

RODALE'S

AMERICAN WOODWORKER

APRIL 1993 #31

**BUILD THE
ULTIMATE
CHOP SAW
STATION P. 28**

▶ **ROUTER JIG
FOR PERFECT OVALS**

▶ **FRAME & PANEL
BASICS P. 22**

▶ **PLUS PLANS:**
• CHEVAL MIRROR
• PORCH BENCH
• BOOK RACK



WE RATE **5** NEW
MITER SAWS

C O N T E N T S

RODALE'S AMERICAN WOODWORKER

Issue No. 31 March/April 1993
Cover Photo: John Hamel



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Page 22 Frame and Panel Door



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ANNOUNCING THE 1993 AMERICAN WOODWORKER



Spread the word. It's time to enter your best work in the 1993 AMERICAN WOODWORKER Excellence in Craftsmanship Awards competition.

Each year, AMERICAN WOODWORKER sponsors this awards program to promote high standards of workmanship and design and to formally recognize the talented and dedicated woodworkers who are producing superior work.

All woodworkers may enter. Amateur and professional entries will be judged separately. This year we've also added a new "student" category. To be eligible for this category, you must be enrolled in a woodworking school or furniture design school in 1993.

Separate prizes will be awarded in each category. The top amateur, professional, and student each will receive \$1,000 and a custom-engraved award. Second-place winners from each category will receive \$300 and an award certificate. Third-place winners will receive \$200 and an award certificate.

All woodworking projects are eligible to win: furniture, turnings, carving, sculpture, musical instruments, toys, etc. Entries will be judged for craftsmanship and design, but designs need not be original to win.

To enter, fill out the form on this page (or a photocopy), and mail it with a photograph(s) of the piece(s) you want to enter (up to three pieces per entrant). Photos can be color slides or color prints. (Include a self-addressed stamped envelope for return of slides. Sorry, prints cannot be returned.) On a separate piece of paper, describe each piece in 100 words or less.

Deadline for entries is September 1, 1993. Finalists will be contacted for additional information and winners will be announced in the February 1994 issue of AMERICAN WOODWORKER.



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33 E. Minor St.
Emmaus, PA 18098

I agree to abide by the rules and to accept the judges' decision as final.

SIGNATURE _____

Deadline for entries is September 1, 1993

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LETTERS

Alternative Turnout

I'd like to suggest an alternative to the turnout leaf supports on Mitch Mandel's harvest table (AW #30). The problem with turnouts is that you have to poke around under the table to find them. Instead of turnouts I prefer pullout supports that slide in and out at right angles to the apron. The pullouts slide in notches cut in the apron and protrude slightly so they're easy to grab. I screw wooden guide brackets to the underside of the top to keep them from wobbling. To make them comfortable to grab, I rout depressions with a core-box bit and a plunge router.

Bernhard Hoffer
Chico, CA

Wrinkled Look Is Out

After seeing your December cover (AW #29) my wife said, "Don't you think they could have the guy on the cover put on a shirt that wasn't wrinkled?" I agree with her and wonder why you would allow this to happen. I'd love to be on your cover and would even iron my shirt.

Bryan Kopesky
Cordova, TN

Thanks for the offer, Bryan, but having a well-dressed guy like you on the cover might ruin our image.

Don't Waste That Wood

Re: "Fire Palaces" (AW #29). The fruits of pyromania may look spectacular but I think we could come up with a better use of scrapwood. The stuff you're calling scrap is bigger than most of the components of the projects my special education and regular education students complete. Save the fires for heating purposes

and try to find somebody with a limited budget who'd welcome free wood.

Tom Albrecht
Evanston/Skokie School District
Evanston, IL

Sharpening Advice

Re: "Sharpening Turning Tools" (AW #30). Stephen Blenk lists M2 as an "exotic hard steel" when in reality virtually all the high-speed steel turning chisels on the market are made from M2 [or] M7. The A11 steel that Jerry Glaser uses [in his turning tools] is not a high speed steel. It is a cold work steel that was developed by my company. Mr. Blenk also implies that D2 [steel] can be subjected to high grinding temperatures in the same way high-speed steel can. This is incorrect because D2 is a cold work tool steel.

[With regard to] grinding wheels, while I will not argue with his apparent success, the carborundum wheel to which Mr. Blenk refers is not proper for grinding any type of tool steel, carbon or high speed. Carborundum is man-made silicon carbide, which is used to grind cast iron and tungsten carbide. Your readers should be advised against using carborundum wheels for grinding tool steels.

Carl Dorsch
Pittsburgh, PA

Most metallurgists believe that [quenching] hot tools fresh off the grinding wheel will shorten the edge life by causing micro-cracks at the edge. My recommendation is to grind gently with a freshly dressed wheel and cool the tool in the air or by laying it on top of the lathe bed or any other large chunk of iron which will help absorb the heat.

Along with the discussion of grinding, there should be a reminder of what kind of sparks come off a grind-

ing wheel when high-speed steel or high carbon steel is ground. The sparks are so distinctive that it is almost impossible to mistake one for the other. Each tool steel has its own spark "signature," but it's not necessary to learn the many types. The only thing a turner should learn is to recognize the type of spark given off by high carbon tool steel. With that knowledge he can grind each tool with the proper respect it deserves.

Jerry Glaser
Playa del Rey, CA

Project Prompts Praise

As I am writing this the final coat of spar varnish is drying on the display cabinet I have built for my wife. I would like to thank Ellis Valentine for this wonderful project (AW #28). It's a pleasure to build and display, and even more enjoyable to field the positive comments from friends and neighbors.

Stan Kuczynski
Orlando, FL

Lighten Up

To thin-skinned Texans, china cabinet bashers and those who don't like nasty boxes: get in the shop and loosen up.

Joseph Beals
Volcano, CA

Turn Old Saws Into Scrapers

Re: Stanley 12½ veneer scraper (Q&A, AW #28). Fine steel scraper blades are very difficult to obtain, but quite often an old damaged Atkins or Disston handsaw can be had very cheaply. By cutting grooves at right angles to the teeth with a three-cornered file and breaking off [the teeth] in a vise, you can get very fine scraper blades.

R.H. Coleman
Decatur, GA

LETTERS

Bravo on Boxes

Enjoyed the "Nasty Boxes" article (AW #29). I made about 20 so far that include a pumpkin head ghost, a rabbit, mice and the snake. I would like to see more on toys and games from the past.

Edwin Leavitt IV
Gloucester, MA

Quality Photos Take Skill

Re: "Photographing Your Work" (AW #30). I must take exception to the statement, "You don't have to be an expert to take professional-quality shots." Much like wood-working, the craft of commercial photography involves lengthy studies, combined with costly trial-and-error experience, to gain a basic understanding of the medium and

tools. Most woodworkers could probably hire a local professional photographer to shoot completed projects for less expense and trouble than that involved in acquiring the camera, lights, stands, reflectors, backdrops and experimenting.

Robert Noel Clarkson
Clarkson Studio Photography
Helena, MN

Don't Drop Your Guard

Re: Ripping square blanks into octagons, ("Dealing with Shop Scrap," AW #29). You would have made your case a much safer one by showing the saw guard in position. Too many "professionals" see danger in using the guard on the saw and they determine they can work safely without it. A novice

may get the same idea and lose a finger in the process.

Donald F. Kinnaman
Phoenix, AZ

Turned on by Turning

I was just delighted by the article on turning Victorian ornaments (AW #29). Stephen Blenk's fine article went right to my shop where it will be put to good use.

Nate Roth
Monroe, WI

What's on your mind? We value your comments, complaints and corrections. Send your letters to: "Editor," AMERICAN WOODWORKER, 33 E. Minor St., Emmaus, PA 18098, or telephone your message to our Letterline: (215) 967-7776. FAX: (215) 967-8956.

D.C. Mitchell

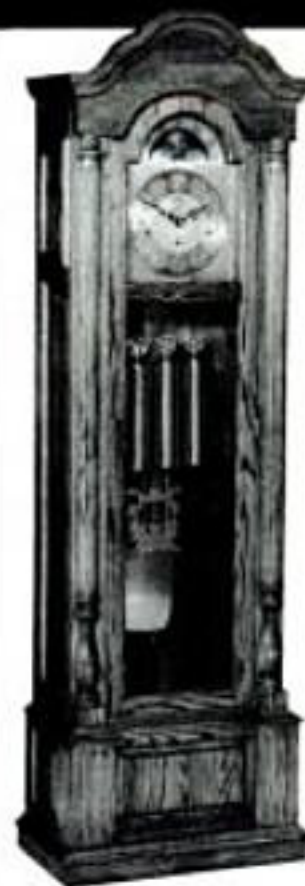
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Alternative Uses For the Drill Press

Q *I've seen accessories that turn a drill press into a routing or shaping machine, and I've heard that you can do sanding and lathe work as well. Is this possible?*

Robert Skar
Glen Ellyn, IL

A A drill press is not an *effective* tool for routing or shaping. First, it does not generate the necessary speed. Most cabinet shop drill presses scarcely go over 3600 rpm, while standard routing speeds range from 12,000 to 20,000 rpm and shapers, typically, from 5,000 to 8,000 rpm. Second, the power of a drill press is insufficient for this kind of work, especially shaping. Most shaper motors are at least 3 HP; drill press motors are typically 1 HP or less. Third, a drill press is designed to take thrust loads, not the side loads common to shaping and routing.

While a drill press will do an excellent job as a spindle sander (see AW #30), as far as lathe work goes, forget it—it's an awkward setup at best.

Bill McCarthy
Cabinetmaker
Riegelsville, PA

Laminating Chair Braces

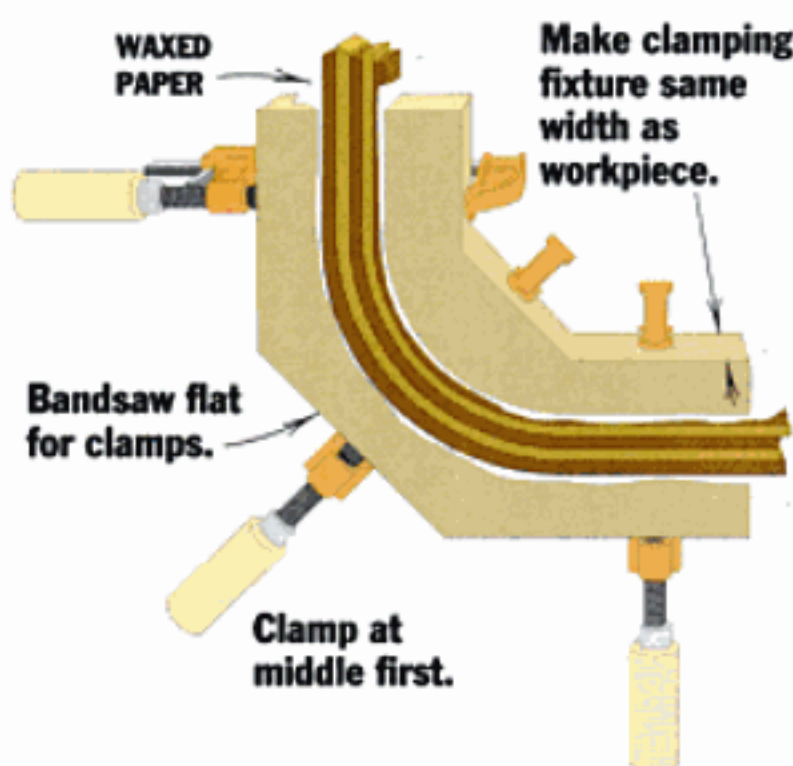
Q *I'm repairing some kitchen chairs, and need to replace the curved braces that strengthen the seat-to-back-leg joint. What's the best way to make these supports, and what kind of wood should I use?*

Noah Eagan
Findlay, IL

A Your braces were probably made from solid stock and steam-bent to form the curve. Steam-bent braces are suitable if they're thick enough and not subject to a lot of stress, but on this type of chair the area the braces support takes a beating. I suggest laminating the braces, using this simple clamping fixture to form

the curve. (See drawing.)

The wood you laminate should have enough tensile strength to resist breaking when it is bent. Hickory would be my first choice. However, any ring-porous wood, such as oak or ash, will bend well. Make sure your stock is straight-grained, preferably quarter-sawn, and cut thin enough ($\frac{1}{8}$ in. or so) to bend easily around the inside curve.



DRAWING BY GLENN HUGHES

If you glue up the strips in the sequence they come off the saw, the glue lines will be hard to detect, making the finished brace look like a solid piece of wood.

Andy Rae
Assistant editor

Hard and Soft Chisels

Q *My friend claims the steel in a woodworking chisel gets softer the farther you get from the edge. I argue that may be true of old chisels and new ones that are tempered by hand, but factory-made chisels today are the same hardness throughout because they're tempered in an oven. What's the truth?*

George Boyd
Jamaica, NY

A Your friend is essentially right—woodworking chisels *do* get softer the farther you get from the edge, but the *degree* to which this is true depends upon the type of steel used and how it was hardened.

Manufacturers harden a chisel by

heating a portion near the tip (known as "zone hardening") to around 1800° and then quenching it, usually in a solution of ethylene glycol. How much of the chisel they harden varies from brand to brand. Record Tools hardens just the first $\frac{1}{2}$ in. to 1 in. of their Marples-brand chisels. Stanley Tool Co. hardens the first 2 in. to 3 in., leaving the top of the chisel (the bolster and the tang) softer so it can "give" more if the chisel is misused. Robert Sorby Ltd. hardens chisels in three zones with the hardest being at the tip.

After hardening, the chisels are tempered to 400° to 450° in an oven and then cooled slowly to room temperature. This removes the brittleness left by the heat treating process but doesn't affect the hardened zones.

Dave Cann
Metal conservationist
Stockton, NJ

Routing Mullions Safely

Q *I'm making a corner cupboard with a glass door. How can I rout the small muntins and mullions and still maintain my fingers?*

J. Albert Hudson
Knoxville, TN

A There are two profiles you rout on a muntin: the ogee profile on the face and the rabbet for the glass on the back. You can help stabilize your stock for both cuts with a push stick and a feather board. Size the push stick so you can hold it flat against your router table fence and use it to direct downward pressure to your workpiece as you feed it past the bit. (See AW #27, page 29.) The feather board, or wooden spring, (see page 27) will direct pressure to the side of the workpiece to keep it from rotating.

When cutting the glass rabbets, attach a strip of wood to the outfeed side of your fence that is the same size as the rabbet you're cutting. This will provide a runner for your newly created rabbet to ride on as it exits the bit.

If your plan calls for coping the

Q & A

ends of the muntins, do that first so any tear-out will be removed when you rout the profiles and rabbets. When coping, I push the stock with a rectangular plywood scrap 8 or 9 in. wide that rides against the fence.

Ellis Valentine
Associate editor

Exporting Timber... and Jobs

Q I've read a lot about loggers being put out of work by environmental policies. Isn't there some way to manage our timber resources without hurting people or the environment?

Dale Richie
Salem, OR

A Over the last two decades, many Third World countries have addressed this issue by curtailing log exports. Naturally, these restric-

tions cost some loggers their jobs, but many more new jobs were created as sawmills and manufacturing industries grew.

India is an excellent example. In the early 1970s the Indian government suspended exports of valuable East Indian rosewood logs and severely restricted lumber exports as well. This policy increased demand for finished goods and led to more responsible logging practices aimed at sustaining yields.

In the United States, logging lobbies, which oppose any restrictions on log exports, overlook the fact that our wood industries lose jobs because they can't compete in world markets. Countries like Japan and Germany buy our timber at bargain-basement prices, then manufacture products for sale back to us at artificially low prices. They reap what we've sown.

Dick Boak
Luthier
Nazareth, PA

WHERE TO FIND IT

Gold leaf and other gilding supplies are available from Sepp Leaf, 381 Park Ave. So., New York, NY 10016, (212) 683-2840.

Epoxies (West System Brand) and related products are available from Gougeon Brothers, Box 908, Bay City, MI 48707, (313) 684-7286.

Metal screening (from bronze to stainless) is available from McNichols Co., 5505 Gray St., Tampa, FL 33609, (800) 237-3820.

Got a woodworking question for the experts? Send it to "Q&A," AMERICAN WOODWORKER, 33 E. Minor St., Emmaus, PA 18098, or telephone your question to our Letterline: (215) 967-7776. FAX: (215) 967-8956.

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TECH TIPS

Dowel-Drilling Jig

If you've ever found it frustrating to drill a hole in the end of a dowel you'll appreciate this simple jig, which fits in a machinist's vise. To make it, simply drill partial holes in a block of wood so about $\frac{1}{16}$ in. of each dowel will be exposed when you slide it into a hole. It's best to use Forstner (rim-guided) bits, since they'll cut clean holes at the edge of the block. If Forstner bits are scarce, clamp a piece of scrapwood to the edge of the jig and drill with a powerbore or paddle bit. When using the jig, put a wood pad between the dowel and the steel vise jaw so the jaw doesn't mar the surface of the dowel.

Tim Green
Lancaster, CA

Schoolroom Sanding Pad

Now that cork pads are hard to find, I've discovered that a chalkboard eraser makes an excellent sanding pad. It's just the right size to grip and the felt provides a flat, yet soft surface—just right for hand sanding. It's particularly useful for breaking edges and gives you a neat, uniform roundover.

David Schiff
Frenchtown, NJ



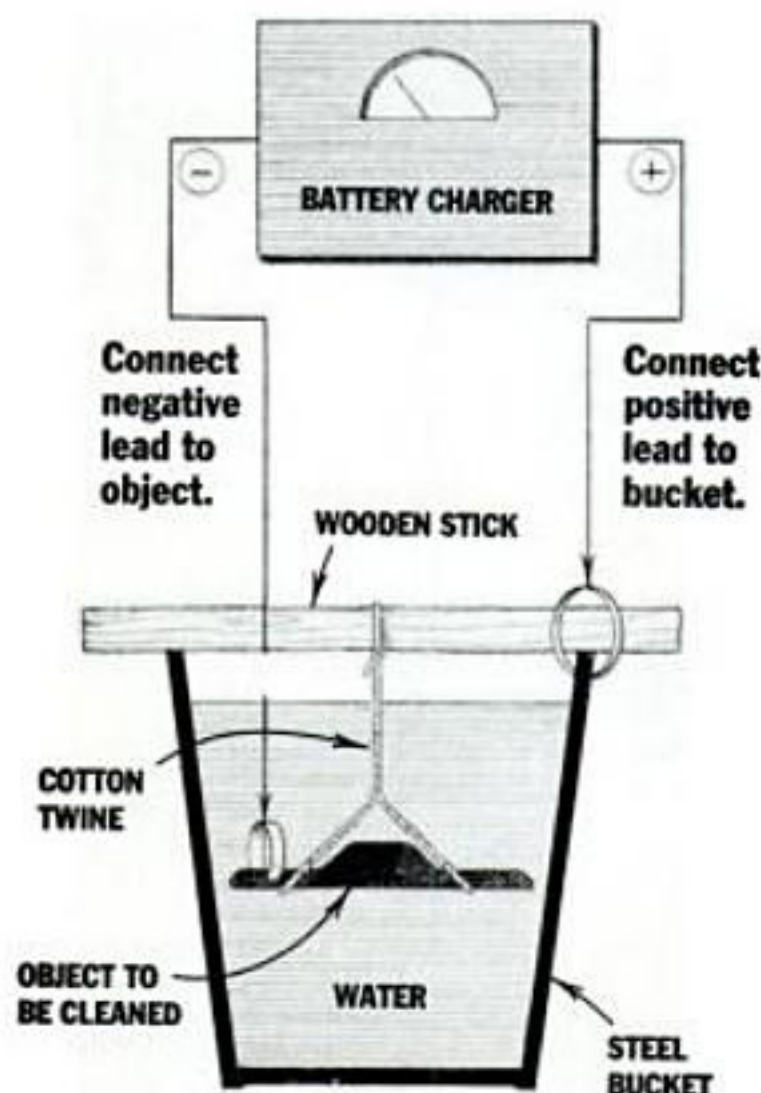
Make Your Own Foam Brushes

A roll of foam rubber weather seal can make hundreds of disposable brushes for just pennies apiece. Cut off the length you want—1 or 2 inches—peel the paper backing off the adhesive, and press the foam onto a wood tongue depressor or popsicle stick.

G.F. Hinderholz
Racine, WI

Electric Rust Remover

This device can bring unrecognizable lumps of rust back to useful forms. Here's how it works: You suspend the object to be cleaned in a steel bucket of water, then hook the negative lead from a battery charger to the object



and the positive lead to the bucket. When you plug in the charger the electric current will draw off the rust. I usually wait about 10 hours, then shut off the current and retrieve the object. After using soap and water to wash off the greasy black residue, I dry the object with an old towel and spray it with WD-40.

David Leard
Mobile, AL

Using Cast-off Casters

Taking up space in my "junk drawer" were a quantity of heavy swivel casters with bolt ends. Since I needed a roller stand I drilled holes on 3-in. centers in a piece of angle iron and mounted the casters so they were all the same height. I then attached the back of the angle iron to a 2x6 and screwed the whole assembly to a sawhorse. I adjusted the height so the rollers were level with the tablesaw or a fraction below it. I use the stand not only when ripping, but when cross-cutting long boards as well. The long row of casters gives just the added support needed.

Frank Mikus
Wescosville, PA

Velcro Tape Holder

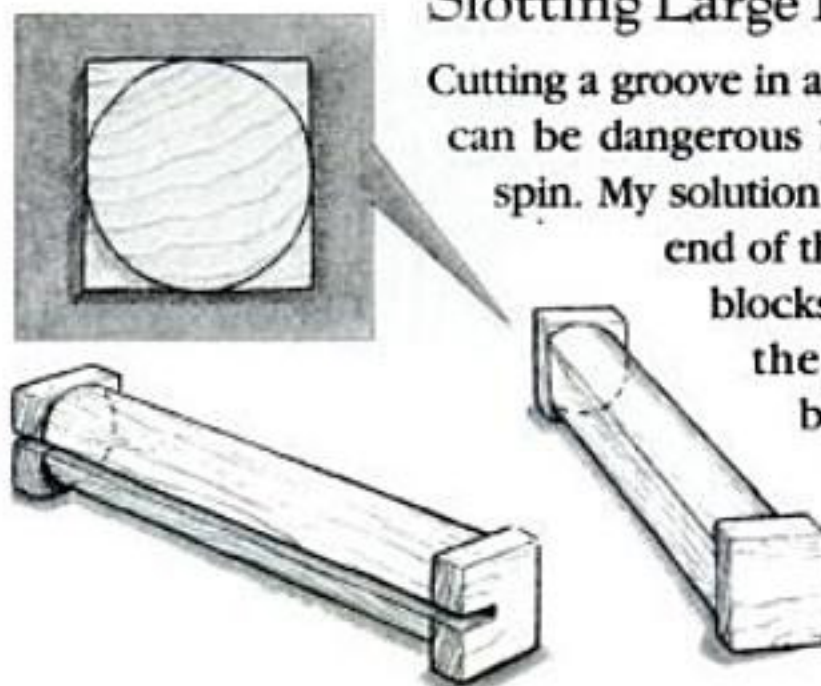
The spring clip that comes with most steel tapes often takes two hands to get back on the belt. I found this awkward, so I removed the spring clip altogether and epoxied a square piece of Velcro to the tape measure. Then I made a matching Velcro patch that I looped around my belt and stapled together. This tape holder is a great improvement.

Wesley Phillips
Greer, SC

Slotting Large Dowels

Cutting a groove in a dowel or sawing a flat on one side of it can be dangerous because the dowel has a tendency to spin. My solution is to simply glue square blocks to each end of the dowel. The length of the sides of the blocks must be the same as the diameter of the dowel (see drawing) and the two blocks must line up exactly so there is no wobble. Then you can go ahead and make your cut with perfect safety.

Yeung Chan
Millbrae, CA



TECH TIPS



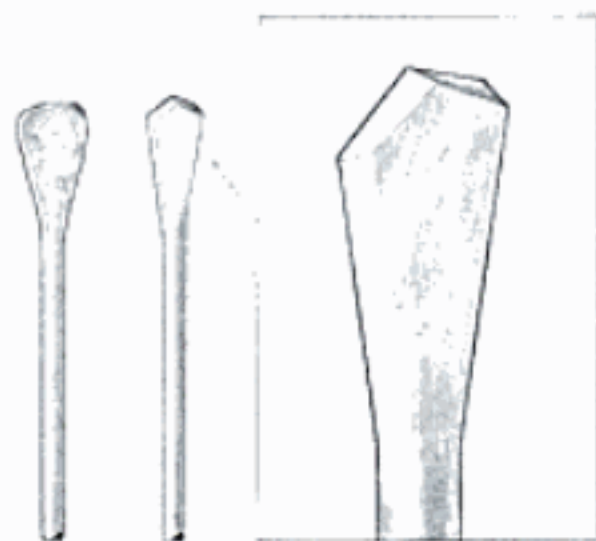
Taming the Router

When remodeling my kitchen recently I had to rout all the face frames flush with the cabinet sides. Rather than fill the room with dust and shavings I adapted a plastic gallon milk jug to pick up the chips. I attached the milk jug to the router base plate making a hole just big enough for the bit. Then I pushed the 1-in. hose of my shop vacuum onto the neck of the bottle, fired up the vacuum and router, and trimmed the face frames with minimal mess.

Mike Cholod
Bensalem, PA

More on Homemade Drill Bits

H.R. McDermid's Tech Tip (AW #30) on homemade drill bits reminds me of an old boat builder I used to work with, Jim Smith. Jim kept a roll of heavy galvanized fence wire in his shop. Whenever he needed a fresh bit for his



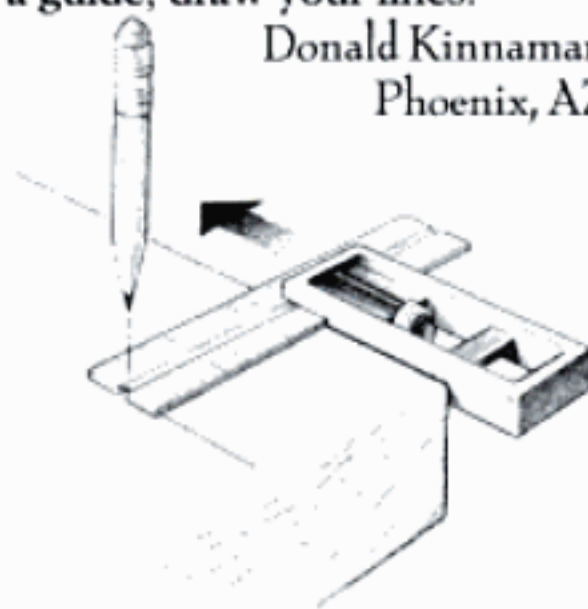
drill he would cut off about a 4-in. length of wire, straighten it and then flatten one end on an anvil. (See drawing.) His final step was to grind the end to a diamond-shaped point on a bench grinder. These homemade drills didn't last forever, but it was only a two-minute job to replace one. I've found that the wire in heavy-gauge coat hangers works equally well.

Pat Jordan
San Francisco, CA

Handy Marking Gauge

A 4-in. machinist's square is easily adapted to double as a marking gauge. Use a fine, triangular file to cut a small V-groove in the center of one end of the sliding rule. Put a pencil or steel scribe in this notch and, using the square's head as a guide, draw your lines.

Donald Kinnaman
Phoenix, AZ



Cleaning Gummy Blades and Bits

The tar and gum that build up on circular saw blades and router bits can increase friction, causing them to heat up and distort, and your wood to burn. The quickest and cheapest method I've found to remove these deposits is with Easy-Off oven cleaner. Just spray the blade or cutter, let it stand for a few minutes and then rinse it off with water. It works every time.

Cary Lowrance
Orland Hills, IL

Low-Tech Blade Cleaner

The quickest and most effective way to clean blades that I know is to use a solution of household ammonia and cider vinegar (1 cup of cider vinegar to 1 quart of ammonia). First, I soak a blade in the solution for an hour or two then I lay it on a wad of newspaper and pour on a little of the mixture. Finally, spread around the mixture with 000 steel wool and watch the tar and pitch melt away. After cleaning, I dry the blade and wipe on a dry lubricant such as Dri-Cote.

Bob Colpetzer
Clinton, TN

Magnetic Key Holder

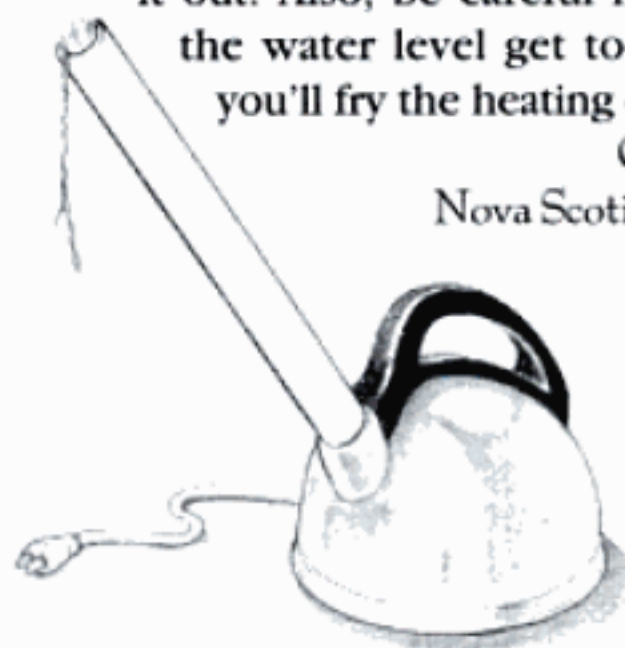
Having the drill press key at the end of a chain is a dangling nuisance. I finally epoxied a small magnet (from an old loudspeaker) to the feed handle hub and stuck my key to it. Now the key is right where I want it with no entangling chains or cords. Magnets also work well on other machines. I added two pieces of self-adhesive magnetic tape to my bandsaw (inset) and now have a handy place to store the allen wrench I use to adjust the guide blocks or thrust bearing.

Pat Sanders
Palm Beach Gardens, FL

Fast Steamer

When steaming small pieces of wood for models, I just stick a piece of PVC pipe, 10 or 15 in. long, into the spout of an electric kettle. You have steam, and plenty of it, in minutes. Tie a length of string to the end of the stock so you don't burn your fingers getting it out. Also, be careful not to let the water level get too low or you'll fry the heating element.

Guy Bush
Nova Scotia, Canada



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 \$50 if we publish your tip.

*A Primer on One of the Basics
of the Cabinetmaker's Craft*

BUILDING FRAME AND PANEL DOORS

BY PETER KORN

Made with a panel that floats inside a frame, this door can cope with seasonal wood movement.

MITCH MANDEL

There are three things in life you can't escape: death, taxes and wood movement. But if you're clever you can painlessly cope with the last one, as woodworkers of old did when they invented frame and panel construction.

Frame and panel construction has been around at least since the time of the pharaohs (examples were found in King Tut's tomb), and it is still the preferred method for creating wide, stable surfaces out of solid timber. The rela-

tively narrow frame components remain stable with changes in moisture, while the wide panel, which is more susceptible to wood movement, floats in a groove. (See Fig. 1.) Since it's free to move, the panel won't split, or distort the frame, as it would if it were glued or nailed in place. And the frame provides rigid support to keep the panel from cupping.

If you're building projects that have large surface areas, such as doors, cabinet backs and sides, and wall paneling,

frame and panel construction is often your best choice. And it's fairly easy to master. In this article I'll explain how to make one simple variation on the frame and panel theme: a cherry cabinet door that has an arched frame and a raised panel. Though you could easily construct this door entirely with power tools, I used a combination of hand tools and power tools because I wanted a bevel on the panel that I couldn't create with my stock shaper and router cutters.



To keep the router bit from grabbing the workpiece, the author uses a single point fence while grooving the curved rail.

you could easily make them with a router or tablesaw. (For more on mortise and tenon joints, see AW #18.)

However you cut them, you'll want to proportion the parts for the greatest strength. My rule of thumb is to make the mortise one-third the thickness of the stock. This gives you a strong tenon while maintaining enough thickness in the wood surrounding the mortise.

Curving and Grooving the Frame

After fitting the joints, mark out and cut the curved arch on the top rail. To do this, I used a tracing taken from my full-scale drawing. Then I bandsawed the curves and cleaned up the saw marks on the convex side with a block plane. On the concave side I use a spokeshave and scraper. I could have used a stationary sander, but hand tools communicate the fairness of curves to my hands in a way that sanding can't match.

The next step is to cut the grooves for the panel in the stiles and rails. I used a 1/4-in. slotting bit on the router table. This bit has a bearing that limits the depth of cut to 3/8 in. I made sure I ran the parts with the same face down

Roughing Out the Parts

Before touching any wood for this door, you'll want to determine the curves for the top rail and panel. I made a full-scale drawing of the entire door and created the curve by flexing a steel rule to a shape that pleased me. The resulting arches, which are somewhat parabolic, interest the eye more than a section of a circle might.

Next, use your drawing to lay out the door components on rough stock, looking for balance and symmetry in the grain. At this point, I like to cut the rails to final length, but I leave the stiles long for trimming later. This

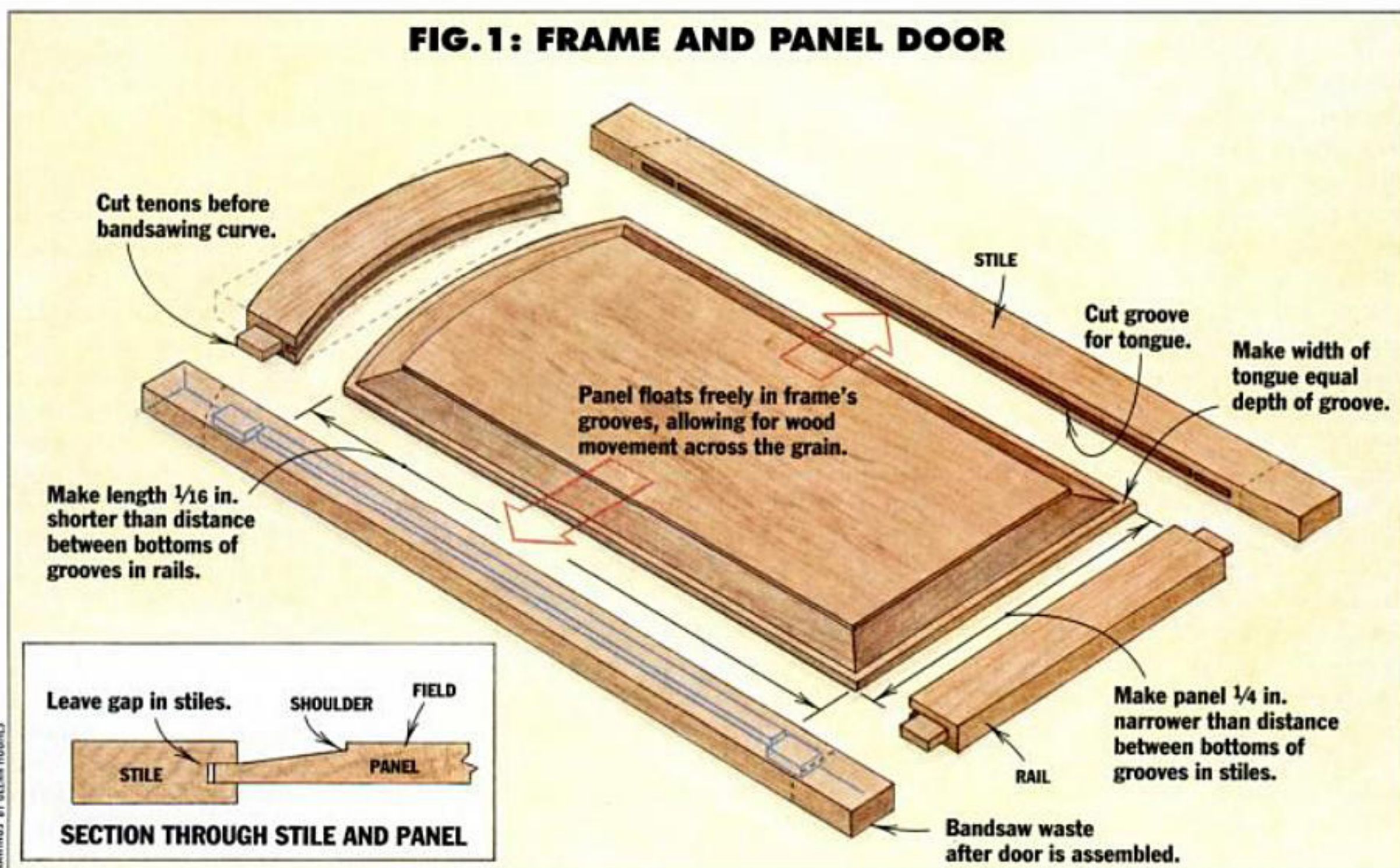
helps prevent the ends of my stock from splitting when I chisel the mortises. Also, I leave the arched top rail four-square to facilitate joinery. It's easier and more accurate to lay out and cut tenons on straight stock.

I planed the frame components for the door to 1 1/16 in., preferring this over 3/4 in. because the latter is so common it tends to bore the eye. Then I roughed out and milled the panel.

Cutting the Joints

With the parts milled, you can cut the mortise and tenon joints. I like to cut these by hand (see sidebar), though

FIG. 1: FRAME AND PANEL DOOR



on the table to ensure that the grooves would line up when I assembled the frame. It's also important to use stopped grooves in the stiles so the grooves won't show at the top and bottom of the finished door. I routed the stiles and the bottom rail against a straight fence, but for the curved top rail, I started the cut against a single-point fence to prevent the bit from grabbing the wood until it touched the bearing on the bit. (See photo, previous page.)

Then after routing, I squared the ends of the stopped grooves in the stiles with a chisel.

Making the Panel

There are four steps to making the panel. First, cut the panel to size. Then form the tongue that fits in the groove on the frame. Next, make the shoulder that defines the panel's field. Finally, finish the panel by creating the taper from the shoulder to the tongue.

When cutting to size, I made the panel $\frac{1}{16}$ in. shorter than the distance between the bottoms of the grooves in the rails. This way, I could be sure that nothing would bind during glue-up. For the width, I made the panel $\frac{1}{4}$ in. narrower than the distance between the bottoms of the grooves in the stiles to allow for expansion across the grain with variations in humidity. After jointing one edge, you can cut the other straight sides on the tablesaw. Then trace the curve at the top of the panel and bandsaw the arch. Smooth the saw marks with a block plane. Plane from each side toward the apex, in order to cut with the grain. When the plane blade makes contact along the entire sweep of a curve, the curve is fair.

Now form the tongue on the panel, aiming for a thickness that lets the panel move but not rattle in the groove when the door is assembled. For this door, I used a $\frac{3}{8}$ -in. rabbeting bit in my router table. The width of the tongue should equal the depth of the grooves in the frame. (See Fig. 1.) Wider panels will move more with changes in moisture content so increase the width of the tongue and leave more space for expansion in the stile grooves. After routing the tongue, I dry-assembled the door to make sure everything fit together.



A router fitted with a straight bit and rub collar (right) makes cutting the shoulder of the fielded panel easier. The author just runs the rub collar against an MDF template to cut the shoulder (above) and freehands the router past each corner to avoid rounding the corners of the field.



The panel has an $\frac{1}{8}$ -in.-deep shoulder around the field. (See Fig. 1.) To make the shoulder, I used a plunge router and a medium density fiberboard (MDF) template. I fit the router with a straight bit that projected through a rub collar, which would ride against the template. (See photo, above right.) Then I cut a template which was smaller than the actual field by $\frac{1}{16}$ in. on each side. The $\frac{1}{16}$ in. represents the distance from the outside of the rub collar to the edge of the router bit. I attached the template to the panel with double-stick tape and a couple of clamps. The tape kept the template from moving when I shifted the clamps halfway through the routing process.

To avoid rounding the corners of the field as I routed, I pushed the router straight past each corner and then came back freehand to begin the next edge. (See photo, above.) This requires a stiff arm and your full concentration. An alternative would be to make an auxiliary straightedge and clamp it at each successive corner as

you proceed around the panel.

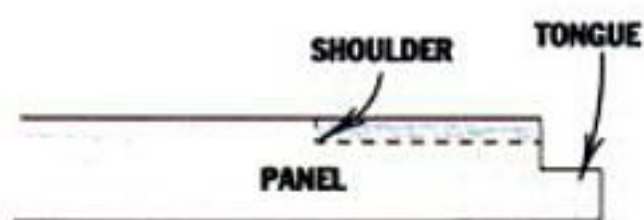
After routing the shoulders, keep the router on the template and remove the surrounding waste to the depth of the shoulder.

Now comes the part where well-tuned hand planes prove their worth: planing the taper between field shoulder and tongue, known as "raising the panel." I began with a block plane and worked with the edge against the field shoulders to rough-shape the taper. (See Fig. 2.) Then when the block plane began to skim the outside of the tongue, I switched to a shoulder plane to finish the taper. (See photo, opposite page, and Fig. 2.)

Finishing Up

With the panel raised, it's time to scrape and sand all its surfaces. Trying to smooth the panel after the door is glued together would be awkward, especially around the edges. If you are planning to finish the door with shellac, varnish or lacquer, you should pre-finish the panel now. If you wait until

FIG. 2: RAISING A PANEL



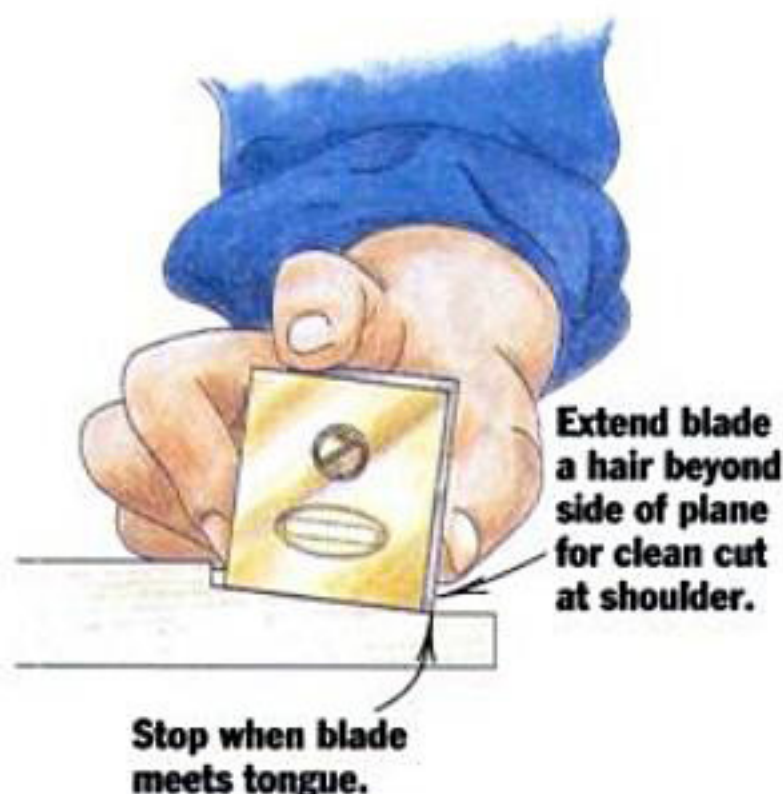
1. Rabbet tongue and rout waste to depth of shoulder.



2. Rough-shape taper with block plane.



3. Switch to shoulder plane and start at shoulder.



4. Shift plane and plane to tongue.



After roughing out with a block plane, author uses a shoulder plane to finish planing the taper.

the door is assembled, unfinished wood could appear at the tongues when the panel shrinks due to seasonal humidity changes. However, I generally finish with an oil/varnish mixture which easily flows into the frame grooves after assembly, so I can finish the door as an entire unit after assembly.

Once the panel is sanded, glue the door together, being careful not to let any glue touch the panel, which must float freely. Wash off squeezed-out glue with a damp rag and a stiff brush, paying special attention to interior corners.

When the glue dries, trim the waste from the extra-long stiles. To do this, first draw the continuation of the arched top rail onto the upper edge of the stiles, then extend a line across the stiles at the bottom of the lower rail. Bandsaw along both these lines. With a block plane, smooth the bottom of the door. Use a file to clean up the top arch, since a block plane will cut against the grain of the rail or stile at the point where they intersect.

Finally, hand plane the faces of the rails and stiles to make their intersections perfectly flush and to remove any

machine marks. Set your blade for a light cut when doing this to avoid tear-out.

Whenever possible, I let a glued frame dry for more than a day before planing the faces to allow any swelling at the joints (caused by moisture absorbed from the glue) to subside. Otherwise, I might plane a joint flush only to see it turn concave as moisture continued to evaporate.

The door is now ready for hinging. Once a door is hinged, I often touch up the edges with a plane for a perfect fit to the carcass. Then I scrape and sand the frame, apply the finish, and attach a handle and catch. ▲

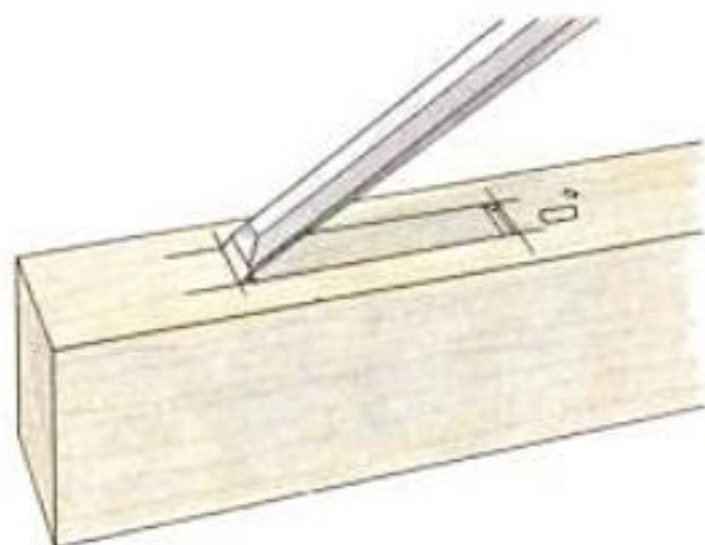


PETER KORN is director of the Center for Furniture Craftsmanship in Camden, Maine, where he teaches two-week workshops for beginning and intermediate woodworkers.

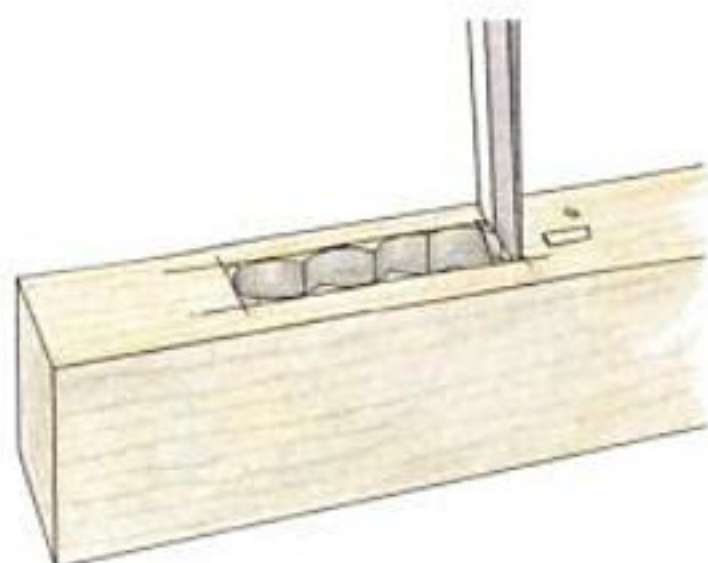
MORTISE

Make mortise one-third the thickness of stock.

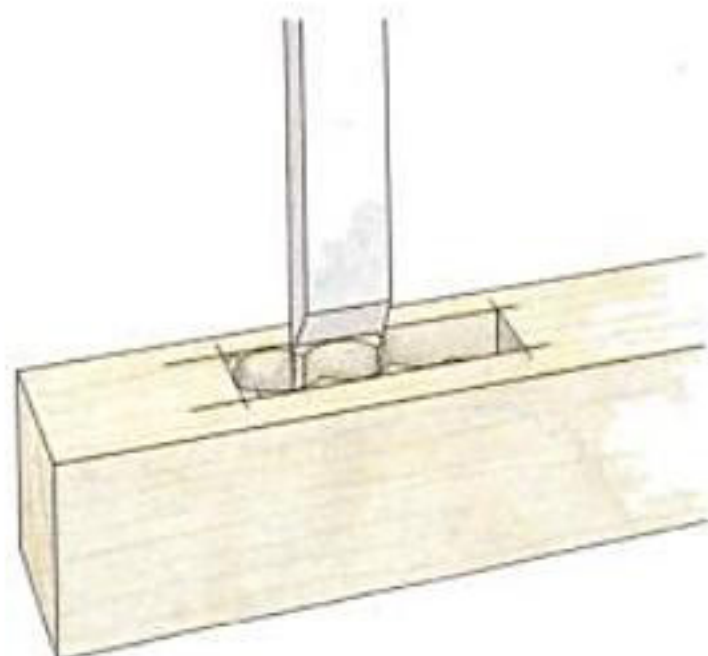
1. Mark layout lines with square, knife and mortising gauge.



2. Cut small grooves at both ends of mortise.



3. Drill out waste, then place chisel in groove and chop straight down to square ends of mortise.



4. Square sides of mortise.

CUTTING A MORTISE AND TENON BY HAND

For me, hand tool joinery is a connection to the rhythms of traditional woodworking. I enjoy the communication between the work, the tools and my hands, and I find hand-cut joints are as accurate as can be.

Mortise and tenon joints are particularly easy to cut by hand. They're simple to make and it doesn't take years of practice to produce joints that fit well.

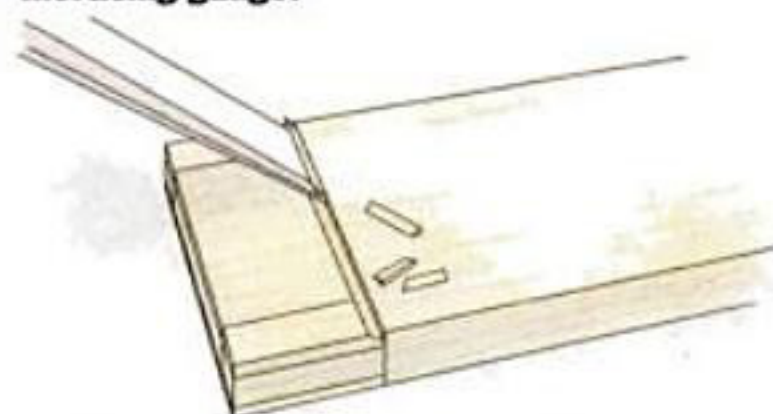
The drawings here show the technique I like to use, which is fairly conventional. But there are a few tips I'll stress that can improve accuracy. First, use a sharp knife—not a pencil—when laying out your shoulders and mortise ends. It's easier to work to the exact edge the knife cuts than to figure out which part of a broad pencil mark indicates where to saw or chisel.

Second, I always make small cuts to the shoulder lines on the tenon and to the mortise ends. This forms a V-groove that helps guide my chisel and saw when cutting. (See drawing.)

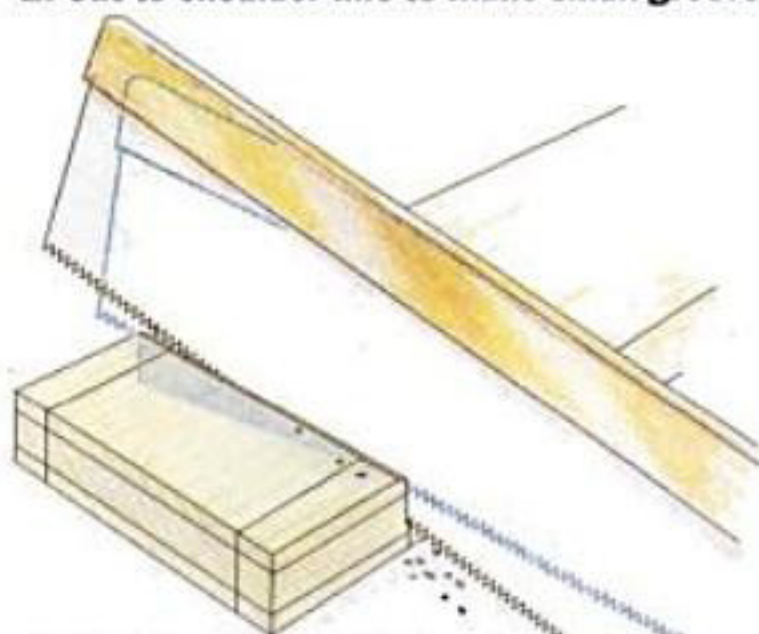
Finally, when making the shoulder cuts on my tenons, I first saw diagonally at each corner, using a fine-toothed backsaw that leaves a thin kerf. (See drawing.) This makes it easy to saw across and down accurately. When I've cut all four shoulders on the diagonal, I finish with straight-across cuts down to the tenon line, using the existing kerfs to guide the saw.—P.K.

TENON

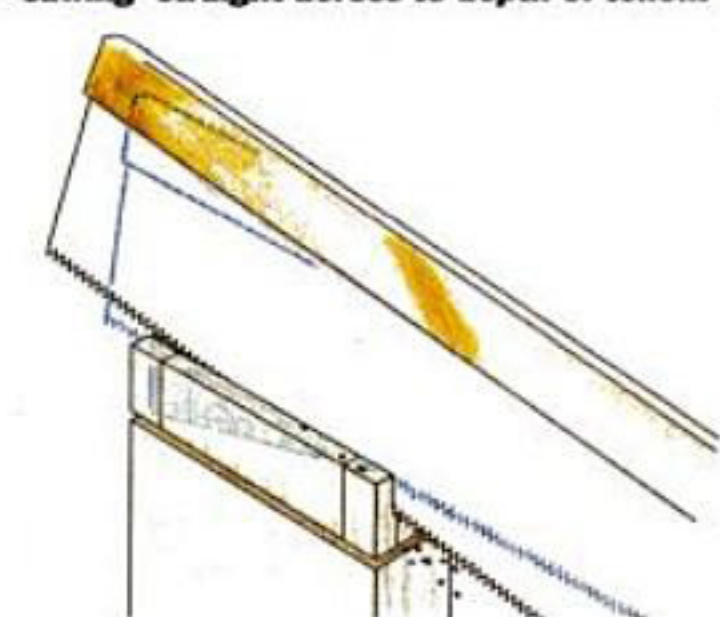
1. Mark layout lines with square, knife and mortising gauge.



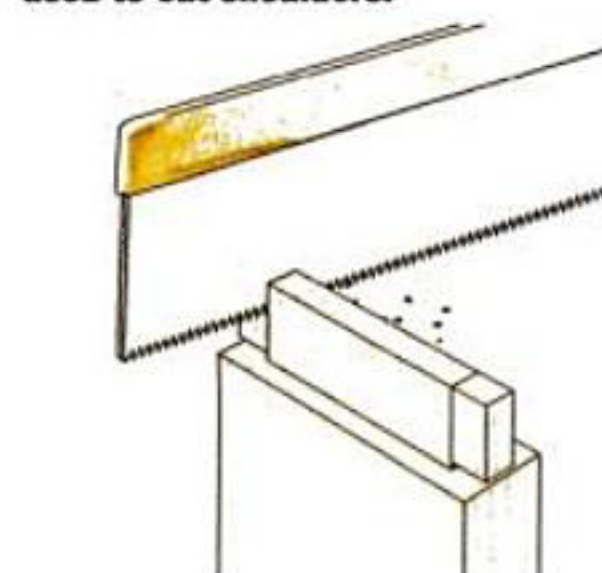
2. Cut to shoulder line to make small grooves.



3. Cut shoulders by first sawing diagonally at each corner, then connecting these cuts by sawing straight across to depth of tenon.



4. Make cheek cuts by repeating technique used to cut shoulders.



5. Re-mark shoulder lines and saw tenon to width. Then, pare tenon to fit mortise.

MITER-SLOT FEATHER BOARD

BY JIM CUMMINS

*A Twist of the Wrist
is All it Takes to Hold
Your Work in Place*

DAVE SELLERS

In my youth, woodworking texts featured feather boards that had to be clumsily clamped in place. None of my machines has ever willingly accepted such an arrangement—if the rip-fence guide bars weren't in the way of the clamps, then the table's bottom was ribbed in all the wrong places.

I found a partial solution when I bought an adjustable miter-slot feather board. But there were several things about the commercial version that I didn't like: It had feathers on just one side, which meant I had to disassem-

ble the thing and reverse it whenever I wanted to switch to the bandsaw. And the single-direction feathers distributed the working pressure so the feather board eventually split down the screw slot. With a price tag of \$25, it was also expensive. So I decided to design a scrapwood alternative.

My feather board has a pointed end, which allows me to switch from the tablesaw to the bandsaw without having to disassemble the gadget. And I can use it when ripping with the tablesaw fence on either side of the blade. The pointed end also

seems to resist splitting better.

Making this feather board is simple. The only critical dimension is for the hardwood bar, which you should cut to fit snugly in your miter slot. I used Brazilian rosewood for the bar and oak for the feather board because I had scraps on hand, but any hardwood that isn't prone to splitting would do.

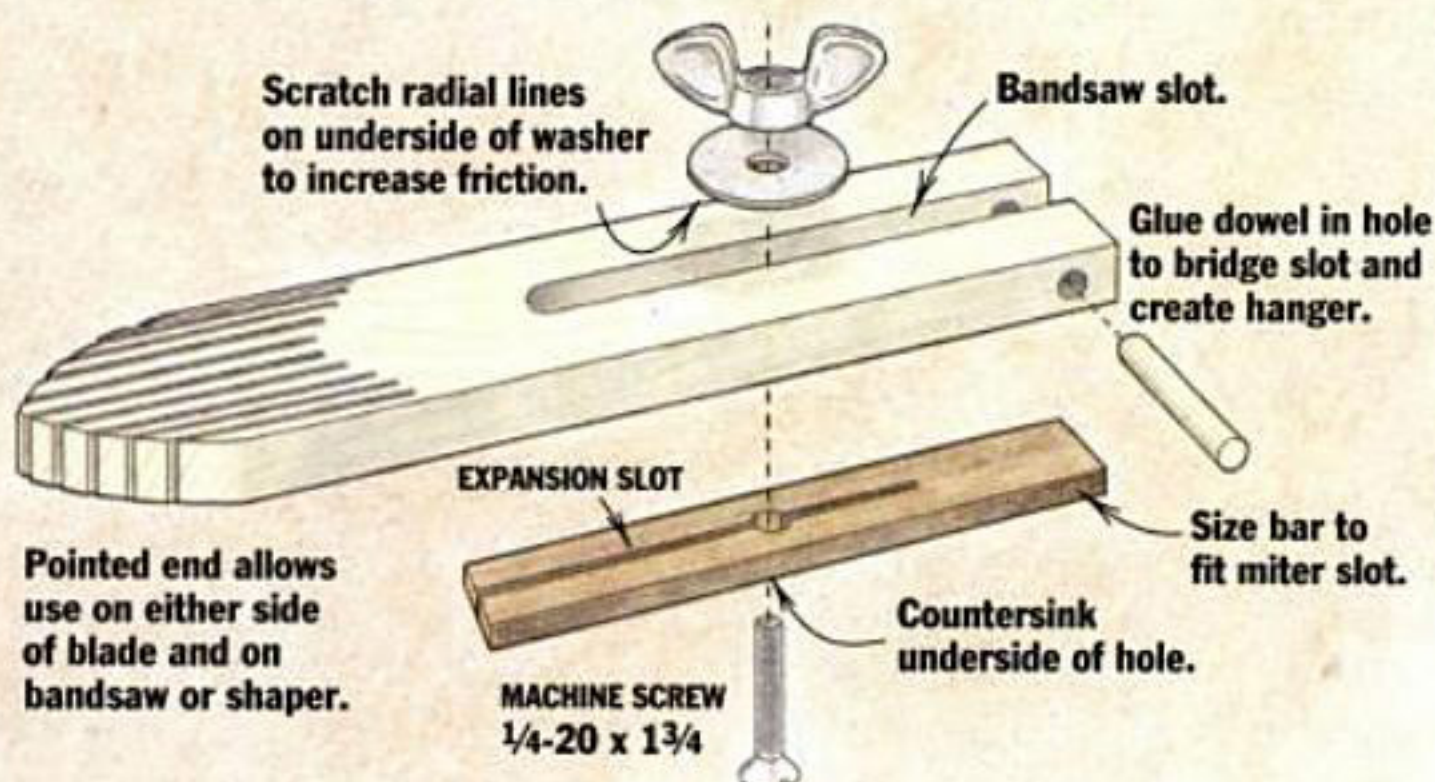
Finding a 1/4-20 wing nut that's large enough to let you apply some pressure can be tricky. My solution was to buy an oversized wing nut, then press-fit and solder a 1/4-20 hex nut into it.

Tightening the wing nut expands the bar and creates enough pressure to resist all but the most extreme force. (No feather board was ever meant to control work that's so warped, twisted or out of shape that would be dangerous to saw in the first place.) ▲



JIM CUMMINS
writes, edits and putters around
his picture-frame shop in upstate
New York.

SHOP-MADE FEATHER BOARD



DRAWING BY GLENN HUGHES

CHOP SAW STATION

BY ANDY RAE

When I joined the staff here at AW, I left behind one of the most beautiful workshops east of the Mississippi. There was plenty of space, lots of light, and a view of 188 acres of rolling pasture.

Now I'm in the fast lane, hard at work editing, and trying to fit my machines into a new, much smaller shop . . . the basement. Some of my bigger machines are never going to fit there, so I've been adapting the smaller tools to give them a bigger capacity like my Hitachi sliding compound miter saw. This saw was already getting daily use, and I knew that with a work station around it, it could do most of what my big radial arm saw used to do. (For a review of sliding compound miter saws, see page 40.)

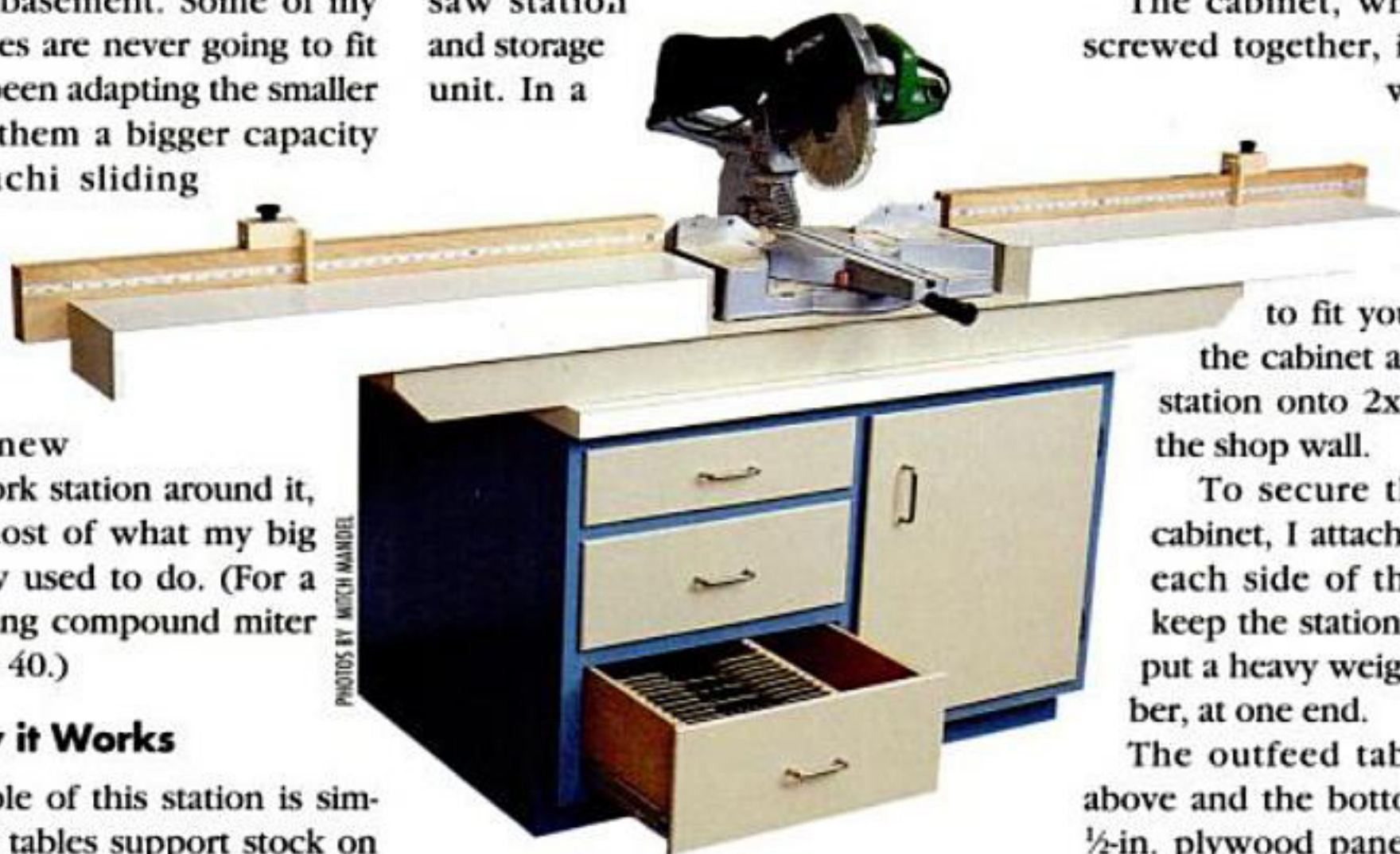
How it Works

The principle of this station is simple. Extension tables support stock on either side of the saw while wooden fences keep long workpieces square to the blade. (See Fig. 1.) Each fence has a stop block and a self-adhesive tape measure attached, letting me make single or repetitive cuts without ever reaching for my hip-side tape. Also, I can flip the stops up and out of the way when I need to square up the end of a long board.

Designing to Fit

To design the station, I got together with Fred Matlack and Phil Gehret, AW's Design Shop veterans, and we figured out what we wanted it to do. First, it had to have support tables long enough to handle large stock on either side of the blade. Second, since I cut a

lot of molding and narrow stock to exact lengths (usually 36 in. or less), the station's stop blocks had to index to these dimensions. Third, it had to be portable so I could take it with me for occasional jobsite work. And finally, since it was going to take up valuable space in my small shop, it had to serve a dual purpose as chop saw station and storage unit. In a



PHOTOS BY MITCH MANDEL

Building a Work Station Around Your Miter Saw Will Make This Tool More Versatile

pinch I can even use the top of the base cabinet as an assembly table.

The design we developed will fit my Hitachi sliding compound chop saw. If you want to adapt this design for any other brand, you may have to modify the cabinet top and support tables. (See Fig. 2.)

Building the Station

We began building from the ground up, making the cabinet first, then the bottom frame assembly, and finally the outfeed tables, fences and stop blocks. (See Fig. 1.) Most of the construction is pretty simple, but there are some steps and techniques I'll explain that help the job go smoothly.

The cabinet, which is glued and screwed together, is made from plywood with a poplar face frame and a plastic laminate top. You can tailor its size

to fit your needs, or forgo the cabinet and simply bolt the station onto 2x4 braces nailed to the shop wall.

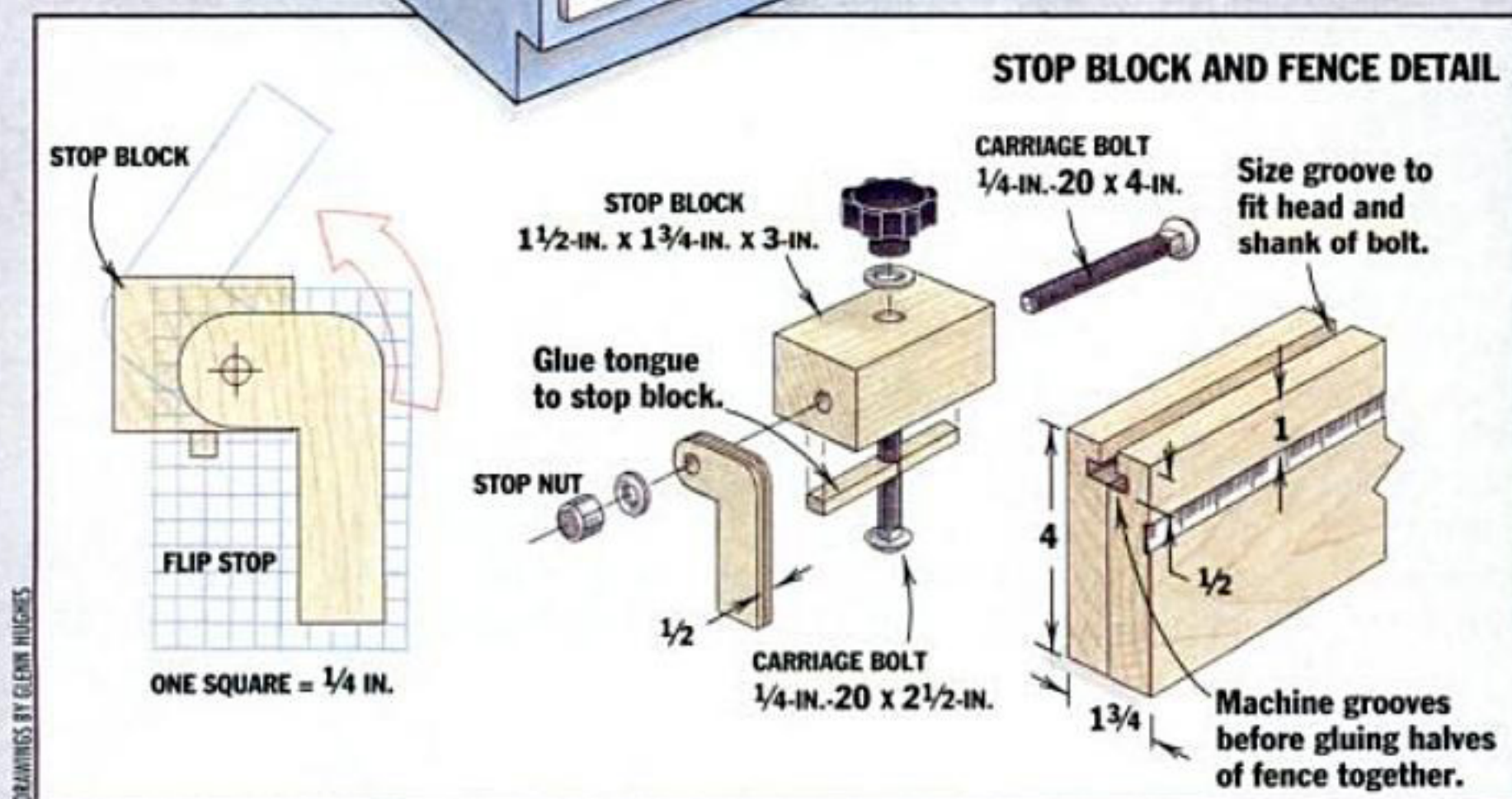
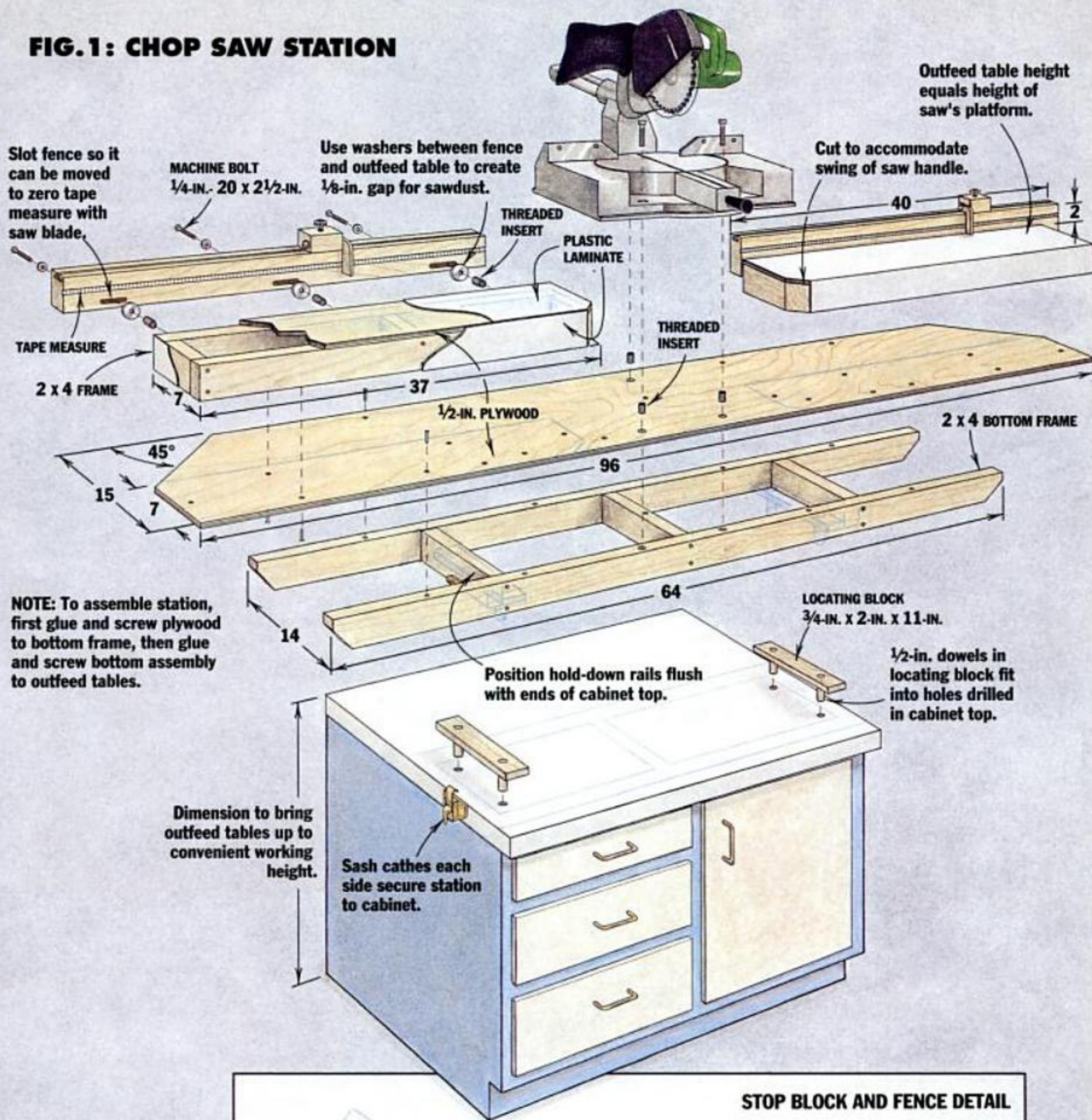
To secure the station to the cabinet, I attached sash catches at each side of the cabinet. These keep the station from lifting if you put a heavy weight, like a large timber, at one end.

The outfeed tables are attached above and the bottom frame below a 1/2-in. plywood panel, creating a rigid assembly without adding undue weight. The entire station fits over two removable locating blocks (see Fig. 1), which keep it from sliding on the cabinet top.

We used lumberyard 2x4s to frame the outfeed tables and bottom frame assembly. We wanted something low in cost and light in weight.

Two design notes: first, when assembling the bottom frame, make sure you position the two hold-down rails so they will be flush with the ends of the cabinet top. Second, when sizing the outfeed tables, be sure to leave clearance so you won't jam your hands between the saw handle and the tables when the saw swings through its greatest angle.

FIG. 1: CHOP SAW STATION



After you've made the bottom frame, use it to help drill the holes in the cabinet top for the doweled locating blocks. Lay the frame on the cabinet top so the hold-down rails are aligned with the edges and the frame is a few inches from the front of the top. Place your pre-drilled locating blocks against the hold-down rails, and mark through the holes onto the cabinet top. Now remove the locating blocks and drill the four holes in the top.

When assembling the parts of the station, glue and screw the plywood panel to the bottom frame first. Then work through this frame to screw and glue the plywood to the outfeed tables, using a straightedge to check that the tables are parallel to each other.

Making the Fences

I used hard maple for the fences and the stop blocks, since they'll receive a lot of wear and tear. The fences are a little longer than the support tables. This allows you to slide the stop blocks right to the ends of the tables.

I made each fence from two boards glued together. (See Fig. 1.) This way, I was able to dado the slots for the carriage bolts on my tablesaw before glue-up. To test-fit the carriage bolts, I dry-clamped the boards together and slid the bolt head through the slot.

Once you've reached this point, you can rout short slots through the sides of the fences for the bolts that hold the fences to the outfeed tables. (See Fig. 1.) These slots allow you to zero the self-adhesive tape measures with the blade. I cut the slots with a straight bit in a plunge router. Next, rout a shallow groove in the faces of the fences for the tapes, but don't install them yet.

I made the stop blocks, and glued small tongues underneath. The tongues slide in the groove at the top of the fences and keep the blocks parallel with the fences. (See Fig. 1.) I used plastic knobs for the stop blocks (available from Reid Tool Supply Co., 2265 Black Creek Rd., Muskegon, MI 49444, 800-253-0421, item #DK-71).

The flip stops need to withstand the pounding they'll get when boards are shoved against them. So instead of using cabinet-grade plywood, I laminated three layers of maple together, ori-

entering the middle layer cross-grain to the two outside pieces.

Final Assembly

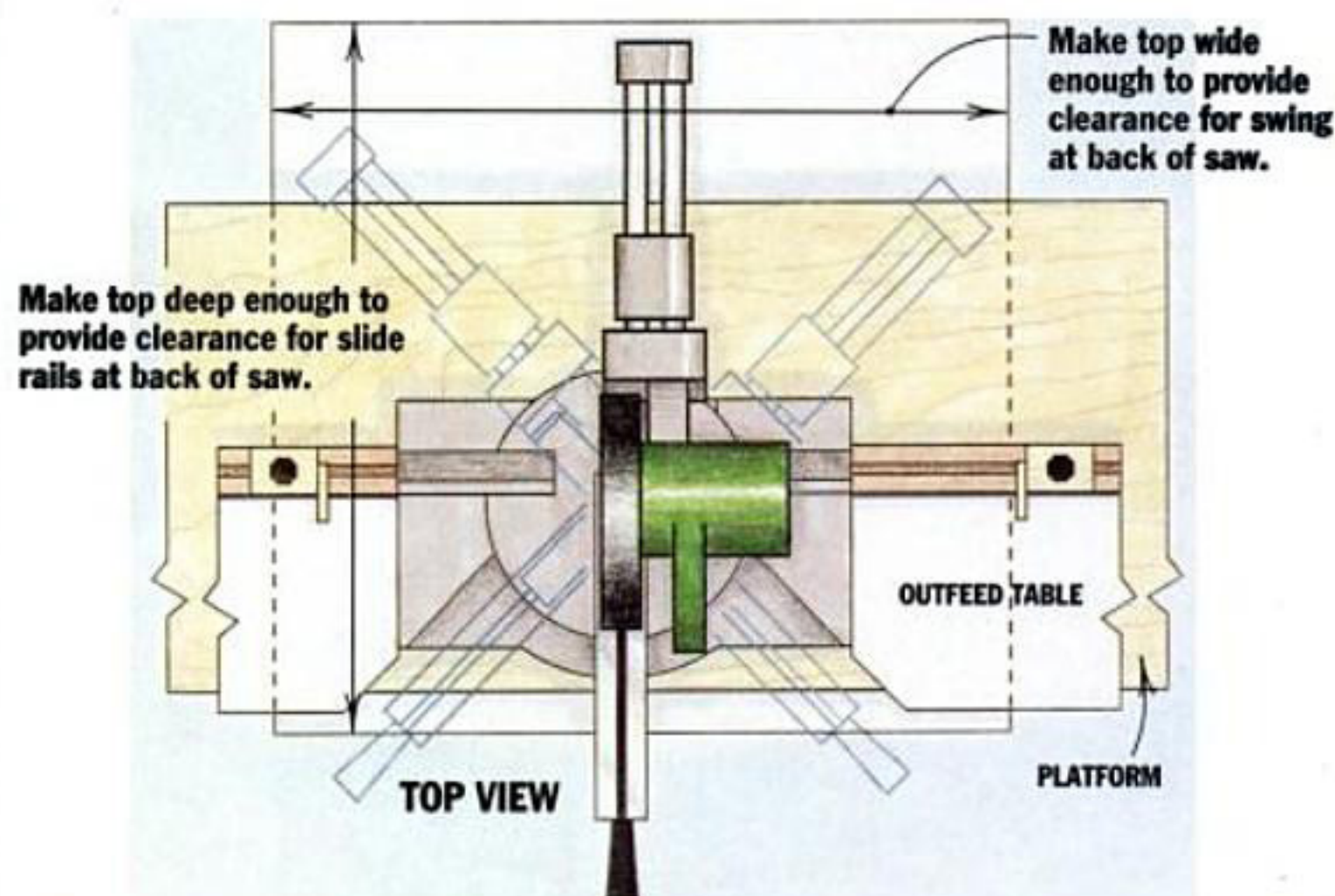
With the fences and stop blocks finished, you can install threaded inserts in the back of the outfeed tables to accept the bolts that hold the fences in place. Use the slots in the fences as guides to locate the threaded inserts.

Attach each fence to its outfeed table, using two 1/4-in. I.D. fender washers on each bolt to create an 1/8-in. space between the fence and the table. (See Fig. 1.) The space allows sawdust to fall through so it won't pile up against the fence and throw a workpiece out of registration.

Now bolt your saw to the bottom frame assembly using a straightedge to line up the saw's fences with the wooden fences on the station.

After the saw is secure, attach the self-adhesive tapes. You'll need two tapes, one that reads left, and one that reads right (available from The Woodworker's Store, 21801 Industrial Blvd., Rogers, MN 55374, 612-428-3200). Align the tapes with the saw blade so you can set the flip stops accurately. To do this on the Hitachi, I measured 12 in. out from each side of the blade and made a mark on my wooden fences. Then I lined up the 12-in. marks on my tapes with the marks on my fences and attached the tapes, trimming the excess tape from

FIG. 2: SIZING THE CABINET TOP



Author incorporates blade storage in one of the cabinet's drawers. Blades slide into individual slots and can be identified by tooth configuration.

each end of the fences.

That's it. To use the station, place the locating blocks in position, set the station in place, and flip the sash catches to keep everything secure. To remove it for jobsite work, first unbolt the saw from the station to lighten the load, then release the sash catches and lift the station off the cabinet. ▲



ANDY RAE
is an assistant editor of *AW* and is outfitting a basement shop in Gardenville, Pennsylvania.



MICHAEL MANDARINO

To cut an ellipse, author rotates the jig platform, moving the workpiece into a stationary router.

ROUTER ELLIPSE JIG

*Now You Can Cut or Draw Perfect Ovals
Without the Hassle of Templates or String*

BY ELLIS VALENTINE

While visiting a friend a few years ago, I spotted a little wooden gift-shop toy with the catchy label, "Bullshit Grinder," on his desk. When you turned a little crank the two perpendicular dovetail slides ran back and forth endlessly. I was intrigued by the way the circular motion of the crank was transformed into the linear motion of the sliding dovetails. On closer inspection, I found the cranking motion wasn't circular at all, it was oval.

I forgot all about the "grinder" until I spotted a glorified version in the AMERICAN WOODWORKER Design Shop. Fred Matlack, our resident mad scientist, had applied the principle to a router jig for cutting elliptical table-tops. It worked great, but you couldn't cut ellipses smaller than 24 in. wide.

Fred and I brainstormed awhile, and came up with a new twist that allows you to rout *or draw* ovals, in a continuous range of sizes and shapes, from ½ in. by 4½ in. to at least 48 in. by 96 in. Using the jig is simple, as Fig. 3 shows. You can cut out ellipses, rabbet them for glass—even rout elliptical inlay grooves—as easily as routing a circle.

Just one warning, though: While this jig is easy to use, it isn't very easy to visualize how it operates. I recommend building it, then experimenting to see how it works.

About Ellipses

Math books give long-winded explanations of the geometry of ellipses. But the easiest way to picture one is to think of it as an oval, like you'd get if you sliced obliquely through a cone. True ellipses are symmetrical about both their major and minor axes (those centerlines of their length and width). Their curves are *fair*, that is, progressing smoothly, without bumps or flat spots. And for any given rectangle, there is only one true ellipse that fits inside.

Most woodworkers know how to draw ellipses using two tacks and some string. But until now, if you wanted to actually cut out an elliptical form, you'd have to draw the ellipse, make a template, trace it out on your workpiece, bandsaw the rough shape, and flush trim to your template. With this jig you can draw or rout a geometrical-

ly correct ellipse directly. All you need to know is its length and width.

Making the Jig

The jig consists of a base, a platform and a separate fixture to hold the pencil or router over the platform. (See Fig. 1 and 2.) When you rotate the platform, hardwood channels attached to its underside slide back and forth on two dovetail blocks attached to the base, producing the elliptical motion of the platform. By changing the distance between the dovetail blocks, you can change the *shape* of the ellipse. The *size* of the ellipse is determined by where you place the router or pencil.

Make the platform first as shown in Fig. 1. I made mine of $\frac{3}{4}$ -in.-thick birch plywood, but an MDF (medium density fiberboard) surface would work even better as a drawing board. Cut your platform to an exact 36-in. by 48-in. rectangle, and carefully lay out

perpendicular centerlines on one face. You'll center your channels on these lines later. Continue your centerlines up the edges and across the top face of the platform.

I made my channels of cherry but any strong hardwood will do. It's important for the channels to be perfectly straight, so I ripped them slightly oversize, then jointed them and ripped them to their finished dimension.

Before routing the dovetail grooves in the channels, I removed as much waste as possible by cutting a $\frac{5}{16}$ -in.-wide by $\frac{7}{16}$ -in.-deep dado up the center of each channel blank. Then I followed up with a 1-in.-dia. dovetail bit in a router table. If you don't have a 1-in. bit, you can make two passes with a $\frac{1}{2}$ -in. bit, referencing off the same edge to keep the width of the groove constant. The rake of the dovetail isn't critical as long as you cut the sliding dovetail blocks to a matching angle.

Next, I cut the points on the channels with my power miter saw and fine-tuned them with a stationary disc sander. These points should be exactly 90° and centered perfectly on the dovetail grooves so the opposite channels will line up when you assemble them to the underside of the platform.

Finally, attach the channels with #8 by 1½-in. drywall screws, making certain the dovetail grooves are exactly perpendicular and centered on the platform's centerlines. An extra chunk of dovetail slide material will help you line up the channels, but I find that the old pool-shooter's eyeball method yields the straightest alignment.

Make the base from a rectangular piece of plywood or other $\frac{3}{4}$ -in.-thick sheet stock. (See Fig. 1.) I used MCP (melamine-coated particleboard) because it's inexpensive and has a friction-free surface for smooth operation.

The base provides points of attach-

FIG. 1: ELLIPSE JIG ASSEMBLY

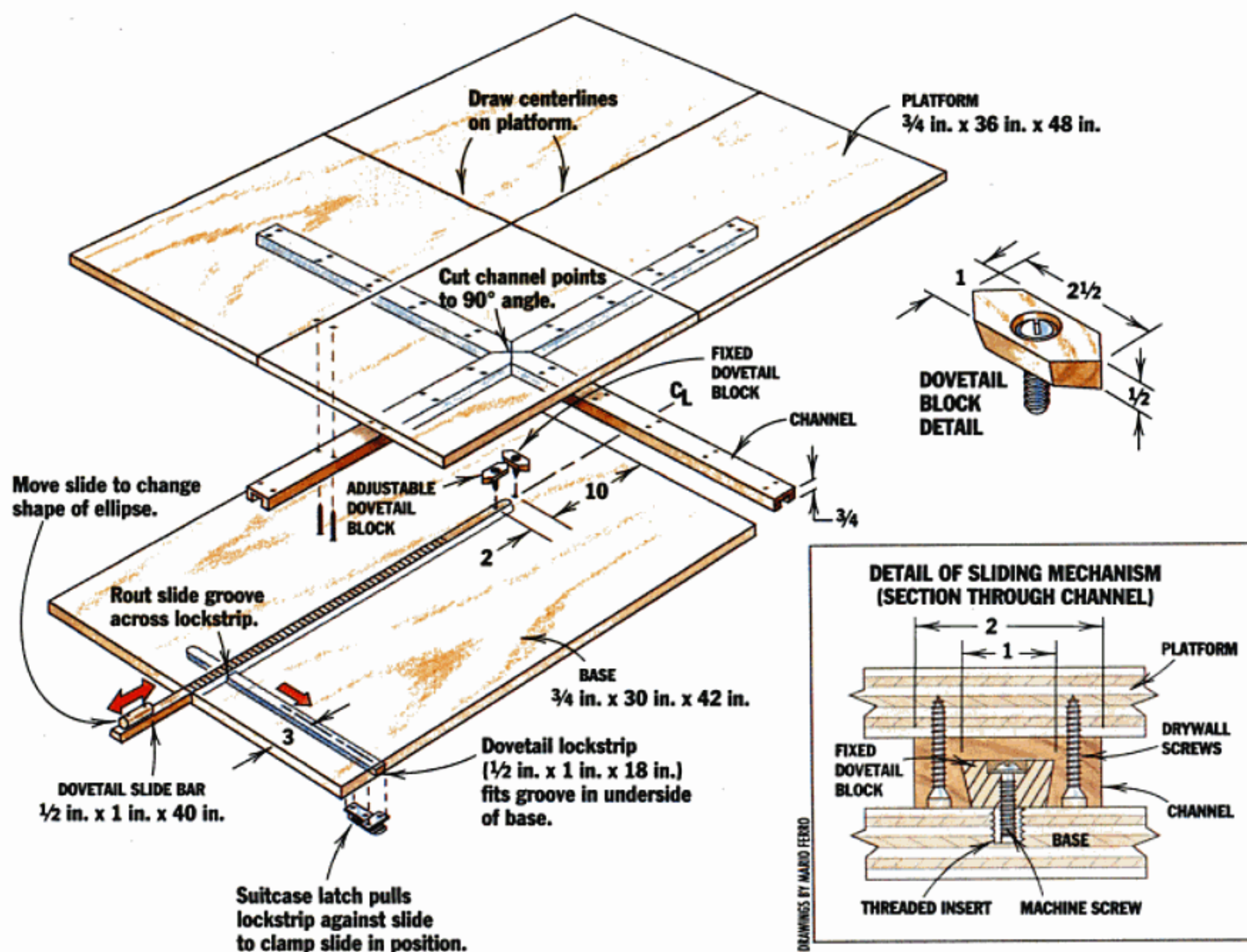
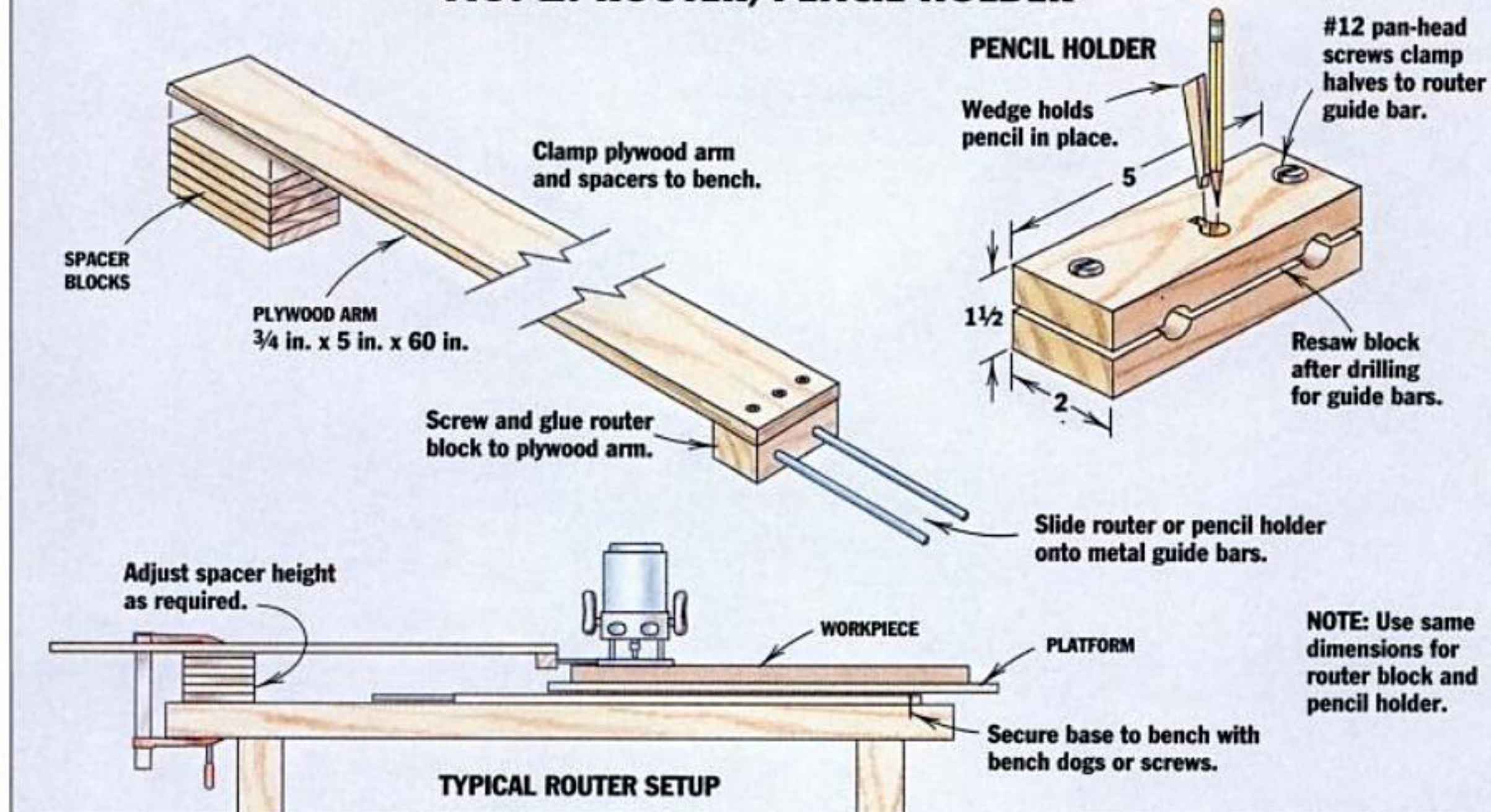


FIG. 2: ROUTER/PENCIL HOLDER



To assemble platform to base, first slide platform channel sideways (left) onto the fixed dovetail block until long axis is centered on slide bar groove, then insert slide bar (above).

ment for two dovetail blocks, one fixed and one connected to an adjustable slide bar. The slide bar, in turn, is clamped securely by a hardwood lockstrip.

Begin by marking out the locations of the fixed dovetail block and the dovetail grooves for the slide bar and the lockstrip. First rout a 1/2-in.-deep by 1-in.-wide dovetail groove for the lockstrip in the underside, about 3 in. from the edge, using a straightedge or a router fence as a guide. This groove should extend about 3 in. past the centerline of the base. Then make a dovetailed hardwood lockstrip and slip it into the groove, flush with the bottom surface of the base.

Clamp the lockstrip in place, turn

the base face-up and rout the groove for the slide bar perpendicular to the lockstrip groove and centered on the long centerline of the base, cutting through the lockstrip. Make the dovetail slide bar about 48 in. long. You'll need about 40 in. for the slide; set the rest aside for the dovetail blocks. (More on this later.) The exact length of the slide isn't critical, but the fit of the dovetail should be just barely snug, not too tight.

Finally, install a suitcase latch, available at most hardware stores, on the lockstrip. Be sure the cam action of the latch clamps the lockstrip firmly onto the slide bar and prevents it from moving. (See Fig. 1.) Any slippage in use

will spoil your ellipse.

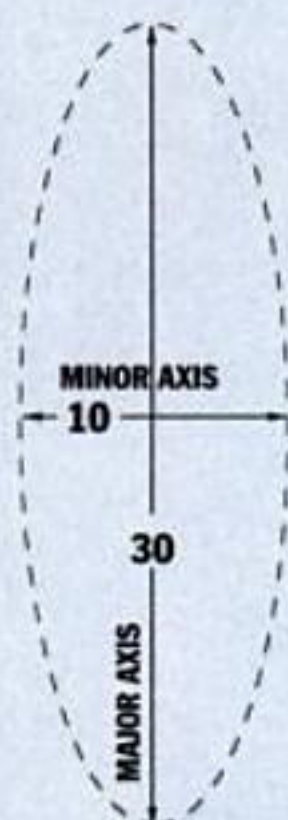
Make the dovetail blocks next, as shown in Fig. 1. The blocks should slide in the channels with no sideplay. File all sharp edges of the block slightly so they won't catch as they slide back and forth across the gap in the center of the channel assembly.

To attach the blocks to the base and slide bar, first drill and counterbore the dovetail blocks for #8-32 by 1 1/4-in. round-head machine screws and washers. (See section view, Fig. 1.) I counterbored with a 1/2-in. Forstner bit, then used a 5/32-in. drill bit for the clearance holes, and chased the holes with my #8 screws and a power screwdriver to produce a zero-tolerance fit.

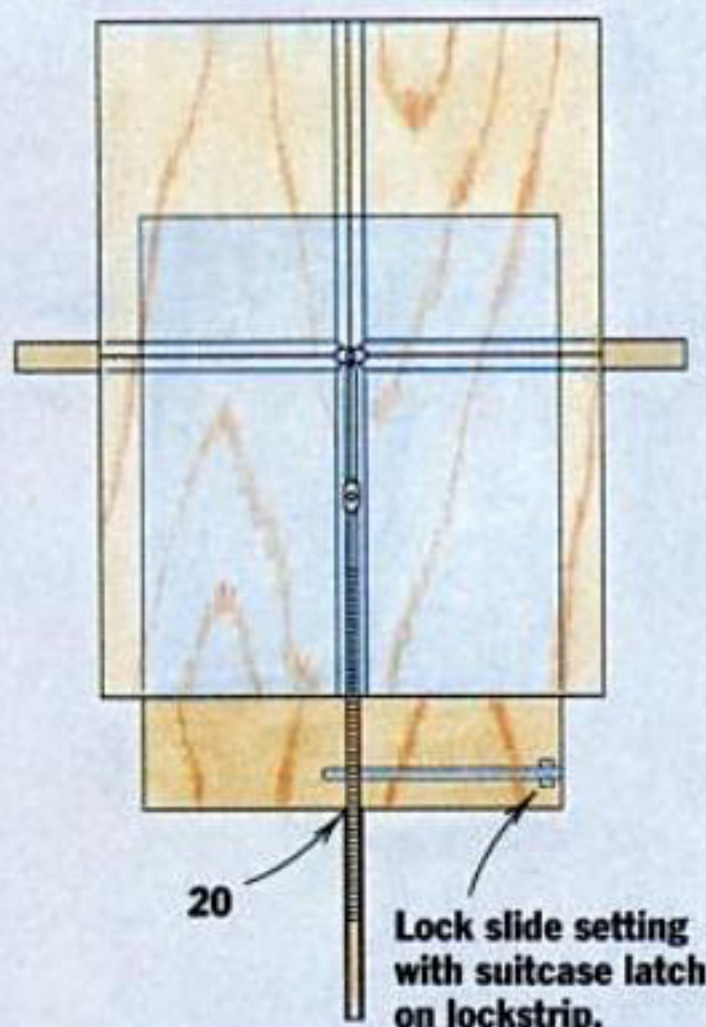
I used threaded inserts in the base and slide bar for attaching the dovetail blocks. To install these, first push the slide bar all the way in, then mark and drill two 3/8-in.-dia. holes, one in the base and one in the slide bar, exactly 2 in. apart. Any closer and the blocks will not clear each other when they rotate. Screw the threaded inserts into these holes flush with the surface of the base and slide bar.

Rub all surfaces of the dovetail blocks with paraffin, then screw them down snug to the base and slide bar with the #8 machine screws. A drop of thread-

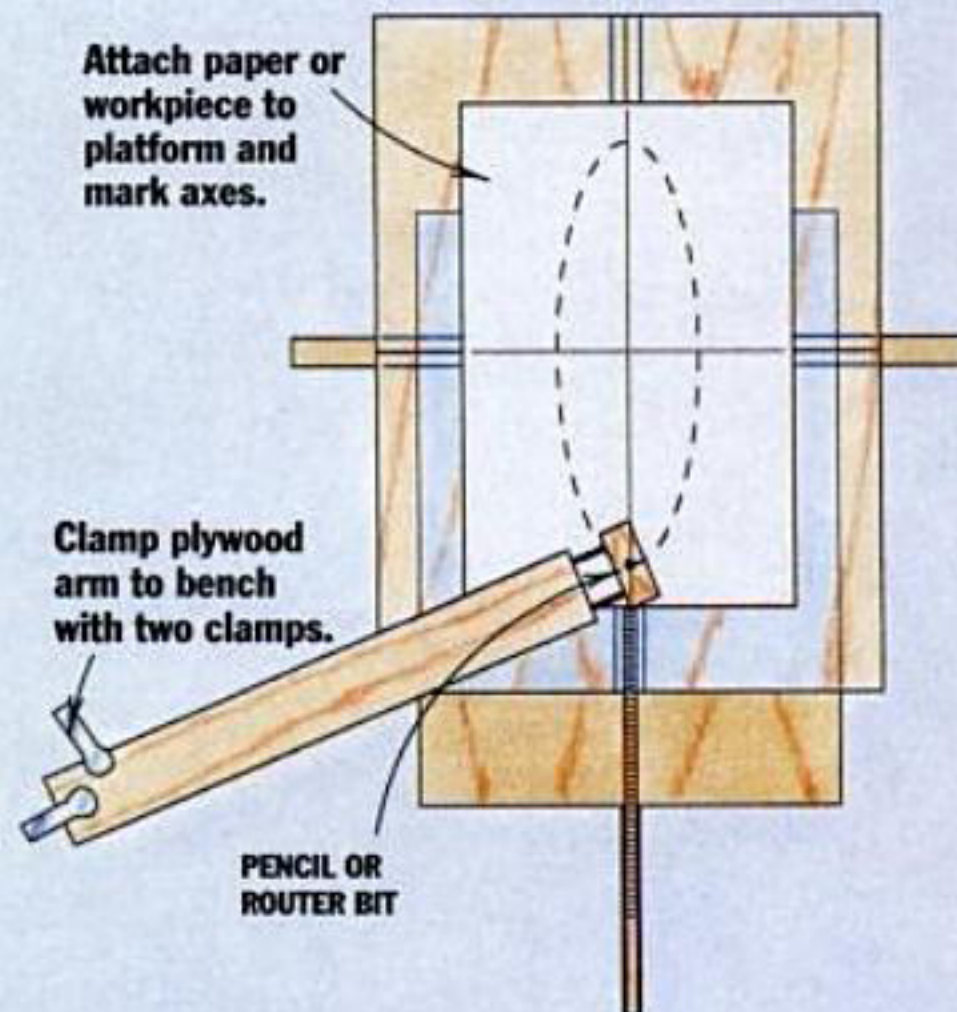
STEP 1: To determine slide setting, subtract minor axis length from major axis length. (In this example, 30 in. - 10 in. = 20 in.)



STEP 2: Center the long axis of the platform on the slide bar and set slide bar to the difference found in Step 1. (Here it's 20 in.)



STEP 3: Position pencil or bit on centerline of platform half the length of the major axis from centerpoint. (In this example, 15 in.)



locking fluid, available at auto supply stores, will keep the screws from coming loose as the blocks rotate in use.

The final step in preparing the base is to calibrate the slide bar. With the slide bar pushed all the way in, you should have exactly 2 in. between the centers of the fixed and adjustable blocks. If necessary, disc sand the nose of the slide bar to reduce the spacing or pull out the slide bar slightly to increase it to 2 in.

Now use a try square to scribe a line across the face of the slide bar at the edge of the base and label it "4." Mark off 1/2-in. increments from this mark toward the dovetail block. Since the space between the two dovetail blocks equals *half the difference* between the length of the major and minor axes of a given ellipse, each 1/2-in. mark on the slide corresponds to a 1-in. difference on the ellipse. (See photo, above.)

Next, assemble the platform to the base. With the adjustable slide bar removed, carefully line up one of the side channel openings with the fixed dovetail block. Then slide the platform onto the block, stopping when the platform is centered on the base. Complete the assembly by inserting the slide bar assembly in its groove and pushing the adjustable dovetail



To calibrate jig, make knife marks at 1/2-in. intervals on the adjustable slide bar.

block into the other channel. (See photos, previous page.)

Making the Router Fixture

The simple fixture I made to hold my plunge router or pencil when using the ellipse jig is shown in Fig. 2. I epoxied two guide bars from a standard router fence into a block, then screwed the block to a plywood arm.

A spacer block about 5 in. high elevates the router fixture above the ellipse jig so the platform can rotate freely under the fixture. (See Fig. 2.) For routing thick stock, you simply add spacers as needed to raise the fixture.

The pencil holder is equally simple

to make. (See Fig. 2.) First drill a 2 1/4-in. hole (big enough for a pencil) through a block the same size as the router fixture, then chisel an 1/8-in.-wide tapered slot for a wedge. I chiseled the slot across the grain, although, like life, it would have been easier going with the grain. Make a simple wedge to fit the slot alongside the pencil hole.

Next, drill two holes through the width of the block for the router guide bars. Draw a line through the centers of these holes and resaw the block on the line. If you like, clean up the band-sawn surfaces with a block plane or a disc sander.

Drill pilot holes through the two halves for the #12 by 1 1/4-in. pan-head screws that clamp the blocks together on the router guide bars. Chase the holes in the upper block with a 7/32-in. drill bit for screw clearance.

Using the Jig

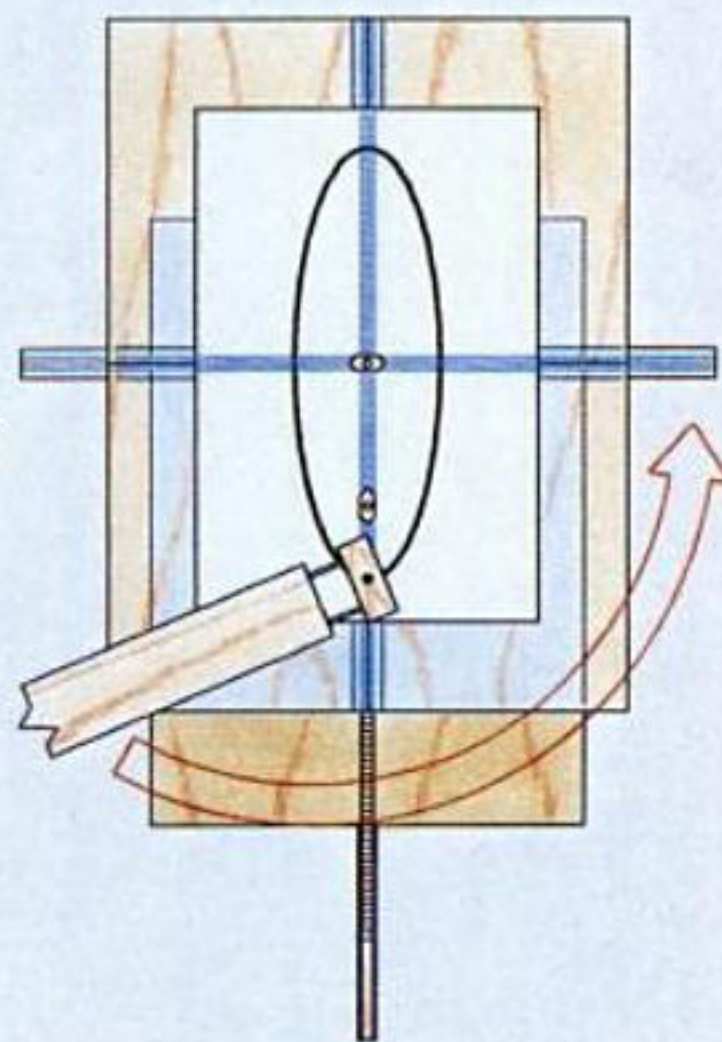
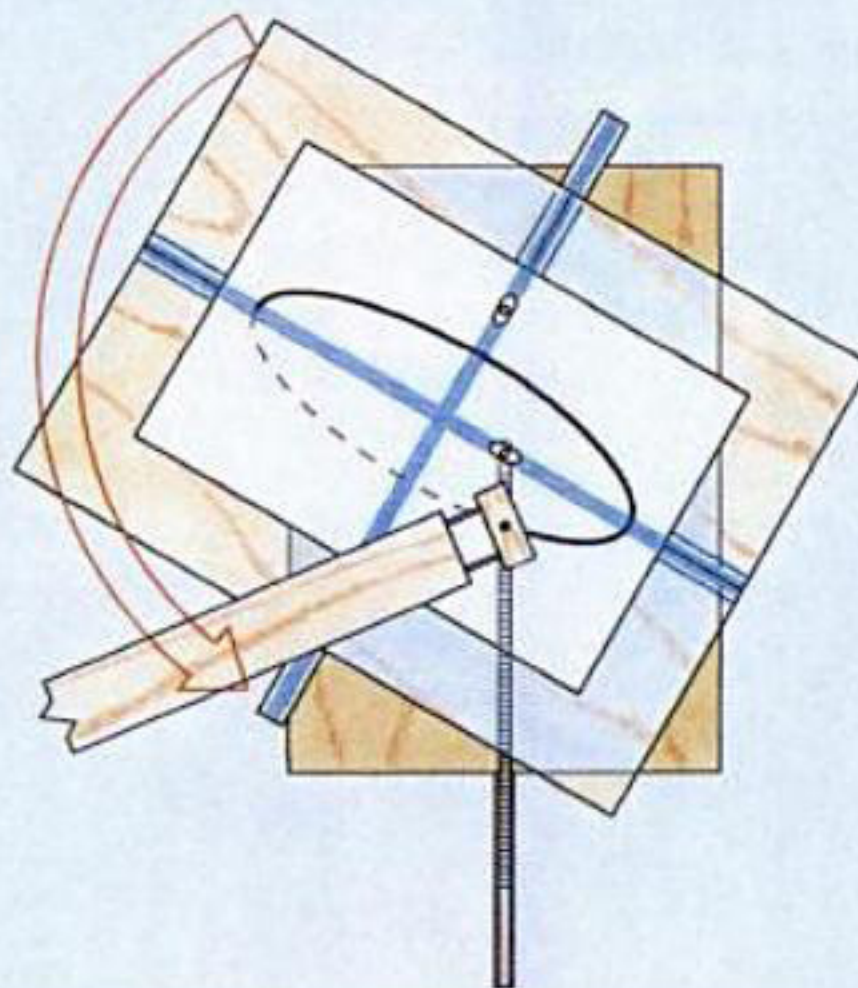
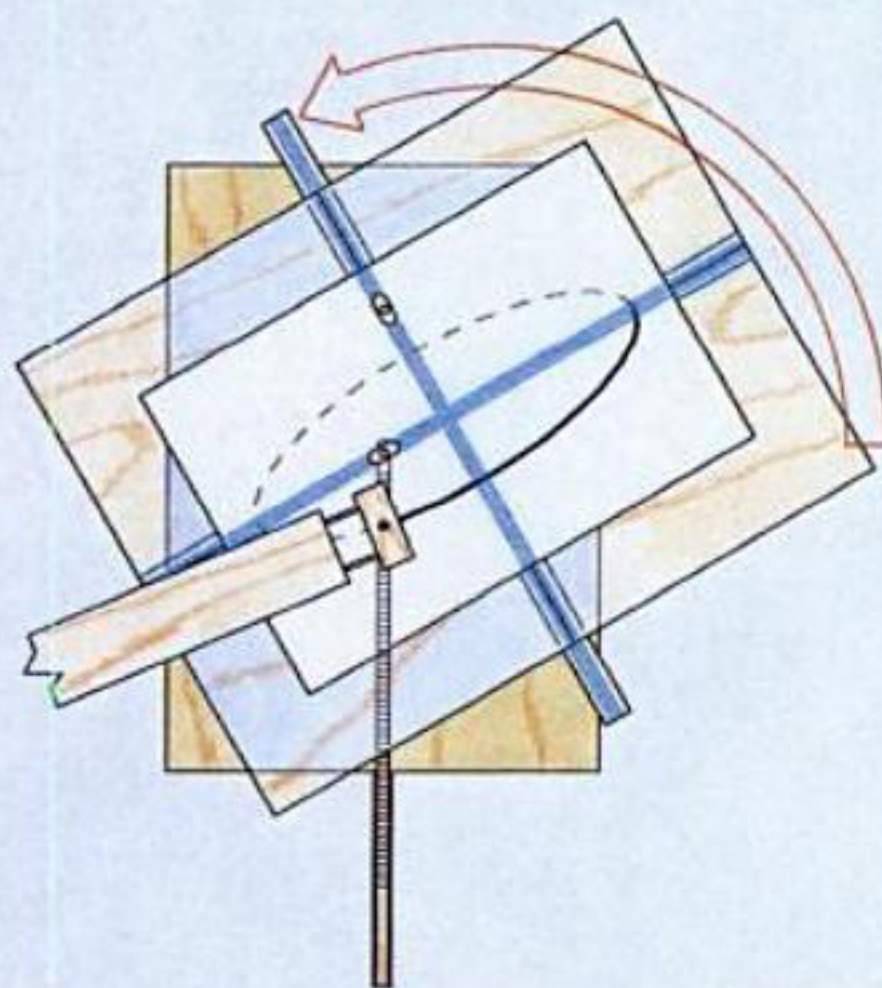
The real advantage to this jig is that you don't have to hassle with templates or inexact drawing methods. You can make a full-size or scale drawing of your project right on the platform of the jig, then proceed directly to the work.

Whether you're routing or drawing, the first step is to clamp the base of the

ELLIPSE JIG

STEP 4: Rotate platform to draw or rout ellipse.

NOTE: As platform rotates, dovetail blocks slide in channels, always staying perpendicular to each other.



assembled jig between bench dogs, or screw it to the workbench, making sure the suitcase latch remains accessible.

To draw an ellipse, first determine the lengths of the major and minor axes of the ellipse, and set the slide for the difference between these lengths. (See Fig. 3.) To avoid undue strain on the dovetail blocks, always center the long axis of the platform on the slide bar before making adjustments. Then simply loosen the lockstrip, pull the slide bar out to the desired difference setting on the scale and reclamp the lockstrip.

Tape your paper to the platform with masking tape and draw faint perpendicular centerlines on the paper coincident with the lines of the platform. The intersection of the lines will always be the exact center of your ellipse.

Set your pencil on the long centerline of the desired ellipse as shown in Fig. 3. You don't want too much pressure on the pencil point, so adjust the height of the holder with additional spacers or loosen the wedge and retract the pencil as needed. Now draw the ellipse by rotating the platform.

To make other ellipses the same shape but of different sizes, simply reset the pencil (or router) location without changing the slide setting. To change the shape of an ellipse, adjust

the slide and reset the pencil (or router) according to the size you want.

Routing an ellipse is only slightly more involved. Instead of your pencil block, attach a plunge router to the guide bars.

Center your workpiece on the platform and attach it with screws, double-stick tape or hot-melt glue. After lining up the major axis with the slide bar as above, mark the long end of the ellipse and line up your router bit on the waste side of your mark.

Be sure you clamp the plywood arm of the router fixture firmly to the bench. Then start the router, plunge the bit about $\frac{1}{4}$ in. into the work, and rotate the platform slowly and evenly **in a clockwise direction**. (See photo, page 31.) It's a good idea to cut a little outside your line and follow up with a final trim pass once you've plunged all the way through.

For cutting out ellipses, a sharp $\frac{3}{8}$ -in. or $\frac{1}{2}$ -in. carbide-tipped straight bit will work fine. If you'd like to chamfer or round over the edge of your ellipse, use a hand-held router and a ball-bearing-pilot bit after you've cut out the elliptical shape.

Troubleshooting the jig is straightforward. If you find that a pencil line or router groove doesn't

pass through the starting point after one revolution of the platform, chances are that something has slipped slightly. Check to see that the jig's base is screwed down properly, that the pencil/router fixture is securely clamped, and that the adjustment slide bar hasn't moved.

If your ellipses appear slightly skewed, either your channels aren't centered properly on the platform centerlines or you didn't have the platform centerline directly over the center of the slide bar when you set the pencil or router on the major axis.

Finally, any wobble in the dovetail blocks could translate into a slight wandering of the pencil or router. Try tightening your attachment screws slightly to take out the slop.

If you need to cut ellipses with a larger axis difference than the 48 in. possible here, you can add extension channels or make a larger jig. ▲



ELLIS VALENTINE
is associate editor of AW.

SLIDING BOOK RACK

It Expands as Your Library Grows

BY TIM SNYDER

Most conventional bookends rely on their heavy weight to keep literary works upright. My design works on leverage.

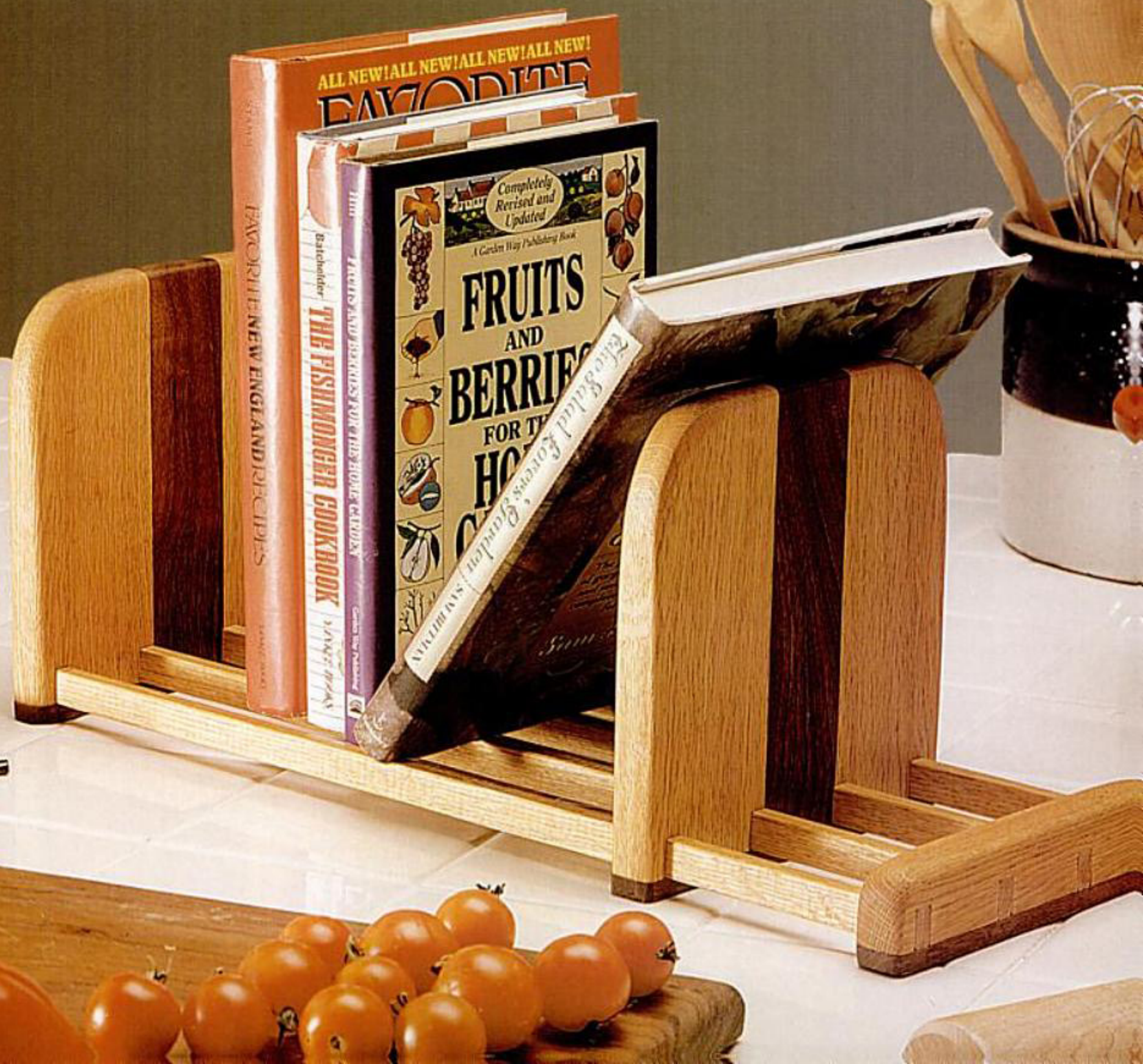
While one bookend is fixed, the other moves on four runners until the weight of the books locks it into place. This system works especially well for holding books that are used frequently.

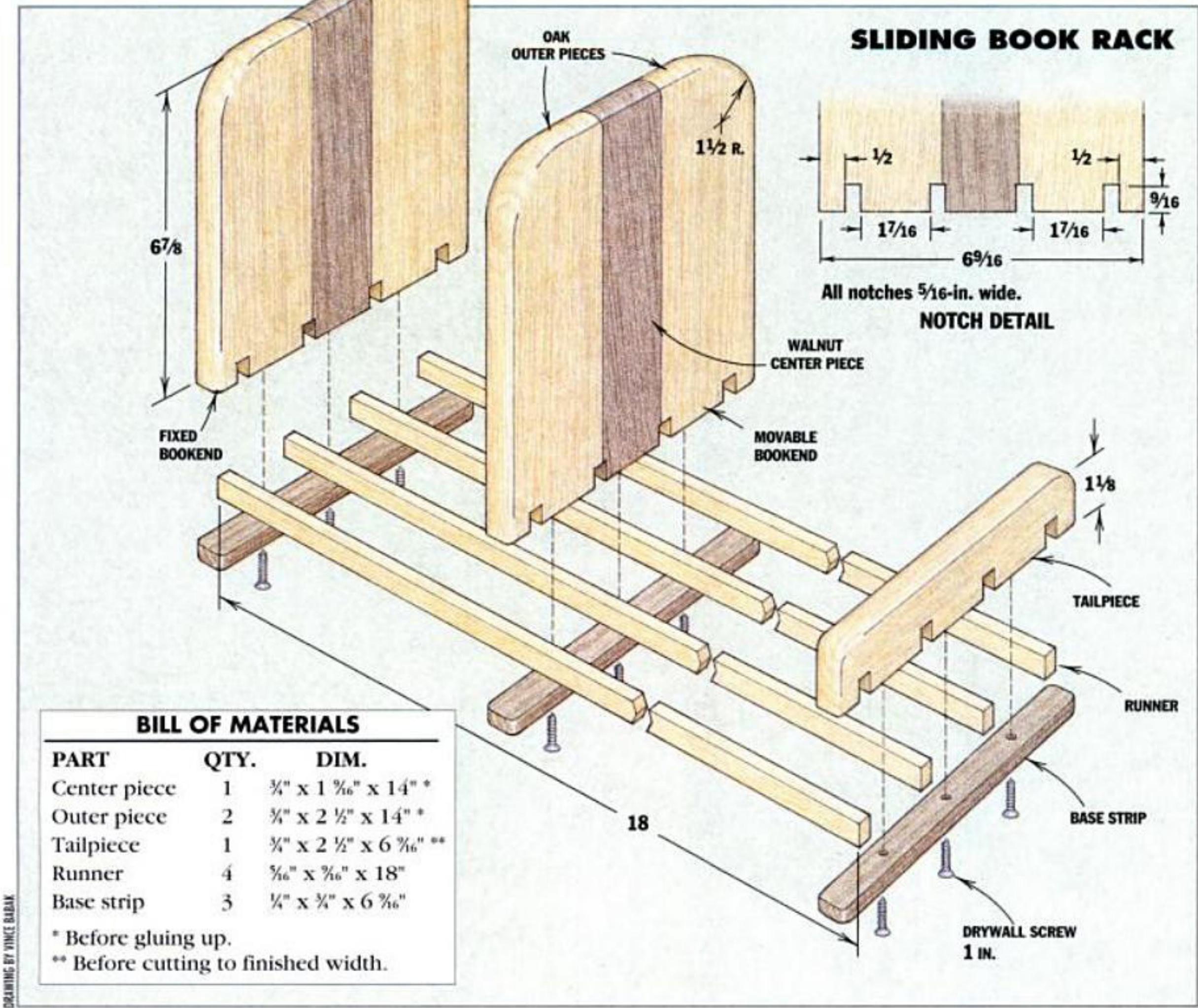
To create the contrasts in the book rack shown here I used light oak and dark walnut. Other hardwoods will work equally well.

Making the Parts

Start by cutting all the parts to the dimensions given in the Bill of Materials. Cut the tailpiece 2½ in. wide at this stage. This makes it easier to clamp it for the notching operation, after which you'll trim it to its final width. Next, glue up the contrasting maple and walnut pieces into a single 14-in.-long board from which both bookends can be cut.

Once the glue has dried, square





off the ends of the board and saw it in half, yielding a pair of bookends 6 7/8 in. long and 6 1/16 in. wide.

Lay out the 1 1/2-in. radii on the top corners of one bookend. Then clamp both of the bookend pieces together, bandsaw the curves and sand the curves smooth.

Now, lay out four notches along the bottom edge of the tailpiece as shown in the drawing. Then clamp the tailpiece and bookend pieces together and cut the notches with a dado blade on a tablesaw. To do this, I use an auxiliary fence on the miter gauge which also acts as a back-up board to prevent tear-out during the cuts.

The dado cutter should be set to a width of 5/16 in. and a height of 5/16 in., and the miter gauge should be set for a 90° cut. Cut a trial notch in some scrap

stock to test the notch dimensions.

When the notches are done, rip the tailpiece to its finished width and cut 1 1/2-in. radii to match the bookends.

Assembly and Finishing

I used 1-in. drywall screws to attach the bookends and tailpiece to the base strips. Countersink pilot holes in the base strips, then glue and screw the pieces together. Then round over the edges of the bookends and tailpiece and finish sand.

I finished the parts before final assembly, taking care to mask off the last 3/4 in. of each runner and the notches in the tailpiece and fixed bookend. This way, the finish won't interfere with the glue-up later. When the finish is dry, apply a light coating of paste wax to the

runners, so the free bookend will be able to move smoothly.

To assemble the piece, slip the runners through the movable bookend, and glue the runner ends in the notches in the fixed bookend and in the tailpiece. As soon as the glue has cured, your book rack is ready to use. ▲



TIM SNYDER

is a woodworker in Pennsylvania. He wrote *Shelving and Storage* (1992, Rodale Press Inc., 33 E. Minor St., Emmaus, PA 18098), in which this article first appeared.

*Tired of Splotchy Stain Jobs?
Here's an Easy Way to
Get an Even Color
on Difficult Woods*



Gel STAINS

BY BOB FLEXNER

As these samples show, gel stains differ in thickness, but they all stain wood more evenly than liquid stains.

PHOTOS BY JIM ROBERSON

Gel stains have been on the market for more than two decades, but they've only recently become popular with woodworkers. They're thicker than liquid stains (see samples above), so they're less likely to drip. They're often marketed for this quality. But their real value comes from their ability to stain difficult woods more uniformly than liquid stains.

About Gel Stains

In composition, gel stains (also called "gelled" or "paste" stains) are similar to other stains. Most contain pigment suspended in a varnish binder thinned with mineral spirits. Some gel stains include dye in the varnish binder, or dye in a water-based acrylic binder. (For more on stains, see AW #17.)

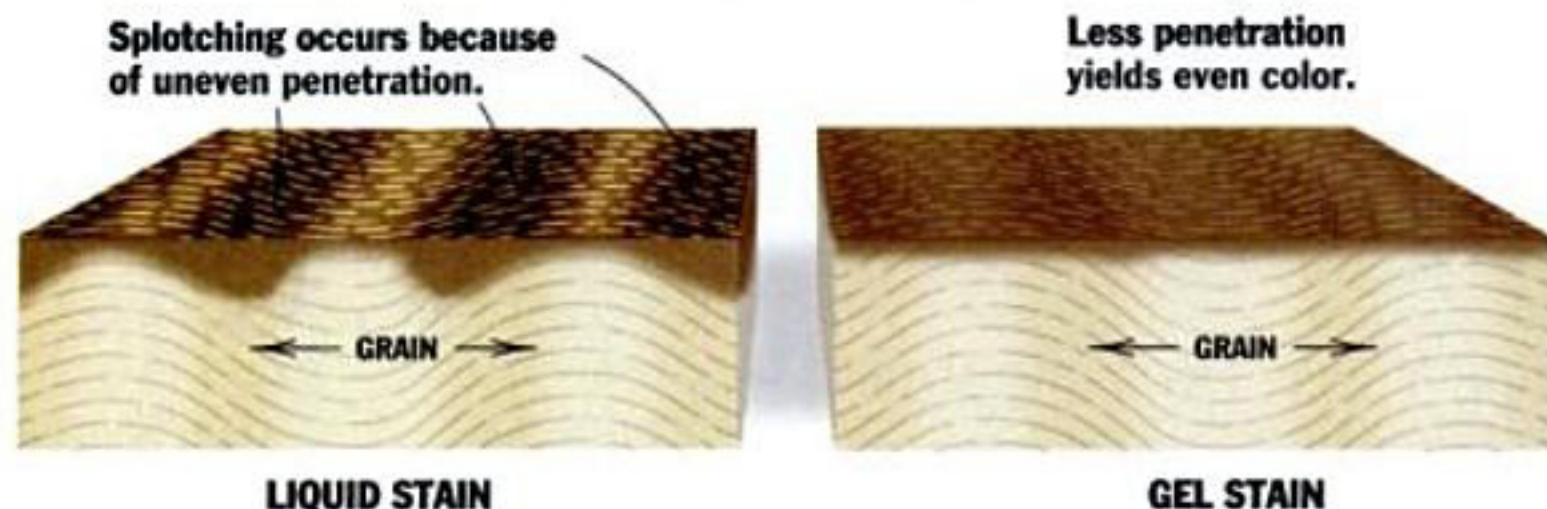
Gel stains differ from liquid stains because they incorporate a property called *thixotropy*. Thixotropy means

the ability of a substance to liquefy when stirred or shaken, and return to a gel when left alone. Ketchup is an example of a thixotropic substance. You have to shake the bottle to get the ketchup out. When the ketchup hits your food, it remains as it landed until you spread it with your knife.

The most critical characteristic of gel stains is this resistance to flow,

because it prevents the stains from penetrating deeply into the wood. Stains that don't penetrate deeply don't cause splotches.

Manufacturers vary the amount of thixotropy in their gel stains, so you will notice some differences between brands. Some, such as Wood-Kote, are so thick they won't flow out of an open can even if you turn the can



When wood grain swirls to the surface, end grain is exposed, allowing liquid stains to penetrate deeply and cause splotching. Gel stains don't penetrate deeply, so they produce a more even appearance.

DRAWING BY GLENN HUGHES

upside down. Others, such as Minwax, are much thinner and will run if you apply them too thickly to vertical surfaces. The thicker and more thixotropic the gel stain, the less it will penetrate and cause splotching.

When to Use Gel Stains

Gel stains are ideal for use on woods that are prone to splotching, such as pine, cherry and birch. Typically, these woods have a grain that swirls in and out along a board. Where the grain swirls toward the surface, end grain is exposed and more stain is absorbed. (See drawing, opposite page.) These areas appear darker and make the board appear splotchy.

Splotchiness is also caused by areas of lower density that occur naturally and randomly in various woods, most often in pine. These less-dense areas absorb more stain and appear darker.

Using a gel stain is a much more predictable way to limit stain penetration than the traditional method for reducing splotching, which is to apply a thinned finish or a slow-evaporating solvent to the wood before applying the stain. If you thin your own finish, it's commonly called a "wash coat." Manufacturers sell thinned finishes and slow-evaporating solvents under names such as "pre-stain," "wood conditioner" and "stain controller." They all partially stop up the pores and the less dense areas in the wood, so when you apply a stain, it penetrates more evenly.

The problem with controlling stain penetration in this way is it's difficult to know just how much of the wash coat to apply. Too little and you'll still have splotching, too much and you won't get any stain penetration at all.

With a gel stain, you will rarely get splotching, no matter how much stain you apply or how long you leave it on the wood. (See photo, above.) So, gel stains have an advantage when you want to change wood color without calling attention to its idiosyncrasies.

Another advantage is that since gel stains don't penetrate, you'll need less stain to cover a given area.

When Not to Use Gel Stains

Don't use a gel stain if you want to bring out the maximum figure and depth in woods such as walnut,



Liquid stains (top row) cause splotching on pine (left) and cherry (center), but highlight the figure of curly maple (right). Gel stains (bottom) stain all three evenly because they penetrate less.

mahogany, curly maple and burls. (See photo, above.) Since gel stains don't penetrate, they don't bring out the wood's depth and richness or highlight contrasting figure. This is just as true for gel stains that use dye as the colorant as it is for those that use pigment. In both cases, the thixotropic gel prevents the colorant from penetrating.

If you used a gel stain on curly maple, mottled mahogany or any other figured wood, you would lose almost all the beautiful definition you were looking for in choosing these woods.

Applying Gel Stains

Applying gel stains is no different than applying other stains. First you brush, wipe or spray the stain on the wood. Then, before the stain dries, you wipe off the excess. Because gel stains dry fairly quickly, you should begin wiping off the excess stain within a few minutes of application. Make your last wiping strokes follow the direction of the grain. This way, any streaks you might leave will be difficult to distinguish from the grain itself.

On large surfaces you may have to apply the stain to smaller sections, overlapping as you go. The areas where you've overlapped the stain often show up darker than the rest of the surface. These darker areas are called "lap marks."

You shouldn't have any trouble wiping off lap marks as long as the first application is still wet. But if the first coat has begun to dry and you do have

trouble, immediately dampen a cloth with mineral spirits (for varnish-based stains) or water (for acrylic-based stains) and try to remove some of the stain. Then feather the lapped and unlapped areas together with more stain. If the gel stain has dried hard before you remove the lap marks, you'll have to strip the entire surface with a paint-and-varnish remover, and restain. (See "Paint Strippers for Furniture," AW #22.) It's not necessary to remove all the color from the wood before restaining.

Those gel stains that contain water will raise the grain of the wood, but not as much as many other water-based stains because the water doesn't penetrate as much. Still, before you apply a gel stain you should raise the grain by wiping the wood with a wet sponge or cloth. Let the wood dry overnight, then sand it with very fine (280-grit or finer) sandpaper, just until the wood feels smooth again. Then when you apply the stain, it won't raise the grain nearly as much. ▲



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is a finishing consultant in Oklahoma. His book, *Understanding Wood Finishing*, will be published in October 1993 by Rodale Press Inc.

A BUYER'S GUIDE TO SLIDING CO

BY DAVE SELLERS

Like many woodworkers, my first stationary wood-working tool was a radial arm saw. I learned to make basic woodworking cuts on it and hacked my way through a number of beginner's projects. But it took up a lot of space in my cramped basement shop, and keeping it adjusted for precise cuts was a pain. As I acquired other basic woodworking machines, the radial arm saw began to take a backseat to them.

If I was setting up a shop today, I'd bypass the radial arm saw altogether and invest in one of the new sliding compound miter saws. These saws can perform most of the functions of a radial arm saw, while taking up less space. (See chart on page 42 for bench width required by different models.) They're simpler to keep adjusted and so compact and light (typically about 40 lbs.) that you can easily lift one up on a benchtop or throw one in your pickup truck for [site work](#). (For a more permanent installation, see [Chop Saw Station](#), page 28.)

Hitachi introduced the first of the current sliding compound miter saws in 1988 and it has since become the company's best-selling tool. These saws are a refinement of the popular power miter saws, or "chop saws." Like chop saws, sliding compound miter saws have pivoting cutterheads (motor and blade) that you plunge into the workpiece to make a cut. Also, with both types of saws you can turn and tilt the cutterhead to make miter, bevel and compound miter/bevel cuts with ease.

But sliding compound miter saws have an added advantage. The cutterhead also slides on rails letting you cut much



HITACHI C 8FB



MAKITA LS 1011



RYOBI TSS-220



AEG SKS 300

PHOTOS BY MITCH MANDEL

COMPOUND MITER SAWS

The Space-Saving Alternative to a Radial Arm Saw

wider stock (up to 12 in.) than you can on a chop saw. When working wide stock with most of these saws (the AEG is the exception), you first pull the cutterhead forward above the stock, then plunge the blade down in the stock and push the blade back toward the fence. This way the blade can't "climb up" on the stock and jerk toward you uncontrollably as it can with a radial arm saw.

(There's another saw on the market that can make miter and bevel cuts: the Delta Sidekick Frame and Trim saw. Its cutterhead slides on two rails that fasten to a rotating turntable. You pull the blade through the workpiece like a radial arm saw—from back to front. The Sidekick's thickness cutting capacity is about 1 in. less than the other saws, and you have to slide workpieces in from the side. Overall, its design and performance weren't what we've come to expect from Delta.)

To see how the chop saw versions of these sliding saws perform, and to compare the brands currently on the market, I tested the five models shown here.

I checked out the saws' safety features, adjustments and controls, and noted how comfortable they were to use. Then I made test cuts in 1-in. pine and 2-in.-thick oak (1½ in. thick for bevel cuts). While cutting, I tested dust collection with both manufacturer-supplied dust bags, and our shop's 1½-HP dust collector.

I found that all the saws cut fairly smoothly and accurately. But each one has strengths and weaknesses. My observations appear later. See the chart on the next page for each saw's specifications and cutting capacities.

How They Measure Up

First I checked the alignment on the saws, since even the most precise saw won't cut straight if it isn't aligned properly. On a sliding compound miter saw, the blade must be perfectly square with both the fence and the flat turntable the stock sits on. Most of the saws were right-on straight from the box, though I did have to adjust the AEG.

To set the blade square to the turntable on all the saws, you simply adjust the 0° bevel stop. The blade-to-fence alignment works differently on different brands. On the AEG, all you do is turn an eccentric shaft with a hex key. On the Ryobi, you loosen four bolts under the turntable. And with the Makita, Sears and Hitachi, you loosen the fence-mounting bolts and move the fence to square it to the blade. I found these bolts must be tightened securely. While jostling a piece of heavy oak into position on the Makita, I pushed the left side fence almost ¼ in. out of square. Retightening solved the problem.

The fences on these saws are similar in design with a gap in the middle to allow the blade to turn and tilt for miter and bevel cuts. The Hitachi's fence gap is 7¼ in.—more than double the gap on the others—which can be a problem if you work with short stock. I found the fence didn't adequately support workpieces less than 10 in. long. To overcome this problem, Hitachi offers add-on plastic fences (\$14.28) you can slide to adjust the gap. The AEG comes standard with similar wooden fences held in place by metal clips, but both the wooden fences and the fixed metal fences are only 1⅞ in. high, which doesn't give



SEARS 23488

AEG
Atlas Copco Electric Tools Inc.
Three Shaws Cove
New London, CT 06320
(800) 243-0870

Hitachi Power Tools USA Ltd.
3950 Steve Reynolds Blvd.
Norcross, GA 30093
(404) 925-1774

Makita USA Inc.
14930 Northam St.
La Mirada, CA 90638
(714) 522-8088

Ryobi America Corp.
1501 Pearman Dairy Rd.
Anderson, SC 29625
(800) 323-4615

Sears Merchandise Group
Craftsman Power Tools
D3 181A, 3333 Beverly Rd.
Hoffman Estates, IL 60179

Delta International Machinery Corp.
246 Alpha Dr.
Pittsburgh, PA 15238
(412) 963-2400

SLIDING COMPOUND

MODEL	COST list / street	WEIGHT lbs.	AMPS	BLADE dia. / type / rpm	CROSSCUT 0° thick. x width	MITER 45° thick. x width	BEVEL 45° thick. x width	COMPOUND 45° - 45° thick. x width	
AEG SKS 300 CIRCLE #607	\$999 / \$699	46.3	9.5	10" / 24T-C / 3360	2 ¹ / ₁₆ x 11 ²⁵ / ₃₂	2 ¹ / ₁₆ x 8 ⁵ / ₁₆	2 ¹ / ₁₆ x 11 ²⁵ / ₃₂	2 ¹ / ₁₆ x 8 ⁵ / ₁₆	
HITACHI C8FB CIRCLE #608	\$921 / \$460	37.4	9.5	8 ¹ / ₂ " / 24T-C / 4900	2 ⁹ / ₁₆ x 12	2 ⁹ / ₁₆ x 8 ²¹ / ₃₂	1 ²⁵ / ₃₂ x 12	1 ²⁵ / ₃₂ x 8 ²¹ / ₃₂	
MAKITA LS1011 CIRCLE #609	\$818 / \$470	34.8	12	10" / 36T-S / 4680	2 ¹⁵ / ₁₆ x 12	2 ¹⁵ / ₁₆ x 8 ⁷ / ₁₆	1 ⁹ / ₁₆ x 12	1 ⁹ / ₁₆ x 8 ⁷ / ₁₆	
RYOBI TSS-220 CIRCLE #610	\$849 / \$460	44	10	8 ¹ / ₂ " / 24T-C / 4500	2 ¹⁵ / ₁₆ x 12	2 ¹⁵ / ₁₆ x 8 ⁵ / ₈	1 ¹⁵ / ₁₆ x 12	1 ¹⁵ / ₁₆ x 8 ¹¹ / ₁₆	
SEARS 23488 CIRCLE #611	\$399	69	10	8 ¹ / ₄ " / 24T-C / 5000	2 ¹ / ₂ x 12	2 ¹ / ₂ x 8 ⁵ / ₈	1 ³ / ₄ x 12	1 ³ / ₄ x 8 ⁵ / ₈	
DELTA SIDEKICK 33-060 CIRCLE #612	\$499 / \$390	42	12	6 ¹ / ₂ " / 18T-C / 5500	1 ³ / ₄ x 12	1 ³ / ₄ x 9 ¹ / ₂	1 ⁵ / ₈ x 12	1 ⁵ / ₈ x 9 ¹ / ₂	

T=Teeth C=Carbide S=Steel

much support to tall stock.

The Ryobi's fence is machined as a solid piece with the base of the saw. The fence on the one I tested was machined a bit roughly and wasn't perfectly flat.

The sliding carriage on these saws must be rigid enough to avoid sideways deflection, yet move freely forward and back. To check deflection, I fully extended each saw's cutterhead, applied a 10-lb. force sideways to the handle and measured movement with a machinist's dial indicator. The deflection readings ranged from 0.013 in. (Hitachi) to 0.024 in. (Ryobi). Deflection doesn't seem to be anything to worry about; it didn't affect the saws' performance during my tests.

Every saw's carriage moved smoothly with no detectable play. The Makita's, the only one that employs a single sliding rod, was most effortless, while the Ryobi's had the most friction. On all the saws the bearings around the sliding rods are sealed to keep out sawdust. Ryobi adds further protection by partially covering the sliding rods with a metal shroud.

Blade guards are standard on these saws—metal on the Ryobi and AEG, clear plastic on all the others. On all but the Hitachi and AEG, a mechanical linkage automatically moves the guard



PHOTOS BY DAVID SELLERS
To adjust the bevel cutting angle on the Hitachi (shown), Sears and Makita saws, you have to reach to grip the rear-mounted bevel lock lever. The bevel scale is just left of the lever.

up as the blade plunges down, making it easier to line up your cut. The Hitachi's two-piece guard hangs loosely and moves up as it contacts the workpiece. I found it more difficult to align a cut on this saw because some part of the guard is always covering the blade so you have to look through the guard to see the blade. On the AEG, you have to pull a large lever behind the handle to raise the guard. I found this awkward because you have to simultaneously push a button to release the trigger lock and pull on the trigger switch. It's a real handful.

As an added safety feature, each of these saws comes with an electronic

brake that stops the blade within a few seconds when you release the trigger.

All these saws excel in making accurate miter and bevel cuts, but the ease of adjustment for these cuts varies among the saws.

To adjust for miter cuts, you rotate the saw's turntable left or right and then tighten a lock knob. I preferred the long front-mounted lock knobs on the Ryobi, Hitachi and Sears. I could loosen the knob and turn the turntable with one hand. The AEG also had a front-mounted lock knob, but it was so tiny it was hard to tighten. On the Makita, the lock knob is attached to the back of the fence. Adjusting it requires a double hand-motion.

Each saw has detents or "stops" for setting common miter angles. (See chart.) Hitachi, Makita and Ryobi also have detents for setting the bevel angles for compound angle cuts for crown molding.

I found the miter detents on the AEG the most positive, even though it's a bit awkward to lift the small lever under the front of the turntable (like a car's hood latch) to release the detent.

The detents felt "soft" on the Hitachi and Ryobi, and slightly soft on the Sears, so I wasn't always sure when the carriage was in position. I would have preferred a reassuring "click" that

ND MITER SAWS

MITER RANGE°	MITER STOPS°	BEVEL RANGE°	BEVEL STOPS°	MOUNTING DEPTH ^①	ACCESSORIES (* - Standard equipment)
45L / 45R	0, 15, 22.5, 30, 45	0 - 45	0, 45	24"	Work vise, metal workstand, table extension for workstand, dust extraction adapter
45L / 57R	0, 15, 22.5, 31.6, 35.3, 45	0 - 47	0, 30, 33.9, 45	28"	Dust bag*, Extension guides & workstop, work vise, auxiliary slide fence, adjustable blade guard
46L / 58R	0, 15, 22.5, 31.5, 45	0 - 45	0, 45	21"	Dust bag*, extension guides & workstop, work vise*
52L / 52R	0, 15, 22.5, 31.5, 45	0 - 45	0, 34, 45	28"	Dust bag*, work vise, extension guides
47L / 52R	0, 15, 22.5, 30, 45	0 - 45	0, 45	28"	Work vise*, dust bag
47L / 47R	0, 22.5, 31.6, 45	0 - 45	0, 45	24"	Work vise, extension guides

① Distance from front of base to back of slide.

indicated a perfect lock on the precise angle setting, but one manufacturer's rep explained that tighter detents would cause rapid wear on turntable parts.

My tests also showed that relying on the detents could provide cuts that were off by a fraction of a degree when sawing 12-in.-wide boards. It's not possible to adjust the detents, but I could get accurate cuts by making a trial cut, then readjusting the angle setting.

To adjust for bevel cuts you loosen a lock lever and tilt the cutterhead. A bevel angle scale indicates the degree of tilt. On the Makita, Sears and Hitachi, the lock lever and bevel angle scale are located at the rear of the saw (see photo, previous page) where they're hard to read while making an adjustment. Makita's scale and lever are the most accessible of these three. (See photo, below right.)

The AEG's bevel lever and scale are behind the left side of the cutterhead (see photo, next page)—more convenient than the first three. But I found it simplest to make bevel adjustments on the Ryobi because the bevel scale and lock lever are just behind the cutterhead where they're easy to see and to reach. (See photo, above right.)

Dust collection is important with these saws because they will quickly cover the surrounding area with a



Ryobi's bevel scale and lock lever are more accessible than rear-mounted ones. The cutterhead tilts by moving on curved trunnions.

thick layer of sawdust. The small bags supplied by some of the manufacturers make nice flags for their logos, but for dust collection, they're almost useless. They only catch a fraction of the dust, and they fill up in about five minutes of cutting. However, hooking up our 1½ HP (900 CFM) dust collector to the saws' dust collection ports made a big difference. On the Hitachi, I'd estimate the system collected 75 percent



The Makita's single sliding rod is just as rigid as the twin rods on other saws, and moves very smoothly. Note bevel lock lever and scale at left.



Auxiliary work vise (standard on Sears and Makita, optional on others) keeps the stock from shifting during the cut (above.)

The AEG's optional dust collection kit provides dust pickup—both behind the blade and under the blade slot in the turntable. Note bevel lock lever and scale behind fence (left).

of the dust, while on all the others it collected perhaps 50 percent.

For this test I had installed the AEG's optional "Dust Extraction Adaptor" kit (\$42), which draws dust from under the turntable as well as from the back of the saw. (See photo.) It helped corral a little more dust, but didn't seem worth the extra cost.

Handle position and noise level are also important if you plan to use a sliding compound miter saw frequently. To me, the handles were all about equally comfortable, but I really liked the bar-like trigger switch on the Makita's handle. And its trigger release button is positioned on top which makes it equally accessible for right-hand or left-hand use. As far as noise goes, the AEG's induction motor ran more quietly than the universal motors on the other saws.

Cutting Tests

By now you're probably asking, "which saw cuts wood best?" There were no sure winners in my tests. I found each saw had plenty of power to cut 1½-in.-thick pine boards—crosscuts as well as miters and bevels.

Then it got tougher. All the saws could crosscut 2-in.-thick oak, but they worked hard to get through it. And when I tried 45° bevel cuts and compound miter/bevel cuts in 1½-in.-thick oak, the saws slowed down significantly, forcing me to reduce the feed rate to keep the saws from stalling. (The

Sears saw bogged down completely, almost stalling and severely burning the wood. However, I found the problem was in the blade, not the saw. When I replaced the blade with another identical Sears blade, the saw cut OK.)

The AEG worked OK on soft wood, but even with its 5° negative hook blade, which is supposed to prevent it from cutting too aggressively, it tended to bite forcefully into the 2-in. oak, sometimes jerking the cutterhead toward you like a big radial arm saw would. Most of the problem was that the AEG operates like a radial arm saw—you first plunge the blade into the stock, then pull the blade toward you. A company spokesman told me you can operate the AEG like the other saws (pull out, plunge and push). That solved the jerking problem, but then the saw's carriage return springs tended to pull the pivoting cutterhead up out of the wood too soon.

There is a problem when making bevel and miter cuts in thick oak with all these saws. That's the stock's tendency to creep slightly along the fence during the cut. This results in ugly teeth marks on the cut end and kerfs that aren't straight. The manufacturers offer work vises (standard on Sears and Makita) that solve this problem by clamping the stock firmly against the base and turntable. (See photo.) The AEG's work vise (\$32) was easiest to position and had a slick handle I could spin with one finger.

Thin-kerf carbide blades are standard on all but the Makita, which has a steel blade. The carbide blades cut fairly smoothly; the steel blade was slightly rough on thick oak. For smoother cuts, I'd suggest using the manufacturers' optional fine-tooth carbide blades with 40, 60 or even 80 teeth. You can't use dado blades on these saws, though the saws do have depth stops that allow you to cut kerfs to precise depths. Then you can cut dados with the standard blade by making repeat kerfs.

You might also want to try a negative hook angle blade which grabs the stock less aggressively and forces the stock down and back against the fence. Several companies make 10-in. versions of these blades. But Freud offers both a 10-in. and an 8½-in. blade with a 5° negative hook angle (model LU91M, available from Tarheel Filing Co. Inc., 3400 Lake Woodard Dr., Raleigh, NC 27604, 800-322-6641).

Last Word

So what's the best buy? There are no clear winners among these saws, and the street prices are all pretty similar except for the higher-priced AEG. If I was buying one, I'd see it as a toss-up between the Hitachi and Makita. But three AW editors thought the Makita had the edge. The fit and finish of both saws is good. I liked the positive miter detents and smooth slide on the Makita. The Hitachi has superior dust collection when used with a shop vacuum, and its standard blade cuts smoothly. Plus, the saw has an overall feeling of quality. If I was on a budget, I'd consider buying the Sears saw. It's the heaviest (69 lbs.), but comes at the lowest price and has no serious deficiencies.

Whichever saw you choose, check and adjust the alignment to ensure that everything is working properly. If there's a problem, it's best to discover it before putting the saw to work. ▲



DAVE SELLERS
is an assistant editor of AW.

PORCH BENCH

BY RIC HANISCH

Comfort Connects With Country in This Knockdown Design

When my friend Frank Palmieri asked me to help design a porch bench for small production runs, I saw it as a great opportunity—collaboration has become a means of continuing my education. Frank was after simplicity and strength in both the construction and

the look of the bench. And because he planned to ship completed pieces, he wanted a bench that could easily be disassembled and reassembled with simple tools and no training. The design we ended up with (see photo, below) fulfilled all these criteria.

The key structural elements of

our knockdown bench are the two rails which support the seat. They firmly tie the end panels to the seat when you wedge tenons into the ends of the rails. (See drawing.) The seat is rabbeted on each end and fits (but is not glued) into 12½-in.-long dadoes in the end panels. The two backboards, which provide strength against racking, are rabbeted to fit into shallow notches in the end panels and are simply screwed in place. The only parts of the bench that are permanently attached are the two armrests which are glued, screwed and pinned to the end panels.

Tips for Construction

The drawing shows the construction details, but some tips on the building process are in order.

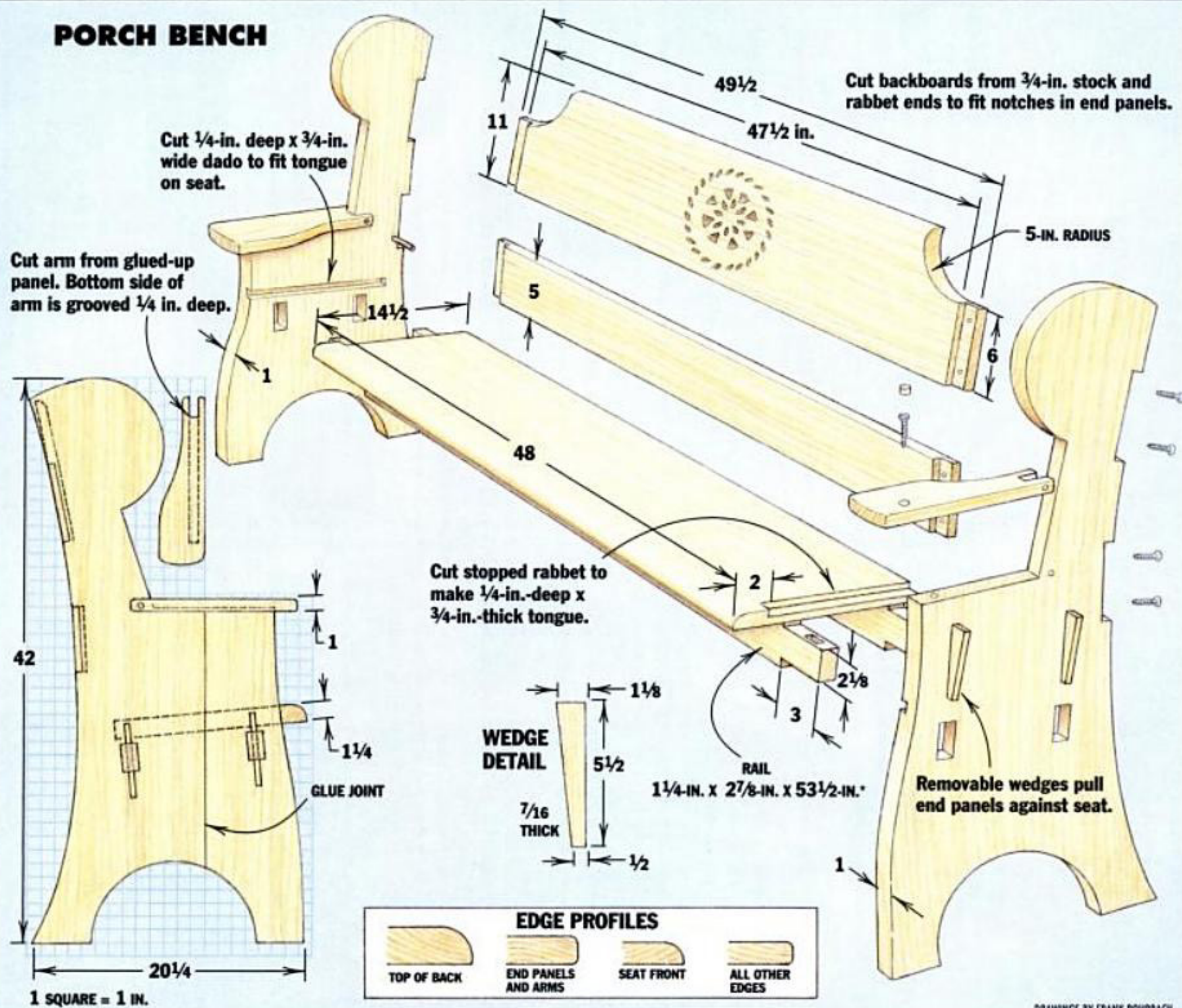
We used poplar because we planned to paint the benches, but just about any hard or softwood will work with this design. The bench ends and



Held together with wedged tenons, this country-style porch bench is solid, yet easy to take apart.

PHOTOS BY RIC HANISCH

PORCH BENCH



armrests are made from two panels glued up as shown in the drawing. We cut the long, gentle curves on the end panels with a bandsaw, and used a saber saw for the tighter arcs and for the backboard notches.

Make sure the seat tongues don't bottom out in the grooves. The bench gets its strength because the shoulders of the tongue butt tightly against the end panels when the rails are wedged.

For the through-mortises on the end panels, we used a drill to bore through the stock and then squared the mortises up with a saber saw. To make the angled through-mortises on the rails, drill first, and then use a chisel to cut the angle and square up. Make sure the wedge mortises are laid out so their inner ends are *slightly inside* the end

panels when the rails are in place. This will ensure that the shoulders seat tightly when the wedges are tapped home.

The way you treat the edges of the boards has a strong influence on the feel of any piece of furniture. We shaped the edges of our bench with a block plane and spokeshave to avoid the machined look that routers produce. (See the profiles in the drawing.) To further enhance the country look of the bench, I designed a pierced and chip-carved rosette for the backrest. (See sidebar, next page.)

For a finish, I used a wash coat of thinned shellac (1/3 alcohol to 2/3 prepared shellac) and rubbed this out with a Scotch-Brite pad. This seals the wood and provides a smooth surface for either a clear or painted finish. I

used latex paint, thinning it enough so that when applied, the color is solid, but the wood grain still shows. This way, the finish will age gracefully, wearing through at the edges rather than chipping off. After painting, I applied one coat of Waterlox, an oil/varnish blend, to create a slight sheen and provide a bit of protection from the elements. ▲

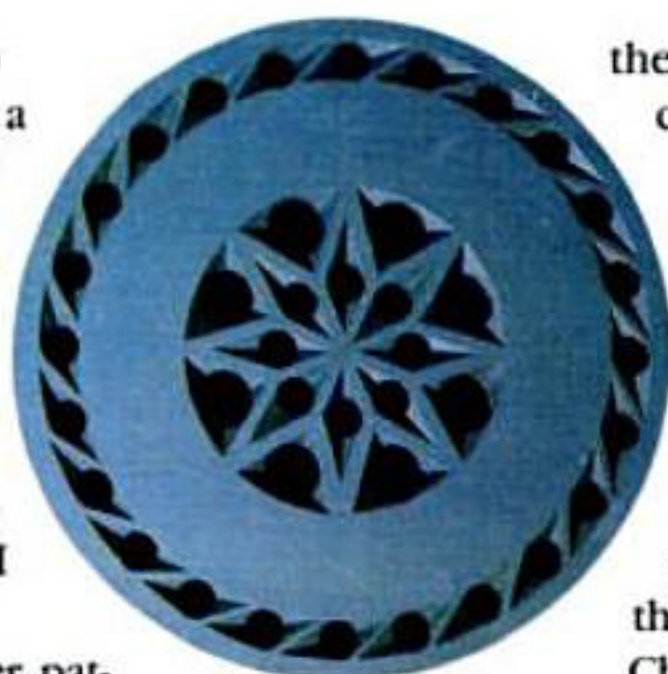


RIC HANISCH
is an architect and designer living in Pennsylvania.

A TEMPLATE FOR LAYING OUT ROSETTES

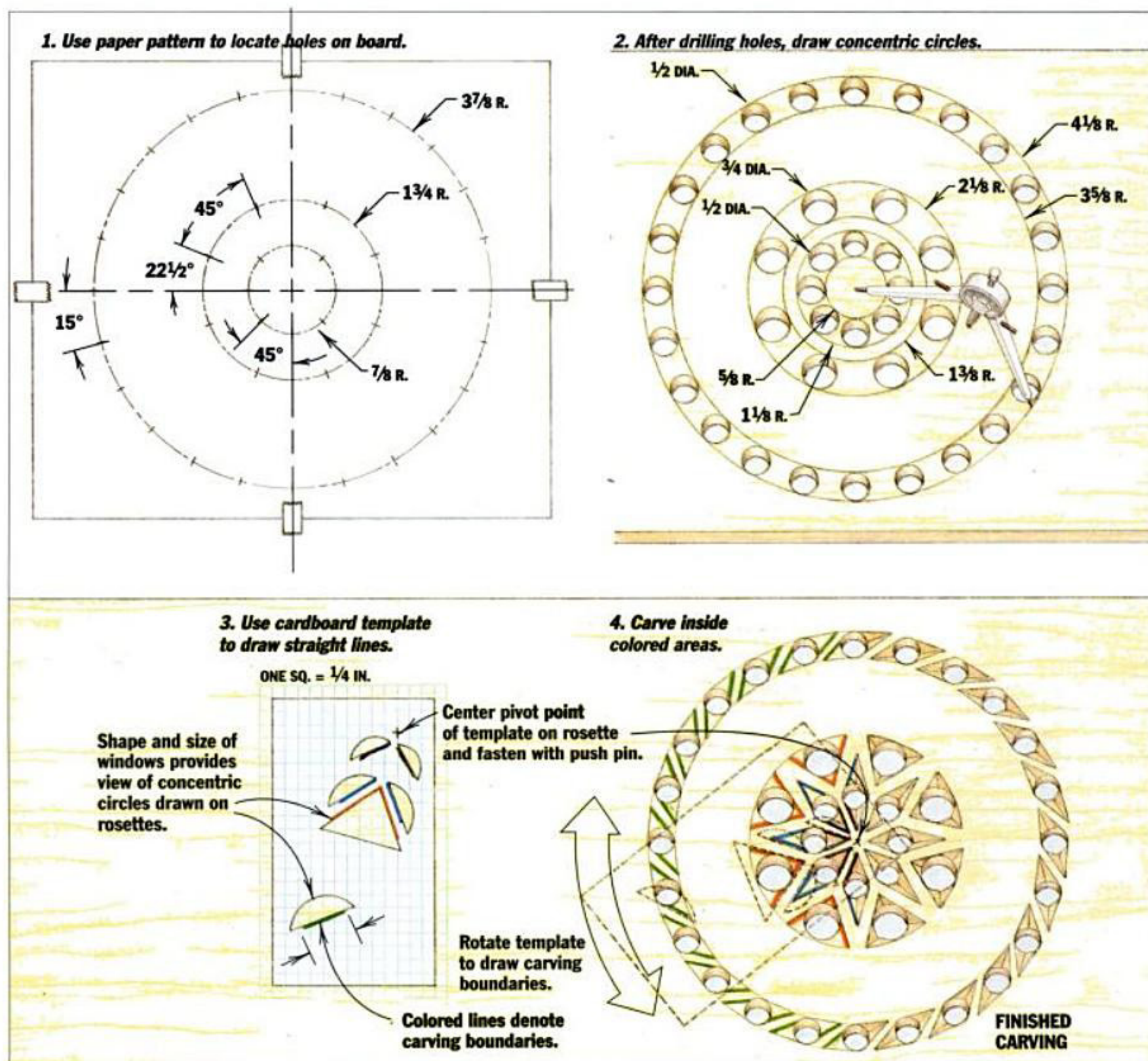
Rosettes are attractive additions to furniture, but plotting them with a compass and square, or transferring an image from paper to wood can be tedious. I came up with a system that allowed me to accurately draw the design right on the work surface. The decoration I wanted was a simple pierced and chip-carved rosette that would complement the backboard on a porch bench I built. (See main article.)

To lay out this rosette I made the paper pattern and a cardboard template shown below. First, I taped the pattern to the board and marked the centers of all holes to be drilled. After removing the pattern and boring



the holes on a drill press, I used a compass to draw concentric circles that marked the boundaries of the curved V-cuts. The remaining V-cut boundaries I laid out using the template. I just attached the pivot point of the template to the center of the rosette with a push pin, then rotated the template. When the straight edges of the template cutouts (color-coded in the drawing) lined up tangent to the holes, I drew the lines on the board.

Chip carving takes a little practice. (See AW #2, May/June 1988, for more on chip carving.) Whether you use a knife or a chisel, the cleanest work results from removing the chips with a few deliberate cuts.—R.H.





JOHN HAMEL

SHAPELY CHEVAL

BY ELLIS VALENTINE

When we decided to feature the ellipse jig in this issue (see page 31), I had plenty of ellipse-based projects in mind, but the one that best reflected the ellipse theme was this walnut cheval mirror.

Over the years, I had tried to avoid making elliptical things because they required too much effort and they never seemed to look exactly right. However, when I realized how easy it was to create perfect ellipses with our jig, I pulled out all the stops. You can build this mirror without using the jig, but I wouldn't advise it. In fact, it's important to read the jig article before tackling this one so you'll understand the terminology used here.

*Here's the Perfect Test for AW's
Ellipse Jig: A Freestanding
Cheval Mirror Made Entirely
of Elliptical Forms*

Designing the Mirror

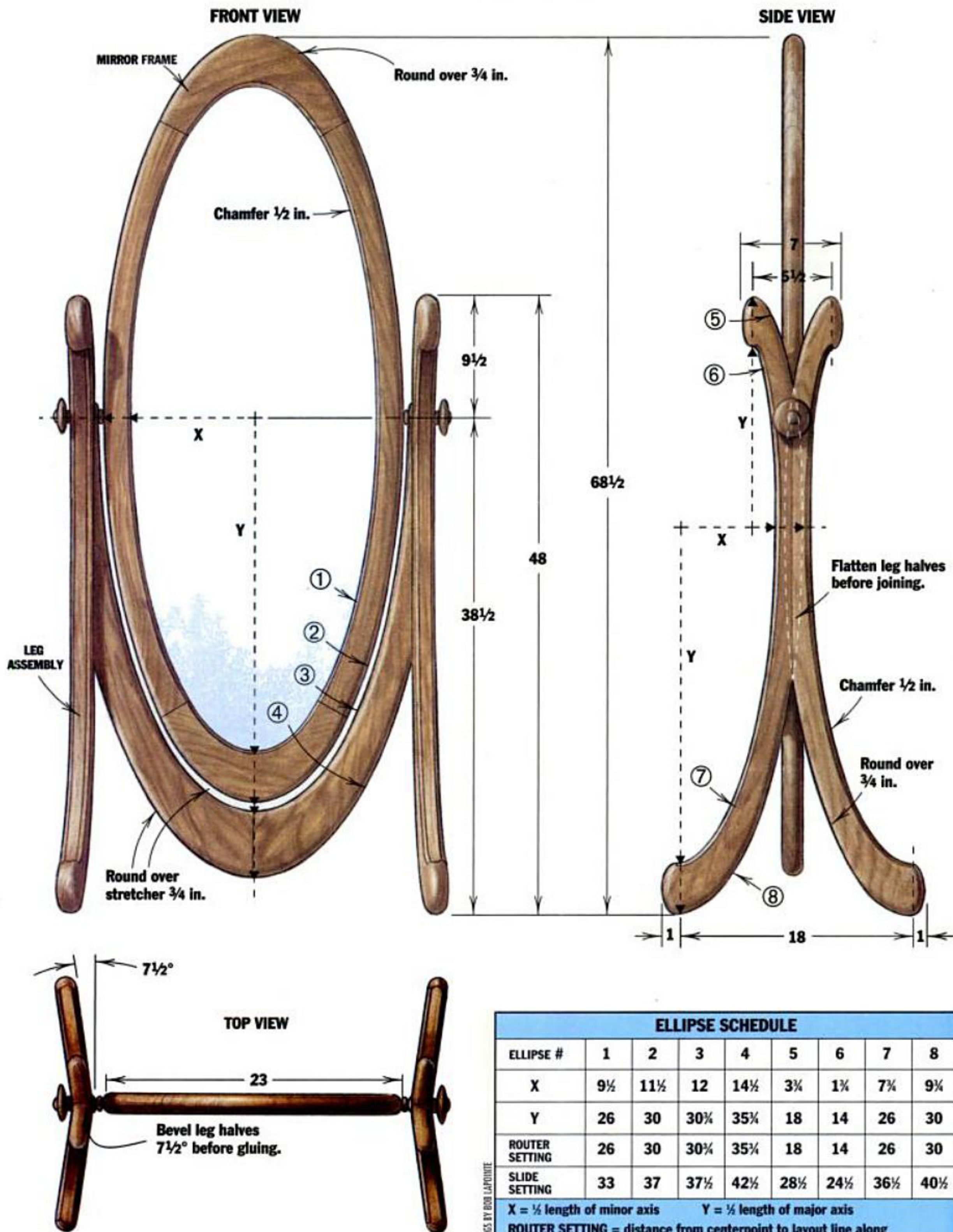
When designing anything, function and appearance are the main concerns. A functional cheval mirror should be sturdy enough to resist tipping over and large enough to be a dressing mirror. Aesthetically, it should be understated so it doesn't overpower the image of the viewer.

But in this case, there was also an additional consideration—I wanted to make the mirror entirely of ellipses, all of which could be cut on the ellipse jig.

I began the design process with some quick sketches of possible overall forms, trying to visualize a finished product. After settling on a favorite, I went to the drawing board and boxed out the overall height, width and depth of the

All the shapes in this cheval mirror were cut with a router and the ellipse jig described in the article on page 31.

FIG. 1: CHEVAL MIRROR

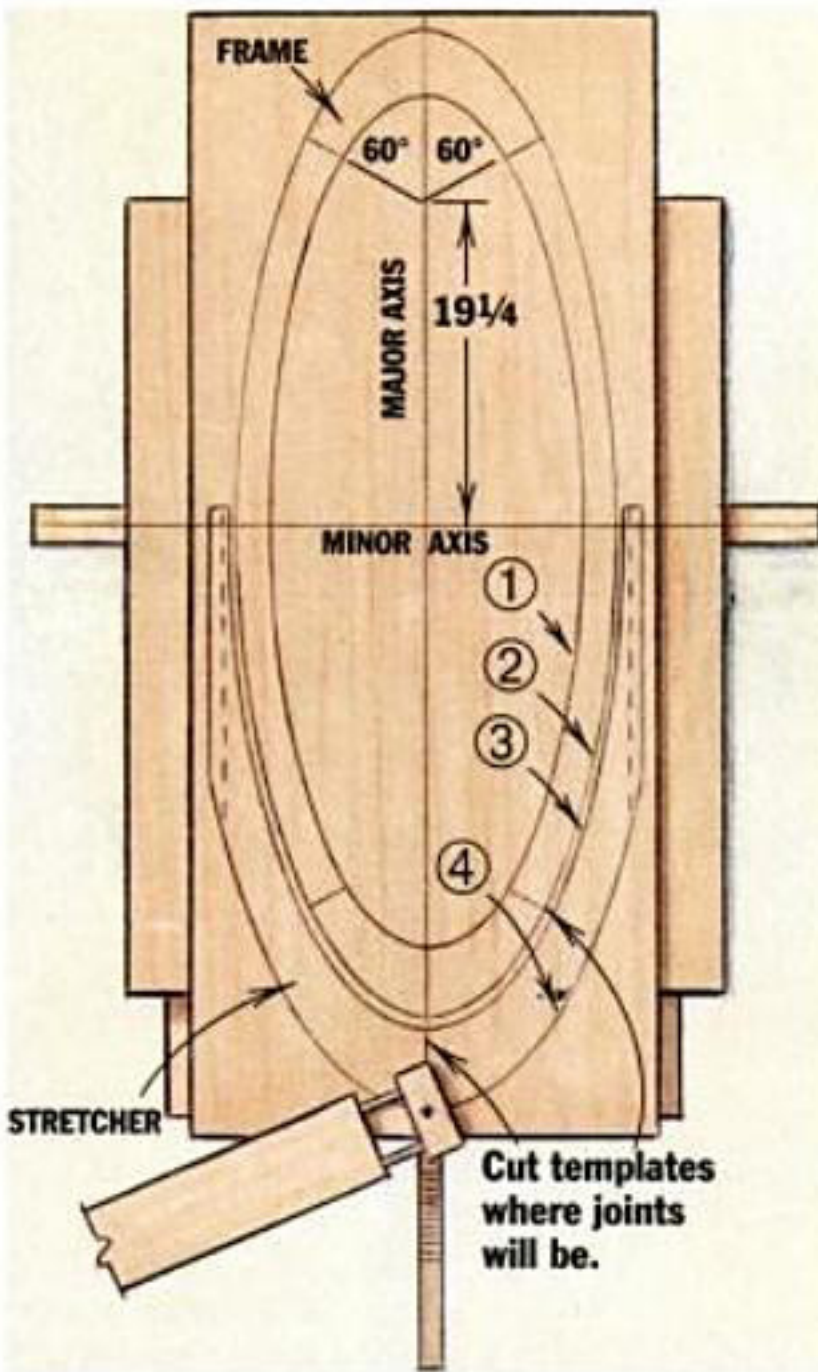


ELLIPSE SCHEDULE								
ELLIPSE #	1	2	3	4	5	6	7	8
X	9 $\frac{1}{2}$	11 $\frac{1}{2}$	12	14 $\frac{1}{2}$	3 $\frac{3}{4}$	1 $\frac{1}{4}$	7 $\frac{1}{4}$	9 $\frac{1}{4}$
Y	26	30	30 $\frac{1}{2}$	35 $\frac{1}{2}$	18	14	26	30
ROUTER SETTING	26	30	30 $\frac{1}{4}$	35 $\frac{1}{4}$	18	14	26	30
SLIDE SETTING	33	37	37 $\frac{1}{2}$	42 $\frac{1}{2}$	28 $\frac{1}{2}$	24 $\frac{1}{2}$	36 $\frac{1}{2}$	40 $\frac{1}{2}$
X = $\frac{1}{2}$ length of minor axis Y = $\frac{1}{2}$ length of major axis ROUTER SETTING = distance from centerpoint to layout line along major axis. (NOTE: Refer to drawing to determine bit placement.)								

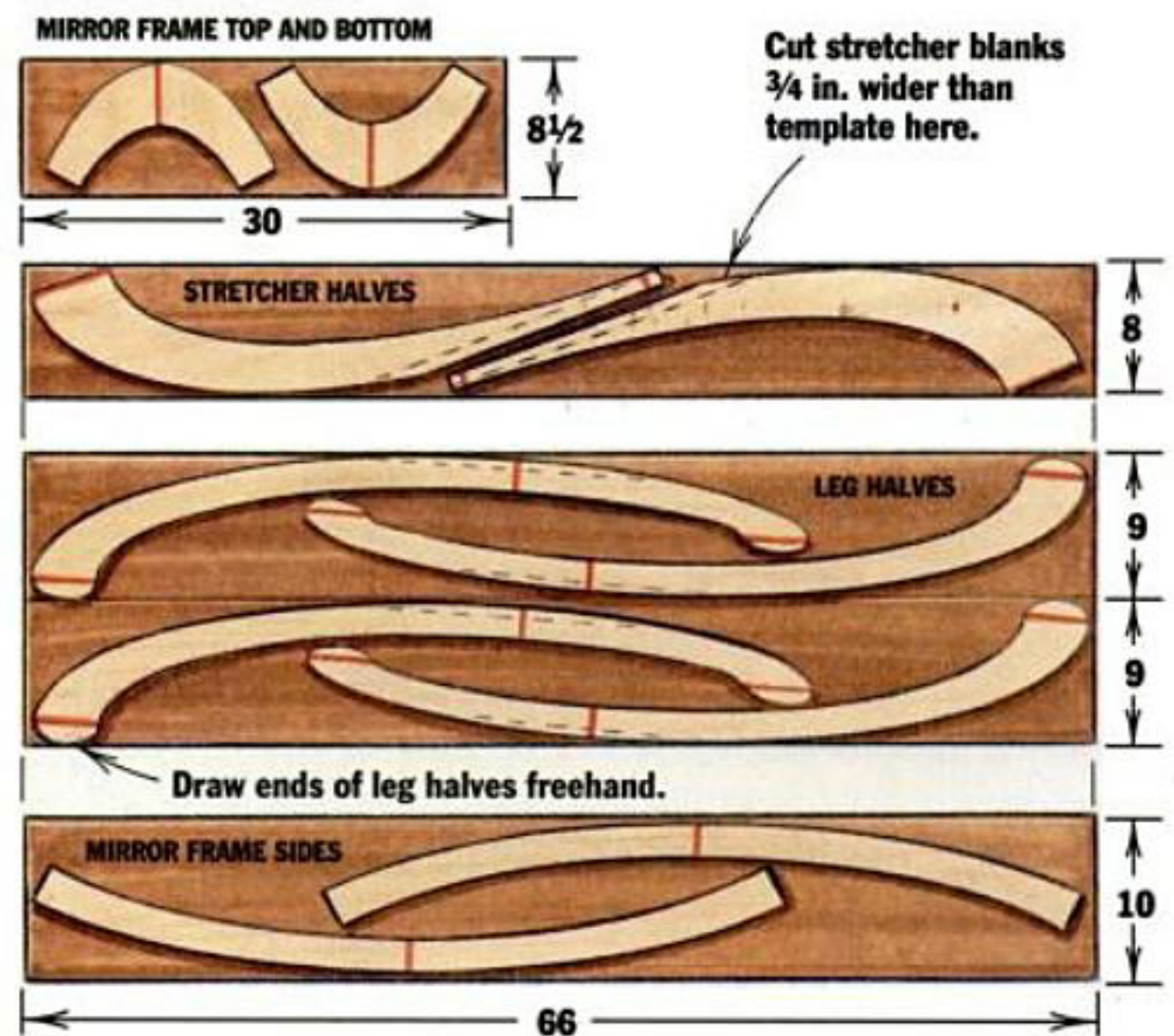
All measurements are in inches.

FIG. 2: MAKING THE PARTS

STEP 1: Draw parts full size on $\frac{1}{4}$ -in. plywood using jig. Bandsaw templates for each mirror part.



STEP 2: Lay out parts on $1\frac{1}{2}$ -in. thickened stock. Mark axes as shown in red. Then cut out blanks, allowing about $\frac{1}{4}$ in. around each piece for trimming.



mirror to scale. Then I sketched the approximate ellipses I wanted in the boxes.

From my sketches I scaled the major and minor axes of each ellipse and used these dimensions to determine the slide settings for the ellipse jig. Then I used the ellipse jig to draw full-sized mirror parts—the mirror frame, the stretcher, and one leg half—on $\frac{1}{4}$ -in. plywood to see what the final mirror would look like. (See Fig. 1 and 2.) This way, I could adjust the jig and pencil settings to produce the most pleasing appearance.

When I was satisfied with each ellipse, I noted the major and minor axis dimensions on a *schedule*. (See Fig. 1.) This gave me all the information I needed to set up the jig, so no formal blueprints were necessary.

Making the Mirror

The first step in constructing the mirror is to create tracing templates for each part, so you can lay out and cut blanks for routing. Begin by bandsawing the templates from the full-size drawings you made on the $\frac{1}{4}$ -in. plywood. Note that on the leg halves you

have to draw the curved ends freehand and draw the straight edges where the halves will be joined. (See Fig. 2.) Make sure to mark the locations of the ellipse axes on the templates.

Trace each template onto $1\frac{1}{2}$ -in. stock as shown in Fig. 2, Step 2, and transfer the axis marks from your templates to these blanks as shown in the drawing. You'll need the marks to position the blanks on the jig. Bandsaw the blanks, leaving about $\frac{1}{4}$ in. extra around each piece and $\frac{3}{4}$ in. extra at the flat part of the stretcher.

Next, join the pieces to make blanks

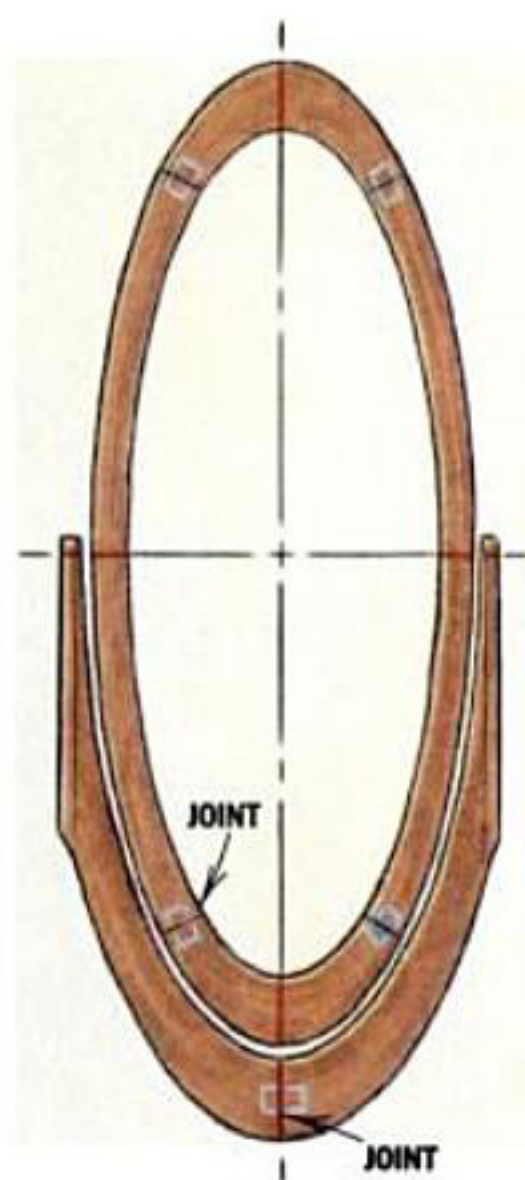
Position each part for routing by aligning its major axis with the jig centerline and measuring from the center point of the platform to the layout line on the blank. A wood block elevates the ruler.



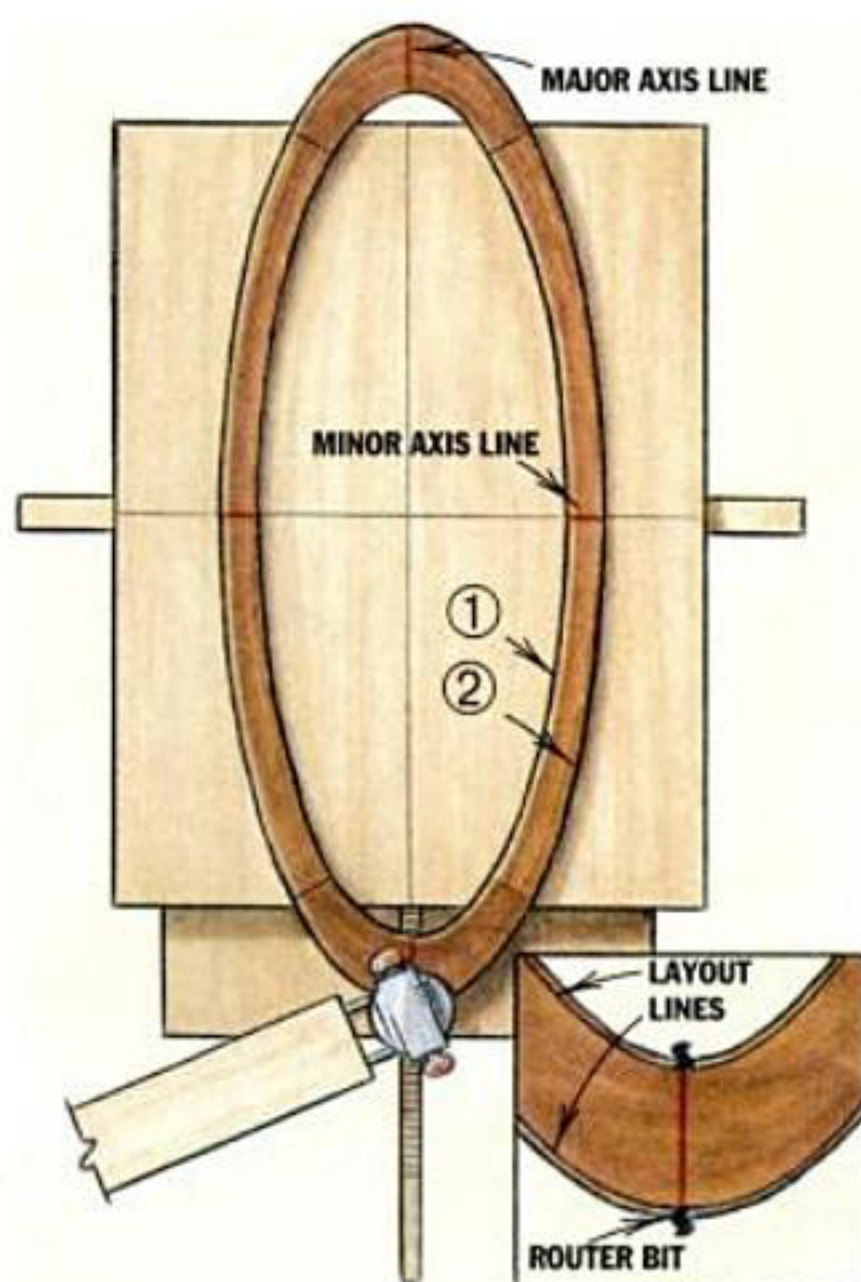
for the mirror frame and the stretcher. I used butt joinery with floating tenons, but you could also dowel the joints with $\frac{1}{2}$ -in. dowels or use splines. True up the mating surfaces on a disc sander or with a block plane. Dry-assemble the parts to make sure all the joints are tight, then mark out and plunge rout the mortises. Finally, glue up the blanks, using angled clamping blocks held on with hot glue to direct the clamping pressure. I used yellow (aliphatic resin) glue throughout the construction of the mirror.

To position each blank for rout-

STEP 3: Join mirror frame and stretcher blanks from their component parts. Use floating tenons, dowels or splines.



STEP 4: Align axis lines on blank with centerlines of platform. Attach blank to platform with hot glue or screws.



ing, first refer to the ellipse schedule to determine the half-lengths ("X" and "Y") of the major and minor axes for the ellipse you're cutting. (See Fig. 1.) Now place your blank on the jig platform and measure these distances along each axis from the center point of the platform to the layout line on the blank. The axis lines of the blank should fall on the centerlines of the jig's platform. (See Fig. 2, Step 4.)

To make measuring easier, I cut a 1-in. by 1½-in. by 6-in. block of wood to elevate my steel ruler to the height of the blank. By placing one edge of the

block along a given axis of the jig, with one end of the block on the opposing axis, I could easily position my walnut blanks according to the dimensions given in the ellipse schedule. (See photo, opposite page.)

Once you've positioned the band-sawn blank, trace its outline on the platform. Turn the blank over, put a few small spots of hot-melt glue on its underside, and quickly press it into position inside the traced outline.

Now you're ready to set the jig and rout the ellipses. First, align the long axis of the platform with the cali-

brated slide. Next, set the slide to the slide setting listed in the ellipse schedule and lock it with the suitcase latch. Firmly attach your plunge router to the router arm and place the arm on the spacer block, with the router resting on the work. Set the cutting edge of the router bit on the intersection of the axis line and the layout line on the blank. (See Fig. 2, Step 4.)

Now clamp the router arm firmly to the spacer block and bench, checking to see that the router baseplate rests flat on the work. If it doesn't, add or subtract spacers as necessary.

With the router switched off and the bit retracted, swing the platform through the arc of the ellipse to make sure the bit follows your tracing line. If it deviates slightly, you can compensate by fine-tuning the slide setting.

(NOTE: If your router arm assembly is rigidly built and clamped tightly to your bench, you should be able to rout the mirror parts without assistance. I suggest a trial run with some scrap-wood to test your setup and build some confidence with the procedure.)

To cut the legs and stretchers, begin routing at either end of the blank. (The mirror frame itself is a closed oval and has no ends, so you can start anywhere.) Plunge the router about ⅜ in. into the wood, lock the plunge mechanism, and rotate the platform steadily through the curve until the router bit just exits the other end. Without raising the bit or turning off the router, rotate the platform back to the starting point and take another plunge. Then rotate the platform in the opposite direction to its original position. You'll find it much easier to turn the platform if you grip it on the side opposite the router.

Don't try to remove too much material at a pass. You'll just overwork the router or burn the bit. More importantly, the torsional forces generated by too deep a cut could overpower the clamps holding your router-arm or change the adjustment slide setting, causing the bit to wander. I found ⅜-in. plunges about right for my combination of walnut, a 3-HP router, and a not-too-sharp ½-in. carbide straight bit. At this rate, it'll take you about eight passes to cut completely through a 1½-in.-thick blank.

Rout each part by plunging the router in ⅜-in. increments and rotating the platform through the arc from one end of the blank to the other.





After rounding over the stretcher, use a spokeshave to contour the last several inches at each end.

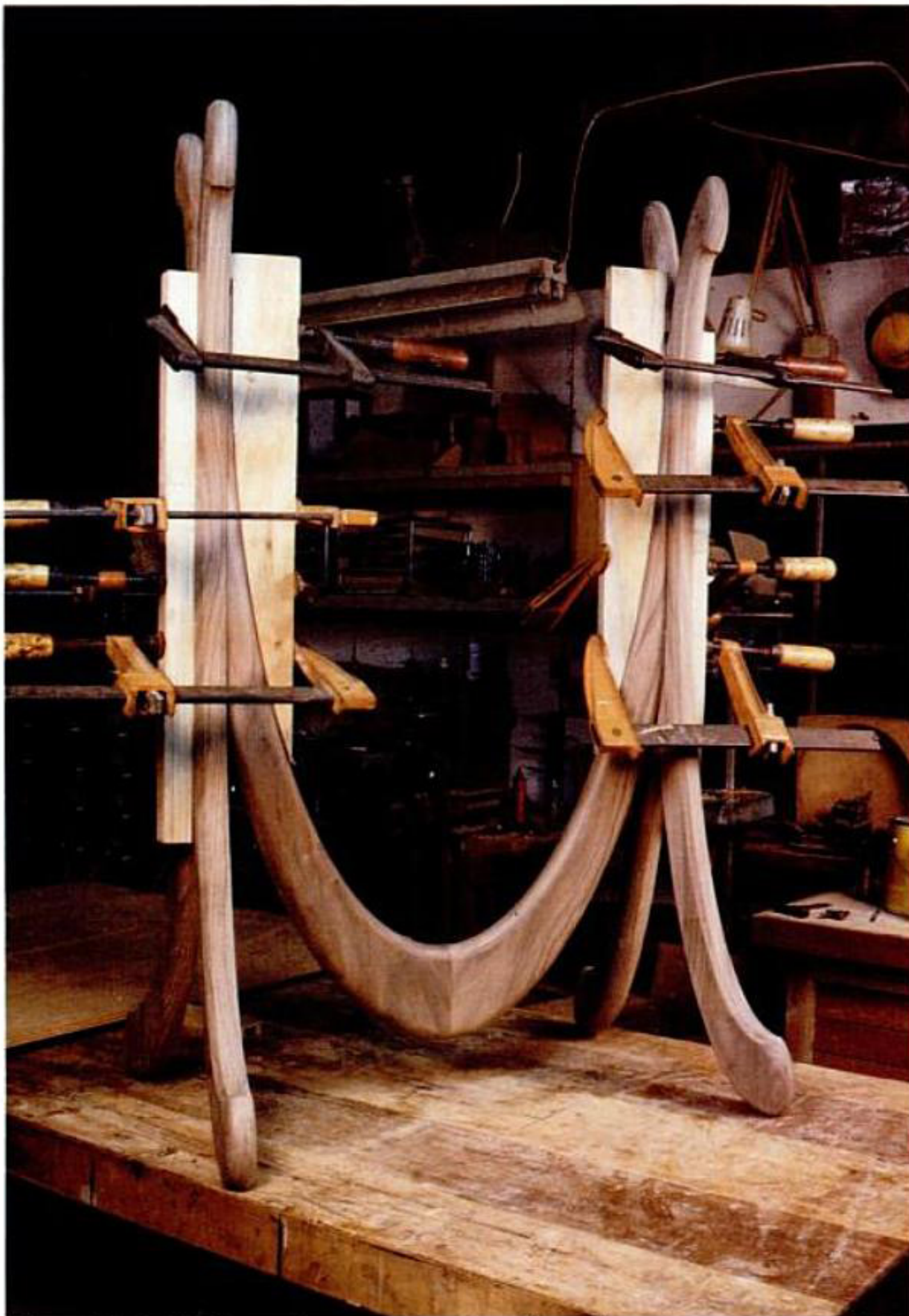
When routing the mirror frame, position the glued-up blank facedown on the platform of the jig. This way, you can rout the outside and inside ellipses and the rabbet for the mirror without changing the position of the blank. Rout the rabbet at the same jig setting you used for the inside cutout, simply moving the router position $\frac{3}{8}$ in. further away from center.

After routing the mirror frame, drill $\frac{7}{16}$ -in.-dia. holes about 1 in. deep, on the minor axis points, for the threaded inserts you'll use to attach the mirror frame to the leg-and-stretcher assembly. (See Fig. 1 and 4.)

After routing all the walnut parts, make a back panel to fit in the rabbet behind the mirror. I used inexpensive $\frac{1}{4}$ -in. plywood because I intended to cover it with fabric, but you could make a fancy veneered panel if you like. Either way, take your unfinished back panel, or a paper pattern made from it, to a local glass supplier to use as a template for cutting a piece of single-strength ($\frac{1}{8}$ in.) mirror. The mirror should cost around \$60.

The next step is to round over and chamfer the edges of the walnut parts as shown in Fig. 1. Don't use the jig for these cuts—ball-bearing-piloted bits do a quicker and better job.

You'll find that the ends of the stretcher are too thin to round over safely with a hand-held router. The trick is to stop the router about 6 in. from the ends and finish rounding over with a spokeshave and block plane. (See photo, above.) Then bandsaw the $\frac{3}{4}$ in. of waste material from the straight outside edges of the stretcher



Clamp blocks bandsawn from scrap lumber direct clamping pressure to the glue line. Threaded rods (hidden) through pivot holes keep parts and blocks in alignment for clamping.

FIG. 3: SECTION THROUGH MIRROR FRAME

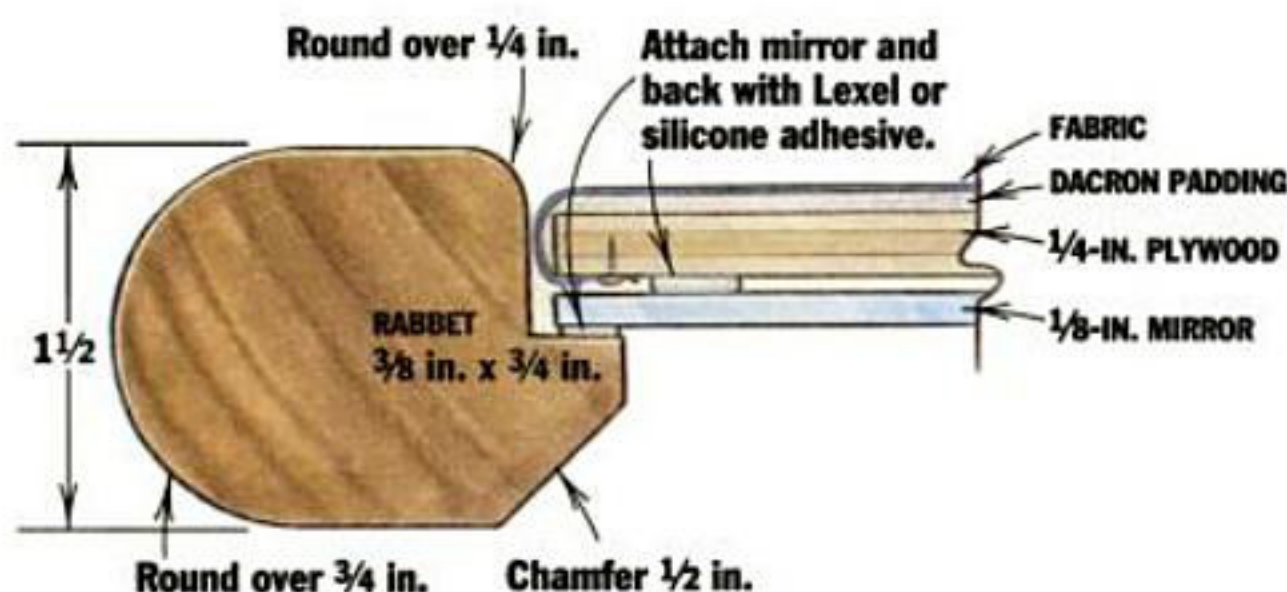
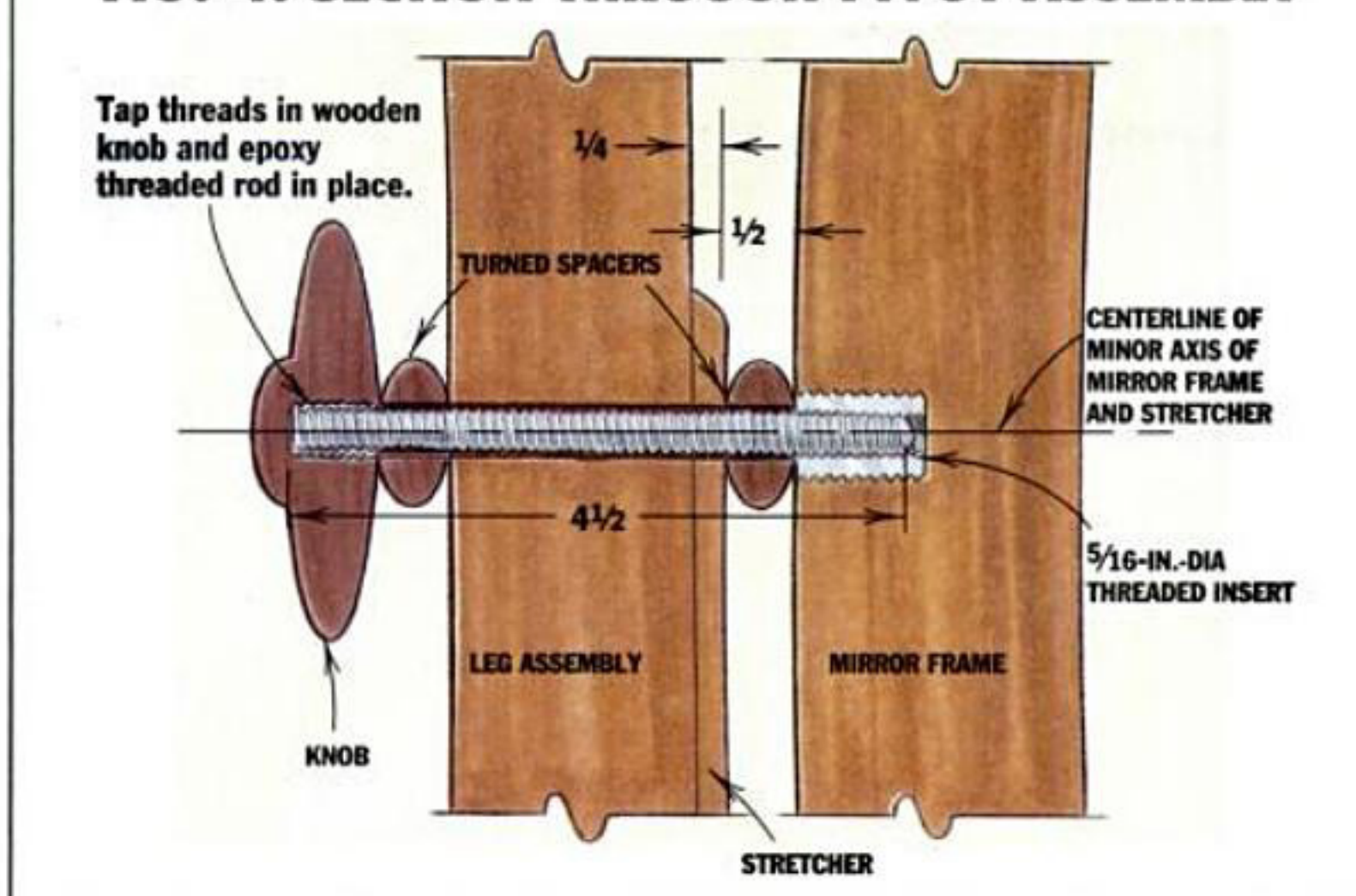


FIG. 4: SECTION THROUGH PIVOT ASSEMBLY



and flatten the edges with a plane for gluing to the leg assemblies.

To make the angled leg assemblies, first plane the straight edges of each leg half to the tracing lines. The legs, when glued up, are slightly splayed. To create this effect, tilt your plane and plane each leg half to a $7\frac{1}{2}^\circ$ angle, remembering that you have left-handed and right-handed parts. (See Fig. 1.)

It's important to register the leg halves for gluing so the joint will be perpendicular to the floor. To do this, lay each pair on the jig platform, with the inside faces up and the straight edges tight together, so that the bottoms are flush with the end of the platform and the seam is centered on the centerline of the jig. Hold a ruler across the seam and draw a pencil line across both halves for registration.

Now glue the halves into leg assemblies. You may find it useful to hot-glue a few $7\frac{1}{2}^\circ$ clamping blocks to the outside surfaces to direct the clamping pressure squarely to the glue line.

When the glue has dried, hand-plane a $1\frac{1}{2}$ -in.-wide flat on the inside face of each leg assembly where the stretcher will be glued. Before gluing the stretcher to the leg assemblies, drill $\frac{5}{16}$ -in. holes through the legs for the bolts that will hold the mirror frame in place. (See Fig. 1 and 4.) These holes should be at precisely the same height above the floor. (See Fig. 1.) Then set the finished stretcher on the platform of the jig with the center of the ellipse

on center with the jig, and mark where the stretcher ends cross the minor axis of the platform. Remove the stretcher from the platform and drill $\frac{5}{16}$ -in. holes through the stretcher ends on the minor axis marks. Then cut off the ends of the stretcher 1 in. above the holes and sand the end grain.

Cut two $4\frac{1}{2}$ -in. lengths of $\frac{5}{16}$ -in. threaded rod next. Dry-assemble the stretcher to the legs, with the threaded rods in the holes to align the parts. Check that the legs are parallel to each other and perpendicular to the floor, adjusting the flat faces of the stretcher as needed with a plane.

Now glue the stretcher to the legs, again using your sections of threaded rod to keep the parts in alignment. This joint doesn't need splines because it's practically long grain. I bandsawed clamping blocks out of scraps of pine to direct the pressure and to keep my clamps from digging into the sanded faces of the legs and stretchers. (See photo, opposite page.) Drill holes in the clamping blocks to accommodate the ends of the threaded rods and make clamping easier.

Finally, resolve the round-overs on the leg halves where they meet. I used chisels, scrapers, half-round files and sandpaper to shape these areas.

Turn the knobs and spacers next. (See Fig. 4.) I applied an oil finish while the parts were still on the lathe. After turning the pieces, drill $\frac{5}{16}$ -in.-dia. clearance holes in the spacers

and drill and tap the knobs to receive the $\frac{5}{16}$ -in. threaded rods. Epoxy the threaded rods into the knobs as shown in Fig. 4.

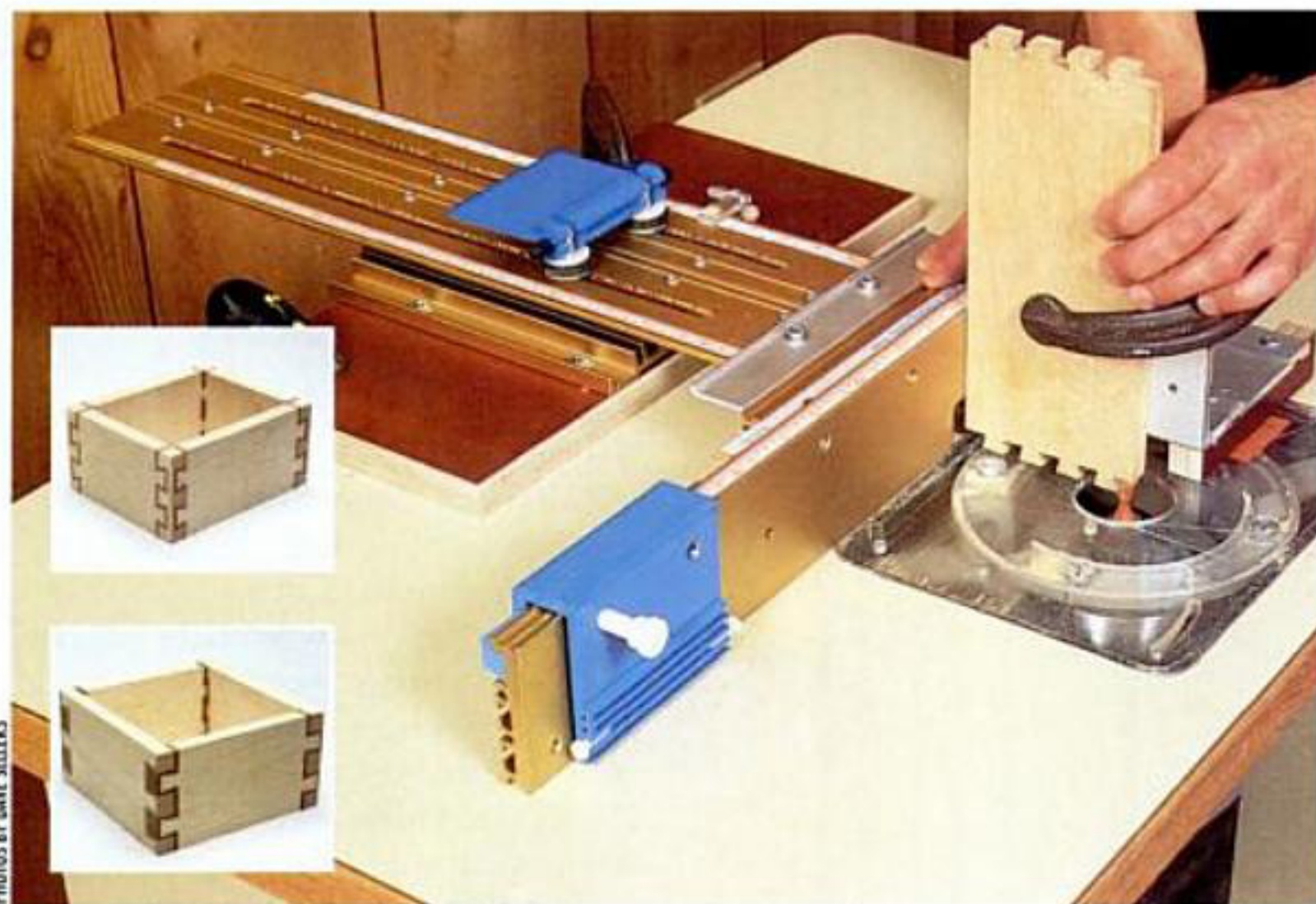
If you decide to upholster your back panel, make sure the plywood blank has at least $\frac{1}{8}$ -in. clearance around it in the mirror frame rabbet. Take the blank to a local upholsterer and have him cover it with a thin layer of Dacron padding and the fabric of your choice. The padding gives a pilloved effect to the panel.

Before trial-assembling all the parts and pieces, install the threaded inserts in the sides of the mirror frame. Clean any dried glue out of the holes in the leg/stretcher assemblies with a $\frac{5}{16}$ -in.-dia. drill bit. Then line up all the parts, hold the frame in position, and screw the threaded rods into the threaded inserts. If the threaded inserts in the mirror frame and the holes through the stretcher are all exactly on the minor axes of the ellipses, the gap between the mirror frame and the stretcher will be even. If it's off by an unacceptable amount, you'll have to relocate one of the holes through the leg/stretcher assembly to compensate.

When you're satisfied with the fit, disassemble the parts and apply a finish. Since the mirror isn't likely to suffer much abuse, almost any finish will be adequate. I chose three thin coats of Waterlox. After the finish dries, set the mirror in a thin, continuous bead of Lexel (available at many hardware stores). I find this clear, silicone-like compound has superior adhesion, but you could use silicone instead. I decided against using mechanical fasteners, assuming I won't be taking the piece apart again unless the mirror breaks, so I attached the back panel directly to the back of the mirror with several small spots of Lexel. But if you'd like to play it safer, you could devise some little clips to hold the back panel in place. ▲



ELLIS VALENTINE
is associate editor of *AW*.



PHOTOS BY DAVE SELLERS

Positioning jigs, like the INCRA Pro model shown here, can provide precise fence settings for routing intricate joints. Inset are some of the exotic inlaid corner joints the jigs can create.

POSITIONING JIGS

BY DAVE SELLERS

Trying to repeat a fence setting or precisely position a fence can be a real pain with many woodworking machines. You have to rely on a ruler, a keen eye and some luck. Or make a lot of test cuts.

Positioning jigs eliminate the guesswork. Once set up and calibrated, they let you locate a fence exactly where you want it and repeat any setting with dead-on accuracy.

There are two brands of positioning jigs currently on the market: the INCRA Jig, which was introduced in 1987, and the JoinTECH, which reached the market in 1991.

Both jigs work on the same principle. You clamp the jig to a machine table and connect it to a fence—either your own or a ready-made one the companies sell. Then you adjust the jig to precisely position your fence.



Sawing uniform veneer or laminates as thin as 1/32 in. is a snap with a positioning jig.

*Make Fence Adjustments
With Machine-Shop
Precision*

You can use a positioning jig for almost any type of operation that requires accurate spacing between cuts. On a router table it will help you make intricate dovetails like those pictured in the inset photos at left. Or you can mount one to your tablesaw to cut perfect finger joints or veneer slices as thin as 1/32 in. (See photo.) They're also handy as incremental stop blocks if you need to precisely index holes on the drill press or make regularly spaced cuts with the radial arm saw.

All this accuracy is great, but how useful are these jigs? To find out, and to compare the JoinTECH and INCRA Jig brands, I took two top-of-the-line models to the AMERICAN WOODWORKER shop and compared them on five factors. I found that though they're very similar in operation, each brand has some strong features worth noting.

Here's how they stand up.

Accuracy. Both jigs offer exceptional accuracy, but they use different principles to position the fence. INCRA Jig relies on interlocking sawtooth racks to provide adjustment in 1/32-in. increments, while JoinTECH offers the same degree of adjustment with a 32-thread-per-in. lead screw. Each jig can also offer "micro-positioning" (an option on the INCRA Jig) to fine-tune adjustments to 0.001 in.

Ease of set-up. This round goes to the JoinTECH, but the verdict is a result of the way the two companies market their products. JoinTECH sells pre-assembled jigs (you still have to attach a fence), while INCRA Jig lets you buy jig parts in, well, increments, and assemble them to fit your needs and budget.

The piece-by-piece pricing makes the INCRA Jig a less-expensive option for the woodworker who wants to ease his way into the positioning jig business. Still, if you outfit both jigs with similar options, as I did for this test, you'll see there's only about a \$50 price difference, and you'll have to put about a half-hour into assembling the INCRA Jig and accessories.

Ease of operation. No clear winners here. I like the smooth movement of the JoinTECH's carriage, which rides on sealed roller bearings, but I found adjusting jig position a minor annoyance. You have to loosen a lock knob with one

INCRA JIG PRO



The INCRA Jig Pro model, above left with optional 28-in. fence, right angle fixture and stop block. (Price as tested: \$239.80.) The optional micro-positioning feature, above right, permits fence adjustment within 0.001 in.

Chris Taylor of Taylor Design Group started the positioning jig business in 1987 when he created the original plastic INCRA Jig (\$39.95 without fence). This clever gadget used interlocking sawtooth racks to position a machine's fence in precise increments.

Recently, Taylor added a top-of-the-line model to his stable that offers some worthwhile refinements. The INCRA Jig Pro (see photo) is made of anodized

aluminum and has a wider range of fence movement. The original jig was limited to 8-in. movement, while the new one is available with 12-in. (\$79.95 without fence and accessories) or 16 $\frac{1}{2}$ -in. (\$89.95 without fence and accessories) range of motion.

All these jigs move in $\frac{1}{32}$ -in. increments. (Optional racks are available for $\frac{1}{20}$ -in. or 1mm.) You can also fine-tune adjustments within 0.001 in. with the optional INCRA Mike, micro-posi-

tioning feature (\$49.95), which also fits the original INCRA Jig.

Also introduced with the Pro Jig model is the optional Pro Fence System that includes an aluminum fence, an adjustable stop block that runs on sawtooth racks and a stop extender bar. With an 18-in. aluminum fence the system costs \$54.95; with a 28-in. aluminum fence it's \$69.95.

Another option available is the INCRA right angle fixture (\$29.95), which mounts on the Pro Fence for holding stock at 90° to the router table, such as when cutting dovetails.

INCRA Jigs come with basic instruction manuals but one of INCRA's strong points is its very thorough optional instructional materials. There's a handbook with 17 templates (\$18.95) for making complex dovetail and finger joints, the Master Template Library (\$29.95), which comes with a detailed manual and 50 templates, and an excellent video (\$19.95).

Taylor Design Group Inc.

Box 810262

Dallas, TX 75381

(214) 243-7943

CIRCLE NO. 613 ON PRODUCT INFORMATION FORM

hand, then hold down a button with the other hand to disengage a quick release nut so you can slide the jig.

With the INCRA Jig, the carriage doesn't move quite as smoothly, but adjustments are a breeze. You simply pull up on a cam-clamp handle and the two sawtooth racks spring apart slightly to let you slide the fence. A downward flip of the handle engages the racks and locks the jig in place. With practice I found I could quickly position the carriage with one hand.

Accessories. There is a wide range of accessories available for each jig, from stop blocks to fences of varying length. A list of options and prices appears in the sidebars; however, I'll comment here on one accessory where there is a difference in operation. Both jigs offer right angle fixtures to which you can clamp a workpiece when making 90° cuts on the router table. The INCRA Jig's aluminum fixture hangs over the top of the fence, while the JoinTECH fixture, made of polyethylene, has a dovetail runner

that fits in a slot on top of the fence.

I found the JoinTECH fixture was the more solid of the two in use. The dovetail kept the fixture square to the fence and the fixture moved smoothly when I fed stock into the bit. With the INCRA Jig fixture, I had to press down and in toward the fence to keep the workpiece square. Also, to make sure the fixture was sitting square when I clamped stock to it, I had to first apply a spring clamp to hold the fixture to the fence.

Another point on accessories: Though you can purchase either jig without a fence and mount it to an existing or shop-made fence, I'd recommend you buy the manufacturer's fence and accessories if you want to use the jig for intricate joinery.

Technical support. Both companies supply solid basic instruction manuals that will get you up and running. But if you want to use these jigs with your router table to make complex joints, you'll need to draw on the additional technical support available because operating them in this

mode gets complicated. You have to be able to plan and visualize each part of the joint and keep track of the many steps as you move the fence and stock to make cuts.

Thankfully, both companies have made intricate joinery easier by marketing "templates"—thin strips of plastic with colored lines on them that indicate the fence position for each cut on a number of complex dovetails and box joints. You just set a hairline cursor on a "template" line, rout that part of the joint, then move on to the next line of the same color.

The companies offer "template" collections as options. And you can get explanatory videos with both that show how to set up and operate the jigs. Overall though, I found INCRA Jig's instructional materials superior.

How Useful are They?

Actually putting the jigs to use proved easy after a few practice runs. I found I could cut simple through and half-blind dovetails and box joints with

either jig. But I wouldn't call the process a "no-brainer." It takes time to learn how to interpret the "templates," especially for inlay joints. You also need to consider bit diameter and geometry since these can affect your joints. (The instruction manuals cover this in detail.)

And if you want to design joints that aren't represented by a "template," you'll have to juggle a host of variables such as stock thickness, dovetail bit diameter and flute angle, and the spacing of the cuts. INCRA Jig's optional handbook offers a whole chapter to help with this subject.

Do You Need One?

By now, you're probably asking yourself, "Should I buy one?" Well, if you like to work with great precision and don't mind focusing your complete attention on a process with lots of little steps, I'd say you'll love either of these jigs.

They're ideal if you want to make small- to medium-sized projects with delicate joinery. But if you're using wide or long stock and doing repetitive router work, or you want to make just one kind of dovetail joint, you'd probably be better off with a Leigh, Keller or Omni dovetail jig, where you can make all the cuts with a hand-held router.

Similarly, you wouldn't want to use a positioning jig on the tablesaw when cutting large, bulky stock because the fence isn't built for such heavy work. ▲

DAVE SELLERS
is an assistant editor of AW.

JOINTECH IPM-1



The Jointech IPM-1, at left with optional 27-in. fence, stop block and stock pusher. (Price as tested: \$255.85.) Below, the jig's micro-positioner, which comes standard.



Jointech introduced its positioning jig to the market about one and a half years ago and now markets the IPM-1 (\$149.95) and the IPM-2 (\$189). The only difference between the two is the range of motion. The IPM-1 will move over a 10½-in. range, while the IPM-2 extends 16½ in.

To incrementally position either jig, loosen a lock knob and disengage a quick release nut, then slide the jig's carriage. For micro-positioning, turn the ¼-in.-dia. chrome-plated screw that feeds past the quick release nut—one turn equals ½ in.

There are two aluminum fence systems available: an 18-in. (\$54.95) with stop block and stop extender bar, and the 27-in. with the same accessories (\$72.95). The stop block doesn't have incremental positioning as the INCRA Jig's does. You set it to a scale by eye. But you can adjust the front of the block up and down to

contact the work, or to clear a router bit if necessary. An optional feather board that attaches to the fence slot is also available (\$22.95).

Jointech also markets a right angle stock pusher made of polyethylene for \$32.95.

Beyond its basic instruction manual, Jointech offers a 41-page instruction book and a 36-piece template set for \$24.95. Two other template sets are also available at \$10.95 and \$14.95. Since this review, they've developed a video, too (\$12.95).

Jointech Corp.

Box 790727

San Antonio, TX 78279

(512) 377-1288

CIRCLE NO. 614 ON PRODUCT INFORMATION FORM

COMPUTERIZED POSITIONING

A new jig brings high tech to the positioning market.

Another positioning jig will soon be on the market called the AutoJig, that will add high-tech electronics to the positioning jig concept. The jig comes without a fence and is designed to be used with an INCRA Jig or Jointech fence.

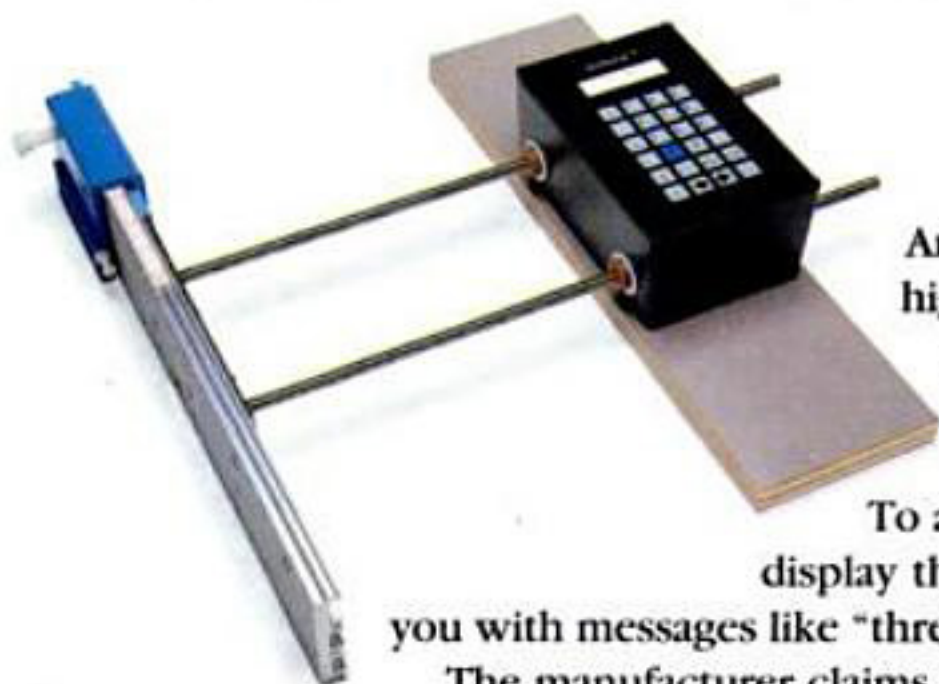
The AutoJig wasn't available for tests, but it has a computer and a small motor to turn twin lead screws that move the fence with 0.001-in. accuracy.

To adjust positioning, you just enter the commands on an attached keypad. A digital display then shows fence position in either fraction or decimal inches, and also prompts you with messages like "three passes required."

The manufacturer claims the computer will help you calculate fine adjustments to improve the fit of dovetails, dados and other joints that wouldn't be possible with the fixed templates the other jigs employ. Once you enter the right information on the keypad, the jig is supposed to set the required fence positions automatically at the push of a button.

Price: \$499; Heartwood Technology, Box 50324, Colorado Springs, CO 80929, (719) 599-9321

CIRCLE NO. 615 ON PRODUCT INFORMATION FORM



WOOD FACTS



Red oak



Flat-sawn white oak



Rift-sawn white oak



Quarter-sawn white oak



English oak

PHOTOS BY MITCH MANDEL

OAK

BY DICK BOAK

MAJOR SPECIES NAMES

Quercus rubra (Northern red oak; Canada and U.S.)

Quercus alba (White oak; Eastern U.S. and S. Eastern Canada)

Quercus robur (European, English, or "pedunculate" oak; Europe)

TRADE NAMES

There are at least five oak species sold as red oak and four sold as white, often carrying additional regional names like "Appalachian," "Northern" or "Southern" oak. Unusual trade names such as swamp or bog oak, and chestnut oak are also common. Oak from outside the United States is usually named for its country of origin, *e.g.*, English brown oak, French oak and Japanese oak.

APPEARANCE

Domestic red oak is generally beige to slightly pink, with reddish overtones. It has a coarse texture and large open pores. Domestic white oak is light tawny yellow to tan and has a smoother surface texture. Oak from northern climates is usually tighter-grained and denser than the faster-growing southern varieties. Quartersawn and rift-cut (45° to growth rings) white oak display dramatic medullary ray patterns, or "silver grain," prized for "Mission" oak furniture. European oaks often have a uniform or mottled brown color caused by spores of a fungus that chemically alter the wood color without seriously damaging the tree.

TECHNICAL PROPERTIES

Oak weighs from 3.4 to 4 lbs. per bd. ft., with density from 41 to 48 lbs. per cu. ft. and specific gravity from .66 to .77. Red and white oak are heaviest, and European oak is at the lighter end of this range. Because of its high tannin content, oak gives off an acrid and pungent odor during machining. Tannin reacts with iron when moisture is present, producing a black stain similar to writing ink. Where possible, you should protect oak counters and tabletops with a film-producing finish and avoid steel fasteners and hardware.

WORKABILITY

Because it's dense, oak is hard on cutting surfaces, so use carbide-tipped blades and cutters. Oak splits fairly easily, so it's best to drill before nailing or screwing. Oak accepts stains readily, although the porous "early wood" growth rings will absorb more stain and appear darker than the harder "summer wood." You also can produce unique coloring effects with substances such as lime, asphalt, bleach and ammonia. If you want a smooth surface, use pore filler before applying a finish.

USES

Oak is one of the most popular woods worldwide. It's used for furniture, cabinetry, flooring, plywood and veneer, barrels, tool handles and packing crates. The bark is used in tanning leather.

SIZES

Oak is commonly available in thicknesses of 4/4 through 8/4. Widths of 6 in. to 12 in. and lengths of 8 ft. to 10 ft. are standard, but longer lengths are common. European oak sizes are less predictable and may be square-edged or "fitch-cut" (cut through-and-through, with the natural edge remaining).

TOXICITY

Some woodworkers find its pungent odor irritating, but oak is not toxic. As with all woods, you should wear a dust mask to protect against airborne dust particles.

SUSTAINABILITY

Although oak grows slowly, it is plentiful because it adapts well to a variety of climates. It is considered a sustainable-yield temperate hardwood.

AVAILABILITY

Red and white oak are widely available at lumberyards and sawmills. European oak is less common but is available from lumber importers and some mail-order suppliers.

COST

Oak prices range from \$1.75 to \$3 per bd. ft. for "select and better" and "FAS" grades. Figured, rift-sawn and quartered white oak sell for \$3 to \$6 per bd. ft. for FAS. English brown oak costs \$7 to \$10 per bd. ft. for air-dried, fitch-cut lumber, and \$10 to \$12 per bd. ft. for square-edge kiln-dried stock. ▲

TOOLBOX

Here's the Beef

Made from 65 lbs. of dense cast iron, the NuCraft Router Table will dampen vibration from the largest routers and won't ever warp. The precision-ground 18-in. by 27-in. tabletop can be mounted as an extension wing on a Delta or Sears tablesaw or used as a stand-alone table with the optional 14-in.-high cast-iron leg set. (See photo.) Other options include a shaper-style fence that you can adjust side-to-side and front-to-back, and cast-iron extensions to make the table area larger. (Price: tabletop \$295; leg set \$125; fence \$134.95; extension \$155)

NuCraft Tools Inc., Dept. AWT, Box 87616, Canton, MI 48187-0616, (313) 981-4454.

CIRCLE NO. 602 ON PRODUCT INFORMATION FORM



In my chairmaking business, I cut a lot of mortises and tenons at odd angles on unusually shaped pieces of wood. Most router-based machines that can do this type of work are complicated to use, with their dense array of hold-downs, levers and adjustment settings. But one, the Stanfield Joiner/Shaper JS 1010, is not only user-friendly, it's quick, precise, sturdy and versatile.

The JS 1010 lets you rout mortises, tenons, box joints, dovetails and custom profiles on wood by hand-guiding a horizontal router carriage on three axes—up-and-down, sideways, and in-and-out. You can use one of the 14 optional template sets to guide your cuts, or make your own templates for custom shapes like cabriole or tapered legs. Also, you can perform horizontal shaping and molding tasks without templates; just install the optional fence (or build one) and lock the router carriage in place.

Unlike other three-dimensional routing machines, the JS 1010 puts you behind the router and gives you a clear view of the bit while cutting. And, because you guide the router carriage by hand, you have a better sense of control over your work.

The basic machine consists of a 15½-in. by 26½-in. plywood worktable and a router carriage that runs on precision guide bars attached to the

STANFIELD JOINER/SHAPER MODEL JS 1010



TESTED BY WILLIAM TANDY YOUNG

machine's welded steel chassis. I bought the optional floor stand, but you could also mount the JS 1010 on a workbench. The heart of the tool is the router carriage. It clamps around most 3½-in. to 4½-in.-dia. router motors and travels up to 23 in. laterally and 4 in. vertically. Maximum plunge travel is 4½ in. A cushion of air, fed to the router carriage from a reserve tank makes the router feel weightless during vertical cuts.

It took about four hours to get the JS 1010 up and running, with half that time going into fitting the router in the carriage and getting everything parallel. I had to file the nylon pads in the router carriage to get my router to fit.

Once set up, the JS 1010 is simple to operate. First, clamp your workpiece to the plywood table with the quick

clamps provided. Next attach a template to the template holder bar, and set the stylus height and depth of cut using the direct-reading scales. Then turn on the router and move the router carriage to make your cut. For shaping or molding operations,

lock the router in place on the guide bars, install the fence, and use the JS 1010 like a horizontal router table.

I tried the standard templates and features on the JS 1010 and found them accurate and easy to use. The guide rails do tend to deflect slightly in heavier cuts, and the dust collection chute could be more effective, but overall, this is a well-thought-out, high-quality tool. It is ideal for light production work, although it can be used by woodworkers of all abilities. The demo video is a good investment at \$4. (Price: JS 1010 \$1,150; joint templates \$13.45 ea.; stand \$127.10; dust collection chute \$29.50; fence \$49; miter table \$89.20; mobile base \$117.85)

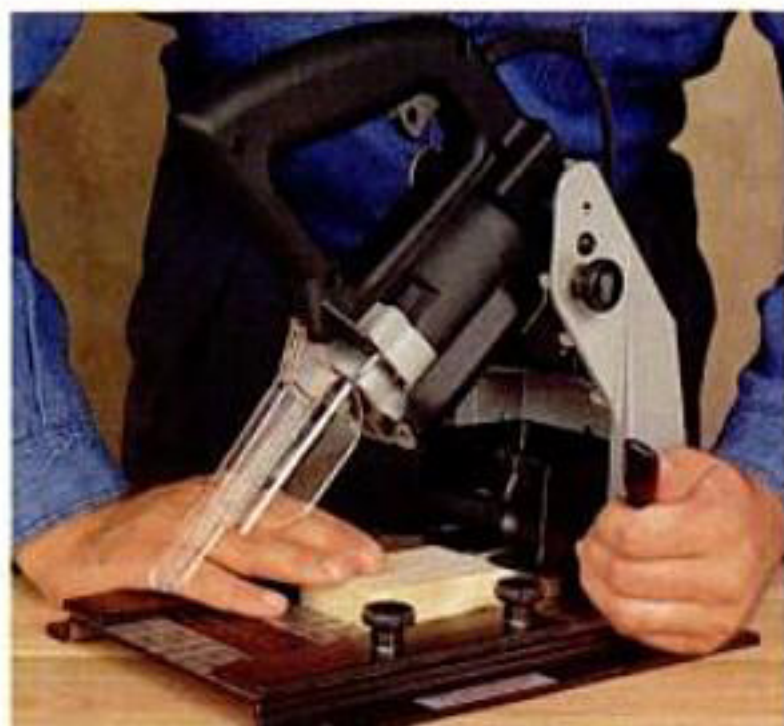
Stanfield Manufacturing Inc., Dept. AWT, 2730-H San Pedro NE, Albuquerque, NM 87110, (505) 889-0022.

CIRCLE NO. 606 ON PRODUCT INFORMATION FORM

TOOLBOX

Perfect Pockets ▶

Porter Cable's new Pocket Cutter (model 550) works in tandem with your portable drill to cut perfect pocket holes for screwing together face frames or joining aprons to tabletops. To use the tool, lock your stock in place with the built-in cam clamp, swing the machine in an arc so the bit "routes" a pocket, then run the supplied drill bit through a bushing in the rear of the tool to create a pilot



hole for the screw. Unlike on other jigs, the Pocket Cutter's pilot holes are parallel with the face of the stock, so your workpieces remain flush when screwed together and there's no chance of a screw tip breaking through the wood. The model 550 has a 5 amp motor and accepts stock from 3/8 in. to 1 1/2 in. thick. (Price: \$330)
Porter Cable, Dept. AWT, Box 2468, Jackson, TN 38302-2468, (901) 664-0307.

CIRCLE NO. 604 ON PRODUCT INFORMATION FORM

Fast Lathe Finish ▶

Most finishes you use on the lathe go on wet, so they're wasteful and leave a smelly, sticky mess on your fingers, rags, lathe and shop wall. HUT is a new dry finish that gives you an instant, durable coating that's water-repellent.

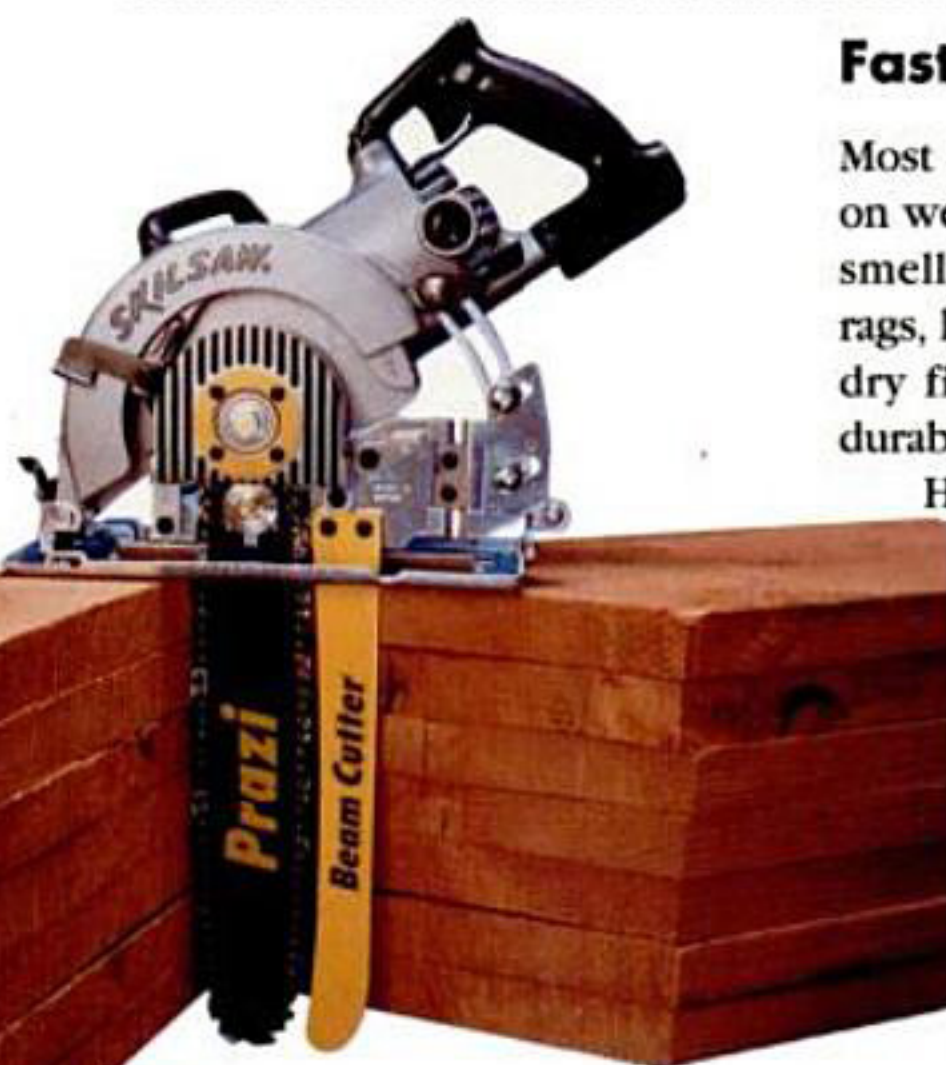
HUT blends natural waxes with a polishing compound to produce a higher polish than ordinary wax alone can. It's available in two colors for light and dark woods. To apply it, you simply spin the workpiece at high speed, then move the block of HUT along the wood applying moderate pressure. Friction melts the wax so it



flows. You burnish by running a crumpled paper towel along the wood, then buff. (Price: \$10.95 for 1/4-lb. block)

Woodcraft, Dept. AWT, 210 Wood County Industrial Park, Box 1686, Parkersburg, WV 26102-1686, (800) 225-1153.

CIRCLE NO. 601 ON PRODUCT INFORMATION FORM



Deep Cuts Made Easy

Add a Prazi Beam Cutter to your worm-drive circular saw and you've got an electric chain saw that will crosscut and rip cleanly to a depth of 12 in. That makes it easy to cut oversize stock to manageable size, or "gang cut" roughsawn stock to equal lengths, or even do timber framing. By tilting the circular saw's carriage you can make bevel cuts. And unlike an ordinary chain saw, the beam cutter won't wander in the cut. The Prazi blade and circular chain assembly bolts to any brand of 7 1/4-in. or 8 1/4-in. worm drive saw. (Price: \$149)

Prazi USA, Dept. AWT, 11812 Western Ave., Stanton, CA 90680, (800) 262-0211.

CIRCLE NO. 603 ON PRODUCT INFORMATION FORM

32mm Drilling Jig ▼

Drilling holes for shelf pins, hinges and drawer slides in the European 32mm system used to mean buying costly machinery or a jig that required assembly and adjustment. EuroLine's 3250 drilling jig is a lower-cost alternative that takes no time to set up. Just use the locator pins to reference the aluminum jig on the edge or corner of a panel and clamp it in place with spring clamps. Then drill holes using a portable drill and the supplied 5mm titanium nitride coated drill bit. The jig's hardened steel bushings guide the bit perfectly. A stop collar on the bit sets hole depth. (Price: \$98)

C&J Enterprises, Dept. AWT, 4558 Lambeth Court, Carlsbad, CA 92008, (619) 720-9245.

CIRCLE NO. 605 ON PRODUCT INFORMATION FORM



JUST FINISHING



BY MICHAEL DRESDNER

HUNTINGTON BEACH, Calif.—A homeowner had her first brush with the law this April when she was slapped with a \$1,600 fine for dumping waste water into the street in front of her home after cleaning latex paint from brushes. An investigator told the Huntington Beach & Fountain Valley Independent that if the water had reached a storm drain, she could have been fined another \$10,000 and spent time in jail.

This is not a horror story from some futuristic society with “Big Brother” environmental storm troopers. It actually happened, and it could happen to you.

Most woodworkers accumulate an assortment of half-used cans of paint, stains and other volatile, flammable or hazardous chemicals. In fact, Americans generate 1.6 million tons of this “household hazardous waste” each year. Disposing of it improperly can have a negative impact on the environment as well as some nasty legal consequences. Although not all communities are as strict as Huntington Beach, it is clearly time for everyone, including hobbyists, to catch up with the latest environmental regulations.

What is Hazardous?

Almost all finishing materials, even most water-based materials, are considered hazardous for waste disposal purposes by the Environmental Protection Agency. This includes varnish, lacquer, paints, stains, strippers and solvents, although their labels can sometimes be misleading. I recently saw a label on a container of paint remover that touted

HAZARDOUS WASTE IN THE SHOP



Disposing of it Improperly Can Have a Negative Impact on the Environment as Well as Some Nasty Legal Consequences

the material as “biodegradable.” I don’t doubt this is true of the stripper in its pure form, but once mixed with dissolved paint, the resulting sludge is no longer biodegradable.

Even solvents that are relatively harmless to use can create havoc in a landfill when mixed with other discarded materials, or when they get into the soil or water table. The general rule for finishing materials is: If in doubt, assume you can’t legally throw it out.

Disposing of Hazardous Waste

So what’s a conscientious woodworker to do? First learn what you’re legally allowed to throw out. Local ordinances probably prohibit mixing cans of paint or other liquid finishing materials with your household trash, but to find out for sure, call your local department of sanitation or solid waste management. If these aren’t listed, try your local municipal government office. Your trash hauler also should be able to tell you what you are permitted to add to the waste stream, which may depend upon the type of waste the

receiving landfill is licensed to accept.

Next, find out if your county or municipality regularly collects household hazardous wastes. More than 3,000 communities now sponsor periodic collections or provide drop-off sites for leftover paints and solvents.

If you can’t get rid of your waste in these ways, your best bet is to convert it to solid form (see below) and then discard it in the trash. Dried paints and coatings are far less troublesome in landfills than liquids.

Paints, lacquers, varnishes—The ideal way to deal with the problem of unusable leftover finishes is not to have any. Buy only what you need, in small containers if possible, and use it all. I try to use up leftover finish by adding an extra coat to surfaces that get more wear, such as tabletops, even if it isn’t absolutely necessary. If I still have some finish left, I’ll brush or spray the extra onto scrap wood or cardboard, then throw it out once the paint has dried. Landfills don’t mind painted scraps. As for the finish that clings to the inside of the can, simply

JUST FINISHING

open the container and let it dry completely before tossing the can.

Solvents--It's easy to get rid of clean solvents. They will eventually evaporate completely if you open the container. But if you do this, make sure you place the open can in a well-ventilated area—preferably outside—and away from children and other air breathers. Sometimes I use a large metal evaporating tray to speed up the process. I do the same with solvents that have been used for cleaning brushes. After the solvent evaporates, you can seal the small amount of dried residue in the can and throw it in the trash.

Most finishing solvents are VOCs (volatile organic compounds) and, as such, contribute to the air pollution problem. However, the amount you are likely to release into the air is infinitesimal compared with other sources of pollution, like your car's

exhaust. All things considered, these solvents are less damaging to the environment as vapors in the air than as liquids in the soil.

Stains--Pigment stains are actually thin paints, and you can handle them like paints. (See above.) Some dye stains, including the water-based ones you mix from powders, will evaporate completely, leaving only a dry residue in the container. Seal the can and throw it away.

Paint remover sludge--Paint remover is a mix of solvents that redissolves paint and varnish, allowing you to scrape the resulting sludge off the wood. If you let the solvents evaporate, you end up with landfill-safe redried paint. I always scrape the sludge onto old newspapers, then let them air out until they are completely stiff and dry before I throw them away.

Clean-up water--I've described how to dispose of solvent used for cleaning varnish brushes, but what about the water used to clean brushes filled with water-based materials? Labels on water-based paints and clear coatings tell you to rinse your brushes in the sink. This is fine if you're tied into a sewer system—the small amount of paint left in your brushes will not cause any problems if you rinse it down the drain. But if you have a septic tank, rinse your brushes in a pail of water, then let the water evaporate as you would other solvents. Whatever you do, don't just dump waste water on the soil or the driveway—especially if you live in Huntington Beach.

Editor's Note: The EPA offers a free pamphlet on managing household hazardous waste. For a copy, call (800) 424-9346. ▲

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DAVID RYAN

Cabinet with fluted doors by Timothy Coleman, Greenfield, MA. White oak veneer, maple, maple veneer. Dimensions: H: 55 in., W: 23½ in., D: 13 in.



BERND KRAUSE

Appalachian mountain dulcimer by Bernd Krause, Johnson City, NY. Walnut, spruce, bubinga. Dimensions: H: 3¼ in., L: 38½ in., W: 7½ in.

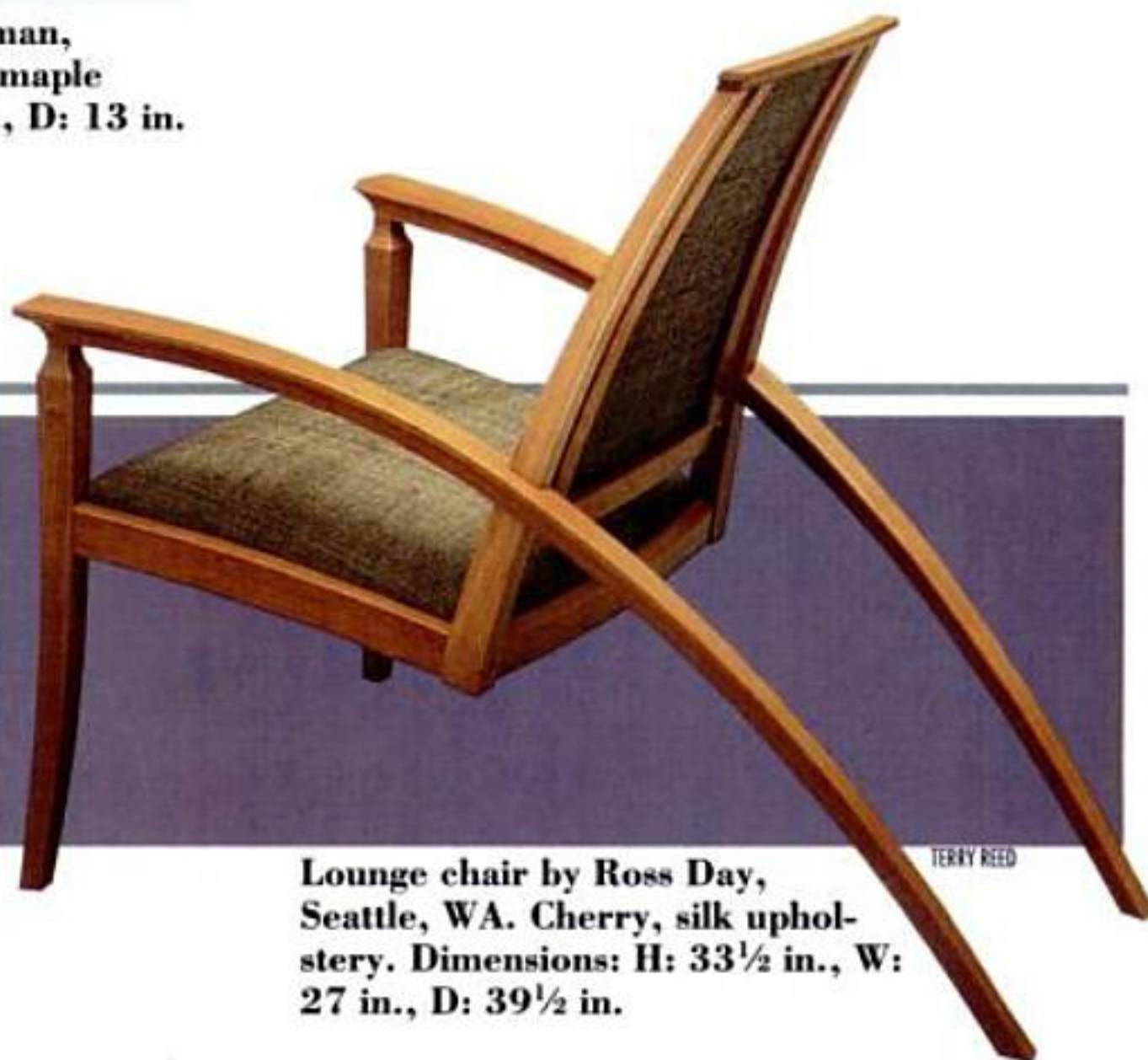
Oh, So Close . . .

The line between winners and runners' up can be razor thin, as is evident in these photos of the entries in our 1992 Excellence in Craftsmanship Awards contest. Though none of these works won a top prize, each one was a finalist. For details on how to enter our 1993 contest, see page 2.

Cabinet by Stephen C. Moss, Fort Bragg, CA. French walnut, Swiss pear, English elm. Dimensions: H: 40 in., W: 28 in., D: 13 in.



SEAN SPRAGUE



TERRY REED

Lounge chair by Ross Day, Seattle, WA. Cherry, silk upholstery. Dimensions: H: 33½ in., W: 27 in., D: 39½ in.

Ladder-back armchair by
Robert Sondag, Free Union,
VA. Bird's-eye maple.
Dimensions: H: 41 $\frac{3}{4}$ in., W:
19 $\frac{1}{2}$ in., D: 18 in.



ERIN GURVEY



PHOTOS BY KEN HAY

Three-drawer chest by Michael Whitmore, Pisgah Forest, NC. Maple,
cherry. Dimensions: H: 40 in., W: 26 in., D: 16 in.

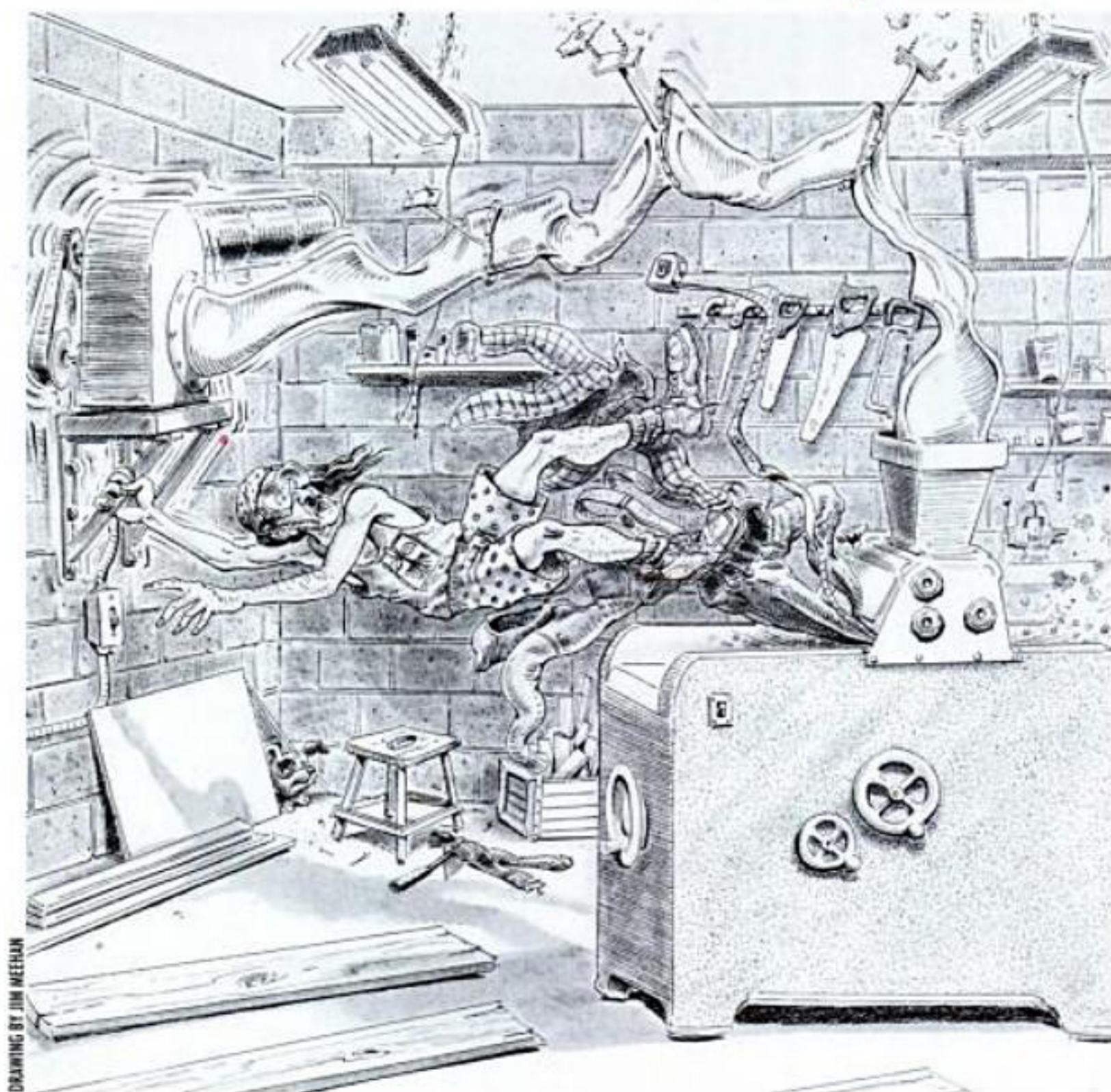
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envelope.



DOM RUSSEL

Ancient Egyptian-inspired table by David J. Marks, Santa Rosa, CA. Mahogany, quilted mahogany, gold leaf, lapis
lazuli, ivory, ebony. Dimensions: H: 18 in., L: 71 in., D: 16 in.

FINAL PASS



DRAWING BY JIM MEEHAN

Pimo and the Blower From Hell

Like any thrifty professional woodworker, Pimo (a.k.a. Steve Metz), is always looking for bargains. So when he saw an ancient 24-in. planer for little more than scrap price, he jumped at it.

There was a catch, however. To clear the whirlwind of chips the planer produced, he'd have to put a dust collection system in his eastern Pennsylvania shop. No problem. The guy selling the planer was willing to throw in a monster 5-HP blower with a 32-in.-dia. squirrel-cage fan, so all Pimo had to do was run ducts and wires.

In keeping with this grand old industrial setup from days when boards grew more than 10 in. wide and squirrels must have been the size of timber wolves, Pimo built a primo system with blast gates, a floor sweep—the works, including huge 11-in.-dia. galvanized pipe for the main line.

After days of sheet metal work, Pimo was ready to fire up that sucker. He took an appraising look at what resembled an aircraft carrier hooked up to the lungs of a brontosaurus and ceremoniously threw the switch. With a three-phase hum the blower surged to warp speed and, “WHUMP,” 10 ft. of 11-in.-dia. pipe was sucked flat. Pimo paled, while the motor roared, ready for the next victim.

Suffice to say the system produced a bit more suction than Pimo needed. He's since put a smaller pulley on the motor to cut the fan speed and now has a system that runs fine. As a bonus, when he needs a little piece of sheet metal he can snip it from the stash of curiously pancaked stuff that he keeps in the corner as a reminder that his grand old Pennsylvania sucker is industrial grade clear through.

Turners Gathering ▼

The American Association of Woodturners will host a gathering of more than 400 turners and collectors at its Seventh National Symposium, June 25-27 at the State University of New York at Purchase, New York. The event will include demonstrations by such well-known turners as David

Ellsworth, Steve Loar, Liam O'Neill and Vic Wood, along with panel discussions on design, an auction of donated works, and a showing of the historically important Edward Jacobson Collection of Turned Bowls. To register, call (613) 484-9094 or write the AAW at 667 Harriet Ave., Shoreview, MN 55126.

Send Us Your Nasty Ideas

Associate Editor Ellis Walentine was so taken with the idea of the nasty boxes we featured in AW #29, that he made several, including this hand-painted one with a carved shark.

If you've made your own menacing variation on this theme, send us a picture of it. We'll print photos of the best and award \$100 to the one we deem the cleverest.



MITCH MANDEL

If you have a news item, anecdote or opinion you think belongs in “Final Pass,” send it to AMERICAN WOODWORKER, 33 E. Minor St., Emmaus, PA 18098.