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AMERICAN WOODWORKER

Colonial Corner Cupboard
How to Sharpen Carving Tools
Oak Filing Cabinet Plans
Spoked Model Wheels

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May/June 1989
COVER PHOTO: Mitch Mandel

PROJECTS AND FEATURES

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A WORD FROM THE EDITOR

TREES FOR TOMORROW

I can't pick up a newspaper or magazine these days without reading about air pollution, rain forests and the "greenhouse effect."

In case you've been hibernating, the "greenhouse effect" refers to the gradual warming of the earth as a result of air pollution—chiefly carbon dioxide—caused by the burning of fossil fuels such as oil, coal and wood. Like the glass walls of a greenhouse, this mantle of pollution works to let in the sun but keeps the heat from escaping into space. As a result, the temperature of the earth is slowly but steadily rising. An increase in global temperature means higher ocean levels and drastic climate changes that will affect every living thing on earth.

Trees not only provide us with wood, fruit, nuts and paper, they also play a major part in controlling air pollution. Trees (and other plants) remove carbon dioxide from the air thereby reducing CO_2 pollution. Trees also give off oxygen as a by-product of photosynthesis. You may not have thought of it this way before, but every living tree is a self-contained pollution-control device. In fact, the average forest tree absorbs about 13 pounds of CO_2 a year.

Thousands of acres of the world's forests are being destroyed every day, much of it in Asia, Africa, Central and South America. Some of these trees are felled for lumber, paper or firewood, but even more forest acreage is simply burned to clear land for farming, grazing and "development." The fires in Brazil's Amazon rain forest alone are so vast, that they account for at least one-tenth of the global, man-made output of carbon dioxide, according to the 1989 World Almanac and Book of Facts. These fires are a major factor in causing the greenhouse effect, not to mention the millions of trees that are being destroyed and no longer filter carbon dioxide from the air.

So what can we, as woodworkers, do about all this? There's not much we can do to *directly* stop deforestation in tropical countries but we can have some effect. Let's all be aware of where our wood comes from and avoid the indiscriminate use of exotic woods. Let's make sure the exotics we do buy come from plantations where replanting replaces the trees that are cut.

We can have an even bigger impact right here at home. Let's revive the spirit of that "old-fashioned" holiday Arbor Day, and start planting trees in our yards, on our farms, in the towns where we live. After all, when it comes to filtering CO_2, a tree is a tree, whether it grows in Minnesota or the Amazon jungle. Not only will the trees we plant reduce the greenhouse effect but you'll also be leaving a legacy of shade, beauty—and wood—for your children and grandchildren.

We're practicing what we preach. Rodale Press is planting an arboretum of native trees that perform many functions—shade, food and wood to name a few. This "Center for Working Trees" is located at the Old Rodale Farm outside Allentown, PA.

Every tree helps. Please, plant at least one this year.

DAVID SLOAN
Editor

LETTERS

Sir:

Some wag once said, "The trouble with the school of hard knocks is that you don't learn anything until after the final exam." In my opinion, you have just put anyone who built Norm Abram's chest of drawers (March/April 1989 AW) through that school. The lesson to be learned is that, with changes in humidity, wood expands and contracts. This [movement] is much more pronounced across the grain than it is with the grain. (If someone wants to try an experiment to prove that, take a piece of 1×12 pine, cut off a foot and rip it into 2-in. wide pieces. Glue these pieces cross grain across the remainder of the board. Given a

TIM SNYDER

reasonable amount of time, maybe a year or so, either the glue joint will fail or the long board will split.)

How does this relate to Norm Abram's article? The long grain sides of the drawer frames are glued cross grain into dados in the sides of the chest. Unless there is a trick of the trade I don't know about, I predict that the joints will fail or the sides will split.

One way to solve the problem, would be to glue the drawer frames at the front of the chest and let the rest of the frame "float" in the dado.

I hope this is taken in a constructive mode. I think it's a super project.

FRED S. UNDERWOOD
Appomattox, VA

NORM ABRAM REPLIES:
The drawer frames are glued for a few inches near the front of the dado and nailed along the entire length of the dado with 4d finish nails, driven at an angle (see photo). The glue holds each drawer frame securely in place so its front edge stays flush with the front edge of the side panel. The thin nails are flexible enough that the panel can expand and contract behind the glued section without any danger of cracking.

Sir:

When I saw Norm Abram on the cover of the March/April 1989 issue of AW working on a piece of furniture with his tool belt around his waist, I laughed out loud. He may be a familiar face, but let's face it, the guy is a carpenter.

As a professional cabinetmaker, I constantly experience what I call the "This Old House" mentality among potential customers. They can't understand why a set of custom cabinets costs so much when they saw Norm and Bob build and install some in half an hour.

My advice to anyone who is thinking of purchasing *The New Yankee Workshop* book is to spend a few extra dollars, and instead buy *The Encyclopedia of Furniture Making* by Ernest Joyce (1987, Sterling Publishing Co., Inc., 2 Park Ave., New York, NY 10016) and *Fine Furniture for the Amateur Cabinetmaker* by A. W. Marlow (1977, Stein and Day Publishers, Scarborough House, Briarcliff Manor, NY 10510). Everything you ever need to know about building fine furniture is contained in these two books.

ROBERT M. RESSEL
Lancaster, PA

Sir:

My compliments to Fiona Wilson on her first article, "Wooden Smoothing Plane" in the January/February 1989 AW. She writes with style and her instructions are clear.

The method of gluing up the body is not only structurally sound but much easier and more precise than hogging the body from a solid block. Her design with the locking pin is superior to the classical shouldered ramps for locking the wedge. It provides extra clearance for shavings.

But to me, wooden planes are more fun to make and look at than they are to use. Adjusting the cut is a chore. I'll take a modern metal plane with its micrometer feed every time.

THOMAS SHARP
Sanibel, FL

Sir:

The January/February 1989 Tech Tips showed a tip on mounting wooden pipe clamp-jaw protectors with screws.

I find it easier to fasten the blocks to the clamp jaws with contact cement.

JIM VALVO
Babylon, NY

Sir:

In the French polishing article (March/April 1989 AW) you recommend keeping shellac and alcohol in glass bottles with notched corks, so you can dribble out a few drops at a time. Get with it guys. This is 1989. The only bottles that have corks these days are wine bottles (wrong kind of alcohol for French polishing).

I dispense shellac and alcohol from little plastic bottles, the kind that some liquid soaps and travel-size shampoos are packaged in. These little bottles have flip-top spouts that snap up to pour, down to close. Not only are they great for French polishing, but every bottle I "recycle" in my shop is one less piece of plastic crap that gets tossed into a landfill somewhere.

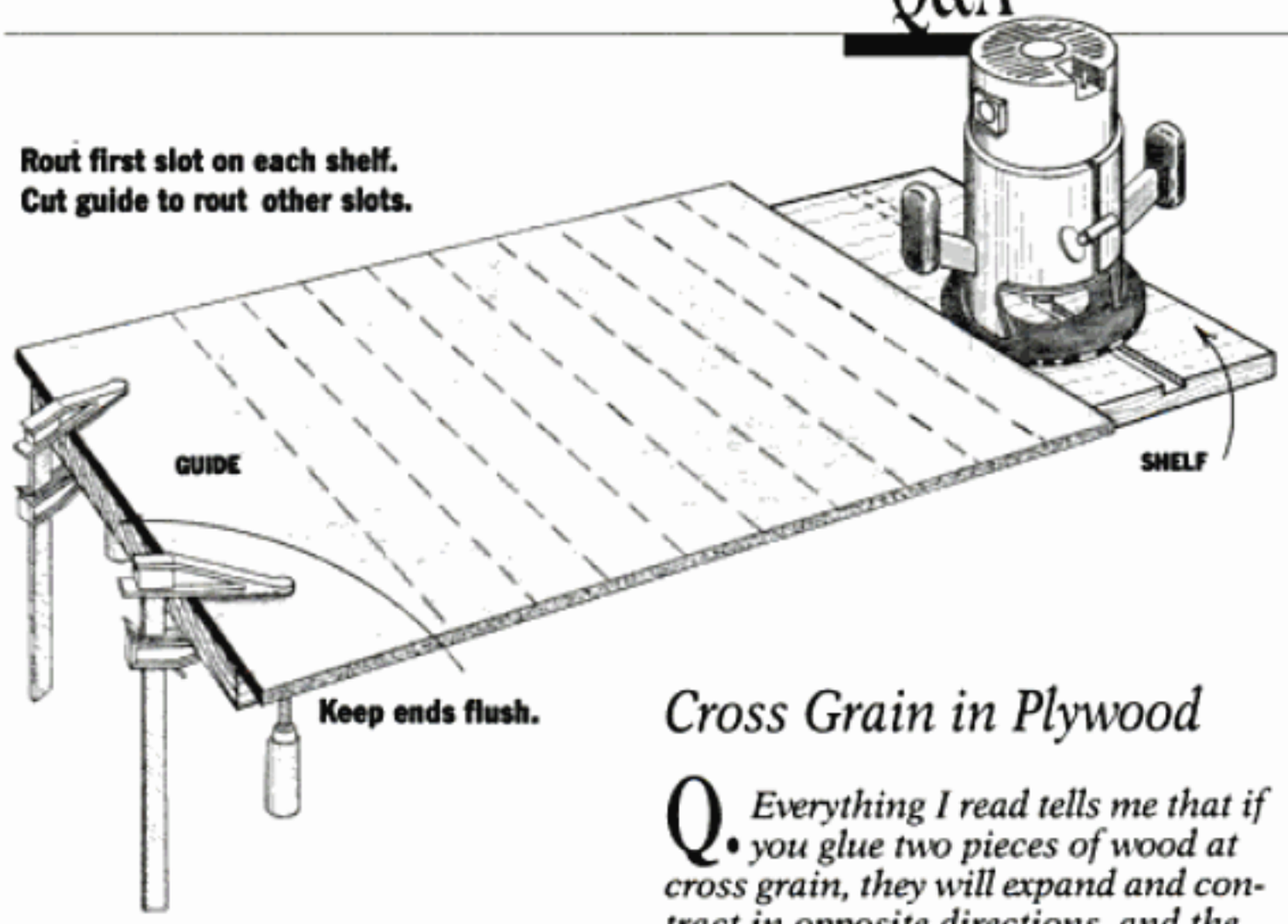
DEREK COLEMAN
Minneapolis, MN

Sir:

I just bought and reviewed my first copy of AW. Besides being informative, I find the print in your magazine better suited for a person that does not have ideal vision. Thanks for that, too.

CHRISTOPHER SWINGLE
New York, NY

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



Routing Shelf Divider Slots

Q. *I'm building a set of shelves with several hardboard dividers to hold sheet music. I want to mount the dividers in slots about 2 in. apart. I'm having trouble getting the slots in the top shelf directly above the slots in the bottom shelf. How can I cut the slots so the bottom and top match?*

RALPH H. JONES
Raymore, MO

A. The simplest solution is to rout the slots in a board twice as wide as the shelf, and then cut the board in half to form two shelves.

In shops where I've worked, this was sometimes impractical—we often had to rout matching slots on 20 or 30 shelves at a time. We solved the problem by cutting the shelves to final size, and then routing the slots with the aid of a simple jig.

We cut the first slot on each shelf by guiding the router along a piece of plywood a little wider and a little shorter than the shelf. Then, to cut a second slot 2 in. away from the first, we'd cut 2 in. off the end of the plywood. When doing this, be sure you've cut the slot on all shelves before cutting the plywood to begin the next series of slots.

Make the plywood jig 1 or 2 in. wider than the shelf to guide the router at the beginning and end of the cut.

JEFF DAY
Senior Editor
AMERICAN WOODWORKER

Cross Grain in Plywood

Q. *Everything I read tells me that if you glue two pieces of wood at cross grain, they will expand and contract in opposite directions, and the glue bond will break. How come this isn't true in plywood, where they've got five or seven layers of veneer, each running perpendicular to the next. Why doesn't the wood movement break the glue bond and cause the plywood to delaminate?*

RICHARD MATTHEWS
Little Rock, AR

A. Wood does indeed shrink or expand more across the grain than it does along the grain—as much as 20 to 50 times more—depending on the species and whether the board is flat-sawn or quarter-sawn. When two pieces of wood are glued together with the grain at right angles, the amount of stress on the glue line depends upon the elasticity of the wood and the thickness of the wood in relation to the number of glue lines.

If two 1/2-in. thick pieces of wood are glued together at right angles, the glue bond is likely to fail. If eight 1/8-in. thick pieces are glued together with the grain directions alternating, as in plywood, then there are seven glue lines instead of one, and seven times as much glue area to resist the shearing forces.

The stiffness of the interior plies is also a factor. This stiffness is measured by the ability of the wood to withstand stress without deforming and is measured by the modulus of elasticity. If the plies are from a species with a lower modulus of elasticity, such as white pine, they can be thicker than they could be with a ply made from maple, which has a higher modulus of elasticity.

Finally, the rotary-cut veneers used to make plywood contain numerous checks that help to reduce the effective cross-grain stiffness of the plys.

The net result is a laminated panel whose dimensional change in both directions is essentially that of wood along the grain. As a result, plywood is an exceptionally stable product—so stable that it has become the favored material of door manufacturers.

JOHN J. ZAHN
Research Engineer
BRYAN H. RIVER
Research Forest Products Technologist,
USDA Forest Products Laboratory
Madison, WI

DRAWING BY FRANK ROHRBACH

Fumes and Safety

Q. *What type of respirator should I wear when applying stains and polyurethanes? My shop is in a confined space, and the ventilation is poor. Needless to say, the fumes present a real problem.*

CHARLIE DIETRICH
Beverly, MA

A. For the type of work you are doing, wear a half- or full-face respirator with organic vapor cartridges. The same cartridges also work for paints, oil finishes and nitrocellulose lacquers. If you are spraying a finish or using a paint remover containing methylene chloride, buy a spray-paint filter that snaps over the cartridges to prevent them from clogging.

The cartridges must be replaced occasionally, depending on exposure to and concentration of fumes. A sure sign that the cartridges are bad is that you can smell fumes through the mask. Replace cartridges before you start smelling fumes. Do this by keeping track of how long it takes before you smell fumes with a new cartridge. Then, with the next cartridge, subtract 20 percent, and consider that to be the effective life of your cartridges.

Incidentally, industrial, two-part polyurethanes are completely different from the polyurethanes made for home use. A cartridge mask *will not* protect you from the two-part

polyurethanes or any finish containing isocyanates. If you are applying such finishes, you will need a special mask and an air-supply line.

Masks and organic vapor cartridges are available from automotive paint distributors, hardware stores and Direct Safety Co., P.O. Box 50050, Phoenix, AZ 85076.

THOMAS A. REINE
Product Manager
Direct Safety Company

Get the Paint Out

Q. *About 20 years ago, my mother-in-law painted two pieces of furniture. I'm trying to remove the paint. I applied several coats of paint remover and sanded after each application, but I can't remove the paint from the pores of the wood. Can you recommend a process that will remove the paint?*

SUSAN MILLER
Port Washington, NY

A. Apply the paint remover one more time, and after letting it work for a few minutes, scrub the wood with a brass wire brush like those sold in paint stores or in supermarkets. Scrub in the direction of the grain, not across it, so that scratching will not be obvious.

When the stripper starts to dry, wipe everything off with paper towels and repeat the process, if necessary. The wood should clean up nicely, although it often takes some work. You may need to sand lightly when you have finished, to smooth the roughened wood. It's not always necessary, though, since the brass wires usually do little damage.

It may help if you understand how paint and varnish remover works. The better removers contain a high percentage of methylene chloride, which causes the finish to swell and break away from what's underneath it. The pigment in paint makes paint much more durable than varnish and more difficult to remove. This is especially true when the paint is lodged in pores. A brass brush dislodges the paint, leaving you with a clean piece of wood.

BOB FLEXNER
Furniture Restorer
Norman, OK

Roycroft Was Here

Q. *I just bought a piece of furniture marked "Roycroft." Who or what was Roycroft?*

RICHARD GREER
Walker Valley, NY

A. At the turn of the century, the Roycroft studio was one of the most influential in creating Mission-style furniture. In 1941, I met and befriended Walter Ingersoll, who in his younger days was secretary to Roycroft founder Elbert Hubbard. Ingersoll and I talked about the Roycrofters often.

Though his simple, rectilinear oak furniture became famous, Hubbard was not a woodworker. In 1895, he opened a print shop that special-

ized in handmade books for the flourishing Arts and Crafts movement. In 1897 he had carpenters, working on his buildings, make some office furniture. Visitors to the shop liked it so well they bought it, and Hubbard went into the cabinetmaking business. The furniture was an important contribution to the Arts and Crafts movement.

The Roycrofters produced furniture from 1897 to 1938, when the company went bankrupt. Hubbard died in 1915 aboard the Lusitania.

GEORGE FRANK
Finisher and Author
Venice, FL

Welding Bandsaw Blades

Q. *Does anybody make a spot welder for repairing bandsaw blades? I hate to throw out a 1/4-in. blade that's still good and sharp but which broke under pressure.*

FRANK J. PONTERIO
Lake Zurich, IL

A. As long as the blade didn't twist or bend when it broke, you can probably repair it. Industrial equipment like we use at the Olson Saw Company is way beyond the price range of the average craftsman. But silver brazing, a soldering technique common for joining blades in the old days, can be done at home. A bandsaw blade splicer is available from many mail-order houses including Olson Saw Company, Rt. 6, Bethel, CT 06801. The splicer is a precision industrial-quality jig which aligns the blade while you braze it. It comes with enough brazing materials for 100 splices. You will also need a grinder and a propane torch.

The process is simple. A joint properly made with the splicer will run as true as commercially welded joints. The brazing normally outlasts the life of the blade. Shear strengths of up to 130,000 PSI are possible on blades joined on the splicer.

When averaging the cost of the splicer into the first 100 joints, each splice costs about 50¢; thereafter, materials for additional splices will cost about 6¢ each.

CHARLES OLSON
Product Manager
Olson Saw Company

Where to Find It

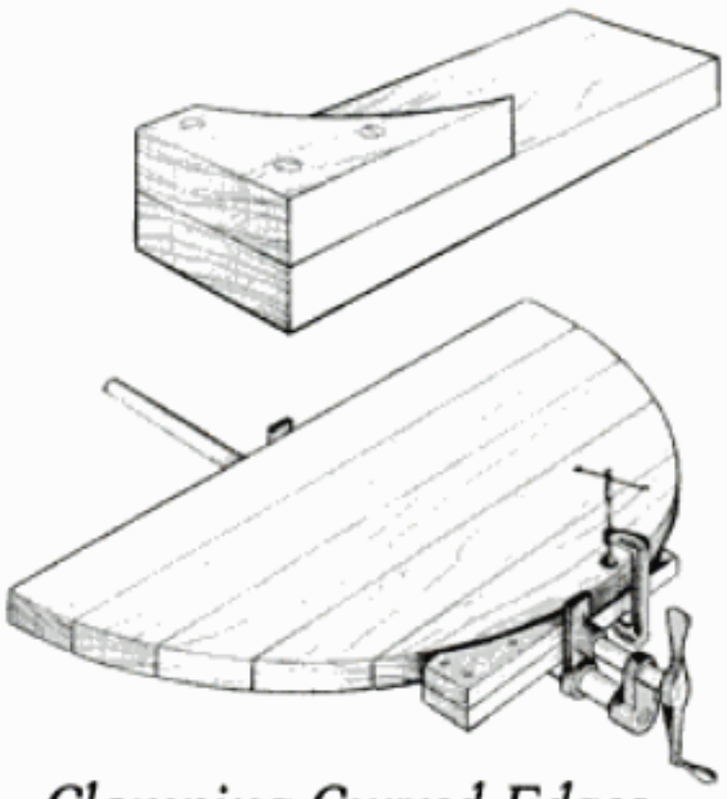
Machined parts for scale-model steam engines and steam trains are available from Saturated Steam, 6899 N.E. Third Ave., P.O. Box 380123, Miami, FL 33238.

Reproduction brass movements for schoolhouse clocks and other clock-making supplies are available from S. LaRose, Inc., 234 Commerce Place, Greensboro, NC 27420.

Pierced tin panels for pie safes, as well as tools and materials to pierce your own panels,are available from Country Accents, P.O. Box 437, Montoursville, PA 17754.

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

TECH TIPS

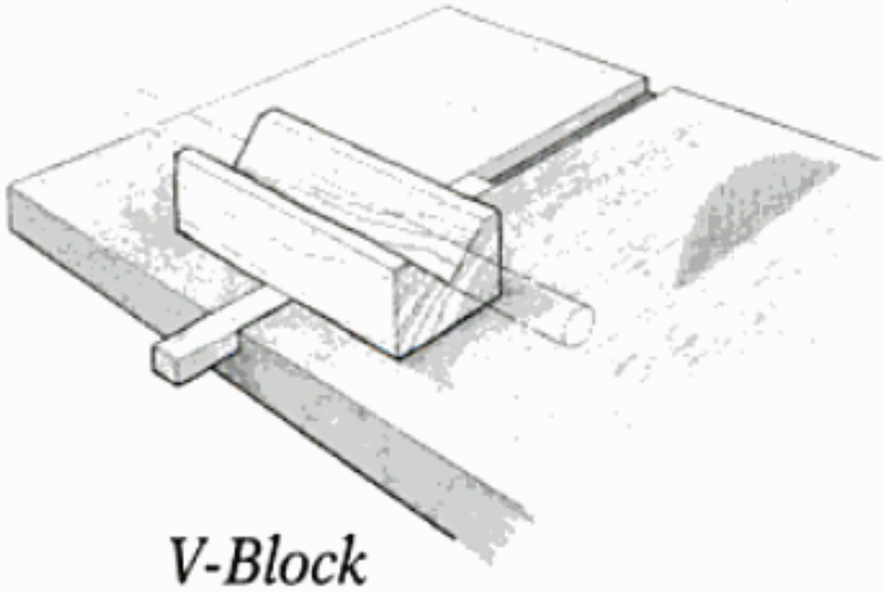


Clamping Curved Edges

Pipe clamps tend to slip on curved edges. Here's a device I made from a 1 × 2 that allows me to clamp curved edges. I use it mostly for repairing tabletops, but it also can be used to glue up boards that have one straight edge and one curved edge.

I clamp the device to the curved edge with a C clamp to hold it in place. Now the pipe clamp can be installed to clamp the boards together.

KENNETH T. MAY
Jeanerette, LA



V-Block for Round Stock

Crosscutting round stock on a bandsaw or tablesaw is easy if you make a V-block jig with a guide strip to fit the miter-gauge slot in the table.

BILL BIGELOW
Surry, NH

Keeping Finishes Fresh

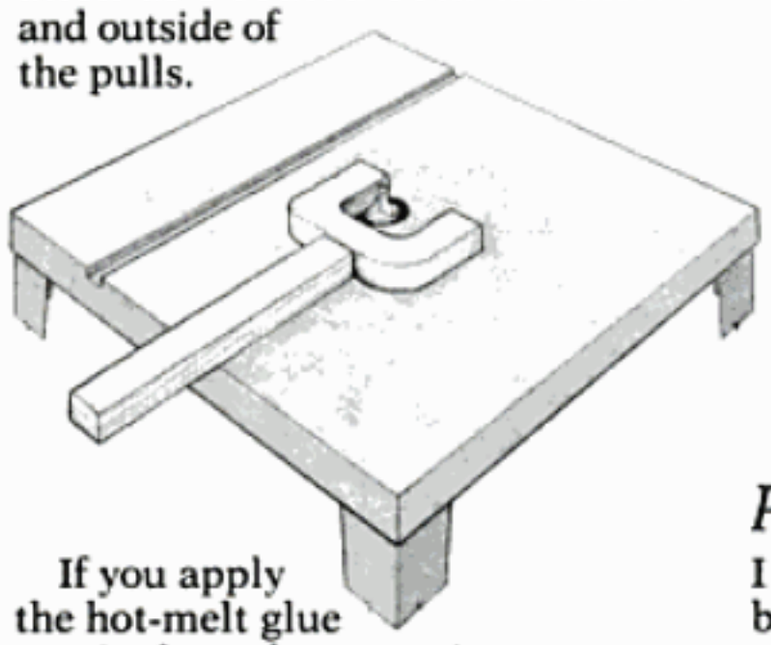
Here's a way to save paints and finishes in a can. Just pour a thin layer of the appropriate thinner on top of the material and cover. Put the can on the shelf without shaking. When you want to use it, stir in the thinner and the finish is good as new.

FRANK DISTEFANO
Rochester, NY

Routing Drawer Pulls

A recent project called for three drawer pulls and I decided to make them from wood. After bandsawing the shape, I planned to round over the edges on the router table. The problem was that my fingers would be too close to the cutter for safety.

The solution was to tack the pull temporarily to a length of scrap wood with a hot-melt glue gun. This way I could shape the handle in safety. In my case this was a two-step operation as I routed both the inside and outside of the pulls.

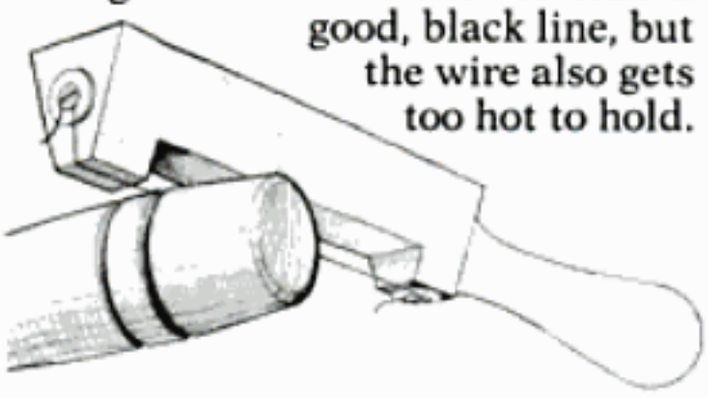


If you apply the hot-melt glue sparingly and remove it as soon as possible, it's easy to separate the workpiece from the scrap.

DEAN ST. CLAIR
Salesville, OH

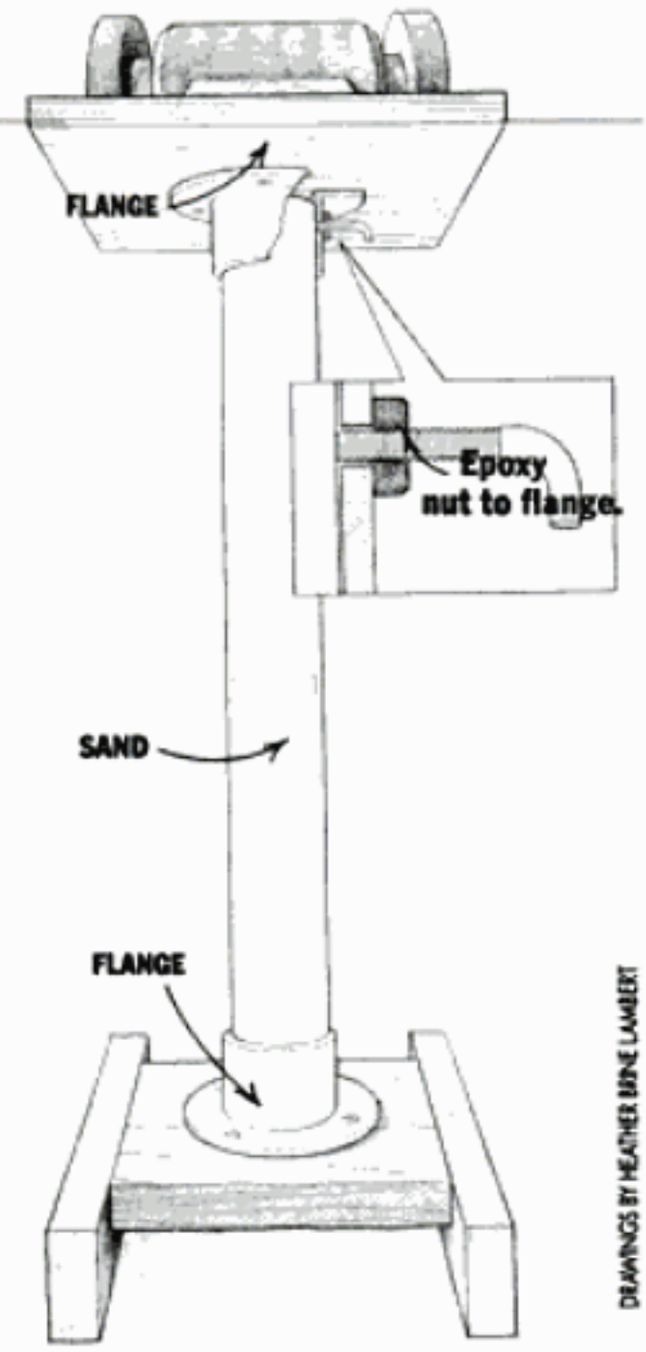
Charring Decorative Lines

Decorative lines cut into tool handles and similar turned objects are often made more prominent by charring the tool-cut lines with a length of iron or steel wire held against the revolving wood. Pressure on the wood soon builds up enough friction and heat to char a good, black line, but the wire also gets too hot to hold.



I've made a tool that enables me to do a more efficient job and avoid burning myself. The tool holds a 6-in. length of 18-gauge wire. So the wire can be tensioned or replaced, I twist its ends around screws with washers under their heads to prevent slipping.

PERCY BLANDFORD
Stratford-upon-Avon, England



DRAWINGS BY HEATHER BRINE LAMBERT

PVC Pipe Stand

I needed a stand for my grinder and bench-top disk/belt sander, but I was discouraged by the high price of manufactured stands. While at my dad's plumbing shop, the idea came to me to make a stand from 4-in. dia. PVC pipe and two toilet flanges.

I cemented the pipe to the bottom flange and filled the pipe full of sand for ballast. I bolted the flange to a wooden base, but it could just as easily be bolted directly to the floor.

So that the top flange could swivel on the pipe, I drilled a 9/32-in. hole in the side of the flange and epoxied a 1/4-in. nut over the hole. A 1/4-in. bolt bent into an "L" shape locked down the top flange on the PVC pipe.

I mounted the grinder on a piece of plywood bolted to the top flange. I painted the stand gray, and boy does it look sharp. The neat part is that I can use the same base for different tools. I just make a separate flanged base for each tool, and I can swap tools when I need to.

BILL BUHRMAN
Salina, KS

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

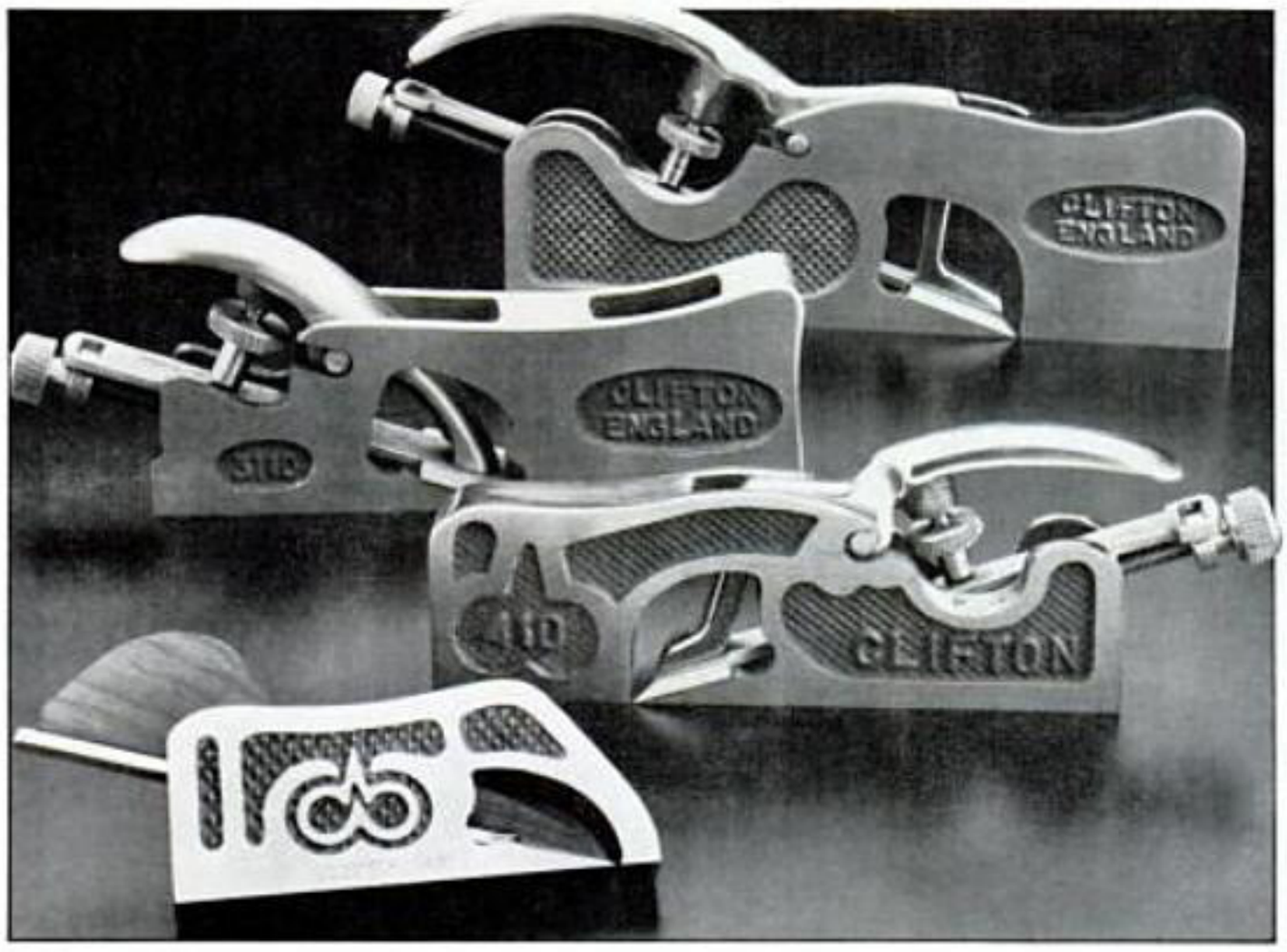
Heavyweight Turning Tools ▶

Decrease vibrations and you'll increase the smoothness of your cut. This simple woodturning formula led metalurgist and turning-tool expert Jerry Glaser to develop a line of turning tools with hexagonal handles made from anodized aluminum. The hexagonal shape makes them easy to grip and the extra weight minimizes vibration. HITEC gouges are also available with lead shot-filled handles for the ultimate in stability. But the excellence of these tools doesn't stop at their handles. Glaser's tools are made from a high-speed steel called A-11, with a high vanadium content for an extremely wear-resistant edge. Bowl-gouge sizes range from 3/8-in. to 1-in. widths. A 1-in. skew chisel and two styles of swivel-tipped boring bars are also available. (Price: $53-$125)

■ *Glaser Engineering Company, Dept. AWT, 1661 East 28th Street, Signal Hill, CA 90806.*

CIRCLE NO. 6 ON READER SERVICE CARD

MITCH MANDEL



Affordable Drum Sander ▼

A drum sander can save you heaps of time, but a good one can cost you heaps of money. The Pro Max drum sander is a well-designed machine that will save you both time and money. The Pro Max package includes: a high capacity 44-in. wide surface thickness sander; a power-feed unit; a 1½-HP, 110V motor; and a metal stand with a laminated wood tabletop. Because these components (and other available options) are priced separately, the woodworker on a pinched budget can buy the critical components and expand as need dictates. (Price: Pro Max Package, $1130)

■ *Performax Products, Inc., Dept. AWT, 11975 Portland Ave. So., Suite 142, Burnsville, MN 55337.*

Planely Superior ▲

A shoulder plane is just the thing for trimming tenon shoulders, dadoes and rabbets. Once available in a range of sizes, shoulder planes—especially in the smaller sizes—were dropped by most major toolmakers long ago.

Enter Clico Tooling Ltd. of Sheffield, England. Clico's cast-iron "Clifton" shoulder planes come in four different models: No. 420, measuring 8 in. long with a 3/4-in. wide iron; No. 410, 5 3/8 in. long with a 5/8-in. iron; and the No. 3110 "3-in-1" plane, measuring 9½ in. long with a 1 1/8-in. wide iron. The 3-in-1 combines all the features of a shoulder, bullnose and chisel plane. On all three planes, a knurled adjustment knob controls depth-of-cut. And, brand new this spring, is the tiny Clifton No. 400 plane, measuring 3¼ in. long with a 3/8-in. wide iron. A rosewood wedge secures the blade and a gentle tap adjusts depth-of-cut. (Prices start at $69.50)

■ *Available from both Woodcraft Supply Corp., Dept. AWT, 41 Atlantic Ave., P.O. Box 4000, Woburn, MA 01888 and Garrett Wade, Dept. AWT, 161 Ave. of the Americas, New York, NY 10013.*

Peerless Veneers ◄

Unlike conventional veneers which come in narrow widths, Braewood Veneers come in big sheets to save you time in veneering large surfaces. Finishing time is also minimized because these sheets are pre-sanded and pre-sealed with a phenolic resin. Braewood Veneers are fabricated from layers of African hardwood veneer using trees harvested on a sustained-yield policy. These layers are then uniformly dyed, laminated back together and sliced at an angle to produce high-quality replicas of both domestic and exotic woods. Consistent and guaranteed defect-free, Braewood Veneers come in several grain patterns and colors, including bird's-eye patterns. Sheets measure 1/48 in. × 51 in. × 135 in. (bird's-eye patterns are 47 in. × 98 1/2 in.). (Price: standard grains, $1.05-$1.10 per sq. ft.; bird's-eye, $2.50 per sq. ft.)

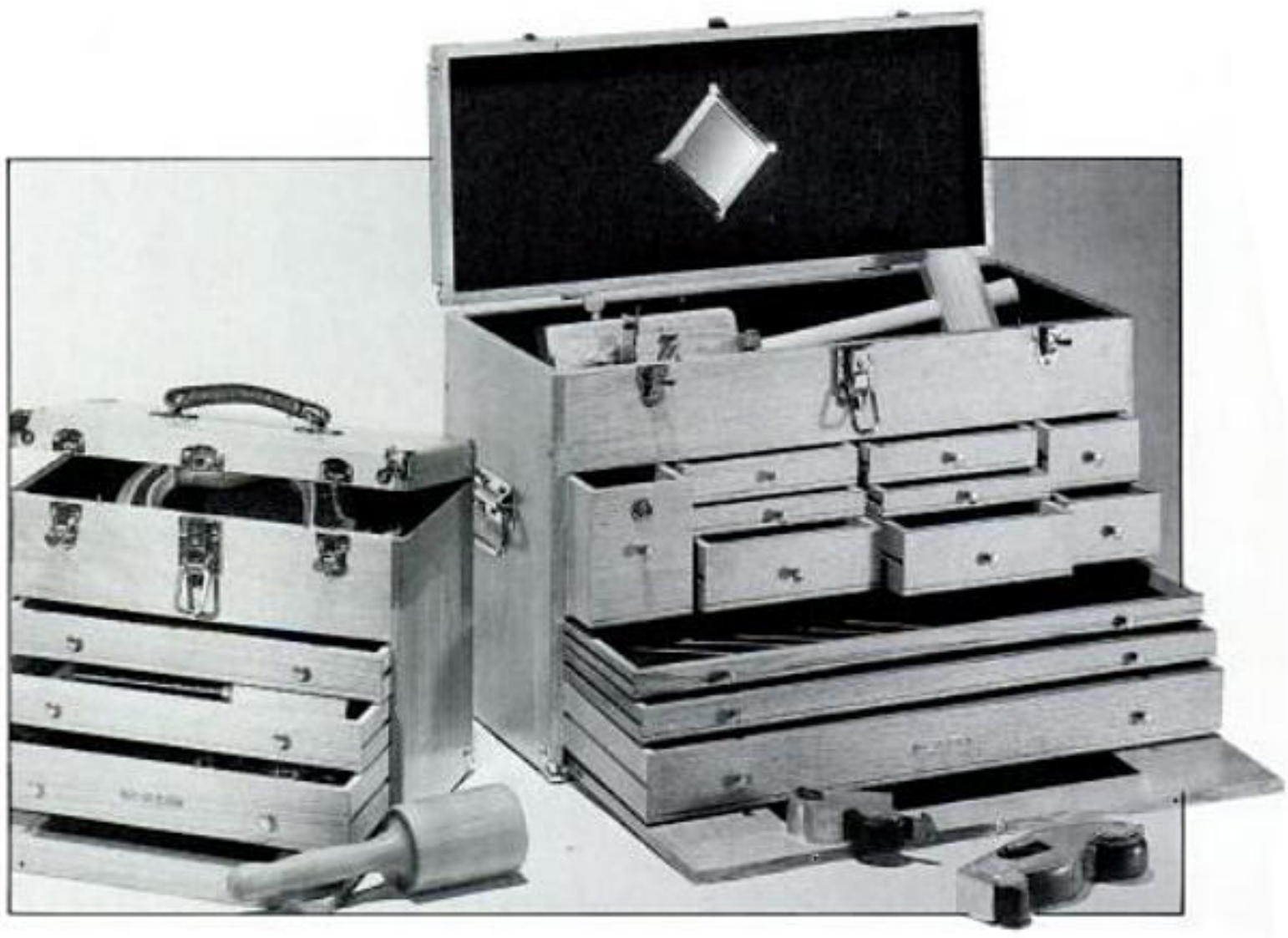
■ *Brookside Veneers Ltd., Dept. AWT, 215 Forrest St., P.O. Box 4348, Metuchen, NJ 08840.*

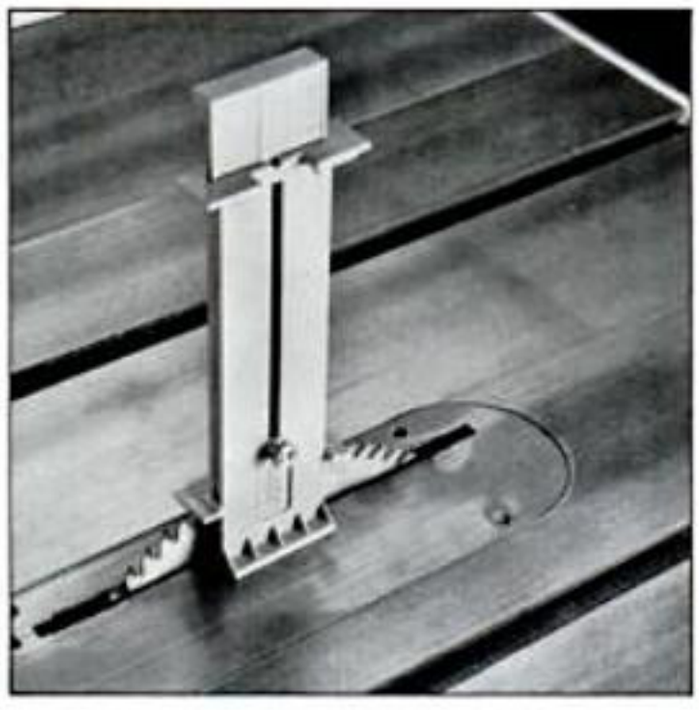
CIRCLE NO. 2 ON READER SERVICE CARD

Versatile Gauge ▼

Why buy another gauge when you already have a drawer full? Because here's the gauge that will do it all. The Incra Gauge (from the manufacturers of the Incra Jig) is truly a versatile tool. You can use it as a marking gauge and a center-finding gauge for board edges measuring up to 2 in. thick. Also, on machines, use it as a free-standing depth-of-cut gauge and a width-of-cut gauge for aligning your blade and fence. Made of precision-cast plastic accurate up to .006 in., the Incra Gauge has interlocking sawtooth racks which lock the gauge at 1/32-in. intervals. (Price: $15.99)

■ *For information write: The Taylor Design Group, Inc., Dept. AWT, P.O. Box 810262, Dallas, TX 75381.*





Tried and True Tool Chests ▲

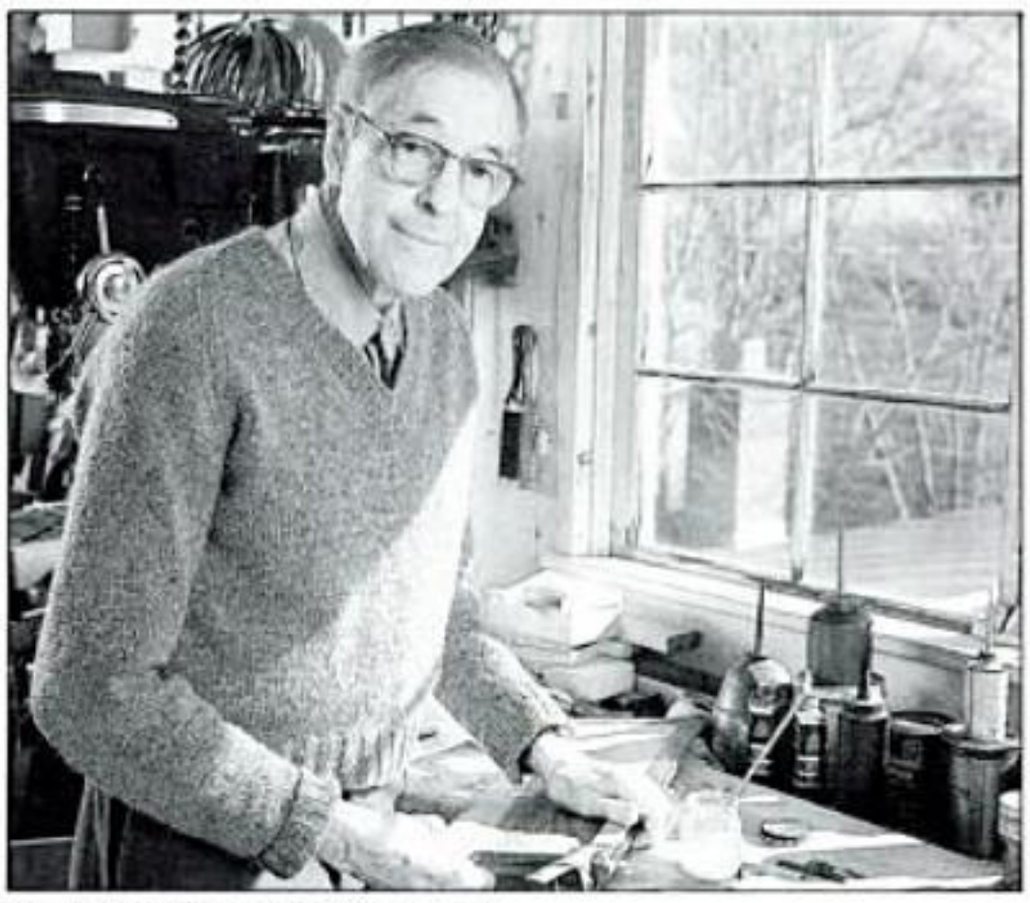
There's nothing new about these handsome tool chests, and that's precisely what we want to point out. Sometimes tried and true is better than new. Gerstner and Sons has been manufacturing hardwood tool chests for over 80 years, but often tool catalogues carry models that are better suited for occupations other than woodworking. Here are two models made with the woodworker in mind. These durable chests have sturdy tongue-and-groove joints, corner brackets and lockable front panels. The felt-lined drawers come in a variety of sizes, and their snug fit ensures maximum protection for your tools. The walnut Wood Carvers Chest measures 16 × 12 1/4 × 8 1/2 in., and the oak Traditional Chest measures 26 × 16 3/4 × 10 1/2 in. (Price: Carver's Chest, $259.95; Traditional Chest, $399.95)

■ *The Fine Tool Shops, Dept. AWT, 170 West Road, P.O. Box 7091, Portsmouth, NH 03801.*

CIRCLE NO. 17 ON READER SERVICE CARD

An 18th-Century Classic From Colonial Virginia

HANGING CORNER CUPBOARD



Master draftsman Carlyle Lynch.

BY CARLYLE LYNCH

In the Tavern at Old Salem Museum in Winston-Salem, North Carolina, hangs an expertly made walnut corner cupboard. It's a charming piece, with a gracefully arched, raised-panel door, brass "H" hinges and three shelves. There are no markings to identify the craftsman, but the folks at Old Salem believe it was made near Blackstone, Virginia about 1780. They discovered the cupboard in the Virginia town of South Hill in 1953. It's been in the Old Salem collection ever since.

The construction is typical of 18th-century furniture. There's no fancy joinery in this piece; the backboards are shiplapped without glue and they're fastened to the sides, top and bottom of the cupboard with hand-forged nails.

The backboards on the original cupboard extend above the top with the ends sawn to form a decorative scalloped curve. I think the cupboard looks better without this decoration so I've omitted it from the plan view of the main drawing. The construction photos

With its gracefully arched, raised-panel door, this walnut corner cupboard will be an heirloom your family will treasure for generations. The original cupboard, circa 1780, is in the collection of Old Salem Museum, in Winston-Salem, North Carolina.

PHOTOS BY MITCH MANDEL

The door frame is joined with through mortise-and-tenon joints (left). A molding around the inside of the frame meets in a miter at the joint. Mill the panel groove and molding on the shaper (or router table) by stacking a straight cutter and a quarter-round cutter (right).

show the original back, and I've drawn this detail in the lower-right corner of the drawing for those who want to build an authentic reproduction.

The door panel on the original cupboard was probably raised and fielded with a panel-raising plane. Original panel-raising planes are nearly impossible to find in usable condition but, if you want to do things the old-fashioned way, new panel raisers are still being made today (available from Garrett Wade, 161 Ave. of the Americas, New York, NY 10013). You can also raise the panel on the tablesaw (see page 33), router table, or the shaper, if you have one as shown in the photo on page 20. If you use either the plane or the tablesaw, you'll have to raise the arched top of the panel by hand with chisels, gouges and scrapers. A shaper is capable of roughing out the curved part of the panel but, no matter which method you use, you'll still have to finish off the corners of the arched top by hand with a chisel.

The moldings on the original cupboard were cut with wooden molding planes; every cabinetmaker had an assortment of shapes and sizes. Many of these wonderful old planes are still around, and they work just as well today for making moldings if you can find the right shapes in usable condition. Molding planes work best on clear straight-grained stock.

The modern counterpart to the molding plane is, of course, the router or the shaper. Stock cutters will bring you pretty close to the profiles of the original moldings. A scratch stock, a scraping tool you make from a broken saw blade gripped in a wooden handle comes in handy for refining the shapes or producing molding profiles you can't find in your router-bit box. I often use a scratch stock for scraping small, delicate moldings and beads. (See January/February 1989 AW.)

BILL OF MATERIALS

QUANTITY	PART	DIMENSIONS
2	Frame Stiles	7/8" × 2 9/16" × 48"
1	Frame Top Rail	7/8" × 3 3/4" × 19 1/2" (17 1/16" between tenons)
1	Bottom Rail	7/8" × 1 3/4" × 19 1/2" (17 1/16" between tenons)
2	Outer Stiles	7/8" × 4 5/16" × 48"
2	Splines	5/16" × 3/4" × 48"
1	Top	7/8" × 16" × 26 1/2"
1	Bottom	7/8" × 16" × 26 1/2"
1	Back	5/8" × 42" × 48" Shiplap boards
1	Top Molding	7/8" × 1 13/16" × 36"
1	Bottom Molding	11/16" × 1 3/16" × 36"
3	Shelves	7/16" × 15 1/2" × 26 1/4"
2	Door Stiles	7/8" × 2 3/4" × 42 1/2"
1	Door Top Rail	7/8" × 5 1/2" × 17" (12 1/4" between tenons)
1	Door Bottom Rail	7/8" × 2 3/4" × 17" (12 1/4" between tenons)
1	Door Panel	11/16" × 12" × 37 1/2"
6	Pegs	1/4" × 1/4" × 1 1/4"
2	Brass "H" Hinges	4 1/2" long approx. (see Sources)
1	Cupboard Lock	13/16" selvage approx. (see Sources)
	Forged Nails	(see Sources)
1	Lock Escutcheon	(see Sources)

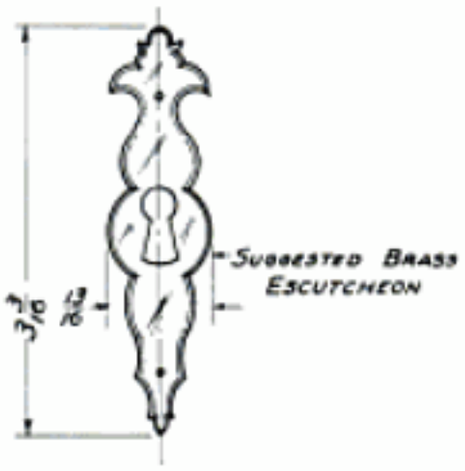
HANGING CORNER CUPBOARD

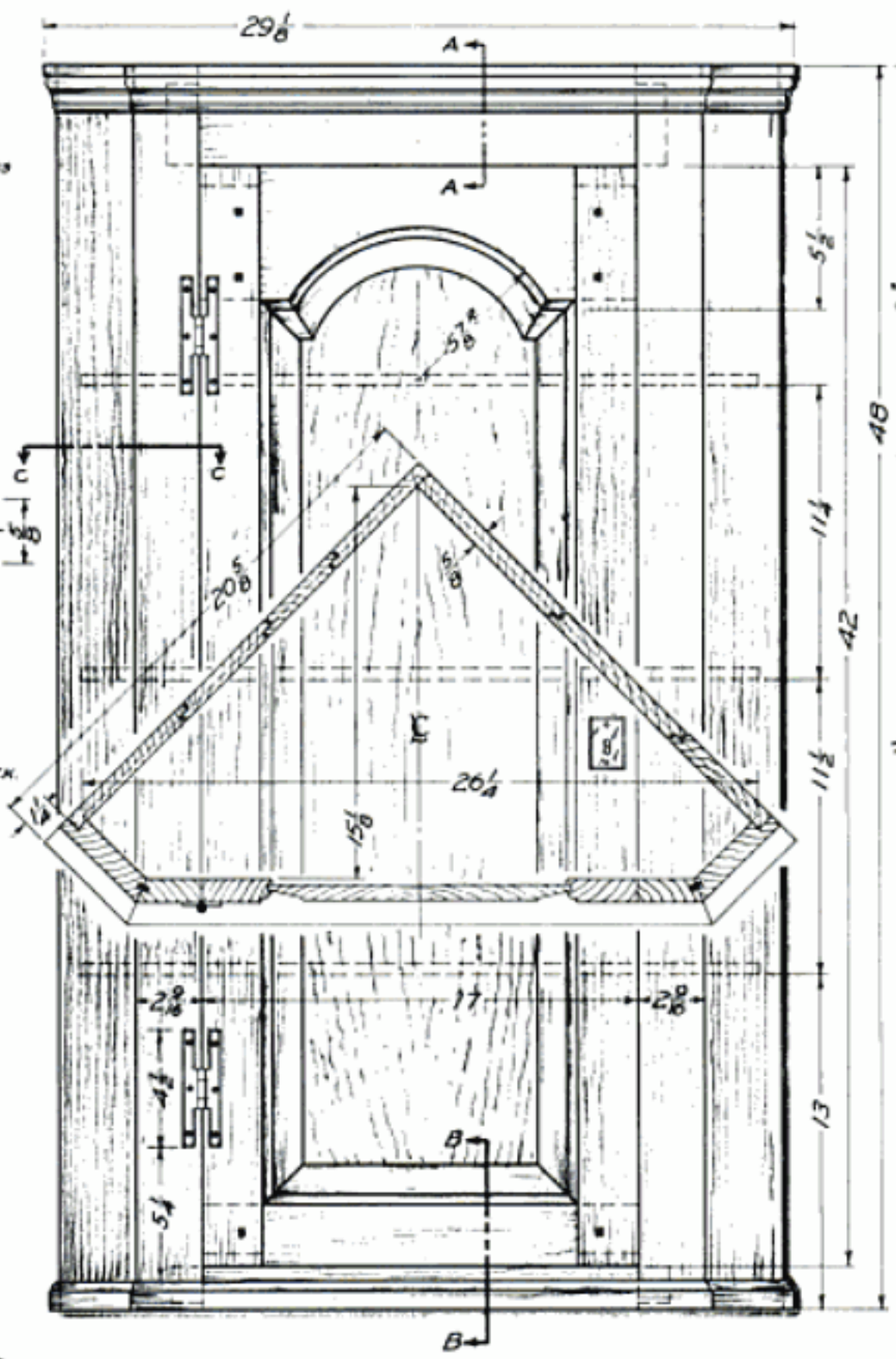
Old Salem Collection

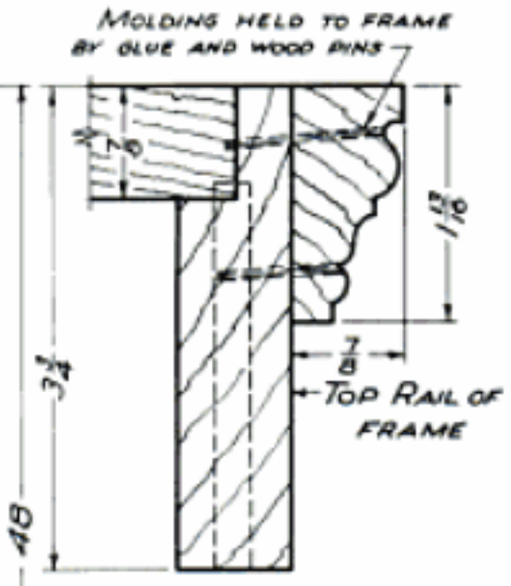
Winston-Salem, North Carolina

Measured & Drawn by Carlyle Lynch

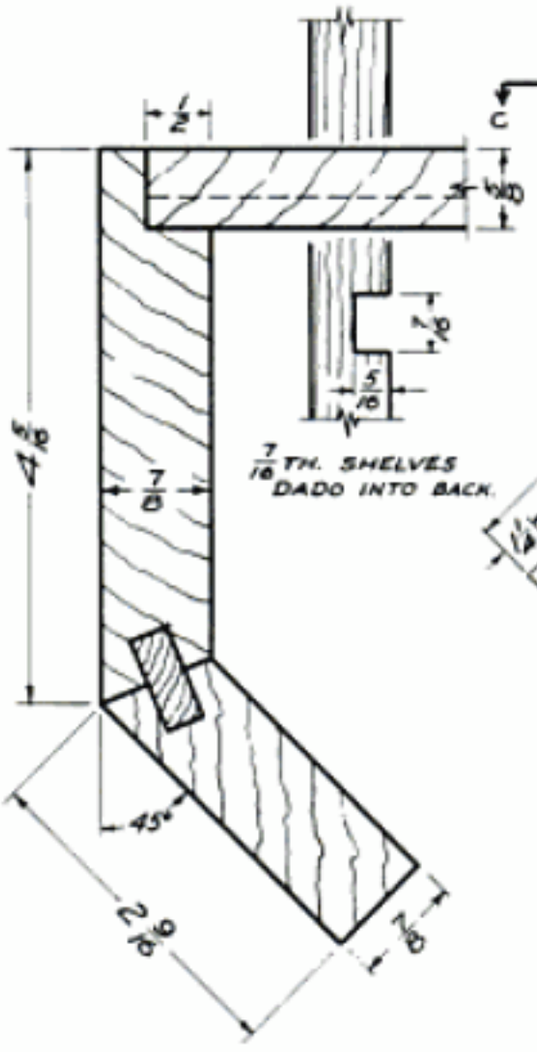
Walnut — *About 1780*



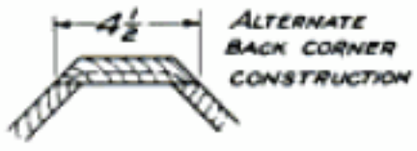


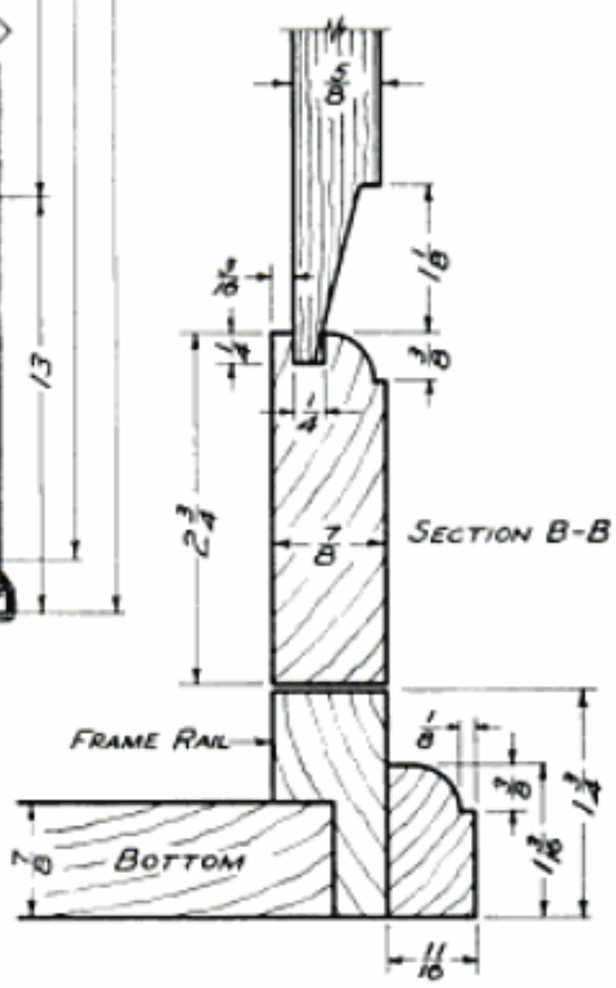


SECTION A-A

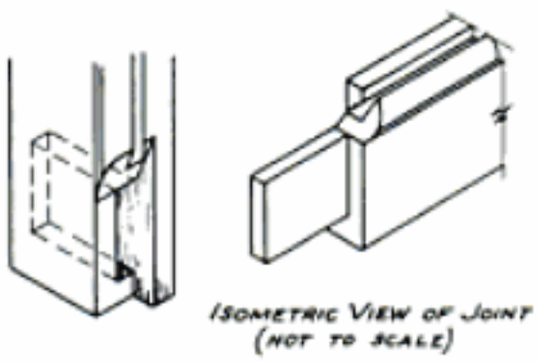


SECTION C-C





NOTE: Original cupboard back boards extend above top to provide hanger holes.



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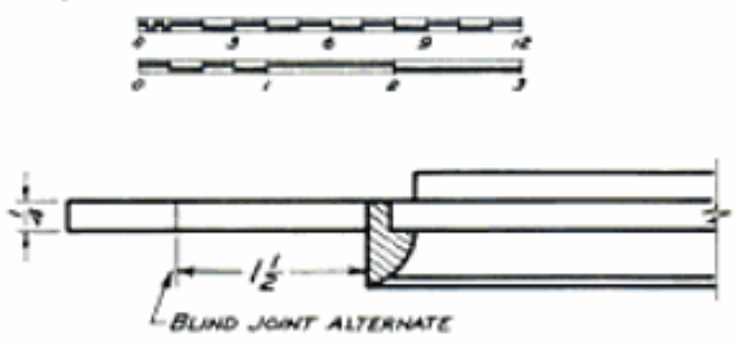
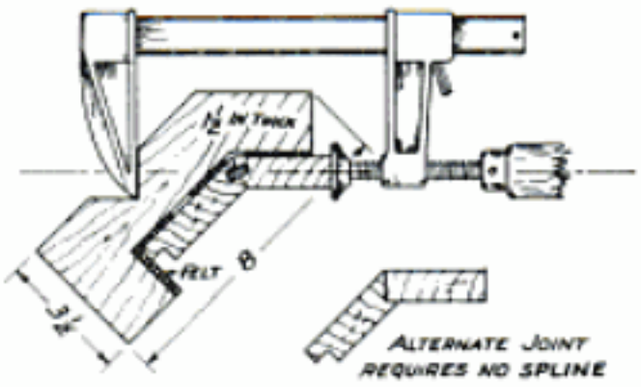


DOOR STILE MORTISE



DRAWING BY CARLYLE LYNCH

The shaper is the best machine for raising the door panel. With a panel-raising cutter and a rub collar, the shaper will cut around the arched top of the panel, guiding the curved edge against the rub collar. An extra disk goes over the rub collar as a safety guard (left).

Building the Cupboard

Start by cutting pieces to make the front frame—two stiles and the top and bottom rails. Lay out and cut the mortises and tenons. Dry assemble the frame, and rabbet the top and bottom of the frame for the cupboard top and bottom.

Two outer stiles join the stiles of the front frame at an angle as shown in the drawing. Cut the two outer stiles to size and rabbet the top and bottom ends for the cupboard top and bottom. Rabbet the back edges of the outer stiles for the $^5/_8$-in. thick back.

Bevel the stiles at $22^1/_2°$ with a smooth-cutting saw blade. Plow grooves for splines, if you wish to use the splined-miter construction shown at Section C-C in the drawing. I've also drawn an alternate joint construction that doesn't require a spline. You'll find this detail in the bottom-right corner of the drawing. Either method will work fine. I can't say for certain how the original is put together since I wasn't able to take the cupboard apart to find out.

Glue up the front frame, checking for squareness by measuring across the diagonals. Make sure the frame is flat and not twisted.

Once the front frame is dry, glue the outer stiles to it. Clamping these miters is tricky. In the bottom-right corner of the drawing I've shown a block that makes clamping easier. I suggest using four of these blocks to clamp up each side of the cupboard. Cut the blocks from a 2×4 and make sure the grain of the blocks runs as shown or the blocks will snap under pressure.

Next, cut the backboards and shelves to size from yellow pine. Rabbet the edges of the backboards for the shiplap joints or cut tongue-and-groove joints. Dado the backboards for the three shelves and cut rabbets for the top and bottom.

Make the top and the bottom and assemble the entire cupboard. On the original cabinet, the bottom and top are nailed in place. The shelves are supported only by glue and nails (or wooden pegs) and the dado grooves in the back of the cupboard as shown with hidden (dashed) lines on the plan-view drawing.

Make the moldings and fasten them to the top and bottom of the cupboard with wooden pins or small finishing nails.

SOURCES

CARLYLE LYNCH, 196A Holly Hill, Broadway, VA 22815: An 18-×24-in. print of Mr. Lynch's Hanging Corner Cupboard plans is available for $7.50. A complete catalog of Mr. Lynch's furniture plans costs $2.00.

BALL AND BALL, 463 W. Lincoln Hwy., Exton, PA 19341: Brass "H" hinges, cabinet lock and escutcheon.

HORTON BRASSES, Nooks Hill Rd., P.O. Box 95, Cromwell, CT 06416: Machine-made nails that look like hand-forged originals.

No matter what method you use to raise the panel, you'll still have some hand work to do at the top. Though the shaper will cut around the curve, you'll still need to finish off the corners with a chisel.

When you glue the door together, don't put any glue in the panel groove. The panel must be free to "float" in the groove. Leave the stiles a bit long and trim them to length after gluing up the door.

Making the Door

Once you've assembled the entire cupboard, you can make the door frame to fit the opening. Cut the stiles and rails to size, then lay out and cut the through mortises in the stiles. Next, cut the moldings and the panel groove on the insides of the stiles and rails. This task is easiest on a shaper or a router table. The next step is to cut the tenons on the rails and miter the corners of the moldings with a sharp chisel so the frame fits together neatly.

Make the panel to fit the frame, raising the panel on either the tablesaw, router table or shaper. The panel should "float" in the panel groove, allowing it to expand and contract across the grain as the humidity changes with the seasons.

Assemble the door frame and panel, but don't get any glue in the panel groove. The original door frame is held together with square pins driven into 1/4-in. holes through the joints. Don't use dowels—they may split the wood. A square pin will never cause a split.

Mortise the right-hand door stile for the lock, and mount the door with "H" hinges (see Sources). With the door in place, mark the edge of the cupboard stile where the lock bolt touches it and cut a mortise for the bolt of the lock. The original cupboard has a simple square lock escutcheon. I've shown a fancier one on the drawings.

The completed cupboard is pretty heavy, especially when it's loaded with plates. When you hang the cupboard, be sure the screws go into studs and not just drywall or lath. ▲

During the last 30 years, draftsman, cabinetmaker and retired Industrial Arts teacher Carlyle Lynch has measured and drawn over 100 pieces of antique furniture.

AN INTRODUCTION TO CARVING

Part Two: Getting The Edge

BY BEN BACON

There's nothing quite like the joy of slicing through wood with a tool that's wonderfully sharp—there's no dragging, no chipping, no shoving against the tool to make it cut. In this article, the second in a series of articles on woodcarving, I'll explain how to sharpen carving tools, taking you step-by-step through a process that should consistently deliver keen edges.

The sequence of steps in the sharpening process is the same for carving tools as for sharpening chisels or any flat blade—grinding, honing and stropping.

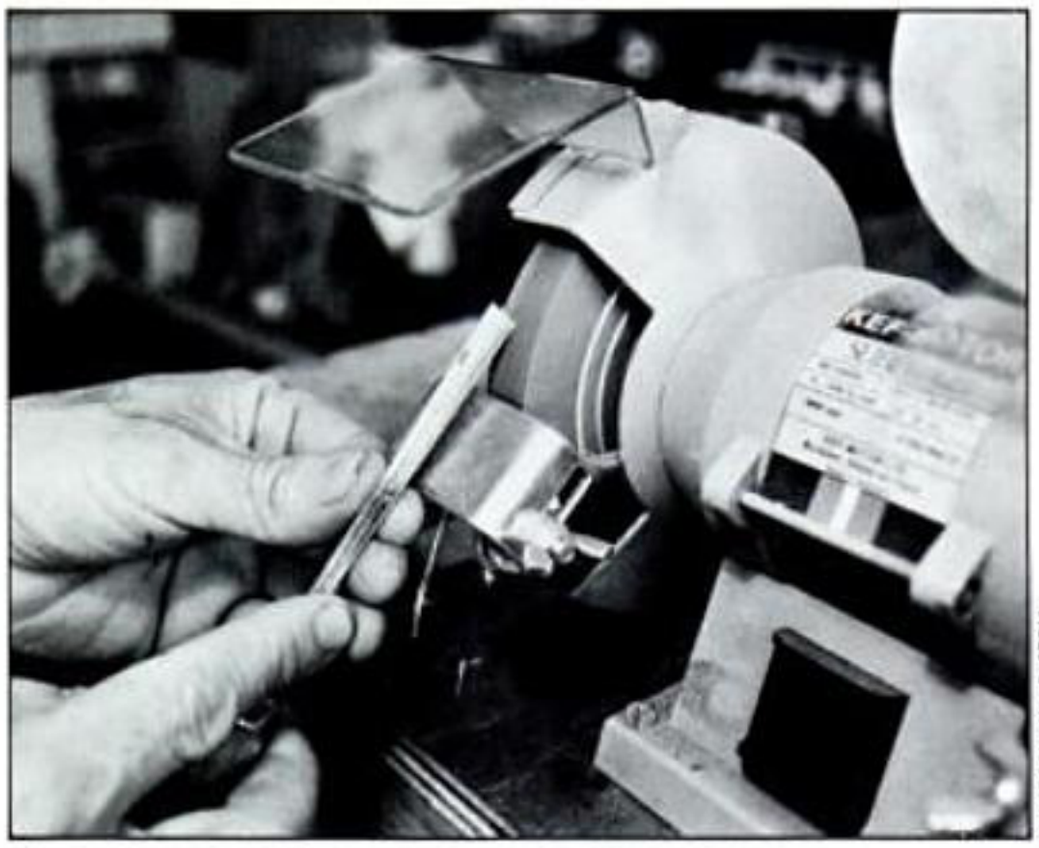
Just like a plane blade or a chisel, a carving tool has a flat surface that intersects a bevelled surface to form a cutting edge. As with plane blades and chisels, the trick is to keep the flat, inside surface of the tool true, and grind and hone only the bevel. The goal is to achieve a well-shaped edge, ground to an appropriate angle for the hardness of the wood you plan to cut and honed to a sharp edge. The idea with many carving tools is to get a sharp, even edge on a curved surface.

The one crucial difference between flat blades and carving tools is that not all carving-tool bevels are undercut, or hollow ground. This is especially true of fine fluters and veiners, which have very pronounced curves. Another important difference is that when sharpening a flat blade such as a chisel, it's vital to keep the blade as steady as possible on the stone. This is not true for carving tools. Carving tools are rolled as they're being sharpened in order to bring all of the bevel into contact with the stone. This is usually where the difficulties arise for the novice sharpener.

The sequence of steps for sharpening carving tools is:
Step 1: Grind the bevel
Step 2: Hone the bevel on a medium- or fine-grit stone
Step 3: Remove the burr from the flat side of the tool with a slip stone
Step 4: Fine-hone the bevel on a hard Arkansas stone
Step 5: Remove the burr with a slip stone
Step 6: Strop or buff

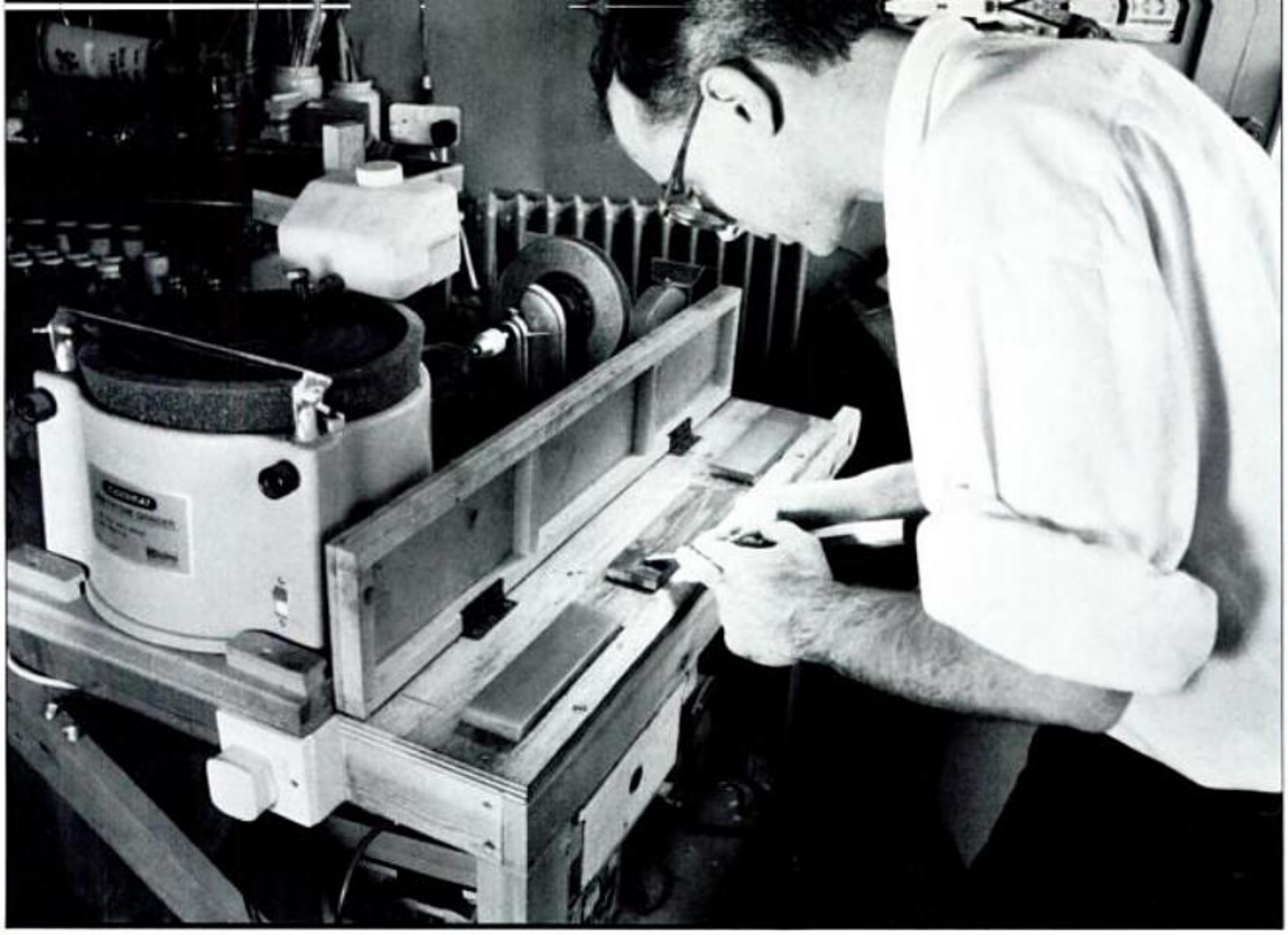
Grinding

Grinding sets the angle of your bevel. The bevel angle of a carving tool relates to the hardness of wood to be carved. A fine, thin edge (20°) is best for soft woods such as pine, a sturdier, shorter edge (25°-30°)



PHOTOS BY JULIA BARTON

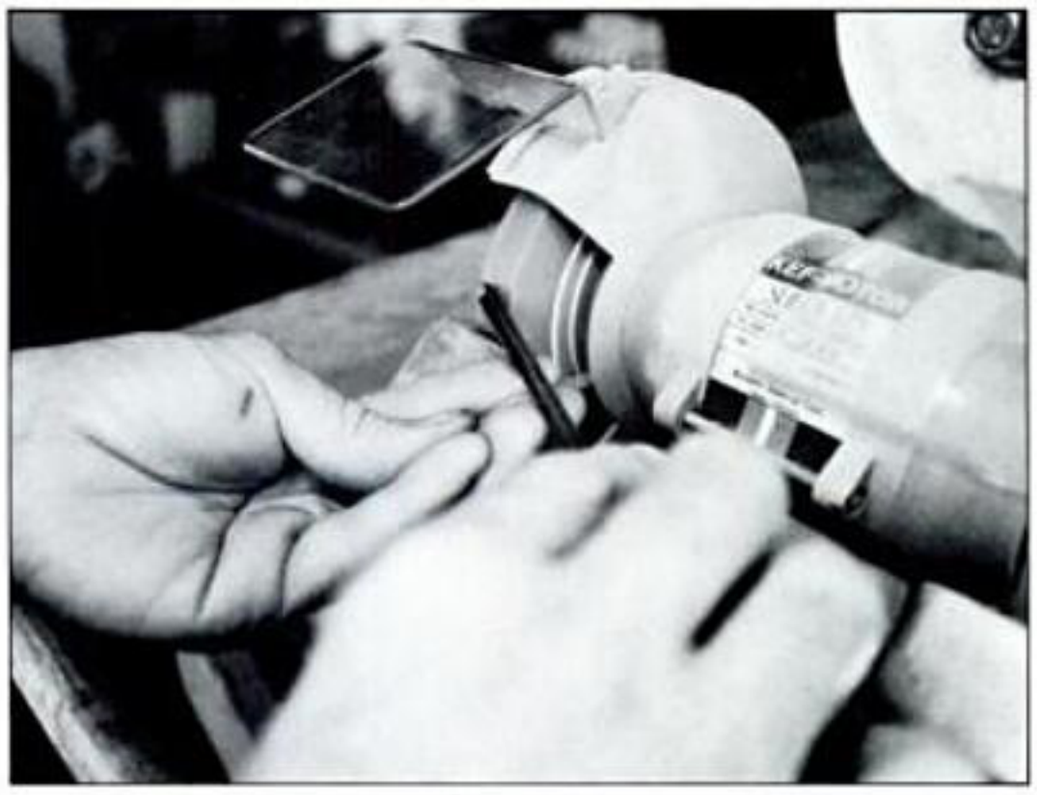
To grind a tool, hold the carving tool with one hand on the handle, the other holding the blade just beneath the rest as shown in the photo.



Grinding, honing and stropping are the basic steps to razor-sharp carving tools.

for harder woods such as oak or ash. You want the lowest angle possible without making the edge so thin that you risk chipping it.

The ideal is to have two grinding wheels, one a conventional dry grinder with a fine- or medium-grit wheel and a fine-grit water-cooled grinder. Water grinders are a luxury and it's perfectly possible to sharpen without them. Professional carvers value them because they're a quick way of fine-tuning tools, especially very delicate ones, without risk of burning the edge. Unless you have a lot of tools less than 5mm wide, you probably won't need to buy a water grinder.



Although it's risky, some experienced carvers prefer to hold the tool at right angles to the wheel. One hand supports the blade, the other holds the handle. Place the tool on the wheel gently, rolling the tool as you go.

To grind a tool, hold the carving tool with one hand on the handle, the other holding the blade just beneath the rest as shown in the photo on page 22. A flat chisel or plane blade should be held perfectly steady at a constant angle and moved back and forth across the wheel. This is also true for carving tools but, because a curved blade can only touch the wheel along part of its width, you have to roll the tool as you slide it across the wheel in order to grind the entire bevel. Sound tricky? It is.

The trick is to use a slow, regular motion, taking the metal off slowly and paying close attention to avoid taking too little or too much off the corners. (Rounded corners on carving tools are as great a liability as they are on chisels.) Use the hand beneath the rest as a guide to keep a constant bevel angle: lock the blade between your thumb and fingers, and slide the back of your forefinger against the rest to guarantee a constant angle. Roll the blade across the grinding wheel from side to side, reversing the roll when you reach the edge of the wheel. Stop grinding when the bevel is regular and a fine burr is turned over onto the inside surface of the tool.

The greatest danger in grinding is burning the cutting edge, especially at the corners. Fine carving tools have very little metal to dissipate the heat of grinding and so heat up quickly. Without moving the position of your guiding fingers, cool the tool in water frequently and take a good look at the bevel to make sure that you're grinding smoothly and evenly. Try to develop a light hand so that you don't overheat the metal.

It's fine to slightly undercut, or hollow grind, the bevel on large or flattish tools—No. 2s or 3s, for example (see Intro to Carving: Part One in November/December 1988 AW for an explanation of gouge

should be placed flat on the bench.

FIG. 1: HONING GOUGES

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wise as you would hold a cabinetmakin

A few words about stones. Mediun
stones are the best to use just after a dr
steel used for carving tools is the sam
hardness used in cabinetmaking tool
grade of stone used on chisels and pla

fine. I don't recommend using the *same* stone for both kinds of tools, though, because stones used for honing carving tools very quickly become irregular, making them unsuitable for sharpening plane blades and chisels. Either buy a new oilstone and sharpen carving tools only on that, or, if you don't want to invest in a new oilstone for carving tools, turn your old oilstone on its side and hone carving tools on the long edges.

Slip stones come in different shapes and hardnesses. I find that in practice, it makes little difference whether you use India or Arkansas slip stones, though the Arkansas stones, if you can find and afford them, are preferable. The two most useful shapes are a 6-in. long cone shape with a flattened bottom (available only as an India stone) and a 2½-in. round taper. These two stones can be used on virtually anything except parting tools, for which you need a flat slip stone, shaped either like a triangle or a wedge. I recommend the wedge shape because the triangle won't fit inside many parting tools.

Ideally, the slip stone should exactly fit the inside shape of the tool. This, unfortunately, isn't always possible, no matter how many slip stones you have. When the slip stone doesn't marry with the tool, carefully move the tool over the stone so that all of the interior surface comes into contact with the stone.

Now that I've given some general tips on grinding and honing, I'll run through specific techniques for grinding and honing gouges, parting tools, and fluters and veiners to give a clear idea what to do with each.

Gouges—Gouges, especially the flatter ones such as No. 2s or 3s, are the easiest carving tools to hone.

If necessary, clean the stone with alcohol and apply fresh oil. Hold the gouge at right angles to the stone at the correct angle for the wood you'll be working. Because the tool surface is curved, it's only possible for it to touch the stone at one point. To hone the entire surface of the bevel, first hold the tool on the left side of the stone, tilting it so that the extreme right corner is touching the stone. Now, slowly slide the tool across the stone, gradually rolling it so that by the time you reach the other side of the stone the left corner of the tool is touching it (see Fig. 1). Repeat the process going the other way, starting on the right and working toward the left.

You'll probably find that it's easy sharpening the middle, but it's hard to adequately sharpen the two corners without rounding them. The solutions to this problem are practice and paying very careful attention to where the steel is touching the stone when you reverse direction. As with grinding, work slowly and carefully. A dozen or so movements across the stone is usually enough honing on a well-ground tool. Once a burr is turned, a tool can get no sharper on that grade of stone, making additional effort wasted. More important, you'll find that the longer you hone a tool the more distorted the edge becomes.

For small tools, hold the tool in one hand and draw the slip stone over the inside with the other.

The burr from grinding should drop away fairly quickly and be replaced by a finer burr from the oilstone. Check that the entire width of the tool is evenly honed by running a finger over the inside, making sure that you've turned a burr along the entire surface. Also, look at the bevelled side of the tool. You should see an even area where the oilstone has ground out the coarse marks left by the grinding wheel. When you're satisfied, it's time to remove the burr with a slip stone.

If you're using a large slip stone, rest it on a bench, make sure it is adequately covered with oil, and then place the carving tool on it with the bevelled side up. The inside surface of the tool should rest absolutely flat on the slip stone. Find the spot on the stone where the stone and the tool shapes marry most closely (because the stone is tapered, the thin end will most closely fit higher-number tools such as No. 7s, and the wider end will fit No. 2s and 3s better), and then gently move the tool over the stone until the burr has disappeared from the inside. This should take at most three or four passes.

If the tool is a small one, and you're using a small slip stone, hold the tool steady with one hand and, holding the stone in the other, rub the stone (again held absolutely flat on the inner surface) over the surface until the fine burr is gone.

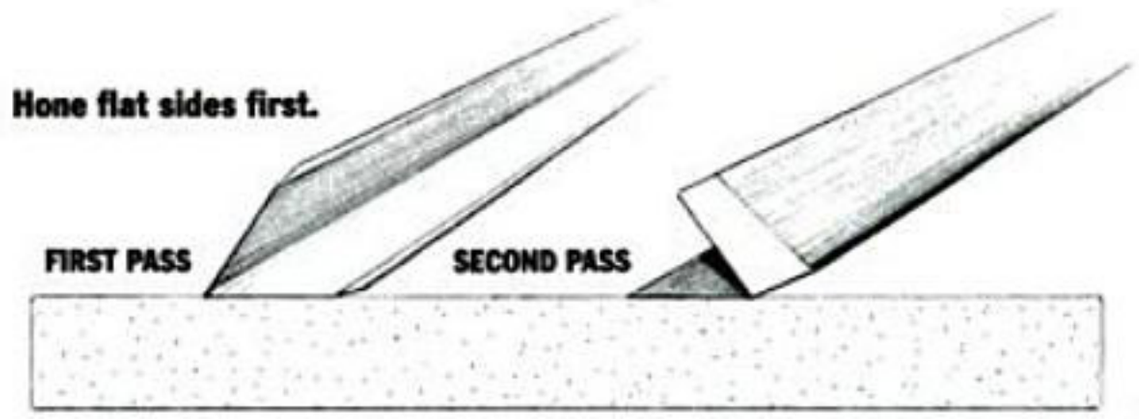
In many instances this degree of sharpness will be adequate—if you're roughing out a large carving, for example, a super-sharp edge is not necessary when doing heavy mallet work. Stropping after using the oilstone is usually sufficient. However, if you are doing fine work, or are working on very fragile woods to carve (such as pine), you'll need extra-sharp tools. To achieve this extra-sharpness you'll have to progress to a finer grade of stone such as a hard Arkansas.

Because an Arkansas stone is so fine-cutting you may have to hone for slightly longer to achieve a sharp edge. When you've turned a fine burr, again use the slip stone on the inner side. After stropping, which I'll cover later, the tool should be razor sharp.

Parting Tools—A cabinetmaker will probably find parting tools the easiest carving tools to sharpen. When grinding or honing a parting tool think of it as two flat surfaces joined on the bevel side by a tiny curve as shown in Fig. 2.

First, grind each flat surface as you would a chisel, except that the bevel should be flat, not undercut. When the two edges are exactly in line with each other and meet precisely at the joint—the tip of the V—grind the joint to the same angle as the bevel of the two flat sides with a very slight curve at the bottom. If you don't take enough metal off this joint, you'll be left with a sharp spur. If you try to grind the two sides so that they meet in a sharp V rather than a curve, you'll find that you grind through the joint and a hole will develop.

Tricky to visualize? Imagine taking a piece of cardboard and bending it so that it forms a V. The inside of the V will be sharp, but the outside of the V will have



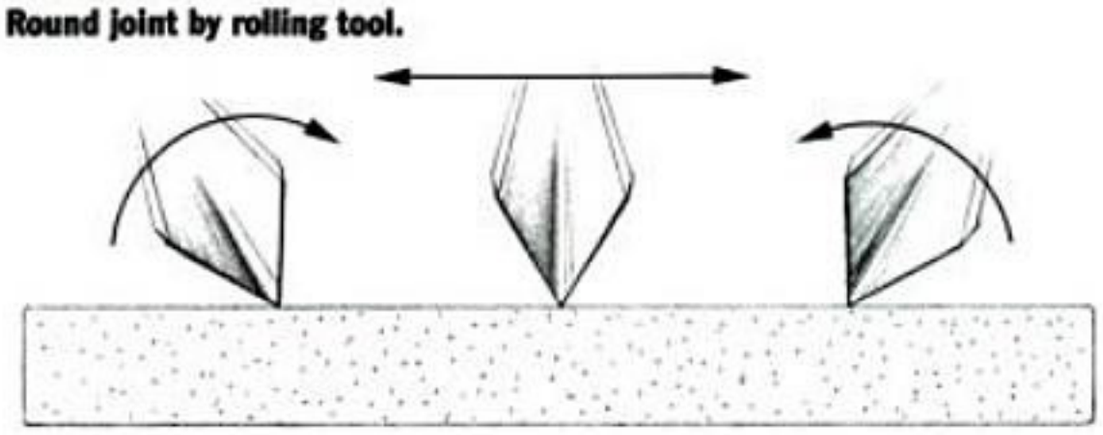
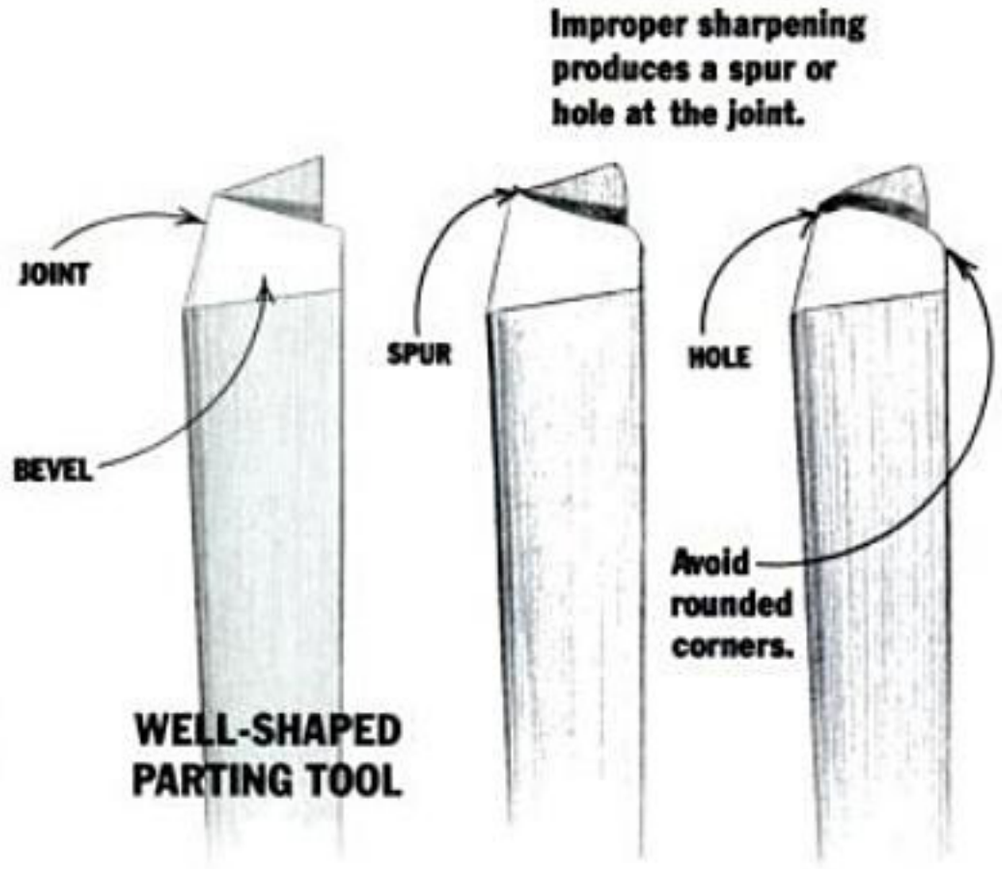


FIG. 2: HONING A PARTING TOOL



a slight curve that connects the two flat sides. A parting tool is shaped the same way.

Parting tools are honed in much the same method as they are ground. First, hone the two flat sides as if they were chisels, holding the tool steady at the correct angle and moving it in a figure eight over the stone. Stop when you've turned a new burr on the inside of each edge.

Next, roll the joint of the tool very gently across the stone, as shown in the drawing, to join the two flat sides with a small curve at the tip of the V. Do this extremely carefully or either a spur or a hole will be left at the joint.

When you've got two perfectly flat sides joined by a tiny curve, use a wedge or triangular slip stone to remove the burrs from the inside of the tool. Hold the tool in one hand and draw the stone over the inside with the other. Make sure the slip stone rests absolutely flat on the inner surface of the tool. If it isn't flat, a hole will develop at the joint at the front of the tool. Repeat the entire honing process on the Arkansas stone and finish up by stropping or buffing as explained below.

Fluters and Veiners—These are the trickiest tools to sharpen, and even the best carvers will have trouble achieving a beautifully shaped, sharp edge. This is especially true of veiners, which have a pronounced U shape. Their shape makes it difficult to evenly roll them across the stone and achieve a uniform bevel. Practice and care are the only solution.

Shape the tool with a grinder, and sharpen it with stones. As with gouges, hold the tool at right angles to the stone and rest the extreme right-hand side on the left side of the stone. Very carefully roll the tool across the stone until the left-hand side touches the stone as shown in Fig. 3. Repeat this process, which usually takes a dozen or so passes, until a uniform burr has been turned on the inside. Try to keep honing to a minimum. Excessive honing will only distort the shape of the edge.

Because of their unusual shapes, it's very difficult to find slip stones that fit fluters and veiners. If you're lucky, you may find some small second-hand slip stones, otherwise you'll have to make your own slip stones and shape them to fit your tools. Shape any suitable stone—I use slivers of roofing slate—and shape them on a belt sander.

Stropping and Buffing

Honing does not leave the edge perfectly sharp. The very tip of the cutting edge tends to bend away from the stone—hence the burr. Finer stones leave a finer burr, but it still needs to be broken off. Stropping on a piece of leather makes a tool sharper by breaking off the very fine wire of metal left by the stone and by polishing the metal so that it glides a little more smoothly through the wood. This is done by pushing the burr back and forth over the leather until it breaks off. To do this, you need to strop both the bevel and the inside surface of the tool. Half a dozen strokes on each side should be sufficient to break the wire, especially on high-quality steel.

Many carvers use a polishing compound on their strops. This abrasive compound doesn't aid in breaking the wire, but it helps polish the metal, especially on the bevel side. It also removes tiny scratches that might lead to chips in the edge or make the edge drag as it slides through the wood. Stropping, like honing, can be done to excess. If you're using a fast-cutting compound you might actually wear away a lot of metal on the very tip of the tool. Though it looks beau-

Stropping on leather makes a tool sharper by breaking off the wire edge left by honing.

tifully polished, you've actually blunted it slightly.

The best way to strop is to lay the strop flat on the bench when stropping the bevel edge, and strop less on the inside surface than on the bevel surface. You'll have to use a piece of leather supple enough to bend to fit the inside curve or shape a piece of wood to match the inside shape of your most commonly used tools and glue leather onto the shaped wood.

Some carvers, myself included, prefer power-buffing wheels to leather strops. I find they give a sharper, truer edge in less time, and the edge stays keener longer. According to one theory, the heat generated by the wheel allows the crystals of steel to align themselves evenly and form a unified, stronger edge.

A power buffer is faster and easier than stropping, but you must be careful of two things. First of all, don't allow the heat to become so great that the edge of the tool burns. A few seconds of buffing should be more than enough to sharpen the edge and polish the bevel. Secondly, and equally important, do NOT buff the inside edge of the tool. A buffing wheel, especially if loaded with compound, wears away metal, and, unintentionally, a bevel can be created on the inside surface. Instead of buffing, use either the slip stone or a pliable leather strop on the inside surface of the tool.

The best buffing wheel that I've come across is a hard, flat-felt wheel (available from Garrett Wade, 161 Ave. of the Americas, New York, NY 10013). The hardness of the felt allows you to carefully buff your tool and avoid rounding the corners. Soft buffing wheels, such as polishing mops, wrap around the metal and invariably produce a tool that resembles a spoon. Don't use them.

An important safety point about power buffers is that they should always rotate *away* from you—not toward you, as a grinding wheel does. If the soft cloth is rotating toward you, the tool edge will cut into the cloth and damage either the buffing wheel or you.

The greatest sharpening advice is to keep tools sharp at all times, and don't neglect them when that keen edge begins to fade. A minute or two of work will restore a near-sharp edge to perfect sharpness, but if you let the edge become blunt or chipped, it will take many minutes of sharpening and time away from your carving, before the tool is once again usable. ▲

Ben Bacon is a professional carver in London, England. The first article in his Introduction to Woodcarving series appeared in the November/December 1988 AW.

Buffing is an alternative to stropping. A hard-felt wheel charged with an abrasive compound produces a keen edge in a minimum of time.

CHOOSING CARVING TOOLS

You need quite a few carving tools to carve, and they're not cheap. Here are some pointers for buying high-quality tools that are good value and are also easy to use.

Always look at carving tools before parting with your money. Unfortunately, many of the carving tools are badly machined or badly made. Even some of the acceptably made tools will take you a long time to get ready for use. Often, having spent good money for a tool, you're expected to put a handle on it (if you buy unhandled tools), grind the bevel, and then soften sharp edges on the shaft so that you don't cut your hands. Sound unfair? I think it is.

The key to a good carving tool is accurate shaping. First of all, the handle and blade should be aligned or, if you've bought an un-handled tool, the tang should be in line with the blade. The second thing to look for is accurate machining of the tool. Is the tool straight? Are the walls around the hollow of a fluter or veiner of equal thickness? Are the two sides of a parting tool joined cleanly at the bottom, and are they the same thickness? Many aren't, and it's always worthwhile checking. Another thing to check is the actual thickness of the steel used in the tool. A tool used for sculpture or with a mallet should be robust, of course. Most carving tools are used with hand pressure only and should be as thin as possible, especially the smaller tools. This lightness makes it easier to do delicate, fine work. Fortunately, the one thing you don't have to check for is the quality of steel. It is uniformly high.

Look at the general condition of the tool and try to decide how long it will take you to fine-tune it for using. Does it need a handle? Are the edges so sharp that you'll need to sand them with 400-grit paper and oil so that you don't cut your hands? Is the tool pre-sharpened or at least pre-ground, eliminating the need for grinding the right bevel onto the tool? All of these things add time, and therefore money, to the price of a tool.

Antique shops and flea markets are other good places to look for tools. When buying old tools make sure the steel isn't pitted or rusted, that the blade isn't distorted, and that there is still enough "life" left to make the tool worthwhile. There's no point in paying money for a tool that has been so heavily used that it has only enough steel left for another year or two of use. Other than that, use the tool sense you use when buying any tool: a well-crafted tool will look and feel good, and a bad tool will always lack a certain something when you handle it.—*B.B.*

Classy Solution to Your Organizational Problems

Oak Filing

This handsome, four-drawer, legal-size filing cabinet is an American classic that is hard to find as a high-quality, manufactured item. Most of the units available are either made of plywood or found only in the smaller, letter-size width. This filing cabinet is made of solid wood, with frame-and-raised-panel sides and matching raised-panel drawer fronts. I chose heavy-duty metal drawer slides for this design, simplifying the carcase construction by eliminating the need for drawer dividers and wooden drawer guides and runners. Rails with very strong, double mortise-and-tenon joints connect the sides.

CABINET

BY MITCH MANDEL

Why settle for a metal monster, when you can make a much more attractive filing cabinet out of solid wood.

Building the Side Frames

Begin construction by preparing the stock for the two frame-and-panel sides of the carcase (see Fig. 1). You'll need four stiles (vertical members), eight upper rails and two wider bottom rails. Refer to the Bill of Materials for exact dimensions.

It's a good idea at this point to mark each piece (front stile, right side, etc.) and also which face is outside or inside. Remember, the front stiles are mirror images as are the rear stiles.

Lay out the 1-in. deep, 1/4-in. wide mortises on all four stiles simultaneously to guarantee that the stiles are all identical (see photo). Clamp the four stiles together, each with its inside edge up, and check that they are lined up flush at each end. Using a square, lay out the mortises across all four stiles. Note that the bottom rail on each side has two tenons on each end instead of one (see Fig. 1). This requires two mortises at the bottom end of each stile. One wide mortise-and-tenon joint would eventually loosen from repeated seasonal movement. Two smaller tenons divide the cross-grain movement between them, making the joint more stable.

Before cutting the mortises, cut a 3/8-in. deep, 1/4-in. wide groove, centered on the inside edge of each board—stiles and rails—to accept the raised panels (see Exploded View, Fig. 1). I cut these grooves on the tablesaw. On the stiles and the top/bottom rails, remember to groove only the inside edge. On the other rails groove both edges.

Next, cut the mortises on the stiles. Use a 1/4-in. Forstner bit or brad-point bit in the drill press to make overlapping holes. Set a fence on the drill-press table so that the bit lines up with the groove. Clean up the sides of the mortise with a wide chisel.

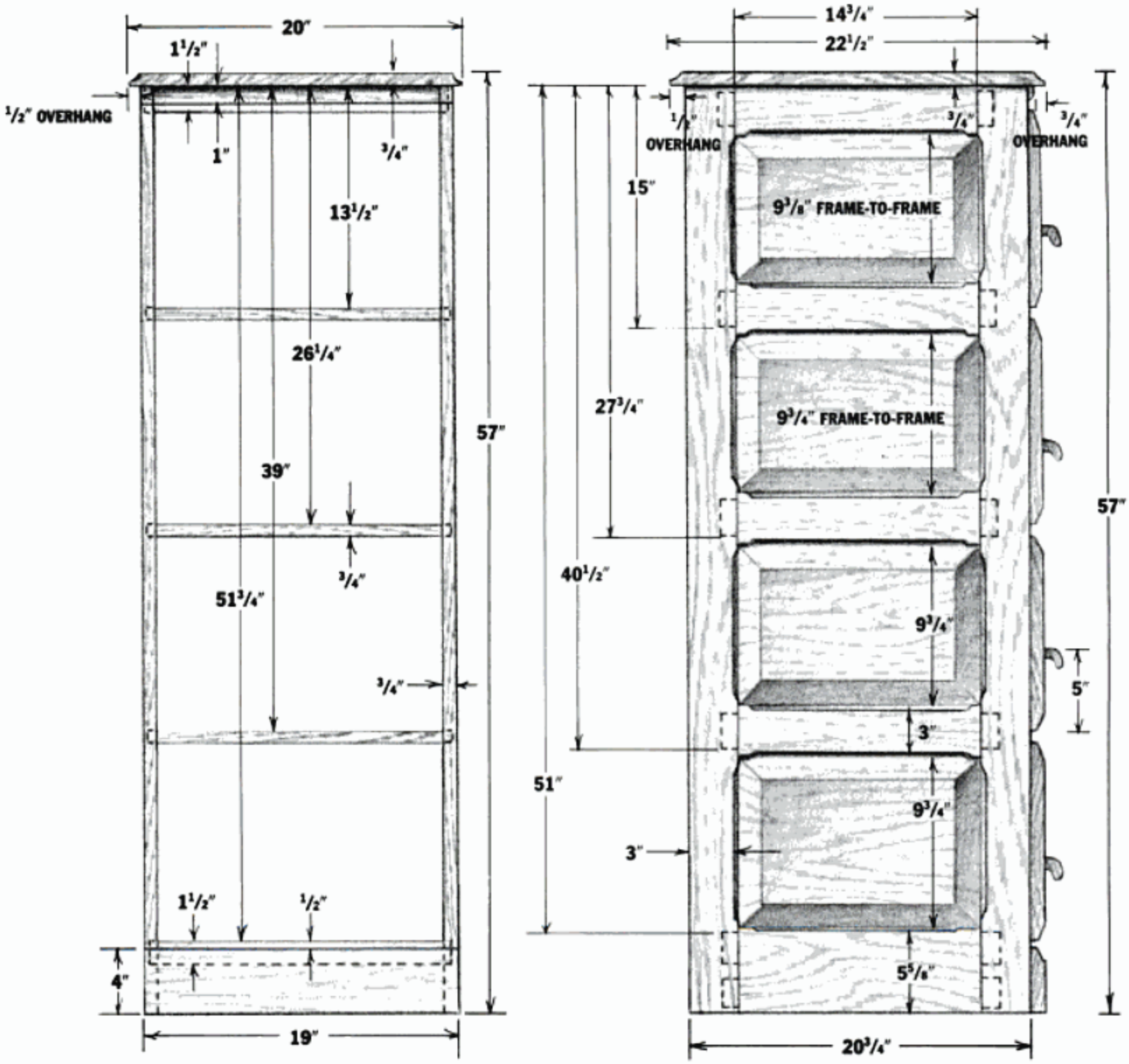
Now you can cut the tenons on the side rails (see Side-Rail Tenon Detail, Fig. 1). I cut these with a tenoning jig on a tablesaw as explained in the sidebar on the tenoning jig.

Dry clamp the side frames together and check for square. Make a mark 1/2 in. from each inside corner (see Round-Over Detail, Fig. 1). This is where to stop the 1/4-in. round-over profile that will be routed on the inside edges of each frame (see photo). I routed these edges on the router table. If you don't have a router table, you could use the router freehand while the frame is dry clamped together. Use a 1/4-in. round-over bit with a pilot bearing. However, since the pilot bearing will fall into the panel groove, you must place a 1/4-in. wide and 3/8-in. deep filler strip in the groove to serve as a bearing surface for the pilot bearing. Take care not to cut beyond your stop marks.

PHOTOS BY MITCH MANDEL

Save time and ensure accuracy by laying out the rail mortises on all four stiles simultaneously.

FIG. 1: FILING CABINET CARCASE



Making the Panels

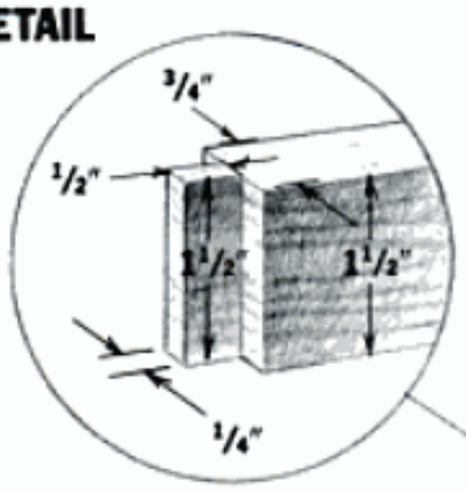
Once you've completed the side frames, you're ready to get the exact dimensions for the raised panels. Measure the distance between the bottoms of opposite grooves. The panels float in the grooves, unglued, so they are free to expand and contract with the seasonal changes in humidity. The dimensions of the panels should be ⅛ in. less than the distance from groove bottom to groove bottom, to allow for this movement. If you are working in winter when wood has shrunk to its smallest size, you may want to make the panels an additional ⅛ in. smaller to allow for expansion.

Next, glue up stock for the eight raised panels. I have included panel dimensions in the Bill of Materials, but these are only estimates. You will need to refer to your own side frames for exact measurements. Note that the upper panel on each side will be approximately ⅜ in. smaller in height than the lower panels (see Fig. 1). Once the panels have been surfaced and cut to size, cut the bevels for the raised panels on the tablesaw (called raising the panel). For pointers, see the sidebar on Raising a Panel.

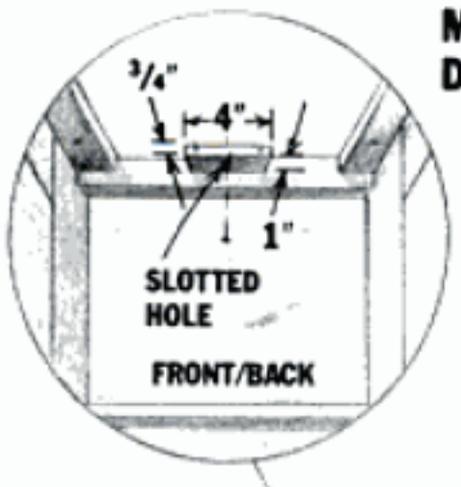
Finish sand the panels before gluing up the sides of the carcase, because you won't have access to the bevels once the panels are in the frame. When gluing, be sure to keep glue out of the grooves and off the panels, leaving them free to move. If you are making the cabinet in the humid days of summer when the wood is at its maximum expansion, you may consider putting the final finish on the panels before glue-up. This would prevent any unfinished wood from showing at the

DRAWINGS BY SALLY ONOPA

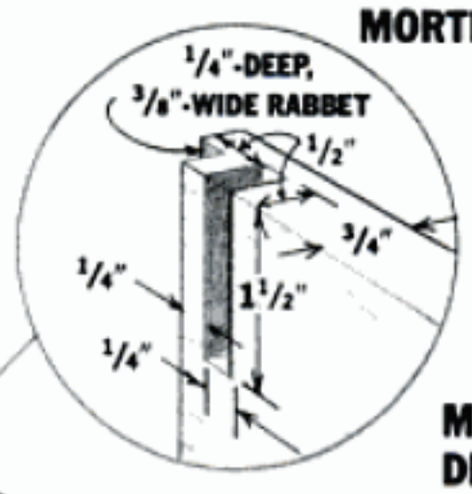
VERTICAL-TENON DETAIL



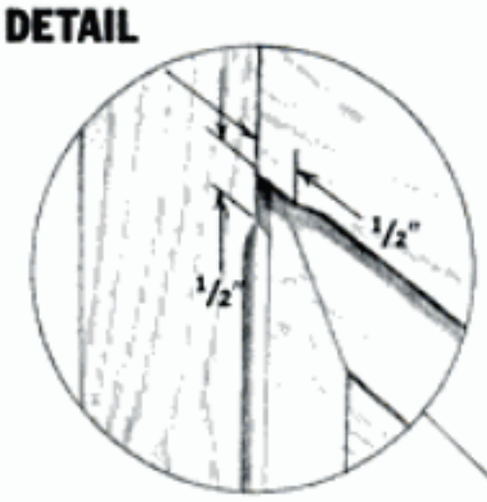
MOUNTING-STRIP DETAIL



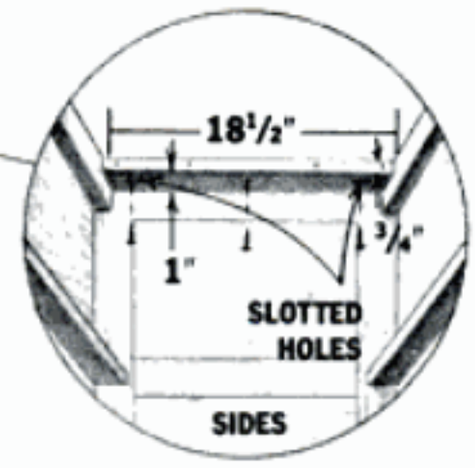
BACK RABBET/OPEN MORTISE DETAIL



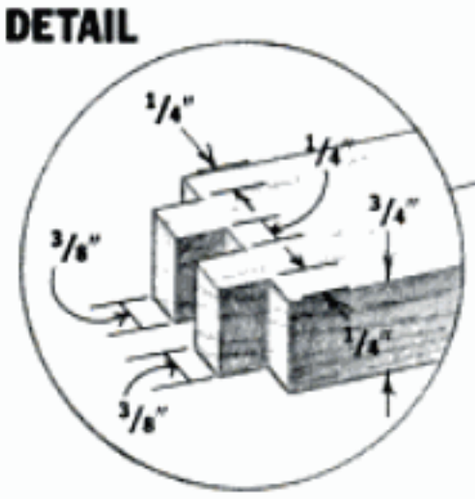
ROUND-OVER DETAIL



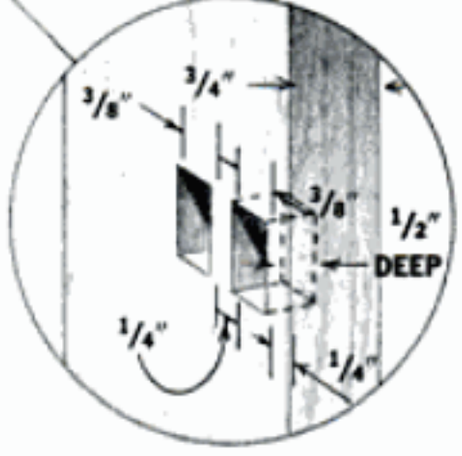
MOUNTING-STRIP DETAIL



TWIN-TENON DETAIL

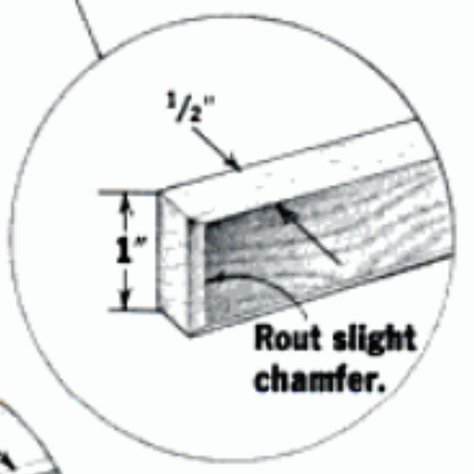


TWIN-MORTISE DETAIL



SIDE-RAIL TENON DETAILS

EXPLODED VIEW



TRIM DETAILS

edges when the wood contracts in the winter. It also has the advantage of preventing any excess glue from adhering to the panels. Coating the grooves with wax can keep the panels from sticking if glue should squeeze out, but be careful to keep the wax out of the mortises.

Connecting the Sides

At this point, the sides are almost finished. Before gluing up, you must mark and drill the mortises for the front and rear rails that connect the two side assemblies (see Fig. 1). Just as you marked all the mortises for the side rails, lay out these mortises on the four stiles simultaneously. A double mortise-and-tenon joint is used here on six of the ten rails for several reasons. A single, horizontal mortise should not be used in this case, because the gluing surfaces would be mostly end grain to long grain—a weak joint. Two vertical mortises maximize the long-grain to long-

Ornament the rails and stiles surrounding the panels with a round-over profile.

TABLESAW TENONING JIG

This tenoning jig is built so it rides smoothly but snugly over the tablesaw fence. I installed a quick-action toggle-type clamp (available from Highland Hardware, 1045 N. Highland Ave., N.E., Atlanta, GA 30306) to clamp the stock to the jig, but a C clamp will work just fine. A dado blade will enable you to cut each tenon cheek in one pass, but a standard tablesaw blade will do fine—it will simply require a few more passes. Set the blade height to the desired tenon length, then set the fence so the blade cuts the first shoulder. Flip the piece to cut the other tenon. Be sure to test your setup first on a piece of scrap. —*M.M.*

A tenoning jig will make the task of cutting tenons on the tablesaw simple and safe.

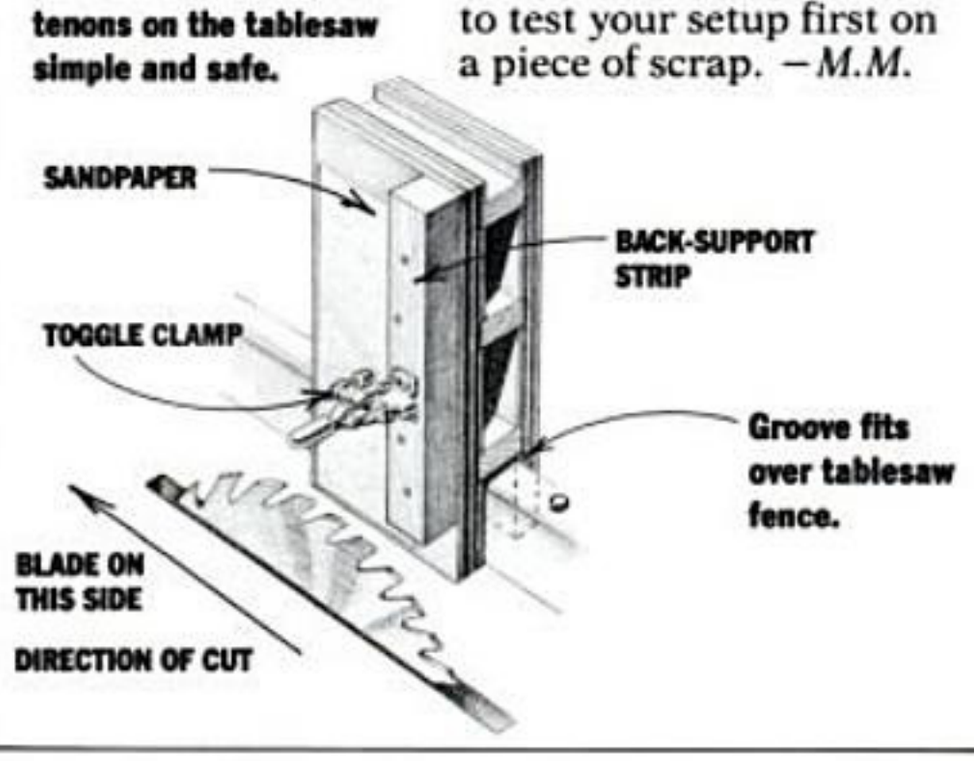
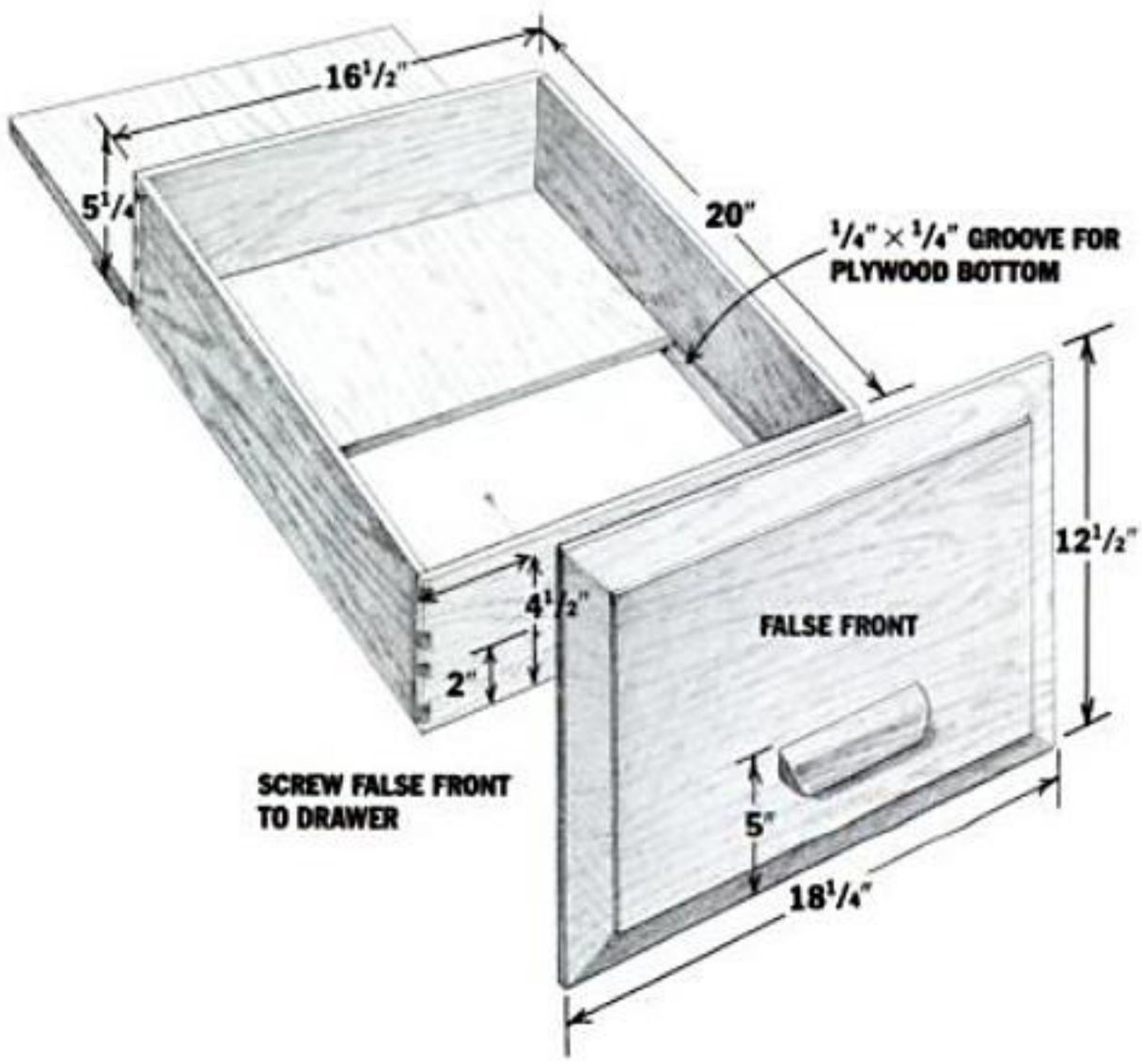
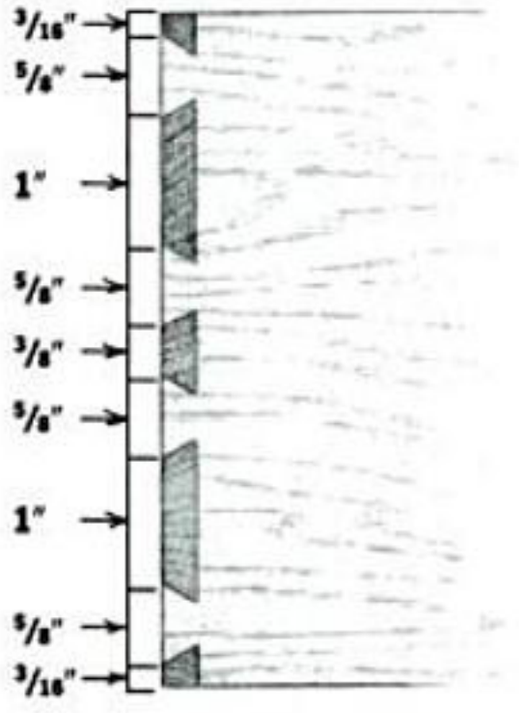
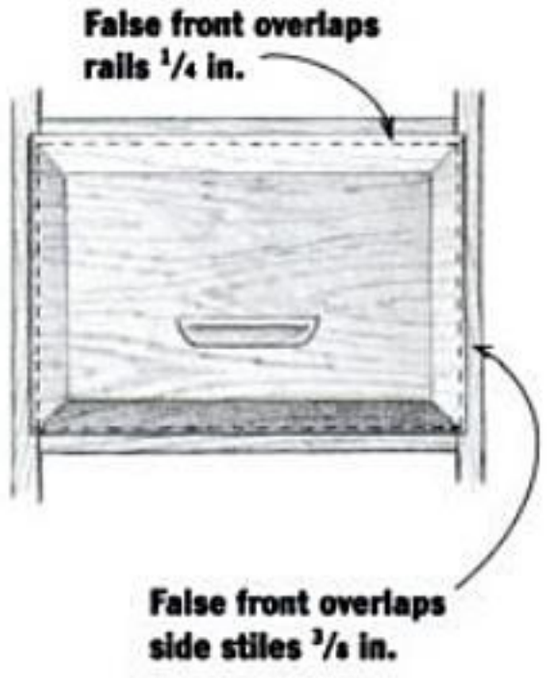


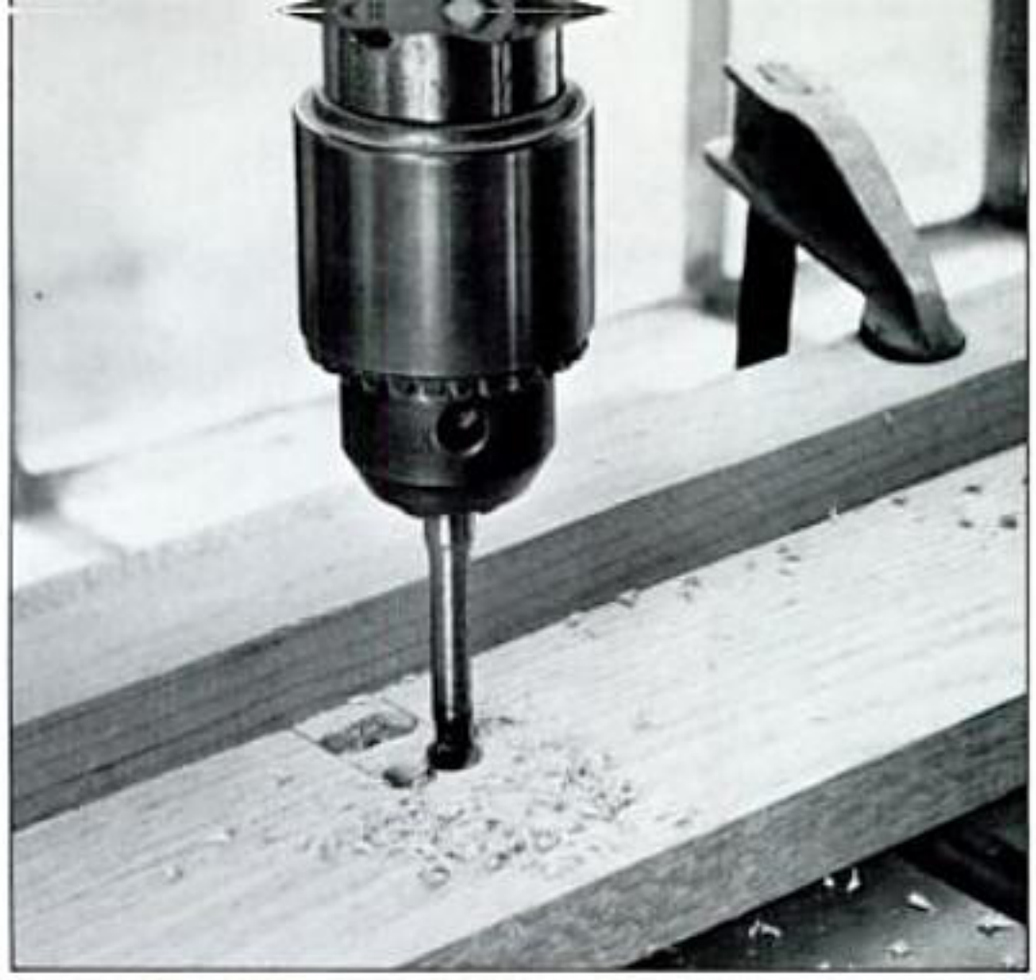
FIG. 2: FILING-CABINET DRAWERS





DOVETAIL DETAIL





By clamping a fence to the table of your drill press, you'll drill the twin mortises more accurately.

grain gluing surface, providing a very strong, mechanical joint.

The top front and back rails and the bottom back rail are joined to the side assemblies by single, vertical tenons in open-ended mortises (see Fig. 1). These open mortises will ease the assembly process later. Note that the bottom front rail has a single, vertical tenon, but its mortise isn't open-ended.

I cut the mortises for the front and back rails on the drill press in the same manner as I cut the mortises for the side rails. Clamp a fence to the drill-press table and cut all the outside mortises on all four stiles first (this will include the top and bottom mortises). Move the fence and cut the inside mortises on each mortise that has a twin (see photo). This will ensure that the spacing between the mortises is consistent. Note also that the mortises for the rear rails are set back from the rear edge 1/4 in. more than the front set to allow room for the rabbet that will hold the back (see Fig. 1).

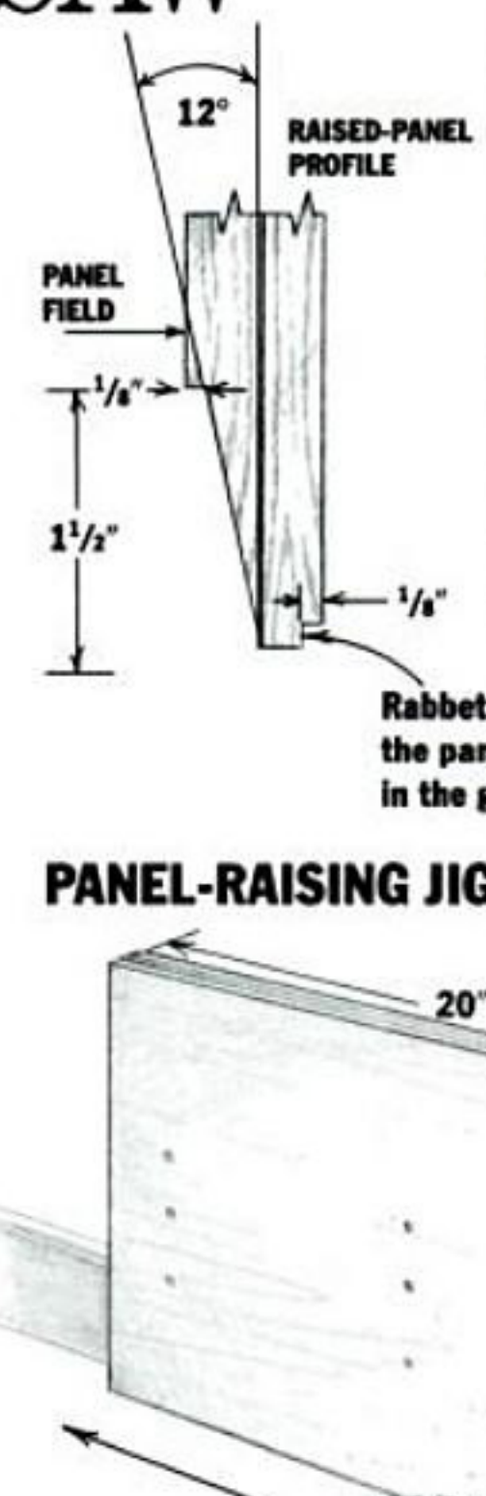
RAISING PANELS ON THE TABLESAW

The usual technique for raised panels on the tablesaw involves running the panel vertically across an angled blade, while supported by a high auxiliary fence. I prefer to use a jig that enables me to keep my hands well-away from the high, unguarded blade, while the workpiece itself is securely clamped and supported.

The jig is made of 3/4-in. plywood, and like the tenoning jig, it should ride smoothly but snugly over the tablesaw fence (see photo). It should be approximately 20 in. long and 12 in. high. Make sure both sides rest firmly on the saw table.

To cut the panels, tilt the blade 12° away from the fence and raise it 1 1/2 in. Position the fence so the blade just barely cuts through the outside of the panel leaving a 1/8-in. shoulder between the bevel and the field as shown in the drawing (the field of a panel is the front-raised face). Clamp the work piece securely to the jig with C clamps and feed it slowly through the saw. Cut the end grain first and then the side grain.

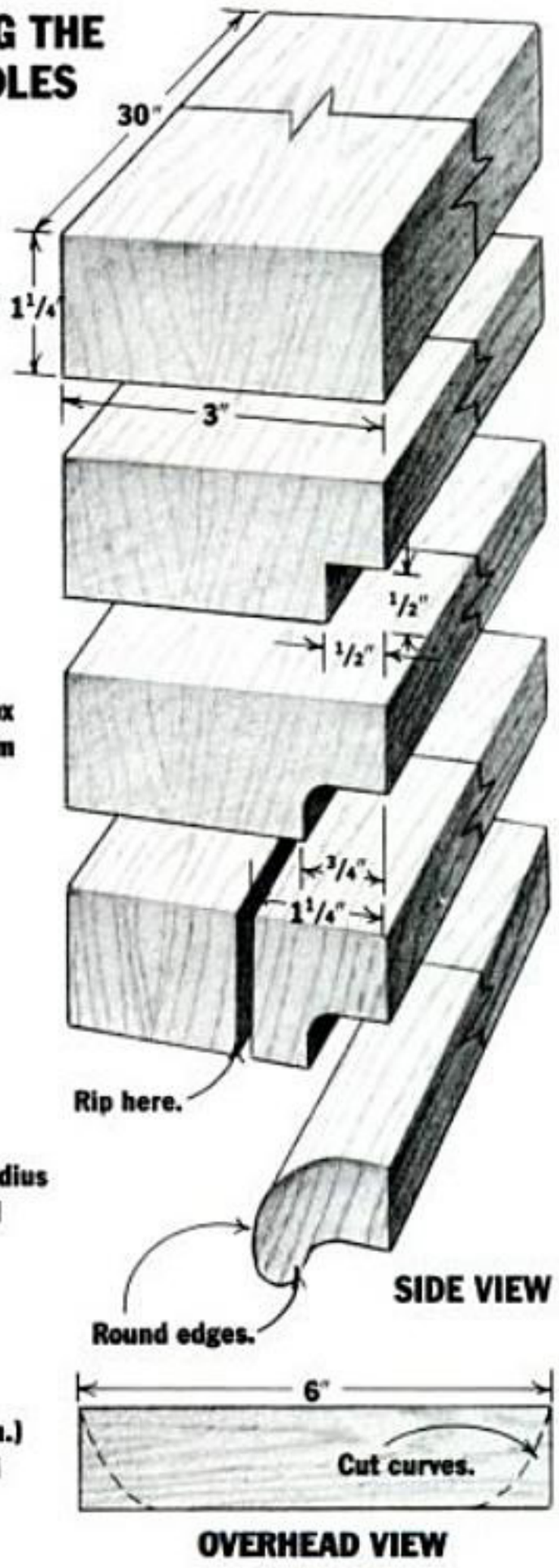
The angled blade will leave an angled shoulder. Clean it up with a rabbet or shoulder plane. The tablesaw blade will leave some marks on the bevel which need to be sanded or scraped clean. For panels that will be enclosed in a frame, you need to cut a 1/8-in. deep, 3/8-in. wide rabbet on the back edges, otherwise the panel will not fit into the grooves in the rails and stiles. This rabbet will set the field of the panel a 1/8 in. proud of the frame. For panels where both sides will be seen, (as in door fronts) another treatment would be to bevel *both* sides of the panel. For drawer fronts, all you need to do is soften the front edges with a plane, file or sandpaper. —*M.M.*



Clamp your panel to the panel-raising jig and push it slowly over the saw. Cut the two end-grain edges first, then the long-grain edges, and, presto, you've raised the panel.

PANEL-RAISING JIG

FIG. 3: MAKING THE DRAWER HANDLES



1. Start with a 1¼ in. × 3 in. × 30 in. board (extra width for safety).

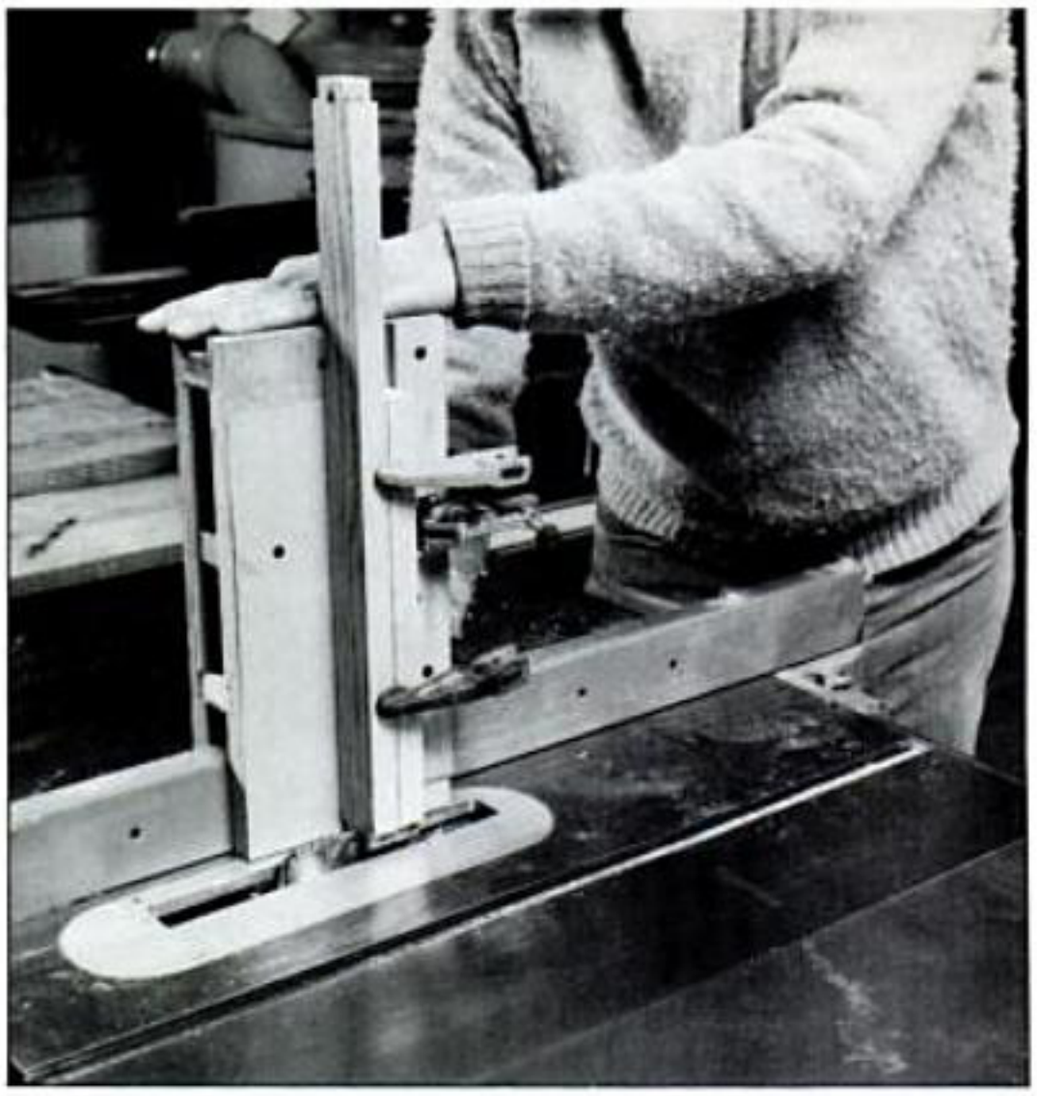
2. Rip ½ in. × ½ in. rabbet on one long edge.

3. Use a ¾-in. core box bit in the router to form the inside radius.

4. Rip the board to 1¼ in. wide.

5. Form the outside radius with a spokeshave and sander.

6. Cut the individual handles to length (6 in.) and form the end radii on the bandsaw.



You can also use the tenoning jig to cut twin tenons. If the board is too wide for the toggle clamp, use C clamps to hold it in place.

Cut this ⅜-in. wide, ¼-in. deep rabbet on the rear stiles for the back plywood panel.

Next, cut the front and rear rails. You'll need ten pieces. Refer to the Bill of Materials for dimensions. Remember that six of the rails have twin tenons, four have single tenons. Cut the twin tenons on a bandsaw or tablesaw. Note that if you cut these tenons with the tablesaw tenoning jig, your back-support strip will need to be close to 1½-in. wide for the toggle clamp to work; however, a C clamp will work. With a ¼-in. dado blade this is a quick operation—you'll need to readjust the blade only once. Make the outside cuts on all six rails first, then flip the pieces to cut the opposite sides. Once the outside faces on all your rails are cut, move the fence for the inside cut (see photo). Cut these tenons a bit on the heavy side, and fit each one individually, paring them down with a file or chisel if necessary to fit the mortise. Then label each set of joints.

After all the pieces for the carcase are cut and fitted, you can glue up the carcase. Glue the side assemblies first. When gluing the two sides together with the rails, it's helpful to have assistance in aligning the rails into their mortises. The top front and rear rails and the bottom rear rail can be slipped into place after the others, so you have three fewer pieces to contend with during the frenzy of the glue-up.

Making the Drawers

Once the case is glued, you can get dimensions for the drawers. I have given the dimensions of the drawers in the Bill of Materials, but, as with the panels, you will need to measure your drawer openings for precise dimensions. The drawers consist of a standard drawer box, each with a separate raised-panel false front attached (see Fig. 2). The drawers need to be 1 in. narrower than the front opening to allow for the ½-in. drawer slides on each side (check the instructions that come with your drawer slides). For maximum strength, I dovetailed all four corners of each drawer.

Make the drawers out of ½-in. stock. I used a combination of poplar (for the sides) and Philippine mahogany (front and back) because these woods are cheaper than oak and readily available in my area. The contrasting colors also highlight the dovetails nicely. You could also use ½-in. veneered plywood. If you do choose plywood, skip the dovetails; use rabbet joints reinforced with nails and cover the edges with veneer tape. Before assembly, plow a ¼-in. deep, ¼-in. wide groove ¼ in. from the bottom on the sides, front and back to hold the plywood bottom (see Fig. 2). Glue the drawers together, remembering to include the plywood bottoms.

Raise the false fronts the same way you raised the side panels, but round them over slightly on the front outside edges with a block plane or file. Refer to the Bill of Materials for drawer-front dimensions.

Make the drawer handles next (see Fig. 3). Then attach the handles to the false fronts from behind, using countersunk 1¼-in. #8 wood screws. I used a simple positioning jig to ensure consistent placement. The jig is a piece of plywood 5 in. high and 12⅛ in. long with two holes drilled in one corner (see photo). Position it at the lower-right corner of the inside of the false front and drill pilot holes through the false front. Keep the holes in the jig small for greater accuracy. Enlarge the pilot holes in the drawer front to accept the counter-

This very basic jig will ensure that the handles are uniformly positioned on the drawer fronts.

sunk screws. Clamp the handle to the upper-left corner of the jig and drill. Remember, *always* keep the same side of the jig toward you when drilling.

Install the 20-in. long, full-extension drawer slides (available from Constantine's, 2050 Eastchester Road, Bronx, NY 10461) in the cabinet and on the drawer boxes according to the instructions. Attach the false fronts to the drawers using six 1 in. #10 wood screws and washers for each drawer. Locate these in two horizontal rows of three, the first row 2 in. from the outside bottom of the drawer, and the second 4½ in. from the outside bottom of the drawer for a neat, finished appearance (see Fig. 2). Do not glue the false fronts on the drawers. Position the false fronts on the boxes so that the fronts overlap the rails by ¼ in. on top and bottom and ⅜ in. on the sides (see Fig. 2).

BILL OF MATERIALS

NAME	QUANTITY	DIMENSIONS (T/W/L)
Carcase:		
Sides:		
FRAMES:		
Stiles	4	¾" × 3" × 56¼"
Rails	8	¾" × 3" × 16¾"
Bottom Rails	2	¾" × 5⅝" × 16¾"
PANELS:		
Upper	6	¾" × 10⅜" × 15⅜"
Lower	2	¾" × 10" × 15⅜"
Front, Back and Top:		
Rails	10	¾" × 1½" × 18½"
BACK:		
Plywood Panel	1	¼" × 18¼" × 56¼"
TRIM:		
Top Trim	1	½" × 1" × 19"
Bottom Trim	1	¾" × 4" × 19"
MOUNTING STRIPS:		
Side Strips	2	¾" × 1" × 18½"
Front/Back Strips	2	¾" × 1" × 4
Top	1	¾" × 22½ × 20"
Drawers:		
False Fronts	4	¾" × 18¼" × 12½"
Handles	4	1¼" × 1¼" × 6"
DRAWER BOX:		
Drawer Sides	8	½" × 5¼" × 20"
Drawer Front/Backs	8	½" × 5¼" × 16½"
DRAWER BOTTOMS:		
Plywood	4	¼" × 16" × 19½"
Hardware:		
DRAWER HARDWARE:		
Full Extension		
Drawer Slides	4 pair	20"
File Folder		
Support Frames	4	legal size

The Final Stretch

Next, cut and shape the top and bottom trim pieces that will attach to the top and bottom rails on the filing cabinet's front side (see Trim Detail, Fig. 1). The bottom trim has a ½-in. chamfer routed deep enough to leave an ⅛-in. shoulder on the top and sides. This piece is glued to the front stile edges at the lower portion of the bottom front rail. Because the top trim piece is only ½ in. thick and 1 in. wide, I put a very narrow chamfer on the sides and bottom edge with a block plane. This piece is glued to the front stile edges at the top rail, flush with the top.

Glue up the top so that the grain direction runs from side to side, not front to back, with the end grain on the sides of the cabinet. The top should overhang the cabinet by ½ in. on the sides and the back and ¾ in. in front (measuring out from the top trim) as shown in the Front and Side Views in Fig. 1. Use the same edge treatment on the top as you did on the bottom trim piece—that is a ½-in. chamfer with an ⅛-in. shoulder. Put a very slight chamfer on the underside edge.

To fasten the top, attach mounting strips on the inside of the sides, front and back (see Mounting Strip Detail, Fig. 1). These strips are screwed and glued to the inside top rails of the cabinet, flush with the top. Drill slotted holes in these strips to allow the screws that attach the top to move with the wood. The holes should be slotted lengthwise (with the grain) in the side strips, and crosswise (across the grain) in the front and rear strips (see September/October 1988 AW, Fastening Table Tops, for more on slotted holes and fastening solid wood tops). Attach the top with 1¼-in. #10 round head wood screws and flat washers. Finally, cut the plywood back, then attach it with glue and finishing nails.

I finished the cabinet with a couple coats of McCloskey's Tung Oil Stain, followed by two coats of McCloskey's Tung Oil Finish (manufactured by McCloskey Varnish Co., 7600 State Rd., Philadelphia, PA 19136), and finally, two coats of wax. Whatever finish you choose, be sure to finish all the wide panels (the top, side panels and drawer fronts) on *both* sides to prevent warping due to uneven moisture absorption.

Finally, insert support frames and standard, legal-size hanging file folders, both of which are available at any good office supply store or by mail from Office Utilities, 1221-27 Sumner Ave., Allentown, PA 18102. ▲

Mitch Mandel is a professional photographer and a woodworker in Allentown, PA. This is his second article for AMERICAN WOODWORKER.

An American Woodworker Profile

THE ARTFUL BODGER

One Man's Exploration of Early Country Woodcraft

BY JOHN BIRCHARD

PHOTO COURTESY OF THE WYCOMBE CHAIR MUSEUM

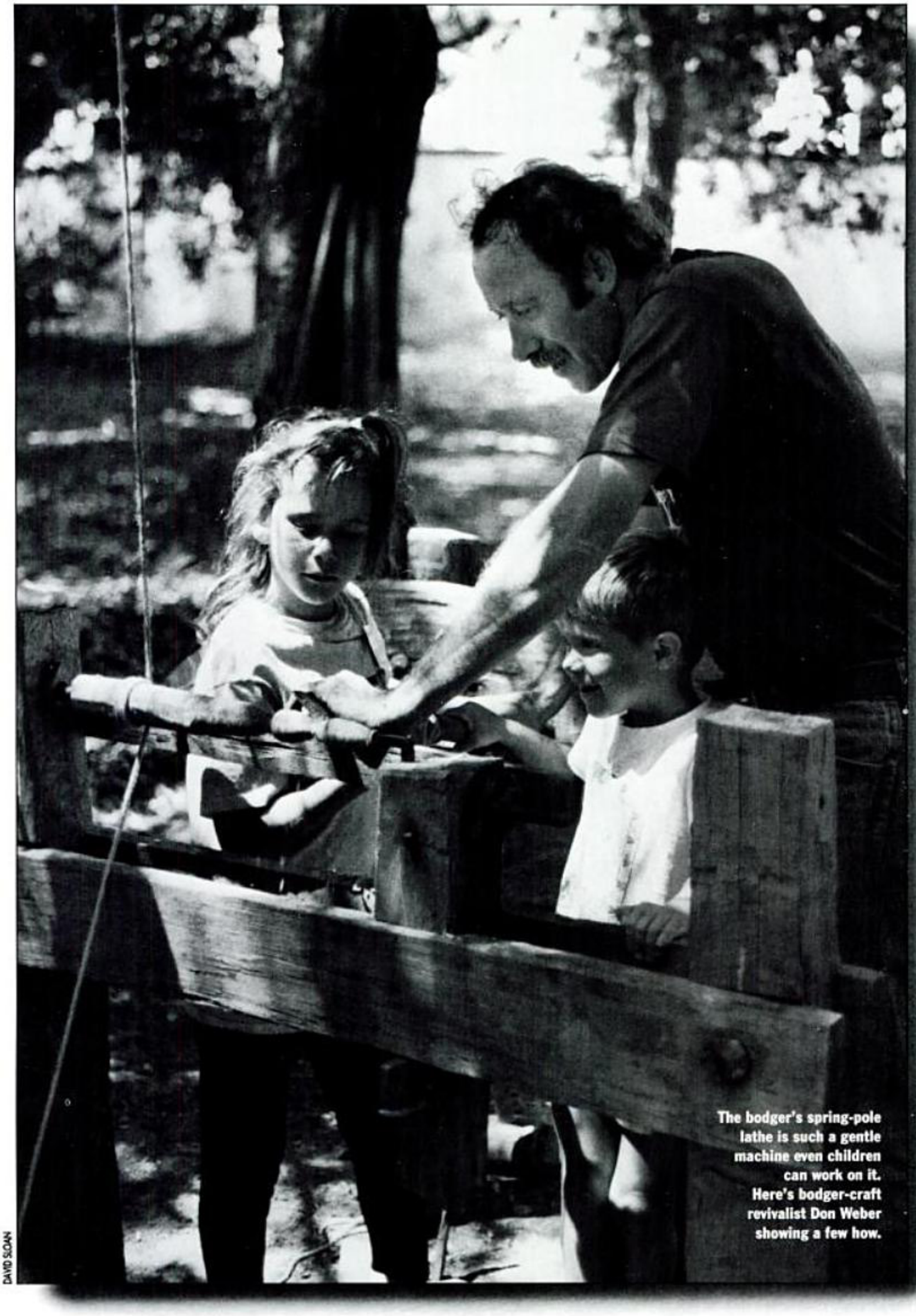
"Bodgers" were itinerant turners who set up shop in the forest and mass-produced chair parts with primitive lathes and tools. This is a typical bodger's camp in the early 1900s.

Don Weber has always felt most at home in the forest. His fondest boyhood memories are of fishing and hiking in the countryside of his native Wales. His deep kinship with nature, along with his interest in the old-fashioned self-sufficiency of his Welsh ancestors have, over the years, propelled Don along some of the lesser-trodden paths of craft exploration. So I wasn't surprised when, during a recent visit to his shop in Northern California, I found him turning chair parts with an antiquated spring-pole lathe. "I'm learnin' t' be a bodger," he said in his lilting way. A bodger? I began to suspect that he had slipped a cog. Perhaps he was feeling older than his years, or maybe this was just his artful way of dodging serious work that could be paying the rent and putting food on the table.

As I soon learned, Don's "bodging" was serious work. He is reviving the craft of the "bodgers," woodturners who flourished in rural Britain until early in this century, turning spindles, rungs and legs for chairs on spring-pole powered lathes.

Though Don makes the bulk of his living repairing and restoring antique furniture, he has also, for the last eight years, taught and demonstrated the techniques of early English and American woodcrafting at shows, conferences and fairs. He dreams of reviving these forgotten arts, and currently his life is dedicated to making this dream come true.

For Don, it has always been the process more than the finished product that has inspired his best labors. The intimacy of choosing his raw materials from the living forest; felling, planking and riving out billets with axe and froe forged by his own hand; the satis-



DAVID SLOAN

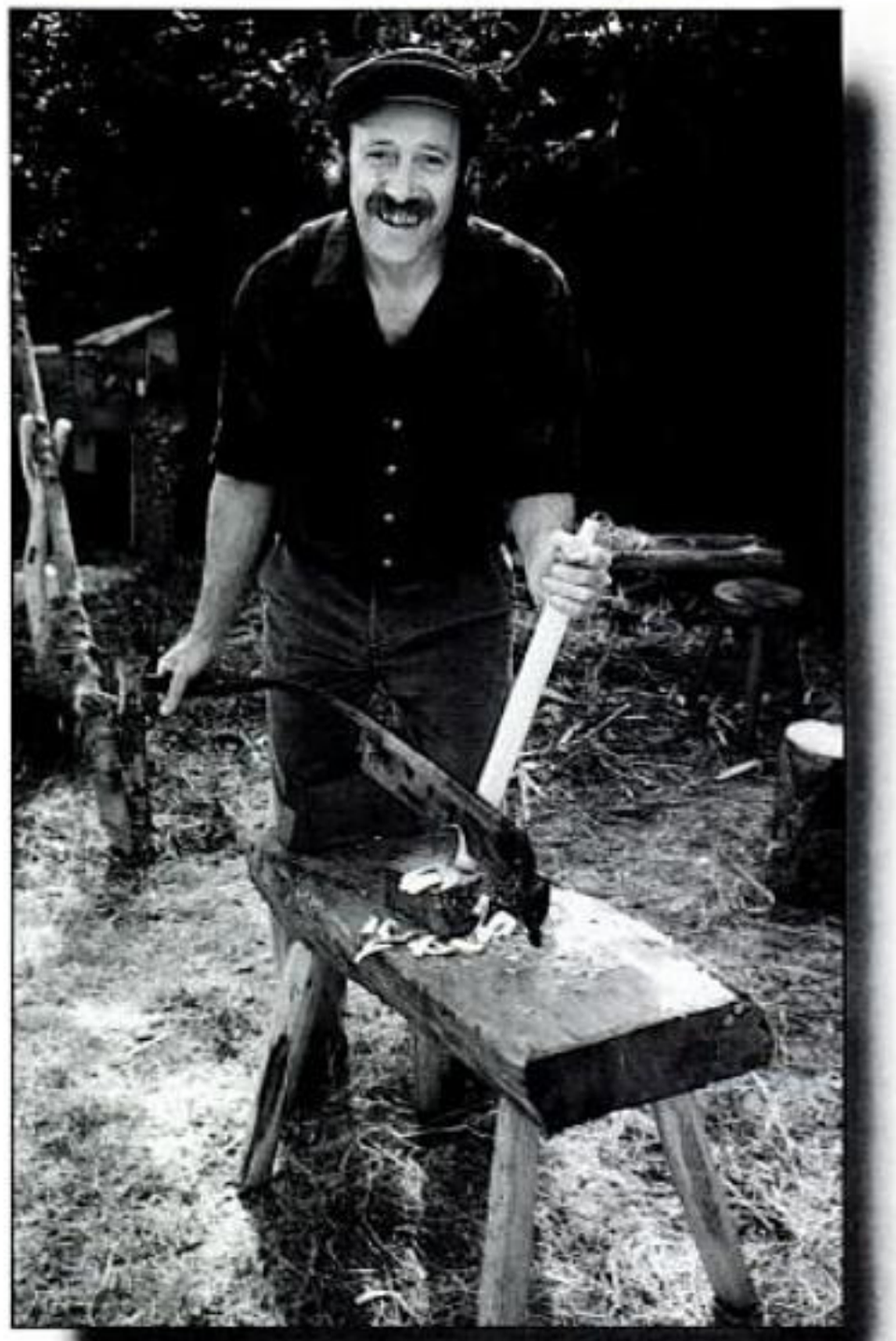
The bodger's spring-pole lathe is such a gentle machine even children can work on it. Here's bodger-craft revivalist Don Weber showing a few how.

PHOTOS BY JOHN BIRCHARD

Up until the 1920s, legs turned by bodgers were in great demand due to their durability.

The block knife is a traditional tool used in roughing the billet to shape before it is mounted on the lathe, but a hatchet or a draw knife will do the trick.

Bodgers started with billets which they split out of select logs. This gave the legs a strength that sawed-out billets would have lacked.



faction of turning spindles and rungs on a primitive lathe—these, more than money, are the rewards he finds in the ancient crafts.

And then, there is the grander process of carrying on the knowledge of the past. It's so easy for us to get caught up in our work-a-day concerns and to forget the important role that tradition plays in our craft. The brute power of modern technology is not the only way to get something accomplished.

Don gained early experience with hand tools when he was briefly apprenticed in an English joinery shop before his family moved to the U.S. in 1962. He also worked for an old New England timber framer soon after arriving. The demands of modern production carpentry went against Don's grain from the beginning. But it was a serious hand injury on the tablesaw—caused by working too fast under pressure—that convinced Don that production woodworking was not for him. After his injury, Don decided to find a way to make a living at a slower pace and began looking for opportunities to learn about, teach and practice the traditional crafts of rural Britain.

Don has since built or collected many of the tools and machines that were used in various woodworking trades before the industrial revolution: spring-pole and treadle-powered lathes, shaving horse, block knife, sash saw, post auger, froe and broad axe, forge and anvil. All these and many more have been bought with earnings from furniture repair, built when time could be spared, salvaged from the junk pile and restored to working condition by a sharp eye and a caring hand.

"It was not easy making the transition from modern carpentry to ancient craft," reflects Don. "With my strong background in the use of hand tools, I was often hired by the 'back to the land' people of the last decade because I could do good work quickly without power tools." During that time, Don also taught classes at the local art center on the care and use of hand tools. His real break came in 1979, when he was hired by the California Renaissance Pleasure Faire to act the part of an Elizabethan woodcrafter.

The fair, held annually in Thousand Oaks and Novato, gave Don a paid excuse to research and build the tools and implements that interested him, and it put him in contact with other people who were practicing similar early crafts. As a part of his act, he made and sold bowls, stools, chairs, rakes, pitchforks, tool han-

Don't let the rustic appearance of the homemade pole lathe fool you. The end result is as fine as can be.

Don makes his own turning tools for working on the pole lathe. Their special shapes maximize his own power since that is what he's relying on.

dles and other items that he produced himself.

Don's fair exhibit began with draw-knife and spoke-shave demonstrations, but it has grown over the years to include many of the English country crafts. His booth at the fair is a half-scale "cruck" frame, a primitive form of timber frame construction commonly used in the 14th century. A cruck frame employs book-matched beams from a curved oak log to form an "A"-frame hut. At the fair, Don makes wooden rakes and pitchforks from green willow poles, woven fences or "hurdles" from hazel, wooden shoes or "clogs" rough-shaped from green hardwoods with a shearing tool called a block knife, bowls on the treadle lathe and more.

As Don is quick to point out, "It's not all just for show." Don and his wife Lilly, a prodigious gardener, have built a traditional hurdle-type fence around the beautiful flower garden adorning their home and workshop. There, they use Don's rakes, baskets and other items regularly. Their home and garden, nestled by a small stream in the backwoods of Mendocino County, are testimony to their self-sufficiency and decision to live lightly and in harmony with their wooded surroundings.

The Bodger's Craft

Bodging currently interests Don the most. He contends the building of a spring-pole, or bodger's lathe, is a simple enough project and a good way to learn turning skills on a very basic machine.

Bodgers spent their long workdays in the beech forests turning the resilient, straight-grained English beech into the legs and rungs for Windsor chairs. Rather than move heavy, green wood to the workshop, the bodgers worked where the trees were felled. They set up their shaving horse and lathe in the open or under a crude shelter, working through the summer months when they weren't needed on the farms for planting and harvesting.

The wood was selected for straightness, and the billets were split or "riven" out with a froe. Then, they were roughly shaped with a broad hatchet, which, like the broad axe, has one flat and one beveled side. Next, the shape of the billet was refined with the draw knife. They had to shape the billets carefully, because one couldn't easily "hog" the waste off with the foot-powered lathe.

Bodgers used a very efficient device, the shaving horse, to hold the billets while they shaped them. The shaving horse is basically a low bench about 3 ft. long, with a foot-operated vise at one end. The vise can be quickly opened and closed to hold pieces that are being shaped with the draw knife.

Speed was essential. Labor was cheap and a slow bodger wouldn't earn enough to keep himself in tea and biscuits. Making rungs as well as the legs, bodgers sold their work by the gross (144 pieces). A pair of

PHOTO COURTESY OF THE WYCOMBE CHAIR MUSEUM

Bodgers usually set up their lathes in rustic huts that offered minimal protection from the elements.

bodgers, working 12 hours a day, five-and-a-half days a week could expect to make four or five gross of parts a week, earning 12 to 14 shillings per gross.

Generally, bodgers worked in pairs. They would buy a few selected trees from a landowner, move in their equipment and set up camp until the stand was exhausted, then move to another area. Trees were selected with a care for perpetuating the forest. Every part of the tree was used including the chips, which were gathered for the charcoal makers. The bodgers themselves used only the straight, clear sections of the trunk and larger limbs.

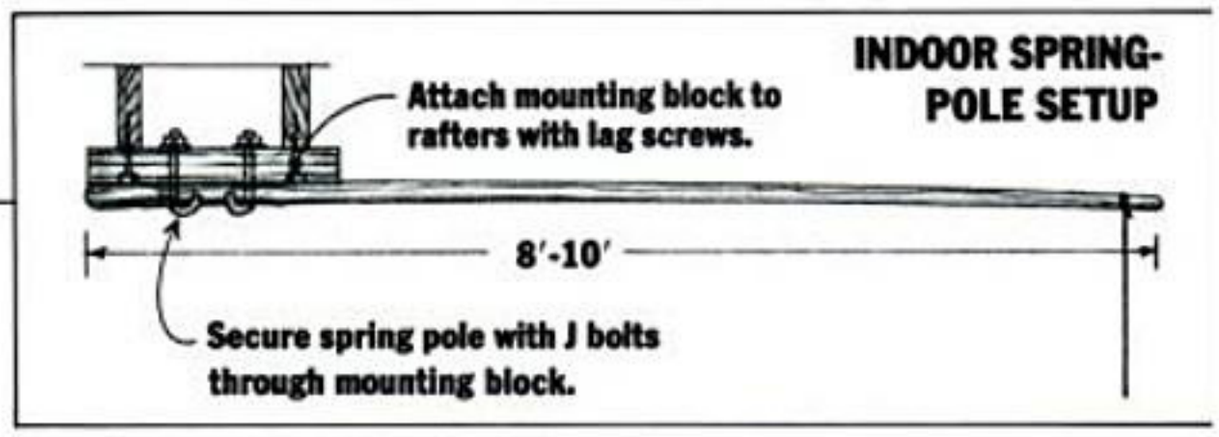
Because the wood was carefully chosen and split out instead of sawed, hand-turned legs were of superior quality. This created a demand for hand-turned legs lasting years after machine-turned legs came on the market. As late as the 1920s, the British War Department still specified hand-turned legs for its chairs. When the war department changed its specifications to allow machine-made legs, the bodger went the way of the wheelwright and the cooper.

The bodgers' spring-pole lathe is one of the most primitive mechanisms for turning wood. It dates to before the time of Christ. Its power source is a foot treadle. Downward pressure on this treadle is transferred to the work through a cord wrapped around the work. The other end of the cord is tied to the tip of a long, springy pole. When the foot pressure is released, the spring pole pulls the treadle back up into the ready position, and the stroke is repeated.

This causes the work to revolve first forward, then backward with a reciprocating action that is character-

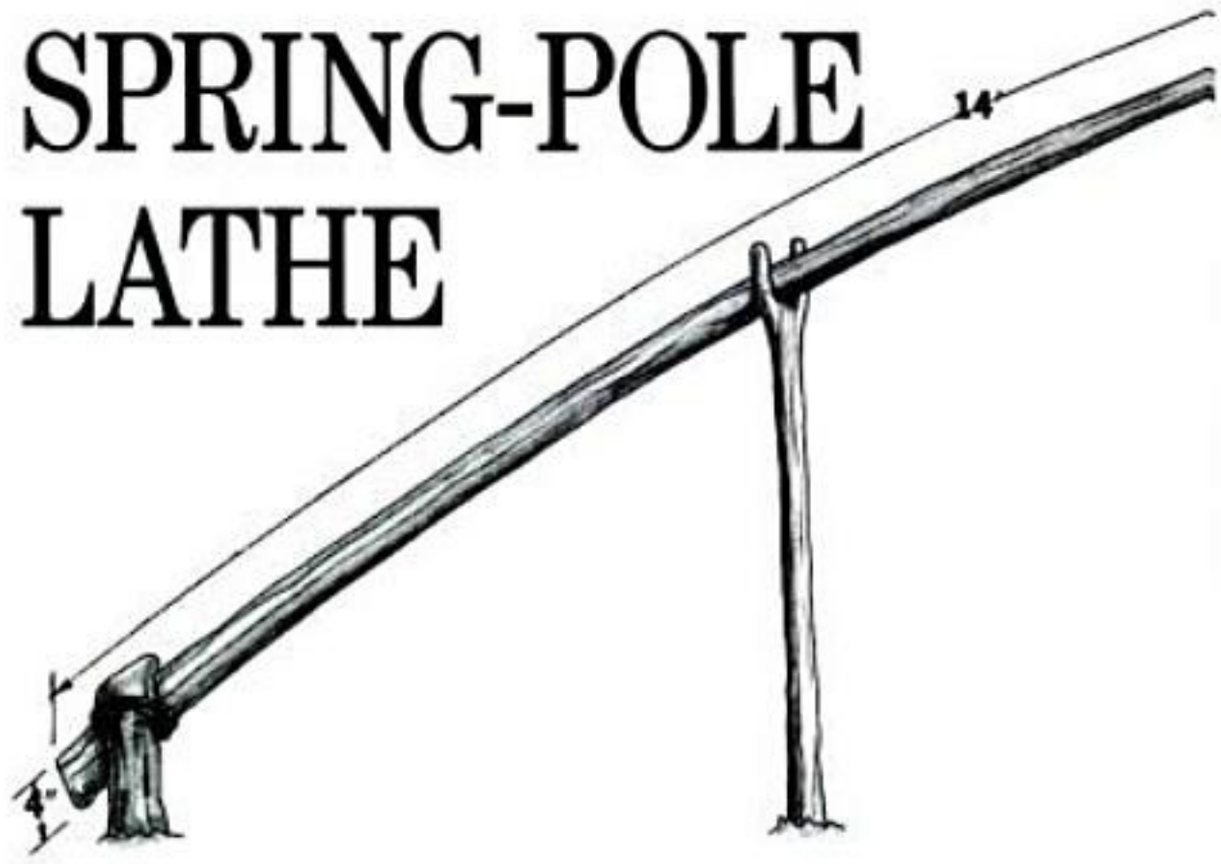
PHOTO COURTESY OF STUART KING

Not every bodger worked in the woods. Pole lathes were also used indoors by mounting the spring pole on the ceiling.



INDOOR SPRING-POLE SETUP

MAKING A SPRING-POLE LATHE



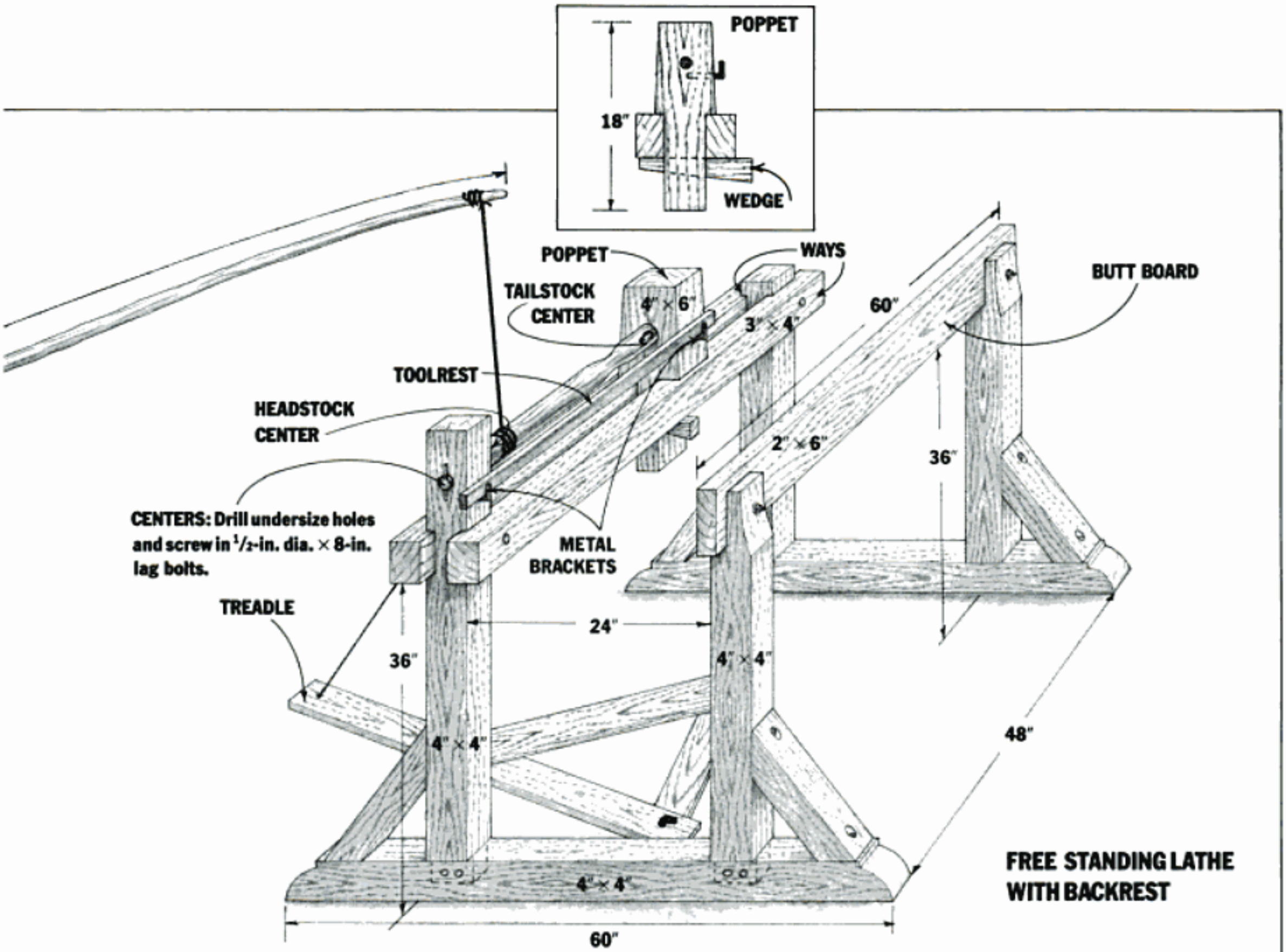
OUTDOOR SPRING-POLE SETUP

The spring-pole lathe is designed for outdoor use, but for those of you who prefer to locate it in your shop, I have included modifications in the design for indoor use. So, before you begin construction on your bodger's lathe or "loom" as it was called, you'll need to decide whether you want to locate it permanently or make it free-standing.

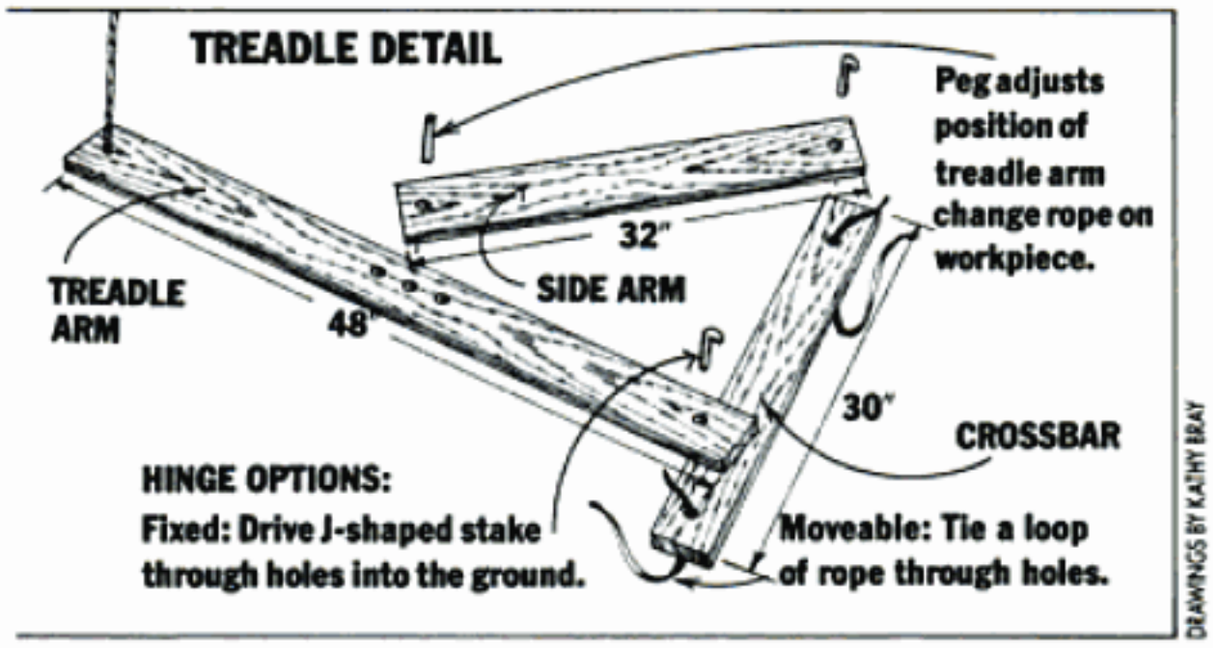
The drawing shows the entire assembly with a base attached, but should you decide to permanently locate your lathe in your backyard grove, simply omit the base and sink the posts about 16 in. into the ground. Note that there are two sets of posts. Two of these posts form the base of the lathe bed, while the other two posts support a "butt board" for you to lean on and steady yourself as you work.

The bed of the lathe consists of two horizontal timbers or "ways," which fit in notches in the upright posts and are pegged or bolted. The head stock is one of these posts while the tail stock, a wooden block called a poppet, can be moved along the track formed by the two timbers. A wedge slides into a mortise at the base of the poppet to hold the poppet securely to the ways.

Make the poppet from a solid block of wood, and cut the tenon so that it fits snugly between the timbers and extends below them with enough space for the wedge. Just below the timbers, cut a mortise in the tenon itself for the wedge. Attach two metal brackets to the poppet



FREE STANDING LATHE WITH BACKREST



DRAWINGS BY KATHY BRAY

and the head stock post to hold the tool rest. The top of the tool rest should be a bit below the center line.

Don forged his own centers for his lathe by twisting square iron stock, but an easier approach that he recommends is to grind the tips of 1/2-in. dia., 8-in. long lag bolts down to a fairly blunt point. The centers should protrude about 2 in. from the poppet/post. Be sure to remove the threads back about an inch from the tip as well. If you like, weld a piece of bar stock to the head of one bolt to form a handle so that it can be easily tightened on the work piece by twisting.

The old bodgers preferred to use seasoned larch for the spring pole, but Don says that green hardwoods like holly or ash also work well. A sapling aged a few months makes a fine spring pole. The old bodgers often ran their poles over the eaves of their huts to support them. However, a crutch or similar support mechanism can easily be constructed from a forked limb. If you choose to make an indoor model for your shop, you can mount your spring pole to the rafters.

The treadle is shaped like a "y" with one long arm and a short cross piece. Drill a series of holes in the middle area of the long arm so that by moving the peg up or down a notch, the position of the rope on the workpiece can be moved from side to side. In the forests, bodgers often hinged the crossbar and arm assembly by driving J-shaped stakes through the holes into the ground about a foot or so in front of the lathe bed. But a freestanding treadle adjusts more readily; in this case, fasten the pieces with rope or a leather thong through the holes. To work with a free-standing treadle, simply step on the crossbar with the one foot while you pump on the treadle arm with the other.

One last note, measurements given here are approximate. You'll need to adjust them to fit your own height and purposes. There are two rules of thumb. The first is that the centers should come to about elbow height. Secondly, you can lower the ways to accommodate larger stock (i.e. bowls), but the lower the ways the less travel in the treadle and the more energy you have to expend pumping. — *J.B.*

PHOTOS BY JOHN BIRCHARD

Modern-day bodger Don Weber keeps the ancient craft alive by working with old-time tools and techniques. He works in a cruck-frame hut, left, like the bodgers of yore.

istic of primitive types of revolving tools. The turner cuts only on the downstroke, when the stock revolves toward the tool. Generally the stock makes two to four revolutions per stroke. "This may sound tedious, but with the proper tools and careful preparation of the stock, the work moves right along," says Don.

As for the turning stock itself, Don has found that West Coast bay laurel works well. He suggests using the tightest grained local hardwood available, as the wood must be worked green for ease of cutting and good results. When the billet is trimmed down as close as it can be with the draw knife, a punch is used to make an indentation in both ends for the centers, and a little bee's wax is applied as a lubricant. One turn of the rope around the workpiece is usually sufficient.

A roughing-out gouge, about 1½ to 2 in. wide and ground straight across, is used to make the rough billet into a round cylinder tapered at both ends. Then a square chisel or a skew is used to cut the beads and tenons. Don uses his skew on edge as a cutting tool for starting beads and indentations and almost flat against the tool rest as a smoothing tool which can take wide shavings off the nearly completed piece.

I tried my hand at turning on Don's spring-pole lathe and found it to be quite enjoyable. It's a bit hard to get used to at first because you have to steady your tool on the tool rest just at the moment when you are pumping down on the treadle. But the green, tight-grained wood cuts smoothly, and the pumping action is not as tiring as you would expect.

"Bodging is more a curiosity than a valid craft these days," says Don. "But experience in low-tech woodworking is also a good way for the beginner to start getting a feel for turning without having to make a huge investment in a modern lathe." Don believes that learning to work well by hand is also a great confidence-booster for those who would like to work in wood but are intimidated by big machines.

Besides building his own lathe, Don has made his own gouge, and forged and ground a special skew which has a concave cutting edge. "This wraps around the work a bit, and allows for a wider cut," explains Don. "When you're working under your own power, you have to be very efficient." That's one of the things Don likes the best about the old country crafts.

And besides all this, it's just plain fun. At the 1987 Southern California Woodworker's Conference in Claremont, California, Don was a little nervous about setting up his humble exhibit next to big-name turners like Bob Stocksdale, Del Stubbs and master chairmaker Michael Dunbar. "But pretty soon, they were all stopping by to try their hand at it," Don recalls. "After the doors were closed in the evening, we had many a lively discussion and a bloody good time." ▲

John Birchard is a professional woodworker and author of Make Your Own Handcrafted Doors & Windows *(1988, Sterling Publishing Co., Inc. New York, NY 10016). He lives in Mendocino, California.*

FOR MORE INFORMATION

If you're interested in learning more about the rural crafts that flourished in the last century, here is a list of books that Don recommends. Many of these books are out of print. Try your local library or contact R. Sorsky, 3845 N. Blackstone, Fresno, CA 93726. Sorsky specializes in out-of-print woodworking books.

Craftsmen of Necessity by Christopher Williams (1974, Vintage Books, Random House, New York, NY 10019).

The Shell Book of Country Crafts by James Arnold (1968, John Baker Pub. Ltd., A&C Black Ltd., 35 Bedford Row, London, England WCIR 43H).

Rural Crafts of England by K.S. Woods (1949, George G. Harrap & Co., Ltd., 182-184 High Holborn, London, England WCIV 7AX).

Treen Woodware by Edward H. Pinto (1949, B.T. Batsford, Ltd., 4 Fitzhardinge St., London, England WIH OAH).

The Craft Architects by Margaret Richardson (1983, Rizzoli International Pub. Inc., 712 Fifth Ave., New York, NY 10019).

The English Country Chair—An Illustrated History of Chairs and Chairmaking by Ivan G. Sparkes (Spurbooks Ltd. Suite 6, Parade Court, Bourne End, Buckinghamshire, Great Britain UB9 5HW).

SHARPENING DRILL BITS

Breathe New Life Into Old Bits

BY FRED MATLACK

High-speed drill bits stay sharp forever, especially around the wood shop. Or at least that's what you may think until the day you pick one up to drill a hole in metal. You push, and the bit makes a little dimple in the metal. You push harder, and the bit heats up. You push even harder, and the bit refuses to budge. The bit you thought would stay sharp forever is not only dull, it probably has been for some time.

Don't throw it out. Don't send it out to be sharpened. If you have a grinder you can sharpen it yourself, and with a little practice, you'll be able to do a good job without a jig.

In simple terms, a drill bit is sharpened by grinding the tip,

PHOTOS BY ANGELO CAGGIANO

Don't throw out your dull drill bits—sharpen them. It's a simple matter to do it freehand.

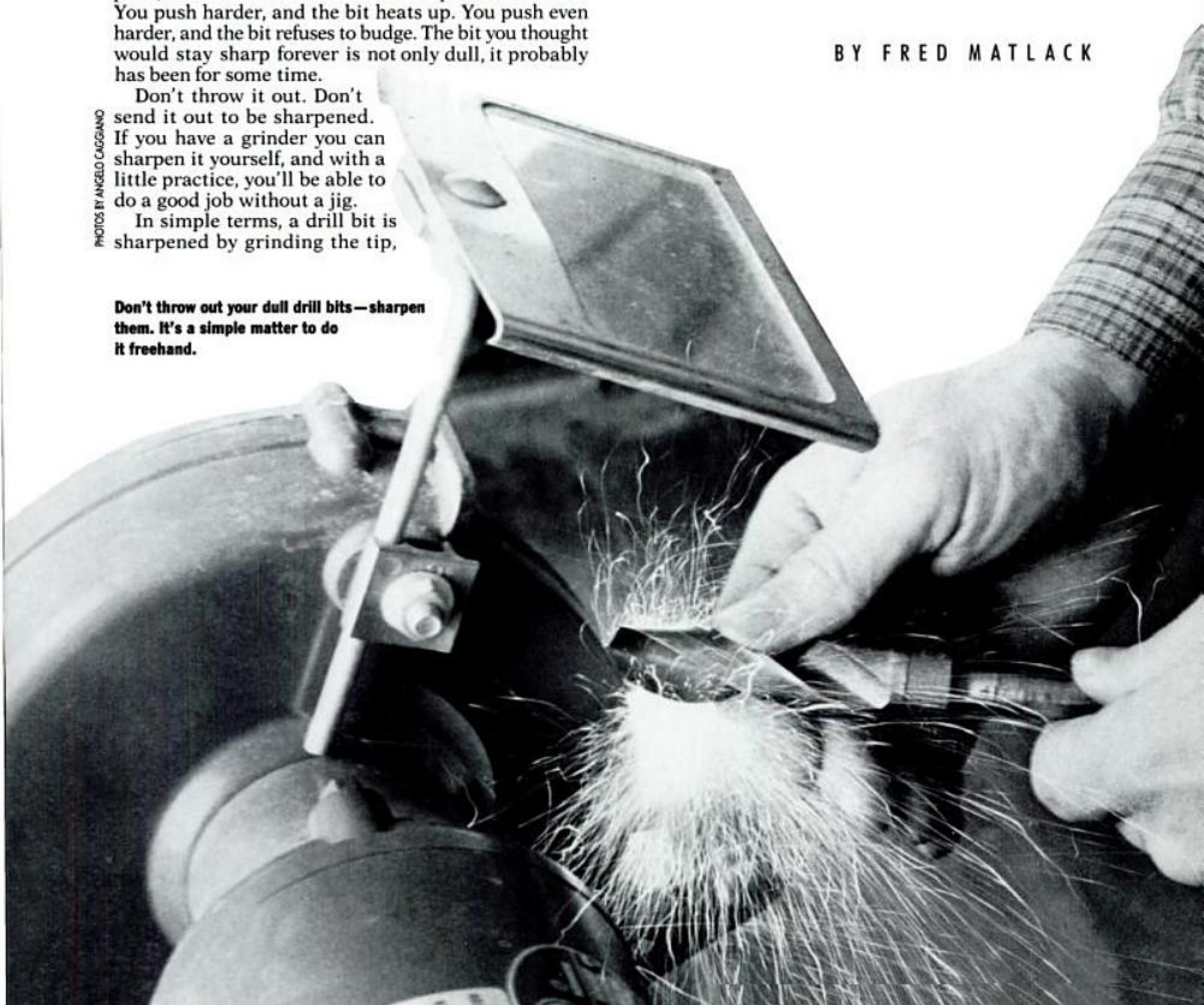
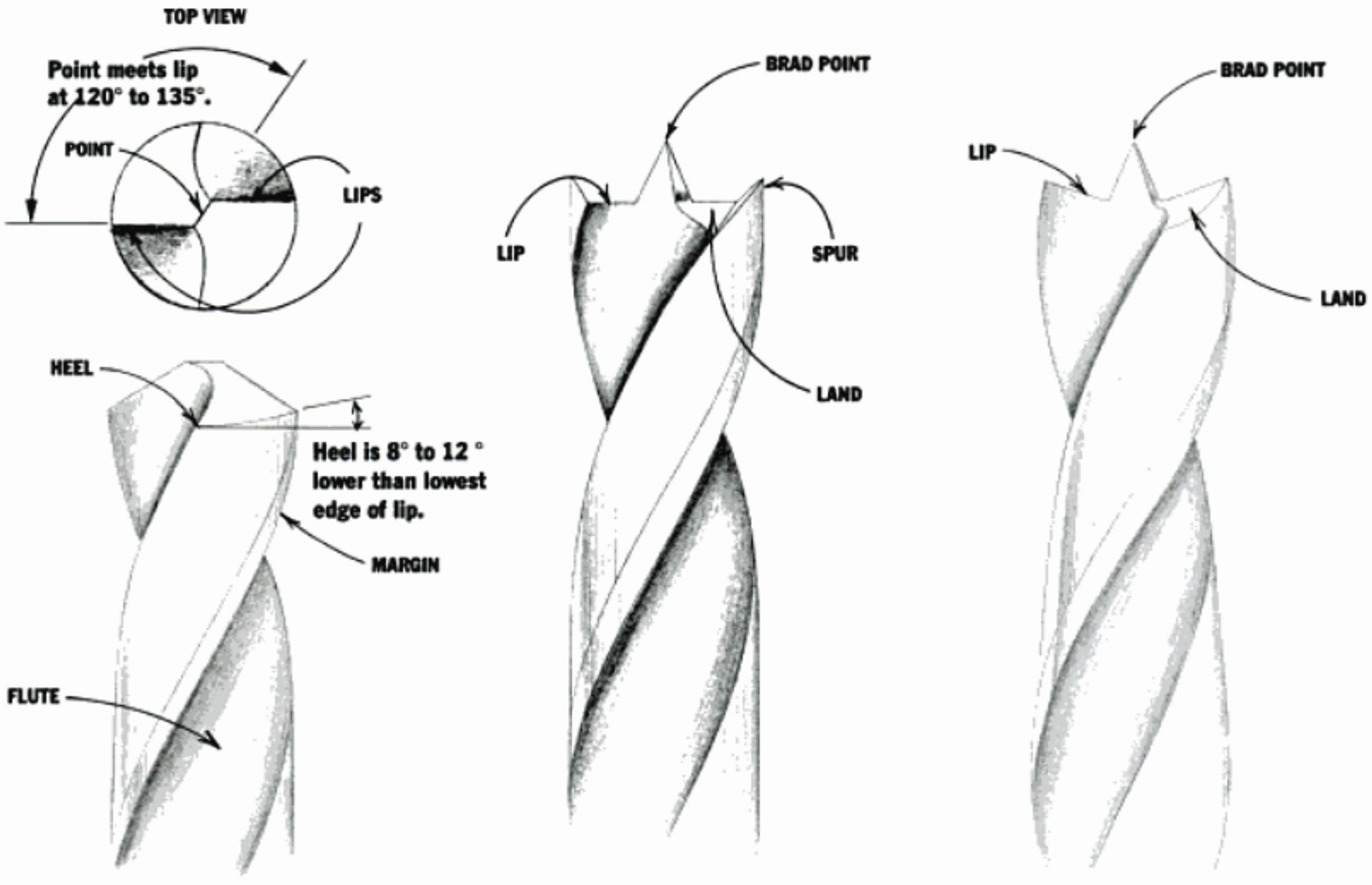


FIG. 1: ANATOMY OF A DRILL BIT



where the cutting action occurs. There are two cutting edges at the tip, called lips as shown in Fig. 1. Each lip is ground at an angle to the axis of the bit. Both lips must be ground at the same angle, though that angle can vary. Because the angle isn't critical, it's a simple matter to sharpen bits freehand.

Getting Ready

Before you start grinding, take a look at your grinder. Make sure the tool rest is solid and doesn't slip. The tool rest should be perpendicular to the grinding wheel and set at the center of the wheel as shown. Having caught my finger between the wheel and a poorly adjusted tool rest, I can tell you the gap between the tool rest and the wheel should be no more than $\frac{1}{8}$ in. If the wheel appears clogged with metal particles, or if the cutting surface is rounded over, touch up the wheel with a wheel dresser (available from Garrett Wade, 161 Ave. of the Americas, New York, NY 10013). Always wear safety glasses when operating the grinder.

Sharpening

When sharpening a drill bit, the main difficulty is in keeping the bit at the proper angle to the grinding wheel. Metal-cutting bits should be sharpened to 59°; woodworking bits are sharpened to more of a point—45° to 50°. The *exact* angle isn't critical, but *the angle must be the same on both lips* or the bit won't cut right.

To help keep the angle consistent, draw a guideline on the tool rest at the proper angle. A pen, pencil, scribe mark or even a piece of tape will work fine. The guideline should extend from the center of the wheel to either side at one of the angles described above.

Before sharpening your first bit, try the procedure a time or two with the grinder turned off. Hold the bit comfortably. I like to hold the bit as shown in Fig. 2, with my index finger on the tool rest and my middle finger against the tool rest's front edge. I lay the drill bit across my index finger and hold it with my thumb. I hold the shank of the bit with my other hand.

In simple terms, the bit is sharpened by putting it against the wheel, lowering the shank slightly, and then removing the bit from the wheel. As you grind, dip the bit into water occasionally to keep it cool.

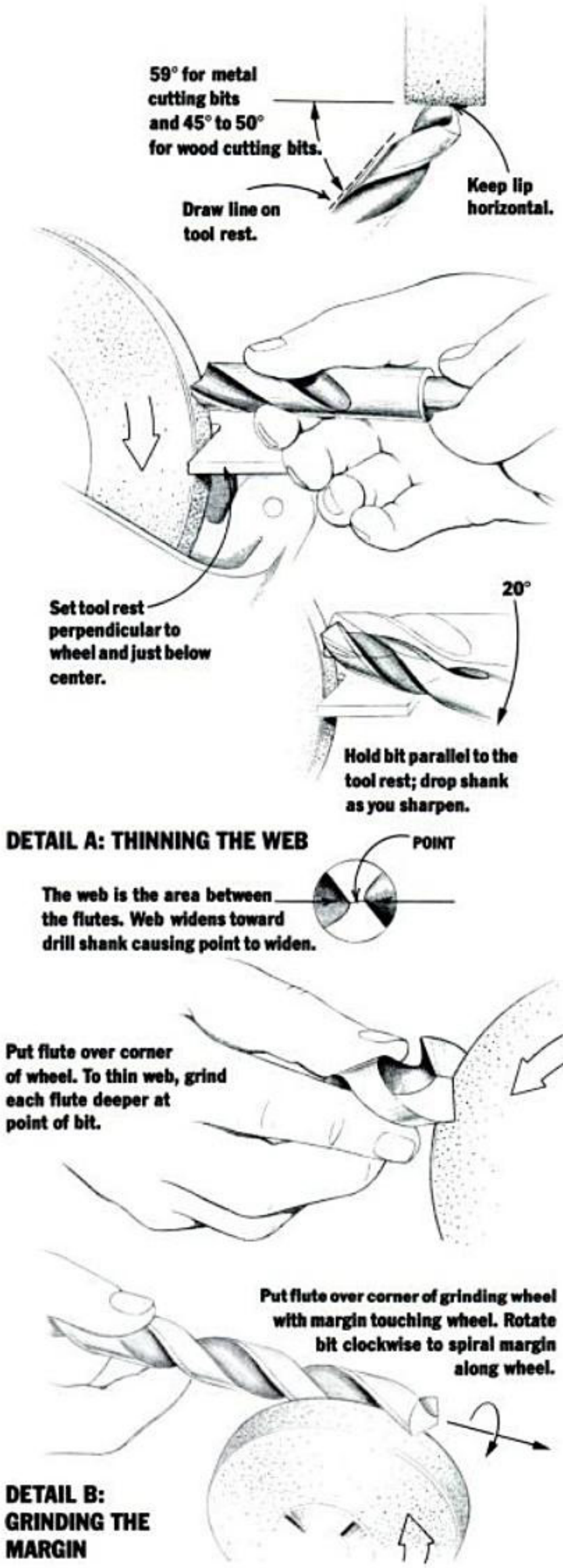
To be more precise, begin with the bit parallel to the tool rest, with the lips horizontal as shown. Align the bit with the guideline and ease the bit into the wheel. When the bit contacts the wheel, slowly lower the shank with your hand until the bit is about 20° from horizontal. Again, this is not a critical angle—if you're sharpening a drill bit about 6 in. long, the shank should drop about 2 in. Repeat this process on the other lip. Some machinists claim you should rotate the bit while dropping the shank. I find it's unnecessary and just causes complications.

After you've ground both lips, look at them closely. Each lip should be a sharp, crisp line. Pay particular attention to the point where the lip meets the outside diameter of the bit—if you see any chipping or rounding over there, grind a little more.

Once the lips are properly ground, you should have

DRAWINGS BY GEORGE BETSECK

FIG. 2: SHARPENING A DRILL BIT



Check the angle and the length of the bit's lips with a drill-point gauge for consistency.

a reasonably sharp drill bit. Drill a test hole. If the bit cuts well and you're not too worried about accuracy, this may be enough. There are, however, several more things to check if you want the best sharpening job.

Using a Drill-Point Gauge

Machinists check the accuracy of their sharpening with a tool called a drill-point gauge (available from McMaster-Carr Supply Co., P.O. Box 440, New Brunswick, NJ 08903). This small L-shaped gauge has one leg at 59° to the other and is designed for checking the lip angle on metal-cutting bits. If you've sharpened the bit to 45° to 50° for boring wood, you can make your own gauge by cutting the proper angle from metal or hardboard.

To check the accuracy of the lip angle, hold the gauge up to the bit as shown in the photo. If the angle is way off or varies from lip to lip, regrind the bit.

When the angle is right, measure the length of the lips. Commercially available gauges already have a scale on them. If you've made your own gauge, measure the lips with a ruler or scribe a few lines about $^{1}/_{32}$ in. apart on your gauge. It doesn't matter what the actual measurement of each lip is as long as both lips are the same. If the lips aren't the same, grind the *shorter* one—this is one of the few things that gets longer as you grind it. Work at it until the lips are the same angle and the same length.

The final step is to check the angle of the lip clearance. Lip clearance refers to the relationship between

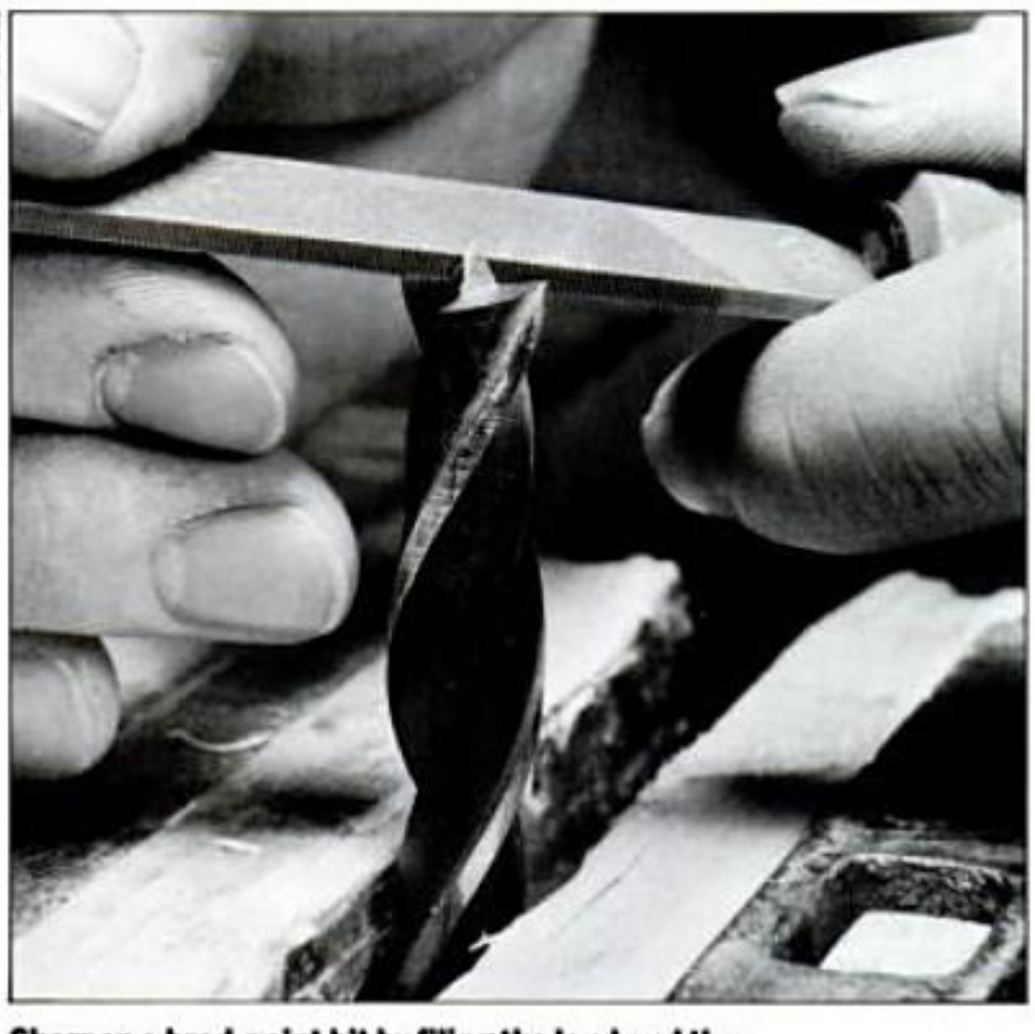
Grinding the damaged lips on the bit in the rear will produce a sharp bit like the one in the foreground.

the lip and a point on the bit's outer diameter called the heel shown in Fig. 1. For a bit to cut properly, the heel must be lower than the lowest point of the cutting lip as shown.

Here's how to check lip clearance. Hold the bit up with the outside corner of the lip pointing to the right as shown in Fig. 1. You should see a line sloping from the lip's outside corner down to the heel at 8° to 12°. If the heel is higher than the lip, the bit will not cut because the heel will prevent the lip from advancing into the material. If necessary, grind the heel lower.

One of the surest ways to tell if everything has gone correctly is to look at the top of the drill bit. The line connecting the two lips is called the point. If the lip clearance is correct, and if the lips are at the proper angle, the point will be a straight line running directly across the bit's center at 120° to 135° to the lips.

MITCH MANDEL



Sharpen a brad-point bit by filing the land and the brad point at the same time.

Refurbishing Old Bits

As bits are sharpened, obviously they get shorter. This is no problem except that as you get closer to the shank of the bit, the flutes get shallower. Shallower flutes make for a wider point,as shown in Fig. 2, and a wider point offers more resistance as you drill.

You can fix this easily by grinding the flute a little deeper with the corner of the grinding wheel. Machinists call this "thinning the web"—the web being the metal that separates the two flutes from each other.

When thinning the web, grind the flute only at the very point of the drill bit. Thin the web after you've sharpened the bit—the thinned area is so small, sharpening will grind much of it away.

To position the bit for grinding, hold it to the right of the grinding wheel, as shown, but don't touch it against the wheel yet. Keep the bit tangent to the grinding wheel and tilt the shank about 5° to 10° to the left. Rotate the bit until you can ease the flute into the wheel as shown. Remove only a tiny amount of material at the very point. (Don't worry if you accidentally grind some of the lip. By happy coincidence, it will sharpen it.)

Thin the web on one side, turn the bit and grind the opposite side of the web in the same manner. To keep the web symmetrical, alternate sides and remove only a small amount from each side at a time. As a rule of thumb, stop grinding when the point is 1/8 of the diameter of the drill bit.

A fairly common malady among old, tired bits is that a bit is sharp and conforms to all of the specs but won't drill very far before it starts to bind and get hot. This is caused by wear on the edges of the flutes, known technically as the "margins." As the margins wear, the bit diameter decreases. Since wear usually occurs only along the first inch of the bit, the result is a tapered drill bit.

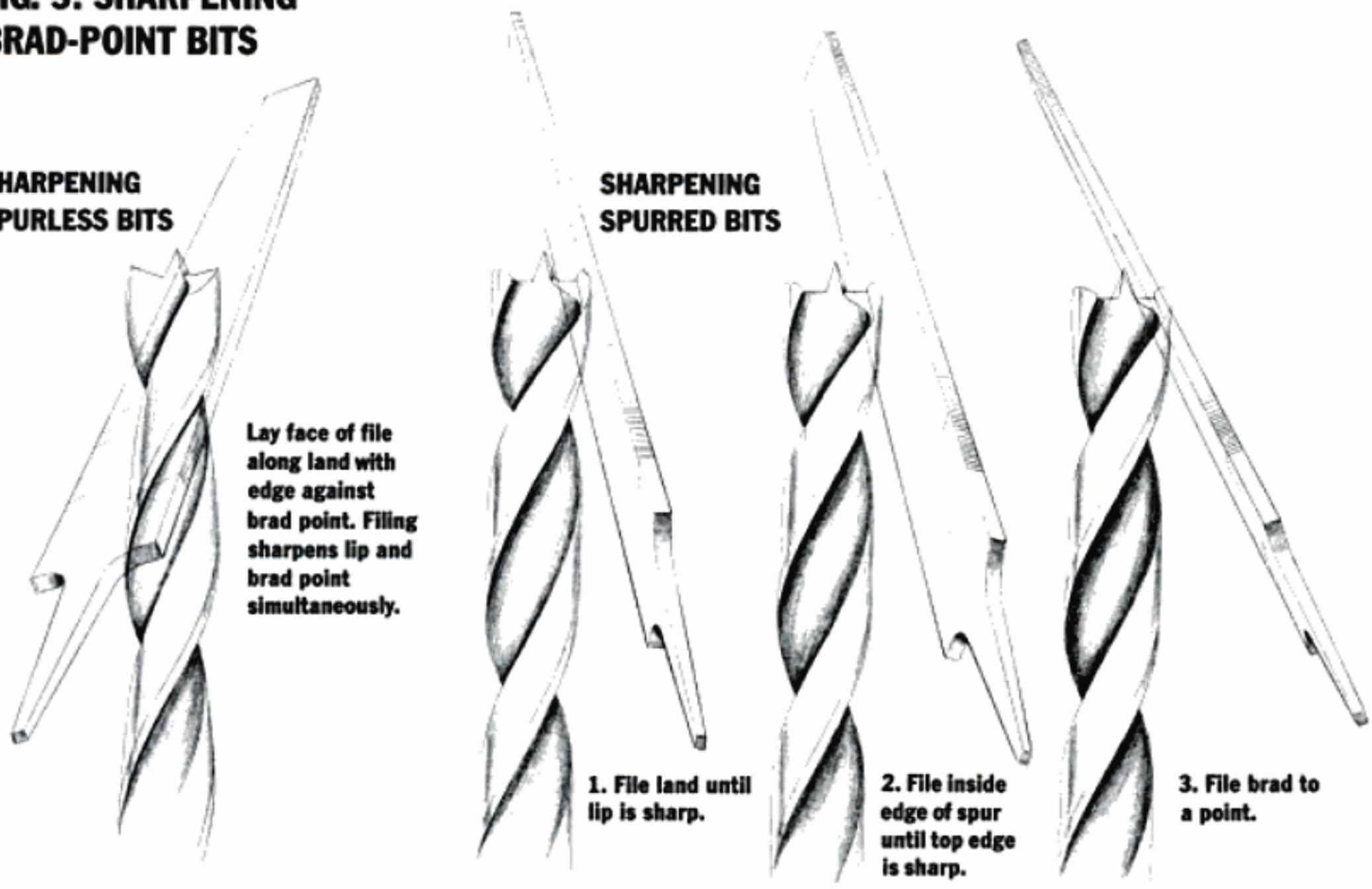
When this happens on a bit of less than 1/2-in. diameter, it's time to throw out the bit. On larger, more expensive bits it may be worth the fuss to restore the bit by "grinding the margin." To do this, spiral the flute along a corner of the grinding wheel as shown in Fig. 2. This widens the flute somewhat, removing the worn edge of the margin.

Grinding the margin requires a small, slow, underpowered grinding wheel. A wheel mounted on an electric drill is fine. The wheel must be open and accessible from all sides, so wear a full-protective face shield.

Practice grinding with the wheel turned off. First, lay the bit across the top of the wheel as shown in the drawing. Put either one of the flutes over, but not touching the wheel's left-hand corner and angle the shank 10° to 15° to the left until the corner of the wheel reaches into the flute. Now, lower the entire bit so that the margin touches the wheel, and rotate the bit clockwise while moving it forward. The bit should spiral forward along the corner of the wheel as you rotate it.

When you grind, grind just enough of the margin to produce a sharp edge at least halfway up the bit. You'll probably also remove some metal from the opposite side of the flute but this is of no consequence. When you've sharpened one margin, repeat the process on the other margin.

FIG. 3: SHARPENING BRAD-POINT BITS



Sharpening Brad-Point Bits

Brad-point drills are a relatively recent variation on the twist drill. The brad-like center point, for which they are named, enters the wood first and directs the cut. Since brad points are specifically intended for wood, they are usually not high-speed steel, making them soft enough to sharpen with a file. Although you can grind them on a small grinder, I recommend sharpening with a file. You can better see what you're doing and are less likely to make major errors like grinding off the center point.

Before you sharpen, take a look at your bit. The lips on some brad points end in spurs as shown in Fig. 1. I'll describe how to sharpen spurred bits after I describe how to sharpen a spurless brad-point bit.

In principle, sharpening a spurless bit is much like sharpening other twist drill bits, except that you are doing it by hand. Put the bit in a vise that has wood or aluminum jaws so that the point protrudes about 1 in. from the top of the jaws. Turn the bit so the cutting lips are parallel to the jaws, and tighten the vise.

As you sharpen, you will file two surfaces at once: the edge of the file sharpens the brad point; the face of the file sharpens the lip. Here's how. Lay a flat mill file on the part of the bit called the land as shown in the drawing. The face of the file should follow the slope of the land. Place the edge of the file against the brad-point bit.

As you file the land, you will also be removing metal at the lip of the bit. A small burr will form as you file —flick it off with your finger. If the resulting edge is crisp and clean, the lip is sharp. If not, file until it is. Then rotate the bit 180° and sharpen the other lip.

On a well-sharpened bit, the brad point enters the wood before the lips. If the point is too short, you may have to file away quite a lot of the land to reshape the point. As you do, pay attention to the lips. For the bit to cut properly, the outside edges of both lips must enter the wood at the same time. Check them with a square as you file. When you put the side of the bit against one leg of the square, both lips should meet the other leg of the square at the same time. The brad point should extend slightly further.

Sharpening Spurred Brad Points

Sharpening spurred brad-point bits is a three-part procedure as shown in the drawing. First you sharpen the lip, then the spur and finally the brad point.

To sharpen the lip, lay the edge of the file on the land, so that it follows the slope of the land. As you file away the land, you will also remove the ragged edge of the lip. Continue until the lip is a sharp, clean line.

When the lip is sharp, turn the file so that its face follows the *inside slope* of the spur as shown in the drawing. (Never sharpen the outside of the spur. It will ruin your bit.) File the spur until its top is a sharp edge. Keep an eye on the brad point while you're filing—make sure you don't slip with the file and dull it.

When the spur is sharp, sharpen the brad point. Lay the face of the file against a side of the point, and dress it lightly. Dress each of the four sides in succession, taking care to keep the brad point centered. Don't get carried away sharpening the brad point. A point that is somewhat blunted will work fine, as long as it is centered and longer than the spurs. ▲

Fred Matlack heads the Rodale Press Design Department in Emmaus, PA.

Build a Basic Bookcase

Reinforced Dadoes Beef Up Bare-Bones Design

BY B. WILLIAM BIGELOW

I know what you're thinking; without a back, this bookcase is doomed to wobble. The fully housed dadoes won't resist racking, the glue joints will fail and the shelves will soon fall out. Well, I built six of these bookcases a year ago for the school where I teach woodworking and they've survived the hard use by teen-agers quite nicely. You see, there's more to this bookcase than meets the eye. The shelves and sides are screwed together. The screws bite into dowels installed in the bottom of each shelf for a stronger joint than you'd get with screws placed into end grain alone. To help counter racking forces, I've rabbeted and screwed the backboard into the sides so that it functions as a sort of a mini-back.

This bookcase has a 4-ft. span. Books are heavy, and this long, unsupported span requires a strong wood to keep the shelves from sagging under the load. I made the shelves from 3/4-in. thick red oak—one of the strongest native woods available. If you choose a weaker wood, I suggest that you shorten the length of the bookcase to 30 or 32 in., so the shelves won't sag.

To start the bookcase, mill and cut the wood to the sizes listed in the Bill of Materials. Leave the kickboard and backboard long and cut them to fit later, after you've assembled the shelves and sides. If you don't have the machinery to joint and plane the wood yourself, you can have the wood milled at your local lumberyard. I've designed this bookcase so that the parts can be cut from seven boards that measure 3/4 × 8 1/2 × 48 in.

The shelves are housed in dadoes cut in the sides of the bookcase as shown in Fig. 1. Although a dado blade on either the tablesaw or radial arm saw works well to cut these dadoes, I prefer a router. A 3/4-in. dia. straight router bit leaves a clean, flat-bottomed cut that doesn't require any cleanup with a chisel.

I built a simple router jig to assure a clean, crisp dado. The jig clamps to the work, and the router travels between two fences to cut the dado. The router base fits snugly between the fences to keep the cut from wandering off course. I let the router cut into part of the jig as shown. The mark that results makes a good index for putting the jig where you want the dado.

Lay out the dadoes at the locations shown in Fig. 1, but before you cut them, clamp the jig to a piece of scrap and rout a sample dado. Test fit your shelves in the sample dado. If the joint is too tight, sand the shelf to fit later. If it's too loose, switch from a 3/4-in. bit to a 1/2-in. bit and cut each dado in two passes—first one side, then the other.

DEBORAH PORTER

There's more to this bookcase than meets the eye. Screws into hidden dowels reinforce the joints.

The only other joints you have to cut are the two short rabbets that house the backboard—one in each side. I cut these rabbets with a router guided along a straight block of wood. Cut each rabbet by taking several light passes with the router, increasing the depth of the router bit with each pass. Remember that the right side and the left side of the bookcase are mirror images. Locate the rabbets accordingly.

The top front corner of each side has a 45° cut on it that is made once you have finished cutting the joints. Make this cut with a handsaw or radial arm saw.

Full dadoes are pretty weak joints because the end grain of the shelf butts into the long grain of the bookcase side. Since there's no long-grain to long-grain contact, you don't get a very strong glue joint. As I mentioned earlier, I reinforced the dadoes with screws. Unfortunately, wood screws lose about 25 percent of their holding power in end grain. To give the screws a little extra strength, I drilled ½-in. dia. holes in the bottom of the shelves and plugged them with dowels as shown. The dowels give the screws some long grain to bite into and strengthen the joint.

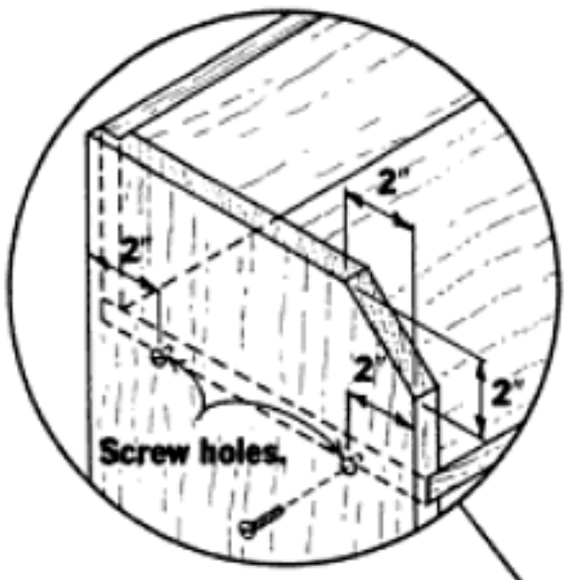
After you've glued the reinforcing dowels in place, lay out and drill the screw holes in the sides of the bookcase as shown in Fig. 1. Counterbore the holes for wooden plugs to cover the screw heads. I drill the holes with a #6 "screw drill" (available from Woodcraft Supply, 41 Atlantic Ave., P.O. Box 4000, Woburn, MA 01888). A screw drill is a combination bit that drills for the screw shank, countersinks for the screw head, and drills a hole for the plug all in one shot. I find that even the best of them break pretty regularly, so I buy the cheapest I can get.

Sand the parts before assembly. If the shelves fit too tightly in their dadoes, sand or scrape them to fit. To help ease the shelves into the dadoes, I sometimes

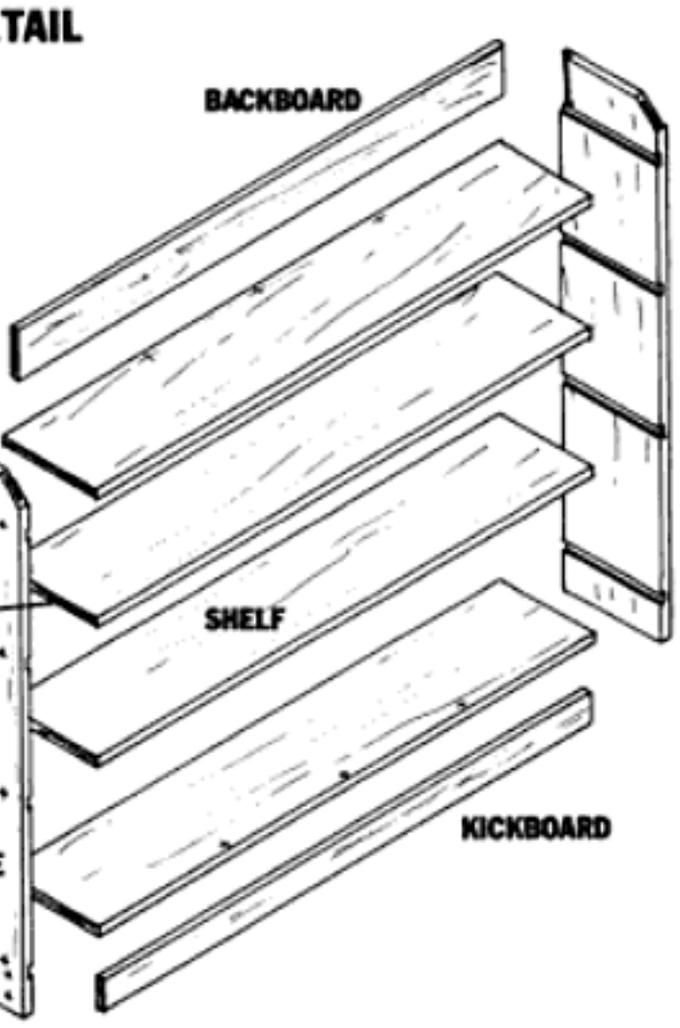
FIG. 1: CONTEMPORARY BOOKCASE

BILL OF MATERIALS

QUANTITY	NAME	DIMENSIONS
2	Sides	¾" × 8½" × 42"
4	Shelves	¾" × 8½" × 47"
1	Backboard	¾" × 4" × 47¾"
1	Kickboard	¾" × 3" × 46½"
30	Drywall screws	#6 × 1½"



END DETAIL



REINFORCING SCREW JOINTS

To strengthen the joint, screws run into dowels installed from the bottom of the shelves.

round over the ends of the shelves with sandpaper. Don't round the shelf ends near the front edge of the shelf or you'll see a gap once the shelf is assembled.

Assemble the bookcase on its back on a wide bench or the floor. Put glue in the dadoes and fasten the shelves with #6 drywall screws. I prefer drywall screws to regular wood screws. They have a good bite and, because they have Phillips heads, I can drive them with a Phillips bit in my electric drill. The screws will pull the bookcase together nicely—you shouldn't need any clamps.

I find assembly goes best if you work on one end of the bookcase at a time. First, apply glue to all the dadoes in the side you're working on. Next, insert the shelves into the dadoes one at a time. When you've got the shelf in its dado, drill pilot holes for the screws using the counterbored holes in the sides as a guide.

Finish assembling one side, then the other side. Don't drive the screws completely home on the second side until you've put *all* the shelves into their dadoes.

Once you've screwed the second side in place, check the squareness of the bookcase by measuring diagonally from one corner to another. Opposite diagonals should measure the same. If the two diagonals are different lengths, the case is out of square.

If necessary, square up the bookcase by putting a bar clamp corner to corner across the longest diagonal. Snug up the clamp until the diagonals are the same length. Protect the corners of the bookcase with scrap wood so the clamp doesn't damage it.

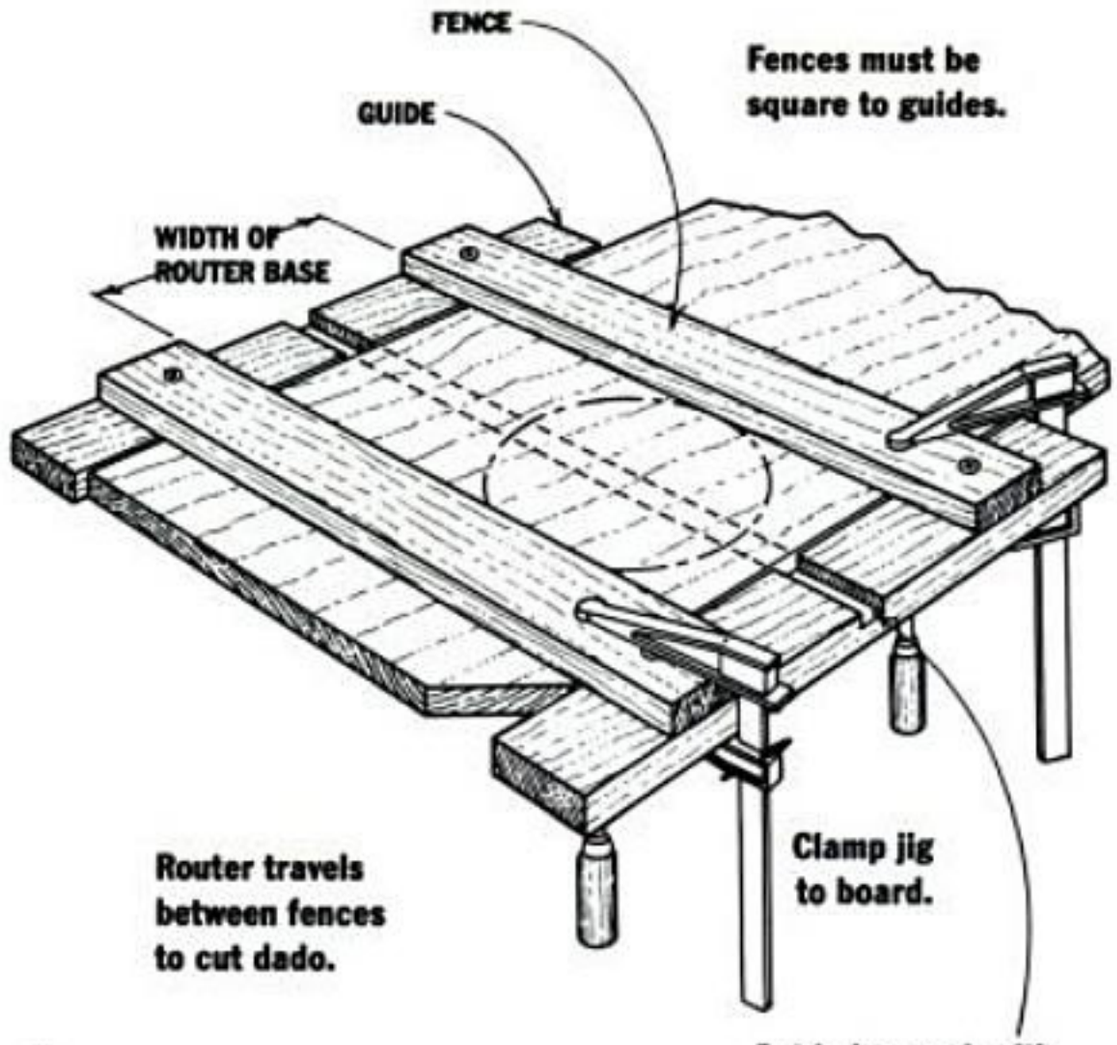
When the case is square, measure for the length of the backboard and kickboard, and cut them to length. Note that the kickboard doesn't touch the floor in the back. The gap allows the bookcase to rest squarely on its sides even if there's a slight hump in the floor. Screw the kickboard and the backboard in place.

Cut plugs for the screw holes with a plug cutter (available from Woodcraft Supply) or install pre-cut plugs. The size of the plug will depend on your screw drill. Cut a few more plugs than you need. Match the grain and color of the plug to the hole it will fill. Glue the plug in place with its grain following the grain of the board. Let the plugs stand slightly proud of the finished surface and sand them flush, or trim them flush with a chisel.

Finish sand everything at this point to remove any marks made during assembly. I finished my bookcases with four coats of Watco Danish Oil Finish (available from Constantine's, 2050 Eastchester Road, Bronx, NY 10461), letting each coat dry for a day. I sanded the third and fourth coats lightly and applied a coat of paste wax. ▲

B. William Bigelow is a high-school industrial arts teacher in Peterborough, New Hampshire and a contributing editor of AMERICAN WOODWORKER.

FIG. 2: DADO ROUTER JIG



DRAWING BY FRANK ROHRBACH

MITCH MANDEL

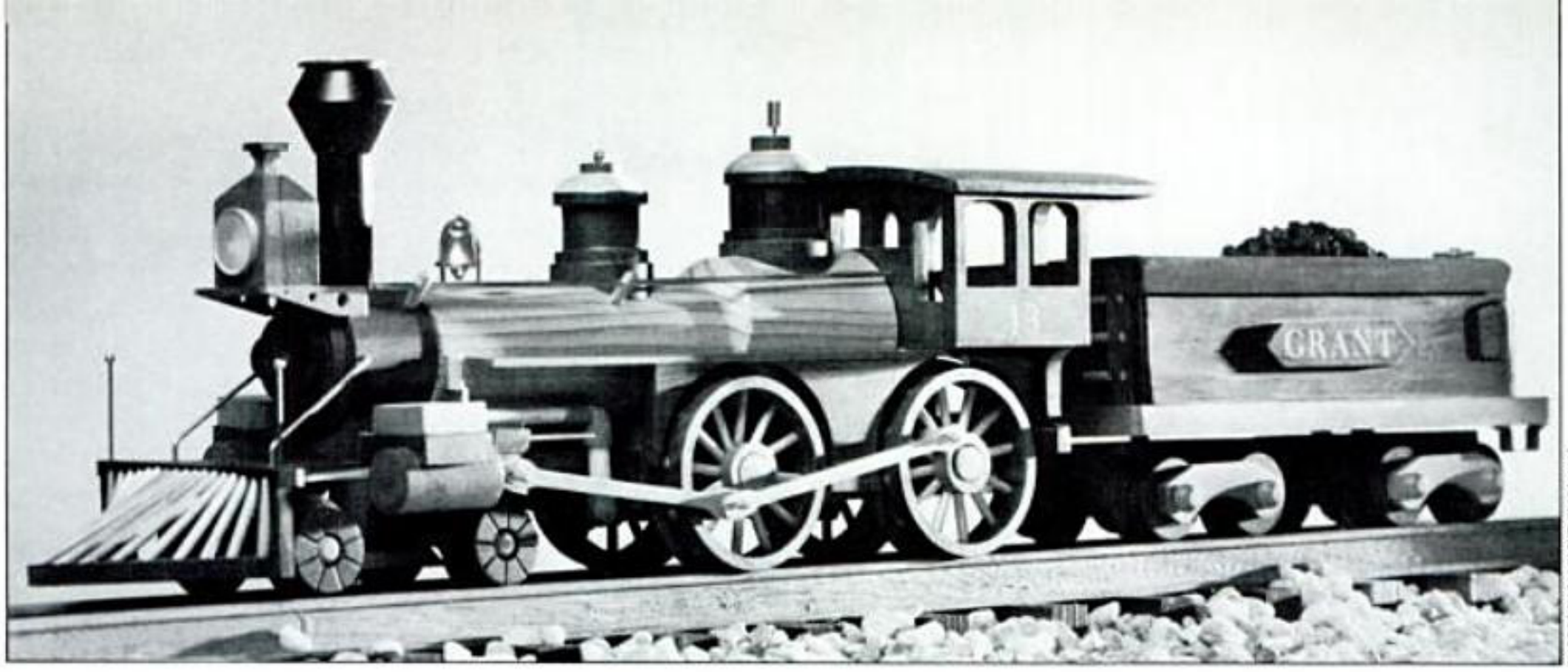
A router jig with two fences keeps the router from wondering off track while routing dadoes.

Add a Touch of Realism to Your Models and Toys

SPOKED WHEELS

BY DOUG KENNEY

You can't buy wheels like these. Making your own spoked wheels adds new realism to scale replicas like this 1873 Grant locomotive.



PHOTOS BY SALLY SHENK ULLMAN

The 1913 Pope-Hartford roadster was my introduction to making scale replicas. I don't think I had ever heard of the Pope-Hartford until one day when I was selling wooden toys at a craft fair. A woman who was related to the family that made the car asked me to make a replica of one for her.

Duplicating the lines of the roadster was difficult enough. Then I discovered the wheels: ten spokes in the front, 12 in the rear and very narrow tires. A few ready-made wheels came close, but I wanted tires that *looked* like tires, rims that looked like rims and spokes that looked like spokes. I decided to make my own.

Now, five years later, I make scale replicas for a living, mainly fire engines and steam trains. I make several styles of spoked wheels, two of which I'll describe —a flanged locomotive wheel and a spoked wheel with a tire. As someone who makes 100 wheels at a time, I can tell you the process isn't difficult. Adding some of my tricks to your toy-making knowledge may help you create a realism you never thought possible.

Among the most complicated wheels I make are the 12-spoked drive wheels for an 1873 Grant coal-burning locomotive. I build the entire locomotive at a scale of 1/2 in. equals a foot. The Grant wheels probably best illustrate my wheel-making process.

On a real locomotive, the wheel has a hub connected by spokes to a rim as shown in Fig. 1. The rim has a flange that encircles it, much like the brim of a hat. The flange rides inside the rail to keep the train on the track.

When I reproduce this locomotive wheel at scale, the spokes and hubs are a simple matter—I cut them from dowels. But the rim, which I make out of walnut, is a bit more complicated. I make it with a series of hole-saw cuts.

Cutting Flanged Rims

It takes cuts from three different hole saws to make the flanged rim as shown in Fig. 2. The largest hole saw cuts the outside diameter of the flange; the second hole saw cuts the outside diameter of the rim. This cut stops well before it goes through the stock, and in so doing, leaves a flange attached to the rim. The smallest hole saw cuts the inside diameter of the rim. To cut the rim, you'll need a 2 3/4-in. hole saw, a 2 1/2-in. hole saw and a 2-in. hole saw. The size of a hole saw is determined by its o.d—the diameter of the hole it cuts.

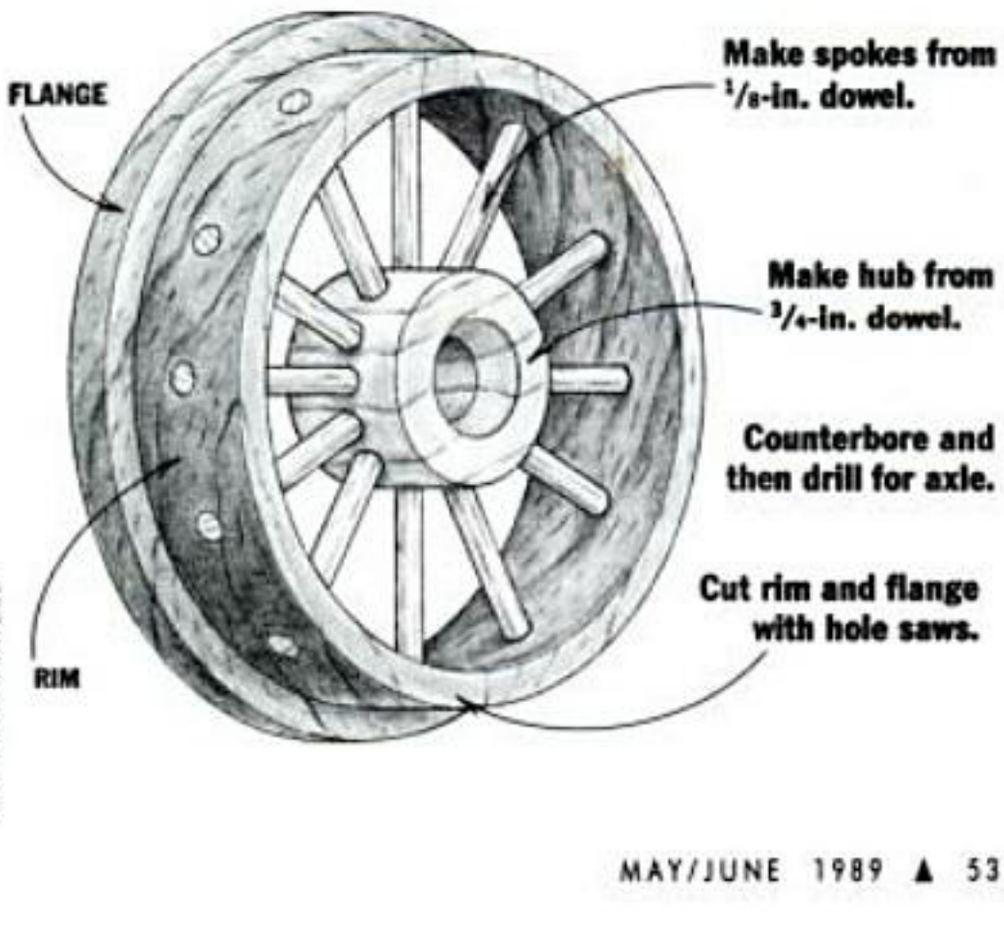
The thickness of hole-saw blades varies from one brand to another. To make this wheel you must use industrial-quality hole saws with blades 3/32-in. thick. I prefer the new Milwaukee model "4/6" bi-metal hole saw designed especially for wood (available from The Source, 7305 Boudinot Drive, Springfield, VA 22150).

I cut the rims from a piece of 5/8- × 3- × 30-in. walnut. I can get 10 wheels from each piece. I lay out the center of each wheel by tapping a center punch at 3-in. intervals down the middle of the board.

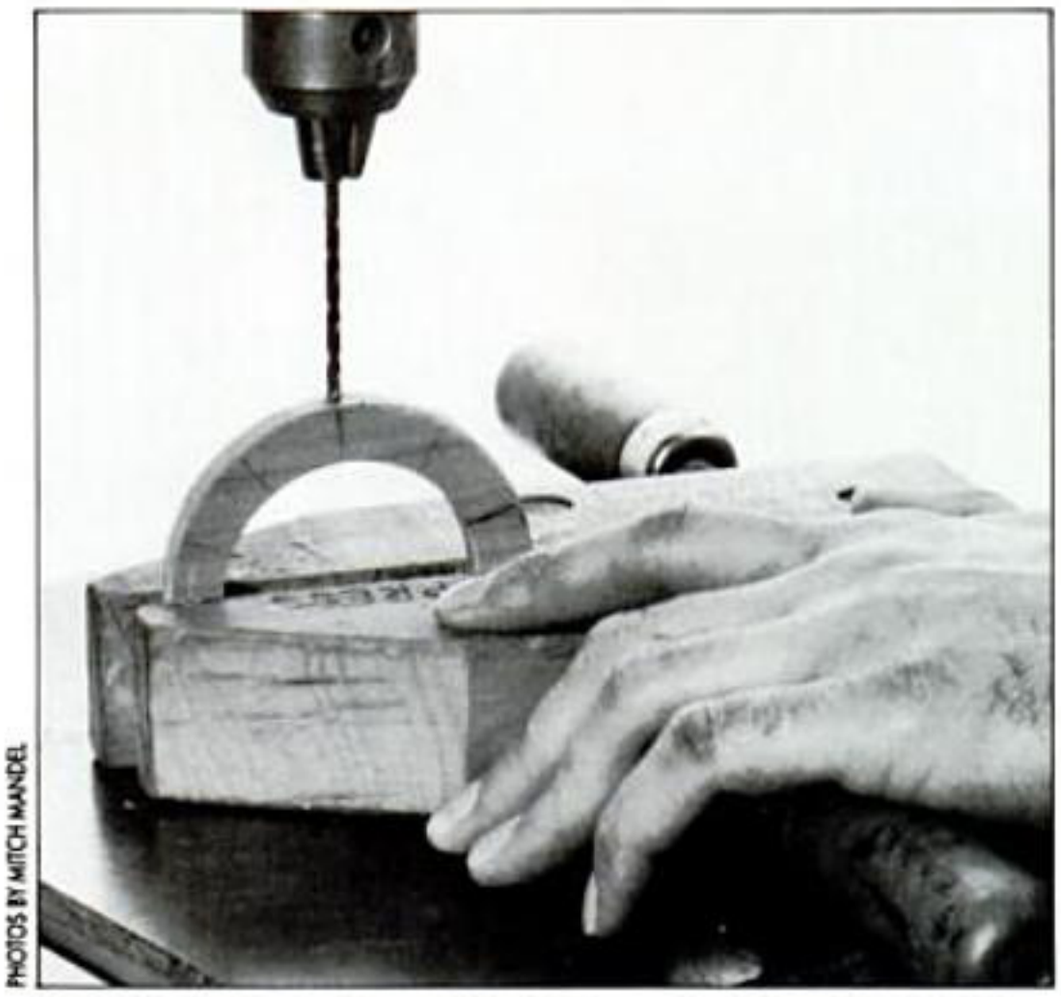
To cut the outside of the flange, set your drill press at 500 rpm (or slower) and chuck up the 2 3/4-in. hole saw. Set the stops on the drill press to cut 1/32 in. less than the thickness of the stock. The thin layer of wood that remains will anchor the wheel blank in the stock while you make the next two series of cuts.

I always put one end of the stock against the left side of the drill-press column to keep it from spinning while I'm drilling. For double safety you can clamp the end of the stock nearest you. When the machine is set up, guide the hole saw's drill bit into the center marks on the stock, and cut the outside of the flange. If I'm making a lot of wheels, I operate the drill press with one hand. With the other hand I hold an air hose

FIG. 1: SPOKED TRAIN WHEEL

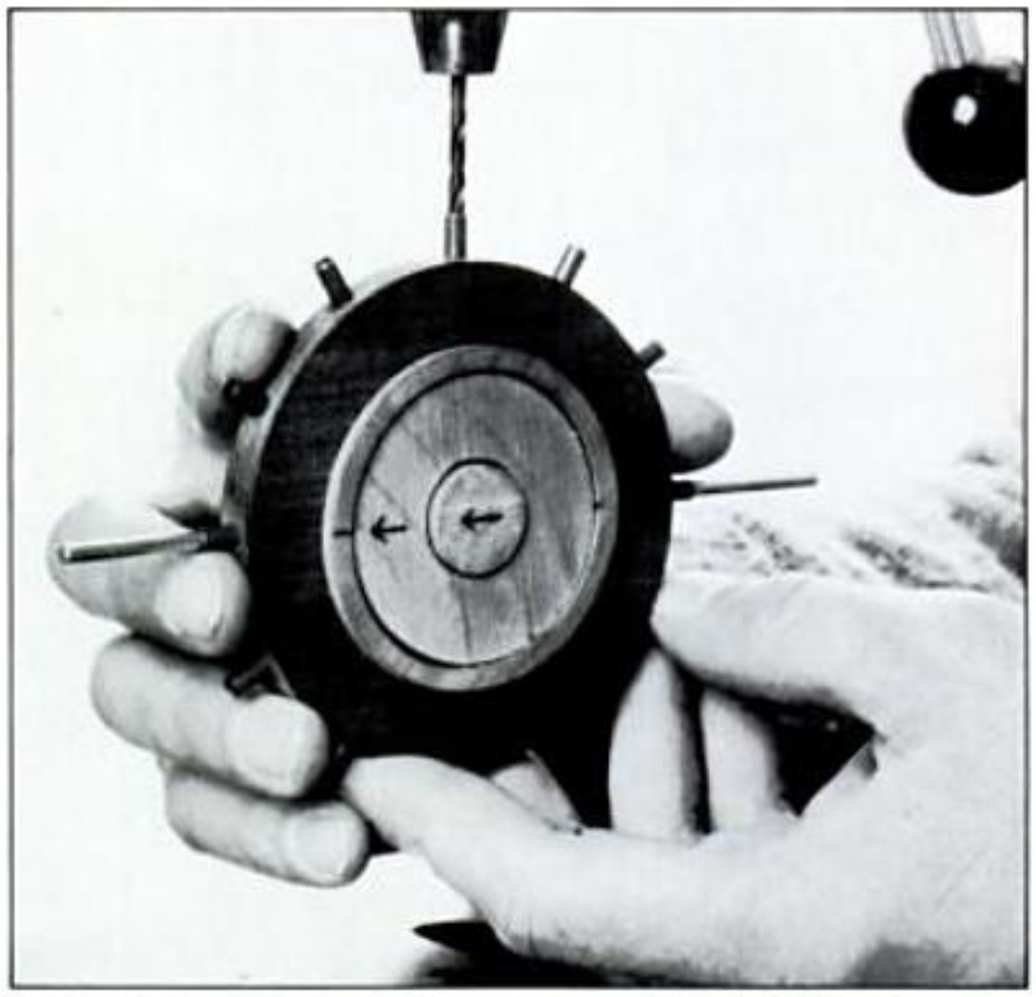


DRAWINGS BY KATHY BEAY



PHOTOS BY MITCH MANDEL

To drill holes for the brass tubes in the spoke-hole guide, hold the guide square to the drill-press table in a wooden hand-screw.



Put the hub and rim in the jig, and bore a hole by raising the assembly into the spinning drill bit.

and shoot a steady stream of air on the hole saw to cool the blade.

Once you've cut the outside of the flange, put a $2^{1}/_{2}$-in. hole saw in the drill press. This next cut does two things. It cuts the outer diameter of the rim, at the same time creating the flange as shown in Fig. 2.

Next, set the stops on the drill press to cut $^{5}/_{32}$ in. less than the thickness of the stock. Cut each wheel, guiding the hole saw's drill bit through the center hole created by the previous cut.

Finally, make the last cut with a 2-in. hole saw. Set the stops to a cutting depth $^{1}/_{32}$ in. less than the stock thickness. Using the same centers as before, bore the inner diameter of the rim.

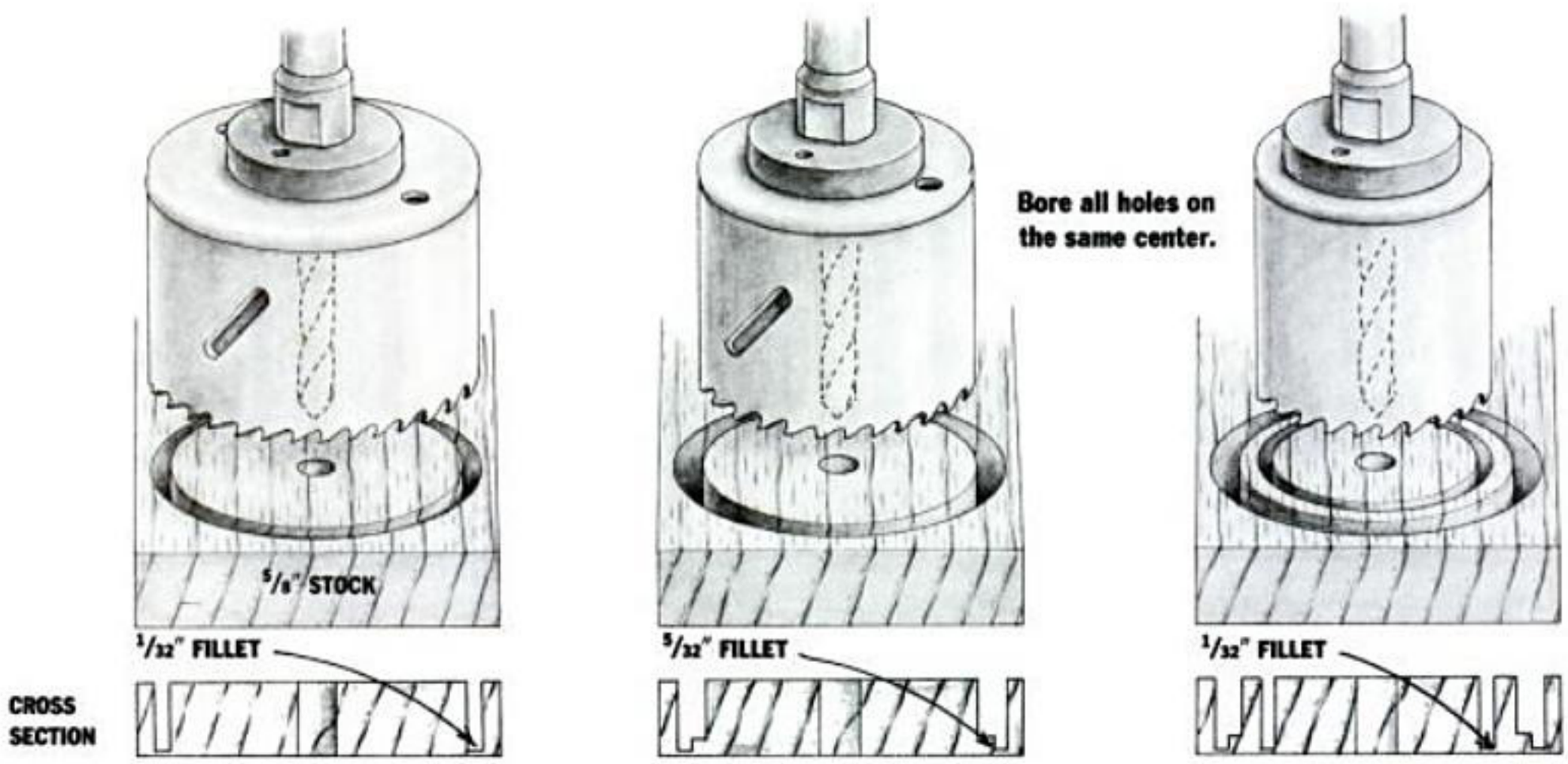
To remove the flanged rims from the board, simply sand away the bottom $^{1}/_{32}$ in. of stock on a stationary belt sander. It's best to sand with a fresh 50-grit belt to cut down on sanding time. In addition to rim/flanges, you will end up with a bucket of $1^{13}/_{16}$-in. solid disks, the by-product of boring with the 2-in. hole saw. Save them—they make great wheels for other projects.

Hubs, Spokes, and Spoke Holes

After all this, making the hubs is a piece of cake. Simply slice a $^{3}/_{4}$-in. dowel into $^{5}/_{8}$-in. lengths on the bandsaw. Don't bore axle holes at this time.

Make the spokes by slicing a $^{1}/_{8}$-in. dowel into 1-in.

FIG. 2: CUTTING A FLANGED RIM



1. Drill hole with $2^{3}/_{4}$-in. hole saw, leaving a $^{1}/_{32}$-in. fillet.

2. Drill hole with $2^{1}/_{2}$-in. hole saw, leaving a $^{5}/_{32}$-in. fillet.

3. Drill hole with 2-in. hole saw leaving $^{1}/_{32}$-in. fillet.

4. Sand away $^{1}/_{32}$-in. fillet to free wheel from stock.

Attach the connecting rods to locomotive driving wheels with a pin made from two dowels. File two spokes to accept the pin and glue the pin between the spokes.

lengths on a bandsaw or scroll saw.

Once you've made all the parts, you need to drill spoke holes through the hub and rim. To make sure the holes are aligned, put the hub and rim together in a jig and drill through the rim into the hub.

The two-piece jig is shown in Fig. 3. One piece of the jig is a spoke-hole guide that looks much like a ship's wheel. To make it, insert brass tubes through a 4-in. dia. hardwood rim at 30° intervals as shown. The tubes act as miniature doweling jigs and guide the drill that makes the spoke holes. The other piece of the guide is a donut-shaped spacer that holds the hub in place inside the jig.

Both parts of the jig—the guide and the spacer—are made with hole saws. Tolerances are *extremely* important here, so it's time for another word about hole saws. Because hole saws are dimensioned by the size hole they drill, the size of the slug they remove is smaller because of the thickness of the blade. As I mentioned earlier, the Milwaukee hole saw has a wall $^{3}/_{32}$-in. thick. Other hole saws, like the Black & Decker, have somewhat thinner walls. To get the right tolerances when making the spoke-hole guide, you will need both Black & Decker and Milwaukee hole saws.

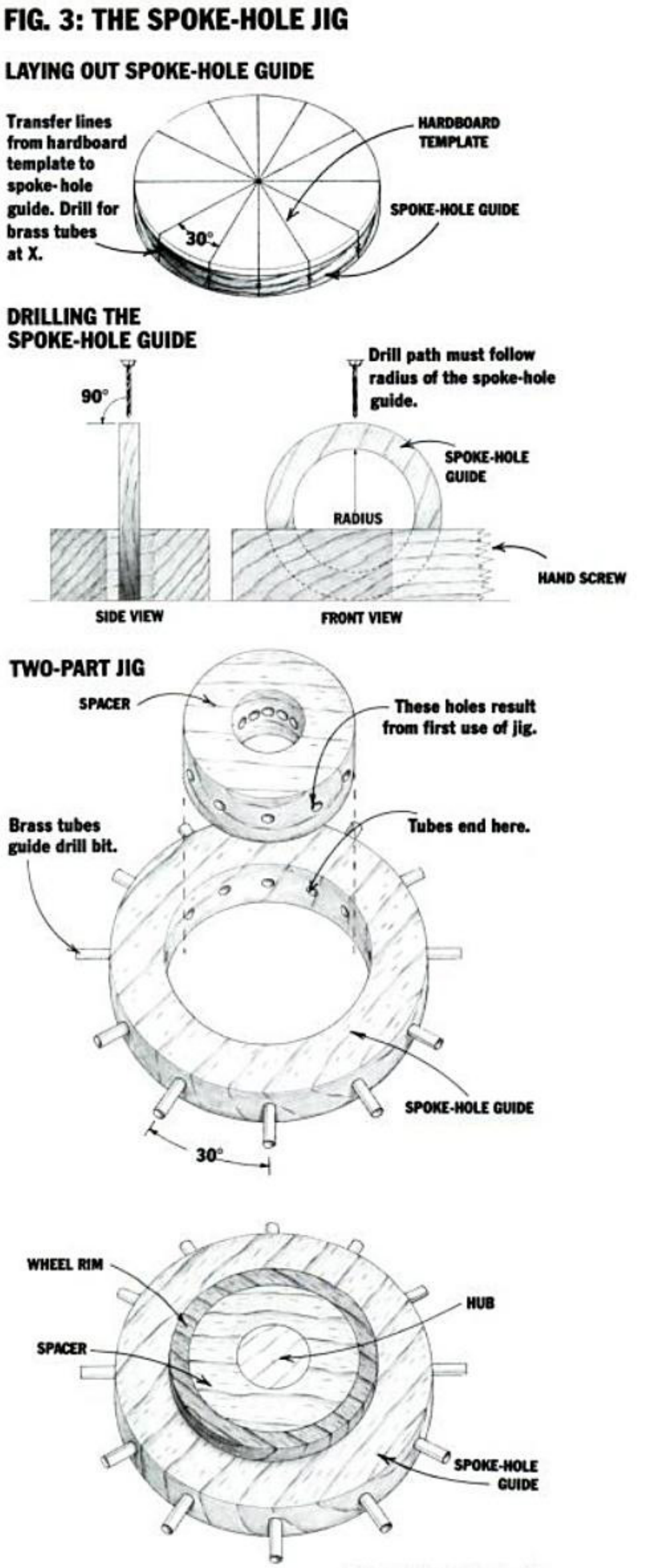
Cut the spoke-hole guide out of $^{3}/_{8}$-in. maple with a $3^{5}/_{8}$- and a $2^{1}/_{4}$-in. Milwaukee hole saw. Cut the spacer out of $^{9}/_{16}$-in. maple with a $2^{1}/_{8}$- and a $^{3}/_{4}$-in. Black & Decker hole saw.

Lay out the location of the brass tubes for the spoke-hole guide with the aid of a hardboard template. Cut a 4-in. circle out of hardboard and lay out the centers of the spokes in pencil at 30° intervals as shown in Fig. 3. Center the template on the backside of the spoke-hole guide, and transfer the lines in pencil to the perimeter of the guide as shown. Mark the center of each line with a center punch.

To keep the drill bit from skating across the spoke-hole guide while drilling, use a $^{5}/_{32}$-in. brad point bit. Hold the jig in a hand-screw as shown in the photo.

Two things are crucial to the success of the jig. First, when viewed from the edge of the spoke-hole

FIG. 3: THE SPOKE-HOLE JIG



guide, the drill bit must be perpendicular to the perimeter. Secondly, the drill's path must run directly along the radius of the spoke-hole guide as shown. The accuracy of these holes is critical to making a successful jig. It's also difficult. I made up three guides so I could select the best for my finished jig.

Once you have drilled all 12 holes, enlarge them with a #22 machinist's drill bit (available from Small Parts Inc., 6891 N.E. Third Ave., P.O. Box 381966, Miami, FL 33238). The #22 bit bores a .1570-in hole that is just a touch larger than the brass tube. This keeps the tube from splitting the rim.

The brass tubes are 1 in. long, cut from 5/32-in. o.d. brass tubing (available from Small Parts Inc.). Cut 12 pieces of tubing, and tap them into the spoke-hole guide with a plastic hammer. The fit is tight enough that gluing isn't needed.

To keep the hub and rim from shifting while drilling the spoke holes, anchor three of the holes with a pin. To make the pins, cut a 1/8-in. brass rod into three 3-in. lengths. Grind a dull point on one end of each rod.

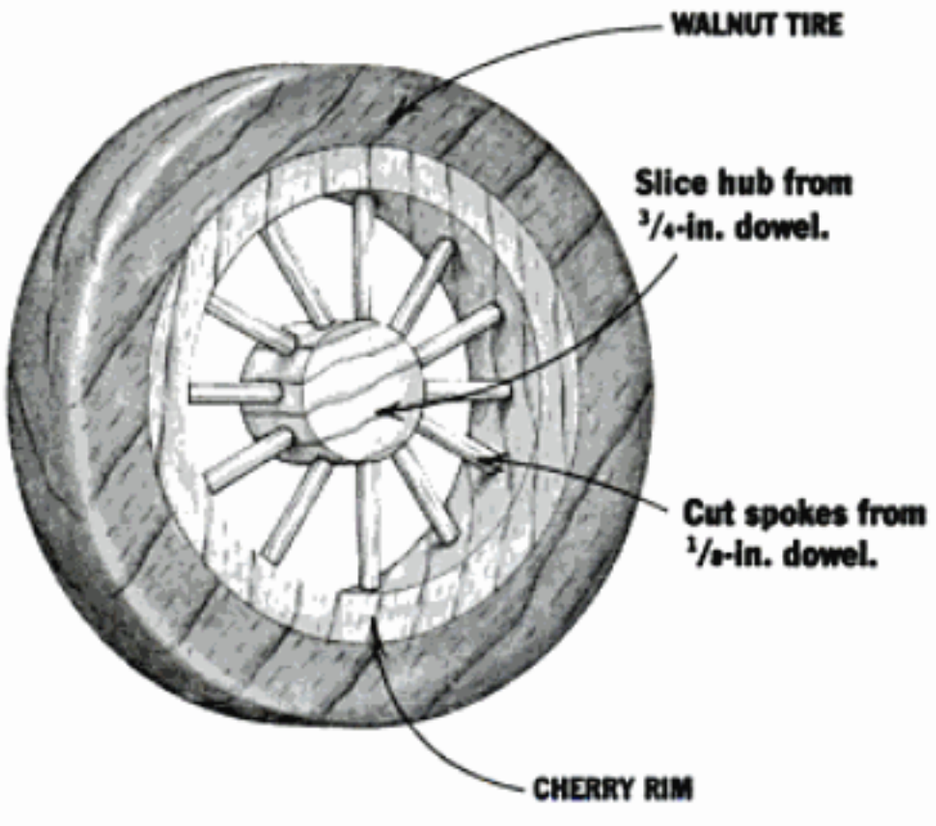
Drilling the Spoke Holes

Assemble the spoke-hole guide, a flanged rim, the spacer, and a hub as shown in the photo. Put a #30 bit into the drill press with just enough bit exposed to bore 3/16 in. into the perimeter of the hub. Grasp the assembly in both hands, and bore the first hole by raising the assembly—freehand—into the drill. The brass tube will guide the bit through the rim, the spacer and 3/16 in. into the hub.

To keep the wheel from shifting in the jig, put one of the 3-in. pins through the jig and into the hole you just bored. Bore a second hole at the 6 o'clock position. Pin that hole with a second brass rod. Bore holes at the 2 and 10 o'clock positions. Arrange the pins so that they are in 2 o'clock, 6 o'clock and 10 o'clock positions and bore the remaining eight holes.

Because there are bound to be inconsistencies in even the best of jigs, I make index marks before I remove the first wheel. I draw a line at 12 o'clock on both the guide and the spacer and always line the two up when I assemble the jig. I also mark 12 o'clock on both the rim and hub, so I can align them correctly during assembly.

FIG. 4: WHEELS WITH TIRES



Assembling the Wheel

Once the parts have been milled and the holes drilled, it's time to assemble the wheel. The spokes must slip through the rim and seat in the hub. To keep them from binding in the rim, enlarge the rim spoke holes with a #29 bit in your drill press. There is no need to glue the spokes in place. Just slip them into the hubs and seat them firmly.

Locate the center of the assembled wheel with a center finder (available from Garrett Wade, 161 Ave. of the Americas, New York, NY 10013). You may discover the center of the wheel does not coincide with the center of the hub. To correct this, jockey the hub into place. Apply a heavy coat of polyurethane to the inside of the wheel at this point. When dry, the polyurethane holds everything in place. Coat the exterior surfaces later.

When the polyurethane dries, you can finally bore the center of the hub. The hole in the wheel must be counterbored to match the shape of the peg that fastens the wheel to the train. (I fasten the wheels to my vehicles with a 7/32-in. axle peg available from Cherry Tree Toys Inc., P.O. Box 369, Belmont, OH 43718.)

Counterbore a 3/8-in. hole 1/8 in. deep in the center of the hub; then bore a 1/4 in. through-hole for the axle.

On steam engines, a piston drives a connecting rod to turn the wheels. The head of the axle peg must be flush to keep it from interfering with the connecting rods. Before putting the peg in the wheel, sand the head down on a 1-in. belt sander. Attach the connecting rods with a small dowel between the spokes as shown in the photograph.

Sand the perimeter of the spoked wheel on a 1-in. belt sander. Mount the wheel on a brass spindle, and slowly turn it against the belt. Sand the front and back surfaces on a stationary belt sander with 100-grit paper.

Wheels With Tires

Until the early 1930s, the wheels on cars, trucks and fire engines had wooden spokes and narrow rubber tires. I make scale wheels for these early vehicles with hole saws and the spoke-hole jig described above.

For example, I make spoked wheels for a 1928 Ahrens-Fox fire engine with the same spoke-hole guide as shown in Fig. 3. You'll need 2 5/16-in. and 3 5/8-in. Milwaukee hole saws to make the tires. Make the rims with 2 1/2-in., and 2-in. Milwaukee hole saws. I make walnut tires with light colored rims. Cut the hubs from a 3/4-in. dowel as before.

Once you've milled the hubs and rims and tires, put them in the spoke-hole guide with the spacer. Drill for the spokes and install them.

To assemble the wheel, lay a bead of glue on the inside of the tire, and as the glue turns tacky, slip the assembled rim and hub into the tire. Drill a hole for the axle when the glue is dry.

Round over the walnut to make it look like a tire. I put a spindle through the axle hole and rock the wheel back and forth against a belt sander to produce the desired round-over.

After two or three coats of polyurethane or oil of your choice, your spoked wheel is, indeed, a rewarding sight. ▲

Doug Kenney makes scale reproductions of fire engines and steam trains on Cape Cod. He learned woodworking while restoring a 1927 custom-built yacht.

BOOKS & VIDEOS

BOOKS

Fine Tuning Your Radial Arm Saw

by Jon Eakes
(1987, Lee Valley Tools, Ltd., 2680 Queensview Drive, Ottawa, Ontario, K2B 8H6 Canada) paperback; 106 pp; $9.95 U.S.; $14.95 Canada.

The radial arm saw is often thought of as a cantankerous tool—difficult, inaccurate and sloppy. In this book, Jon Eakes successfully salvages the radial arm saw's reputation with step-by-step directions for tuning up three popular models.

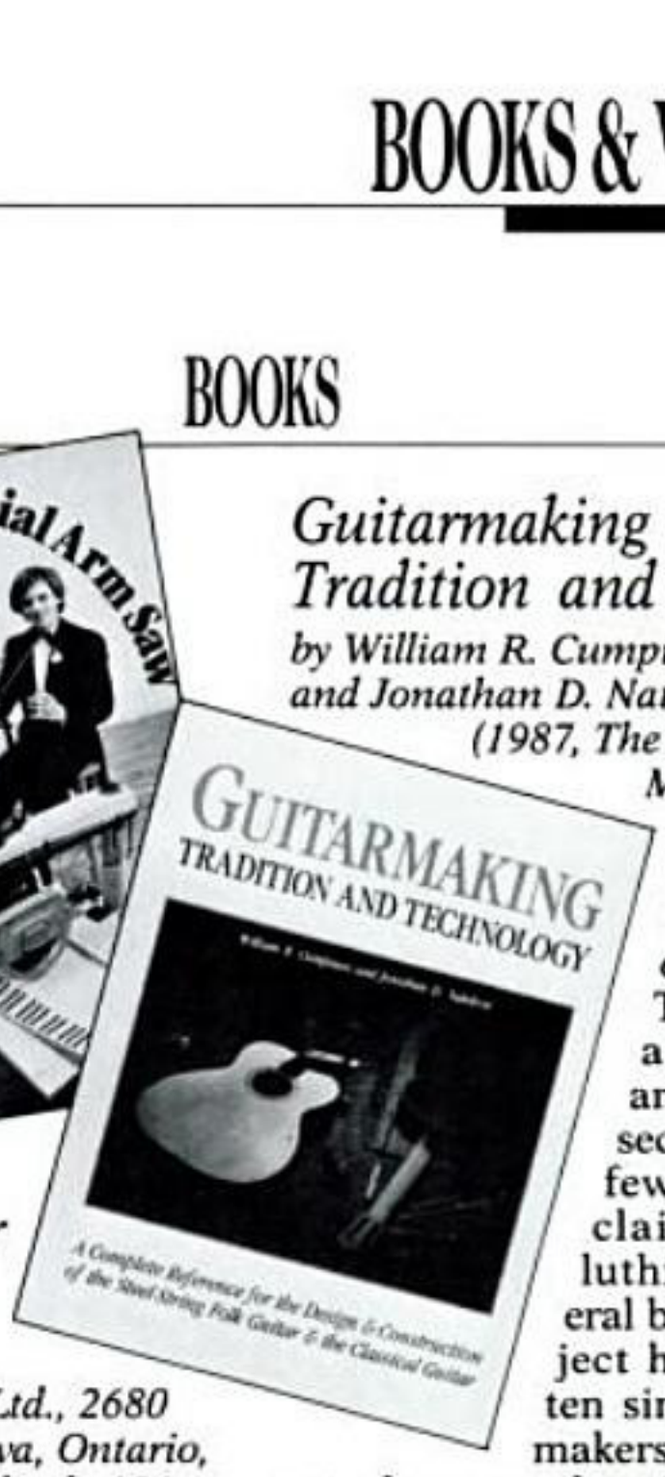
Eakes begins with some guidelines that are helpful in tuning all tools. Some of these basics include making sure moving parts are snug; final-checking all settings by making an actual cut and allowing for the slack inherent in screws when making settings.

From there, Eakes moves to simple step-by-step instructions for fine-tuning Craftsman, DeWalt and Rockwell/Delta radial arm saws. Each step is illustrated with crisp, clear photos showing how to make adjustments on each machine.

This is not a book that explains how to use your radial arm saw—it isn't meant to be. It is a book that tells you, at long last, how to get a square cut, avoid tearout, position the back rail and the table and get the table flat.

The book approaches the radial arm saw as a misunderstood child. And like a child, with care and understanding the saw's potential can be realized. It emerges as a precision machine, capable of doing anything the tablesaw can do.

JEFF DAY



Guitarmaking Tradition and Technology

by William R. Cumpiano and Jonathan D. Natelson
(1987, The Rosewood Press, Mountain Farms Mall, Russell St., Hadley, MA 01035) hardcover; 387 pp; $48.

Twenty years ago, there was an often arrogant secrecy among the few and self-proclaimed "master" luthiers. While several books on the subject have been written since then, guitar makers still longed for a truly comprehensive book.

Now, *Guitarmaking: Tradition and Technology* has arrived and has already become the guitar maker's bible. It deals ambitiously with building two guitars—a traditional classical guitar made for nylon strings, and a steel-string guitar more common to folk, pop, bluegrass and country music.

The book begins with general historical and technical comments about guitar anatomy. The authors discuss tools and make sensible recommendations about templates and molds that simplify building. Wood procurement and preparation are also thoroughly outlined, but the vast portion of the text deals with step-by-step guitar making.

There are hundreds of processes in making a guitar. Each step is dealt with simply and concisely. Whole chapters are dedicated to specific details and technical procedures. Most important, the authors steer the reader toward quality and craftsmanship. The nearly 400 photographs and 100 line drawings are well executed and presented.

The book is intended to sit, like an old master, on the workbench in the basement amidst the sawdust and wood shavings. But it is almost too precious a book to subject to the risks and spillage that pervade most shops. I keep mine upstairs on the coffee table.

DICK BOAK

VIDEOS

Shopsmith, Inc. Hands-on Series

with Avian Rogers and Les Cizek
Building Cabinets; 35 minutes
Building Tables; 40 minutes
(1986, Shopsmith, Inc., 3931 Image Drive, Dayton, OH 45414) VHS and Beta; $24.95 each.

The folks at Shopsmith have produced an entire series of instructional videotapes aimed at the beginning woodworker. *Building Cabinets* demonstrates how to make a bathroom vanity while *Building Tables* shows how to build an occasional table.

Hosts Avian Rogers (of television's "Do-it Yourself Show") and Les Cizek approach the material in an amiable and straightforward manner. Both videos follow essentially the same format, discussing design, tools and materials, stock selection and appropriate joinery techniques. Each video takes you through all the steps necessary to complete a sample project, albeit in a very basic, almost cursory manner.

While the videos cover a variety of tools and techniques, they tend to feature Shopsmith tools and accessories at the expense of alternative methods. But, for the novice woodworker looking for a quick overview of basic woodworking, these tapes should prove worthwhile.

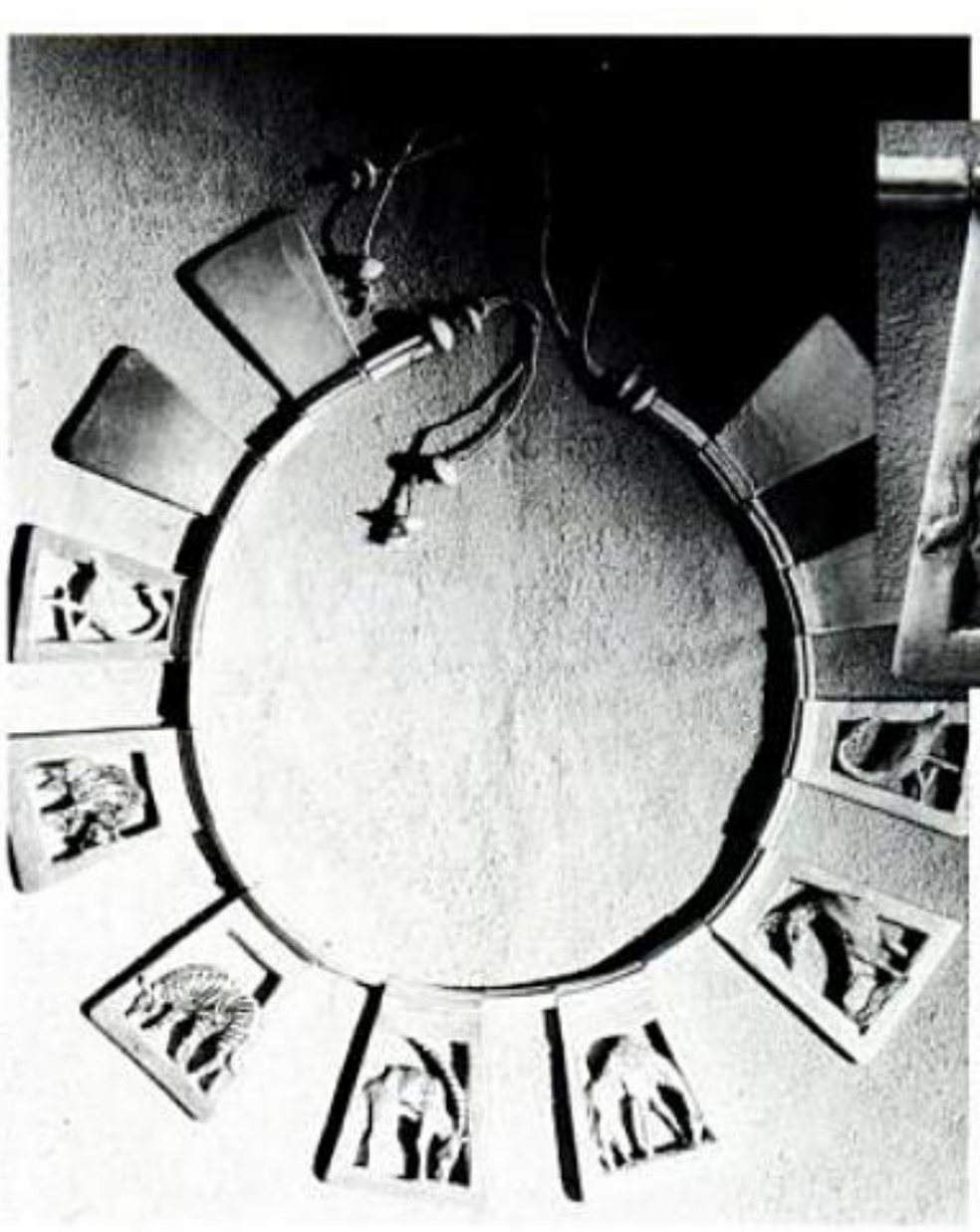
MITCH MANDEL

GALLERY

CURRENT WORK BY OUR READERS

Rare, indeed, is the woodworker who is capable of moving beyond traditional forms to create works of lasting beauty. Jon Alley is such a craftsman. Jon's influences come from a diversity of sources—a background in the fine arts and an African influence from time spent working in Kenya. Yet far from being chaotic, Alley's pieces are integrated and harmonious. A Pennsylvania native, Jon still lives and works in his home state teaching furniture design and construction at Bucks County Community College in Newtown. He has been working with wood professionally for 20 years. The pieces shown here display Jon's talent and subtle humor.

"Room Screen." Bubinga, padauk, mahogany ply panels with gold leaf. Dimensions: H: 71 in., W: 48 in.



"Pokot 1." Hard maple, pierce-carved, gold leaf with paint. Detail of zebra pendant: 1½ in. × 1¾ in.

PHOTOS BY JON ALLEY

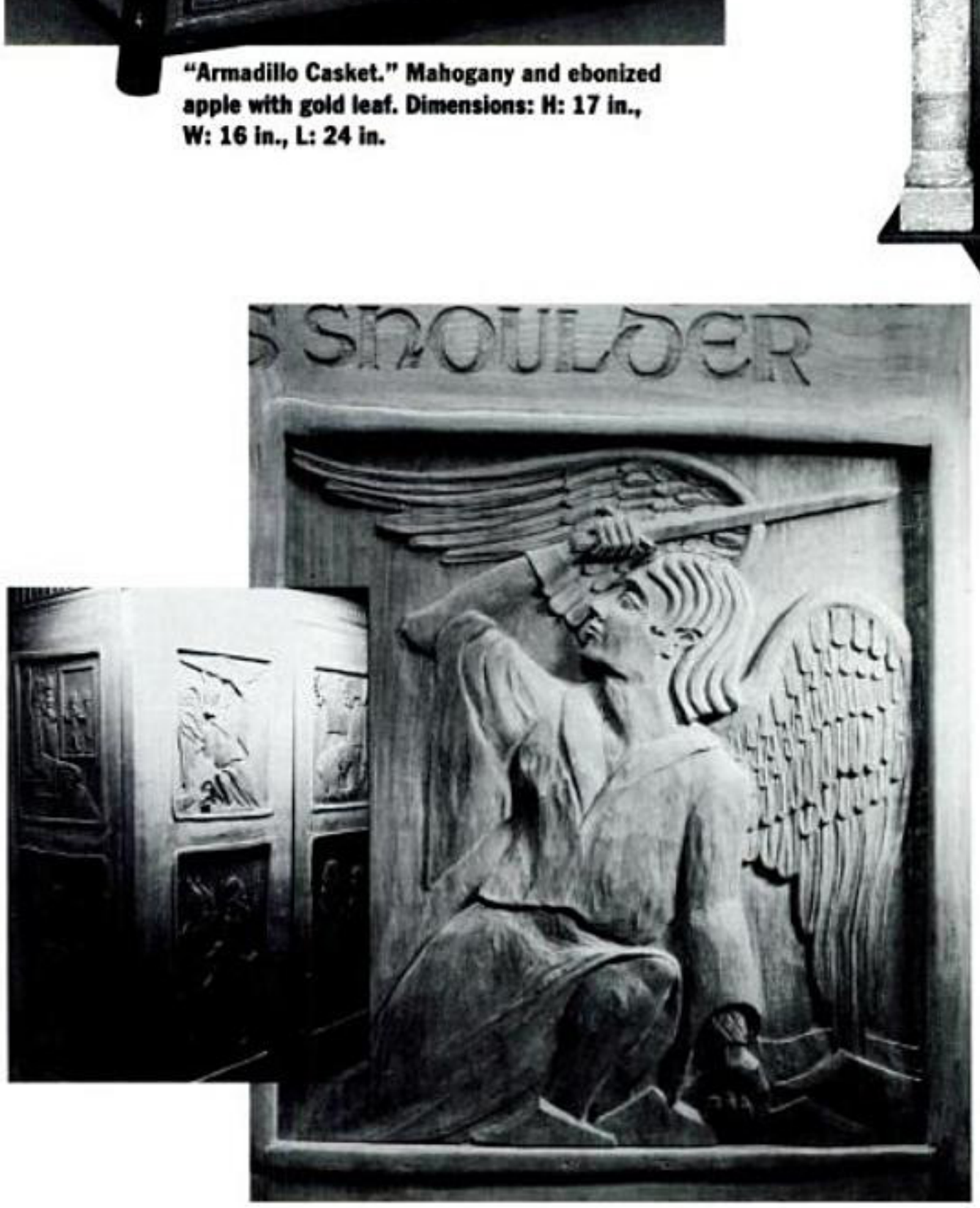
"Walnut Goldfish Bowl." Turned and carved from solid wood with gold leaf. Dimensions: H: 7 in., Dia: 15½ in.

GALLERY

CURRENT WORK BY OUR READERS

"Early Exit." Mahogany and maple ply, goncalo alves with gold leaf and paint. Custom-made copper hinges. Dimensions: H: 34 in., W: 20 in., D: 9 in.

"Armadillo Casket." Mahogany and ebonized apple with gold leaf. Dimensions: H: 17 in., W: 16 in., L: 24 in.



"Key Cabinet." Teak with monel fittings. Dimensions: H: 88 in., W: 52 in., D: 28 in.

Want to see your work in Gallery? Send photographs and a description of the piece to: AMERICAN WOODWORKER, *33 E. Minor St., Emmaus, PA 18098. Only black and white prints (4 × 5 in. or larger) or color slides will be accepted. Please do not send color prints or snapshots. Enclose a self-addressed envelope for return of photos.*

FINAL PASS

WOODWORKING NEWS & NONSENSE

Big Jointer Contest

You may have seen prettier jointers. You may have seen older jointers. But we'll bet that you've never seen a larger jointer. We're going on record with the audacious and unprovable claim that this is the World's Largest Jointer, and we're offering a prize to the reader who proves us wrong.

First the facts: Cabinetmaker Glenn Bostock bought this monster jointer—marked "The Porter"—back in 1978 for $1100. The tables measure 24 in. wide and 86½ in. long. It needed a motor and a fence, but Bostock couldn't pass the machine up when he came across it in a used-equipment warehouse.

He couldn't pick it up either. The few times he's had to move the jointer, he's disassembled it, rounded up all his friends, and rolled the pieces across the floor on pipes. His friends have stopped returning his calls.

Based on the serial number, Bostock thinks the machine was made in 1941. He joints wood on the machine daily in his Rushland, Pennsylvania cabinet shop.

Now the contest rules: If you think you know of a bigger jointer, send a photo along with dimensions and a description to:

JEFF DAY

This is the World's Largest Jointer, or so we think. It measures 24 in. wide and 86½ in. long. If you know of a bigger one, enter our Big Jointer Contest.

Big Jointer Contest
AMERICAN WOODWORKER
33 E. Minor St.,
Emmaus, PA 18098

The reader who sends us a photo of the *biggest* jointer will win $50, a year's subscription to AMERICAN WOODWORKER and an AMERICAN WOODWORKER T-shirt. The winner will be announced in the September/October 1989 issue of AMERICAN WOODWORKER.

Send black and white prints or color slides only (we can't publish color prints). Photographs become property of AMERICAN WOODWORKER and cannot be returned. Entries must be received no later than July 15, 1989.

Send no actual machinery.

Look, It's a Bird

At Boston Garden, where a tribute to basketball player Larry Bird was held a year ago, fans received twice the treat and, no, they weren't seeing double. As they looked on, they saw Bird as never before. He was literally beside himself.

This was not a magician's trick but instead an illusion created by the magical hands of a furniture-maker-turned sculptor who had carved a life-size statue of the famous Celtic. Self-taught Rhode Island carver Armand LaMontagne had given this wood a life of its own, capturing Bird from the size 14 Converse sneaks to the ripples in his green uniform.

The 7-ft. high, 275-lb. sculpture made of basswood and painted in authentic colors, depicts Bird in action, poised for a shot. Carved from a 1,800-lb. block of wood, it took LaMontagne 2,000 hours to finish and is precise to the smallest detail.

Sculptor Armand LaMontagne captured cager Larry Bird in wood with a life-size carving of the famous Celtic.

The piece not only raised funds for the New England Sports Museum but it also allowed Larry Bird the privilege of meeting his maker.

LaMontagne hasn't stopped there. Instead, he's remained hard at work on another chip off the old block. This time he's sculpted a life-size replica of Boston Bruins hockey great Bobby Orr. Like Bird, Orr is frozen in action, crouched, eyes fixed and ready to take a shot. This latest creation was unveiled in March and, since April, has been on permanent display at the sports museum.