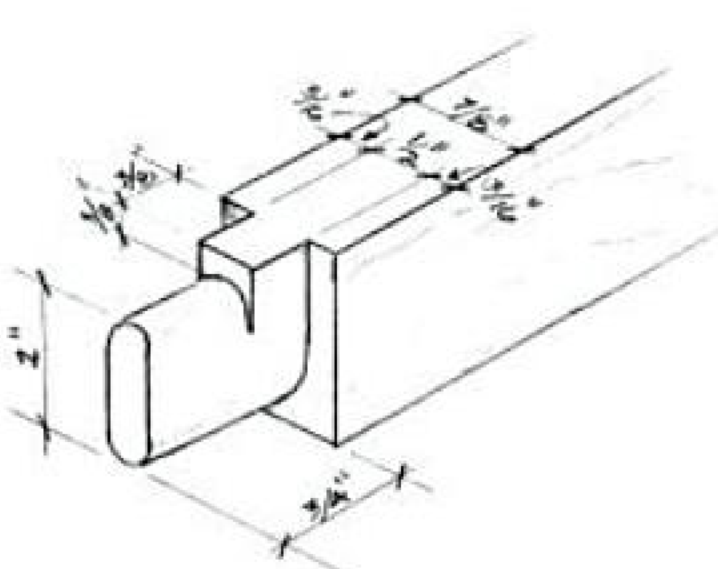


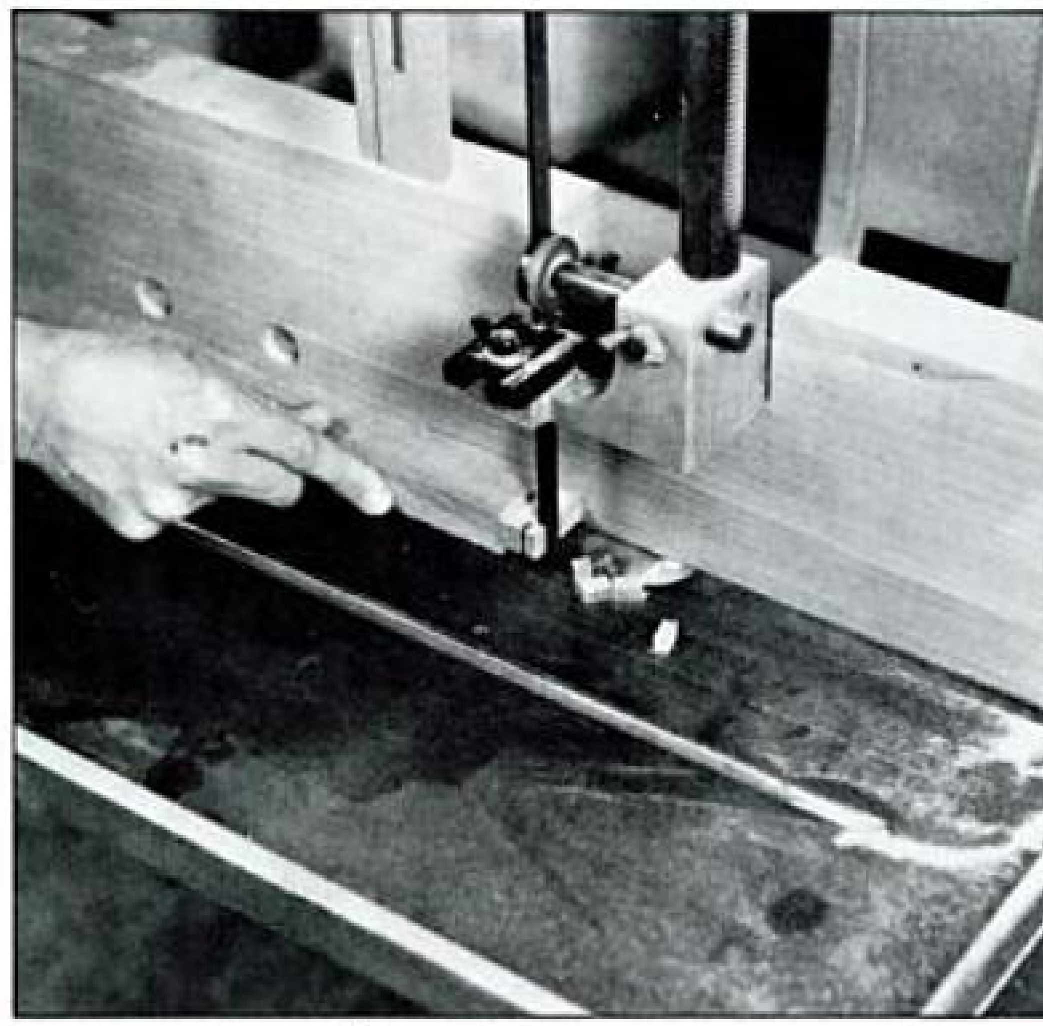
FIG. 3: TENON LAYOUT



tical. Next, on the tablesaw, saw the cheeks with a tenoning jig that clamps the stock in a vertical position. (See May/June, 1989 *AW*.) Finally, on a bandsaw that has a fence, make two rip cuts to cut away the top and bottom excess. (See photo page 25.)

Now for some hand work—the part of the project that I savor. With a sharp chisel, clean where the shoulders meet the tenon. You can undercut this area ever so slightly if you want, so there's nothing left in the corner to keep the joint from closing tightly. The undercut will also allow a little space for the glue to squeeze out. Don't undercut at the top of the haunch, though, or you'll see gaps at the top of the leg.

Then, with your favorite carving knife, round the tops and bottoms of the tenons to fit the rounded ends of the router-cut mortises. I spend only two or three

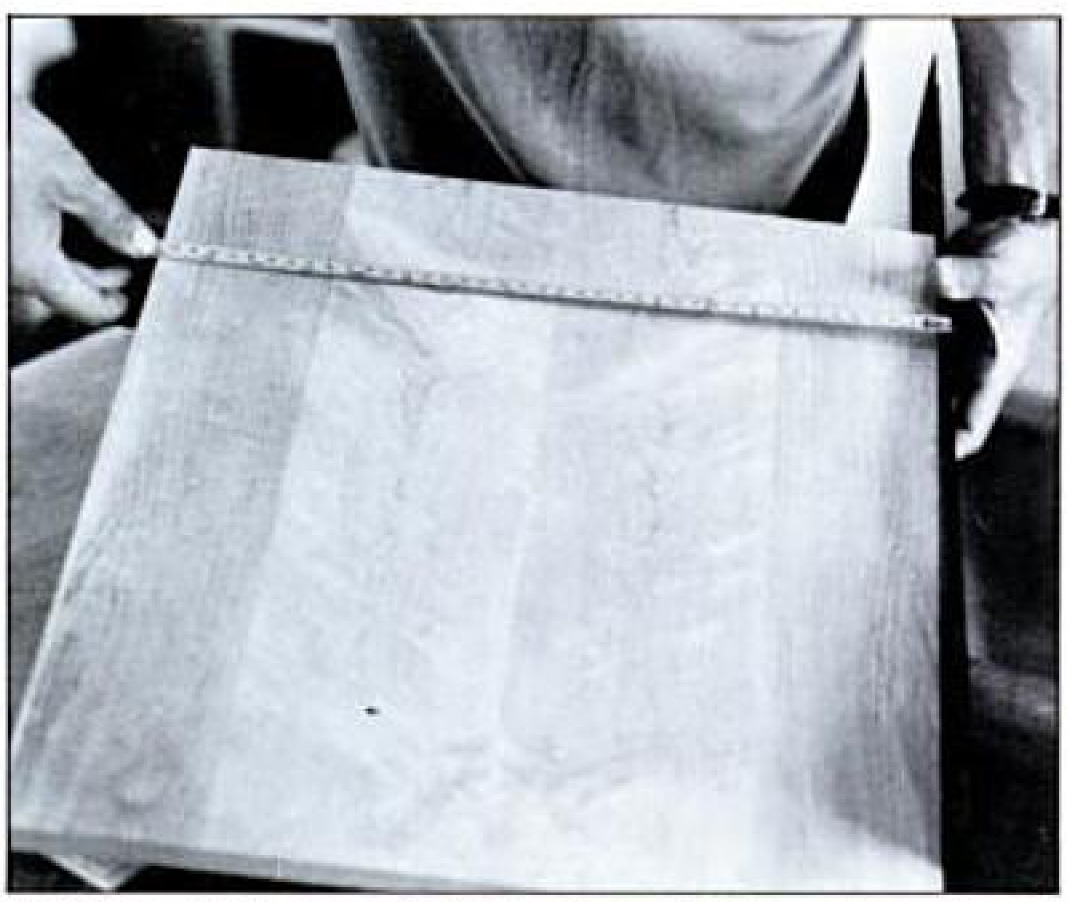


Saw the shoulders and cheeks of the haunched tenons on the tablesaw, then remove the excess by making two rip cuts on the bandsaw.

To mark the miter at the end of each tenon, mark the tenon with a pencil through the opposing mortise.

To determine the width of the ledger, subtract the veneered panel's thickness from the width of the stretcher, and add $^3/_{32}$ in. to this figure.

1. Joint one edge of panel, then square second edge to 90° on the tablesaw. A crosscut table increases accuracy.



2. Hold two thicknesses of edge banding against one edge, and mark panel so it will be just slightly too wide to fit frame opening when edge banding is glued on.

3. Set a stop on crosscut fence to the mark, and cut two remaining sides to 90°.

minutes per tenon. They don't have to be works of art, just a good fit. Of course if you hand chopped your mortises it won't be necessary to round over the tenons.

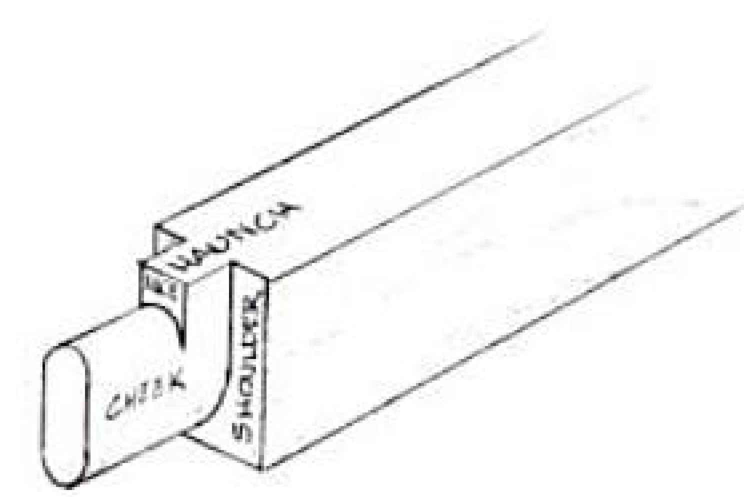
Next, slip the tenons into their mortises one at a time. To mark the miter at the end of each tenon, mark the tenon with a pencil through the oppposing mortise. Clamp the stretcher to your bench, and with a sharp chisel, miter each tenon. Check the fit of each leg with both stretchers in place, to make sure you've trimmed away enough wood.

The ledger that supports the top comes next. The ledger must be positioned so the top panel protrudes $^{3}/_{32}$ in. above the stretchers, as shown in the drawing. Subtract the thickness of your top panel from the width of the stretchers. Add $^{3}/_{32}$ in. to this number and trim the ledger stock to this dimension. Cut one end of the stock square, then trim it to length at exactly the distance you have between the shoulders of the stretchers. Glue these ledgers flush with the bottom inside of each stretcher, as shown in the drawing. When the glue has dried, plane the bottom of the stretcher clean and flush so the joint is invisible.

Now that you've made all the parts, clean them up and chamfer the edges. Don't forget to chamfer the bottom inside edges of the ledger, so you won't feel any sharp edges when you pick up the table.

If you're planning to apply an oil finish, as I did, try finishing before glue-up. If you've ever seen a piece of furniture that's as beautifully finished on the underside as it is on the top, this is how it's done. The other

HAUNCHED TENONS



A haunched tenon is a compromise. A taller tenon is more resistant to twisting and to racking in one direction—across the width of the tenon. If the entire tenon were to come all the way through to the top of a leg or a door stile, though, the tenon would have little resistance to racking in the other direction—in line with the tenon, and the leg or stile would have a greater tendency to split along the grain. The haunch serves to increase the strength of the joint, and in the case of the Parsons table in the accompanying article, the haunches also give an interesting pattern to the leg tops.—*K.S.*

advantage of this approach is that you'll have no glue stains under the finish. What squeeze-out there is during glue-up pops right off the oiled surface without a trace, after it dries.

Dry fit the frame together, apply a *light* coat of oil, and allow it to dry. Applying the oil too heavily will cause seepage into the joints where you don't want it. Disassemble the table, and apply a second coat of oil over the first. Don't get oil on any of the joint surfaces or the tops of the ledger strips, because the glue won't stick to the oil.

Once the second coat of finish is buffed out, glue two legs to a stretcher. Do the same to the opposing set of legs, and allow the glue to dry. Finish the glue-up by joining the two legs assemblies with the remaining stretchers. While the glue is still wet, check the frame for square by measuring across the diagonals. Don't wipe the glue squeeze-out with a wet rag. The water could spoil the finish. Simply let the glue droplets dry, then go in with a chisel and they'll pop off the oiled surface without a trace.

Now that the frame is in the clamps, don't sit down. Rummage through those scraps of precious wood you couldn't throw away, and choose a dark contrasting wood to make the edge banding for the top. Mill four strips, 3/32 in. thick, 16 in. long, and slightly wider than the panel is thick.

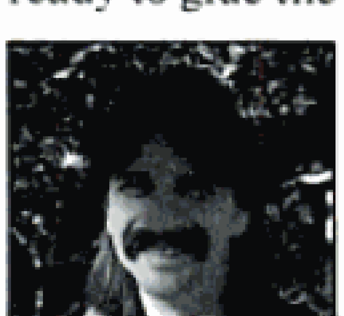
Next, cut your veneered panel to size so the panel, with the edge banding on, is just slightly wider than the opening in the frame. Here's how to determine the size. Measure the opening that the top will fit into, and square up the panel according to the sequence given in the photos on page 26. After you've squared the panel, glue on the edge banding. Don't fuss too much over how flush the ends of the banding come to the panel corners. The corners will be trimmed away later.

Plane the banding flush with the top and bottom of the panel. Stand the panel on edge in your crosscut table, and cut a 3/8-in. square notch in each corner to fit around the legs.

With the corners removed, you're ready to fit the panel into the frame. Plane the edges of the banding at a slight bevel, so that plane-stroke by plane-stroke the top fits gradually into the frame opening like a cork being pressed into a bottle. This is the point of the project that holds the greatest risk, but you will be impressed with the accuracy you'll get from your plane. It took me about an hour to get the fit I wanted.

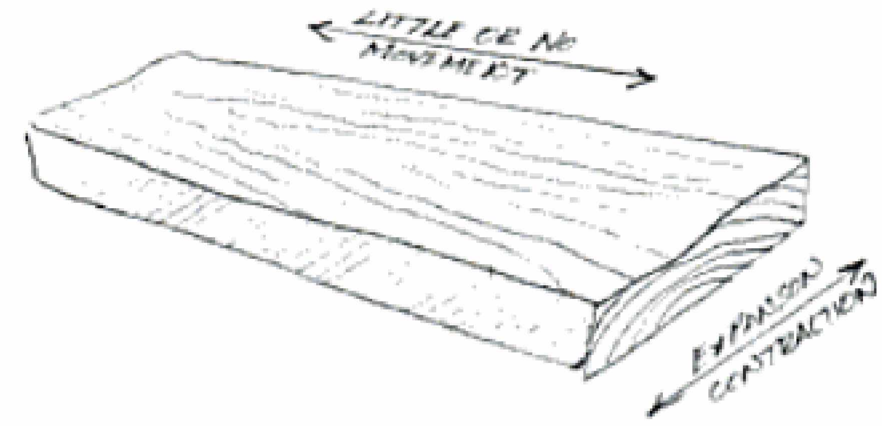
Once the top rests on the ledgers, return to the crosscut table, and trim the corner notches enough to allow a gap of 3/32 in. between the corner notch and the legs. Miter and glue pieces of edge banding into these notches. Plane this notch banding off flush, and slip the top into the frame. The top should protrude 3/32 in. above the stretchers. Trace a line around the edge of the top, and remove the top from the frame.

With a plane and a file, bevel the banding from this line to the edge of the veneer, as shown in the close up photo of the top. Put a finish on the top and you're ready to glue the top into the frame. ▲

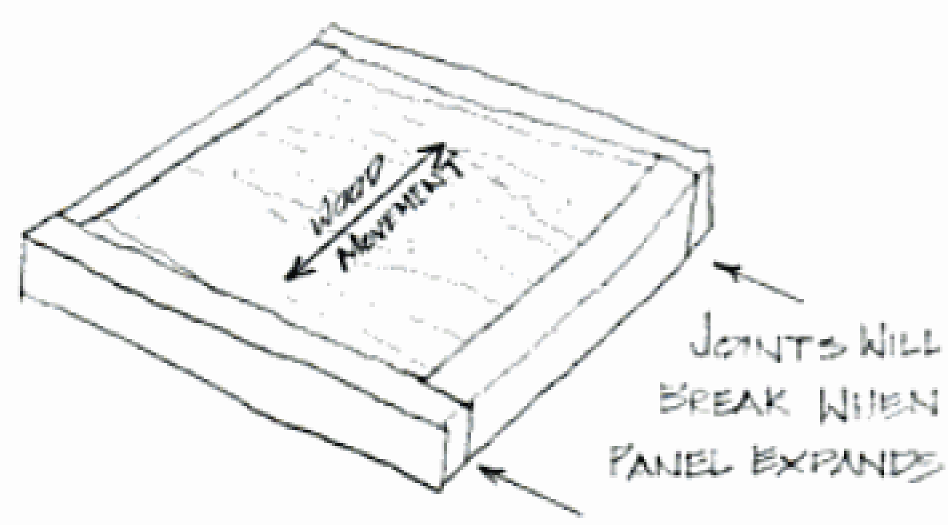


Karl Shumaker is a professional woodworker in Petaluma California. He does custom design and one-of-a-kind pieces for galleries.

THEORY OF WOOD MOVEMENT



IF YOU THINK OF WOOD FIBERS AS STRINGS, YOU CAN THINK OF A BOARD AS A BUNDLE OF STRINGS. AS HUMIDITY CHANGES THE BOARD SWELLS OR SHRINKS LIKE A SPONGE AS IT TAKES ON OR GIVES OFF WATER. UNLIKE THE SPONGE THOUGH, THE BOARD IS MADE OF FIBERS THAT DO NOT CHANGE IN LENGTH. THEREFOR A BOARD CHANGES DIMENSION IN WIDTH BUT NOT IN LENGTH.



A FRAME CAN BE CONSIDERED DIMENSIONALLY STABLE SINCE IT'S ALL LONG GRAIN. A SOLID WOOD PANEL ON THE OTHER HAND IS STABLE ONLY IN ONE DIRECTION.

THE SITUATION ABOVE AS WITH OUR END TABLE REQUIRES THAT THE PANEL BE VENEERED.

BY MICHAEL DUNBAR

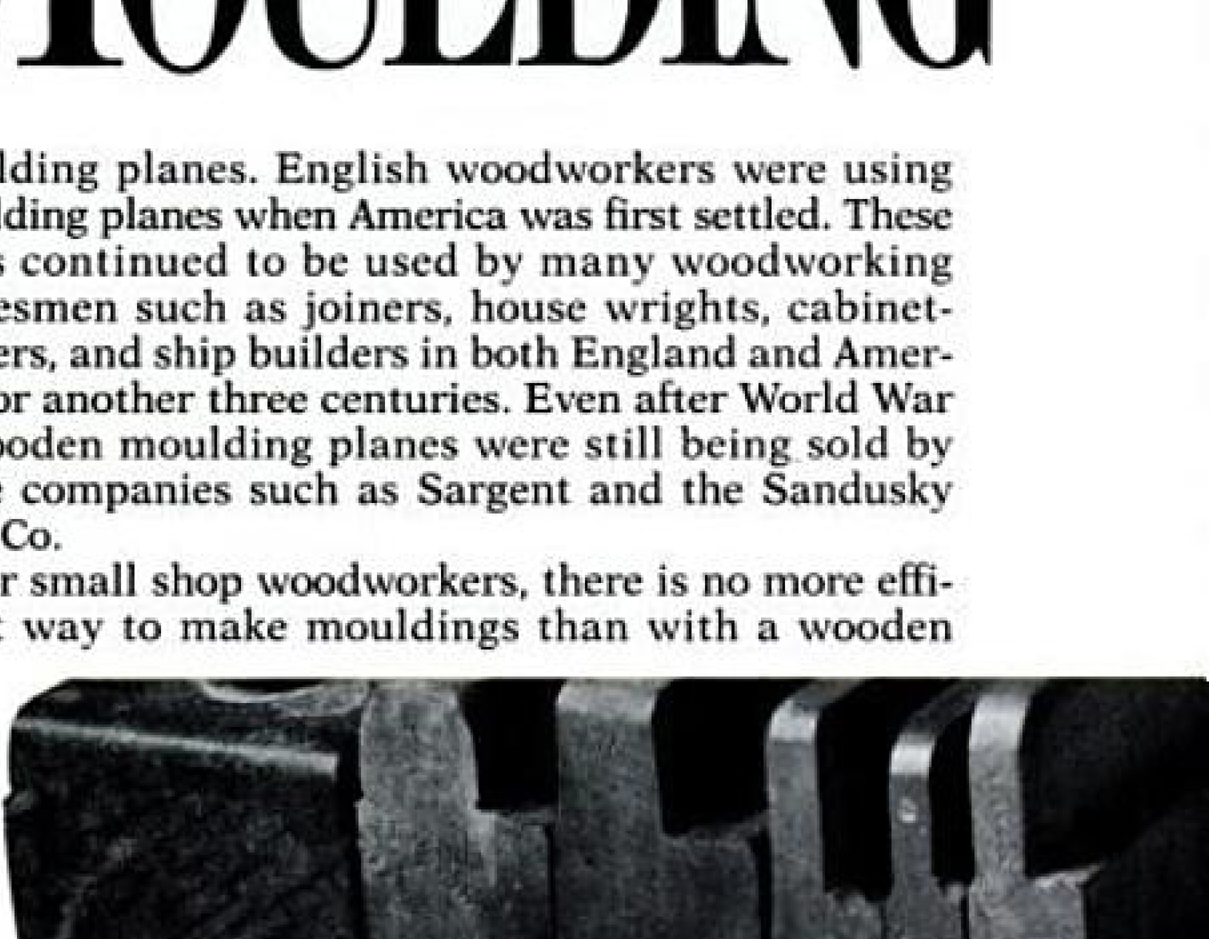
WOODEN MOULDING

This is Part 1 of a two-part series on Wooden Moulding Planes from the book, Restoring Tuning and Using Classic Woodworking Tools, *by Michael Dunbar. Reprinted by permission of Sterling Publishing Co., Inc., 387 Park Ave. South, New York, NY 10016. © 1989 Michael Dunbar*

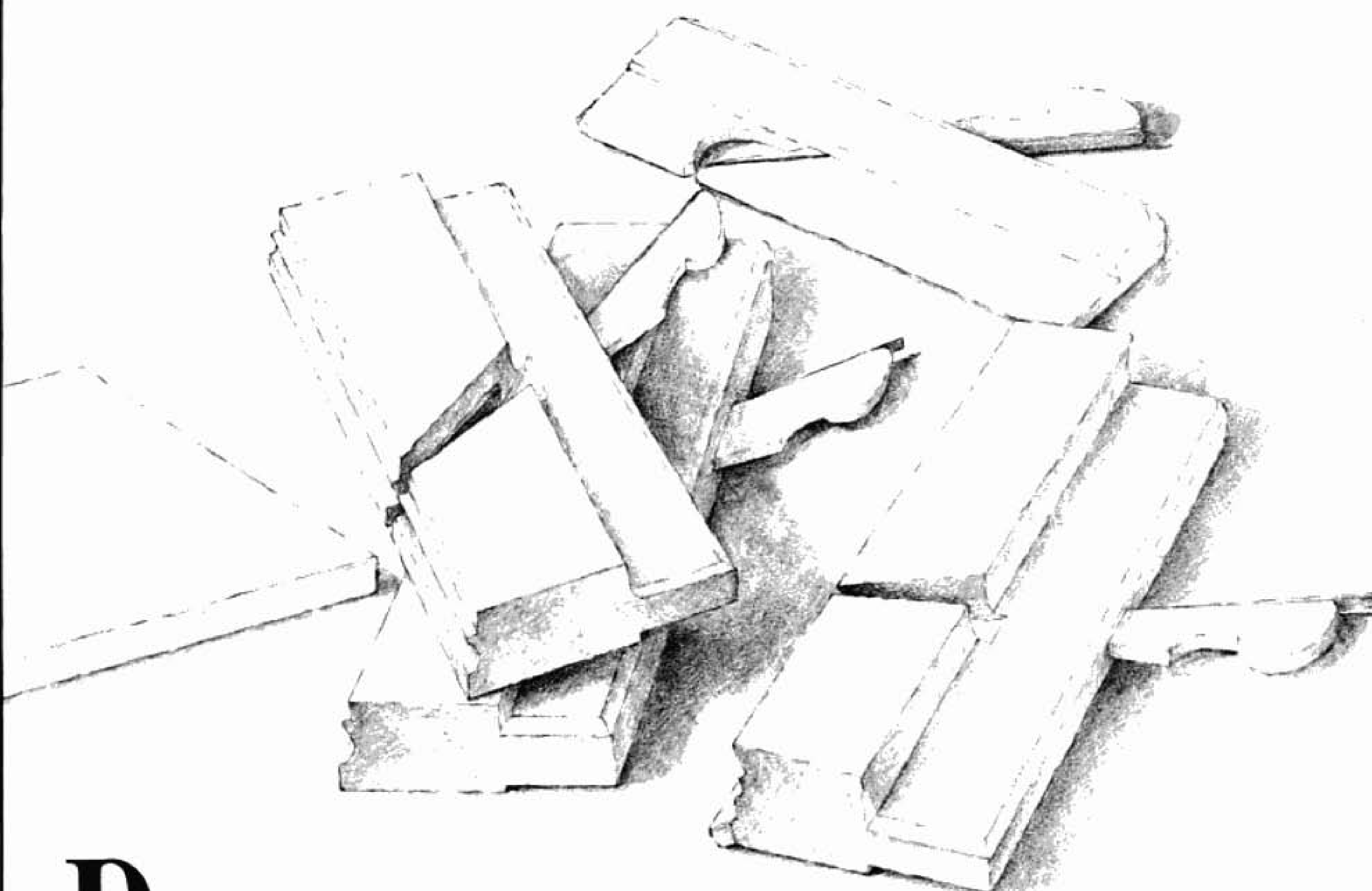
Woodworkers have used mouldings to embellish furniture and architecture for hundreds of years. These decorative, three-dimensional bands, many with unfamiliar Latin names have been used to add a special effect to homes and furniture. In better houses, different moulding profiles were used to make door and window architraves, cornices, chair rails and mopboards.

Today, all commercial mouldings are made by machine. However, from the time of the Romans until the mid-19th century, mouldings were made with wooden moulding planes. English woodworkers were using moulding planes when America was first settled. These tools continued to be used by many woodworking tradesmen such as joiners, house wrights, cabinetmakers, and ship builders in both England and America for another three centuries. Even after World War I, wooden moulding planes were still being sold by large companies such as Sargent and the Sandusky Tool Co.

For small shop woodworkers, there is no more efficient way to make mouldings than with a wooden



Moulding planes come in a great variety of sizes, ranging from those that are very wide and shallow to those that are narrow and deep.



PLANES *Getting to Know Them, Body and Sole*

moulding plane. In fact, the methods used today are more difficult and more complicated, and the results are worse.

Moulding planes were made in prodigious numbers, both in England and in America, and, therefore, can still be found in large quantities on today's secondhand tool market. As you look for secondhand tools to use for woodworking, you will come across many wooden moulding planes. They are available everywhere: in flea markets, yard sales, antique shops, and, above all, from specialized tool dealers.

If you acquire just a few basic moulding planes and learn to use them, you will discover how easy it is to make mouldings with them, and will probably begin to include more mouldings in your woodworking than ever before. You do not have to make reproductions of furniture to use moulding planes; mouldings look good even on contemporary furniture.

Many moulding planes look very much alike, but there is also a tremendous variety. Some planes make mouldings only a fraction-of-an-inch wide, while others cut four- and five-inch cornices. Some planes produce a wide flat shape, while others have to be worked down into the wood an inch or more to form a narrow but very deep, moulding. (See photo, page 28.) Some planes are so small that they can fit in the palm of a hand, while others are so big that one worker alone does not have the strength to use them. In the latter case, a rope is attached to the front of the plane, which is pulled by one worker and pushed (and guided) by another.

DRAWINGS BY KATHY BRAY

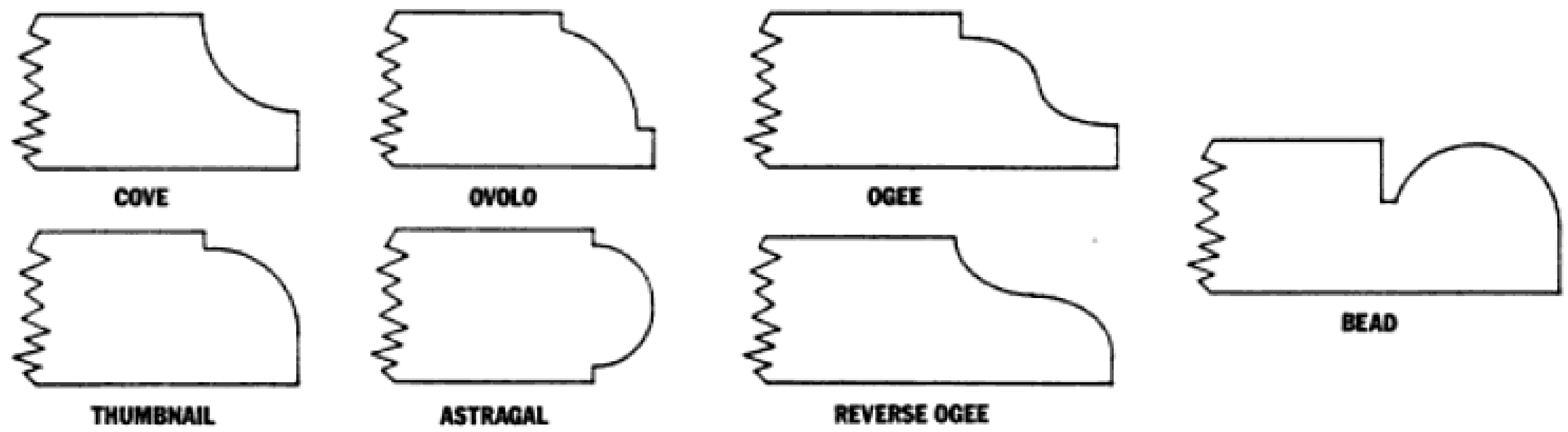
Types of Moulding Planes

Moulding planes can be grouped into three general categories: shaping, simple, and complex planes. Of the three, shaping planes—also called hollows and rounds—are the least complicated. Simple moulding planes make just one basic moulding profile, while complex planes make a combination of two or more of the simple shapes.

Hollows and Rounds—Shaping planes are called hollows and rounds. (See photo, page 31.) These names refer to the shape of the tool's sole rather than the shape the tool makes. The sole of a hollow plane is con-

PHOTOS BY ANDY EDGAR

FIG. 1: SIMPLE MOULDINGS



cave, and the sole of a round plane is convex.

Hollows and rounds are very simple tools but can be difficult to understand. They were made in graduated sets of pairs: each hollow plane had a matching round plane. Tool factories sold them in sets of nine, ten, 18, 20, and 24 pairs. Thus, the smallest set contained 18 planes, and the largest had 48 planes.

Usually, the arc that forms a hollow plane's concave sole (or a round plane's convex sole) is one-sixth the circumference of a circle. This means that the distance across the sole is a chord that is the same length as the arc's radius. More concisely, the distance across the sole is one-half the diameter of the circle the plane works. When you measure a pair of these planes, it is easiest to measure point to point on the hollow. So, a hollow plane that measures 1/2 in. works a one-inch-diameter circle. So does its matching round.

In a set of hollows and rounds, the pairs are usually numbered sequentially. So, the number stamped on the heel is not necessarily the length of its radius. A set of nine pairs is often numbered from 1 to 9. These pairs of planes are usually graduated in increments of 1/8 in. of radius, with the first pair starting at either 1/8 in. or 1/4 in. If pair #1 is 1/8 in., each succeeding number *will* correspond to the number of eighths-of-an-inch. For example, #5 will be 5/8 in. and #6 will be 6/8 (3/4) in.

If pair #1 starts with 1/4 in., the number on the heel *will not* correspond to the number of eights. Pair #2 will be 3/8 in., #5, 3/4 in., and #6, 7/8 in.

In a set of nine pairs, the planes can also be numbered using even numbers from 2 to 18. In this case, the number again corresponds to the number of eighths-of-an-inch of radius. For example: pair #2 would usually have a radius of 1/4 in. (2/8), and the radius of pair #4 would be 1/2 in. (4/8), etc., up to #18, which would have a radius of $2\frac{1}{4}$ in. (18/8 in.).

The largest set of 24 pairs is usually numbered from 1 to 24. In this case, the number on the heel again corresponds to the number of eighths-of-an-inch of radius. However, to make things even more confusing, this system sometimes changes after #20. The last four planes #21 to #24, increase by quarter-inch increments. Thus, pair #21 has a radius of $2\frac{3}{4}$ in., 1/4 in. larger than pair #20. Pair #24 has a $3\frac{1}{2}$-in. radius.

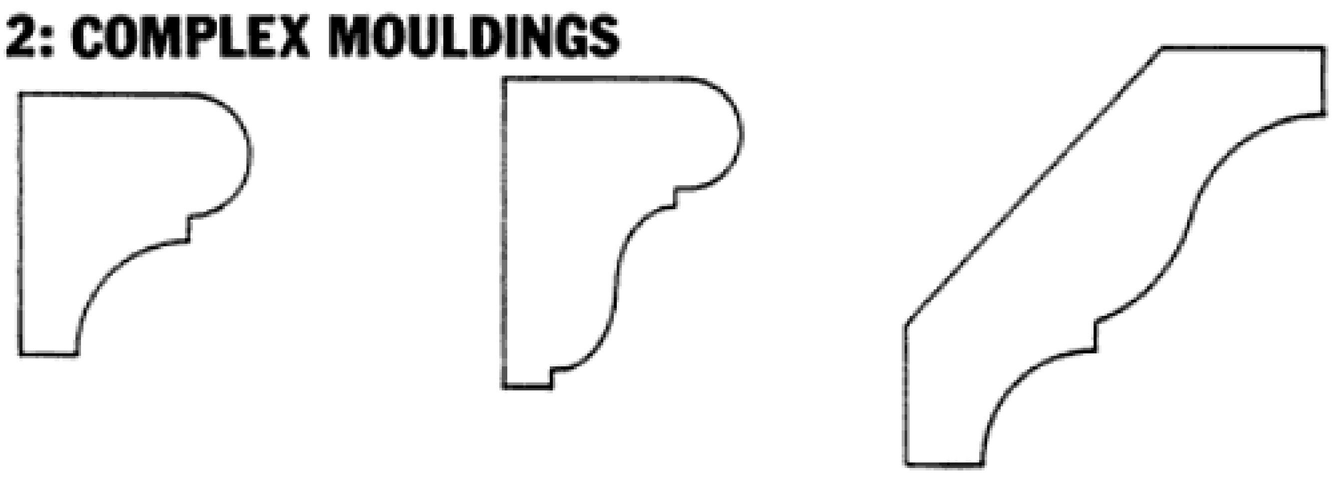
If this is not confusing enough, not all American tool companies used these systems. And the English used a different method, so their numbers do not correspond to the same numbers on American planes. Some English hollows and rounds are numbered from 1 to 20, and increase by increments of a sixteenth-of-an-inch, except after #12 when they increase by eighths-of-an-inch. Thus, pair #1 is slightly under 1/8 (listed as 1/8 bare). Pair #2 is a full 1/8 in., #3 is 3/16 in., #4 is 1/4 in., and #5 is 5/16 in. Pair #12 is 3/4 in., but #13 is 7/8 in.

Sets of hollows and rounds are not common; most sets have been broken up over the years. If you buy a set and its numbering does not conform to any of the systems described above, you can probably deduce the numbering from the information you have. Most of the hollows and rounds you will find come as single planes that have been separated from their original sets. I will not buy lone planes, as they are not very useful without their mates. I assembled my set of hollows and rounds by buying pairs. I ignore the numbers stamped into their heels and instead designate them by the length of their radii, writing the size on the end grain in ink. If you do this, measure point to point on the sole of the hollow.

When you need a plane, you can usually just look at the width of its sole to conclude whether or not it will do the job that has to be done. If you own an assortment of pairs made in both England and America, look up the maker's mark to determine if it is an English or American plane.

Most simple and complex moulding planes have two features, called the fence and stop, built into the

FIG. 2: COMPLEX MOULDINGS



Complex mouldings: 1 is an astragal and cove, and was commonly used as a chair rail, under stair treads, and on window stools. 2 is an astragal and cyma recta (reverse OG). It was used as a chair rail and to cap hand rails on banisters. 3 is a cyma recta and cove and was used as a cornice.

Pairs of hollows and rounds. The largest pair, which measures 2 in. in radius and is marked #30, was made by Chapin-Stephens, a company that was formed in 1901.

sole. These features keep the tool square against the edge that is being moulded and stop the cutting at a certain depth. They also help you to cut identical mouldings every time you use the plane.

Hollows and rounds do not have either a fence or a stop. In concept, they are similar to spokeshaves in that they are used for shaping. However, because they are moulding planes, they work on straight edges, rather than curves.

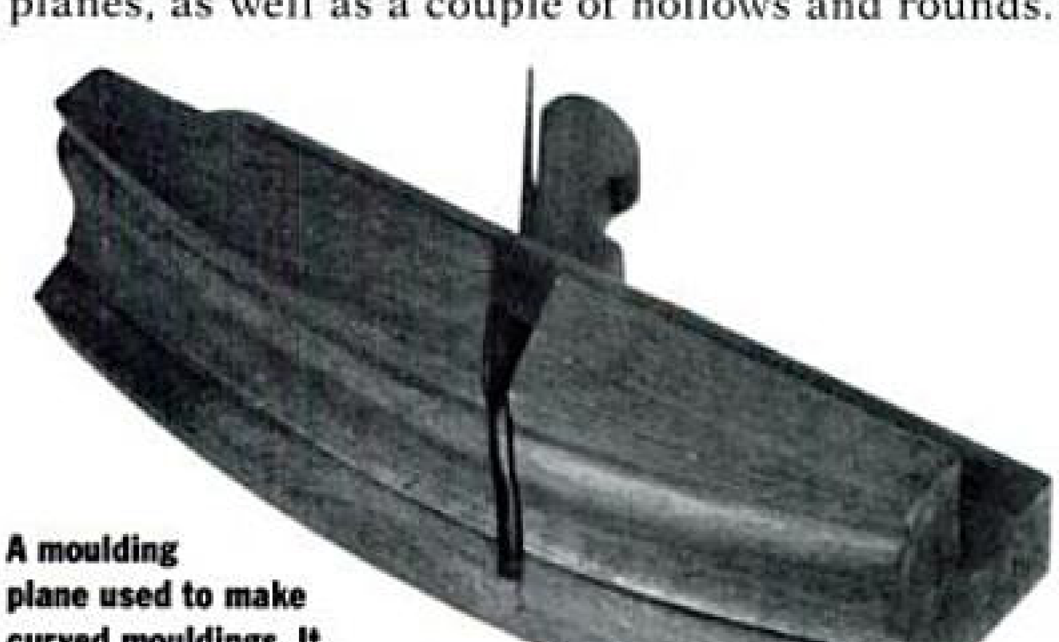
Hollows and rounds are very uncomplicated tools, although they do very complicated work. For example, these planes will make lengths of replacement mouldings. They are handy for making repairs or for making precise copies when you cannot find a moulding plane of the original shape.

It is surprising how often hollows and rounds come in handy for general woodworking. For example, a round plane run against a straight edge clamped to a board will by itself make flutes; a hollow will make reeds. If you own hollows and rounds and are familiar with how they work, you will discover all kinds of uses for them—jobs you once tried to do with carving tools, scratch tools, a router, etc.

Simple Moulding Planes—These moulding planes make one basic profile, but unlike hollows and rounds which do shaping, they are truly moulding planes. Simple moulding planes make simple profiles that include the bead, the cove, the thumbnail, the ovolo, the astragal, and the S-shaped cyma curves (also known as ogees). (See Fig. 1.)

The bead is the most widely known simple moulding. This basic profile has always been, and continues to be, so common that you will certainly recognize it even if you do not know it by name.

A bead is a half-round on the edge of a board that's set off by a narrow groove called a quirk. In the past, woodworkers referred to this moulding as a quirked bead. Every craftsman owned at least a couple of bead planes, as well as a couple of hollows and rounds.



A moulding plane used to make curved mouldings. It makes a cyma reversa (OG) moulding. It was made by Moseley & Son, King St. & Bedford St., Cove Garden, London.

More advanced joiners probably owned entire sets. A set would have contained many of the following sizes: 1/8, 5/32, 3/16, 1/4, 5/16, 3/8, 1/2, 5/8, 3/4, 7/8, 8/8, and 1 1/4 in.

Bead planes, along with hollows and rounds, are by far the most common moulding planes sold on the secondhand tool market. You may have to sort through anywhere from 10 to 30 or more bead planes and hollows and rounds to find one plane that makes any of the other simple or complex shapes described below.

The thumbnail is another simple moulding; it's called a thumbnail because its profile looks like the end of your thumb when it's viewed from the side. It is similar to a quarter-round moulding, only its shape is based on the ellipse, rather than the circle. During the 18th century, it was commonly used around drawer fronts, the lids of chests, and the edges of stiles and rails of raised-panel walls and doors. During the 19th century, the bead, the ovolo, and sometimes the ogee often replaced the thumbnail for these uses.

The ovolo is a quarter-round moulding set off on both ends by a short, straight drop called a fillet. An astragal is similar to the ovolo, except that the astragal is a half-round moulding set off by two fillets. The cove is a concave quarter-round moulding.

Some of the most common profiles used during the 18th century were the S-shaped curves called cyma curves. The true S curve (concave at the top and convex at the bottom) is the cyma recta. The reverse S curve (convex at the top and concave at the bottom) is called a cyma reversa. (See photo page 31.)

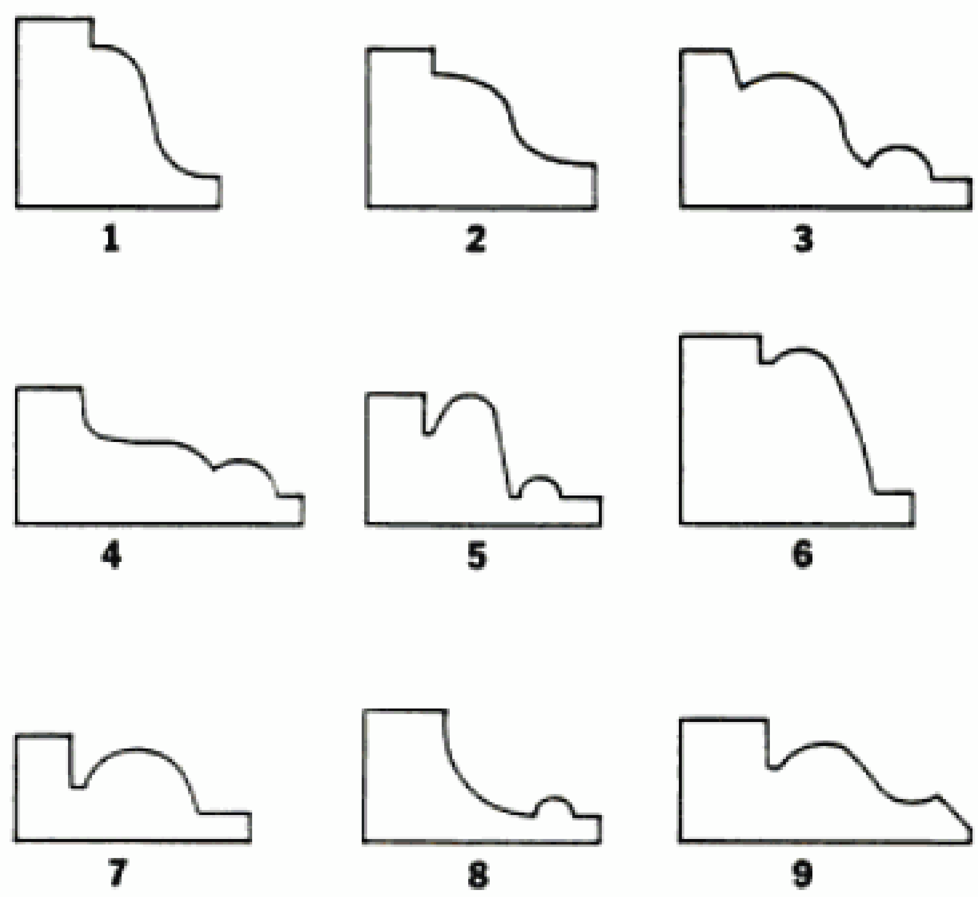
During the 19th century, cyma curves were also given the name ogee curves (also referred to as OG). Distinguishing between these names is somewhat complicated because the reverse S shape (the cyma recta) is called a reverse ogee.

As with bead planes, moulding planes that made simple profiles came in graduated sets. The size of the moulding plane is usually stamped into the heel. This is generally expressed as a complete fraction (for example 3/4). However, it can be expressed in the number of eighths-of-an-inch (for example, #6 = 3/4 in.).

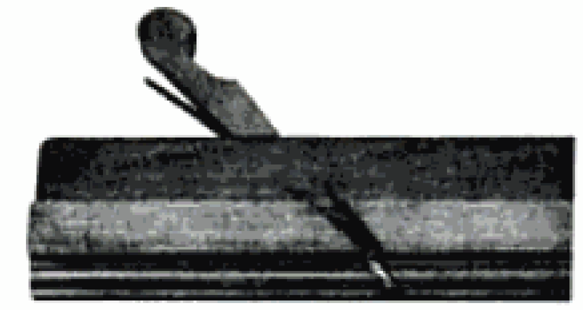
Complex Moulding Planes—Complex mouldings are made up of two or more basic shapes. For example, a large cyma recta over a smaller cyma reversa was a very common 18th-century cornice (the large moulding placed at the intersection of the walls and ceiling). In Fig. 2, some other complex mouldings are also shown and are identified according to some of their common uses.

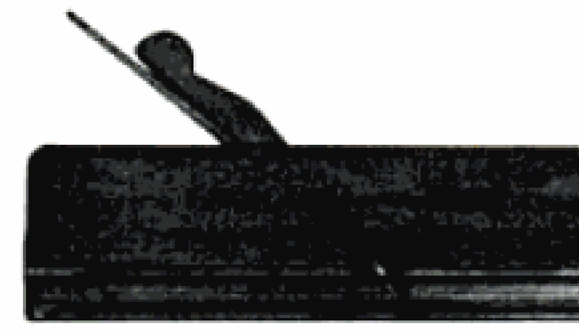
Over the nearly three centuries that moulding planes

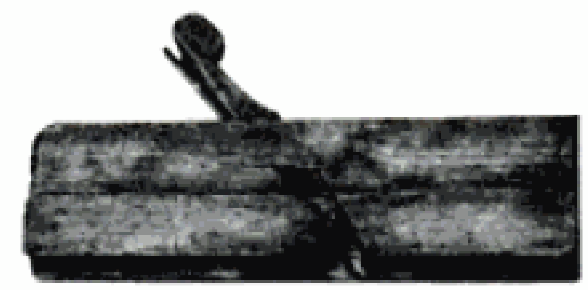
FIG. 3:

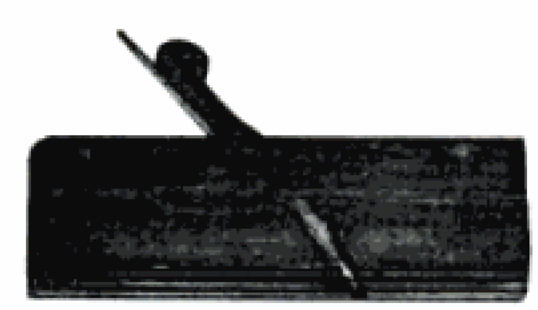


Over time, mouldings changed with fashion, and someone who is knowledgeable can assign a moulding a date and likely use. The mouldings shown here are all back bands, the moulding applied around the outside of fireplace, window, and door architraves (casings). Number 1 is a 17th-century back band, 2 is early Georgian, 3 and 4 are late Georgian, 5 to 8 are Federal, and 9 is Greek Revival.









A group of "18th-century" planes that were handmade by plane makers working in the craft-shop tradition. Note the variety in length and in the shapes of the stocks and wedges.

were in use, various profiles appeared and disappeared according to fashion. As a result, there are distinct Georgian, Federal Greek Revival, and Gothic shapes. (See Fig. 3.) All these periods occurred simultaneously in England and America. It is possible for someone who is knowledgeable about mouldings and architecture to pick up a complex plane and assign a date, as well as a likely use, to the mouldings it made.

Maker's Marks—Many moulding planes found in American were made in England. These planes can be difficult to identify, because (like bench planes) those made in both countries look alike. Also, the same moulding profiles were popular simultaneously in both countries.

Like bench planes, moulding planes often have names stamped into the end grain of the plane's stock. Most are owners' stamps, and these will usually be less elaborate than a maker's mark. You generally have to look at the maker's marks to identify where a plane was made.

Collectors like moulding planes more than bench planes. Although the prices of average planes are still quite inconsistent, some planes are very valuable because of their maker's marks. For example, during the early 18th century there was a group of plane makers in southeastern Massachusetts in the towns around Roehoboth and Wrentham. This group included such famous plane makers as Francis Nicholson and Cesar Chelor. Some of these planes made by these craftsmen sell for a great deal of money.

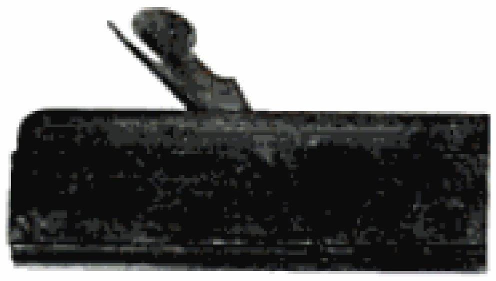
18th- and 19th-Century Planes—The earliest moulding planes were made in the same craft shops where bench planes were made. In the second quarter of the 19th century, during the Industrial Revolution, the manufacture of moulding planes moved from the craft shop to the factory. Once again, bench planes and moulding planes were made in the same factories.

Just as the sizes and shapes of factory-made bench planes became very standardized, so did the sizes and shapes of moulding planes. Therefore, most 19th century planes look very much alike, and any woodworker who knows what to look for can easily distinguish between what tool dealers refer to as "18th- and 19th-century" planes.

The terms 18th and 19th century are somewhat arbitrary. Eighteenth century really means handmade, while 19th century means factory-made. However, the craft tradition of plane making continued for well into the 19th century. Therefore, planes referred to as 18th-century planes could very well have been made as late as 1825, about the time factories were being built.

The terms 18th century and 19th century apply more to a plane's characteristics than to the actual date it was made. If a dealer's stock of moulding planes were to be arranged side by side on a shelf or stacked end up in a box, you can quickly pick out the earlier planes. Nineteenth-century factory planes rarely vary in length, and are a standard $9^1/_2$ in. long. There is a good possibility that any moulding plane in the collection that is either longer or shorter than the other moulding planes was made earlier.

A group of "19th-century" factory-made moulding planes. Even though they were made in different factories, these planes look remarkably alike.



Several different types of boxing. The boxwood inserts wore better than the native hardwood (usually beech) used to make the stock.

Even this technique is not absolutely foolproof. Nineteenth-century woodworkers often stored their planes end up in boxes and would occasionally cut the stock of a longer, earlier plane, to make it fit. This alteration destroys the collector value and antique price of the plane. But, since shortened stock does not necessarily affect the way a tool works, this type of alteration can be a bargain for a woodworker who wants to use the plane.

When you do find a longer 18th-century plane, take it down from the shelf and compare it with later planes. You will notice some other interesting differences between this handmade plane and one made in a factory. (See photos page 32.)

A factory that produced as many as a hundred planes a day used machinery. As a result, all of its plane stocks and wedges were standardized. The stock's shoulders are plain and embellished by only a slight concave channel. Four decorative chips were generally carved from each corner of a factory plane. The edges of 19th-century planes were softened only slightly.

A craft-shop plane maker sought to make a plane that looked good and worked well. The chamber that relieves the corners and edges of the stock of an 18th-century plane was done by hand and is very pronounced, a true bevel. The layout lines are often visible. These craftsmen even used moulding planes to decorate the moulding planes they were making, and almost always ran a fully developed moulding on the shoulder. While a cove was the most common moulding used, some makers used an ovolo or a cyma recta.

Earlier planes made in the craft-shop tradition display a great deal of individuality. When individual characteristics of furniture are identified, they can be used to distinguish furniture made in different regions and occasionally by individual cabinetmakers. The same method of identification now is being used on the different characteristics of 18th-century planes. For example, certain plane makers used distinctive wedges that can help identify their work.

Like bench planes, 18th-century planes were made of a variety of hardwoods, either the wood the maker preferred or the wood he had on hand. Nineteenth-century moulding planes were generally made of beech or yellow birch.

Boxwood Inserts—There are other ways to distinguish 19th-century planes from earlier, handmade ones. Plane-making factories developed an innovation that was only rarely used, if at all, during the craft-shop period; boxwood inserts were set into the soles of some planes to prevent wear. The inserts are called "boxing," and such a plane is said to be "boxed." (See photo page 33.)

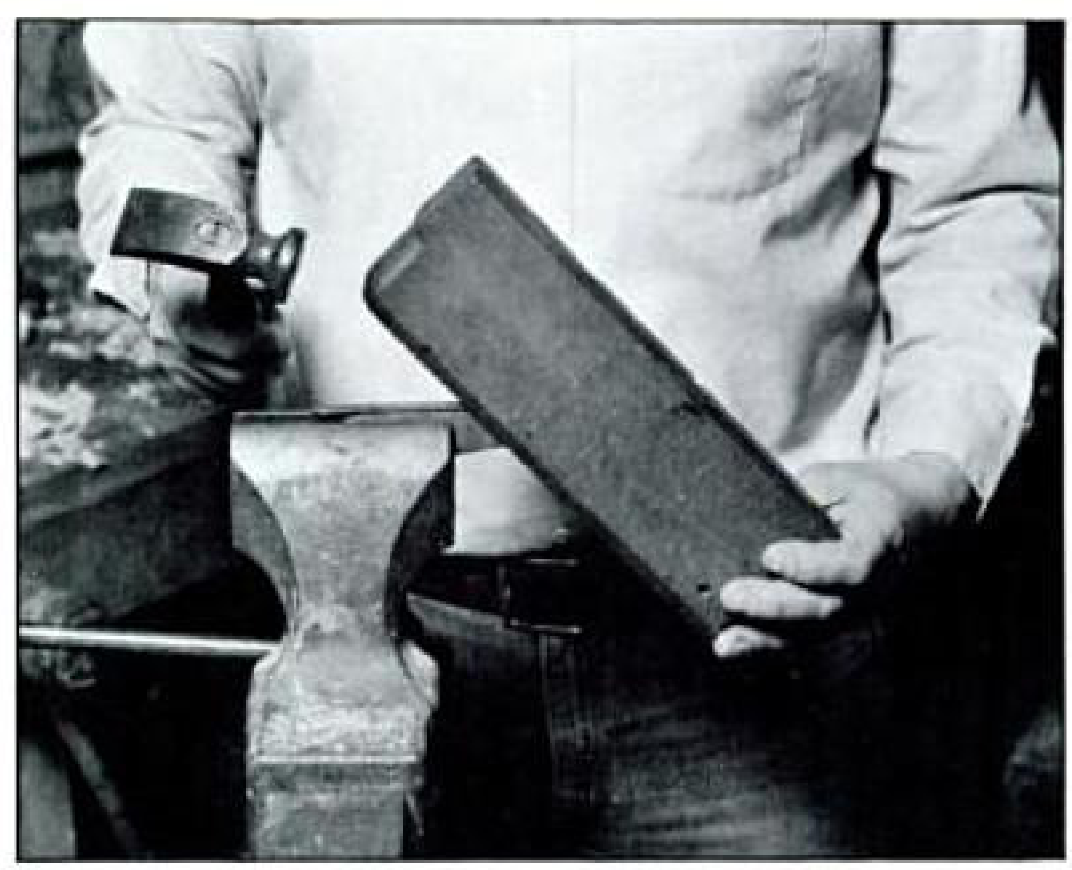
A bench plane's sole will wear out eventually, and has to be jointed. However, very little can be done to correct the sole on a moulding plane. When it wears out, the tool is useless. So boxing was inserted at the points in the sole where the most friction (and the resulting wear) occurs. Since boxwood is an extremely dense wood that is more durable than even beech, boxing increased a plane's working lifetime. The boxing could be as simple as a narrow strip placed at just the wear points, or the entire sole could be made from a length of box keyed into the stock with an elaborate joint called a dovetail (although the term dovetails used in this context is different from its meaning in cabinetmaking).

Factories called their boxed planes their "best" planes, and planes without boxing were called "common." Moulding planes with boxing are often in better shape than those without it, so you should be on the lookout for them. Boxed planes should be more expensive, but often they are not.

Plane Parts and Characteristics

The best way to familiarize yourself with a moulding plane is to examine one. When you do, you'll discover that, besides the body and sole, these tools have many other parts in common with bench planes. The sides are called the cheeks. The right-hand cheek is open so that the chip can be ejected. The opening is called the throat. The opening in the sole that leads to the throat is the mouth. The iron rests on the rear surface of the throat, called the bed, while the forward surface is called the wear. The front end is the toe, and the rear the heel.

Remove the iron. Though the wedge's shape looks like it was meant to be driven upwards by striking it just under the top lobe; do not do this. The wedge is made of thin stock and can easily be damaged. Also,



If you cannot remove a moulding plane's wedge either by pulling it with your hand or by rapping on the heel, do not strike the wedge. Grip it in a vise and drive the stock off it.

Moulding planes have different pitches; those with higher bedding angles work best on figured woods. Above from left to right are planes with following pitches: common pitch, York pitch, middle pitch, and half pitch.

the lobe has a very short length of grain, and a sharp blow can snap it off. As you examine moulding planes in dealer shops, you will certainly find planes with wedges that have been damaged in this way.

First, remove the wedge. It will lock when it is tapped in place, but eventually this lock will release

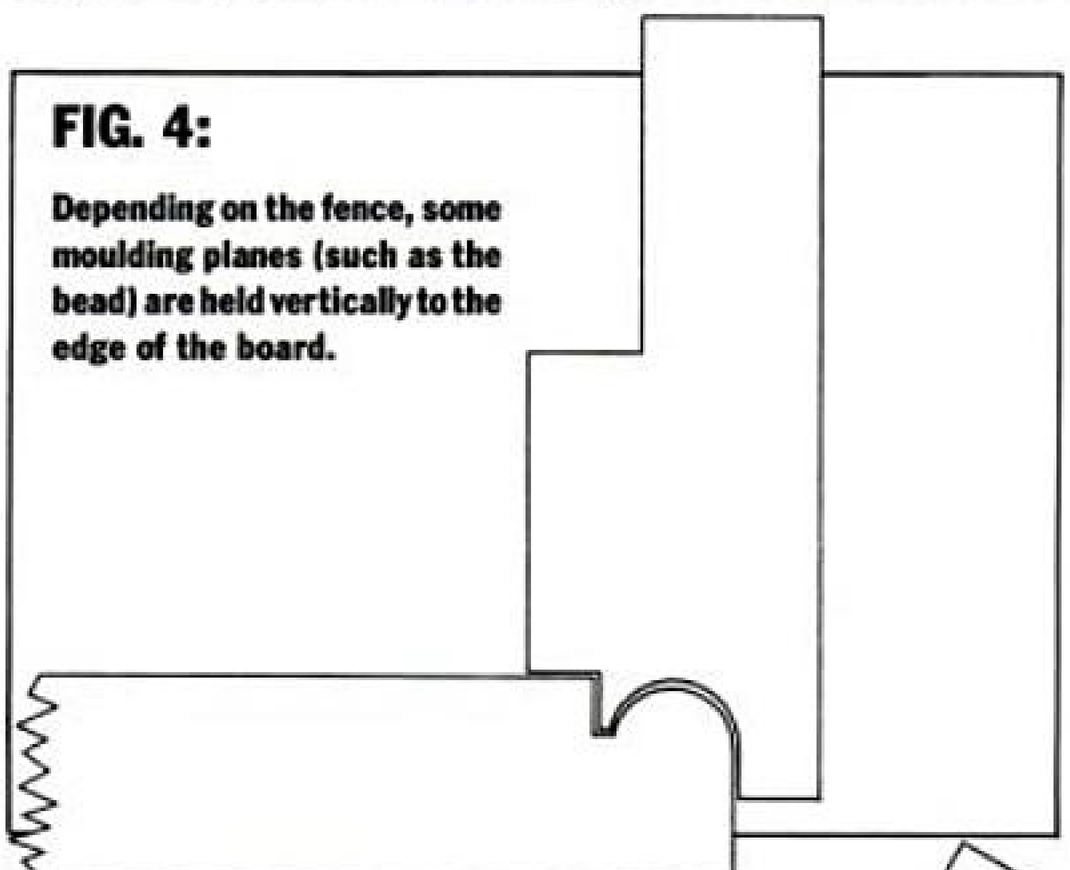


FIG. 4:

Depending on the fence, some moulding planes (such as the bead) are held vertically to the edge of the board.

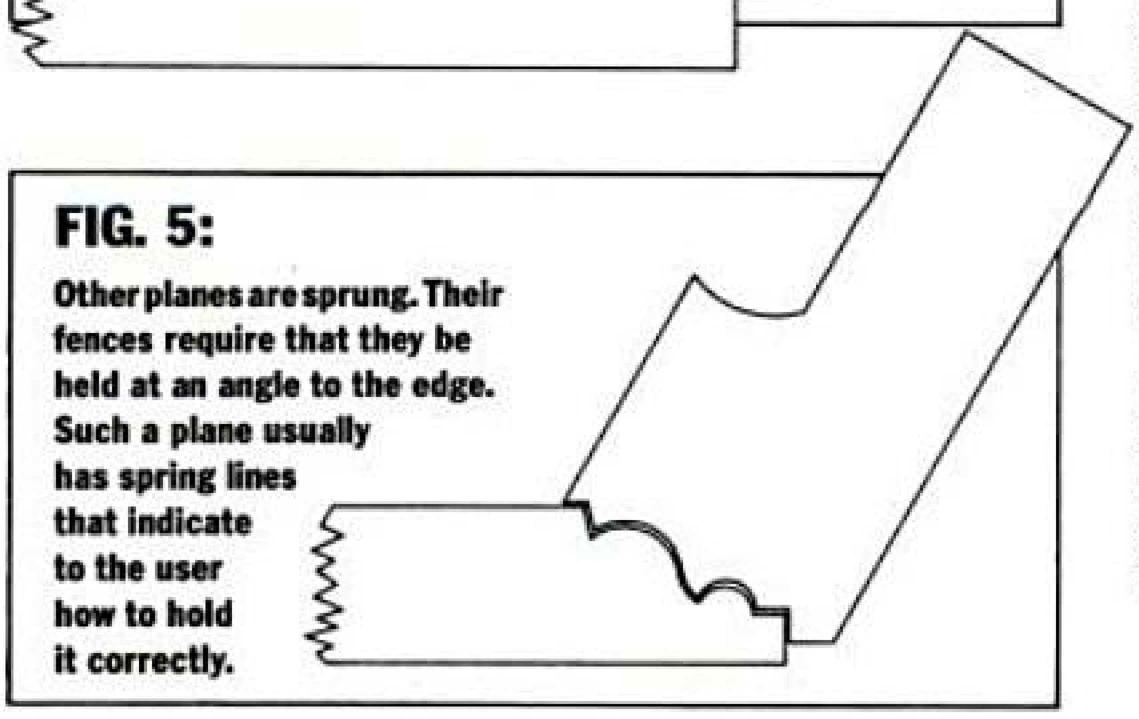


FIG. 5:

Other planes are sprung. Their fences require that they be held at an angle to the edge. Such a plane usually has spring lines that indicate to the user how to hold it correctly.

due to the stock's seasonal movement. Try pulling it out with your hand. If the wedge is not loose enough to be pulled out of its slot, rap the stock on the heel with a wooden mallet or a flat-faced hammer such as a cobbler's hammer. A regular carpenter's hammer can damage the wood.

If the wedge will not loosen after the blow from the hammer, perhaps it is stuck in place by rust or grime. To loosen it, drive the stock off the wedge. Turn the plane upside down, and grip the wedge in the jaws of a vise so the wedge is held securely and safely, while you drive the upper rear corner of the heel. (See photo page 33.)

Like the irons of bench planes, moulding-plane cutters are often tapered so that a permanent lock is created by two tapers working against each other. If the wedge still will not release, try driving the tang of the iron downwards with a hammer. This will force the blade out of the stock via the mouth. So that this problem does not reoccur, never set the wedge too tightly.

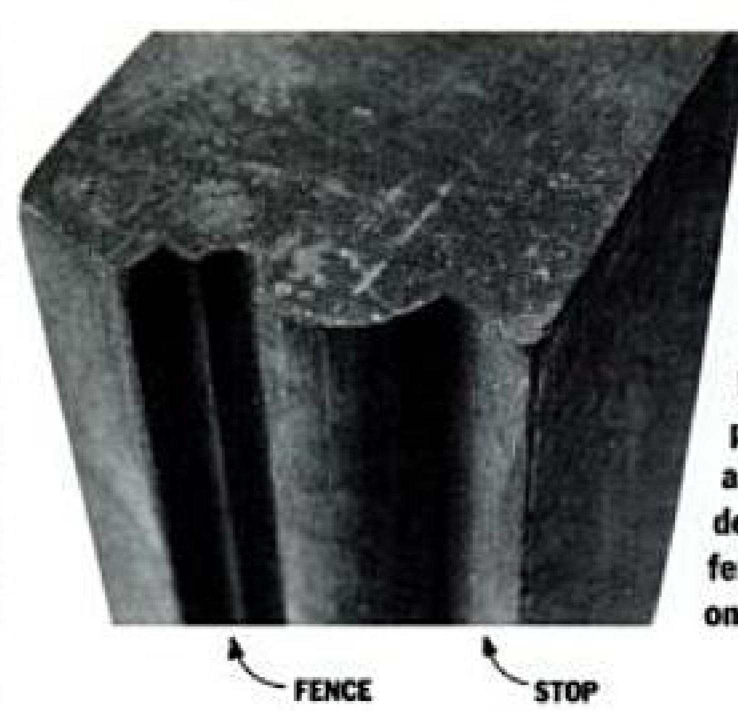
Pitch—Moulding planes were used in many branches of woodworking, but primarily by cabinetmakers and interior joiners. Although these crafts are similar in some respects, there is one important distinction: The interior joiner did not make the same demands on his planes the cabinetmaker made. He worked almost exclusively with pine, poplar, or other soft conifer and deciduous woods that were selected from the best boards he would find.

On the other hand, cabinetmakers usually used hardwoods to build furniture. Moreover, they used hardwoods with pronounced figure, which is difficult to work. Curly and bird's-eye maple will try men's souls, as well as the soles of their planes.

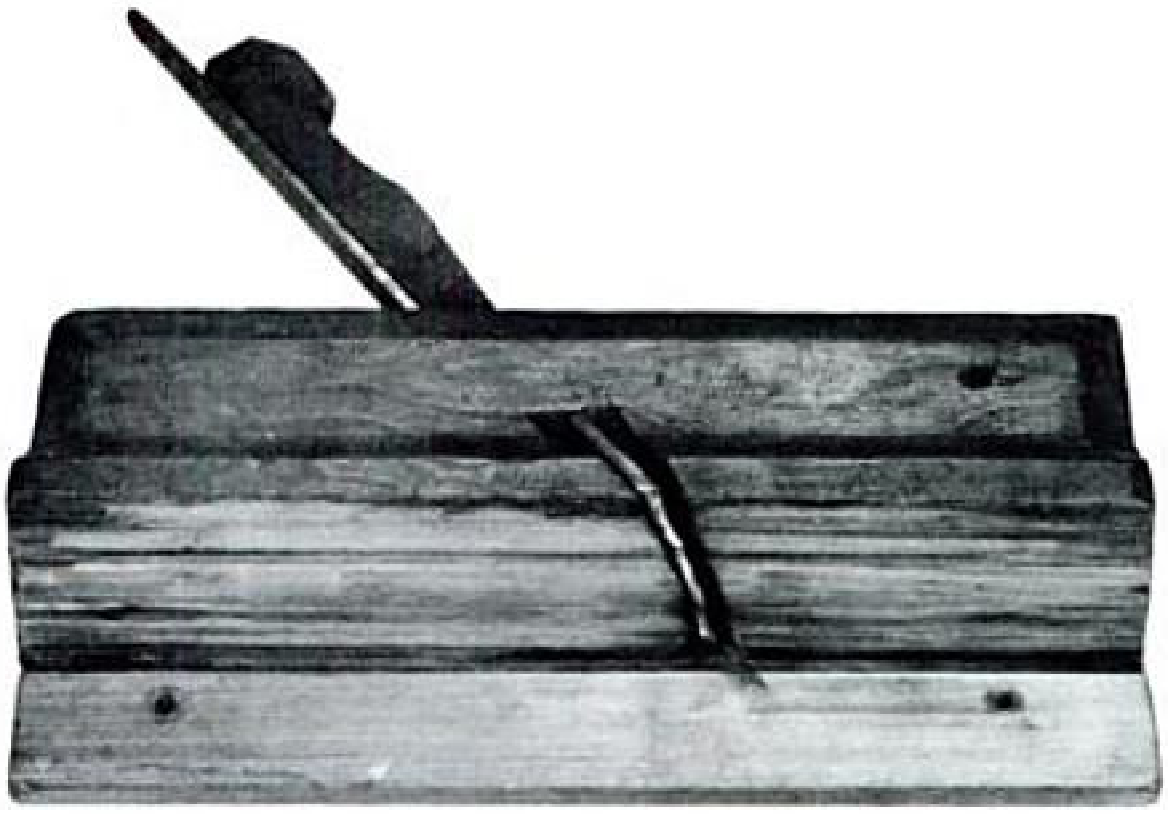
A cabinetmaker's moulding planes often had a high pitch (angle of the plane iron). The steeper angles are called the York, middle, and half pitch. A plane with a common pitch is more likely to have belonged to a craftsman who worked in building construction. (See photo page 34.)

Fence and Stop—Almost every moulding plane, except hollows and rounds and some thumbnail planes, has two critical surfaces that regulate its use: the fence and the stop. The fence is on the left-hand side of the plane, and when pressed against the edge of a jointed board it prevents the plane from wandering either left or right. (See photo page 34.) The fence is also at a right angle to the stop, and while the plane is in motion, the fence keeps the tool in the proper position relative to the surface of the work.

The stop is on the right-hand side of the plane. Each time the moulding plane is run down the edge of a board, it removes a shaving and brings the moulding closer to its final form. Each pass also brings the stop closer to the upper surface of the board. Eventually, it makes contact with this surface and rides on it, pre-



This cove and astragal profile was often used as a back band on Federal-period door and window architraves. The vertical detail on the left is the fence. The horizontal detail on the right is the stop.



When a fence is too worn to track on the edge of a board, the only solution is to add an extension. This 18th-century plane makes a moulding that was often used in the Georgian period to make the cap for a stair banister.

venting the iron from engaging the wood. It has stopped the cutting action. During the final pass of the plane, the fence rides on the board's outer edge and the stop on the upper surface.

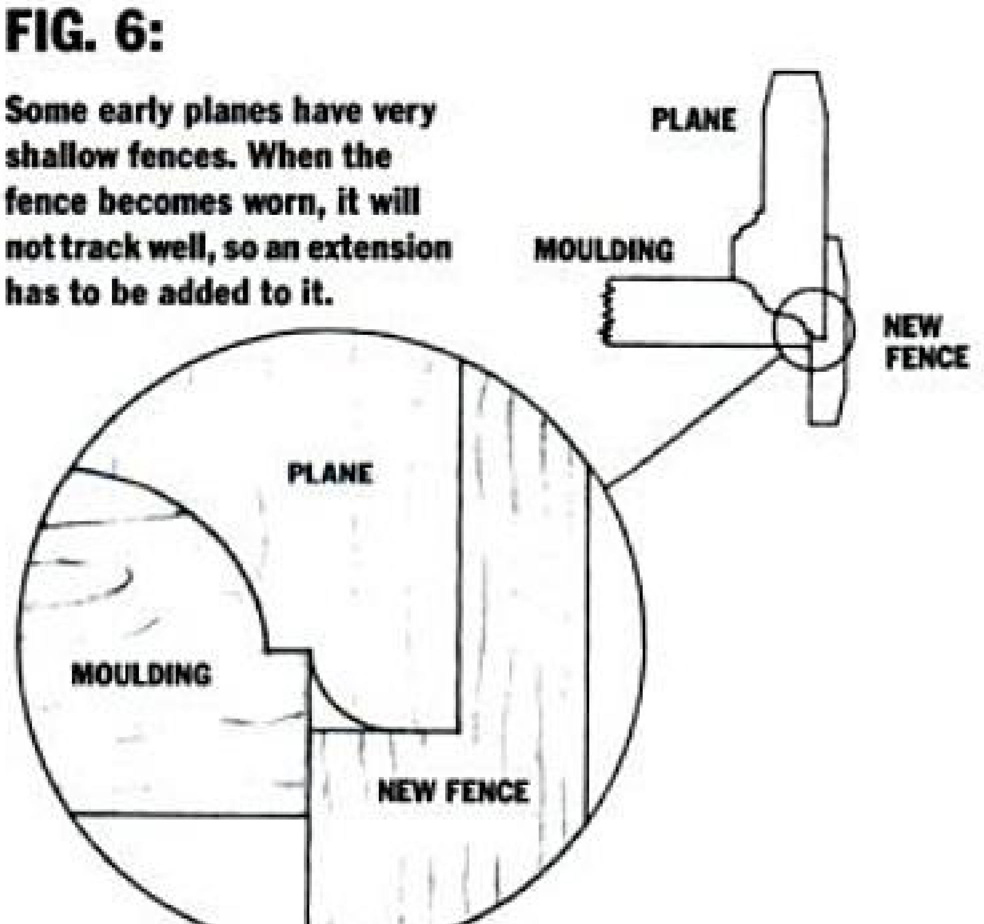
Spring—Because of their fences, some moulding planes have to be held vertically to the edge of the board and at a right angle to the upper surface. Bead planes, for example, are held this way. (See Fig. 4.)

A vertical position works for simple, shallow mouldings. However, on wider or deeper profiles the plane works more efficiently if it is held at an angle, biased towards the person using it. This position, with the plane essentially pushed downwards at about 45° against the arris (the corner formed by the edge and upper surface), helps keep the plane on track. (See Fig. 5.) This angle relative to the surface of the work is called the "spring," and a plane that is made this way is said to be sprung.

Many 18th-century planes are not sprung, and can be difficult to use. The left-hand edge has to cut down almost to the finished depth before the rest of the profile is developed. This means that just the fence keeps the plane tracking, without help from the moulding's shape. It is very easy for one of these deep (not sprung) planes to jump off the board. When you find these

FIG. 6:

Some early planes have very shallow fences. When the fence becomes worn, it will not track well, so an extension has to be added to it.



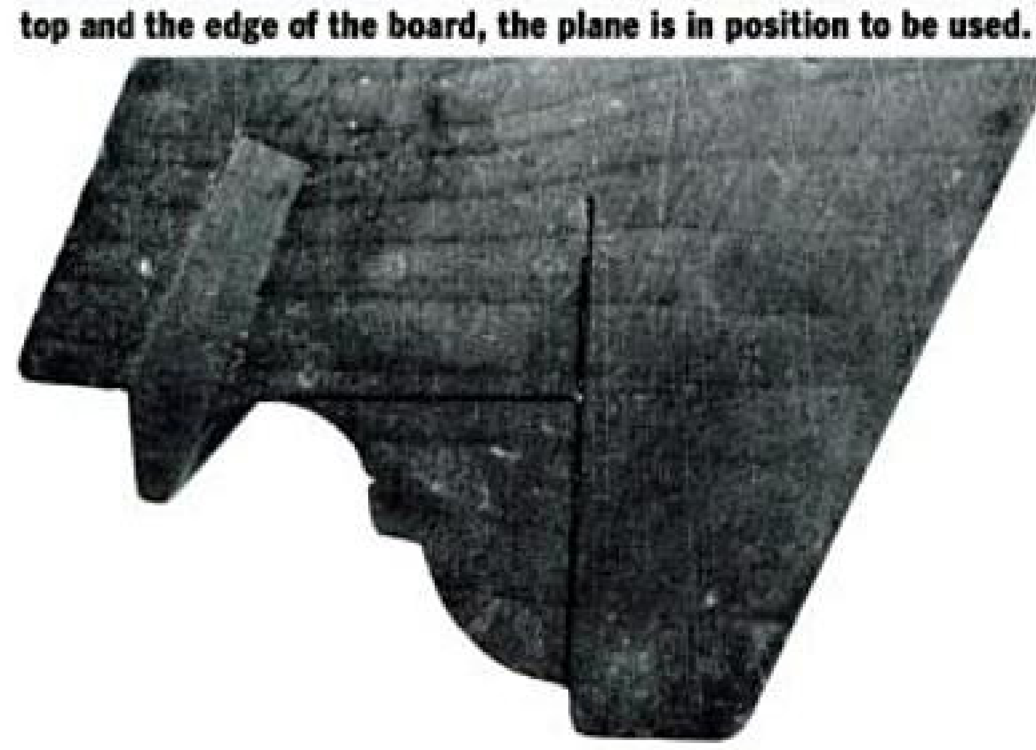
early planes, you'll notice that they often have been given a second, wider fence by a former owner who decided to correct this problem. (See photo page 35.)

If you buy a plane that jumps easily off the edge, first make sure the problem is the fence and not a wracked stock. This problem will be discussed in Part 2 of this series, under the section on Selecting Moulding Planes. If, however, you discover that it is the fence, you can make an extension. (See Fig. 6.) Rabbet a piece of hardwood to the same depth as the fence's thickness. Set the rabbet over the outside edge of the plane and attach it with wood screws. The surface that extends below the old, worn fence should be flush with the original. This new extension will keep the plane on track. Also, it damages the plane as little as possible. Usually, three small screw holes are all that are needed.

A sprung plane usually has some guides from which you can tell how to hold the tool. On the plane's toe, you will see two (sometimes just one) scribed lines. These are called spring lines, and they intersect to form a right angle. Each line is a continuation of the fence and/or the stop. Since these two surfaces are at 90° to each other, so are the two spring lines. When there is only one line, it usually is a continuation of the fence and tells you how the plane should be held relative to the vertical.

If you tilt the plane until the spring lines are paral-

The spring lines on this moulding plane have been darkened so that they can be seen in the photograph. One line indicates the vertical, and the other the horizontal. When the spring lines are parallel to the top and the edge of the board, the plane is in position to be used.



lel to both the board's edge and upper surface, you automatically bring the plane to the angle at which it is supposed to be used. Before beginning each cut, just glance downwards to make a quick, final check of your angle. You can also keep and eye on this angle while the plane is in motion. (See photo page 35.)

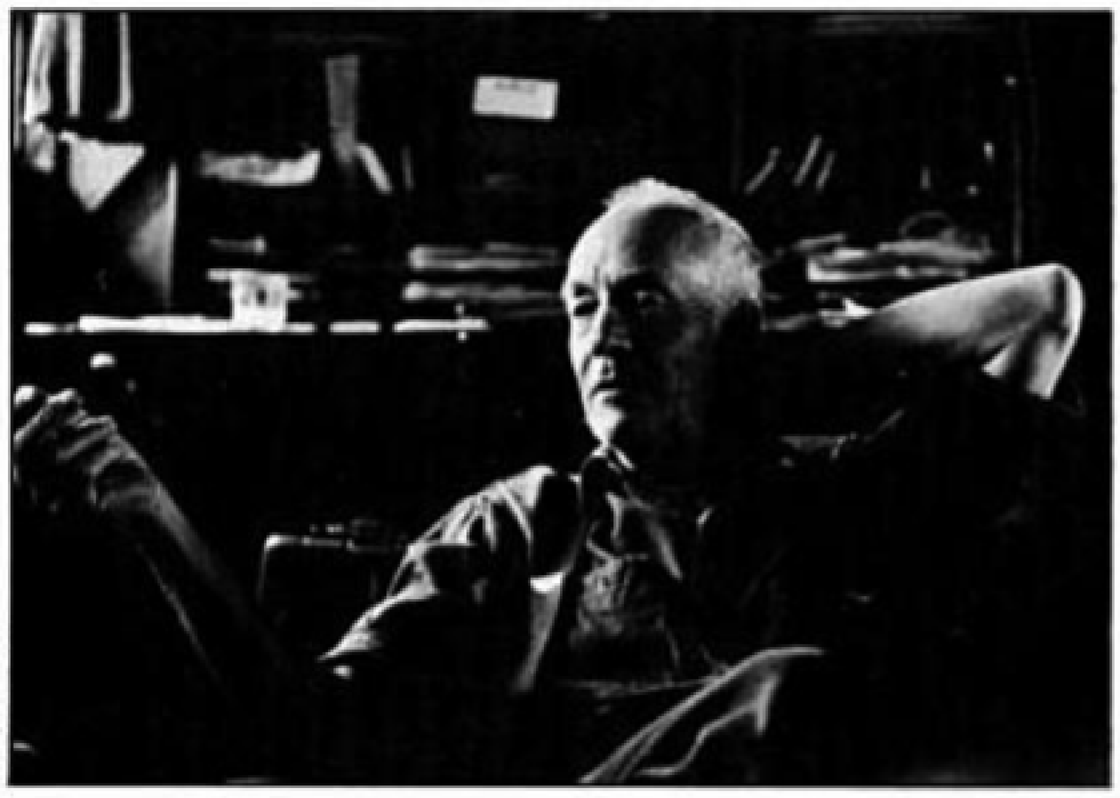
If you have a sprung plane that does not have spring lines, you can make them yourself. Before buying a plane, make sure that the lines relate to the profile the plane makes. If not, the plane has perhaps been damaged or altered.

Coming next issue: purchasing, reconditioning, sharpening. ▲

Contributing Editor Mike Dunbar is a furniture maker and author of books on windsor chairs, federal furniture and antique tools.

WHARTON ESHERICK

DEAN OF AMERICAN CRAFTSMEN


SUSAN SHERMAN

A Master Woodworker Inspired by the Grace of Natural Forms

BY SUSAN R. HINKEL

Among skilled woodworkers, both professional and amateur, the name Wharton Esherick has become a sort of touchstone. His remarkable mixing of innovation with classicism, grandeur with intimacy, has served as a springboard for our present generation of woodworking "greats." Wendell Castle recalls, "Esherick changed my entire thinking about furniture." For Arthur Espenet Carpenter, he was "the progenitor of the present furniture craft." And, Sam Maloof has called him "the dean of American craftsmen."

Although Esherick's view of furniture as utilitarian sculpture has inspired new generations of woodworkers, his own work remains inimitable. Seeing it, we crave the impossible: to master its tantalizing simplicity, identify its source—in short, to grasp the working of his genius and make it our own. These ends being unattainable, however, let's settle for a more humble goal. To learn something from hi

This carved dropleaf desk (1927) is one of the last pieces Esherick built with surface decoration. The desk stool in front (1929) illustrates his change over to sculptural forms.

children. Would he like to try some woodcut illustrations—just for fun? Esherick couldn't resist, and soon he was ahead of the writer, challenging her to match his cuts with more verses. By 1922, when the poems were published, Esherick was painting less and carving more and relishing his work as never before. (See photo page 40.)

Later, recalling this period, he was to say that over-education as a painter had left him frustrated and worn out. Burdened by the influence of every great artist he'd studied, he had been unable to find his own creative identity. But, wood had opened a new world to him—a world which became his playground. For he had also discovered that hard work could take him only so far. Without fun, there was no divine spark—no creation. In his new vocation Esherick did not teach nor did he take apprentices. This was partly due to his personal reaction against "too much learning," but a more basic reason was the total commitment to his work, which left no room for teaching. Explaining this to Don McKinley and Sam Maloof, he said, "I make, I don't teach. I say, 'Bring your class out here. If they can't learn by looking at the thing, all my chattering will never teach them.'" By choice, he did the major part of his creative work in privacy on his own turf.

During the brief transition from painting to woodwork (1920-1924), Esherick produced a myriad of woodcuts as well as simple, massive furniture—refectory-type tables and heavy chests embellished with surface carving. These early pieces, in the mode of the then-current "Arts and Crafts" movement, were designed with decorative carving in mind—a style he would abandon in less than a decade when he shifted his focus from surface to form. (See photos of desks.)

By 1925, Esherick recognized that if he were to develop his furniture, he would need skilled help, for it was his furniture, not his sculpture, which paid the bills. Esherick, the artist, was still a novice at dovetailing, joinery, and many intricate details crucial to cabinetry. He also lacked equipment and, at the time, space. So he began taking pieces down the road to the shop of John Schmidt, a German cabinetmaker. The two men worked there together, Schmidt doing most of the flat work and joinery while Esherick designed, carved, and sculpted.

Then, after two years Esherick decided to try making something by himself—a great carved desk. The front of the desk shows, in low relief, a bottom panel of trees, a center pattern of branches and a top design of soaring birds. (See photo.) When asked how long it took him, he said, "Too damn long!" He now understood the process, but it was not his forte. Content to turn over the time-consuming joinery to other hands, he devoted himself to the sculptural design aspects. As they continued to work together, Esherick kept challenging Schmidt with strange, innovative problems while Schmidt kept meeting the challenge.

Later, when Schmidt moved away, Esherick expanded his own shop and hired men to work there with him. Having served his own apprenticeship, he could now direct them in method, but the sculptural design work was always his. Whereas his helpers were able to assemble his popular three-legged stools, there was no way to show them how each seat must take its shape from the configuration and grain pattern of its chosen wood. Such matters were unteachable.

During his first 10 years of woodworking, Esherick used imported, exotic woods such as cocabola, rosewood, ebony, padouk, Honduran mahagony, and snakewood. But as he got into larger furniture and sculpture requiring big logs or unusual cuts, he turned to local woods: oak, walnut, cherry, apple, hickory, pine, cottonwood. This was a matter of economy for him as well. Yet later, he came to the conviction that, "If I can't make something beautiful out of what I find in my

INFORMATION ON EXHIBITED WORKS:

Examples of Esherick's work may be found in New York's Metropolitan Museum of Art, Whitney Museum, and American Craft Museum; Philadelphia's Museum of Art and Pennsylvania Academy of Fine Arts; and in Richmond's Virginia Museum of Art. But, the most comprehensive collection is housed in his former studio-home overlooking the Great Valley, west of Philadelphia. Open to the public March through December, the museum offers hourly tours on weekends, restricting the number of guests to ten or less at one time. Advance reservations are necessary, and private weekday group tours may also be prearranged. The museum staff will be glad to supply further information and give travel directions. Those planning to visit should call (215) 644-5822, or write The Wharton Esherick Museum, Box 595, Paoli, PA 19301.— *S.R.H.*

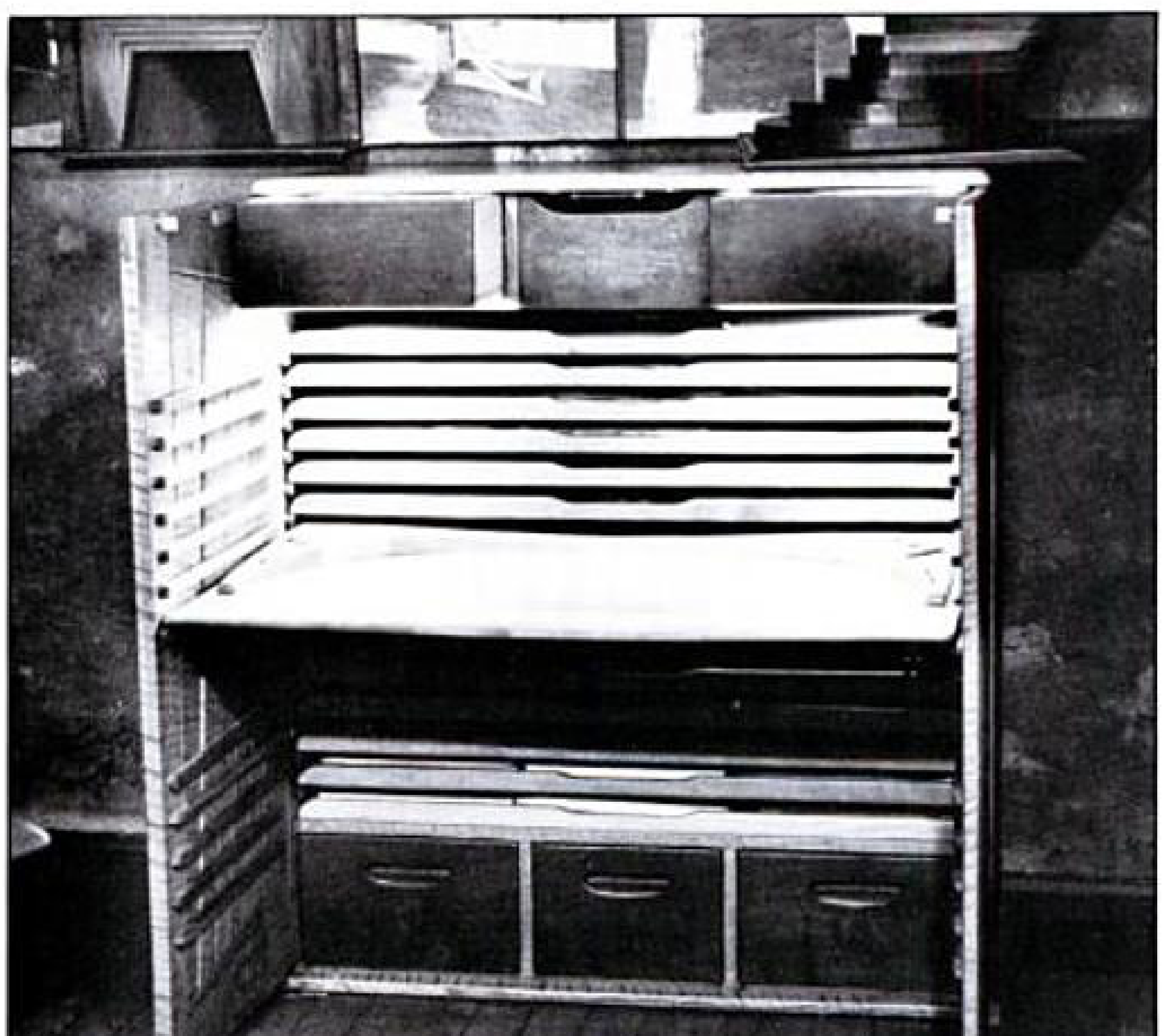
backyard, I had better not make anything." Here again, Schmidt was invaluable, for in those depression years Schmidt supplemented his income by felling trees and selling the wood. In addition to the machinery and tools in his shop, he had an enormous homemade bandsaw—a lumbermill, in fact—two stories high and powered by a big Packard engine. It would take logs 4 feet in diameter and saw them into boards, which Esherick could finish with a cupping plane. He'd then air dry the wood on a rack behind his studio—2 years for every inch of thickness.

Schmidt's successor as lumberman, Ed Ray, developed a unique understanding of the sculptor's needs. He knew that gnarled trunks, burls, twisted branches, or crotch wood with swirling, firey grain were exciting, suggestive material for Esherick, inspiring sculptural forms by their eccentric character. But, sometimes it would take Ray several years to find a piece of wood with specific dimensions and curvature for a special purpose. With both sculpture and furniture, Esherick would exploit, modify or develop inherent qualities of the wood, but he never made demands that violated the nature of his medium.

Although Esherick had begun his hillside studio in a more simple era, 30 years later when he decided to build a separate shop, he found that a permit was required. No longer free to follow his fancy, he turned to his architect friend, Louis Kahn, to have the necessary plans drawn up. They were an odd couple for such an undertaking.

While Esherick liked constant change, Kahn liked constant repetition. While Kahn liked geometric forms, Esherick liked the unpredictable. The result, after a series of compromises on both their parts, was a building which each man regarded as the other one's work. It took the form of three joined hexagons, each with three diamond-shaped roof-planes and sloping—not horizontal—eaves. The first hexagonal bay contained wall racks for holding seasoned lumber brought in from the wood rack to finish drying under heated conditions. In the middle of this bay was a great planer and a jointer. The central bay, used for shaping, cutting, and assembling, held the work benches, bandsaws, electric drills, and other power and hand tools. The third bay was used primarily for signing and finishing. Here, there were cabinets and benches and a vise able to turn six different directions for cutting wood blocks and for carving sculpture. Esherick did the final sanding and finishing there and had a little space for keeping his records. The one thing this hexagonal complex lacked was a right-angled corner to replicate a room in an average house, for which most of his furniture was destined.

Crucial to the designing of any major piece was a visit to its proposed location. Before making a commissioned dining table, for instance, Esherick would lay paper on his client's floor, sketch a tentative outline on it, and then ask family members to sit and move around it. When satisfied that it suited the spatial context and traffic flow, he would roll up the sketch and go home to select the boards from his woodshed. Often, his designs would involve a fanning configuration. If so, he might cut his boards on a lengthwise diagonal, so that when placed edge-to-edge, they would produce a radiating pattern of wood grain. Then, preferring curves to straight lines and sharp angles, he would



The desk cabinet built in 1958 (below and left) was Esherick's unique solution to desk storage and lighting: note the flat files above and below the writing surface, and the light coming from the underside of the drawers. The sculpture (above) is a padouk light pull, carved around 1931.

PHOTOS BY MANSFIELD BASCOM

shape and smooth the outer edges of the table, making bottom and top surfaces melt into a continuous flow inviting to both eye and hand. Legs, too, instead of attaching with right-angled rigidity, curved into the tabletop much as a tree trunk curves into its crown of branches.

On Esherick's pieces, finishing was always a painstaking procedure for which there were no shortcuts. In the 20s, when Esherick was making his early pieces, he used a mixture of boiled linseed oil, turpentine, and beeswax, which had to be applied at a very critical temperature—hot enough to melt the beeswax but not too hot to ignite the turpentine. In his later furniture, however, he found that the boiled linseed oil alone in repeated applications was equally good. This process began with several days of hand sanding, alternately wetting down the wood and sanding, again, and again, until the grain no longer stood up. Then, he would continue the process with boiled linseed oil rather than water, repeatedly sanding the grain and wiping it dry, using increasingly finer sandpaper. Finally, he massaged very fine pumice into the wood with his bare

A VISIT TO THE WHARTON ESHERICK STUDIO

BY FIONA A. WILSON

The Wharton Esherick Studio isn't a "museum" in the traditional sense of the word. While it resembles a museum in that it displays a collection of art works, the resemblance stops there. Unlike a museum, Esherick's studio does not just display items "out on the floor." Instead, the display starts with the floor itself, and the ceiling, and all the walls in between. Even before we entered the studio, my tour guide, Bob Bascom, was pointing out the roof's singular curve, and the red, blue and yellow pigments in the wall of the "silo." Then, as I was invited inside, Mr. Bascom said something I've never heard mentioned in museums, that from the latch forward the rule of the tour was *touch*.

As I entered the studio, the spiral stairway I'd seen so often in pictures loomed larger than life before me. Its sinuous shape reached upward like a fantastic tree with angular, horizontal branches. It wasn't the sort of stairway you would want to rocket up—but rather one that required deliberate attention with each step. Esherick built it as he did any sculpture—he drew no lines between the functional and the aesthetic. More than merely an architectural element, this stairway stood as a compelling sculpture in its own right.

As the tour moved on through the room, I began to notice smaller items that were part of the very structure of the space: a carved padouk light pull in the shape of a tiny woman holding onto the string for dear life (see photo page 39); half-a-dozen wooden coat hooks, each with its own face, carved to represent the respective builders who worked on the house; a built-in wooden seat curved to fit the exact spot it occupied. These and other smaller items have been published less frequently than his larger works, but these are the things that give glimpses of Esherick's character. His seamless creativity didn't stop when he closed the door of his shop at night—he was scheming 24 hours a day. The legacy is a studio that feels as if it's all one intricate, hand-woven fabric.

On the wall farthest from the entrance, I noticed a large, pale-toned portrait Esherick had painted of himself during a time he was trying to establish an identity as a painter. It seemed for-

MANSFIELD BASCOM

Be it "Rhythms," a 1922 woodcut (above), or "Horse Race," a 1920 game (below), Esherick's work shows a mastery of movement and sensuality.

hands, until the surface was like marble. When polyurethane became available late in his career, Esherick experimented with it for surfaces like countertops, which could be expected to take very heavy wear and moisture. But for normal furniture his standard finish remained boiled linseed oil.

On certain pieces of furniture, as well as interior units and whole rooms, Esherick often used other materials in combination with wood. Displeased with an early experiment of putting an aluminum surface on a flat-topped desk, he later set black plastic in the top of a table made for display at the 1939 World's Fair. This combination worked—the sinuous hickory almost growing out of that sleek, black surface flowing down into the legs and stretchers. He also found wood paneling mutually complementary with stone or stucco where a wall abutted a fireplace. Copper, too, was inviting in color and feel when set into wood countertops for kitchen sink or bathroom basin. And, emphatic texture and color contrast could be achieved with black iron hinges, latches, stair rails, or hot-air registers. Fabric for his upholstered sofas was care-

mal and rigid and out of place among all the jubilant, organic shapes about the room. But, as Mr. Bascom carefully pointed out, the painting signified an important part of Esherick's creative process—the beginning. I then realized that I wasn't just seeing a collection of Esherick's work, but rather the sequence of his artistic evolution.

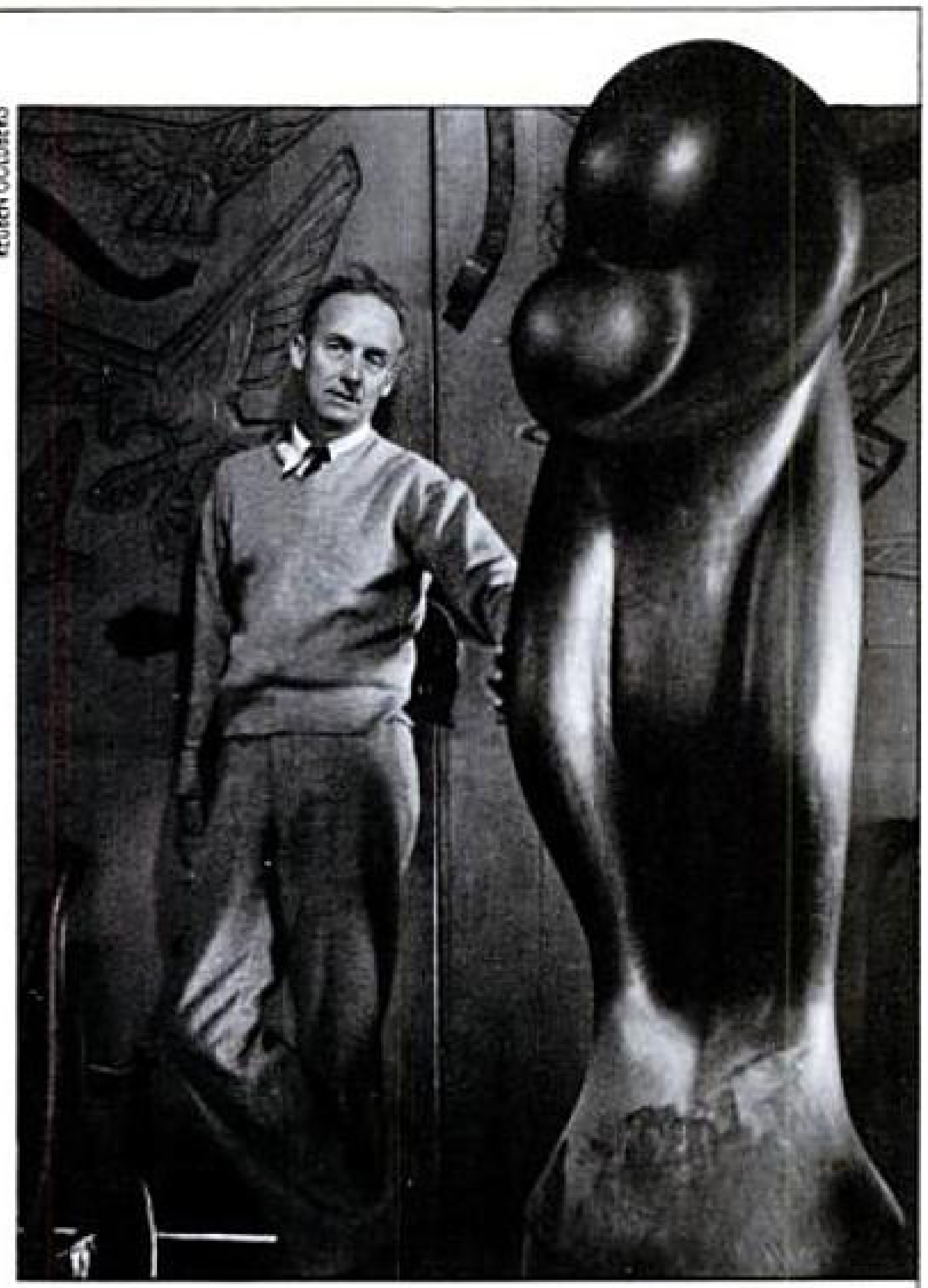
To illustrate the next step in this sequence, Mr. Bascom moved over to a wall where several of Esherick's woodcut prints were hanging. Like the painted self-portrait, the prints were two-dimensional, but they had an entirely different mood about them. They were unfettered and lovely. One showed supple dancers circling, entwined. Another showed white caps breaking across a rocky shore. My favorite was of a Japanese mother cradling her baby after a bath. Although each print was different in style, they all shared a similar organic, sculptural quality. It wasn't long into Esherick's artistic career that this sculptural quality burst its two-dimensional confines in search of a third.

Esherick's three-dimensional work was, quite simply, astonishing. It showed a meticulous attention to detail. Mr. Bascom brought me before a large cabinet and asked me to guess its function. After several wrong answers, I gave in, and he opened the doors wide to reveal an intriguing desk. The writing surface pulled out from the cabinet, flanked above and below by flat-file drawers. But, the best part was the desk's built-in lighting mechanism. Mr. Bascom pulled out the two uppermost drawers, and from their undersides two streams of light came flooding down onto the writing surface. No detail escaped Esherick's attention. (See photo page 39.)

It's no surprise Esherick considered himself primarily a sculptor. He had a gift for capturing motion, passion and humor in his pieces. I laughed out loud when I saw his game, "Horse Race." The bright-colored game pieces were carved horse and riders. Each piece had a different posture, yet all of them looked to be moving at top speed. "Oblivion," a much larger sculpture depicting a couple tenderly embracing, is hypnotic in its sensual lines, so beautifully carved your hands beg to touch it.

Even though Wharton Esherick is no longer alive, his studio is very much a living testament to the man and his creative genius. A tour of the Esherick studio is a visual and tactile feast. Unlike the often impersonal tours offered in larger museums, the tour of Esherick's place is intimate and personal. You feel like a special guest made privy to the household treasures. Every corner holds a surprise. When I wasn't full of questions, Mr. Bascom was steering me toward new discoveries about Esherick's work. He was intent on leaving no stone unturned. I came away feeling wholly new toward my craft—recommitted and ready to try anything.

REUBEN GOLDBERG

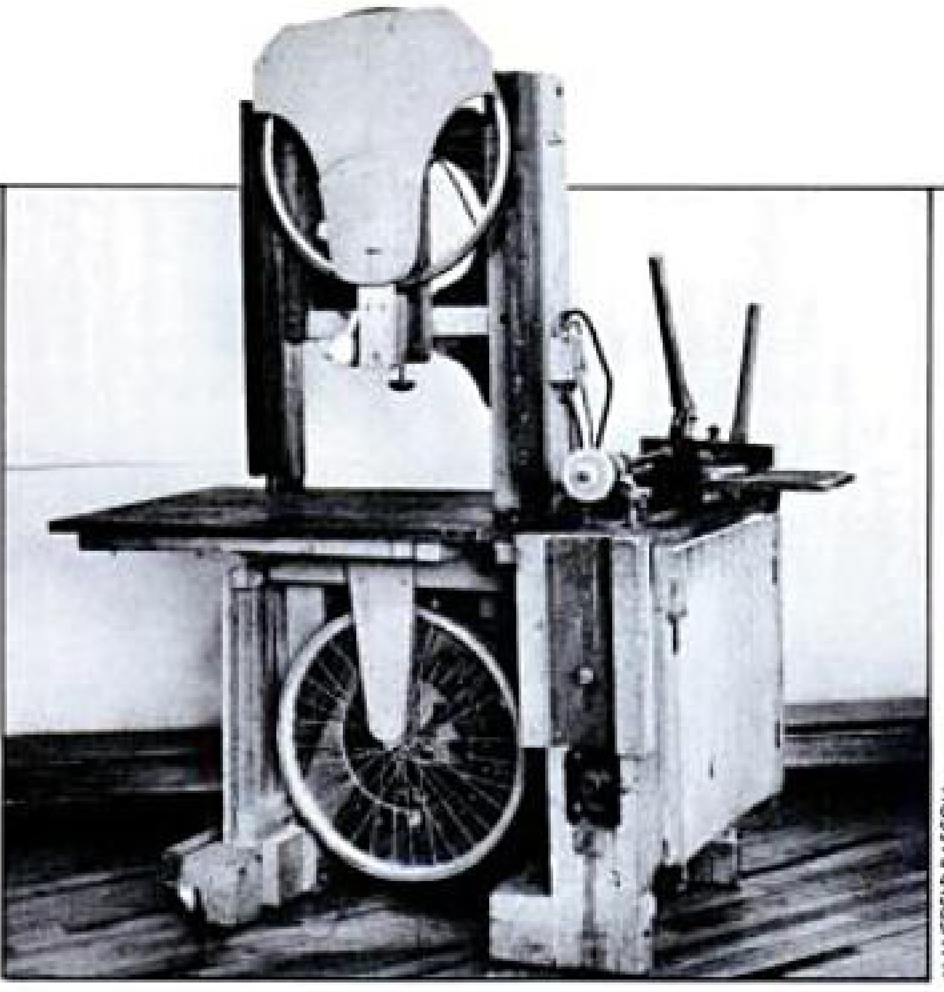


Esherick stands next to a sculpture entitled "Oblivion" (1934), which depicts a passionate embrace.

To remind myself of the inspiring visit to Esherick's studio, I bought a print of one of his woodcuts. It's not up on my wall yet,though; I haven't found a frame handsome enough for it. I've been thinking about getting a small set of carving tools and making my own frame. Why not? ▲

Fiona A. Wilson is Associate Editor of AMERICAN WOODWORKER.

THE HOMEMADE BANDSAW



Esherick's combination machine was built with parts scavenged from junkyards, dumps and auctions.

John Schmidt, the German cabinetmaker with whom Esherick worked, had a large, homemade bandsaw in his shop, which he later copied and improved upon when Esherick asked for one of his own. Neither man could have afforded the standard commercial equipment, but most of the needed components were scavenged from dumps, junk yards, or auctions.

The resulting machine had all of the capabilities of commercial models, in addition to a larger capacity and several ingenious features, which enhanced its usefulness. The Esherick bandsaw (still operable and part of the museum collection) is made of oak and walnut, has two bicycle wheels with wooden "tires" and leather "treads," and is powered by an electric motor with leather belting. (See photo.) It is, moreover, a combination bandsaw, circular tablesaw, and grindstone. It includes, behind the tablesaw platform, a drill chuck which makes a horizontal boring mill. The bandsaw's blade can be raised to accommodate larger pieces and lowered for more control, while the upper bicycle wheel can be raised if more tension is needed. For long pieces like tabletops, its large, lockable casters let Esherick stop a cut at any point and move the saw, ensuring plenty of room for the emerging piece.

In later years, Esherick also had a store-bought bandsaw, which he used for smaller jobs, but the big, homemade machine remained his standby. His shop eventually contained all the basic, modern equipment that one could wish for, including a big jointer, planer, radial arm saw, and drill press. Although each piece of furniture he produced was unique in design and scrupulously hand finished, he had no qualms about old-fashioned hand work. It was the end product not the method which concerned him. "I use any damn machinery I can get hold of," he said in an interview for "Craft Horizons." "Handcrafted has nothing to do with it. I'll use my teeth if I have to!"—*S.R.H.*

fully chosen for its contributing color, texture, and pattern. And, of course, leather, both in the form of woven strips and drumhead-taut sheets of rawhide, made handsome seats for his chairs. Canvas webbing, another successful choice for chair seats, resulted from depression-era economy, for it was salvaged from machine belts sold at auction when a factory closed down. Some of the chairs themselves, in fact, were made from two barrels of hammer handles Esherick had bought at a depression auction, while another of his chair designs grew out of a large supply of defective wagon-wheel rims.

Certain stylistic qualities come to mind when one thinks of Esherick's work—dramatic impact, fluid line, and classic simplicity. One wonders what influences, if any, were at work in the development of his highly original forms. Although he appreciated and partook of the artistic climate of his time, he was never a follower of current fashion. Rather, he would try out approaches and concepts which seemed valid, incorporating into his work whatever was suitable to it. One may see in his curvilinear forms, an outgrowth of Art Deco, and in his off-angled planes an adaptation of Cubism. But, after finding his creativity hampered by his study of the painting masters, Esherick came to cherish his creative freedom and was wary of submitting to direct influence.

In the last analysis, from early carvings to mature free-form sculpture, the only consistent influence on Esherick was nature. Yet, we also find that despite five intervening decades of experiment, his earliest piece of sculpture is in the same free-form style as his late work. "Horse Race," a set of simplified, dashing horse-and-rider figures, was carved in 1920 for a family game—a task so light-hearted that he could work with complete freedom, not even thinking of it as an art form. (See photo page 40.)

It took many years of conscious trial and error, quest and experiment for him to rediscover what had come instinctively in that game. Then, finally, when the hard lessons had been learned, when the anxiety about his work had fallen off, and when the fussy details which beset both art and existence had given way to essentials, Esherick had three bits of wisdom to leave with the young and earnest: first, *get rid of your teachers;* second, *have fun;* and third, *simplify*. Will his advice serve others? Perhaps. The only road we can follow, however, lies under our own feet. To each his own, then, and Godspeed. ▲

Susan R. Hinkel is a writer, actress and puppeteer. She met the Esherick family through her work at the Hedgerow Theater in Moylan, Pennsylvania. Her interests include quilting and country living.

HOMEMADE HARDWARE

When Anything Less Than Your Own Won't Do

BY PATRICK STAFFORD

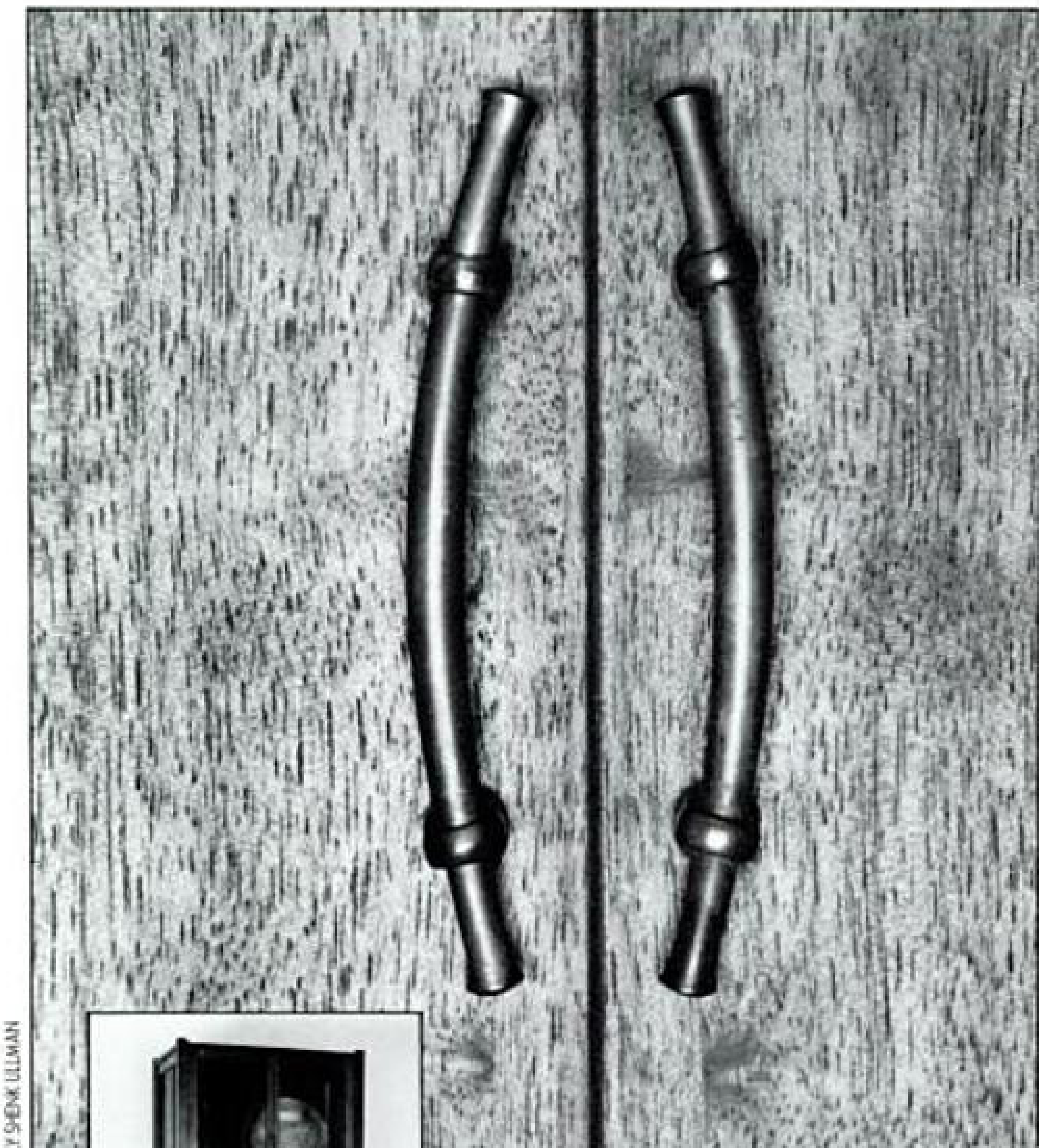
Shopping for furniture hardware can be frustrating when you need something a little out of the ordinary. Sometimes you just can't seem to find the right size, shape or style of hardware to suit the piece you're working on. And, if you do manage to find it, the hardware you want is often out of stock. When I can't find the hardware I want, I don't compromise my design by working around the hardware that *is* available. I simply make the hardware myself.

Making my own hardware also saves me time. Even when I *have* found the style of hardware I want, it sometimes comes from the store in very rough condition and requires a good deal of my time to file off the burrs and polish out the scratches. If I have to spend time rehabilitating store-bought hardware, I might as well spend the time making the hardware I want.

I'm no metalsmith by trade. I got my start in metalworking purely out of necessity—when I could no longer find the parts I needed to fix my aging Volkswagon. In making the parts myself, I realized there was no great mystery to metalwork. And, it wasn't long before I started applying the skills I learned on that old car to my woodworking, in the form of hardware.

In this article I'll explain how to make three pieces of hardware—a knife hinge, a folding-screen hinge, and a basic handle. This hardware is fairly simple and can be made with a minimum of tools. I think you'll find that it's not only easy to make your own hardware, but also quite enjoyable, knowing that you actually made the *whole* piece of furniture. If you spend two months building a masterpiece, the hardware you make may well be the *pièce dé resistance.*

All of the hardware I'll describe in this article is made using, what I call, the reduction method of metalworking. That is, I get a picture in my mind of the shape I want to make, and then I carefully remove, from solid stock, all the metal that isn't part of that picture. The opposite method would be soldering—where you build up a piece by attaching various parts. None of the hardware covered here requires any soldering, so you won't need torches and such. If you've never worked with metal, the reduction method is a great way to start. You may find that once you've mastered it, soldering becomes a bit less intimidating.

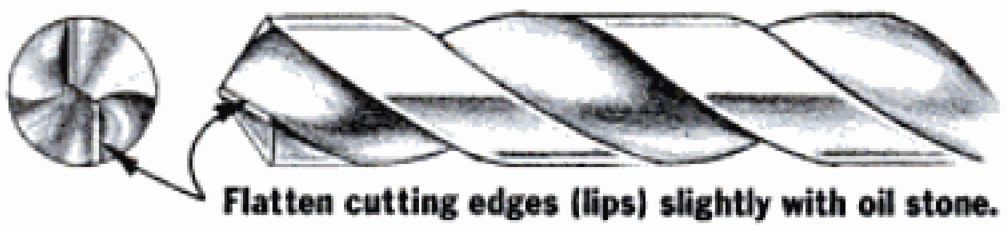


SALLY SHENK ULLMAN

SEAN SPRAGUE

These handmade brass handles are a variation on the Japanese Tansu cabinet handles. The china hutch, complete with handles, was made by the author.

FIG. 1: MODIFYING A BIT FOR DRILLING BRASS



Tools and Supplies

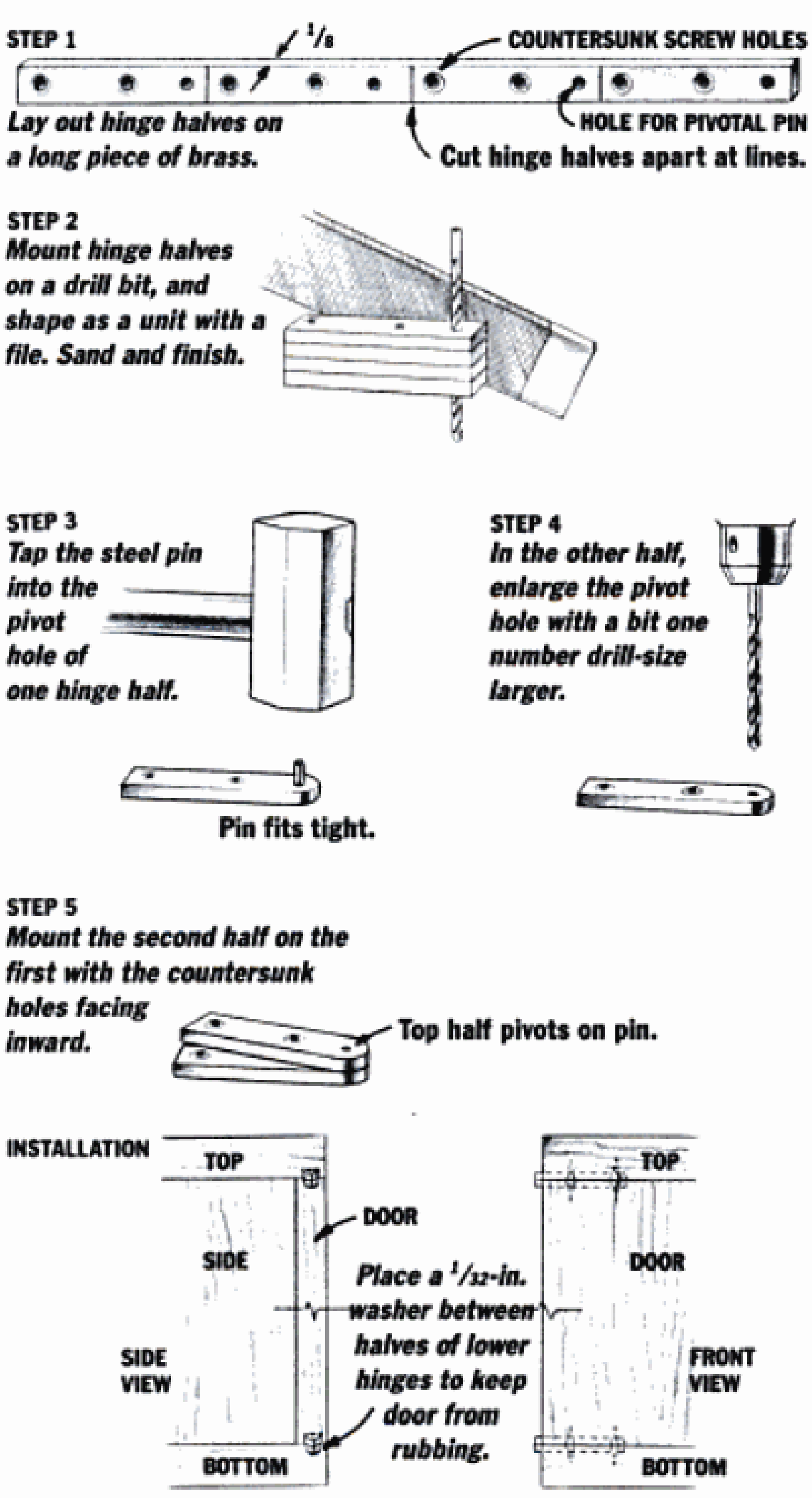
You won't need many tools to make these items of hardware. You'll need something to cut the metal—this could be a metal-cutting blade on your bandsaw, or it could be a hacksaw. Whatever you're comfortable with. You'll also need a grinding wheel, a few metal files, some kind of small vise, drill bits, steel wool, and a supply of brass and steel stock.

A few points about these tools. If you cut metal on your bandsaw, make an auxiliary table to close up the throat opening. (See Tech Tips, January/February, 1989 *AW.*) Also, when grinding brass, your wheel will load up with brass particles, so be prepared to dress the wheel frequently (See March/April, 1988 *AW.*) Files, too, have a tendency to clog up with metal, and these particles can scratch your work. If you rub your files thoroughly with chalk before filing, it will keep them from clogging with metal. And, finally since you'll be working mostly in brass, you might want to modify a few drill bits especially for drilling brass. Though regular twist drills will drill brass, they tend to pull the metal around the hole upward as you're drilling. If you just slightly flatten the two cutting edges (the lips) with an oil stone, this will cause a scraping action as opposed to a pulling action. (See Fig. 1.) Don't modify bits you intend to use again on steel.

As for finishing hardware after I've filed it, I usually sand the hardware with 320- to 400-grit paper. For a dull finish on brass, I buff with 000 steel wool, paying close attention to the direction of my scratches. For a bright finish, I use 0000 steel wool. If I want the brightest finish, I follow with leather (or a cloth buffing wheel) loaded with rouge or powder from my finest water stone. In the event that I desire an aged brass patina, I suspend the hardware, with wire, from the lid of a closed jar containing $^1/_2$-in. of household ammonia. The ammonia fumes darken the brass.

For brass stock, I guarantee that there are a multitude of obscure sources in your area. It may take some research, but it's worth it. Old-style hardware stores often still carry brass stock, but the stores themselves seem to be disappearing at an alarming rate. Look for supplies in hobby stores, welding-supply and tool-rental shops. I've even found some good steel stock for hinge pins in those mysterious orange banks of drawers in auto-supply stores. Whatever steel you come by, be certain that it is mild steel, so you can cut it to length. If you have no local sources, brass, copper and steel stock is available by mail from: Small Parts Inc., 6891 Third Ave., P.O. Box 381736, Miami, FL 33238. One last word about safety—metal dust isn't kind to the eyes or the lungs, so always wear a dust mask and goggles when working with metal. O.K. we're all prepared, so let's do it.

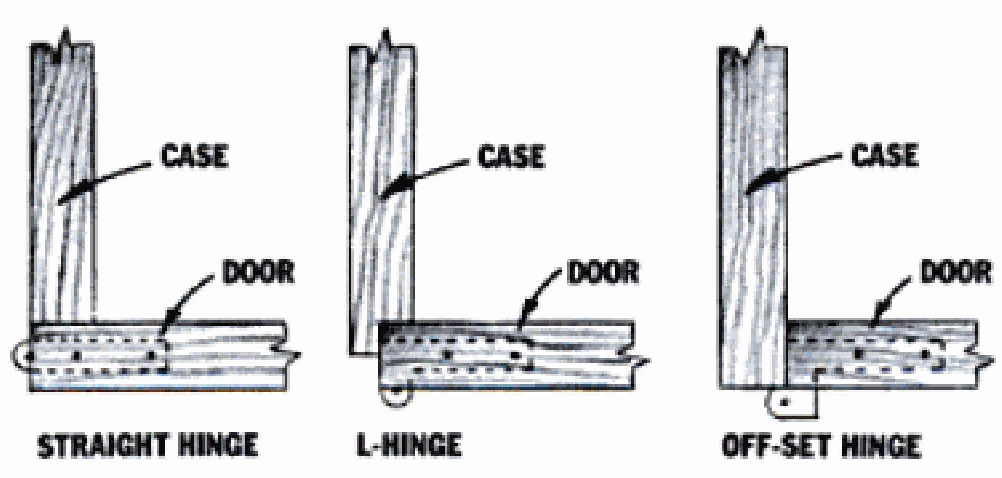
FIG. 2: HOW TO MAKE KNIFE HINGES



Knife Hinges

Knife hinges are one of the easiest pieces of hardware to make and thus a good place to start. You can also make L-hinges and other shapes to suit your needs. (See Fig. 3.) You'll need brass stock, approximately $^1/_8$ in. thick by whatever width you require. (The ones shown here are $^5/_{16}$ in. wide.) I make several hinge halves at a time on one long strip of brass, and then cut them apart. It's easier and safer to work the brass as one long piece. Plan the length of your hinge

FIG. 3: KNIFE-HINGE STYLES



DRAWINGS BY SALLY ONOPA

PAT STAFFORD

Store-bought knife hinges may not always come in the sizes you need—but it's a snap to build your own. The cabinet and hinges shown here were built by the author.

SALLY SHENK ULLMAN

halves so that they are long enough to allow for three holes: a hole for the pivot pin at one end and two other screw holes. (The hinge shown here is $1\frac{9}{16}$ in. long.)

Leaving the brass stock long, mark out with an awl and drill the pivot hole and screw holes for each hinge half. (See Fig. 2.) Cut each hinge half off the long stock. File off any burrs left by the drill, and stack the hinge halves on a drill bit (through the pivot hole). Grind and file them to shape as a unit.

To assemble the hinges, tap the pin (already cut to length) into the pivot hole in one half, being certain to go in straight. Then redrill the pivot hole in the other half of the hinge one number drill bit-size larger (i.e. If you drilled the original hole with a #30 bit, use a #29 bit to widen the hole.) This way, one hinge half is fixed to the pivot, and the other half rotates around it.

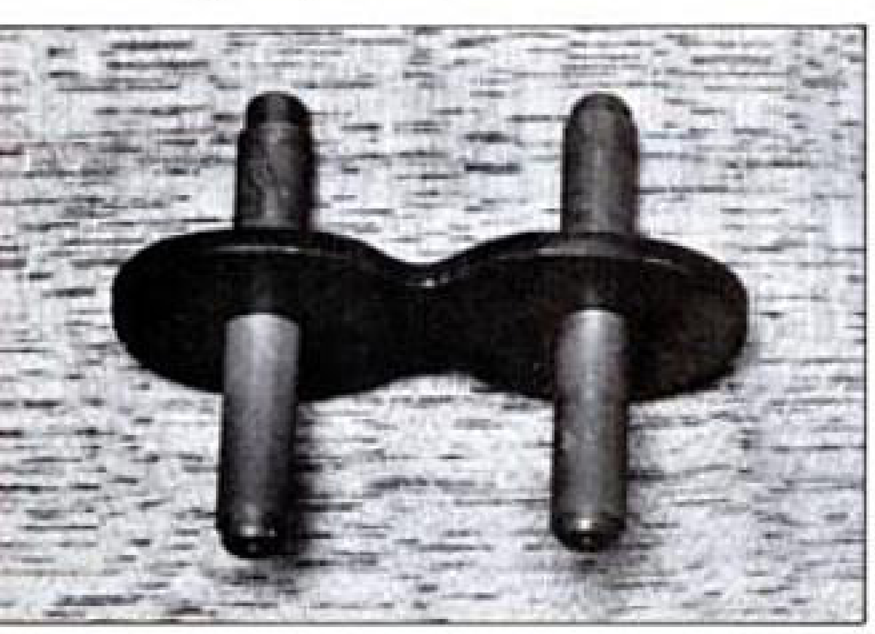
The only other part you'll need (besides screws) is a $\frac{1}{32}$-in. thick washer to place between the halves of the hinge that will be mounted on the bottom side of the cabinet door. The washer separates the hinge halves and keeps the door from rubbing.

Folding Screen Hinges

I developed these hinges for a set of serpentine folding screens. Each screen needed to rotate on its hinge more than 180° so that the curves of the screens would nestle into each other when they were folded up. I saw a variation of these hinges in another woodworking magazine, but they were made of wood, and I felt that they were too rustic for the piece. So, I decided to slim them down and use steel. The steel I used was cut from an electrical-box cover plate, and the pins are roller

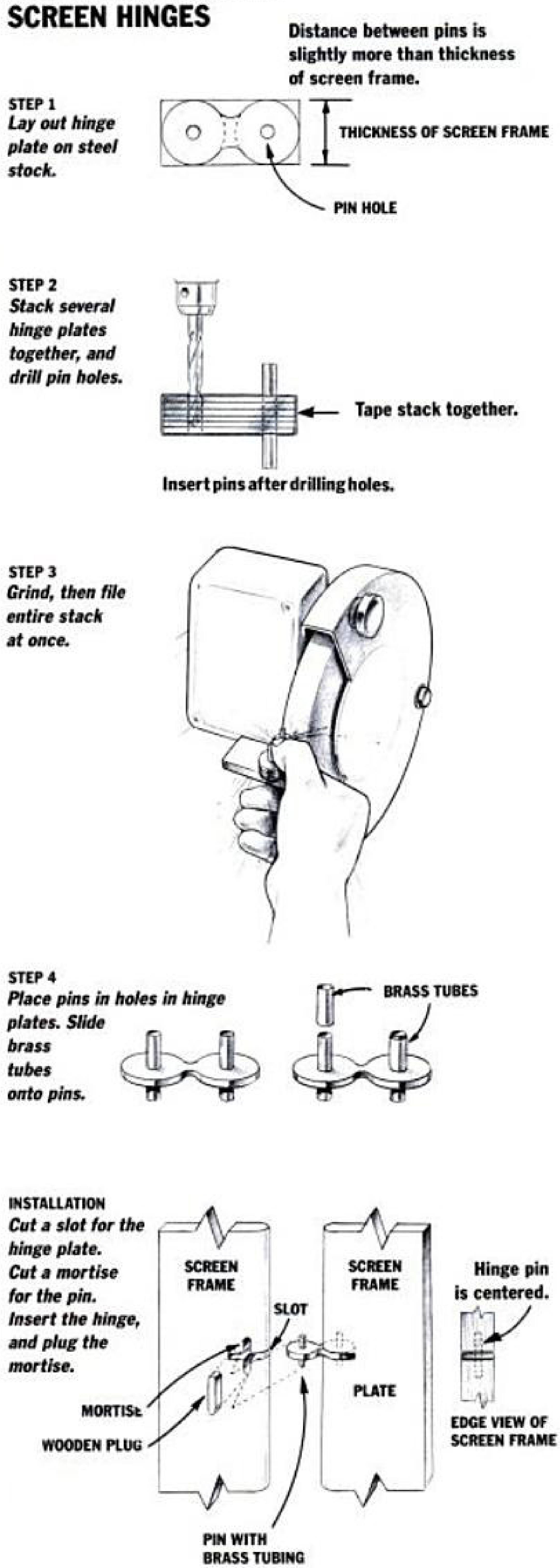
SALLY SHENK ULLMAN

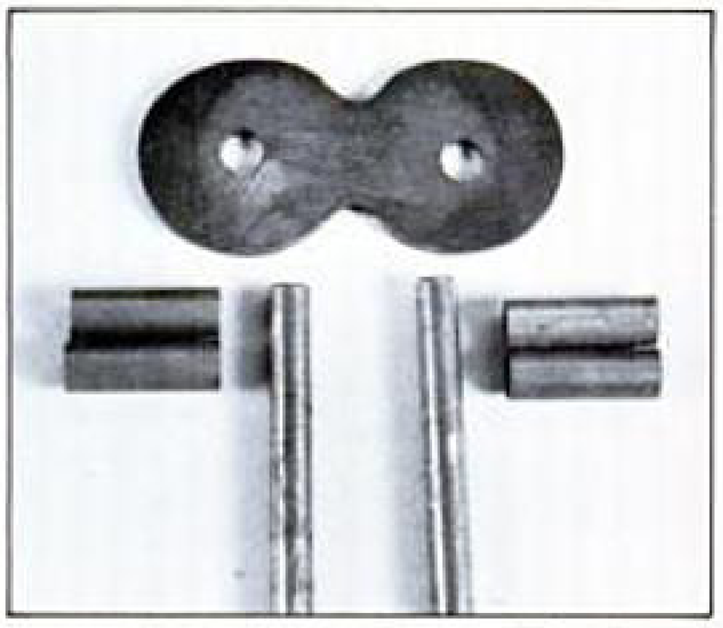
The author designed these screen hinges to allow the curved folding screens, shown in the insert, to rotate more than 180° on the hinge axis, allowing the screens to nestle into each other when folded up.



SEAN SPRAGUE

FIG. 4: HOW TO MAKE SCREEN HINGES





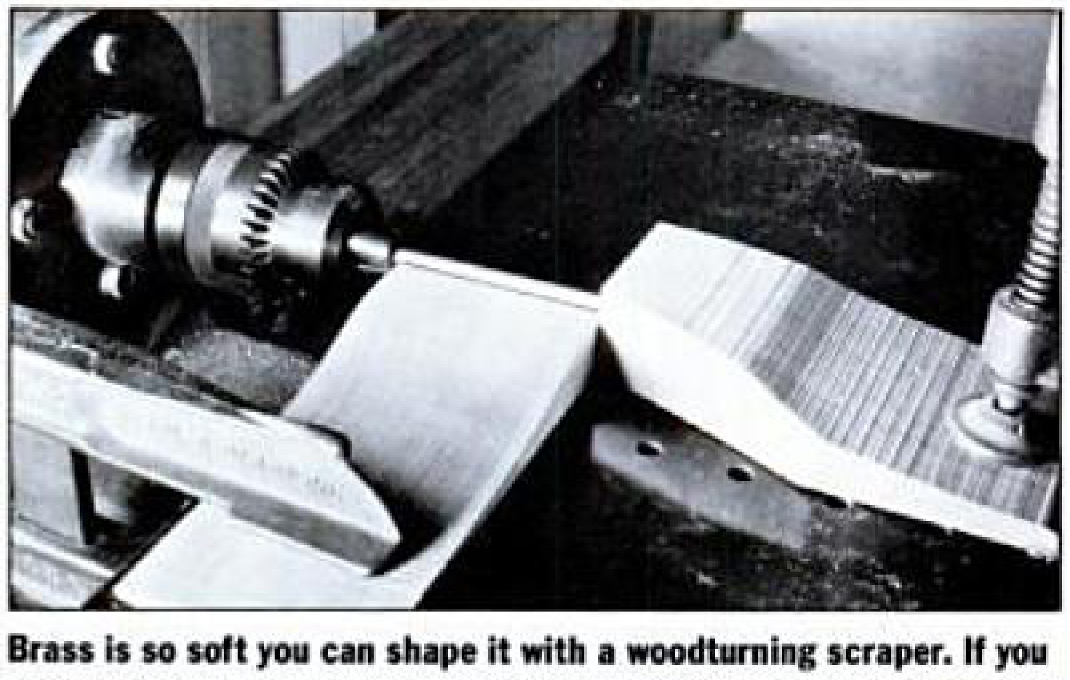
Each screen hinge is made up of a steel plate, two steel pins and four brass tubes that fit over the pins, on each side of the plate.

bearings—1/8-in. dia. steel stock. On these roller bearings I placed close-fitting brass tubing sleeves. The tubing rotates on the pin like a bushing and also protects the bearing surfaces from the glue used to plug the hinge mortise. (See photo.)

Before you make the hinge, I suggest making a mock-up of the surfaces you'll be hinging, so that you're able to work out the dynamics of the movement on a scrap setup. The hinged members should be at least three times as wide as they are thick, because the cross-grain slot you'll cut to install the hinge will weaken narrower frame members. The basic formula is as shown in Fig. 4.

I find it easiest to cut strips for hinge plates out of mild steel with a hacksaw. Take off the burr, stack the pieces, and tape them together. Then, lay out the distance between pins, and drill all the hinge plates as a unit so that the pins are spaced apart equally. Now, slide the pins through the stack and shape them on the grinding wheel. File them to a finished shape, and sand or buff them on a cloth wheel. To achieve a dark blue color, I hold a torch to each plate and cosmetically "temper" it for color. If the steel is galvanized, don't breathe the fumes. Pin length needs to be at least 1 in. and should fit in the plate snugly. Cut the brass tubing to length, slide it over the exposed ends of the pins, and Voila!

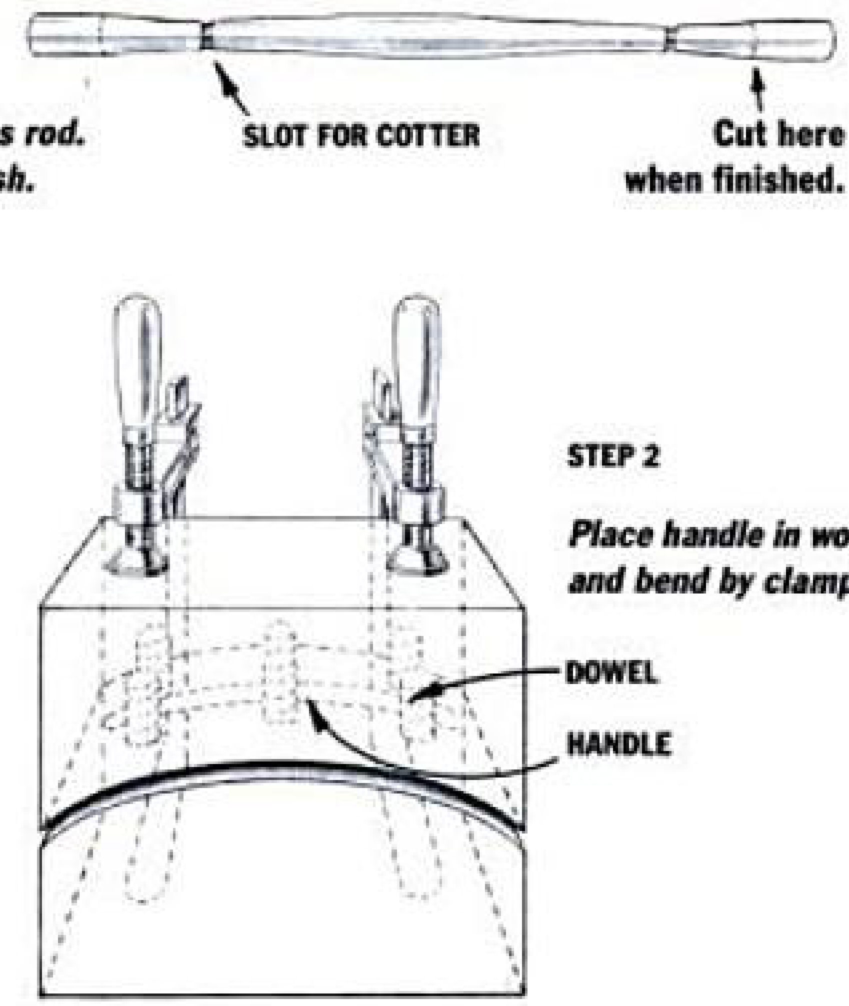
The installation is very simple, but try it on a test piece first. Cut the slot the same thickness as the plates. (A thin, kerf plywood blade is what I used.) Then, cut a mortise for the pin so that the pin is centered in the member's thickness. (See Fig. 4.) Finally, glue in a matching wooden plug that is shaped to fill the mortise. When it is dry, plane or scrape it flush, and the plug will be invisible.



PHOTOS BY PAT STAFFORD

Brass is so soft you can shape it with a woodturning scraper. If you don't have a lathe, turn the handle in an electric drill. Grip one end in the chuck and the other in a hole in a piece of scrap. Set a scrapwood tool rest parallel to the rod.

FIG. 5: HOW TO MAKE TANSU HANDLES



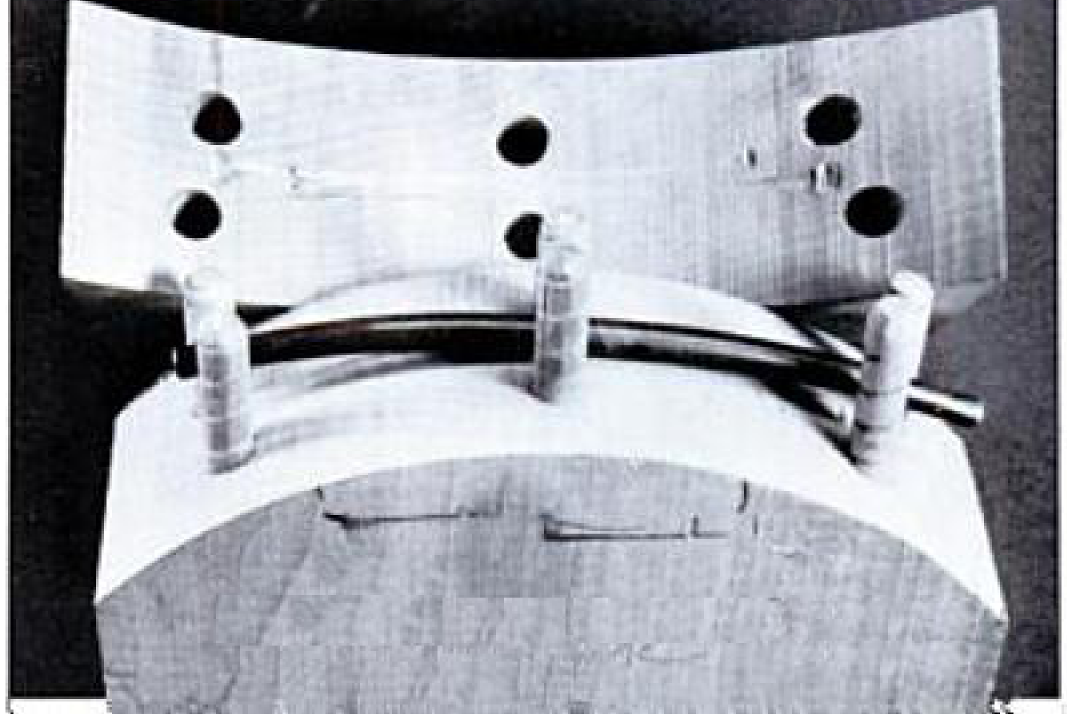
Tansu Handles

The handles shown here and in the lead photo are variations on the traditional handles used on Japanese Tansu cabinets. This design is very versatile—I have used it both horizontally and vertically in pairs. I'll illustrate and describe two methods of attaching the handle—a set-screw method I developed and a cotter-pin attachment my colleague, Reg Herndon, devised for a small jewelry box.

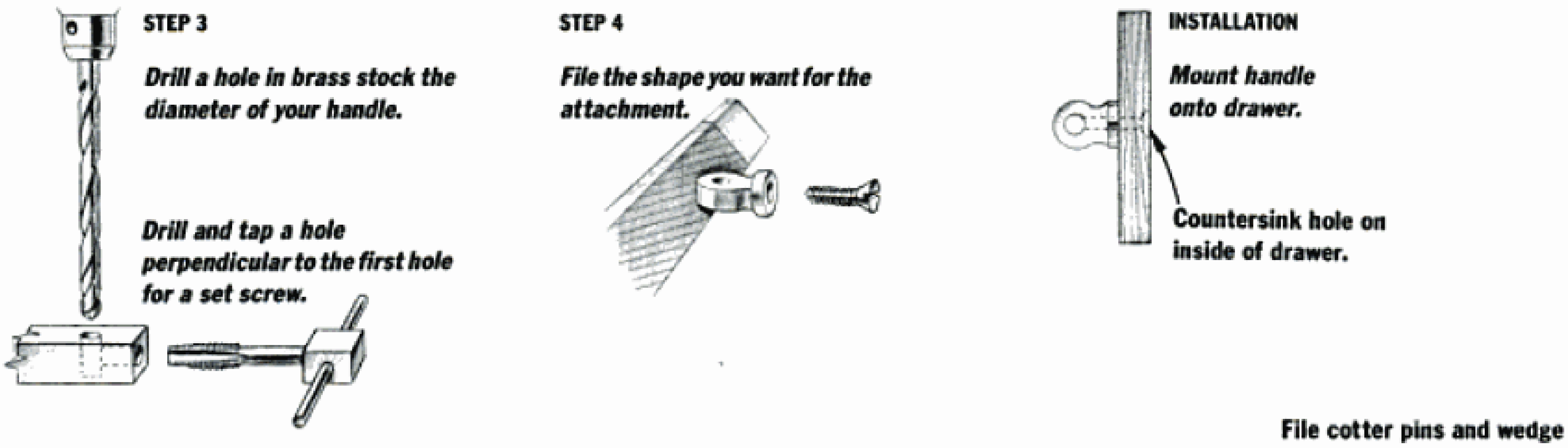
The handles themselves are turned from a 1/4-in. dia. brass rod. Brass is soft enough to be turned, at a low speed, with a scraping tool such as that used for woodturning. Chuck the brass in your wood lathe if you have one. If not, you can improvise by using a horizontal boring machine or even an electric drill as a "lathe." My handle-turning setup is shown in the photo. I chuck one end of the brass rod in the chuck of my horizontal boring machine and support the other end in a hole in a scrap block of wood clamped to the table. I set up a scrap-wood "tool rest" mounted parallel to the brass rod and as close to the rod as possible.

Turn the rod shape, as shown in the drawing. If the

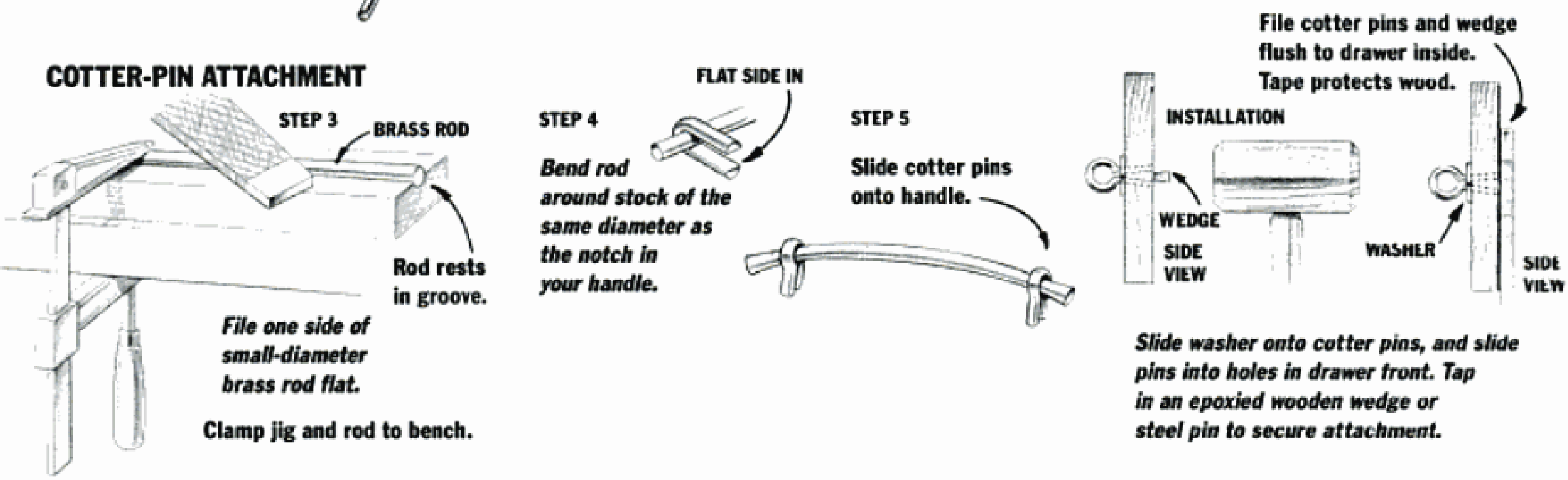
To bend the Tansu handles, use a two-part hardwood mold with dowel registers. Place the brass rod between dowels, and bend by clamping.



SET-SCREW ATTACHMENT



COTTER-PIN ATTACHMENT



tool begins to chatter, you are either pressing too hard or addressing the workpiece at the wrong angle—it's a matter of feel. If you choose to use the cotter-pin attachment, turn two shallow grooves in the rod at the points where the mounting hardware attaches, as shown in Fig. 5. The cotter-pin mount hardware is designed to lock into these grooves to keep the handle from moving sideways.

After you've turned the rod to shape, sand the rod while it's spinning. Be certain to keep the sandpaper moving to avoid scratches. Cut off the excess length, then shape the ends with a file and finish.

To bend the handles into a curve, you'll need to make a two-part hardwood mold. The mold is cut to a bit more of an arc than the finished handle curve to allow for spring-back. Locating dowels serve to both center the mold and hold the rod in place. (See photo.) Place the rod in the mold, and bend the rod by clamping the mold halves together.

Your next task is to decide which of the two attachment methods—the set-screw mount or the cotter-pin mount—best suits your design. If you want the handle to be solidly locked in place, the set-screw mount is a better choice. If you want the handle to swivel freely in its mounts, use the cotter-pin attachment.

You can make set-screw mounts from any brass stock thick enough to drill a hole for the handle. I made the set-screw mounts in the photo from a brass tuna swivel I found in a fishing-supply store. I cut the swivel in half, then drilled holes for the handle and the set screws that come through the back of the drawer. The screws secure the handle mounts to the drawer front and hold the rod in place. You can lock the handle in place or allow it to swivel in its mounts depending on the length of the screw.

To make the hardware, simply drill a hole in each mount for the handle rod and a second hole for the screw at 90° to the handle hole, as shown in the Fig. 5. Finally, tap threads in the screw holes. If you're making your mounts from round stock, you'll need to make a V-block cradle to hold the work from turning as you drill it. Mark your holes with a center punch, and clamp the stock firmly before you drill. Grind and file your mounts to shape and finish.

The cotter-pin attachment is a better way to mount the handle if you want it to swivel. If you can't find cotter pins in the size and type of metal you need, you can easily make them. (See Fig. 5.) File a small diameter brazing rod flat on one side. Then, cut sections a bit longer than finished length. Bend each of these around a piece of stock the same diameter as the notch in your handles. If you have to use pliers, protect the brass with a piece of leather, so you don't scar it.

To attach the handles, slip the cotter pins over your handle and then through brass washers (these are meant to show on the drawer front) and finally through a hole in the drawer front. Countersink the hole on the inside of the drawer. The washers both protect the wood around the attachments and add a nice element to the design. Spread the cotter pin, and tap a wooden wedge in between the two halves of the cotter pin from the inside. A little epoxy will keep the wedge in place. File the cotter pin and the wedge flush with the inside of the drawer, protecting the wood by putting some tape around the hole. ▲

Patrick Stafford is a professional woodworker in Santa Cruz, California. He has been working with wood for 16 years. He studied and has taught with James Krenov in the Fine Furniture Program at the College of the Redwoods in Fort Bragg, California.

JAPANESE SAWHORSES

Working at a Lower Center of Gravity

BY JAY VAN ARSDALE

The common ground for all woodworkers is the workbench. In the Japanese approach to woodworking, the craftsman works at a lower center of gravity, using methods that emphasize the natural balance and harmony between his tools and the movements of his body. A workbench at this lower height can be much simpler than those used by Western-style woodworkers.

In the Japanese woodworking tradition, the concept of a workbench is very flexible. It's not a solid, permanent object, but a modular work station that can be easily changed and moved to suit different woodworking tasks or job locations. The work surface is made of planks that span a pair of sawhorses. Different-size planks are chosen according to the job at hand.

It's easy to estimate the ideal height for the work surface you need to use these techniques. It's simply the height of the bottom of your knuckles when standing erect with arms relaxed at your side (usually about 24 to 26 in. for average-height people). Because the work surface is lower, clamps and vises are rarely needed to secure the work. When chiseling a mortise, a craftsman will hold the workpiece on the planks simply by sitting on it. A bench dog made of a small wooden pin or a nail or screw, is all that is needed to hold the wood for planing.

Traditional Japanese carpenters use sawhorses like this because they are convenient and portable. I use them in my own shop and on remote job sites. Even if you don't care for the Japanese style of woodworking, or don't have any Japanese tools, making a pair of these sawhorses is a good basic-joinery project, and you'll find them very useful around the shop.

The sawhorses are designed with joinery that helps them resist tipping and rocking in all directions and to bear a heavy load. The horses are made to be lightweight and easily knocked down for portability—there are no glued joints or metal fasteners. This opens up possibilities for using these structural elements in designs for other furniture and projects.

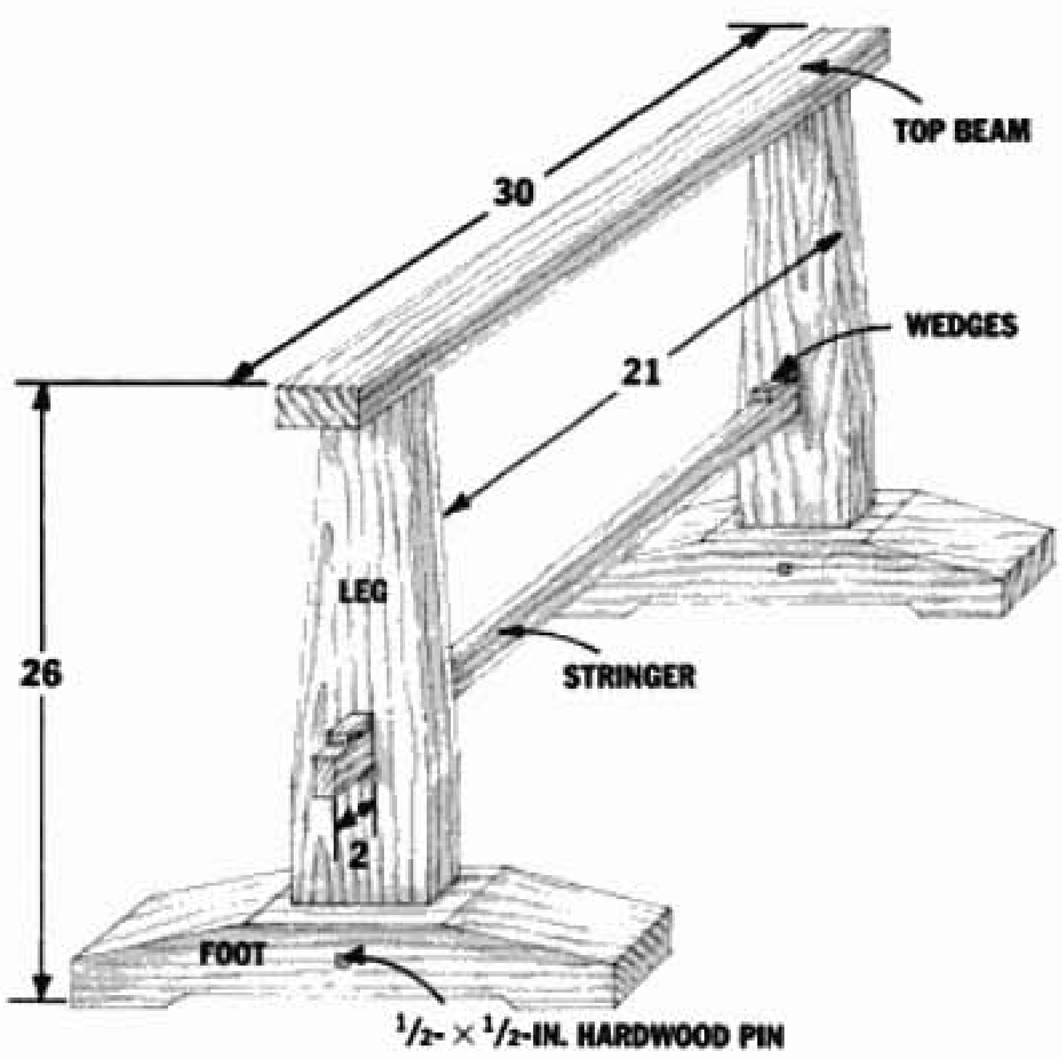
I choose to do the majority of my work by hand simply because I enjoy this type of work—and it *is* work. I use power tools for milling and some heavier tasks, but I use my hand tools whenever I can, which is quite a bit. This approach ties in very naturally with my style of woodworking, which I find personally rewarding. That's why I encourage you to develop your hand skills and use them often in your own woodworking.

The spirit of Japanese woodworking is rooted in the concepts of *simplicity and balance*. This becomes most apparent when working with Japanese tools, which have evolved to allow working at a lower center of gravity. Japanese planes and saws, for example, work backward when compared to Western tools. They cut on the *pull* stroke. Using these tools at a lower working height, with the knees slightly bent, means you can utilize the strong leg and belly muscles for power, leaving the arms and hands more relaxed for sensitivity and control. This approach leads to an economy of movement that is difficult to achieve with the higher off-balance lunge of push tools.

PHOTOS BY KAREN EHRHARDT

A few stout planks across these sawhorses create a sturdy workbench. The bench's low height makes it comfortable to sit on your work to hold it in place.

FIG. 1: JAPANESE SAW HORSE



DRAWINGS BY KATHY BRAY

Design and Layout

The construction of these sawhorses is simple and straightforward, with plenty of room for customizing the design and finish details. The dimensions of the horses in the drawings are based on dimension lumber sizes and are meant as a guideline only; feel free to vary the dimensions to meet your own needs. For example, if you would like to use the stringer as a shelf support for storing materials, consider making it from heavier stock.

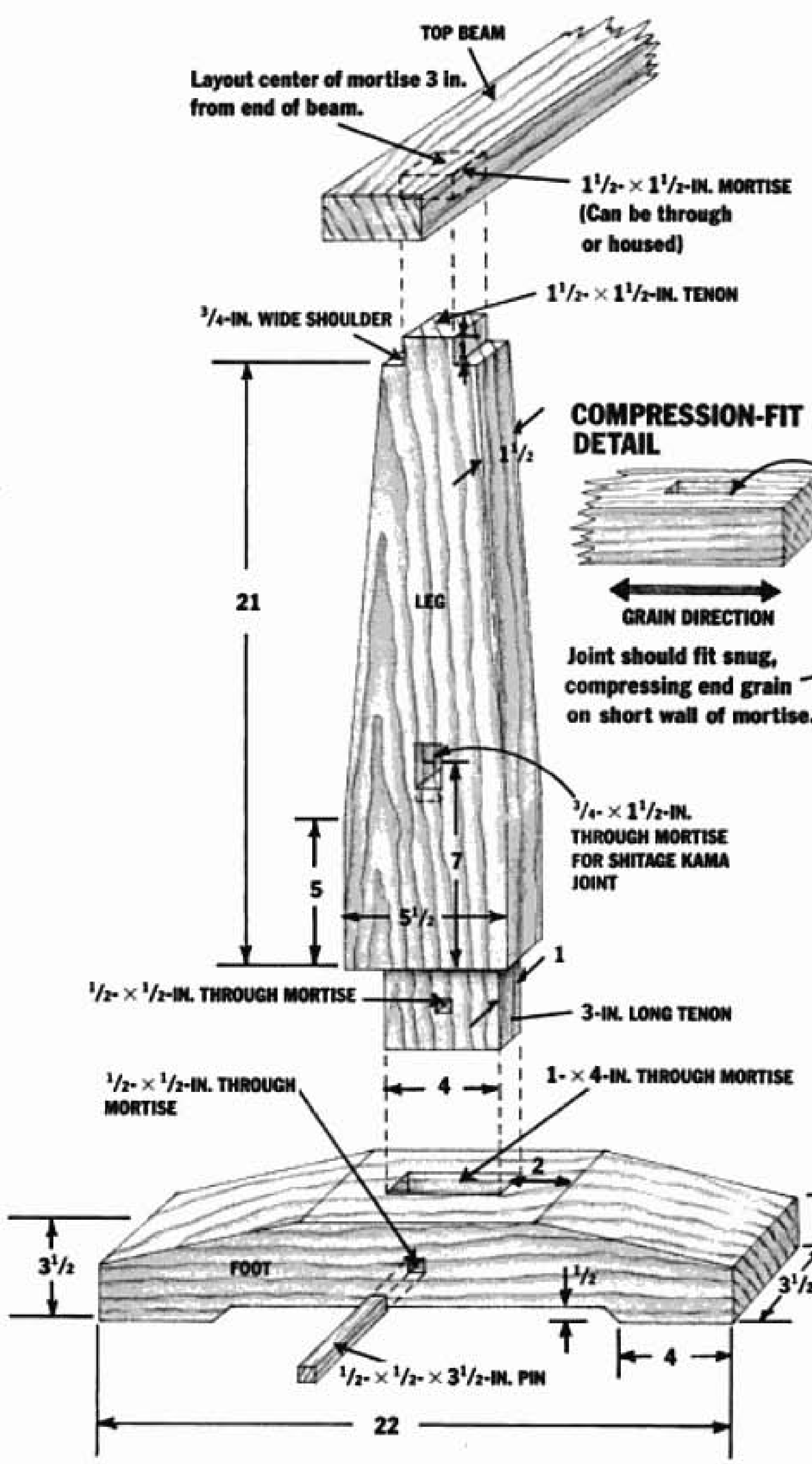
Each sawhorse consists of six pieces of wood plus two pins and two sets of wedges. Every joint is either a basic mortise-and-tenon joint or a simple variation. The joint that connects the stringer and the legs is called the *shitage kama* (shee-taĥ-jee cá-ma) in Japanese. It's a through mortise and tenon with half a dovetail, secured by wedges. The *shitage kama* is a Japanese architectural joint used to resist shear stress or lateral "racking" without the use of crossbracing or plywood gussets. The leg-to-foot mortise and tenon is secured by a ½-in. square pin driven through a small mortise in both the foot and the leg tenon.

The top beam-to-leg joint is a mortise and tenon held in position by gravity and a good compression fit. This joint can be a housed mortise and tenon, which looks better, or a through mortise and tenon which is easier to make and just as strong. The mortises in the beam are centered about 3 in. from the ends of the beam. This lets the work surface extend outward so the foot isn't in the way when you're working at the bench. This joint should be about 1½-in. square which allows a ¾-in. shoulder on two sides of the tenon. The long edge of the top beam will overhang about ¼ in., offering a good opportunity for a chamfer detail.

The horses need not be made out of exotic or expensive woods. Use what is available in your area. Traditional wood species for the sawhorses are Port Orford cedar (also called Lawson cypress, or *hinoki* in Japanese), Lawson cypress or white cedar. I like cedar the best, but have also used redwood, alder, poplar and Douglas fir. Choose the straightest and most consistent pieces you can, usually a clear grade or tight-knot grade. The wedges and pins should be made of harder woods. Tropical hardwoods add a nice detail of color, but avoid making wedges from oily woods like teak or rosewood. These woods are slippery and the wedges won't stay in place. Make sure the wood has been dried properly. Though they may not be fine furniture, there's no reason the sawhorses shouldn't be beautiful and long lived.

Determine the height for your horses by the "bottom of the knuckles" method mentioned above. The length of the top beam is determined by the size of the work surface you want. A beam shorter than 18 in.

FIG. 2: SAWHORSE JOINTS



Cut the sawhorses' leg tenons carefully, letting the saw kerf take half the layout line. The Japanese saw cuts on the pull stroke, making it easy to hold the work by hand.

puts the feet of the sawhorse too close together. Usually a 30- to 36-in. top beam is plenty long and will support one stout 4- × 10-in. plank strong enough for planing and the pounding involved in cutting mortises. There's also room to support 1 × planks to set tools on, keeping the primary work surface clear. Beams 4 ft. or longer should be made of 4 × 4 stock.

Centerlines are the main reference for laying out all the joints. For example, lay out a mortise by first marking the center line of the piece. Then, lay out the sides of the mortise from the center line. Layouts are important to the concept of *compression fit*, which is integral to Japanese joinery. The underlying idea is to get a perfectly snug joint—not too loose, and not too tight. This requires accurate and consistent layouts of all the parts. When chopping a mortise, remove the waste carefully, just to the inside of the layout lines. Final paring should clean up all the surfaces and leave about half of the layout line for adjusting the final fit.

In a properly cut mortise and tenon, there should be a slight compression between the tenon and the end-grain walls of the mortise as shown in Fig. 2. The compression on the *sides* of the mortise, across the grain of the stock, should be less, or the mortise could split. The compression means the joint will fit fairly snug, requiring some tapping with a mallet to get the tenon seated in the mortise. The wood should be at equilibrium moisture content, or it may crack when the mortised piece shrinks across the grain where it surrounds the tenon.

Making the Sawhorses

To make the work flow smoothly, it's important to do things in a logical sequence. I like to cut the pieces to length first, then plane them true and square with an 8- to 10-in. smoothing plane. Next, I lay out the lines for the joinery (centerlines first), and check them again. At this point I think about the final shape I want for the pieces and lay out those lines too. This includes tapering the legs and feet, the cutouts in the bottom of the feet, and other chamfering you may want.

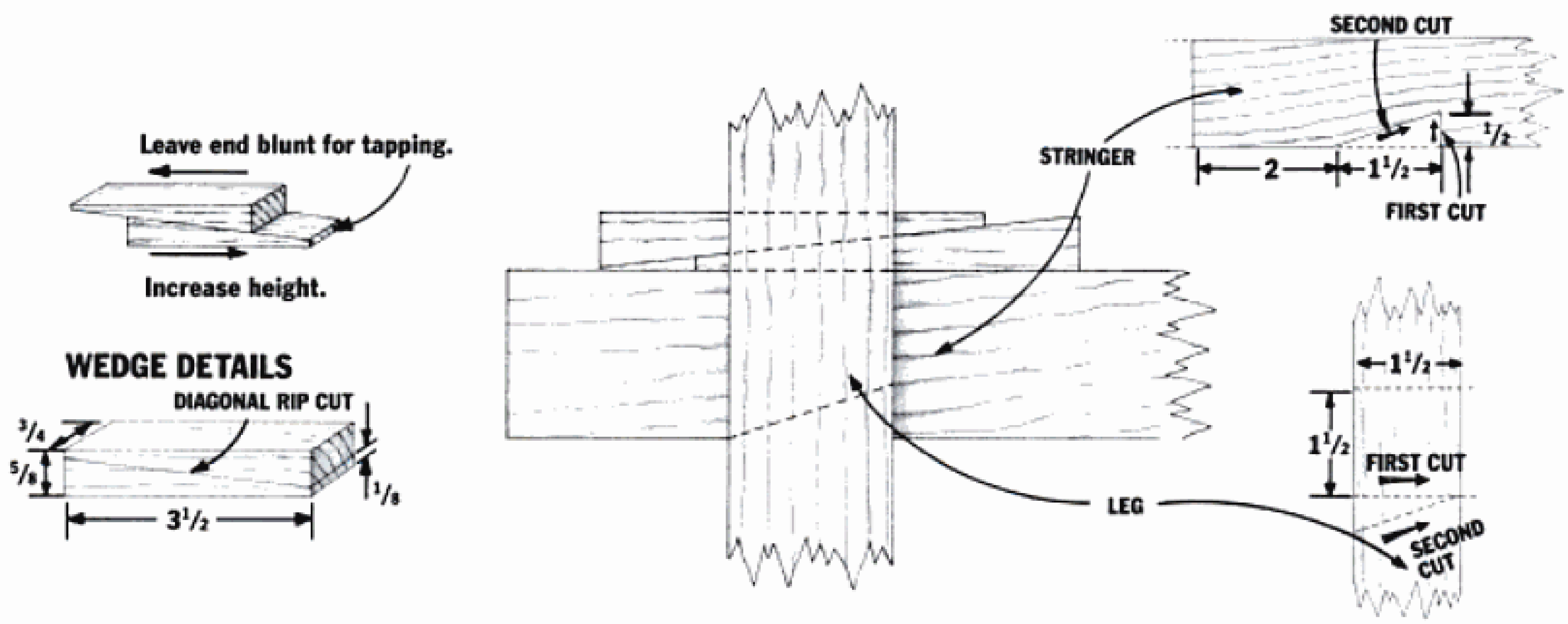
It's easier to hold the pieces if all the joints are cut before you start to do the shaping and chamfering. If this type of joinery is a totally new process for you, it might be a good idea to work on one horse at a time. This way, any mistakes or inaccuracies can be corrected before repeating them.

Chop all the mortises first. When cutting the mortises in the foot, it's best to cut the small, pin mortise first. That will avoid splitting out the inside surface of the large mortise. This is a prime example of a general rule of thumb: *always do the hard part first*. The small $1/2$-in. square mortise is tough to cut because it's also deep—there's not much room for the chisel to work. Of course, it could be drilled for a dowel instead, but I like to think of this as an opportunity to test and improve your skills. So, take your time, try to make the mortise clean and neat, and have fun.

The vertical placement of these small, pin mortises in the foot and leg tenon is crucial. The pin mortise in the foot is centered *directly above* the horizontal centerline, while the mortise in the leg tenon is centered $1/32$ in. above the horizontal centerline. (See Fig. 2.) This $1/32$ in. or so pulls the shoulders of the tenon snug against the top surface of the foot. Don't offset these mortises more than $1/32$ in. or the mortises won't line up at all, and the pin can't be inserted without damage. Taper the entry end of the pin slightly to help ease it into the leg mortise.

The center of the *shitage kama* joint of the stringer and leg is usually located about a third of the way up the leg. First, cut the mortise square through the leg, then create the sloped lower surface by chiseling uphill from the outside of the leg toward the inside. (See detail in Fig. 3.)

FIG. 3: STRINGER TO LEG JOINT (SHITAGE KAMA)



After chopping the mortises, saw all the tenons. Rip cuts are usually made first, then crosscuts. This keeps the layout lines longer, so the accuracy they represent can be used before the lines are removed. When making a crosscut that ends at the kerf of a rip cut, listen to the change in sound as you get close to the line. That helps judge the depth of the cut, so you don't saw too deeply and weaken a tenon, for example.

To make the cutback for the half-dovetail on the stringer, first saw the line perpendicular to the edge, then saw or pare the sloped line. A 1/2-in. cutback gives good binding surfaces for the dovetail and leaves enough room for good-size wedges which will withstand the compression. If the cutback is less, the wedges become too thin. If the cutback is more, the stringer could be weakened by having too much wood cut away. It's important to orient the cutback on the tenon to the inside of the horse—this lessens the possibility of splitting.

When the stringer is seated into its mortise, the wedges are put into the gap between the top of the stringer and the top surface of the mortise. It's always best to design the joint with the wedges on the top. If the wedges are placed on the bottom where they carry the weight of the stringer, the joint is likely to loosen.

It's easier to cut the wedges from a piece of stock longer than the wedges themselves. This longer length helps in holding the stock as you make the rip cuts with your saw. The thickness of the wedge stock should equal the thickness of the stringer. The final length of the wedges should be about 2 1/2 times the thickness of the leg. When inserting these wedges, place the sawn rough sides together to increase the friction between them. These similar sides will also remain parallel as the sloped surfaces slide across each other while adjusting the wedges' height. For a cutback height of 1/2-in., wedges about 5/8 in. in height (when measured together) are good for proper compression.

After the joinery and shaping has been done, inspect all surfaces to see if they're true and aligned. Check the fit of joints in pairs and adjust them accordingly. Put index marks on the matched joints for the final assembly.

Now take the pieces apart and finish plane them to clean up any layout lines and work grime. I use a 48- to 70-millimeter Japanese *burnishing plane* with a razor-sharp blade adjusted to take a very thin cut (available from Hida Tool, 1333 San Pablo Ave., Berkeley, CA 94702). The action of this plane, shearing the wood fibers very cleanly, along with the friction it develops, burnishes the wood to a polish. If done properly, the pieces should sparkle.

The exposed end grain can also be planed, then sealed or painted to reduce the transfer of moisture through the end grain. This can also add a significant splash of color to your sawhorses. Reassemble the planed and finished pieces, following the indexing marks you applied earlier. Your sawhorses are ready to be used and admired.

If you'll be using your sawhorses for a workbench, the planks that span the horses should be heavy enough to support the work without sagging or being springy. Planks of 2 × stock are good for short spans of about 4 to 5 ft. between horses. The planks can overhang the horses for a working length of 7 to 8 ft. For longer spans of 6 to 10 ft. between the horses, larger 4 × planks are needed to give adequate support and mass. The mass is needed to counteract the pull created by planing. A pin or nail in the underside of the plank, outside the top beam, will hold it in position against the horse for pull planing.

In addition to the sawhorses shown here, I sometimes use a heavier set of sawhorses in my shop with 4- × 4-in. beams to support two 12-ft., 4- × 20-in. planks. I usually place a piece of 3/4-in. plywood over the planks to create a larger work area. As the surface becomes rough from working, the plywood top can be rotated, flipped or replaced. When a clean top is needed for working or assembly, a 1/8-in. plywood skin over the 3/4-in. plywood gives a fresh surface that won't mar or scratch the work. It also makes a great drawing board for full-scale project drawings. ▲

Jay van Arsdale practices and teaches Japanese woodworking techniques. His new book, Shoji: How to Design, Build and Install Japanese Screens *(1988, Kodansha Int., 114 Fifth Ave., New York, NY 10011) was reviewed in the November/December, 1989 AW.*

MISSION-OAK PLATE RACK

Stickley-Style Shelves That Will Flatter Your Platters

SALLY SHENK ULLMAN DISPLAY ITEMS COURTESY KUTZTOWN ANTIQUE GALLERY

BY DAVID SLOAN

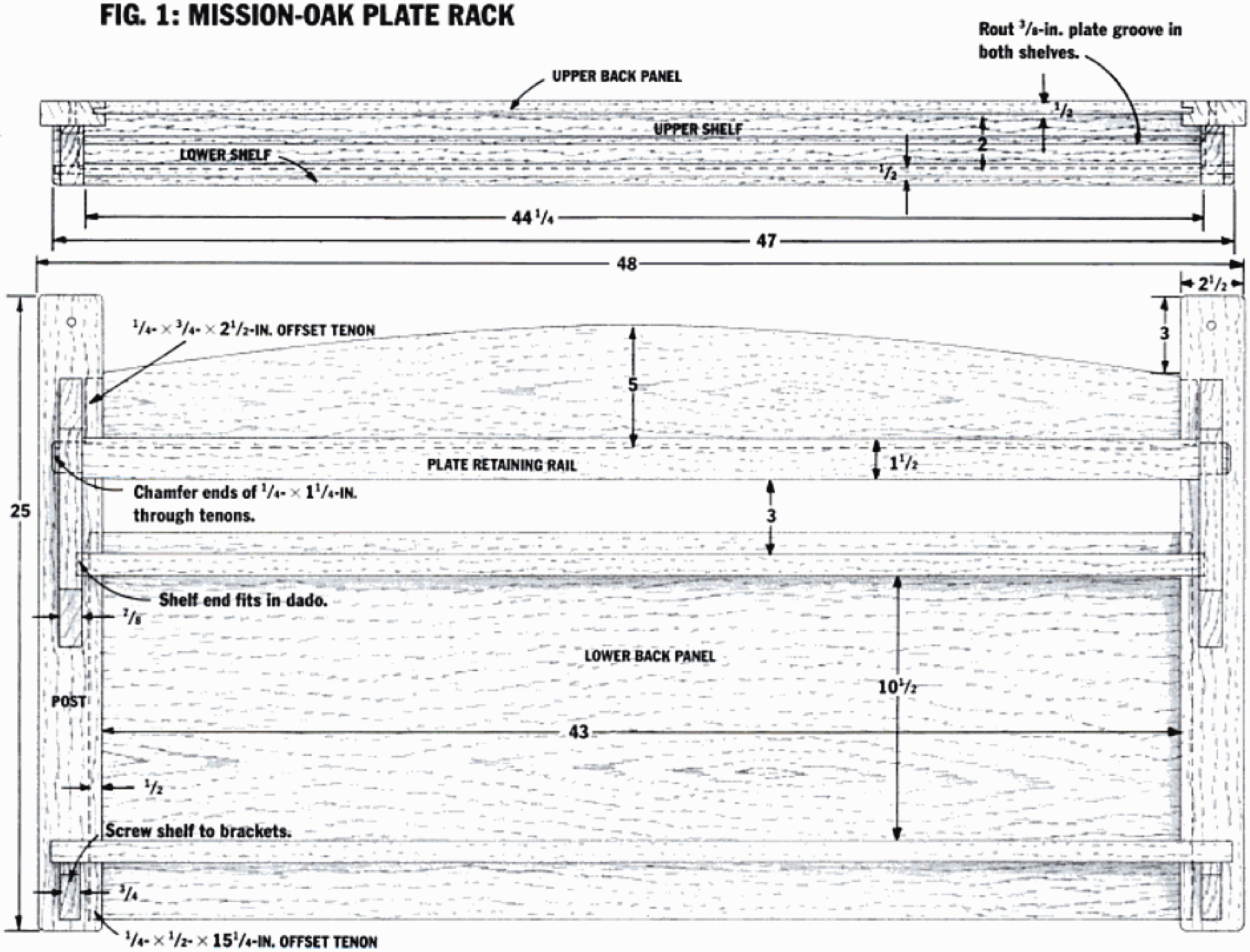
Mission furniture, also known as "Craftsman" or "Arts and Crafts" furniture, was an American style popular between 1900 and 1916. Sturdy and simple, with exposed mortise-and-tenon joinery and solid-wood construction, Mission furniture heralded a full retreat from the ornate excesses of the fancy Victorian styles popular at the time.

The Mission style evolved from the philosophy of the Arts and Crafts movement, which held that the machines and factories of the industrial age had corrupted the quality of furniture and other household items. Followers of the Arts and Crafts movement advocated simplicity and integrity in their designs and strove, at least in theory, to do the work by hand.

This plate rack is similar to one designed by Gustav Stickley, the best-known furniture designer and manufacturer of the American Arts and Crafts period. Stickley's monthly magazine, "The Craftsman," (pub-

This Mission-style plate rack is based on a design by Gustav Stickley, the best known furniture maker of the American Arts and Crafts period (1900 to 1916).

FIG. 1: MISSION-OAK PLATE RACK



BILL OF MATERIALS

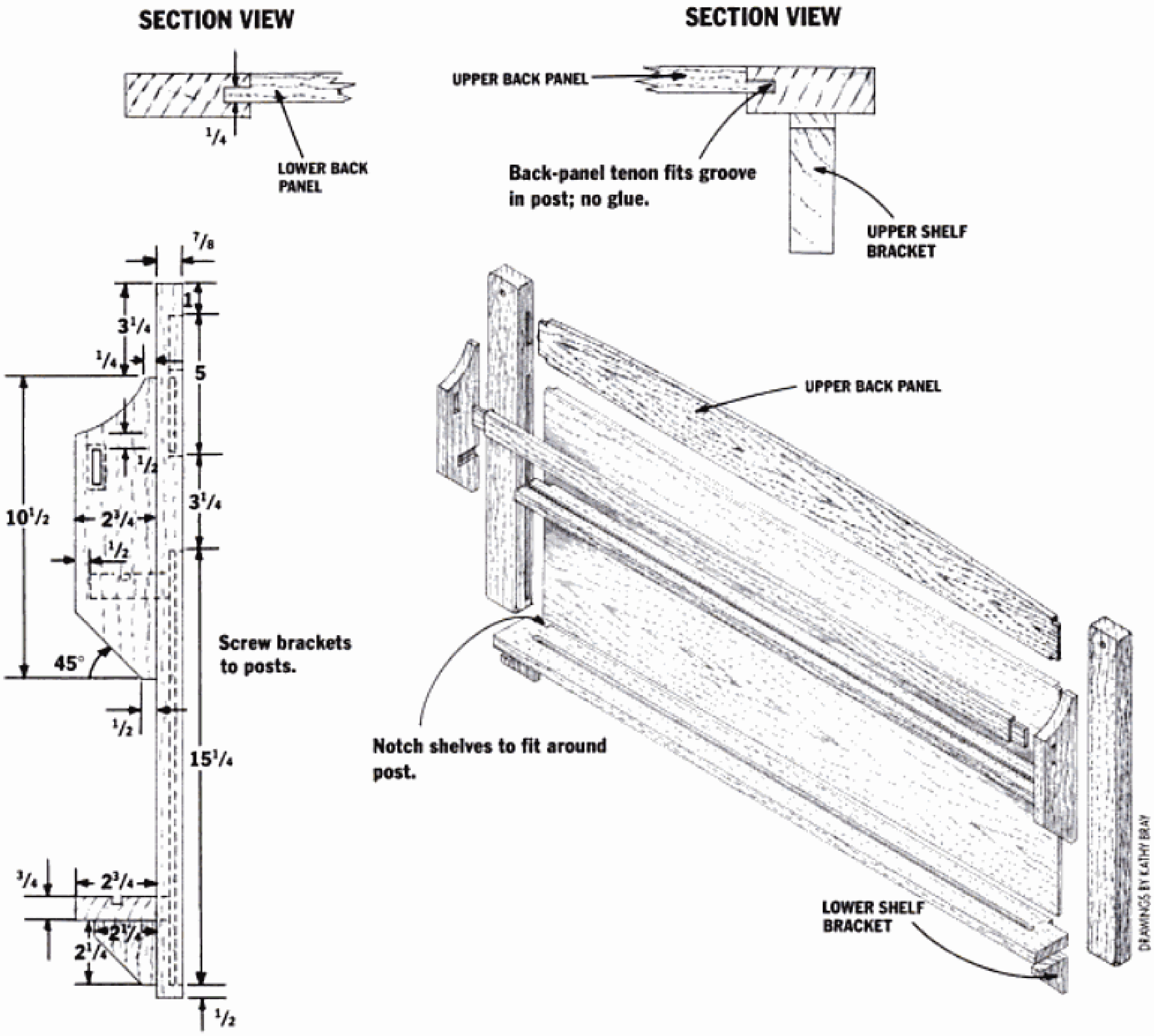
PART	QUANTITY	DIMENSION
Upper Back Panel	1	1/2" × 5" × 44 1/2"
Lower Back Panel	1	1/2" × 15 1/4" × 44"
Posts	2	7/8" × 2 1/2" × 25"
Upper Shelf Brackets	2	7/8" × 2 3/4" × 10 1/2"
Lower Shelf Brackets	2	3/4" × 2 1/4" × 2 1/4"
Upper Shelf	1	3/4" × 2 5/8" × 45 1/4"
Lower Shelf	1	3/4" × 3 1/8" × 47"
Plate Retaining Rail	1	1/2" × 1 1/2" × 47"

lished from 1901 to 1916) featured plans for a similar plate rack, but I can't find any evidence that Stickley actually manufactured this particular design.

Like most of Stickley's original Craftsman furniture, this plate rack is made of white oak. Red oak would work just as well. Stickley often used quartersawn oak to show off the flashy, flake figure characteristic of quartersawn oak. (Quartersawn white oak is available from Talarico Hardwoods, R.D. 3, Box 3268, Mohnton, PA 19540.)

The construction is fairly simple, as you can see from the drawing. The two back panels have 1/4-in. thick offset tenons that fit into mortises in the vertical posts. The back panels are not glued in their mortises, so they're free to expand and contract across the grain without risk of splitting. The four shelf brackets are screwed to the vertical posts from the back, with flat head screws, and the plate rail is through-mortised and glued into the two upper brackets. The ends of the upper shelf fit into dadoes in the two upper shelf brackets. Both the upper and lower shelves are notched, to fit around the vertical posts, and screwed to the vertical posts from the back. Both shelves have a 1/4-in. deep plate groove routed with a 3/8-in. core box bit. A 3/8-in. straight bit would work, too.

Stickley's original Craftsman oak furniture was finished by exposing the wood to concentrated ammonia vapors—a process known as "fuming." The ammonia fumes react with the tannin in oak to darken the wood. Stickley describes the fuming process in a foreword to one of his furniture catalogs: The wood is "moistened all over to open the pores and then put into an airtight compartment, on the floor of which are placed basins of very strong (26%) ammonia. The time usually demanded for this fuming is 48 hours, but that is varied according to the wood and the depth of color required. After fuming, the wood is carefully sandpa-



pered by hand until all the loose fiber is rubbed away and every trace of roughness removed. Then comes the final finish."

Instead of fuming this plate rack, the wood was darkened with a brown aniline dye (November/December, 1988 *AW*). After staining, dying or fuming, an oil finish such as Watco or Minwax Antique Oil Finish comes close to duplicating the look of Stickley's original finish.

Photos I've seen of Arts and Crafts rooms often show objects such as plate racks and mirrors suspended on iron chains from a "picture molding" near the ceiling. The plate rack could also be secured to the wall studs with screws, if you like, but in keeping with the Arts and Crafts "feel," hand-wrought fasteners would be more appropriate.

I took several lag screws and heated the heads to a red heat with a propane torch. I placed the hot lag screw, head up, in a big machinist's vise and gave the head four whacks with a big hammer to create the appearance of a hand-forged head. When the lag screws cooled off, the shiny zinc plating was gone, and the heads had a bluish-black color that looked just right. ▲

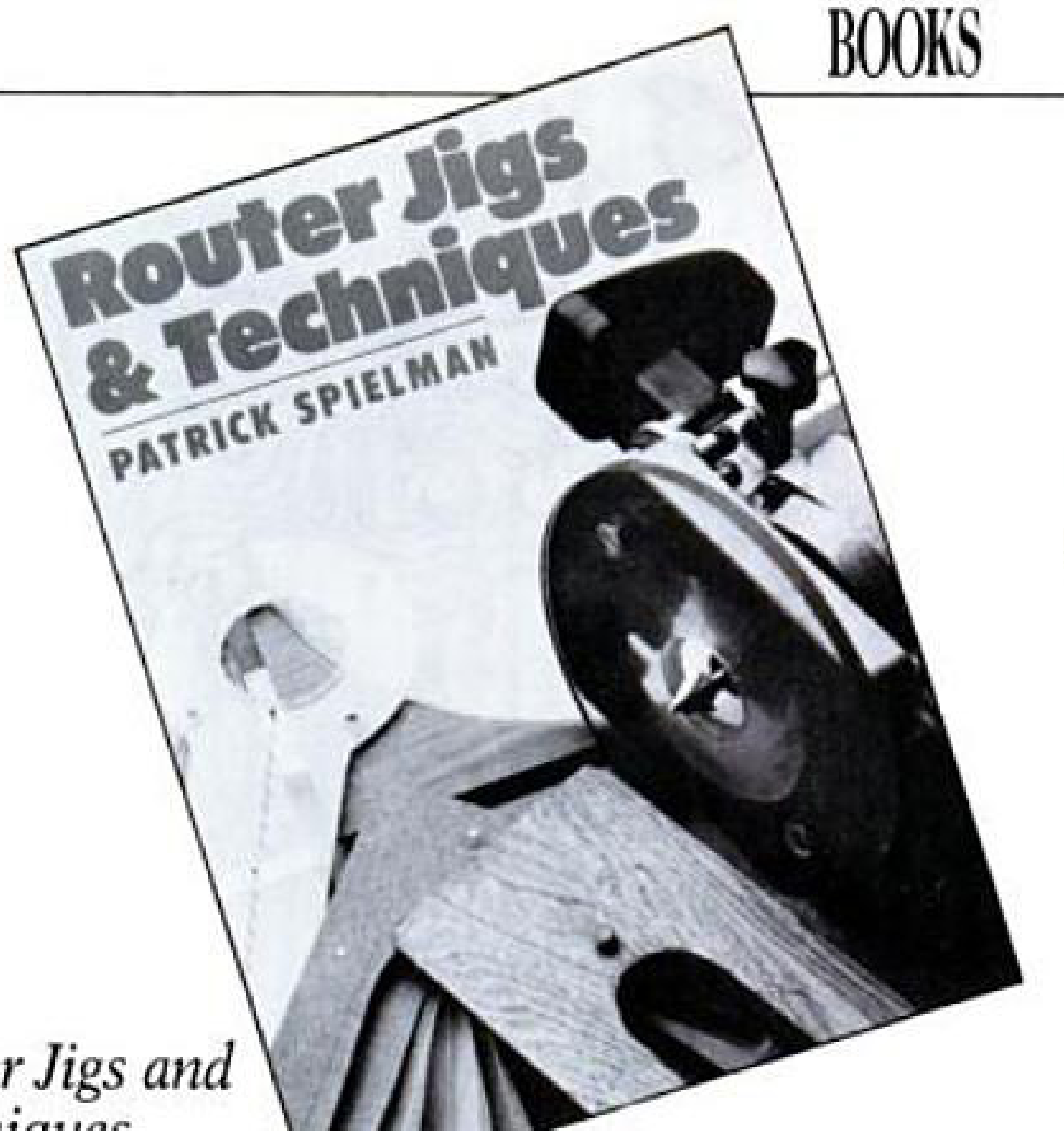
David Sloan is editor of AMERICAN WOODWORKER.

FOR MORE INFORMATION

For further reading on Mission furniture, see the following books:

- *Furniture of the American Arts & Crafts Movement: Stickley and Roycroft Mission Oak*, by David M. Cathers (1981, Apollo Books, 5 Schoolhouse Ln., Poughkeepsie, NY 12603).
- *Stickley Craftsman Furniture Catalogs* (1979, Dover Publications, Inc., 31 E. 2nd St., Mineola, NY 11501).
- *Making Authentic Craftsman Furniture: Instructions and Plans for 62 Projects*, reprinted from "The Craftsman" (1986, Dover Publications, Inc.).
- *Mission Furniture: How to Make It*, by Popular Mechanics Staff, reprint of 1909 edition (1980, Dover Publications, Inc.).
- *Mission Furniture of L. & J.G. Stickley*, edited by Stephen Gray (1983, Turn of Century Editions, 250 W. Broadway, New York, NY 10013).

BOOKS



Router Jigs and Techniques

by Patrick Spielman
(1988, Sterling Publishing, 387 Park Ave., New York, NY 10016) 383 pp; paperback, $14.95.

In *Router Jigs and Techniques,* Patrick Spielman brings us up-to-date on the never-ending flood of new products, and ideas extending the usefulness of one of the mainstays of the modern woodworker—the router. Spielman's first book on the subject, *Router Handbook* (also from Sterling) has become a classic of instructional literature, with well over half-a-million copies in print.

With this in mind, a sequel to *Router Handbook* was, of course, inevitable, but a lame follow-up it's not. There have been so many innovations and developments in the field, that *Jigs and Techniques* needs nearly 400 pages to cover the more important ones.

The book starts with a comprehensive section on bits, including chapters on developments and innovations, quality, selection, and a long chapter called "Special Bits" that illustrates many of the new specialty bits on the market.

Spielman deals with safety and safety devices in the next section, then moves on to Part III, "Commercial Aids and Devices," and Part IV, "Commercial Router Machines." All kinds of commercially available devices are reviewed in these chapters, from straightedge clamps to joint-making machines. After a short description and a listing of each item's capabilities, Spielman gives the name and address of the manufacturer. This feature alone makes this book an invaluable shop aid.

Spielman goes on, in Part V, to explain and illustrate nearly 100 pages of "shopmade jigs, fixtures and useful devices." This is the real hardcore, how-to section of the book, where inventiveness reigns supreme. Spielman reveals numerous delightful tricks and techniques, that will expand your woodworking repertoire without damaging your pocketbook.

The final section of the book is entitled "The Ultimate Router Table." Here, Spielman spends several chapters describing his version of the ultimate router table, complete with photographs and drawings. He's packed enough ideas into his system to make it, at least, the penultimate, if not the greatest, pie-in-the-sky of all router tables.

If you're like me, you tend to get set in your ways of doing things. *Router Jigs and Techniques* woke me up to numerous possibilities of improving and streamlining my work routines and therefore, I highly recommend it.

JOHN BIRCHARD

Classic Architectural Birdhouses and Feeders

by Malcolm Wells
(1988, Malcolm Wells, 673 Satucket Rd., Brewster, MA 02631) 92 pp; paperback, $9.95.

Don't let the title fool you. This little book is *not* about building a Taj Mahal for tanagers or a scaled-down "Tara" with perches on the portico. What it attempts to do, and accomplishes rather nicely, is to get you thinking about birdhouse design. *Thinking* about birdhouse design? You bet.

Malcolm Wells, architect and author of several books on energy-efficient housing design, takes a hard look at the classic six-board bird box and finds it wanting—both functionally and aesthetically. Wells makes the case that birdhouses and feeders should mimic birds' natural habitat. He backs up his point with dozens of sketches of imaginative examples.

The rest of the book is devoted to plans for more than 20 houses and feeders. Most can be built from scrap wood and found materials with a bare minimum of tools. While most of these structures are easy to build, don't look for much hand holding on the how-to. Wells supplies architect-style working drawings and written comments about key points.

In addition to feeders and houses, there's a chapter showing how to cast birdbaths by pouring concrete into a bowl-shaped hole in the ground—something I plan to try.

If you're a thinker and a builder who appreciates innovation, I recommend this book. Wells' unusual designs are bound to tickle your fancy and fire up your creativity.

DAVID SLOAN

VIDEOS

Faceplate Cabinetmaking

Five-part series with Dr. Roger Cliffe (1988, Vidwood, P.O. Box 116, 511 S. 2nd St., DeKalb IL 60115) VHS and BETA; length: 5½ hrs.; $29.95 each, $139.95, set.

Watching Roger Cliffe through all five videos of *Faceplate Cabinetmaking* is much like watching a teacher with his first class. Dr. Cliffe has many years of experience teaching college and lecturing around the country. But, through the five videos, we see Cliffe develop from a nervous and easily flustered, rather stiff and occasionally ill-prepared presenter to a smooth, comfortable, focused, and even humorous teacher.

Designed for the "amateur or novice home-shop woodworker," the set begins with an introduction to building the carcass of this style of cabinet, moves to Basic and Advanced Drawers, and in turn to Basic and Advanced Doors. The set of videos deals with what it advertises—and is specifically *not* a how-to on machine usage, sanding, or finishing, although these topics are dealt with when pertinent to the cabinetmaking. In approximately 5½ hours we are taken through the entire process of constructing the cabinet, shown alternatives and variations in both the materials and means, and then are generally shown how to make one of the less demanding types. Notably, basic shop tools and equipment are used.

All the videos could basically stand alone, but are best seen either as a group or in one of the "sets" mentioned above. They definitely make the most sense as a whole, in that some of the information given in one often fills a gap in another.

Each video begins with a note about the use of guards, and this use is underscored in actual tool operation. Guards are used wherever possible, as long as they don't block our view. Push sticks and backup boards are in use throughout. The sound is clear and even, and voice-over is selectively used, and there are no messy power cords. Planning, organization, and the use of drawings are uniformly stressed. Another feature of Cliffe's method of instruction is that not everything fits slick and tidy the first time. He repeatedly gets the cut close, and then takes us through the adjustments necessary to the proper fit.

Now, about Video 1, "Building the Cabinet." This one needs to be reorganized and re-shot, or lengthened into two. The amateur will gain from the overview, but the novice will suffer in ignorance, because a fair amount of information is not provided. While a basic introduction *is* given, there are terms, concepts, and materials constantly introduced with no explanation.

Also in Video 1, Roger and his camera crew are seemingly fresh to the game. Very few close-ups are used, and they are roughly executed. Most of this magically changes with Video 2, the "Basic Drawer" and simply gets better through to Video 5, the "Advanced Door" cassette.

We get solid coverage with the Drawer videos. Good information is provided on types, their parts, and an array of joinery. There is lots of information on hardware, its features, fit, and application. We also begin to see a more comfortable Cliffe.

"Basic and Advanced Doors" are the best two tapes of the series. "Basic Doors" is simply *packed* with information. By now, Cliffe has a plan and everything needed to deliver it. We get samples, models, unglued parts and assemblies, nomenclature, options, tolerances, and clear explanations as to *why* things are the way they are. There are not only lots of close-ups, but they are smoothly done, they're in tight, they give lots of visual information. What seems to be the true Cliffe emerges.

These tapes are not the stuff of art furniture nor hand-cut dovetails. Cliffe shows how to produce solid, functional cabinetry. It is done with common materials, understandable techniques and tolerances, and ordinary equipment. The set of five videos is very informative and should have wide appeal.

STEVE LOAR

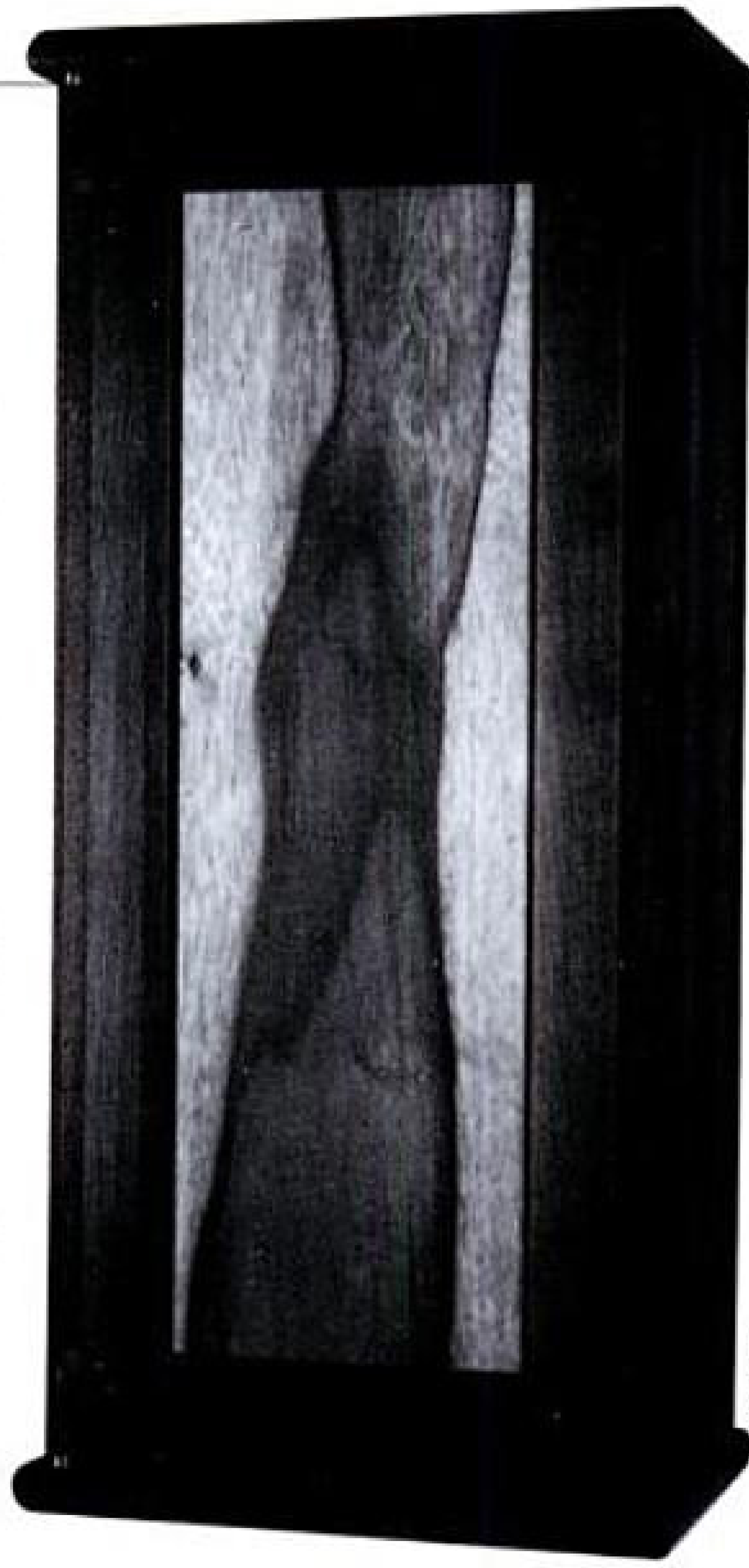
"Going with the grain" is a phrase that's taken quite literally at the Fine Furniture Program at the College of the Redwoods in Fort Bragg, California. Headed by master cabinetmaker James Krenov, the program aims to teach its students the complete craft of woodworking, with the emphasis on *wood.* Krenov and his staff encourage in their students, a passion for the unique grain patterns and figuring inherent in wood. Students come to respect peculiarities that arise in the wood, often turning a "defect" into an asset within their designs. The year-long, intensive program stresses practical design and construction, using methods both old and new. Shown here are just a few examples of the fine work done in the program.

BRIAN ROY

Coffee Table by Brian Roy, Elizabeth Lake, California. Shedua. Dimensions: H: 16 in., W: 16 in., L: 34 in.

DAVID RYAN

Library Cabinet and Chairs by Timothy Coleman, Greenfield, Massachusetts. American cherry, Honduran rosewood, parquetry. Dimensions: Cabinet, H: 59 5/8 in., W: 35 in., D: 14 in. Chairs, H: 31 in., W: 26 in., D: 21 5/8 in.



JIM FULLER

Wall Cabinet by Jim Fuller, Sebastopol, California. Granadillo, wenge. Dimensions: H: 22 in., W: 9 in., D: 7 in.

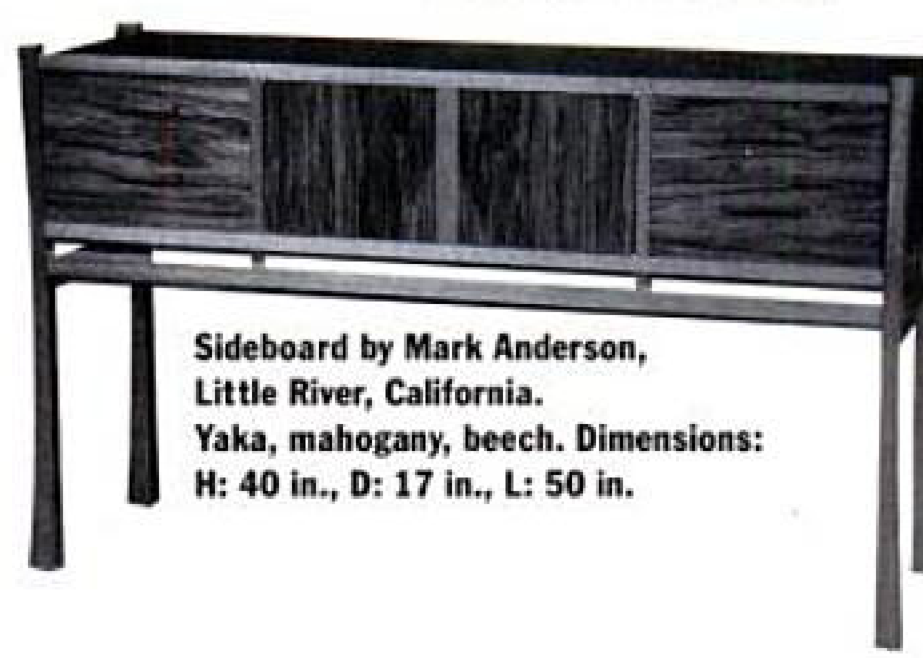


PHOTO BY SEAN SPRAGUE

Sideboard by Mark Anderson, Little River, California. Yaka, mahogany, beech. Dimensions: H: 40 in., D: 17 in., L: 50 in.

PHOTOS BY SEAN SPRAGUE

Musical Jewelry Box (open).

Musical Jewelry Box by Jim Fuller, Sebastopol, California. Partridge wood, unknown wood, suede, musical works. Dimensions: H: 4 3/4 in., W: 12 in., L: 23 in.

GALLERY

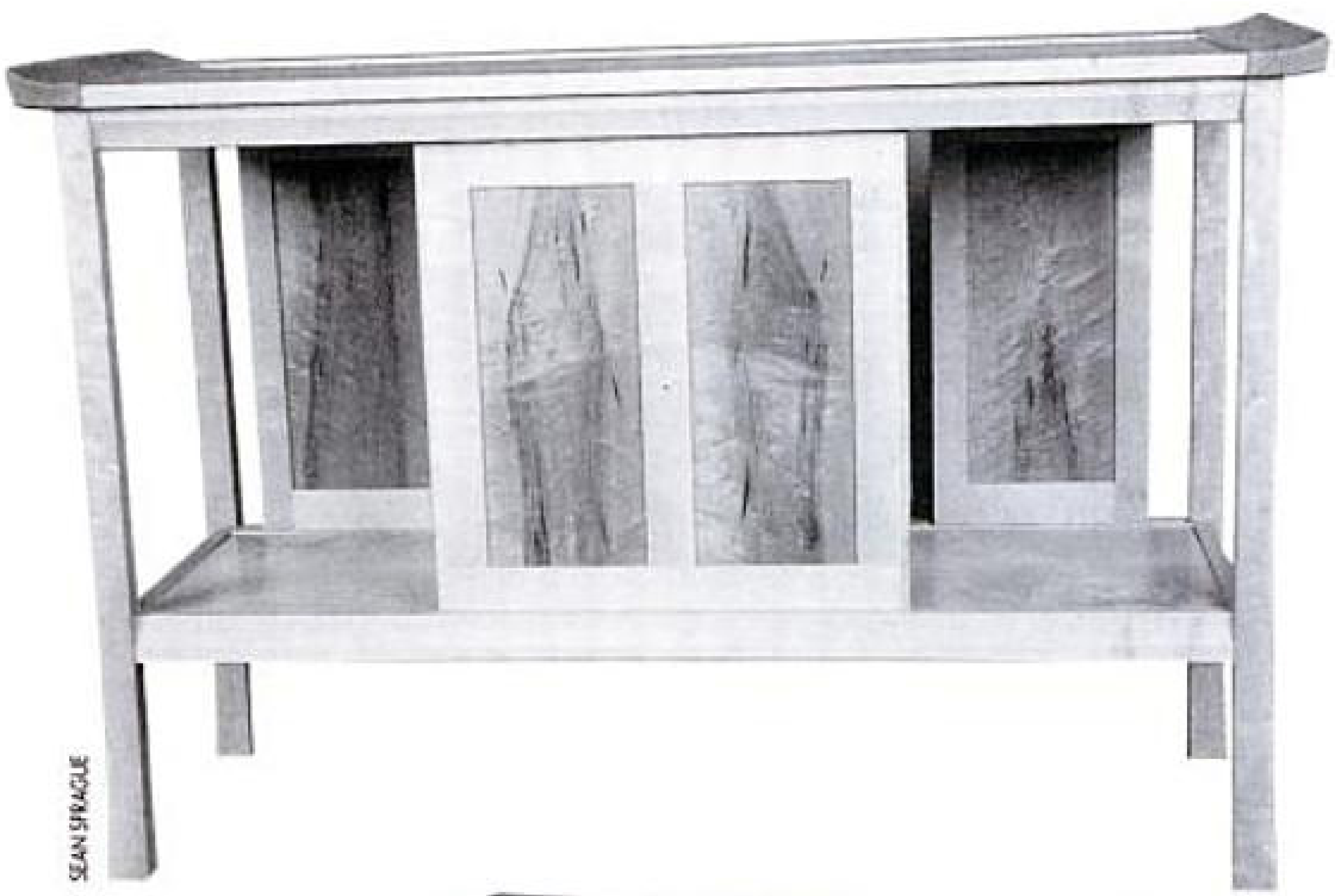
Cherry Wall Cabinet (open).

PHOTOS BY MICHAEL GIDRON

Cherry Wall Cabinet by Michael Gidron, Fort Bragg, California. Cherry, curly cherry, Honduran rosewood. Dimensions: H: $27\frac{1}{4}$ in., W: $16\frac{3}{8}$ in., D: $7\frac{1}{4}$ in.

Display Top Coffee Table by Ted Lombard, Ventura, California. Teak, maple, glass, white sand. Dimensions: H: 18 in., W: 25 in., L: 38 in.

SEAN SPRAGUE



SEAN SPRAGUE

Table for Display by David Ryan, Fort Bragg, California. Maple. Dimensions: H: 37 in., D: 17 in., L: 51 in.

SEAN SPRAGUE

Jewelry Box by Susan Detjens, San Anselmo, California. Cherry, curly maple, applewood. Dimensions: H: 5 in., D: 9 in., L: 12 in.

SEAN SPRAGUE

Wall Cabinet by Joseph Nattress, Bolinas, California. Eastern walnut, macassar ebony. Dimensions: H: 26 in., W: 30 in., D: 7 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 in. × 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.*

RICH RISKI

From left, William Earls, Frank Waleczak and Randall Smith give their time making toys, brightening Christmas for needy children.

Working on Their Convictions

At Clallam Bay Corrections Center in Clallam Bay, Washington, months of Christmas preparation have finally ended—ended in smiles, that is. A handful of inmates spent the last few months as Santa's helpers, fashioning toys for children who otherwise would not have gotten much.

These men are participants in the Clallam Bay Inmates Care Program, which is loosely based on the Toys for Tots concept, but with a twist. These fellows don't just donate the toys, they make them.

Interested inmates spend free time working in the prison's shop handcrafting the wooden toys that will go to needy kids at Christmastime. The number of participants is limited to five, and there is a waiting list of several months. Community and prison volunteers donate their time and expertise to supervise the design and building of these playthings.

The lucky recipients of this year's toys ranged from the area food bank and Salvation Army to the Department of Social and Health Services. Toys this year included logging trucks and walking ducks, planes, trains and automobiles and a menagerie of pull toys.

Because the prison is state run, it can not spend its funds to operate this community program. That means, to keep it going, all materials must be donated. Needed most are non-toxic paint, brushes and wooden dowels. If interested in giving, call program director Michael LaFreniere at (206) 963-2000, and let these guys make Christmas come again.

NANCY WALLACE HUMES

A.S.O.F.A. to the Rescue

During the past year, an organization has formed for the sole purpose of promoting "art furniture" and the artists who make it.

This year-old group, called the American Society of Furniture Artists (A.S.O.F.A.), is one of the only national organizations for the professional designer/craftsman. The A.S.O.F.A. has a two-fold function. It serves as a pipeline for ideas and information to its designer members, and acts as a liaison between these designers and galleries, museums and buyers.

A monthly newsletter keeps members up-to-date on trends, and legal and marketing aspects of running a custom-furniture business. In addition, a slide catalog of members' work is available to buyers, interior designers and exhibitors.

A.S.O.F.A has two types of membership, Professional and Affiliate. The Professional level is based on a juried selection procedure, and so far, 50 designers have qualified. Recently, the Affliate category was added for businesses and non-professional individuals. For information, write: A.S.O.F.A., National Headquarters, Attn: Membership, P.O. Box 270188, Houston, TX 77277.

DAVID SLOAN ITEMS COURTESY OF CORT MOORE

The tagua nut, cut open at right, has a meat so much like ivory in look and feel, that only an expert knows for sure. Tagua can be carved like this 1¾-in. geisha from Hong Kong, or turned, like this small bowl.

Alternatives to Ivory

What has a trunk, a rough, wrinkly skin, is as tall as a house, and provides ivory? An elephant, you say? No, actually it's a South American palm tree that grows tagua nuts. The meat of the nut has a texture and color so similar to ivory, that to the untrained eye, they are indistinguishable from each other.

Tagua nuts come from the *Phytelephas Macrocarpa* palm, a native of the Andes mountains in Ecuador, Colombia and Peru. These nuts are prized for their hard, white, close-grained ivory-like flesh. In fact, this "vegetable ivory" looks and feels so much like ivory that it's hard to tell the two apart.

Tagua has long been used in buttons, thimbles and skrimshaw. Today, it appears in such common items as earrings, dice and inlays. Because it can be carved, turned, embossed, dyed and polished so easily, its other possibilities run almost as high as an elephant's eye.

Tagua is increasingly popular in Japan for carving and in Europe, where it is viewed as an ecological alternative to ivory. If it caught on world-wide, it just might help save the elephant from extinction.

Tagua nuts, also called ivory nuts, are available from Woodcraft Supply, 210 Wood County Industrial Park, P.O. Box 1686, Parkersburg, WV 26102. NANCY WALLACE HUMES