# AMERICAN WOODWORKER™

APRIL 1996 #51

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# AMERICAN WOODWORKER™

Issue No. 51 April 1996


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## DEPARTMENTS



## FEATURES



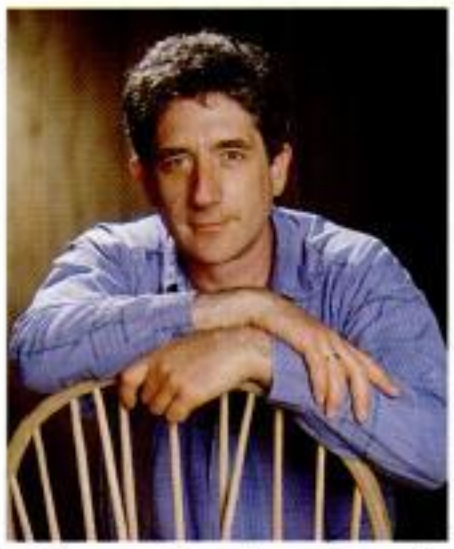

A RODALE PRESS PUBLICATION


***On the cover:*** *Bob Moran's tablesaw tapering jig makes these specialized cuts stone simple—with no angles to figure. See the article on page 30.*

PHOTO BY JOHN HAMEL

# A WORD FROM THE PUBLISHER

## Don't Lose Touch with the Wood



**It was a nicely built** piece. An oak chest of drawers with tight-fitting joints, drawers that slid smoothly and a flawless finish. Yet something wasn't right. I took a step back to get a look at the big picture.

It wasn't the proportions that bothered me—the lines were quite graceful. The problem was all in the choice of the wood. The gaudy grain lines of the plain-sawn red oak were about as subtle as the loud checkered plaid on a used-car salesman's suit (you know the kind). The drawer fronts were cut from just any old boards without regard for how they'd look together when the drawers were stacked up. The top was glued up from four mismatching pieces that looked more like stripes than a single, wide board. All this visual clutter spoiled a well-crafted piece...and there was no one to blame but myself. You see, I was the guy who lost touch with the wood.

Most of us woodworkers are "techies" at heart. Tool junkies. Problem solvers. Left-brain analytical thinkers. We love gadgets that promise precision and speed. We like drawing things out with a T-square and rule. We get so wrapped up in the tools and the process and the technical details that we sometimes lose touch with the creative, right-brain, visual side of ourselves—the side that can see like an artist. But craftsmanship is a balance between art and technique. Tip the scale too far in either direction and you end up with something that's less than the best.

I learned a valuable lesson from that chest of drawers long ago. I now devote as much thought to selecting my boards and laying out the parts for the best color and figure as I do to the design and construction.

Next time you're choosing boards or veneer for a special project, take time to plan the visual effect that you want to create. Don't let it happen by chance. I like to sketch out the parts on the board with chalk so I can see what the effect of the figure will be. Look for the pattern possibilities—symmetrical or otherwise—in stiles, doors and drawers. Cut out drawer fronts and rails from a single wide board so the figure will match. Lay out box sides end to end on the board so the grain pattern runs around the sides of the box. You get the idea.

Be especially cautious when you're considering coarse-grained woods like red oak or ash. The strong, contrasty grain of these woods can overwhelm a small or a delicate piece—especially when the boards are plain-sawn. The straight grain of quartersawn boards is less visually busy.

Treat the wood as an ally, let it help your design. Stay in touch with the wood and your work will reach a whole new level of refinement.

*David Sloan*
*Editor & publisher*

### PLAY IT SAFE

Woodworking can be dangerous. Safety equipment such as guards, hold-downs, goggles, dust masks and hearing protection can greatly reduce your risk of injury. But even the best guard won't make up for poor judgment. Use common sense and caution in the workshop. If a procedure feels dangerous, don't try it, no matter how many other folks work that way. Figure out an alternative that feels safe. Your safety is your responsibility.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# LETTERS

## Good Show!

*Following* AMERICAN WOODWORKER'S *first-ever woodworking show last November (see page 20), we were flooded with letters, faxes, and e-mail offering words of thanks and encouragement. A representative selection of correspondence appears below.—Eds.*

Not only was this the best show that I have ever attended, I must blame you for all the money I spent. If this is the type of show that can be assembled by an organization like yours, please "do it again, Sam!" It was enlightening and fun. Thanks.

Royce M. Ray
SooEee@aol.com

Just a word of thanks. The show was about the best woodworking show I've been to in eight years of working wood. I'm just sorry I couldn't get there till Sunday and that was for limited time. "Too many things to see and too little time to see them." Please do this again.

Dan Campbell
DanCam22@aol.com

The show was awesome. I saw Frank Klausz, Mike Dunbar, Ernie Conover, Toshio Odate, and Ed Bennett, just to name a few; everybody who was somebody was there. I stayed for about six hours, and still didn't get to take everything in. I didn't get to see Norm Abram—the crowd waiting to see him was incredible. But I did enjoy viewing some of his projects from "The New Yankee Workshop." Is this going to be offered every year? If so, I'll just forgo attending any other woodworking shows for this one. Why bother with the small fry when you can hit the big one once a year and get everything?

Bill Millios
millios@hogpg.ho.att.com

Your woodworking show was an extraordinary event—well-planned and expertly organized. I attended two fabulous seminars (Kirby and Duginske) and purchased almost $1,000 of equipment. The demonstrations were interesting and worthwhile. Thanks for doing this.

Donald A. Hamburg
DAHamburg@aol.com
Great Neck, NY

After spending a full three days at the show (as an exhibitor!), I can confirm that it *was* really good. The best part was being able to meet all the recreational woodworkers who stopped by my booth. The difference between this show and most other regional shows was the number of national companies represented and the presence of so many big-name woodworkers for demos and seminars. Too often, local shows feature only those vendors that travel the circuit and a few local demonstrators. There's only one reason why this show was so different: the folks at AW. Thanks again!

Ed Bennett
Inventor of TS-Aligner
ejb@primenet.com

## The Desk Is Done!

It took me some time to figure out a few problems with the dimensions for Kiera's desk (AW #44). But now it's done. As you can see, I used walnut and cherry as the principal woods, just as (designer and builder) Ron Layport did. Thanks for the opportunity to build this piece, and for the follow-up work that helped me with dimensions and joinery details.

Kurtis Perry Huggins
Bob100@ix.netcom.com
Murrysville, PA

## Feedback on Cabinet Saw Test

Now? NOW you test 10-in. tablesaws! Where were you last year when I needed you! AAAARRRRGGGGHHHH!

Robert Baumann
Copiague, NY

In your cabinet saw test, I don't think you paid enough attention to dust collection provisions. On my General 350, the dust-collection hole (located in the bottom of the motor cover) does not promote efficient collection inside the cabinet, even with my fairly powerful dust collector. The Delta, on the other hand, has a built-in shelf which directs dust and chips toward the pickup port—a much better design.

Marshall D. Brodsky
Denver, CO

Regarding your "Tablesaw Showdown" article (AW #49), I'd like to mention a few points in favor of the Delta Unisaw. It's $500 cheaper than the Powermatic. So go out and buy Delta's optional sawdust port and a Biesemeyer fence; the price will still be cheaper than the Powermatic. If a comparison were done between the two saws at the same price, I bet the Delta would come out on top.

The Delta has a better motor than any of the other saws; the motor's magnequench magnets reduce the amount of current needed for a given horsepower. And Delta uses the best shielded bearings you can buy over the counter.

**STAY IN TOUCH!** ***If you have comments, corrections or news to share, we want to hear from you.***

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- For e-mail correspondence, send letters to: **AWLetters@aol.com**

**= Electronic Mail**

# LETTERS

My local bearing distributor charges $17 for Delta replacement bearings vs. $4.50 for Jet bearings.

A final point: Delta is hardly standing still. They just bought Biesemeyer (the company, not the fence) and Biesemeyer fences will be standard on the Unisaw starting in 1996.

Pete_Smullen
hbk@shivasys.com

## Plane Position

On page 5 of your 1996 Buyer's Guide issue, I was surprised to see a photo showing hand planes set down on their cutting edges. I was taught never to do this. Instead, rest the heel on a strip of wood, or set the plane on its side.

Art Potter
Gulfport, MS

*Frank Klausz replies: Planes need to be placed "face down," with their soles flat on the bench. This is the best way to protect their cutting edges. I learned this from my father, who learned it from his father. In the top photo on that page, you'll see I'm taking very thin shavings with the plane I'm using. When the blade is adjusted for such a light cut, as my planes usually are, there's no danger that you'll cut into your workbench surface. Nor is there any danger that the plane blade will be damaged.*

*I urge woodworkers to avoid storing hand planes on their sides. When a plane is lying on its side, the blade is exposed. It can easily be nicked by a hammer, a pair of pliers, a screwdriver, another plane, or any metal object. It's also much easier to cut yourself. As long as your workbench has a wooden top, it's better to keep your planes resting on their soles.*

## Misguided Guide Bushings

In last issue's "Buyer's Guide to Premium Dovetail Jigs," we gave an incorrect size for one of the two bushings required for the Leigh D4 jig. The correct bushing diameters are 5/8 in. and 7/16 in.—*Eds.*

## Hammering It Home

Please tell us loyal AW readers that Greg Harkins is not truly going to strike the chair post with that large steel ball peen hammer! (See AW #47, page 78.)

R. Nelson
Nampa, ID

*Harkins replies: I've been using that hammer to assemble green oak chairs since I bought the tool back in 1976. Oak is extremely resilient before it begins to dry out. It can take hard blows—even from a steel hammer—and the wood bounces back in a day or so. If any minimal marks remain, I can easily sand or scrape them out. The hammer's force is necessary: I cut my tenons to fit tightly in their holes because I know the wood will shrink. Driving the joint together ensures that it will stay tight as the wood dries out.*

*Also, my porch rocker is a rustic piece of furniture, not a formal dining chair. If a few hammer marks remain in the finished chair, these only contribute to its character.*

# Q&A

## Biscuit Telegraphing

**Q** My new biscuit joiner worked great when I edge-joined several boards to make a tabletop. But after I finished the top, I noticed a row of slight depressions along the joints. What did I do wrong?

Barbara Farmer
Occidental, CA

**A** What you've experienced is biscuit "telegraphing." When you apply glue to a biscuit joint, it causes the adjacent wood to swell in roughly the form of the biscuit. If the joint is allowed to dry for a couple of days, the moisture will equalize and the wood surface will reflatten. If, however, you sand or plane the surface while it's still swollen, the result will be a depression in the wood when the moisture does equalize. Unfortunately, there isn't much you can do to fix your tabletop except resurface it and refinish it.

Bob Jardinico
Kingston, MA

## Aging Cherry with Lye

**Q** I've been told that treating cherry with lye will give it the color of naturally aged cherry. What is the process?

Warren Singleton
Bakersfield, CA

**A** Cherry's color deepens naturally over time with exposure to light. Lye, when applied to cherry, causes a chemical reaction which mimics this naturally aged color of the wood. Lye comes in powdered form, which you mix into water for application. You want 100 percent lye (sodium hydroxide—available at larger supermarkets and hardware stores), not Drano or some other proprietary mixture. *Caution: Lye is highly corrosive and will burn skin. Wear a face shield, chemical-resistant gloves and an apron.*

To artificially age wood this way, first prepare your work surface by sanding the wood, raising the grain with water, then sanding it again to 180 grit after the wood dries. (The chemical reaction doesn't penetrate very deeply into the wood, and you don't want to cut through the color when sanding raised grain afterward.)

## Routing Spline Miter Grooves

**Q** I would like to try spline mitering a solid wood carcase for my next project, but I'm not sure how to rout the spline grooves. How do I register a router fence against a 45° miter angle? And what keeps the router from tipping while it's sitting on the narrow face of the miter?

Jerry Glascow
Toronto, Ontario, Canada

**A** When routing grooves for spline miters, I clamp all four case sides together as shown in the drawing. This creates a square shoulder for the router fence and at the same time provides sufficient bearing surface for the router base. It also references the grooves from the outside—rather than the inside—of the miters, so the carcase corners will line up even if there is a discrepancy in the thickness of the boards.

When you're clamping, make sure to line up the ends of the two center boards carefully: Any misalignment here will affect the placement of the groove. Place your clamps as close as possible to the ends of the boards without obstructing the router's path. With the boards clamped up, secure the assembly vertically in a vise or clamp it vertically to the edge of your workbench.

Adjust your router fence to position the bit closer to the inside of the miter than the outside, then cut the first two grooves. (Follow the feed direction shown in the drawing to prevent your bit from climb-cutting.)

Unclamp the assembly, then line up the opposite ends in the same manner. Clamp them and cut the next two grooves. Then switch the sandwich, placing the ungrooved boards between the ones you just routed, and repeat the procedure.

When you've done this process once, you'll find it easy.

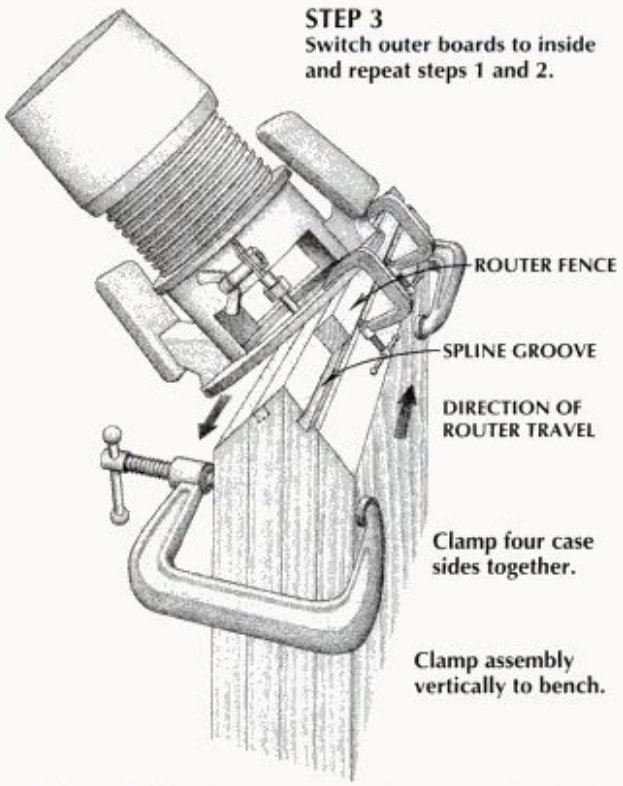
Paul Anthony
Associate editor

### ROUTING SPLINE MITER GROOVES

**STEP 1**
Rout grooves on inner boards.

**STEP 2**
Line up opposite ends as shown and rout inner grooves.

**STEP 3**
Switch outer boards to inside and repeat steps 1 and 2.



Now, mix the lye powder into water in a glass container. *Caution: Never use a metal container and never add water to the lye—always add the lye to water.* The depth of color you achieve will depend on the strength of your solution. Experiment with the proportions. Start by adding one tablespoon of lye to a quart of lukewarm water *(never use hot water)* and test it on a piece of scrap.

To avoid lap marks, apply the solution quickly, wetting the surface uniformly. A sponge works best for flat surfaces, but you may need to use a nylon-bristle brush to work the mixture into recesses. Wait an hour or so to see the full effect. Then add more lye to the solution if you like, but eight tablespoons per quart of water seems to be about the maximum. Multiple applications don't darken the wood significantly, so experiment on scrap to get the mixture that gives you the desired color in one application.

After treating your project, let the work dry for eight to 12 hours in a dry place. Then sand any raised grain very lightly with 220-grit wet-or-dry paper. If you sand through the color, you can try masking off the section and reapplying the mixture to the affected area, but it's best to just not sand through.

Pat O'Daly
Professional finisher
Sonoma, CA

## Maintaining a Lathe Bed

**Q** I keep all my metal machine surfaces clean and waxed to protect the metal. I'm finding, though, that the wax on my lathe bed causes the tailstock to creep. What can I use to protect the metal that won't allow this to happen?

Mark Leslie
Jacksonville, FL

**A** On the surface of a lathe's bed, or *ways,* you don't want the clean slick surfaces that work so well on a jointer or tablesaw. As a matter of fact, I find that a slightly pocked surface on the ways helps to prevent the tailstock and tool rest from sliding when locked. Here's my approach to maintaining the ways of a lathe:

First, clean off the wax with mineral spirits. Then cover the ways with freshly cut oak or walnut shavings and leave

### WHERE TO FIND IT

**Pumice, rottenstone and felt blocks** for rubbing out finishes are available from Klingspor, Box 3737, Hickory, NC 28603, (800) 228-0000.

**Pantographs and pounce wheels** for transferring patterns are available from Lee Valley Tools, Box 6295, Stn. J, Ottawa, Ontario, Canada K2A 1T4, (800) 267-8767.

**Hardware for iceboxes** is available from Woodworker's Hardware, Box 180, Sauk Rapids, MN 56379, (800) 383-0130.

# Your best projects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them overnight. The tannins in the shavings will quickly produce a light coat of rust on the ways. The next day, spray the ways with WD-40, wipe off the rust with fine steel wool, then wipe the bed off with a clean rag. This leaves a rust-free but slightly pocked surface that provides traction for the locked tailstock and tool rest while allowing them to slide easily when unlocked. Repeat this as often as seems necessary. As radical as this method might seem, I've been doing it for 25 years and it works.

David Ellsworth
Turner
Quakertown, PA

### Avoiding Bending Fractures

**Q** I tried to steam a 5/8-in. by 7/8-in. piece of knot-free oak that I rived from a quarter-section of a 1-ft.-dia. log stored in my garage for a year. I used the "ultimate steam box" built from Mike Dunbar's article in AW #43 and allowed the wood to steam for an hour. When I tried bending the wood to about a 12-in. radius, it fractured. What happened?

Donald Wentworth
Marshall, MI

**A** Bending wood is more art than science. I can tell you what you did right, but it's difficult to diagnose specific problems without inspecting the wood and observing your bending process.

Air-dried oak was a good choice of material for bending. And riving (splitting) the piece from the log was wise because it results in annular layers that run the full length of the piece. This reduces the chance of the wood splitting between annular rings that might otherwise run off the edge of a sawn piece.

If you were using my steam box design, the supply of steam should have been fine. My box is very efficient and heats wood to the necessary 180°F very quickly. I seldom steam a piece more than 15 minutes, so an hour should have been more than enough. And, in my experience, you can't oversteam a piece.

As for technique, you need to work quickly before the wood begins to cool. As you bend the wood, pull it steadily; don't yank it. Too quick a motion won't give the fibers time to stretch. A metal backup strap placed around the outside of the curve also helps reduce fracture.

It's possible that your log has begun to decay. A log this size is too big to dry completely in a year, and fungus often grows in wet wood—especially if bark was left on. Look for the blue or brown speckling that marks early stages of decay.

Mike Dunbar
Windsor chairmaker
Portsmouth, NH

**WOODWORKING QUESTIONS?**
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# offcuts

## AMERICAN WOODWORKER'S SHOW A ROUSING SUCCESS


***Ultimate router table.*** *AW managing editor Tim Snyder puts our router table (see AW #44) to the test.*

***Packed to the max.*** *Nearly 10,000 woodworkers attended AW's first-ever woodworking show last fall in Fort Washington, PA.*

***Meeting Norm in person.*** *Television star Norm Abram takes time out from signing autographs to talk shop with a loyal fan.*

AMERICAN WOODWORKER hosted the first Woodworking in America Show™ last November—the first show ever produced by a U.S. woodworking magazine. This three-day event at the Fort Washington Expo Center near Philadelphia attracted almost 10,000 woodworkers from as far away as England and Japan.

Never before have so many master woodworkers gathered together under one roof. Frank Klausz, Toshio Odate, Steve Blenk, Simon Watts, Wayne Barton, Zachary Taylor and many other top craftsmen demonstrated their skills at booths on the show floor. Carving, turning, chair-making, joinery, coopering, musical instrument making—you name it, somebody was doing it. Vintage-machine buff Bill McCarthy even fired up his old steam-powered woodworking machines, to the delight of the crowd.

Seminar rooms were packed with woodworkers getting in-depth instruction on power-tool techniques, furniture design, sharpening, bowl turning, finishing, veneering and more. Leonard Lee, Mark Duginske, Ian Kirby, Mike Dunbar, Ernie Conover and Frank Pollaro were just a few of the fine craftsmen who shared their secrets.

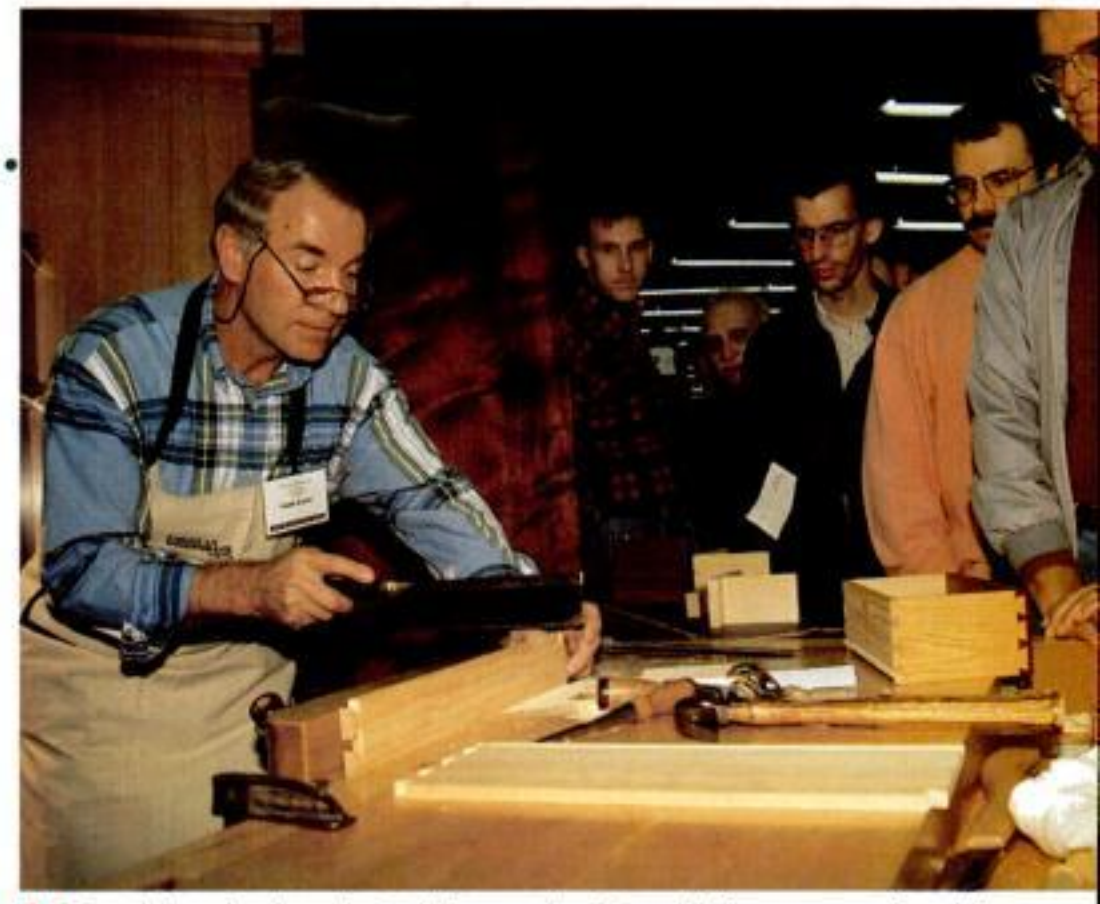
And then there was Norm. Thousands of woodworkers stopped by to meet the congenial star of PBS TV's "This Old House" and "The New Yankee Workshop." Norm signed autographs at the Porter-Cable and Delta booths, and he gave two seminars on building a workshop.

AW's show was also a tool shopper's dream come true. Over 230 booths displayed everything from the hottest new power tools to specialty hardware, hand tools and supplies. Manufacturers like Bosch, Delta, DeWalt, Freud, Porter-Cable and Ryobi were on hand, as were mail-order retailers including Constantine's, Craft Supplies, Garrett Wade and Woodcraft. Regional tool and wood dealers were also out in force with discounts aplenty.

An invitational gallery showcased breathtaking work by noted craftspeople. Turnings and carvings of all sizes shared space with furniture in every style from Windsor to postmodern. Attendees voted for their favorites, and cash prizes totaling almost $2,000 were awarded to the three most popular entries.

AW will host another giant show in Fort Washington, PA, the weekend of November 8-10, 1996. Stay tuned for more show dates and locations. Don't miss the next one!


▲ ***A good turn.*** *Chips fly as Palmer Sharpless makes a mushroom-shaped, natural-edge box.*



▲ ***Precision by hand.*** *Cabinetmaker Frank Klausz steadies his saw to cut a dovetail.*

▶ ***Shapely legs.*** *AW contributing editor Lonnie Bird discusses the fine points of cabriole legs.*


▲ ***Japanese joinery.*** *Toshio Odate fits stiles and rails on a shoji screen panel.*

▶ ***Green woodworking.*** *A crowd gathers to watch "bodger" Don Weber do green wood turning on a foot-powered lathe.*

# TECH TIPS

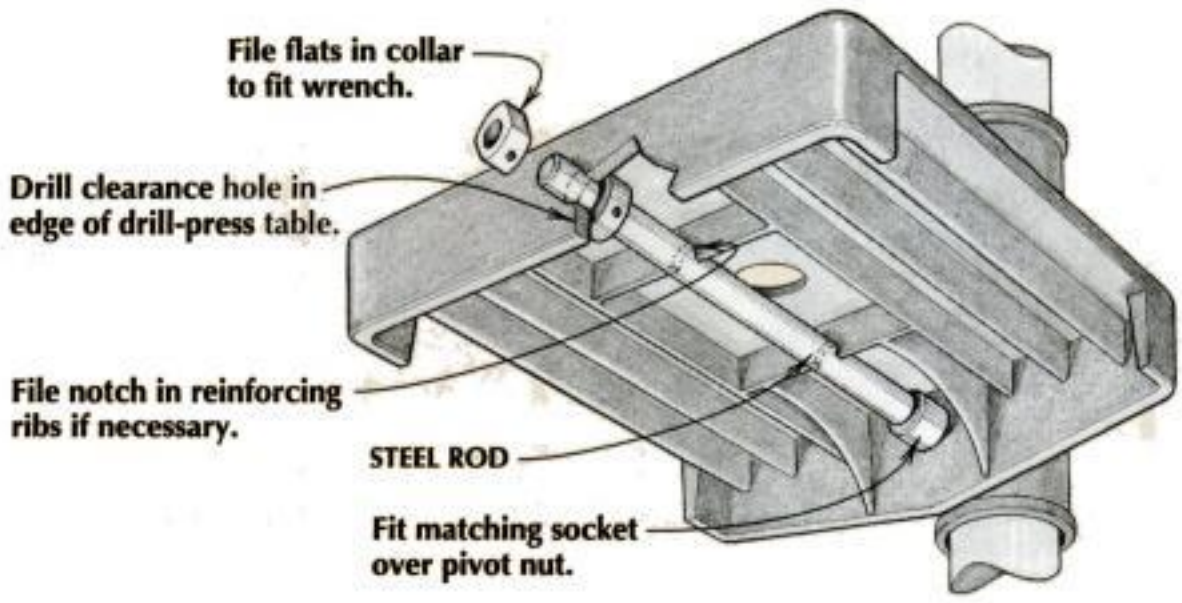
## BEST TIP WINS $200

Know a better way of doing something? Designed a clever jig? Send your original woodworking tips, along with a sketch or a snapshot to: "Tech Tips," AMERICAN WOODWORKER, 33 E. Minor St., Emmaus, PA 18098. We'll pay $50 for each tip we publish and $200 for the best tip of the issue.

### Upgrade for Drill-Press Table

Tired of groping around underneath the drill-press table for the table's pivot nut? This simple linkage makes for quicker and easier table-tilt adjustments. You will need a socket to fit the pivot nut, a length of steel rod, and two collars that can be locked on the rod with setscrews. File a square section on the "inboard" end of the rod to fit the socket. The collars keep the rod in place.

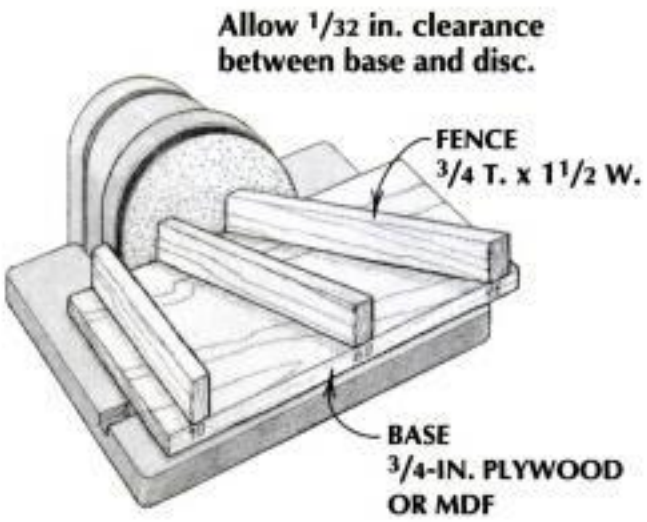
Dick Dorn
Oelwein, IA




### Disc-Sander Miter Jig

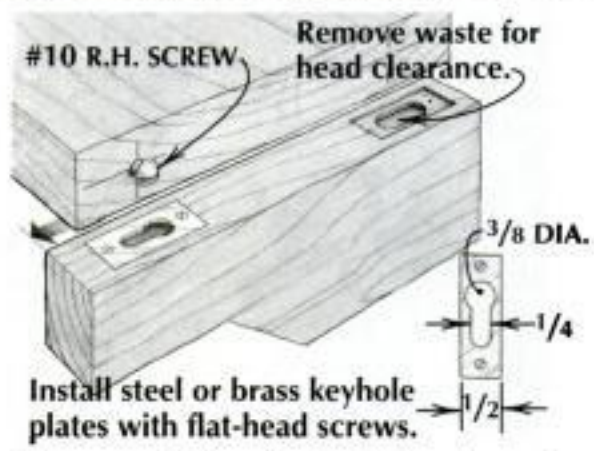
Adjustable miter gauges don't work well with a disc sander—they're inaccurate and they don't fully support the workpiece. My sliding miter box has an 8-in. by 16-in. base, with a hardwood runner screwed to the underside. I screwed fences to the base at precise 90°, 60° and 45° angles. You can add other angles as needed.

Willard Anderson
Chapel Hill, NC




### Secret Slots & Screws

With this fitting you can make a secure edge-to-edge joint that you can take apart easily by simply sliding the boards sideways. Make the keyhole plates from brass or steel strip and install them flush with the surface, as shown in the drawing. Then insert 3/8-in. dowel centers and mark the centers of the screw pilot holes in the opposite edge. Turn the screw in or out until the head engages the plate without jamming.




Percy Blandford
Stratford-upon-Avon, United Kingdom

### Auto Air Filter Traps Super-Fine Dust

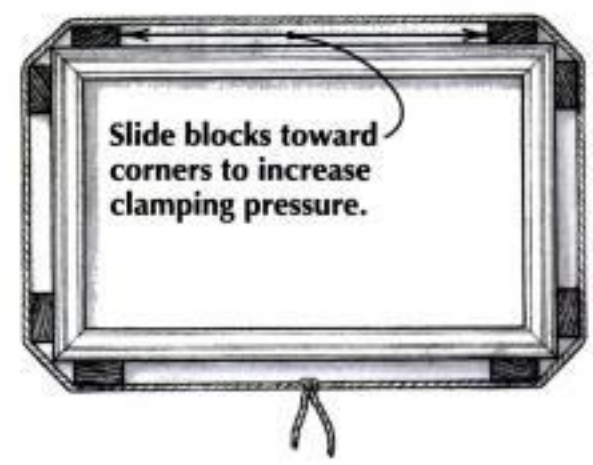
The filter bag on my dust collector can't trap super-fine airborne dust, but this automotive air filter can. The auto air filter I use is made from pleated paper, has rubber gaskets along top and bottom edges, and costs about $10. I mounted it between a pair of plywood discs that are attached to a flange that comes off my dust-collection ductwork. A pair of machine bolts, with washers and wing nuts, keeps the assembly together until the filter needs cleaning. To clean, simply take the filter outside and shake it a few times.


Lawrence Heinonen
Union City, MI

### Cord Clamp

To clamp picture frames during glue-up, I tie a piece of nylon parachute cord around the assembly. Then I insert two wooden blocks on each side and slide them out toward the corners to increase the clamping pressure. For deep frames I use a double loop.

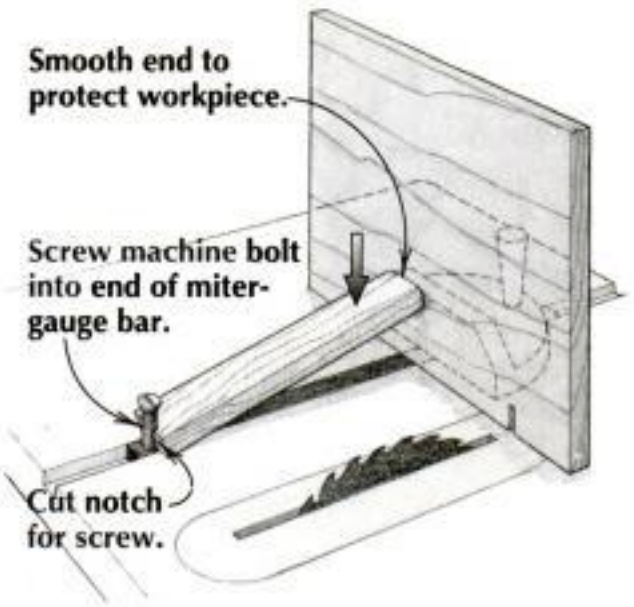
Andrew Martin
Park City, UT



# TECH TIPS

## Hold-Down Wedge

Wide boards tend to wobble and twist sideways when I'm crosscutting with the miter gauge. To solve this problem, I screwed a 1-in.-long machine bolt into the end hole of the miter-gauge bar. Then I cut a piece of hardwood that was 5/8 in. shorter than the distance between the bolt and the face of

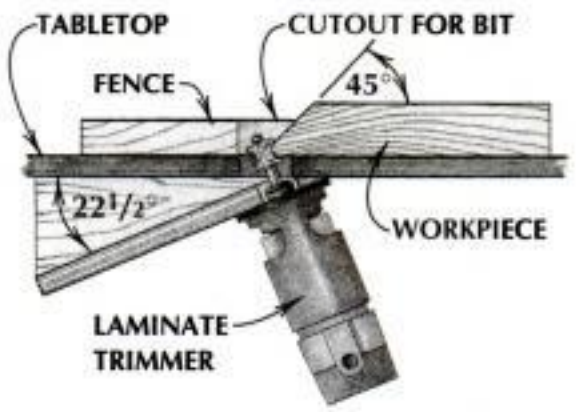



the miter gauge. This works only for boards 3/4 in. thick—cut it longer or shorter depending on the thickness of your workpiece.

James Porterfield
Park Ridge, IL

## Rounding by Router

I recently needed to cut a clean, rounded edge along a 45° corner. So I devised a jig that works like a miniature router table. The small diameter (3 in.) of my laminate trimmer allows me to mount the trimmer under the table at a 22 1/2° angle and still reach the workpiece with a 1/4-in.-radius fingernail bit (available from MLCS Ltd., Box 4053,

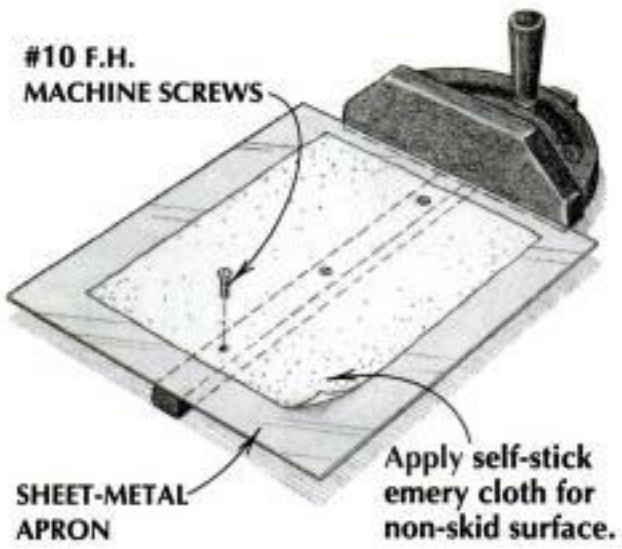



Rydal, PA 19046, 800-533-9298). When routing, guide the workpiece against a fence that has a 45° edge and a cutout area for the bit.

Yeung Chan
Millbrae, CA

## An Apron for Your Miter Gauge

I've found this apron especially useful when I'm making angled cuts on short pieces of stock. It acts like a rolling

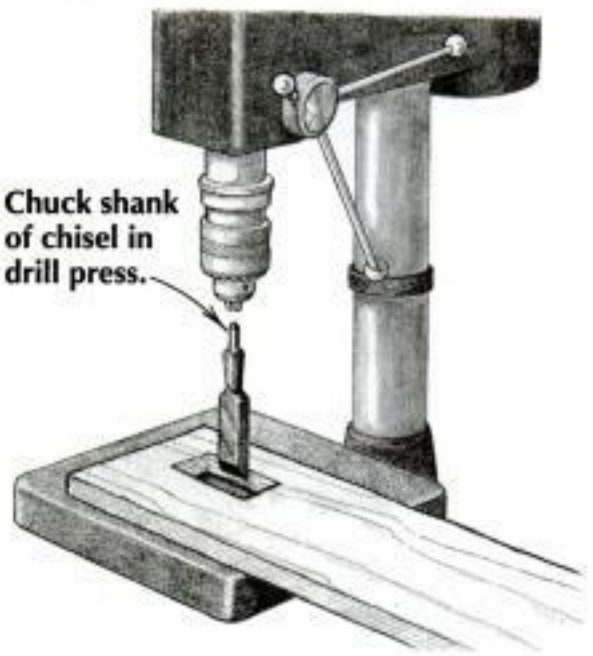



table, eliminating friction between the work and the saw table. Use sheet metal for the apron—either stainless steel or aluminum that's 0.015 in. to 0.030 in. thick. Size the sheet so that it just clears the saw blade when the miter gauge is in either slot.

Milan Fiske
Burnt Hills, NY

## Mortising the Old Way

Many woodworkers now have mortising attachments for their drill presses. At age 77, I prefer an older, quieter way: I drill




out the waste, then chuck a sharp chisel blade in my drill press and work with the power turned off. For angled cuts I tilt the table. Plastic-handled chisels work well; the blade is easily freed by cracking the handle in a metal vise.

Jack McGary
Spring Valley, MN

## See-Through Clamping Blocks

Clamping blocks often conceal the item being glued—especially when it's small. I use pads of Lexan (other clear plastic will also work) so I can position the work precisely. Round the edges of the pads so they don't mar the surface.

Blaine Haines
Quarryville, PA

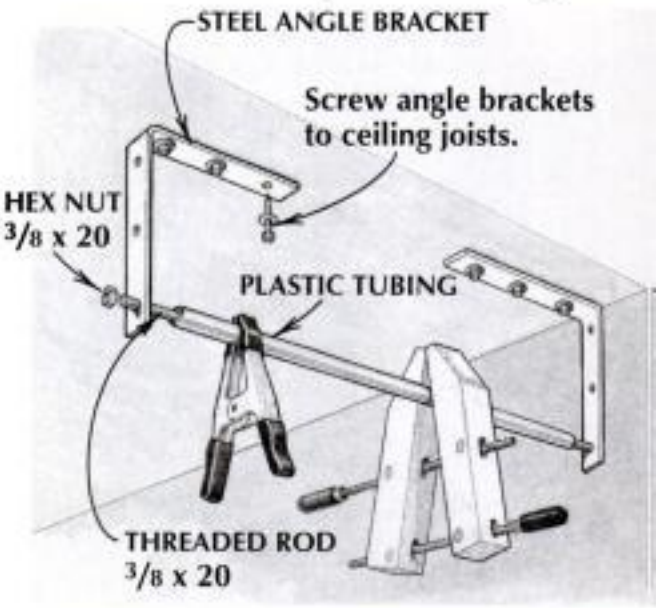
## Getting Cold Feet?

The concrete floor in my workshop was cold, hard on my feet and unfriendly to dropped tools. So I covered the entire floor with carpet underlayment topped by rubber roofing membrane. Commonly known as EPDM, the roofing membrane comes in rolls 10 ft. or 20 ft. wide; it's available through building supply outlets and roofing contractors.

Howard Heidman
Hendersonville, NC

## Hang That Clamp

This is the cheapest, most effective way to hang wood clamps and spring clips I've come across. All you need to buy are




a length of 3/8-in. threaded rod with nuts, two 7-in. steel angle brackets and a piece of plastic tubing.

Everett Rhodes
Lewiston, ID

## Down-Under Wax

I've found that Kiwi brand neutral shoe polish is the best wax for lubricating metal planer beds, saw tables and jointers. It does not transfer to the wood, it comes in a convenient flat can and it also inhibits the formation of rust.

Tim Hanson
Indianapolis, IN

# Tablesaw Tapering Jig

## Adjusts to the Dimensions You Know— Not the Angles You Don't

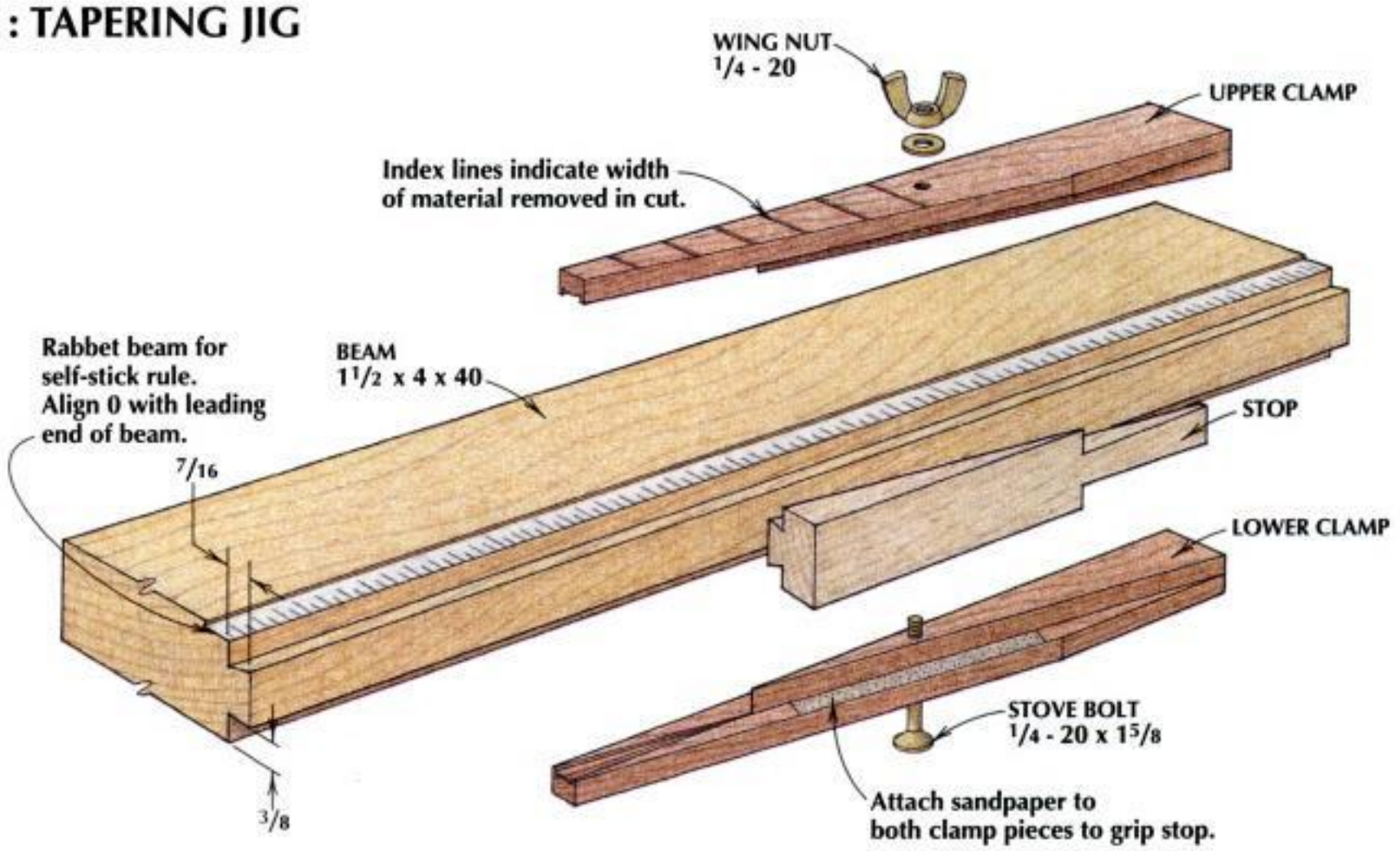
### *Here's how:*

**Step 1**
Set the width. Set the width of the desired *offcut* by aligning the end of the stop with the index line on the clamp.

**Step 2**
Set the length. Slide the clamp so the index line points to the desired length of taper on the measuring tape. Lock both settings with the wing nut.

**Step 3**
Position the jig against your tablesaw fence. Place the end of the workpiece against the stop and adjust the rip fence so that the blade cuts where you want the taper to start. Turn on the saw and slide the jig and workpiece through the blade.

## FIG. 1: TAPERING JIG




*by Bob Moran*

Why is it that some jigs become indispensable and others wind up gathering dust on the top shelf? A good jig has to be dependable, versatile, and stone simple to set up and use. I designed this tablesaw tapering jig with just those qualities in mind and it's one of the most often-used jigs in my shop.

With most other tapering jigs, you have to guess at the right angle. This one allows you to key in actual dimensions: the width of the stock you need to remove, and the length of the taper. The jig locks in place for repeated cuts, yet it can be easily readjusted simply by loosening the wing nut.

Although the parts of the jig might look complex, it's easy to make. There are four main parts: the beam, upper and lower clamps, and a sliding stop. (See Fig. 1.) Don't let the intersecting dovetail tenons and weird angles scare you off—it's much easier than it looks. Just follow the steps that are described in Figs. 2 and 3.

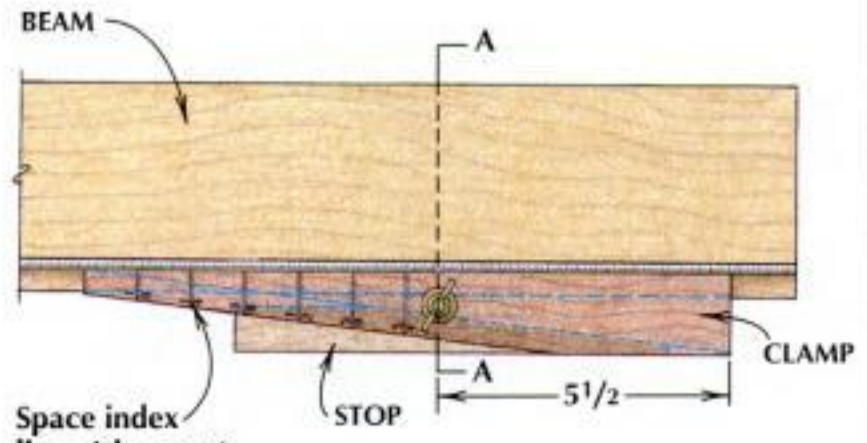
### Making the Beam and Clamps

Start by cutting the beam to size. (See Fig. 1.) Cut the beam 8 in. longer than the finished length; you'll use this 8-in. offcut later to make the stop. The drawing shows a 40-in.-long beam—a good size for tapering table legs. You can make the beam longer or shorter to suit your work. A 60-in. beam will taper huntboard or standing-desk legs.

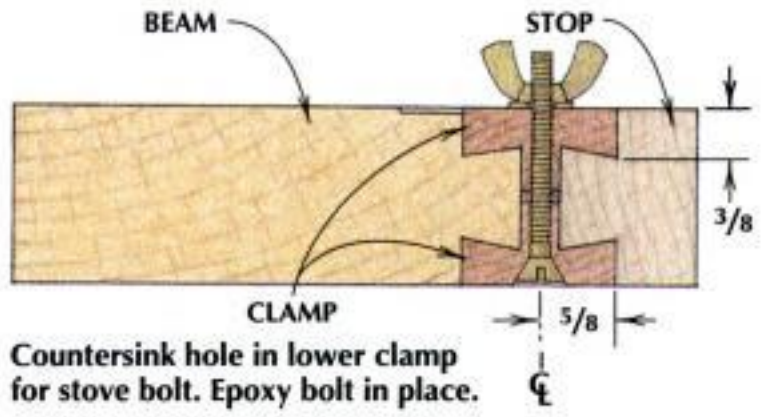
Next, cut the clamp stock to size. Both the upper and lower clamps are made from a single piece of wood that measures 1½ in. by 1½ in. by 12 in. You'll need to shape this piece, then rip it down the middle to create the two clamps.

First, the clamp stock needs to be tapered, as shown in Fig. 2, Step 1. To do this, make a temporary tapering jig out of a 4-in. by 14-in. scrap of ¾-in. plywood. Starting from one end of the plywood, draw a layout line at a slope of 1:8 (a 1-in. rise over an 8-in. run). Saw the taper on the bandsaw, but leave about an inch at the bottom to serve as the push block.

### CLAMP AND STOP DETAILS




### SECTION THROUGH A - A

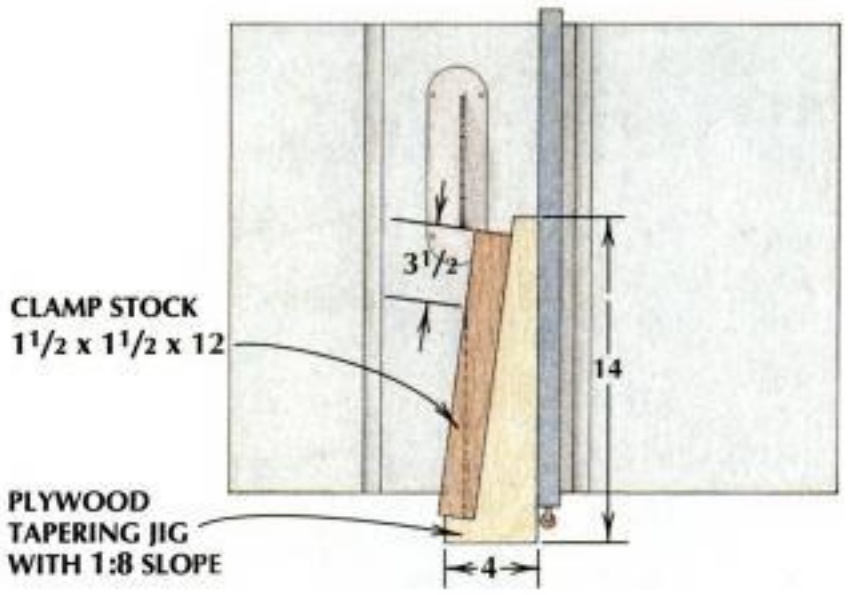


# FIG. 2: MAKING THE CLAMPS

**Follow this step-by-step sequence** to make the tapering jig's upper and lower clamps. To avoid burning the stock or causing tearout, make each router cut in three passes, moving the router-table fence approximately 1/8 in. for each pass. For clarity, cuts are shown being made in a single pass.

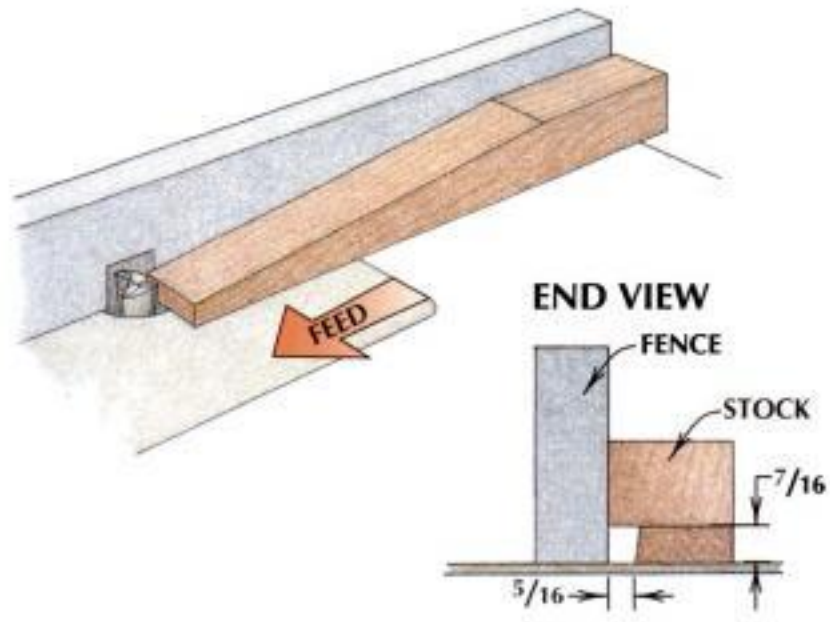
## STEP 1

Place the clamp stock against the temporary plywood tapering jig and rip the taper.



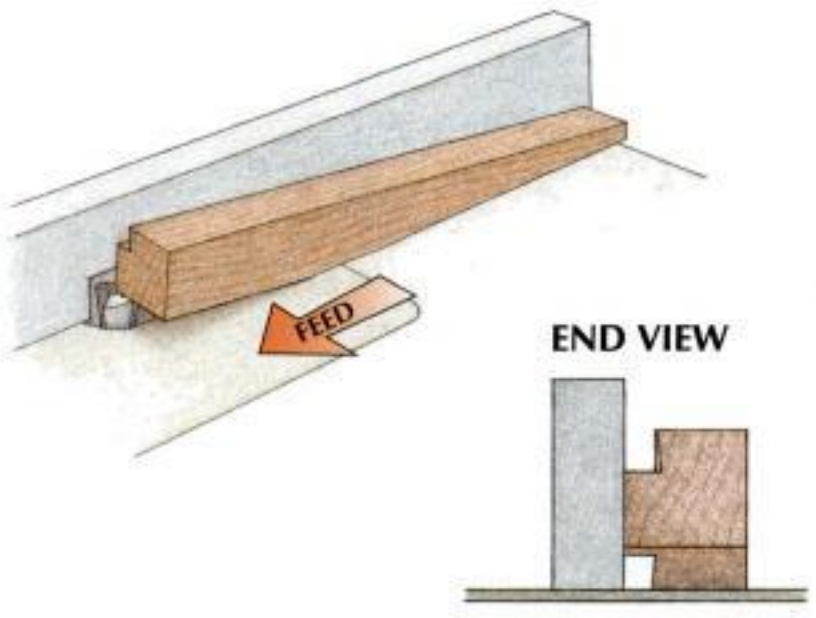

## STEP 2

Position the clamp stock on the router table with the tapered edge facing up. Guide the stock against the fence as shown.



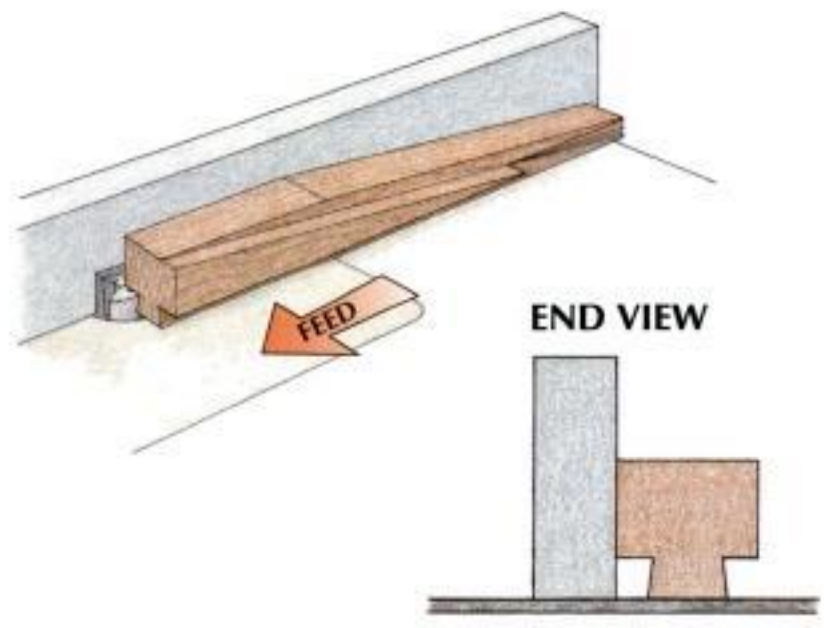

## STEP 3

Keep the same edge against the fence and flip stock end-for-end. Hold the tapered face flat against the table while cutting.



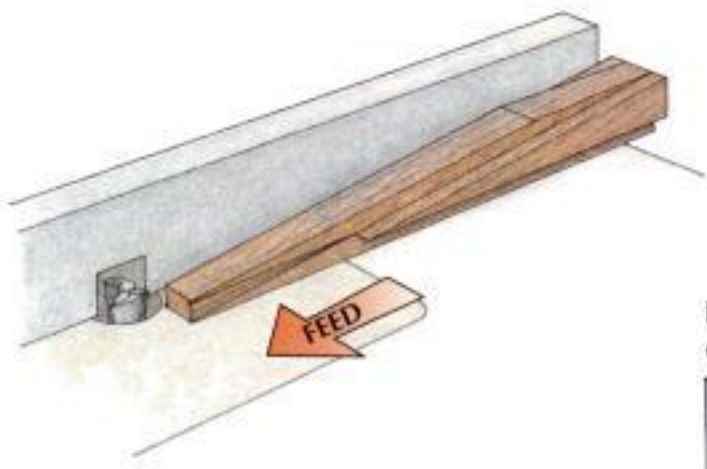

## STEP 4

Rotate the stock 180° so the last cut is facing away from the fence, and make the third cut.




## STEP 5

Keep the same edge against the fence and flip stock end-for-end.



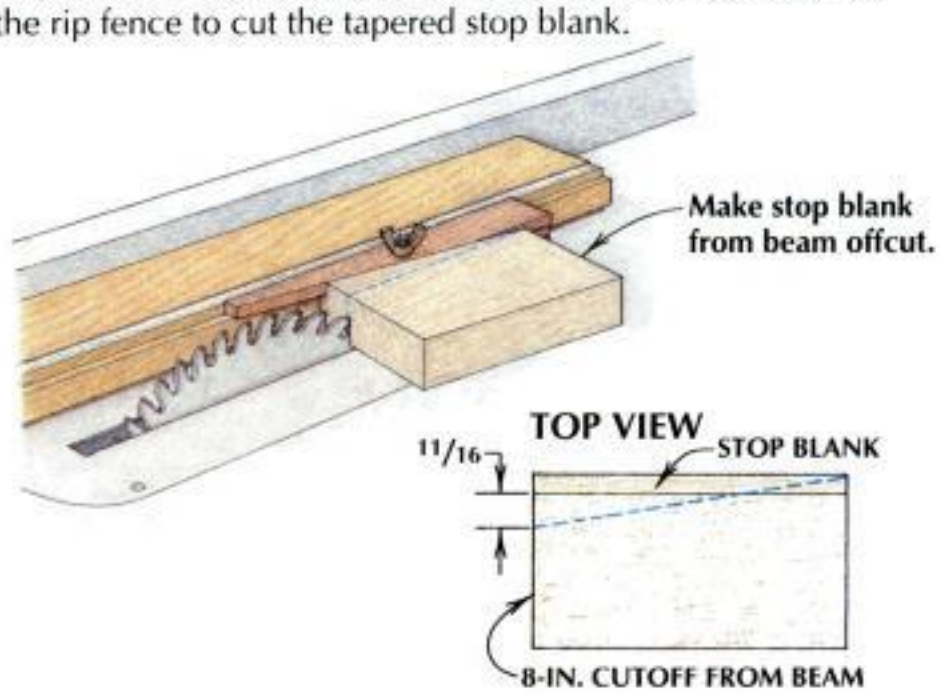

## STEP 6

Rip the clamp stock to make the upper and lower clamp pieces.

## FIG. 3: MAKING THE STOP

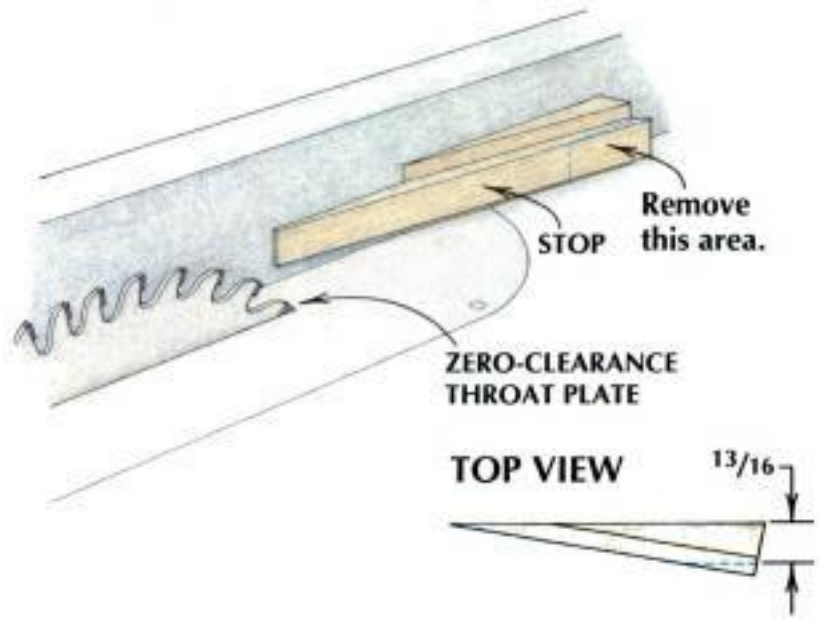
### STEP 1

Assemble the jig with the stop blank. Run the beam against the rip fence to cut the tapered stop blank.




### STEP 2

Set the rip fence to 13/16 in. from the right side of the blade. Use a push stick and zero-clearance throat plate for a safe cut.




Place the clamp stock against the tapered edge of the plywood and set the rip fence on your tablesaw to start cutting the stock 3½ in. from the leading end. (See Fig. 2, Step 1.) To rip the taper, slide the jig and clamp through the saw.

The next step is to rout the dovetails on the clamp stock. Make all of the dovetail cuts on your router table with a standard 14° dovetail bit raised to 7/16 in. Follow the step-by-step sequence shown in Steps 1 through 5 of Fig. 2, and you'll end up with the shape you need. To avoid burning the stock or causing tearout, make the router cuts in three passes.

The last step is to rip the clamp stock right down the middle to form the upper and lower clamp pieces. (See Fig. 2, Step 6.) Draw a centerline on the tapered surface of the blank, and saw along the line. I like to do this on the bandsaw.

Now restack the clamp pieces so that the dovetailed edges face inward (see Fig. 1) and temporarily tape the two pieces together with double-faced tape. Mark the location of the bolt hole and bore a ¼-in.-dia. hole through both pieces. Countersink the hole on the lower clamp to recess the head of the stove bolt. Note: If you're left-handed and prefer to rip with the tablesaw fence to the left of the blade, you'll want to countersink the *opposite* clamp piece from the one that's shown in Fig. 1.

With the clamps complete, use the same router-table setup to rout the dovetail on the edge of the beam. (See Fig. 1.)

### Making the Stop

To make the stop, crosscut an 8-in.-long piece off one end of the beam. Assemble the jig with this 8-in. piece held between the jig's upper and lower clamps, as shown in Fig. 3. On the tablesaw, taper the stop to the dimensions shown by running the beam against the rip fence.

The next step is to trim the dovetailed edge of the stop. (See Fig. 3, Step 2.) This trim cut is parallel to the taper cut you just made. Remove the stop blank from the clamps, set the rip fence 13/16 in. from the right side of the blade, and place the tapered edge you just cut in the previous step against the fence. Use a push stick and a zero-clearance throat plate for safety. To finish the stop, trim its front end square to the two cuts you've just finished.

### Assembling the Jig

Assemble the jig by clamping the beam and the stop between the upper and lower clamp pieces and tightening the wing nut. (See Fig. 1.) Sand or plane the top and bottom surfaces of the beam, clamp and stop so that everything is flush.

At this point, rout a shallow, ½-in.-wide rabbet for the adhesive-backed measuring tape (available from Woodworker's Supply Inc., 800-645-9292) so that it sits flush with the top of the beam. (See Fig. 1.) When installing the tape, make sure that the zero mark aligns with the beam's leading end. For a left-handed jig, align the tape's zero mark with the opposite end from that shown in the drawing.

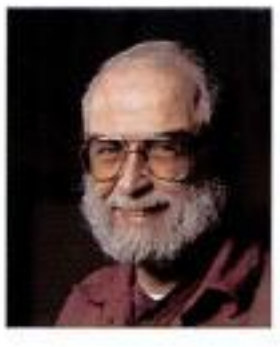
You'll need to draw index lines on the upper clamp to indicate the width of material that will be *removed* during a cut. Given the 1:8 slope of the clamp's taper, sliding the stop forward or backward by 1 in. adjusts the width of the taper by ⅛ in.; ½ in. adjusts the width by 1/16 in.; ¼ in. by 1/32 in., etc.

Mark the 1-in. index lines with a pencil and square, measuring from the narrow end of the clamp. (See Clamp and Stop Details, Fig. 1.) To make the lines permanent and easy to read, scribe the lines with a layout knife, ink the scribe marks with a felt-tipped pen, and then sand the surface lightly.

Now tighten the stove bolt. If the stop can still move, glue some strips of 80-grit sandpaper under the angled portion of the dovetails on the upper and lower clamps. (See Fig. 1.)

Finally, epoxy the stove bolt in place. Apply epoxy to the shank next to the bolt head and to the sloped recess of the countersink. Push the bolt home and scrape off any squeeze-out.

This jig is bound to make your "user" list. Give all the parts a coat or two of polyurethane or another durable finish, to keep it looking good and working well for many years. ▲



**BOB MORAN** *is an editor of Rodale books. This article is adapted from the book,* Woodworking: The Right Technique *(1996, Rodale Press, 33 E. Minor St., Emmaus, PA 18098).*

# Magic Coin Bank

**The Coin Disappears... Can You Figure Out How?**

*by Frank Klausz*

***Money in the bank.*** *Place a coin in the drawer... close the drawer... and watch your coin disappear!*

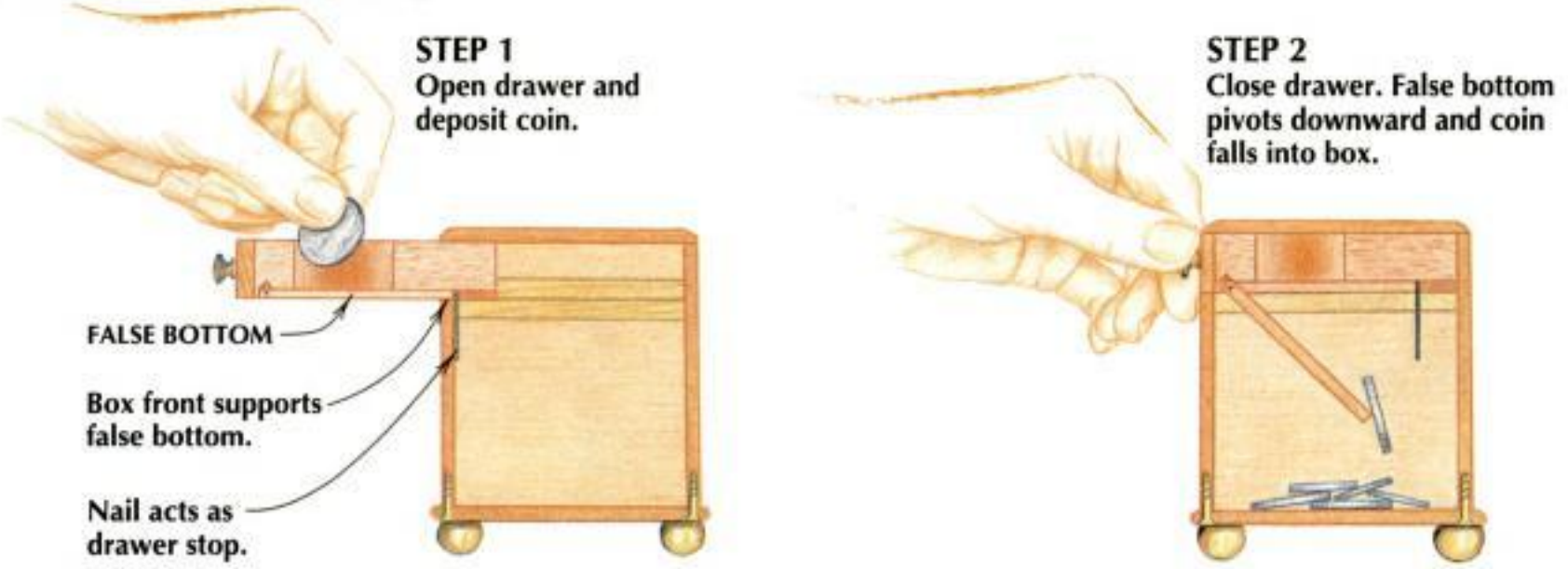
In a Christmas day many years ago, my grandfather gave me a wooden coin bank he had made, similar to the one shown here. The bank had a little drawer where you dropped in a coin. When you closed the drawer and opened it again, the coin was gone. While my grandfather's intent was to encourage me to save money, to my young mind the box was pure magic.

A few years later, as a teenager working in my father's woodshop, I opened my bank for the first time to discover how the "magic" worked. Here's what I found out:

The little drawer has a false bottom that's hinged to a block of wood via small brads. (See Fig. 2.) The block has a hole drilled through it for the coin. Pull the drawer outward and the bottom stays tight to the block, giving the illusion of a solid bottom. But when you push the drawer shut, the drawer bottom pivots downward, depositing the coin inside the box. (See Fig. 1.) Pulling the drawer out again snaps the bottom up against the block, keeping the "magic" a secret.

PHOTOS BY JOHN HAMEL

## FIG. 1: HOW IT WORKS




Following my grandfather's example, I've made many of these boxes for the children on my own Christmas list. I've found that using a hardwood is preferable, especially for the little drawer. You can join the sides of the box however you want—dovetails, box joints, even a nailed and glued butt joint will do.

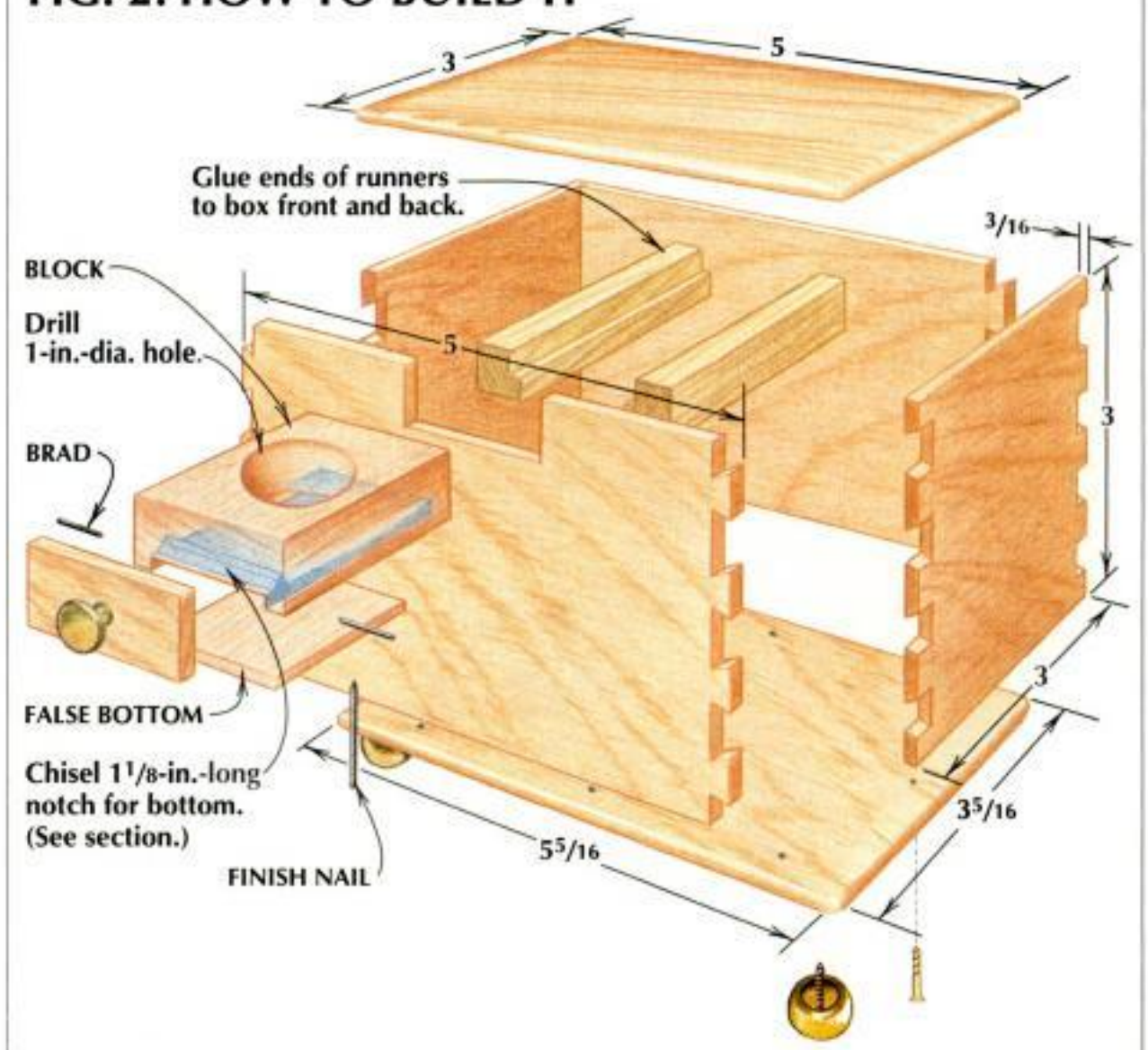
To align and install the drawer runners, glue them in place after the box sides are joined, but before you glue on the top. You'll get a smooth, sliding fit for the drawer if you wrap it in a piece of paper, tap the runners into approximate position, place the drawer between the runners, and then pull the runners tight to the paper-wrapped drawer. Remove the drawer and allow the glue to dry before using the box.

Before you screw the bottom in place, tap a small finish nail into the underside of the drawer to act as a drawer stop. (See Figs. 1 and 2.) A pair of pliers works well for holding the nail as you tap it home with a small hammer. Finish up by attaching the brass "feet" and drawer knob (available from Constantine's, 2050 Eastchester Rd, Bronx, NY 10461, 800-223-8087).

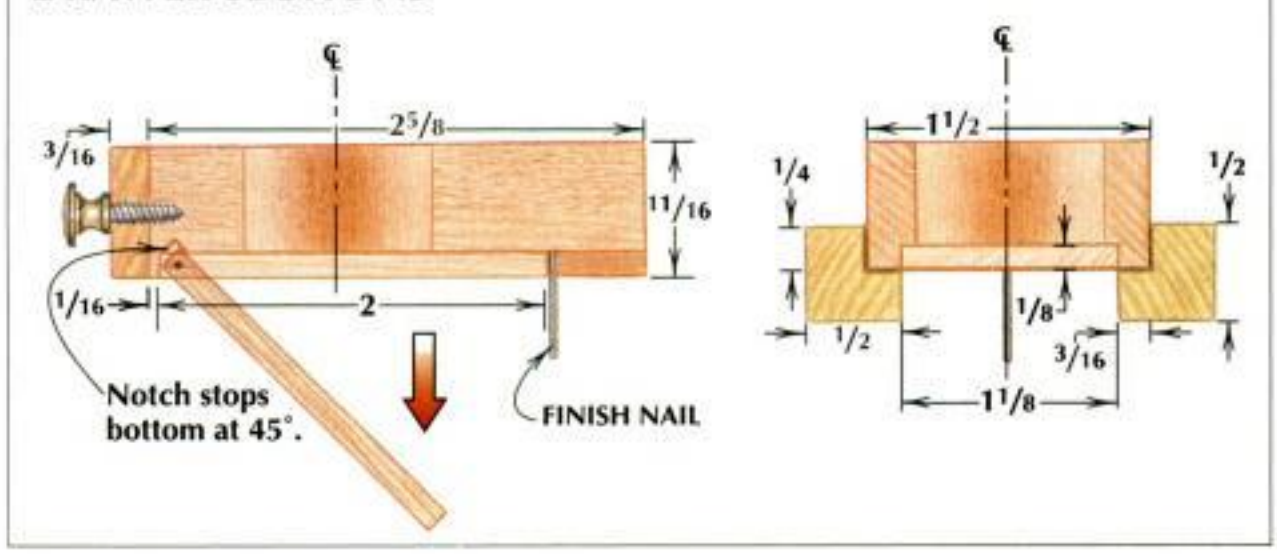
To empty the bank, simply unscrew the bottom. As you present your own gift to the little one you love, remember to repeat the words that my grandfather passed on to me: "I hope you never need a screwdriver." ▲

**FRANK KLAUSZ**
*is a third-generation cabinetmaker. He owns and operates a cabinet shop in New Jersey.*

## FIG. 2: HOW TO BUILD IT

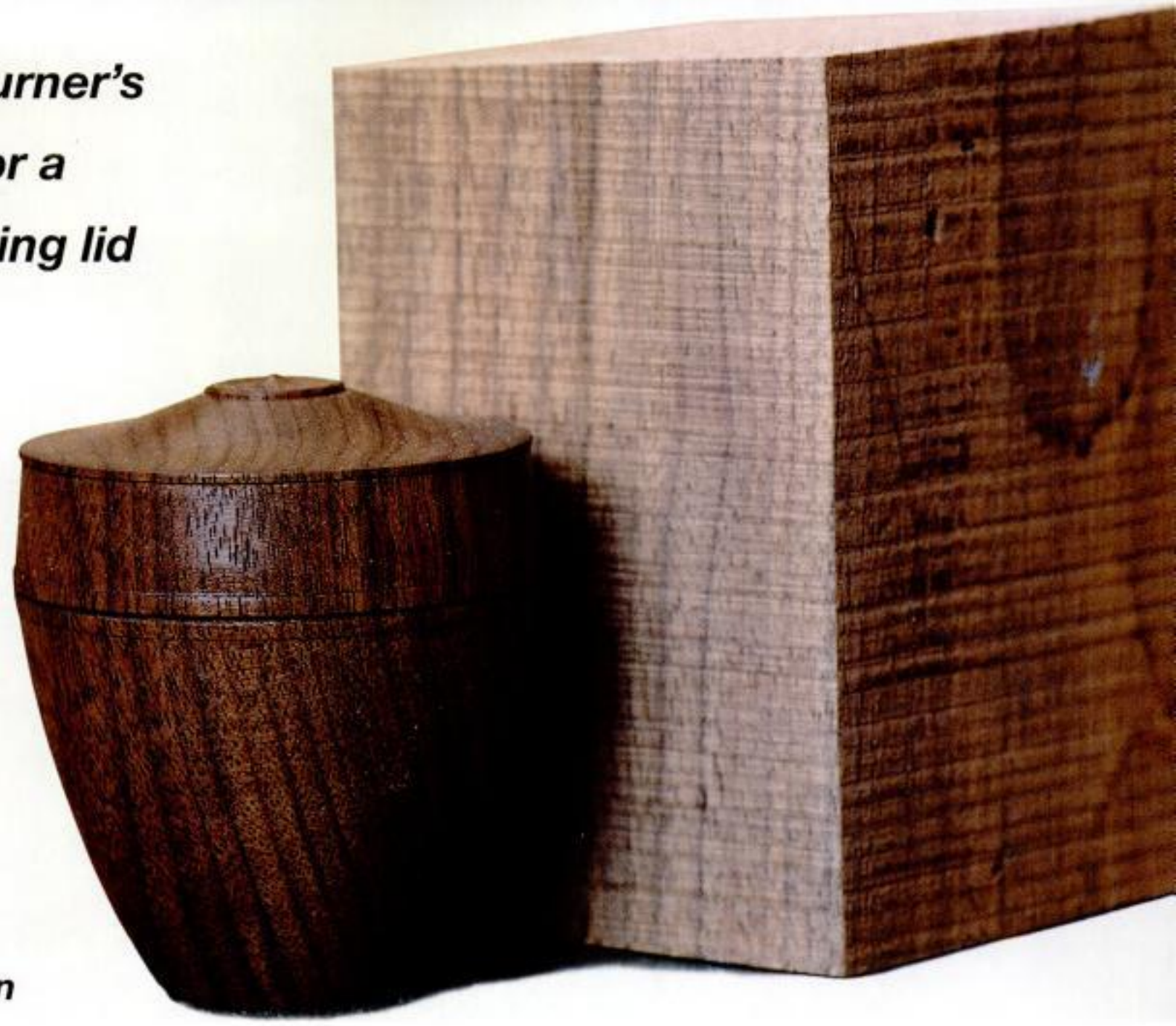



## DRAWER SECTIONS



# Turn a Lidded Box

***A master turner's methods for a perfect-fitting lid***



***by Richard Raffan***

When I decided to turn wood for a living late in 1969, I knew practically nothing of the craft. But I did know that I wanted to turn boxes—lidded containers for spices, jewelry, shells, ball bearings or any of the innumerable personal treasures we all possess.

I hadn't a clue then that turning boxes offers a slew of challenges. Today, I still enjoy creating pleasing curves, details and proportions. But the challenge that remains most fascinating to me is getting the fit of the lid just right. I like to create a lid with a vacuum fit. Air pressure, not friction, keeps the lid on the base of the box until you want to remove it. Lift it off and you'll hear that soft pop—the telltale sign of a vacuum fit. In this article, I'll explain how to get that elusive fit on your next turned box.

***Turning treasure.*** *Who would guess that a blank of walnut could yield such a beautiful box? Raffan's turned containers are famous for their graceful forms and for the perfect fit of the lids.*

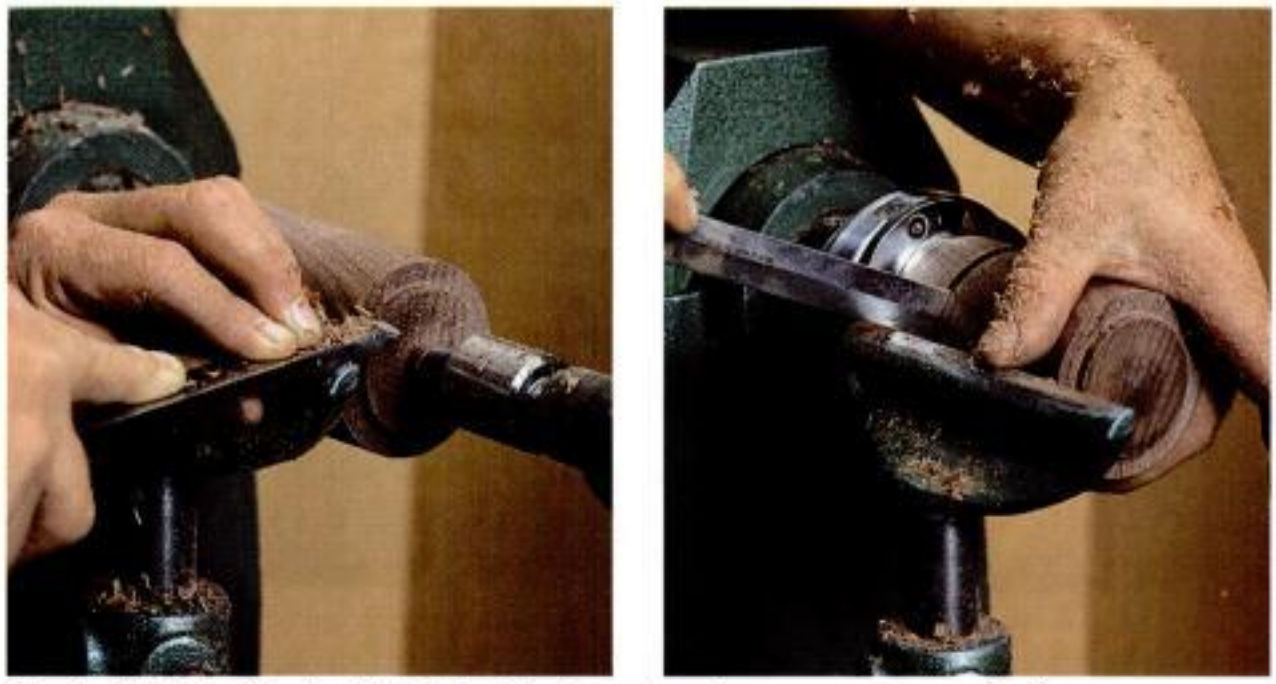
A box is an end-grain project—the grain runs from the top of the box to the bottom. This is partly for ease of working, and partly for stability, since wood shrinks more evenly in this alignment. Choose a stable, well-seasoned wood. I used walnut for the box shown here. Even with good wood, it's important to account for some wood movement between the body of the box and its lid. I detail this joint with a groove or bead, so that any slight warping doesn't jump to the eye.

The tools and techniques for this project are those for centerwork and hollowing end grain. You'll need a self-centering chuck (I use a Vicmarc), a small skew chisel, two shallow gouges (1/2 in. and 3/8 in.) and two scrapers—one with a square end and one that's radiused. Set lathe speed between 1,500 and 2,000 rpm.

## Preparing the Blank

Set up your blank between centers so the grain runs parallel to the turning axis. For the box shown here, I turned a cylinder about 4 in. long, with a diameter of about 3 in. Make a shoulder at each end of the cylinder to fit your chuck. (See photo, near right.) Make sure to cut each shoulder flat or concave so that it will fit securely in your chuck. Also, make your shoulders deep enough so that the indents made by your centers can be pared off, which is the next step.

After turning the shoulders, I mount the blank in my Vicmarc chuck. The nice thing about this type of self-centering chuck is that it's easy to mount and remount the workpiece to get at either end. Turn off the waste until each end is flat. Then separate the base section from the lid with a parting tool. (See photo, far right.) This will leave the lid blank in the chuck and ready to go.



***Start with the blank.*** *With the blank turning between centers (left), cut a shoulder at each end of the blank to fit in a self-centering chuck. At right, Raffan uses a parting tool to cut the base of the box free of its lid.*

## Hollowing the Lid

First, use your skew chisel to make the lid blank's end-grain face slightly concave. This will allow the lid's rim to seat nicely on the base. Then begin hollowing out the inside of the lid. I hollow with a 1/2-in. shallow gouge, working from the center outward, toward 1:00 or 2:00 with the tool almost upside down—a technique called *back hollowing.* (See left photo, below.)

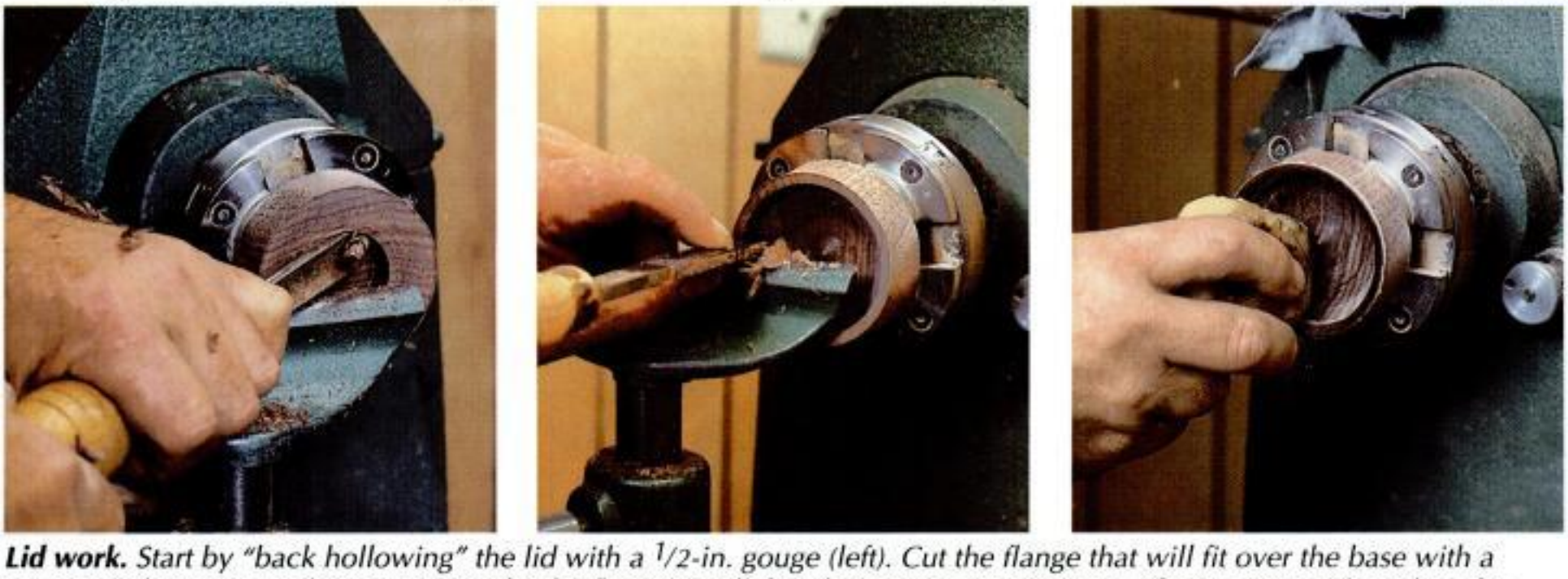
Use a square-end scraper to cut the flange which will fit over the base. *Important: This cut must be made parallel to the lathe axis.* (See center photo, below.) If it's not, the later steps of turning the outside of the lid and final-fitting the lid will be needlessly difficult. Position your tool rest at center height to ensure that only the corner and top side of the scraper contact the wood. Use calipers to check the inside surface of the flange and make sure that it doesn't taper in or out.

When you're satisfied with the flange, use a round-nose scraper to complete the inside of the lid. I sweep the tool away from the center, leaving a central cone or bead. This gives the top of the lid strength where the short grain is comparatively weak. To finish up the lid interior, I sand it through to 360 grit, then hold a lump of beeswax against the spinning wood to build up a film that I buff with a soft cloth. (See right photo, below.)

## Hollowing the Base

With the base chucked in the lathe, turn a shoulder tapered at approximately 30°, over which the flange of the lid will just barely fit. (See drawing, page 39.) I use the skew flat on its side to peel the waste away and create the shoulder. *Important: Don't fit the lid tight at this stage.*

Now you can hollow and finish the inside of the base. As when hollowing the lid, I hog out the bulk of the waste with a gouge. (See top left photo, page 38.) Finish hollowing using a 1 3/8-in. scraper. (See center photo, page 38.) Sweep the tool in from the rim first, using the tool edge to brush the surface gently. It's a good idea to keep your left hand on the outside of the base while you're scraping to limit vibration and chatter. Your left hand also serves as a built-in thermostat—it gets hot when you're being too aggressive with the tool. Hold the scraper near the ferrule with the handle aligned under your arm; this will help absorb any tendency for the tool to catch. Notice in the center photo



***Lid work.*** *Start by "back hollowing" the lid with a 1/2-in. gouge (left). Cut the flange that will fit over the base with a square-end scraper, making sure to make the flange parallel to the turning axis (center). After turning and sanding the inside of the lid, apply a coat of beeswax and buff it out (right).*



***Shaping the base.*** *Rough out the interior with a gouge after turning a shoulder for a rough fit with the lid (left). Then refine the interior shape with a scraper (center). After finishing the interior, turn the flange for a tight fit with the lid (right).*

above that my left thumb is on the rest and against the tool. This enables me to finely control the path of the tool edge.

To complete the inside of the base, sweep your scraper from the center of the bottom outward to fair in with the side. To prevent the tool from moving too abruptly against the end grain, I grip the blade tightly with my left hand, which is planted firmly on the rest. With the cutting edge deep in the recess, you'll have to work by feel. Chances are that you'll have a tiny cone at center to get rid of. If you bring the tool gently but firmly up from underneath the cone, it should vanish with virtually no effort.

You'll see from the cross section (see section view, page 36) that the inside of the box widens just below the flange. This is primarily so that the base will mount readily on a jam chuck when I turn off the bottom. But it also takes bulk and weight from the center of the piece, thus enhancing its feel. I like to hollow to within 1/4 in. of the bottom of the blank to minimize the amount of turning required on the underside. When you're done turning the inside of the base, sand, wax and polish it as you did with the inside of the lid.

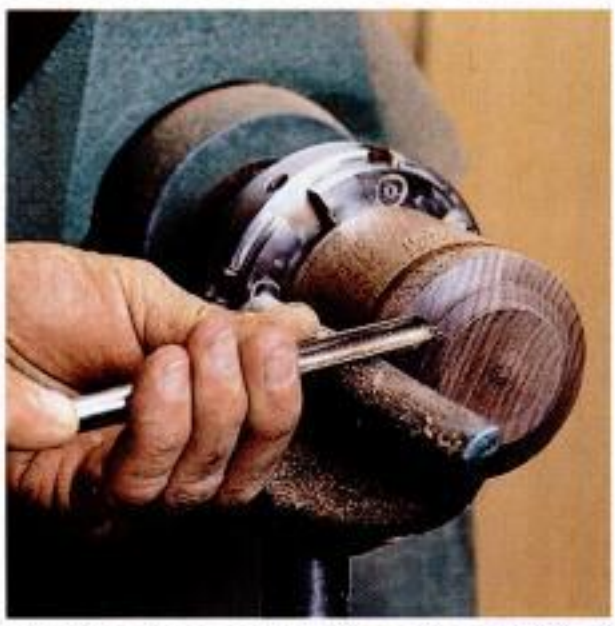
**Now you can fit the lid tightly to the base.** Think in terms of the base flange having a 1° taper, so that the rim is narrower at its edge than farther down the shoulder. True the flange. Then, with the piece spinning, ease the lid on carefully until it rubs. This contact will create a burnish mark that indicates the exact diameter on which the lid fits. Using the skew flat on its side, move the long point from the burnish line gently into the shoulder to create the very shallow taper over which you can tightly fit the lid. (See right photo, above.) It needs to be on tight enough so that you can turn the base and lid together, but not so tight that you can't remove it later.

## Completing the Profile

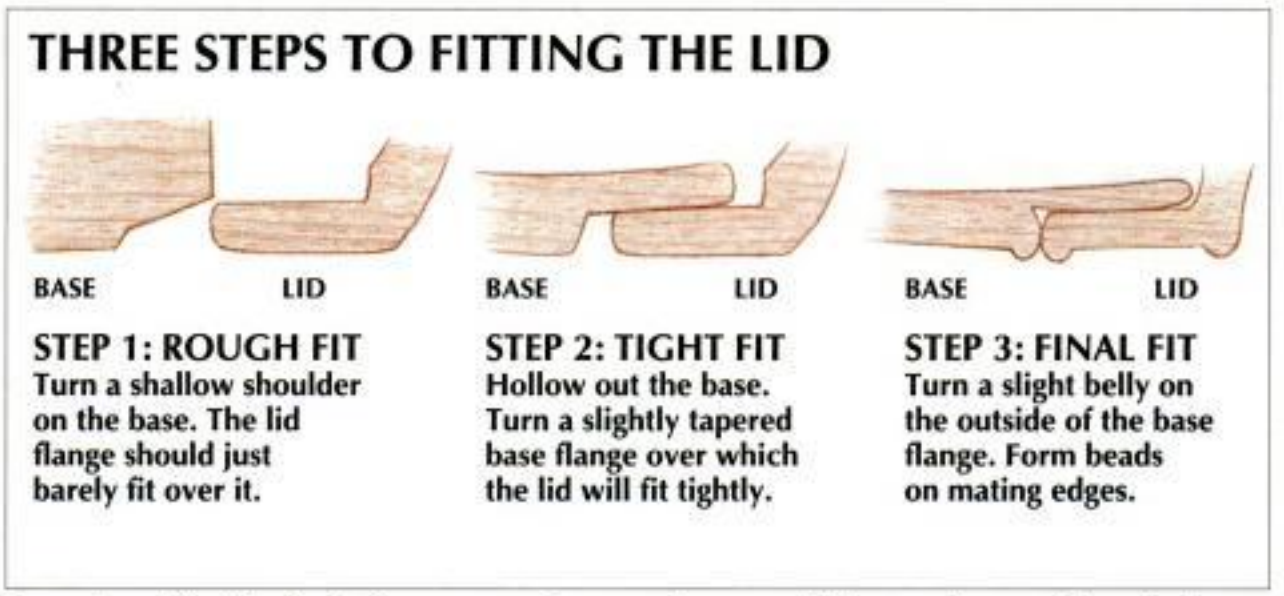
As you work toward the final form of the box, it's important to maintain as much support from the chuck as possible. Don't make a parting cut to establish the height of the box before you complete your work on the upper sections. Making a premature parting cut will leave the work supported on only a small amount of short grain, causing vibration problems or even breakage.

Start to develop the profile on the lid. (See left photo, below.) My favorite tool for this is the 3/8-in. shallow or spindle gouge, ground to a long fingernail edge. As I develop the contour of the lid, I keep popping the lid on and off to check on its wall thickness. Overly thick walls detract from the feel of the lid. Remember: It's worth risking that extra cut instead of settling for a heavier, more ponderous profile.

Start profiling the base as you finish up the lid. Rough out the broad form using the gouge; then refine the curve and form the beads with a skew. (See center photo, below.) To detail around the beads, I flip the skew flat on its side, taking very light peeling cuts. My skew chisels are ground with a slight curve, which prevents more than 1/8 in. of the edge from being in contact with the wood. This is an advan-



***Turning base and lid together.*** *With the lid fit tightly on the base, turn the final detail on the top of the lid (left). Form the beads on both sides of the opening with a skew (center). Buff on a beeswax finish after sanding the profiled sides (right).*




***Final fit.*** *With the interior of the base hollowed and finished, Raffan uses a skew and a very light touch to refine the base flange for a perfect fit with the lid. The evolution of the fit is shown in the drawing above.*

tage when turning beads. Ease the long point of the tool into the wood to detail the angle at the base of a bead.

Now sand and polish the outside. (See bottom right photo, opposite page.) Remember not to wrap the polishing cloth around your fingers; if it gets caught, you could lose a finger. Note that at the polishing stage I still retain some of the blank against the chuck jaws to provide support for the final fitting of the lid.

## Final Fit

At this stage, the lid should still be on tightly. For the final fit, you need to detach the lid and remove a smidgen off the base flange. The objective is to create a very slight belly in the base flange. The straight sides of the lid flange rest on the fullness of this curve. (See drawing.) You can tell exactly where the lid fits by holding it lightly over the revolving base so that it leaves a burnish mark. If you fail to hold the lid square, you might get two marks, in which case your point of reference is between the two marks. With the skew chisel on its side, use the point of the skew to make a very delicate peeling cut. You'll need a curved skew for this, so that the point can work into the corner of the flange without messing up the fullness of the curve. Aim to get your lid sliding on with just a hint of air pressure building up, and the resistance of a slight vacuum as you remove it.

## Completing the Base

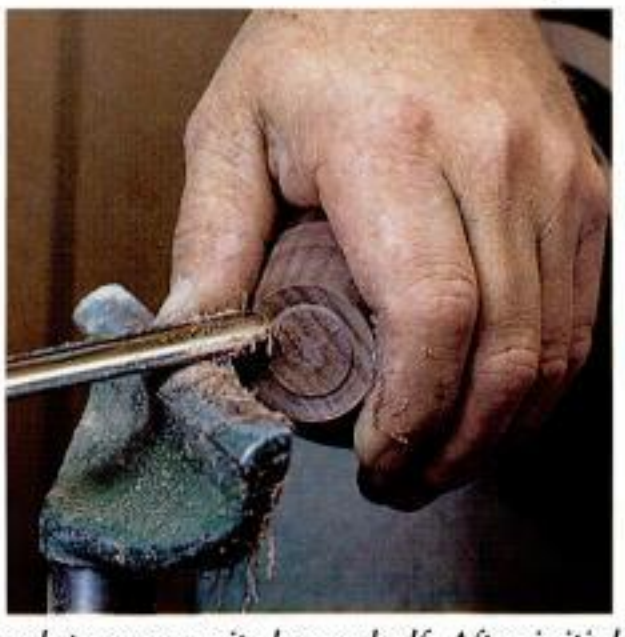
Now it's time to part the box from the chuck. Start by peeling the waste from the base of the box with a skew. Use the long point down to make a shear cut, continuing the flow of the profile. Then part off the base with a parting tool. The safest way to free the base from the waste wood held in the chuck is to part nearly all the way through the work, then simply break the base free.

Make a jam chuck for the base—a tapered wood tenon over which the base can be securely mounted. Fit the base on the jam chuck and begin to turn off the bottom. I start to turn off the surplus material with a 3/8-in. gouge. Then I grab my skew chisel to refine the final surface. (See left photo, below.)

Finally, I turn my attention to the bottom of the base, which needs to be hollowed out slightly. As with the sides, I start removing stock with the gouge. (See center photo, below.) Then I finish up with the skew, using it like a scraper. I hold the skew flat on its side, and ease the short corner of the edge into the wood just inside the rim to create a recessed bottom. (See right photo, below.)

Finish up the box by buffing a coat of beeswax onto the base. You'll need to wait a couple of minutes for the base to cool. Then you can enjoy the soft pop as you pull the lid off. ▲

**RICHARD RAFFAN**
*is a turner and author in New South Wales, Australia.*



***Final cuts.*** *Wedge the base onto a jam chuck to expose its lower half. After initial shaping with a gouge, refine the sides with a skew (left). Work the underside first with a gouge (center), then with a skew (right). Hold the skew flat on the rest.*

# Build a Bar Stool

## *Splayed Legs Are a Snap With Loose-Tenon Joinery*

**by Andy Rae**

The simple bar stool gets a bum rap. This unassuming piece of furniture has great practicality. It waits patiently under a counter, eager to support our posteriors, or it sits quietly in a corner, holding our potted plants. Because it's light and compact, a bar stool can be used anywhere inside the house or out, and it's ready at a moment's notice for impromptu seating.

I designed the stool shown here as part of a set that includes a small breakfast table and two stools (the table plans appear in AW #50). Building the stool is a pleasant exercise in small-scale furniture making, though I recommend making several at a time. This particular piece lends itself to production runs—and, like clamps, you can never have too many stools.

If you want to make a stool that can withstand everyday use and abuse, it's important to consider two aspects of design: stability and sound joinery. I used mortise-and-tenon joinery for strength, and I splayed the legs outward to give the stool a solid, stable stance that won't accidentally upset the sitter. To simplify the construction process, I chose loose-tenon joinery for the necessary compound-angled joints. All you'll need to cut these joints is a tablesaw and a plunge router. More on this later.

At 24 in. high, the stool is designed to stow comfortably underneath the breakfast table in the set. (See photo, left.) If this isn't important to you, alter the height of the stool to suit your own needs. In any case, I suggest you stay within a degree or two of the splay shown in Figs. 1 and 2, to ensure that the stool will be stable in use.

***Strong and stable.*** *Splayed legs and mortise-and-tenon joints make a solid seat that's built to last. The stool and its mate are designed to complement the author's kitchen worktable.*

I recommend that you make the stool from a hardwood for strength. I made the stool shown here from cherry except for the seat, which is made from a piece of butternut. Before cutting any wood, I made a full-size drawing of the stool on a scrap panel. Then I used my bevel gauge to lay out the necessary angles and to set the angles on blades, fences and the like.

## Construction Notes

All the information you need to build the stool is shown in Figs. 1 and 2, but a few notes about the construction process are in order:

**Sawing angles**—Making the compound angle cuts on the ends of the legs (see Fig. 1) is simply a matter of tilting your saw blade and adjusting your miter gauge to the correct angles. I cut one end on all of the legs, then I marked each leg to length and cut its opposite end by lining up the leg to the blade by eye.

I find it best to make each pair of upper and lower rails (see Fig. 1) from one piece of wood, then rip the stock into two pieces later. This allows me to get a nice grain match and simplifies angling and mortising the ends. I used a sliding miter saw to make the angled cuts, but you can use the tablesaw and a miter gauge easily enough. Just adjust the miter gauge to the correct angle. At this point, cut only one end of each stretcher; you'll cut the opposite end later. Rip the bevel on the edges of the stock by tilting the saw blade to the same angle used to cut the ends of the legs as above. (See Fig. 1.)

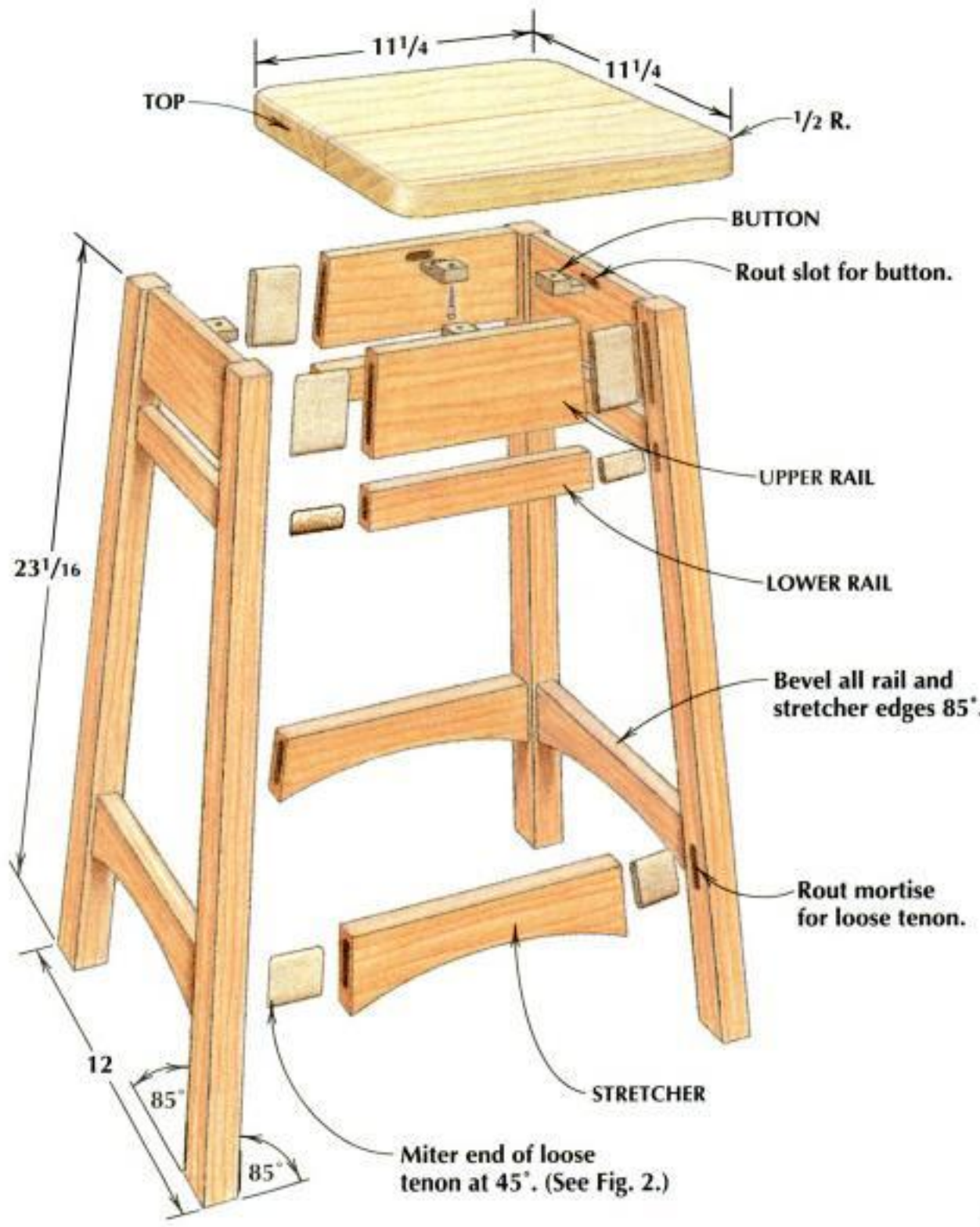
**Routing mortises**—I routed all the mortises on the legs, rail stock and stretchers at the bench with a plunge router and edge guide. It's a quick, easy, accurate way to mill mortises.

Rout the leg mortises by ganging two legs together to provide a stable platform for the router, as shown in the left photo on page 42. To control the cut, rout against the rotation of the bit by keeping the edge guide on the right side of the workpiece as you push the router away from you.

Next, clamp a rail between two legs and mark the finished length of a stretcher. (See center photo, page 42.) Cut the angle on the end of the stretcher on the tablesaw as before, then use this piece to lay out the remaining stretchers and cut them to length as well.

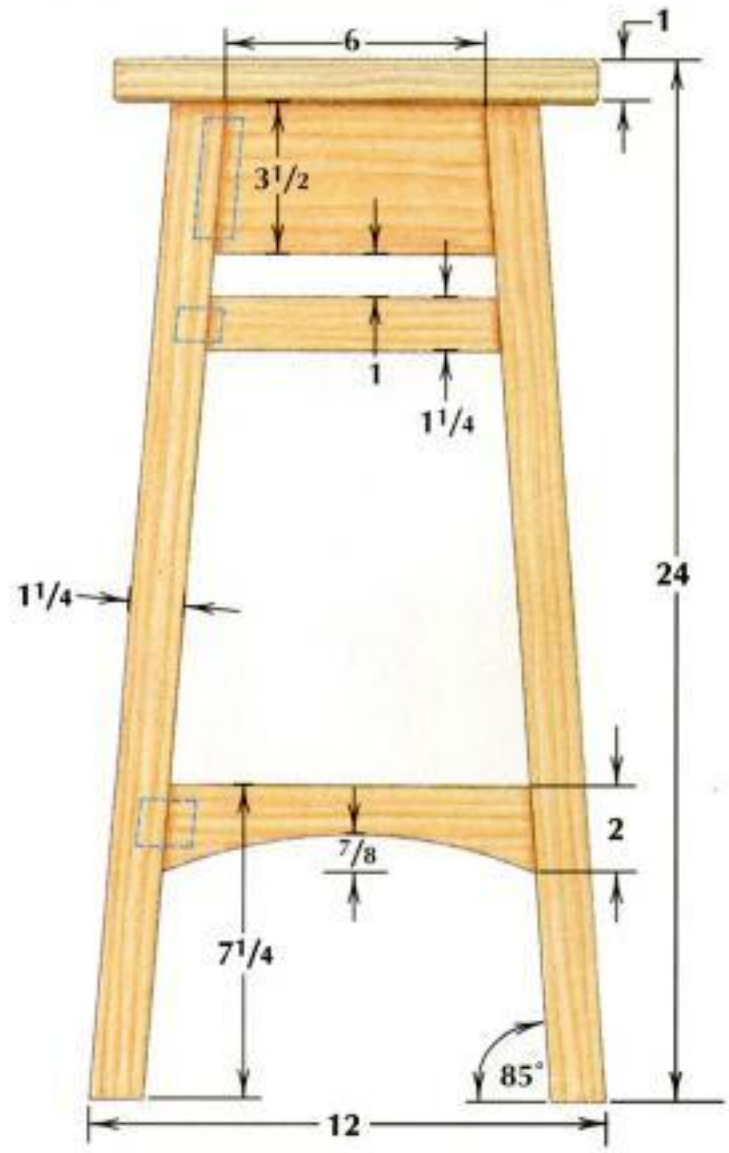
I routed the mortises in the rail stock and the stretchers with the work held

## FIG. 1: STOOL

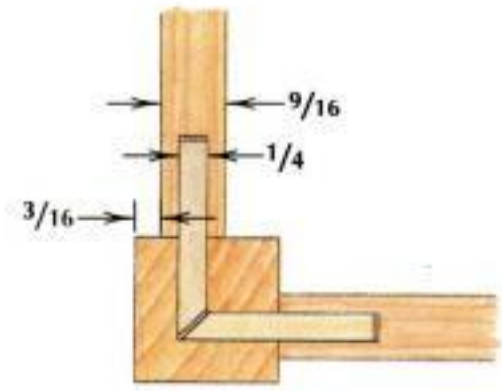



***Compound cutting.*** *Trim the legs to length by beveling the blade and angling the miter gauge.*

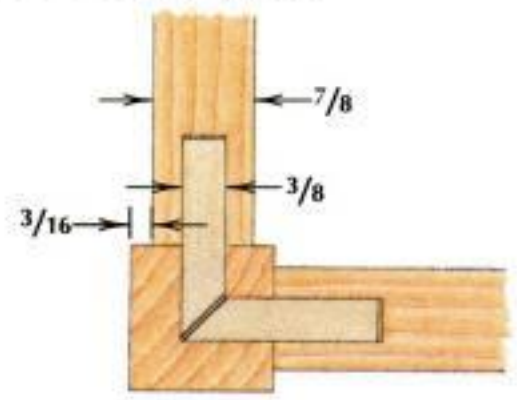
## FIG. 2: ELEVATION AND SECTIONS




### SECTION THROUGH LEG AND UPPER RAILS




### SECTION THROUGH LEG AND STRETCHERS



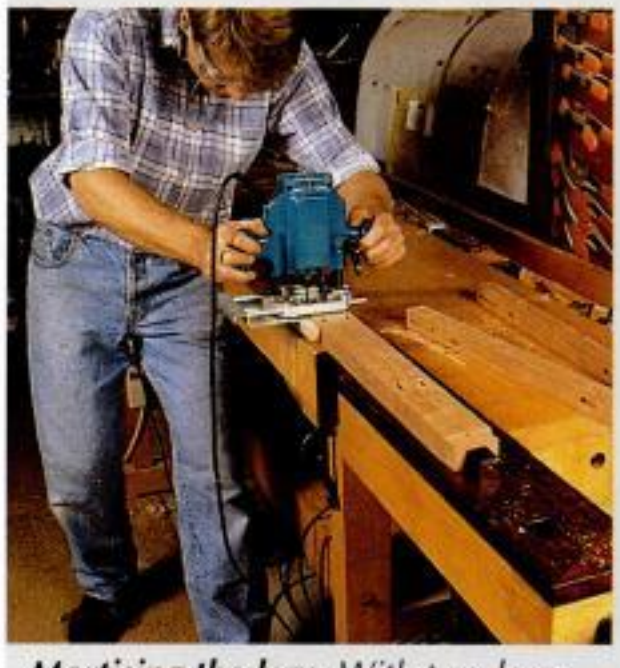

vertically in my bench vise. To support the router, I clamped a scrap block to the benchtop, then I clamped the workpiece flush with the top of the block. (See right photo, below.) Once you've cut the mortises in the rail stock, rip each piece into two separate rails, beveling them at the same time by adjusting the blade to the correct angle.

If you opt to use wooden buttons to attach the seat to the undercarriage as I did, rout the slots for the buttons in the top rails now. (See Fig. 1.) Another option is to use metal tabletop fasteners (available from Constantine's, 2050 Eastchester Rd., Bronx, NY 10461, 800-223-8087). You can cut the slots for these fasteners by sawing a groove in the rails on the tablesaw or by cutting a series of slots with plunge cuts from a biscuit joiner.

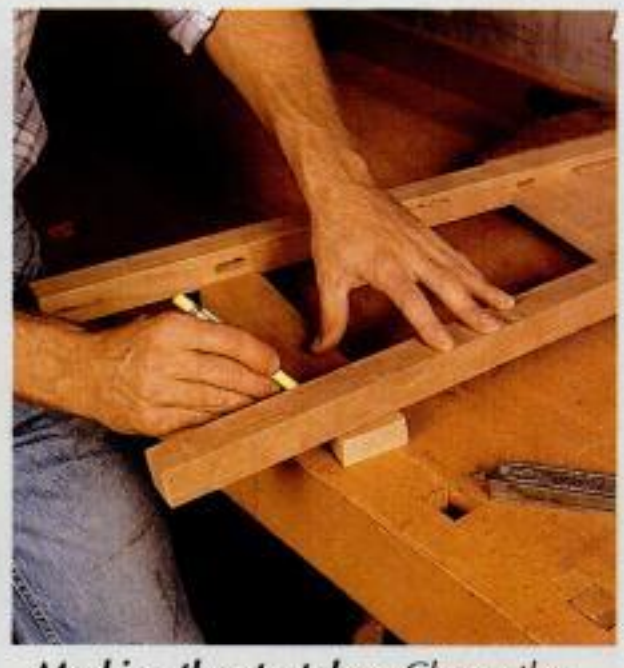
**Curving the stretchers**—To lay out the curve on the stretchers, I flexed a thin strip of straight-grained wood into my desired curve and traced the curve onto a stretcher.

I cut the curve on the bandsaw, tilting

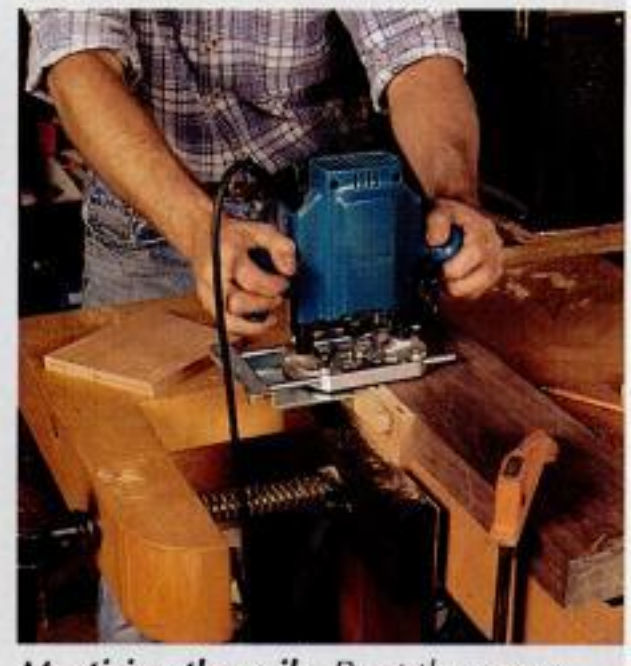
## ANGLED JOINERY WITH A ROUTER



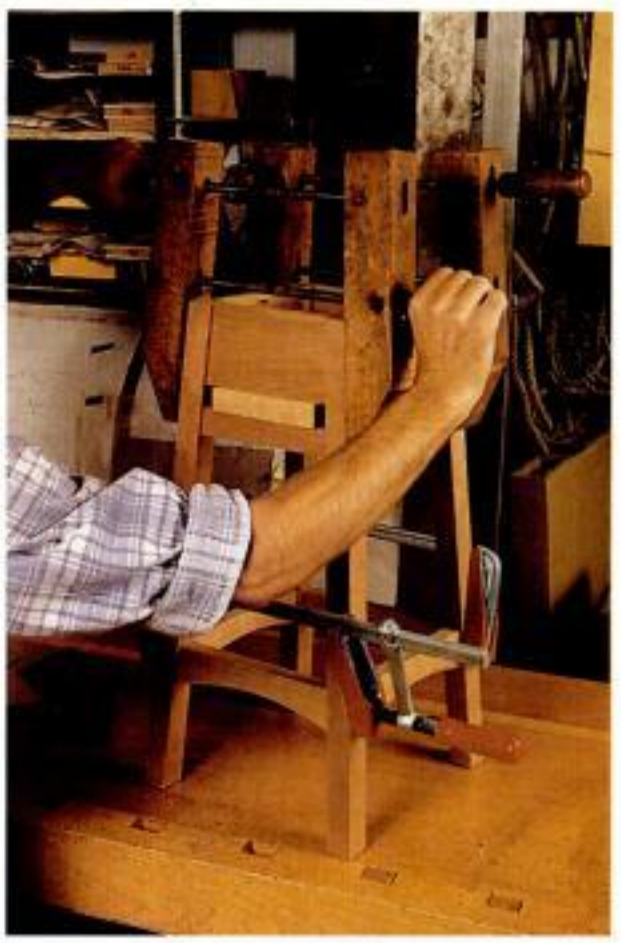
***Mortising the legs.*** *With two legs ganged together for support, plunge-cut the mortises by guiding the router with an edge guide.*



***Marking the stretcher.*** *Clamp the rail stock to the legs, then align the angled end of the stretcher to the leg and mark the opposite end to length.*



***Mortising the rails.*** *Rout the upper and lower rails as one piece, then rip the stock apart on the tablesaw. A scrap block supports the router.*



***Angled clamping.*** *A flat surface and clamps with adjustable jaws ensure that the side assembly glues together without slippage or twist. The author uses a scrap block between the upper and lower rails to keep the spacing correct (left). Make sure the entire assembly is true by gluing it together upright on the bench (right).*

the table 5° in order to bevel the bottom edge of each stretcher at the same angle as the top edge. Use the curved stretcher to lay out the remaining stretchers and saw the curves on these pieces. You could clean up the bandsaw marks with a curved block of wood and some sandpaper, but I prefer to use a spokeshave because it's quick and dust-free. Set the blade for a light cut and push the spokeshave "downhill" from the ends of each rail toward the center to avoid tearout. Use firm, long strokes to prevent chatter.

**Loose tenons**—I made the loose tenons by thickness-planing some cherry stock until it slipped into a mortise with a slight amount of friction. Once the fit was correct, I ripped the stock into strips of the necessary width, then lowered the blade and cut shallow grooves on both sides of the strips. The grooves allow air and excess glue to escape during assembly.

To fit the curved ends of the routed mortises, I routed the edges of the tenon stock on the router table using a 1/8-in. round-over bit. (See photo, right.) Form each individual tenon by mitering one end of the stock on the tablesaw or chop saw, then cut the tenon to finished length. (See Fig. 2.)

**Rounding the seat**—To make the seat more comfortable, I rounded the corners of the blank slightly. (See Fig. 1.) Saw the corners on the bandsaw, then clean up and smooth the curves with a spokeshave or a drum sander.

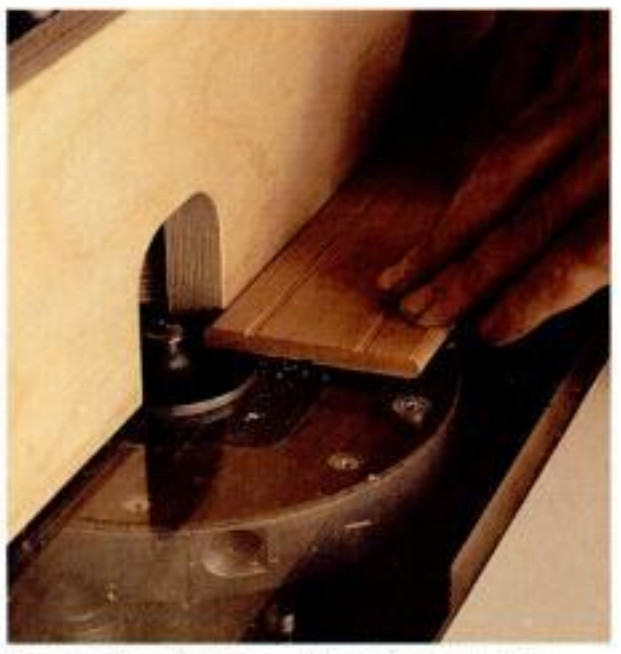
**Angled clamping**—Gluing up angled workpieces can be tricky because in these situations parts and clamps have an annoying tendency to slip. My solution is to use wooden handscrews and Bessey Flex K clamps (available from Tool Crib, Box 14040, Grand Forks, ND 58208, 800-358-3096). These types of clamps adjust to the angle of the work so that clamp pressure bears over the center of the joints. (See photos, above.)

Gluing up the stool all at once requires more clamps than are feasible, and the process can get hectic even if you use a slow-setting glue. I decided to work at a gentler pace by gluing together the two side assemblies separately. To avoid clamping any twist into each assembly, I glued up the parts on the flat surface of my bench. (See left photo, above.)

Once the glue was dry, I glued the side assemblies together by clamping them vertically on my bench, keeping a watchful eye on the legs as I tightened the clamps to make sure the assembly stayed level with the surface of the bench. (See right photo, above.)

**Finishing up**—I applied a wiping varnish to the seat and to the undercarriage separately, making it easier to get my hands inside the framework of the undercarriage.

Once the finish dried, I attached the seat to the undercarriage. To do this, insert the buttons into the slots in the top rails and then screw through the buttons into the seat. Now pull up a stool and relax. ▲



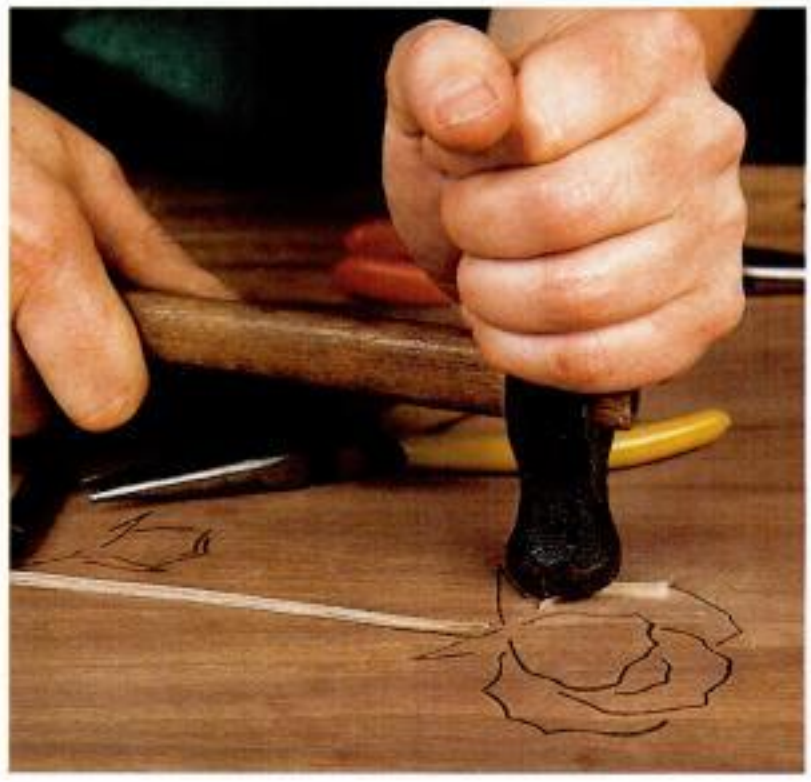
***Rounding tenons.*** *Round over the edges of the loose tenon stock on the router table to fit the curved ends of the mortises.*

**ANDY RAE**
*is a furniture maker and an associate editor of AW.*

# Wire Inlay

*Make Delicate Designs in Wood with a Plunge Router, a Template, and a Tiny Bit*

**Drawing in wood.** *The elegant flower design on a walnut veneer cabinet (above) is made from thin strips of silver, pressed into narrow grooves routed with templates and a tiny bit. Below, the author presses metal into a groove.*



FLOWER PHOTO BY MICHAEL BEILER, COURTESY OF STUDIO DESIGN. INSET PHOTO BY JOHN HAMEL

**by Jane Swanson**

Wire inlay is the art of setting narrow ribbons of metal into grooves cut in a wooden surface. Traditionally, it was done with hand tools to decorate gunstocks and boxes; modern applications are limited only by your imagination. My technique uses a plunge router, templates and tiny machinists' micro-end mill bits to cut the grooves. It's a simple and accurate method that gives me a lot of creative freedom. In this article, I'll discuss the materials, tools and techniques I use in my work.

## Tools and Materials

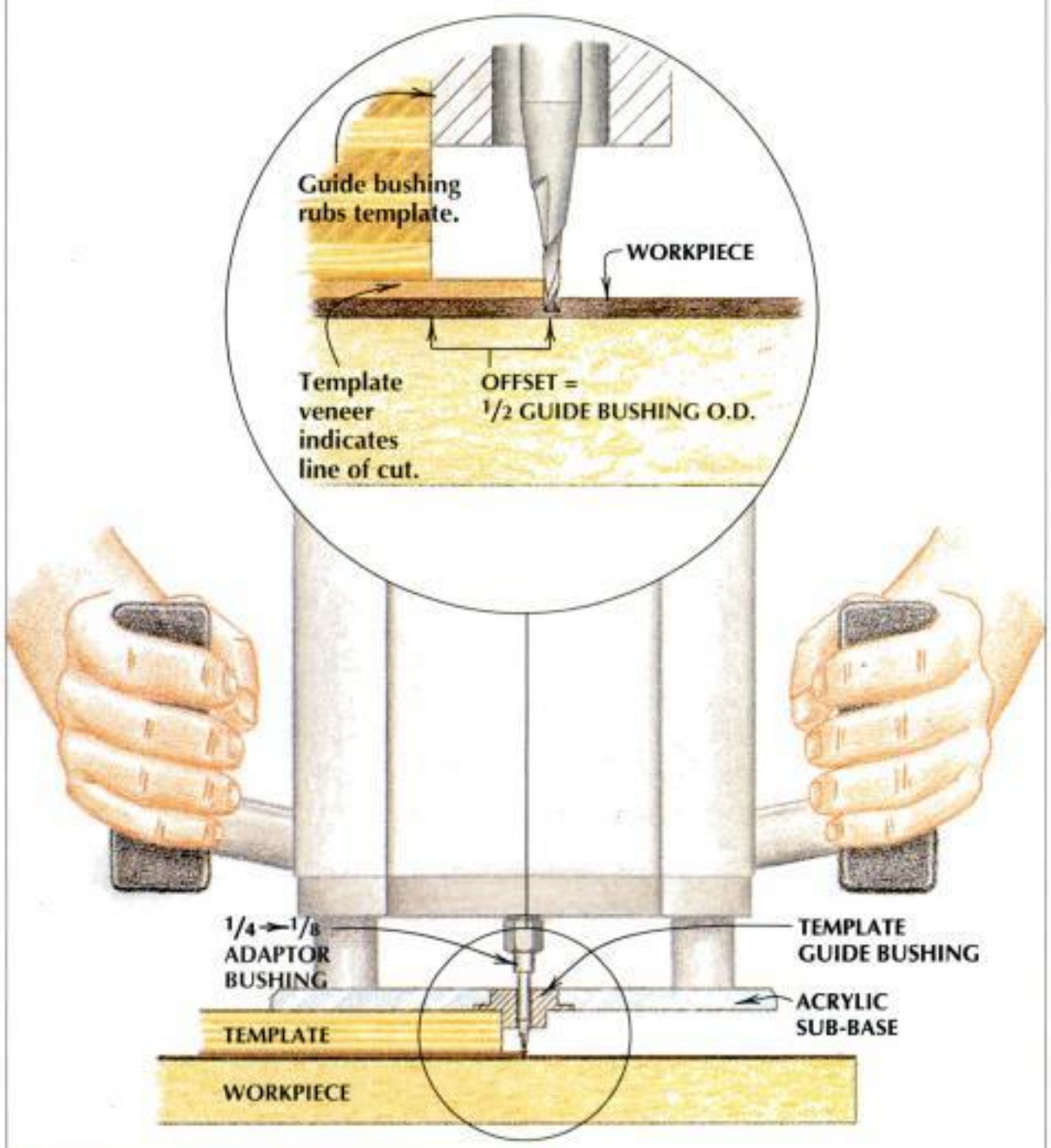
**Metal**—Although this technique is called wire inlay, I actually use narrow (1/8-in.-wide) strips of metal, of varying thicknesses. I have used three metals in my furniture: pewter, silver and brass, and I recommend them in that order.

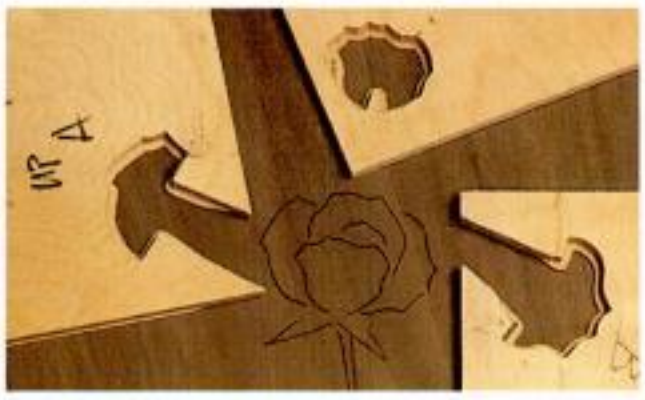
Pewter is a good metal for inlaying because it is relatively soft. In fact, it's so soft that it's generally not available in strip, or wire, form. But I've found that I can rip pewter sheet into strips on the tablesaw with a metal-cutting blade. I use a 6-in.-dia., 190-tooth, high-speed-steel metal-cutting blade (see Sources, page 47) and a zero-clearance throat plate. (See top photo, page 46.) If you don't feel comfortable ripping sheet metal yourself, a local metalworking shop can cut it for you on a metal shear.

Silver is another fairly soft metal. Fine silver (unalloyed) is easier to work than sterling silver. You can buy silver in sheet form, but it is also available in precut strips—which I prefer—or in longer, coiled strips commonly called flat wire. (See Sources.)

Brass is more difficult to work with. You'll have to buy it in sheet form, and I do not recommend ripping it yourself; it is too hard to

## TEMPLATE ROUTING FOR WIRE INLAY



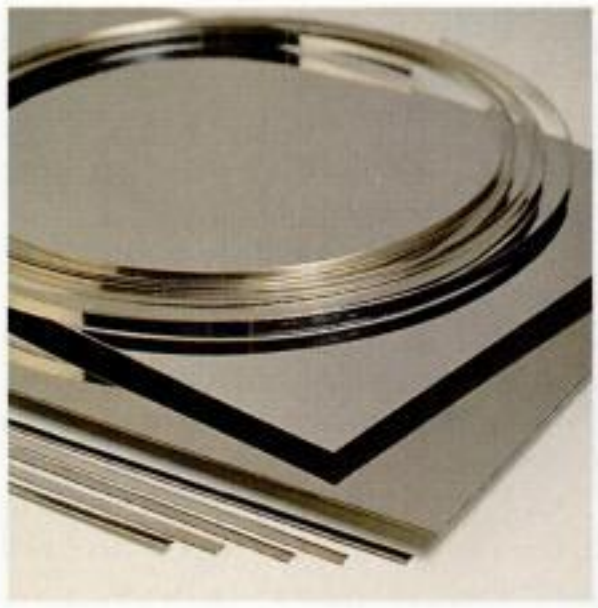



***Two-layer templates.*** *The top layer is plywood; it guides the bushing. The bottom layer is veneer; it shows the bit's cutting line, making it easier to align the template. Complicated designs like this rose call for several templates (left).*

## MATCH THE BIT TO THE METAL

Micro-end mill bits come in 0.005-in.-dia. increments. Metal is usually measured in gauge. Gauges that are multiples of 0.005 in. give a perfect fit.

| METAL GAUGE | INCH EQUIVALENT |
|---|---|
| 16 | 0.051 |
| **18** | **0.040** |
| 20 | 0.032 |
| **22** | **0.025** |
| **24** | **0.020** |
| 26 | 0.016 |
| 28 | 0.012 |
| **30** | **0.010** |



***Mélange of metals.*** *You can buy metal in several forms. From top: fine silver flat wire; 30-gauge fine silver sheet; 18-gauge pewter sheet; precut fine silver strips.*

rip safely on a tablesaw. And because of its relative hardness, brass is also more difficult to inlay.

**The thickness of the metal** determines the width of your inlay. When you're designing the inlay pattern and choosing the metal, keep in mind that while metal thickness is measured in gauge, micro-end mill bits are made in 0.005-in.-dia. increments. (See chart, above right.) It's simplest to choose a metal gauge that coincides with a micro-end mill bit diameter—such as 18, 22, 24 or 30 gauge. This will give you a perfect fit.

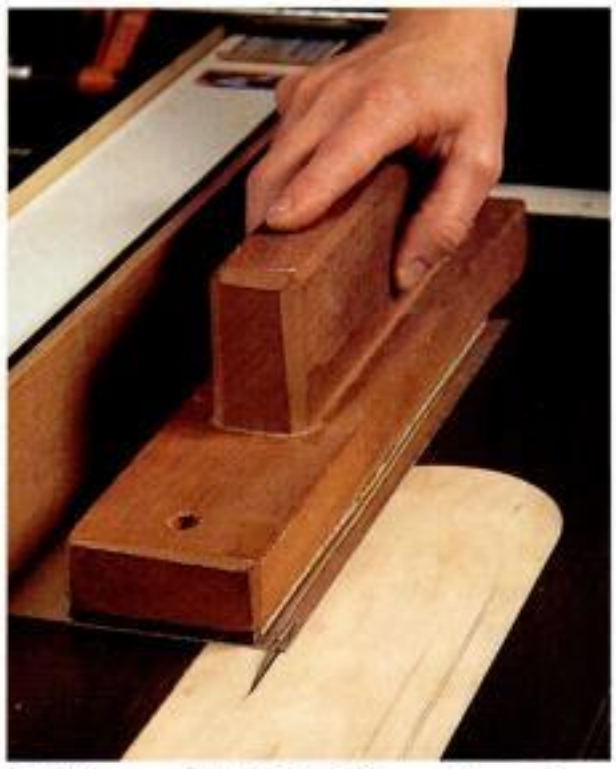
**Bits**—Machinists' micro-end mill bits are like straight router bits, only much smaller. The ones I use have a 1/8-in.-dia. shank that tapers into a tiny cutting end with straight sides and a flat bottom—perfect for routing delicate grooves. (See top photo.)

Micro-end mill bits are available in high-speed steel or carbide. (See Sources.) I prefer carbide bits. Several designs are available; for this procedure, you'll want a two-flute, single flat end bit. Choose an end diameter that matches the metal thickness you plan to use. (See chart.)

**Bushings**—Aside from the bits, I need a bushing to adapt my 1/4-in. router collet to the 1/8-in.-dia. bit shank. I also need a template guide bushing to guide my router along the template. (See Sources.)

### Making Templates

Router templates give me smooth, accurate grooves. Making the templates requires a little forethought. I have to offset the profile of the template to account for the distance from the outside of the guide bushing's rub collar—which rubs against the template—to the



***Cutting metal strips.*** *The author rips a thin inlay strip from a sheet of pewter, using a metal-cutting blade. A zero-clearance throat plate, an auxiliary fence and a push stick make for safe, accurate cuts.*

centerline of the bit. This works out to half the outside diameter of the rub collar. So, with my 1/4-in.-o.d. guide bushing, I need an 1/8-in. offset. (See drawing detail, page 45.)

The template material should be at least as thick as the depth of the rub collar on your guide bushing. (See drawing.) I make my templates from 1/4-in.-thick Baltic birch plywood; it provides a clean edge when worked with hand tools.

An easy way to make templates is to mark the centerline of the desired groove on the template blank, set a compass to the offset distance (see drawing), mark an offset line parallel to the original line and bandsaw almost to the offset line. I refine the edge with a spokeshave, a scraper and sandpaper.

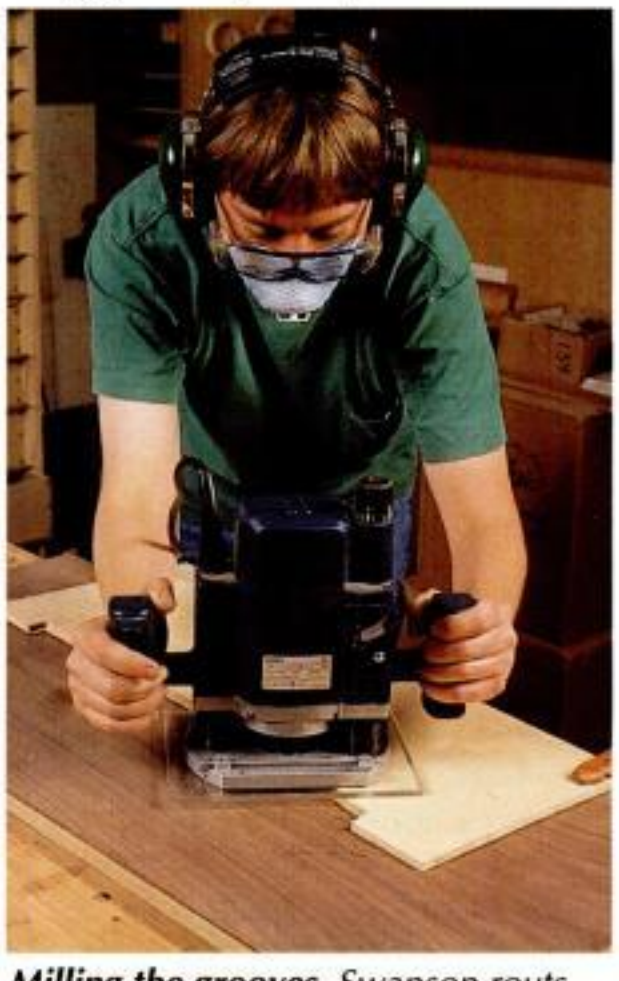
With the template/guide bushing arrangement, I can't see exactly where the routed groove will fall on my workpiece. If you're routing a simple pattern, the template alone provides sufficient guidance. For more accurate results—especially on complex curves—I glue a layer of maple backing veneer to the bottom surface of the template. Then, with the guide bushing riding firmly against the template, I rout through the veneer with the micro-end mill bit. The resulting edge of the veneer shows exactly where the groove will be, so I can position the template exactly where I want it on the work. (See drawing.)

## Preparing the Wood and Metal

For my inlay surface, I usually use a thick veneer (1/16 in. to 1/8 in.) pre-glued to its substrate. Thick veneer allows some leeway for the flush-off process. You can also lay metal into solid wood, if lines don't travel far in the cross-grain direction. Wood movement can cause cross-grain inlay to loosen over time.

I seal the wood with a wash of four parts water to one part liquid hide glue. before routing the groove. This helps prevent darkened pores later, if epoxy squeezes out of the groove when I glue in the metal. Open-grained wood like oak is especially prone to darkening; I recommend experimenting on a sample with the epoxy, a sealer and your finish.

**If I'm cutting my own pewter or silver** strips on the tablesaw, I set the metal-cutting blade low and run the sheet metal slowly over the blade. I run the bulk of the sheet between the blade and my wooden auxiliary fence, and I hold it down with my jointer push stick, which I've shimmed up with veneer, double-faced tape and a layer of sandpaper for a better grip on the metal. (See photo, left.) The push stick has a "heel" on the back, so it contacts the sheet on one side and one edge. I cut one strip, then adjust the fence and cut the next strip. Strips should be wider than the inlay groove depth, so you can do a test fit and still remove them to glue. I rout my grooves 1/16 in. deep and cut my strips 3/32 in. to 1/8 in. wide.



***Milling the grooves.*** *Swanson routs each inlay groove at a very slow feed rate, guiding her router firmly against the template.*

## Routing the Inlay Groove

Next, I position my template on the workpiece and clamp it in place. (See photo, below.) I do a "test run" without the bit plunged down, to get a feel for the template.

I set the plunge depth to about 1/16 in., keeping my strip width in mind. If you have a variable-speed router, set it to the fastest speed. Keeping the guide bushing against the template and the stop, I plunge into the surface, and feed very slowly—about 6 seconds per inch, or slower on short or curvy sections—to minimize strain on the fragile bit.

Little cleanup is necessary with my technique. I remove any debris with a mat knife or by blowing compressed air into the groove.

If two lines meet at an acute angle or with little grain between, I'll inlay one line and flush off the inlay before cutting the groove for the second line, to avoid short grain breakage in the corner.

The hole in a standard router sub-base (see drawing) isn't always perfectly centered, which can create a wobbly line if you inadvertently rotate the router while cutting. It helps to keep the router facing the same direction as you guide it along the template.

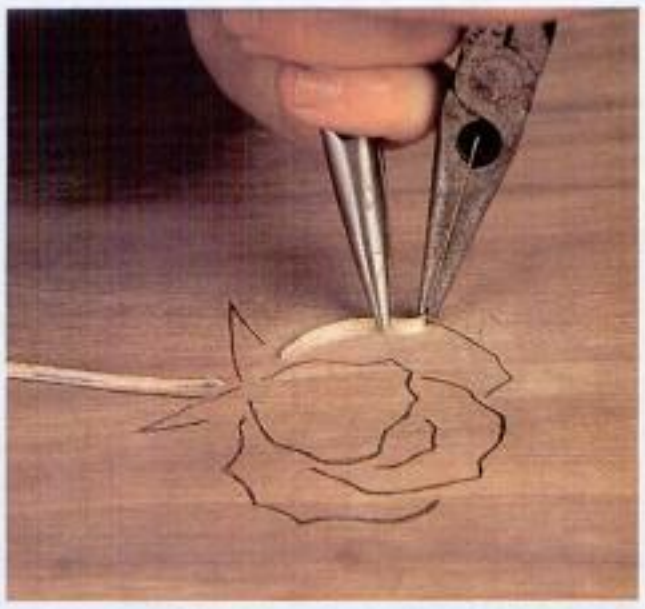
I wanted even greater accuracy, so I replaced my router's standard sub-base with a piece of 1/4-in.-thick acrylic. To get a perfectly centered hole for the guide bushing, I mounted the acrylic on my router base and plunge-cut a hole with a bit the same diameter as the guide bushing's threaded section. On the underside of the acrylic, I counterbored (going only partway through) with a bit whose diameter matched the guide bushing's widest section. (See drawing.) Then I attached the guide bushing and remounted the acrylic right side up.

## Laying In the Metal

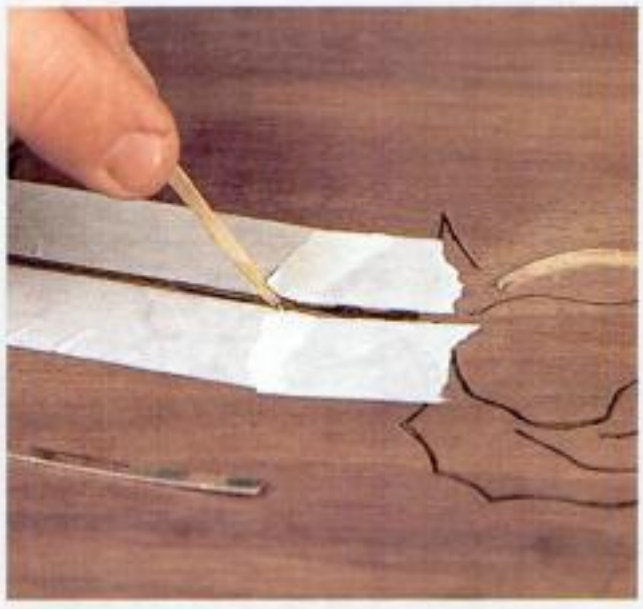
Once the groove is cut, I snip a strip of metal slightly longer than the groove with wire cutters and file the end to fit. Where inlay lines intersect, I bevel the end of the strip as necessary. I ease the bottom edge of each strip slightly with sandpaper so it goes into the groove more smoothly. As I test fit, I pre-bend the strip to the curves of the groove with needlenose pliers. (See top left photo, opposite page.) This makes the final fitting much easier.

PHOTOS BY JOHN HAMEL

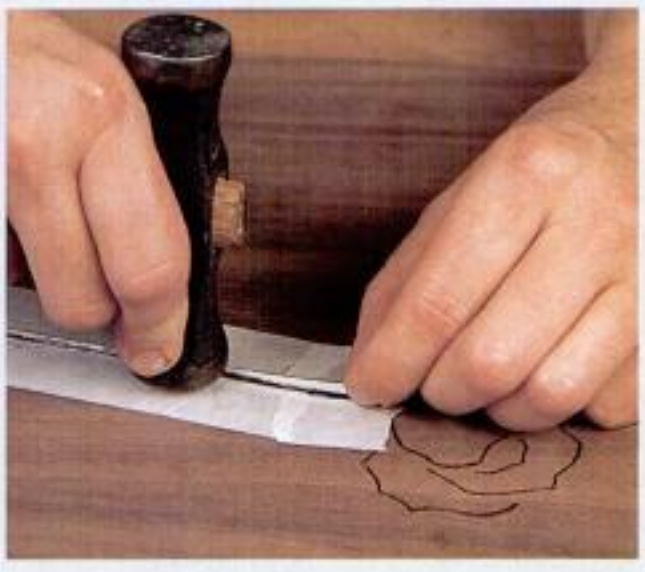
## LAYING IN THE METAL



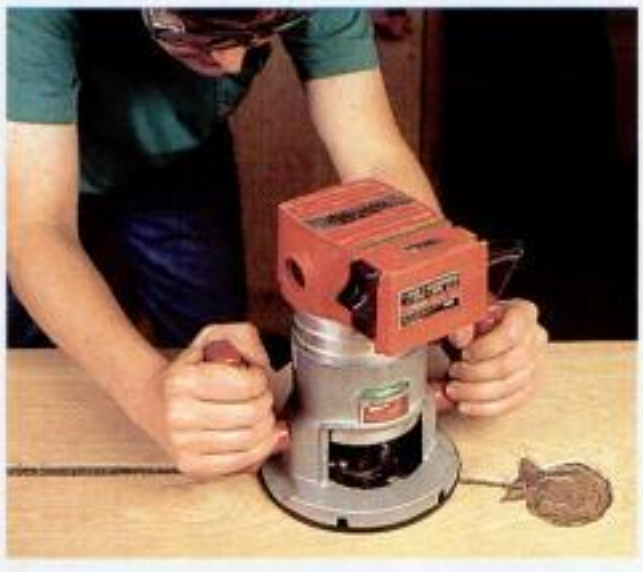
***STEP 1***
***Pre-bend curved strips.*** *Curved inlay strips go in easier if they're bent beforehand. Here, the author shapes a strip with needle-nose pliers.*



***STEP 2***
***Spread the glue.*** *Masking tape protects the surrounding wood as Swanson spreads the epoxy in an inlay groove.*



***STEP 3***
***Press in the metal.*** *Swanson gently presses the matching strip into the groove with a hammer head.*



***STEP 4***
***Rout the remainder.*** *The author routs the proud metal almost flush, then does final smoothing with a hand plane, a scraper or a sanding block.*

When the strip fits well, I remove it and scuff lightly with sandpaper to improve glue adhesion. Then I clean it with acetone.

I glue the inlay in place using West System Brand Epoxy 205 hardener with the 105 resin. (See Sources.) Epoxy adheres well to metal, but it can darken the pores of the surrounding wood. While sealing the wood ahead of time limits epoxy penetrating, for extra insurance I often lay masking tape next to the groove to catch squeeze-out.

I spread the epoxy along the groove with a splinter of veneer or whatever will fit. (See top right photo, above.) Then, I place the metal in one end of the groove and press it in gently with a hammer head. (See bottom left photo, above.) You don't have to bear down too hard; just make sure the strip is seated firmly in the groove. I wipe off squeeze-out before it dries.

### Flushing Off and Finishing

I remove most of the metal standing above the wood surface with my router and a 1/2-in.-dia. carbide straight bit. I block up the router to span the metal (you can use your templates to work one narrow area at a time) and set the bit to just above the surface of the wood. (See bottom right photo, above.) You could use a single-cut mill file instead; just be sure to tape up the ends of the file so they don't mar the wood.

Once I'm close to flush, I finish up with a scraper or a hand plane—unless I'm working with brass. The only way I've found to work brass is with sandpaper wrapped around a hard block. Even then the metal provides much more resistance than the wood, and a slightly undulating surface can result.

You can finish the inlaid surface with any product that protects the metal from tarnishing. Traditionally, lacquer was used. I've used Waterlox and shellac successfully thus far. ▲

**JANE SWANSON** *is a professional furniture maker in southeastern Pennsylvania. She likes to incorporate natural forms in her inlays.*

## SOURCES

**Pewter, silver and brass sheet and silver wire:**
T.B. Hagstoz and Son Inc.
(800) 922-1006 *Circle #601*

**Precut fine silver strips:**
Hoover and Strong
$100 minimum purchase
(800) 759-9997 *Circle #602*

**Metal-cutting tablesaw blades:**
J & B/Eastern Saw and Tool Service
(215) 467-2245 *Circle #603*

**Machinists' micro-end mill bits:**
MSC Industrial Supply Co.
(800) 645-7270 *Circle #604*

**Bushings to adapt a 1/4-in. collet to 1/8-in. bit shanks:**
MLCS Ltd.
(800) 533-9298 *Circle #605*

**Template guide bushings:**
CMT Tools
(800) 531-5559 *Circle #606*

**West System Brand Epoxy:**
Gougeon Brothers Inc.
(517) 684-7286 *Circle #607*

# Furniture with a Secret

## *Hidden Compartments Designed to Deceive*

**by Greg Landrey**

Concealed compartments in furniture have a long tradition. Early American and European furniture makers prided themselves on designing and creating hidden compartments that were known only to the owner. The lack of easily accessible banks to keep money, important documents and precious personal belongings compelled some patrons to request secret and secure compartments when they commissioned a piece of furniture. The imaginative craftsman was only too happy to oblige. The surviving products give us insight into creative ways to hide drawers and conceal storage areas within furniture.

Wooden springs, triggers, and sliding panels are commonly found in 18th-century cabinetry. The compartments or hidden drawers are revealed once the notch or hole has been found to trigger the release of the box or sliding panel. The craftsman found room for an unexpected compartment by taking advantage of wasted space.

These pieces from the Winterthur Museum in Winterthur, DE, show us how the masters from another age incorporated these tricks of the trade into the furniture they built. I can imagine how amused these craftsmen would be to know just how long and how well their secrets have lasted. Several of these compartments eluded the museum staff for years.

Such personal detail is a distinguishing factor between production items and one-of-a-kind furniture. Examining these pieces of furniture not only increases our respect for our own woodworking heritage but also provides us with the inspiration to carry on the "secret tradition." ▲

**GREG LANDREY** *is the Director of Conservation/Senior Conservator of the Henry Francis du Pont Winterthur Museum in Winterthur, DE.*

***Safe secrets.*** *Can you find the 11 secret compartments located in this desk?*

# Fall-Front Desk

*Chester County, Pennsylvania*

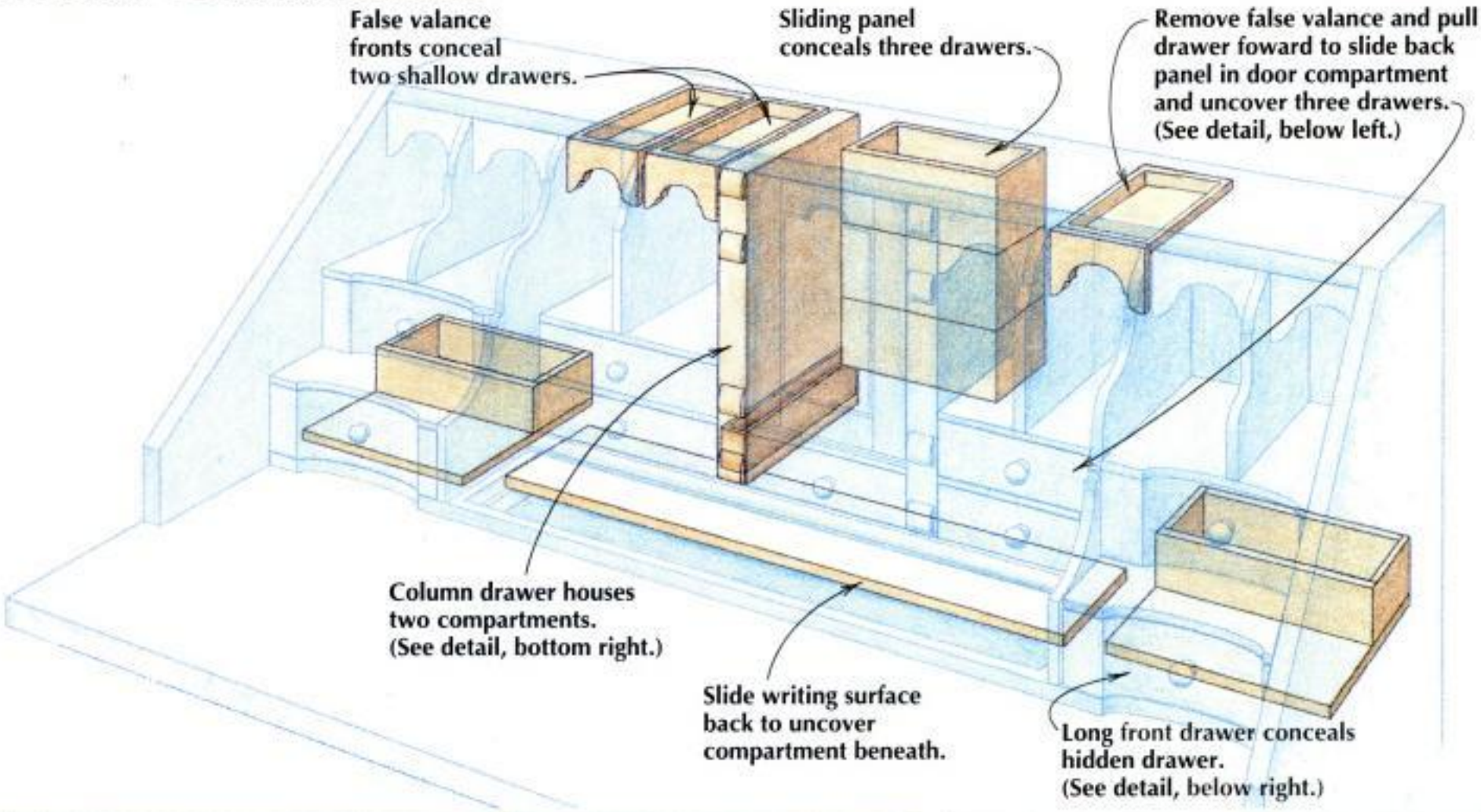
**c. 1747-1748**

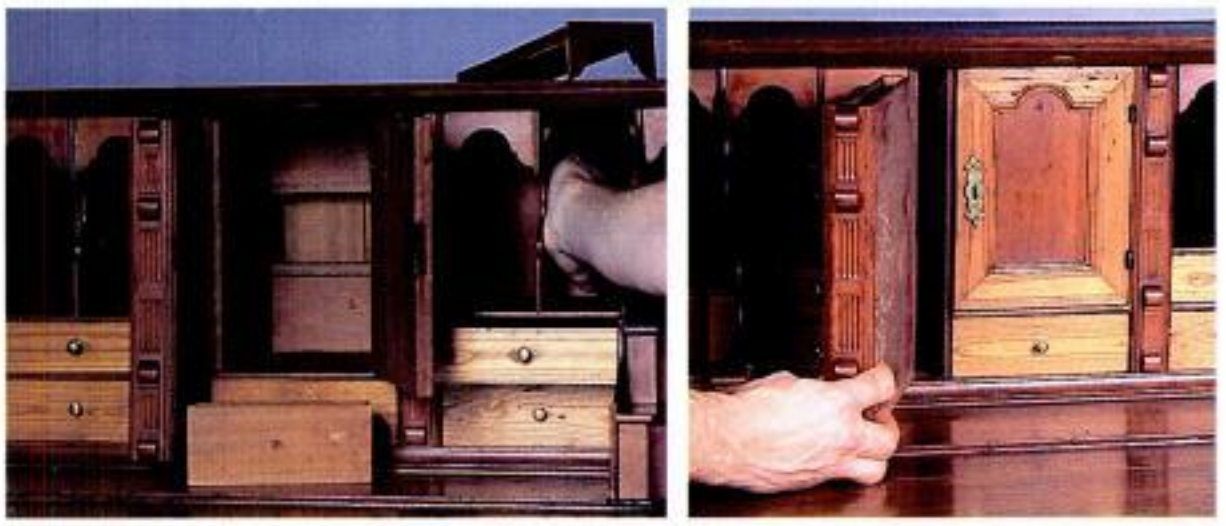
This desk is impressive in many aspects: the use of local woods, including walnut, tulip, chestnut, holly and cedar; the unique "line and berry" inlay; and the architecturally inspired interior. Equally impressive, but much less obvious, are 11 hidden compartments. A few of these secret drawers were discovered only after the museum began further study of the object. In fact, our staff found a set of jade-handled dinner knives in a concealed drawer.

In studying this desk, you might successfully identify a few of the compartments, but I doubt you could find all 11. Examine the drawings on the opposite page to see how one Colonial craftsman had fun providing his client with a wealth of hiding spots.

PHOTOS BY HERB CROSSAN, COURTESY OF WINTERTHUR MUSEUM

# 11 SECRET COMPARTMENTS



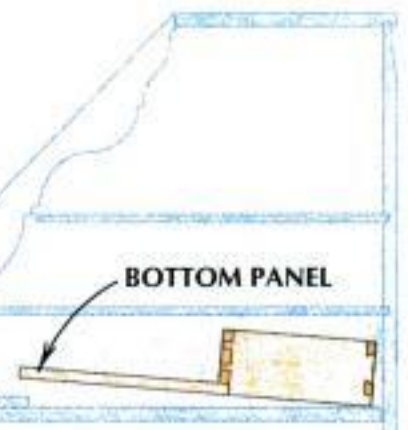



***Secret drawers.*** *Three drawers hide behind the center door compartment. To access: Remove false valance and pull upper drawer forward (left). Slide panel to right to reveal drawers. Middle drawer (shown, left, on desk top) hides a wooden spring that unlocks secret column drawer (right).*

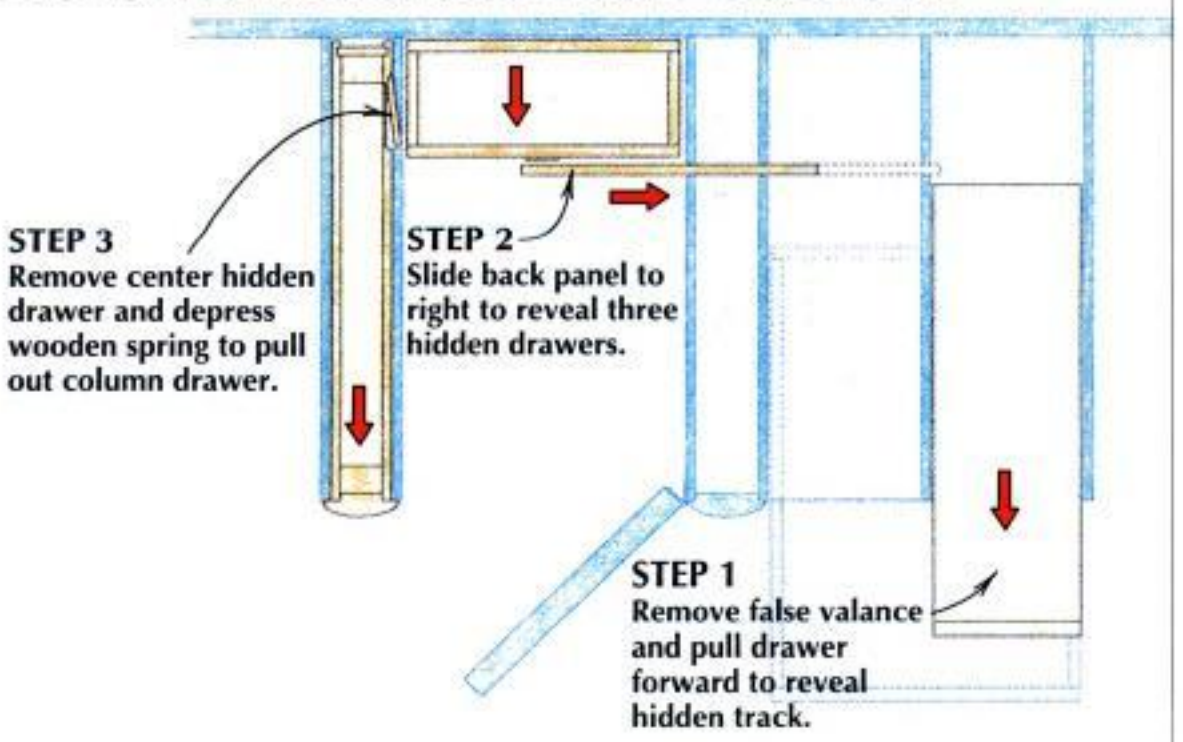
## HIDDEN DRAWER DETAIL

**STEP 1**
Remove drawer.

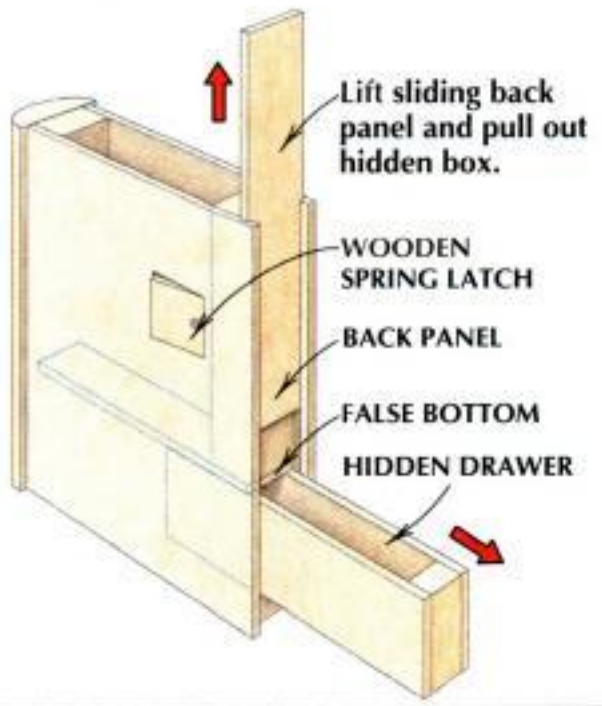
**STEP 2**
Pry up bottom panel and pull forward to reveal secret compartment.




## SLIDING PANELS AND SECRET DRAWERS




## SECRET COLUMN DRAWER DETAIL




ILLUSTRATIONS BY FRANK ROHRBACH

# Schrank

*Lancaster County, Pennsylvania*

**1768**

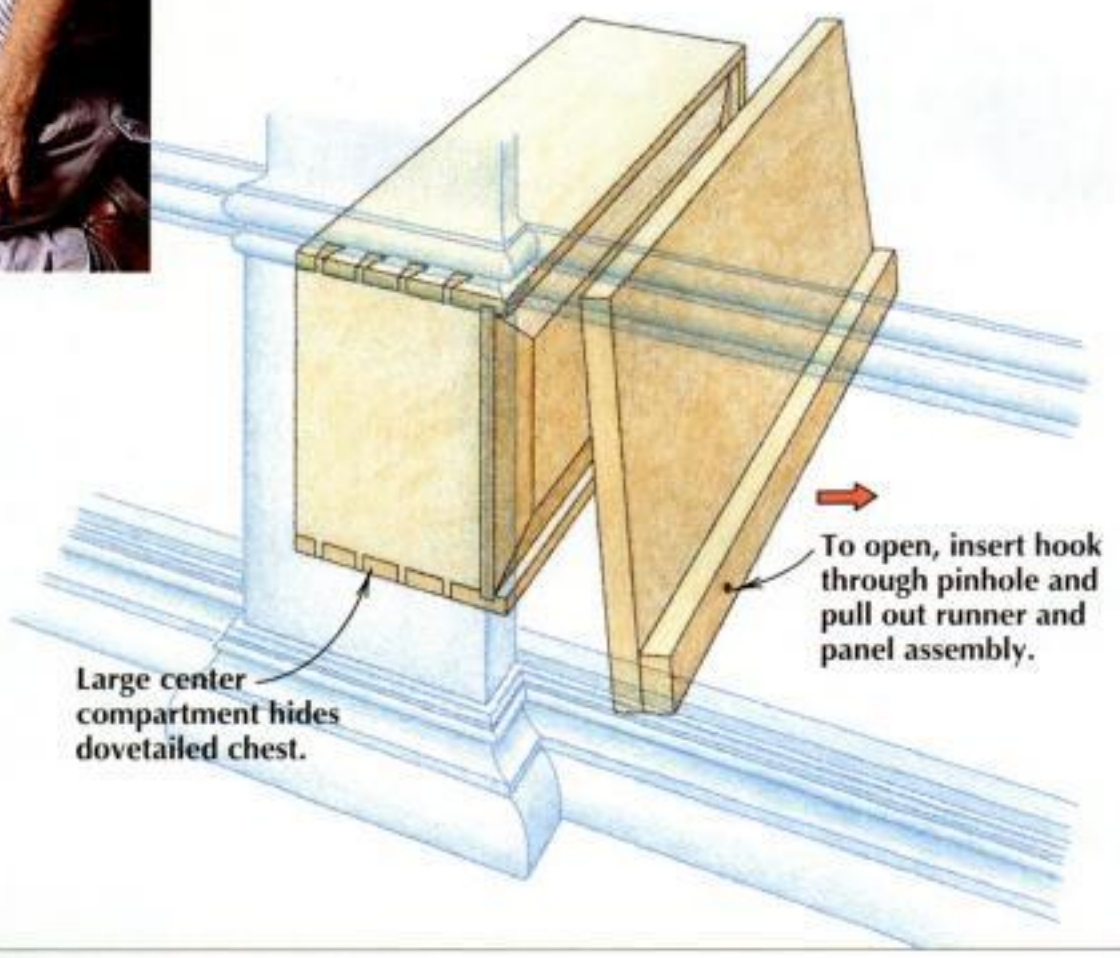
Judging by the molten sulfur inscription, "Emmanuel Herr Feb d. 17 Ma Her 1768," this walnut *Schrank,* or wardrobe, was built as a wedding gift. The craftsmen who built this chest knew the newlyweds' need not only for everyday storage, but also for a safe spot for their most valuable possessions.

Except for a small hole in the drawer guide, these compartments aren't obvious, yet the solution to this mystery is remarkably simple.

To reveal each compartment, remove the drawers, insert a small metal hook in the hole located in the runner, and pull. The runner and its vertical support piece slide into the drawer opening, providing access to the compartment behind it. (See drawing.) The three compartments are surprisingly roomy; the center space is even outfitted with a large dovetailed box with a paneled sliding lid.

***Safety vault.*** *The author pulls out a runner and panel assembly to reveal an inner chamber. Two other compartments are similarly concealed within the thick-looking side columns.*

## SCHRANK WITH PULL-OUT PANELS



# Dower Chest

*Lancaster County, Pennsylvania*

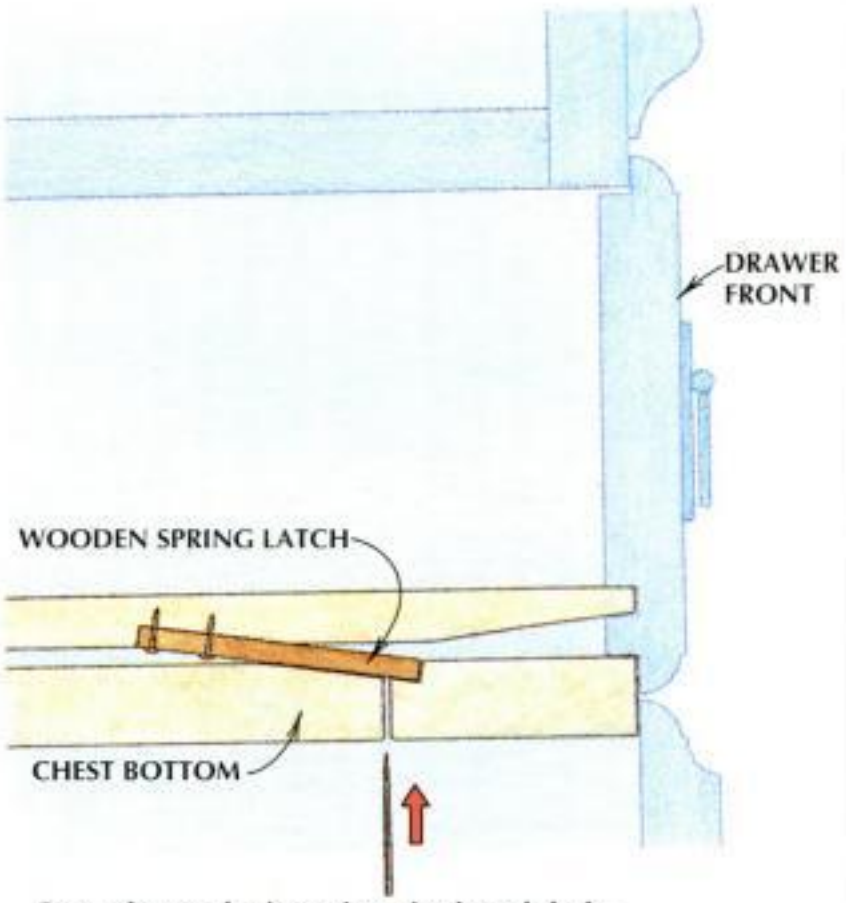
**1741**

Built for a family in Gap, PA, this is one of the Winterthur Museum's oldest surviving examples of Pennsylvania German furniture. This chest is a wonderful study in early inlay work. There are inlaid horses, clusters of berries, and other wildlife. This surface decoration distracts the viewer from two secrets: locked drawers and a secret compartment.

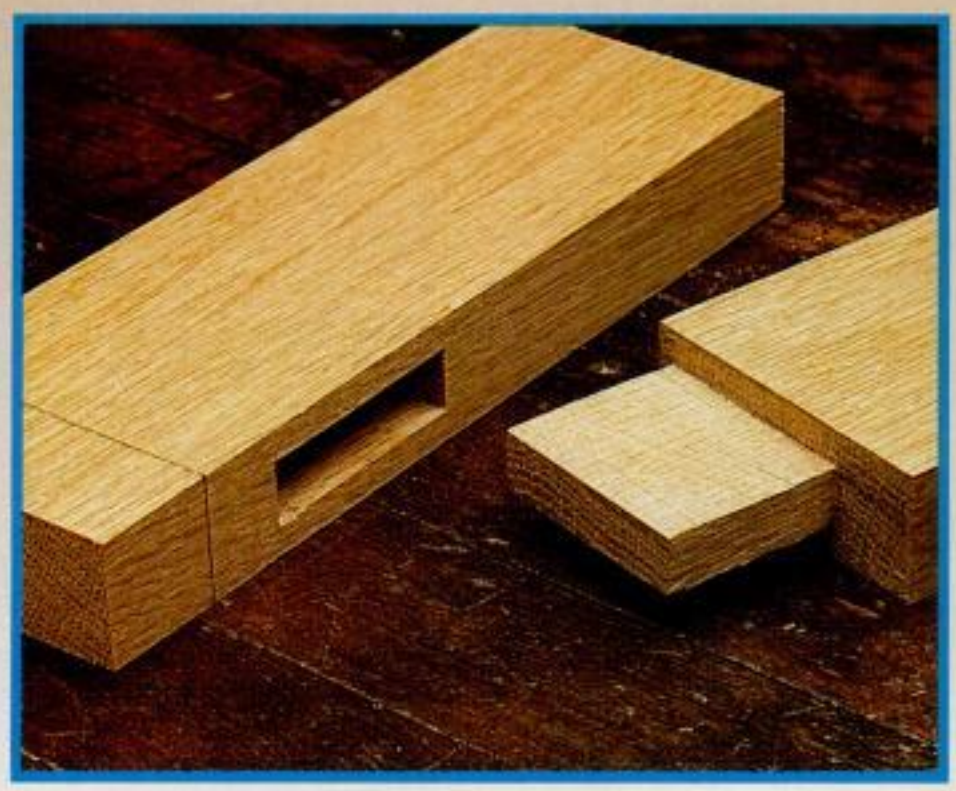
The first secret becomes evident when you tug at the handle of each drawer—the drawers are locked. But this is no ordinary lock: Both drawers are held in place with hidden wooden spring latches. To release the spring, you must first locate the small pinhole in the bottom of the chest and release the catch by pushing upward with a pin. (See drawing.) To uncover the second secret compartment, you first remove both drawers. Masquerading as a simple divider is a full-length drawer large enough to hide a family's collection of important papers and valuables. The wide ogee lip on the front drawers conceals this center compartment and locks it in place. (See photo, below.)


***Sprung shut.*** *A wooden spring attached to the drawer catches a groove in the bottom of the case. The wide thumbnail molding on both front drawers conceals the center drawer while locking it in place.*

## DOWER CHEST WITH PINPOINT LOCKS




**Open drawer by inserting pin though hole in bottom of chest to release spring latch.**



PHOTOS BY MITCH MANDEL

***Strong and stronger.*** *The mortise and tenon is the classic rail joint. Its strength comes from a tenon with flat and parallel faces, square shoulders all in one plane, and a smooth surface for gluing. The through-wedged tenon (right) derives its great looks and exceptional strength from* ***wedges*** *driven* ***in from*** *the* ***outside of the*** *joint.*

# Designing Rail Joints

## Make the Connection with a Mortise and Tenon

*by Ian J. Kirby and John Kelsey*

In broad terms, the design of the mortise and tenon is brutally simple: Excavate a hole in the wood, then carve a peg to fill it. The situation is more complex when you get to details—what are the right shape and size of the mating parts, and exactly where do they have to be located?

The answers depend on what you are trying to make. In furniture we use mortise-and-tenon, or "rail," joints in three basic situations—flat frames, structural frames and underframes—each of which imposes a different set of requirements.

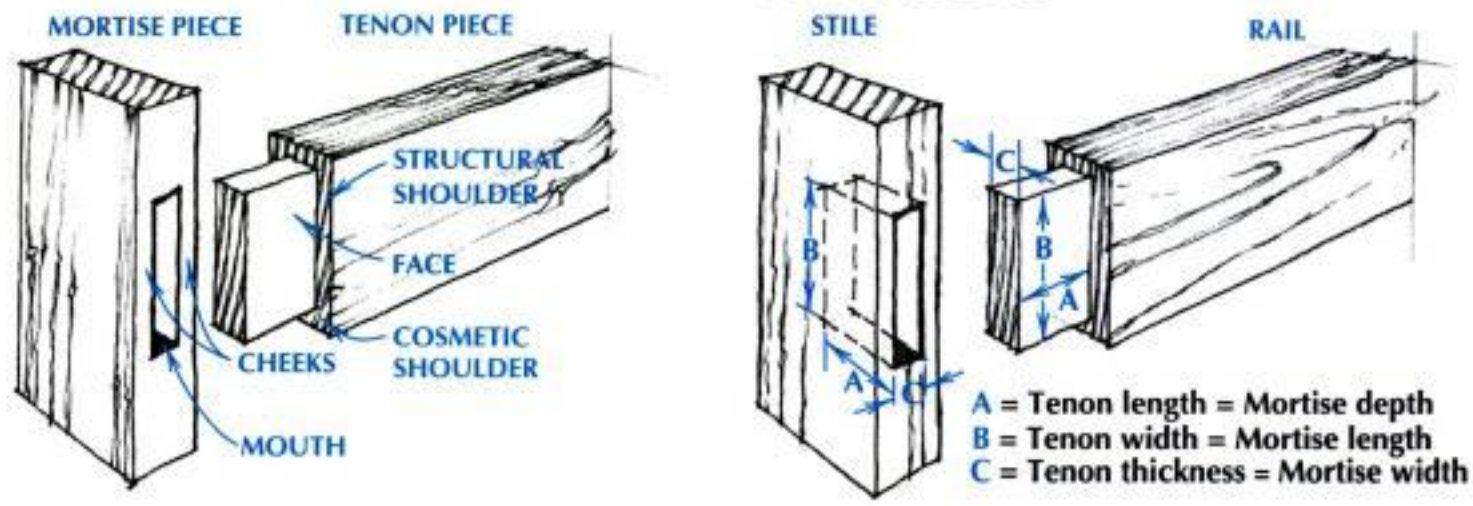
The joint gets its strength from the proportions of its mating parts and from their close mechanical fit, which forms a good glue bond. The technical objective is to make parts that fit closely together. The design objective is to increase the amount of gluing area while balancing the amount of wood tissue contributed by each member. As in all joint-making, however, the overriding consideration is grain direction.

The rail is the horizontal stick of wood, and the stile or leg is the vertical one. (See Fig. 1.) The corner where the two meet is inevitably a cross-grain construction, so normal wood movement will always be pushing the joint apart. You must design the pieces to minimize this slow rush toward self-destruction.

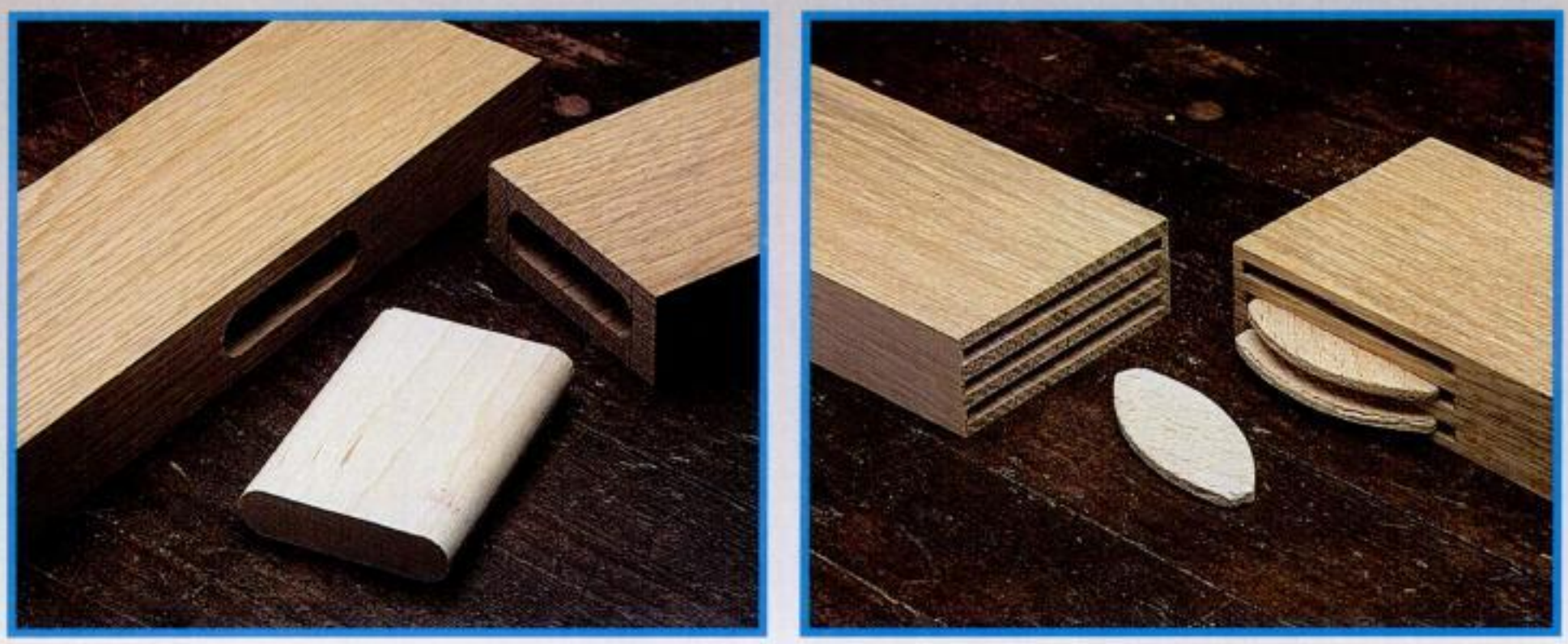
### EDITOR'S NOTE

*This article is the second in a series about the design of joints. Subsequent articles will focus on carcase joinery in solid wood and man-made materials.*

### FIG. 1: MORTISE & TENON—THE BASIC RAIL JOINT




ILLUSTRATIONS BY IAN KIRBY



***Modern alternatives.*** *The loose-tenon joint, made with a plunge router, is as strong as the classic mortise and tenon. Another variation, the biscuit joint, is popular because it is easy to make. Multiple biscuits multiply the gluing area for greater strength.*

In the old days there was only one way to make a rail joint: Chop the mortise with a chisel, then saw the tenon to fit. Today we not only have several ways to make the mortise and tenon—including hollow-chisel mortisers and routers—we also have two entirely new configurations: the loose tenon and the biscuit joint. When correctly designed, these new joints are as good as the classical joint, and in some cases they are better.

## Three Constructions

**Flat frames** make frame-and-panel doors or carcase sides, which we use to fill in openings. Generally they are not structural elements, in that a door only supports its own weight. This ingenious construction is not only the foundation of all furniture making, it remains the only method we have for making a stable plane out of unstable solid wood. The rail and stile generally are about the same size in cross section. Factors affecting the design of the joint include the groove or rabbet that traps the panel in the frame, whether the mortise is at the end or in the middle of the stile, and any molding done to the edges of the frame.

**Structural frames** make table bases and the skeletons of large cases. Three members generally connect, for example a table leg and two rails or aprons. In most situations the vertical leg is more or less square in section, while the incoming rails are flat. Factors affecting the design of the joint include the width or depth of the rails, the exact placement of the rails on the faces of the leg, and complications caused by drawers or doors.

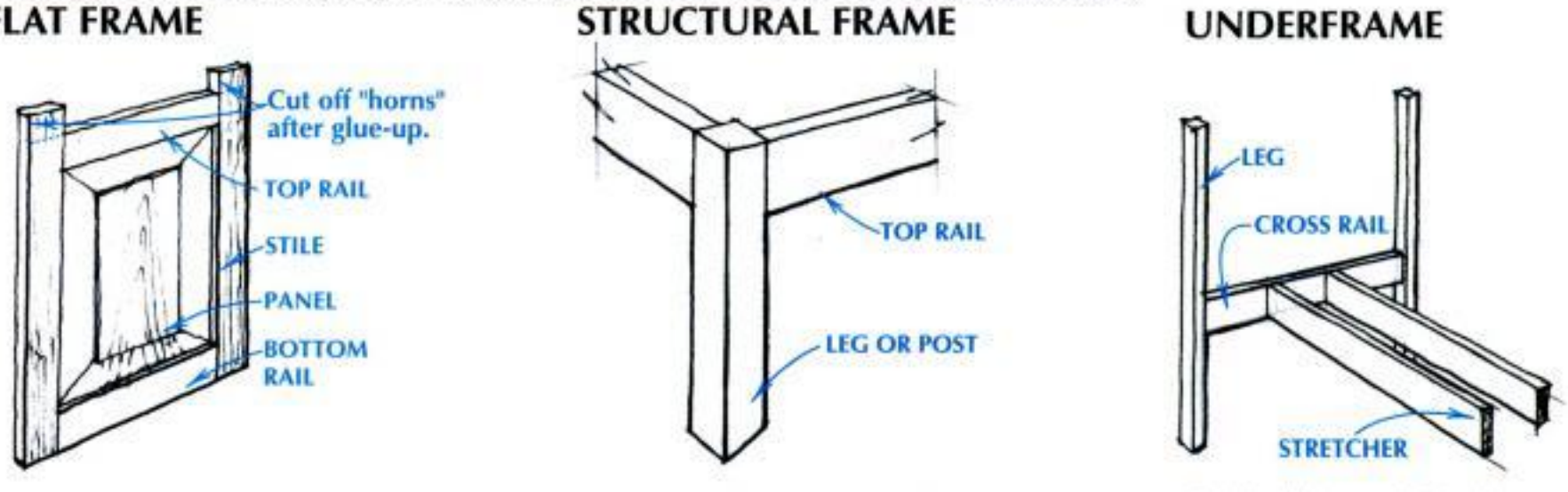
**Underframes** impart stability to a piece of furniture, by bracing the structure and by reducing the unsupported or cantilevered length of legs. They often do double duty as supports for drawers or shelves. Underframe joints make a T-shaped junction and they often require dividing the tenon. (See Fig. 3.) Underframe joints also offer decorative opportunities, which affect their design and the way they are made.

## Dimensioning the Joint

All rail joints are cross-grain constructions. They always include long-grain gluing surfaces, but these never run in the same direction in both pieces of wood. Even without the stress of use, the joint is always being stressed by wood movement. If you make joints in unstable wood, such as the distorted tissue surrounding knots, you'll introduce unpredictable movement (and you'll find it very difficult to cut accurately fitting parts). Choose straight stock, and don't crosscut just off of a knot or a

## FIG. 2: THREE TYPES OF CONSTRUCTION

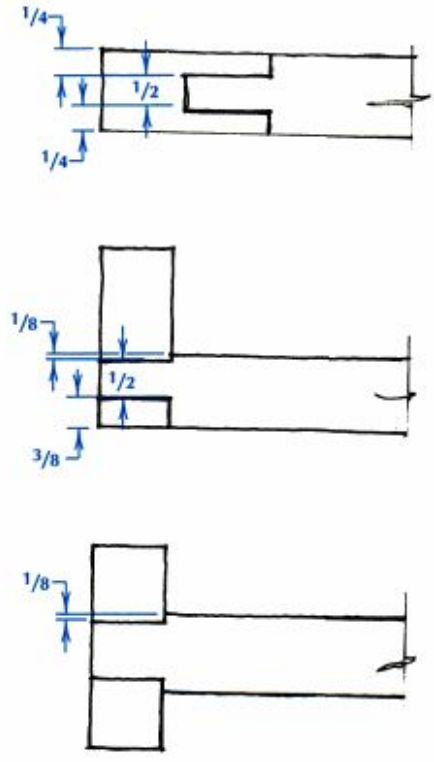
**The mortise and tenon creates a sturdy connection in flat frames, structural frames and underframes.**

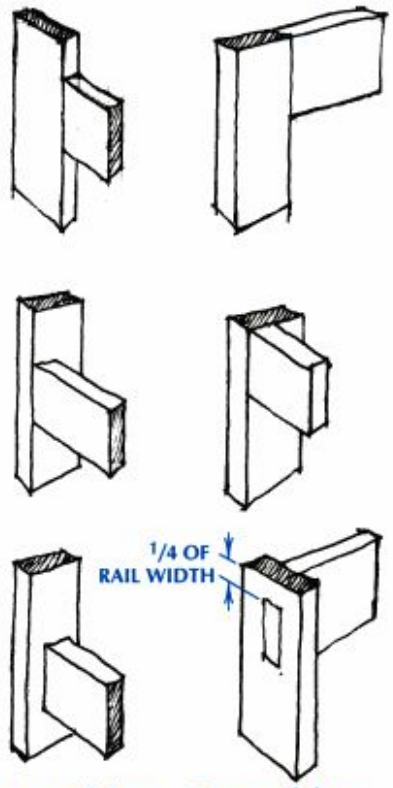


# FIG. 3: JOINT POSITION AND PROPORTION

**Offset the tenon to balance the strength of the mating pieces. Centered rails have the beefiest tenons.**

## FLAT FRAMES



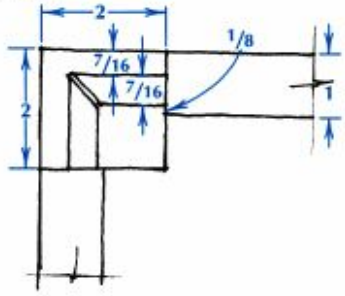



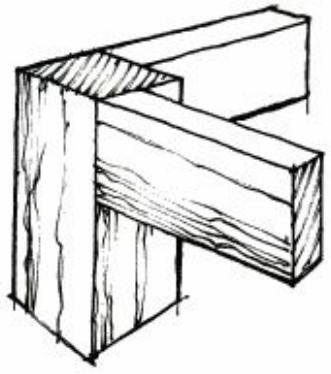

Center rails have 1/8-in. cosmetic shoulders top and bottom.

Corner rails have narrow cosmetic shoulder on bottom, wider shoulder on top.

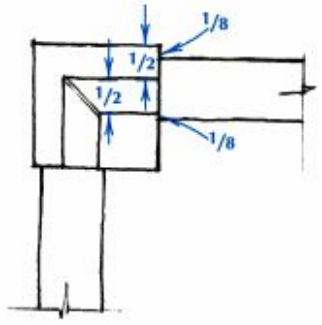
## STRUCTURAL FRAMES

### RAIL FLUSH

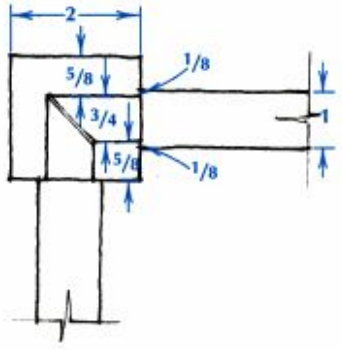


### RAIL INSET 1/8 IN.



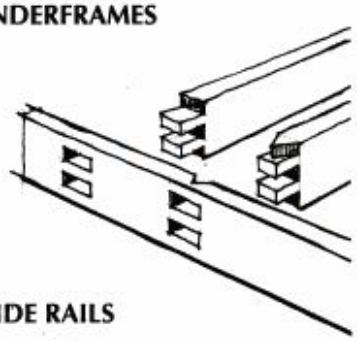

### RAIL CENTERED



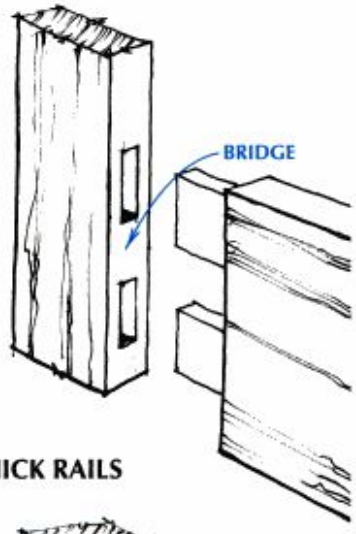

## DIVIDED TENONS

**Divide tenons to accommodate wood movement and to increase strength through greater glue area.**

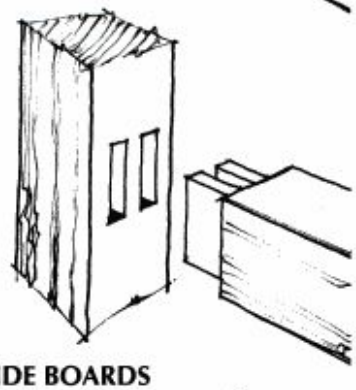
### UNDERFRAMES



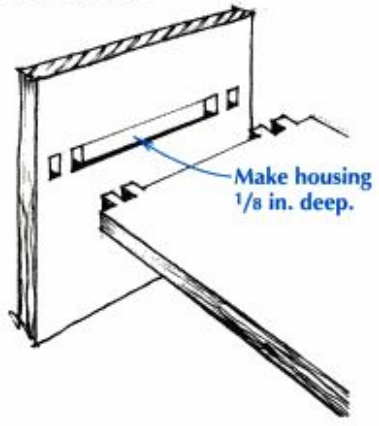
### WIDE RAILS




### THICK RAILS



### WIDE BOARDS



knee. Eliminate any knots in your wood by crosscutting to where the grain is no longer distorted.

When you prepare your wood for mortise-and-tenon joints, make sure your drawing gives the full length of the tenon piece, not the between-shoulders distance. If the rail dimensions are between shoulders, be sure to add the length of the tenons themselves. Whenever a mortise will be cut at the end of the piece, always add an extra inch of length, called the *horn*. The horn protects the fragile short grain between the mortise and the end of the stick until after glue-up, whereupon you saw it off.

**Shoulders**—All tenons should have shoulders. Because of wood movement, you must expect the tenon to shrink in width, away from the ends of the mortise. When this happens, the long structural shoulders (see Fig. 1) are what resist racking stresses, while the short cosmetic shoulders conceal the gap. Although the details of the construction may require eliminating one or two of the tenon's four shoulders, barefaced tenons without any shoulders cannot effectively brace a structure and are not appropriate for furniture. When you've finally finished the furniture, the shoulder line is all you will see of the joint.

**Balance the joint**—Ideally, you would always design a balanced joint, where both parts were equally able to resist stress. This means that when the two pieces of wood are about the same size, there should be as much wood in the tenon as there is in the combined thickness of the mortise cheeks. The old rule of thumb, whereby you make the tenon one-third the thickness of wood, results in an unbalanced joint with a weak tenon.

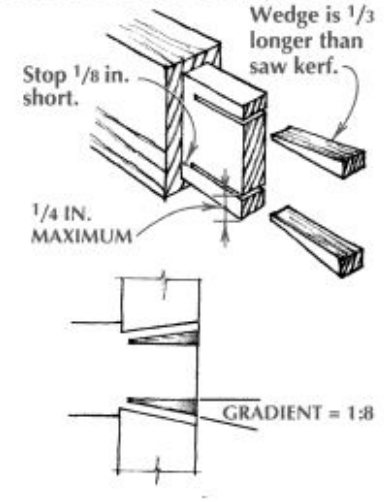
When one piece of wood is substantially larger than the other, make the tenon as thick as possible, as shown in Fig. 3, while still leaving a shoulder of about 1/8 in. When the tenon will be offset toward the face of the leg or post, subtract the 1/8-in. inside shoulder, and divide the remaining thickness in two, half of it for the tenon and the other half for the mortise cheek. In practice, we make the design calculation, adjust the mortise to match the width of mortising tools, then cut the tenon to fit.

**Length of tenon**—The more gluing surface, the stronger the bond, so common sense might tell you to maximize glue area by making the tenon as long as possible. However, this ignores the cross-grain construction of the joint, and at some point failure is likely. A short tenon minimizes the risk due to wood movement, but at some point it's just too short to hold together. You can strike a balance by mortising about halfway into the stile, and a bit more than halfway if the stock is narrow. Make the mortise about 1/16 in. deeper than the length of the tenon, to leave room for squeezed glue.

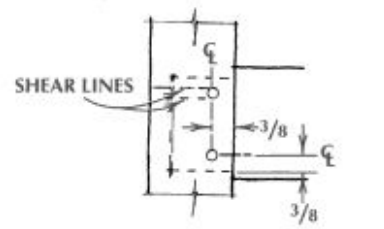
## FIG. 4: MAKING THE JOINT STRONGER

**Wedges lock the tenon in the mortise, but pegs are just for looks. To avoid tenon failure, place pegs close to shoulders.**

### THROUGH-WEDGED JOINT




### PEGGED JOINT




**Length of mortise**—The length of the mortise, and therefore the width of the tenon, depend upon the location of the joint. When the mortise is somewhere in the middle of the stile, make the tenon almost the full width of the stock, with a cosmetic shoulder of only 1/8 in. (See Fig. 3.) When the mortise is at the end of the stile, avoid fragile short grain by offsetting the tenon a quarter of its width, making a wide shoulder.

**Divided tenons**—When the tenon is more than 10 times wider than it is thick, it should be divided. Double tenons occur on the kick-rails of entry doors, and on bedsteads. If you don't divide these wide tenons, not only will the joint suffer from excessive wood movement, the walls of the long mortise will belly outward. Lay out the shoulders, then divide the remaining width into three and cut away the middle third. The corresponding plug inside the mortise is called a *bridge*. (See Fig. 3.)

Another form of divided tenon or twin tenon occurs on stretcher rails in underframes, where the mortised piece is relatively thin. Dividing the tenon doubles the long-grain gluing area, greatly increasing the strength of the joint. These joints are often bare-faced; that is, they have no side shoulders. They can be finished with a mitered shoulder on top where it shows.

In general, whenever a furniture rail is thick enough to make twin tenons, do it, because it doubles the gluing area. This is the reason for making twin tenons on the seat-rails of chairs. It's possible to fit shouldered twin tenons 1/4 in. thick into a mere inch of wood thickness, though in most practical situations you would have somewhat more to work with.

Short twin tenons also occur in carcase sides, where a partition ties the case together and also acts as a shelf. Make a housing about 1/8 in. deep between the mortises, as shown in Fig. 3. Housed twin tenons not only make the shelf able to bear a heavy load, but they also flatten the cup out of both panels.

### Strengthening the Joint

One way to sidestep the problem of wood movement is to mortise right through the stile. Then if you glue a wedge into the tenon from the back side, it'll never work loose. This is probably the strongest variation, and it adds a visual detail to an otherwise concealed joint. The wedge has to be designed into the joint, not simply hammered into the wood. (See Fig. 4.) Cut a kerf into the tenon, slope the end walls of the mortise, and dimension the wedge to take up these spaces.

**Drawboring** is a timber-framing technique for pulling large joints together in the absence of clamps and glue. You drill a hole through the mortise cheeks, then offset toward the shoulder line the corresponding hole through the tenon face. Driving in a tapered peg pulls, or draws, the joint home.

In furniture making, since we have both glue and clamps, there's no reason to make the drawbored joint—in fact, it would only introduce stress and increase

the risk of joint failure. Nevertheless, people like how it looks, so we often drill and peg through the joint without offsetting the holes. Pegs don't make the joint any stronger, though they are insurance against the unlikely event of glue failure.

Locate the pegs as shown in Fig. 4: spaced widely apart but close to the mouth of the mortise. If you center them or move them toward the outside of the joint, they'll become an anchor against normal wood movement and split the tenon along its shear lines, or cause its shoulder to open up. Drill for the pegs after you glue and clamp the joint. You can make the pegs out of a contrasting wood, and you can add decorative shapes to their heads.

### Complicating the Joint

Whenever you shape the inside edges of a frame, you'll interfere with the basic geometry of the mortise-and-tenon joint. Some edge shapes, such as the grooves or rabbets that retain panels, are structural and require you to change the design of the joint. Most decorative shaping can be achieved with separate moldings tacked and glued, or "planted," onto a square-cut frame. This approach not only avoids complicating the joint, it also imposes no limitations on the complexity of the molding itself.

**The haunch**—The haunched joint is an artifact of the days when grooves had to be plowed by hand. The plow plane can't make a stopped groove, it has to run right through the end of the piece. As shown in Fig. 5, the haunch is simply a chunk of wood left on the tenon for the purpose of plugging the end of the groove. When you rout or saw the groove, it's easy to stop it in the middle of the mortise, in which case there's no need to make a haunch.

**Long-and-short shoulder**—To set glass into a frame, or to make a removable panel, you can make a rabbet on one side of the rails and stiles. A molding tacked into the rabbet retains the glass, but there'll be a gap where the rabbet runs through the joint. You can compensate for the gap by relocating one of the tenon shoulders, as shown in Fig. 5. Do it by measuring the shoulder-to-shoulder distance from the bottom of the rabbets. Make and fit the joint, and you'll see where you have to recut the shoulder.

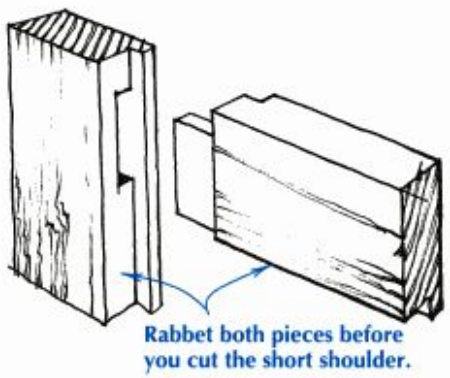
**Planted moldings**—Woodworkers often overlook moldings that are nailed or glued, or "planted," perhaps because the technique seems too simple. In fact, it is the method of choice in work of the highest quality, because it doesn't interfere with the joints and it imposes absolutely no visual limitations. You can make undercut moldings, you can compose complicated moldings from several pieces of wood, and you can incorporate panel-retaining grooves or rabbets in the molding itself, instead of in the frame.

Planting the moldings permits you to make all of your frames from straight, square wood, using your technology of choice—biscuits, loose tenons, whatever. All you need is a dead-accurate way of mitering the ends of the molding—a tablesaw jig, a chop saw, or a sharp chisel. The basic approach is to dry assemble the frame, then fit the moldings as you go: Miter one end, hold the molding in place, mark the other miter, cut and tack, and onward around the framed opening. When everything fits, glue up the frame and plant the moldings with brads or glue, or both.

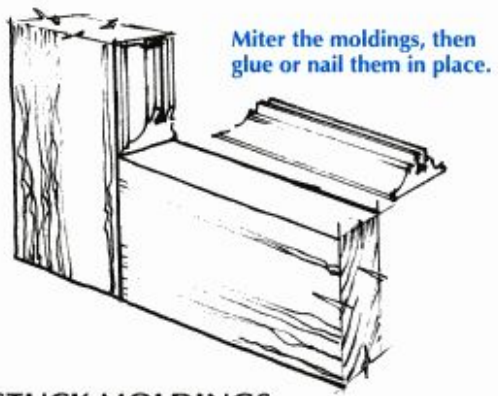
## FIG. 5: MOLDING THE FRAME

**The joint must be adjusted to accommodate rabbets, grooves and attached or stuck moldings. Planted moldings don't affect the joint.**

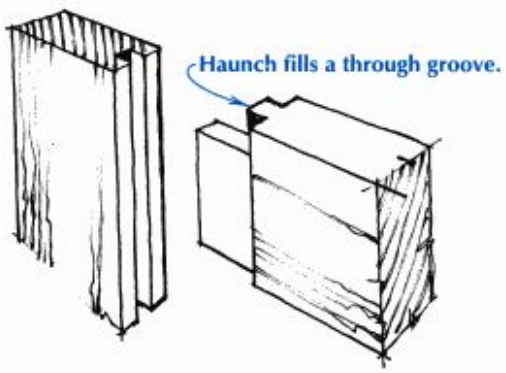
### UNEQUAL-SHOULDER MORTISE AND TENON



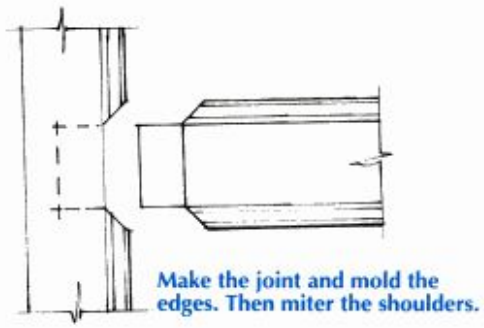

### PLANTED MOLDINGS




### HAUNCHED MORTISE AND TENON




### STUCK MOLDINGS



**Stuck moldings**—When you machine a molding right onto the rails and stiles, it's "stuck" there, and you've made "sticking." The molding is going to interfere with the joint, leaving you with two choices: cut it back to a mitered shoulder alongside the tenon and at the mouth of the mortise, or "cope" the tenon shoulder to fit over the molded rail.

The manufacturers of router cutters have generated a lot of interest in coped sticking, which does make a neat finish when accurately cut. But achieving a good fit can be difficult when you are manually feeding stock on a table-mounted router, because of normal stock movement. Any distortion will disrupt perfect contact between the wood and the table or fence, and the smallest amount of deflection has to throw the cut off. For consistently good results, you need a heavy shaper with a powered stock feeder. For the small shop, planted moldings are the more appropriate technology.

### New Technologies

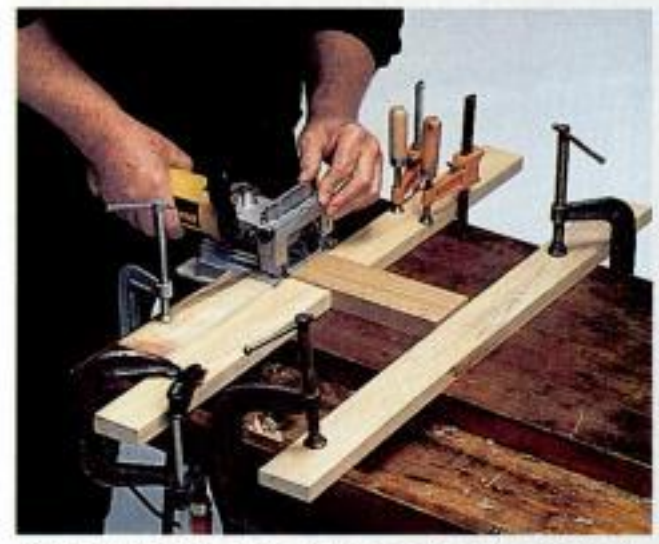
Until recently, all methods of making the joint required one set of tooling for the mortise and an entirely different setup for the tenon. It's no wonder that an accurate fit is difficult to achieve. The industrial slot mortiser—and the plunge router—can mortise into end grain, which makes it possible to eliminate one of those setups. You simply rout identical mortises in the face of the rail and in the end of the stile. Then you glue a **loose tenon** into both mortises. It acts as if it grew there. Except for its rounded ends, the design of the loose-tenon joint is exactly the same as the classical joint. (See left photo, page 53.)

**Dowel joints** are just undersized loose tenons with inadequate long-grain gluing area, which is why they don't always work. You need to make a smooth and accurate hole that's square to the surface. There are a lot of doweling jigs on the market, but for the best results, plunge rout the holes. Buy dowels manufactured for joinery—not sections of dowel rod, which are neither round nor accurately sized. Put a minimum of two dowels into each joint. I prefer dowels with sharp splines instead of the spiral-grooved kind. They bite into the wood and they hold the glue better.

**The biscuit joint,** another recent innovation, resembles the loose-tenon joint in that you make matching slots in both pieces of wood and insert a third piece, but the football-shaped biscuit is relatively small. It's strong because the dedicated biscuit-joining machine can make a very accurate slot, and the biscuits are somewhat compressed so they swell when the glue hits. Biscuits make a superb joint in both man-made board and solid wood.

This joint probably isn't as strong as the regular mortise and tenon, but we haven't done any definitive testing, and we don't really know. There's no doubt it's more than strong enough for frame-and-panel applications, such as cabinet doors. In more demanding applications, such as the joint between a chair leg and seat rail, you can double and triple the biscuits, which doubles or triples the gluing area. You can get two biscuits into stock as thin as 3/4 in., and three into a full inch, as shown in the sidebar above. It's probably strong enough for a chair if you build in some insurance by adding an underframe of stretcher rails to help resist racking stress.

The versatility of biscuit joints in combination with solid wood, plywood and other man-made boards suggests many interesting possibilities for furniture construction. Once you understand the design requirements of making joints, you're equipped to exploit this new technology—and anything else that comes along. ▲



***Block jig.*** *Blocks clamped to the benchtop trap the work in position for making biscuit slots into end grain.*

## MAKING THE BISCUIT JOINT

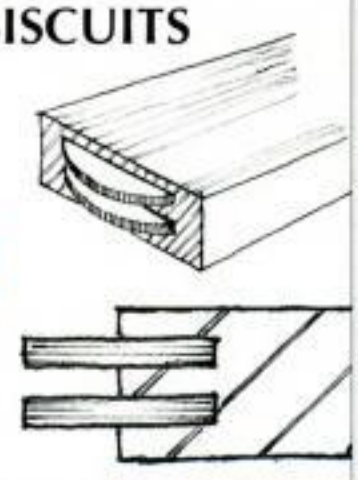
As it comes out of the box, the biscuit joiner is set up for making slots in the faces and edges of boards. When you want to double up the biscuits in the thickness of the stock, you can adjust the machine's fence, or you can put shims under the baseplate. To make rail joints, however, you must also cut slots into end grain, which the machine is not set up to do.

In the end of a stick, the biscuit slot is almost as wide as the workpiece. There's not enough surface for the machine's fence, and its locating pins have nowhere to bite. You could build a fancy jig for cutting slots into end grain, but I usually get the job done with a few locating blocks clamped to the benchtop, as shown in the photo at right.

As with other kinds of joinery, accuracy is the key to a good biscuit joint. Block and clamp the stock so that it can't move, hold the machine firmly on the benchtop, and press the cutter into the wood with a slow, steady movement. If you jam it in fast and hard, it will bounce and cut an oversized slot. If you're shopping for a biscuit-joining setup and you plan to do a lot of rail-and-stile work with it, you might want to consider a table-mounted machine.

*—I.K. and J.K.*

### STACKED BISCUITS



Double the glue area by fitting two biscuits into 3/4 in. of thickness.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**JOHN KELSEY**
*is a writer and occasional woodworker in Connecticut. Their new book, Making Joints, will be published by Rodale Press this year.*

# Mirror & Table Ensemble

***Hang it on the wall in your bedroom or the hall***

by Simon Watts

There's a certain mystery about mirrors. I remember as a child wondering why everything was backwards but not upside down—something no grown-up could explain. *Alice Through the Looking Glass* has become a classic and so has Jean Cocteau's film, *Orphée*, in which the characters pass silently through long, shimmering mirrors into the Underworld. And then there's the frightful legend of the Gorgon....

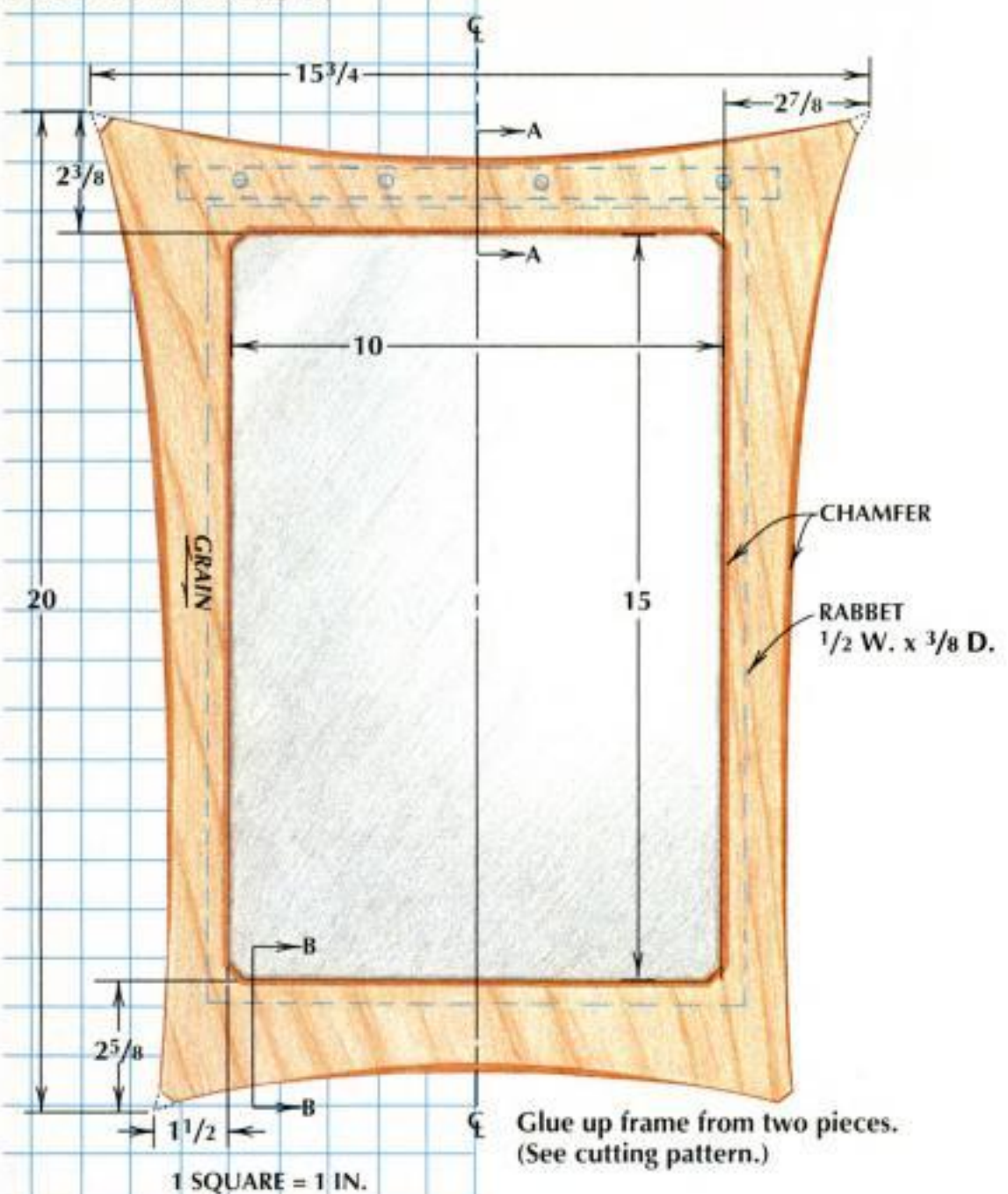
I designed this mirror to be hung on a wall above the table shown at left. Although the mirror and table—both made of mahogany—were designed to be hung together, they can be used separately. The mirror by itself makes a handsome addition to a dressing table, bureau or sideboard—either hung or leaned against a wall. Small rubber pads under the bottom corners prevent it from slipping if you decide to display it leaning.

The wall-hung table will also serve a variety of purposes. With no legs to trip over, it's especially suited to narrow hallways. Hang it near the front door to collect keys and letters, or use it to support a lamp beside your bed or favorite reading chair. This table is small (9 in. deep by 19 in. long), but you can scale it up according to your specific needs.

***A duet in mahogany.*** *This contemporary mirror and table were designed to complement each other, but each can be used individually as well.*

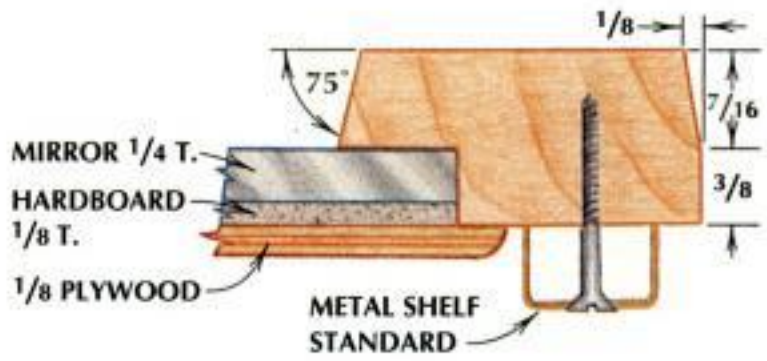
PHOTO BY KAZ TSURUTA

## FIG. 1: MIRROR

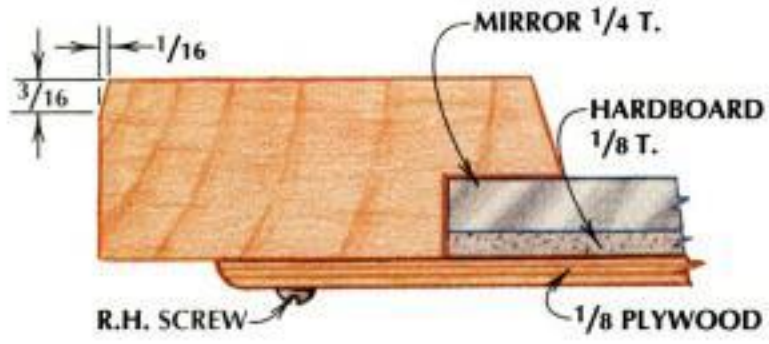



Glue up frame from two pieces. (See cutting pattern.)

### SECTION A - A




### SECTION B - B




### CUTTING PATTERN

The mirror and table are both excellent projects for people who like to work with hand tools—especially spokeshaves. A spokeshave is necessary for cleaning up the curved bandsawn edges and for tapering the outer chamfers on these pieces.

### The Mirror

Unlike most wooden mirror frames, this one has no corner joints; because the frame is cut out of a single, edge-glued blank of wood, all of the grain runs vertically.

I recommend making an accurate, full-size pattern of the mirror frame. (See Fig. 1.) The 1/8-in.-thick plywood available at some lumberyards makes ideal pattern stock.

It's wasteful to cut the frame from a 16-in.-wide board, so I cut two pieces from a narrower board and edge-glued them together to make the frame blank. Since both pieces came from one straight-grained mahogany board, the joints are nearly invisible. Fig. 1 shows the cutting pattern.

Before you do any cutting, plane the board to 13/16 in. thick. Glue up the pieces to make the frame blank, and then lay the pattern on the stock. Marking the outline of the frame with a sharp knife rather than a pencil yields a more accurate cut line.

Since I don't have a bandsaw, I cut the outside curves of the frame with a 265mm Japanese Zeta™ saw. The blade on these saws is flexible enough to cut moderate curves, yet it's also stiff enough to cut straight when required (available from Tashiro's, 2939 4th Ave. S., Seattle, WA 98134, 206-621-0199). I then sawed to the frame's interior lines and trimmed the interior 45° corners with a chisel.

Next, cut a rabbet in the back of the frame for the mirror. Normally, a router equipped with a straight or rabbeting bit is the obvious tool for this job. Routers, however, are unacceptably noisy for my apartment workshop, so I drilled the majority of the waste out on a drill press and then cleaned up with a rabbet plane.

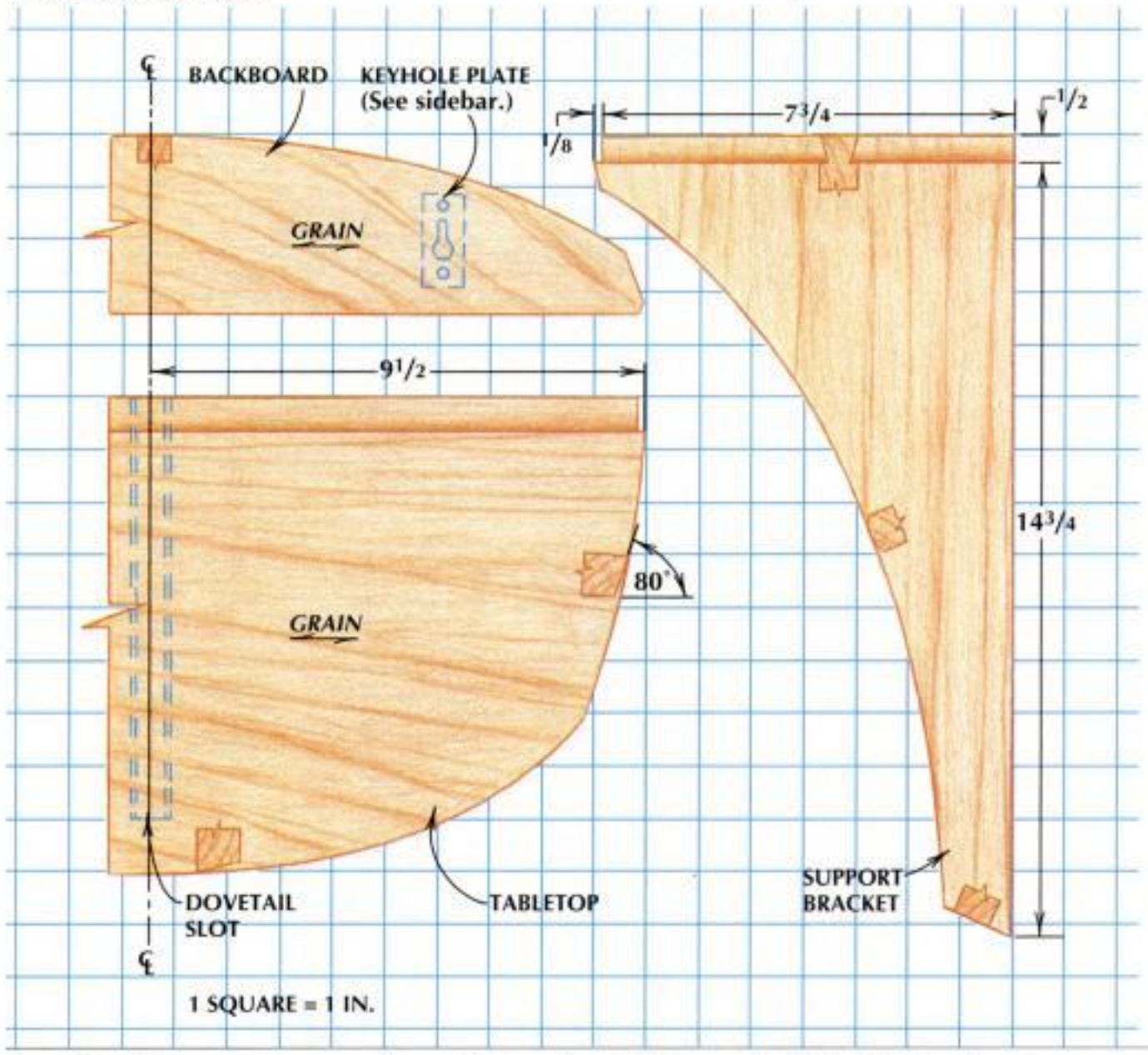
Next, cut the chamfer that runs around the interior edges of the frame. Scribe a pencil line on the face of the frame 1/8 in. in from the inside edge of the frame. This defines the edge of the chamfer. (See Fig. 1.) Use a rabbet plane to cut as much of this chamfer as possible; you'll need to clean up the corners with a chisel. Check the angle with a bevel gauge set to 75°.

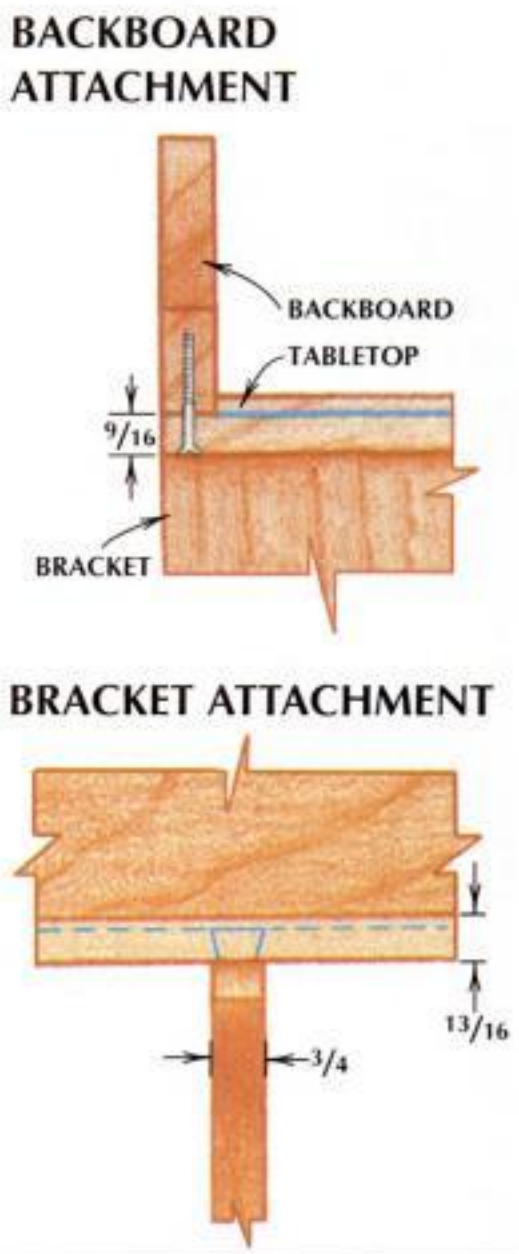
Clean up the outside edges of the frame with a spokeshave, then cut the tapered chamfers on the outside edges of the frame. You can see in Fig. 1 that the chamfers fade out to nothing as they approach each corner. I advise practicing first on a piece of scrap sawn to the same curve. After shaping the chamfers, I cleaned up the frame by sanding with 220-grit paper.

Before setting the mirror in the frame, I applied several coats of tung oil varnish, sanding with 600-grit wet-or-dry paper between coats.

When you cut the hardboard backing piece that fits into the frame behind the mirror, make it at least 1/8 in. smaller

## FIG. 2: TABLE



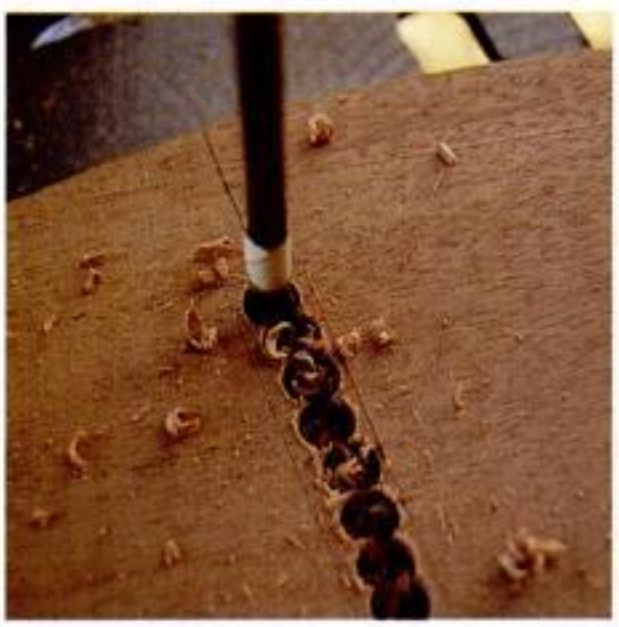

than the distance between the rabbet shoulders to allow for wood movement. I gave this backing piece to the glass cutter to use as a pattern for the mirror. The advantage here is that if the mirror doesn't fit the frame, there's no argument. Before installing it in the frame, seal the edges of the mirror with nail polish. This helps to prevent subsequent tarnishing of the reflecting surface.

When you install the mirror and backing board, they should fill the depth of the rabbet exactly. If they're shy, insert a piece of cardboard behind the mirror to fill the gap. The mirror, cardboard and backing board are all held in the rabbet by a piece of 1/8-in.-thick birch plywood that is fastened to the back of the frame with round-head brass wood screws. (See Fig. 1.)

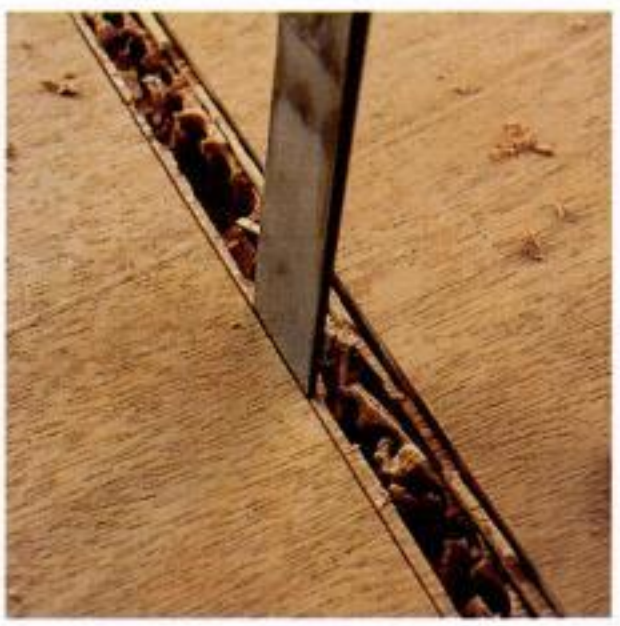
To hang the mirror, I screwed a 12-in. length of U-shaped shelf standard to the back of the frame as shown in Fig. 1. The shelf standard reinforces the wood across the short grain and it also simplifies hanging: You can thread it with a length of light brass chain. For a concealed hanger, drill and file a keyhole slot in the standard.

### The Table

The table is made of three parts: the top, the backboard and the support bracket. The backboard is glued and screwed to a rabbet in the top, and the support bracket is attached to the top with a



***Drilling out the waste.*** *The author removes most of the waste from the sliding dovetail slot using a Forstner bit in his drill press.*



***Paring the sides of the slot.*** *After scoring a line to define the width of the dovetail slot, Watts uses a chisel to create the slot's angled walls.*

***Paring the bottom of the slot.*** *After the walls of the slot have been cleaned up, the author pares the bottom flat with a chisel.*

# MAKING KEYHOLE PLATES

Keyhole plates are a strong, convenient way to hang light furniture on a wall. They are also completely concealed. For this table, I used 3/4-in.-wide, 1/8-in.-thick brass, but steel or aluminum would work equally well (available from Small Parts Inc., Box 4650, Miami Lakes, FL 33014, 800-220-4242). Lay out the holes as shown in the drawing. Make the plate as shown in the photos. The keyhole slot is created by removing the waste between the two middle holes with a small, flat file.

Keyhole plates need to be inset, or else there will be a slight gap between the back of the piece and the wall. Be sure to drill out sufficient waste behind the plate to provide clearance for the head of the supporting screw in the wall.

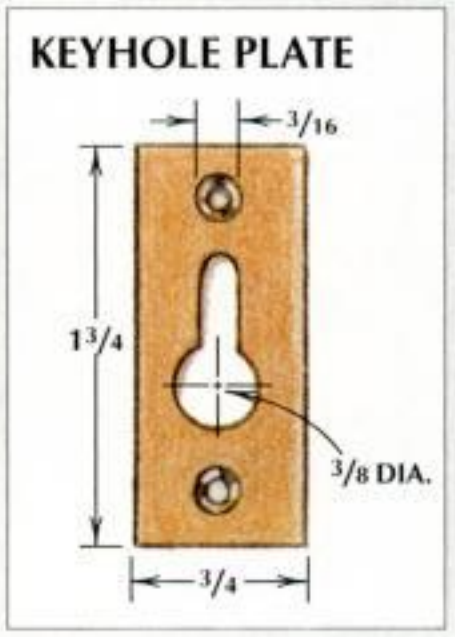
Make sure to place the supporting screws in the wall on exactly the same centers as the keyhole plates—otherwise they won't fit. —*S.W.*

***Ready for attachment.*** *Check the mortise fit, then drill and chisel out a recess behind the slot for a screw head.*

***Drill the holes.*** *Lay out the holes as shown in the drawing at right. Drilling small pilot holes first helps to guide the larger bits.*

***Countersink for plate screws.*** *File between the holes to make the keyhole slot, then countersink the holes for the plate screws.*

***Chisel out the plate mortise.*** *Scribe the outline of the plate with a knife, drill out the center waste, then clean up with a chisel.*




sliding dovetail. (See Fig. 2.) The table hangs on the wall with brass keyhole plates. (See sidebar, above.)

Begin by making full-size patterns. Enlarge the patterns shown in Fig. 2, and transfer the outlines to 1/8-in.-thick plywood. Then cut out the basic shapes.

Two cuts on the tablesaw make the rabbet. The sliding dovetail joint is a little trickier to make. You may choose to rout the sliding dovetail and its slot with a dovetail bit. However, having no router, I cut the dovetail itself on the tablesaw and then drilled and chiseled out its slot by hand.

***Attaching the support bracket.*** *The author uses a clamp to coax the sliding dovetail on the bracket into its slot on the table's underside.*

To cut the dovetail on the bracket, I set the tablesaw blade to a 15° angle and sawed the sides of the dovetail while feeding the bracket vertically along the fence. Then I laid the bracket flat on the saw table and cut the shoulders with the blade at 90°.

Next, I made the dovetail slot in the underside of the table. I marked out the slot, drilled out the majority of the waste, then cleaned up the rest with chisels. (See photos, opposite page.)

For drilling out slots, I use a brad-point bit or a Forstner bit to avoid going through the workpiece. Choose a bit with a diameter a fraction less than the width of the dovetail slot.

To remove the waste from the slot, I first defined the edges of the slot with a knife. Then I cleaned up the sides, holding my chisel at a 15° angle off of vertical. Use a bevel gauge to help guide you when paring, or cut a piece of scrap to match the angle. A thick, beveled block of wood will also work.

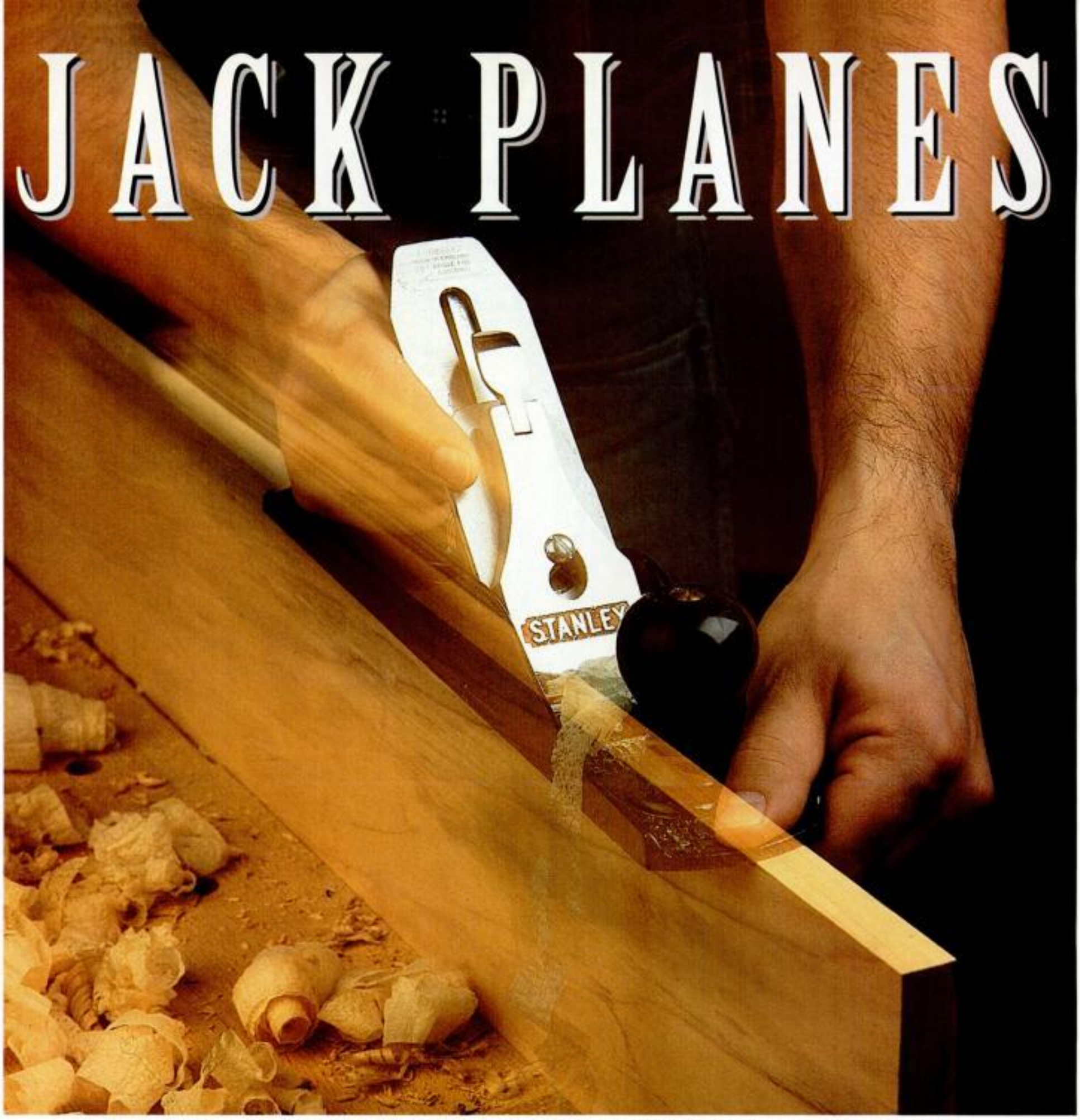
With the sides of the slot cleaned up, pare the bottom with a chisel. Then test fit the joint, trimming as necessary until you have an easy, sliding fit: Otherwise the joint is likely to jam up after you apply the glue.

When you're satisfied with the fit of the joint, shape the curved edges of the table parts with a spokeshave. Then sand these edges smooth using 220-grit sandpaper and a cork or softwood block that's shaped to match the curve. Glue and screw the backboard into its rabbet, and then glue up the sliding dovetail, pulling it gently into place with a clamp as shown in the nearest photo at left. Use plastic resin glue rather than aliphatic resin glue to give yourself ample assembly time.

To finish up, I applied several coats of tung oil varnish to the table, wet-sanding between coats with 600-grit wet-or-dry paper. The final step—installing the keyhole plates—is explained in the sidebar above. ▲

**SIMON WATTS**
*is the West Coast editor of AW.*

# JACK PLANES



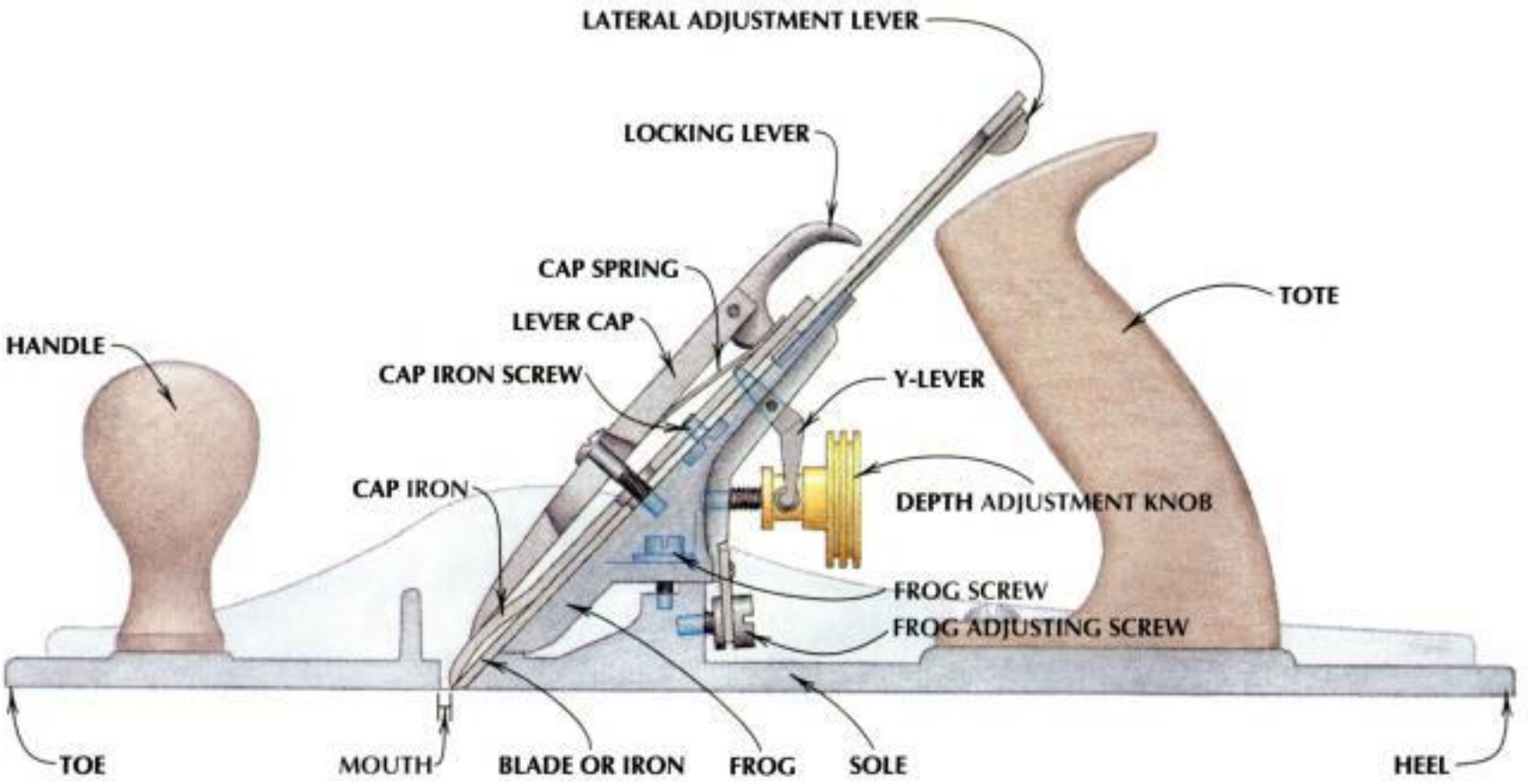

**Plane portrait.** *The do-it-all jack plane is equally useful for jointing edges and general smoothing.*

## We Test Seven Planes To Find The Best Performers

Spend some time with a well-tuned jack plane and you'll have no trouble understanding how this age-old tool earned its title as a "jack-of-all-trades." The jack, or No. 5, bench plane is easier to handle than a large jointer plane (No. 8) and only slightly less maneuverable than the smaller smooth (No. 4) plane. At 14 in. long, the No. 5 is conveniently sized for either jointing an edge or smoothing a surface. If forced to pare their plane collection down to a single tool, most woodworkers would hold onto their versatile jack.

For this buyer's guide, we tested and compared seven metal-bodied jack planes from six different manufacturers. Prices ranged from $29.95 for the Anant, manufactured in India, to $69.95 for the Stanley Bailey. Just for fun, we also tested a couple of old-timers—a 1935 Stanley Bailey, and a Stanley Bed

# ANATOMY OF A METAL HAND PLANE




Rock (No. 605) that was made between 1911 and 1922—to see if they really did make 'em better in the good old days. (See sidebar, page 66.)

## Plane Truths

These metal-bodied planes share the same basic anatomy (see drawing), but not all planes are created equal. We found some differences in construction that added up to noticeable differences in feel and performance. You'll find these summarized in the chart on page 64. Here are the elements that affect a plane's performance.

**A flat sole**—For a plane to work effectively, the general rule is: The flatter the sole, the better. We tested each sole for flatness on a granite surface plate by first coating the plate with a thin film of Prussian blue machinist's dye and then rubbing the plane over the plate. The areas that didn't pick up the blue compound indicated low spots. (See photos, below.)

As shown in the photos below, none of the planes had a truly flat sole. The Record had the flattest sole of all the new planes. The Great Neck plane got the only unacceptable grade. Its sole was dished by more than 3/32 in., rendering the tool useless for all but the roughest work unless you spend some serious time flattening the sole. (See sidebar, page 65.)

**A good blade**—Before the testing got underway, we flattened the back of each plane iron and honed the bevel. All of the blades took a keen edge, but some blades stayed sharp longer than others. Although blade hardness is only one indication of a good steel (see "Bench Chisel Challenge," AW #47), our results matched the lab's findings: A higher RC number meant a longer-lasting edge. (See chart.)

***Test of sole.*** *Right out of the box, plane soles were tested for flatness on a surfacing plate (left). At right, blue dye shows where the sole contacted the plate. The more blue, the flatter the sole. From top: AMT, Anant, new Stanley Bailey, vintage Stanley Bed Rock, vintage Stanley Bailey, Record, Footprint, Great Neck, Stanley Contractor.*

# JACK PLANES

| Model Name<br>Price<br>Sources | PERFORMANCE RATINGS<br>Sole Flatness | <br>Handles & Adjustments | <br>Finish | SPECIFICATIONS<br>Weight (lbs.) | <br>Blade Hardness (RC) | <br>Material For Handles, Depth Adj. Knob | Comments |
|---|---|---|---|---|---|---|---|
|  <br>**AMT**<br>$42<br>**Available from American Machine & Tool Co., (800) 435-8665**<br>***Circle #608*** | ●● | ●●● | ●● | 4.2 | 56.6 | Plastic, Brass with plastic ring | Sole 11 1/2 in. long; blade 1 3/4 in. wide; ineffective lever cap; frog surface not machined flat. |
|  <br>**Anant**<br>$29.95<br>**Available from Woodworker's Supply Inc., (800) 645-9292**<br>***Circle #609*** | ●● | ●●●●● | ●●● | 4.6 | 58.6 | Plastic, Steel | |
|  <br>**Footprint**<br>$64.95<br>**Available from Classic Woodcraft Supply, (714) 532-4677, & other mail-order suppliers**<br>***Circle #610*** | ●●● | ●●●●● | ●●●●● | 5.25 | 60 | Wood, Brass | Comfortable tote; large cast depth adjustment knob. |
|  <br>**Great Neck**<br>$35<br>**Available at hardware stores and home centers**<br>***Circle #611*** | ● | ●● | ●● | 4.55 | 55.6 | Plastic, Brass | Sole dished 3/32 in. around throat; ineffective lever cam; lever cap jammed on screw, required filing; no cap spring; frog surface not machined flat. |
|  <br>**Record**<br>$67.95<br>**Available from Garrett Wade, (800) 221-2942, & other mail-order suppliers**<br>***Circle #612*** | ●●●● | ●●●● | ●●●●● | 5.25 | 59.5 | Wood, Brass | Screw-tightened lever cap is easy to adjust. |
|  <br>**Stanley Bailey**<br>$69.95<br>**Available from Woodcraft, (800) 225-1153, & other mail-order suppliers**<br>***Circle #613*** | ●● | ●●●● | ●●●● | 4.9 | 63 | Plastic, Brass | Comfortable plastic tote. |
|  <br>**Stanley Contractor**<br>$33.49<br>**Available from William Alden Co., (800) 249-8665**<br>***Circle #614*** | ●● | ●●● | ●●● | 4.6 | 63 | Plastic, Plastic | Comfortable plastic tote; front edge of frog is unsupported; no cap spring. |

**KEY: ●●●●● = Excellent, ●●●● = Good, ●●● = Fair, ●● = Poor, ● = Unacceptable.**

***Back up your blade.*** *The frog supports the blade for chatter-free planing. The Record's frog (left) seats firmly and supports the blade. The frog on the Stanley Contractor (right) does not provide as much support, and the blade can vibrate in use.*

***Get a grip.*** *A good tool must be comfortable to use. We preferred the Footprint's nicely contoured wooden tote and large cast knob (left) and disliked the Great Neck's plastic tote and small stamped knob (right).*

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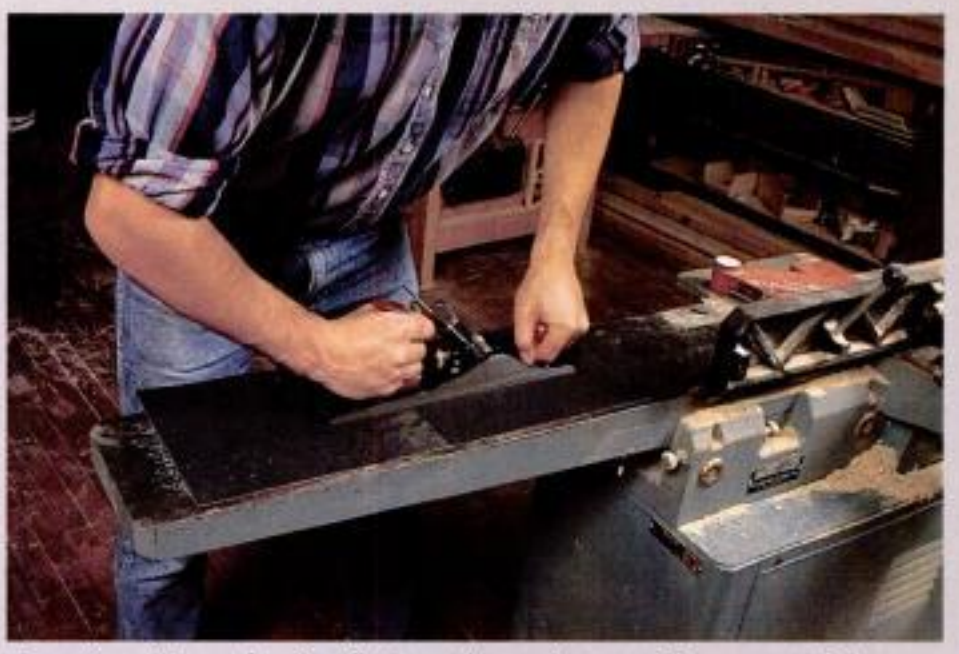
Blade thickness made a considerable difference in the way these planes performed. We tried two aftermarket blades which were thicker than the standard blades and found that the thicker cutters helped eliminate chatter, or excessive vibration. The Lie-Nielsen replacement blade ($25 from Lie-Nielsen Toolworks, 800-327-2520) noticeably improved the performance of the test planes, but the 1/8-in.-thick Lie-Nielsen blade was too thick to fit in the older Bailey and Bed Rock planes. The 3/32-in.-thick Hock blade ($24.95 from The Japan Woodworker, 800-537-7820) fit into even the old-timers without any alterations, with similar improved results.

**A stable frog**—The frog on a plane has a tricky assignment. (See drawing.) It has to provide a flat and stable platform to support the blade at an angle to the work; yet it also needs to be adjustable. Moving the frog forward on the plane body reduces the size of the mouth, which makes it easier to produce super-thin shavings when working with difficult-grained wood or when making those final passes on a finished surface.

A couple of things can go wrong with the frog to cause the blade to chatter in use. First, a frog that isn't well seated against the sole cannot provide the solid support that the blade needs to cut smoothly. Second, a frog that leaves the blade's



***Lapping the sole.*** *To flatten the sole on silicon carbide paper, maintain even pressure over the sole. A jointer table makes a reliable flat surface.*

## FLATTENING A SOLE

The flatter the better. That's the simple rule that applies to a plane's sole. If your sole comes up short—as many do—you have two choices. It will cost about $50 to have a machine shop flatten the sole of a plane. But you can also flatten the sole yourself. All you'll need is a few dollars' worth of 180-grit wet-or-dry silicon carbide sandpaper and a flat reference surface, such as a piece of 3/8-in.-thick float glass or a jointer table.

To prepare your lapping surface, first attach the paper to a surface with spray adhesive. Butt several sheets edge to edge to make a surface at least 1 1/2 times the length of the sole. To lap the sole, lubricate the paper with a few drops of water and simply rub the plane up and down the paper. Direct the pressure over the center of the tool so that it wears evenly. (See photo, above.) After your first few strokes, check your progress. The freshly abraded surfaces are the high spots. (See photo, right.) Continue with 180-grit paper until the key areas around the throat, toe and heel have a uniform sheen.

Before smoothing the sole with finer paper, lightly chamfer the bottom edges with a fine file to knock off any sharp edges that could gouge the surface of your work. Continue working up in grit to about 320. When you're through, clean everything with a spritz of WD-40. Last, rub on a light coat of paste wax to prevent rust and provide a smooth bearing surface.

***Highs and lows.*** *Reflective areas indicate low spots. Continue flattening until the key areas around the throat, toe and heel have a uniform sheen.*

***Old faithfuls.*** *These vintage Stanley Bailey and Bed Rock planes proved they can hold their own against newer competition.*

## DO THEY STILL MAKE 'EM LIKE THEY USED TO?

Old-timers tout the virtues of old planes like vintage Stanley Baileys and Bed Rocks. To satisfy our own curiosity, we bought two used planes: a 1935 vintage Stanley Bailey No. 5 (we paid $20 at a yard sale) and a Stanley Bed Rock No. 605, circa 1911-1922 ($58 from a tool collector). We compared these to the new planes we tested to see if it's true that "they don't make 'em like they used to."

Our verdict: Don't let a little rust fool you; these tools are in a class by themselves.

**The antique Bailey** had nicer castings and better milled surfaces than our spanking-new Stanley Bailey. The oldster also had a rosewood handle that begged to be held. This flea-market find was an instant shop favorite—at about half the price of a shiny new model.

***Back to Bed Rock.*** *The flat-milled frog on this old Stanley Bed Rock plane beds itself against a milled ramp in the sole for solid, chatterless performance.*

**In 1900, Stanley designed the Bed Rock** to be "the best plane ever made." It was then, and it still is now. Although collector-quality planes cost several hundred dollars, we bought this well-worn "worker" plane for under $60.

Unlike other planes, the Bed Rock's flat-milled frog literally beds itself against the ramp in the sole for chatter-free planing. (See photo, above right.) Another unique detail is the frog adjustment mechanism: Two clamping screws press against a pair of pins to wedge the frog in place. To adjust the mouth, loosen the clamping screws and adjust the center screw; there's no need to remove the lever or blade.

There's a downside to rescuing vintage tools. Assuming that you can find them, you can expect to spend some time tuning and cleaning. And there's no guarantee with second-hand tools; if a tote's cracked or you're missing a screw, you're out of luck. But I enjoy tuning up old tools. For me, the thrill of finding an old friend is worth the risk. —*Joe Wajszczuk*

cutting end unsupported will allow it to flex, producing the same chattering effect.

The frogs on the Record, Footprint, Anant and Bailey all rested against their respective soles on machined ways. With the other planes, the frogs rested on cast surfaces—a definite disadvantage.

On the Stanley Bailey and the Record plane, the low-reaching frog fully supported the blade. With the Stanley Contractor plane, the frog's poorly seated front edge didn't support the blade adequately. This resulted in noticeable chatter when the plane was adjusted for a small throat opening. (See top left photo, page 65.) The Anant's thicker sole also created problems by not supporting the cutting edge close to the work. Both planes performed well when their blades rested against the back of the throat.

The frogs we liked best were on our two vintage planes. Not only were both frog and sole machined flat, but the soles were stepped down to support the blade right to the top of its bevel.

**The right feel**—To rate these planes for feel we looked at two factors: comfort and controls. The tote and the handle, or knob at the front, are both important—a tool must be comfortable enough for you to want to work with it. Controls should also do what they're supposed to, responding easily to the task at hand.

We preferred the wooden totes and handles to the plastic ones. In particular, we all liked the Footprint's contoured wooden tote. (See bottom left photo, page 65.) The plastic-toted Stanleys were also fairly comfortable; however, they began to feel slimy as soon as your hand started to sweat. Both the AMT and the Great Neck require some alteration—the raised molding seams became really annoying in no time.

Planing a curl as thick as 1/32 in. or as thin as 0.001 in.—and back again—should be a matter of a few revolutions of the depth adjustment knob. Look for a smoothly operating depth adjustment knob and a lateral adjustment lever that doesn't have excessive play. The Footprint beat the rest with its tight-action, solid brass depth adjustment knob.

A smoothly operating lever cap is equally important—it keeps the blade tight against the frog. The Record led the pack with its screw-down lever cap, which was the easiest to adjust and remove. By comparison, the lever caps on the Great Neck and AMT fit too loosely in the "locked" position; we had to screw the cap down so tight that the lateral adjustment became too difficult to use.

### Recommendations

After some tuning, all of the planes tested cut a decent shaving. To some degree, you get what you pay for: Expect to spend more time tuning less-expensive planes to get reasonable performance. The AMT came up short, not as much in performance as in design. With an 11 1/2-in.-long sole and 1 3/4-in.-wide blade, it's neither a No. 4 nor a No. 5. It doesn't have the length to do the same jointing work as the other planes.

Both the Footprint and Record are first-class planes, and both earned our Editors' Choice award as the best performers. These two tools are the kind that you will enjoy using every day and can expect to pass down to the next generation of woodworkers.

Our Best Buy Award—best value for the price—goes to the Anant. Clean up a few rough corners, buy yourself a premium blade, and you'll have a first-class performer at a low price. ▲

# WOOD FACTS

## Redwood

**by Paul McClure**

**Before the Ice Ages,** redwood trees grew throughout much of the northern hemisphere. But as the climate changed, they retreated to a narrow band about 500 miles long and 35 miles wide along the coast of the northwestern U.S. Redwoods are among the oldest and largest living things in North America. Some are estimated to be more than 2,000 years old. Mature redwoods can reach diameters of 27 ft. and heights of 300 ft.

Few of the big old-growth trees are left. Today, many conservationist groups are fighting to protect the remaining stands of old-growth redwood from the saw. Of the two species of redwood—*Sequoia gigantea* and *Sequoia sempervirens*—only the latter is widely sold commercially.

### Appearance

Heartwood is bright red when freshly cut but darkens to a brownish red and ultimately to a silvery gray upon exposure to air and sunlight. The sapwood is creamy white and is clearly demarcated from the heartwood. The wood has a smooth texture and straight grain.

### Workability

Redwood works easily with both hand and power tools, but it tends to split and splinter, so sharp cutting edges are a must. Redwood doesn't hold screws well; whenever possible, use bolts instead. Avoid standard steel hardware; it reacts with the wood, producing black stains. Use brass, or galvanized or stainless steel.

Power sanders can cut quickly through this soft wood, leaving ridges and uneven surfaces. I recommend hand sanding whenever feasible. Redwood glues easily.

### Uses

Redwood is valued for its stability and for its extremely durable heartwood. It has many exterior uses including siding, fence posts, signs, decks, and outdoor furniture. Redwood's resistance to rot also makes it a preferred choice for hot tubs, wine casks, and even caskets. Some redwood lumber may contain sapwood, which is not resistant to rot. Interior uses include paneling and millwork. Figured logs, particularly burls, are often made into veneer for furniture. Redwood burl is always in demand for turning stock.

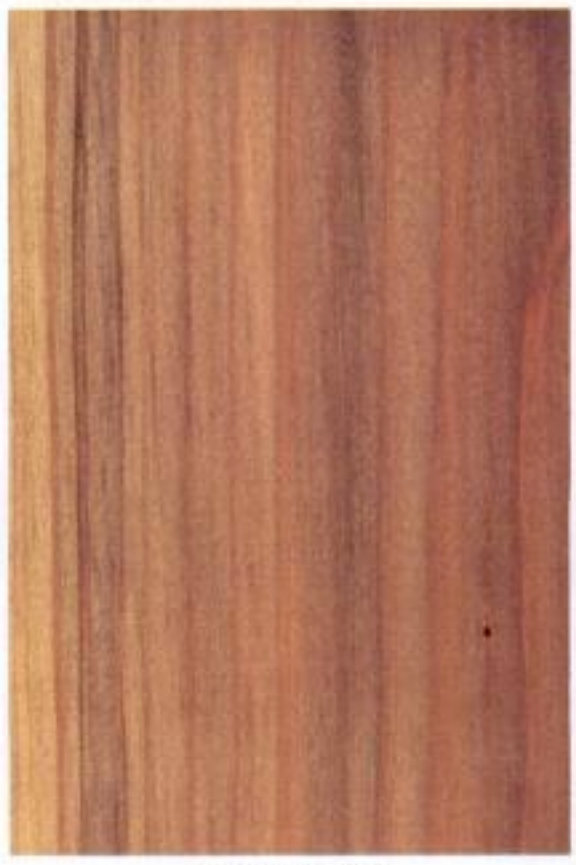
"Clear heart" grade redwood is dried to about 8 percent moisture content and is generally available in nominal 1-in. and 2-in. thicknesses. "Construction heart"—like most construction lumber—is only dried to about 15 percent moisture content and is generally only available in 2-in. thicknesses. ▲

### REDWOOD

| | |
|---|---|
| **Species and Common Names** | *Sequoia sempervirens—redwood, California redwood, coast redwood*<br>*Sequoia gigantea—giant redwood* |
| **Growing Region** | *Southwestern Oregon to northern California in a 35-mile-wide band east to west* |
| **Specific Gravity** | *0.33 (young growth) to 0.39 (old growth)* |
| **Density** | *22 to 27 lbs. per cubic ft.* |
| **Wood Movement[1]** | *Tangential (flatsawn): very small (3/32 in. per ft.)*<br>*Radial (quartersawn): very small (3/32 in. per ft.)* |
| **Durability** | *Highly resistant to fungal attack; susceptible to insect attack* |
| **Sustainability** | *Old growth cannot be replaced. Lumber industry claims new growth is sustainable but many environmentalists disagree.* |
| **Availability** | *Construction lumber dealers; some home centers* |
| **Size: Thicknesses** | *4/4 through 16/4* |
| **Widths** | *2 to 12 in.* |
| **Lengths** | *8 to 16 ft.* |
| **Cost: Lumber[2]** | *Dry "clear heart"—$5.20 per bd. ft.*<br>*"Construction heart"—$1 per bd. ft.* |
| **Veneer** | *Figured—$4.95 per sq. ft.* |

[1] *Indicates wood movement across the grain from 6 to 12 percent moisture content.*

[2] *Prices vary greatly between East Coast and West Coast.*



**REDWOOD**

# JUST FINISHING

## Exterior Clear Finishes

*How to Protect and Beautify Your Outside Woodwork*

**by Michael Dresdner**

**Wouldn't finishing** be easy if we could use the same coatings on everything we make? The sad truth is that furniture forced to live outdoors all year long takes a lot more of a beating than its cousins inside. So, when choosing an exterior finish we have to consider not only appearance but also the effects of the sun and the weather.

No finish I know of will stand up to the ravages of weather indefinitely. The best you can hope for is a few years of good looks, along with the promise of easy renewal when the time comes to rejuvenate the finish. Depending on your definition of "good looks," your choice is often between the ease of rejuvenating the finish and the length of time between facelifts. To help us decide, let's look at the relative merits of different exterior finishes—from the simplest to the most complex.

### Cheap and Easy

The cheapest and easiest way to finish exterior projects is to put nothing at all on the wood. For many woods and designs, this is the best option. Cedar, cypress and redwood weather nicely without any help from us. Mahogany and teak—two woods that are traditionally finished with film coatings—develop a charming, silvery patina that is as elegant as the white beard on St. Nick. While some may argue that a finish helps wood to survive longer, I feel it is legitimate to let wood age and die gracefully as nature runs its course. In any case, I've seen pieces older than I—and I'm 45 years old—that time and the elements have not yet destroyed.

### Oils: Hardier but Harder

After *au naturel,* the simplest exterior finish is the same as the simplest interior finish: oil. Several wiped-on coats of linseed oil (raw or boiled) or tung oil will add depth and beauty to the wood and help it shed water while maintaining the wood's color. To keep the finish healthy looking, clean the piece with a bit of naphtha-soaked steel wool or Scotch-Brite™ and re-oil once or twice a year. It's a lot of effort spread out over years of easy-to-manage installments.

Wood "treatments" such as Thompson's Water Seal and other silicone products are fine for protecting decks, but they are not finishes. While they help the wood shed water for a period of three to six months, they do little else to protect the wood from stains or graying.

Similar to oils—but with just a tad more protective "oomph"—are the liquid or gel type wipe-on oil-based varnishes. These are combinations of oil and oil-based resins, such as alkyds and polyurethanes, and they're generally as easy to apply as straight oils. Although wipe-on varnishes also need frequent rejuvenation, the process is the same simple one as for oils.

### Film Finishes

Another rung up the ladder are the brush-on varnishes. These film-type coatings add real gloss as well as protection. They will last at least a year or two before recoat time, depending on the exposure and finish depth, but recoating will be more work. Choose either a spar varnish (tung oil and phenolic resin) or an exterior (aliphatic) urethane and apply at least three coats. When the gloss level begins to fade it's time to recoat. Clean and lightly sand the surface before brushing on another layer. Don't let

***A clear choice.*** *There are several ways to keep outdoor projects looking great and protect them from the elements. All require routine maintenance.*

these finishes go too long or they are likely to start peeling. When that happens, you'll have to remove the old finish before recoating, a task far more onerous than normal maintenance.

If you plan to use a film finish on pressure-treated lumber, it is best to let the wood air out for six months to a year before finishing, to prevent peeling. Considering how unattractive most pressure-treated lumber is, I'd recommend leaving it unfinished to let the surface oxidize naturally; silvery gray is a lot more appealing than sickly green.

### Marine Epoxies

The heavyweights of exterior finishes, weighing in at three years or more of protection, are marine epoxies. Designed to impregnate and seal the wood against finish peeling, epoxies also boast fairly long life as top coats. They consist of two parts that must be mixed before use. I like West System Brand Epoxy (available from Gougeon Bros. Inc., Box 908, Bay City, MI 48707, 517-684-7286) and System Three Resin (available from System Three Resins, Box 70436, Seattle, WA 98107, 800-333-5514).

Once you've brushed the first coat on, you have two options for topcoating: You can proceed with another coat of epoxy for added durability, or you can switch to varnish, which is less expensive and a little easier to sand when it's time to recoat. A good spar varnish or polyurethane containing ultraviolet (UV) inhibitors helps protect the epoxy from the destructive effects of ultraviolet light.

### Adding Color

You can add a coat of stain beneath any of these clear finishes. However, because the fading effects of the sun are so strong, it is best to avoid dyes of any type. Stick to pigment-type stains. All dyes will eventually fade in direct sunlight, but many pigments—especially those that are based on iron oxides—will hold their color indefinitely.

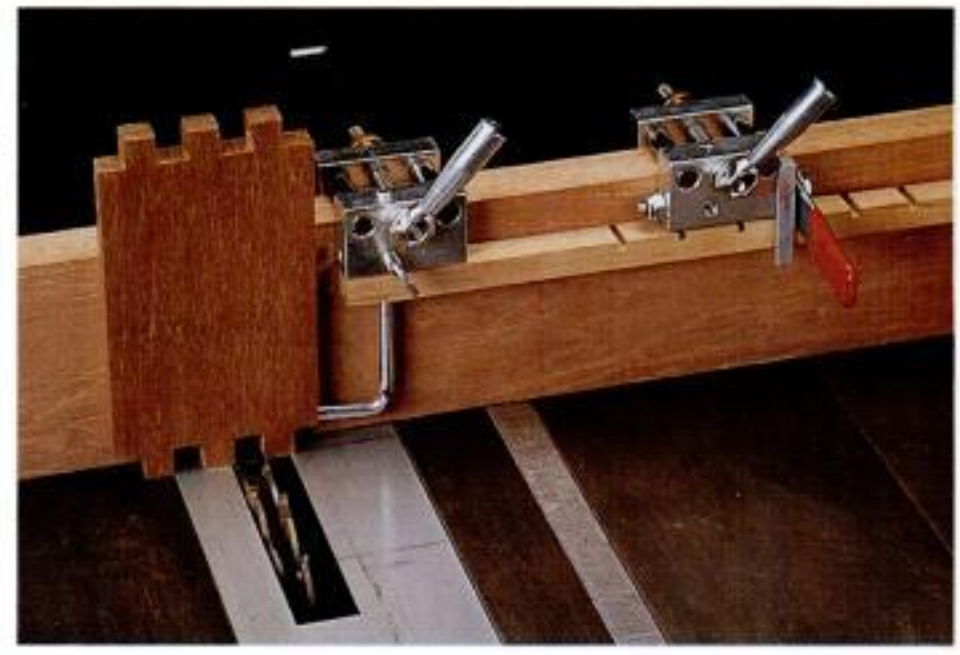
Look for exterior "deck" stains or stains that say "100 percent pigment." Deck stains are essentially oil-varnish mixes (see above) with lots of pigment. The pigment adds a small amount of durability as well as adding color. If you prefer the look of color but still desire durability, you can use a deck stain instead of a clear coat. When it comes time to recoat, you have the option of simply adding another coat of stain or switching to one of the clear exterior finishes discussed above. ▲

**Join Michael Dresdner live** on America Online Sunday nights from 9:30 pm to 10:30 pm eastern time for answers to your finishing questions. Keyword "wood" takes you to AMERICAN WOODWORKER Magazine Online. Click the "Shop Talk" icon to enter the chat room.

# TOOLBOX

## Easy Repeat Cuts

**PRO-CUT is a positioning jig that makes it easy** to perform precise, repetitive operations like cutting dentil molding, box joints, shutter slots or spaced hole patterns. The jig mounts easily on the fence of your tablesaw, router table or other machine; alternatively, you can mount it right on the workpiece. The PRO-CUT jig consists of two Multi-Stops and a pair of layout templates called "memory sticks." The memory sticks enable you to index the stock position in 1/2-in. or 3/8-in. increments for repeat cuts with no cumulative error. Memory sticks with different increments are available, and you can also get blank sticks to create your own increments. (Price: $79.95 for complete jig; $14.95 for kit if you own Multi-Stops) *Woodworker's Supply, Dept. AWT, 1108 N. Glenn Rd., Casper, WY 82601, (800) 645-9292.* **Circle #615**



## Get It Straight

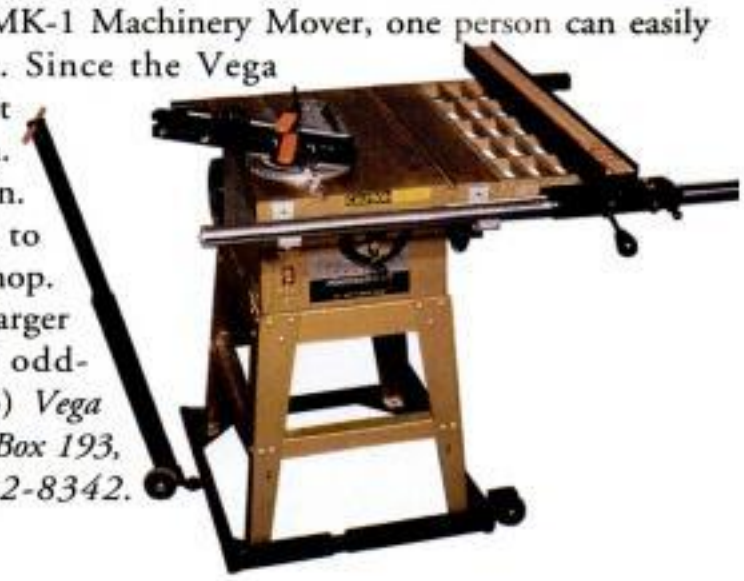
**Good woodworking starts** with straight, square edges, but a jointer isn't the only way to get them. The Joint-A-Billi-T is a work-holding fixture that clamps to a bench or stand and teams up with your router and a straight bit to cut glue-joint perfect edges. In addition to jointing solid stock, the portable Joint-A-Billi-T lets you cut rabbets, grooves and dadoes and square off large panels, doors and tabletops. The fixture comes in different models to accommodate different size stock. (Price: 60-in. model, $135; 96-in. model, $175) *Gudeman Enterprises, Dept. AWT, Box 126, Goodfield, IL 61742, (309) 965-2183.* **Circle #616**

## Scraper Burnisher

**Sharpening a turning scraper** used to mean a trip to the grinding wheel to raise a fresh burr at the cutting edge. The Veritas Scraper Burnisher lets you raise a burr that will cut cleaner and last longer than one produced on a grinder alone—even on high-speed-steel scrapers. After you've ground the initial bevel, you simply lay the scraper flat and rub the cutting edge against a special, cone-shaped carbide burnishing rod that's set in a machined aluminum base. You can reburnish the burr two or three times before it's necessary to grind the bevel again. (Price: $29.95) *Veritas Tools Inc., Dept. AWT, 12 E. River St., Ogdensburg, NY 13669, (800) 667-2986.* **Circle #617**

## Get Up and Go!

**Occasionally even "stationary" machines** must be moved, and it's backbreaking labor. But with the Vega MMK-1 Machinery Mover, one person can easily move machines up to 800 lbs. Since the Vega mover's adjustable base will fit most machines (with bases 13 in. to 28 in. wide and 17 in. to 29 in. long), you only need one unit to handle most machines in your shop. The mover is also available in larger models to handle very big or odd-shaped machines. (Price: $99.95) *Vega Enterprises, Dept. AWT, R.R. #3, Box 193, Decatur, IL 62526, (800) 222-8342.* **Circle #618**



## Filter Upgrade for Shop Vacuums

**The W.L. Gore Co., manufacturer of Gore-Tex**—a breathable fabric used in outdoor clothes and equipment—has introduced a new line of "CleanStream" filters for shop vacuums. The super-efficient filters can capture the ultra-fine wood dust (99.7 percent of particles as small as 0.3 micron) that ordinary filters miss, including drywall dust. CleanStream filters have a nonstick surface that resists clogging and can be easily cleaned with water. They work for both wet and dry pickup, and sizes are available to fit shop vacuums from Genie, Hoover, Shop-Vac and Sears. (Price: $21 to $30 per filter) *W.L. Gore and Associates, Dept. AWT, Box 1100, Elkton, MD21922, (800) 758-6755.* **Circle #619**

## Affordable Cyclone Collector

**Oneida Air Systems' new Cyclonic Dust Collector** is designed and priced for the small shop. The 1½-HP unit features a funnel-shaped "cyclone" that preseparates 99.9 percent of the dust and deposits it in a barrel (included). A cartridge filter housed inside the cyclone captures the remaining ultra-fine dust and can run for up to 500 hours between cleanings. With no dust bag, the unit is very compact—it takes up a scant 4 sq. ft. of floor area. The collector generates 750 cubic ft. per minute of air flow at 8 in. of static pressure—enough suction power to serve a tablesaw and a jointer at once. (Price: $694) *Oneida Air Systems, Dept. AWT, 1005 W. Fayette St., Syracuse, NY 13204, (315) 476-5151.* **Circle #620**

## ROUTERTRAC MORTISE & TENON JIG by Dave Sellers

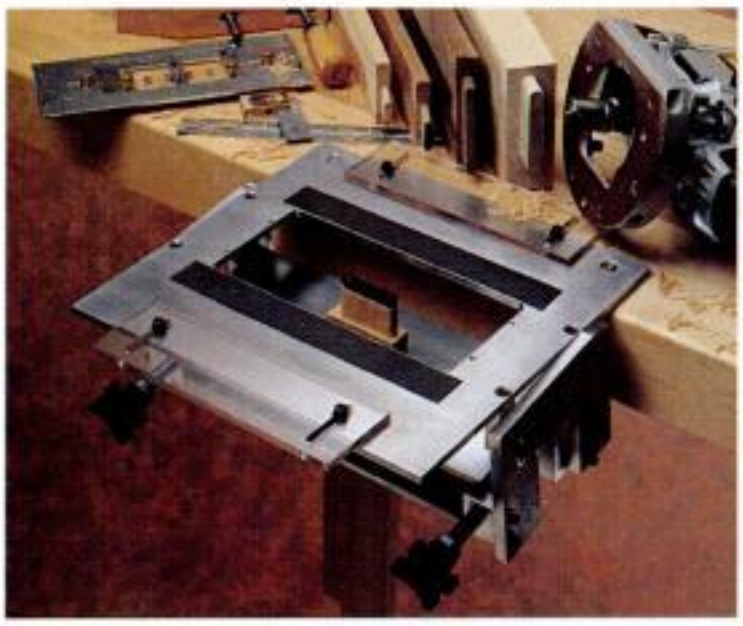
SHOP TESTED

**There are many ways** to make mortise-and-tenon joints. Most methods involve some test-fitting and fine-tuning to get a precise fit. Not so with the routerTrac, a new jig designed for cutting mortises and tenons with a plunge router.

The way the jig works is simple. Tenons are cut with a carbide-tipped pattern-cutting bit (supplied) that follows a template which fastens to the end of the workpiece with two small pins. A drill guide (included) helps you drill the shallow holes for the template pins. The router base rides on a horizontal platform with a rectangular cutout that provides clearance for the bit to do its work.

Because you can clamp the workpiece at just about any angle beneath the platform, it's easy to set up for cutting angled (and even compound-angled) tenons. The router bit leaves radiused tenon ends. Tenon cheeks are flat and parallel. Shoulders are crisply radiused, and thickness is uniform.

To change from tenoning to mortising mode, you reset the position of the platform—a procedure that takes a minute or so. Then you clamp the stock horizontally under the platform and plunge rout the mortise with an up-cutting spiral bit (not supplied). Adjustable stops and fences locate the mortises and ensure that they match the tenons. You won't need to do any hand work to fine-tune the fit between mortises and tenons.



***Mortise-and-tenon template.*** *The routerTrac jig makes it easy to cut precise mortise-and-tenon joints with your plunge router.*

The jig is ruggedly built from aluminum plate stock and should stand up well to production use. It's precisely made, too. No assembly is required. I simply bolted the jig to a piece of ¾-in.-thick plywood, bolted this base on my workbench, and began to experiment with different setups for mortising and tenoning. The instruction manual is well written, but more detailed explanations are needed for some procedures. Jim McCracken, routerTrac's inventor, says a more comprehensive manual will be available soon.

RouterTrac does have some limitations worth noting. Tenon length is limited to 1 in. with the supplied pattern-cutting bit. To make longer tenons, you'll need to buy a longer pattern-cutting bit. Also, the tenon template pins leave small holes in the ends of the tenons. These holes will show in the end of a through tenon, unless you cut kerfs across them for wedges.

You can choose templates for tenons ¼ in., ⅜ in. and ½ in. thick. Tenon widths are available from 1 in. to 3 in.

This is an ideal jig for chairmakers or for anyone who needs precise angled tenons. And the routerTrac is also easy to use for accurate conventional tenons. If you can live with the selection of tenon thicknesses and the range of widths, it's great for production work. This jig takes the hand work out of getting precisely fitting mortise-and-tenon joints. (Price: $527, includes two tenon templates) *CenterLine Tool, Dept. AWT, 2518 Buckhill Ct., San Jose, CA 95148, (800) 717-8722.* **Circle #621**

GALLERY

# Hot Seats

**It's a big deal** when an exhibition in Asheville, NC, draws some 75,000 visitors. That's what happened last October and November, when the Southern Highland Craft Guild sponsored "The Chair Show." Held in Asheville's Folk Art Center, the show drew entries from chairmakers all over the country. A total of 46 woodworkers were represented in the exhibit. Have a look at some of our favorite pieces.

"Sunday Judge-In" by Mark Cherry, New Windsor, MD. Vine-wrapped maple saplings and maple slabs. W: 33. D: 31. H: 58.

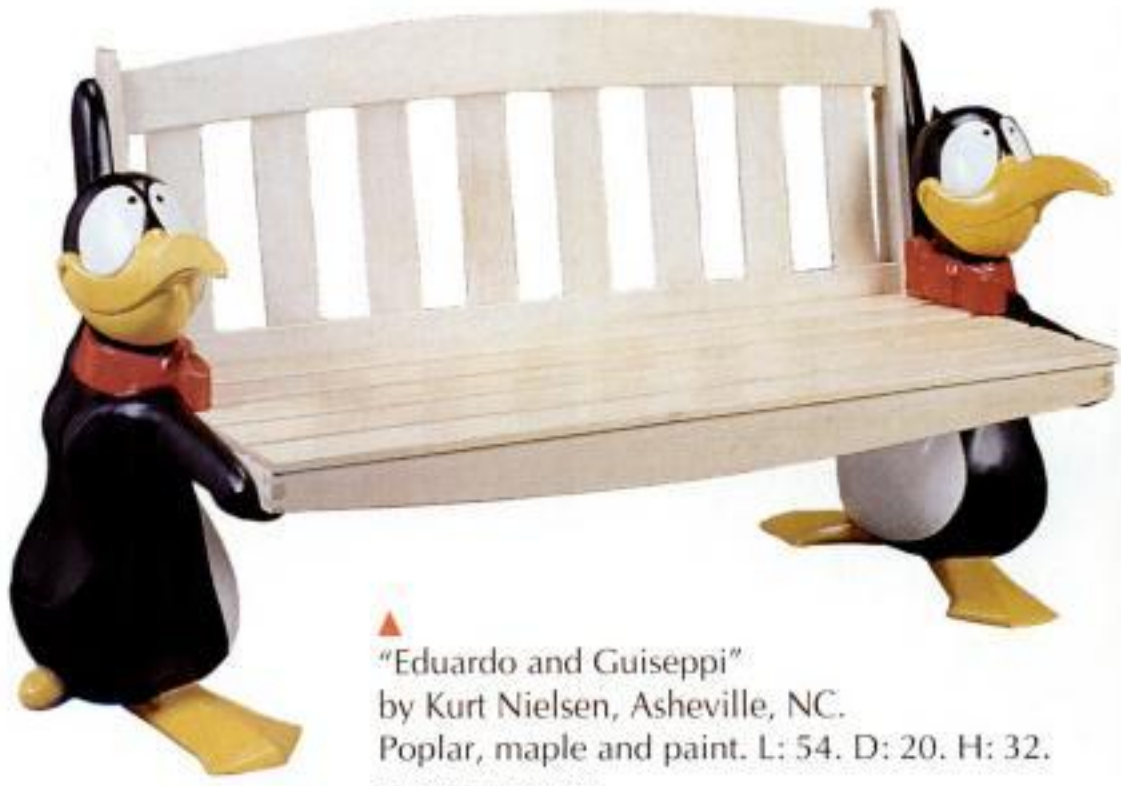
PHOTO BY BART WALTER

"Watershed Series Arm Chair" by J.M. Syron and Bonnie Bishoff, Philadelphia, PA. Walnut, walnut burl, upholstery. W: 25. D: 32. H: 29.

PHOTO BY JOSEPH DOMINIC CHIELLI

Federal side chair by B.A. Harrington, Somerville, MA. Cherry, madrone burl veneer, ebony, upholstery. W: 19 1/2. D: 17 1/4. H: 35 3/8.

PHOTO BY LANCE PATTERSON



"Eduardo and Guiseppi" by Kurt Nielsen, Asheville, NC. Poplar, maple and paint. L: 54. D: 20. H: 32.

PHOTO BY KURT NIELSEN

"Kanji Chair"
by Bayley Wharton,
Raleigh, NC.
Tiger maple,
purpleheart.
W: 22. D: 26. H: 44.

PHOTO BY BAYLEY WHARTON

"Two-Seater Settee," 1/4 scale, by Roger Hauge, Evanston, IL.
Peeled maple, hand-dyed reed. L: 10. D: 4 1/2. H: 11.

PHOTO BY ROGER HAUGE

"Patra's Chair,"
fan-back Windsor
by Curtis Buchanan,
Jonesborough, TN.
Sugar maple,
tulipwood, red oak
and milk paint.
W: 20. D: 19. H: 39.

PHOTO BY TOM PARDUE

Chair and footstool
by Dominick Ferullo,
Saluda, NC. Peeled
maple branches,
reed rush.
Chair:
W: 22. D: 22. H: 68.
Stool:
W: 18 1/2. D: 15. H: 20.

PHOTO BY TIM BARNWELL

**Want to see your work in "Gallery"?** Send color slides or color transparencies to: "Gallery," AMERICAN WOODWORKER, 33 E. Minor St., Emmaus, PA 18098. Please include a title, a brief description of techniques used, materials, dimensions, name of photographer, your name, address, and phone number. We'll pay you $35 per entry published. If you want your photos returned, enclose a self-addressed stamped envelope.

# FINAL PASS

## Norm Abram Visits the AMERICAN WOODWORKER Shop!

*AW's Router Table Will Star on "The New Yankee Workshop"*

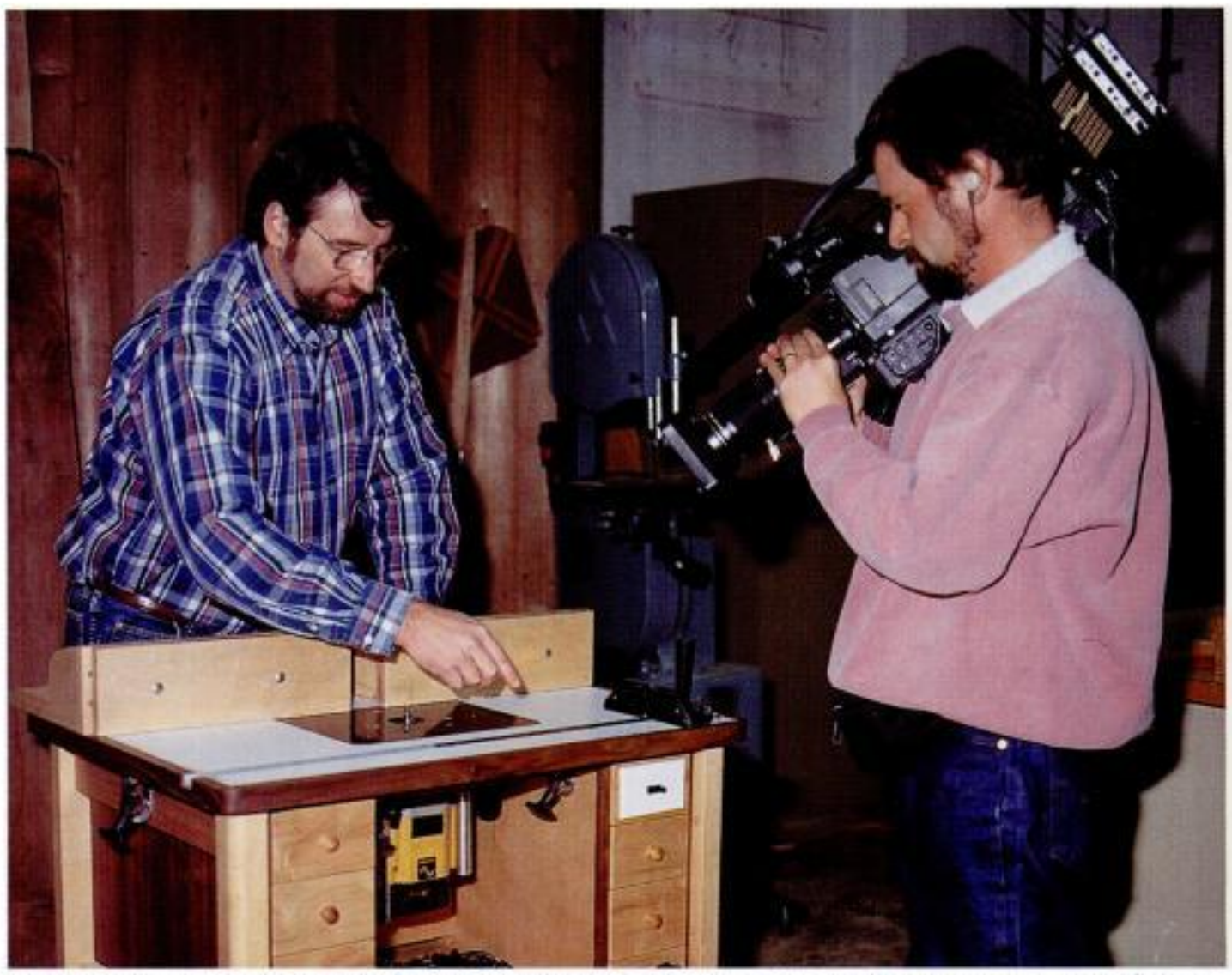
**Norm Abram** and the crew of PBS's "The New Yankee Workshop" paid a visit to the AMERICAN WOODWORKER shop last November. Their objective: to check out our Revolutionary Router Table, which was featured on the cover of AW #44.

Norm and producer-director Russell Morash were impressed with the innovative design of the router table. "The outboard crank adjustment for bit height is a great feature," commented Norm.

Norm plans to incorporate some features from AW's router table in his own "New Yankee Workshop" version.

### CATCH NORM AT THE AW SHOP!

**Norm's version of AW's router table is scheduled to air on "The New Yankee Workshop" the week of April 8th. Check your local PBS listings.**



***Focus on features.*** *"The New Yankee Workshop" cameraman Joel Coblenz zooms in on Norm Abram at the AW shop. Norm plans to use AW's Revolutionary Router Table (shown above) as a model for his own version, to be featured in an April episode.*

***Check it out.*** *Ellis Walentine (at right) explains the router-table fence to Norm and producer-director Russell Morash.*

***Outtakes.*** *A little levity loosens up staff members and star as Morash (at left) sets up the opening shot for the show.*