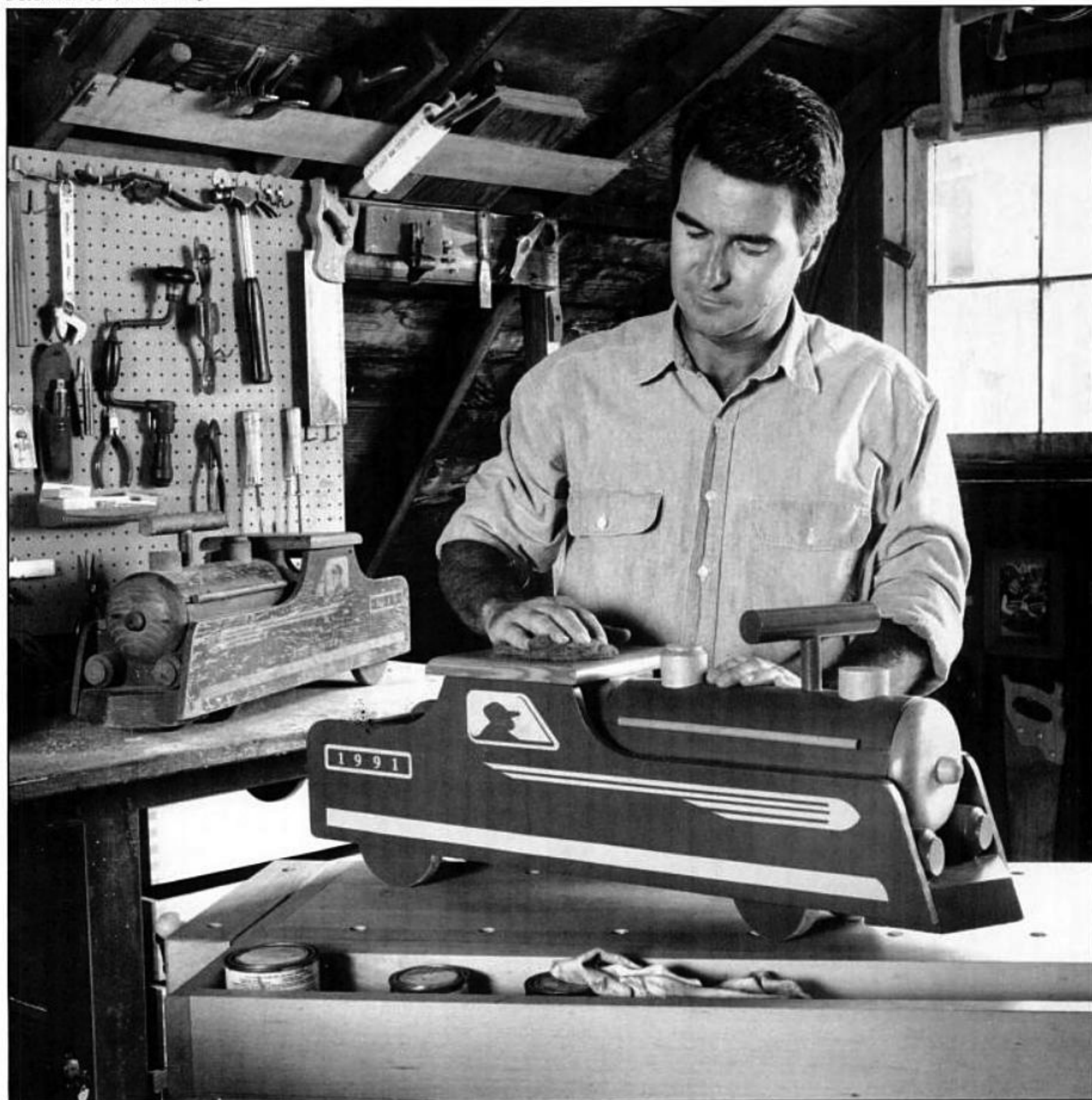


# AMERICAN WOODWORKER

December 1991, Issue No. 23



\$3.95

***Streamlined Steamer: Build a Riding Locomotive from the 1930s***

***12 Curved Bandsaw Fences: A Clever Technique for Cutting Curves***

***Heirloom Silver-Chest Plans***

***Six Great Projects for Holiday Gifts***



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November/December 1991  
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Locomotive by Charles Linn

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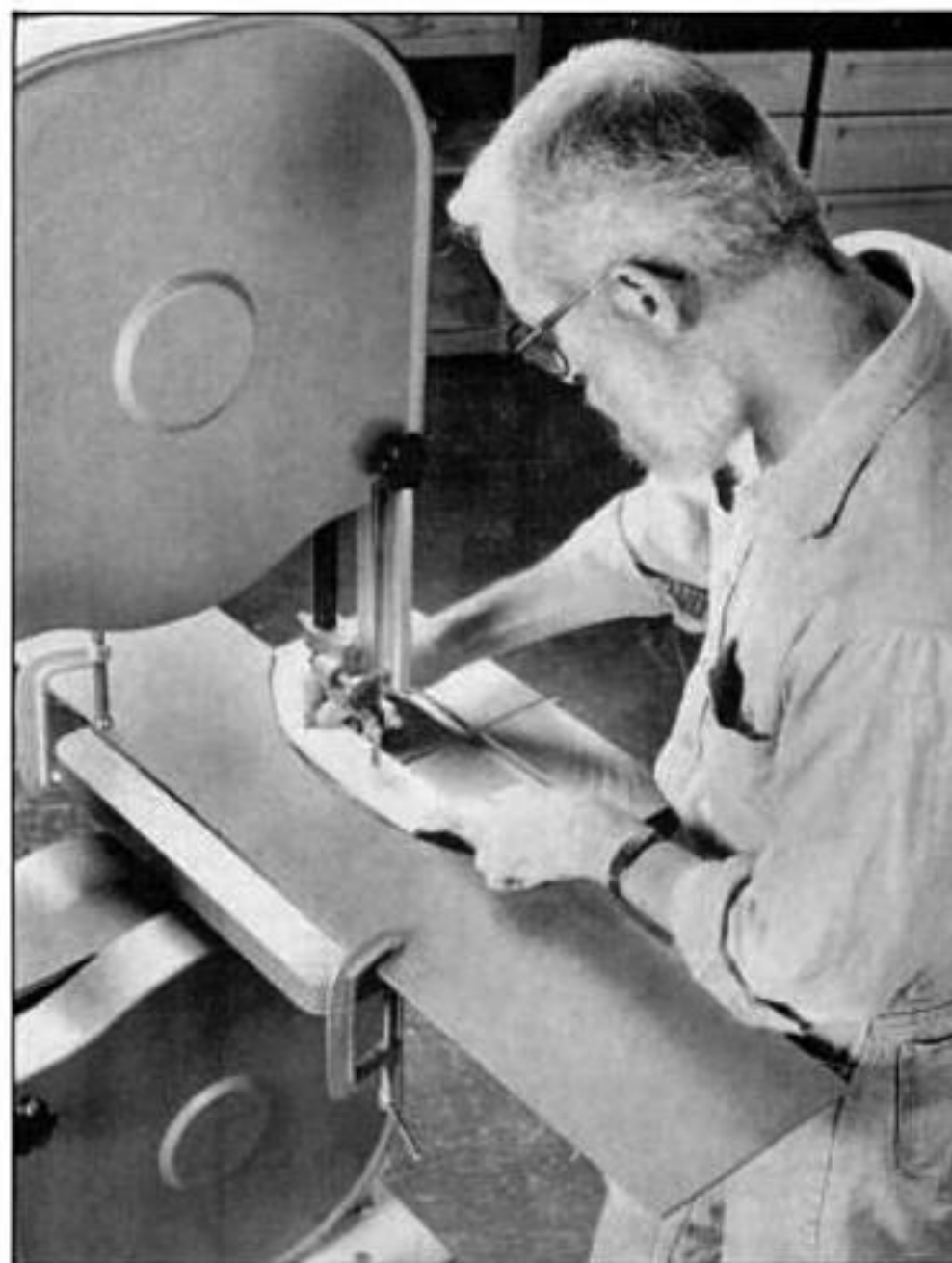


PHOTO BY JOHN HAMEL

**CURVED BANDSAW FENCES 18**

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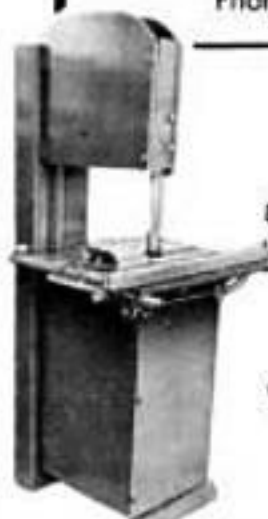
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## A WORD FROM THE STAFF



### *Happy Holidays From the Staff of American Woodworker*

FRED MATLACK   GLENN HUGHES   BOB MORAN   DAVE SELLERS   MICHAEL MANDARANO  
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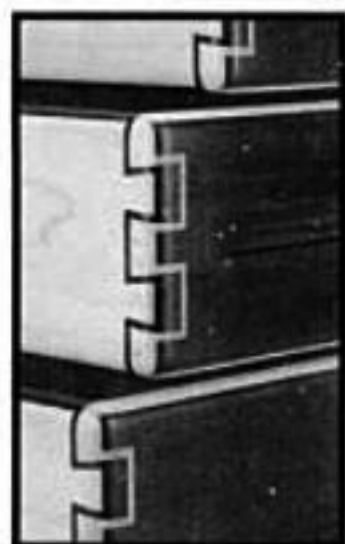
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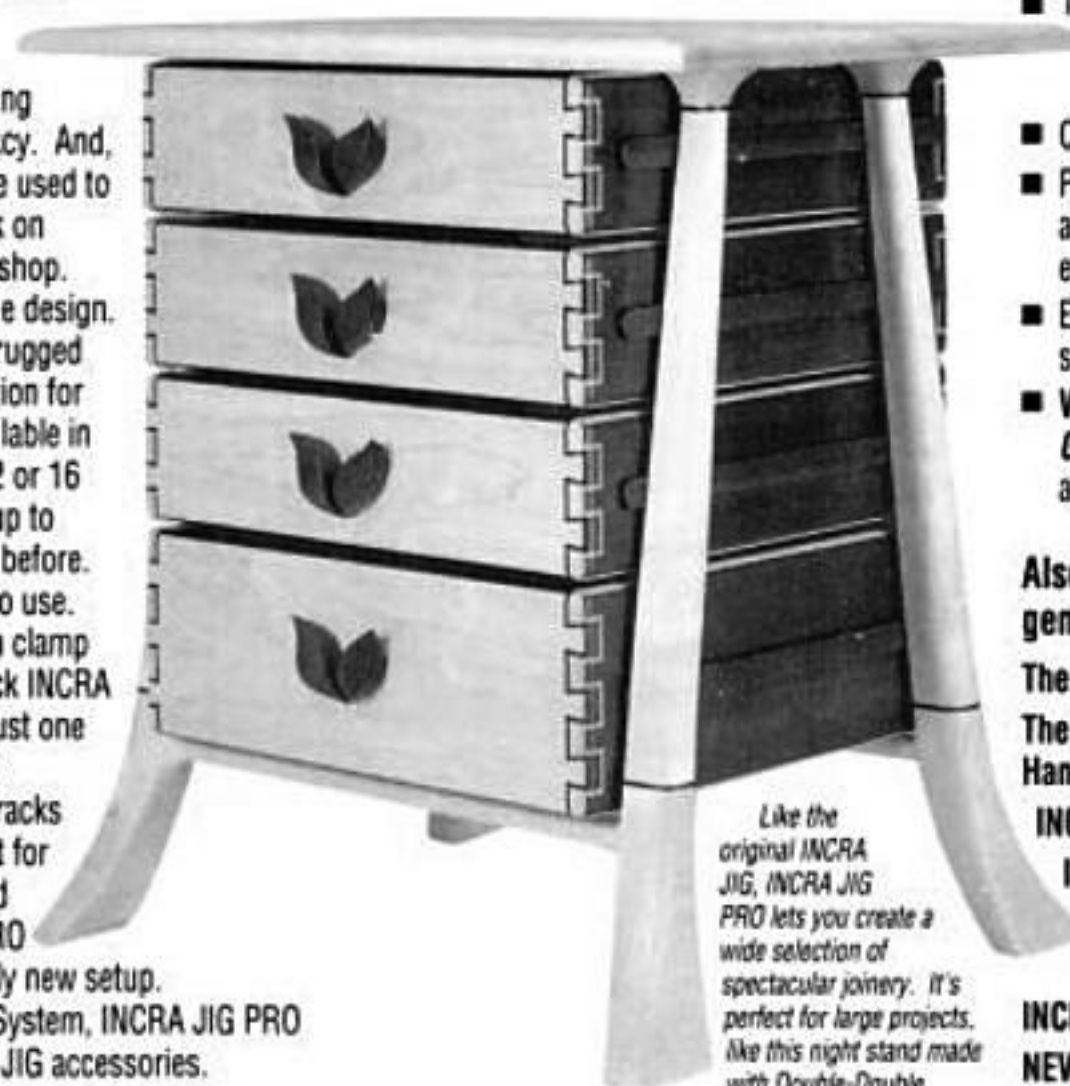
**T**he new INCRA JIG PRO, the latest innovation from Taylor Design, uses the same rack positioning technique that gives INCRA JIG its phenomenal accuracy. And, just like the original INCRA JIG, INCRA JIG PRO can be used to produce flawless joinery as well as other intricate work on virtually any stationary woodworking machine in your shop.



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## Discount Prices: The Real Bottom Line

Your article on mail-order shopping troubled me. Your conclusion is to always buy from the lowest-priced supplier. There are a few problems with this as a general policy.

1. Where are you going to get replacement parts for the tool you buy? Most deep-discounters avoid carrying any service parts because they are low volume and unprofitable at any price.

2. Where are you going to find out about the tools that you are going to purchase at the lowest possible price? You will find that the "laundry-list" fellows provide little or no information. Their specialty is cashing in on the information and advertising efforts of others. You can only publish a laundry list if someone else has already educated the customer.

3. Who is going to test a new product and introduce it to the consumer? Again, not the laundry-list fellows.

4. Where are you going to buy veneer tape, glue brushes, cabinet scrapers, and all the small-dollar items that a shop needs? The laundry-list fellows only stock the hot movers, not the broad spectrum of tools necessary to every shop.

5. When you choose the lowest price, are you achieving the lowest cost? When our customers return a product that is unsuitable for any reason, we pay the return-shipping cost as well as refund all original charges, including outgoing-shipping charges. Lowest price isn't always lowest cost.

6. When the deep discounts have finally removed research, education, testing, and design from everybody's budget, where will new tools come from? They will only come from national advertisers (the Ryobis and Makitas), and the quality will drop because there will be fewer critical vendors. If you can't afford to analyze the product and put it through some tests, how can you provide feedback to the manufacturer? Without a functioning feedback loop, a manufacturer rapidly becomes ignorant.

LEONARD G. LEE  
President, Lee Valley Tools Ltd.  
Ontario, Canada

## You Must Be Joking

C'mon, come clean. Those "Sunrise dovetails" sketched by Karl Shumaker (AW, #21) have got to be a joke! Even if you can cut them, I can't see how you can get them together. There's no way to slide the pins into the tails! If I'm mistaken, I hope you can show me where I've gone wrong.

JIM ORR  
Portland, OR

**Karl Shumaker responds:** *Good eye! The "Sunrise dovetail" doesn't look like it will go together, but it will. I'll show how to make the joint in a future issue.*

## Shaker Postmark

Your editorial in the June issue (AW, #20) overlooked a fine Shaker museum, containing one of the largest collections of Shaker furniture that's still housed in an original building at the South Union, Kentucky colony. It is the only colony that still has an oper-

ating U.S. post office in one of its original buildings. One can still get an official and authentic Shaker postmark stamped "South Union KY". South Union is 12 miles south of Bowling Green on U.S. Rt. 68.

DAVID GORDON  
Bowling Green, KY

## Recycling Solvents

With regard to the June 1991, AW letter asking about saving/disposing of paint thinner et al.; I recycle it by keeping it in a metal container and letting the solids settle out for future brush cleaning, etc. It takes anywhere from two weeks to a month for the solvent to settle out clear. I then pour it into a supply container. Just make sure the settling containers are made of metal for safety reasons. Cleaned-out (old) varnish cans work fine. As a result of this, I haven't bought more than about a gallon per year (of paint thinner).

BOB KONIGSBERG  
Los Gatos, CA

An answer to the "Toxic Dilemma" might be as close as your local body shop. All body shops and mechanic shops are supposed to have their waste solvents and paint picked up periodically. You might have to pay a small fee, but some body shops will take the solvents off your hands. Another thought might be to have your local woodworking club establish a contract with such a company.

CRAIG S. BUNKER  
Savannah, GA

## Correction

Woodstock International is a manufacturer of woodworking tools and accessories and is not a mail-order company as listed in AW, #22.

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

## Checking Jointer Table Flatness

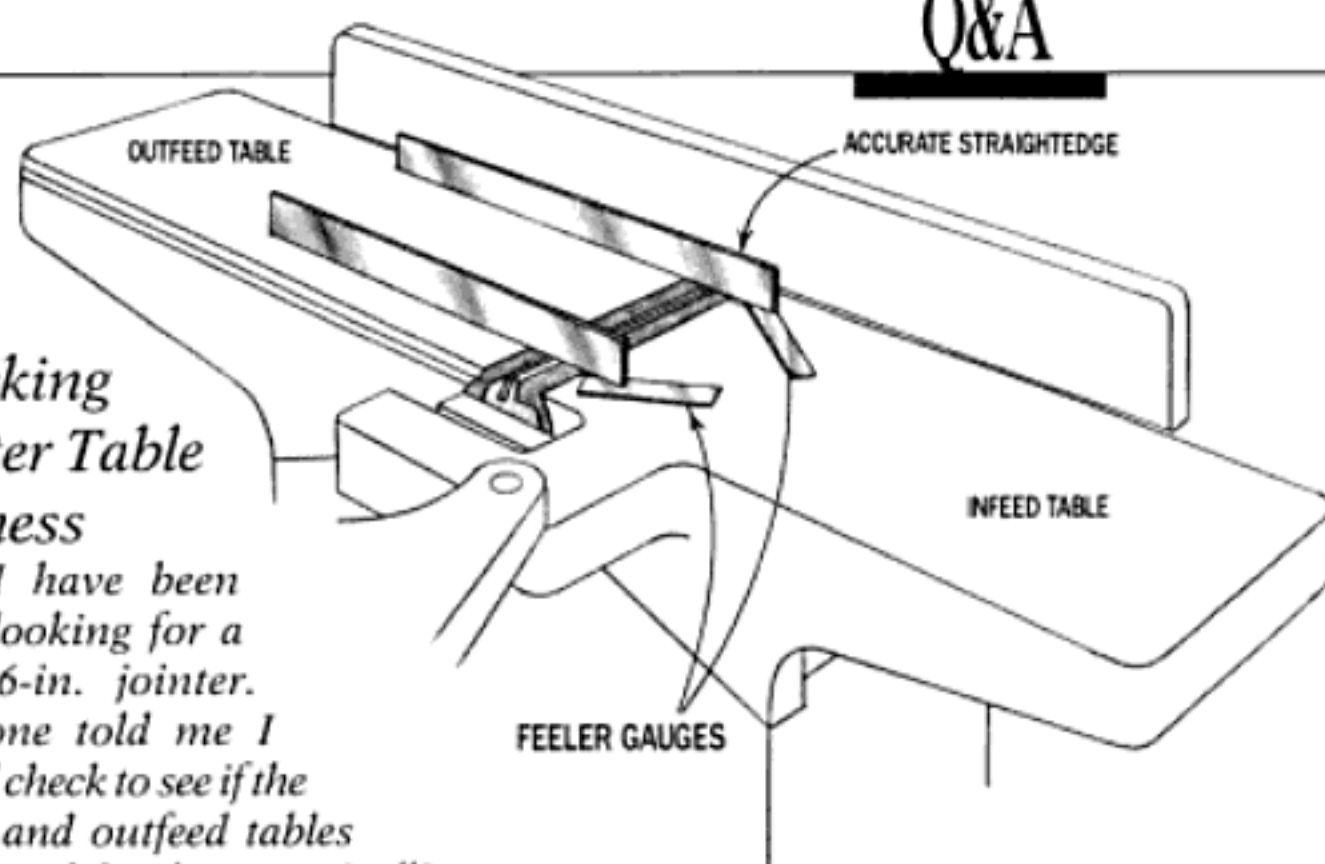
**Q.** I have been looking for a used 6-in. jointer. Someone told me I should check to see if the infeed and outfeed tables are warped, but how can I tell?

**A.** It's fairly simple to check jointer tables for warping and parallelism. You'll need two accurate straightedges, one about 1 ft. long and another about 4 ft. long, and two sets of feeler gauges (available at auto-supply stores).

With the jointer unplugged, adjust the gib screws on the infeed and outfeed tables so the tables can be raised and lowered smoothly but with no play. You may need to partially disassemble, clean and relubricate the tables to do this well. Next, adjust the infeed table so it's just slightly lower than the outfeed table and lock both tables. Move the fence and guard out of the way.

First check for out-of-parallel across the width of the tables. Place the short straightedge on one side of the outfeed table, and extend it slightly over the infeed table. (See drawing.) Measure the clearance between the straightedge and the infeed table with feeler gauges as shown. Move the straightedge to the other side of the table and measure again. The difference in the measurements indicates how much the tables are out-of-parallel across their width. New machines should be within .001 in. Most woodworkers will get satisfactory results from a machine that is .002 in. out of parallel.

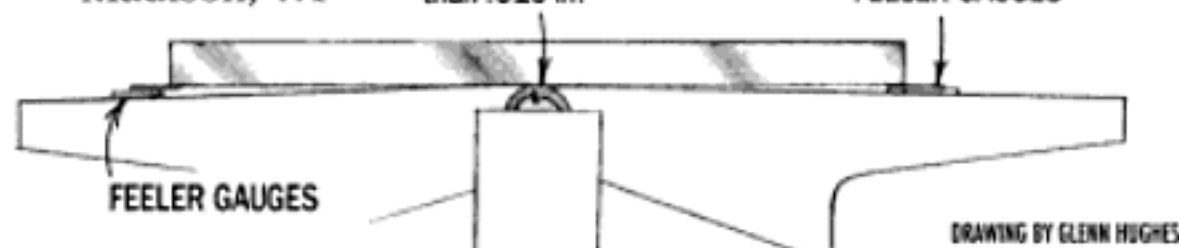
Next, check along the length of the tables. Hold the short straightedge in the same position as mentioned above and raise the infeed table to just touch it. Remove the short straightedge and place the long straightedge along the



BUDD GROSS  
Madison, WI

Center should "rise" no more than .010 in.

FEELER GAUGES



center across both tables. At each end of the straightedge, insert equal thicknesses of feeler gauge between the straightedge and the table. Try different thicknesses until the straightedge barely touches the tables at the cutterhead opening. (See drawing.) New jointers should be no more than .006 in. out of flat along the length of the tables. As much as .010 in. out of flat is acceptable for a used jointer.

To check for warping, repeat this test, placing the long straightedge diagonally across both tables. If one or both tables are warped, the rise measured on one diagonal will not be the same as the rise measured on the other diagonal.

CHESTER GREATHOUSE  
Vice President of Engineering  
Powermatic  
McMinnville, TN

## Case Hardening Explained

**Q.** I bought some flat-sawn, kiln-dried black cherry that was almost all heartwood and almost free of defects. When I ripped the boards to narrower widths, some of the boards immediately started to warp. What happened?

JAMES CLARK  
Garland, TX

**A.** Your letter indicates "immediate warp," so there's no doubt your lumber has been case hardened.

This is a drying defect that results in abnormal tension in the outer wood fibers of a board. Case hardening is caused by the outer fibers drying and beginning to shrink while the inner fibers are still moist and haven't shrunk, thereby causing tension.

When case-hardened lumber is ripped, the cut unbalances the fiber tension and it warps.

In normal drying procedures, lumber is "conditioned" by brief steaming at the end of drying. This swells the outer fibers while the inner fibers remain unaffected, canceling the tension. Properly done, conditioning creates stress-free lumber.

DR. EUGENE WENGERT  
Professor, wood technology  
Virginia Polytechnic Institute  
Blacksburg, VA

## Lathe Scrapers from Files

**Q.** I like to turn bowls on my lathe. I want to try making some scrapers for turning out of old metal files. Is this possible? How do I go about it?

ROBINSON R. GOIN  
Babylon, NY

**A.** It's possible to make perfectly good lathe tools from thick old files. I suggest that you shorten the file to about 8 in. and keep the cutting edge no more than 1/2 in. from the tool rest when working to minimize the risk of breakage. To shorten a file, grind a "V" groove on both sides and snap it off.

To make a scraper, first grind the bottom of the file smooth with a coarse belt on a belt sander. Dip the file in water often to cool it. If it gets hot enough to turn blue, you've removed the temper. It's not necessary to grind the teeth off the bottom, but you want them smooth so they won't cut the tool rest. On the top, grind the teeth completely off for about 1 in. behind the cutting edge.

Next, grind the end to the desired shape with a bench grinder and sharpen the scraper by grinding a 15° bevel along the shaped end, to create

a wire edge, which will do the cutting. Regrind often for the best cutting.

ANDY BARNUM  
Turner and toolmaker  
Carmel, NY

## Refinishing Golf Clubs

**Q.** A friend asked me to refinish the wooden heads of some golf clubs. What would you recommend as the best finish to use and how would you apply it?

THURMAN EVANS  
Crossville, TN

**A.** First notice the etched lines across the slightly curved face of the club head. The lines and the profile of the curved face determine the trajectory of the ball for your friend's next "hole in one," so disturb them as little as possible. Leave the metal weight screwed into the bottom of the head.

Mask the finial area (where the head joins the shaft) with masking tape. Strip off the old finish with paint remover and rinse the wood with lacquer thinner. Clean out the etched lines on the face with a toothpick. Once dry, sand very lightly.

For the new finish, I'd recommend a pigmented oil stain (like Minwax) with a clear polyurethane top coat. For a two-tone finish, apply the lighter or transparent color first. Let it dry overnight before masking and applying the darker color. Next, apply four coats of polyurethane, scuff sanding between coats. After the polyurethane is completely dry (in about a week) rub it out with paste wax and #0000 steel wool. Golf clubs take their greatest beating from sunlight and banging around in the golf bag, so keep the socks on the clubs.

NANCY LINDQUIST  
Refinishing consultant  
Kansas City, MO

## WHERE TO FIND IT

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**Glass-etching materials** in a kit, are available from Mason & Sullivan Co., 586 Higgins Crowell Rd., West Yarmouth, Cape Cod MA 02673.

**Snap-apart hinges** with spring-loaded hinge pins to make doors easy to remove are available from Jamestown Distributors, P.O. Box 348, Jamestown, RI 02835.

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Same as Above With Plastic Case  
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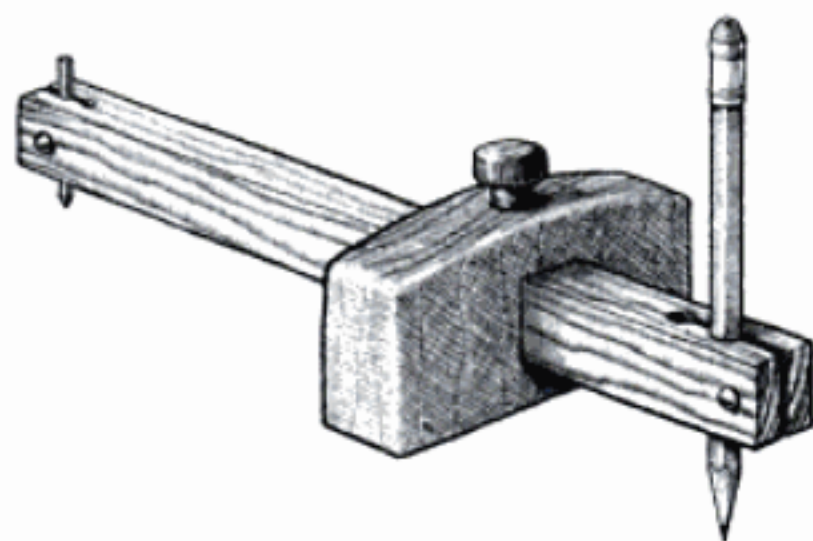
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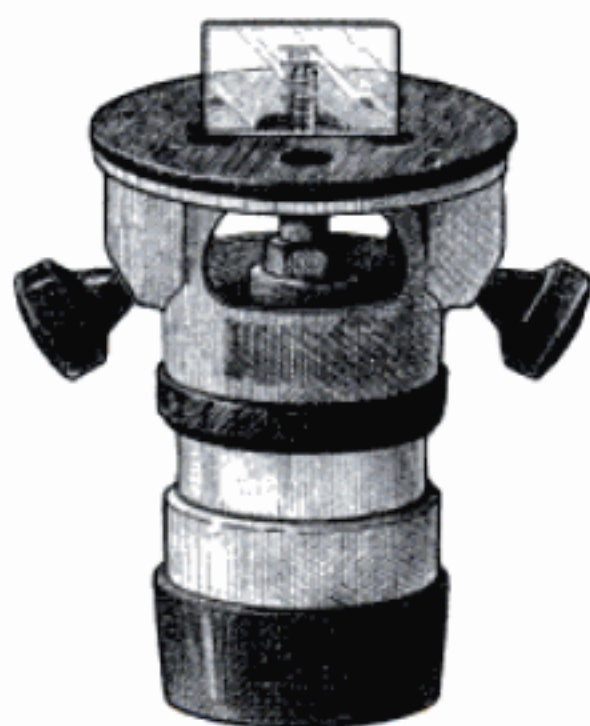
CIRCLE NO. 3 ON PRODUCT LITERATURE CARD



## Versatile Marking Gauge

You can make your marking gauge more versatile by drilling a hole in it to hold a pencil. Drill the end opposite the scribing point and saw a kerf as shown. Drive in a screw so you can tighten the grip on the pencil. When a scribe mark won't do, you can stick in your pencil and use the pencil end of the gauge.

SIMON WATTS  
San Francisco, CA



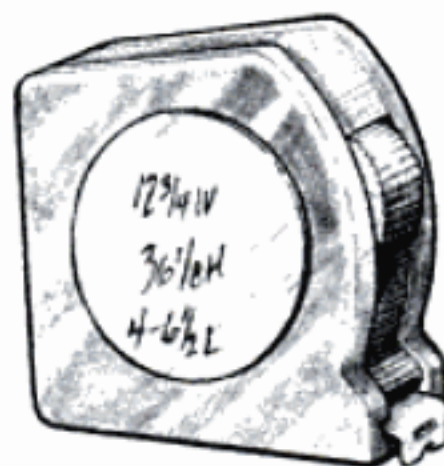
## Tool Setting Scale

I use a see-through scale that I made from Lucite for setting the depth-of-cut for router bits, saw blades and similar tools. It's easy and accurate to use because the marks are on the side of the Lucite that is against the cutter. The Lucite is so clear that it's like having the marks suspended in midair. Make it any size you like, and use whatever pattern of marks you prefer. Scribe the marks in the Lucite, and then if you want them bolder, go over them with a felt-tip pen and rub off the excess ink. If you label the marks, be sure to put the labels on the side of the Lucite opposite to the marks so they don't appear backward when you use the scale.

## Tape Measure Turned Note Pad

Have you ever noticed how easy it is to erase pencil marks from plastic laminate? A wet thumb will do it. I peeled off the label from my tape measure and glued a round scrap of plastic laminate in its place with contact cement. Now whenever I measure anything, I've got a handy spot to jot down the measurement.

CHRIS CAREY  
Houston, TX



## Centering Jig

You can make your own centering jig for drilling or marking. Bore three evenly spaced holes through a piece of scrap wood in a straight line. The distance between the outer holes must be greater than the width of the stock you want to center on. Glue short dowels in the outer two holes (1/4-in. dia. is appropriate, but use whatever you have.) For mark-

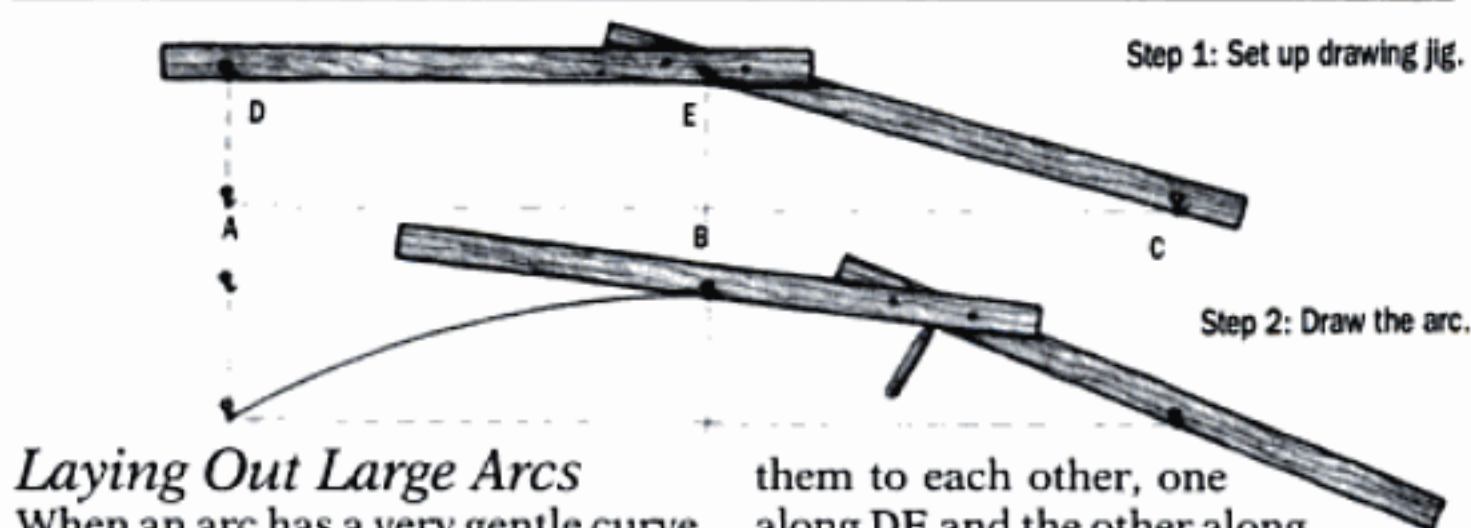
ing, the center hole should be sized to hold your pencil snugly. For centering a drill bit, the center hole must be the same diameter as the drill bit. To use the jig, place it on the stock so the dowels are over the edges and twist it until the dowels touch the edges. You can slide it along to mark a centered line.

J. A. WILSON  
Lexington, MA

## Precise Door Alignment

Mounting hinges on small doors or lids to the proper clearance or alignment can be a frustrating problem. When I use a hinge that requires a mortise on the case but not on the door or lid, I first cut the mortise and screw the hinge to the case. Next, I close the hinge, put a drop of hot-melt glue on the unattached leaf and lay the door in place carefully aligned. When the glue sets in a minute or two I add the screws.

DAVID JOHNSON  
Apple Valley, MN



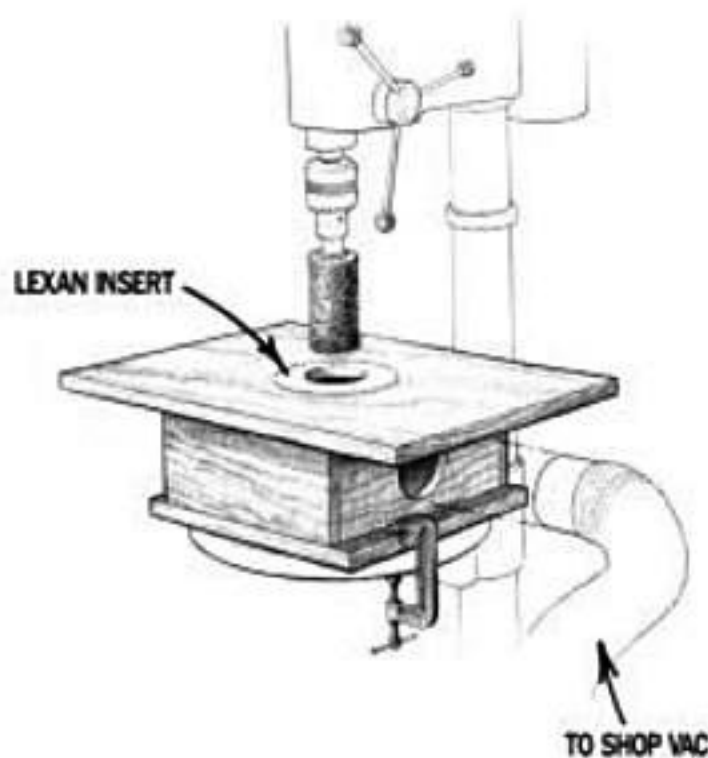
## Laying Out Large Arcs

When an arc has a very gentle curve, it may be easier to lay it out from the span and rise instead of from the radius. You'll need two sticks and a few nails. First lay out the span, AC, the midpoint, B, and the rise, E, directly above B. Next add D directly above A so that AD also equals the rise. Drive nails part way in at A, C, D and E. Take two sticks, each a few inches longer than EC, and nail

them to each other, one along DE and the other along EC as shown. Nail the sticks securely so the angle between them doesn't change. Put your pencil in the angle where the two sticks join and slide the sticks through one half of the arc and then the other half. Hold the sticks against the nails at A and E and then against the nails at E and C.

ANGELO ROTONDO  
Pueblo, CO

# TECH TIPS



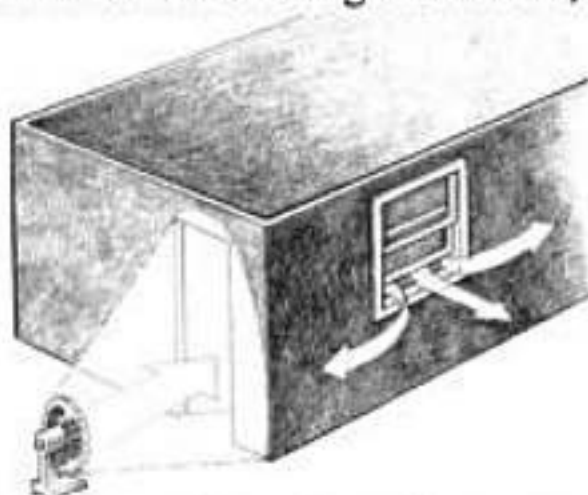
## Dust-Free Sanding

For dust-free drum sanding on your drill press, build a sanding table to clamp to your drill-press table as shown in the drawing. The  $\frac{3}{8}$ -in. thick Lexan inserts allow you to use different-diameter drums and maintain a  $\frac{1}{8}$  in. maximum clearance between the drum and the insert.

JEFF CHANCEY  
Stevensville, MI

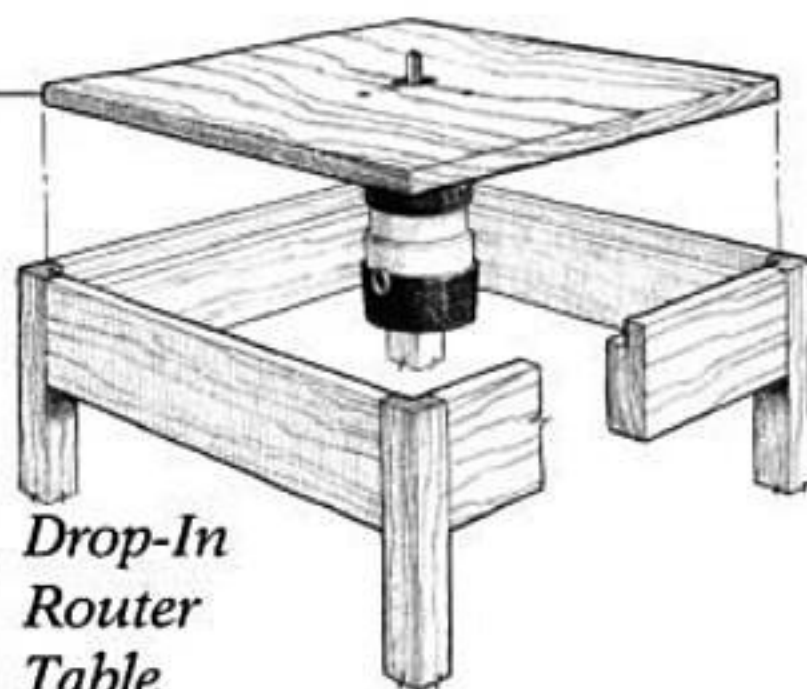
## Positive-Pressure Ventilation

Positive-pressure ventilation (PPV) safely removes solvent fumes from a room more effectively than suction. If you place a fan 3 ft. to 12 ft. outside a room to blow through the door, the



fan's cone of moving air covers the doorway and pressurizes the inside. By opening a window, you allow the pressure and fumes to escape. The room will clear quickly and no explosive fumes pass through the fan.

STEVE LONG  
Norman, OK



## Drop-In Router Table

I built my router table so the tabletop fits in a rabbet along the inner edge of a frame. The weight of the router keeps the top in place, but it's removable for easy installation or adjustment of the router.

WESLEY PHILLIPS  
Greer, SC

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

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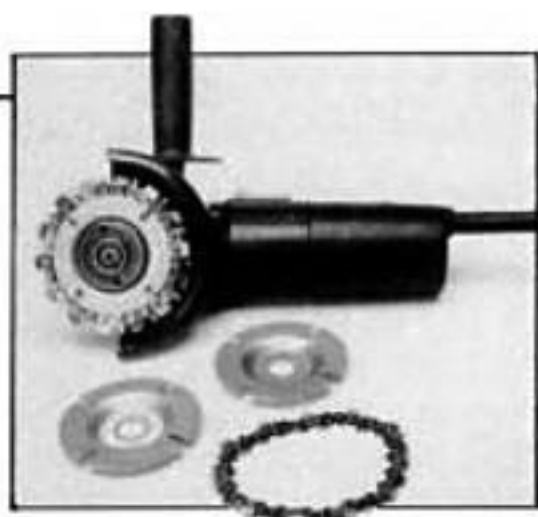
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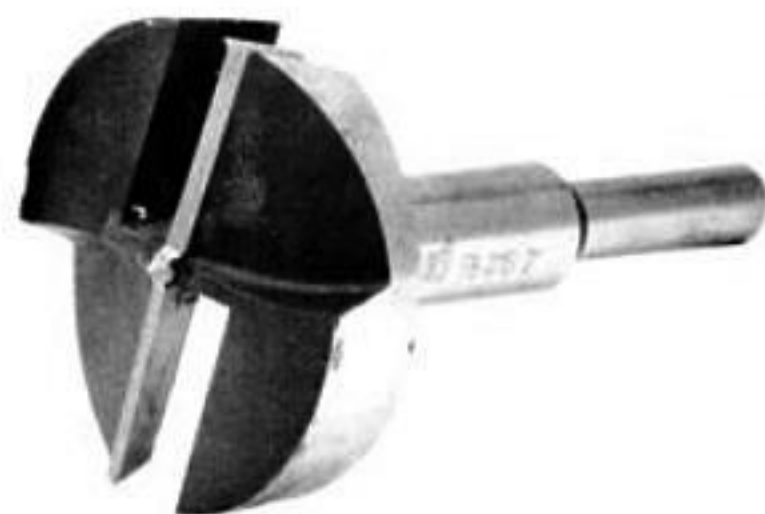
## Carving Tool With Teeth

Lancelot is the name of a new accessory for right-angle grinders that cuts, carves, hollows and shapes wood. It consists of a 4-in. dia. closed "circlet" of chain-saw teeth mounted between the rims of two stainless-steel discs. Slots in the discs keep the saw teeth cool. The assembly fits 4-in. and 4½-in. right-angle grinders with ⅝-in. and ⅞-in. dia. arbors. Models are available with two different chain-saw circlets—a 14-tooth for roughing out large areas with rapid wood removal, and a 22-tooth for a smoother surface finish. The saw teeth are easy to sharpen with a chain-saw file, and replacement chain circlets are available. (Price: \$34.95 plus \$4 shipping) ■ *FEC International, Dept. AWT, 3225 Earl Dr., Tallahassee, FL 32308, (800) 942-1300.*

## The Best From the Hardware Show

The National Hardware Show in Chicago is the biggest event of its kind. Each year, manufacturers exhibit an unbelievable variety of new tools, materials, and hardware items. This year there were 3,000 exhibitors who covered 19 acres of floor space! Hardware retailers—from local mom-and-pop stores to the largest nationwide chain stores—came to the show to choose the new products they'll sell on their shelves in the coming year.

Here's a sampling of the best new woodworking products that *AMERICAN WOODWORKER* editors spied at the 1991 National Hardware Show in August.



## Carbide Forstner Bits

Chances are you'll never have to worry about sharpening the cutting edge on Freud's new carbide-tipped Forstner bits. They'll last up to 40 times longer than ordinary steel Forstner bits, and they won't lose their temper if they get hot. You also can drill holes in laminate and solid surfacing material with the new carbide Forstner bits. They're available in sizes from ⅝-in. dia. up to 2 ½-in. dia. in ⅛-in. increments. Sets of seven or 16 bits will be offered. (Price: \$10 for ⅝-in. to \$45 for 2 ½-in.)

■ *Freud, Dept. AWT, P.O. Box 7187, High Point, NC 27264, (919) 434-3171.*

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**A / Giant 17" x 11" Aluminum Shop Dustpan Makes Short Work Of Clean Up**  
Shops generate huge amounts of debris. The extra capacity of this dustpan makes clean-up faster. It's like using a shovel instead of a trowel.

24K03.01 Giant Dustpan \$13.40

**B / Band Saw Blade Tuning Stone Helps Produce Tighter, Smoother Curves**  
This 3" x ½" x ¼" Silicon Carbide stone is strongly recommended in the best-seller *Band Saw Handbook*. Comes with complete instructions on how to gently round the backs of your blades. The difference in performance is remarkable.

38M01.01 Blade Tuning Stone \$8.95

**C / Versatile & Strong Shop Cloths Repay Their Extra Cost Quickly**  
Soft as cotton rags but much thicker, and alot stronger than paper toweling. Very absorbent, lint free and can be rinsed and reused many times. Great for picking up glue squeeze-out and staining as well as machinery clean-up. Each is 10¼" x 16½".

23K02.01 100 Shop Cloths \$12.95



**F**

**G**

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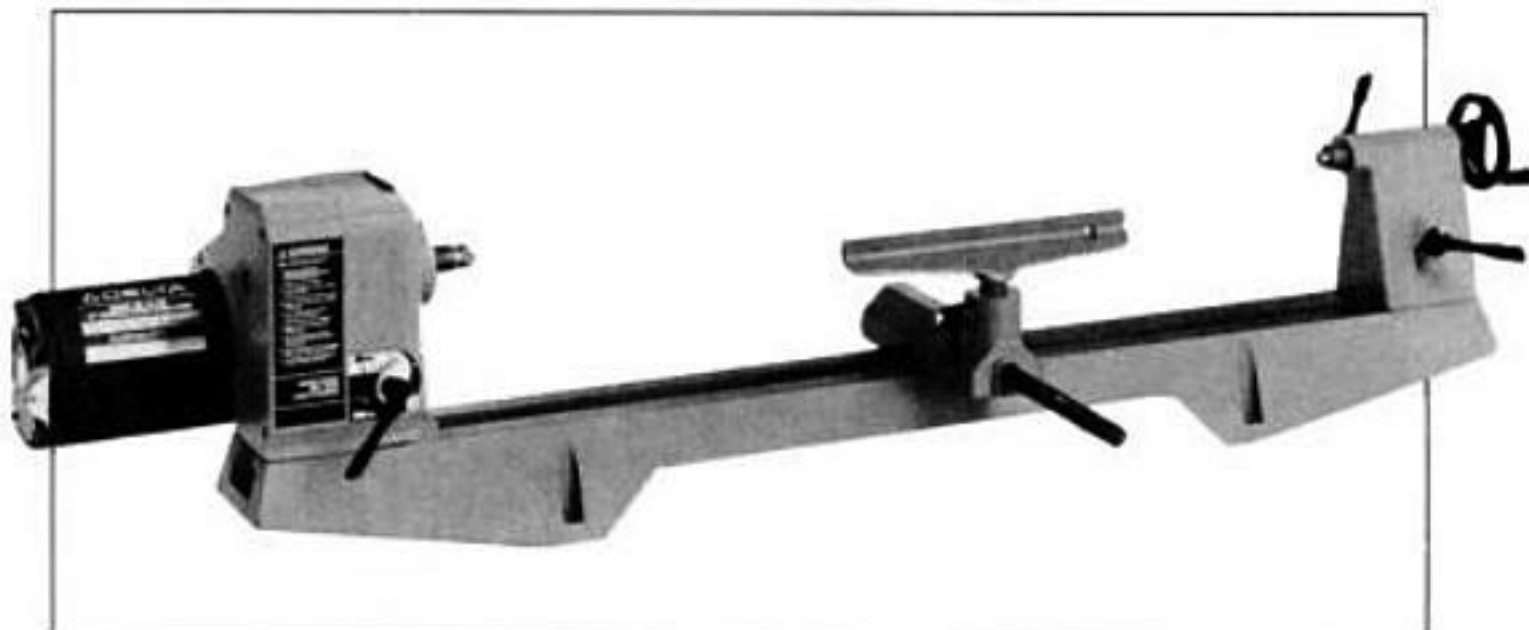
# TOOLBOX

## Waterproof Woodworking Glue



Until recently, waterproof glues had to be mixed from two different components to prepare the glue for use. Titebond II from Franklin is the first one-part woodworking glue to pass ANSI (American National Standards Institute) Type II waterproof testing. This means it is recommended for all outdoor wood gluing projects *except* joints that will be continually submerged in water. Titebond II works just like the original Titebond yellow (aliphatic resin) woodworking glue. It sets quickly, cleans up with water, cures overnight, sands easily and forms a bond stronger than the wood. (Price: \$3.56, 8 oz.; \$5.90, 16 oz.; \$24.22, 1 gal.)

■ Franklin International, Dept. AWT, 2020 Bruck St., Columbus, OH 43207, (614) 443-0241.



## New Delta Lathe

Delta's new lathe offers the weight and stability of cast-iron construction at a price that's right for the home-shop woodworker. It has a beefy cast-iron bed, 3/4-HP motor and variable-speed range from 500 to 2,000 rpm. It can turn stock up to 12 in. in diameter and 36 in. long between centers. The head stock is

a new design that can swivel at right angles to the lathe bed in order to turn faceplate projects up to 16 in. in diameter. The lathe mounts to a benchtop or a stand you can construct yourself. (Price: \$600)

■ Delta International Machinery Co., Dept. AWT, 246 Alpha Dr., Pittsburgh, PA 15238, (800) 223-7278.

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| 201B                                                                                  | 1/4  | 3/16    | 11.00    | 703   | 1/4      |          | 5/8     | 5/8 11.00           |            |
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# CURVED BANDSAW FENCES

FIG. 1: SAWING WITH A CURVED BANDSAW FENCE

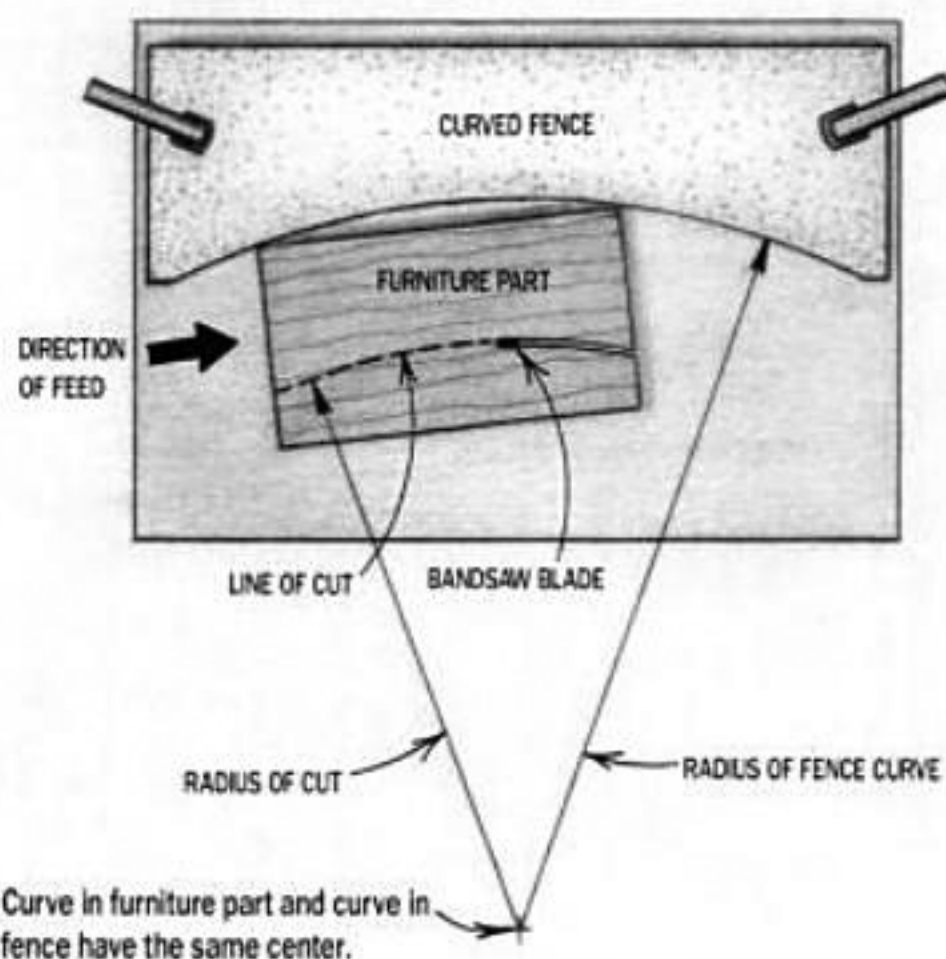
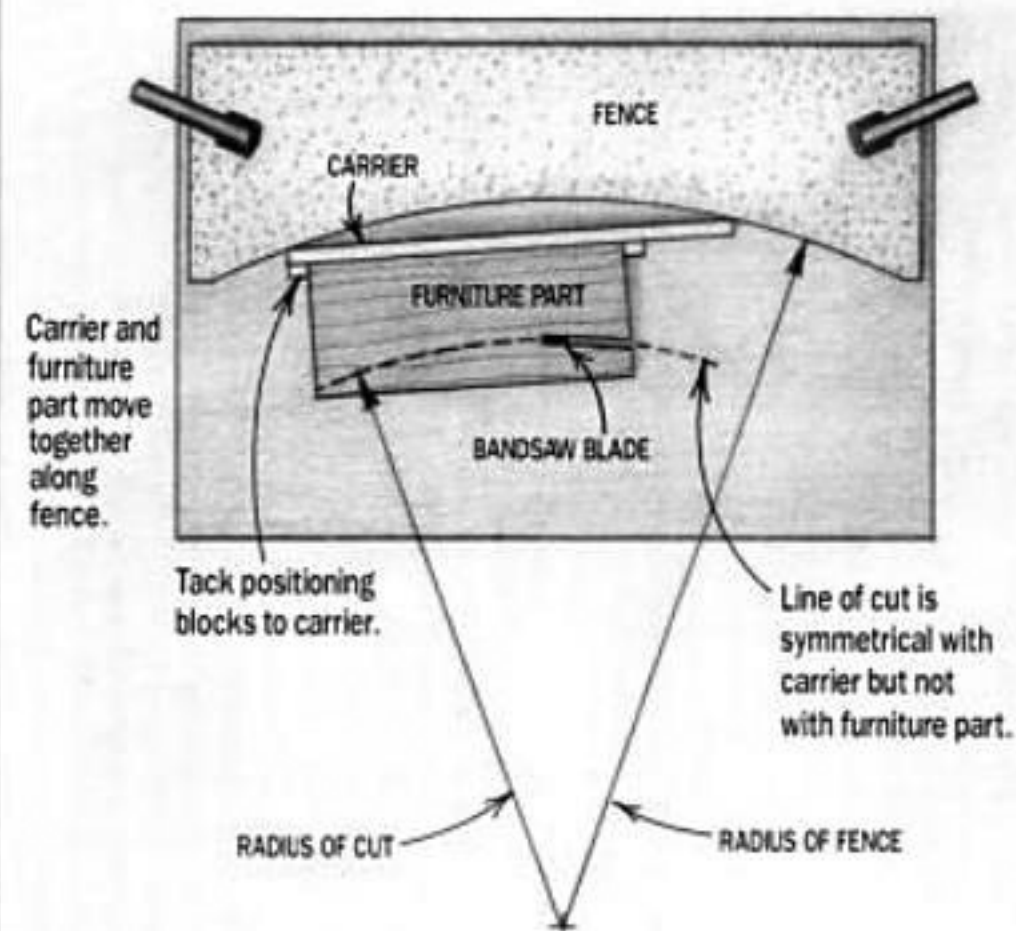


FIG. 2: SAWING ASYMMETRICAL PARTS



# A Clever Way to Cut Duplicate Arcs

BY BOB MORAN

Discovering a good, new technique always makes my day. I recently made such a discovery while bandsawing identical arcs in a batch of small furniture parts. I noticed how the sawdust on the bandsaw table accumulated everywhere except where the pieces of wood passed. Because I was cutting arcs, the pieces of wood followed a curved path and the clean part of the bandsaw table had a curved edge.

"Hmmm..." I thought. "A curved fence right where that sawdust lies would guide these pieces through exactly the same path." In less than five minutes I had cut out my first curved bandsaw fence, clamped it in place, and started feeding the rest of my furniture parts through the saw. The photo on the opposite page and Fig. 1 show the setup. The results were not only faster but also more uniform than marking each piece and carefully sawing to the line. I was sold. Curved bandsaw fences now have a permanent place in my "bag of tricks."

To get the correct fence curve, I lay out the line of cut directly on a piece of 1/4-in. hardboard, then place a workpiece in position over the line of cut and trace around it. Finally, I draw the curve for the fence so it touches the corners of the traced workpiece. I usually make the fence about two-and-a-half times as long as the length of the part to be sawn. I saw the curve in the fence freehand, then smooth the saw cut with a spokeshave, clamp it in place on the bandsaw table, and I'm ready to feed the parts through the saw.

Notice that the setup shown in Fig. 1 will cut the curve at the midpoint of the workpiece; that is, the finished piece will be symmetrical. That's fine for aprons, rails, door frames and so on, which are usually symmetrical. If you need to cut a curve of this sort in a non-symmetrical part, you'll have to make a carrier like the one shown in Fig. 2. The carrier and workpiece move together along the fence.

If you want your workpiece to have a convex curve instead of a concave curve, you can plan things so the concave piece against the fence is the waste piece. The only drawback to this approach is that the concave waste piece must be wide enough so it won't flex and cause an inaccurate cut. This may mean wasting a bit more wood than you would otherwise need to waste.

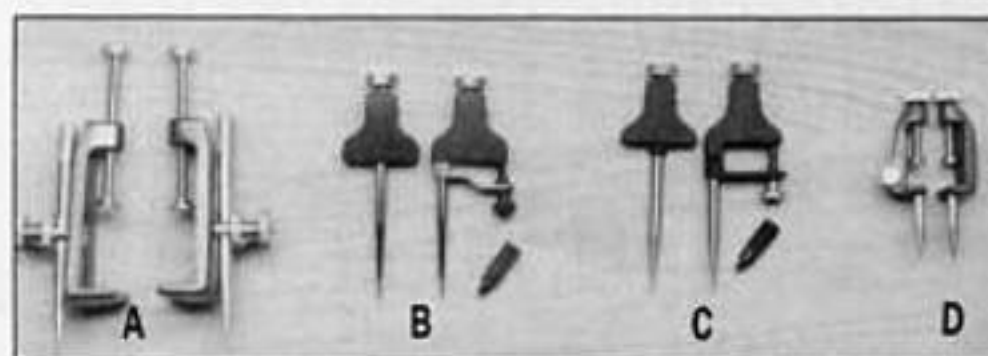
I use a similar technique for sawing curves on the front face of chair rails as shown in the photos above. By tilting the bandsaw table, the blade cuts a curve in one edge of the stock but exits from the face of the stock without cutting the second edge.

Sawing curves with a curved fence on a bandsaw is as easy as sawing a straight line with a straight fence. Try it. I guarantee, you'll like it. ▲

Bob Moran is assistant editor of AMERICAN WOODWORKER.



Tilting the bandsaw table and sawing a curve on the edge of the stock (above) produces the subtle arch in the lower rail of a chair (right).



## TRAMMEL POINTS: LAYOUT TOOL FOR LARGE ARCS

Large circles or arcs are drawn, or "struck," with a pair of trammel points. Two trammel points clamped to a stick, or "beam," work like large dividers. You buy the trammel points and make your own beam, usually out of wood.

There's variety in the quality of trammel-point sets. Ruggedness, precision and finish improved as the price goes up. Here are some highlights.

The Kunz set (photo D) from Woodcraft is notable for its ruggedness. The Starrett set (photo C) from Garrett Wade is beautifully finished and very precise. The very similar General set (photo B) from Trend-Lines lacks the fine finish but costs much less than the others. Garrett Wade's 10N35.01 set (photo A) is rugged, precise, and will clamp to a very large beam. It's my first choice. Tool catalogs also list less expensive "beam compasses" that mark with a pencil instead of scribing with a steel point.

### MAIL-ORDER SOURCES

Trammel-point sets and beams are available from:  
**Garrett Wade**, 161 Ave. of the Americas, New York, NY 10013, (800) 221-2942.

**Trend-Lines**, 375 Beacham St., Chelsea, MA 02150, (800) 343-3248.

**Woodcraft**, P.O. Box 1686, Parkersburg, WV 26102, (800) 225-1153.

**Woodworker's Supply**, 5604 Alameda Place N.E., Albuquerque, NM 87113, (800) 645-9292.



**Riding the rails in style. This streamlined locomotive is a reproduction of an original 1930s-era riding toy.**

PHOTOS BY MITCH MANDEL

*A Child-Powered  
Classic Rides the  
Rails Again*



PHOTOS BY JOHN HAMEL

# WOODEN LOCOMOTIVE

BY CHARLES LINN

When I spotted this 1930s-era locomotive in an antique store, I just had to build one like it. The form and utility of this object are easy to appreciate. Its maker combined inexpensive softwood and the simplest joinery with a streamlined, aerodynamically inspired form. The resulting toy was a winner at a time when money was scarce and toys were luxury items for many American families.

Clearly, the locomotive's manufacturer was intent on keeping costs down. Most of the boards are planed on the outside only; the undercarriage looks as if it were assembled from scraps. There's no fancy joinery—only butt joints held with box nails. The original is so crookedly constructed, I've wondered if it wasn't hastily assembled from a kit by a nervous daddy on a Christmas Eve long ago.

I found this basic scrap construction to be part of the appeal of this design. This locomotive can be built in a few workshop sessions with very basic tools. You might even find most of the needed wood in your scrap box.

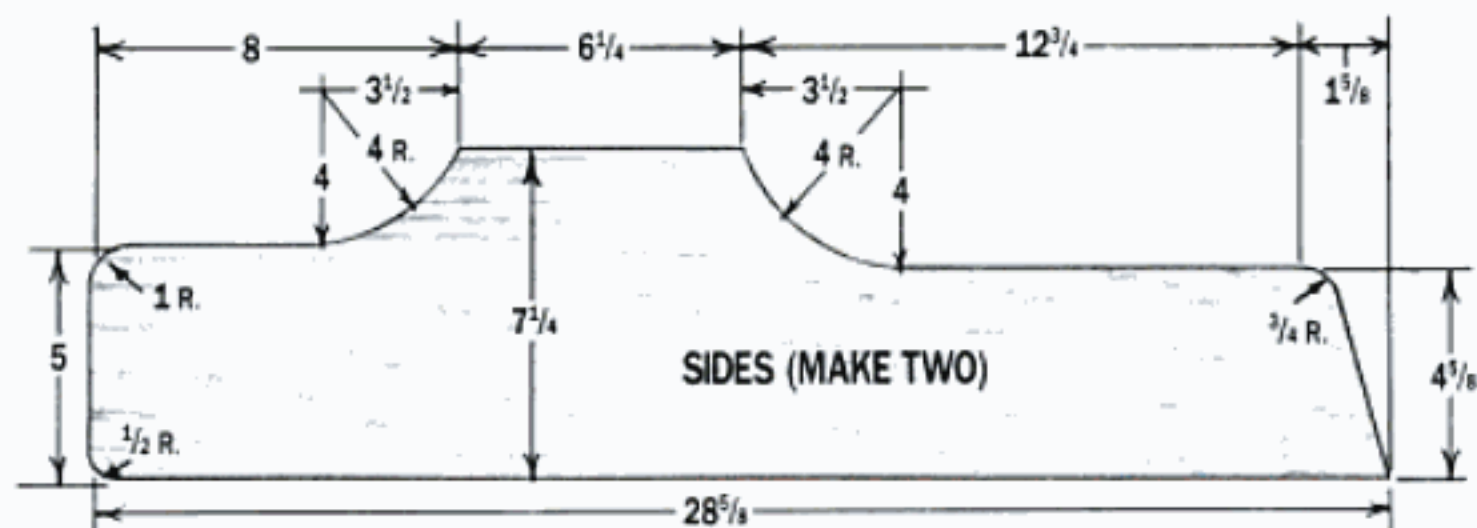
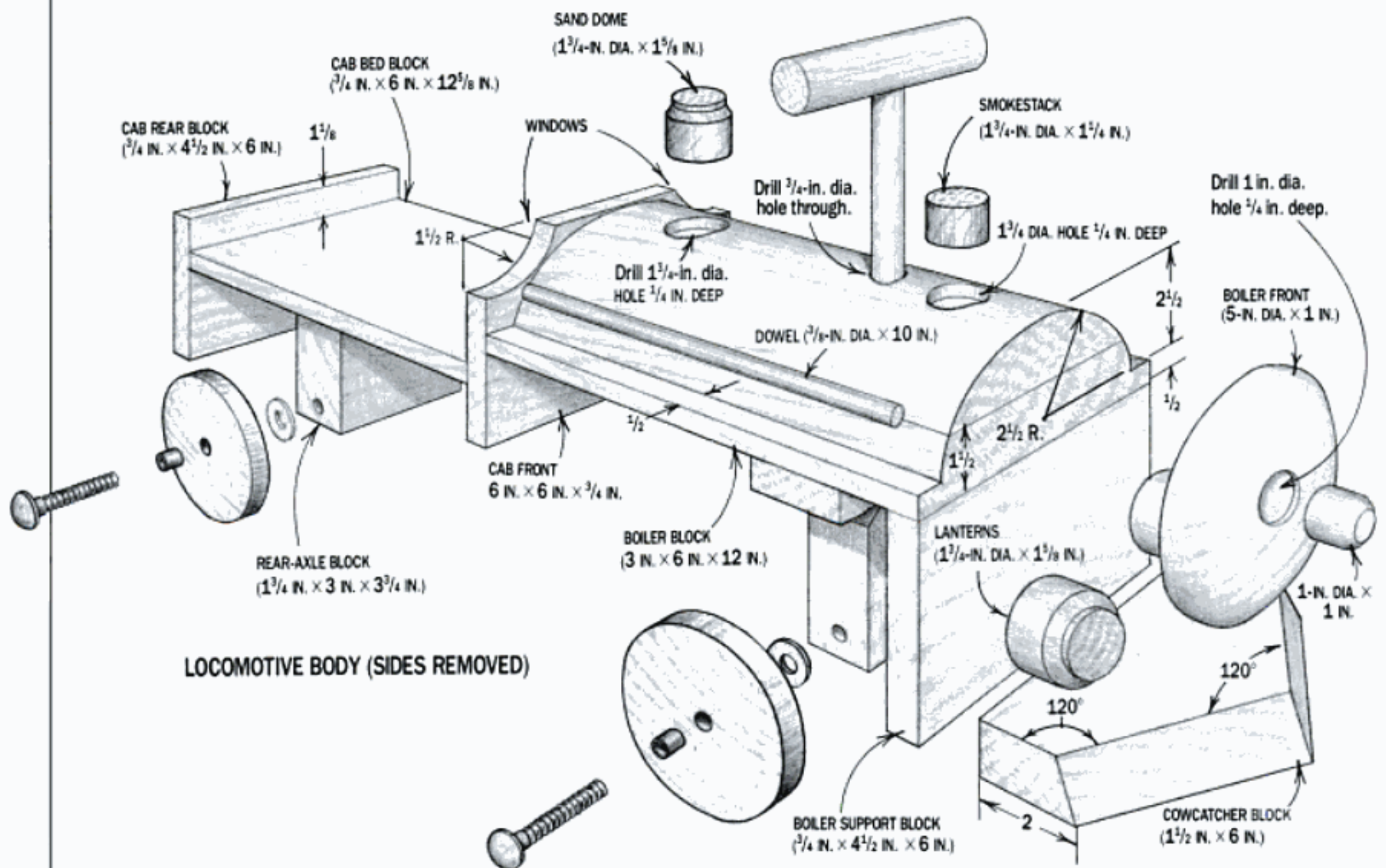
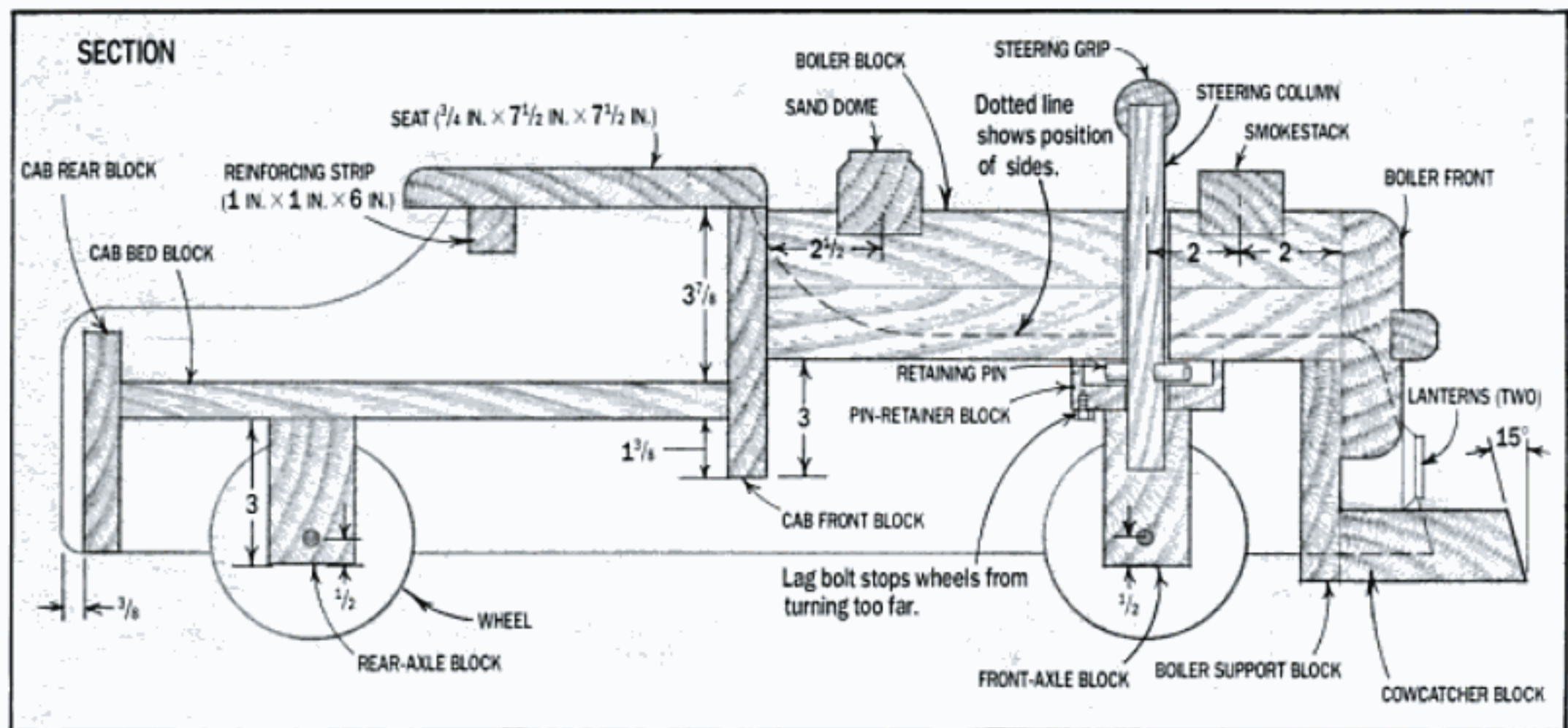
The materials couldn't be more simple. I used  $\frac{3}{4}$ -in. and  $1\frac{1}{2}$ -in. thick fir scraps for the body of the locomotive,  $\frac{3}{4}$ -in. thick hard maple for the wheels, and tough  $1\frac{3}{4}$ -in. thick oak for the axle blocks. (See Fig. 1.)

## *Building the Locomotive*

**STEP 1: Bandsaw out the locomotive's two sides.** I made these out of  $\frac{1}{2}$ -in. thick fir, planed down from  $\frac{3}{4}$ -in. stock. I had the benefit of using the original locomotive as a pattern, but you should have no trouble laying out the sides from the dimensions shown in Fig. 1. I clamped the two side boards together and used a bandsaw to cut them both out at the same time. You could just as well use a saber saw.

**STEP 2: Cut out and construct the cab assembly.** The cab front, bed and back form the cab assembly. (See Fig. 1.) There isn't a whole lot to these parts. After you bandsaw out the quarter-round "windows" in the cab front, glue the cab assembly together and reinforce the

FIG. 1: WOODEN LOCOMOTIVE



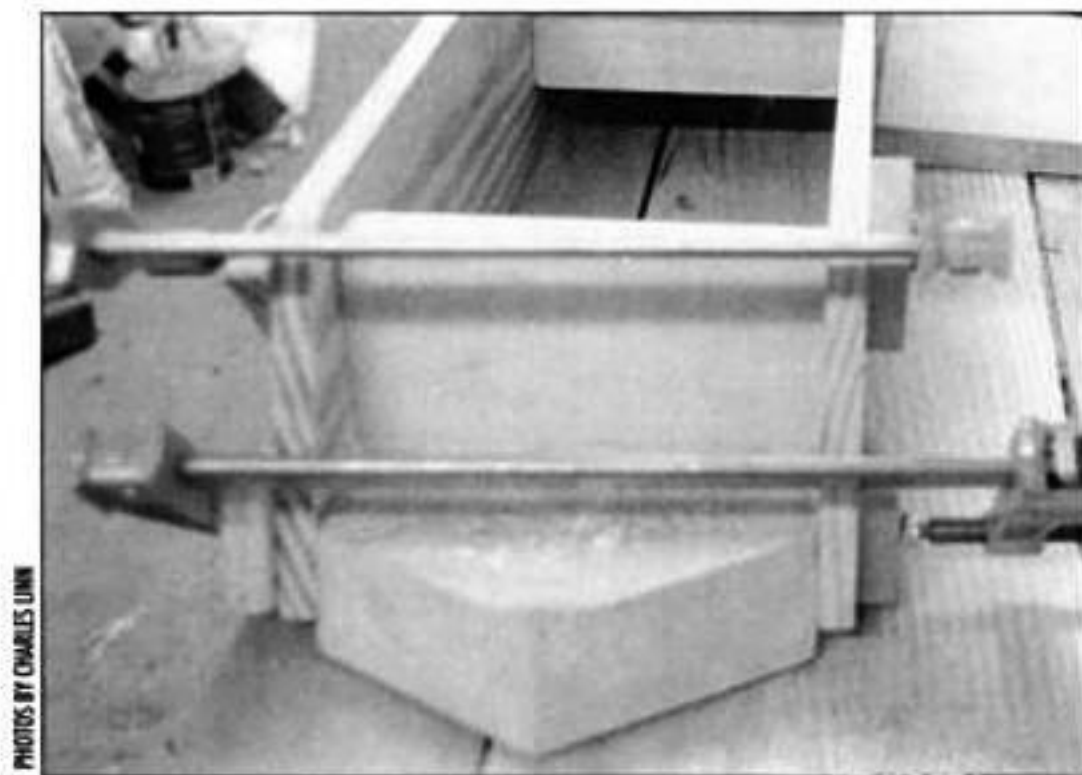
glue joints with 1½-in. finish nails.

**STEP 3: Cut out and construct the cowcatcher assembly.** The boiler support block and cowcatcher form the cowcatcher assembly. (See Fig. 1.) I used a tablesaw to bevel the front end of the cowcatcher block, setting the miter gauge at 60° and the blade at 15°. After mitering the cowcatcher front, I glued the boiler support block to the back of it, using finish nails to reinforce the glue joint.

**STEP 4: Attach the cab and cowcatcher assemblies to the locomotive sides.** Refer to Fig. 1 for the exact location of assemblies, and glue the whole lot together. Use 1-in. finish nails to reinforce the glue joint. This forms the body of the locomotive. (See photo below.)

**STEP 5: Construct the boiler block.** The boiler block is a semi-cylindrical part with a lip on the bottom edge. (See Fig. 1.) You could turn the cylindrical shape in the boiler block, then slice it below center and add the lower lip. I chose a different method. I made the boiler block out of two pieces of 1½-in. thick clear fir both a foot long; one was 6 in. wide and the other 5 in. wide. I placed these two pieces together with the smaller one on top, and drew a partial circle on each end of these stacked pieces. (See Fig. 1) I used a 5-in. dia. cardboard circle as my template to mark the 2½-in. radius with a central point ½ in. up from the bottom edge of the lower piece. You could just as well use a compass.

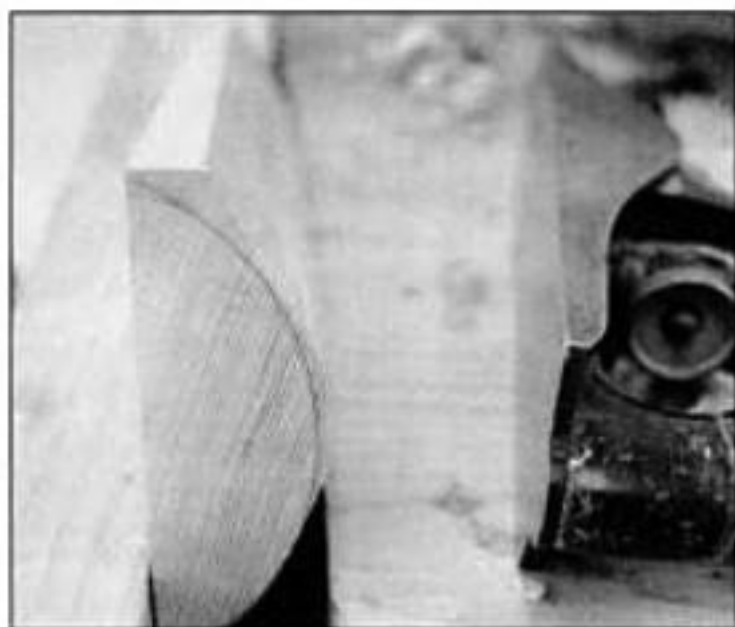
To produce the cylindrical shape, I first sawed away much of the waste on each piece on the tablesaw. I then shaved off the rest with a hand plane. (See photo below.) Be sure to leave the ½-in. lip along the bottom sides of the cylinder. Finally, I glued the two pieces together to form the boiler block.



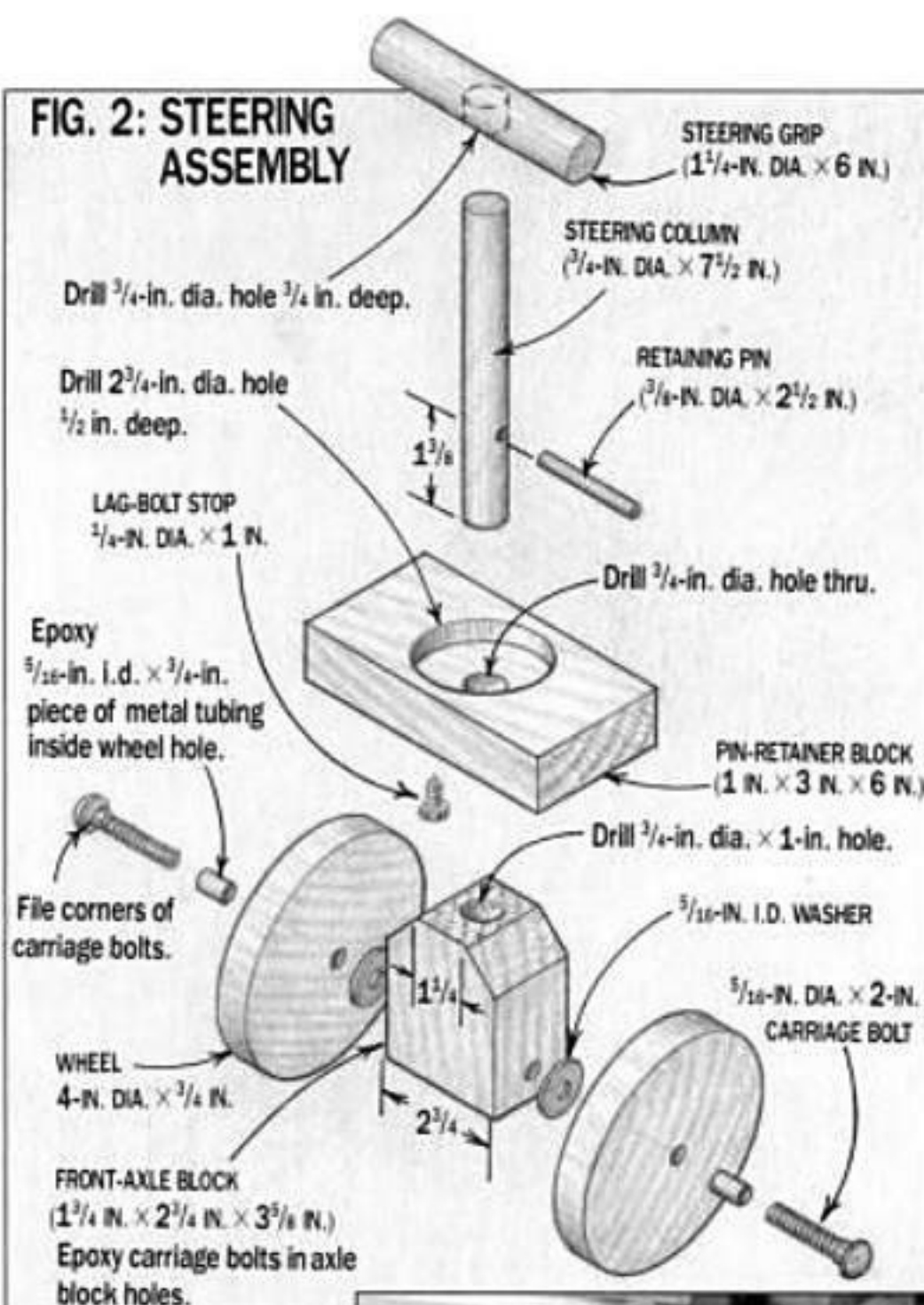
PHOTOS BY CHARLES UNN

Glue and nail the cab and cowcatcher assembly between the sides of the locomotive (above).

To shape the cylindrical boiler block, first cut off excess waste on the tablesaw, then hand plane it down to its cylindrical shape (right).



**FIG. 2: STEERING ASSEMBLY**



To prevent the steering column from sliding down in the boiler block, insert a retaining pin in the steering column on the underside of the boiler block, and attach a pin-retainer block over it.



**STEP 6: Drill holes in the boiler block for the smokestack, the sand dome and the steering column.** I used a brace and an adjustable expansion auger bit to drill 1¾-in. dia. x ¼-in. deep holes in the top of the boiler block. (See Fig. 1.) You'll attach the smokestack and sand dome after the train is painted. Next, on a drill press with the boiler block right-side up, drill the ¾-in. dia. hole for the steering column. Unlike the smokestack holes, you'll need to drill the steering-column hole all the way through the boiler block. It's important to drill this hole perpendicular to the bottom surface of the boiler block to allow the steering mechanism to work properly.

**STEP 7: Construct the steering-column assembly.** The steering-column assembly consists of a ¾-in. dia. dowel steering column, a 1¼-in. dia. dowel steering grip, a ¾-in. dia. dowel retaining pin and a pin-retainer block. (See Fig. 2.) After you cut these parts to size and drill the indicated holes, glue the steering grip to the steering column and insert the steering column through the boiler block. Turn the boiler block upside down and insert the

retaining pin in the hole in the steering column. Finally, slide the pin-retainer block over the bottom end of the steering column and glue it to the bottom of the boiler block as shown in the photo on page 23. The purpose of the pin and pin-retainer block is to keep the steering column from sliding down when the train is picked up.

**STEP 8: Glue the boiler block to the locomotive body.** Refer to Fig. 1 for correct placement of the boiler block, then glue it to the cab front, the boiler support block and the sides of the locomotive. (See photo above.)



Glue the boiler block to the cab front, boiler support block and locomotive sides (above). Reinforce the glue joint between the cab front and the boiler block with finish nails.



I reinforced the glue joint between the boiler block and the cab front with 1½-in. finish nails.

**STEP 9: Cut out the locomotive wheels.** I used a 4-in. dia. hole saw with a ⅝-in. pilot drill chucked into a drill press to cut out the maple wheels. You could just as well turn the wheels on a lathe. Make sure your saw is sharp, and go slow because major tear-outs and burning can result. I avoided tearing the faces of the wheels by sawing halfway through each wheel, then turning the board over to finish the task. To make the wheels a bit more durable, I epoxied a piece of ⅝-in. i.d. metal tubing in the central hole of each wheel. Finally, I mounted each wheel on the lathe and gave it a bit of a crown. You don't have to do this, but it will prevent the wheels from chipping along the edges when junior engineer rides the locomotive on the driveway.

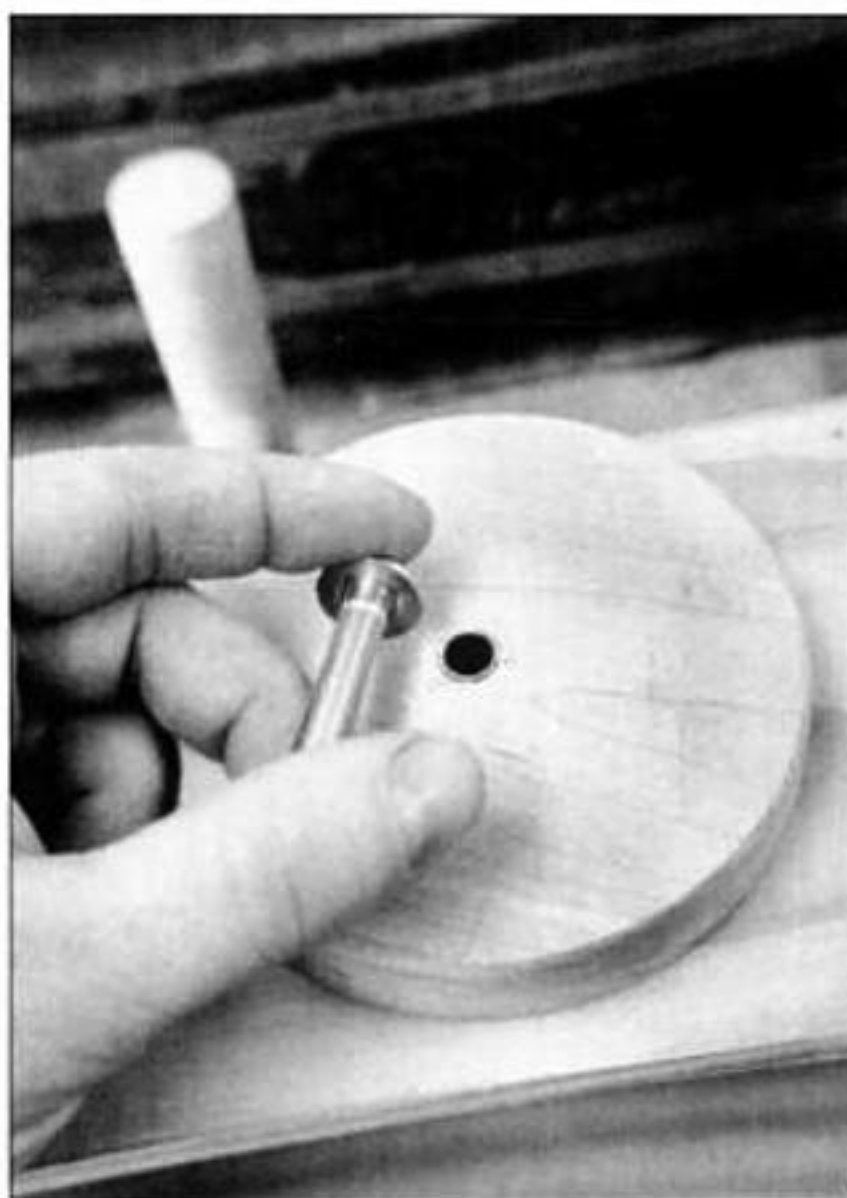
**STEP 10: Cut out the front and rear axle blocks.** These parts will be under stress, so choose split-resistant wood 1¾ in. thick. I used oak. Since the top side of the front axle bears against the pin-retainer block when the

steering column is turned (see Fig. 1), reducing the size of the bearing surface will make turning the wheels easier. To do this, bandsaw off two of the top corners on the front axle block, then drill a ¾-in. dia. hole approximately 1 in. deep for the steering column in the top of the front axle block. (See Fig. 2.) Next, drill the ⅝-in. dia. holes approximately 1½-in. deep for the axles on both sides of each block.

**STEP 11: Attach the wheels to the axle blocks with carriage bolts.** The axles are 2-in. x ⅝-in. dia.

carriage bolts. File off the square corners on the bolts between the cap and the threads so the wheels can spin freely. (See photo.) Partially fill each of the four holes you drilled in the axle blocks with epoxy. Mount a wheel and a spacer washer on each axle and insert it into one of the holes in the axle blocks. Be careful not to get epoxy on the wheels because the wheels will stick. Leave each wheel loose enough to spin freely, but not so loose that it wobbles when spun.

**STEP 12: Attach the axle blocks to the locomotive.** After the epoxied axles have set, glue the rear wheel assembly to the underside of the cab bed. Glue the front wheel assembly on the bottom of the steering column. Don't get glue on the underside of the pin-retainer block



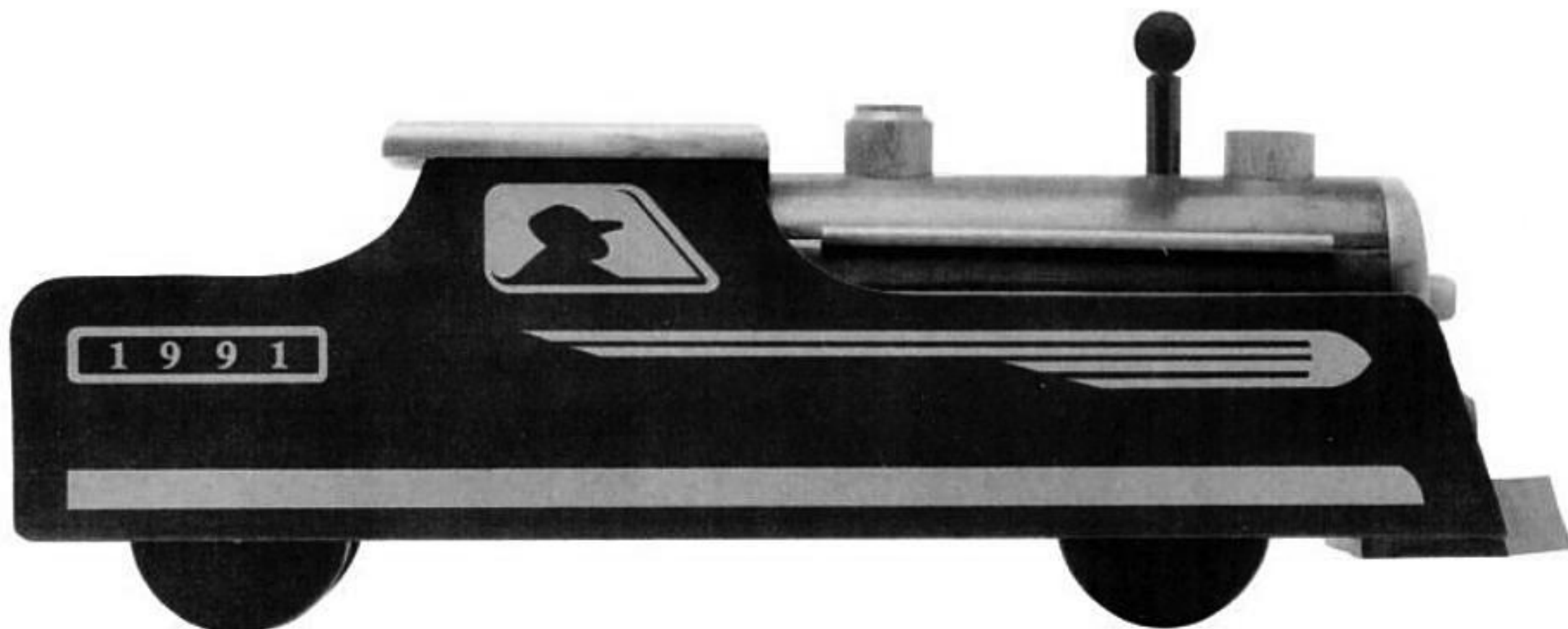
Attach the wheels to the axle blocks with carriage bolts (above). File off the square corners underneath the carriage bolt heads so the wheels spin smoothly. Glue the front axle block to the bottom end of the steering column (left). Fasten a lag bolt behind the front axle block to prevent the wheels from turning too far.

because the front axle block will stick.

Then, to prevent your young engineer from steering too far sideways and capsizing, you need to restrict the rotation of the steering gear. Do this by screwing a short lag bolt into the retainer block ¼ in. behind the front axle block. (See photo and Fig. 1.) Now if you try to turn the steering column, the front axle block bumps against the head of the bolt, limiting your turning capability.

**STEP 13: Turn the sand dome, the lanterns, the boiler front and front button.** I turned the sand dome and lanterns from 1¾-in. dia. dowels. The smokestack is also part of a 1¾-in. dia. dowel, but requires no turning. I turned the boiler front from a 1-in. thick piece of clear fir, using a 1-in. dia. dowel for the button in the middle. At this time, I also cut out the two ⅝-in. dia. dowels attached to the sides of the boiler block. (See Fig. 1.) Don't attach any of these parts yet, because you'll first need to apply a clear finish on them instead of the paint that's on the rest of the locomotive.

**STEP 14: Assemble the locomotive seat.** The seat



The graphics on the sides of the locomotive are computer-generated decals. See the text for a source.

JOHN HAMEL

assembly consists of a top board and a reinforcing strip glued and finish nailed to the underside. I made the seat assembly from  $\frac{3}{4}$ -in. thick clear fir. I used a hand plane to round off the top edges of the seat all the way around. As with the parts in Step 13, leave the seat off until after you've painted the locomotive because the seat will need a clear finish.

**STEP 15: Apply the finish to the locomotive.** I used bright red, oil-based enamel for the body of the locomotive. Although this finish is durable and inexpensive, if you don't spray it on, the brush marks tend to show. To remedy this, once the first coat dried, I sanded it down with fine sandpaper. I then applied a second coat. Once it dried, I rubbed it down with a pumice-and-water solution. Finally, I applied a third coat and rubbed it down with a rottenstone-and-water solution. This yields a nice satin finish. (Pumice and rottenstone are available from well-supplied paint stores.) You could substitute extremely fine wet-or-dry sandpaper and get similar results.

I finished the seat and trim pieces with Deft, a nitro-cellulose-based brushing lacquer, and rubbed the parts down with fine steel wool (#0000) between coats. After all of the varnishing and painting was completed, I glued the trim and seat to the locomotive body. I reinforced the glue joints on the seat, the boiler front, the lanterns and the dowel strips with finish nails.

**STEP 16: Apply graphics to the locomotive sides.** The graphics on the original locomotive were silkscreened. This technique is still common today, although it's not terribly practical unless you're printing on many items. Hiring a sign painter to do the work by hand can also be expensive.

I decided on a different approach. I took my locomotive and my design to a shop that makes vinyl signs with the use of a computer. The computer "scans" a piece of artwork and sends instructions to a vinyl-cutting machine. It cuts a replica of the art out of self-adhesive vinyl. I then applied this replica to the side of the locomotive somewhat the same way you'd apply a bumper sticker to a car. The process is inexpensive and doesn't take long at all.

The only problem is that, on a small scale, the machine is a bit limited in the amount of detail it can reproduce. This meant I had to simplify the graphics of the original somewhat, but this was no problem, since I never intended to reproduce the original locomotive down to the last detail, anyway.

If you'd like to use the same graphics I did, you can order a set of your own in the color of your choice. (Locomotive graphics order #1365 includes directions and applicator tool, \$19 plus postage, available from Rainbow Graphics, P.O. Box 969, Creswell, OR 97426, 503-895-4757.)

### *One Final Thought*

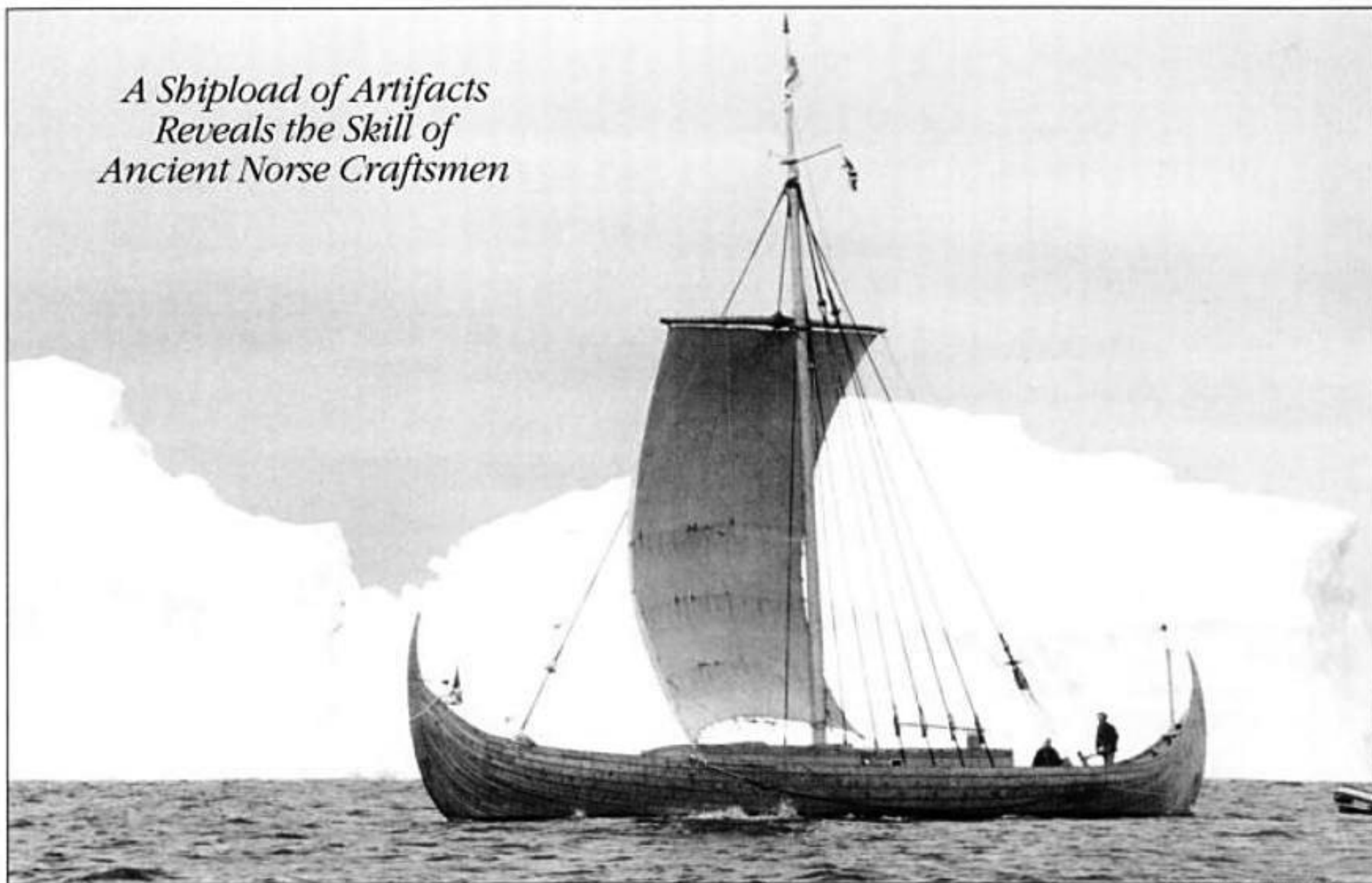
When I finished the locomotive, I was a little disappointed in my workmanship. Here, a tear-out I didn't fix; there, a few plane marks on the boiler block; over there, some inaccuracies in the turnings. At first, I thought I must have been influenced a bit too much by the rough construction of the original. Or maybe the knowledge that this locomotive would probably be dropped down stairways and ridden over cliffs made me think that building it to patternmaker's tolerances was a folly.

But I realized that some part of me really didn't want my locomotive to be perfect. I wanted someone in the future to be able to look at it and know that parts of it were made by hand—that it wasn't just another mass-produced toy. Most kids grow up today without ever having the opportunity to touch, let alone own, something that was made by hand. It's a wonderful thing to give a child something that isn't made of plastic, doesn't use batteries, has no integrated circuits to burn out and probably won't wind up in a landfill. Flaws and all, somebody's just going to love this locomotive. ▲



*Charles Linn is an architect, editor and woodworker. He lives in Oregon.*

*A Shipload of Artifacts  
Reveals the Skill of  
Ancient Norse Craftsmen*



THE GAI, VIKING SHIP REPLICA

PHOTO COURTESY OF THE CANADIAN PRESS

# VIKING FURNITURE

BY SIMON WATTS



SIMON WATTS

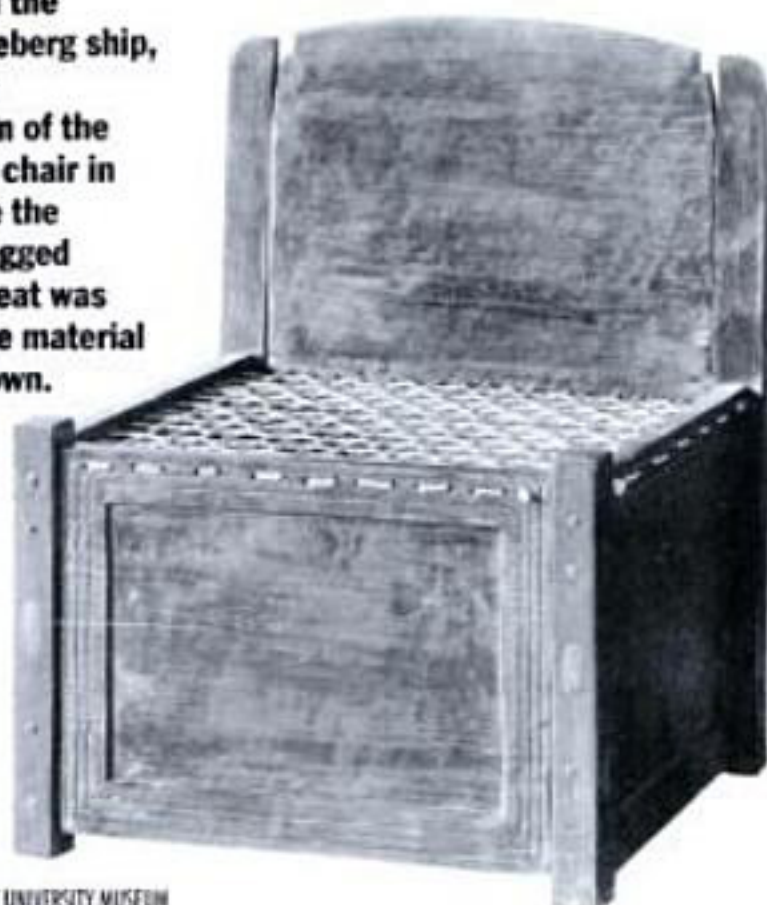
**I**n the popular image of a Viking ship burial, the fallen chieftain sets off on his final voyage into a blazing sunset as his proud ship blazes up around him. Fortunately for us, the Oseberg ship was not burned but buried under a mound at Slagen in southern Norway, becoming the final resting place for two Norse women. When excavated in 1904, it turned out to be one of the great archaeological finds of all time. (See sidebar, page 29). Not only was the ship itself found almost intact, but it was also fitted out as if for a voyage, with the household goods and furnishings used by persons of rank in the ninth century.

Furniture from the Viking period is extremely rare. Most wooden artifacts succumbed to the destructive

combination of civil strife and a damp climate. By the time the Oseberg ship was excavated in 1904 (it was the third ancient burial ship to be discovered), conservation techniques in Norway were very advanced. Wooden parts could be stabilized and preserved for the painstaking work of reconstruction—one of the sleds found on board was in more than a thousand fragments. In most cases, it was possible to piece these parts back together and make measured drawings with a fair degree of accuracy. Reproductions could then be built for further study.

The furniture found inside the Oseberg ship included beds, chests, a chair, a kitchen stool and several looms. A close look at a few pieces shows a style of furniture that was handsome, sturdy and practical—beds were made to

Found aboard the excavated Oseberg ship, this chair is a reconstruction of the oldest-known chair in Norway. Note the staggered, pegged tenons. The seat was woven, but the material used is unknown.



PHOTOS COURTESY OF THE UNIVERSITY MUSEUM OF NATIONAL ANTIQUITIES, OSLO, NORWAY. ©

knock down so they could be assembled for use on land and then taken apart for stowage on board.

The chair found in the ship (see photo above) is the oldest one known in Norway. It is made of beechwood and, being less than 15½ in. high, may have been for a child. When first excavated, there were traces of ornament. Animal designs were painted in black or dark brown on a light-colored background. Little was left, and consequently all that remained was lost during conservation. The seat had decayed, but it was apparently woven of either leather, grass rope or withes (flexible branches).

On all four panels of the chair and the backrest the grain runs horizontally. The wooden pegs you see in the chair post were used as an alternative to nails in much Viking woodwork. They are called "trae-nagler", or "tree-nails." The front and rear panels of the chair are housed in the posts as well as being through-tenoned. A close look at the photo shows that adjacent tenons are offset so they don't interfere with each other or weaken the posts. The upper seat back is attached to the posts by a continuous stub tenon.

Another item found inside the ship is the chest shown below. Chests were an essential item on board a Viking ship. They doubled as rowing seats, and most likely the crew kept its personal gear in them, as well. The chest shown here is so well-preserved that the hinge and lock



In Viking times, chests doubled as rowing benches and storage bins for personal gear. This restored chest may have been used as a safe or strong box because the iron bands were spaced to prevent thieves from gaining entry.

still worked, although the key is lost. The elaborate locking arrangement on the chest has three separate iron hasps secured by a sliding locking pin. The technique of dovetailing was unknown to the Vikings, so the corners are simply lapped and nailed.

Although there are no lifting handles, this chest has the look of a safe or strong box. The iron bands are so close that, even by cutting through the wood, extracting the contents would be difficult. The bands are attached to the wood with iron nails, which have tin-plated heads.

There were five beds found aboard the Oseberg ship. The one shown below is a reconstruction of an oak bed. Before its use as a burial ship, the Oseberg had no cabin or shelter, meaning this elaborate bed must have been taken ashore at night, set up in a tent and dismantled in



Mortise-and-tenon joints with loose wedges allowed this bed to be easily disassembled for stowage on board a ship. It could be quickly assembled once ashore.

the morning. It is almost square in plan with a length, head to foot, of only 5 ft. 8 in. The occupants must have been somewhat shorter. The ferocious looking carved animal heads on the posts were no doubt intended to protect the sleepers from wandering land spirits.

Each side rail of the bed has a half lap at the head end where it fastens to the head posts with wood dowels, pointed at one end. At the other end, the rails are mortised through the foot posts and secured with loose wedges. The headboard and one of the bed slats is fastened in the same way. The original bed posts had traces of paint and geometric ornament, but so little remained that they were impossible to duplicate with authenticity.

Viking furniture makers showed a preference for oak, which they rived (split) rather than sawed out of logs. They would work the wood with a combination of axes and adzes. Finally, they used an iron tool, found in many Viking graves, that is similar to the blade of an old-fashioned wooden spokeshave. It would act like something between a plane and a scraper. ▲



Simon Watts is a journalist and a contributing editor for AW. Arne Emil Christensen, curator of the University Museum of National Antiquities, Norway has been helpful in obtaining photos and supplying information.



Buried for a thousand years under a mound in Norway, the Osberg ship contained the remains of two Viking women and numerous artifacts. Note that the ship is moored to a huge rock to prevent it from sailing away.

# SHIPS OF THE DEAD



BY SIMON WATTS

In 1904, archaeologists discovered the Viking ship Oseberg beneath a mound in southern Norway. Buried in the ninth century, the ship was fully equipped and contained the remains of two Norse women. The burial site is now 2½ miles from the sea, but in Viking times it may have been closer. When buried the ship was hauled into a long trench dug into the local blue clay and then filled with rocks. On top of the rocks were layers of peat, grass-side down, packed tightly together, thus sealing the contents. Upon completion, it's been estimated that the mound was approximately 20 ft. high and 143 ft. in diameter.

Because of the anaerobic conditions under the peat and clay, the ship and its contents were miraculously preserved from decay for more than a thousand years. Nothing, however, could save the ship from the considerable mechanical damage from the weight and the settling of the stones and turf on top of it.

Scattered throughout the ship was an astonishing variety of objects. Found in the stern were kitchen utensils, including two iron cauldrons, wooden dishes, ladles and knives. A stool and two small axes complete with wooden handles were also uncovered. Up in the bow were the remains of three beds, a small chair, two tents, a four-wheeled cart as well as the ship's gear—a gang plank, 15 pairs of unused oars and an anchor. In addition to the cart, there were three sleighs and a sled. Around the site, both inside and outside of the ship were the skeletons of 13 horses, three dogs and an ox.

In the center of the ship, directly behind the mast, a tent-like wooden structure had been erected as a grave chamber. Parts can be seen in the photo. Under this wreckage lay the

remains of two beds and the skeletons of the two women. The skeleton of the older woman was almost intact, but that of the younger had been disturbed. Intruders had chopped the bed into pieces and scattered the bones. The accepted view is that the younger of the two women was a certain Queen Asa, and the older her crippled servant. (Queen Asa was a powerful, vengeful woman named in one Norse Saga as having instigated the murder of her violent husband).

The grave chamber had been richly furnished. It was hung with tapestries and provided with quilts, blankets and pillows. There were also several chests, one of which was intact and contained lamps, scissors and other personal items.

The Oseberg ship was built in the ninth century. Dated by its carvings, it has been determined the ship had already seen some 50 years of service before it was buried. Measuring 71 ft. 6 in. from stem to stern with a 17-ft. beam, this lapstrake ship was built entirely of oak. It was lightly constructed with a low freeboard, and was never intended for long sea passages. Like most Viking ships of the period, the vessel had no cabin or fixed shelter on board. Tents, complete with beds and bedding, were taken ashore and set up at night. One gets the impression of leisurely day-cruises in fine weather with most of the comforts of home.

Like the two burial ships previously excavated, the Oseberg ship lay with its bow pointing toward the sea. It was not anchored but securely tied to a large rock, as seen in the 1904 photo on the opposite page. Was this just the habit of a seafaring people? Or was it, along with the crushing load of rocks, to ensure that the ship made no more voyages but instead remained fast in the mound? Why, then, 15 pairs of new oars on board, who was to do the rowing?

## *Life After Death*

To understand why the Vikings went to such enormous expense and labor to bury two people, it helps to know something of their traditions.

A casual reading of the Norse Sagas shows a belief that people continued their lives after death underground. This conviction was so compelling that it was natural to provide the dead with all the furnishings they had enjoyed during their lives. The higher the rank of the deceased, the more elaborate the burial.

There was an even darker side to this belief. There are numerous stories in Viking literature of the dead returning to abuse and terrorize the living. The more powerful and contentious an individual had been in life, the more capable of mischief after death. Good reason, indeed, to make sure that the dead lacked nothing for the continuation of their existence in the mound. Only by accepting the reality of this belief can one understand the motivation for the ship burials.

The power that these ancient ships still exercise over our imaginations is evident by the number of replicas built and successfully sailed across the sea to the "New World." The first of these was the "Raven" in 1893, and most recently, the 78-ft. "Gaia" arrived in Newfoundland on August 2. No doubt there will be more.

## MORE INFORMATION

The Oseberg Ship and some of its contents are displayed at The Viking Ship Hall, Bygdoy, near Oslo, Norway.

A full-size replica of the Gokstad ship "Raven" is at the Lincoln Park Zoo in Chicago.

*Ingenius Design  
Lets You Cover the  
Clutter*



Unlike most slant-top desks, the lid on this desk folds out of the way, giving easy access to the drawers and writing surface.



MITCH MANDEL

# SLANT-TOP WRITING DESK

BY NELSON RITTENHOUSE

I got the idea for this desk from a friend of mine, Michael DeNike. As a writer, DeNike needed a desk light enough that it could be conveniently carried from one part of his house to another.

Although the base of the desk is reminiscent of a Shaker side table, and the upper part resembles the school desks we sat at years ago, the desk's clean lines and natural finish give it a contemporary look.

I made the first of these desks in oak and the second in maple and birch. Weighing only 35 pounds and with a width of 20 in., the desk can easily be carried sideways through even a narrow doorway.

This desk has numerous parts. To make things easier, in Fig. 1 I've assigned a letter to each part. In the text, whenever I refer to a part for the first time, I will also include the corresponding letter in parenthesis after the part name.

## *Making the Base*

Start by dimensioning the four legs. (See Fig. 1, A.) Mark out and rout the mortises. I did this with a plunge router and the shop-made jig described in the Mortising Jig sidebar. Mortises produced by this device are so smooth that you need no subsequent trimming. However, you will still have to square off the rounded ends of each mortise with a chisel.

Now mark out and cut the tapers on the legs on the tablesaw or bandsaw. You need to taper only the two inner surfaces of each leg. Be sure to end the taper 4½ in. from the top of the leg. (See Fig. 1.)

I cut the tapers on a tablesaw with the aid of a shop-made tapering jig. The jig is essentially a large, adjustable-angle push-stick. The photo (top right) pretty much tells it all—two boards hinged at the back end, with a push stop that butts up against the leg. To find the specific taper on any given leg, I simply adjust the angle of the jig until the saw blade runs parallel to the taper drawn on the leg. Be sure to place the leg in the jig so it can rotate 90° clockwise to make the second cut. In other words, the newly sawn surface should be uppermost—not facing the saw table. When done, clean up the sawn surfaces with

a low-angle block plane or cabinet scraper, round the corners and finish sand.

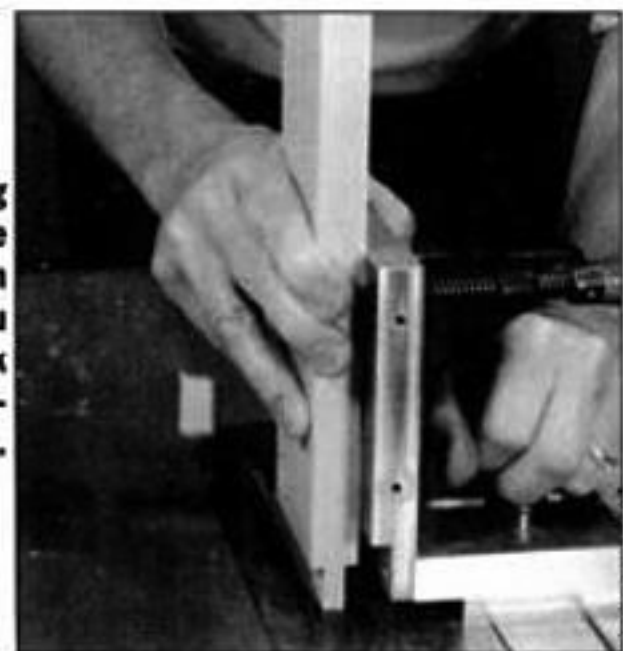
**Next, dimension the four aprons** (See Fig. 1, B and C.) These are conspicuous parts, so select the stock carefully for grain and color. Rip these to 3-in. widths, cut them to length (including the tenons), then saw out the tenons. I cut the tenons on my tablesaw with a tenoning jig that holds the stock vertically as I pass it over the blade. (See photo below.) Once you've cut the tenon cheeks,



PHOTOS BY GLENN HUGHES

**Cutting tapers** is a simple task with a tapering jig. The jig is merely two boards hinged at the back end for adjusting the angle, a push stop for pushing the leg and a handle for safety.

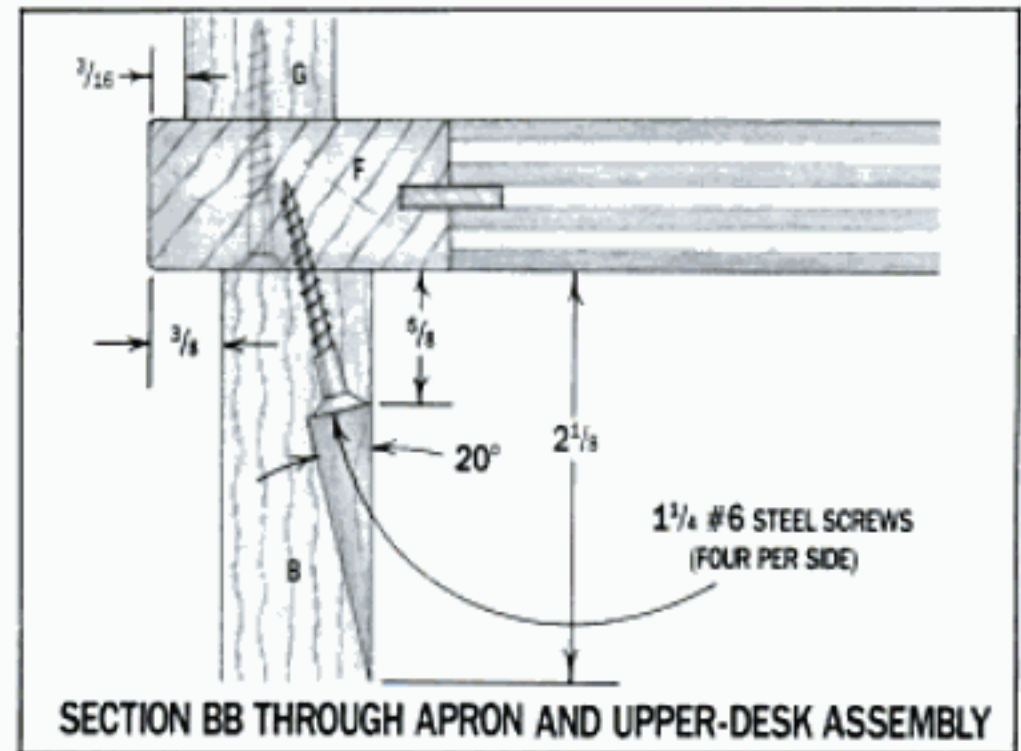
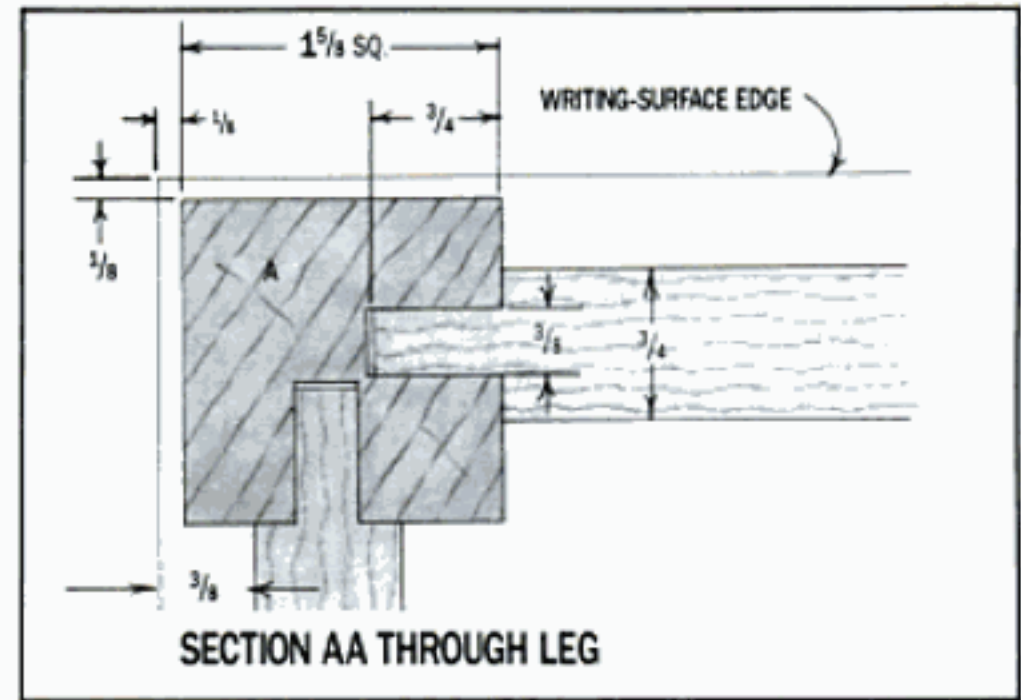
**Cutting tenons** on the tablesaw is much safer when you clamp the stock against a shop-made tenoning jig.



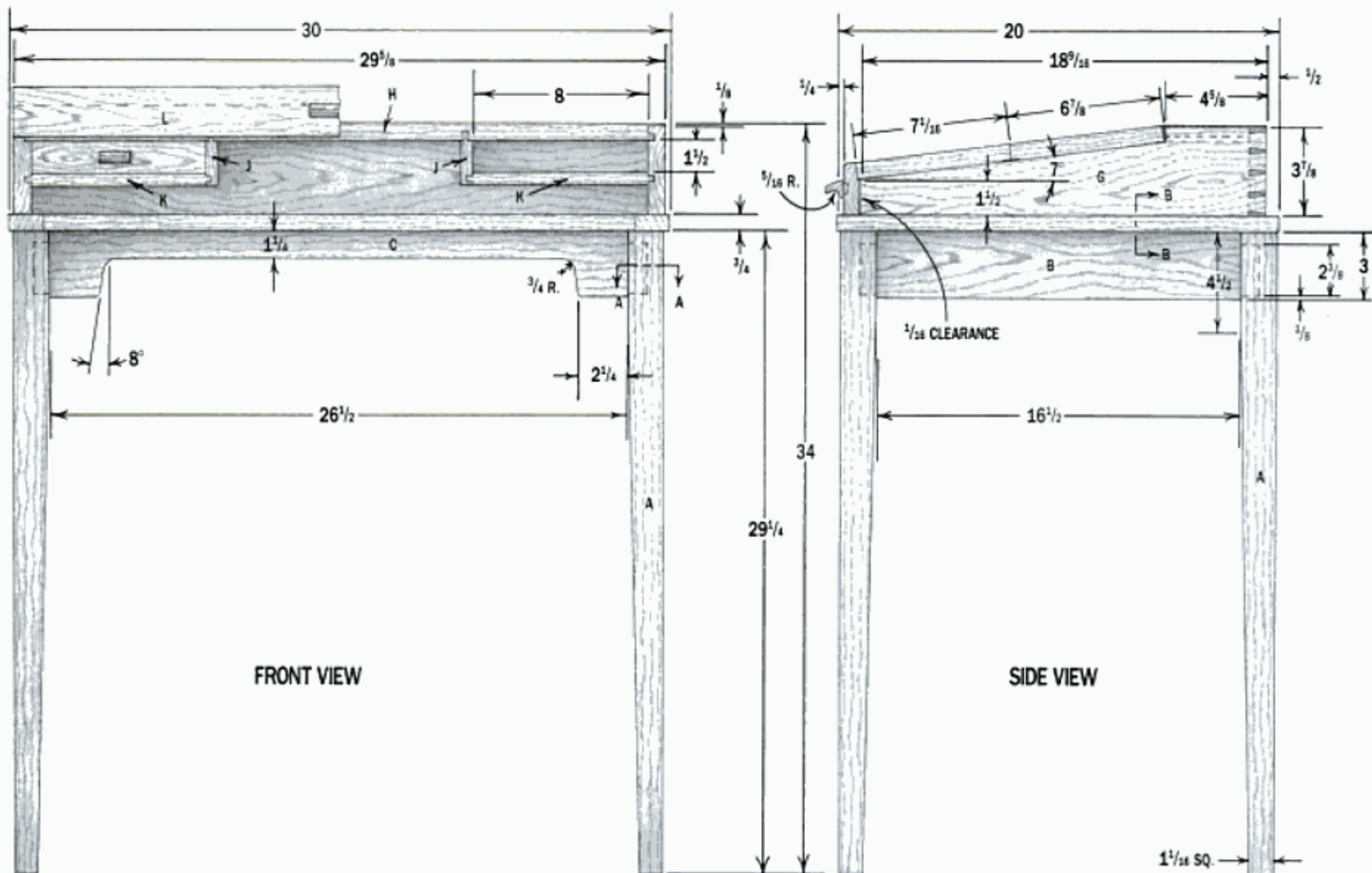
NELSON RITTENHOUSE

## DESK PARTS LIST

| PART                           | QUANTITY | DIMENSIONS                                                                                      |
|--------------------------------|----------|-------------------------------------------------------------------------------------------------|
| A. LEG                         | 4        | 1 <sup>5</sup> / <sub>8</sub> SQ. x 29 <sup>1</sup> / <sub>4</sub>                              |
| B. SIDE APRON                  | 2        | 3 <sup>1</sup> / <sub>4</sub> x 3 x 18                                                          |
| C. FRONT AND BACK APRON        | 2        | 3 <sup>1</sup> / <sub>4</sub> x 3 x 28                                                          |
| D. WRITING SURFACE             | 1        | 3 <sup>1</sup> / <sub>4</sub> x 17 x 27                                                         |
| E. WRITING SURFACE EDGING      | 2        | 3 <sup>1</sup> / <sub>4</sub> x 1 <sup>1</sup> / <sub>2</sub> x 27                              |
| F. WRITING SURFACE EDGING      | 2        | 3 <sup>1</sup> / <sub>4</sub> x 1 <sup>1</sup> / <sub>2</sub> x 20                              |
| G. UPPER-DESK ASSEMBLY SIDES   | 2        | 3 <sup>1</sup> / <sub>4</sub> x 3 <sup>1</sup> / <sub>8</sub> x 18 <sup>9</sup> / <sub>16</sub> |
| H. UPPER-DESK ASSEMBLY TOP     | 1        | 3 <sup>1</sup> / <sub>4</sub> x 4 <sup>5</sup> / <sub>8</sub> x 29 <sup>5</sup> / <sub>8</sub>  |
| I. UPPER-DESK ASSEMBLY BACK    | 1        | 3 <sup>1</sup> / <sub>4</sub> x 3 <sup>7</sup> / <sub>8</sub> x 29 <sup>5</sup> / <sub>8</sub>  |
| J. DRAWER FRAME, vertical      | 2        | 1 <sup>1</sup> / <sub>2</sub> x 2 <sup>1</sup> / <sub>2</sub> x 3 <sup>7</sup> / <sub>8</sub>   |
| K. DRAWER FRAME, horizontal    | 2        | 1 <sup>1</sup> / <sub>2</sub> x 3 <sup>7</sup> / <sub>8</sub> x 8 <sup>1</sup> / <sub>2</sub>   |
| L. DESK-LID (cut in half)      | 1        | 3 <sup>1</sup> / <sub>4</sub> x 11 <sup>5</sup> / <sub>8</sub> x 26 <sup>5</sup> / <sub>8</sub> |
| M. DESK-LID EDGING, vertical   | 2        | 3 <sup>1</sup> / <sub>4</sub> x 1 <sup>1</sup> / <sub>2</sub> x 14 <sup>1</sup> / <sub>16</sub> |
| N. DESK-LID EDGING, horizontal | 1        | 3 <sup>1</sup> / <sub>4</sub> x 1 <sup>1</sup> / <sub>2</sub> x 26 <sup>5</sup> / <sub>8</sub>  |
| O. DESK-LID EDGING, horizontal | 1        | 3 <sup>1</sup> / <sub>4</sub> x 1 <sup>5</sup> / <sub>16</sub> x 26 <sup>5</sup> / <sub>8</sub> |
| P. DESK-LID FACIA              | 1        | 5 <sup>5</sup> / <sub>8</sub> x 2 <sup>1</sup> / <sub>4</sub> x 29 <sup>5</sup> / <sub>8</sub>  |
| Q. DRAWER STOPS                | 2        | 3 <sup>1</sup> / <sub>16</sub> x 1 x 2                                                          |
| R. DRAWER FRONTS               | 2        | 1 <sup>1</sup> / <sub>2</sub> x 1 <sup>1</sup> / <sub>2</sub> x 8                               |
| S. DRAWER BACKS                | 2        | 1 <sup>1</sup> / <sub>2</sub> x 1 <sup>1</sup> / <sub>4</sub> x 7 <sup>1</sup> / <sub>2</sub>   |
| T. DRAWER SIDES                | 4        | 1 <sup>1</sup> / <sub>2</sub> x 1 <sup>1</sup> / <sub>2</sub> x 3 <sup>3</sup> / <sub>4</sub>   |
| U. DRAWER BOTTOMS              | 2        | 1 <sup>1</sup> / <sub>8</sub> x 7 <sup>3</sup> / <sub>8</sub> x 3 <sup>1</sup> / <sub>2</sub>   |
| V. LID HANDLE                  | 1        | 7 <sup>1</sup> / <sub>8</sub> x 1 <sup>5</sup> / <sub>16</sub> x 2 <sup>5</sup> / <sub>8</sub>  |
| W. DRAWER HANDLES              | 2        | 7 <sup>1</sup> / <sub>8</sub> x 1 <sup>5</sup> / <sub>16</sub> x 1 <sup>3</sup> / <sub>8</sub>  |



**FIG. 1: SLANT-TOP WRITING DESK**



# UPPER-DESK ASSEMBLY DETAIL

Attach edging with biscuits.

Glue facia to front edging.

See detail below.

See detail below.

1 1/16-IN. x 27 1/2-IN. PIANO HINGE

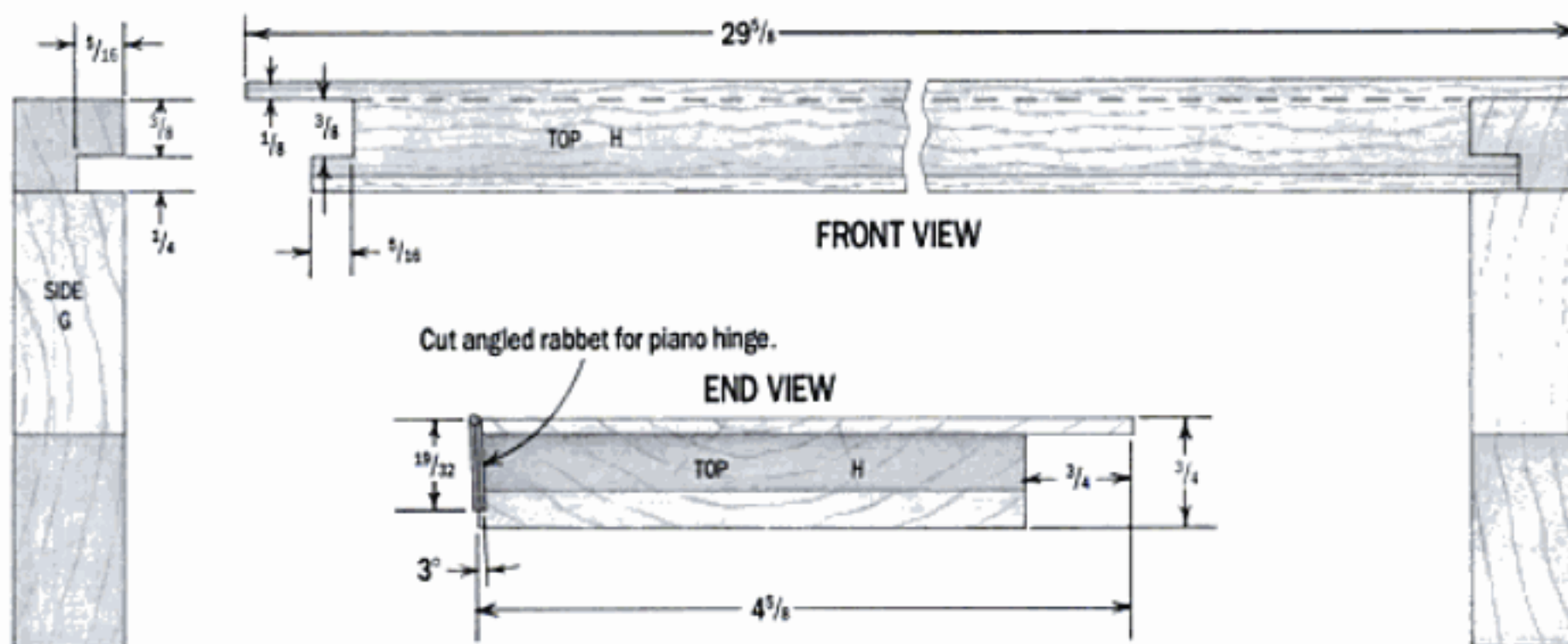
1 1/16-IN. x 29 5/8-IN. PIANO HINGE

SLIDING DOVETAIL

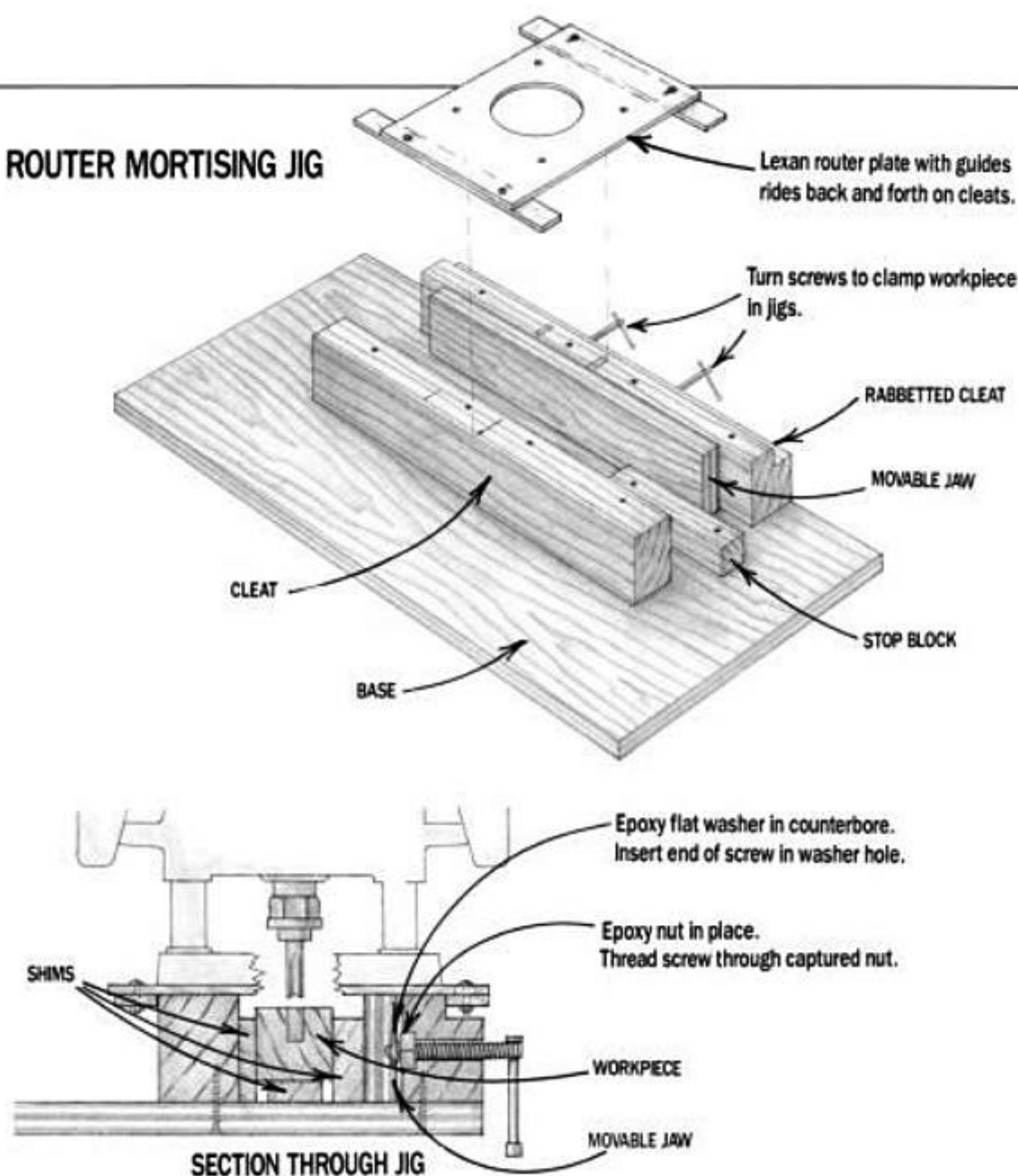
Attach edging with biscuits.  
(FOUR PER SIDE)

EXPLODED VIEW

## SIDE AND TOP DETAIL



## ROUTER MORTISING JIG



The mortising jig you see here enables you to use a plunge router to cut accurate, consistent mortises in legs (and other narrow wooden parts). The jig consists of a modified router plate and an adjustable wooden frame that clamps the part you're mortising within it. It works like this: The guides on the router plate ride back and forth on the cleats of the wooden frame, guiding the router bit to cut the mortise.

To make the router plate and guides, I used a 1/4-in. thick polycarbonate called Lexan (available from Highland Hardware, 1045 N. Highland Ave., NE, Atlanta, GA 30306, (800) 241-6748). Hardboard would also work. Make the base of the jig from 3/4-in. plywood and the cleats from solid wood.—N.R.

mark and saw each tenon to its correct width.

Now bandsaw out the knee-hole in the most presentable of the two long aprons. (See Fig. 1.) If you don't have a bandsaw blade narrow enough to make the radius, cut the knee-hole out with a coping saw.

Other than sanding, the last step before gluing the base of the desk together is drilling the screw pockets for the screws that attach the base to the writing surface. (See Fig. 1, Section Through Apron and Upper-Desk Assembly.) Drill four screw pockets in each apron. I used the simple jig shown in the photo (below) and a 3/4-in. Forstner bit.

**When gluing up the base,** I find it's easiest to glue the legs in pairs first and then to glue the pairs together. After clamping, sight along the two legs to make sure they're not twisted. Also, make sure the diagonal measurements between corners are the same, and adjust by varying the pressure point of the clamp.

## Making the Writing Surface

The writing surface (see Fig. 1, D) is a rectangular piece of 3/4-in. birch plywood edged on all four sides with solid wood. (See Fig. 1, E and F.) I attached this edging with glue and biscuits. If you don't own a biscuit joiner, use 3/8-in. dowels and a doweling jig, instead.

Rip all the edging pieces to 1 1/2 in. but leave them a 1/2 in. or so over their finished length.

Glue the two long sides first, then trim the ends off on the tablesaw. Attach the short pieces next and trim them on the tablesaw as before. Put the whole assembly in a vise and hand plane the edges and chamfer any sharp corners.

Now turn the writing surface over and lay it face down on a padded surface. Give it a light sanding and a thin coat of shellac. Apply shellac to the top edges of the aprons, and then drill through the screw pockets. Temporarily screw the writing surface to the base with 1 1/4-in. screws.

## Making the Upper-Desk Assembly

There are three sections to the upper-desk assembly (see Fig. 1): the dovetailed sides (G) and back (I) and top (H); two drawers with their surrounding frames (J and K); and a hinged lid (L) made of 3/4-in. plywood edged with solid wood edges (M, N and P).

First, dimension the two sides and the back. Cut the sloping surface in each side with a bandsaw or saber saw, and clean up the sawn surfaces with a disc sander or

Drill screw pockets in the aprons with this simple angled fence.



block plane. Use a sharp chisel to clean up the corner where the top of the slope meets the  $4\frac{5}{8}$ -in. notch at the back of the side pieces.

The top and sides of the upper-desk assembly are fastened with a tongued joint. (See Fig. 1.) Rout a  $\frac{1}{4}$ -in. groove on the inside surface of both sides for the tongues on the top. I prefer to use a router for this job so I can stop the grooves  $\frac{1}{2}$  in. from the back. If you let them run through, you'll find yourself with two square holes to plug in the back of the desk. While you have the router out, also rout the two  $\frac{1}{4}$ -in. grooves in the sides for the drawer frame. Note that these must also be stopped, front and back, so they don't show.

**Now lay out and cut the two sets of dovetails** on the back and sides. (See Fig. 1.) (See AW, #19 for more on how to cut dovetails.)

The final piece of this assembly is the top. This has a tongue at each end and a lip that covers the top edge of the back and sides. These are best cut on the tablesaw with the back section clamped to a tenoning jig as shown in the photo on page 31.

This is also a good time to cut the rabbet in the front edge of the top for the piano hinge. (Piano hinges available from Garrett Wade, 161 Ave. of the Americas, New York, NY 10013, 800-221-2942.) Notice in Fig. 1 that this cut is angled at  $3^\circ$  and runs along the entire length of the back section.

Rout the two vertical drawer frame grooves in the top. (See Fig. 1.) Use a dovetail bit. This will prevent the frame from dropping out with the weight of the drawer. You can rout these grooves out the back because they'll be covered.

### *Drawer Frames and Drawers*

Cut out the four pieces that make up the two drawer frames. The grain must run horizontally and vertically—not from front to back.

On a router table, using the same dovetail bit used to cut the grooves for the drawer frames, experiment at cutting the dovetail tenon with pieces of scrap the same thickness as the drawer frames. Keep testing on the scrap until you can get an easy, sliding fit with the grooves, then rout the actual frame pieces. Now change over to a  $\frac{1}{4}$ -in. straight bit and cut the remaining grooves in the two drawer side frames. The drawer frame bottoms have continuous tongues, which can be cut on the tablesaw.

**At this point, assemble the upper-desk parts.** Do a dry run first to make sure that all the parts fit. When satisfied with the fit, take the upper-desk assembly apart, clean up exposed surfaces with a plane and cabinet scraper, then glue it up. I found it convenient to glue up the two drawer frames as subassemblies. Make sure each one is exactly square and that all is square and free from twist. When the glue has set, plane the dovetails flush and finish sand the whole assembly.

To make the drawers, cut the drawer fronts first to make sure they fit the openings. Next, build the two drawers. (See Fig. 1.) When the glue has set, fit the drawers. (See "All About Drawers," page 52 for more on making and fitting drawers.)

### *Mounting the Upper-Desk Assembly*

Position the upper-desk assembly on the writing surface so the sides of the upper-desk assembly are  $\frac{3}{16}$  in. in from the edges of the writing surface. At the back, this offset should be  $\frac{1}{2}$  in. With a soft pencil, trace the outline of the two side pieces onto the writing surface, inside and out. When you remove the upper-desk assembly, you'll find two pairs of parallel lines a little more than  $\frac{3}{4}$  in.

apart. Mark for the screws, four to each side, exactly between these lines. Position them so they don't interfere with the screws already in place.

Now remove the writing surface from the base and drill  $\frac{7}{64}$ -in. holes vertically down through the writing surface where marked. Replace the upper-desk assembly exactly within the outline you drew and clamp it steady. Now using the existing holes as guides, drill  $\frac{7}{64}$ -in. holes up through the writing surface and into the sides. These are pilot holes for the screws. Next, run a larger bit through the holes in the writing surface for the screw shank and countersink for the head. Screw the upper-desk assembly to the writing surface, and then refasten the base.

### *Making the Hinged Lid*

The lid (see Fig. 1, L, M, N, O) is made in a similar way to the writing surface. It's a piece of  $\frac{3}{4}$ -in. birch plywood edged on all four sides with solid wood. I made up the lid in one piece, complete with edging, and then ripped it into two pieces on the tablesaw to create the central hinged joint. (Parts-list dimension of lid and edging allows  $\frac{1}{8}$  in. for kerf.) If you find the exposed plywood edges in this central joint unsightly, you could alter the design to include solid-wood edging along both sides of the seam. However, if the desk sits up against a wall, you won't even see the exposed plywood when the lid is up since it's at the back of the desk.

I attached two drawer stops (see Fig. 1, Q) to the underside of the lid at the back to prevent the drawers from falling out when the desk is moved. The front of the lid (see Fig. 1, P), the fascia, is also solid wood, with its mating edge sawn to a  $7^\circ$  angle as shown. I found that table-sawing this  $7^\circ$  angle created a slight recess, making the front of the lid easier to position during glue-up.

Now you're ready to hinge the lid together. Notice in Fig. 1 that this central hinge is mounted underneath the lid. I did this to get the tightest possible seam on top of the lid so the lid itself could be used as a writing surface. Also, I found routing a shallow recess for the hinge (rather than surface mounting it) gave the lid a neater look. You'll find it easier to fit and attach the upper half of the lid to the top first, then attach the lower half.

### *Making the Lid Lift and Drawer Pulls*

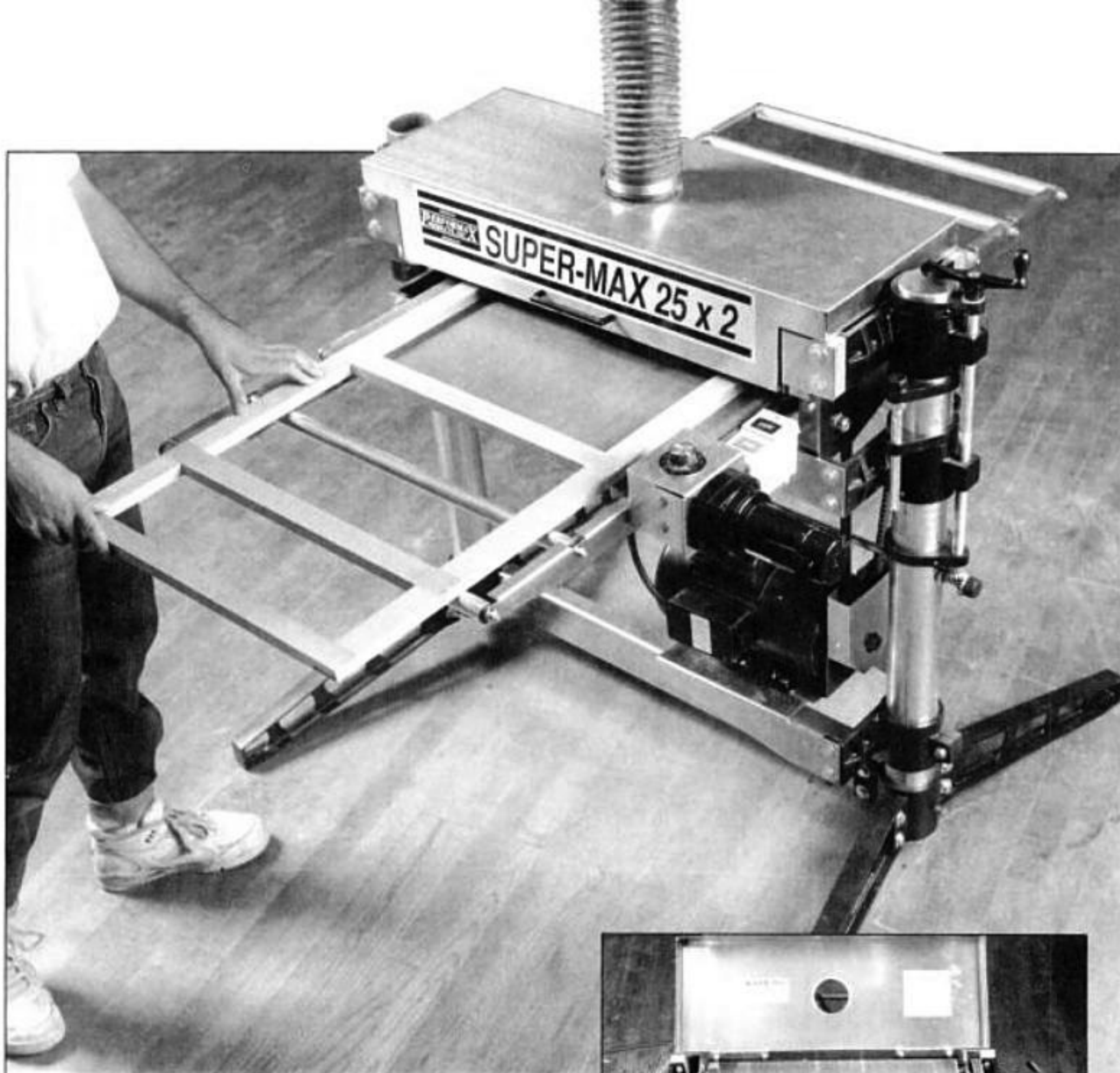
I used the same profile but different lengths for the lid lift and the drawer pulls. (See Fig. 1.) I shaped these by drilling a long  $\frac{5}{8}$ -in. dia. hole in a piece of ash. This hole corresponds to the cove underneath the pull/lift. I then did the rest of the shaping on the bandsaw. You can attach the pulls and lift either with stub tenons or with dowels or screws from the inside. You could also buy ready-made knobs.

### *Finishing*

I first applied a thin coat of shellac. After a light sanding with 320-grit sandpaper, I applied Deft Clear Wood Finish semi-gloss lacquer directly from the spray can. Two or three coats is enough but you can apply a final coat of Deft gloss if that is what you prefer. ▲



*Nelson Rittenhouse is a design engineer and has been building furniture since high school.*



A drum sander works like an abrasive planer to smooth and flatten boards, panels and assemblies—even the cross grain on the rails in this face frame. Opening the cover on this Performax Super Max 25 drum sander (right) reveals two sanding drums, which allow you to sand with both course and fine grits in one pass.



PHOTOS BY JOHN HAMEL

# DRUM SANDERS

*Automated Sanding  
for the Small Shop*

BY DAVE SELLERS

Sanding is the bane of woodworkers. Oh, there might be a few individuals (with time on their hands) who enjoy smoothing wood with sandpaper, but I don't know any. That endless rubbing gets old fast. And sanding is a pretty crude operation—scratching and tearing the wood fibers, rather than severing them cleanly as, say, a hand plane would do.

Yet, sanding surely has its place. It's relatively easy, fast, and if done correctly by progressing from coarse grit to fine grit, sanding can produce a surface ready for finishing on the finest furniture. A variety of portable sanding machines helps, too. Disc sanders, pad sanders, belt sanders and random-orbit sanders (see AW, #22) all do a good job, but they're limited in a couple of areas. They smooth the surface, but can't get it perfectly flat. And on big jobs, the sheer volume of work—holding a noisy, vibrating sander—slows production and can drive you crazy with boredom.

If this sounds familiar, perhaps it's time to consider a stationary drum-sanding machine. With this machine, you'll be able to automate many sanding jobs, surface and thickness-plane rough stock and free up your time to use your woodworking skills where they count. In this article, I'll explain how drum sanders work and describe some of the models currently on the market for less than \$2,500.

## A Look at Drum Sanders

A drum-sanding machine works a lot like a thickness planer. In fact, a drum sander is often called a *thickness sander* or an *abrasive planer*.

Where a planer has a rotating cutterhead with a set of knives, a drum sander has a metal cylinder covered by a strip of sandpaper wrapped around it in a spiral pattern. Wood passing underneath the rotating drum is sanded smooth and flat instead of being cut with knives. The sanding drums are about 5 in. or 6 in. in diameter and from 12 in. to about 38 in. long, depending on the width of the machine.

**So what are the advantages of a drum sander over a planer?** There are several. A planer has trouble surfacing highly figured wood, burls, crotches and other wild grain patterns. The planer's knives can tear the grain and chip out little pieces of wood. In contrast, a sander simply grinds away the top surface of the wood regardless of the grain direction, putting a smooth surface on any type of wood with equal ease.

Also, on a drum sander you can change the paper to match the abrasive grit to the job at hand. The range of grits used on drum sanders commonly runs from about 36-grit for very rough stock removal up to 220-grit for fine finish sanding.

Planers usually leave a faint series of ridges on the wood surface called "mill marks," which are caused by the rotating planer knives. The wood may feel smooth and the mill marks may be invisible on freshly planed

wood, but they'll show up when the wood is stained or finished. For this reason, planed wood has to be scraped or sanded before finishing. With fine-grit paper on a drum sander, the wood can be ready for finishing as it leaves the machine.

Drum sanders can handle foreign objects hidden in rough wood better than a planer can handle them. Unseen nails, stones or other debris can render a planer blade useless. A sander will glide over these objects—tearing a few dollars worth of sandpaper at worst.

Finally, a drum sander excels at surfacing flat *assemblies* such as face frames, door and window frames, picture frames and glued-up panels like tabletops and butcher-block tops (even end grain). Imagine trying to put a whole frame-and-panel door through your planer to even up the joints—it would likely be torn up pretty badly where the cross grain of the rails went under the

cutterhead. In contrast, assemblies like this come out of the drum sander with all joints flush, the whole surface smooth and the whole assembly uniformly thick. The sanding will leave tiny cross-grain scratches on the rails of frames, but these can be sanded out by hand in a short time with fine sandpaper in a pad sander. Because a drum sander won't chip out and can be adjusted to take very thin cuts, it's also a natural for sanding delicate inlay work, marquetry and veneered panels.

OK, if they're so great, why haven't drum sanders replaced planers entirely? First, drum sanders can't handle the large cuts that a planer can. A thickness planer can take off  $\frac{1}{16}$  in. or more (depending on size and motor power) in one pass, which makes it a better choice for surfacing rough-sawn boards or for removing large amounts of stock quickly. A drum sander can surface rough stock, too, with very coarse abrasive paper. But since it requires light cuts and multiple passes, it's not nearly as efficient as a planer. If you take too big a cut with a drum sander, you'll end up with burned wood and torn paper. And, though each type of machine makes a lot of debris, the fine dust from a drum sander is more bothersome to clean up and more hazardous to your lungs than the larger shavings from a planer. For this reason, a dust-collection system is a *must* with a drum sander.

Actually, thickness planers and drum sanders complement each other. In shops lucky enough to have both machines, you can bring stock close to final thickness on the planer and run it through the drum sander to remove the last  $\frac{1}{64}$  in. or so to produce a finished surface.

## Drum Sanders Today

Drum sanders were developed in the 1920s and used extensively in large production shops until the 1950s when a newer, more efficient type of machine—a *wide-belt sander*—began to replace them. On a wide-belt sander a sanding belt is stretched between two rollers,

***"To set the thickness of the cut, adjust the height of the conveyor belt so the wood misses the drum by an eighth of an inch or so. Start the wood through and turn the crank to raise the belt until the wood just touches the drum. . . you'll hear the drum make contact. That's the setting you want."***

JERRY GRAHAM

Custom cabinetmaker and furniture maker

Clearfield, PA

Woodmaster drum sander

**The Woodmaster #2675 26-in. drum sander has a sheet-steel enclosure and stand. Turn the crank on top to set the height of the power-feed conveyor belt, which adjusts the thickness of the cut.**

PHOTO COURTESY OF WOODMASTER



so the paper runs cooler, lasts longer and is easier to change. Today, there are many makes of wide-belt sanders with prices starting around \$5,000 for the most basic machine.

Drum sanders are less expensive because they have fewer parts and are easier to manufacture. There are several drum-sander models available in the \$1,000 to \$2,500 price range that make them attractive to small-shop owners or any woodworker who wants to automate sanding chores. Design improvements have made it easier to replace the paper on drum sanders, and a paper change on a drum sander costs much less than on a wide-belt sander. Enough new paper to cover one 25-in. wide drum should cost about \$7 to \$10. Bulk purchases of sanding paper are the most economical way to go.

If you're tired of spending hours going over your projects with hand-held portable sanders, but you can't justify the expense of a wide-belt sander, take a look at some of these drum sanders.

### *Drum Sanders for Different Needs*

Drum sanders are available in different sizes and configurations to meet different needs. Though larger drum sanders are available, we've focused on several smaller models for less than \$2,500. Within this price range, more money buys you wider capacity and added features like power-feed conveyor belts (instead of having to hand feed the stock) and two sanding drums, which allow you to have coarse-grit on the first drum and finer-grit on the second—thus doing the work of two sanders in one pass.

**Woodmaster** sells a 26-in. capacity drum sander with a 5-HP motor and a power-feed conveyor with variable-speed feed rates from 0 to 16 feet per minute. This model #2675 single-drum sander sells for \$2,199 and has a heavy-gauge sheet-steel stand that covers the mechanical parts of the machine as shown in the photo (above). One

innovation on the Woodmaster sander is the paper-attachment system—there's Velcro on the drum and felt-backed sandpaper, which is wrapped in a spiral around the drum. Built-in dust chutes enable a powerful shop vac to extract sanding dust from the *bottom* of the drum, which helps prevent loading of the abrasive and gives longer abrasive life.

**The Excalibur Machine Co.** makes a small Ross #SS-12, 12-in. wide drum sander priced at \$1,054, which is just right for smoothing 1 x 12 boards. (See photo below.) This machine has an enclosed sheet-steel stand, with a 1-HP motor and a power-feed conveyor belt with fixed speed. The spiral-wrapped sanding strip is held in place with reinforced filament wrapping tape. Excalibur will be introducing a 20-in. wide, single-drum sander with a 3-HP motor for less than \$2,000 in December.

**Lobo** offers two different drum sanders—a 15-in., 3-HP model (#SK-15DS) for \$1,995 and a 20-in. 5-HP model (#SK-20DS) for \$2,450. Both have double sanding drums for mounting a different grit on each drum, and power-feed conveyor belts running at a fixed speed of 12 feet per minute.

**Performax Products** offers several drum sanders in different configurations. At the top of the Performax line is the Super Max 25, a single-drum machine priced at

\$2,195, and the Super Max 25 x 2, a double-drum machine at \$2,595. These sanders stand firmly on two posts, are powered by a 5-HP motor and come standard with power-feed conveyor belt with variable speed of 0 to 20 feet per minute. The 25 x 2 model has a secondary

sanding drum that can be fitted with finer paper than the primary drum. All the Performax drum sanders feature a spring-loaded take-up mechanism in the drum that automatically takes up the slack in the spirally wrapped sanding belt as it stretches during use.

*"With hand sanding, each piece might stain differently, sometimes blotchy, which caused a lot of trouble. Now after running my stock through the drum sander, it takes stain more evenly."*

BOB SMAJSTRLA  
Garden Acres Country Woodworking  
Burleson, TX  
Ross drum sander

**The Ross 12-in. drum sander is just right for surfacing 1 x 12 or narrower boards. Notice how a light pass begins to smooth the surface of the rough-cut board.**



## Conversion Kits

You can get set up for drum sanding for as little as \$300 with an accessory kit from Performax Products that converts a radial arm saw into a drum sander. (See photo below.) The Performax model ST kit relies on the saw's column to mount the drum mechanism, and it uses the saw's motor to power the drum. The 22-in. wide drum is suspended in a rigid cast-aluminum frame that hangs—cantilever fashion—out over the saw's work table. You might think the outboard end of the drum would be too flexible to sand a consistent thickness, but it works fine if you take light cuts with reasonable feed speeds. One advantage of this open-sided design is the ability to sand panels up to 44 in. wide by running them through the sander one side at a time. Once you get used to it, mounting or removing the sander from the radial arm saw takes about 10 minutes.

For woodworkers without a radial arm saw, Performax offers an auxiliary stand (\$350) on which to mount the model ST drum sander, and a separate 1 1/2-HP motor to power it. Also available is an optional power-feed attachment (\$330) that feeds the stock under the drum on a flat conveyor belt at a variable speed of 0 to 10 feet per minute. (It also can be used with the model ST below.) You can buy a package deal called the Performax Pro Max II, which consists of the model ST, auxiliary stand, power-feed attachment, and 1 1/2-HP motor for a price of \$1,495.

If you already own a Woodmaster or RBIndustries



The Performax ST is the least expensive way to get drum-sanding capability in your shop. The sander mounts on a radial arm saw column and uses the saw's motor for power. This setup also shows the optional Performax power feed accessory.

PHOTO COURTESY OF  
PERFORMAX

planer, both companies offer an accessory kit to convert their planers to a drum sander. The conversion kit for the Woodmaster's 12-in. planer costs \$99, \$169 for the 18-in. wide planer and \$199 for the RBIndustries 12 1/4-in. wide planer.

The **Belsaw Co.** (formerly Foley Belsaw) also has a kit available to convert its planer to a drum sander for \$89. The kit, called the Tri-Sand System, makes use of the planer's cutterhead by providing the parts necessary to mount pieces of sandpaper in each of the cutterhead's three knife slots.

Dave Sellers is an assistant editor of *AMERICAN WOODWORKER*

## OPERATING TIPS

If you decide to take the plunge and buy a drum sander, you'll probably wonder how you got along without one. Like any other machine, there are some things you should know about the drum sander that will help optimize its performance. Here are some tips:

- **Be realistic**—A drum sander is not a substitute for a thickness planer. It can thickness boards like a planer, but if that's the main job you'll be using it for, a planer would be a better choice. You'll get a better finish with several light passes instead of a single heavy pass. Your sandpaper will last longer, too.

- **Use an adequate dust collection system**—The bigger drum sanders require high-capacity dust collection.

- **Clean the drum's abrasive paper often**—Gum rubber cleaning sticks work well to keep the abrasive clean. If the paper stretches after a period of use, rewrap it to take up the slack.

- **Start with a slow feed speed at first**—After using the sander awhile, you'll know how fast you can feed the stock without burning or clogging the abrasive.

- **When the abrasive paper no longer cuts well, even if it's clean, it's time to replace it**—The service life of abrasive paper depends on wood type, feed speed and depth-of-cut, so, as you might expect, it varies widely.

- **Use auxiliary stands or rollers to support long boards or frames as they enter and exit the sander**—Otherwise, if the stock tips up or down, it's very easy to get gouges or snipes from the sanding drum.—D.S.

## Sources

**BELSAW CO.** (formerly Foley Belsaw)  
4111 Central Ave. NE  
Minneapolis, MN 55421  
(800) 468-4449

**EXCALIBUR MACHINE CORP.** (Ross sanders)  
P.O. Box 82  
Anderson, MO 64831  
(800) 368-7677

**LOBO POWER TOOLS INC.**  
9034 Bermudez St.  
Pico River, CA 90660  
(213) 949-3747

**PERFORMAX PRODUCTS INC.**  
12211 Woodlake Dr.  
Burnsville, MN 55337  
(800) 334-4910

**WOODMASTER TOOLS INC.**  
2908 Oak St.  
Kansas City, MO 64108  
(816) 756-2195

**RBINDUSTRIES**  
1801 Vine St., P.O. Box 369  
Harrisonville, MO 64701  
(800) 487-2623

# SILVER CHEST

*A Fitting Home  
for Your Finest  
Flatware*



BY JONATHAN CLARKE

**S**terling silver is heirloom stuff, family treasure. This two-drawer silverware chest, inspired by the English Arts-and-Crafts Movement, is an ideal place to keep and protect your silver.

The chest has a nice, clean look that's complemented by decorative scallops carved around the front edges of the carcass. The carcass is joined with blind mitered dovetails (sometimes referred to as full-blind dovetails). The drawers feature half-blind dovetails in front and through dovetails at the back. The silver chest isn't a complicated piece to build, but it requires good fit and finish to live up to the task of holding the family silver.

The sidebar on page 42 takes you step by step through the process of cutting blind mitered dovetails. No single step is particularly difficult, so a patient and careful woodworker can undertake the project with confidence. If you'd rather avoid the hand-cut joints, you could substitute a splined miter for the blind mitered dovetails.

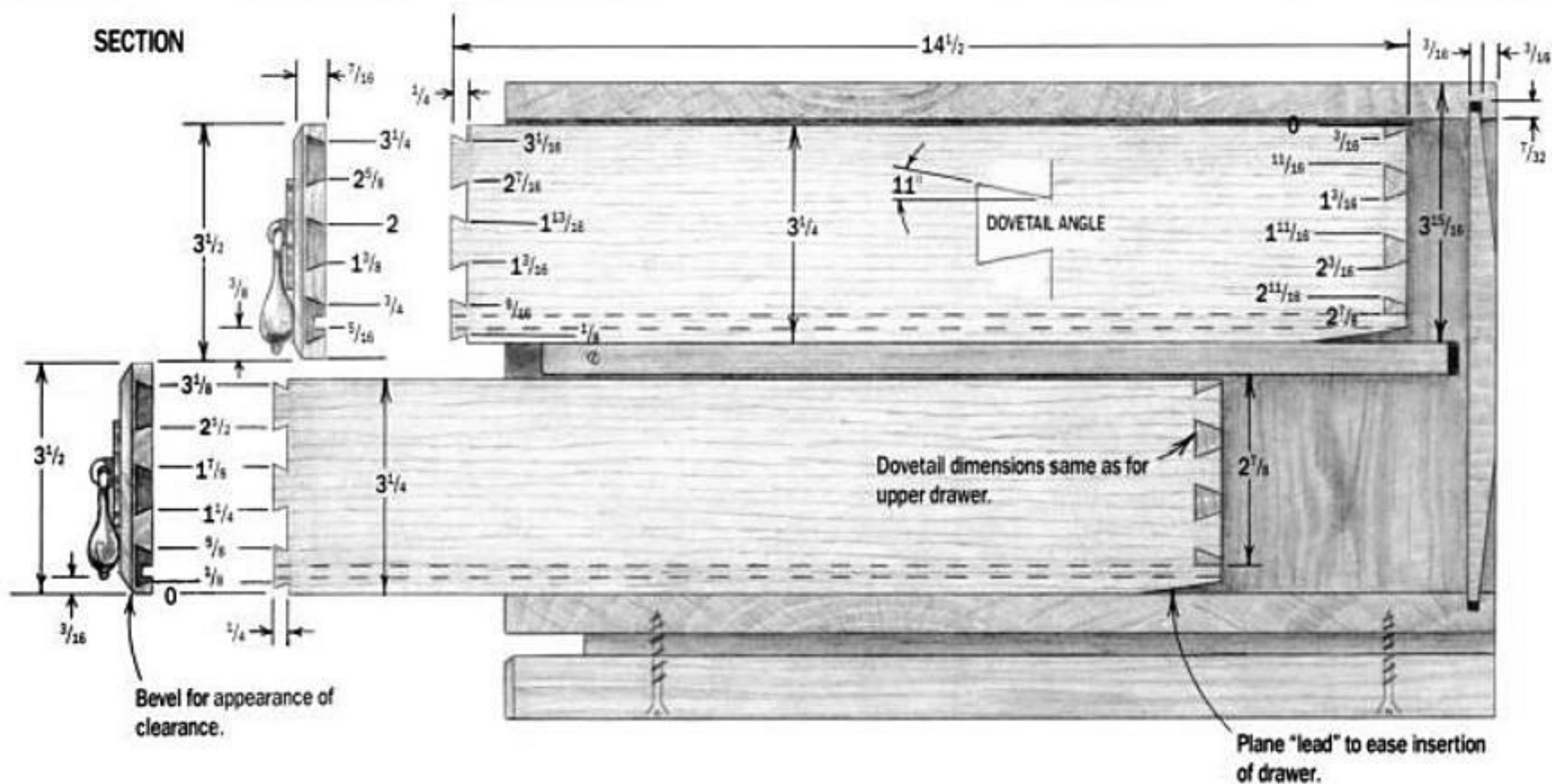
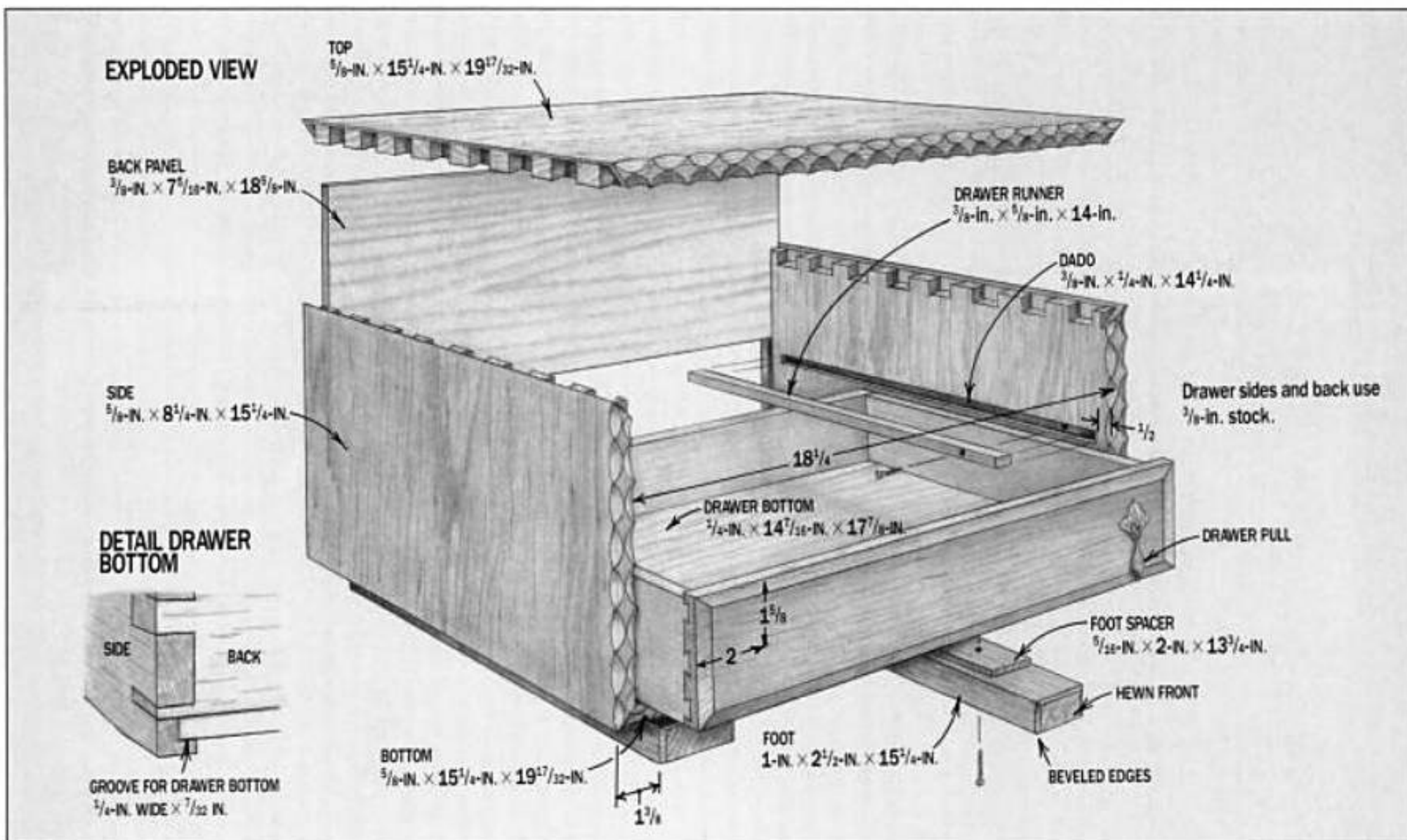
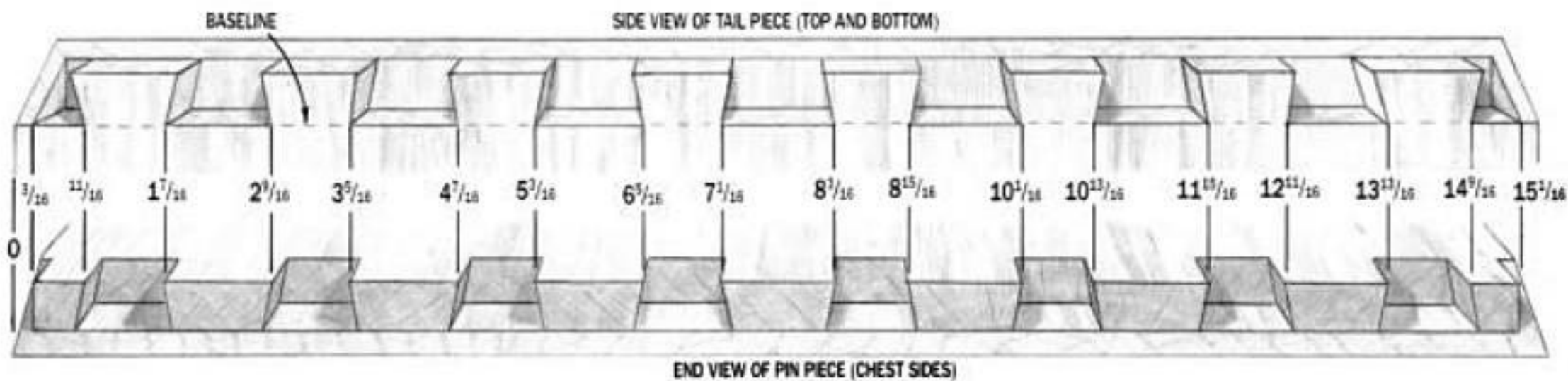
I designed the chest so the drawers would hold a com-

mercially made silverware insert covered with a tarnish-resisting cloth (item #19547 available from The Woodworker's Store, 21801 Industrial Blvd., Rogers, MN 55374, 612-428-2199). The insert holds twelve six-piece place settings. I fitted this insert into the lower drawer and left the upper drawer open to provide space for large serving utensils. You can line the upper drawer with tarnish-resisting silver cloth (available from most fabric shops or from Nancy's Notions, P.O. Box 683, Beaver Dam, WI 53916, 414-887-0391). You could also leave out the insert and fill the chest with other valuables.

## *Cutting Out the Parts*

Except for the carcass back and drawer bottoms, I made the chest from white oak. If you edge join boards to make the carcass, I suggest that you glue up one piece long enough to make the two sides and the top. Cut these parts so that the grain and the edge joints will run continuously up one side, across **Continued on page 44**

**FIG. 1: SILVER CHEST**



# BLIND MITERED DOVETAILS

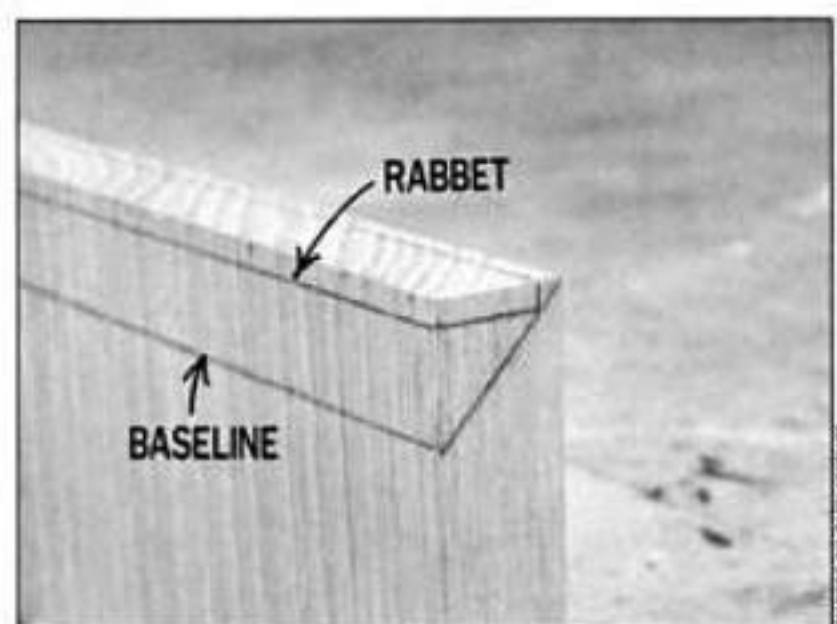
## STEP BY STEP

**B**lind mitered dovetails combine the look of a miter joint with the strength of dovetails. The dovetails remain totally hidden in the finished joint as though you had assembled a through-dovetail joint and covered it with  $\frac{1}{8}$ -in. thick veneer mitered at the corners. While the joint may appear complicated, each step in the process is simple and straightforward.

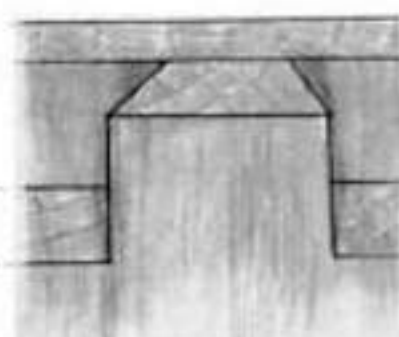
Blind mitered dovetails (also known as secret mitered dovetails or full-blind dovetails) are most often used for

carcase construction where solid-wood sides must join a solid-wood top but where the design doesn't allow exposed joinery. The silver chest in the accompanying article is a good example.

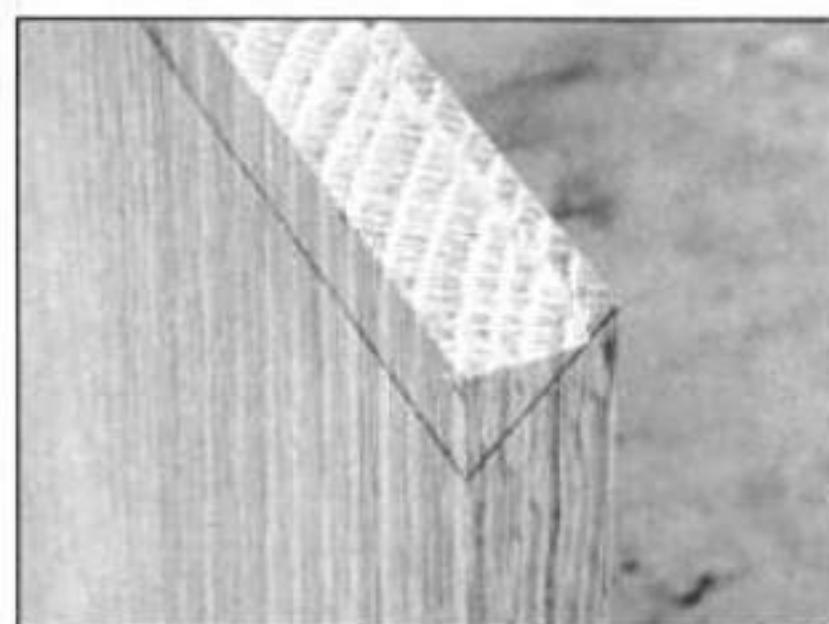
In addition to chisels, mallets and layout tools used for hand-cut through dovetails, I use a  $\frac{3}{8}$ -in. Forstner bit in the drill press to remove waste, a tablesaw for cutting the initial rabbet and a shoulder plane for final trimming of the miter.



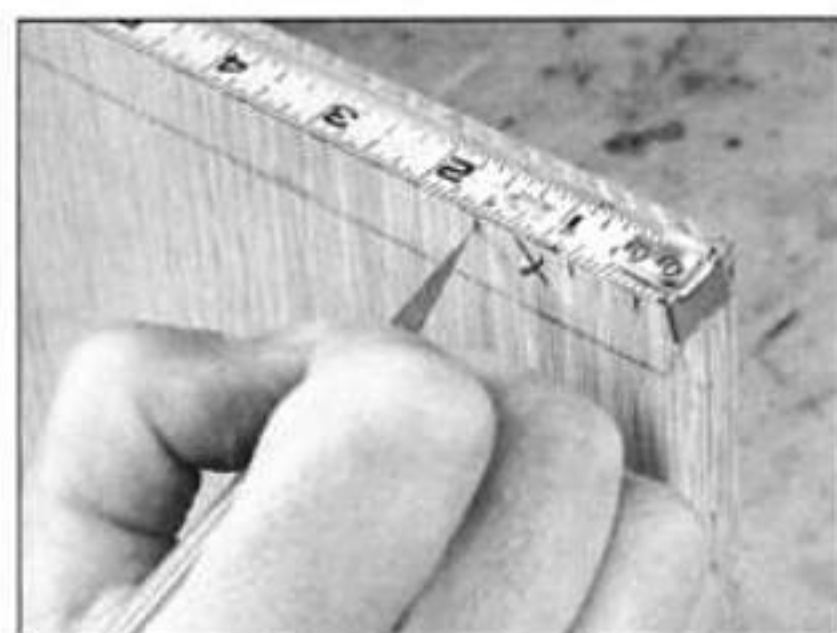
**STEP 1:** Scribe the miters first, then the rabbet and baselines on both the pin and tail pieces. The  $45^\circ$  miter must intersect the outside corner of the board exactly. The corner of the rabbet should just touch the miter line. The baseline must meet the inner end of the miter line exactly.



Pin



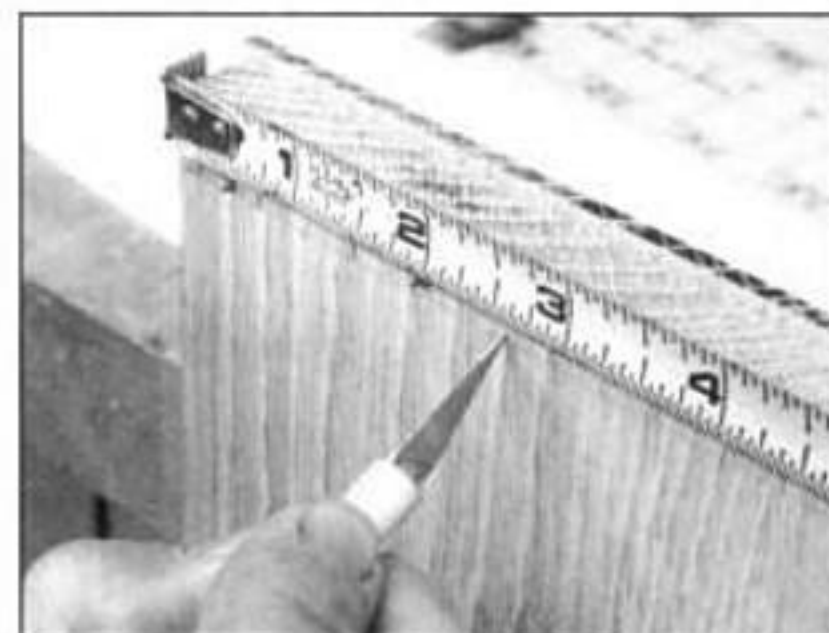
**STEP 2:** Cut the rabbet on the tablesaw, with a router, or with a backsaw and a shoulder plane. The corner of the rabbet should just touch the miter line. If it falls short, the dovetails will close before the miter closes. If it goes beyond, you will have a visible gap at that spot.



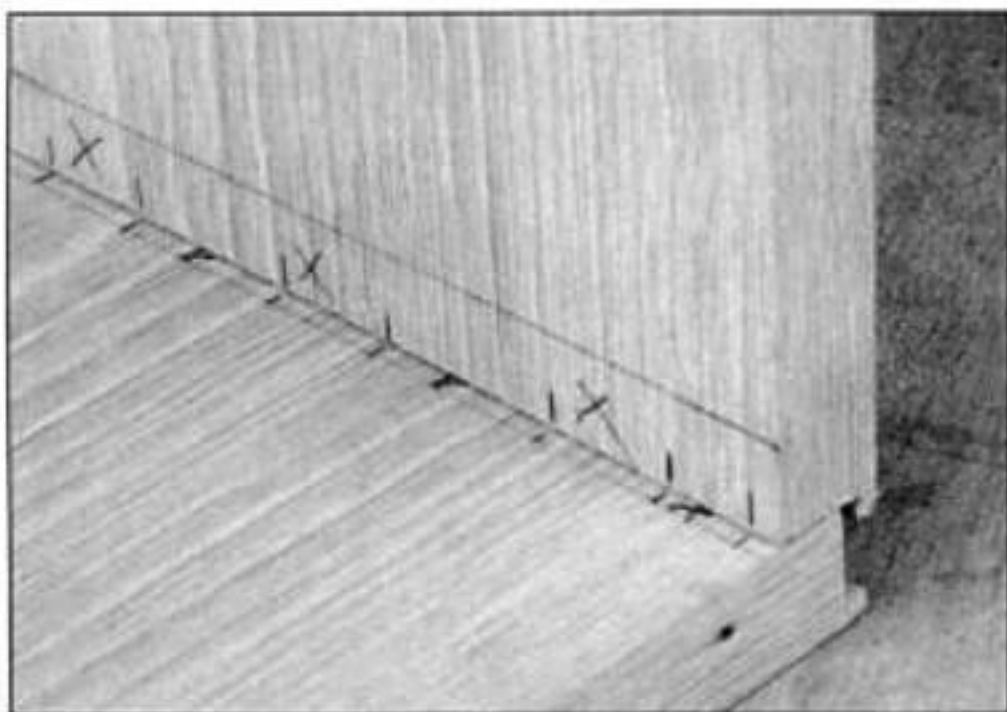
**STEP 3:** Lay out the pins. Mark the wide part of each pin on the inside corner of the pin piece and mark the waste areas with a penciled X. Measure from the front or "face" edge of the board. The row of pins begins and ends with a mitered section, then a half pin, then alternating tail sockets and pins.



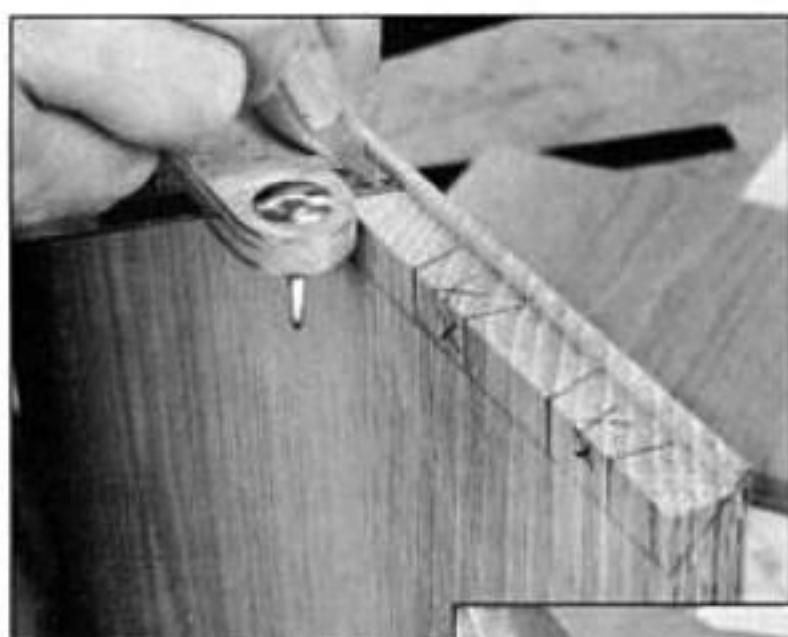
Tail



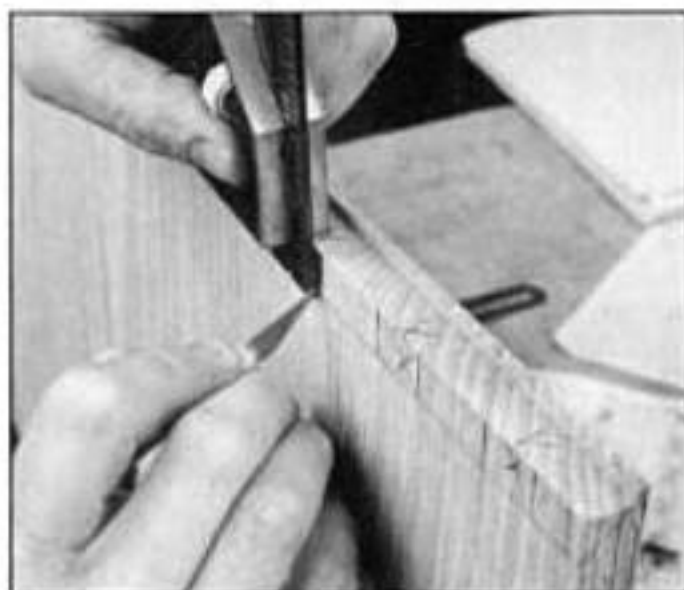
**STEP 4:** Lay out the tails. Mark the narrow part of each tail on the baseline with the same measurements used for the wide part of the pins. Again, measure from the "face" edge of the board. Mark the waste areas. The row of tails begins and ends with a mitered section, then a socket for the half pin, then alternating tails and pin sockets.



**STEP 5:** Double check the layout by holding the pin layout up to the tail layout. The pin marks should line up with the tail marks perfectly. Separate the two pieces a fraction of an inch and check that the waste Xs alternate.



**STEP 6:** Set a sliding bevel to the angle of the dovetails (I use an angle of  $11^\circ$ ) and scribe the ends of the pins on the wide surface of the rabbet. Keeping the same adjustment on the sliding bevel, scribe the faces of the tails on the inside surface of the tail piece.

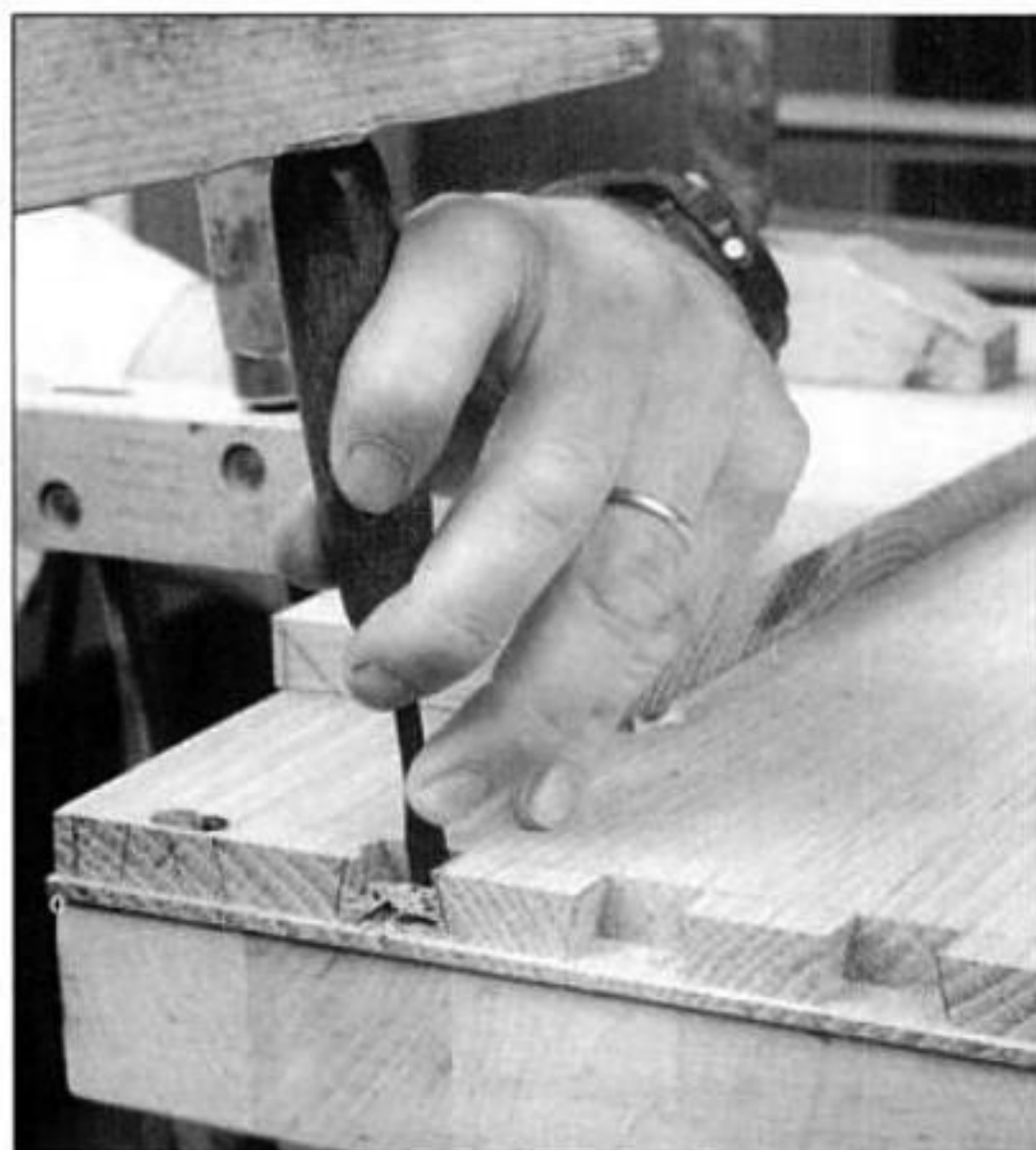


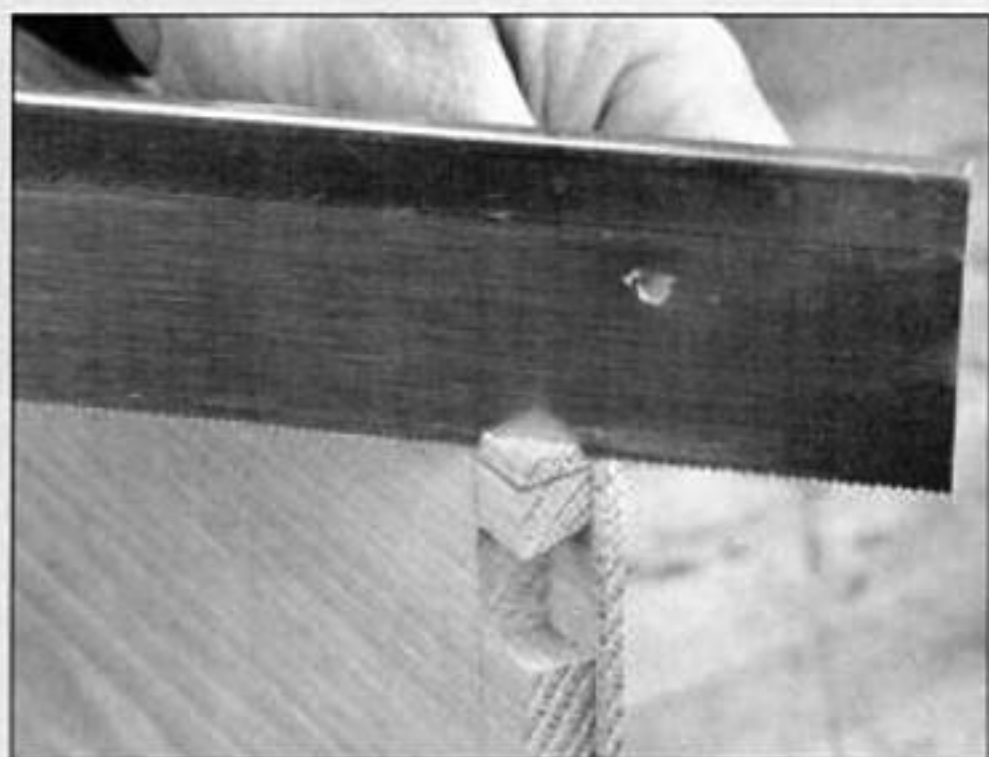
**STEP 7:** Square down the faces of the pins and across the ends of the tails.



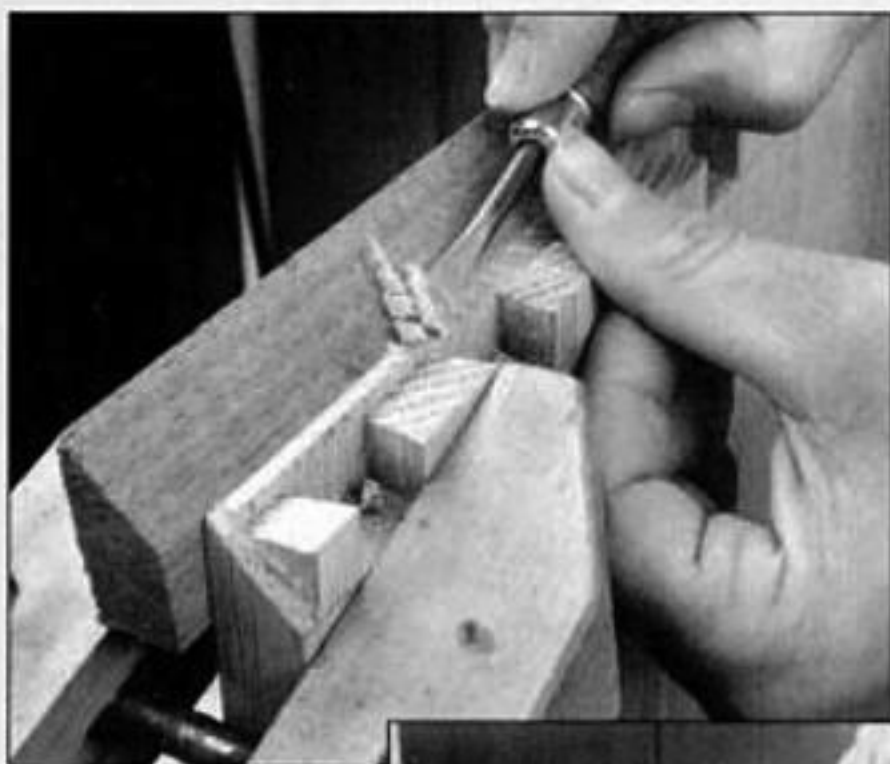
**STEP 8:** Chop out the waste between the tails. I remove as much waste as possible with a  $\frac{3}{8}$ -in. Forstner bit in the drill press, then I chop and pare the remainder with chisels. Place the chisel directly in the scribe mark for the last cut. Clean each recess thoroughly. A different perspective often reveals that the sides of a recess are slanting inward, so check from different angles.

**STEP 9:** Chop out the waste between the pins with the same "drill, chop and pare" technique used for the tails. **Continued**





**STEP 10:** Cut the miters at the ends of the joint on both the pin and tail pieces. I saw safely outside the knife line with a small backsaw, and then I pare to the line with a razor-sharp chisel. The cuts must be square with the edges of the boards.



**STEP 11:** Pare off the waste along the long narrow part of the miters. I begin freehand with a sharp chisel and finish with a shoulder plane. A board sawn at 45° and clamped along the edge will serve as a guide. Work carefully and plane up to the corner but not beyond.



### *Trial Fitting*

Trial fit your dovetails. They should tap together snugly. If they don't go together, check to see where a pin or tail needs some trimming. Pare off small amounts as necessary. If they go together but don't fully close, check for pin or tail sockets that taper toward the bottom or haven't been completely chiseled out. A little study and careful trimming should make things mesh.—J.C.

the top, and down the other side. (See AW, #17 for more on edge joining.) You can make the bottom of the carcass from a separate piece.

The ends of the top, bottom and sides of the carcass must be perfectly square. Make sure both ends of each board are square by checking that the boards are exactly the same length on each edge, exactly the same width on each end and that the two diagonals of each board are exactly the same length.

Cut the drawer parts, runners and foot parts to size. By sawing the drawer fronts to the dimensions in the drawing, they will fill the opening tightly from top to bottom. When you fit the drawers, you will trim them with a plane to give uniform clearance all the way around. I cut the drawer bottoms and the carcass back out of pine.

### *Carcass Joinery*

With all the parts cut to size, you can start cutting and fitting joints. The runners that support the upper drawer fit in stopped dadoes in the carcass sides as shown in Fig. 1. You can cut these dadoes with a router and square the ends with a chisel. I prefer to work with hand tools, so I laid the dadoes out with a knife, drilled out the waste, cut to the lines with a chisel and cleaned the bottoms with a router plane. Whichever way you cut them, finish the dadoes first, and then plane the runners to fit tightly.

Next, lay out and cut the blind mitered dovetails that join the carcass sides to the top and bottom. The sidebar on page 42 describes how to cut this joint. Once the miters are cut, be careful when handling these pieces so the delicate edges of the miters aren't damaged.

Dry assemble the carcass and check that the front and back edges are flush at all the corners. Correct any small discrepancies with a smooth plane.

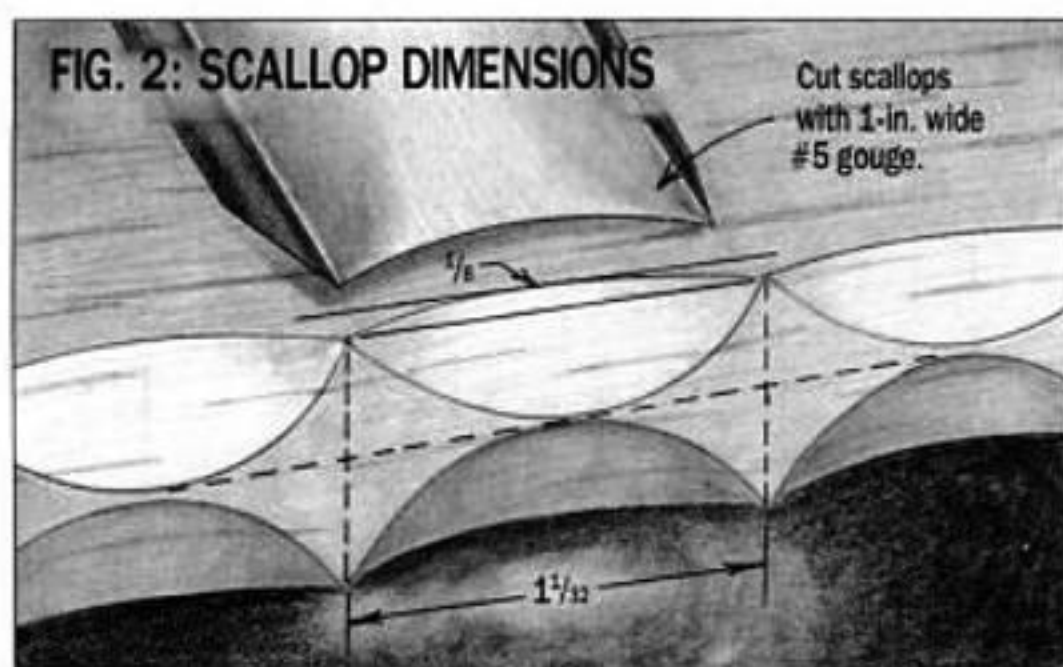
With the dovetails cut and the corners flush, cut the grooves for the back panel. (See Fig. 1.) I cut them in two passes on the tablesaw with a flat-top grind rip blade. I also cut the grooves for the drawer bottoms at this time while the tablesaw was set up for the job. Note that the groove in the upper drawer front is further from the edge than the other grooves.

Thin the edges of the back to fit in the grooves by planing a bevel on the back side of the panel on all four edges.

### *Decorative Carving*

I decorated the front edges of the carcass with a series of scallop-shaped cuts that left a series of diamond-shaped fields. The photo on page 40 shows the visual effect. Fig. 2 gives the dimensions that produce that effect. Lay out the centerlines of the diamonds with light pencil lines. The diamonds are  $1\frac{1}{2}$  in. center to center. Measuring up the carcass sides, eight of these spaces come out to exactly the height of the sides. Across the top and bottom of the carcass you need to fudge  $\frac{3}{32}$  in. to bring the total length of 19 spaces down to  $19\frac{1}{32}$  in. If you fudge  $\frac{1}{64}$  in. on four of them, nobody will notice and you'll come out right. Lay out the centerline that runs the length of the edge and the depth line that runs along the side.

Carve the scallops with a #5 sweep gouge, the wider the better. I used a 1-in. wide gouge. Place the gouge midway between two diamonds and cut toward the centerline on



the edge of the board as shown in Fig. 2. Take several light cuts for each scallop. The curve of the gouge will produce the desired shape. Work up to the last cut, which should just touch the depth line and the diamond centerlines running across the board edge. The cut should fall just short of the diamond centerline running the length of the board edge. This will leave a narrow flat between opposite scallops.

You might want to practice your carving on scrap oak. Carving the scallops is a somewhat tedious job but easy once you get the knack. Erase the pencil marks when you've finished the carving. (White oak tends to smudge when pencil marks are erased with a pencil eraser. I use a Faber-Castell "Magic-rub" with good, clean results.)

### Assembling the Carcase

With the carving complete, you can assemble the carcase. Apply glue sparingly to the sides of the pins and tails with a narrow brush. Avoid getting glue on the surfaces of the miters. Assemble the two sides to the bottom, slip in the back (making sure the bevels are facing out) and fit the top on. Clamp from top to bottom, keeping the pressure directly over the line of the dovetails. Use plenty of clamps (you need pressure all along the miters), but don't over-tighten. Too much pressure or poorly positioned clamps will bow the boards inward and open the miters. Double check that the assembly is square.

### Making the Drawers

The drawers for the chest are quite conventional. The fronts join the sides with half-blind dovetails, and the backs join with through dovetails. The drawer bottoms fit in grooves in the sides and the fronts. (See page 52 for more on drawers.) Notice in Fig. 1 that the upper drawer front extends below the drawer sides to cover half of the drawer runner, and the lower drawer front extends above the drawer sides to cover the other half of the drawer runner. Fig. 1 provides all the necessary dovetail dimensions to accommodate these differences. Label the parts clearly to keep from getting them confused.

When you've finished the dovetails and have them trial-fit together, bevel the front and side edges of the drawer bottoms as you did for the carcase back so they'll slide into the grooves without difficulty. Then hand plane the bevels on the drawer fronts as shown in Fig. 1.

Glue up the drawers on a flat surface, measuring their diagonals to be sure the drawers are perfectly square. When dry, insert the bottoms and fix them with a small

brad at the center of each drawer back.

Secure each drawer runner in its dado in the carcase side with a single screw near the front. (See Fig. 1.) Since the front ends of the runners act as drawer stops, be sure they are exactly 1/2 in. from the front edge of the carcase sides. Leave the rear of the runners free to allow the sides to expand and contract as the moisture content of the sides changes. Don't glue the runners into their dados.

Fit the drawers by inserting them in the carcase and noting the clearance at the ends, top and bottom of each drawer. Plane the top and bottom edges of the drawer fronts to make the clearances the same all the way around both drawers. Don't be in a hurry; you can't put wood back. Take a stroke or two and reinsert the drawer to judge your progress. When planing the bottom edge of the bottom drawer front, hold the plane at an angle to create a bevel; along this edge you are only trying to create the appearance of clearance. (See Fig. 1.)

### Finishing Touches

The chest stands on two "feet" that are separated from the chest by spacers, giving the impression that the chest is floating above the feet. I carved the end grain of the feet with a gouge to give them a hewn appearance, and I planed a small bevel around the edges on the ends of the feet as shown in Fig. 1. Next, I glued the spacers to the feet and screwed the assembly to the chest.

The only finish on my chest is wax. For the first coat, I melted Butcher's Boston Polish, an amber wax, in a double boiler and wiped it on hot. I also put a coat of this melted wax on all the interior parts except the drawer bottoms and the back. Wax is extremely flammable so use *extreme caution*. Always melt wax in a double boiler—never put the wax pot directly on the burner. I use an electric hot plate on low, *not* an open flame.

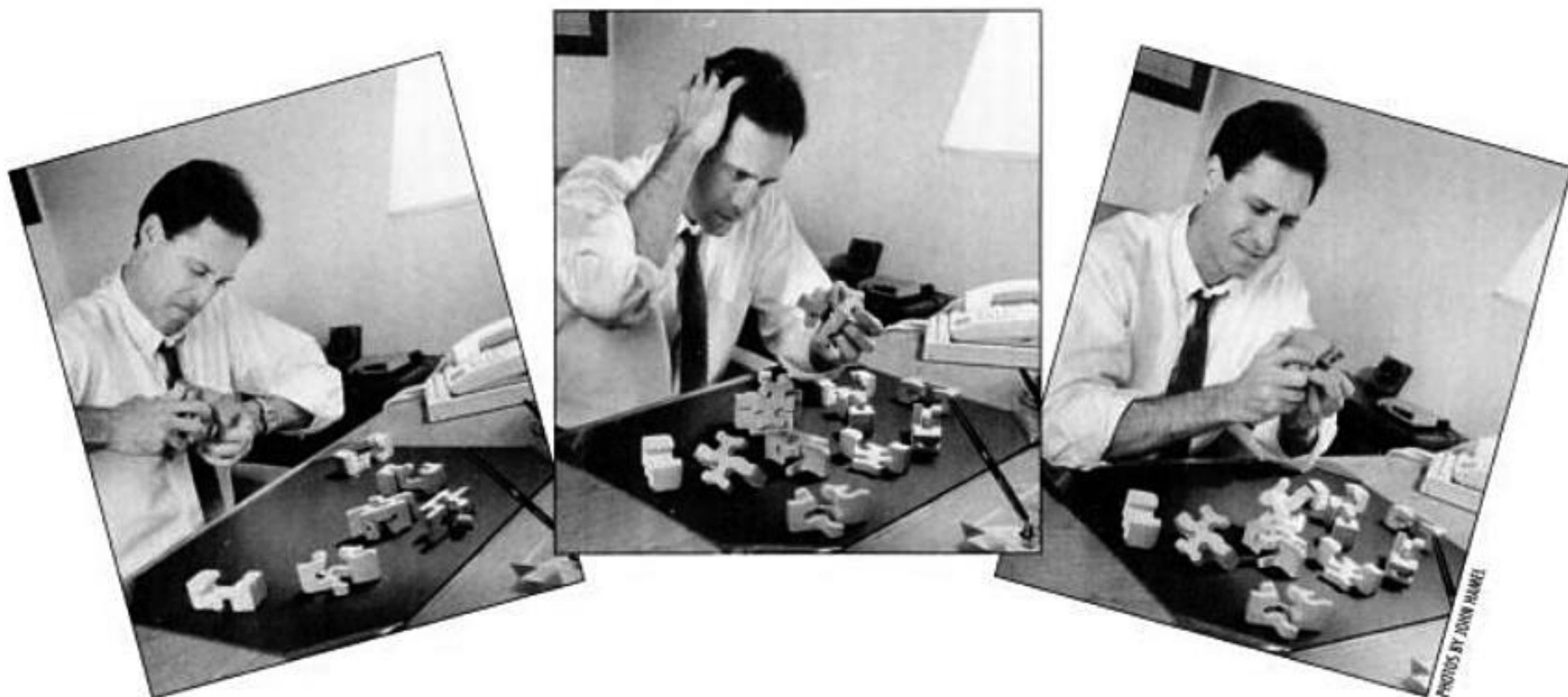
I followed the amber wax with successive coats of Butcher's Bowling Alley Wax (a white wax). I applied the white wax with a soft cloth at room temperature, buffing between applications with another soft cloth until I was satisfied with the depth of the finish.

With the finish complete, I mounted the pulls. (Style H-115, "bright" finish available from Horton Brasses, Nooks Hill Rd., P.O. Box 95, Cromwell, CT 06416, 203-635-4400). Notice on the drawing that the pulls are positioned 1/8 in. above the center of the drawer.

The final step is to install the silverware insert in the lower drawer. The insert consists of a piece of heavy poster board with attached fitments for knives and for stacking forks and spoons. It's covered with tarnish-resisting cloth and has a flap of the same cloth to drape over the silverware. The insert should just press into the drawer snugly. ▲



Jonathan Clarke is a woodworker, furniture maker and timber framer whose main job is single-handedly raising his eight-year-old son.



## A 3-D Brain Tease

# BLOCK PUZZLE

BY RAY LEVY

Most any woodworking project is a puzzle of sorts—when the pieces finally fit, you get that familiar feeling of satisfaction. Here's another type of puzzle—a wooden puzzle that's meant to be taken apart and reassembled again and again to test just how clever you are.

Making this puzzle is a matter of preparing a wooden cube and bandsawing out the puzzle pieces from two sides of the cube in two separate steps. It's fairly easy to make, but not so simple to solve. Look at Fig. 2 and the photos, and you'll be able to figure out how the interlocking pieces slip together.

Choose a uniformly grained wood of medium density to make the puzzle. I've had good results with poplar, basswood and mahogany. It's best to avoid the harder woods because they can cause a narrow bandsaw blade to wander from a straight cut in the wide wood. (See sidebar, *Tips for Bandsawing Thick Wood*.) You will need a 3¾-in. thick cube. If you can't get 3¾-in. thick stock, glue up the block from two or more individual pieces. Match the grain carefully to help hide the glue-joint line.

You'll need to make a copy or tracing of the serpentine line patterns in Fig. 1 (see page 48) to help guide the bandsawn cuts. (Be sure it is a full-size copy.) Glue the copy directly to two adjacent sides of the wooden cube. Next, saw along the lines with a ⅛-in. bandsaw blade. The step-

by-step photos show how it's done.

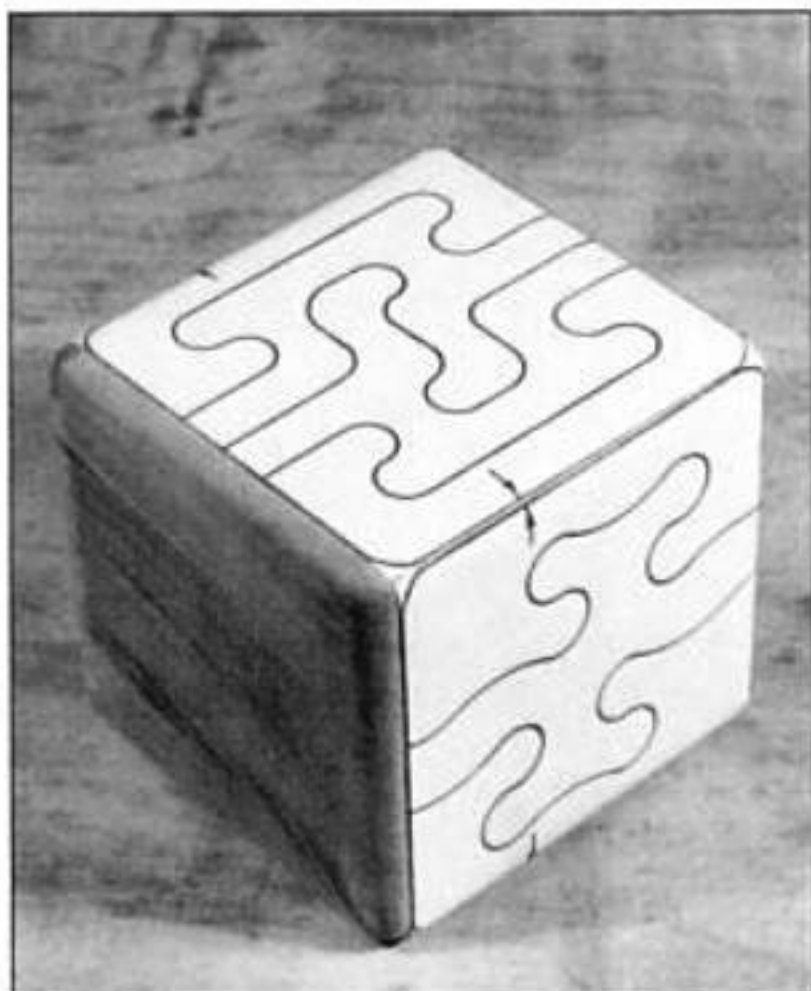
When the sawing is completed, lightly sand the bandsawn surfaces by hand. You can make a simple hand-sanding stick with a dowel and a piece of sandpaper as shown in Fig. 3. After sanding, apply a finish that won't build up on the wood surface and doesn't require sanding. I'd recommend a penetrating oil finish like those from Watco or Minwax. Apply the finish to every surface of each of the puzzle pieces.

**The best way to disassemble the puzzle** is to slide it apart in layers, either horizontally or vertically. (See Fig. 2.) Disassemble each layer. Reverse the order to assemble the puzzle. Don't start assembly of the puzzle in two directions at the same time—it won't work. Hint: If your wood puzzle block has a prominent end-grain figure, use it as a visual aid to assist the assembly.

One final caution: I'd bring this puzzle out *after* dinner to amuse guests. Otherwise, you could end up with empty chairs at the table until the puzzle is solved. ▲

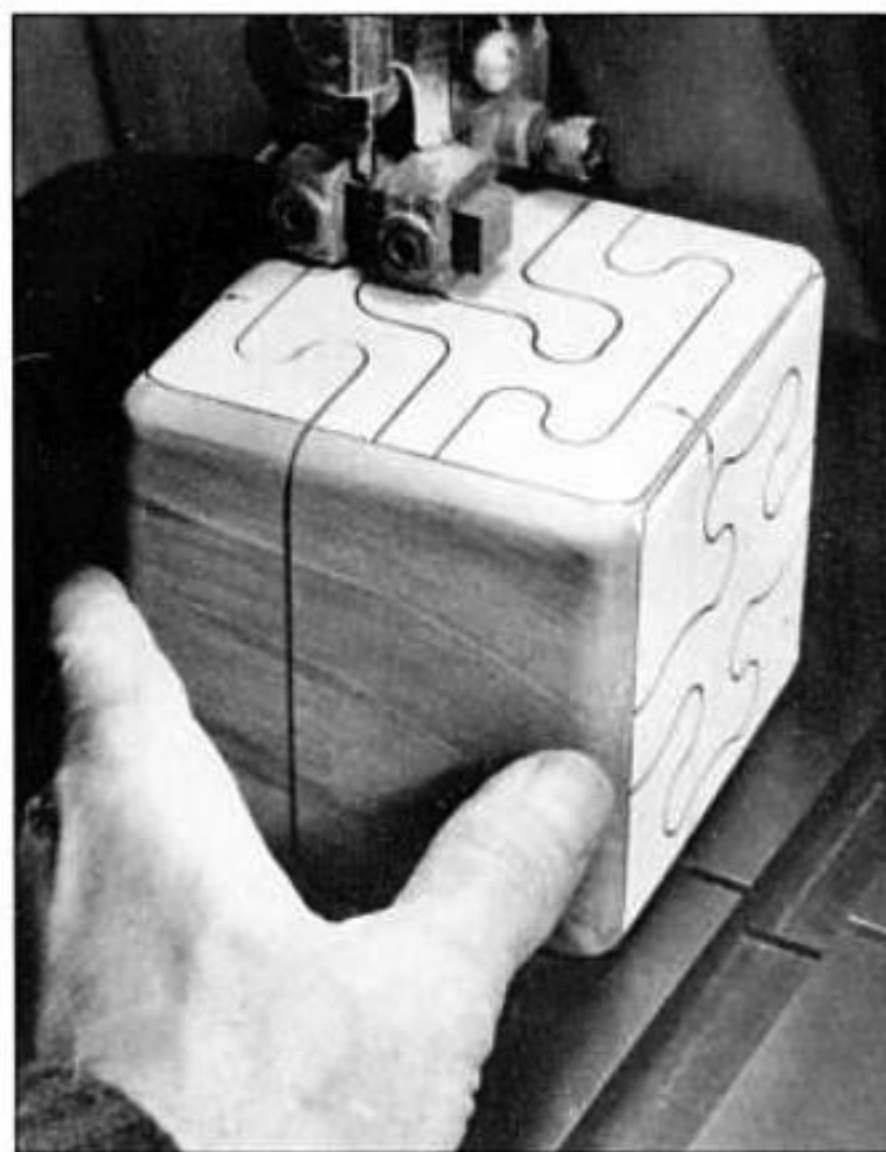


Ray Levy is a retired mechanical designer who has been working wood most of his life. He has a new book out, *Making Mechanical Marvels in Wood* (1991, Sterling Publishing Co. Inc., 387 Park Ave. S., New York, NY 10016).



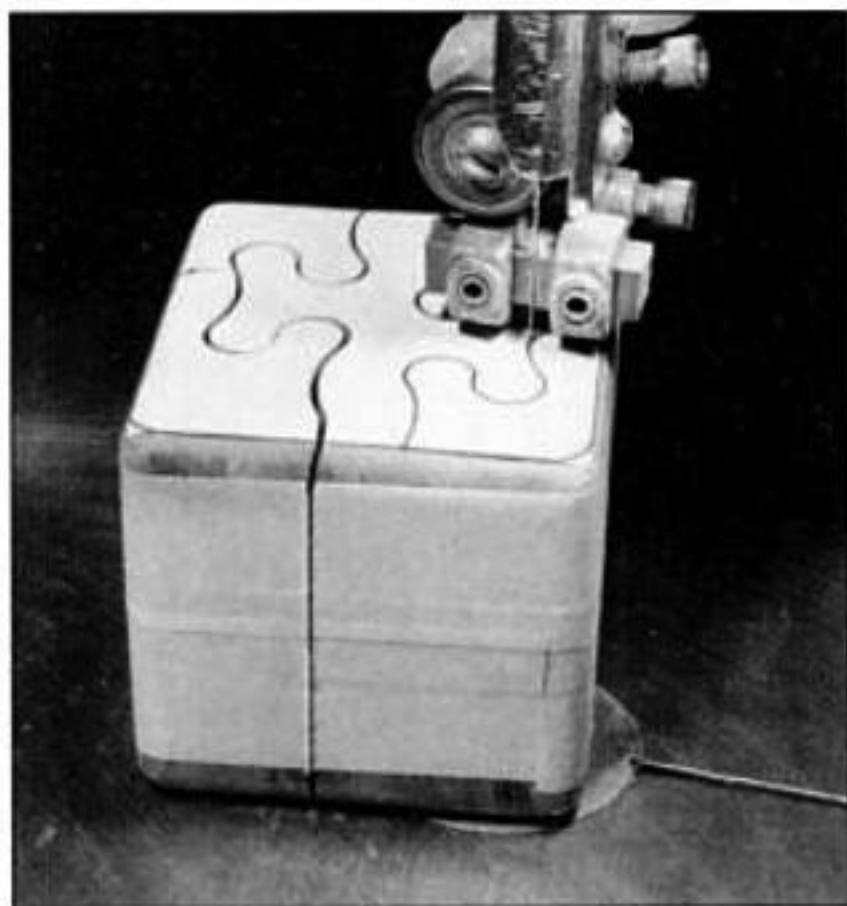
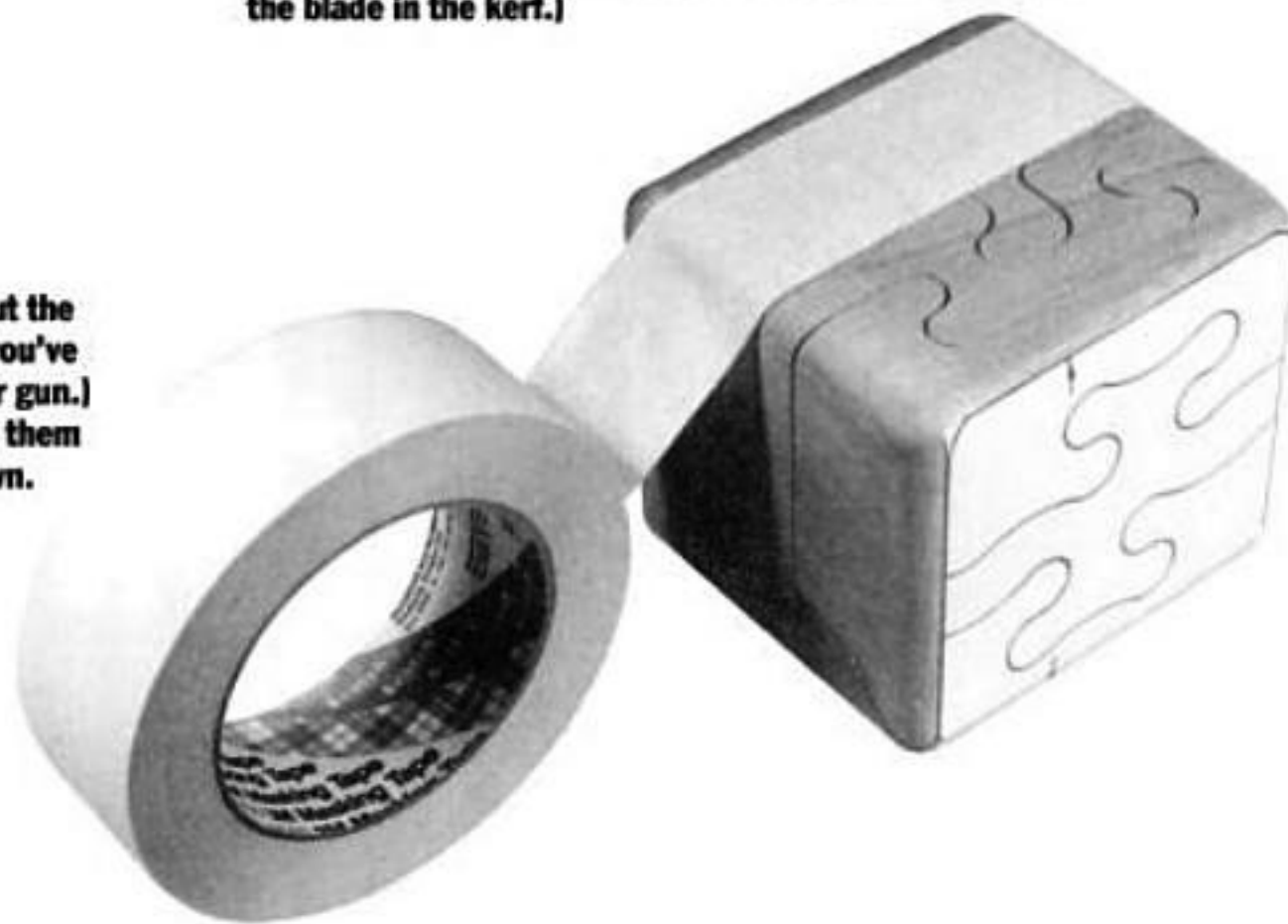
PHOTOS BY RAY LEVY

**1.** To make the puzzle, start by squaring up the sides of a 3 3/4-in. block. Round the edges with a 3/16-in. round-over router bit, and fine sand the faces of the block. Make a full-size copy of the two puzzle patterns shown in Fig. 1. Glue the patterns to the block with spray adhesive, centering them on two adjacent faces of the block and aligning the two arrows where the patterns meet.

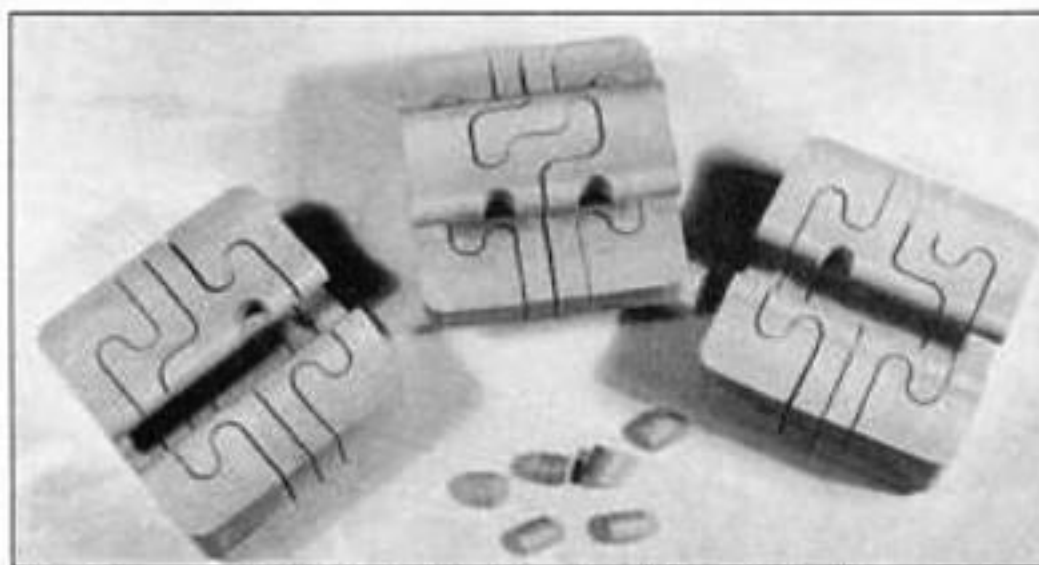


**2.** Bandsaw along the puzzle lines on one side with a slow, even feed. Try to split the pattern lines with the blade, and keep the cut square and straight. (Don't bow the blade in the kerf.)

**3.** When you've finished cutting one side, blow out the dust and remove the pattern on the side that you've cut. (It'll come off easily if you warm it with a hot-air gun.) Next, set the puzzle parts on a flat surface and tape them together securely, keeping the ends aligned as shown.



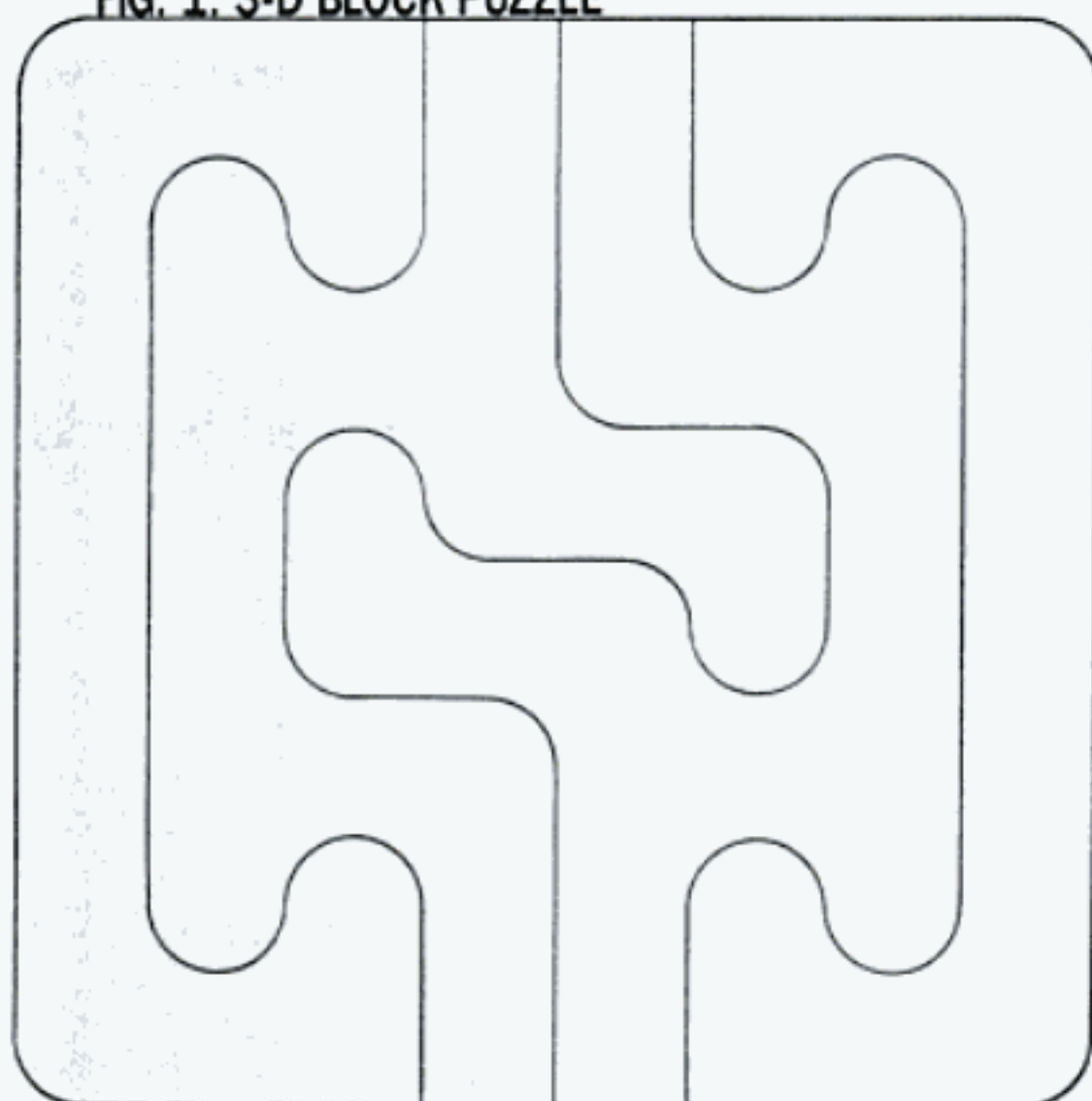
**4.** Turn the block so the remaining pattern faces up, and bandsaw out the lines on the second side. Remove the tape and patterns from the puzzle pieces.



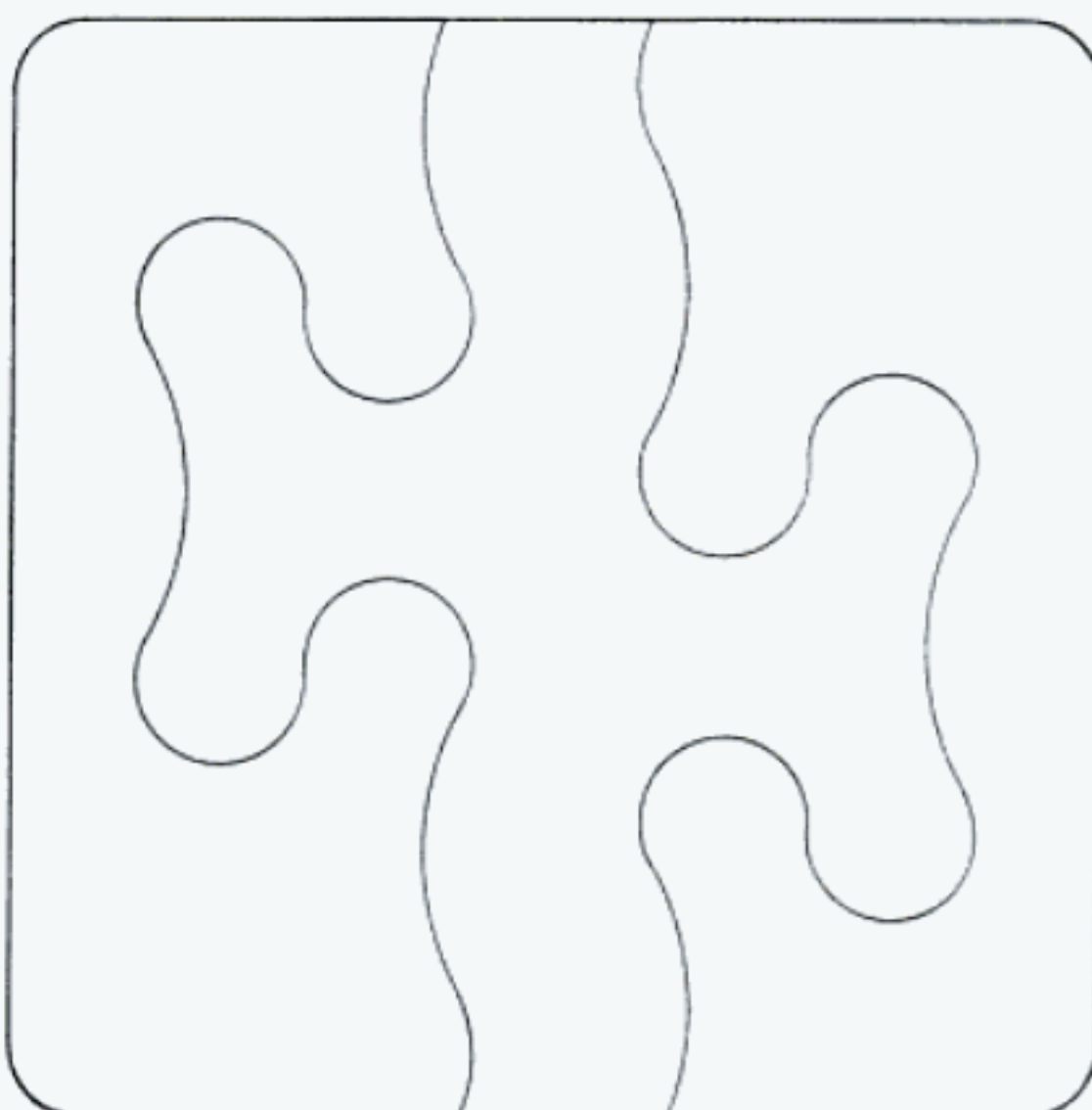
**5.** The puzzle block looks like this when it's partially disassembled. The small waste pieces result from the intersecting bandsaw cuts and won't affect the puzzle. Sand the bandsawn surfaces and finish.

**Continued**

FIG. 1: 3-D BLOCK PUZZLE

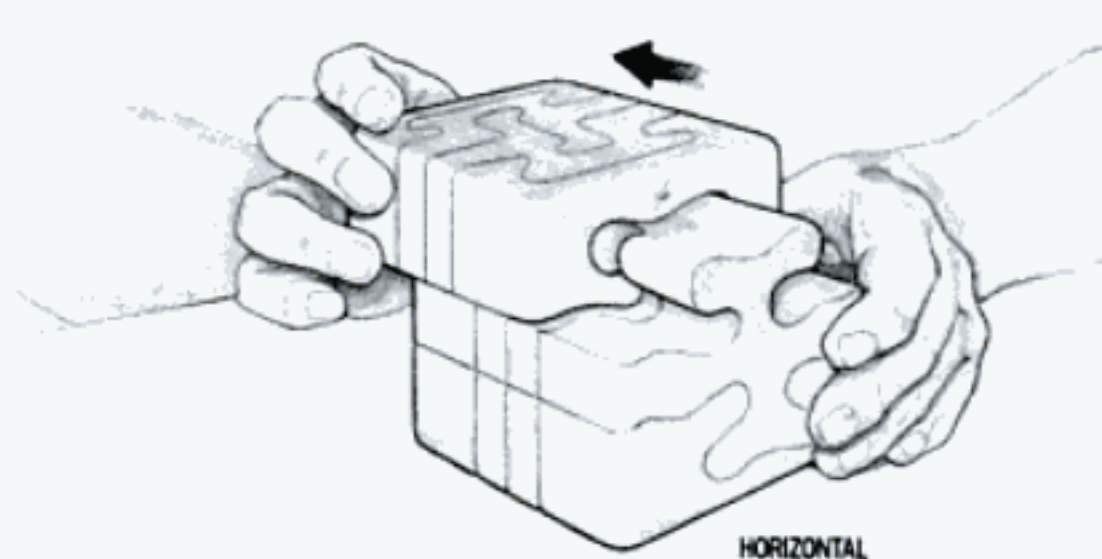
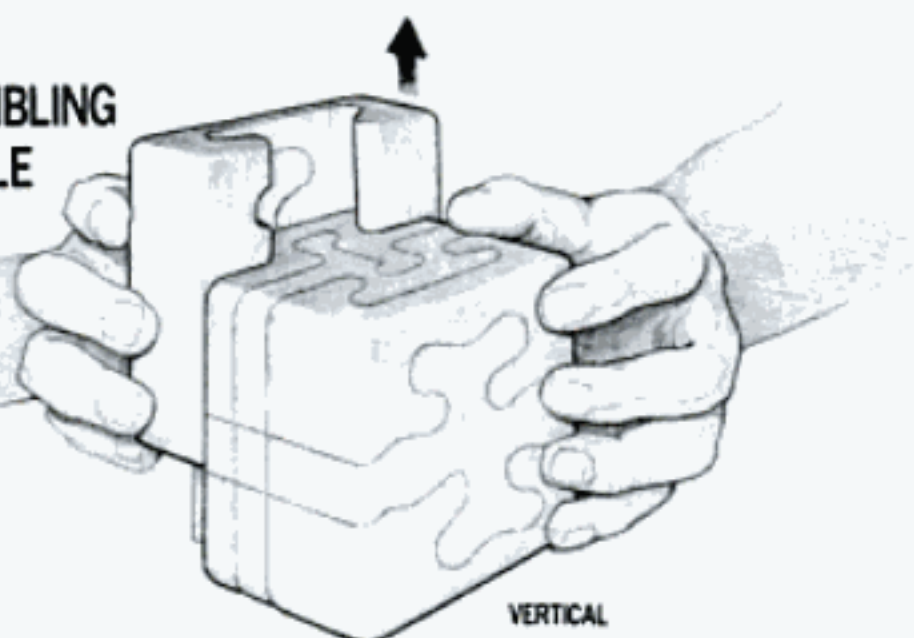


FULL SCALE



DRAWINGS BY HEATHER BRINE LAMBERT

FIG. 2:  
DISASSEMBLING  
THE PUZZLE

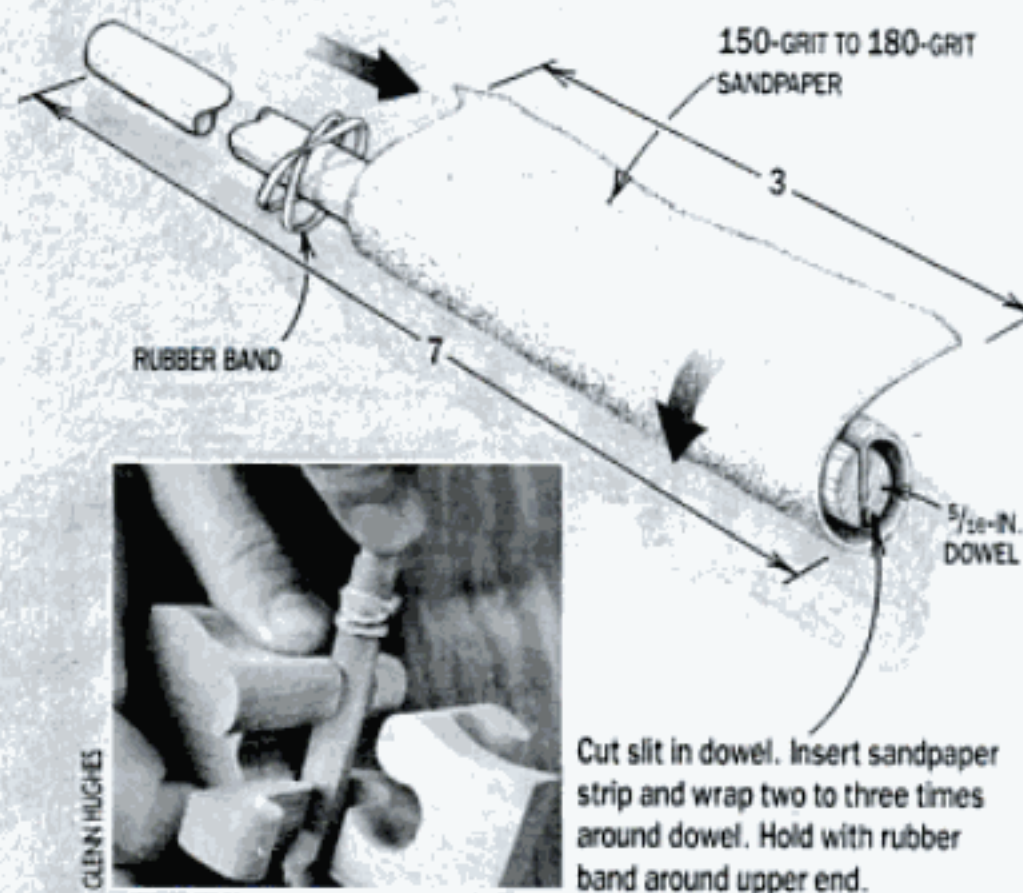


## TIPS FOR BANDSAWING THICK WOOD

**B**andsawing tight curves in thick wood often results in the blade binding or bowing in the kerf. Here are some tips for trouble-free sawing:

- Pick the right blade. I recommend a  $\frac{1}{8}$ -in. hook-tooth blade with nine teeth per inch (available from Olson Saw Co., 16 Stony Hill Rd., Bethel, CT 06801, 800-634-4047).
- Check the blade for squareness to the bandsaw table on both front and side. When sawing, don't push too hard on the wooden block. Let the cut proceed at its own pace, nudging it gently around the contours.
- To avoid wide kerfs and rapid blade wear, slow the bandsaw speed to match the slower feed rate. To do this, I install a  $1\frac{1}{2}$ -in. drive pulley on the bandsaw motor, and an 8-in. driven pulley on the saw. With this setup, a 1725 rpm motor turning a 14-in. bandsaw wheel will give a blade speed of 1185 ft. per minute, which is just about right for this job. Changing pulleys isn't for everyone, but you'll find the cutting will go more smoothly if you do.—R.L.

FIG. 3: SHOP-MADE HAND-SANDING STICK



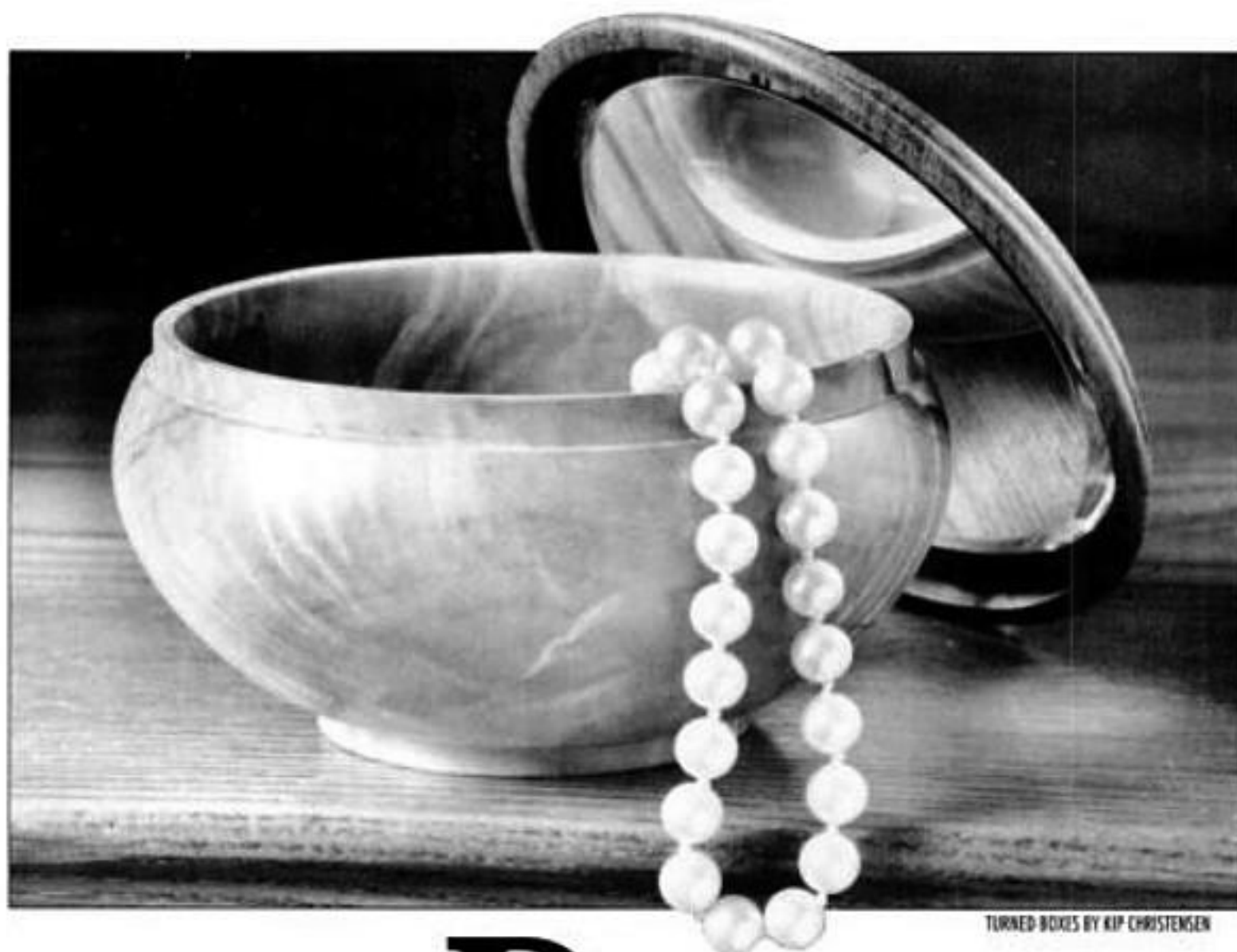
GLENN HUGHES

Smooth the puzzle parts with this shop-made sanding stick.

Cut slit in dowel. Insert sandpaper strip and wrap two to three times around dowel. Hold with rubber band around upper end.

*A Gift That  
Reflects Your  
Woodturning  
Skill*

# TURN A MIRROR BOX



TURNED BOXES BY KIP CHRISTENSEN

MITCH MANDEL

BY DALE L. NISH



If there is a special someone you would like to charm this Christmas, one of these turned mirror boxes might be just the ticket. They're the perfect container for storing jewelry or favorite personal items. In fact, you could fill one with treasures for an extra-special holiday gift.

With most turned boxes, the lid and the base are turned from a single block of wood. The mirror boxes shown here are turned from two different pieces, so you don't have to worry about matching the grain between the lid and the base. You can mix and match any woods you like for the top and bottom. Because the lid is more visible, I recommend turning it

from a special piece of rare or highly figured wood.

You'll need to purchase a circular, beveled mirror for the inside of the lid. The finished box will be about 1 in. larger in diameter than the mirror. First, decide what size box you want to make, then select a mirror size that's appropriate for the box. (Mirrors are available in diameters of 3 in., 4 in., 5 in. and 6 in. from Craft Supplies USA, 1287 E. 1120 S., Provo, UT 84601, 801-373-0917). The specific contours of the lid and base are up to you. The drawing on the next page shows some dimensions for a suggested shape, but feel free to use your imagination by trying other shapes.

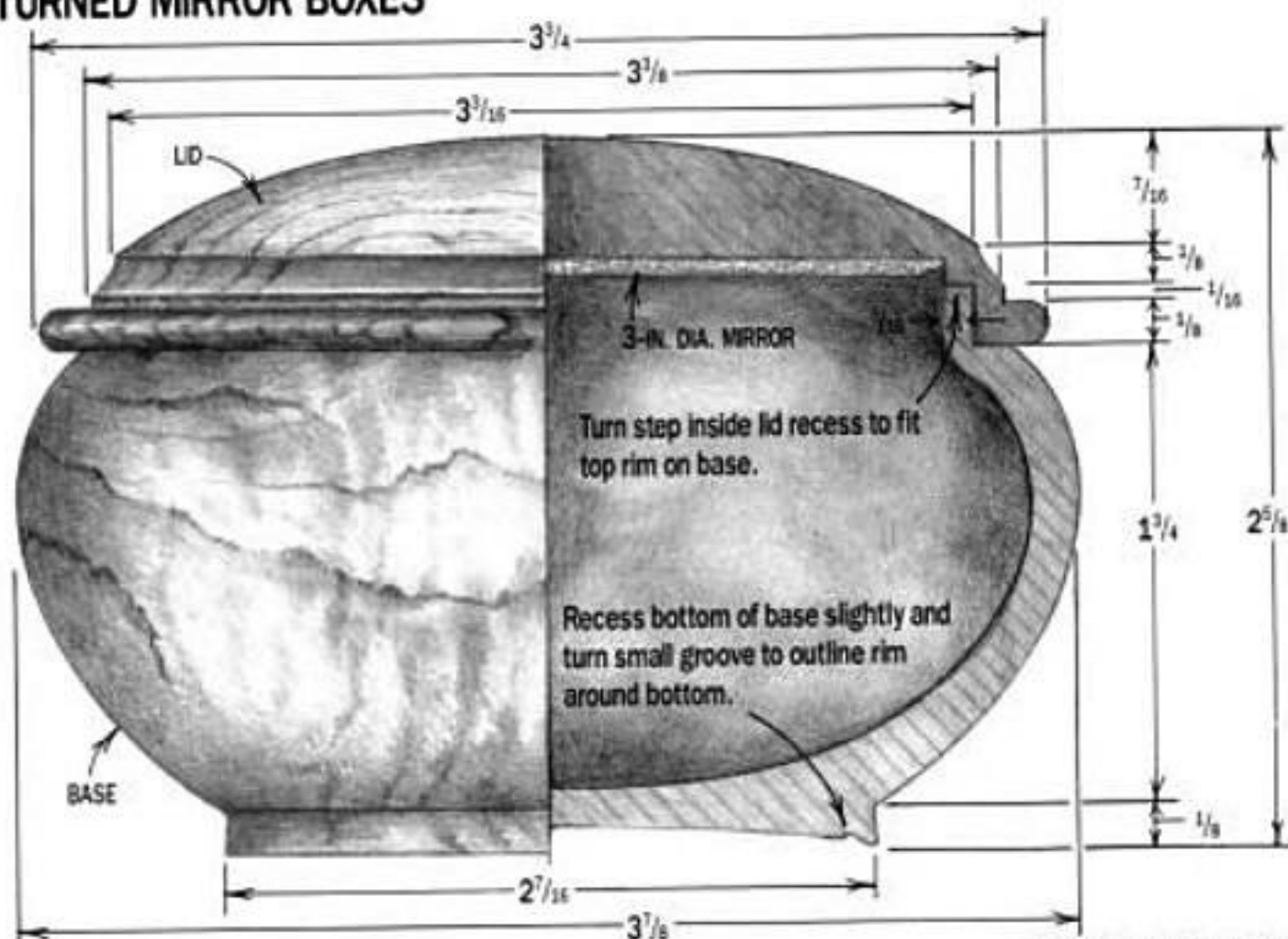
## *Making the Box*

**STEP 1. Cut out a dry piece of figured wood for the lid.** The wood

should be  $\frac{3}{4}$  in. to 1 in. thick and at least 1 in. larger in diameter than the diameter of your mirror. (The lid and base in the drawing were turned from 4-in. dia. blocks.)

**STEP 2. Mount the lid blank on a faceplate with a waste block.** Make a waste block by truing a piece of scrap so both sides are flat and parallel. Cut out a 3-in. or 4-in. dia. circular section from the scrap and screw it to the faceplate. Mount the lid blank to the waste block with glue or double-sided tape. Move the tail stock into position and apply moderate pressure against the lid blank. Put a scrap piece in between to protect the lid from the point of the tail stock. Leave the temporary tail-stock "clamp" in place for five minutes if you're using double-sided tape, or if you're using glue, until

## TURNED MIRROR BOXES



DRAWINGS BY MICHAEL MANDARINO



Fasten the lid piece to the waste block with glue or double-sided tape (shown here).

it sets. Then back the tail stock away.

**STEP 3. Lay out the recess in the lid for the mirror.** To do this, set a pair of dividers to the mirror diameter, turn on the lathe and hold the points of the dividers up to the flat face of the lid blank to scribe a circle. (See photo.) To center the scribe lines, touch the divider points to the wood lightly and slide the dividers to one



To mark the mirror recess, set a pair of dividers to the diameter of the mirror. Center the dividers on the spinning lid and push the downhill point of the dividers into the lid.

side or the other on the tool rest while watching the faint scribe lines. The scribe lines will be centered when both divider points run in the same

groove. When you find this center position, push the front point of the divider into the wood to mark the recess. (The front point is the one closest to you on the side of the lid that's rotating down toward the tool rest.)

**STEP 4. Turn the recess for the mirror** by removing wood from inside the scribed circle with a gouge or round-nose chisel. Keep the sides of the recess straight by cutting to the final inside diameter with a sharp skew chisel in scraping position. Hold



Cut the sides of the mirror recess straight and flat with a skew chisel in scraping position

the skew parallel to the lathe axis and use the point of the skew to cut against the wall of the recess. Make the recess about  $\frac{5}{16}$  in. to  $\frac{3}{8}$  in. deep, which will leave enough wood to form a lip around the edge of the lid.

**STEP 5. Check the fit of the mirror in the recess.** You don't want the mirror too tight in the recess or wood shrinkage could cause the mirror to crack or the lid to split. Enlarge the recess if necessary. A recess about  $\frac{1}{16}$  in. larger in diameter than the mirror is about right. Tip: It'll be easier to check the fit of the mirror if you stick a piece of masking tape or a small suc-



Check the fit of the mirror in the recess. The recess should be about  $\frac{1}{16}$  in. larger in diameter than the mirror.

tion cup to the front of the mirror to lift it in and out of the lid.

**STEP 6. Enlarge the diameter of the recess** so it steps out  $\frac{3}{16}$  in. to form a lip on the lid. This will enlarge the inside diameter of the recess by  $\frac{3}{8}$  in. (See Fig. 1.) Then deepen the step until it comes within about  $\frac{1}{16}$  in. of the depth of the initial recess. This enlargement will allow the rim of the box base to fit inside the lid. Sand the inside of the lid and apply a finish. (See Step 9 for more on finishes.) Don't finish the bottom of the recess where the mirror will be glued.

**STEP 7. Remove the lid from the waste block.** If you used double-sided tape, wedge a chisel between the waste block and the lid. Tip: Use slow, gentle pressure with the chisel, and let the tape release slowly. If you glued the lid to the waste block, you can remove the lid while the lathe is turning. Do this with a parting tool to part off the lid by sacrificing a thin section of the waste block to the parting cut.

**STEP 8. Remount the lid on the waste block with its top facing out** to be shaped and finished. To do this, turn a spigot (a short, round tenon) on the waste block so the lid recess will mount over it with a jamb (tight) fit. With a skew chisel, turn the spigot so it has straight sides and fits tightly in the lid's recess. Tap the lid onto the spigot on the waste block and make sure it's running true.

**STEP 9. Turn the outside of the lid to the desired shape** and sand and finish the lid. Sand with progressively finer grits, ending with 220-grit or 320-grit sandpaper. I like to seal the wood with a fast-drying brushing lacquer such as Deft Semi-Gloss Clear Wood Finish. With the lathe turned off, apply a wet coat of finish with a brush, let the finish soak in for two to three minutes, and wipe dry with a soft cloth or paper towel. Turn on the lathe and buff the surface of the lid with a soft cloth until it's smooth and dry. Apply a light coat of hard wax with the lathe running and buff the

wood to a low sheen.

**STEP 10. Cut out a piece of wood for the base of the box** and mount it on the waste block. The blank for the base should be the same outside diam-



Reverse the lid on the waste block to shape and finish the top of the lid. First, turn a spigot on the waste block so you can fit the lid recess on the spigot. Then turn the outside shape of the lid and apply a finish of brushing lacquer followed by hard carnauba wax.

eter as the lid and about 2 in. thick. Fasten the box's base blank to the waste block with glue or double-sided tape. Use the tail stock as a temporary clamp as explained in Step 2.

**STEP 11. Turn a spigot on the box base to fit inside the lid.** In this case, the spigot is a turned lip, or rim, on the top of the base as shown in the photo. Use a skew chisel on its side in scraping position to cut this rim so it has clean, sharp and flat (not tapered) shoulders. The rim should just fit inside the top with little or no clear-



Begin shaping the box base by turning a spigot on the base so it fits inside the stepped recess in the lid.

ance. (The fit should be loose enough that you can remove the lid of the finished box with one hand without lifting up the base.)

**STEP 12. Hollow out the box base** by removing wood with a  $\frac{3}{8}$ -in. spindle gouge or  $\frac{1}{2}$ -in. scraper. Shape the final contour of the inside with a sharp round-nose scraper. Sand the inside of the box on the lathe and finish as in Step 9. Remove the box from the waste block.



Hollow out the box base with a round-nose scraper. Leave the rim around the opening about  $\frac{3}{16}$  in. thick.

**STEP 13. Turn a groove into the face of the waste block** to accept the rim of the base as shown in the photo. The groove should be a bit wider than the thickness of the rim, and the spigot formed inside the groove should be sized so the rim of the box fits over it with a jamb fit.



Reverse the base on the waste block to finish shaping the bottom of the base. To do this, turn a groove in the waste block so you can mount the open end of the base to the waste block with a jamb fit.

**STEP 14. Jamb fit the box base rim over the spigot** so the bottom of the box is exposed for turning. If the fit is slightly loose, put a piece of paper towel over the rim before pushing it into the groove. (See photo.) The paper towel will act as a shim to tighten the fit and to protect the rim from scratches. Don't get the fit too tight or the rim



If the base is a loose fit on the waste block, a paper shim will take up the slack. Bring up the tail-stock center to hold the base for shaping the outside.

may crack. Move the tail stock into position and advance the live center against the base to help prevent it from

coming loose. To protect the base, don't push the point of the tail center in very tight, or put a scrap piece between the center and the wood. Make light, shearing cuts with a  $\frac{3}{8}$ -in. spindle gouge to complete the outside shape of the base.

**STEP 15. Shape the bottom of the base** by turning a shallow,  $\frac{1}{8}$ -in. recess. Turn a small groove inside the recess to outline a small rim for the bottom of the base as shown in the photo. First, you'll have to remove the tail-stock center and move the tool rest across the base as shown. Make light, shearing cuts with a  $\frac{3}{8}$ -in. gouge.



Recess the bottom of the base and cut a small groove to accentuate a rim around the bottom.

Be careful not to let the tool catch or it could flip the base off the waste block. You could use a skew chisel in scraping position to shape the base bottom, but the cut won't be as clean and smooth.

**STEP 16. Sand and finish the outside of the box base.** When you remove the base from the lathe, you



Glue the mirror into the lid's recess with a flexible adhesive.

can finish the inside of the base, too.

**STEP 17. Glue the mirror into the recess in the lid.** Use a flexible adhesive (available from Craft Supplies) to prevent the mirror from cracking when the wood expands and contracts. ▲



Dale L. Nish is a professor of industrial education at Brigham Young University.



# ALL ABOUT DRAWERS

BY ROGER HOLMES

**M**aking your first drawer is a rite of passage. Granted, a drawer is just an open box, and you may have made lots of boxes already. But it takes a different kind of skill to make and fit a box that slides smoothly and effortlessly in and out of a case. Once you're comfortable making drawers, your range of wood-working possibilities will expand, as will your confidence in your skills.

Last issue, in *All About Drawers: Part 1*, I discussed possibilities for housing and mounting drawers in carcasses and tables. This article will take a look at the basic options for constructing a drawer and outlines the methods that I use to fit a drawer into its opening.

## *Part 2: Making and Fitting Drawers*

### *First Considerations*

Before you embark on a drawer-making project, it's prudent to think realistically about your skills. If you've never made a drawer, start with a simple project and simple construction—rabbets and dados rather than dovetails. In this way you can concentrate on organizing all the pieces, making the drawers and carcass square and getting the drawers to run smoothly. Likewise, when you tackle your first dovetailed drawers, keep them simple (cock beads and inlay can come later) so you can focus on the basic construction and the fit.

Finally, don't get discouraged. I remember feeling utterly defeated as I viewed my first dovetailed drawer,

lying on the workbench encased in a welter of clamps. Those clamps never did pull that drawer square, but my next drawer went much better, and yours will, too.

### Drawer-Front Options

The simplest way to separate one type of drawer from another is to examine how the drawer front relates to the carcass in which it is housed. There are three basic drawer-front types (and seemingly endless variations) as shown in Fig. 1. *Flush drawer fronts* fit entirely within the carcass. *Overlay drawer fronts* completely cover adjacent edges of the carcass. Many are false fronts attached to the drawer's structural front. *Rabbeted, or partial-overlay, fronts* are rabbeted to create a lip that covers a portion of the adjacent carcass edges.

### Drawer-Construction Options

Drawer construction presents a whole smorgasbord of possibilities. Fortunately, the menu can be divided into three tidy categories: joining the sides to the front; joining the back to the sides; joining the bottom to everything else. One choice doesn't necessarily determine another (any back-to-side joint will work with any front-to-side joint), but considerations of design, aesthetics and efficiency tend to group them. For example, it's unlikely you'll dovetail the back while nailing the sides to a rabbeted front.

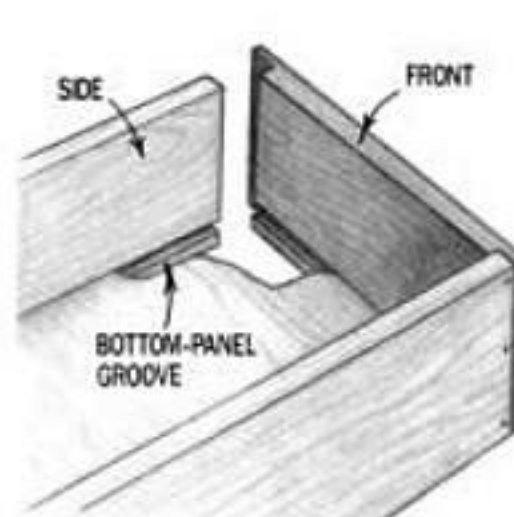
**Joining the sides to the front** can be done in any of the eight basic ways shown in Fig. 1 (A to H). Kitchens everywhere are full of drawers with *rabbeted joints*. They're easy to make and surprisingly durable when the glued joint is reinforced with nails, screws or dowels—the rabbeted drawers my dad made for our kitchen withstood years of brutal treatment from children.

The dado joints in examples B to E can all be cut on a tablesaw or with a router. The *straight dado* is the simplest, but it's also the weakest, with nothing but the fit and the glue to prevent the front from pulling off. Nevertheless, it's handy if you need to make a lot of small, light-duty drawers quickly. The overhanging front provides a built-in drawer stop.

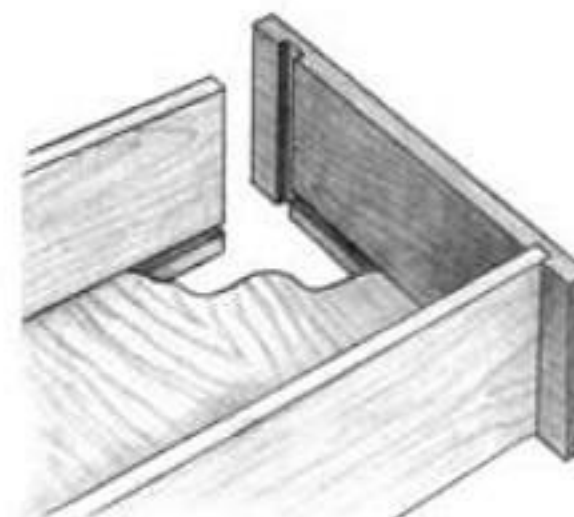
FIG. 1: DRAWER-FRONT OPTIONS



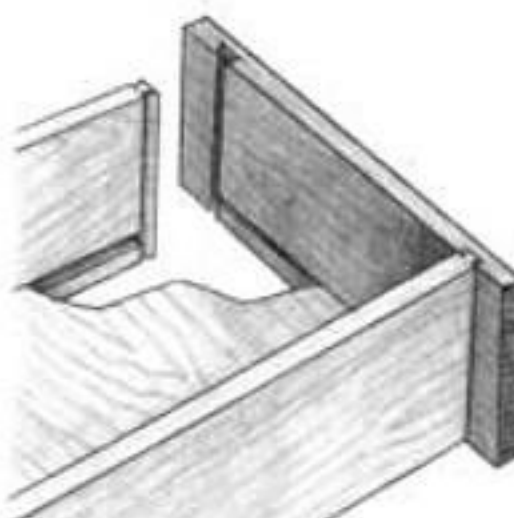
#### SIDE-TO-FRONT JOINTS



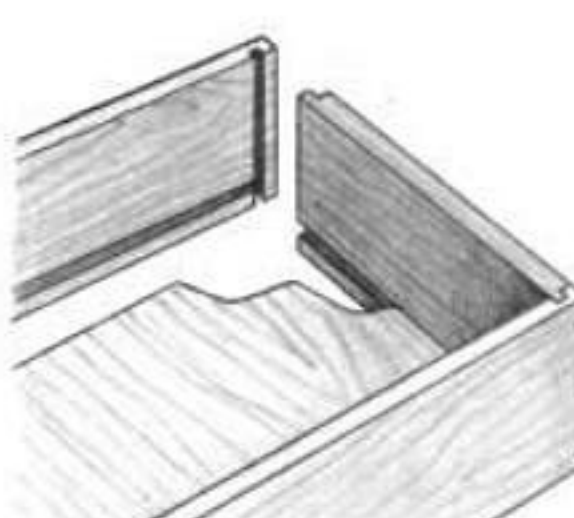
(A) RABBIT JOINT



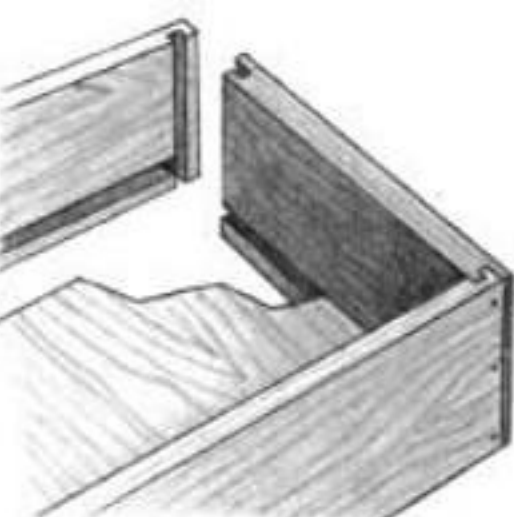
(B) BASIC DADO



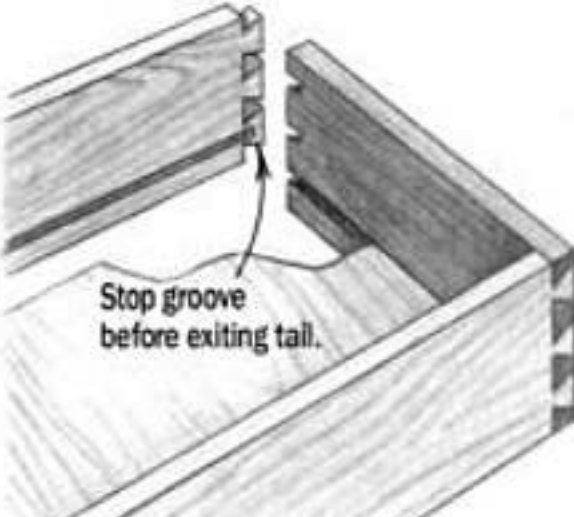
(C) SLIDING DOVETAIL



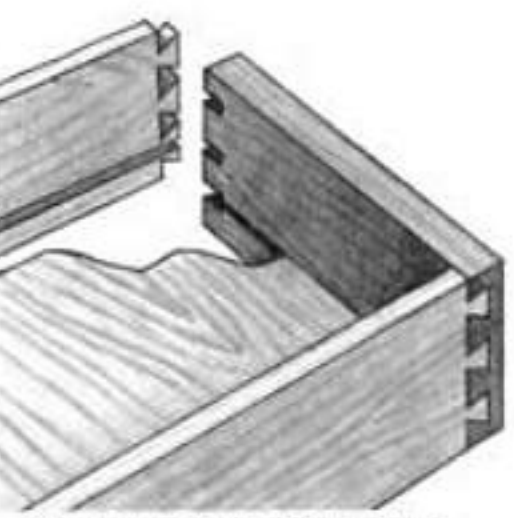
(D) DADO AND TONGUE



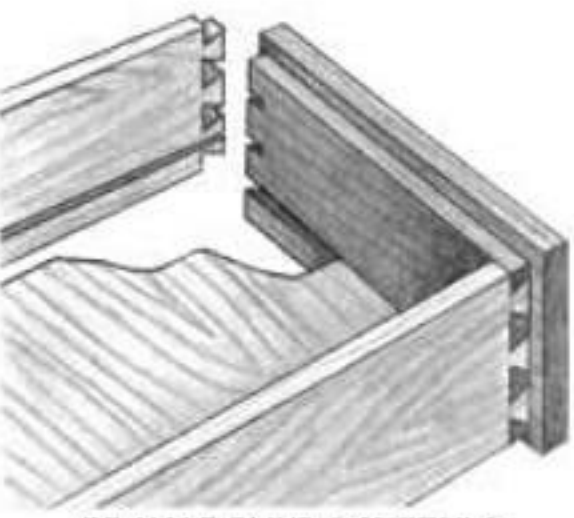
(E) CONCEALED DADO AND TONGUE



(F) THROUGH DOVETAILS



(G) HALF-BLIND DOVETAILS  
(FLUSH FRONT)



(H) HALF-BLIND DOVETAILS  
(PARTIAL-OVERLAY FRONT)

Substituting a *sliding dovetail* for the dado transforms the joint into one of the strongest. If you're using it for a deep drawer, however, taper the dovetail and the dado it fits in along their length because the glue could seize up the joint when it is only halfway home. (See AW, #15, page 15.)

The *dado-and-tongue joint* is strong enough to hold together with glue alone because the tongue is at right angles to the pull on the front. Four or five years ago, I made several wide drawers with this joint, and they're still in good shape. If you don't want to see the end grain, choose the *concealed dado-and-tongue* variation. The machine setups for this version require patience and test cuts, but once you get them right, you can do a whole stack of drawers in the time it takes to hand-dovetail one.

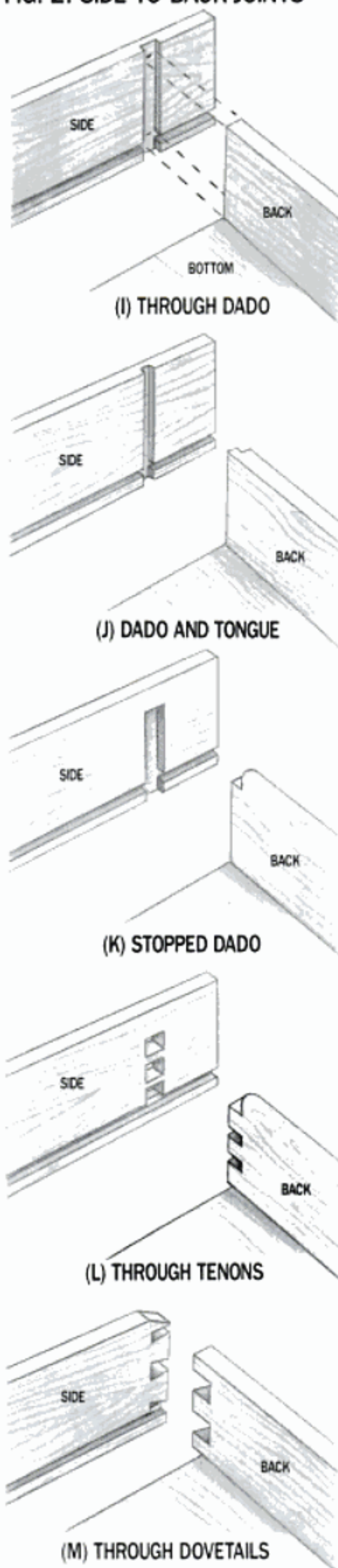
To me, nothing exemplifies quality craftsmanship as much as hand-dovetailed drawers. Dovetails are very strong, even when the pins are reduced to mere slivers as was fashionable in high-style work of the 18th century. *Through dovetails* are often used, perhaps overused, for their decorative quality and because they're quicker and easier to cut than *half-blind dovetails*. Although there are router jigs that will produce the spacing and look of a hand-cut dovetail, I think it's worth learning to cut them with backsaw and chisel.

False drawer fronts are frequently applied to the structural drawer front. This is because it's much easier to first fit the drawer shell to the carcass and then add and align the applied front. The dado-and-tongue joint is ideal for use with an applied front as shown in Fig. 1.

**Joining the back to the sides** has its own range of options. Fig. 2 shows five of these (I to M).

Traditionally, drawer backs are set on top of the drawer bottom and slightly below the top edges of the sides. This leaves room to slide the bottom in under the back, making construction and assembly much easier. You can then add the bottom after assembling the drawer. I think custom more than practicality has a lot to do with why the back is lower than the sides, though this practice does allow air to escape when closing a tightly fitted drawer. It also creates needed

FIG. 2: SIDE-TO-BACK JOINTS



clearance if you fix a stop block to the underside of the rail above the drawer. (More about stop blocks later.)

All of the joints shown in Fig. 2 are durable. The simple, dadoed examples—the *through dado* and the *dado and tongue*—are easy to cut, but I prefer the others—the *stopped dado*, the *through tenons* and the *through dovetails*—for top-quality drawers. Where possible, I extend the drawer sides several inches beyond the back (I to L). This allows access to stuff at the back of the drawer without having to pull the drawer entirely out of the case.

**Drawer bottoms** don't offer quite as many choices. Fig. 3 shows four (N to Q). Almost all drawer bottoms fit in grooves cut directly in the drawer sides (*side/front grooves*). If the sides are very thin, the grooves can be cut in strips of wood called *slips* that are glued to the sides. Slips also increase the bearing surface and reduce the wear and tear on sides that slide on runners.

If you don't use slips, for some side-to-front joints you'll need to cut stopped grooves to prevent them from showing on the outside of the drawer (Fig. 1: D, E, F). Overlapping construction masks the grooves on the others. Note how the groove falls within the bottom tail for half-blind dovetail joints (Fig. 1: G, H). I like to position the groove to give the drawer bottom at least  $\frac{1}{8}$  in. clearance above the front rail of the carcass. If the bottom does sag a little, it won't scrape on the front rail. Very wide, thin bottoms can be reinforced in the middle with a central rail fixed to the drawer front and back as shown in Fig. 4.

To allow for expansion and contraction of solid-wood bottoms, run the grain from side to side. Glue or pin the front edge to the groove in the drawer front and slot-screw the rear edge to the back. Plywood bottoms won't move, of course, but I prefer to orient the grain of the face veneer from side to side anyway.

A very useful exception to the standard bottom, indeed, to the standard drawer, is the bottom-hung drawer. (See AW, #22, All About Drawers: Part 1.) Here, a plywood bottom extends beyond the drawer sides to support the drawer in grooves cut in the carcass. These "bottom-hung" drawer/trays are perfect for workshop storage, and stacks of them can be run up very quickly. I haven't seen the idea put to "finer" use but see no reason why it couldn't be. **Continued**

## Choosing Materials

Stability, durability, workability, availability and looks all figure in when choosing material for drawers. The first four qualities are most important for sides, backs and bottoms. Looks usually outweigh the others when selecting fronts, sometimes with dire consequences.

Woods vary in how much they expand and contract with changes in humidity. Cured from green to oven-dry, a flat-sawn piece of white oak 10 in. wide will shrink about 1 in. in width, while a similar piece of Eastern white pine will loose about  $\frac{5}{8}$  in. The way the wood is cut will also affect its movement. When sawn perpendicular to the growth rings (quartersawn), wood shrinks less—white oak about half as much, and the pine will shrink only a third as much. Bruce Hoadley's book, *Understanding Wood* (1980, The Taunton Press, 63 S. Main St., Newtown, CT 06470) lists shrinkage rates for more than 90 domestic and imported hardwoods and softwoods.

If stability were the only consideration, the pine would win hands down. But other factors weigh in. The soft pine sides won't wear as well as those made of the harder oak. You may be able to get the radially sawn oak but not pine, or the oak may look better with your design.

In practice, I regularly use radially sawn white oak, mahogany and pine (It may wear down in 100 years, but....) Over the years I've seen fine pieces with drawer sides of radially sawn maple, cedar of Lebanon, walnut, teak, even ebony. The rule—if there is one—seems to be that you can make acceptable drawer sides from many moderately stable, moderately durable woods as long as they are radially sawn or close to it (quartersawn, or live-sawn pieces selected from near the center of the tree.) The radial cut minimizes cupping as well as shrinkage. This is critical for drawers that have been fit snug from side to side.

FIG. 3: DRAWER-BOTTOM OPTIONS

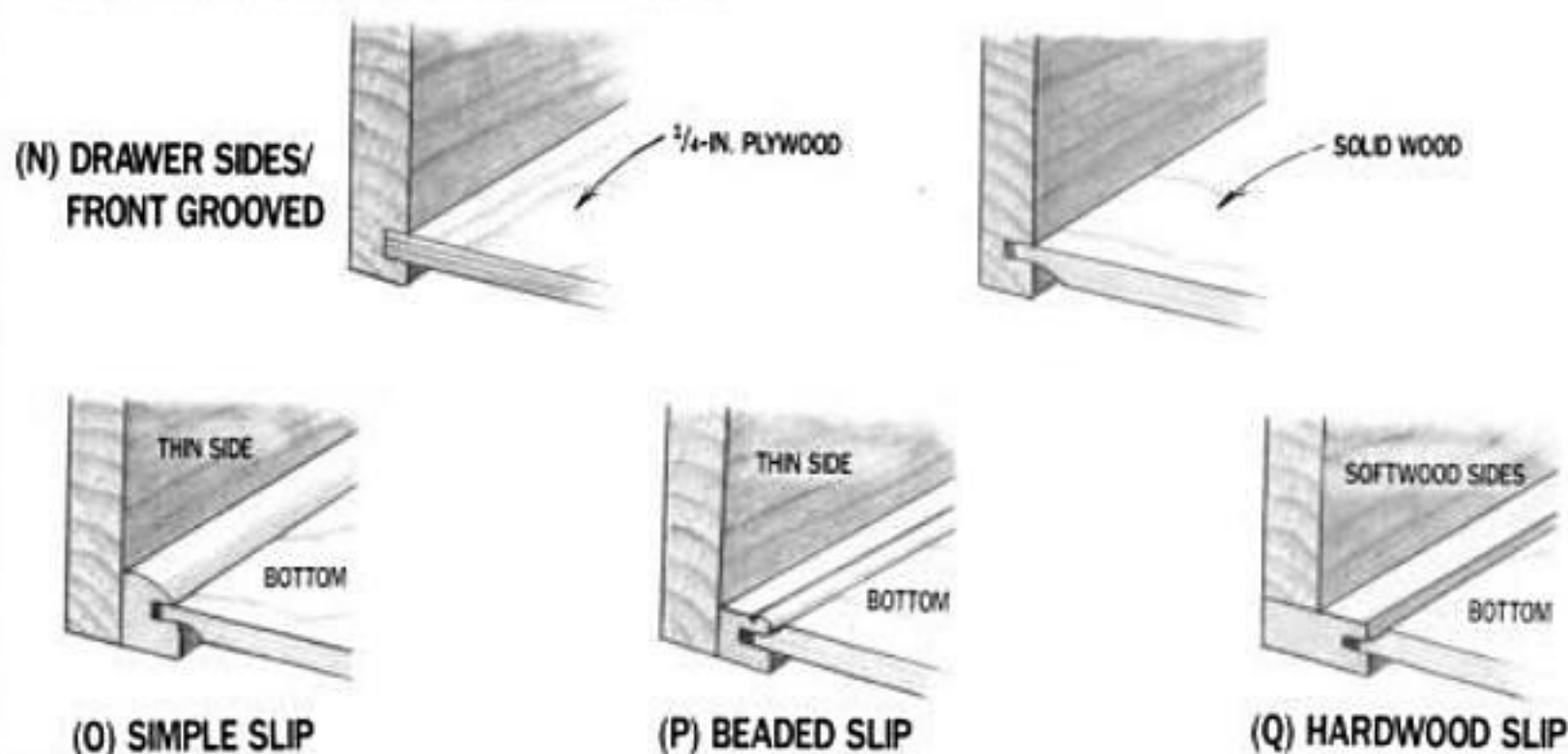
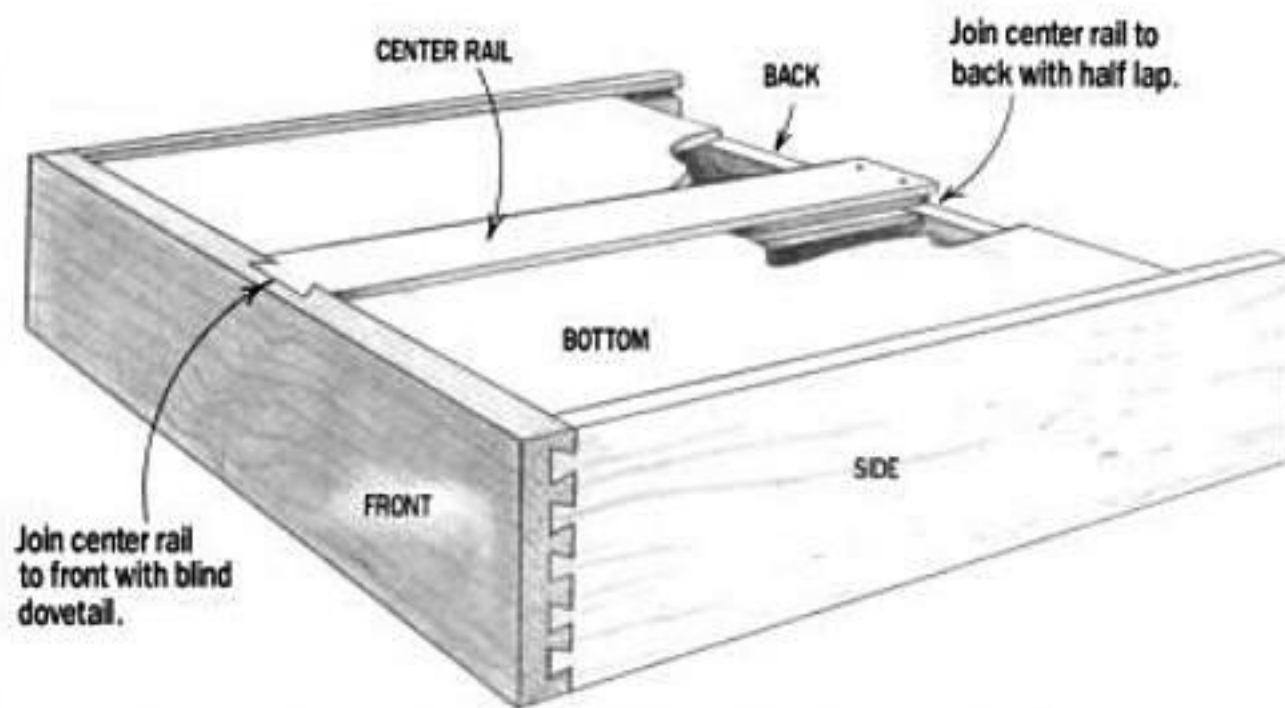


FIG. 4: REINFORCING A DRAWER BOTTOM

Central rail reinforces wide, thin drawer bottoms (back removed).



(See AW, #21, for more on the different ways lumber is sawn.)

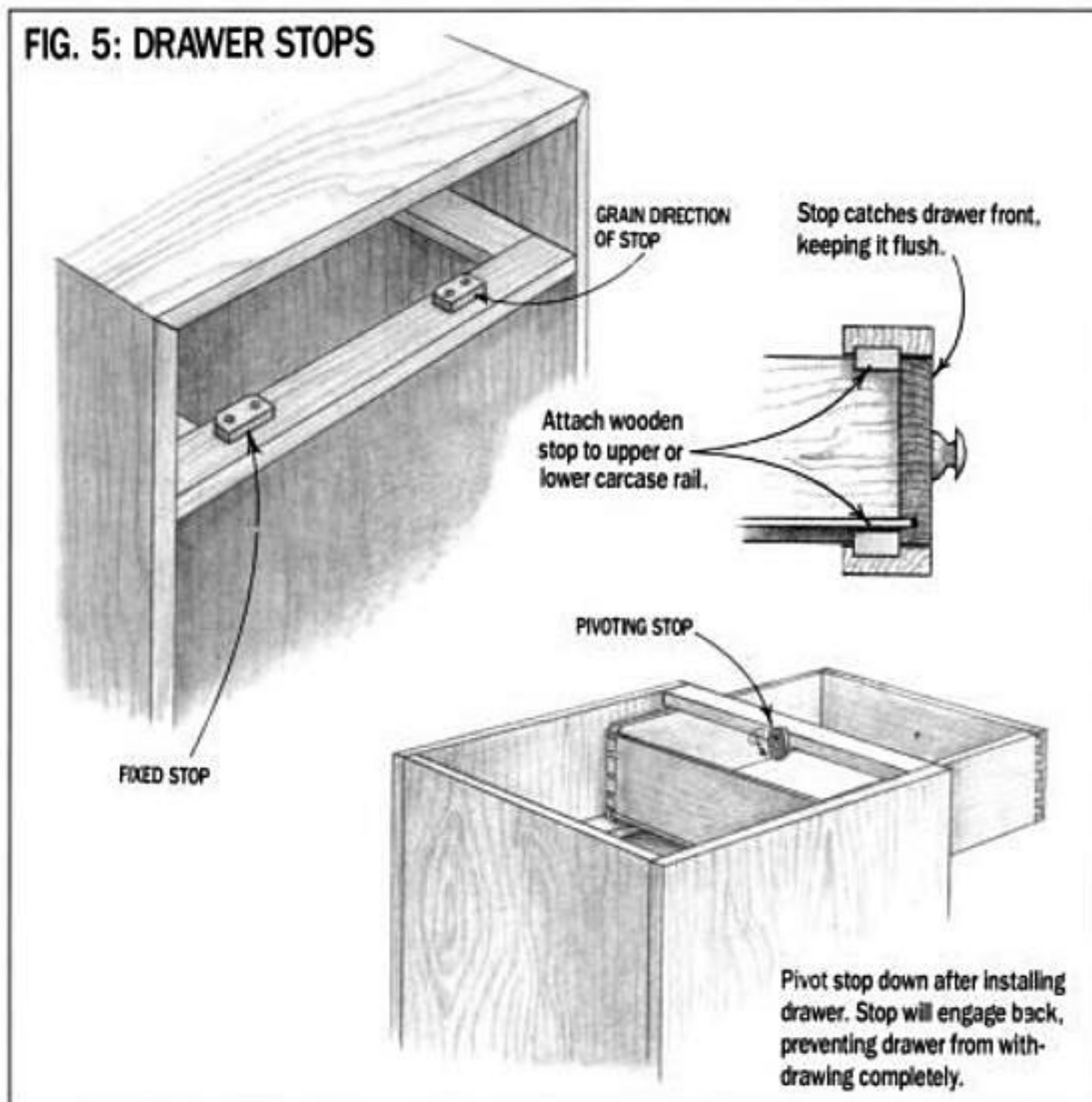
You can avoid all this muddle by using high-quality plywoods such as Finply and Baltic birch. They don't move, they wear like iron and they can be assembled with any of the joints I've discussed. They're expensive, however, and you can't plane them thinner to fit an opening. But for built-ins, kitchens and

durable everyday furniture, they're hard to beat.

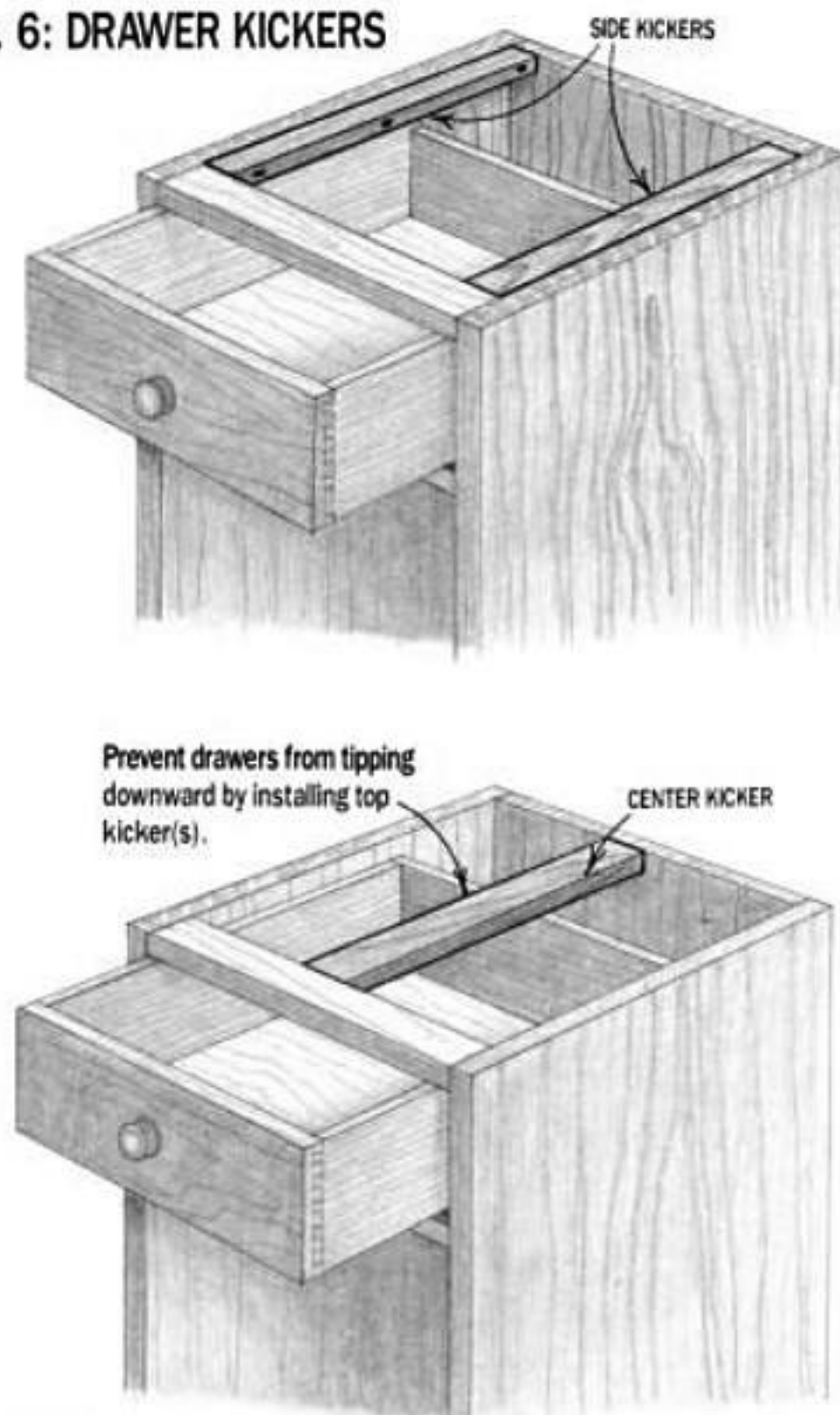
## How Thick?

Beginners are likely to over-build things. If you're uncertain about joinery and materials, there's a great temptation to compensate by beefing everything up. Unfortunately bulk doesn't necessarily strengthen a poorly made piece.

**FIG. 5: DRAWER STOPS**



**FIG. 6: DRAWER KICKERS**



Very few drawers need sides or backs as thick as  $\frac{1}{2}$  in., and most can do with  $\frac{3}{8}$  in. or even  $\frac{5}{16}$  in. Aesthetics has more to do with the thickness of drawer fronts, but it makes sense to keep them in proportion to the size of the drawer. Bottoms should be thick enough to resist sagging under a load. Solid-wood bottoms  $\frac{5}{16}$  in. or  $\frac{3}{8}$  in. thick (relieved along the edges to fit in  $\frac{1}{4}$ -in. grooves) or  $\frac{1}{4}$ -in. plywood will handle most loads.

### *Drawer Stops and Kickers*

The overlay and rabbeted drawer fronts operate as built-in drawer stops. Flush fronts require something extra to keep them flush. I glue and screw small stops on the carcass rails above or below the drawer. (See Fig. 5.) I've also seen these stops mortised in place. I orient the stops so the end grain makes contact with the drawer front as shown in the drawing, and I trim them as necessary to align the fronts. You could attach stops to the runners or carcass sides in back of the drawer, but I find these more trouble to work on. If you've decided to side-hang the drawers (see AW, #22, All About Drawers, Part 1), you won't need stops. If you position the fillets properly, they'll work nicely as built-in stops.

It's a bad idea to let the carcass back serve as a stop. Contact makes a racket and can damage the back or even push it off. And the position of the closed drawer front won't be adjustable.

If you're worried about someone accidentally pulling the drawer out of the carcass and spilling its contents, you can attach a pivoting stop to the rail above the drawer to engage the drawer back as shown in Fig. 5.

In a few situations where there's no rail immediately above the drawer, you'll need to add top-kickers to keep the drawer from pitching down when it's pulled from the carcass. (See Fig. 6.) These simple strips of wood can usually be added to an assembled carcass with little trouble before or during fitting. Screw one above each drawer side or one above the center of the drawer. ▲



Roger Holmes is a contributing editor of AW. He works wood in western Connecticut.



## FITTING DRAWERS: THE TYRANNY OF TOLERANCES

**B**asic drawers for ordinary pieces require no fitting—just make them smaller (allowing for expansion) than the height and width of the opening and slide them in.

But for that special piece, you'll want something better. I remember marveling the first time I opened a drawer in a cabinet made at Edward Barnsley's shop in England. It seemed to glide as if on a cushion of air, with almost no movement up and down or side to side, until it was practically out of the case. There was so little tolerance in the fit that when one drawer was pushed in, it compressed the air behind it, forcing the others in the case to slide out slightly.

When I attempt such a fit, I start by making the drawer as close to the size of the opening as I can. I plane the drawer front so it just slips in place and I cut the back to the same length. I plane the width of the drawer sides so they'll just squeeze between the carcass rails above and below. Then, after joining and assembling the drawer, the back and forth begins: I try the drawer in its opening, then shave a bit off its sides or top edges, then back to the opening and so on. When all the drawers fit like I want, I plane the fronts to make the gaps that are visible around the fronts uniform.

Since the drawer sides will expand and contract very little in thickness, the fit can be closer across the width of the opening than across its height. Ideally, the outer faces of the drawer sides slide against the carcass sides (or against the guide strips in a frame-and-panel carcass) like a piston in a cylinder. In prac-

tice, you'll get the same effect if you fit each drawer so it's most snug near the front of the opening. One of Barnsley's cabinetmakers told me that they would stick a slip of paper under the blade of the square when laying out the carcass joints to make the case just slightly wider at the back than the front.

It is expansion in height that causes headaches. Shortly after I returned from England, keen to show off what I had learned, I made and fitted all the drawers in a friend's kitchen to the closest tolerances I could muster. I installed the cabinets in midwinter and basked in her "oohs" and "aahs" as she marveled at the fit. Come the spring, however, she couldn't move a single drawer. Nebraska, with its swings between bone-dry winter and humid summer, certainly wasn't mild, mellow England. The drawer sides expanded despite the use of well-seasoned quartersawn white oak, I had to plane off as much as  $\frac{1}{8}$  in. on some  $4\frac{1}{2}$ -in. wide drawer sides to get them to slide freely again.

The lesson: Pay attention to seasonal conditions in the house or room where the piece will live. If possible, fit drawers at the wettest time of the year—drawers that shrink can still be opened.

Drawers side-hung on wooden fillets can also be fitted to close tolerances. Either the drawer sides can slide against the carcass sides or the contact can be restricted to that between the fillet and the groove. Some commercially made drawer slides allow little play, while others are quite sloppy. Ask your dealer if you can see installed samples.—R.H.

# WALL ORGANIZER

*A Place for Everything; Everything in Its Place*

BY TIM SNYDER

Don't let the diminutive size of this wall organizer fool you—it can handle a lion's share of storage. Contrasting with the dark grain of the walnut, the thin pine dividers in the "letter-box" section keep bills, letters, and envelopes in order. The organizer would work well above a bedroom dresser, holding small items like brushes, wallets, cologne and a current novel or two. Or you may find these shelves equally useful in the kitchen or by the front door. The shelves are wide enough to hold magazines, and the drawer can fit in either of two openings on different levels. You can fasten these shelves to the wall, or simply set the unit down on top of a larger flat surface.

Most lumber dealers don't have 1/2-in. thick hardwood in stock, so you'll have to use a thickness planer to plane down 3/4-in. thick stock, or have a millwork shop do this work for you. If you have trouble finding 7-in. wide boards, buy narrower stock and edge glue your boards to make up the 7-in. width.

## *Making the Parts*

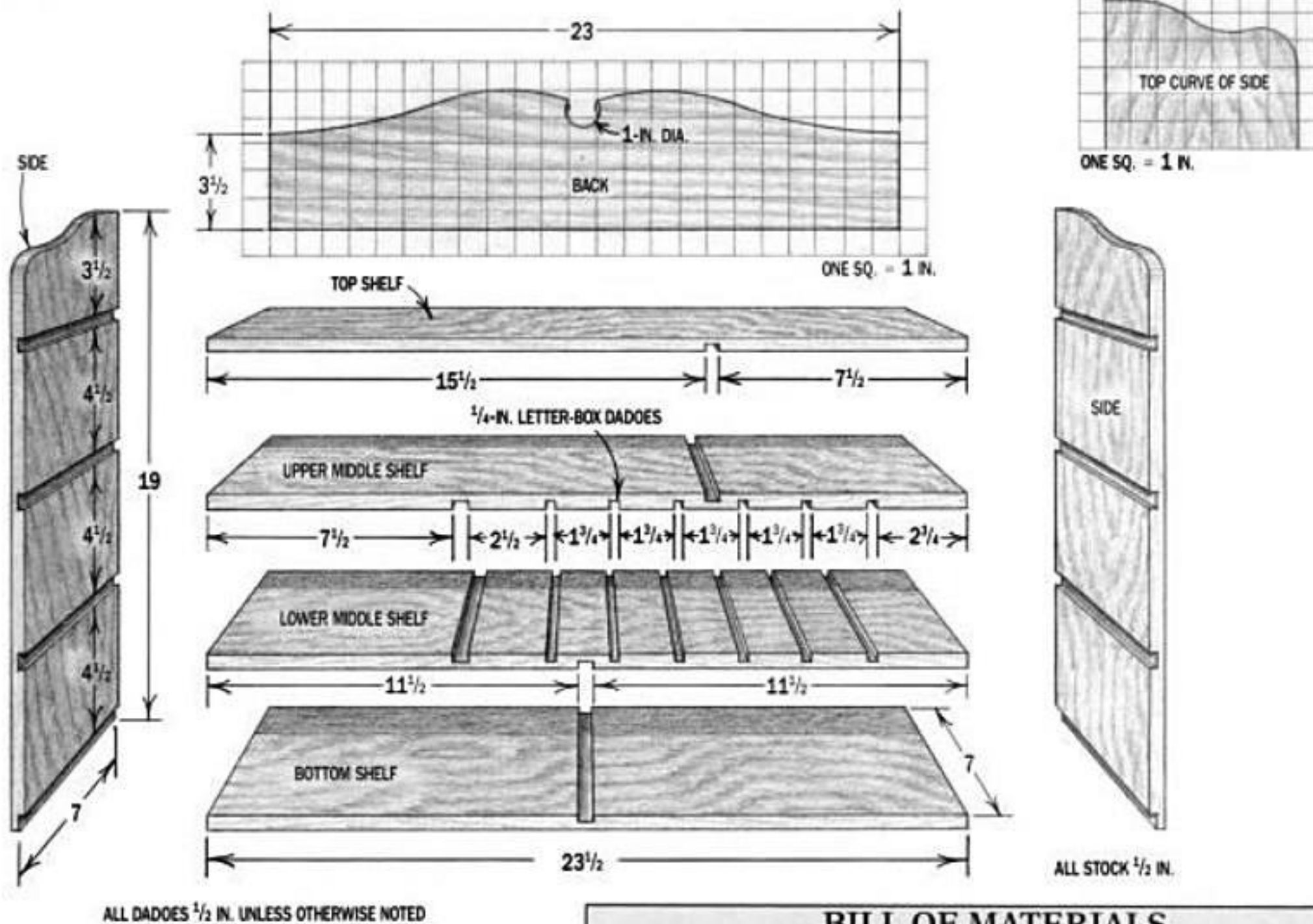
For the sides, shelves and dividers to go together squarely, opposing dados must be milled in matching locations. To accomplish this, lay out all your joints carefully, making sure not to confuse one part or side for another.

**Cut the sides, shelves, and 1/2-in. dividers to size.** All these parts are 7 in. wide, so rip enough stock now to make all of them. Then cut the shelves and sides to the finished lengths given in the Bill of Materials. Don't cut the dividers to length now; wait until you've assembled the shelves and sides.

**Set up for cutting dados and rabbets.** First, square your tablesaw's miter gauge to the miter-gauge slot. Then mount a dado cutter on the arbor and adjust the cutter width to 1/2-in. Adjust



**FIG. 1: WALL ORGANIZER**



## BILL OF MATERIALS

| PART                | QUANTITY | DIMENSION                                               |
|---------------------|----------|---------------------------------------------------------|
| Sides               | 2        | $\frac{1}{2}$ " x 7" x 19"                              |
| Shelves             | 4        | $\frac{1}{2}$ " x 7" x 23 $\frac{1}{2}$ "               |
| Dividers            | 3        | $\frac{1}{2}$ " x 7" x 5"                               |
| Back                | 1        | $\frac{1}{2}$ " x 5 $\frac{1}{8}$ " x 23"               |
| Letter-box dividers | 6        | $\frac{1}{4}$ " x 7" x 5"                               |
| Drawer sides        | 2        | $\frac{1}{2}$ " x 4 $\frac{3}{8}$ " x 7"                |
| Drawer front        | 1        | $\frac{1}{2}$ " x 4 $\frac{3}{8}$ " x 7 $\frac{1}{8}$ " |
| Drawer back         | 1        | $\frac{1}{2}$ " x 3 $\frac{7}{8}$ " x 6 $\frac{1}{8}$ " |
| Drawer bottom       | 1        | $\frac{1}{4}$ " x 6 $\frac{3}{4}$ " x 6 $\frac{5}{8}$ " |
| Knob                | 1        | 1-in. dia., mounting screw                              |
| Brads               |          | $\frac{7}{8}$ "                                         |
| Linoleum nails      |          | $\frac{5}{8}$ " brass-plated ,<br>round-head            |



**A stop block clamped to an auxiliary miter-gauge fence ensures accurate repeat cuts when cutting dados.**



**When gluing the back to the top shelf, put a softwood block in the back's circular cutout to protect it from the clamp.**

the cutter height to  $\frac{1}{4}$  in.

Attach a wood auxiliary fence to the miter gauge. Use a straight, 3/4-in. thick board about 20 in. long and 2 1/2 in. wide. Secure it to the gauge so that one end extends about 4 in. beyond the cutting line of the dado cutter. Now turn on the saw and push the miter gauge forward so that the dado cutter makes a notch in the bottom edge of the auxiliary fence. Extend the shoulder lines of the notch by making two vertical marks on the auxiliary fence. These lines will let you align the layout marks on the shelves and sides with the dado cutter.

Now lay out the locations of the dadoes and rabbets on the shelves and sides. (See Fig 1.) Mark the dado and rabbet shoulder lines across the edges and sides of these parts. To avoid confusing one shelf for another, as the

dadoes are milled, label the top right-rear corner of each shelf with a "T" for the top shelf, a "UM" for the upper middle shelf, and so on.

**Mill dadoes and rabbets in the sides and shelves.** Align the layout marks on a shelf or side with the notch shoulder lines on the fence. Keeping the workpiece against the miter-gauge fence, butt a small stop block against one end of the board and clamp the block to the fence. (See photo.) Turn on the saw and cut the joint. Leave the stop block in place to align the opposing dado or rabbet. For each stop-block setting, one piece will be cut with its back edge against the fence while the other piece will be cut with its front edge against the fence.

When you've milled all of the rabbets and dadoes for the shelves and 1/2-in. thick dividers, readjust the width of the dado cutter to 1/4-in. to match the thickness of your letter-box dividers. Shift the auxiliary fence over about an inch and mill a new 1/4-in. wide by 1/4-in. deep alignment notch in the fence. Extend the notch shoulder lines and use a stop block when dadoing the two center shelves for the letter-box dividers.

**Cut the curves in the sides.** The pattern for the ogee-style curve on the top of each side is shown in Fig. 1. Trace a full-scale pattern onto one side, and then clamp both sides together so that you can cut them at the same time. Make sure all of the edges are flush before cutting. Once you've made the curved cut, separate the sides and sand the curves smooth.

## Assembling the Shelves, Sides, and Back

**Join the shelves and sides.** In this design, the brass-plated round-head nails used to fasten the shelves to the sides are left exposed as decoration. Drive them with a tack hammer until they set flush with the wood surface. To avoid splitting the wood or bending the nails, predrill nail holes in the sides with a 1/16-in. dia. bit. Drill holes for three nails at each rabbet or dado joint. Put a nail hole in the middle of each joint and the other holes 1 in. from the edges.

Spread a light, even coat of glue in the rabbet and dadoes in one side piece, then fit the shelves into the joints. Make sure that the front edges of all the parts are flush. Now glue and nail the other side to the shelves.

**Cut and install the back.** The pattern for the curved back is shown in Fig. 1. Cut the back to fit between the sides, then trace and cut the curve. Sand the curved edge thoroughly, smoothing out saw marks and softening corners. Spread glue on the bottom edge and ends, then fit it into place. Clamp the back down against the top shelf. To protect the round cutout in the back and keep the clamp in position, use a small clamping block as shown in the photo on the previous page. Clamp the sides against the ends of the back by tightening a clamp across the width of the unit.

## Adding the Dividers

**Cut the 1/2-in. walnut dividers** to fit in the dadoes in the shelves. Select straight stock, and make your cuts so that the grain will run in the same direction as the shelves. This hides the end grain and allows the dividers to expand and contract in the same direction as the

shelves. Spread glue in the joints before slipping the dividers into place, but don't nail them. Use a pair of C clamps or pipe clamps for each divider.

**Cut the 1/4-in. pine letter-box dividers** to fit between the 1/4-in. dadoes. Again, run the grain in the same direction as the shelves. Fig. 2 shows the curved cut on the front edges of these dividers. Trace this pattern onto one divider blank. Clamp two more divider blanks below the first. Check that all edges are flush, then make the curved cut in three pieces at once. (See photo above.) To make installation easier, chisel a chamfer onto the edges that will fit into the dadoes. (See photo below.) When chamfering, leave the two front corners of the divider square. Don't install these dividers yet.

**Sand and apply a finish.** Thoroughly sand the assembled parts and letter-box dividers. Soften the corners and edges and finish with 220-grit sandpaper.

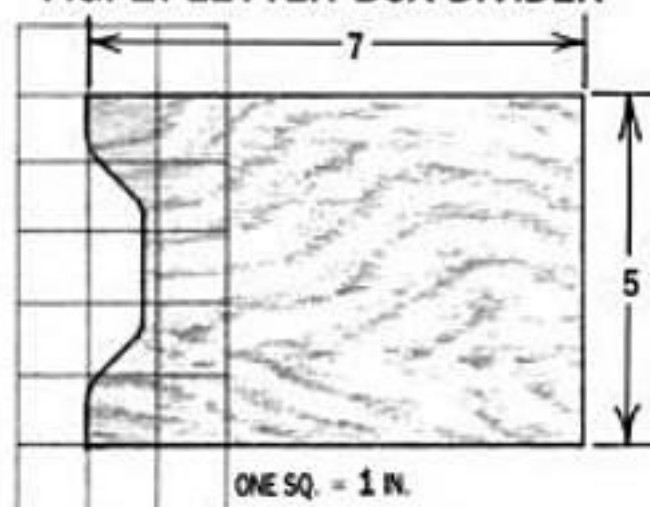
Wipe the surfaces free of sawdust, then apply a penetrating oil finish. Be sure to coat all the parts evenly, including the undersides and back edges. Apply the finish to the individual 1/4-in. thick dividers.

**Install the 1/4-in. dividers.** Slide them carefully into their dadoes, flush with the shelf front edges. If they fit



Saw the curved front edges of the letter-box dividers three at a time with a fine-tooth blade in the jig saw.

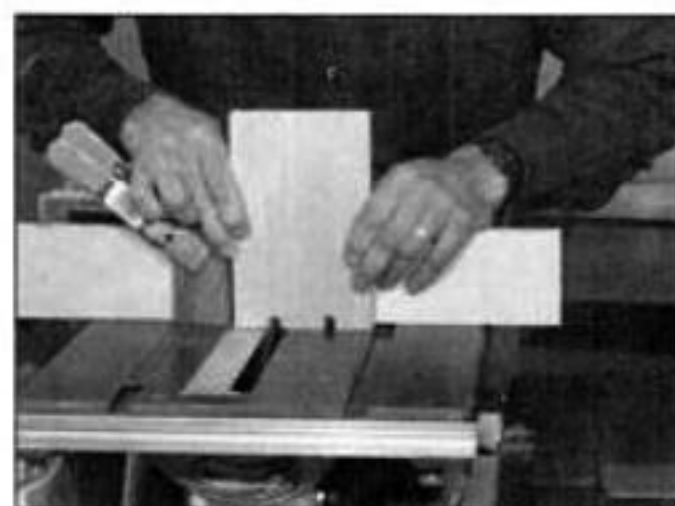
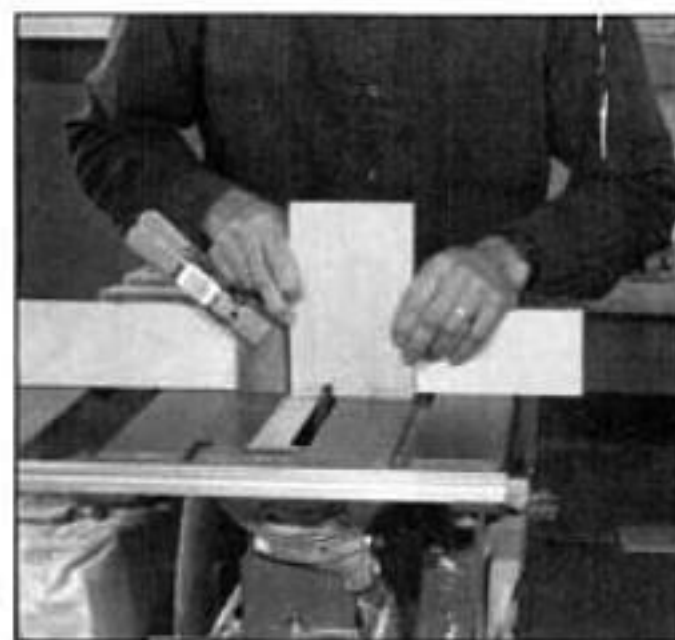
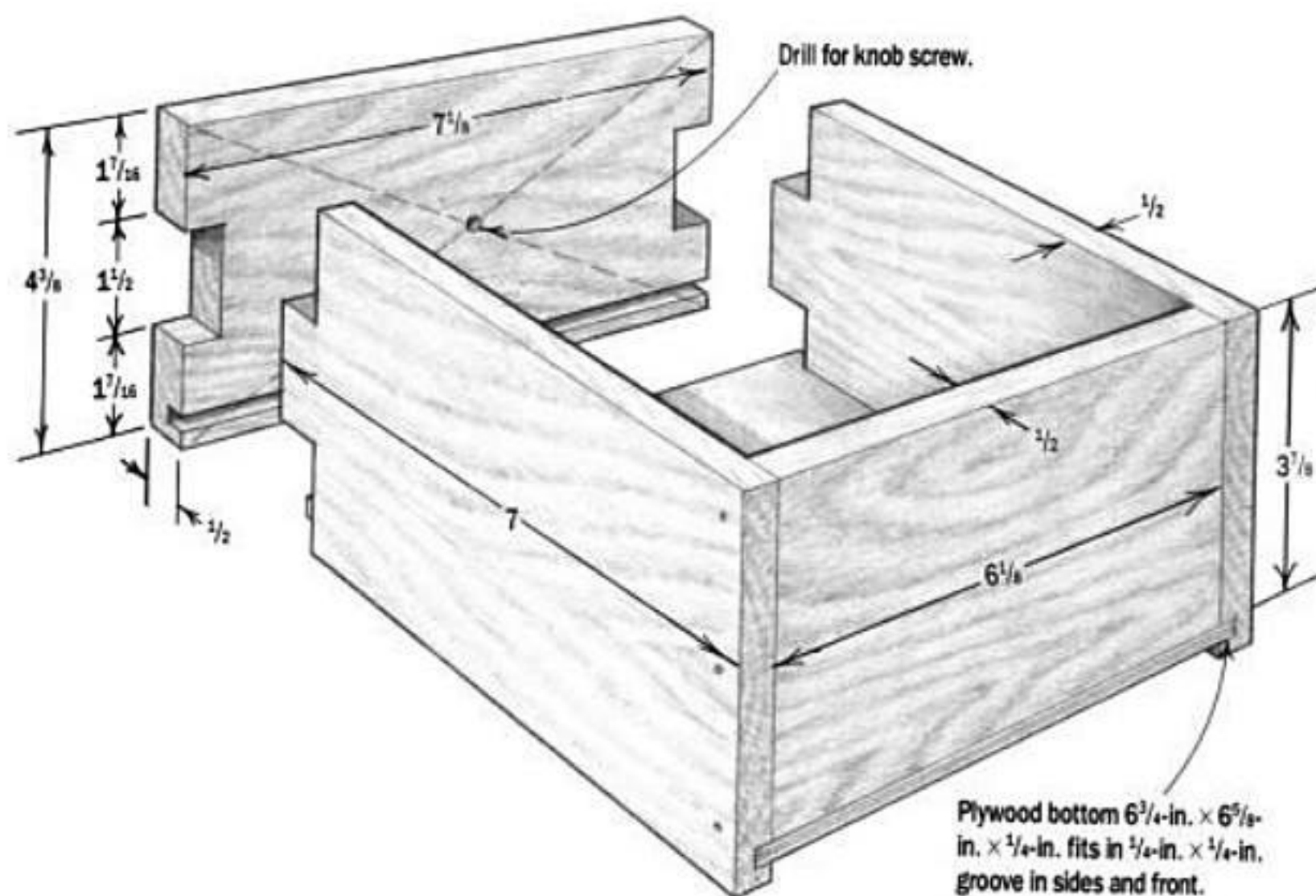
FIG. 2: LETTER-BOX DIVIDER



Chamfer the top and bottom edges of the letter-box dividers for an easier fit in the shelf dadoes. Note that the grain runs parallel to the shorter dimension of the divider.



FIG. 3: DRAWER DETAILS



To make sure the finger on a drawer side is centered, cut the shoulders of the finger with first one edge of the side and then the other edge, against a stop block clamped to the miter-gauge fence.

well, you don't need to glue them; you may find it convenient to have them removable. Otherwise, a drop of glue in a groove will hold them in place.

### Making the Drawer

The three-finger joint connecting the drawer sides to the front provides good strength and a pleasing appearance. You can cut this joint the same way you cut rabbets and dados.

**Cut the front, sides and back to size.** Use the given dimensions as a guide, but cut the parts to fit the actual openings with  $\frac{1}{8}$ -in. of free play from side to side and from top to bottom.

**Cut the three-finger joint in the front and sides.** Adjust the dado cutter in the tablesaw to maximum width, and adjust the cutter height to equal the thickness of the front and sides ( $\frac{1}{2}$  in.). Lay out the finger joint on one side and temporarily nail the sides together with all edges flush and the joint layout showing. Now turn on the saw, position the sides as shown in the photos above, and line up the joint layout with the cutter. Clamp a stop block against the fence as shown and make the first shoulder cut. Then flip the workpiece so that the opposite side and edge are against the fence and stop block, and cut the second shoulder. With both shoulders cut, you can now "nibble" away the remaining waste.

Now separate the sides. Put one side on top of the drawer front and trace around the finger to lay out the notch on the drawer front. Reset the stop block and cut out the notch. Test fit the joints, and with a chisel pare

the surfaces for a better fit if necessary.

**Groove the front and sides to hold the bottom.** Adjust the dado cutter to cut a groove  $\frac{1}{4}$  in. wide and  $\frac{1}{4}$  in. deep. Position the rip fence  $\frac{1}{4}$  in. from the cutter and cut the grooves in the front and sides.

**Assemble the front, sides, bottom, and back.** Fasten the sides to the front with glue and  $\frac{7}{8}$ -in. brads. Drive a single brad through each finger into the notch in the front. Set the nails and fill the holes with putty.

Cut the bottom to fit into its grooves, then slip it into place. Now cut the back to fit between the sides. The top edge of the back should be flush with the top edges of the sides as shown in Fig. 3. Fasten the back with glue and  $\frac{7}{8}$ -in. brads. Check to make sure your drawer is square. If necessary, clamp it against two straight-edged boards screwed to a work surface to form a right angle.

**Install the wooden knob and finish the drawer.** Find the centerpoint of the drawer front by crossing diagonals, then drill a hole for the knob screw. Give the entire drawer a thorough sanding before installing the knob. Finally, apply a penetrating oil finish to all surfaces of the drawer. ▲



This article is excerpted from Tim Snyder's book *Shelving and Storage*, 25 Easy-To-Build Projects for Every Part of the House available January, 1992, from Rodale Press, 33 E. Minor Street, Emmaus, PA 18098.



## *The Traditional Furniture Maker*

by David Bryant

(1990, Guild of Master Craftsman Publications, Ltd., Castle Place, 166 High St., Lewes, East Sussex BN71XU, United Kingdom. Distributed by Trafalgar Square, North Pomfret, VT 05053) 219 pp.; softcover, \$45

This handsome book has a misleading title. A more accurate title would be "Reproducing Traditional British Furniture" since the book describes the construction of 30 furniture pieces. Most of the projects are fairly complex, and author David Bryant covers a wide variety of styles, ranging from Jacobean, and William and Mary to the Regency period. The projects include a bed, a cradle and case pieces, but chairs and tables dominate the mix.

Unlike typical books of this sort, there are no chapters on tools, techniques or finishing. In several chapters, more text is devoted to the history of the buildings that house the pieces than to the furniture itself. The construction descriptions are fairly brief throughout, but Bryant gives some good tips. There is a section of color photos covering 13 of the pieces. Unfortunately, the black-and-white photos are often dark and lacking in detail.

The drawings are very comprehensive and should be sufficient for a skilled cabinetmaker to reproduce any of the pieces, although the metric dimensions could slow down some woodworkers. A bill of materials accompanies each piece, which helps

in figuring out lumber needs.

Although I found this book to be quite interesting and informative, it may have limited appeal to woodworkers on this side of the Atlantic. The vernacular is typically British and can be tedious. Many American woodworkers might prefer to build reproductions of traditional American pieces. Regardless, this book remains a worthy guide to building British reproduction furniture.

CRAIG BENTZLEY

## *Green Woodworking: Handcrafting Wood from Log to Finished Product*

by Drew Langsner

(1987, Rodale Press, 33 E. Minor St., Emmaus, PA 18098) 304 pp.; hardcover, \$19.95



Green woodworking is the craft of working wood that has been taken straight from the tree. It represents hand craft in the truest sense and calls for knives, axes, drawshaves and similarly specialized tools powered solely by the craftsman. More often than not, the wood is hand-held while it is worked.

Green woodworkers make items as diverse as wooden spoons, bark canoes, and Windsor chairs. Author Drew Langsner has been teaching green woodworking at his rural North Carolina home for more than five years. His excellent book reflects a

great deal of understanding of wood and the trees from which it comes.

Langsner introduces green woodworking with a description of the techniques, a history of the trade and a cultural perspective, and he ends with some personal insights on its value in today's society. He then thoroughly describes various woods and explains their special properties and suitability for different green-wood techniques. He suggests ways to get suitable wood and points out that it is plentiful and inexpensive.

Each succeeding chapter uses text, photos and drawings to describe a different technique that he uses in a project. The chapter on knife work, for instance, includes instruction on making wooden spoons. In many chapters, Langsner gives instruction on making the tools themselves. He covers sharpening and maintenance in great detail.

After presenting the techniques, Langsner gives the personal profiles of several workers of green wood. He introduces us to chairmakers, basket weavers, canoemakers, snowshoemakers and many others in these relevant sketches.

The courses in green woodworking that Langsner teaches at his home are really a treat—I've taken three of them. I felt a special sense of empowerment from working so closely and directly with wood. This feeling can easily be sampled by reading Langsner's book, and experienced by working green wood.

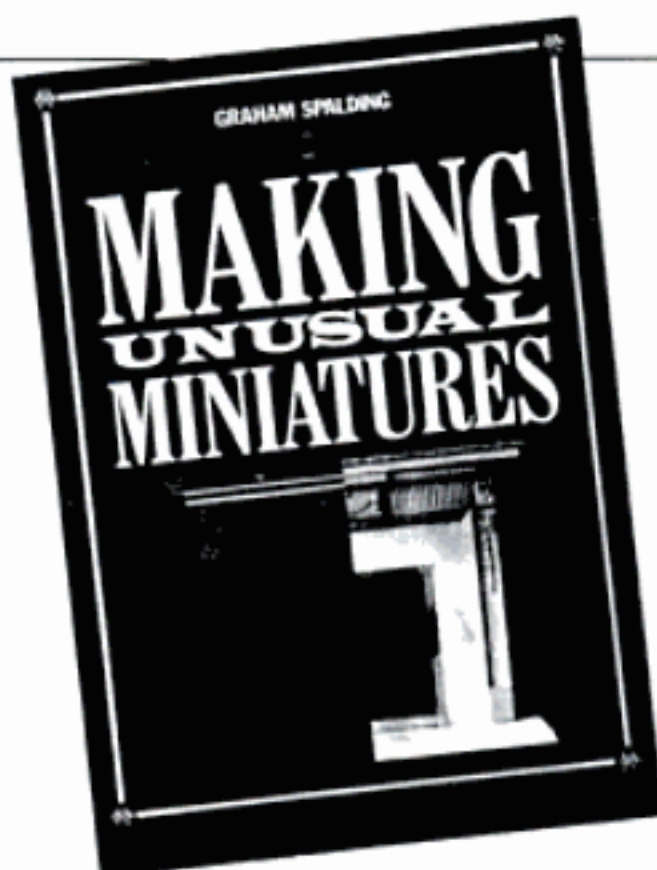
DAN STALZER

## *Making Unusual Miniatures*

by Graham Spalding

(1989, Guild of Master Craftsman Publications, Ltd., Castle Place, 166 High St., Lewes, East Sussex BN71XU, United Kingdom. Distributed by Garrett Wade, 161 Ave. of the Americas, New York, NY 10031) 120 pp.; softcover \$14.95

*Making Unusual Miniatures* is true to its name. The projects in the book are indeed unusual—a ship's wheel or an orchestral harp are not ordinary pro-



jects. This book would have been a godsend 15 years ago when I was building scale furniture.

Graham Spalding begins his book with a chapter on woods appropriate for small-scale work. The author describes nearly two dozen of his favorite woods, discussing the color, the scale of the grain and some of the working properties.

The second chapter, "Tools and Tips," explains and illustrates the basic tools. Most of the tools

described in the book are practical hand tools. This approach seems a good way to encourage a beginner to get started and not be intimidated by the thought of buying expensive power tools. Spalding further offers alternative methods of construction and describes how to make several very handy jigs.

In all but one of his projects, Spalding sticks to the standard scale for miniatures and doll-house building of 1 in. = 1 ft. This is a small point but an important one for anyone planning to build small-scale pieces. Each project is accompanied by clear black-and-white photographs that show parts and assembly details as well as the finished piece. There are plenty of line drawings in the 1-in. = 1-ft. scale, making it possible to take direct measurements.

The book contains more than a dozen projects, including an uphol-

stered leather wing chair, a Georgian drum table with working drawers and a spinning wheel. I particularly enjoyed the historical comments and the ideas for possible alterations to the plans, all sprinkled with the author's encouraging attitude and good humor. More interesting still were the projects that incorporated techniques such as making leaded glass and drawer pulls, blackening brass, French knitting, veneering, upholstering and carving.

In the final chapter, Spalding explains his method of scaling down photographs to produce working drawings for future projects. I found this helpful for those wanting to build their own designs. Further, if one were to make only a few of the projects in the book and stop there, it still would be a great learning experience.

BONNIE KLEIN

## MLCS, Ltd.

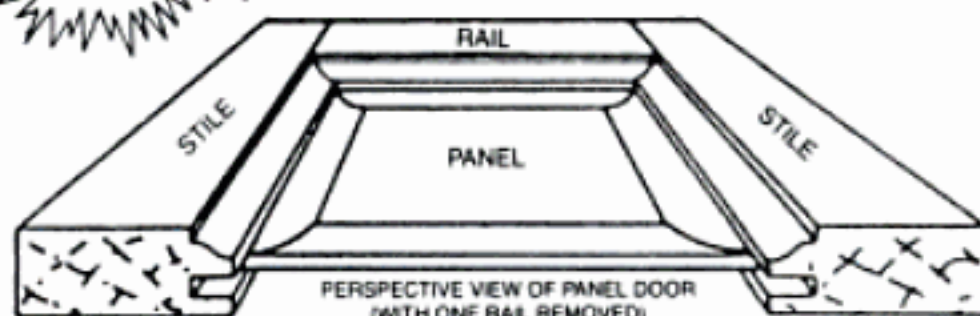
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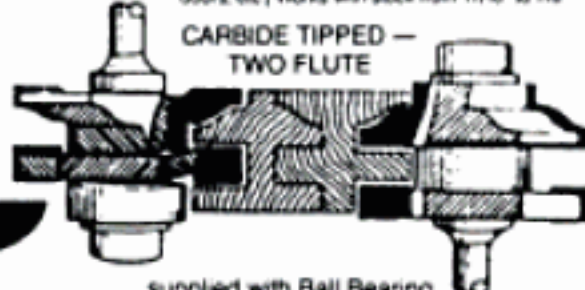
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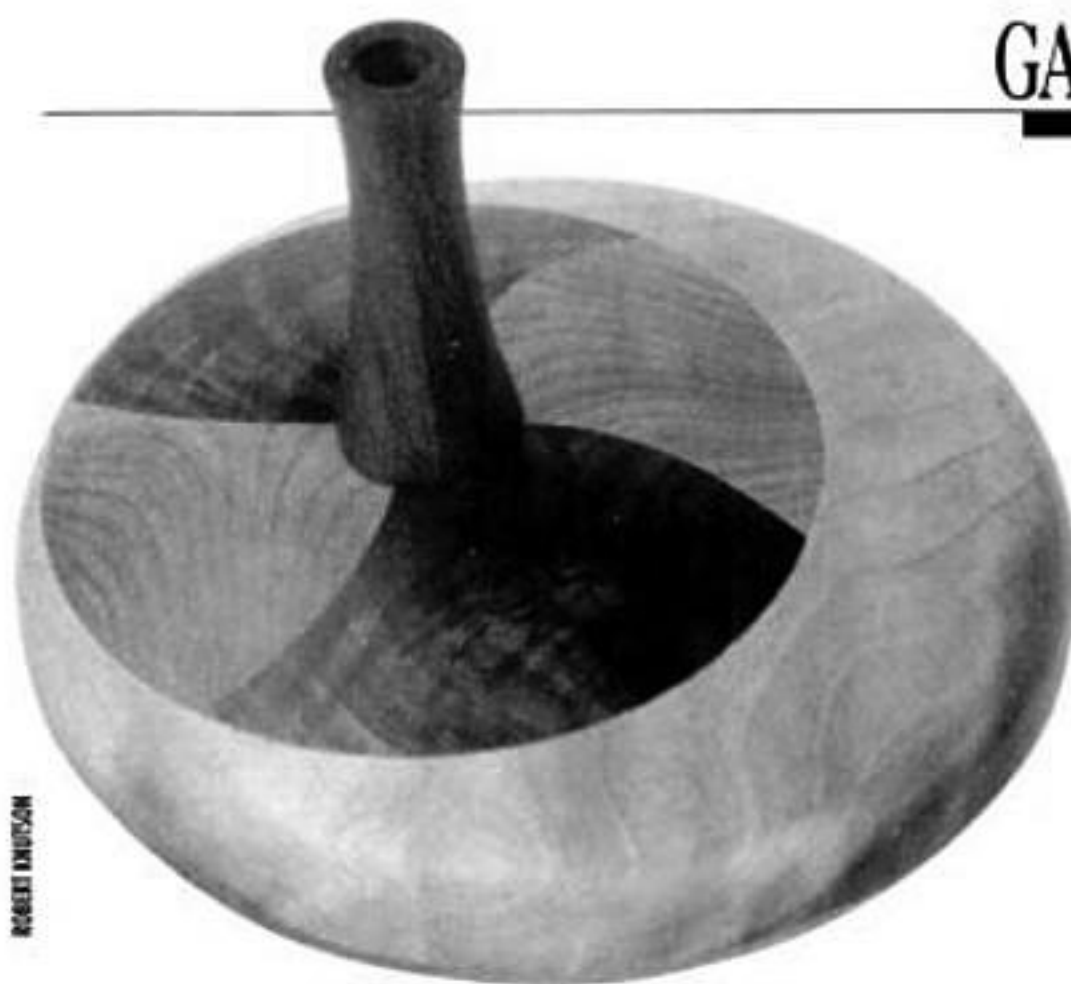
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CIRCLE NO. 30 ON PRODUCT LITERATURE CARD



ROBERT KNUTSON

**Vessel, by Gothard Knutson, Fargo, North Dakota. Birch, walnut, maple. Dimensions: H: 6 in., Dia.: 8 in.**



BARBARA SNYDER

**Twig Chair, by Barbara Snyder, Nazareth, Pennsylvania. Maple, birch. Dimensions: H: 46 in., W: 20 in., D: 15 in.**

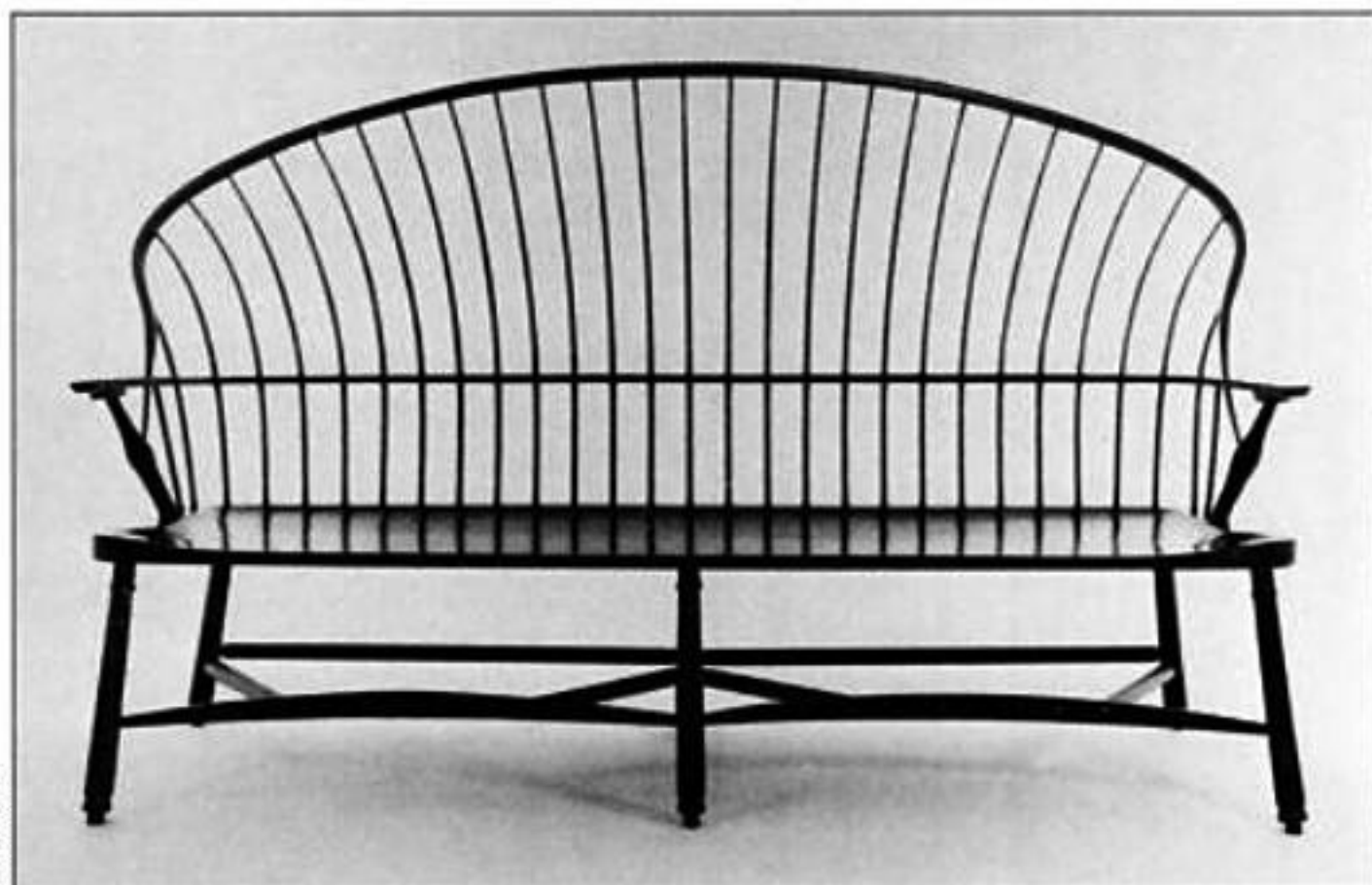


PETER KRAMER

**Regal Secretary, by Peter Kramer, Washington, Virginia. Cherry. Dimensions: H: 85 in., W: 41 in., D: 24 in.**



# GALLERY



PETER KRAMER

**Windsor Bench, by Peter Kramer, Washington, Virginia. Cherry, pine. Dimensions: H: 43 in., W: 75 in., D: 27 in.**



RICHARD SARGENT

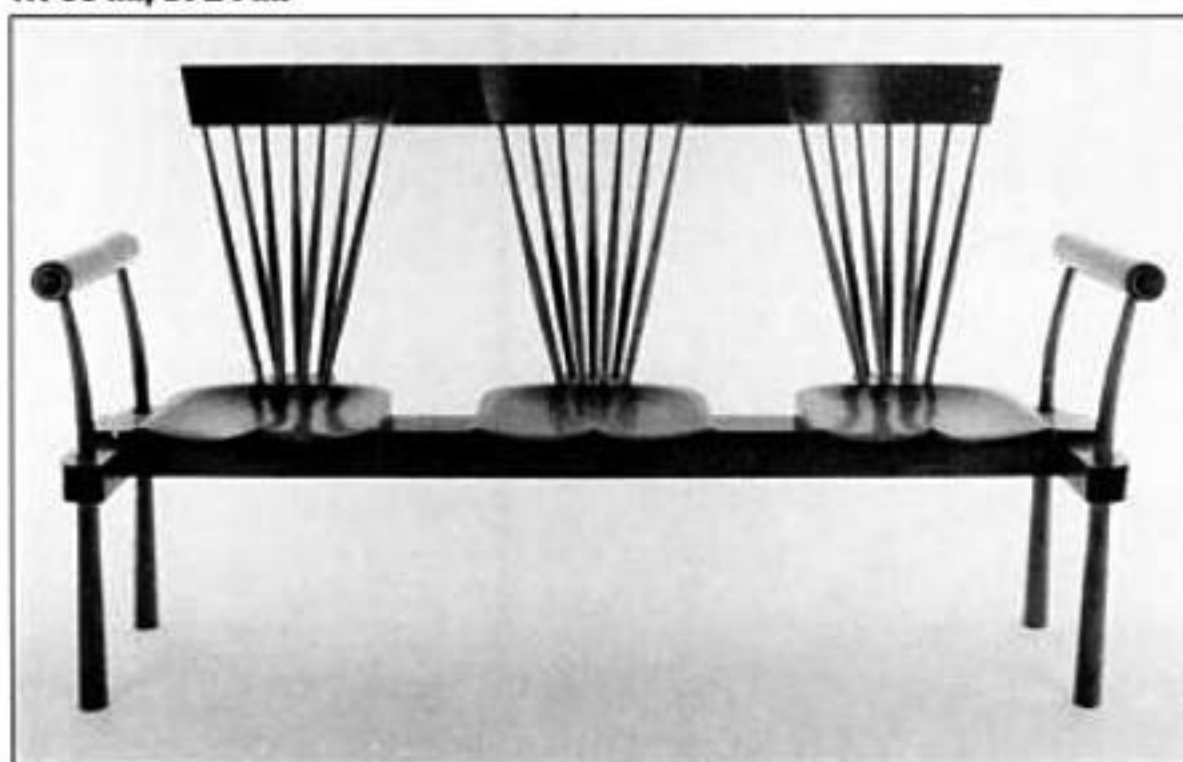
**Ornamented Turning, by Jon Sauer, Daly City, California. Madagascar rosewood, blackwood, zaccariaeus nut. Dimensions: H: 7 in., Dia.: 2½ in.**



SEAN SPRADUE

**Folding Screen, by Patrick Stafford, Santa Cruz, California. Red gum, mahogany, California live oak. Dimensions: H: 72 in., W: 56 in., D: 1 in.**

**Three-Bottom Bench, by Peter Kramer, Washington, Virginia. Cherry. Dimensions: H: 36 in., W: 66 in., D: 24 in.**



PETER KRAMER

*Want to see your work in Gallery? Send color slides or color transparencies to AMERICAN WOODWORKER Gallery, 33 E. Minor St., Emmaus, PA 18098. Please include: materials, dimensions, name of photographer, your name, address and telephone number. Enclose a self-addressed envelope for returning photos.*



## George Frank's Fables

Some time ago, I delivered a freshly restored chest to an antique dealer in the "village." Neither of us was young or ever in a hurry, so we exchanged some ideas over a bottle of good wine. While doing this, a prospective customer entered the store. He had a markedly Slavic look and talked with a matching accent. He inquired about the price of a beautiful salt and pepper set in the window. The crystal containers were set into an exquisitely carved wooden tray and was well worth the \$250 my friend was asking for it. The customer, after due deliberation, asked where the set originat-

ed and whose initials were S and P.

In a sudden inspiration, I mixed myself into the conversation and said, "It must be Russian. Those are the initials of Serge Prokofieff, the Russian composer."

He paid the price without further ado and left with the set. He was back a week later. "You are a phony. S and P means salt and pepper," said he to my friend. "Do you want your money back?" asked my friend. "Oh, no. I sold the set to a commissar at the Russian Embassy for \$500. So, I brought you this bottle of wine," he replied.

## New Woodworking TV Show

In case you've missed it, there's a new TV series on woodworking that started this fall on public television.

"Woodworking for Everyone" is hosted by teacher and author Richard Starr. As the title implies, the show focuses on woodworkers of all ages. Adults and children work together, learning such basic skills as joinery and sharpening. They can also be seen designing and building projects that range from wooden toys to workbenches.

Check your local PBS schedule or contact the station to find out if the series is broadcast in your area.

## Shellac Facts

If all you know about shellac is that it comes in a can at the hardware store, there's plenty you don't know about this natural finishing resin. For instance, do you realize that shellac comes from an insect; that it's processed by hand; that it's one of the oldest of finishes, used since the 16th century?

The lore and history surrounding this finish are presented in a 19-page pamphlet, "The Story of Shellac," updated and reprinted 16 times since its original publishing in 1913. Practical uses and correct applications of shellac are discussed in detail in this pocket-size brochure available free by writing William Zinsser & Co., Inc., 39 Belmont Dr., Somerset, NJ 08875.



## Regreening America

The National Arbor Day Foundation has an offer you can hardly refuse.

Each new member to join the foundation will receive ten Colorado blue spruce trees. The free trees are part of the non-profit foundation's Trees for America program. The blue spruce was chosen for this membership campaign because of its

versatility. Not only is it an attractive evergreen but it is hardy, adaptable and can serve as a windbreak or a privacy screen. (For Southern and West Coast states, conifers suited for those climates will be substituted.)

The 6-in. to 12-in. seedlings will be shipped postpaid in fall or spring with planting instructions included. If the trees do not thrive, they will be replaced for free.

To join the foundation, send \$10 to Ten Blue Spruces, National Arbor Day Foundation, 100 Arbor Ave., Nebraska City, NE 68410.

**COMING NEXT ISSUE:**  
**DUST-COLLECTION**  
**SYSTEM**

**GLAZING CABINET**  
**DOORS**

**WORLD-CLASS ROUTER**  
**TABLE**

**MIKE DUNBAR'S**  
**WINDSOR SIDE CHAIR**