

AMERICAN WOODWORKER

FROM THE DESK OF
M. N. PEISCHL

February 1992, Issue No. 24

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ANDY EDGAR

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A WORD FROM THE EDITOR



You hold in your hands the last black and white issue of AMERICAN WOODWORKER. Starting in March, we're rolling out with a colorful new design. Color will enable us to cover subjects we just couldn't pull off in black and white.

Finishing is a perfect example. In black-and-white photos, finishes all look alike. In color, we can show you the difference. You'll see a lot more finishing articles in the color AW. In fact, starting next issue, we're adding a

new department, "Just Finishing," by Michael Dresdner. Michael is well-known in the finishing field, and we're proud to have him aboard. You'll also see more articles on wood, veneers, tool tempering, marquetry and many other subjects that really need color to get the information across.

So here's a fond farewell to the good ol' black-and-white AW. It's been fun. Now it's time to move on.

If you want to kick off a lively debate, just bring up the subject of logging old-growth forests. Old-growth forest, for those who don't know, is virgin forest that has never been cut. Giant trees that have stood for hundreds—maybe thousands—of years. Wooded wilderness.

Of the virgin forest that covered this country in the 1600s, only about 5 percent remains uncut today. Yet old-growth forest is still being logged off at an alarming rate—70,000 acres a year throughout the 1980s. Clear-cutting is the common practice—entire

patches are logged off and burned. Though these areas are usually replanted with seedlings, you can't recreate an old-growth forest by planting. Once it's cut, it's gone forever.

Most of the remaining old-growth forest lies on Government land under the jurisdiction of the U.S. Forest Service and the Federal Bureau of Land Management. There's big money in old-growth logs and the Forest Service continues to sell off logging rights to old-growth forest on public lands. If this practice continues, there soon won't be any old-growth forest left to cut.

There's plenty of other timber available to meet our country's needs and provide jobs for people in the timber industry. Please urge your congressional representative to vote for a ban on all logging of old-growth forests on public lands. Let's preserve what's left for our children.

DAVID SLOAN
Editor and Publisher

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CIRCLE NO. 4 ON PRODUCT LITERATURE CARD

JANUARY/FEBRUARY • 3

Finally Sawin' My Own

Re: Backyard Lumbermaking (AW, #21): Bob Moran did a terrific job outlining the many options that exist for the burgeoning sawyer. It was just what I needed to prompt me to go out and finally purchase the Rip Saw by Better Built Corp.

ERIC OTTUM
Falmouth, ME

Nix on Positive-Pressure Ventilation

Positive-pressure ventilation as explained by Steve Long (Tech Tips, AW, #23) can move a larger volume of air but the exhaust opening(s) would have to be relatively large to allow the high-volume/low-pressure flow of air to be exhausted. This larger volume of air is not a benefit of positive pressure but of the "cone of air." A negative-pressure setup would move just as much air. The reliability of either method, however, would be in question as even a moderate breeze could reverse or at least impede the flow of air and toxic or explosive fumes.

What's worse with positive pressure is that "pressure and fumes" will not only escape out of the opening you want them to, but also through every opening in the room. You don't want

to expose your family, especially young children and pets, to these dangerous fumes. Unless your shop is airtight or not attached to your home, do not use positive pressure.

If you don't have an explosion-proof exhaust fan, as commercial shops should, do all work with flammable substances outdoors. To exhaust toxic fumes and dust, use an exhaust fan with sufficient rating to keep your work area safe. Don't rely on the "cone of air" to increase the capacity of an undersized fan. Even negative pressure can be dangerous, as it can cause the flow of chimney gases to reverse, filling your shop with carbon monoxide, smoke and other toxic substances. Don't forget to open some windows.

TONY CRUZ
Carteret, NJ

Dealers Do it Better

I am writing regarding your article "Buying Tools by Mail" in your October issue (AW, #23).

Your article leads one to the conclusion that you can always save big bucks buying by mail, which is patently untrue. Misleading also is the insinuation that it doesn't matter with whom you deal, just so you shop for the best price.

Let's take the example you use, the

Delta Contractor's Saw. Many a local Delta dealer will deliver our contractor's saw for \$595, and some will even assemble it for that price. Assembled or in a box, it's probably worth the sales-tax difference to not have a 200-pound saw handed to you off the back of a tractor trailer.

The direct-mail people have made products for woodworking widely available and their four-color catalogs have made shopping easier (particularly for the rural user), but the local dealer still provides services that can't be duplicated by mail-order marketers. If you want to feel, touch and test, you are not going to do that through the mail. Getting good advice on the right product for you is usually best obtained from the local dealer if one is available.

WALDO E. BAIR
Vice president marketing sales
Delta International
Pittsburgh, PA

Think Before You Toss

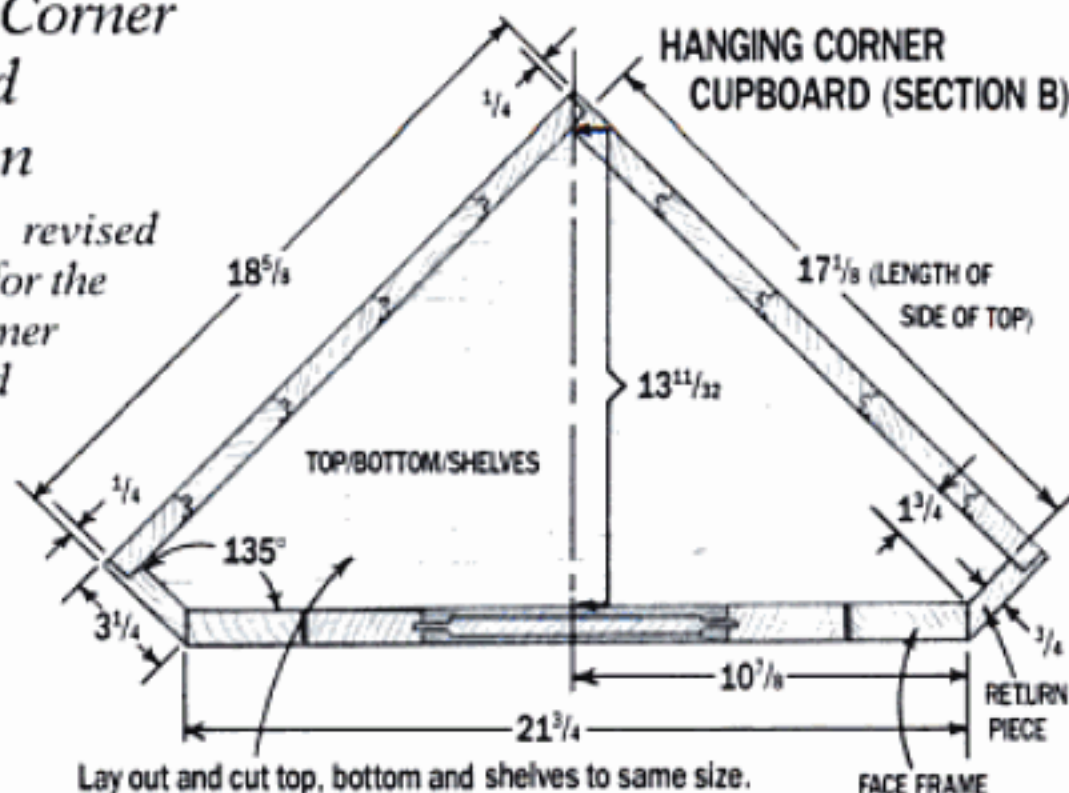
I enjoyed and learned a lot from Bob Flexner's article (AW, #22) on paint strippers. But I choked a bit on the very last sentence in the last part of the article, "Stripping Tips." The statement is "Sending dried paint sludge to the landfill is no more polluting than tossing the entire painted object into the landfill." It is a true statement, but is it really what we want to encourage?

That poisonous paint sludge could end up just where someone, years from now, plants a vegetable garden, or closer to the heart, where someone plants a walnut tree for his or her grandchildren.

HARRY RUDIN
Oberrieden, Switzerland

Hanging Corner Cupboard Correction

Please note revised dimensions for the Hanging Corner Cupboard (AW, #22).

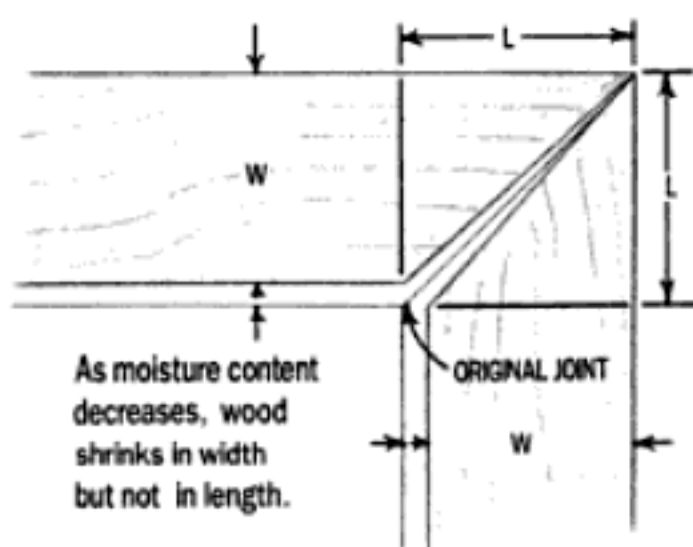
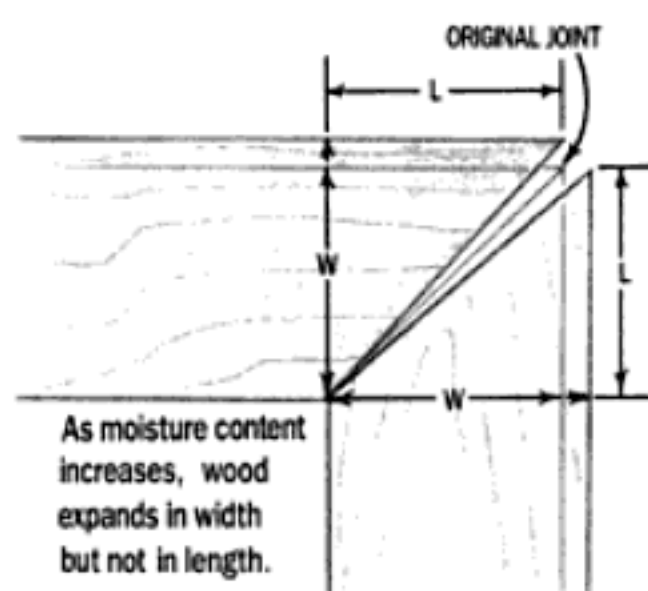


Tell us what you think. Send your comments, complaints, compliments and corrections to Editor, AMERICAN WOODWORKER, 33 E. Minor St., Emmaus, PA 18098.

Why Miters Open

Q. My sister-in-law has an oak coffee table with mitered joints in the top. She has an evaporative cooler in the same room. The mitered joints in the coffee table keep splitting open. Can anything be done to stop this?

ROBERT WEAVER
Pampa, TX



DRAWING BY GLENN HUGHES

A. Changes in air humidity cause changes in wood moisture content. When humidity and the moisture content of wood go up, the wood expands. When humidity and the moisture content of wood go down, the wood shrinks. Unfortunately, wood doesn't expand and shrink uniformly. Dimensional changes in the direction of the grain are so small that they can be ignored. Across the grain, however, the expansion and shrinkage will be quite noticeable.

The drawing shows how this difference in the amount of expansion or shrinkage changes the angles in a miter joint. These changes in the miter angles are responsible for the gaps in

the miters on your sister-in-law's table. The evaporative cooler is probably aggravating the problem by creating a humidity range greater than the normal seasonal humidity range.

The only way to stop the wood from expanding and shrinking is to stop the moisture content from changing. Some surface coatings (finishes) will slow the change in moisture content in wood but no finish will stop it. In a nutshell, if you can't hold the humidity in the air to within a narrow range, you can't stop the miter joints from opening up.

In well-designed furniture, the parts are arranged so the wood can expand and contract without problems.

BOB MORAN
Assistant editor

Lowdown on Furniture Polish

Q. My parents oil their furniture once a week with furniture polish. Some of the furniture is veneered. Is this healthy for the furniture?

AVIAN WILSON
Englewood, CO

A. It makes no difference whether the wood is solid or veneer; nor is the species of wood important. When you oil your furniture with any polish, oil, cream or treatment from the supermarket you're putting a very thin layer of oil on top of a finish. The oil is intended to keep liquids such as oil, water and perspiration out of the wood. The idea that you need to replace the natural oils in the wood is nonsense. With few exceptions, such as teak and rosewood, the wood never had any natural oil in it; and teak and rosewood don't need their oil replaced.

Furniture polishes contain a very light oil that evaporates. The oil helps remove certain kinds of dirt and grime from the furniture and leaves a film that smears when you touch it, but also makes the furniture shine. The cut (weight) of oil used in a polish determines how quickly it will evaporate. When its gone, the shine that it gave the furniture is gone.

Clear polishes contain only oils. Polishes that appear milky are emul-

sions, mixtures of water and oil. Water helps soften and remove certain kinds of dirt and grime that oil won't touch.

So what good are furniture polishes? They make dust stick to your dust rag. They help in removing dirt and grime from the furniture. They make your furniture shine by leaving a thin film of oil on the surface. They create a low-friction surface that allows scuffs to skid off instead of scratch. More subjectively, they spread a pleasant scent around the room to give you the feeling that the room is clean.

Choose a polish for its cleaning characteristics, ease of use, scent, its shine and for the amount of smearing you can tolerate.

BOB FLEXNER
Finishing consultant
Norman, OK

Drying Thick Slabs

Q. I have a 2-ft. long x 15-in. dia. section of the stump end of a soft maple log that I want to cut into 1-in. or 2-in. thick slabs for tabletops. How do I keep the wood from cracking as it's drying out? Should I saw the log into slabs, or let the whole section dry first?

GEORGE YEAGER
Evansville, IL

A. Drying slabs of wood for tabletops is risky at best. Stump wood usually has interesting grain patterns, but those patterns dry with unusual shrinkage, which encourages warps and cracks.

Here's how you can try to dry the wood. First, cut the log into slabs a little thicker than you want for the tabletop to allow for warp and shrinkage. Seal the end grain and any area around knots to prevent fast drying. Asphalt roofing cement is a good sealing material, or try "Anchorseal," a wax emulsion specially formulated for sealing wood during drying (available from U.C. Coatings, P.O. Box 1066, Buffalo, NY 14215, 716-833-9366).

Dry the slabs very slowly. One way to slow down the drying is to put the slabs in a freezer or cold room for six months or longer. Another method is to put the wood outside in a cool, shady spot with high humidity and lit-

tle wind. There is always the risk of the wood getting moldy and stained.

For a stable tabletop, you'll need to get the moisture content of the wood down to 6 or 7 percent. To do this, you'll have to monitor the moisture content with a moisture meter until it drops to about 20 percent. After that, put the wood in a heated drying area like a solar kiln or a heated room to dry it to the 6 to 7 percent range.

An alternate approach is to soak the wood in PEG (polyethylene glycol) (available with instructions from Constantine's, 2050 Eastchester Rd., Bronx, NY 10461, 212-792-1600). PEG reduces shrinkage (and the cracking and warping that result) by replacing the moisture in the wood.

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

Clearing Planer Chips

Q. *Wood shavings stick to the outfeed roller of my 20-in. Jet planer and get pressed into the freshly planed surface of the stock. I've cleaned the roller thoroughly but the shavings soon build up again. What can I do?*

KLEMENS F. JOHNSON
Camano Island, WA

A. Planer chips should never get to the outfeed roller because they can mar the surface of your stock even if they don't stick to the roller. Your problem is poor evacuation of the chips.

The chips should be funneled up and out through the dust opening by the chip breaker. If there's no dust collector attached, chip removal depends solely on the chips being thrown by the cutterhead, and some chips don't make it. They can easily wind up pressed into the wood as it passes under the outfeed roller. You can minimize the number of chips left behind by taking shallower cuts, using slower feed rates, keeping the knives sharp and properly adjusted, and by checking that there are no obstructions in the exit opening.

Some machine makes, including your Jet, require a dust collector for

proper chip removal. A 20-in. planer like yours needs a collector that moves about 1200 cubic feet of air per minute.

KELLY MEHLER
Furniture maker
Berea, KY

A. Shavings from resinous wood can be so tacky that they require much more than normal air flow from a collector for proper removal. I gave up on one batch of pine because shavings stuck to everything and left a resinous residue on all my tools. I've also had problems in especially cold, dry weather when static build-up caused every stray shaving to cling tenaciously to the nearest surface of the machine. After a few minutes of operation, I couldn't see the planer under its plumage of wood shavings. A pan of water on the wood stove raised the humidity enough to solve the static problem.

BOB MORAN
Assistant editor

Restoring Planes

Q. *I recently bought some old planes with wooden bodies and metal blade mechanisms. The blades need to be reground and honed, but should I clean up and polish the entire blade? What's the best way to overhaul these old metal parts?*

THEODORE ROSE
Waxahachie, TX

A. Your planes are usually termed "transitional" because they were once thought to be a transition between wooden and metal planes. In reality, Stanley and other makers made this type of plane for carpenters at the same time that they made all-metal planes that could be adjusted with more precision for more demanding woodworking.

To clean the parts, first disassemble the plane. The wooden parts are varnished, and some of the metal parts have a shiny finish called "japanning." To protect your plane's antique value, do not strip any finished surfaces with paint remover. Live with the nicks, chips and stains. You can clean the

surfaces with a toothbrush and paint thinner. Remove rust with steel wool and protect the bare metal with a rust inhibitor such as WD-40.

To restore the cutting edge, first, grind the bevel to remove nicks and establish the bevel angle. (See AW, #19, page 8 for more on shaping a plane blade.)

Next, flatten the back of the blade for about 1 in. behind the cutting edge. I do this by rubbing the blade on a piece of emery cloth placed on some 3/8-in. thick glass. I finish with a medium and a fine sharpening stone. For the edge to be razor sharp, you must polish this back surface until you can literally see your reflection in the steel. Finally, hone the bevel to the same degree of polish.

For more information on transitional planes and sharpening, see my book *Restoring, Tuning, and Using Classic Woodworking Tools*.

MICHAEL DUNBAR
Contributing editor

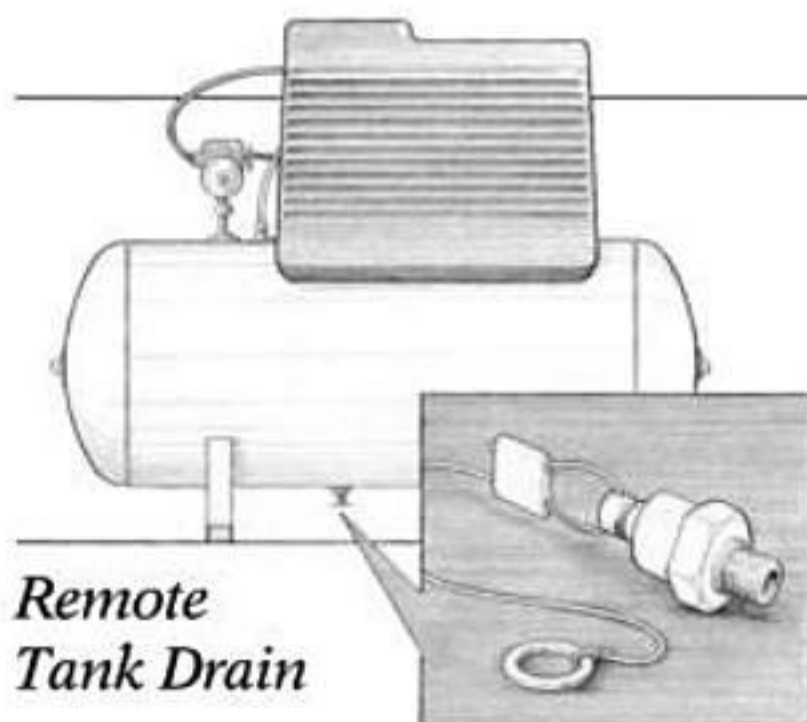
WHERE TO FIND IT

Brass-covered wood moldings for adding a decorative touch to small projects are available from Lee Valley Tools, Ltd., P. O. Box 6295 Station J, Ottawa, Ontario K2A 1T4, (800) 461-5053.

Out-of-print and reprinted classic books on woodworking, ranging from coachmaking to architectural mill work are available from R. Sorsky Bookseller, 352 W. Bedford #105, Fresno, CA 93711, (800) 345-4447.

Bent oak chair braces (hip rests) for repairing old (or building new) chairs are available from The Woodworkers' Store, 21801 Industrial Blvd., Rogers, MN 55374, (612) 428-2199.

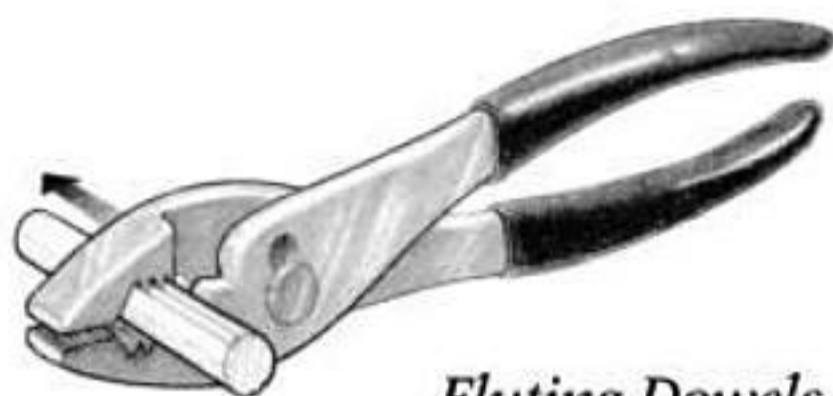
Got a woodworking question for the experts? Send it to Q&A, AMERICAN WOODWORKER, 33 E. Minor St., Emmaus, PA 18098.



Remote Tank Drain

My air compressor is located conveniently out of my way, but inconveniently for draining the condensation from the tank. To solve the problem, I replaced the original drain cock with a remote tank drain valve designed for large trucks with air brakes (NAPA #66164). The new valve has a 5-ft. cable that I can pull when I need to drain the tank. When I release the cable, the valve recloses.

WALTER COLTON
Wellsboro, PA



Fluting Dowels

I make my own fluted dowels without a special tool or jig. I simply crimp the dowel with the inner pipe-gripping teeth of ordinary pliers in a series of squeezes. It takes about five seconds to flute a 2-in. length of dowel.

ROBERT PAULEY
Decatur, GA

Matching Half-Round Turnings

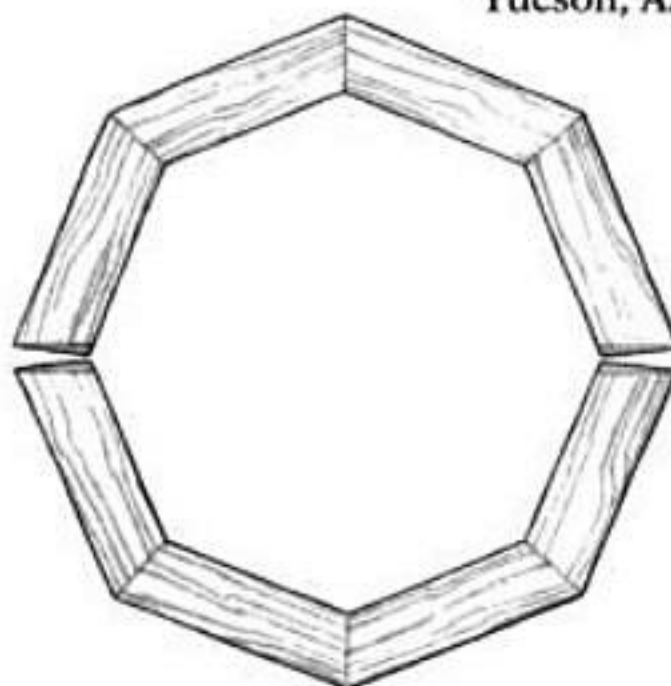
I make matching half-round turnings for the restoration of antique clock cases. I use contact cement to glue two blanks together, back to back. After turning, I start prying the two pieces apart with a chisel, dribbling a little lacquer thinner in the resulting crack. As it grows, I add more thinner until the two halves pop apart. The two turnings are a full half-round with no loss to a saw kerf.

DAVID JOHNSON
Apple Valley, MN

Easy-Out Router Bits

A router bit tends to "freeze" in the collet when used a long time. The secret to freeing a bit begins when you first insert it. Push the bit all the way in, then pull it back out about $\frac{1}{8}$ in. Now if it freezes in the collet you can tap it in with a stick of wood. The bit can break free into the $\frac{1}{8}$ -in. of room above it.

HUGH WILLIAMSON
Tucson, AZ



Gluing Up Polygons

When trying to make a many-sided project, whether flat like a picture frame or coopered like an architectural column, tiny angle errors accumulate and become a big error when all of the parts are brought together. Instead of fiddling endlessly with impossibly fine adjustments of each angle, I glue up the parts in two halves. I then plane the joining surfaces flat before gluing the two halves together to make the whole.

GLENN HUGHES
Dublin, PA

Disc Storage

Storage or file boxes for computer disks make great organizers for sanding discs. These boxes come in a variety of capacities with and without



DRAWINGS BY HEATHER BRINE LAMBERT

dividers. They're designed for 3 $\frac{1}{2}$ -in., 5 $\frac{1}{4}$ -in., and 8-in. floppy disks. A 6-in. dia. sanding disc fits nicely in file boxes intended for 5 $\frac{1}{4}$ -in. computer disks.

ANDREW LENHART
Royal Oak, MI



Disposable Spreader

Pipe cleaners are excellent for spreading glue in dowel holes or biscuit-joint slots. I also use them for applying stains and finishes in hard-to-reach spots.

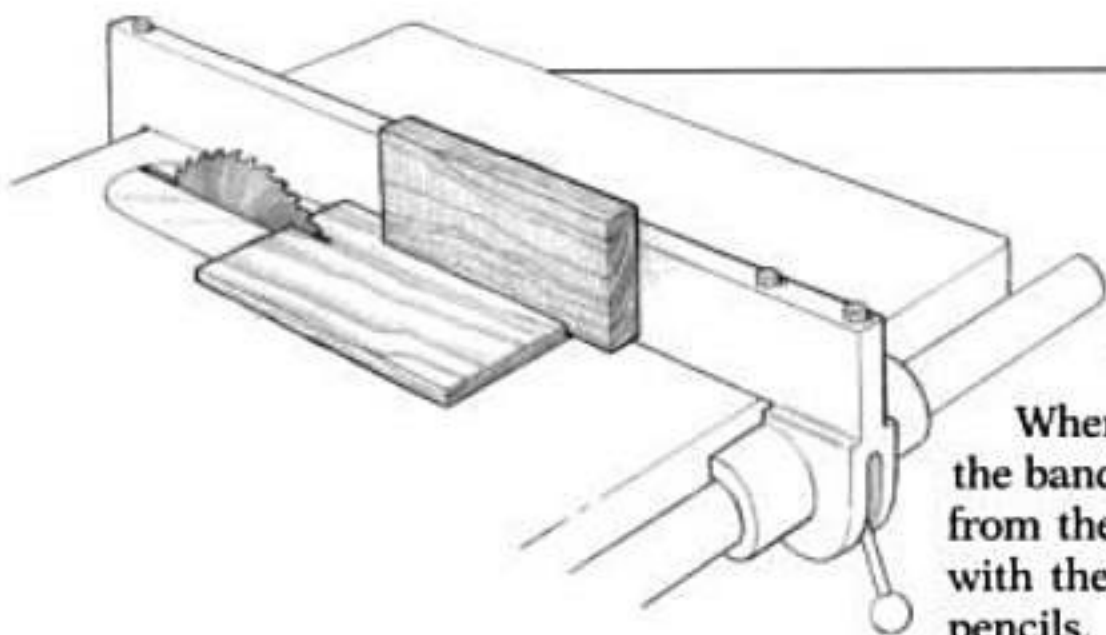
RALPH MEYER
Nashotah, WI

Miter-Gauge Fence and Stop

My miter-gauge auxiliary fence incorporates an adjustable stop that locks in place with wing nuts on $\frac{1}{4}$ -in. x 2-in. carriage bolts. I use a $\frac{3}{4}$ -in. plywood fence 3 in. wide x 40 in. long. The $\frac{1}{4}$ -in. wide slot for the carriage bolts ends 1 in. from the ends of the fence.

BRUCE LEVINE
New York, NY

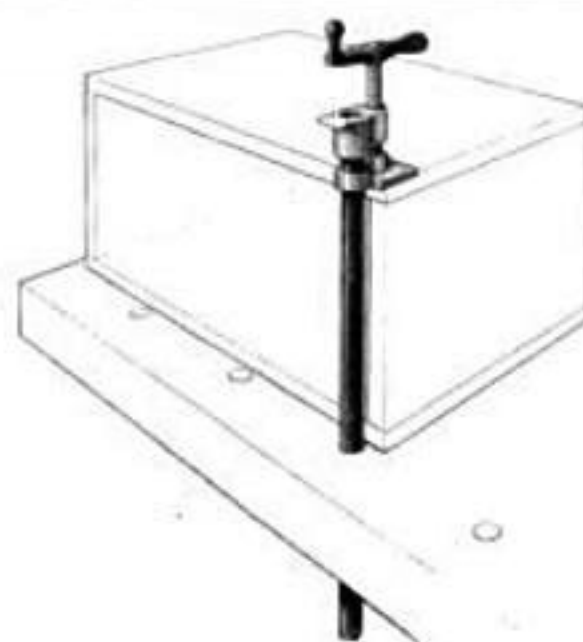




Erasers for Safety

When I have to cut small pieces on the bandsaw, I keep my fingers away from the blade by steering the piece with the erasers on the ends of two pencils.

GLENN HUGHES
Dublin, PA



Double-Duty Dog Holes

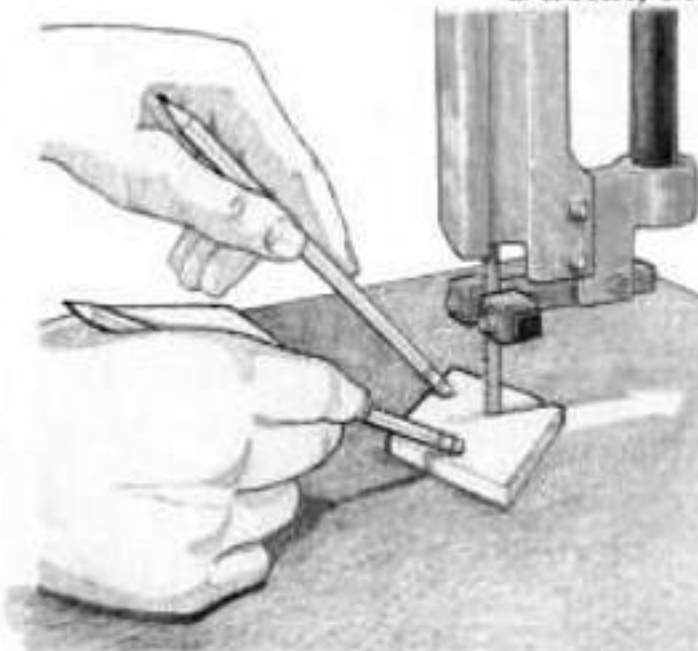
If you build (or convert) your workbench with dog holes large enough to accommodate a 3/4-in. pipe, you can conveniently clamp awkward shapes directly to your benchtop. You can then assemble a pipe clamp right through the benchtop.

GLENN HUGHES
Dublin, PA

Push-Stick/Hold-Down

Keep narrow or thin pieces of wood under control and your fingers at a safe distance from the blade while ripping on the tablesaw with a combination push-stick/hold-down as shown in the drawing. The 1/8-in. to 1/4-in. heel catches the trailing end of the workpiece to push it through while the rest of the pusher holds the narrow piece of stock flat on the table.

RIC HANISCH
Quakertown, PA



Damping Scroll-Saw Vibrations

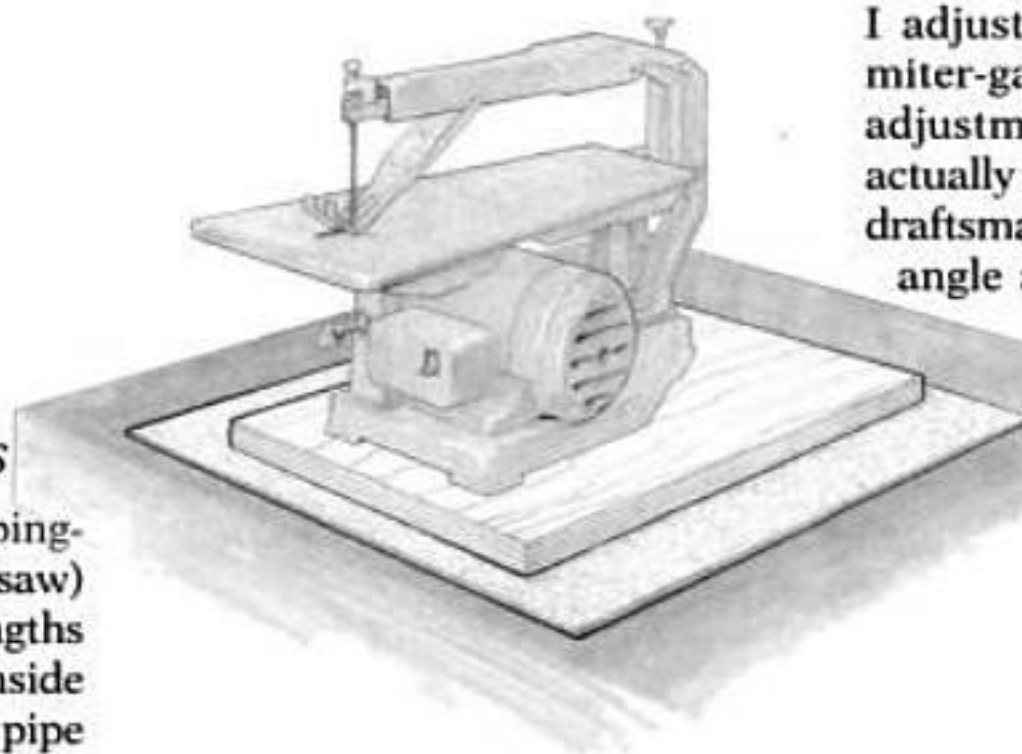
I didn't have room for a separate stand for my scroll saw, so I bolted it to a 3/4-in. plywood base. But when I used it on top of my workbench, it vibrated so much I had to clamp it to the benchtop. I solved the vibration problem by putting the saw on a routing/sanding



Transferring Angles

I adjust my tablesaw bevel angle, miter-gauge angle and other angle adjustments on machines without actually measuring the angles. I set a draftsman's adjustable triangle to the angle as shown in the drawing. I then adjust the blade tilt or miter gauge to the adjustable triangle. If I'm working by hand, I transfer the angle directly to the stock.

RIC HANISCH
Quakertown, PA



Organizing Small Blades

I keep all of my small blades (coping-saw, scroll-saw, saber-saw, hack saw) organized and stored in short lengths of plastic pipe. I put the blades inside the pipes and cork one or both pipe ends. To keep these homemade containers convenient, I store them in slightly larger pieces of plastic pipe. I fasten the pipe sections to the wall with a screw at the top and a long screw or nail at the bottom as shown in the drawing.

BILL HOUGHTON
Sebastopol, CA



pad—a foam pad (sold by woodworking-supply companies) for holding small items stationary. The pad keeps the scroll saw from "walking around" and dampens the vibrations. Now it's much easier to get accurate cuts.

WAYNE DRAGISH
Linwood, PA

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



Tonic for Tired Machines

Here's a trio of new high-tech coatings that will help your woodworking by lubricating and sealing the working parts of your machines. The coatings

are solid fluoropolymer materials that are sprayed on in submicroscopic particles that bond to metal surfaces, forming durable films that won't break down under high temperature and pressure. And they don't contain any silicones or petroleum oils, which can stain wood. **DriCote** is a treatment for saw blades, drills and router bits that lubricates and protects against wood acids and resin build-up. **TopCote** reduces friction, repels

moisture and seals against corrosion on metal machinery tables. **Bearing Lubricant** increases the life of router-bit pilot bearings by sealing out dirt, moisture and protecting against heat from friction. (Price: DriCote and TopCote \$10.95, 11.5-oz. spray; Bearing Lubricant \$3.99, 2-oz. spray) ■ **Sandaro Industries Inc., Dept. AWT, 68 Leveroni Dr., Novato, CA 94949, (800) 999-7009.**

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SHOP TEST

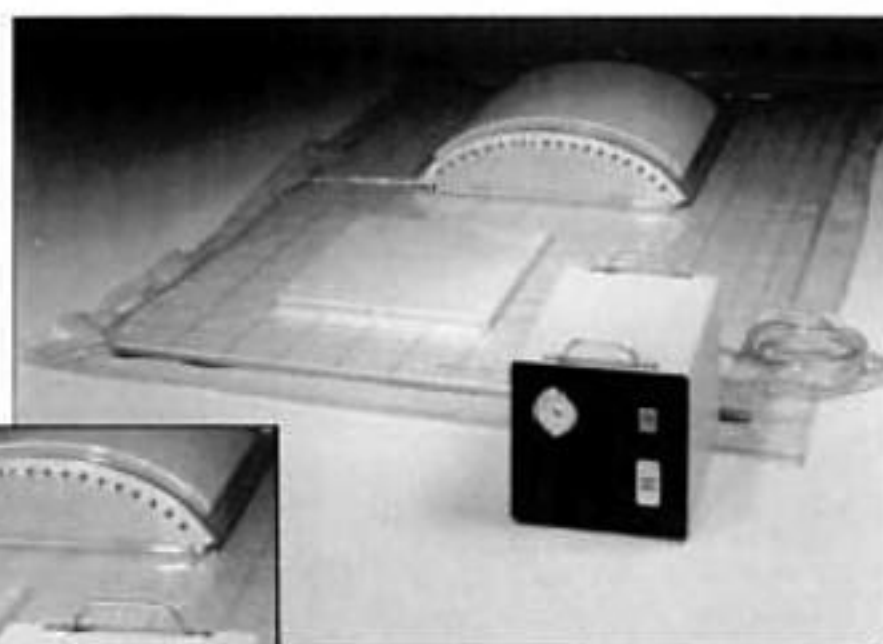
Mercury Vacuum Press

Tested by Monroe Robinson

I used to be skeptical of vacuum presses for veneering. When I saw how well a friend's crude homemade vacuum press made veneered panels and bent laminations, I recognized the vacuum press had some advantages over my old mechanical veneer press with its heavy press screws. That's why I was eager to try the new Mercury Vacuum Press in my own shop.

Vacuum presses work by taking advantage of atmospheric pressure. You simply put the material you want to press into a large plastic bag and seal it shut. When you suck all the air out of the bag, atmospheric pressure bears down on the contents of the bag—squeezing the veneer to the substrate. The advantage is that this pressing action is uniform—it presses just as evenly on surfaces with complex curves as on flat surfaces.

The Mercury Vacuum Press package consists of an oilless rotary-vane vacuum pump powered by a 1/4-HP motor, and a 20-mil. (.020-in. thick) flexible vinyl bag with electronically welded seams and a heavy-duty plastic zipper. The bag is available in three sizes (48 in. x 36 in.; 48 in. x 72 in. and 48 in. x 108 in.). The pump pulls 5 CFM (cubic feet per minute) to make



the bag very nearly a vacuum. There are two air filters to prevent dirt from being drawn into the pump and a muffler for quiet operation.

To put the press into operation, I had to construct a "grid" by scoring a large piece of 3/4-in. particleboard with a grid-work pattern of 1/8-in. saw kerfs. The grid is placed flat in the bottom of the bag, and the piece being veneered is placed over the grid. The saw kerfs act as little "pathways" for the evacuation of the air, which ensures that the pressure will be exerted evenly.

Once the grid is made, it only takes a few minutes to set up the bag for pressing. The work slides in easily, though with large bent laminations, I have to prop the bag open so the top of the bag doesn't get in the way. The bag's zipper requires some effort to close, but it makes a very effective seal—it takes about a minute or two to draw the vacuum to 12 psi (24 in. Hg.).

An automatic vacuum switch turns the pump off. After that, the pump will run a few seconds every five to twenty minutes to restore the vacuum lost to the inevitable tiny leaks in the system. The clear vinyl bag allows you to see the work inside—if the veneers slip out of place a bit, you can fix them while the vacuum pulls the bag tight.

The Mercury Vacuum Press is a joy to use because it's so much more versatile than a traditional frame press. It'll press any size project you want—just buy the appropriate-size bag and you're in business. It excels at clamping bent laminations because of the even pressure it exerts, eliminating the bumpy surface I get with hand clamps. The only limitations are bent laminations with a very narrow dimension or with plies too stiff for the desired curve. These situations may require more pressure than is possible with a vacuum press. The owner's manual gives standard operating instructions and explains the technique of vacuum pressing. (Price: \$690, 48-in. x 36-in. bag)

■ **Mercury Vacuum Presses, Dept. AWT, P.O. Box 2232, Fort Bragg, CA 95437 (707) 964-7557.**

(Monroe Robinson will teach a two-week course on vacuum-press veneering at Anderson Ranch this summer. See AW Calendar for dates in upcoming issue.)

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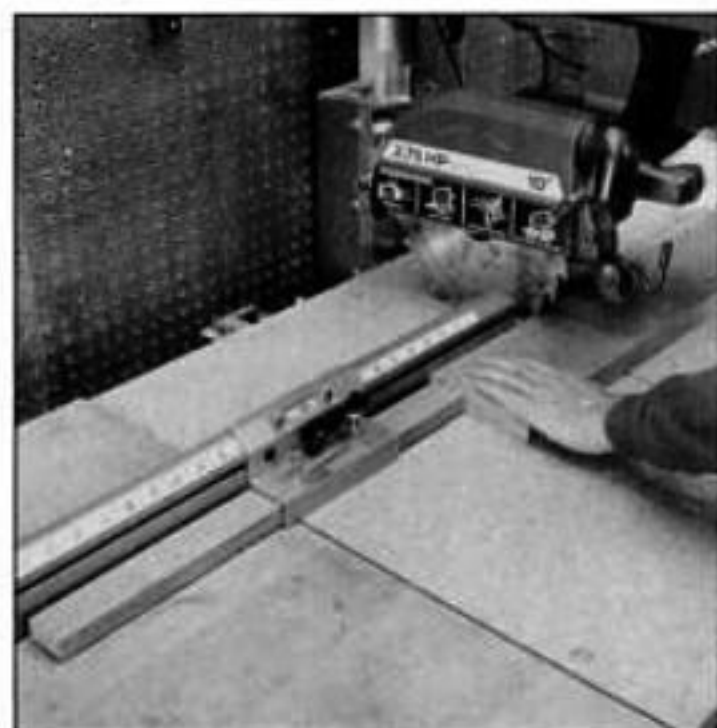
Fence and Stop System

You'll get accurate, repeatable cross-cutting on miter saws and radial arm saws with the Myte-R-Kut Fence and Stop system. The extruded aluminum fence is available in 4-ft. or 6-ft. lengths, which can be ganged together to make longer fences. The machined-aluminum stop gauge slides along the fence and locks securely

with a quick-action lock lever. A measuring scale on the top of the fence is visible through an opening in the stop. An easy zero adjustment compensates for different blade kerfs. (Price: \$89.95, 4-ft. fence; \$99.95, 6-ft. fence)

■ **Professional Tools, Inc., Dept. AWT, P.O. Box 672525, Houston, TX 77267, (713) 872-1885.**

CIRCLE NO. 603 ON PRODUCT LITERATURE CARD



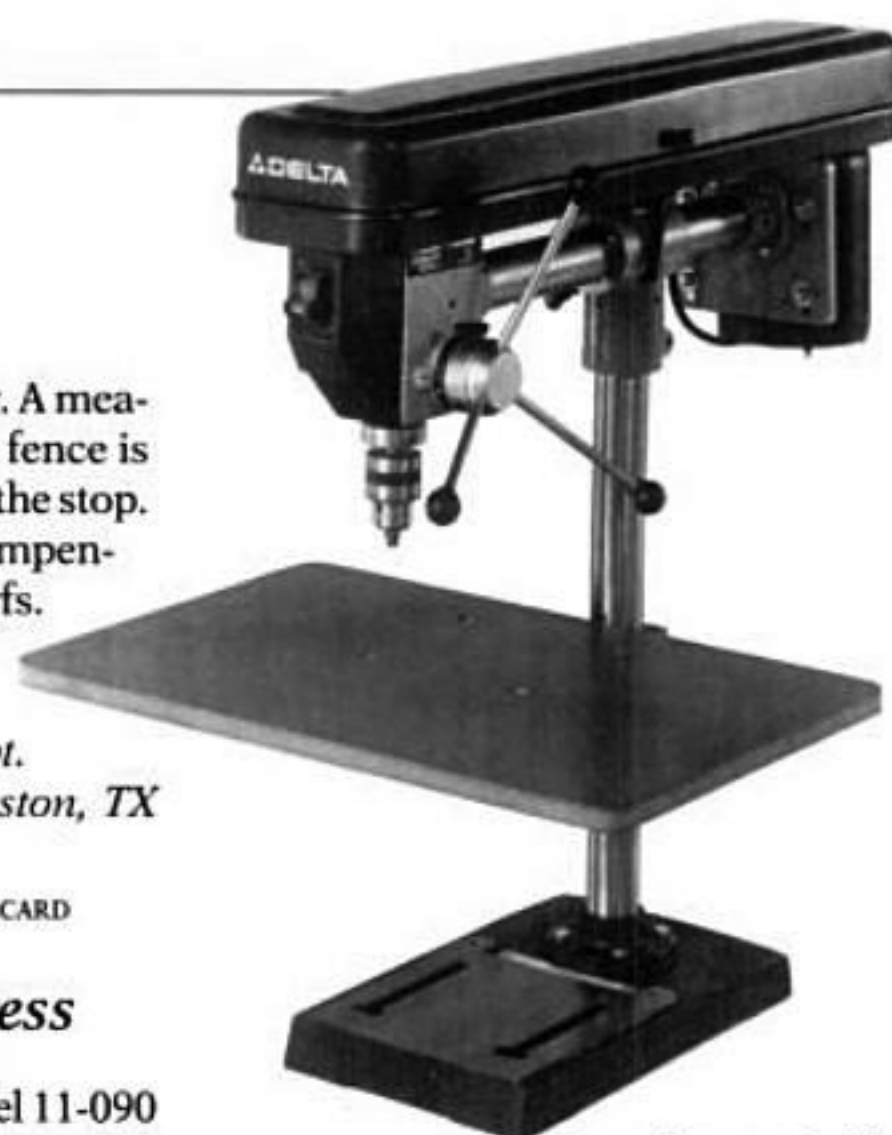
Delta Radial Drill Press

The new Delta benchtop Model 11-090 Radial Drill Press delivers versatile drilling capabilities affordable to the small-shop woodworker. It has a tilting drilling head for drilling angled holes and for horizontal boring as well as straight drilling. A movable arm expands the capacity to allow drilling to the center of a 32-in. circle. The head also swivels 360° around the column for working on or off the table. It

has five spindle speeds (580 rpm to 3450 rpm), a 1/2-in. chuck and 1/2-HP motor. The standard cast-iron table can be enlarged with the addition of an accessory 23 7/8-in. x 15 7/8-in. table. (Price \$399)

■ **Delta International Machinery Corp., Dept. AWT, 246 Alpha Dr., Pittsburgh, PA 15238, (800) 438-2486.**

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Buy 1 Tool And Get Our 228 Page Tool Free.

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 1/2" x 1/4" 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 10 1/4" x 16 1/2".
23K02.01 100 Shop Cloths \$12.95

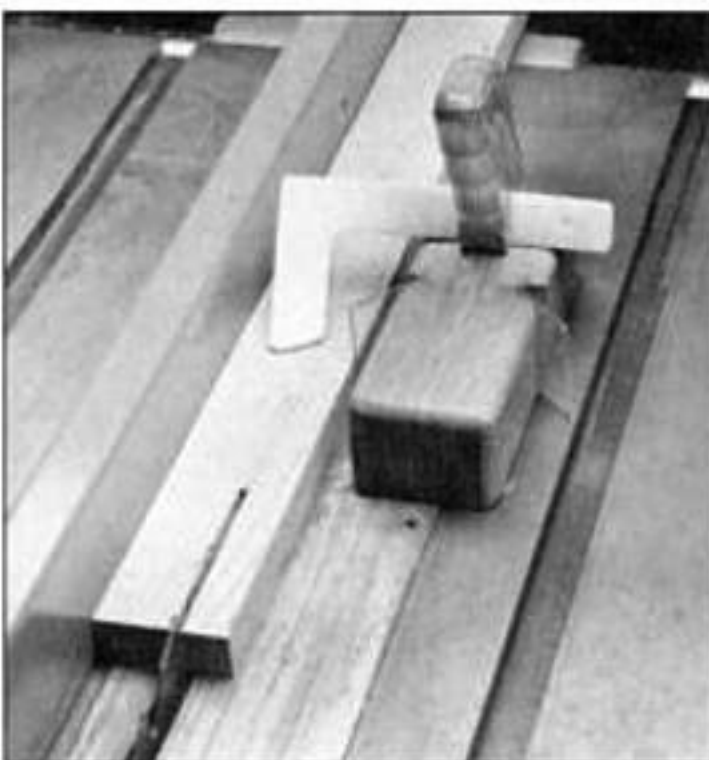


HVLP sprayer technology uses high air volume at low pressure from a special turbine pump to spray finishes. The Wagner Finecoat HVLP sprayer is the first of its kind designed and priced for the consumer market (professional shops have used more expensive HVLP sprayers for years). With the Finecoat sprayer, you'll get greater control of the spray pattern and less overspray than with conventional high-pressure or airless sprayers. It's easier on the environment because fewer solvents are released into the air, and there's less waste because more finish goes on the wood (higher transfer efficiency). The

■ **Wagner Spray Tech Corp., Dept. AWT,**
1770 Fernbrook Ln., Minneapolis, MN
55447, (612) 553-7000.

Featherboards are usually held with clamps, but sometimes it's awkward to position them correctly. The Grip-Tite magnetic featherboard employs a big, permanent magnet to hold it in place. Flexible Lexan feather blades hold the stock firmly down and against the fence to prevent kickback. The body of the Grip-Tite featherboard is oak and the magnet is let into the base. The magnet sticks to any iron or steel machine table—tablesaw, bandsaw, jointer, drill press, etc.—with a force of 80 pounds.

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GRAND TOTAL

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Traditional Hand Tools Still Do It Best

This type of Windsor is known as a bow back or hoop back. The turned and bent parts were made from stock that was split from the log instead of sawn.

PHOTO BY AMY EDGAR

MAKE A WINDSOR SIDE CHAIR

BY MICHAEL DUNBAR

Most woodworkers are familiar with the unique construction of Windsor chairs. In a Windsor, the solid wooden seat is the central focus and structural anchor of the other chair elements. The bent chair back and legs are constructed separately and fitted independently into the seat with socketed joints—round tenons fitted into round sockets.

Unlike chairs where the back is an extension of the rear legs, the Windsor style allows the back to recline while the legs can be splayed outward for greater stability. Back in the late 18th century, this development was a real step forward in chair comfort and ease of construction.

I bought the model for this side chair long ago in an antique shop in southern Maine, but the chair was probably made in the New York City area circa 1785 to 1800.

Today, this type of Windsor is often called a hoop back or bow back, but the man who made it knew it as an "oval-back" chair. This Windsor side chair includes a "tail-piece," which projects from the back of the seat to hold two extra "bracing spindles." These parts can be omitted from the design, but they make the chair much stronger by reinforcing the bow against the sitter's weight.

Windsor chairs were traditionally made from riven green wood. That is, the pieces for the bent back, spindles, legs and stretchers were shaped and turned from wood that was *split* from the log along its natural grain lines. Such pieces are considerably stronger than pieces that are *sawn* from the log (sawing cuts indiscriminately through the grain lines). Modern technology hasn't changed this truth a whit—a Windsor handmade from riven stock is more graceful and delicate looking, and just as strong as a modern factory-made Windsor with clunky kiln-dried, machine-shaped parts.

Making a Windsor chair by hand can be a challenge to woodworkers who may be more comfortable with table-saw and router techniques. A lathe is the only power tool you'll need. If you're new to hand-tool methods, steam bending, turning, working with green wood or if you just want to learn more about the fine points of Windsor construction, I strongly advise you to study my book, *Make a Windsor Chair* (1984, The Taunton Press, Box 5506, Newtown, CT 06470). There you'll find more detailed instruction on all the steps covered in this article.

You'll need a selection of traditional hand tools to make the Windsor chair with the methods shown here. You may already have a few of these tools such as a drawknife and spokeshave. Others, like a gutter adze, scorp and travisher for shaping the seat, and spoon bits and reamer for making the seat holes, are rare. You can get by without these special hand tools, but if Windsor

chairmaking gets in your blood as it did mine, you may want to purchase your own collection of tools. Recently, The Olde Mill Cabinet Shop in York, Pennsylvania has made available a complete collection of high-quality, reproduction Windsor chairmaking tools. (See Sources.)

One of the nice things about handmade Windsor chairs is that each one is a little different (especially for first-time chairmakers). The drawings and measurements reproduced here are extremely useful as a guide. But the exact length of a part or position of a socket must be determined uniquely for your chair as you go along in the construction process. Because assembling the chair requires a lot of test fitting and adjustments, I recommend a white polyvinyl acetate glue (like Elmer's Glue-All), which sets more slowly than yellow glue.

I begin a chair by making all the parts except the stretchers. The stretchers vary in length from chair to chair and are therefore turned after the four legs are fitted to the seat. I'll tell you how to turn them later.

Bending the Bow

First, I make and steam-bend the bow because it has to dry before it can be attached to the chair. To bend the bow, you'll need to build a bending form and steam box as shown in the photos. (See Windsor Cradle, AW, #9, July/August, 1989 for more on making a steam box.) I made my bending form from a plywood backboard and a 2-in. thick pine bending block fastened to the backboard with drywall screws. Shape the bending block following the measurements in Fig. 1. Drill holes in the backboard so you can secure the bow in place with dowels and wedges after bending it around the bending block.

The bow of an oval-back Windsor is easier to bend than the bows on other types of Windsor chairs. Still, I strongly recommend riven (split) red oak, which bends

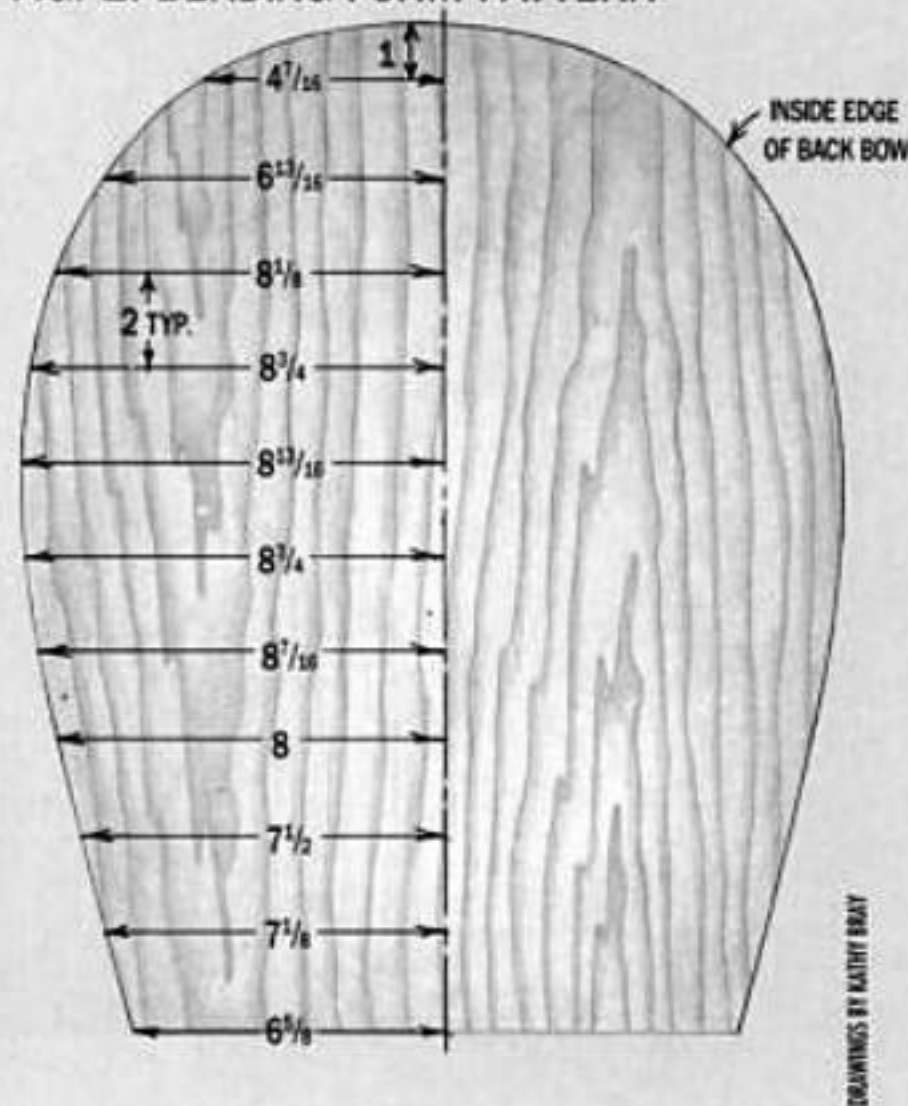


Align the center mark on the back bow and bend it around the bending form with a slow, steady force. After each side is bent, hold the bow against the form by placing dowels in predrilled holes in the backboard and driving wedges between the dowels and the bow.

The author's steam box is simply a 4-in. dia. PVC pipe with end caps propped on two concrete blocks. Steam comes from two tea kettles heating on a portable camp stove and rises into the pipe through two flexible PVC hoses. Holes drilled in the downhill end of the pipe allow condensation to drain.



FIG. 1: BENDING FORM PATTERN



easier than other species. If you saw the wood for the bent bow, the grain can run out at the edge of the stock, which guarantees a weak spot that will split or break upon bending. You can rive the wood from a log, or you can purchase riven stock by mail. (See Sources.)

Fig. 4 shows the bow's cross section—flat and square on three sides, with a rounded back. I begin shaping the bow by hand planing either the upper or lower surface. I inspect the wood's grain and try not to cut across individual layers of annual growth rings, which would create weak spots. I then plane the opposite surface parallel to the first surface with a thickness planer, though it can also be done by hand. I hand plane the front surface square with the top and bottom, and the back surface parallel with the front. I then round the back of the bow with a forkstaff (a wooden-body plane with its sole curved concave side to side). A spokeshave will also work, although it is slower.

Mark the center of the bow with a heavy pencil mark. Heat the bow in the steam box for 30 to 45 minutes. Take the bow out of the box (be careful, it's hot), align the center mark with the center of the form and secure it with a wedge between the bow and a dowel at the center. Bend one side of the bow at a time around the form with a slow steady motion, inserting dowels and wedges to lock the bow in position. When the bow is cool to the touch, remove it from the form, tie the two ends together with string and hang it up to completely dry.

Making the Seat

I made the seat for this chair from white pine. Sugar pine, ponderosa pine or the green-colored heart wood of yellow poplar (tulip polar) all work well as does bass, cypress, mahogany or any soft, stable, even-grained, wood. Avoid hard woods like cherry, maple or walnut.

Cut out a solid blank $1\frac{1}{4}$ in. thick, 17 in. wide and 21 in. long. Plane the top, trace the pattern on the blank (see Fig. 2) and saw out the shape on a bandsaw.

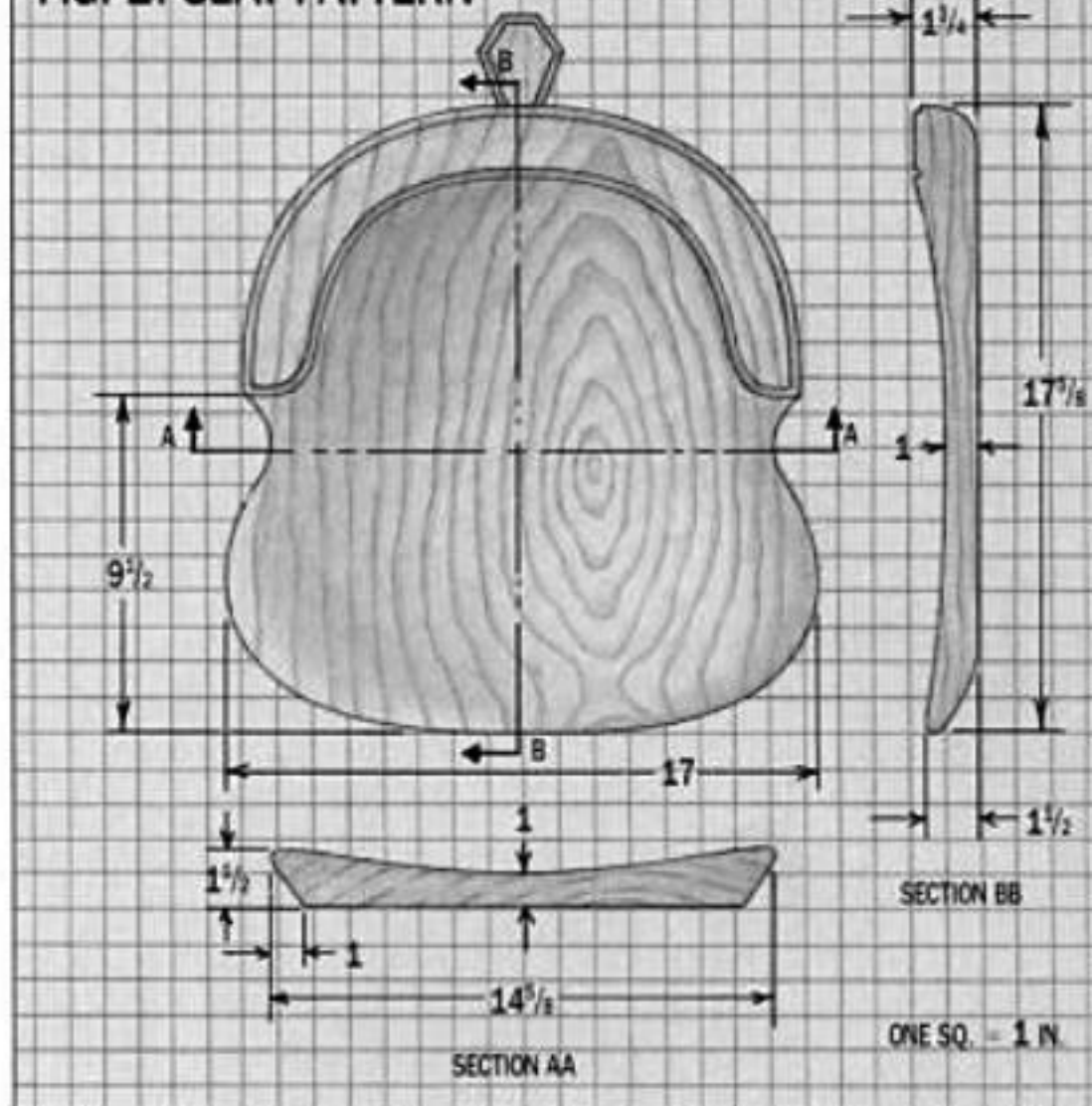
I shape the seat's outside edge with a drawknife for quick, rough removal of waste wood. I finish the edge, shaping with a special round-sole spokeshave, which works well for the very tight "S" curves on the sides of the seat. A Surform plane or a rasp, followed by sanding, will also work well to shape this area.

Seen from below, the tailpiece is a three dimensional diamond shape with pronounced facets. (See Fig. 3.) I lay



Rough out the dished saddle area on the top of the seat with a gutter adze. Finish the saddle shaping with a scorp (curved drawknife) and travisher (curved spokeshave).

FIG. 2: SEAT PATTERN



Blend the contour of the seat's edge into the dished saddle with a spokeshave. Complete the final shaping with a curved-sole compass plane or travisher.

out the facets by drawing a pencil line around the tailpiece $\frac{3}{4}$ in. down from the top edge. I pare the facets with a razor-sharp 2-in. butt firmer chisel with a long handle.

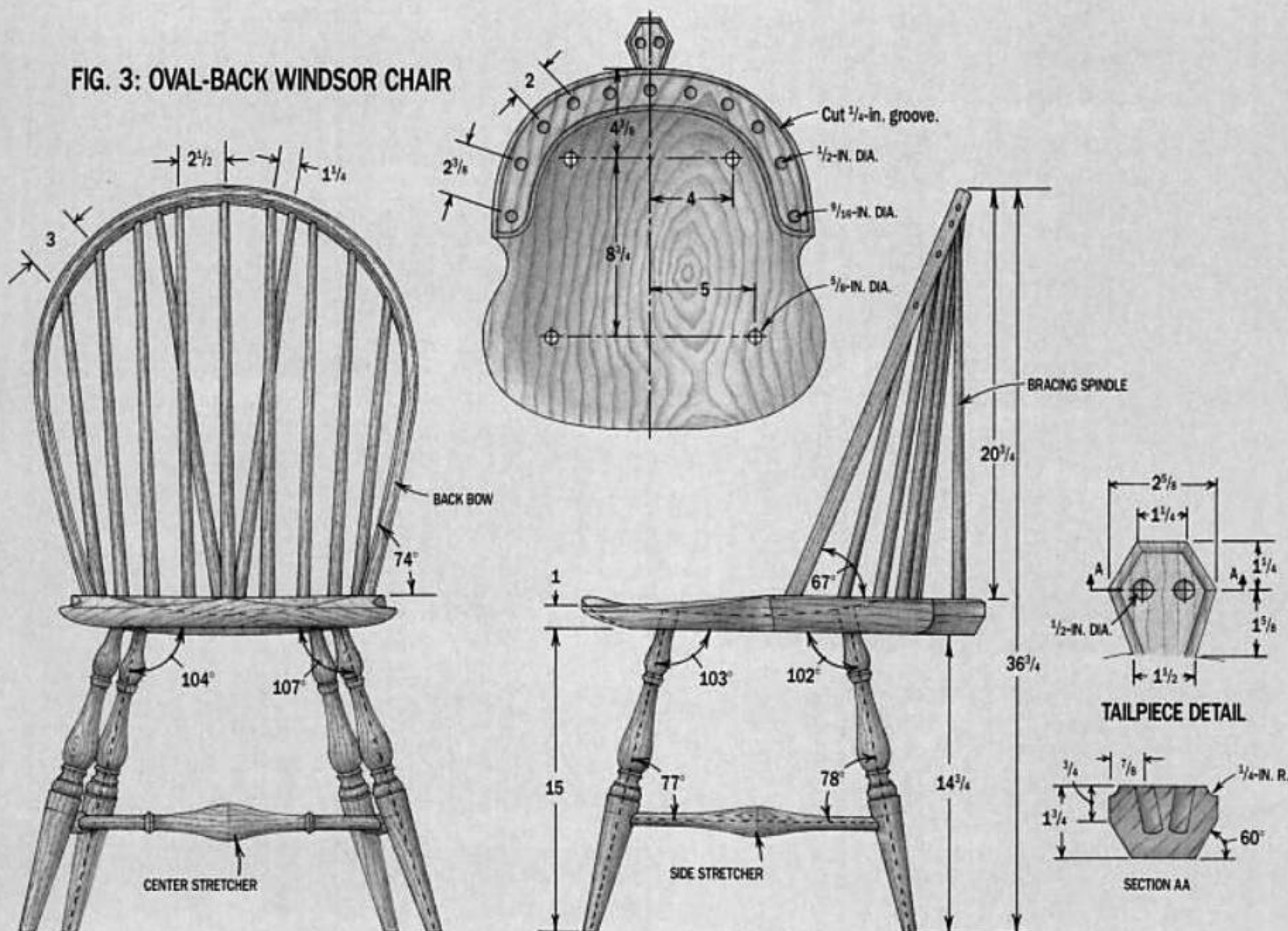
The saddle is the term for the dished-out area of the seat, and the raised point in the front is called a "pom-mel." I shape the saddle with a gutter adze, an aggressive chopping tool that quickly takes out large chunks of wood. (See photo.) I refine the saddle shape with a "scorp"—a kind of rounded drawknife. If the adze makes you nervous or if you can't find one, you can do the shaping with a scorp or with one of the new rotary wood-shaping cutters like the Ryobi Woodcarver, which fits on a small angle grinder.

After roughing out the saddle, I blend the edges of the seat into the saddle with a spokeshave. (See photo.) I use a wooden curved-sole compass plane and travisher (a solid-brass, curved-sole spokeshave) to do the final shaping. Finally, I cut a $\frac{1}{4}$ -in. groove around the back area of the seat where the spindle and bow sockets will be drilled. (See Fig. 2.) I cut the groove by hand with a #11 sweep 7-mm veiner gouge.

Back Spindles, Legs and Stretchers

I whittle the spindles for the back from riven red oak. Because the riving process follows the grain, the spindles are easy to whittle and I can make them thin and delicate without their becoming too fragile. I rough the spindles

FIG. 3: OVAL-BACK WINDSOR CHAIR



to shape with a drawknife and finish with a spokeshave, scraper and a light sanding. (See Fig. 4.) If you make your spindles from sawn stock, select only the very straightest grain. You can turn the spindles on a lathe if you like, but it's difficult to turn such slender pieces, and I find I can whittle a perfect spindle about six times faster than I can turn one.

I make my spindles slightly longer than their finished length. The unfinished length of the three center and two bracing spindles is 23 in.; the next pair is 22 in.; the last pair is 20 in. As you shape each spindle, test the size of the upper end by passing it through a $\frac{3}{8}$ -in. hole drilled in a waste block that simulates the $\frac{3}{8}$ -in. spindle holes in the bow. The first 3 in. to 4 in. (after the taper stops) should pass easily, but not loosely, through the test hole.

I make the legs from birch. Maple is also a good choice. Avoid ring-porous woods such as ash or oak. They won't turn as crisply and their open pores show through the finish. I rive the turning billets directly from the log to ensure that the grain follows the length of the piece. If you saw your stock, make sure the grain is as straight as possible. Turn the legs according to the dimen-

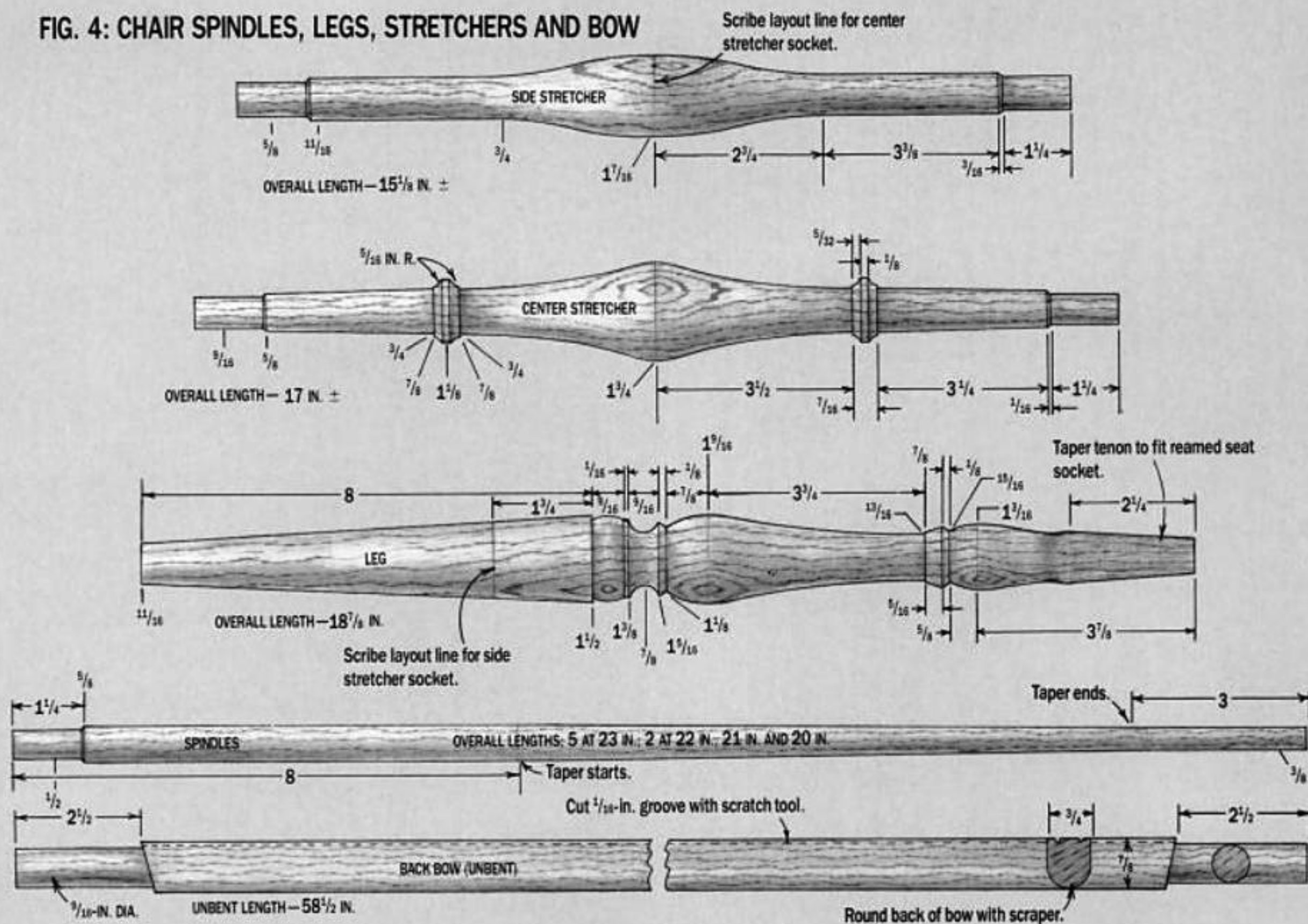
sions in Fig. 4. Also, mark a layout line near the top of the leg's taper to indicate where the sockets for the side stretchers will be drilled.

You can make the leg tenons a simple, straight cylinder with a shoulder or a more sophisticated taper that "locks" itself in the seat sockets. (See Fig. 4.) A little pressure (like a person's weight) causes this joint to tighten like a morse taper. Tapered tenons are easy to turn, but you'll need a reamer to form the corresponding tapered hole in the seat. If you're making a tapered joint, I suggest you drill and ream a test hole in a block of 2-in. thick softwood. When turning the leg tenon, remove it from the lathe to check the tenon's fit, and correct the fit if necessary. It's important that you fit the tenon to a hole made by *your* reamer.

Assembling Legs and Stretchers

The leg tenons fit into sockets in the underside of the seat. I drill these holes with a brace and bit because it's slow enough to give me complete control. I prefer to use a spoon bit, an ancient but marvelous cutter whose cutting speed is regulated by pressure. Spoon bits can also

FIG. 4: CHAIR SPINDLES, LEGS, STRETCHERS AND BOW



drill at very acute angles such as where the outside pairs of spindles meet the bow. You can also use a spade bit or brad-point bit in a variable-speed electric drill. Never put a spoon bit or a reamer in an electric drill. I don't recommend drilling a Windsor chair's joints on a drill press because it requires all kinds of special jigs to set up for the necessary angles. It's much easier to eyeball the angles as you drill the holes by hand.

Like most joints in a Windsor chair, the leg holes are drilled at a compound angle (that is, two angles). Set a sliding T-bevel to each of the required angles and place them on the seat blank as a visual guide for angling the brace and bit. (See photo.) When drilling, pause frequently to make sure the drill is following the correct angles. On your first several chairs, it's handy to have help from another pair of eyes.

If you taper your leg tenons, taper the leg hole with a reamer and test the leg's fit. If the angles are slightly off, use the reamer to make a small correction.

Set the four legs into their seat sockets and stand the assembly upright. Measure the distance between the front

and back legs to determine the length of the side stretchers from tenon shoulder to tenon shoulder. I add 1/4 in. to this measured length. This extra length "preloads" the stretchers in compression so the stretcher-to-leg joints won't separate should the glue fail.

Cut the two side stretcher billets (I use birch) to their measured length plus 2 3/4 in. (1/4-in. to allow for the "preload" length and two 1 1/4-in. long tenons). If your stretchers are different lengths, mark them to avoid confusion later. Turn the stretchers on the lathe. (See Fig. 4.) Mark a layout line around the center bulge of the side stretchers to indicate where the sockets will be drilled for the center stretcher.

Next, drill the side-stretcher socket holes in the legs. (The angle of the hole is different for the front legs and back legs as shown in Fig. 3.) First, set the angles on two different T-bevels for the two different angles. To do this, dry assemble the legs in the seat and hold a straightedge against the legs at the height of the stretcher-socket layout lines. Set the T-bevels to the angles formed by the intersection of the straightedge and each leg's center-



To help visualize the compound angles for the leg-socket holes in the seat, set two T-bevels to the correct angles and place them on the seat as a guide to cant your brace and bit.

To set a T-bevel for guiding the drilling of the angled side-stretcher sockets in the legs, place a straightedge against the legs at the socket-layout lines. The angle formed by the straightedge and the centerline of the leg is the correct angle.



line. (See photo, above.)

Attach the stretchers to the legs and the legs to the seat. To determine the length of the center stretcher, measure between the side stretchers at the layout lines for the sockets for the center stretcher. (See Fig. 4.) Add $2\frac{3}{4}$ in. ($\frac{1}{4}$ -in. preload plus two $1\frac{1}{4}$ -in. tenons), and turn the center-stretcher on the lathe. Determine the angle of the center stretcher sockets in the side stretchers by placing the ends of the front legs against the edge of the workbench. Lay a straightedge on the benchtop against the bottom of a front leg and the corresponding rear leg. The intersection of the straightedge and the bench edge is the proper angle. Set your T-bevel to this angle to guide you when drilling the center-stretcher sockets.

Glue and assemble the legs and stretchers, then glue the legs into the seat holes. The parts should fit tight and require a bit of "worrying" to go together because of the preload. Set the chair up on its legs.

To secure the leg joints, I drive wedges into the ends of the tenons from the top of the seat. With the leg tenons driven into their sockets, I use a chisel to split the end of the leg tenon at a right angle to the grain of the seat. I make my wedges with a drawknife. Drive the wedges into the splits and saw them off close to the tenons. Shave the leg tenons flush with the top of the seat.

To trim the bottom of the legs so the chair base doesn't rock, I cut three legs to the desired length. I then place the chair on the bench with these three legs on the benchtop. I hang the end of the fourth leg over the edge of the bench. (See photo.) I cut the fourth leg where it meets the edge of the benchtop.

Back Bow and Spindle Assembly

Scrape the bow with a hand scraper to remove any discoloration caused by steaming. I use a simple scratch tool



To cut the bottom of the legs even, cut three legs to the correct length. Place these legs on the benchtop with the end of the fourth leg over the edge of the bench. Trim the fourth leg where it meets the edge of the benchtop.

(see AW, #22, page 20) to form the two grooves in the forward surface of the bow, and I round the top and bottom back corners with a scraper.

The bow mortises on the original Windsor chair I copied are rectangular and are cut with a mortise chisel. The bow tenons are made with a dovetail saw. However, I find it much faster (and equally strong) to join the bow with round tenons in drilled sockets. I make $\frac{9}{16}$ -in. dia. tenons on the ends of the bow by cutting the round-tenon shoulders with a dovetail saw and whittling the tenons with a 35-mm #3 sweep gouge. Also, mark the location of the spindle sockets in the bow by walking off the distances between sockets with a pair of dividers. (See Fig. 3.)

To locate the socket holes in the seat for the back bow and spindles, trace a full-size pattern of the seat (see Figs. 2 and 3) and place it on the top of the seat. Mark the locations for the bow sockets and spindle sockets, including those for the bracing spindles in the tailpiece. Drill the $\frac{9}{16}$ -in. dia. sockets for the bow tenons with a spoon bit in the brace. A pair of T-bevels set to the compound bow socket angles will help guide you.

If you have trouble making the bow's round-tenon shoulders fit tightly in the seat, lay a small piece of $\frac{1}{4}$ -in. scrap on the seat top against the bow. (See photo.) Hold a pencil against the top edge of the scrap and push it around the bow, tracing a line parallel to the seat. Cut a new shoulder following this mark and it will fit perfectly.

Drill all the $\frac{1}{2}$ -in. dia. spindle sockets in the seat with a spoon bit in a ratchet brace (or brad-point bit in an elec-



The author marks a line for the bow's tenon shoulders by propping a pencil on a piece of $\frac{1}{4}$ -in. scrap and pushing the pencil and scrap around the bow parallel to the seat. A shoulder cut on this mark will fit perfectly against the seat top.



To drill the spindle socket holes in the seat with the correct angle, line up the axis of the brace and bit on an imaginary line between a mark for the spindle socket on the seat and a corresponding mark on the bow.

Drill the spindle socket holes in the bow by gripping the bow in a bench vise with the front surface of the bow facing outward, and drill the holes toward the bench. Assemble the bow and one spindle in the seat to test the angle of the bow hole.



tric drill). These sockets are "blind" holes, 1¼-in. deep. To help guide the drilling, put the bow in place in its seat sockets. Picture imaginary lines running between the marks for the spindle sockets in the seat and the corresponding marks for the spindle sockets on the bow. Now simply line up the axis of the brace (or drill) along one of these imaginary lines to drill each hole as shown in the photo. Also, drill the two holes in the tailpiece for the bracing spindles.

Whittle 1¼-in. long tenons on the lower ends of the spindles and place them loosely in their blind sockets in the seat to be sure they fan out correctly along the bow. To make these spindles fit tighter, I whittle the spindle tenons slightly oversize, and then cut pronounced facets on the tenons. When they're driven into the seat sockets, the socket holes will conform to the facets, which helps to lock the tenons in place. Should the glue someday fail, these joints will not loosen.

I drill the spindle holes in the bow by gripping the bow in my bench's side vise (remove the bow from the seat) with the front surface of the bow facing outward. (See photo.) With the bow in this position, it's easy to get confused about which way to angle the spindle holes in the bow. The correct way is to drill the holes with the bit angled toward the vise as shown in the photo. Drill the middle hole first, put the middle spindle in the bow and place both on the chair to test the angle of the spindle hole in the bow. Make any corrections and drill the other holes. Glue and assemble the bow and spindles in the seat for the final time. Wedge the top of each spindle and the end of each bow tenon just as you did the leg tenons in the seat.

Finally, locate and drill the holes in the bow for the two bracing spindles. These holes should be angled so they point toward the holes in the tailpiece. You can accomplish this by aiming the drill (like it's a gun) at the holes



Drill the sockets for the bracing spindles in the bow by aiming the axis of the brace and bit at the spindle sockets in the tailpiece.

in the tailpiece while drilling from the top of the bow. (See photo.) One at a time, slide the bracing spindles up through the bow holes far enough to clear the tailpiece, and then push the spindles into the tailpiece holes. Wedge and trim the tops of the spindles. Scrape and sand to smooth the bow's surface.

Before applying a finish, clean off any spilled glue and lightly sand the chair all over. I use Lexington Green milk paint (see Sources), which is a very close match to the color used on original Windsor chairs.

The original makers intended the graceful contours of the seat, bow and turned parts of the Windsor chair to be noticed. They painted their chairs to emphasize these shapes. A clear finish emphasizes the wood itself, diverting attention from the chair's clean lines. Think about this before you reach for the stain and clear finish. ▲

Mike Dunbar is a contributing editor of AW and author of books on Windsor chairs, Federal furniture and antique tools.



He wrote about turning "bent" chair posts in AW, #22; wooden molding planes in AW, #12 and #14; Windsor Cradles in AW, #9 and shooting boards in AW, #7. He teaches seminars on Windsor chairmaking across the U.S.

SOURCES

Tools and materials to make Windsor chairs are available from the following sources:

Windsor chairmaking tools: Olde Mill Cabinet Shop, 1660 Camp Betty Washington Rd., York, PA 17402, (717) 755-8884.

Riven (split) red oak for chair bow, spindles, legs and stretchers: Byrom International, Conover Dept., 21 Industrial Parkway, Chardon, OH 44024, (216) 285-2341.

Lexington Green milk paint: The Old Fashioned Milk Paint Co., Box 222, Groton, MA 01450, (508) 448-6336.

Windsor Green paint: The Woodworker's Store, 21801 Industrial Blvd., Rogers, MN 55374, (612) 428-2199.



Children will love getting one of these little stools to call their own. It's easy to make several with the production jigs described in the article.

THREE LEGGED STOOL

Make One or a Dozen With Production Jigs

BY PATRICK KELLY

This little stool is patterned after an old-time farm milking stool but at a smaller size to make it convenient for a child to sit on. Because it's portable, your kids can plunk it in front of the TV or pull it up to a little desk. Yet, it's built ruggedly enough to come in handy for all sorts of uses around the house.

The stool is simple to make and takes a minimum of material. You may want to make several of the stools at one time as I do. The three shop-built jigs shown here make the construction easy, whether you're making one stool or a dozen.

I made the seats from white ash and the legs from red elm, although you could choose any strong hardwood for these parts. The tapered, lathe-turned legs are fastened to the seat by a wedged mortise-and-tenon joint. The legs splay out at a 10° angle, so drilling the mortise holes for the legs correctly is tricky.

Start With the Legs

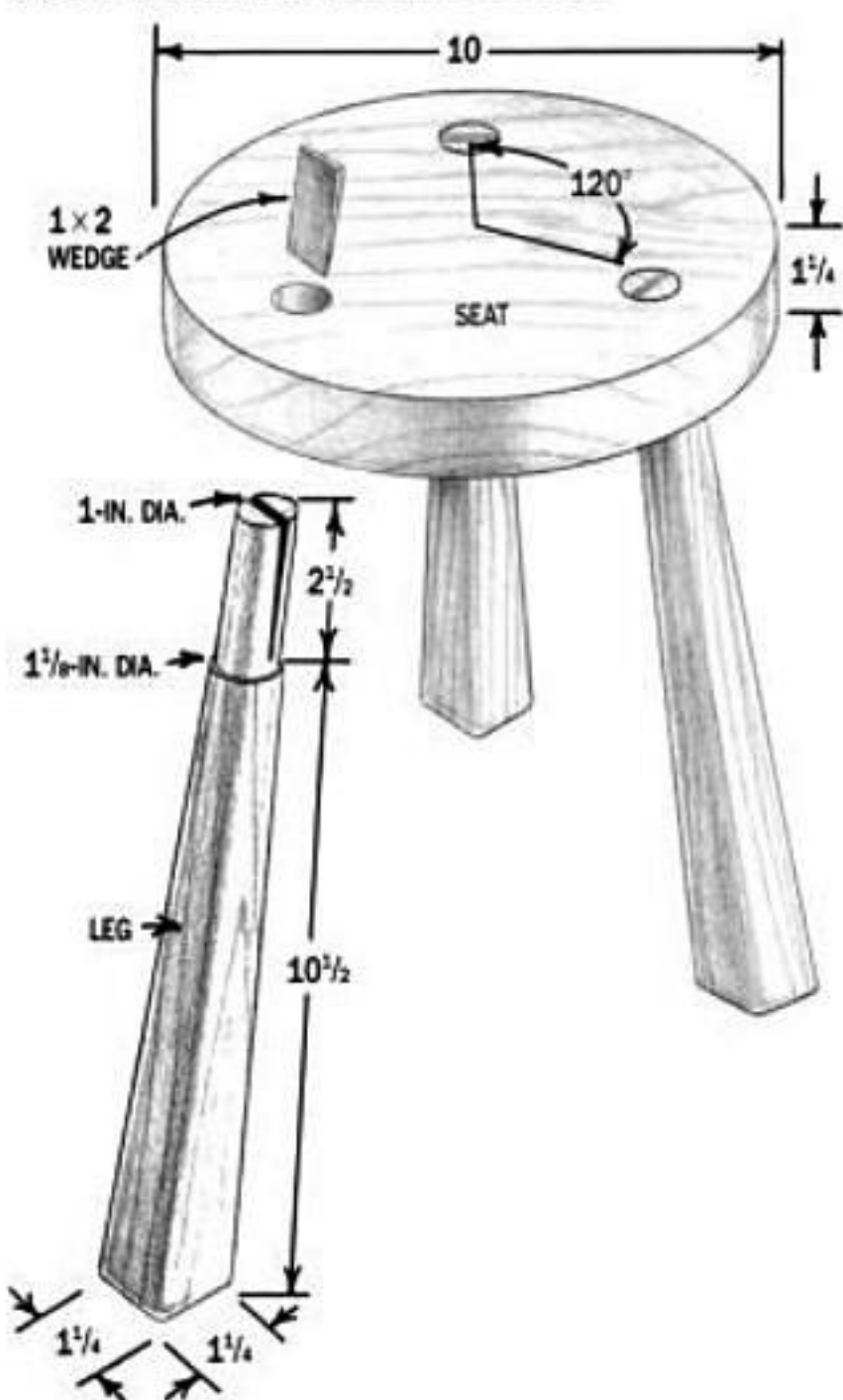
Begin by ripping out three leg blanks and crosscutting to length. The leg stock should be jointed or planed on all four sides to 1 1/4-in. square. The leg will have a slight taper, making the cross-sectional shape of the leg gradually change from the round tenon on the top end to a square at the bottom end.

Turn the legs in a lathe to make the taper. I use a four-spur drive center in my lathe. To help mount the legs on the drive center, I made a jig to bandsaw two diagonal notches, or slits, in the end grain of each leg to locate the

spurs. (See photo.) The jig has two V-groove cutouts to hold the leg and a bottom-mounted hardwood slat that rides in the bandsaw's miter-gauge slot. The jig doesn't have to be fancy—I made it with pieces of scrap stock held together with drywall screws. The most important part is the slat, which must be located so the bandsaw's blade falls exactly in the bottom of the V-grooves when the slat is in the miter-gauge slot.

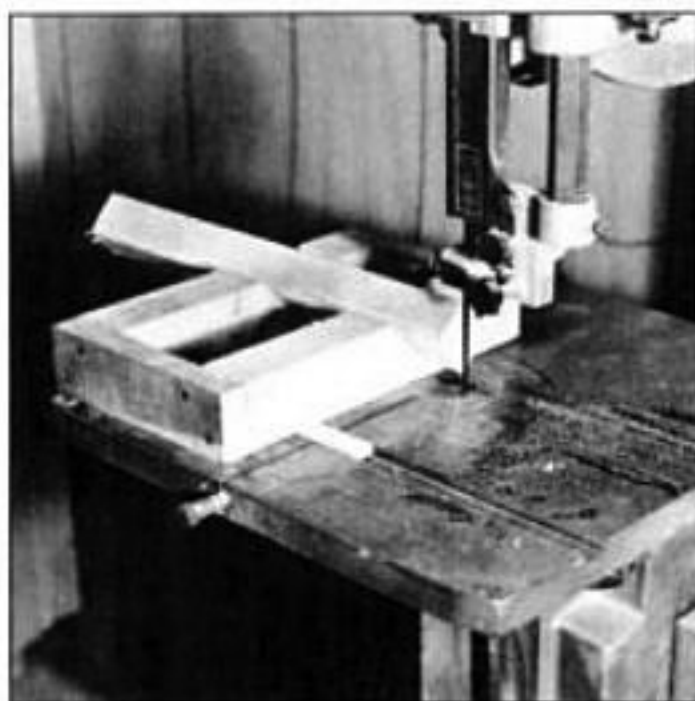
Once the jig is made, bandsaw two diagonal slits in each leg about $\frac{1}{4}$ in. deep for the spur drive center. Now turn the leg around in the jig and lightly touch the bandsaw blade against the opposite end grain to make two diagonal marks. Make a hole for the tail center in this end by driving in an awl where these diagonals cross.

FIG. 1: THREE-LEGGED STOOL



DRAWINGS BY SALLY ONOPKA

Bandsaw diagonal kerfs in the ends of the leg blanks with this simple jig. The kerfs accept the lathe's drive-center spurs and locate the tail center.



PHOTOS BY PATRICK KELLY

Mount the leg blank between centers and adjust the tool rest to the taper angle of the leg—it tapers from $1\frac{1}{4}$ in. square at the head-stock end to $1\frac{1}{8}$ in. in diameter at the tenon shoulder. Use a large gouge to break the edges of the leg blank slightly. With a parting tool, make a cut for the tenon shoulder $1\frac{1}{8}$ in. in diameter and $2\frac{1}{2}$ in. from the tail center end. Rough out the shape of the leg with a large gouge, using the tool rest as a guide for the taper. With a skew chisel, bring the leg to final shape. Turn the tenon on the leg to 1 in. in diameter and $2\frac{1}{2}$ in. long. A 1-in. hole bored in a piece of scrap makes a good gauge for checking the tenon's fit. Sand the legs before removing them from the lathe.

The square end of the legs must be cut off at the same 10° angle as the angle of the mortise holes through the seat. This allows the legs to rest flat on the floor when they're fitted into the seat. To help make this repeated cut with accuracy, I made another bandsaw jig. (See Fig. 2.) Like the first jig, this one has a hardwood slat on the bottom that rides in the miter-gauge slot. This positions the bandsaw blade to pass right at the end of the jig. When you place the leg on the jig with one of its flat sides down, it will overhang the end of the jig slightly and the blade will cut it at a compound-bevel angle. You can mount the jig's stop block in different positions to vary the length of the legs if you want a taller or shorter stool. For this stool, I mounted the stop on the jig to make the leg $10\frac{1}{2}$ in. from the tenon shoulder to the bottom cut. Cut each leg so its best-looking sides will face out when assembled. When the leg is in the jig, the two outer faces are the one facing up and the one facing the fence.

To finish the legs, use the first jig to cut wedge slots in the ends of the tenons. Place the legs in the V-grooves of the jig with the tenons toward the bandsaw blade. Before you make the cut, consider how you would like the wedge slots to appear in the finished stool. If you put the longest tip of the leg's square end (from the previous bottom cut) oriented up or down in the V-grooves, the wedge slots will all point toward the center of the seat when assembled. If the leg's longest tip is placed to the side in the jig, the wedge slots will be perpendicular to the seat's radius. Saw the slots to within $\frac{1}{4}$ in. of the tenon shoulder.

Making the Seat

Now you're ready to cut out the stool seat. Simply draw the seat's circumference on $1\frac{1}{4}$ -in. thick stock with a compass set to a 5-in. radius. If you don't have stock 10 in. wide, glue up some stock to the required width. (See AW, #17 for more on edge gluing.) Cut the seat blank out on a bandsaw. Shape the top edge of the seat with a $\frac{1}{4}$ -in. round-over bit in a router and sand the seat's edges and top smooth.

The next step is to bore the mortise holes in the seat for the leg tenons. To locate the holes, mark three radial lines on the top of the seat 120° apart. If you're making several stools, a handmade cardboard template shaped like a 120° segment of a circle can mark the hole centers. I centered my holes on the radial lines $1\frac{1}{4}$ in. from the edge of the top.

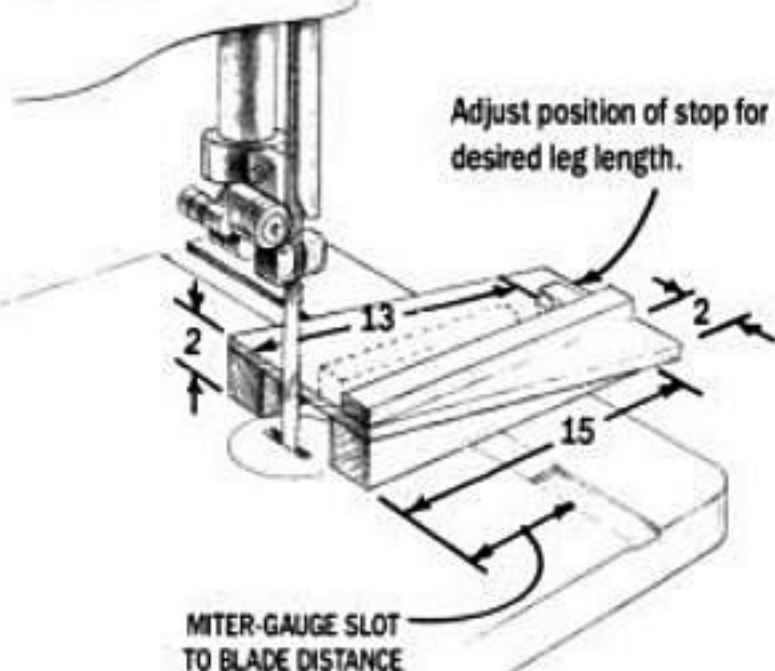
I use a drill press with a 1-in. spade bit to drill the mortise holes. The holes are drilled so the legs splay out at a

10° angle. To make things easier, I've devised a simple angle-boring jig to hold the seat at the required angle on the drill-press table. (See Fig. 3.) It's nothing more than a slanted, flat top with two stop blocks for the stool seat to fit against. Mount the stop blocks along lines drawn at a 45° angle to the centerline of the jig. To hold the jig in place, I make a drill-press "pad" by bolting a 3/4-in. thick square piece of plywood to the drill-press table, and I then screw the jig to the pad. Locate the jig so its centerline falls right under the drill's chuck. Place the seat blank right-side up on the jig against the stops and bore a hole all the way through the seat. (See photo.) Rotate the seat 120° to the next mark to bore the second hole and then the third hole.

I cut the tenon wedges from black walnut for contrasting color. The wedges should be about 2 in. long by 1 in. wide, and they should taper from 1/8 in. thick to about as thin as you can get them. I sawed enough wedges for several stools from a block of wood 1 in. thick by 2 in. wide by 3 in. long. To do this, I set up a small taper guide against the rip fence of my bandsaw. I ran the wood block against the taper guide to saw out the first wedge, then reversed the block front to back to saw out the sec-

FIG. 2: COMPOUND-BEVEL JIG

Size slat to fit miter-gauge slot.

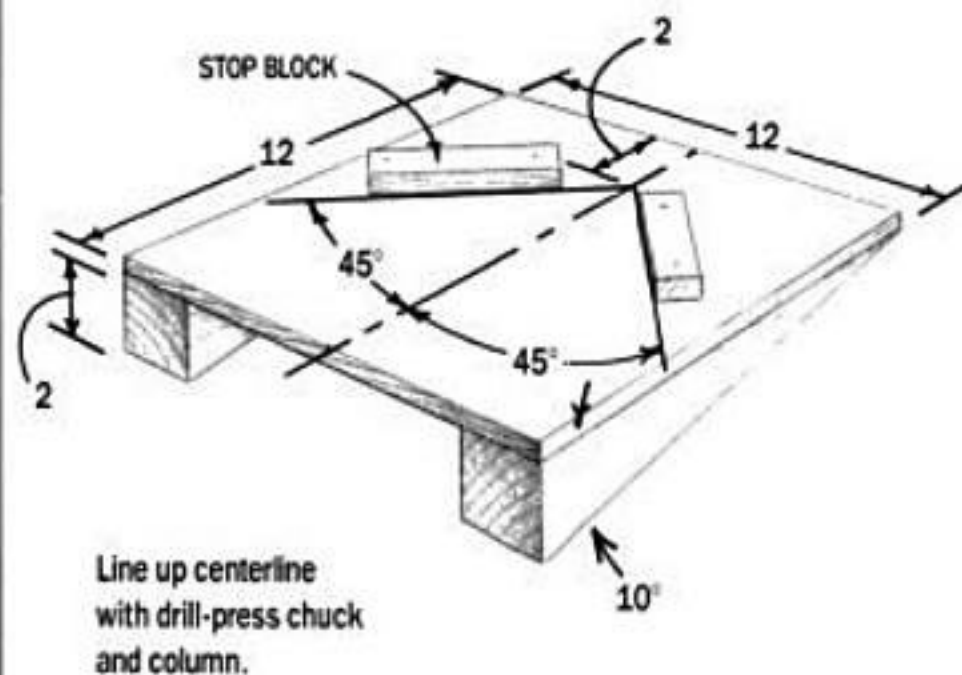


ond wedge, and so on. Rough-surface wedges hold better than smooth, so there's no need to sand.

To assemble the stool, brush a thin coat of glue around each leg tenon and insert the tenon into one of the mortise holes with the shoulder against the bottom of the seat. The tenon should protrude about 3/4 in. above the seat top. When all three legs are in, set the stool on a level surface (like the top of your tablesaw) and rotate each leg until its outside and inside edges (the edges with the longest and shortest tip) line up with a radius line from the center of the stool. At this point, the angled bottom of the leg should rest flat on the surface. Brush a little glue on the wedges and tap them into the wedge slots with a mallet until they're snug. (See photo.)

When the glue is dry, saw off the excess tenons with a hand saw. First place a thin piece of cardboard around the tenon on the top of the stool to protect the top from

FIG. 3: ANGLE-BORING JIG



This tilt-top jig will help you drill the compound-angle holes in the seat for the leg tenons. The centerline of the jig must line up with the drill-press chuck and column.

Set the stool on a flat surface to adjust the legs so they rest evenly on the floor, then tap in the wedges. When the glue dries, saw off the excess tenon.



getting marred by the saw teeth. Next, use a belt sander to sand the top, smoothing the sawed-off tenons. Sand with the grain of the wood. Finish sand with a pad sander or by hand sanding, including a final sanding on the legs. I finish my stools with three coats of clear lacquer, but you can use any finish that suits your fancy. ▲



Patrick Kelly is a retired industrial arts teacher who's done woodworking for 36 years. He sells stools, cedar chests and wooden toys at craft fairs and uses lumber cut from his own land.

*Display
your
favorite
collection
safely
away
from the
hands of
youngsters.*



CHINA CABINET

Don't Let the Bow Front Throw You a Curve

BY DAVID DONNELLY

This oak china cabinet conjures up an image from the Golden Age of Oak—a popular style in the early part of this century that blended Victorian decoration with Arts-and-Crafts simplicity.

The cabinet has three curved-glass panels set into frames. The frame stiles are straight, but the rails or “bows” in the door and the two side frames are curved to match the curve of the glass. I built a simple jig to cut these curved bows on the bandsaw. (See sidebar, page 33.) The glass panels fit into $\frac{3}{8}$ -in. x $\frac{3}{8}$ -in. rabbets routed in the frames and are held in place by retainer clips.

One of the difficult tasks of designing a display case is to ensure that the look of the piece doesn't overpower the objects inside it. China cabinets of this type are often elaborately carved, but I decided to limit ornamentation to a beveled oval mirror in a frame flanked by two small display shelves with turned spindles. Also, I added Victorian-style scroll feet.

I never would have tackled this project if I hadn't discovered Van Dyke's—a mail-order company that sells and ships curved glass of all shapes and sizes as well as custom-sized mirrors, hardware and many pre-cut wooden parts, including curved bows and “carved” wooden ornaments. I ordered the curved glass and all the hardware for my china cabinet from Van Dyke's (P.O. Box 278, Woonsocket, SD 57385, 800-843-3320).

Door and Side Frames

Before cutting the parts, order the curved glass and the mirror. Curved glass has three critical measurements: length, width, and radius. The length is simply the long dimension of the glass from end to end. The width is measured by laying a flexible measuring tape across the glass, following the curve from side to side. The radius is the actual radius of the curve—the shorter the radius, the more pronounced the curve.

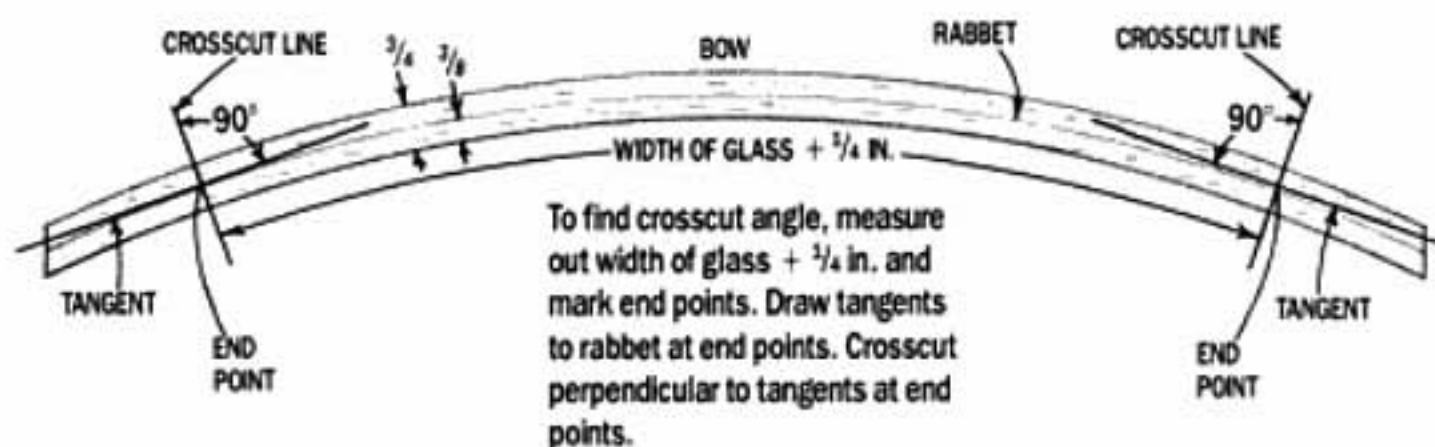
The glass for the sides of the cabinet is 48 in. long and 16 in. wide with a 17-in. radius. I wanted the curve of the door to be flatter than the sides, so I chose a larger radius. The door glass is 48 in. long, 16 in. wide with a 24-in. radius.

When the glass arrives, you can begin. Start by making the door and side frames. You'll use them to size and dimension the rest of the cabinet. First, lay out and band-saw the bows on the door and side frames. (See Fig. 2.) The sidebar explains how to lay out and cut curved bows.

After sawing out the bows, rout a $\frac{3}{8}$ -in. x $\frac{3}{8}$ -in. rabbet on the inside edge of each bow. (See Fig. 2.) The glass fits into this rabbet. I used a $\frac{3}{8}$ -in. rabbeting bit with a pilot bearing and made the cut on a router table.

Next, cut the door and side-frame stiles to size and rout a $\frac{3}{8}$ -in. x $\frac{3}{8}$ -in. rabbet in each of them for the glass. (See Fig. 2 and Fig. 3.) The two rear stiles for the side

FIG. 1: CROSSCUTTING THE BOWS



**FIG. 2: CHINA CABINET
EXPLODED VIEW**

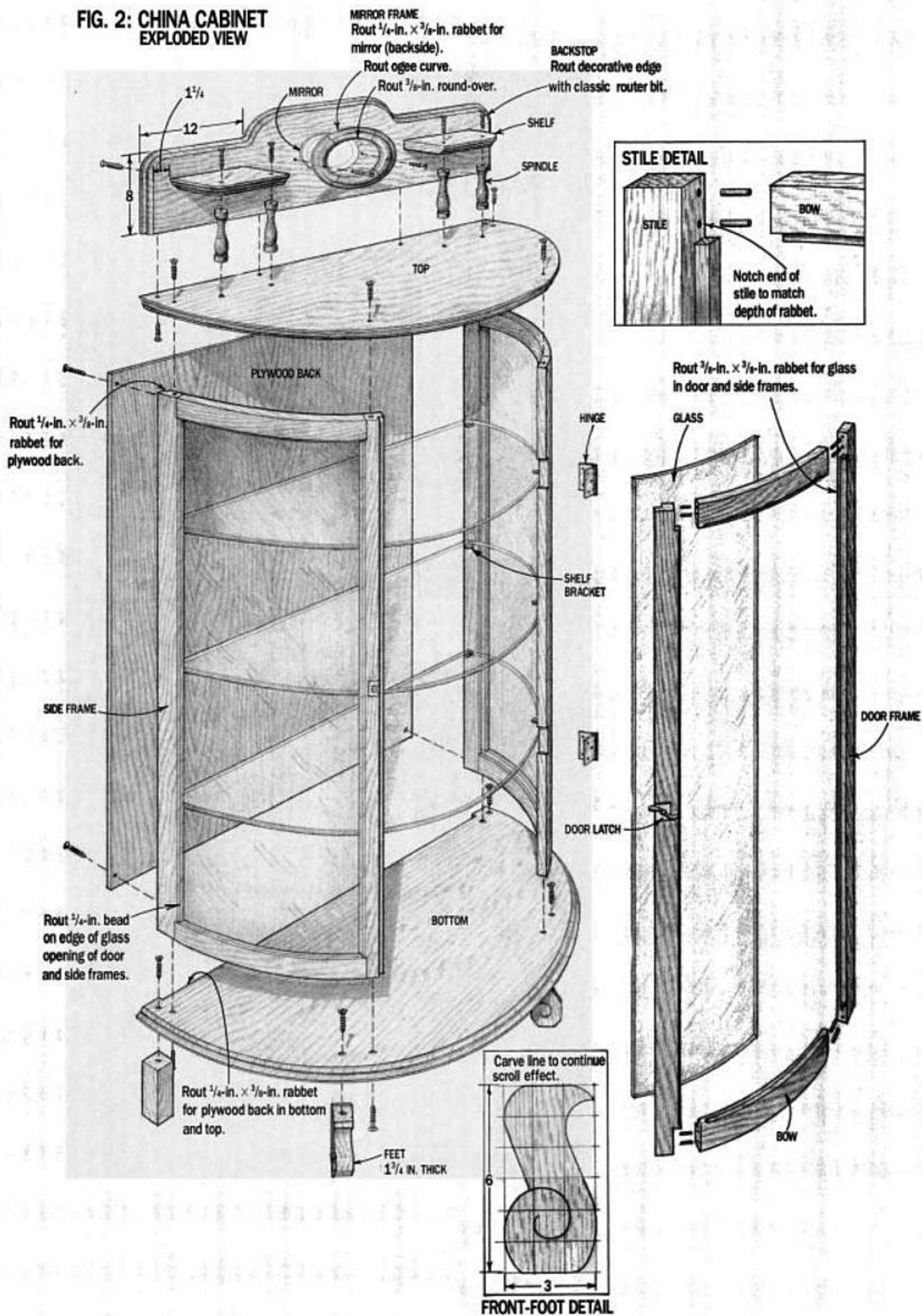
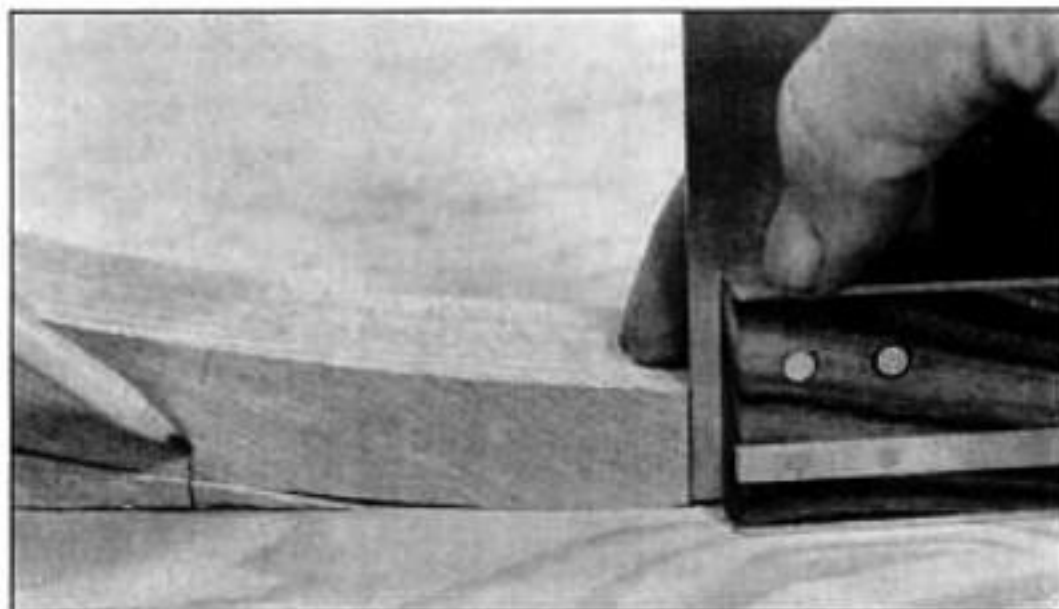
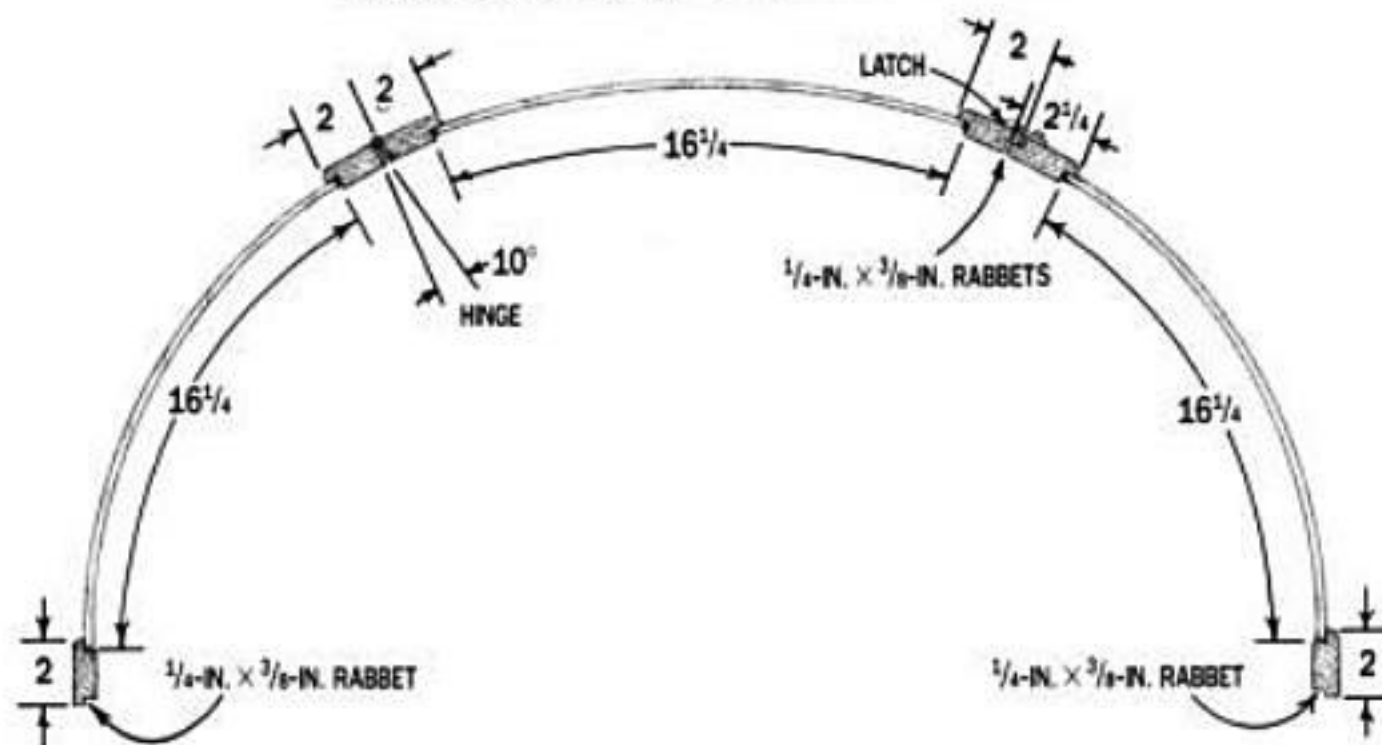
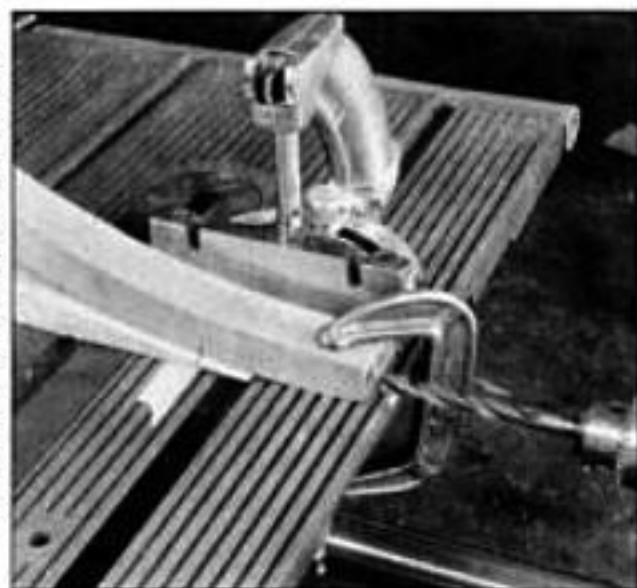


FIG. 3: TOP VIEW OF GLASS FRAMES



To drill the dowel holes in each bow, author wedged the bow so its end was 90° to the table, marking the correct position. He clamped the bow in place and used the horizontal borer on his Shopsmith to drill the holes.



panels also have a 1/4-in. x 3/8-in. rabbet along the back edge to hold the plywood back of the cabinet. Finally, rout a 1/4-in. x 3/8-in. rabbet on the side stile and the latch stile of the door. These rabbets overlap when the door is closed.

As Fig. 2 shows, cut a 3/8-in. notch at each end of all the stiles where the bows will join the stiles. (See stile detail in Fig. 2.) I cut these on the tablesaw.

Next, cut the bows to their finished length. The angle of the cut is important to make the bow join the stile with a smooth, continuous curve. Fig. 1 shows how to determine the proper angle for the cut. The process involves a bit of eyeballing. Make the cuts with a backsaw.

I joined the door and side frames with 3/8-in. dowels. I own a Shopsmith, which makes a great horizontal borer. As shown in the photos, I drilled the dowel holes by wedging the bow with the end perpendicular to the drill bit and clamping it to the table. You could also drill the holes on a drill press if the table pivots vertically.

After drilling the dowel holes in the ends of the bows, use dowel centers to mark the corresponding holes in the stiles. Drill the stile holes, and glue and clamp the frames.

When the glue dries, trim up the frames and rout a decorative molding around the glass openings with a 1/4-in.

beading bit. (See photo.) Next, drill 1/4-in. holes in the side stiles to hold shelf brackets to support the three glass shelves. (See Fig. 2.)

Sizing the Top and Bottom

The top and bottom of the cabinet come next. It's important to trace the top and bottom directly from the glass frames themselves. The size and shape of the top and bottom can vary, depending on how you choose to position the sides. For example, turning the sides inward sharply makes a deep, narrow cabinet. By mocking up a sample bottom and positioning the side and door frames on it, you can visually explore the size and shape you'd like your cabinet to be as well as the relationship of the pieces to one another.

For this reason, I recommend making a bottom/top template out of plywood and positioning your frames on it. (See photo.) Angle the three frames until they look good and the door fits between the two side frames. I jointed the hinge side of the door's edge 10° so that it would fit snug against the frame. (See Fig. 3.) Once I got

BILL OF MATERIALS

All thicknesses 3/4 in. unless otherwise indicated.

PART	QUANTITY	DIMENSION
Side/Door bows	(6)	1 3/4 x 16 3/4 (cut to fit)
Stiles	(5)	2 x 51
Side stile (at latch)	(1)	2 1/4 x 51
Top/Bottom	(2)	20 1/2 x 40
Back	(1)	1/4 x 36 x 51 1/4 (cut to fit)
Backstop	(1)	10 x 40
Shelves	(2)	5 3/4 x 8
Spindles	(4)	1 1/2-dia. x 5
Back feet	(2)	1 3/4 x 1 3/4 x 6
Front feet	(2)	1 3/4 x 3 x 6
Mirror frame	(1)	8 x 11

SUPPLIES:

Side glass (2) 16 in. x 48 in. x 17-in. radius (2.5-mm thick)
 Door glass (1) 16 in. x 48 in. x 24-in. radius (2.5-mm thick)
 Glass shelves (3) 3/4-in. thick (use template to size)
 Glass-retainer clips (18)
 3-in. brass cabinet hinges (2)
 Brass cabinet handle (1)
 Cabinet lock, escutcheon, strike (1 each)
 China cabinet light (1) (optional)
 6 x 9 oval mirror with 1-in. bevel (1)
 Brackets for glass shelves (12)



Rout the glass opening of the frames with a decorative $\frac{1}{4}$ -in. beading bit and the outer edges of the top and bottom with a "classic" router bit.

the frames where they looked good, I screwed the side frames to the template to be sure the door fit properly. I installed the hinges on the door and hinge stile to test the swing and the fit.

After you've found the curve you want, and your frame and doors are positioned, trace the outline of the frame members on the plywood template. Be sure to draw both the inside and outside of the frames and door. Add another $1\frac{1}{2}$ in. to the outside line. That's where you'll cut the curve for the top and bottom. Cut the plywood template to size, then trace around it onto the top and bottom blanks. Bandsaw the top and bottom to size, then rout a $\frac{1}{4}$ -in. x $\frac{3}{8}$ -in. rabbet on the inside back edges for the plywood back. Finally, rout a decorative molding on the top and bottom. I used a fancy molding bit called a "classical" bit in many catalogs.

Backstop, Spindles, Shelves and Feet

The backstop, wood shelves, and turned spindles on the top of the cabinet play no structural role and can be customized to suit your taste. The backstop is simply glued and screwed to the cabinet top. After you bandsaw them out, rout the edges of the backstop and wood shelves on the outer or front edges with the same router bit you used on the top and bottom.

The scroll feet on the front of the cabinet are bandsawed from $1\frac{3}{4}$ -in. oak. I carved the scroll in low relief. The two back feet are square in cross section.

Making the Mirror Frame

The mirror and frame come next. The mirror is a 6-in. x 9-in. oval, $\frac{1}{4}$ in. thick, with a beveled edge (available from Van Dyke's or a local glass shop). As for the mirror frame, you have a few options. For simplicity, you could make your mirror frame from one or two pieces of wood. However, I recommend using four pieces doweled together, to minimize short grain. (See Fig. 4.)

Cut four triangular pieces of $\frac{3}{4}$ oak and lay them out point to point to form a square as shown in Fig. 4. Center the mirror on top of these pieces and trace around the outline of the mirror. Measure 1 in. outward from the mirror outline and draw the frame's outer perimeter. Measure $\frac{3}{8}$ in. inward from the mirror outline and draw



When the frames are completed, position them on a scrap plywood bottom to determine the shape of the cabinet's curve. Use the plywood as a template for the real top and bottom.

the frame's mirror opening. Dowel the four pieces together with the dowels positioned within the frame band. Once joined, cut out the outer perimeter of the frame on a bandsaw and the inner opening with a scroll saw or jigsaw. On the backside of the frame, rout a $\frac{1}{4}$ -in. x $\frac{3}{8}$ -in. rabbet for the mirror. Rout a decorative edge around the inside and outside of the frame. I routed an ogee curve around the outer perimeter and a small $\frac{3}{8}$ -in. round-over around the inside.

Putting It All Together

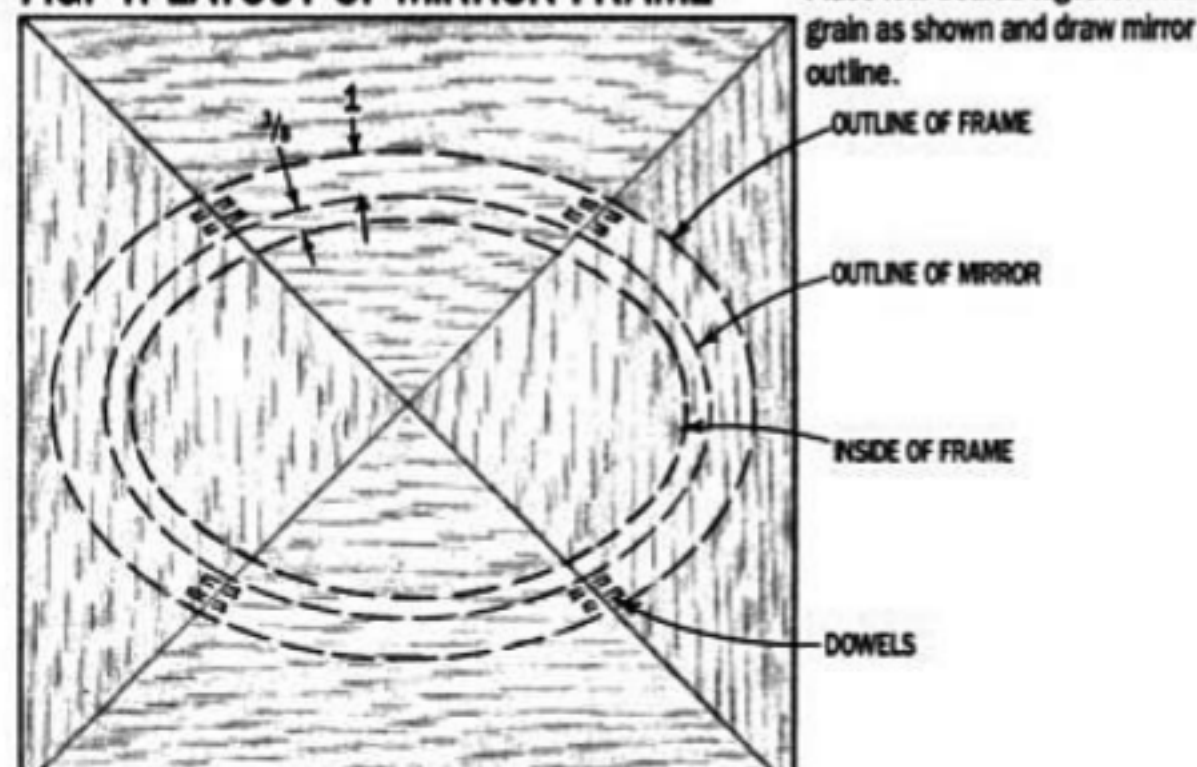
Once the components are completed, you're ready to sand all the frames and screw the assembly together. Glue and screw the frames, top, bottom, feet, backstop, shelves and spindles in place on the cabinet. Countersink and plug the screws that show. Don't attach the mirror frame or hinge the door until after you've applied the finish. Also, don't install the plywood back until after you've installed the glass panels and the shelves.

With the cabinet assembled, determine the width of the plywood back by measuring the distance between the rabbets in the two back stiles. Cut the plywood back to size.

Finishing

door frame. Notice also that the rabbet on the vertical stile ends where the horizontal bow meets the stile. The side frames are assembled in similar fashion.

FIG. 4: LAYOUT OF MIRROR FRAME



able from Van Dyke's).

Sizing the Shelves

With the cabinet assembled, you can determine the size of the three glass shelves. Cut out a cardboard pattern of the size of the inner curve on the plywood template made for laying out the top and bottom of the cabi-



ERIC SLOANE

A Tribute in Black and White

BY DAVID SLOAN



"The good things of the past were not so often articles as they were the manner in which people lived or the things that the people thought."

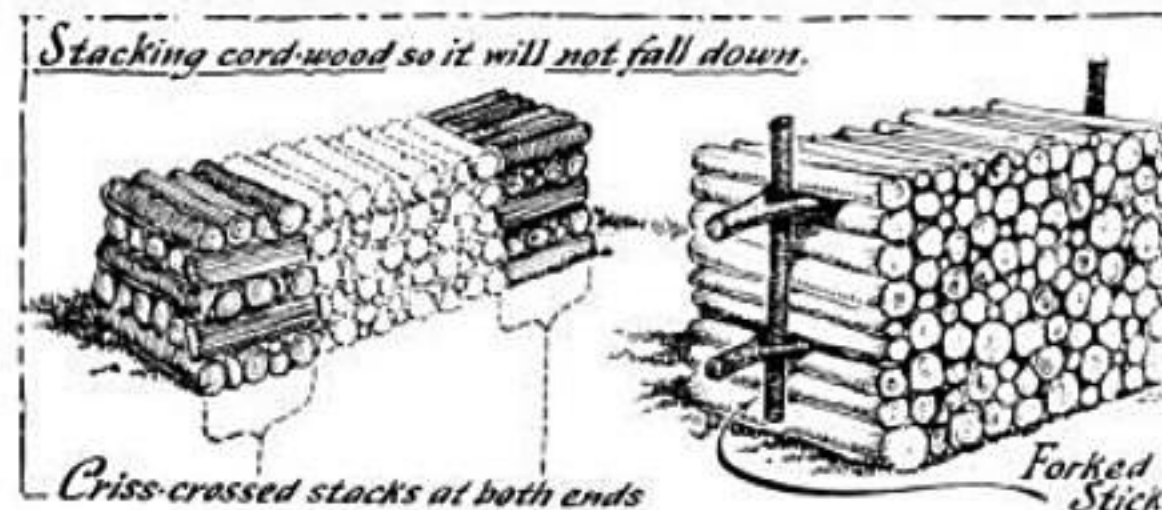
Books were a special pleasure when I was a boy. When my parents dragged me along on a visit, I liked nothing better than to sneak away from the boring, old grownups to find a quiet room full of unexplored books. One rainy day, at the home of my uncle, I came across a curious set of three slim volumes in a box. I took out a book and studied the cover. . . *Our Vanishing Landscape* by Eric Sloane. Inside I found fascinating pen-and-ink drawings that told stories about the past. Not dry, stuffy tales about campaigns and politics, but tangible facts about everyday life—the tools, the villages, the barns and the bridges of a vanished America. I was hooked. This man had the power to bring the past back to life.

I promptly adopted Eric Sloane as my teacher, my mentor, my hero. His books solved the riddles that puzzled my 12-year-old mind. From him I learned why stone walls run through dense woods, how wood expands and contracts, how snow was once packed down with rollers to make sleigh travel easier.

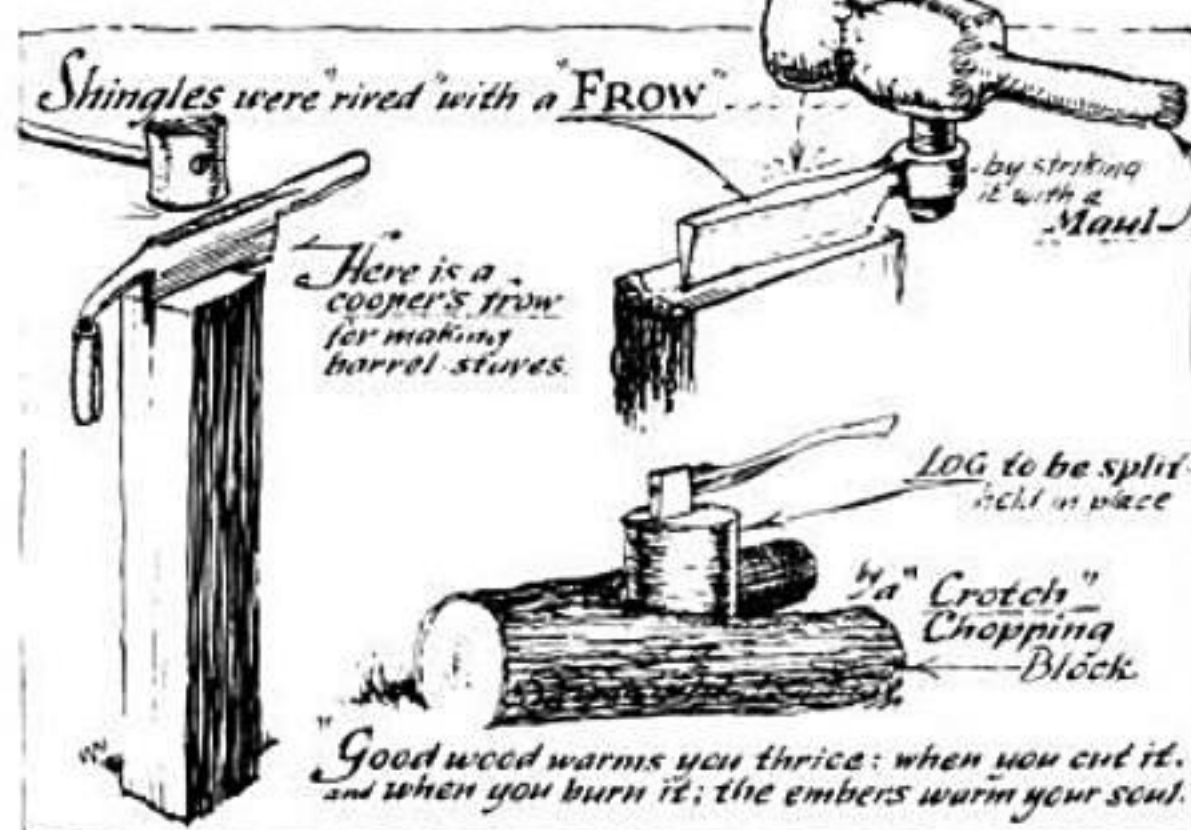
Eric Sloane's hold on me as a youth was no accident. He knew how to fan the flames of a young person's curiosity. Sloane wrote, "When I show my [antique] collection to young people, I am very careful to avoid saying, 'See how old these things are.' Instead I say, 'See how carefully and beautifully people created things in those days. How aware these people were of the kinds of materials they worked with. How aware they were of the time in which they lived; everything is dated and signed. How richly awake they must have been to every moment of each day!'"

Eric Sloane was born Everard Hinrichs in New York City in 1905. In the mid-1920s, Sloane hit the road as a traveling sign painter, sketching the countryside as he went. Planning his routes through the smallest villages, Sloane set up his "studio" in a "cabin camp" (the motel of the day), and painted posters and signs for the community. "My introduction to barn lore began in the Lancaster [Pennsylvania] area: the pen sketches I did there resulted in a reverence for old farm buildings and the wish to learn more about them. But there wasn't a single volume written about the subject, and so I resorted to my "learning by writing" theory by doing a first book about the Early-American barn [*American Barns and Covered Bridges*, 1954]. I have always said, tongue-in-cheek,

Some SECRETS and JOYS in the FINE ART of



WORKING in the WOODSHED



that the easiest way to learn any subject at all is to write a book about it."

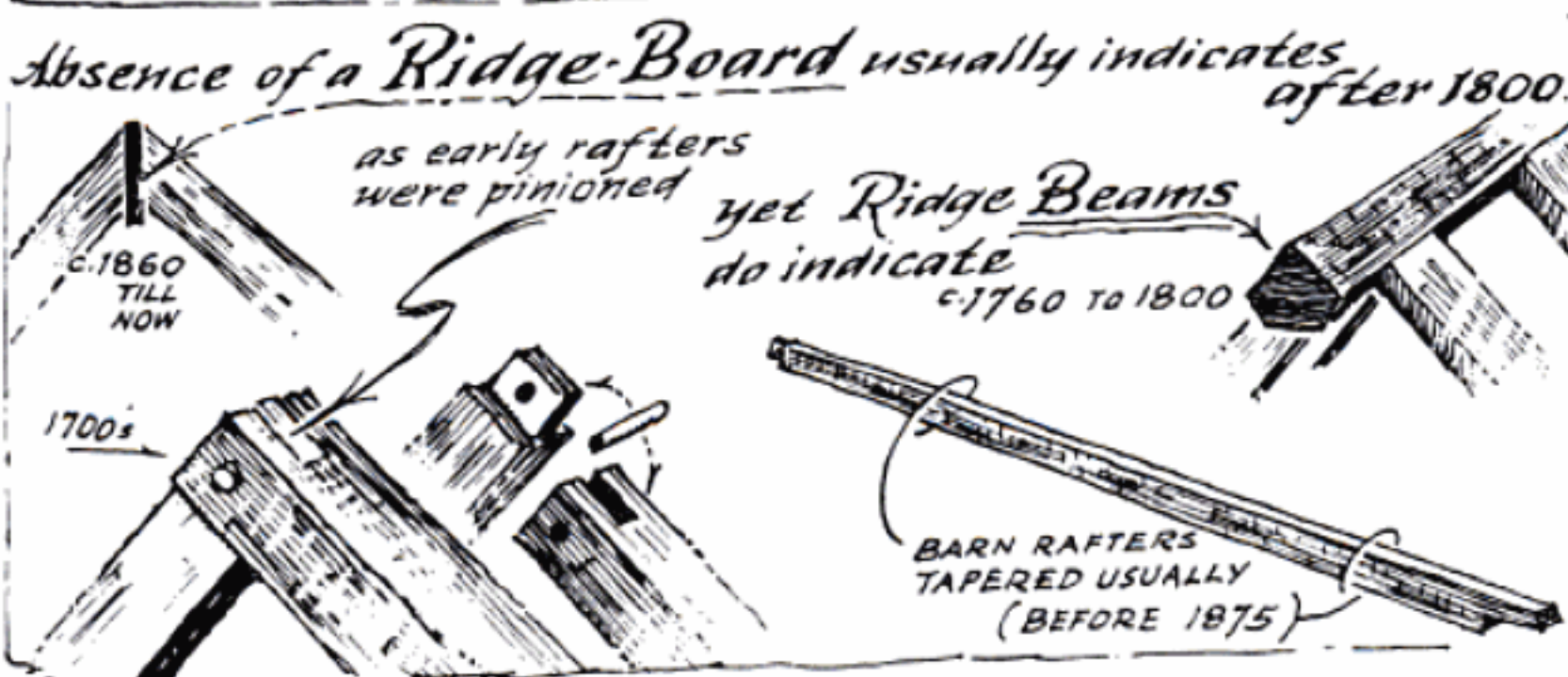
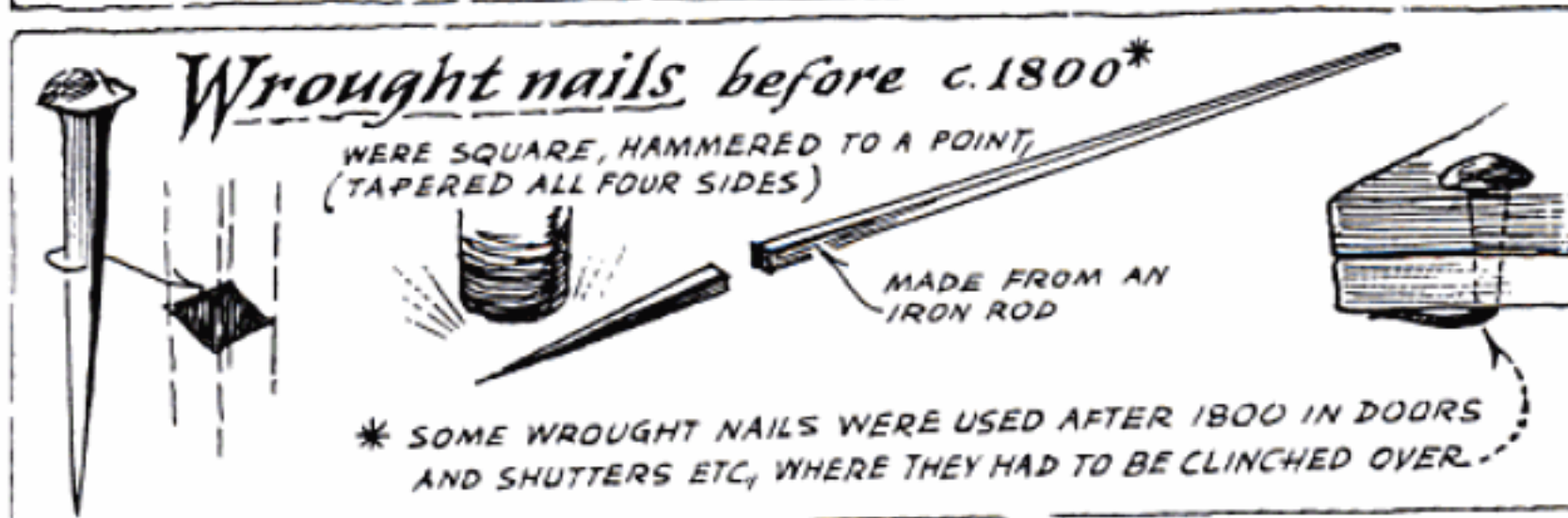
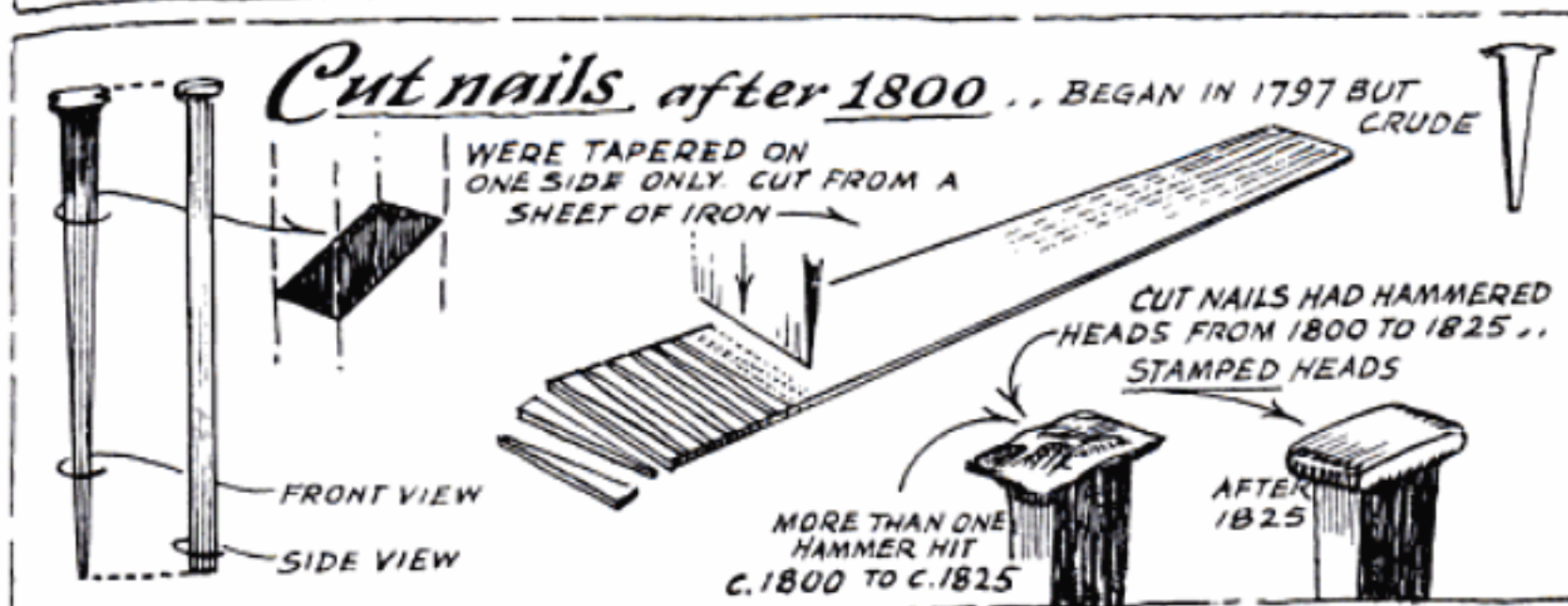
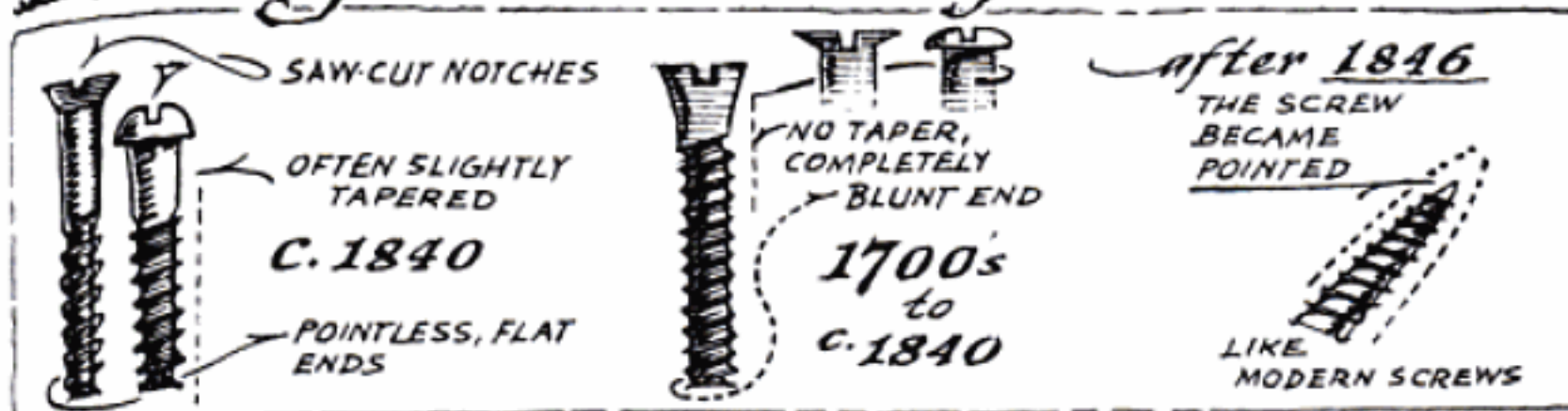
Sloane was a man of many interests. He took up flying in the early days of aeronautics, hobnobbing with aviation legends Amelia Erhart and Wiley Post. He painted the clouds and learned enough about weather to become a noted authority on the subject. He wrote several books about weather and flying and even had the distinction of being the first TV weatherman.

While he wore many hats in the 80 years he was alive—author, painter, tool collector, meteorologist, pilot and historian to name a few—Sloane was first an artist who tried to capture the American spirit in pictures and words.

Here is a sampler of Eric Sloane's work—his sketches, his thoughts. I hope it whets your appetite for more.

Many of Eric Sloane's books (including a limited number of out-of-print editions) are available from The Connecticut Historical Commission, 59 S. Prospect St., Hartford, CT 06106. **Continued**

Dating an old building. . . .



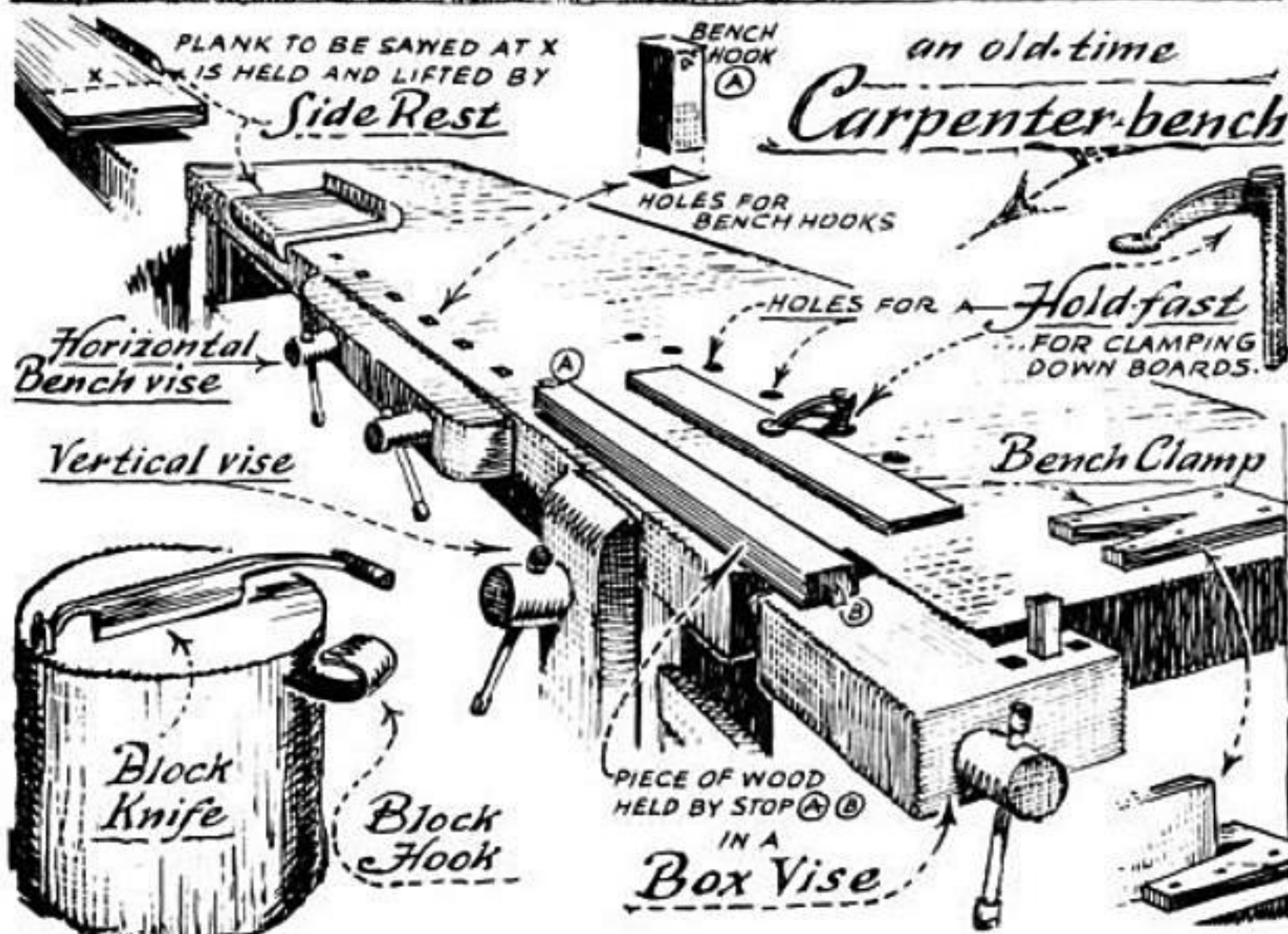
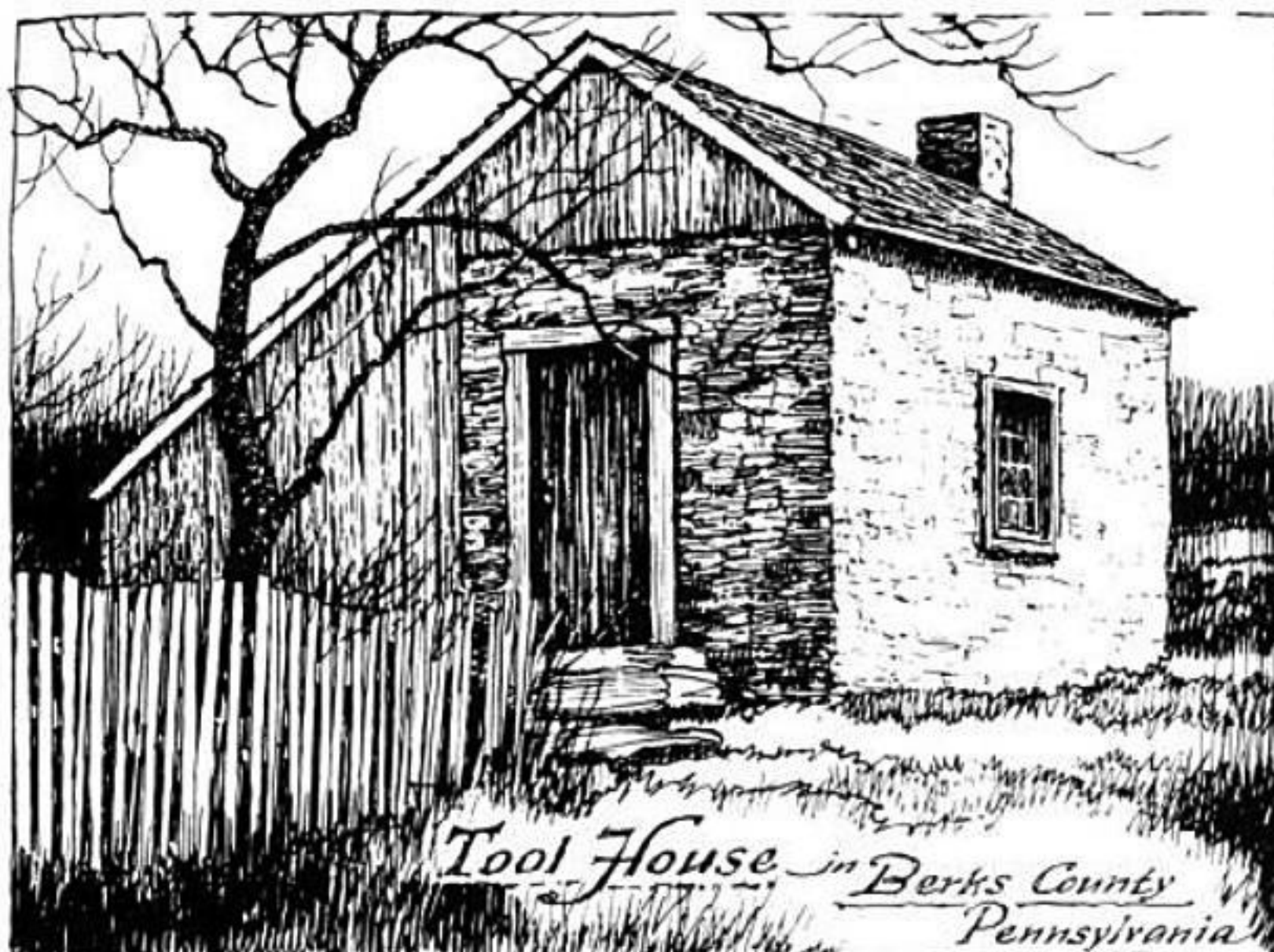
THE SLOANE-STANLEY MUSEUM

In 1969, Eric Sloane gathered his collection of early-American tools into a museum (built by The Stanley Works) near the ruins of an iron furnace in Kent, Connecticut. The Sloane-Stanley Museum is open Wednesday through Sunday from mid-May through October. On display are Mr. Sloane's tools and artwork as well as a re-creation of the studio at his Warren, Connecticut home. For information call: (203) 566-3005.



COURTESY OF CONNECTICUT HISTORICAL COMMISSION

The Sloane-Stanley Museum houses Eric Sloane's tool collection and artwork.



The Romance of Tools.

BY ERIC SLOANE

Finding an ancient tool in a stone fence or in a dark corner of some decaying barn is receiving a symbol from another world for it gives you a particular and interesting contact with the past. Men used to build and create as much for future generations as for their own needs, so their tools have a special message for us and our time. When you hold an early implement, when you close your hand over the worn wooden handle, you know exactly how it felt to the craftsman whose hand had smoothed it to its rich patina. In that instant, you are as close to that craftsman as you can be—even closer than if you live in the house that he built or sit in the chair that he made. In that moment, you are near to another being in another life, and you are that much richer.

Why an ancient tool should be closer to the early craftsman than a modern tool is to a modern workman is not readily understood by most people. Even the ardent collector is sometimes unaware of the reason an ancient tool meant so much to its user. But reason there is. Henry Ward Beecher said it nicely when he explained that "a tool is but the extension of a man's hand." Whereas today's implements are designed with the idea of "getting the job done quickly," there was an added quality to early workmanship, too. For, like the nails on a beast's paws, the old tools were so much an extension of a man's hand or an added appendage to his arm that the resulting workmanship seemed to flow directly from the body of the maker and to carry something of himself into the work. True, by looking at an old house or an old piece of furniture, you can imagine the maker much more clearly than you can by beholding anything made today.

The early implement was also a piece of art, as much as the work it fashioned, for the worker



*Like extensions of
the Human Hand.*

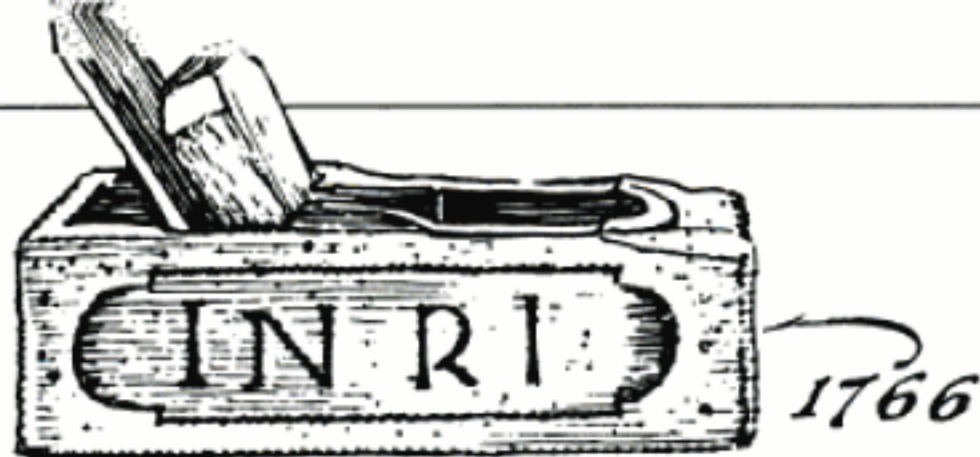


designed his tools, too. In early America, the ironworkers forged only the cutting blade; they gave no thought to the design of the wooden handle and the rest of the finished tool. Plane blades and even knife blades were hand forged and sold like ax heads, and the craftsman was left to make his own wooden "hand" to hold the "fingernail," or cutting part. A small hand needed a small handle and a big hand needed a big handle; the man who used an apprentice had notches in his big plane that enabled the apprentice to help push it along with a stick.

A man whose architectural creations followed the Greek or Roman tradition would find it natural to include Greek or Roman artistic touches in the ornamentation of his implements. Decoration on the early tool, however, sprang from the pride of the maker rather than from any custom.

The feeling that certain tools had souls of their own was not unusual; an ax might be marked "Tom" or "Jack" simply because the owner felt it was a companion worthy of a pet name. All this sounds strangely superstitious. Yet, today motor trucks are often named "Sally" or "Babe;" boats almost always have names; even large machine tools such as presses or bulldozers are graced with pet names.

The religious man probably felt that sacred initials or Biblical quotations might have their

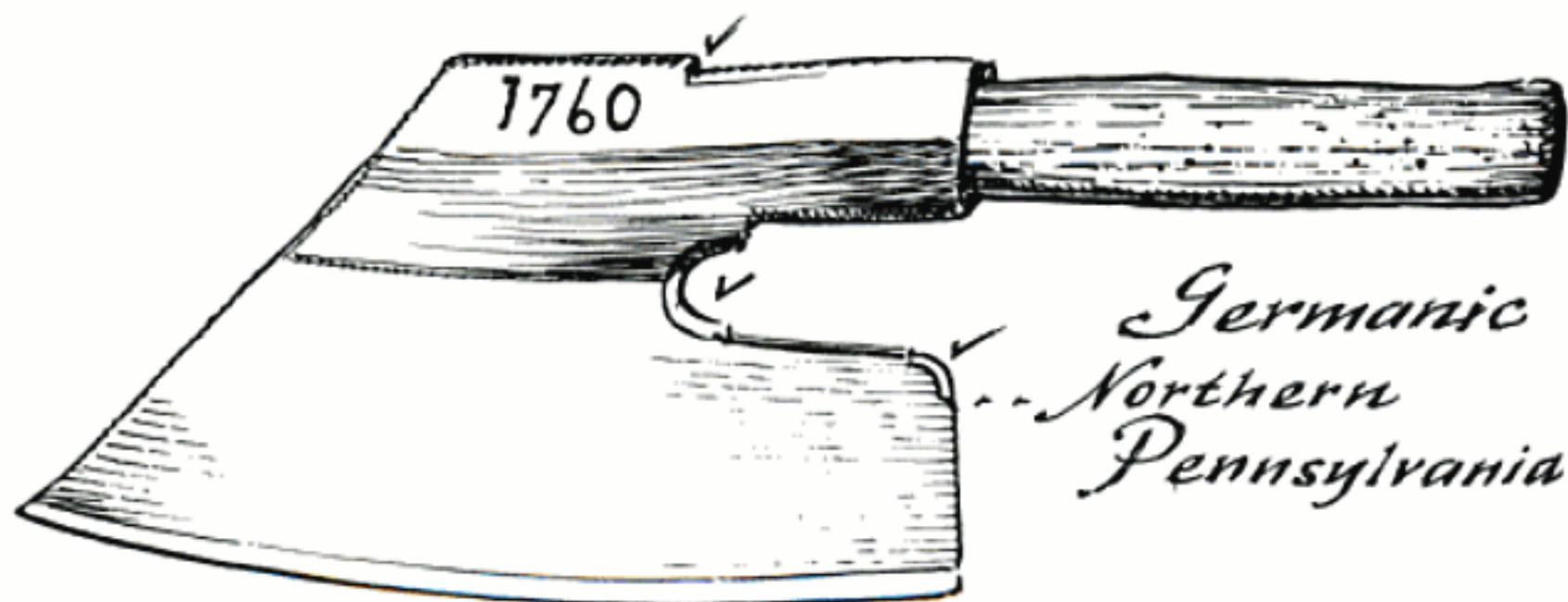


*Sacred initials on one side, the
date on the other.*

effect upon the work done by that tool. Perhaps, mindful that the carpenter Jesus once worked with such tools, some of the early woodworking implements have crosses carved upon them.

One of the finer pieces in a recent showing of modern art was a piece of steel that curved like a bird's wing. It was set into a square block of wood and its title in the catalog was "Number 1760." The artist had an even more honest sense of beauty than a sense of humor, for if you looked closely and with an informed eye, you could recognize the piece as the head of an Early-American "goose-wing" broad ax. In the back of the blade, the year 1760 had been marked, which of course, explained the title. To many it was, at first, the most beautiful piece of art there, but when they learned that it was only an old ax head, they felt as if they had been hoaxed. How, after all, could an ax head be considered a work of art!

The Civil War period marked a turning point in tool design as it did for so much Americana. Before that time, the word tool meant an implement that could make one thing at a time; mass-production tools then entered the scene, and the word tool, which had meant only "hand tool," took on many new meanings. Finally, the word tool came to mean any



item having to do with the production of an item; it could be the machine and also the building that housed the machine. Even the salesmen, the advertising gadgets and the business offices are "tools of the trade."

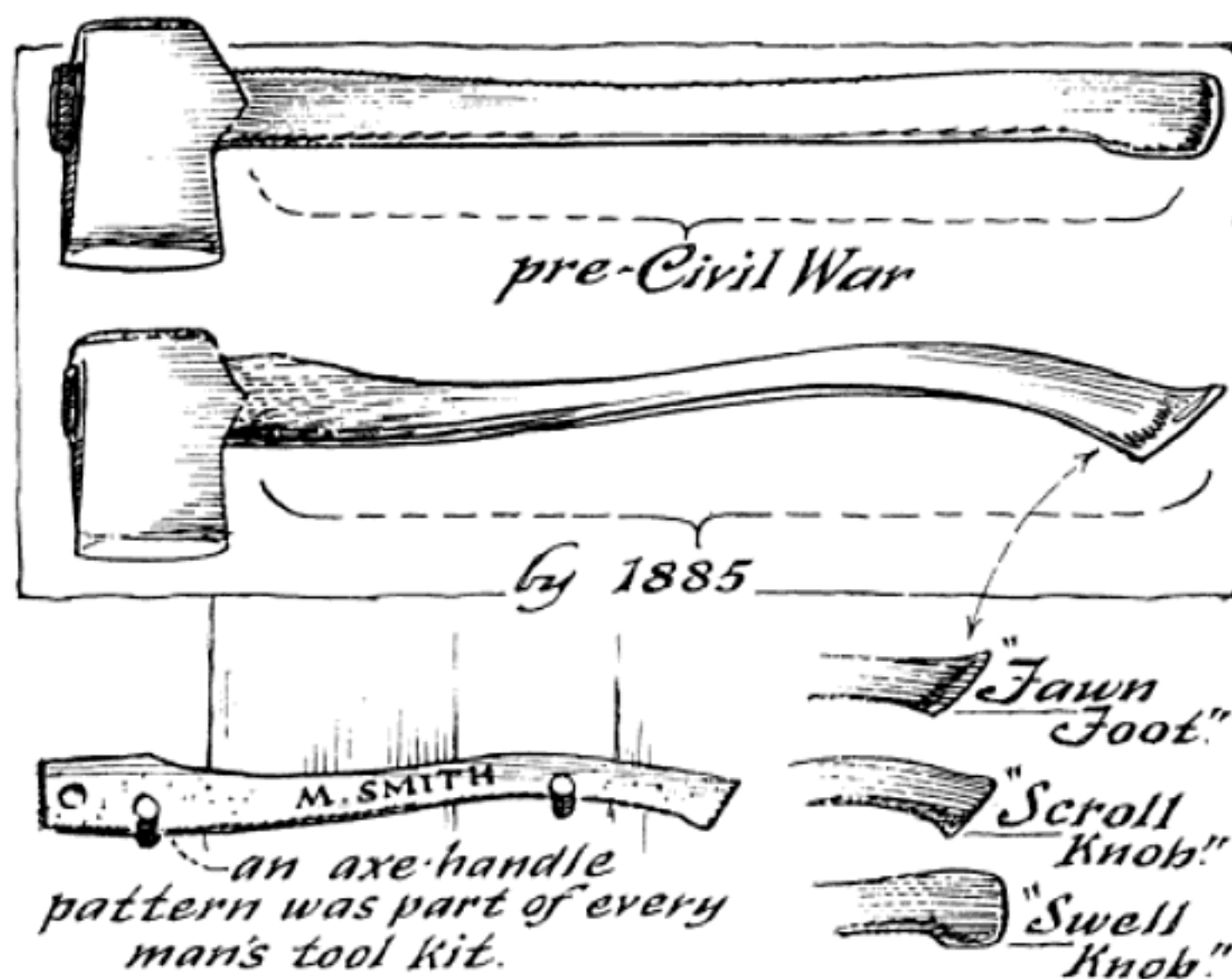
Generally speaking, hand tools made after the Civil War period lacked the simple beauty of those of the antebellum period. Things were made to sell quickly, things were made in large quantities so that they could be cataloged identically, and handmade implements began to disappear. Wooden handles became "fancier," more curved and ornamental, but the severe beauty of folk art and primitive usage was lost. Saw handles became "trickier;" they were designed to appeal to the eye instead of to fit the hand. Ax handles, which had almost always been straight as a good club should be, took on curves such as the "fawn foot" and the "scroll knob." By 1885, handles on axes and adzes had become almost too curved, but by the 1900s, they'd settled down to a sensible and standard design such as that of those you can buy now at the hardware store.

Before the Civil War, most ax handles (like the handles of all tools) were made by the man who would use the ax. A pattern was cut from a piece of flat wood and saved as the model from which future handles would be fashioned. Ax patterns (which you can still find in old barns) were so subtly curved and proportioned that they were as distinctive as a man's signature; you could take one look at it and say, "This tool belongs to Jones" or "That tool belongs to Smith." Very often an ax-handle pattern was handed down from generation to

generation, and it was considered counterfeit for another family to copy it.

While we are on the subject of old tools, I would like to point out that the collector should understand something of the philosophy about the connection between the workman's hand and that part of the tool that he touches. Most modern workmen will scoff at the idea, but any fine craftsman will tell you that the right wooden handle (let us say, on a hammer) helps you along with your work. A metal or plastic handle or even an incorrect wooden handle can feel "dead" and not "spring back" against pressure, thus causing blisters and slowing your work. The proper handle's "feel" or "heft" is the unexplainable quality that a fine violin has to the musician. The Oxford History of Technology quotes Christian Barman's comments on an exhibition of early hand tools: "Everybody who appreciates the qualities of materials loves wood, and here was wood formed into a special kind of tactile sculpture made to be felt with the hand. I remembered that old craftsmen, when they buy a new set of modern chisels, throw away the handles and carefully fit their own. These handles, polished bright by a lifetime of use, became part of the owners' lives."

Always in the fine art of working with wood, the old-time craftsman's laboratory was in his head and his hands and his heart. He called it "knack;" some now believe it was a "sixth



sense" or an extrasensory power. Elusive as this "knack" may be, it is the most important part of those small differences that distinguish the master craftsman from the good workman.

When we consider tools, we are dealing with human benefactors of the most primary sort. Tools increase and vary human power; they economize human time, and they convert raw substances into valuable and useful products. So when we muse on historic tools as symbols, we are always analyzing the romance of human progress.

Although Early-American tools were traditional in design to such an extent that one can usually tell the nationality of the maker, there are almost always subtle differences and decorative touches in design that equally identify the region of American countryside from which the tool came. A collector can easily tell a piece coming from Pennsylvania from one originating in Connecticut. This distinctiveness was often intentional; the early American's urge for identification was born of pride both in himself and in his time. An extraordinary awareness of life and time permeated our early days; when something was made and the maker was satisfied, it wasn't complete until his mark and the date were added.

Nowadays, things are almost obsolete before they leave the drawing board. How lucky we are that so many of the old tools and the things that were made with them were dated and touched with the craftsman's art.

Reprinted with permission from A Museum of Early American Tools, by Eric Sloane (1964, Random House, 201 E. 50th St., New York NY 10022.)

BUILD A ROUTER TABLE

*It's Like Having a Small
Shaper in the Shop*



**This router table will make
your router the workhorse
of your shop.**

PHOTOS BY MITCH MANDEL

BY FRED MATLACK
AND DAVE SELLERS

More than any other modern tool, the router has changed the way we work wood. Its ability to be an all-purpose cutter, groover, molder, and shaper has encouraged a revolution of creative ways to use a router in home shops and small production shops. When you mount a router upside down in a stationary table, it works like a small shaper and is more versatile. You can bring the work to the router (which is now reassuringly stable) instead of having to heft a heavy router over the work. Good ideas get around. As the use of router tables has expanded, manufacturers have responded by offering larger, more powerful routers and a greater variety of bits and cutters.

You can make a router table as simple or as complex as you want. For some woodworkers, a piece of plywood with a hole in the middle clamped over a couple of sawhorses is all that's needed to mount a router. But to utilize the full potential of a router table—to enable a big router to do the work of a small shaper (and do it safely), a router table should be carefully designed.

We designed the router table in this article to handle most any job. We built in features like an adjustable fence, dust collection, an easy-to-reach switch, and convenient storage for bits, accessories and even a router or two. We wanted to incorporate features that make routing easier and safer, but we wanted to keep the design as simple as possible. (The niftiest feature isn't worth much if it's too complicated or cumbersome to use.) We think the router table looks pretty good, too.

The router table is designed around a big router. We chose a #7518 Porter Cable Speedmatic, 3¼-HP production router with variable-speed control. Although plunge routers are a popular choice for router tables, we decided against using one. Compared to a fixed-base production router, a plunge router has a bit more mechanical play in its plunging mechanism. Most of the time this wouldn't be a concern. But when powering a big 2-in. or 3-in. dia. panel-raising bit, for example, the extra rigidity of a fixed-base router will help eliminate any flexing of the machine and chattering of the bit from the huge forces involved. (Note: Operating large-diameter bits can be dangerous because of the extremely high speed at the outer tips of the cutters. For safe routing, use a speed-controlled router on low speed, and don't try to remove too much wood in one pass.)

We made the cabinet of the router table big enough to provide a solid base for the top and roomy enough for lots of storage. (See Fig. 1.) It has a row of drawers on each side to hold router bits and accessories, and double doors



The birch-plywood cabinet is joined with dadoes and butt joints.

with self-closing hinges on the large bottom storage space. We used birch plywood, joined with dadoes and butt joints, for the cabinet construction. An oak face frame, recessed plinth on the bottom and inlaid ¼-in. plywood back complete the cabinet. We finished our router table with a coat of primer and a top coat of semi-gloss acrylic enamel paint.

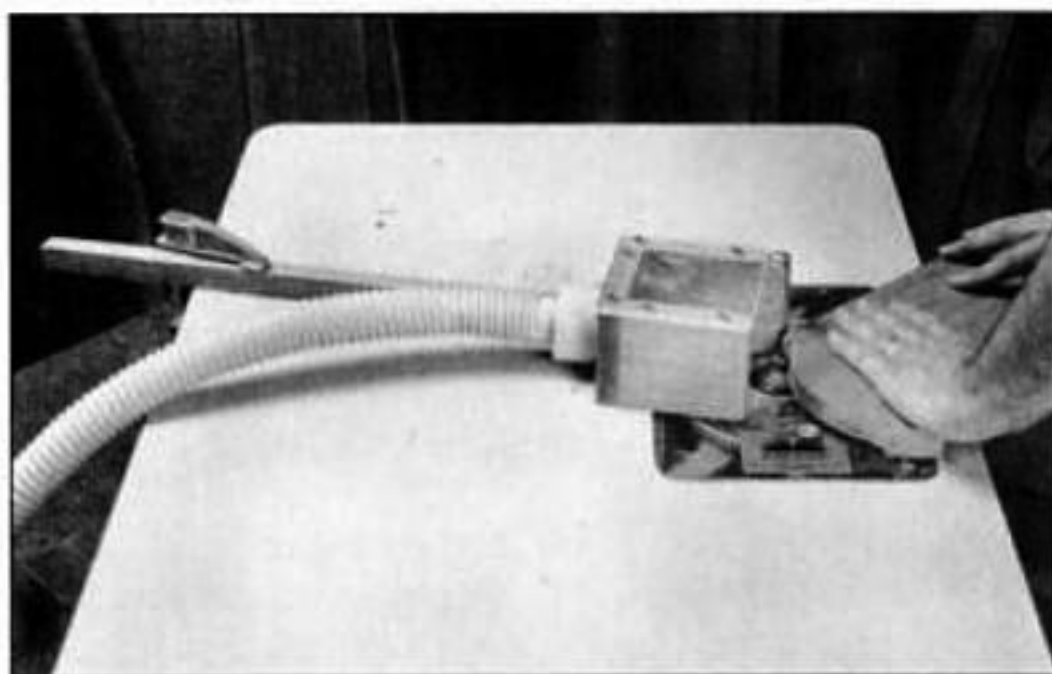
The top of the router table is where the real action takes place. We made the top wide enough to support fairly large pieces of wood, and to overhang the cabinet by 3 in. on the sides and 1½ in. in the front and back. We made the top from two layers of ¾-in. AC plywood glued together. Particleboard or MDF (medium-density fiberboard) would work too, though particleboard is not as stiff as plywood, and MDF is more expensive. To provide a durable, smooth working surface, we installed plastic laminate on both sides of the top and glued a ¾-in. thick solid-oak edge band around the perimeter. Finally, we cut a radius on each corner of the top and chamfered the top edge of the laminate.

We mounted the router on a rectangular base plate of ¾-in. clear-acrylic plastic that fits in a rabbeted cutout in the top. (Remove your router's original subbase first.) With the router mounted this way, it's easy to pop out the router/base-plate assembly to change bits. We bought a ready-made clear-plastic base plate (including a pre-cut hole for the router bit and a hole for a starting pin) from Woodhaven, a mail-order source for router accessories (5323 W. Kimberly, Davenport, IA 52806, 800-344-6657). Also, you could buy a piece of plastic from a local plastics supply house and make a base plate. Phenolic plastic will wear better than the acrylic but it's opaque instead of transparent.

The cutout for the base plate is located near the front edge of the top. (See Fig. 1.) We did this for a couple of reasons. First, it's easier to reach the router for adjustments or to push it out of the top, and it's easier to control the work when pushing it past the bit. It also allows a lot of room in back of the fence to place an indexing jig (for example, the "Inkra Jig"), and if you need to work on a wide piece of wood, you can turn the fence around and



To rout grooves, dados and coves use the main fence alone.



When routing freehand (no fence) with a pilot bearing on the bit, position the movable dust collector directly in the path of the chips coming off the bit, and clamp its long arm at the edge of the top.

use the wide, rear portion of the top.

The fence is perhaps the trickiest part of the router table to design. The main fence is built from a piece of 1 1/4 in. x 3-in. oak as shown in Fig. 2. In some designs, the fence is secured with bolts that pass through holes or routed slots in the top of the table. But these slots gather dirt, and a fence like that can only move more or less parallel to the edge of the top. Instead, we worked out a way to clamp the fence to the edges of the table with big, plastic wing nuts (available from Woodhaven) to tighten simple, wooden clamping blocks under the top overhang. This way, the top doesn't have to be drilled or slotted, and you can skew the fence at an angle across the top if need be.

The main fence can be used the way it is, though it's not high enough to support wide pieces on edge. To give the fence more versatility, we mounted two adjustable auxiliary fences to the main fence with slotted wooden angle brackets. (See photo, above.) These auxiliary fences are fastened to the main fence with knobbed wing nuts and carriage bolts. You can move the auxiliary fences closer together or further apart to adjust the width of the opening between them at the router bit. You can also move either auxiliary fence forward toward the front edge of the table. You can use the router table like a jointer (with a straight bit in the router) by moving the outfeed (left) auxiliary fence forward a fraction of an inch. This allows the outfeed fence to support the part of the



For shaping the edge of long pieces, rout with auxiliary fences in place. Fasten the small dust-collector box to the right-side fence with a screw.

work that's been cut away the same way as the outfeed table on a jointer.

Finally, there's the issue of dust collection. Because the router table can be used with or without a fence (by using bits with pilot bearings), we made up two options for dust collection as shown in the photos and in Fig. 3.

The first collector is a simple, open-sided wooden box covered with clear plastic, which sits atop the main fence between the auxiliary fences. The box has a large hole in the back to accept a standard-size shop-vac hose.

The second collector is a similar wooden box, but it's designed to be placed almost anywhere on the top of the table, independent of the fence. It has a long extension arm (see photo, above), which allows it to be clamped anywhere around the top's edge. When routing against a pilot-bearing bit without the fence, you can put this collector where it can collect the stream of chips coming off the bit. What's more, this dust-collector box has a rounded right-front edge that's drilled for a carriage bolt that holds the box in place in a hole in the base plate. The rounded edge functions like a starting pin on a shaper to support the work.

For routing the end grain of a long piece of wood, many router tables provide a slot across the top for a miter gauge to ride in. That's a good idea, but the slot interrupts the nice, flat surface of the top, weakens the top and tends to collect dirt. Instead of a miter gauge, we plan to make a simple jig that rides along the *front edge* of the table and holds the workpiece with toggle clamps. Of course, if you want to use a miter gauge, simply rout a slot across the top of the table for the gauge to ride in. Better still, rout a larger slot to inlet a strip of hard maple, which can be routed to accept the miter gauge. ▲

Fred Matlack heads the Rodale Press Design Center and collects antique pedal-powered woodworking machines. Dave Sellers is assistant editor of AW.

MAKING THE ROUTER TABLE

Start by cutting out the plywood parts for the cabinet according to the dimensions in Fig. 1. Notice that the horizontal panel in the middle and the bottom panel are dadoed into the cabinet sides. The two small top panels above the drawer spaces fit into rabbets cut in the top edge of the sides and the inside walls of the drawer spaces. Everything else is fastened with butt joints. Glue and nail the $\frac{1}{2}$ -in. thick drawer runners in place on the sides of the drawer spaces. (The top-right drawer has a false front where the on/off switch will be mounted.) Nail a plywood divider panel between the two inner drawer sides.

Next, rout a $\frac{3}{8}$ -in. x $\frac{1}{4}$ -in. deep rabbet around the inner perimeter of the back of the cabinet to hold the back panel. Cut a piece of $\frac{1}{4}$ -in. plywood to fit in the rabbet (leaving the space behind the divider open). Make a face frame for the front of the cabinet by cutting $\frac{3}{4}$ -in. x $\frac{3}{4}$ -in. oak strips to size. Glue and nail them in place on the front edges of the cabinet parts. Make the bottom oak strip $1\frac{3}{4}$ in. wide to cover part of the plinth. The oak strips are simply butted together. Chamfer the edges of the oak strips slightly with a chamfering router bit. Finally, cut out the pieces for the plinth and fasten them against the recessed bottom of the cabinet.

To make the top, cut two pieces of $\frac{3}{4}$ -in. AC plywood to size and glue them together to make the required $1\frac{1}{2}$ -in. thickness. (See Fig. 1.) Glue on the $\frac{3}{4}$ -in. x $1\frac{1}{2}$ -in. oak edge banding and miter the joints at the corners. Cut a $1\frac{1}{4}$ -in. radius on the edge banding at the corners. Now glue a piece of plastic laminate on the top surface and a piece of laminate backer board (plastic laminate without the colored top layer) on the bottom surface of the top. Finally, chamfer the top edge of the laminate and edge banding with a router bit.

To prepare for mounting the router in the top, lay out the location of the cutout in the top for the router base plate. Now rout a $\frac{3}{8}$ -in. wide x $\frac{3}{8}$ -in. deep groove around the inside perimeter of the layout lines to begin forming the cutout exactly the same size as the base plate. (See



Shape the rectangular cutout in the top by routing a groove along a router template sized from the new plastic base plate.

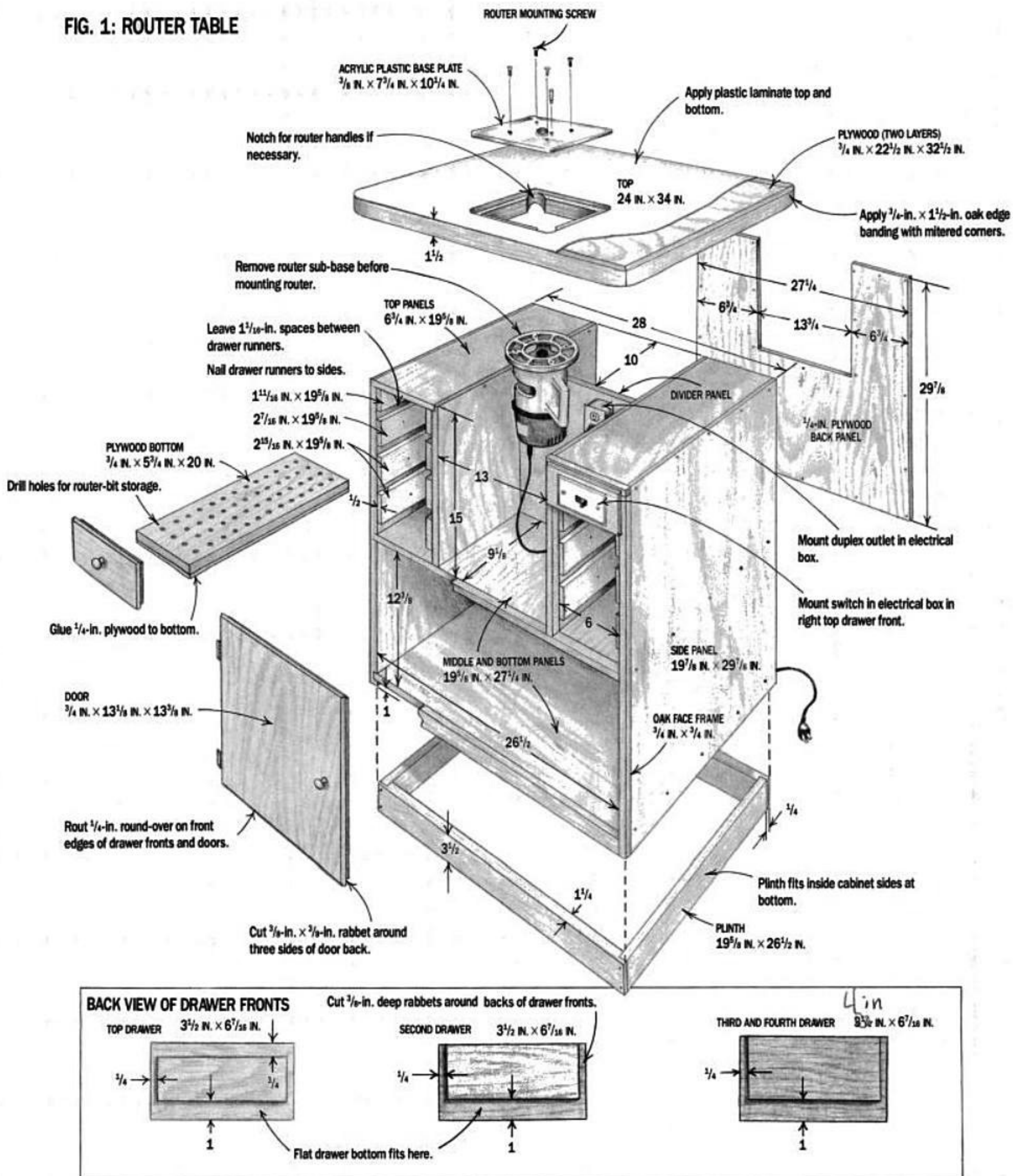
photo.) The easiest way to rout this groove is to use a template sized from the base plate. A template-guide bushing installed on the router rides the template to guide the bit as it cuts the groove. After cutting the groove, remove the interior of the cutout by sawing completely through the top with a saber saw, leaving a $\frac{3}{8}$ -in. wide rabbet around the inside edge of the opening. This rabbet, which is really the bottom of the groove you cut, will hold the base plate. Screw the top to the cabinet with four 2-in. drywall screws.

Mount the router on the center of the base plate. Orient the router in the top so its handles will clear the cutout. Also, make sure the router's clamping mechanism will be easy to reach. You may need to cut notches in the rabbeted edge of the cutout to allow clearance for the router handles when lifting the router and base-plate assembly in and out of the top. (See Fig. 1.) We removed the router's original sub-base and used it as a pattern to mark the mounting-screw holes in the new plastic base plate. Drill and countersink the mounting holes, and mount the router on the base plate. If you're making your own base plate, you'll also need to cut a hole in the middle of the base plate for the router bit to project through.

The drawers are simply flat pieces of plywood drilled with holes for bit storage and fitted with a lipped birch-plywood front. To make the flat drawers, cut pieces of $\frac{3}{4}$ -in. plywood to size as shown in Fig. 1. Drill a selection of $\frac{9}{32}$ -in. and $\frac{17}{32}$ -in. holes through the plywood for your $\frac{1}{4}$ -in. and $\frac{1}{2}$ -in. router-bit shanks. (Tip: Since you're drilling the holes *through* the drawer bottoms, you can stack two or three pieces together and drill them all at once.) Glue a piece of $\frac{1}{4}$ -in. plywood on the bottom of each drawer to act as a stop for the bit shanks. Finally, cut out the drawer fronts, rabbet their backsides to form a lipped edge (see detail in Fig. 1), and fasten them to the drilled drawer pieces. Install the knobs. You can modify one or more drawers by installing sides so the drawers can hold router accessories. Paint the cabinet.

We provided an auxiliary on/off switch for the router

FIG. 1: ROUTER TABLE



by mounting an electrical outlet box (available at any hardware store) in the top-right false-drawer front. Omit the drilled drawer piece. Mount a 20-amp household electrical switch in the outlet box. Wire the on/off switch to a 20-amp duplex outlet fixture mounted in an outlet box near the router. Run a power cord from the back through a hole in the divider to power this outlet. You can plug your shop vac in this outlet as well as the router and run them simultaneously.

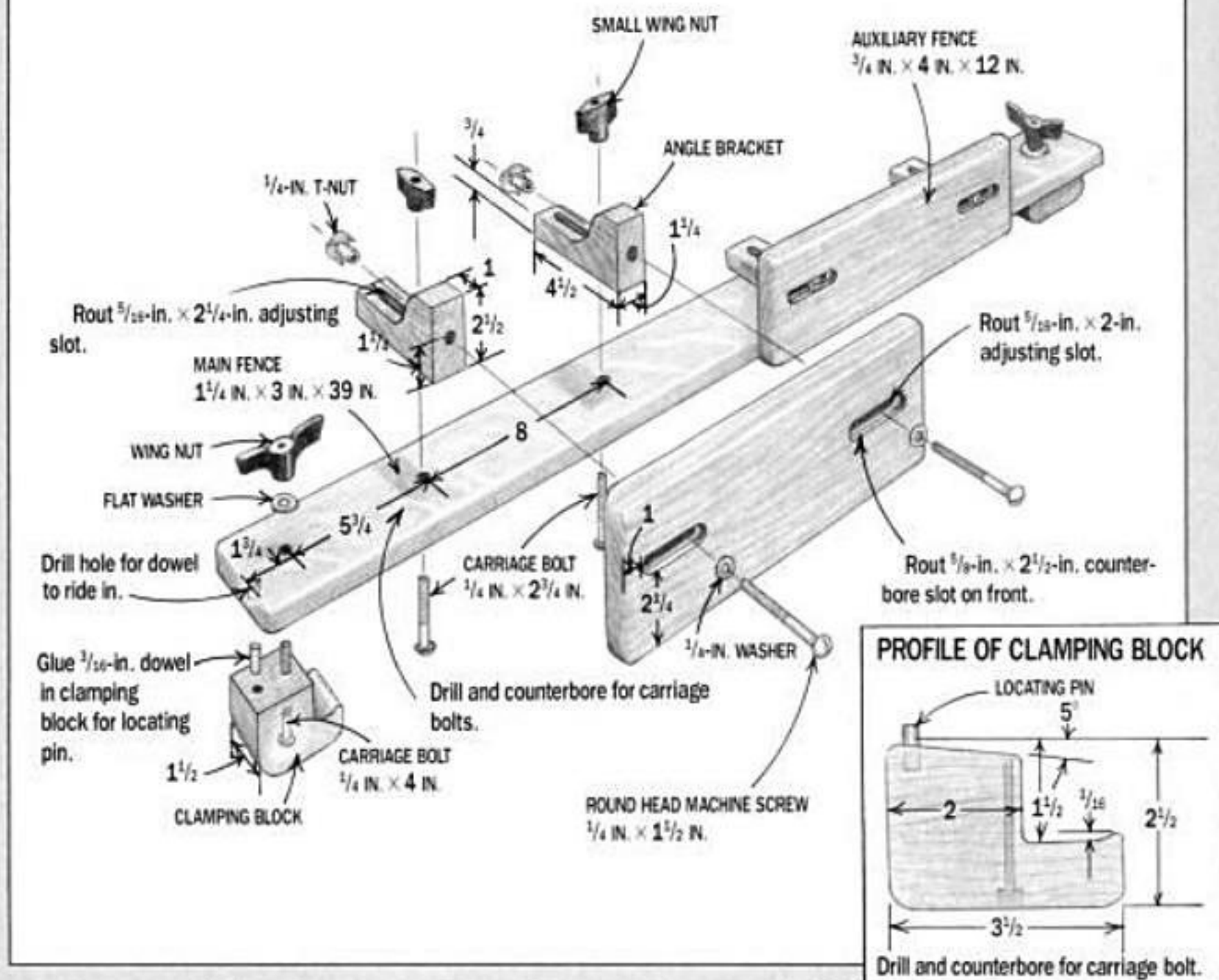
You can use the router table just as it is, but a versatile fence will greatly expand the number of operations you can do on the router table.

Fence and Dust-Collector Boxes

To begin, cut out a piece for the main fence from $5/4$ stock as shown in Fig. 2. We used oak for the fence parts, but hard maple or some other stable hardwood would work as well. Cut out the various parts of the fence and shape them as shown in Fig. 2. Cut the adjusting slots in the angle brackets and the auxiliary fences with a straight router bit. We slightly rounded all the edges of the oak fence parts with a $3/16$ -in. round-over router bit. Drill the holes and counterbores for the threaded carriage bolts and T-nuts where shown. Glue a small piece of dowel in the top of each clamping block. Next, drill a small hole for the dowels to fit loosely in the underside of the main fence at each end. The dowels will prevent the clamping blocks from twisting when you're tightening the wing nuts.

Cut out the pieces for the dust-collector boxes, and glue and screw them together as shown in Fig. 3. Screw the clear-acrylic plastic tops on the boxes. Measure the diam-

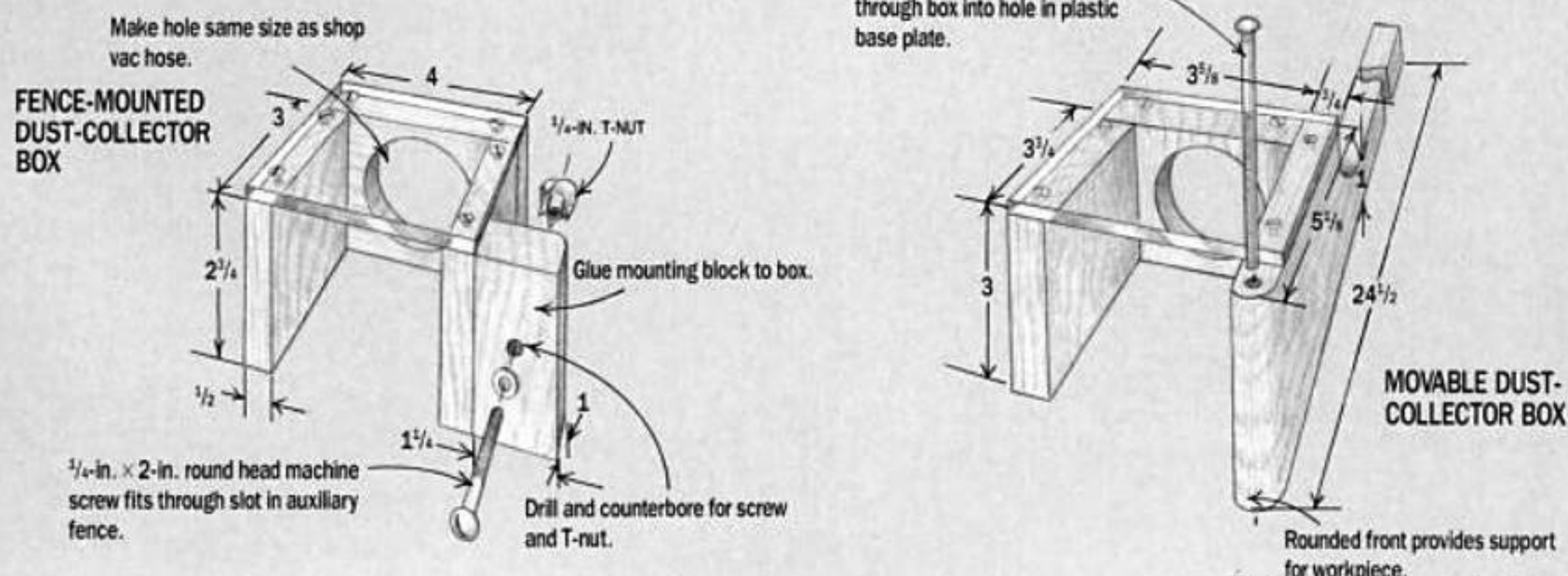
FIG. 2: ROUTER-TABLE FENCE



eter of your shop vac's hose and drill a hole that size in the back of each dust box with a hole saw. Make a "test hole" in a scrap piece to adjust the size of the hole so the hose is an easy press fit.

The dust box used with the fence has an extra mounting block glued to its side for attaching to the slot in the auxiliary fence with a bolt and T-nut. The other dust box has a long extension arm so it can clamp anywhere around the edge of the top. Drill an extra hole in the plastic base plate to accept the end of the carriage bolt that holds the dust box in place. Apply a clear finish to the fence parts, dust collector boxes and the oak face frame on the cabinet.—D.S., F.M.

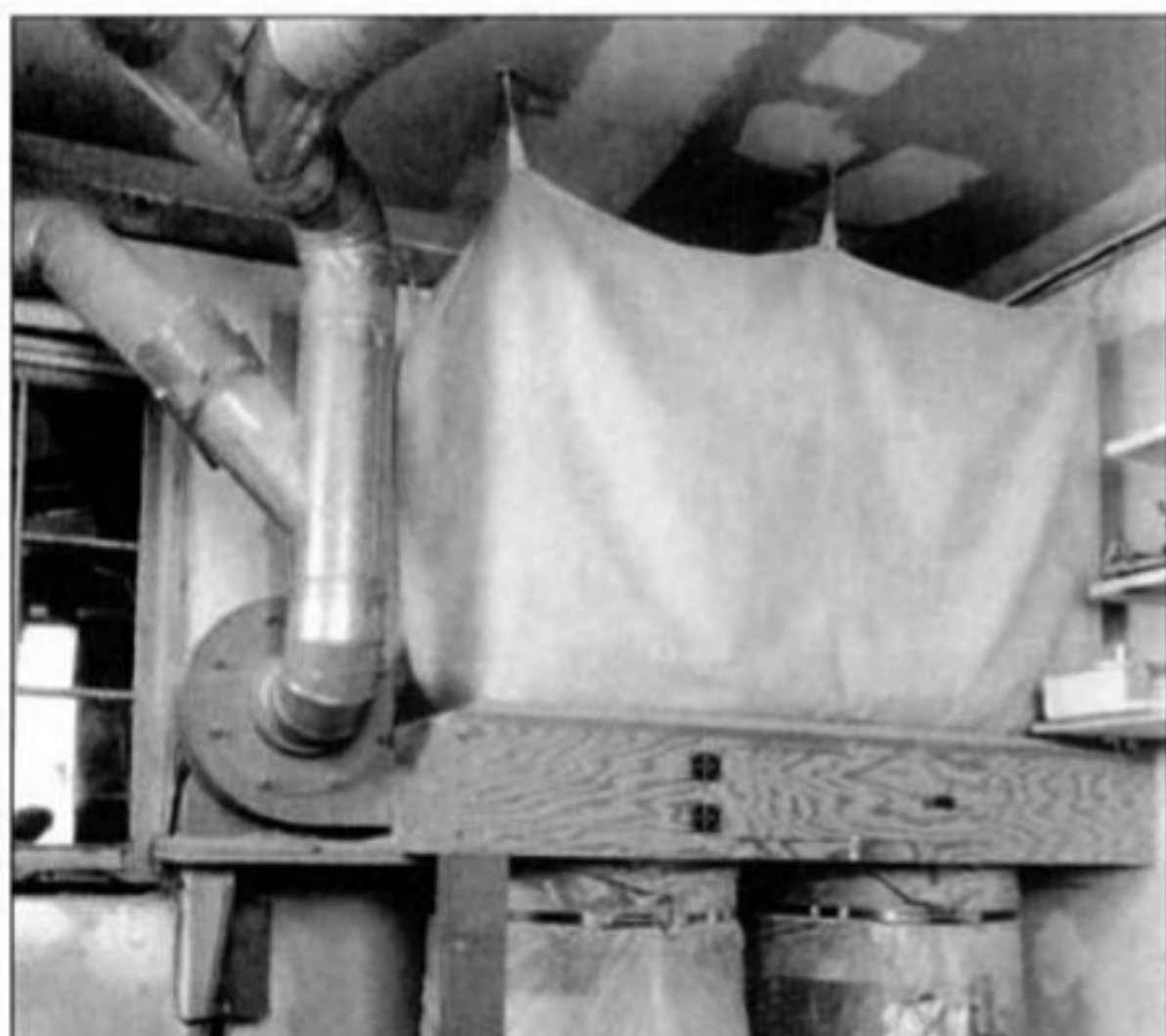
FIG. 3: DUST-COLLECTOR BOXES



DEALING WITH DUST

A Survey of Small-Shop Solutions

BY SCOTT LANDIS

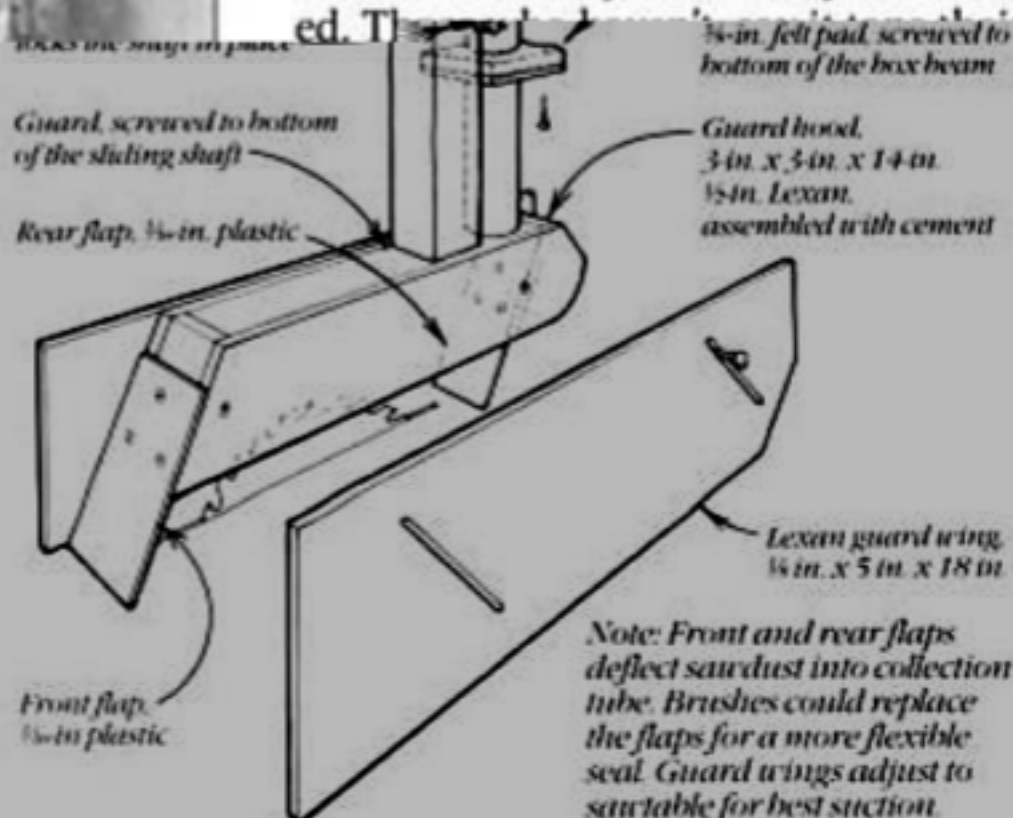


When I started working wood about 20 years ago, dust came with the territory. The collection system in my earliest workshops amounted to a coal shovel and a gunny sack; my cheap filter mask gathered dust on the shelf during all but the most noxious operations. At the end of a day of heavy milling or sanding, I would blow the dust cake from my nose without concern. I must have figured that because sawdust was "natural" it was safe to inhale. In any case, it had to be better than smoking cigarettes or breathing carbon monoxide.

Times have changed. The majority of woodworkers I interviewed for this book have installed some kind of dust-collection system, many of them quite sophisticated. The

ded material for all industrial air-handling systems. According to one manufacturer I spoke to, PVC has several important drawbacks. It tends to accumulate static electricity, it is difficult to ground, and if a spark ignites residue of sawdust inside the pipe, the PVC could ignite or even explode. Its heavier weight also makes it impractical for large, commercial installations.

That's serious stuff, and I'm told you can sometimes get an electricity pop as it is discharged inside a PVC pipe. Still, PVC remains popular because it costs much less than galvanized metal, and it is readily available and easy to install in small runs. What's more, the woodworkers I met who use PVC report little or no buildup of



DRAWING BY HEATHER BRINE LAMBERT



level of static electricity in the duct work. (To err on the side of caution, several woodworkers

operations. The concrete floor and high ceiling of many large, industrial spaces will make it necessary to hang a major duct from the ceiling, which is fed by a succession of vertical branch lines from each machine.

Straight runs of pipe or gentle curves are always preferable to right-angle bends and angular junctions because they reduce pressure losses in the system and eliminate ridges and dead pockets that harbor dust. Where curved sections are required, smooth elbows and 45° Ts should be used in place of square junction boxes or right-angle connectors, which will accumulate dust. Flexible plastic hose is often used to connect machinery to major ducts, particularly where two or more machines share the same branch line. The ridges in the wall of the flex hose create dust traps that impede the air flow, but this should not present a major problem as long as it is used in short lengths (under 5 ft.). Flexible hose should never be used for major runs.

Many woodworkers prefer not to cement the joints in their PVC duct work—mainly to provide easy access for cleaning—but leakage can be an important consideration. Duct tape is a common solution since it is relatively cheap and can be readily removed if the system needs cleaning or adjustment. David Scott, president of Manufacturers' Service Co., a producer of dust-collection systems, prefers a good-quality silicone sealant. Duct tape, he notes, is "unsightly, it deteriorates and it doesn't have elasticity."

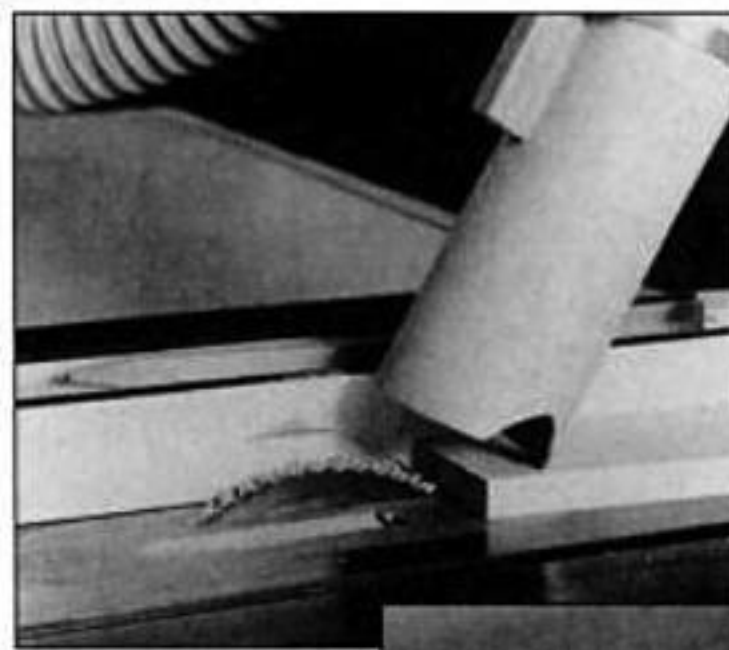
To fasten metal pipes together, Scott prefers rivets to screws or bolts. Rivets are more permanent but their smooth inside surface won't restrict the flow of material inside the duct. Again, Scott points out that four screws protruding inside a 4-in. dia. pipe will reduce its efficiency considerably. Instead, he suggests three pop rivets at each joint—at 4 o'clock, 8 o'clock and 12 o'clock. Don't install any rivets near the bottom of the pipe (6 o'clock), where they can snag dust.

Bags, boxes and blowers. Dust-collection bags and boxes take up space and the blowers make a racket. Woodworkers in warmer climates can put them outside, which keeps the shop cleaner and much quieter. Those who are loathe to lose valuable warm air in the winter or who don't want to offend the neighbors, often place them in a corner of the shop. Earl Magnuson built a separate enclosure room to house his collector. The noise is isolated from the work space and air is returned to the shop through a small furnace filter. The chamber, a cube four ft. on a side, is attached to Magnuson's partially excavated basement shop in Little Rock, Arkansas. It is insulated with fiberglass and ¾-in. thick, foil-faced foam panels, and an adjustable vent in the outside wall can be opened to add fresh air to the system if necessary.

Machine enclosures and pickups. Apart from a good blower and collection bags, two things are required for an effective dust system. Machines must be enclosed and pickups must be installed in close proximity to the source of dust. This is harder to do with some types of machinery than others, and the tablesaw is one of the shop's worst offenders. Most dust collectors access only the chamber below the table, which is marginally enclosed on most saws. And few woodworkers bother with a pickup for the blade for fear of obstructing the saw's operation. (I'm

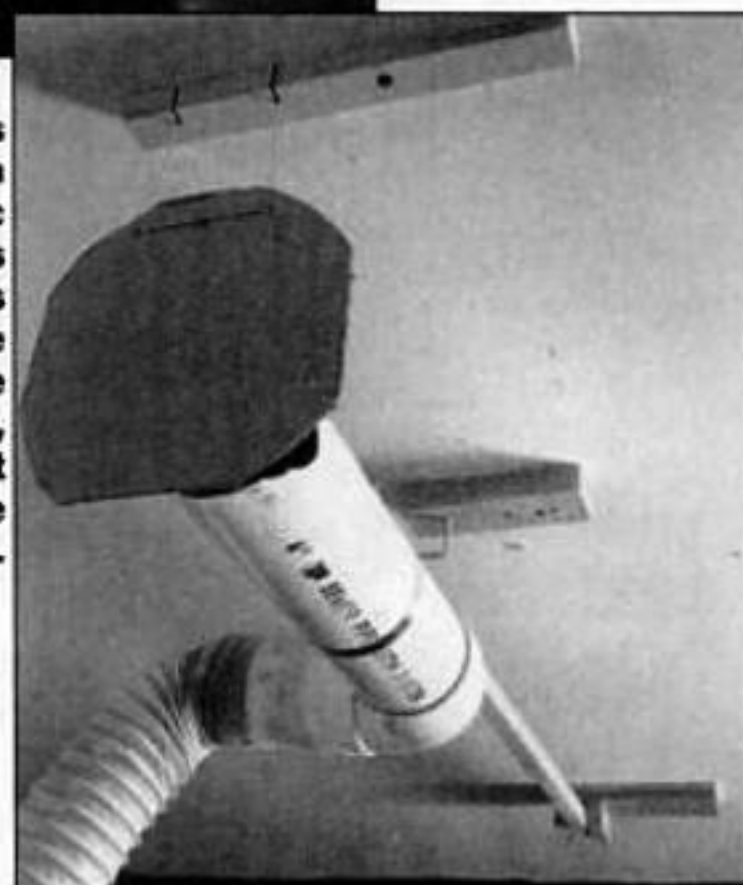
aware of only one commercial pickup for a tablesaw blade, which is made by Biesemeyer (216 Alma School Rd., Suite 3, Mesa, AZ 85202, 800-782-1831). As a result, perhaps as much of the dust escapes through the orifices in the base or is spewed from the top of the blade as is actually collected.

Many woodworkers give up on the tablesaw and focus their attention on other machinery that is easier to



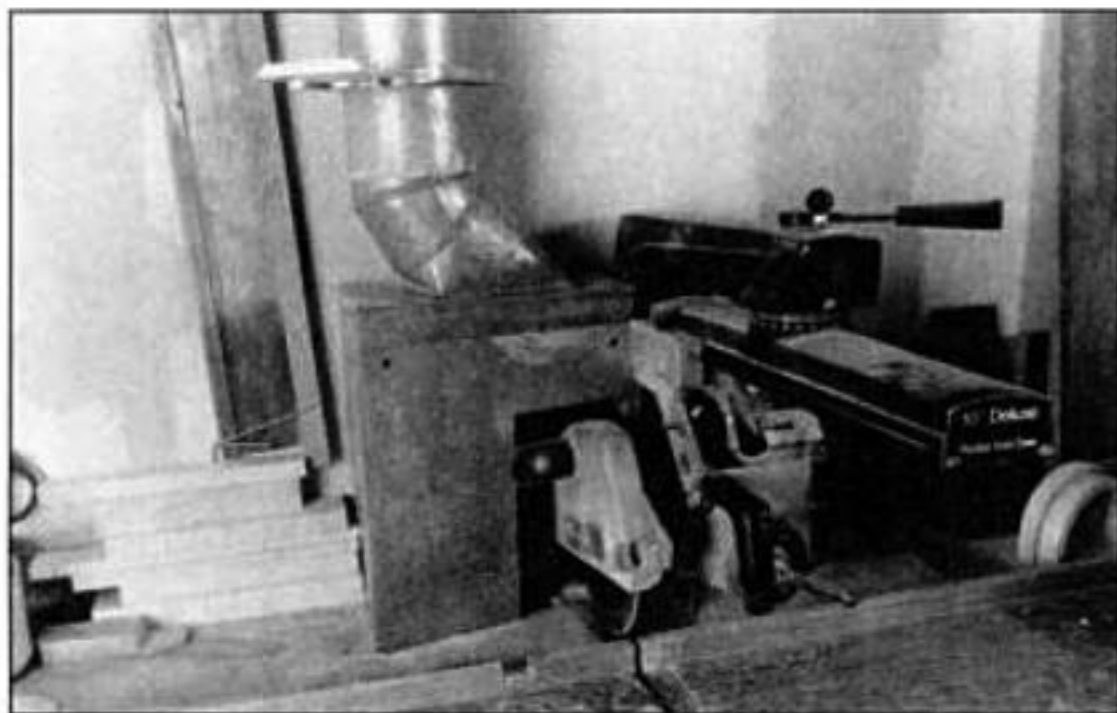
Matt Burak's tablesaw collector is merely a piece of 4-in. PVC pipe attached to a length of flexible hose. The pipe is fixed to a stick hinged to the ceiling.

When the collector is swung up out of use, a cardboard disc hanging a few inches in front of the pipe is sucked against the opening when the system is turned on, forming a crude, but reasonably effective blast gate.

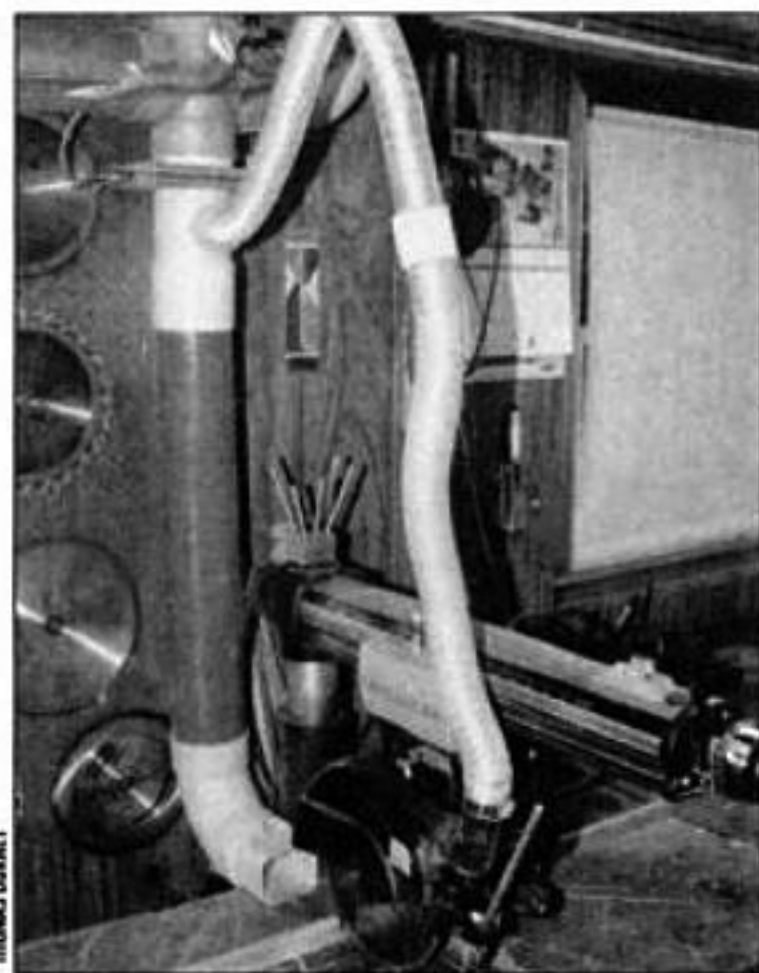


enclose, but I saw several good solutions to the tablesaw problem. Charlie Mastro of Seattle, designed the combination guard and collector shown in the photo and drawing on the previous page. Dust captured by a see-through plastic guard is drawn through a Plexiglas tube into a box beam that is connected to a branch line of the dust collector. The guard is screwed to the bottom of a 2-in. by 2-in. wooden shaft, which slides up and down inside a channel formed by the sides of the box beam; the shaft is locked in position with a quick-action clamp. The box beam is braced to the ceiling and the sliding shaft is counterweighted, enabling the guard to be lifted with one finger.

Mastro adapted the device from a pickup on a fancy German saw. It took him about a day to construct it. In combination with his collector—a \$400, 2-HP Jet machine, rated for 1,100 cfm—the homemade pickup makes a big dent in the ambient dust level in the shop. After about nine months of operation, Mastro suggested two changes to the design. He would move the plastic front flap on the guard forward to better deflect the dust from the front of the blade up the suction tube, and he would raise the height of the box beam to provide more



A sheet-metal hood directs most of the dust from the radial arm saw to Norm Vandal's collector.



Thomas Durney rigged the double pickup to suction dust in front of and behind the blade.

than the current 21½-in. maximum clearance beneath the guard for certain operations. In addition, he noted that a narrower guard hood would permit closer placement of the fence, but it would further restrict the angle of the blade, which is currently limited to a 35° tilt.

A simpler but effective tablesaw pickup (see photos, previous page), was designed by Matt Burak and uses a short section of 4-in. PVC pipe attached to a length of flexible hose. The pipe is clamped to a piece of wood hinged to the ceiling above the operator. When he's not using it, Burak swings the pipe up and fastens it to a hook on the ceiling. (The pipe is easily pushed sideways to accommodate narrow rip cuts.) In operation, the pipe is simply unhooked and lowered onto the table. The height is self-adjusting—the pipe rides up onto the board as the board is pushed through. "It's a little spooky at first," one of Burak's employees admitted, because the pipe obscures the blade, but he's gotten used to it.

Sawdust is easier to collect from a radial arm saw than from a tablesaw, and effective pickups are therefore much more common on that machine. Two typical examples are shown in the photos, above. Norm Vandal of Roxbury, VT, built a sheet-metal box behind the blade to gather the bulk of the dust, which is projected backwards from the rotating blade. Thomas Durney of Laplata, Maryland,

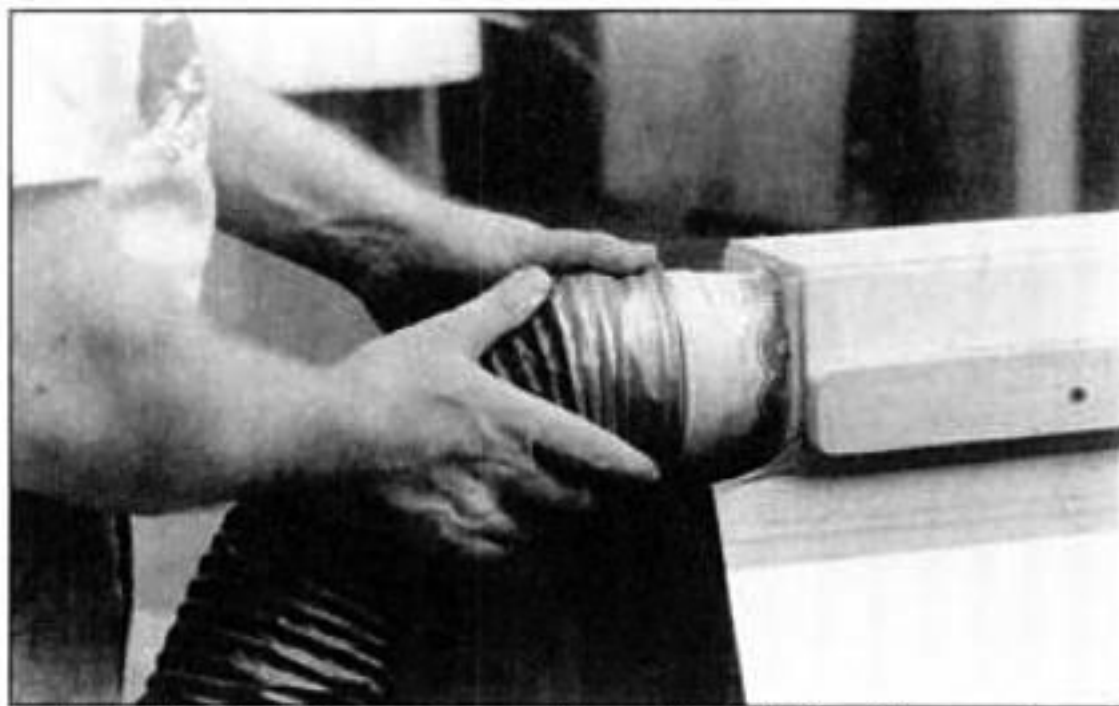
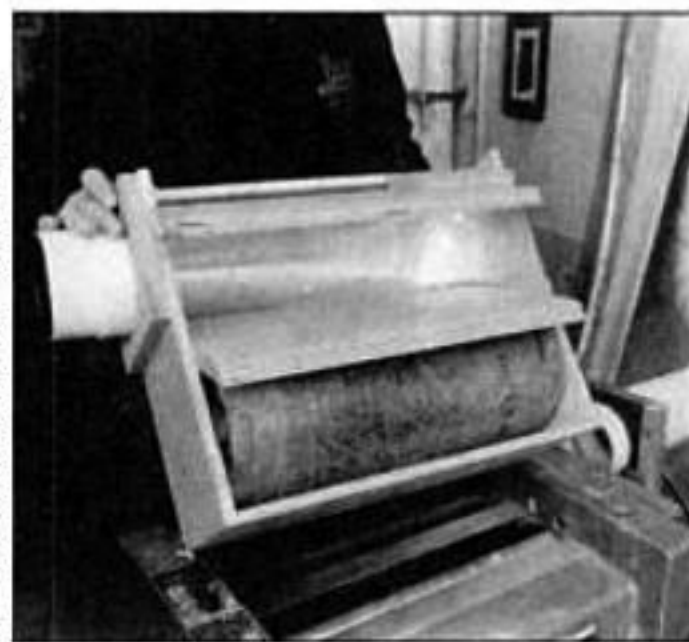
installed a double pickup, using a slotted PVC rain spout behind the blade and a flexible aluminum 1¾-in. dia. carburetor preheater hose to suction sawdust from the front of the housing.

The thickness planer is another major generator of sawdust, and few machines come equipped with an adequate hood. Shown in the photo below is the dust cover Roger Heitzman designed for his Makita planer. Heitzman shaped and tacked aluminum roof flashing inside the plywood shell to keep shavings from accumulating in the corners. He screwed four strips of Micarta (plastic laminate) to the top of the cover, making it easy to slide boards back and forth between passes.

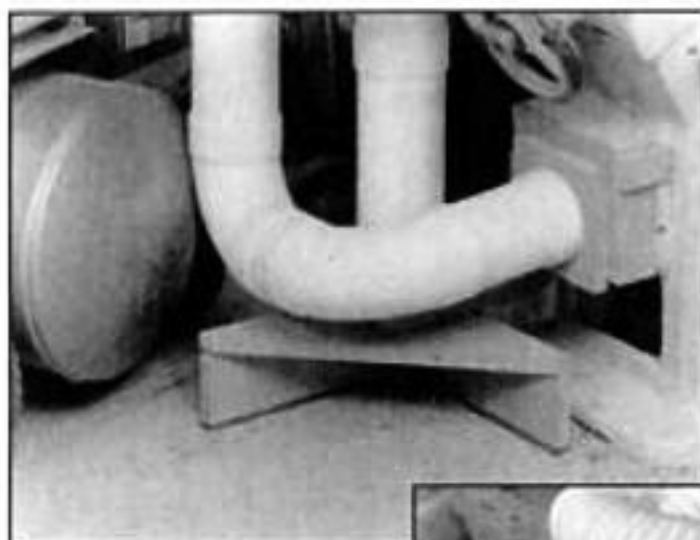
Warren May uses a portable dust collector to service several machines in his Kentucky workshop, and he's devised a novel friction-fit connector as seen in the photo below for the end of the flexible hose. May cut the bottom out of an extra-large, fast-food beverage cup and used duct tape to attach the wide end of the plastic cup to the end of the hose. The tapered cup slips into a hole bored in the end of the dust cover and is easily transferred from one machine to another.

No matter how carefully you enclose your machinery or design your pickups, you'll have to deal with dust on the floor. You can sweep it up the old-fashioned way, or push it to a floor sweep-out like Roger Heitzman's (see photo, next page), which is controlled by a blast gate. Or, you can vacuum it up with a rolling pickup like Matt Burak's. (See photo, next page.) "Sweeping is a disaster,"

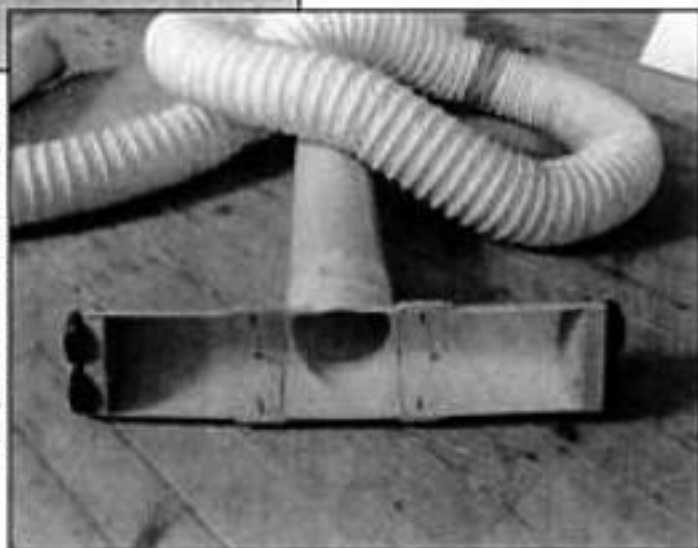
Roger Heitzman made his planer dust cover of plywood and aluminum roof flashing. To determine the best angle for the interior baffles, Heitzman observed the direction of chips exiting the planer head. The lower compartment is filled with fiberglass insulation to help muffle the sound.



A plastic, fast-food beverage cup makes an ideal friction-fit connector for Warren May's dust collector. The large end is taped to the flexible hose of a portable collector while the smaller, tapered end fits snugly into openings cut in various machine dust covers around the shop.



Two methods of clearing the floor of dust: Roger Heitzman sweeps it into a particleboard floor hood which resides beneath the outfeed table of his jointer.



Matt Burak made his own vacuum pickup from a length of PVC pipe sawn in half. A T-section is installed in the middle and small wheels are mounted on the ends, which are blocked with wood.

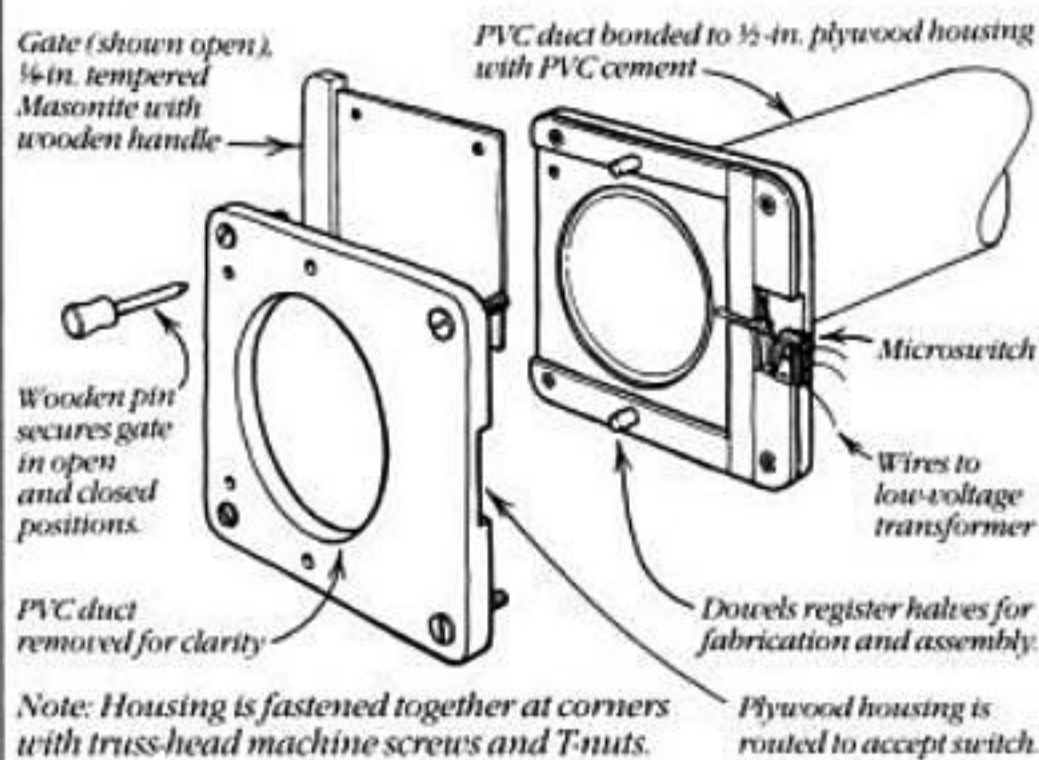
Burak told me. It just redistributes the dust. He plugs the flexible hose into one of three wall pickups in his machine room and does the job more effectively than with a broom and dust pan.

Blast gates and remote switches. Unless your collector is very large or if you have more than two machines on the same system, you'll need to close off the ducts that are not in use to maintain sufficient suction at the operating machine. This is best accomplished with blast gates installed near the intake duct at each machine. You can

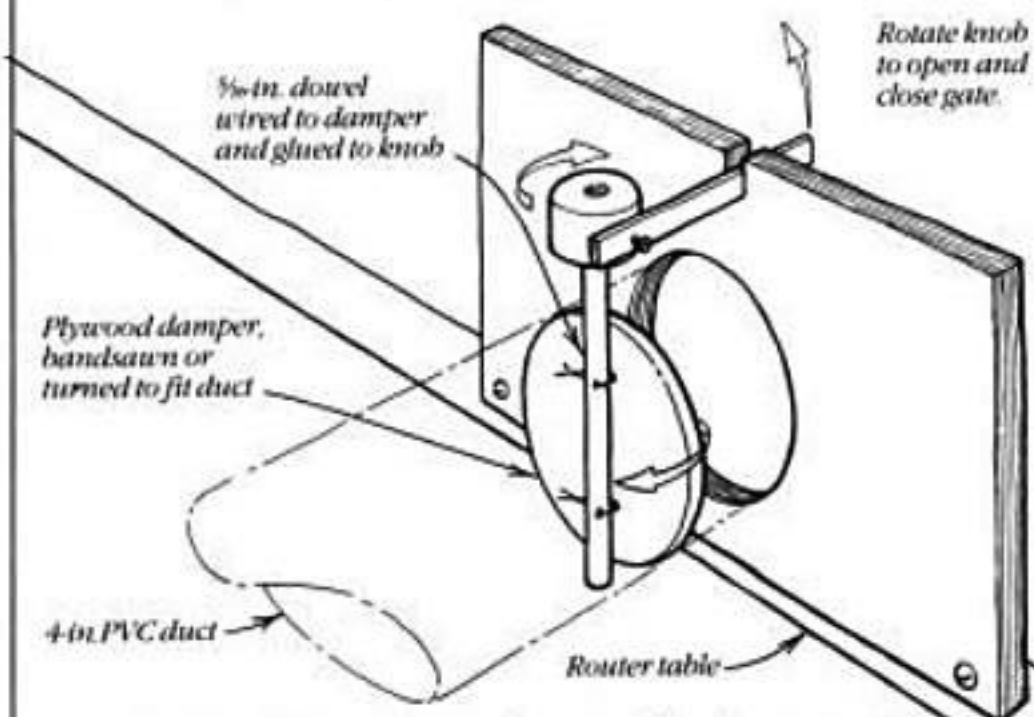
purchase ready-made blast gates from a number of manufacturers, but they're not cheap. A 4-in. aluminum gate costs about \$16; an 8-in. gate costs more than twice as much. Ten store-bought blast gates can cost as much as a small collector.

Many woodworkers make their own blast gates out of a variety of materials. Masonite, sheet metal or even cardboard can be fitted to the intake duct of the collector to close off the opening. Richard Schneider turned his blast gates out of wood as shown in the photo, below left, while Rick Stodola made his out of small plywood discs, which rotate on a dowel in the same fashion as a stovepipe damper. (See drawing, below left.) Damper-style gates

Thomas Durney's microswitched gate



Rick Stodola's "damper" blast gate and router-table pickup

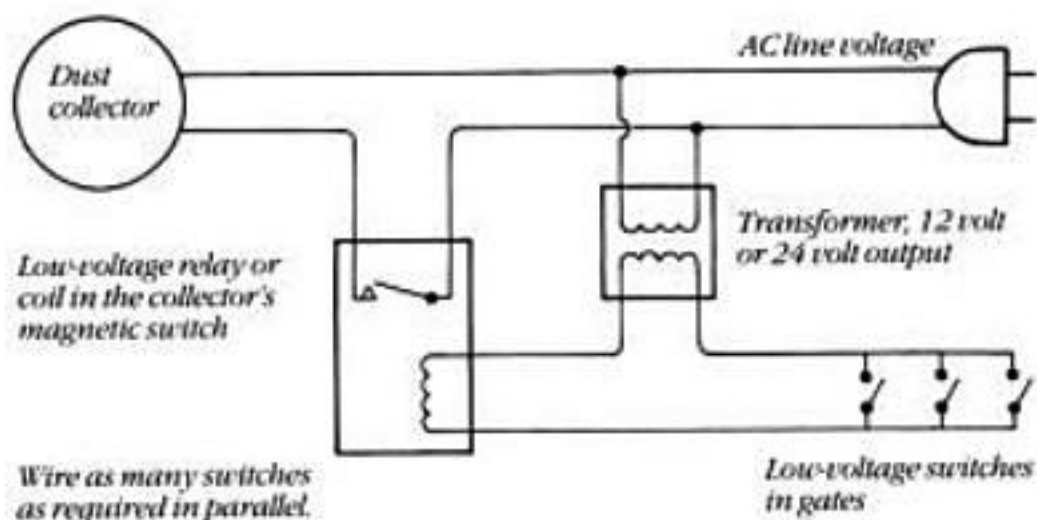


Note: PVC duct fits into plywood housing bolted to router table. Tack duct to plywood and add cowling for effective dust collection.



Richard Schneider's turned wooden plugs make effective blast gates for open-ended collection ducts.

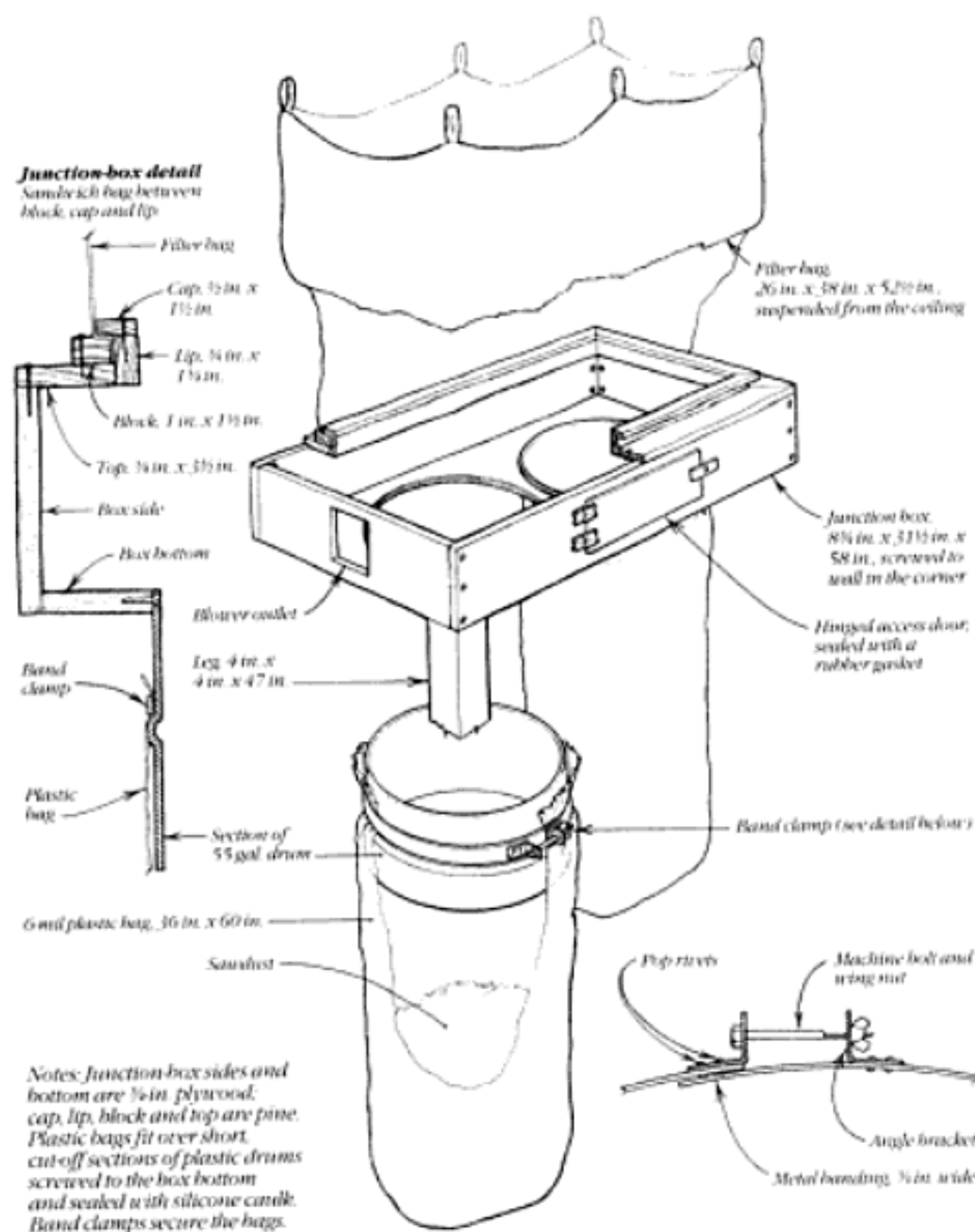
Wiring blast-gate switches



work fine for small shavings and dust, but long shavings from the planer or jointer tend to snag on the disc and clog the duct.

If you take the trouble to make your own, you might as well wire it to the dust-collector switch—open the gate and the system switches on, saving a walk to a switch across the shop (an obvious deterrent to using the system). In some shops, the dust collector is wired directly to the machine switches, turning it on automatically when any of the major machinery is started. But that doesn't mean you'll remember (or bother) to open and shut the gates every time you use a machine. If you wire the blast gates, you'll have to shut them when you're done with a machine or the collector will keep running.

Norm Vandal's dust collector



Quite a few woodworkers have wired low-voltage microswitches into the blast gates to trigger the collector (See drawing, previous page). A 12-volt or 24-volt transformer is required to operate the low-voltage system, and the collector must be fitted with a magnetic starter switch. Different styles of microswitch are available at most electronic-supply houses and usually cost a few dollars.

Thomas Durney built his blast gate (see drawing, previous page) out of 1/2-in. plywood and 1/8-in. Masonite and routed the plywood to accept a microswitch. The hole in the gate is a close fit for Durney's PVC collection pipe, which is sealed with silicone adhesive. Pulling the Masonite slide energizes the low-voltage circuit, which in turn fires the dust-collector relay. To prevent slides in ceiling-mounted ducts from slipping out and activating the system while the shop is unattended, Durney secures them with small wooden pins. (Pins also hold the gates mounted in other positions open to keep them from vibrating shut.)

If all you want is a convenient way to turn the dust-collection system on and off from the shop floor, there's an

easier way. Curtis Erpelding uses a small radio-controlled (RC) transmitter to operate his dust collector from several central machine locations in the shop. Erpelding spent about \$100 for three transmitters, a receiver and the relay, which is wired to the dust collector. (For complete portability, another woodworker I know carries an RC transmitter in the pocket of his shop apron to control the collector from anywhere in the shop.) An RC setup is a good alternative for a very large shop where a lot of wiring or custom-made blast gates would be a nuisance, or if you already have store-bought blast gates.

Two simple collectors. You can spend a lot of money on a sophisticated collection system, but you can also suck up most of the dust without taking out a second mortgage. A perfectly acceptable in-shop collector can be fashioned from new and used materials at a fraction the cost. Norm Vandal's homemade collector (see drawing, left) is a good example.

Vandal started out as a hand-tool woodworker, but over the years he has steadily added machinery to his 24 ft. by 30 ft. workshop, which he built in 1982 and now shares with one employee. To handle the dust, Vandal installed his collector in one corner of the shop and powered it with a 10-in. dia., radial-blade blower. (To prevent sparks, the blower has bronze blades.) The radial arm saw, thickness planer, tenoner and shaper are all connected to the collector by 6-in. dia. galvanized stove pipe with a blast gate at each machine. The system is controlled by a magnetic starter switch mounted on

one of the central posts in the shop.

The dust is shot first into a plywood junction box where the heavier shavings drop immediately into two collector bags. Vandal purchases 6-mil plastic bags from a mail-order packing-supply company and extends their life with duct-tape patches. The bags fit over two cutoff sections of plastic industrial drums screwed to the bottom of the plywood box. They are secured to the drum flanges with 3/4-in. metal banding. The air is returned to the shop through a custom-made cotton filter bag suspended by six loops from the ceiling.

Periodically, Vandal beats the filter bag with a stick to release the dust. On occasion, he opens the door in the plywood junction box to redistribute the dust or to lightly scrape the inside of the filter bag. (The dust cake on the inside of the bag helps trap fine particles, so it's best not to scrape it too clean.) The system is strong enough to draw dust from two machines at once, but it would be enhanced by greater airflow around the filter bag.

Vandal estimates the total cost of his system at less than \$500, including the plywood for the box, the relay



Rick Stodola's octopus extractor services six machines and a sanding table in his basement workshop.



Sculptor Paul Perras maneuvers the sheet-metal nozzle of his carving-station dust collector into place.

switch (\$5 from a salvage yard), blast gates (about \$15 each), blower (\$90) and the 2-HP, direct-drive Dayton motor (\$200). The duct work came free from local plumbing and heating contractors who had pulled it out of buildings that they were converting from forced-air to hot-water heat. The system even earns him a little money—he sells his maple and pine dust for animal bedding for \$1.50 per bag.

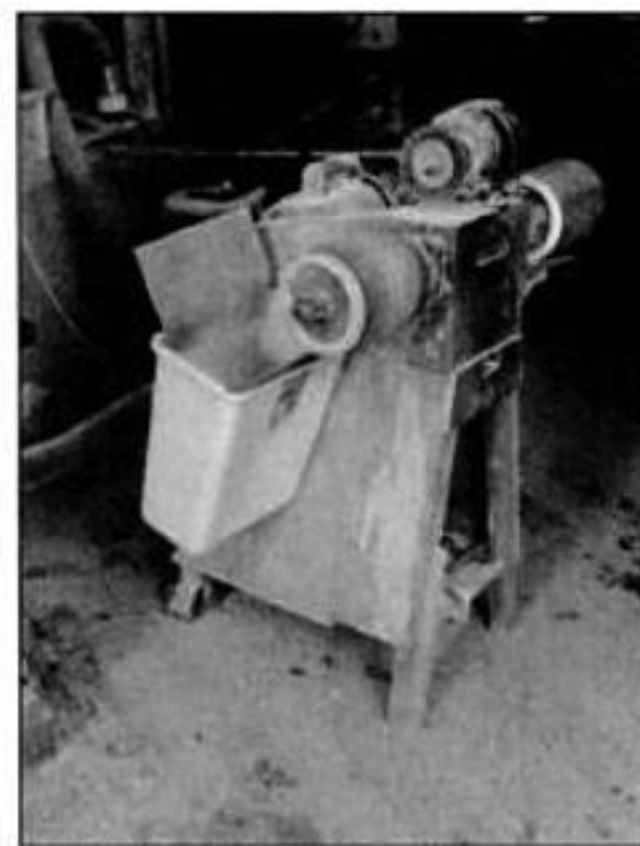
Apart from the band-saw, which is connected to a portable shop vacuum, the only major power tools not hooked up to the system are the tablesaw and an old 20-in. jointer. The open jointer base, in particular, would have to be sealed with an elaborate box construction for effective collection. Instead, Norm simply sweeps the shavings to a vacuum pickup located on the floor near both machines. To suck the fine dust out of the air after a major mahogany job, he opens all the blast gates and the shop door, and turns on the collector. (In Toronto, Michael Fortune installed a movable baffle in a similar collector to divert the flow of dust to one or the other collection bag. He also uses a pair of old ski bindings to fasten his filter bags quickly and securely.)

For about \$250, Rick Stodola, an amateur woodworker near St. Johnsbury, Vermont, put together the octopus collector shown in the photo, above, to service six stationary machines and a sanding table. (Why are so many interesting dust-collection systems to be found in

Vermont? Perhaps it's coincidence, or perhaps it's because New Englanders are constrained to the shop for a large portion of the year when they dare not open the door without risk of frostbite.)

At the center of the system is a 1-HP, 1.75-cu. ft., two-bag dust collector, made by Central Machinery. On top of the blower, Stodola installed a 10-in. square by 6-in. high plywood junction box to accept the four main branch lines. Except for elbows and other connectors, he used 4-in. dia. aluminum dryer ducts instead of PVC pipe to reduce the likelihood of static electricity. (The short run of pipe enables him to operate two machines at once.) The joints are assembled with duct tape for easy disassembly in the event of a clog, and cardboard cowlings at each machine help direct the flow of sawdust to the collection pipe.

Stodola's circular layout is a model of efficiency for a small basement shop. It's about 10 ft. in diameter, leaving about four feet of clearance between the machines and the



A plastic wastebasket with aluminum deflector captures a lot of dust from Carl Hathaway's pneumatic sander. A hose connected to the basket through the stand leads to a collector.



When working with his pneumatic sander, Kelly Mehler positions a household fan on one side of the machine and a large window fan on the other to draw off most of the offending dust.

shelving along both walls. The tools are at different heights and positioned so that work is fed at a tangent to the circular layout where it's least likely to be obstructed by other machinery or shop fixtures.

Coping with fine dust. For all their effectiveness, dust collectors, brooms and vacuums miss a lot of the most dangerous and irritating dust in the shop—the minute airborne particles churned up by a sander or thrown off



The sanding station in Michael Elkan's shop sucks up dust from portable sanders.

of a tablesaw blade. According to the Occupational Health and Safety Administration's (OSHA) Dr. Peter Infante, "there's no question. . . wood dust is a carcinogen." Obviously, it's not the long, pine ribbons churned out by a planer that will kill you, but the almost invisible dust you inhale every day. Here are some of the methods woodworkers I visited employed to corral fine dust.

One of the simplest and most flexible methods was rigged up by Paul Perras for the carving station shown in the photo, previous page, which he installed atop the base of a surgical operating table. A sculptor who works with dense, resinous woods as well as stone, Perras needed a pickup he could position right next to the point of cut. He mounted a 45 gallon drum collector in the rafters above the carving station and attached a long length of 4-in. dia. hose with a sheet-metal nozzle fashioned at the pickup end. Much of the time, the hose rests in one of the scalloped recesses in the top of the plywood station, but it can be raised or lowered with a rope cleated to the side of the station. (The rope passes through a small pulley that hangs from a swivel bracket above the station.) The plywood enclosure helps support the work and contains the dust in the immediate area.

Carl Hathaway who works in Saranac Lake, New York, uses a pneumatic Sand-rite sander to smooth the ribs of his Adirondack guideboats and canoes as shown in the photo, previous page. He attached a plastic waste basket to the machine and added an aluminum shield to deflect the dust. A flexible hose connected to the waste basket draws the dust to Hathaway's Grizzly collector, which is located in an adjacent work room.

Kelly Mehler found that his 5-HP collector was not worth starting for small operations. When at the lathe, pneumatic sander and workbench he opens a window nearby and relies on a simple combination of fans and dust masks to clear the air. (Forget this method in January, but the fan will help cool the shop all summer—whether or not you're making dust.)

The plywood sanding station (see photo, above) tackles one of the nagging problems of the workshop—how to collect sawdust from portable hand sanders. Most of us just wear a mask and let the dust fall where it may. In Michael Elkan's production box shop, dust is contained and funneled toward the pickup at the back by the sides

and top of the box. The station was designed to handle a large volume of work and resembles the "elephant trunk" system commonly found in major museum conservation labs, which typically employs flexible pickups at individual work stations for vapor and solvent extraction.

In praise of the portable shop vacuum. If you're feeling intimidated by all this equipment, there are some simpler options. Large central dust-collection units are usually more efficient than small, individual collectors, but a matrix of overhead duct work takes up a lot of room and requires a large expenditure in pipe, reduction fittings and blast gates. Depending on the work you do and the size of your shop, a small portable unit such as Tage Frid's Makita collector (see photo, below), may be more flexible and cost-effective.

Don't dismiss the humble Sears ShopVac. Many shops have two or three instead of or in addition to a large, central unit. Richard Schneider turned his 2 1/2-HP ShopVac into a small, central collector for his guitar shop. Most of the time, the ShopVac resides in a storage room adjacent to the shop. It is connected to the bandsaw and sander with PVC pipe that runs through the crawl space beneath the floor. In her cabinet shop next door, Schneider's wife Martha Collins uses a large central collector and more than 100 ft. of pipe to handle the volume of sawdust from her industrial machinery.

If you don't do a lot of heavy machine work, a portable unit may be able to handle all your shop equipment. When there's no air in the bag, the Makita #410 is easily toted around the shop.



The system is economical, quiet and adequate for the relatively small volume of dust Schneider creates. In fact, he discovered that even the ShopVac can be too strong for delicate operations like dusting the inside of a guitar. In that case, he just opens another blast gate to reduce the amount of suction. As Schneider explains, the ShopVac has the added advantage of portability, "You can clean your car with it or bring it inside to vacuum." ▲

Scott Landis is a writer, photographer and author of *The Workbench Book*. He's a founding member of WARP (The Woodworkers' Alliance for Rainforest Protection). This



article is excerpted from his newly released book, *The Workshop Book*, copyright 1991, The Taunton Press. Reprinted with permission. To order, send \$34.95 plus \$4 shipping to The Taunton Press, Box 5506, Newtown, CT 06470.



Wedged mortise-and-tenon joints decorate the sides of these curved-top recipe boxes.

RECIPE BOX



*The Curved Lid Props Your Recipes Right
Where You Need 'Em*

BY PATRICK STAFFORD

A lot of woodworkers I know are great cooks, possibly because most of us can't afford to go out. . . At any rate, I designed these curved-top boxes to hold recipes. The mortise-and-tenon joints are cut with a router and a simple template, making these recipe boxes ideal for small production runs if you're inclined. The curved lids can either be coopered or cut from solid

stock. Or, if you prefer, you could make a flat lid, altering the upper profile of the box sides to match.

My first attempt was the smaller of the two boxes you see here. It holds 3-in. x 5-in. cards and has worked well enough for me. The only problem is that I found myself copying many recipes out of magazines onto the small cards. I realized that if I had larger cards I could simply cut the

whole recipe out of the magazine and paste it right on the card, so I made a larger recipe box for 5-in. x 8-in. cards. Fig. 1 gives the dimensions for the larger box. Should you wish to make the smaller box, simply scale down the dimensions.

The boxes have short dividers that hold the cards upright, preventing them from falling back in the box and becoming wedged. You can begin filling the front slot and move back as your recipes increase.

Building the Box

Start by thickening your box stock. (Leave the lid stock until later.) Make sure you have a few extra scrap pieces of the same thickness. They'll come in handy as test pieces when you cut the tenons. Cut the sides to their final width and length,

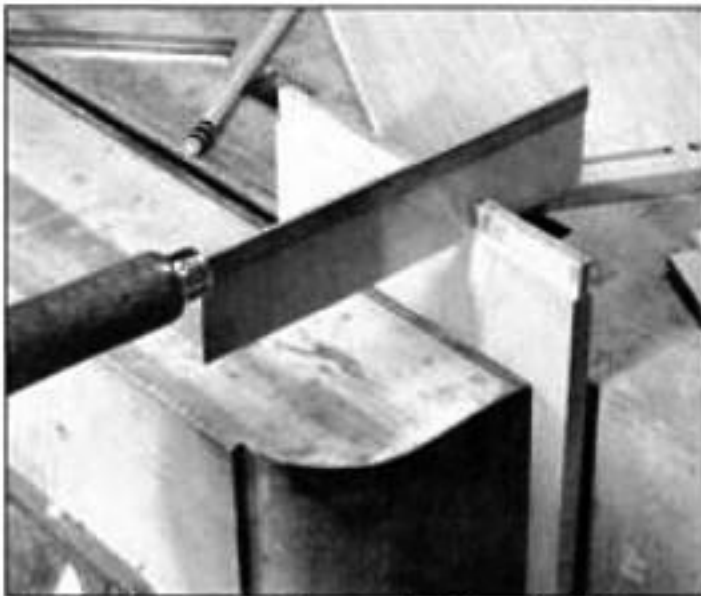


After sawing the tenon cheeks on the box front and back, mark the lengths of the tenons with a straightedge and pencil.

but wait until later to cut the curves in the top edges. (See Fig. 1.) Cut the front and back to their final widths and lengths. If you plan on having the tenons sit proud of the box sides (see photo of larger box, previous page), be sure to leave extra length on the front and back pieces. See that the ends of these pieces are exactly square, otherwise the joints won't fit tight. You may find it helpful to first make a practice corner out of scrap. This practice

corner will be useful later when you're working out the hinging of the lid.

First, cut the mortises for the corner joints, using the template described on the next page. (See sidebar, Templates for the Recipe Box.) Then cut the tenons. (See Fig. 1.) To do this, first crosscut the shoulders of the tenon cheeks, then saw the cheeks on a tablesaw. I use scrap pieces as



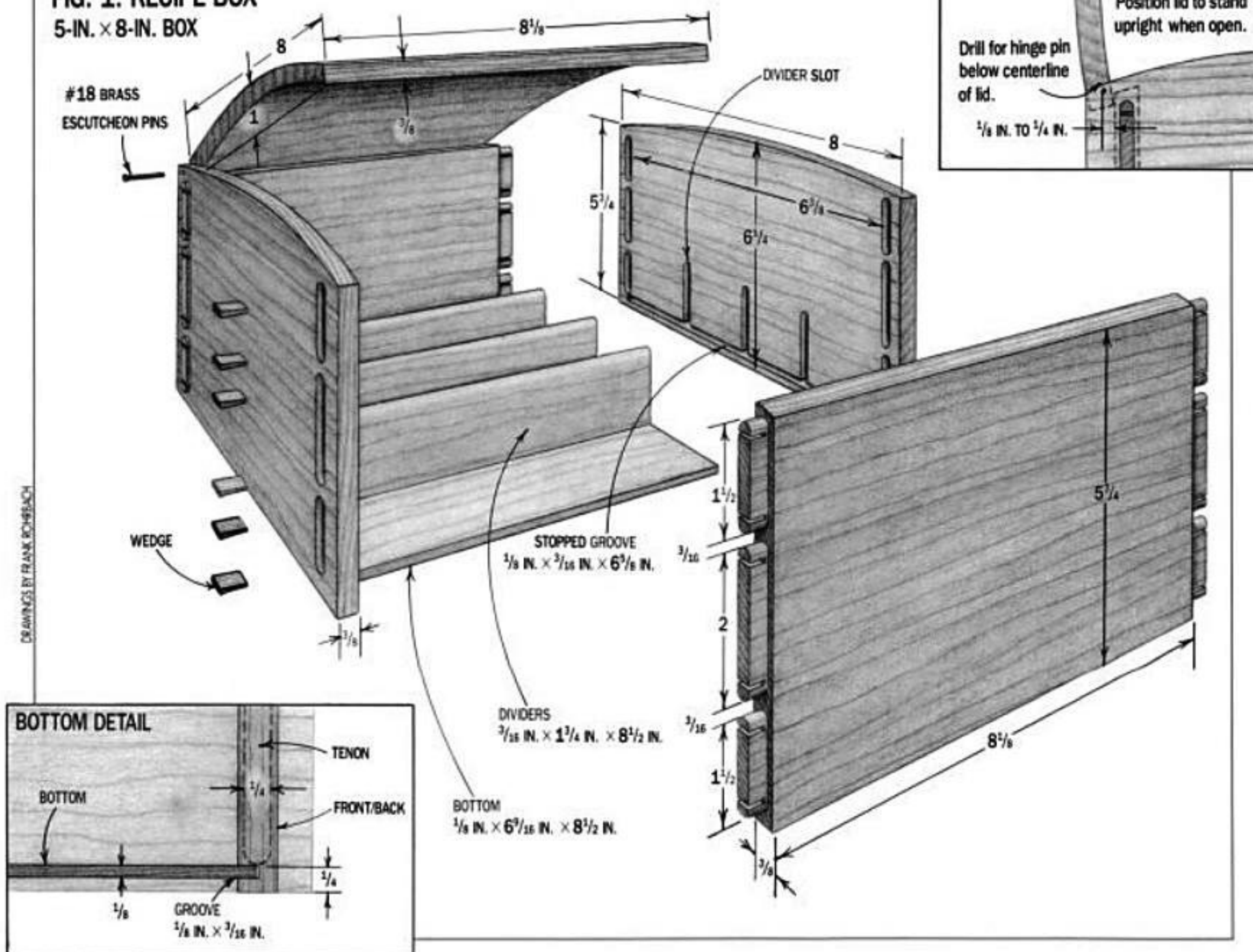
Cut the tenons to the marked length with a handsaw.



Mark out the rounded shape of the tenons by tracing through the mortises onto the tenon ends.

guides to set up the saw to the correct thickness to cut the tenons. After that, I cut the real tenons. Next, use the mortises in the side pieces to mark out the positioning of the tenons on the front and back pieces. (See photo.) Use a handsaw to cut the edges of each tenon accurately as the photo shows. With a crosscut box on the tablesaw, remove the waste between tenons. You could also use a bandsaw with a fence. Keep track of mortise-and-tenon pairs.

FIG. 1: RECIPE BOX
5-IN. x 8-IN. BOX



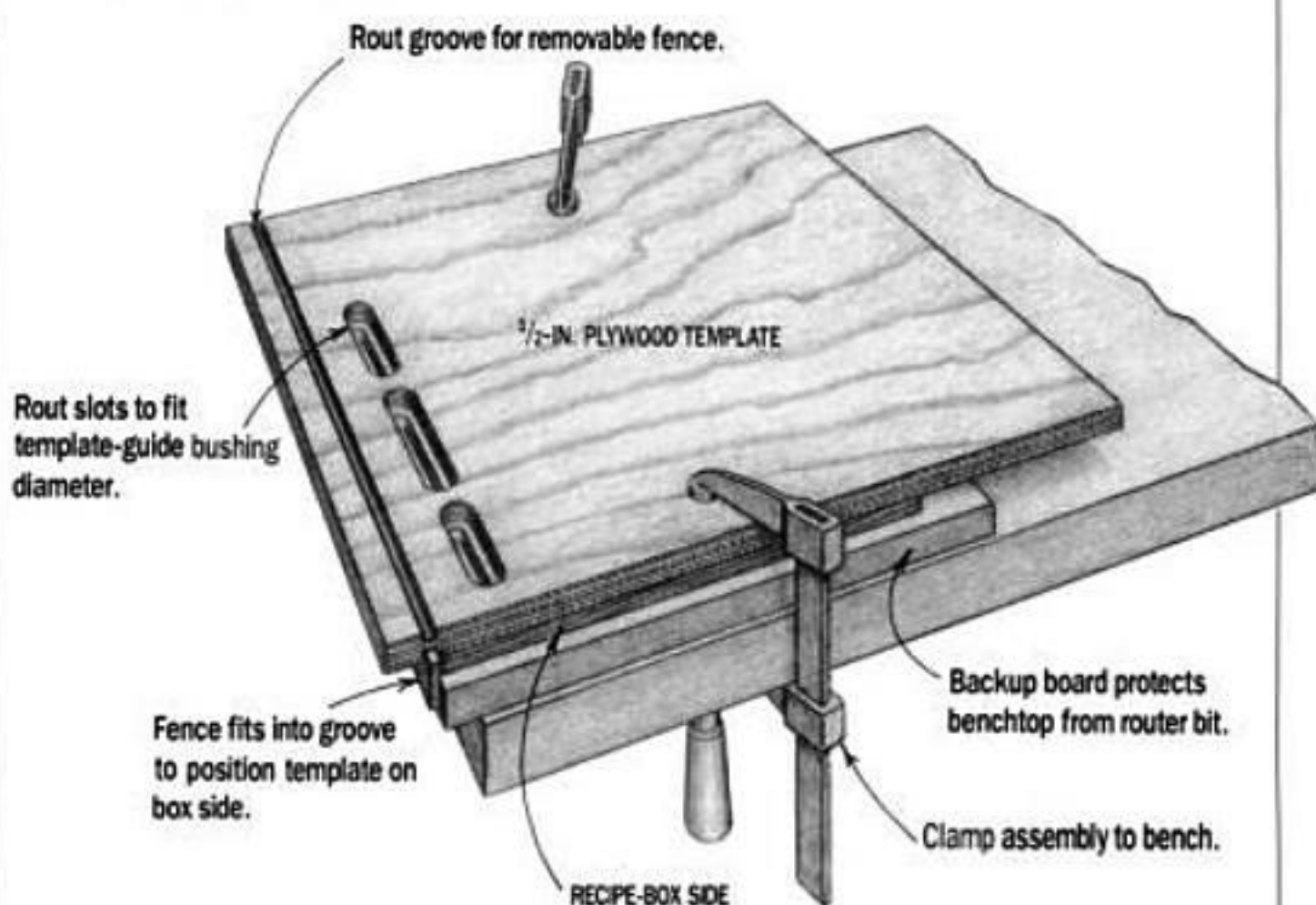
TEMPLATES FOR THE RECIPE BOX

Router templates make quick work of the mortises and the divider slots on these recipe boxes, and that makes these boxes ideal as production projects. These two templates are designed to be used with a template-guide bushing. Rout the slots in the templates to match the diameter of your router's template-guide bushing.

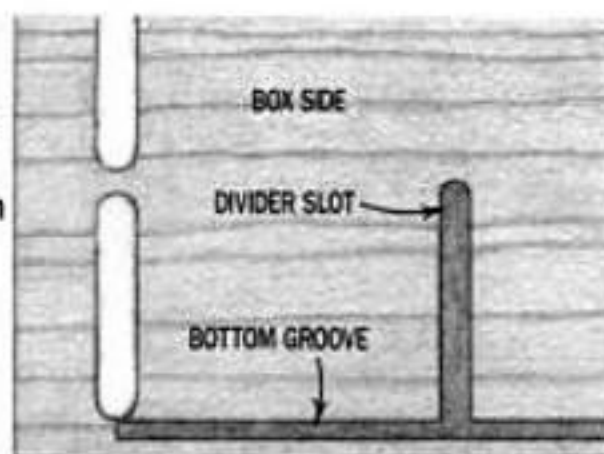
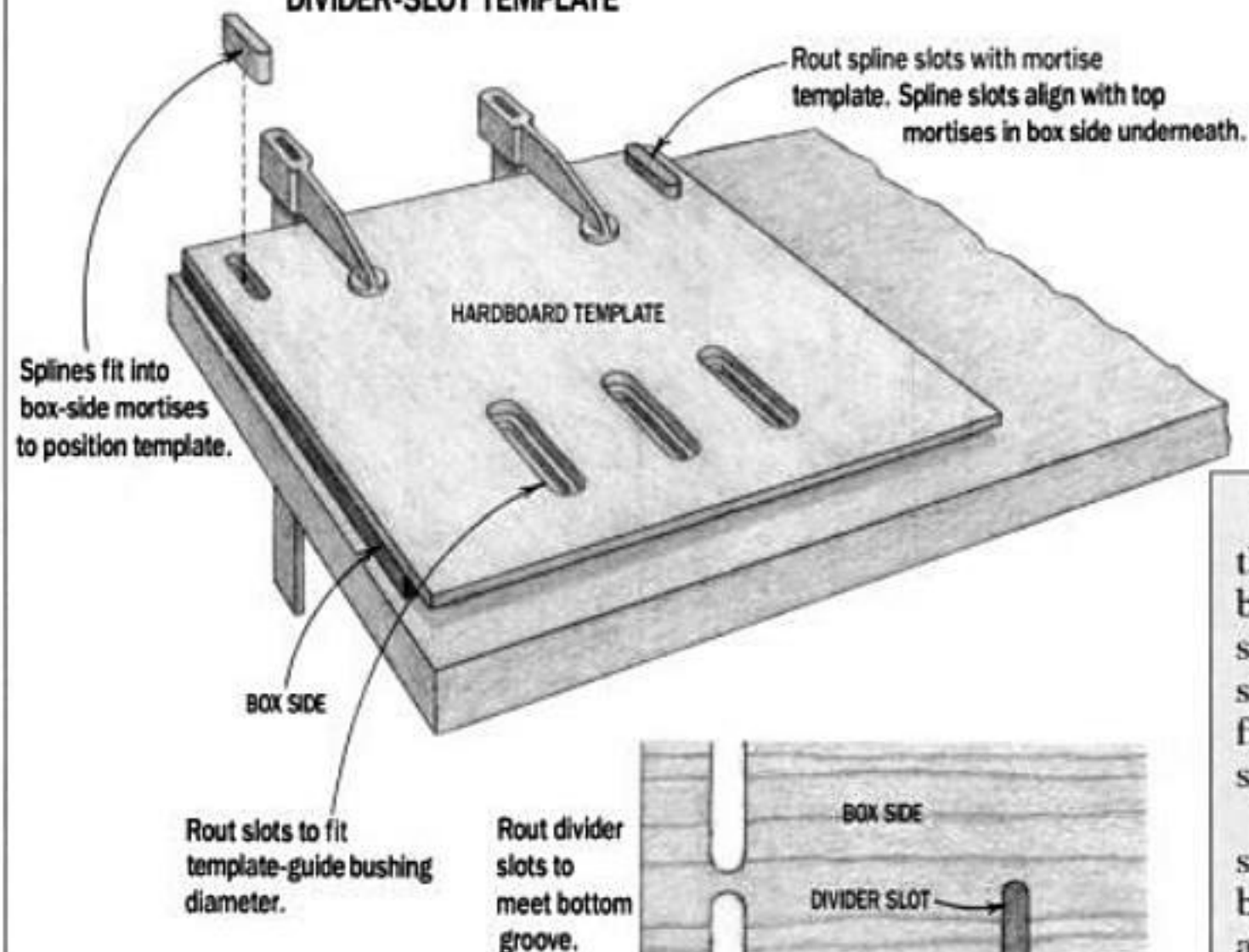
The mortising template is used to rout the mortises in the box sides. The key to the accuracy of this template is that you must *always place it against the inside surface of the box side you're routing*. Once you've done this, insert the fence in the groove on the underside of the template. Position the template by first pushing the fence firmly up against the edge of the box side and then by aligning the bottom edge of the template with the bottom edge of the box side. Clamp the assembly in this position with a backup board underneath as the drawing shows, then rout the mortises. You'll need to flip the mortising template over once (moving the fence to the opposite side) to rout the mortises on the other edge of the box side. Do each box side in this manner.

Be sure you make the template large enough to support the router throughout its travel and long enough to prevent the router from bumping the clamps that hold it to the workpiece.

MORTISE TEMPLATE

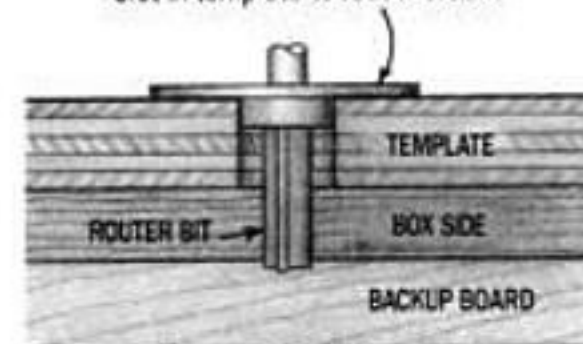


DIVIDER-SLOT TEMPLATE



DIVIDER-SLOT DETAIL

Template-guide bushing follows slot in template to rout mortise.



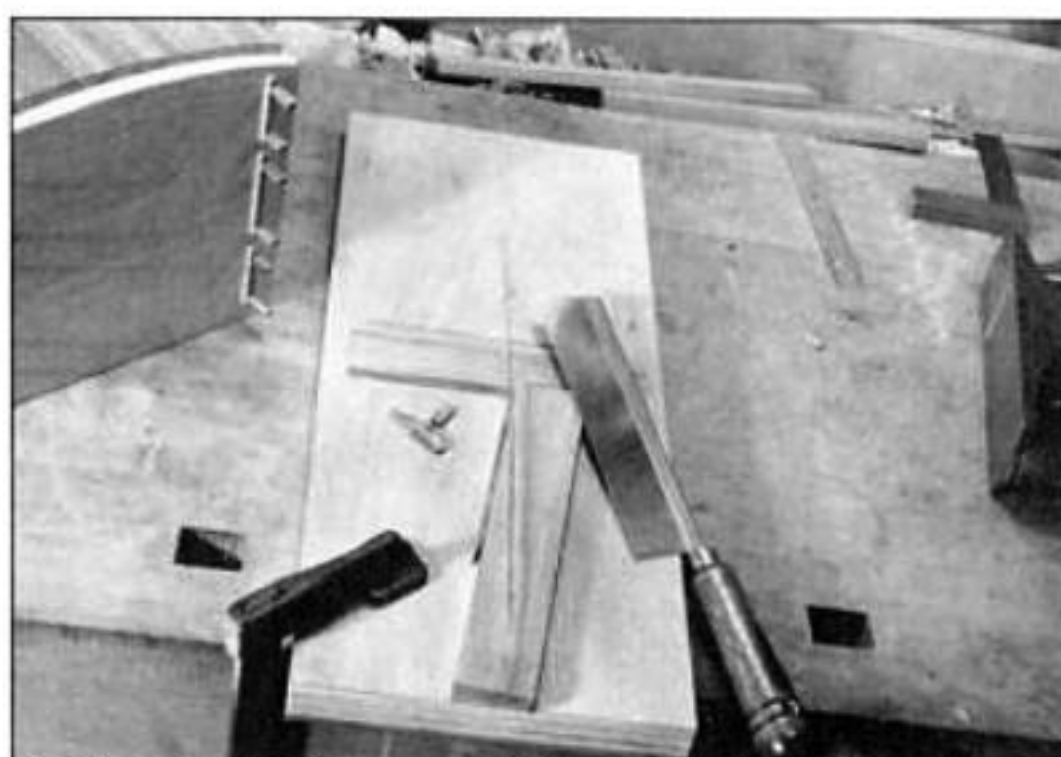
SECTION AT MORTISE

The divider slot template is for routing the divider slots on the inside surface of the box sides. Unlike the mortises, these divider slots do not go all the way through the box sides. Be sure to make the mortise template first, because you'll need it to rout the spline slots in the divider-slot template.

To use the divider-slot template, locate and secure the template to the inside face of the box side by inserting splines the same width and thickness as the tenons through the spline slots in the template and into the upper mortises in the box side as the drawing shows, then rout the divider slots.—P.S.



Saw kerfs in the tenons for the wedges. Don't cut all the way to the shoulder. Leave about $\frac{1}{16}$ in. at the bottom of the tenon.



Sawing wedges to the proper angle is much easier with this wedge-sawing jig. Hold wedge stock against the angled block and saw in the jig's kerf. The angle of the fence to the kerf is approximately 15° .

Before fitting the tenons, clean up the tenon shoulders with a paring chisel. Round the tops and bottoms of the tenons to fit the mortises. I do this by marking through the mortises onto the tenon ends to provide a visual guide. (See photo.) Then I round the tenons with a chisel and a gouge. (Caution: Sometimes the grain on the tenons will cause the gouge to cut deep into the tenon, so take small bites.) Do the final shaping of the tenons with a file that has a "safe" (smooth) edge so you don't accidentally file the shoulders.

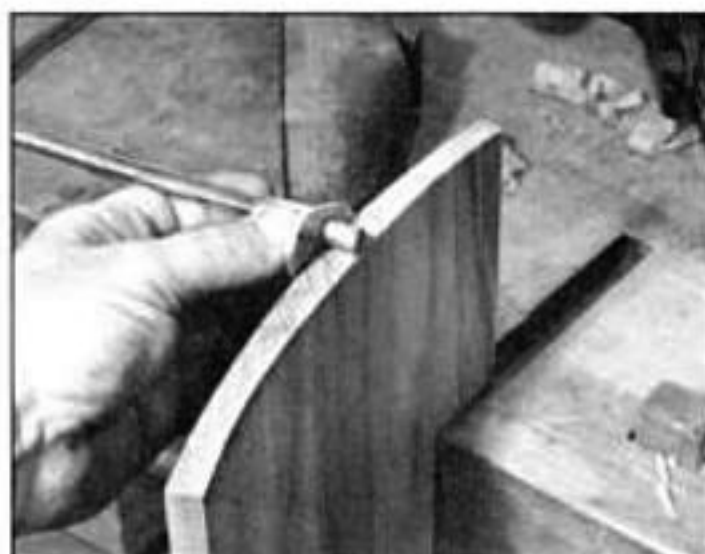
When fitting the joinery, go slow and don't try to force the tenons home. By pushing the joints together a bit at a time, the mortises will "burnish" the tight spots on the tenons. These burnished places are the areas you need to file. Because the tenons are wedged, it's helpful to file the mortises to splay outward slightly at each end. When you drive the wedges in, the tenon will spread to fill the mortise.

After fitting all the tenons, take the box apart and cut the wedge slots in the tenons. I used a backsaw for this. (See photo, above.) Don't cut all the way to the shoulder. Leave at least $\frac{1}{16}$ in. at the bottom of the tenon. Also, if you want proud tenons, this is the time to round the ends of each tenon with a file. (Trying to shape these tenons after glue-up will result in scratches and nicks in your side pieces.)

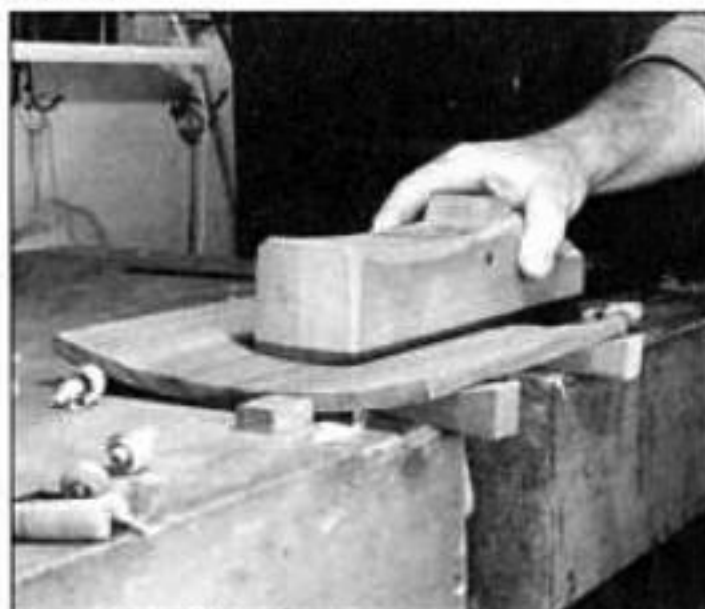
To rout the groove for the bottom panel, first dry assemble the box. Plane the bottom edges of all four sides until they are flush with each other and the box sits flat on your bench. Take the box apart, and on a router table with a fence, cut the



After bandsawing the lid's curve, hand plane it even. A flexible curve comes in handy when doing this.



After planing the top, scribe a line with a marking gauge to mark the curve for the bottom.



Plane the underside of the lid down to the scribe line with a round-bottom plane.

grooves in the box sides and in the front and back to hold the bottom panel. (See Fig. 1.) Dry assemble the box and use measuring sticks (see AW, #17, page 59) to find the exact dimensions of the bottom panel. Cut the panel to size, making sure the grain direction runs from box side to box side. The bottom panel should be snug along its length and allow about $\frac{1}{16}$ in. clearance along its width for wood movement.

Next, rout the divider slots with the divider-slot template. (See sidebar, Templates for the Recipe Box.) Make the dividers. (See Fig. 1.)

Now make the wedges for the tenons. First, rip a strip of wood with relatively straight grain and contrasting color to about $\frac{3}{32}$ in. thick and as wide as the thickness of the tenons. Hand saw this strip into the individual wedges, each about $\frac{3}{4}$ in. long. (You'll cut off the excess length later.) Making the wedges the correct angle is important. If the wedges are too blunt, they'll weaken the tenon. If they're too sharp, they'll bottom out in the kerf before the tenon is snug. I've found the simple jig shown in the photo above makes the task of sawing up wedges much easier. Clean up the wedges with sandpaper backed by a flat surface.

Again, put the box together and place the wedges loosely in the tenons. See that everything fits (bottom, dividers, and joints).

Making the Top

You can make a flat or curved top. If you choose a flat top, the fit of the lid is the same as for the curved top—

the only difference is that you'll need to cut the upper edges of the box's sides flat rather than arc shaped.

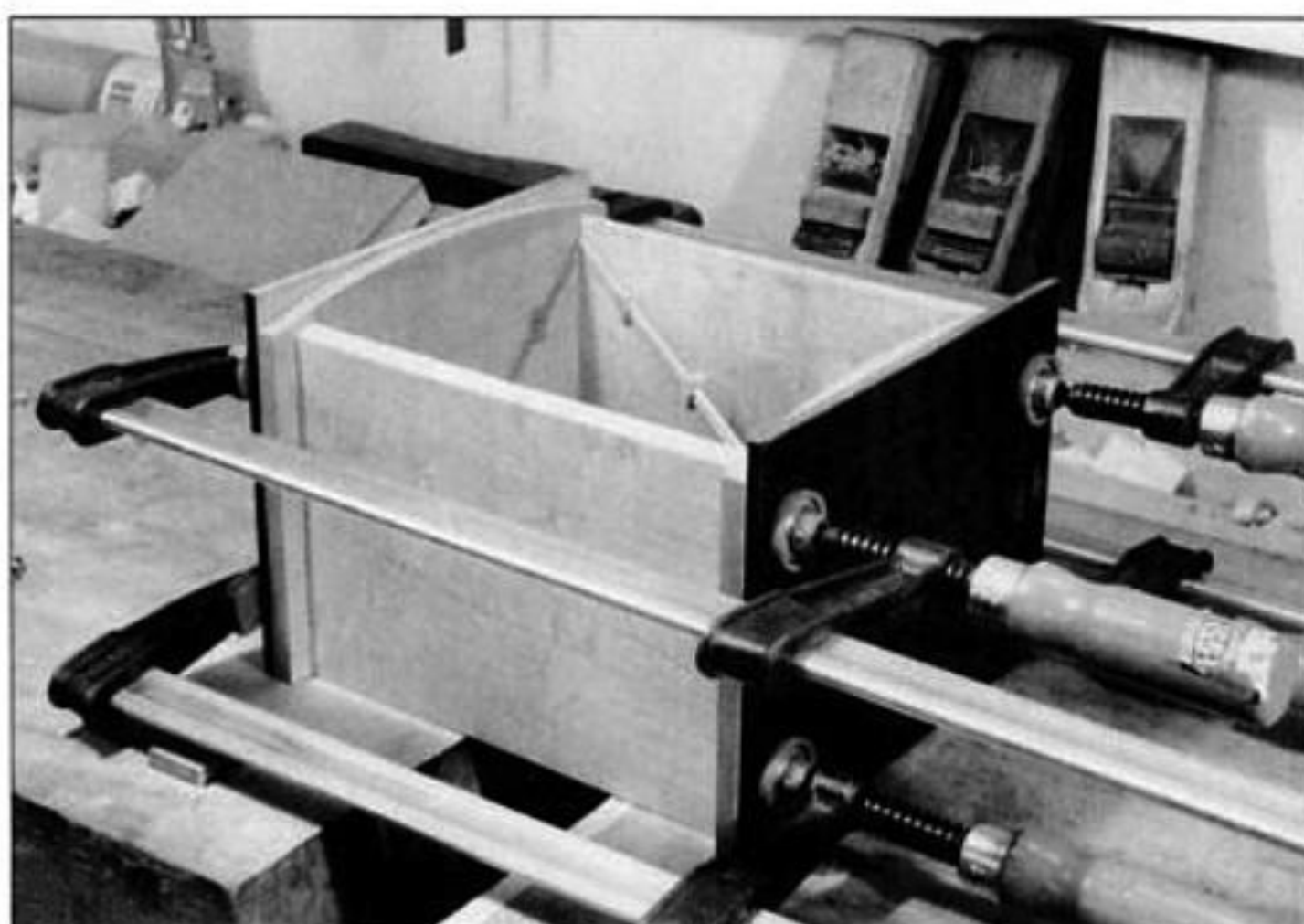
I coopered the top on the smaller of the two boxes shown in the lead photo. I don't have room to cover this technique here. If you'd like a detailed description on coopering, I recommend you read James Krenov's book *The Fine Art of Cabinetmaking* (1977, reprinted by Sterling Publishing, available March 1992).

On the larger box, I cut the curve out of solid stock on the bandsaw. To do this, you'll need a relatively stable wood, thick enough to accommodate the curve and approximately 1/2 in. longer than the dimensions call for. First, cut out the convex (outer) side of the lid and plane it to shape. (See photo, previous page.) Avoid introducing a twist here.

Cut out the concave (inner) side on a bandsaw equipped with a fence. You need to push it through, turning as you go to keep the convex side against the fence at the point of the blade. This will ensure an even thickness. After sawing, set a marking gauge to the desired lid thickness and scribe the edges of the lid, holding the marking-gauge fence against the convex side. (See photo, previous page.) Use a round-bottom plane to plane the concave side down to the scribe line. (See photo, previous page.) Once you're sure the lid edges are parallel and the top has no twist, cut a strip about 1/4 in. wide off one end. Use this scrap later as a test piece to work out the hinge dynamics on your practice corner. Finally, cut the lid to the correct length to fit your box.

Check the fit of the lid on the box. The lid is the same width as the length of the box sides—it should fit between the box sides, resting on the front and back pieces. The front edge of the lid should be flush with the front edges of the box sides. (This means it will overlap the front and back of the box.) You may need to pull the box apart slightly to be sure the lid sits flat on the front and back. If you find a bit of twist in the top and it won't sit flat on both front and back, you can easily plane a bit off the top edge of the front or back of the box to adjust for this. Final fitting of the top is done after glue-up.

The hinges on these boxes are noth-



To be sure the tenons and wedges don't obstruct the clamps during glue-up, make glue boards with openings around the tenons.

ing more than #18 brass escutcheon pins nailed through the sides into the ends of the lid. (See Fig. 1.) You can find brass escutcheon pins at any good hardware store. I recommend you first work out the exact placement of the hinge pin on the practice corner. While working out the hinging, I substituted #18 steel brads because they're easier to insert and remove. If hinged properly, the lid will open and stop just past vertical, creating an ideal place to prop a recipe while you're cooking. Be sure to drill a snug pilot hole for the pins in the position shown in Fig. 1 or the lid won't work properly. Once you've worked out the lid, bandsaw the curve (or the flat) on the upper edges of the box's sides.

Finish and Assemble the Box

Sand all box surfaces and soften all edges. Before glue-up, apply your choice of finish to the inside of all the box pieces (except for the lid) and the outside of the front, back and bottom pieces. I used shellac as a sanding sealer and polymerized tung oil for the top coats. Masking tape can protect glue surfaces from any finishing materials.

Now it's time to glue the box together. Anticipate your clamp-

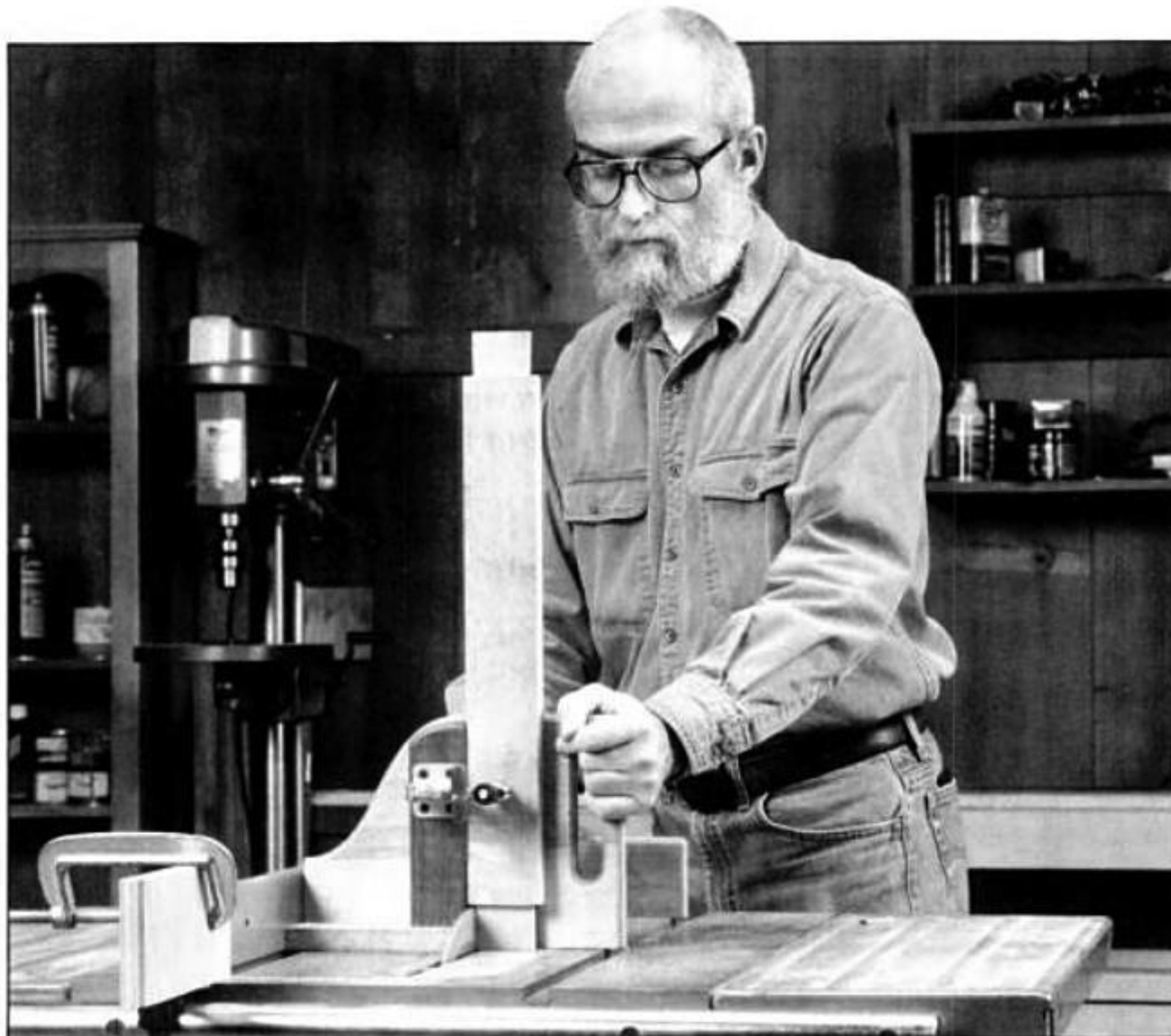
ing needs before you start spreading the glue. You'll need to make clamping blocks that prevent the wedges and tenons from getting in the way of the clamps. I found it helpful to make a pair of glue boards out of scrap hardboard. (See photo.) I routed slightly oversized mortises in these glue boards to fit over the tenons. I also made a thinner version of these boards out of formica to act as shields for the box sides when I sawed and filed the wedges flush with the tenons.

Apply glue only to the mortises and tenons, not to the bottom or the dividers. Clamp the joints tight. Remove the clamps while the glue is still wet and carefully glue and tap in the wedges. Finally, replace the clamps, avoiding protruding wedges.

Once the glue has dried, saw off the extra length on the wedges. Saw the tenons off close to the surface of the box sides and plane them flush. Or, using your "protective formica shields," saw and file the wedges flush with the protruding tenons. Do the final fitting of the lid. When satisfied, apply finish to the box sides and lid. When the lid is dry, mount it on the box with the hinge pins. ▲

Patrick Stafford is a professional woodworker in California. He wrote about homemade hardware in AW, #12 and making a jewelry box in AW, #17.





A good tenoning jig and consistent work methods will help you cut precision tenons with a perfect fit.

PHOTOS BY MITCH MANDEL

TENONS ON THE TABLESAW

Tips for Cutting Better-Fitting Tenons

BY BOB MORAN

Cutting a mortise-and-tenon joint that glues well is a challenge. A good, solid glue bond requires long-grain-to-long-grain contact. (Glue doesn't bond well to end grain.) In a mortise-and-tenon joint, the only place long-grain contact occurs is between the tenon cheeks and the sides of the mortise. (See Fig. 1.) For a strong glue joint, the tenon must be just the right thickness to slide into the mortise snugly, but not too snugly, and the tenon cheeks must be smooth and parallel to the sides of the mortise.

Getting the mortises right is easy. With today's spiral router bits, a careful beginner can cut mortises that are smoother, more accurate and more consistent than the hand-cut mortises of a master craftsman. Making tenons that are equally precise, however, isn't quite that simple.

I've tried making tenons a number of ways during the years. Through trial and error I've settled on some tablesaw techniques that give me consistently accurate tenons.

There are three distinct cuts that make up a tenon: shoulder cuts, cheek cuts and edge cuts. I'll describe the techniques in the order that I make the cuts.

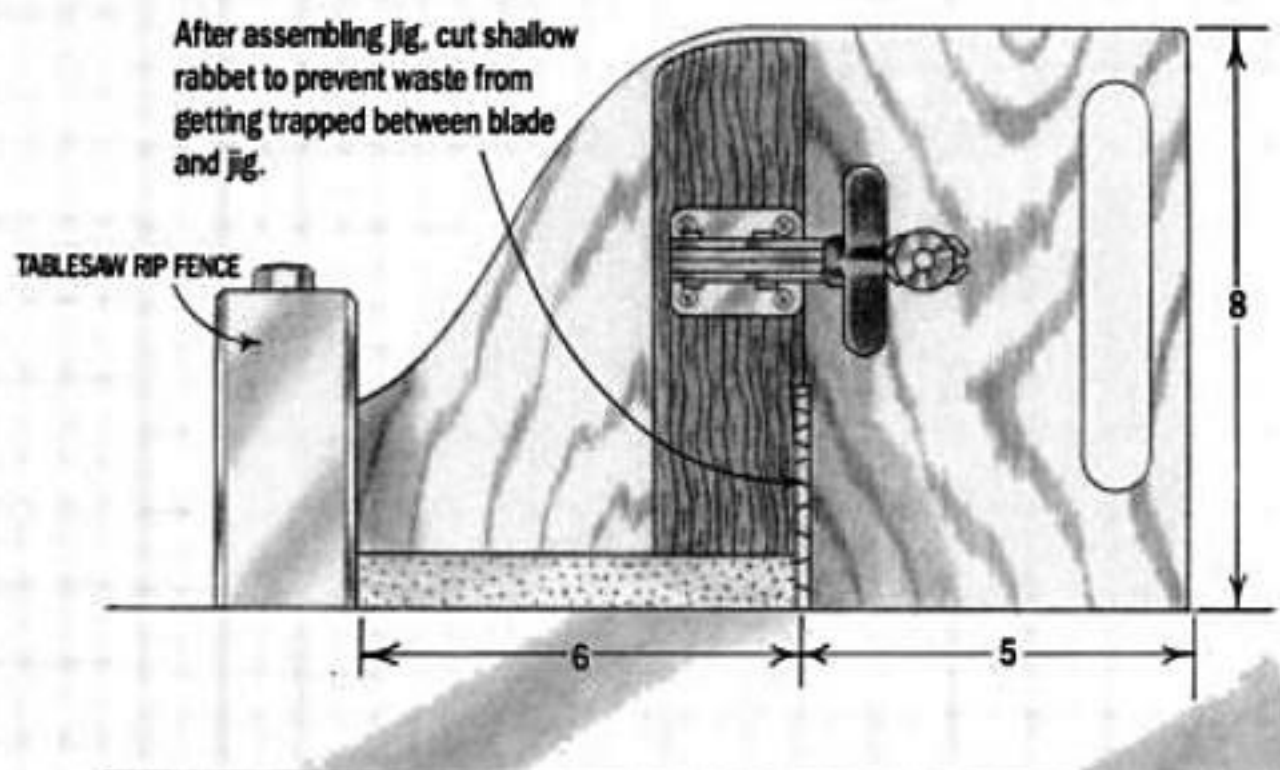
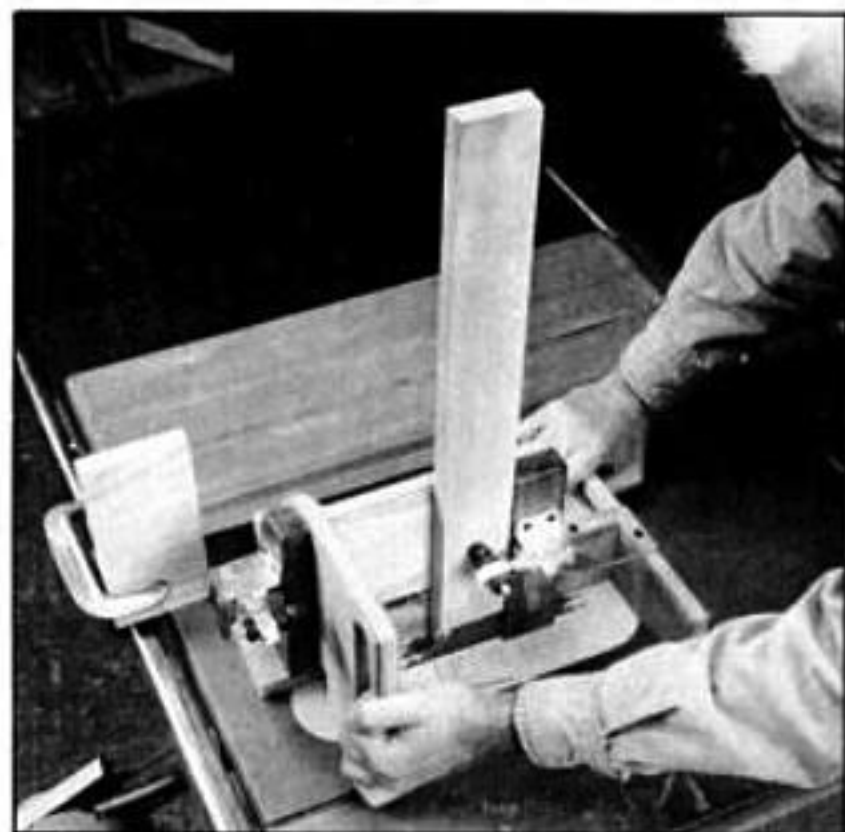
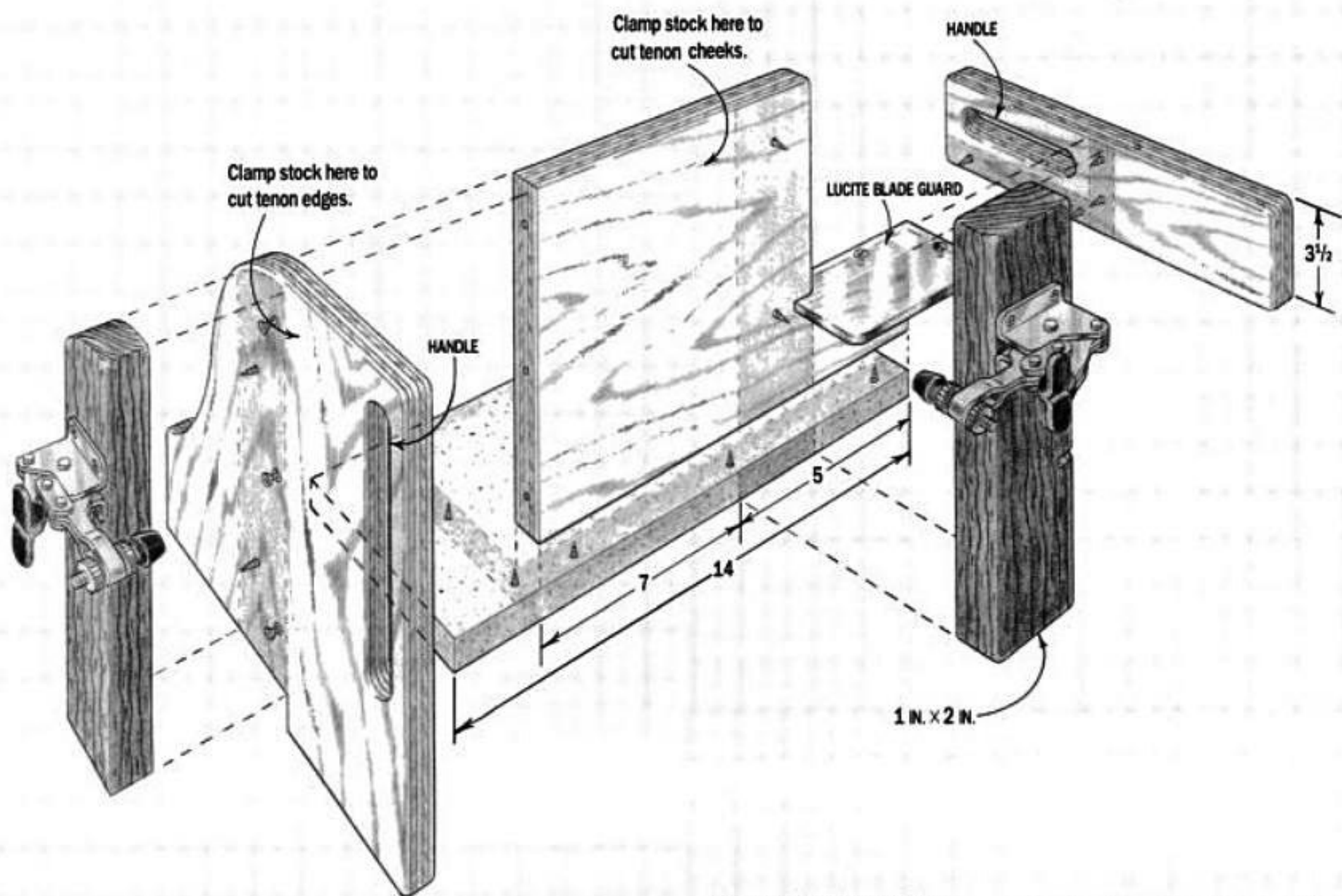
Shoulder Cuts

I cut the tenon shoulders first. Clean, accurate shoulder cuts are important for final appearance. They also add to strength by providing a good bear-

TENONING JIG

A well-designed tenoning jig helps you cut tenons safely with consistently accurate results. Unlike some jigs that straddle the rip fence, my jig rides against the side of the fence, eliminating side-to-side play. The big, flat base prevents the jig from tipping when I'm cutting the cheeks on a long piece of stock. The handles provide a safe place to grip with my hands well away from the blade. Clamps hold the stock securely on end.

One word of caution: Tablesaw-blade guards don't work in conjunction with a tenoning jig. I designed a few guards and shields to protect me from the blade. Exercise caution when using this or any other tenoning jig.—B.M.



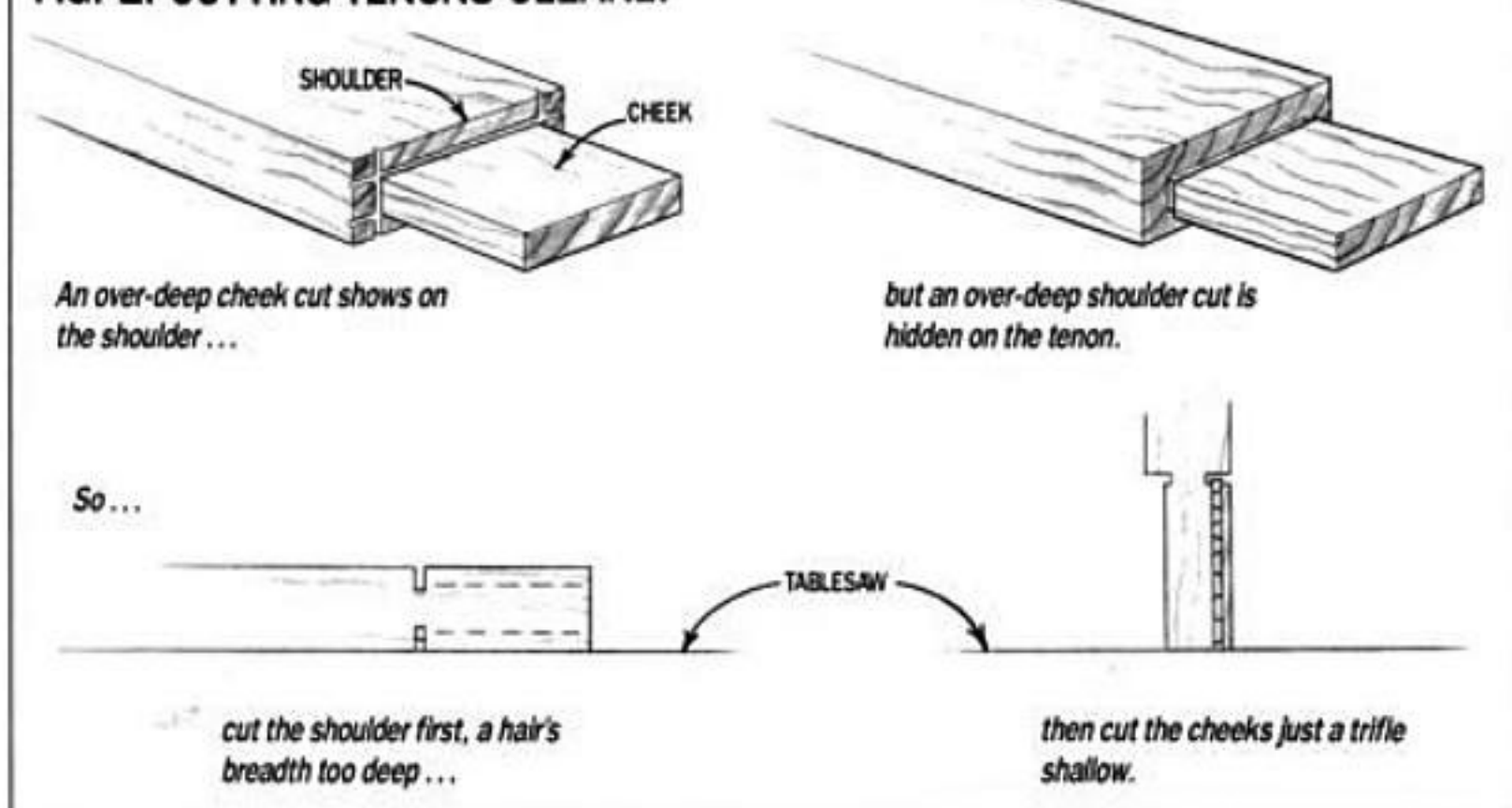
ing surface. For a smooth cut and a minimum of tear-out, I use a 60-tooth carbide crosscut blade with an alternate-top-bevel (ATB) grind. (See AW, #13 for more on carbide saw blades.)

A tenon has to have a clean, square corner where the shoulder cuts and cheek cuts meet. The ideal would be to have the shoulder and cheek cuts meet exactly, accurate to within the thickness of a wood cell. The real-world way to avoid a lot of cleaning up with a utility knife is to cut the shoulders a hair's breadth over-deep as shown in Fig. 1. To do this, I raise the blade a bit higher than the width of the shoulder.

I use a miter gauge to feed the stock into the blade. I prefer this method because it allows the stock to slide directly onto the saw table, giving me the most consistent depth-of-cut. A sliding table would be even better.

I position the tablesaw's rip fence to determine the length of the tenon. I then position the stock against the miter gauge and butt the end against the fence. To check

FIG. 1: CUTTING TENONS CLEANLY



fence as shown in the photo.

If the blade leaves score marks on the shoulders, I check that the saw blade is parallel to the miter-gauge slot. If it isn't, I get out my tablesaw manual and correct it. (See AW, #9 July/August, 1989 for more on tablesaw tuneup.)

Second, I check the miter gauge for side-play in the slot. If I detect any play, I raise little dimples along the side of the bar with a center punch and hammer.

Third, I make sure the rip fence is parallel to the miter-gauge slot and is solidly locked in position. If I'm not certain that the fence is perfectly parallel, I clamp a stop block to the fence and butt the end of the tenon stock against the stop block instead of the rip fence to determine the length of the tenon. I hold the stock securely to the miter-gauge fence during the cut.

Cheek Cuts

The cheek cuts determine the thickness of the tenon—the critical tenon dimension for a good, strong glue joint. The tenon must be thick enough to fit the mortise snugly without being too tight. I strive for tenons that fit in the mortises with firm finger pressure but not so tightly that I need to apply thumb pressure. It may seem like nit-picking, but that's what distinguishes a good glue bond from a mediocre one.

I make the cheek cuts with the workpiece on end, held in a tenoning jig that rides against the rip fence. (See Fig. 1.) To get the best-fitting tenons, I cut both cheeks in a single pass with two identical saw blades separated by accurately machined spacers. I've cut tenon cheeks with a single blade in the past (I'll explain how a bit later), but I was so impressed with the consistent accuracy of this two-blade method that I now use it routinely.

You can buy blade spacers manufactured by Delta, or a local machine shop or amateur machinist can make them for you. (Delta spacers, #34-171 are available from Seven Corners Ace Hardware, 216 W. Seventh St., St. Paul, MN 55102, 800-328-0457.)

I use sharp rip blades with no more than 24 teeth. A blade with more teeth is likely to overheat and burn the wood. The two saw blades must be exactly the same diameter (not all saw blades are). I bought a pair of identical blades and use them only for cutting tenon cheeks.

Make sure the miter-gauge fence is square with the miter-gauge bar with an accurate square.



The miter gauge and rip fence both contribute to consistently accurate shoulder cuts. A 60-tooth alternate-top-bevel grind crosscut blade makes a smooth cut with minimum tear-out.



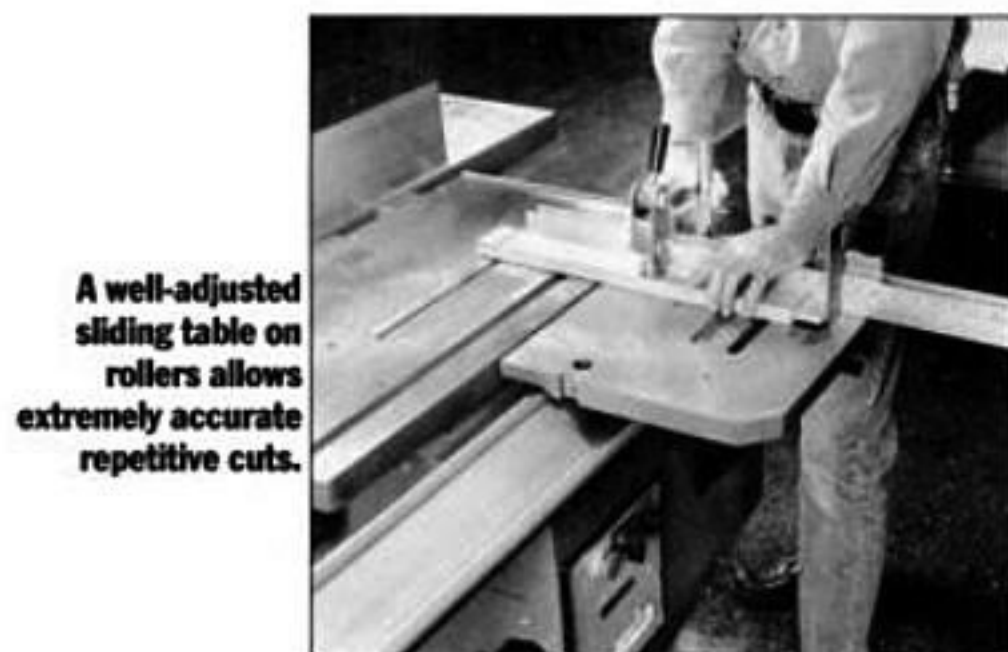
the setup, I make four shoulder cuts on a test piece.

If the shoulder cuts don't come out smooth and perfectly flush with each other, I check the following trouble spots:

First, I check to see if the fence on the miter gauge is absolutely square with the *direction of travel*, that is, square with the miter-gauge bar. I check with an accurate square held against the miter-gauge bar and the

To check the diameter of your saw blades, mount them on the saw with the spacers between them. Adjust the blade height to about $\frac{3}{8}$ in. above the table, and crosscut a piece of $\frac{3}{4}$ -in. thick stock. The depth of the kerfs made by the two blades should differ by no more than half the width of the saw kerf.

Thin-kerf saw blades are a good idea on a moderately powered tablesaw. Making two cuts simultaneously takes twice as much power. Because they cut a narrower kerf, using thin-kerf blades requires less motor power.



A well-adjusted sliding table on rollers allows extremely accurate repetitive cuts.

Mounting the blades on the saw is much like mounting a stack-dado head. The thickness of spacers between the blades must equal the tenon thickness plus twice the *tooth-side clearance* (the amount the teeth overhang the saw plate).

I make a new wooden table insert for the saw and bring the two spinning blades up through the insert. I then test the spacing of the blades by making a trial cut with the tenoning jig. I use the same species of wood as my project. In this way, the trial cuts duplicate the cuts in the furniture parts as closely as possible.

I test the fit of the trial tenon in the mortise and adjust the thickness by adding or removing paper shims between the blades and the spacers. I have to lower the blades and bring them up through the wooden table insert each time I readjust the spacing.

When I get the spacing right, I adjust the height of the blades. As shown in Fig. 1, I adjust the height of the blade to cut into, but not beyond, the kerf from the shoulder cut.

With the blade spacing and height adjusted, I adjust the saw fence to correctly position the tenon on the end of the workpiece (centered or offset, depending on my design). After making another test cut to check the setup, I cut the tenon cheeks on the furniture parts.

To simplify the duplication of setups for future use, I mark the spacers and shims that give me tenons that fit mortises cut with specific mortising bits.

To cut the cheeks with a single blade in two separate passes, I adjust the height of the blade as shown in Fig. 1 and adjust the rip fence to cut the cheek nearer the "finish," or outside surface of the workpiece. This is the cheek that determines whether the tenon piece and mortise piece will be flush on the front.

When the setup for the first cheek cut is right on the money, I cut several test pieces to use later for setting up the other cheek cut. I then make the first cheek cut on all

my furniture parts.

The setup for the second cheek cut determines the thickness of the tenon. To get just the right fit, I make the final fine adjustments by applying wide masking-tape shims to the surface of the tenoning jig where the stock is clamped. It's much easier to adjust the cut a few thousandths of an inch with a masking-tape shim than to try to make that fine an adjustment by moving the saw fence. When the test piece fits the mortises, I cut the second cheek on all my tenons.

Edge Cuts

The third and final cuts, the edge cuts, determine the width of the tenons.

For square-edged tenons, I use a single blade on the saw, making a separate pass to cut each edge and holding the stock on end in the tenoning jig. I set up the saw as described above for cutting the cheeks with a single blade. I can't use the two-blade technique for making the edge cuts because the saw arbor is too short to space the blades far enough apart. Besides, precision in the width of the tenon isn't critical because the end grain in the mortise prevents a good glue bond no matter how good the fit.

Round-edged tenons are a different story. I usually want tenons with round edges to match the round ends of router-cut mortises. The tablesaw can't cut the round edges, so if I'm cutting a half-dozen or fewer tenons, I simply round the edges with a chisel. If I have to round over the edges of more than a half-dozen tenons, I set up a half-round (bull nose) cutter on the router table. The router bit won't cut all the way up to the shoulder without ruin-



Two blades with accurately machined spacers between them cut the most accurate tenon cheeks.

ing the shoulder, but it serves two useful purposes. First, it removes the bulk of the material, leaving less hand work. Second, it provides a guiding shape for finishing up the cut with a chisel.

When I cut the shoulders for round-edged tenons, I cut them deep enough that I won't have to chop end grain when rounding the tenon edge. The small notch that's left won't weaken the tenon significantly.

There you have it; the cuts that produce a precision tenon. To get the best possible glue bond, I assemble the joints with glue as soon as possible after cutting the tenons. Wood movement from humidity changes could destroy the fit I've taken such care to achieve. ▲

Bob Moran ran a professional shop in Middletown Springs, Vermont before becoming assistant editor of AW in 1990.

FOUR RULES FOR PRECISION CUTS

Make these rules a habit and you'll find that precision woodworking becomes the routine, not the exception. The principles apply to a wide range of sawing, routing and machining operations.

Rule 1: Reference (that is, measure from) the minimum number of surfaces when making a cut.

This prevents several small inaccuracies from adding up to one that's big enough to be noticed.

Rule 2: Test every setup by making a trial cut and checking the fit of the sample to make sure that it's right.

It's tempting to test a setup, discover it's off a hair, adjust it a hair and then cut the workpiece without testing the second setup. Always test the final setup.

Rule 3: Make sure all adjustments are locked solidly.

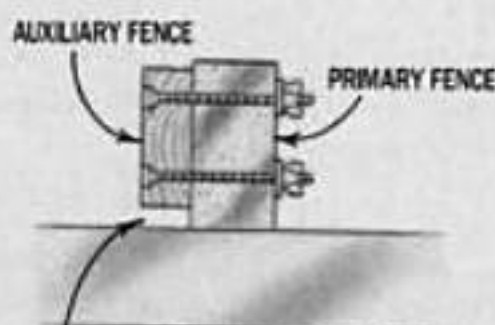
Nothing is gained by an accurate setup that wanders. A stop block held with a spring clamp can move a tiny bit each time you register a piece of wood against it. To prevent movement, clamp the block with a small C clamp, or glue sandpaper to one face of the stop block and clamp the sandpapered side against the rip fence.

Rule 4: Keep all reference surfaces free of debris.

Since corners are particularly difficult to keep clean, always arrange a place for the debris to go by raising auxiliary fences and stop blocks up off the saw table. (See drawing.) This provides a gap underneath the fence or stop block for sawdust to accumulate.

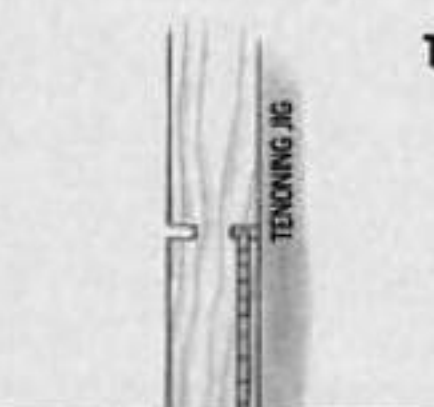
Another little trick for keeping debris from interfering with a setup is to fit stop blocks with pan-head sheet-metal screws or machine screws. When cutting, simply butt the stock against the

screw head itself. This leaves a space for debris to collect without getting in the way. Another plus is that you can make very small adjustments by turning the screw.—B.M.

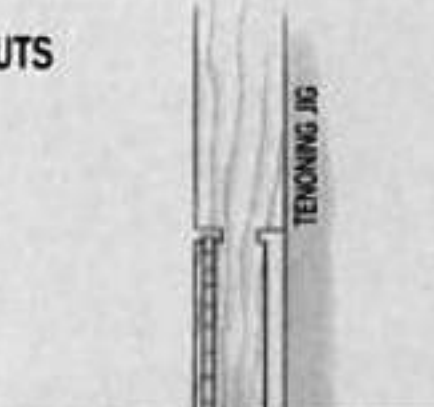


Space under auxiliary fence on table saw allows room for debris to escape.

TENON-CHEEK CUTS RIGHT WAY

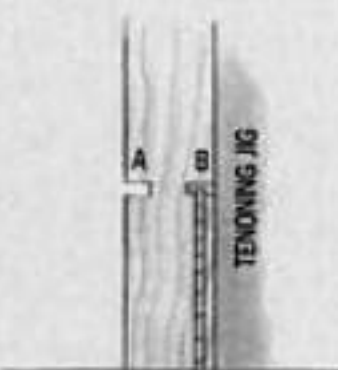


Adjust the saw and tenoning jig for the first cheek cut ...



then readjust for the second cut, referencing the same surface ... because ...

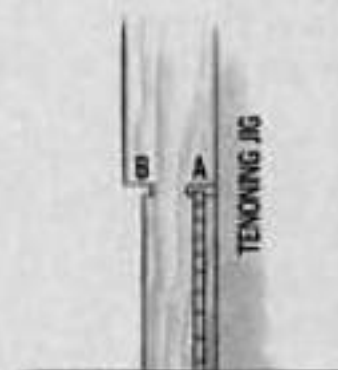
WRONG WAY



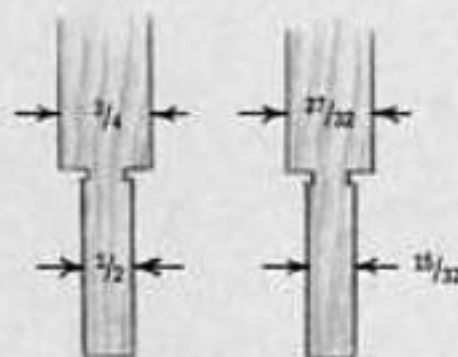
if you set up the saw to cut one cheek ...



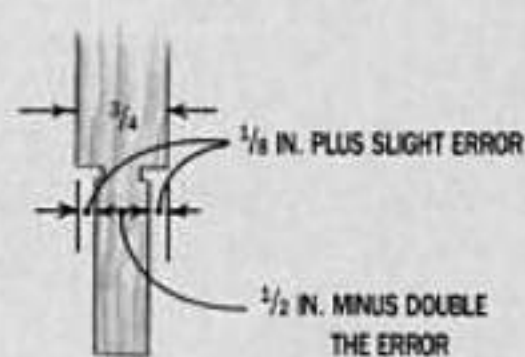
then reverse the piece ...



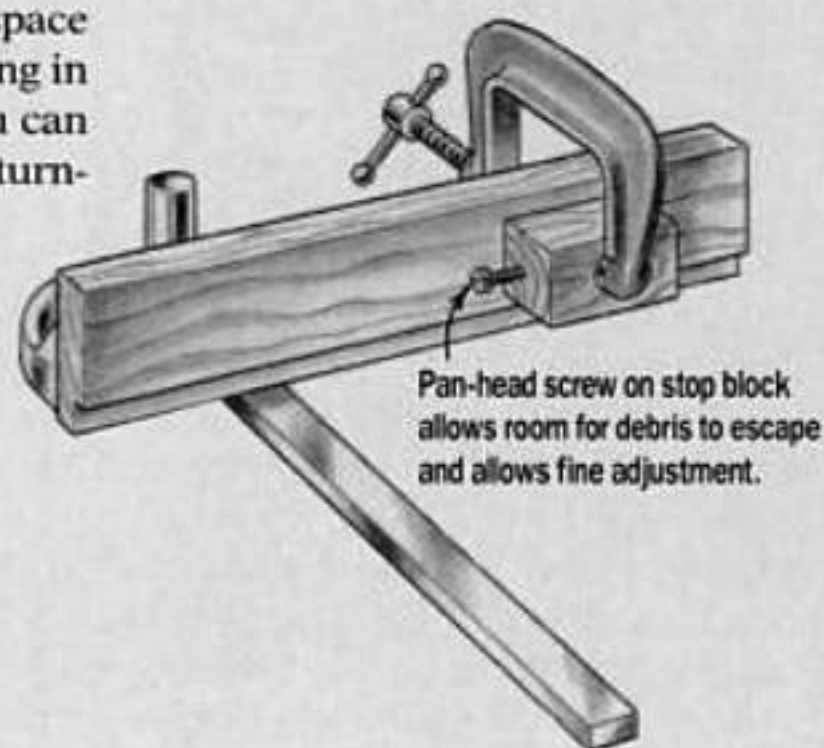
to cut the second cheek ...



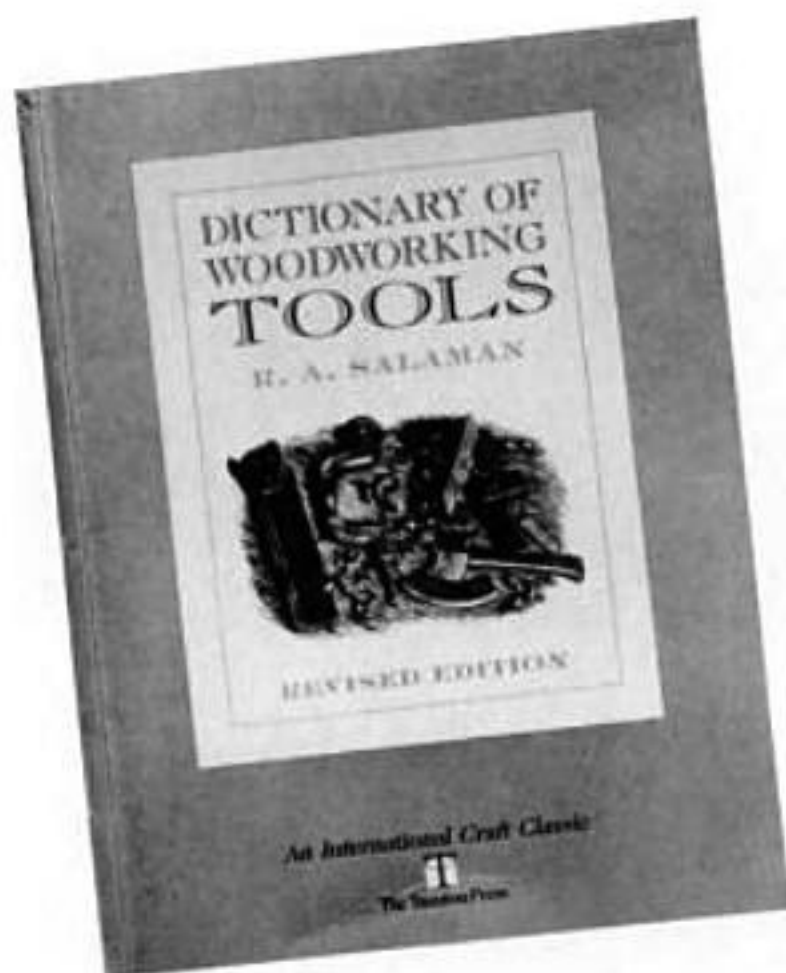
workpieces that vary slightly in thickness will have tenons that vary ...



and any minor error is doubled in the tenon thickness.



Pan-head screw on stop block allows room for debris to escape and allows fine adjustment.



BOOK

Dictionary of Woodworking Tools

by R. A. Salaman

(1990, Taunton Press, Box 5506, Newtown, CT 06470) 546 pp.; softcover, \$27.95

Thanks to the efforts of some devoted researchers, there now are many books on the subject of antique woodworking tools. A few deal with wooden planes, and another is a study of patented metal planes. There are other books on Stanley tools and another on wooden rulers.

One of the earliest and best books is R. A. Salaman's "Dictionary of Woodworking Tools," which has been the standard reference book for tool collectors since it was first published in 1975. The expanded Taunton Press edition, published in 1990, includes the knowledge and expertise of an additional 50 woodworkers, which enriches this book as a tool reference guide. It is likely to become popular with tool users as it becomes more widely known.

In the original version, Salaman's goal was to record and describe all woodworking tools from about 1700 to the present. (Modern tools have been ignored as this is actually a history of traditional tools.) Like other dictionaries, the book has its critics, but most scholars and collectors

believe Salaman performed an invaluable service by organizing and recording what is known about hand tools.

Salaman was not content to do a cursory study. He devoted eight pages to adzes alone, and 77 pages to planes. Each traditional tool is studied with equal care.

That a new edition of Salaman's book is available right now is appropriate. Many amateur (and professional) woodworkers have become acutely aware of the health and safety hazards of power-tool woodworking. Those who do woodworking out of the love of the craft have little incentive to jeopardize their health. Traditional hand tools also make for a more pleasing experience when working wood. Could any screaming router match an old molding plane for sheer pleasure in use?

Whether you work entirely with hand tools or with a mix of power tools and hand tools, it's unlikely that you could pick up this book and not learn something. . . and isn't that one of our ongoing goals in mastering the craft?

ANDY BARNUM

BOOK

Woodturning: A Foundation Course

by Keith Rowley

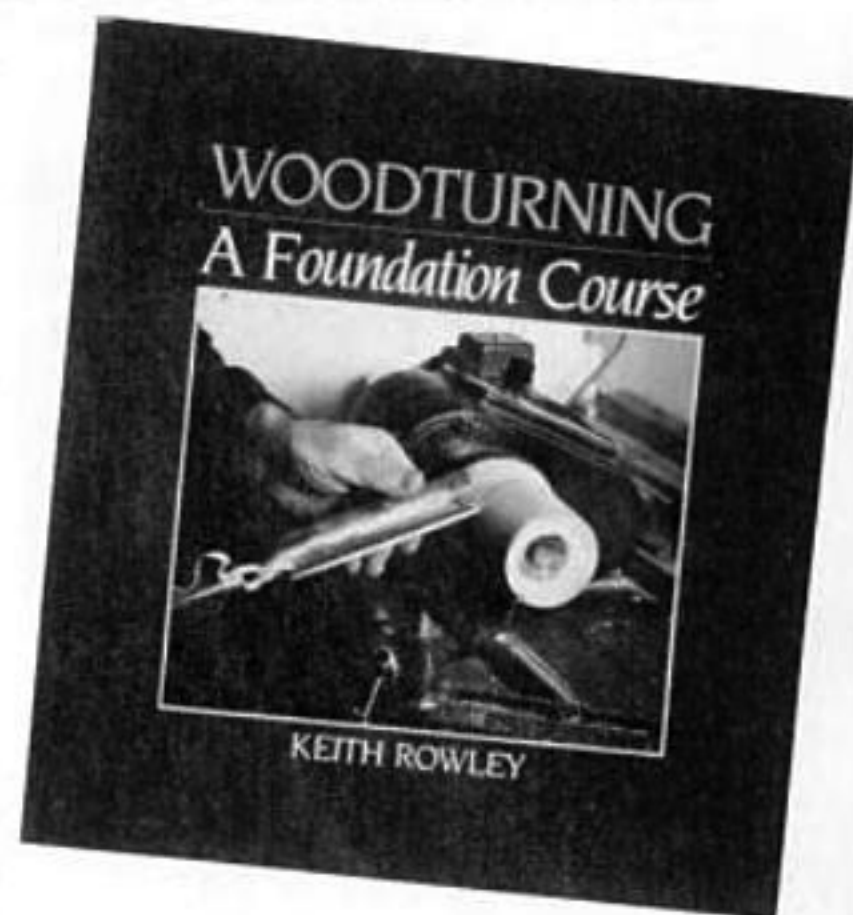
(1989, Guild of Master Craftsmen Publications Ltd. Distributed by Garrett Wade, 161 Ave. of the Americas, New York, NY 10031) 160 pp.; softcover, \$14.95

During Keith Rowley's 20 years as a policeman, he honed his ability to take the essence of a situation and commit it logically to paper. Both the structure and the clarity of *A Foundation Course* seem the result of that work. He's also a keen observer of human nature, and through his years of doing and teaching woodturning, he has developed the very best qualities of the insightful educator. This book is as close as one is likely to get to the assurance and

intimacy of personal instruction.

As with the best of beginner courses, Rowley assumes that you have an interest, and darn little else. Each chapter opens with anecdotes, which help establish a personal connection. The chapter then develops the basic concepts and skills taught in the section, and concludes with a summary of the main points. We are treated to exceptionally clear drawings and diagrams that, like the photos, deal with the three-dimensional spatial aspects of the turning experience—a notable accomplishment.

We are introduced to wood as a material along with some of its qualities and problems. What follows is a discussion of lathes, basic tools and the operations. His "Five Laws of Woodturning" are a unique contribution, and as with everything in this book, they are crucial bits of information presented in a clear, understandable way. Common sense is the main



ingredient here, and wisely dealt with as if it weren't so common.

Weaknesses are few. Grinding wheels for sharpening are well covered, but there's no mention of the speed at which they should be operated. A simple, effective grinding jig is explained, but, at the same time, is there a need for a how-to on building a lathe bench?

Given the world readership that this book is likely to enjoy, it seems naively provincial to discuss local timbers

BOOKS & VIDEOS

(of Great Britain) and to present "types of lathes" as a few particular English brands.

Woodturning: A Foundation Course is a rare book that introduces the joy of the craft to the beginner with no pretenses toward more complex issues. If you have an interest, but lack the confidence to take the plunge, or if the other introductory books look too stiff or heavy-handed, get yourself a copy of *A Foundation Course*.

STEVE LOAR

VIDEO

Ultralight Boatbuilding

with Thomas J. Hill

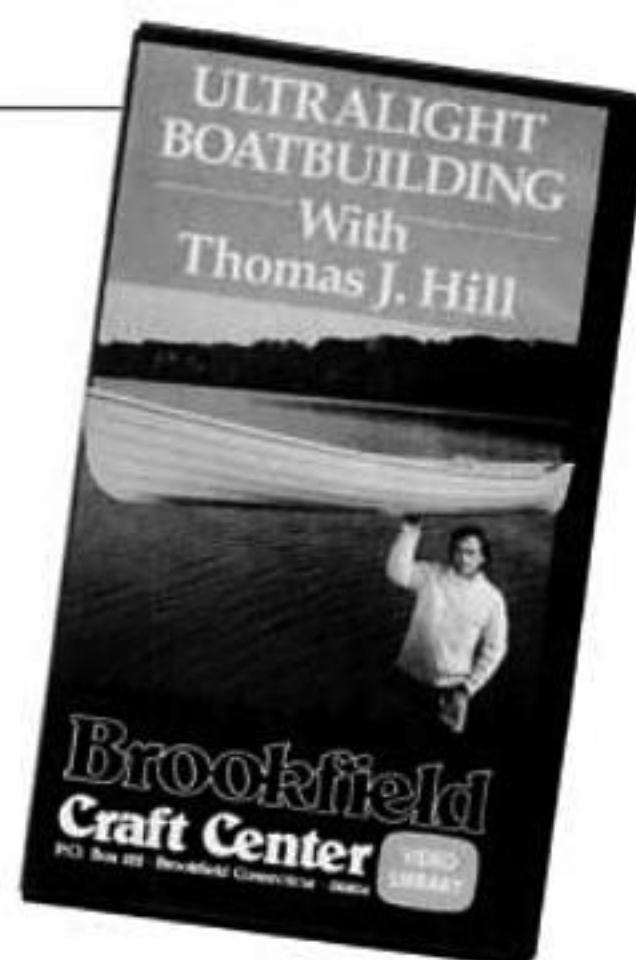
(1990, Brookfield Craft Center, Inc., P.O. Box 122, Brookfield CT 06804) 135 min.; VHS, \$49.95

This two-hour video covers the entire process of building a lightweight, plywood lapstrake canoe. Thomas Hill starts with some brief comments on lofting, defines several boatbuilding terms and then proceeds to build the strongback and molds. From there he continues at a leisurely pace through planking, and installing the breast-hooks, gunwales and backrest. He then moves on to finishing. Making paddles is not covered in the video.

Along this route are several useful digressions on tool sharpening, Japanese saws, epoxy and planes. Hill emphasizes safety throughout—whenever there is a chance of injury, a warning briefly flashes on the screen.

The video comes with a table of contents (timed to the second) so you can find a particular sequence. A list of suppliers of tools and materials in North America is also included.

Keep in mind that you can't build the boat simply by following the video.



It would be necessary to first buy the blueprints from the Hill Family Boatbuilding Co. in Vermont.

I think that this tape offers an excellent example of a straightforward instructional video. It's not easy to find craftspeople with both the technical skill and the ability to speak confidently in front of a movie camera. Fortunately, Hill can do both.

SIMON WATTS



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Cigar Box, by Nelson R. Krupp Jr.,
Roslyn, Pennsylvania. Red-oak
plywood, teak, walnut, lead.
Dimensions: H: 8 in., W: 12 in., D: 9 in.
NELSON R. KRUPP JR.

Coffee Table, by Paul Anthony,
Bodega, California. Bubinga.
Dimensions: H: 18 in., W: 20 in.,
L: 46 in.
PAUL ANTHONY



Lion's-Head Fireplace Mantel, by
Jim Starchuk, Ontario, Canada.
Basswood. Dimensions: H: 67 in.,
W: 67 in., D: 20 in.
JIM STARCHUK

Rocker With Cradle, by
Glenn H. Bostock,
Rushland, Pennsylvania.
Walnut, cherry.
Dimensions: H: 40 in., W:
53 in., D: 21 in.
GLENN H. BOSTOCK



GALLERY



Jewelry Box, by Paul Anthony, Bodega, California. Padauk, wenge. Dimensions: H: 7 1/2 in., W: 10 in., D: 8 in.

PAUL ANTHONY

Settee, by Edward F. Rizzardi, Upland, California. Walnut. Dimensions: H: 26 in., L: 40 in., D: 26 in.

HUDSON PATE



Turned Vessel, by Robert M. Richter, New York, New York. Swiss pear, ebony, purpleheart. Dimensions: H: 4 1/2 in., Dia: 10 1/2 in.

ROBERT M. RICHTER

Oak Table, by Paul Anthony, Bodega, California. Oak. Dimensions: H: 24 in., W: 24 in., D: 16 in.

PAUL ANTHONY



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



Not Just Peanuts

Finally, there's an environmentally safer alternative to those ubiquitous little Styrofoam peanuts—you know, those white packing puffs that cushion items during shipping.

Developed by a food engineer, the "natural" packing pellets are made of corn starch, wheat starch, and water. That's it. They are completely biodegradable, and in fact, they're safe enough to eat. Pop one in your mouth. These little pellets taste much like unsweetened cereal. The preferred

GLENN HUGHES

method of disposal is to melt them under running water—they disappear in seconds.

The Woodworker's Store, a mail-order supplier of woodworking tools and materials, is so pleased with these "new" packing pellets that it is using them in all its shipments.

While these organic packing chips are cheaper to produce than their polystyrene counterparts, they do weigh more, which means shipping costs have slightly increased. The Woodworker's Store contends that despite this, customers praise the changeover and find the additional postage costs are a small price to pay for a better environment.

NANCY WALLACE HUMES

Eat My Dust

There's a new sport on the boards that's really stirring things up. It's belt-sander racing.

A past-time that was once hidden behind the cloistered doors of shop classes has come out of the closet and gone legit. Organized belt-sander races are a highlight at the Triple R, a biker bar in Bath, Maine, where fans whoop it up as the sanders buzz down a custom-made track.

Though the practice is not sanctioned by most woodworking instructors or power-tool manufacturers, it's said to be contagious after just one race. And despite its inherent dangers, the Triple R draws a consistent crowd and willing competitors for every race. Next year, the bar is planning on sponsoring The Nationals.

Gentlemen, start your sanders!

NANCY WALLACE HUMES

Liability on the Line

The Wood Machinery Manufacturers of America is trying to convince Congress to pass the Product Liability Fairness Act of 1991. The WMMA has pushed for such reforms since 1976.

The bill contains an important provision, a 25-year statute of repose,

which would eliminate liability suits that involve machinery more than 25 years old. According to a survey by the WMMA, most woodworking machines named in injury lawsuits are at least 25 years old. In most cases, accidents occurred because the tool was improperly maintained or operated.

OSHA Booklet

A new booklet published by The Occupational Safety & Health Administration outlines some health problems common to woodworkers and carpenters.

The 24-page publication titled, "Ergonomics: The Study of Work" is the product of a year-long study by OSHA on cumulative trauma disorders (CTD), also called repetitive-motion disorders. These include such physical disabilities as carpal tunnel syndrome, tendinitis, back ailments and hearing loss.

The booklet describes these various CTD, the repetitive on-the-job motion that causes them, and ways to avoid and correct these work patterns.

The booklet costs \$1. For a copy, contact the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402, (202) 275-0019.



TAMIA NEUMANN, DEPARTMENT OF THE INTERIOR

Secretary of the Interior Manuel Lujan cuts a unique figure in the carpentry shop at the Interior Department.

The Politics of Woodworking

In Washington, D.C. political circles, lots of things happen behind closed doors—even woodworking. Just ask Secretary of the Interior Manuel Lujan.

Besides being a Cabinet member, Lujan is a cabinetmaker. To get away from the pressures of the job, he "works out" on the tablesaw. Lujan relaxes during his lunch hours in the maintenance carpentry shop, tucked away in the depths of the Interior Department building. It's not uncommon to see him strolling the halls in overalls and work shirt.

Lujan's work runs the gamut. One Christmas he made wooden ornaments—coyotes, cactus and the like—to decorate the office tree. Larger undertakings include a chest of drawers, Victorian table and a home he built in Albuquerque. His aim is to one day make a roll-top desk, and he probably will. He hasn't earned the nickname "Manual Labor" for nothing.

NANCY WALLACE HUMES

COMING NEXT ISSUE:
Grandfather-Clock Plans
Tuning a Bandsaw
Portable Planers
AND
Introducing:
"Just Finishing," a new
finishing column by
Michael Dresdner