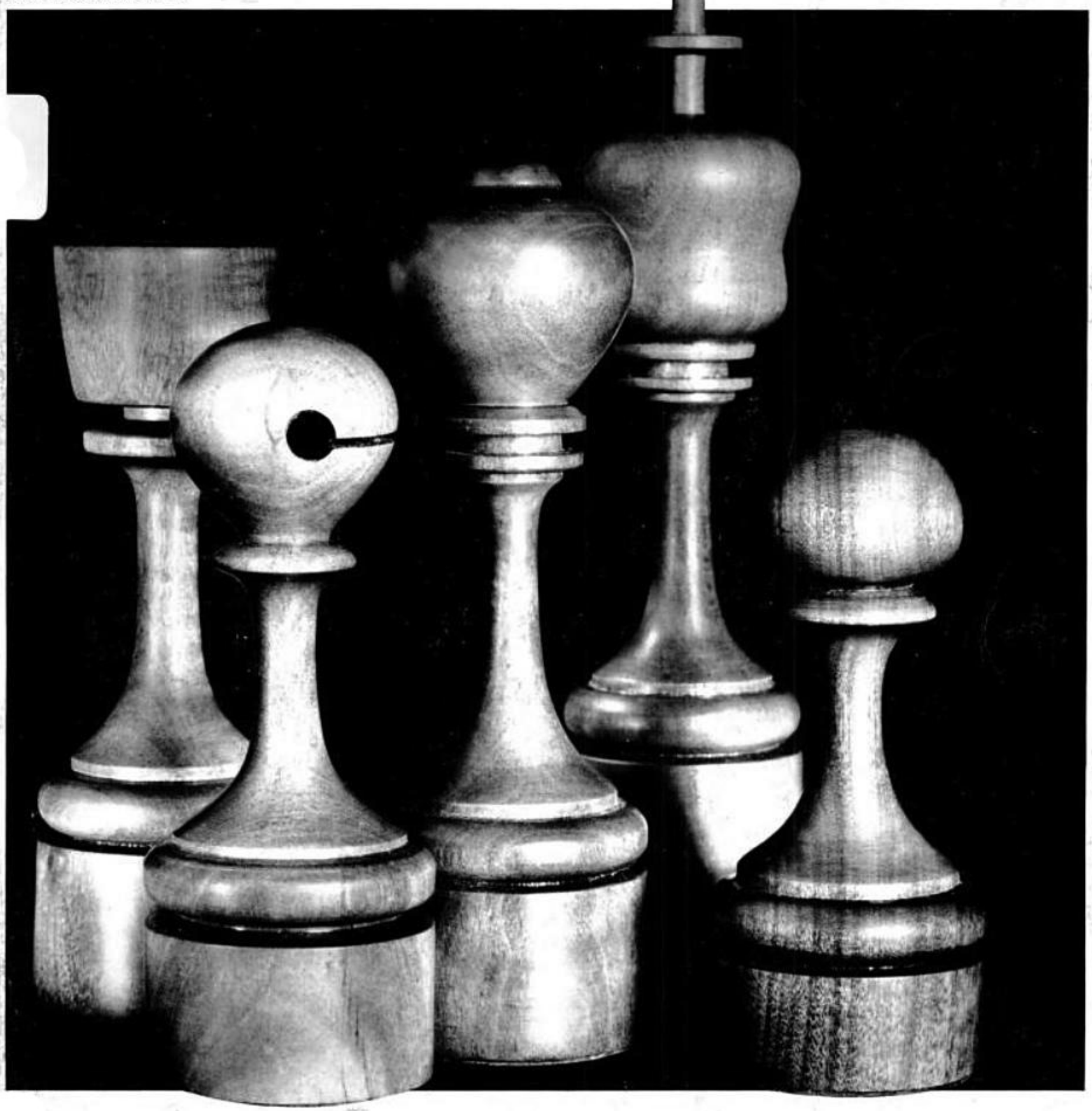
AMERICAN WOODWORKER

October 1990, Issue No. 16



$4.50

0 71486 01507 9 10

Checkmate! Turn a Chess Set with Rude Osolnik

Belt Sanders: Get the Most Brawn for Your Buck

Sharpening Basics: Get That Razor-Sharp Edge

Two Great Jigs for Gap-Free Miters

CONTENTS

Issue No. 16
September/October, 1990
COVER PHOTO: Sally Shenk Ullman
Chess Set by Rude Osolnik

PROJECTS AND FEATURES

SHARPENING BASICS **40**

DEPARTMENTS

AMERICAN WOODWORKER

EXECUTIVE EDITOR
David Sloan

ART DIRECTORS
Ayers/Johanek
Publication Design

ART ASSISTANT
Suzanne Burke

ASSOCIATE EDITOR
Fiona A. Wilson

ASSISTANT EDITORS
Robert Moran
Dave Sellers

COPY EDITOR
Nancy Wallace Humes

SEC./PRODUCTION COORDINATOR
M.N. Lhuillery-Peischl

CONTRIBUTING EDITORS
Ernie Conover
Mike Dunbar
Nick Engler
Franklin H. Gottshall
W. Curtis Johnson
Simon Watts

PUBLISHER
Pat Corpora

ADVERTISING SALES MANAGER
James Owens

SALES SERVICE COORDINATOR
Sharon George

CLASSIFIED SALES REPRESENTATIVE
Louise Rader

ADVERTISING SALES OFFICES
East
33 E. Minor St., Emmaus, PA 18098
(215) 967-5171

ADVERTISING SALES REPRESENTATIVE
Renée James

West
James G. Elliott Company
714 W. Olympic Blvd., Suite 1120
Los Angeles, CA 90015
(213) 746-8800

ADVERTISING SALES REPRESENTATIVE
Jacqueline M. Neumeier

CIRCULATION MANAGER
JoyceAnn Sokol

SUBSCRIPTION SERVICE MANAGER
Jane Hollingsworth Morris

PRODUCTION DIRECTOR
Harry Ardoline

AMERICAN WOODWORKER (ISSN 8750-9318) is published six times a year in January, March, May, July, September and November by Rodale Press Inc., 33 E. Minor St., Emmaus, PA 18098, (215) 967-5171.

SUBSCRIPTION RATES: U.S. one-year $27, two-year $54. Single-copy $4.50. Canada one-year $35, two-year $70 (Canadian funds). Foreign, one-year $35, two-year $70 (U.S. funds). U.S newsstand distribution by Eastern News Distributors, Inc., 1130 Cleveland Rd., Sandusky, OH 44870. **SECOND-CLASS POSTAGE:** paid at Emmaus, PA and additional mailing offices. **POSTMASTER:** Send address changes to AMERICAN WOODWORKER, 33 E. Minor St., Emmaus, PA 18098. **CONTRIBUTOR GUIDELINES:** available upon request. We will treat unsolicited material with care, but cannot assume responsibility for loss or damage. Send a stamped, self-addressed envelope for return of material.

A WORD FROM THE EDITOR

DIFFERENT STROKES

As I was editing Roger Holmes' sharpening article in this issue I was struck by the difference between Roger's sharpening technique and the method that works for me. Roger hones chisels and plane irons on an India stone, switches to a soft Arkansas stone, and finishes up by stropping the edge on a piece of leather charged with abrasive compound. He holds the blade with one hand and strokes the tool backwards, away from the edge. After every few strokes on the bevel, he flips the tool over and hones a few strokes on the back. That's the way he learned to sharpen and it works fine for him.

My approach is a little different. I prefer Japanese water stones for sharpening chisels and plane irons. I start out on a 1,000-grit stone, switch to 6,000 grit and finish up on an 8,000-grit stone. I hold the tool with both hands and bear down hard, stroking the tool back and forth along the length of the stone. After working the bevel, I hone the back of the tool on the two finer stones. I like to work with my stones on the floor so I can use the weight of my upper body to bear down on the blade (and so I don't have to clean the watery mess off my bench top every time I sharpen). It's an unorthodox approach, perhaps, but the method works fine for me.

As I was tracking down photomicrographs for the sharpening article, I spoke with Leonard Lee of Lee Valley Tools in Ontario, Canada. Mr. Lee gets the ultimate edge by taking my sharpening approach one step further. After honing on an 8,000-grit waterstone he follows up by buffing the edge on a felt wheel charged with a 16,000-grit chromium-oxide buffing compound he's developed. Viewed by an electron microscope, his buffed edges are noticeably smoother than those honed on the 8,000-grit stone alone.

These different approaches to sharpening—each of them effective—drove home the point that there's rarely one "right" way to get a job done. People are different and so are their methods. The articles we publish reflect this diversity. Over the course of a year, you might see several approaches to doing the same task. Try the techniques if you can—you're bound to learn something and maybe add a new technique or two to your repertoire. But don't get bogged down in the details—it's the principles that are most important. Once you understand what you're trying to accomplish, you can pick and choose from the techniques of others and tailor them to suit your own personal style.

DAVID SLOAN
Editor

LETTERS

Good, Better, Best

When you describe a machine or tool in your "Buyer's Guides," I want to know the disadvantages and bad aspects as well as the good. Also, when you compare machines in the same category I would like to know which ones are best and conversely, which ones I should stay away from.

MARION C. STAVES
Kennett Square, PA

We're often asked why we don't recommend a particular "best" machine in our "Buyer's Guide" articles. The question is, best for whom? In most cases, we haven't found a clear-cut, overall "best" performer when we've compared woodworking machines. "Best" in a price range, maybe. Personal favorite, definitely. It's really a subjective call. A machine that meets the casual hobbyist's needs might be too puny for a shop that builds lots of furniture. Instead of picking our personal favorites (and we editors don't always agree), we try to provide information that will enable you to choose the machine that's best for you—your style of work and your budget. If a machine's a real dog we'll let you know.

Playing the Numbers

The 1989 issues of *AW* are identified by a volume number and an issue number. For example, November/December 1989 is marked Vol. V, No. 6. I assume this would be interpreted as your sixth issue of your fifth year of publication which would make, actually, the thirtieth magazine (assuming six issues per year for five years).

My first issue for 1990 was marked simply, "Issue #12." This would imply that you are only in your second year of publication (again assuming six issues per year).

Would you please explain your issue numbering system to me and why you recently changed it.

JAMES CLARK
Garland, TX

We changed from the cumbersome "Volume, Number" system primarily to make indexing easier.

For the first three years of its life, AW *was published as a quarterly by J.M. Publications. Volumes I, II, and III each contain only four issues. When Rodale Press acquired* AW *in 1988, we increased the frequency to six issues per year. Our first issue came out in March, so Vol. IV (1988) has only five issues. There are six issues in Vol. V (1989). (Getting confused?)*

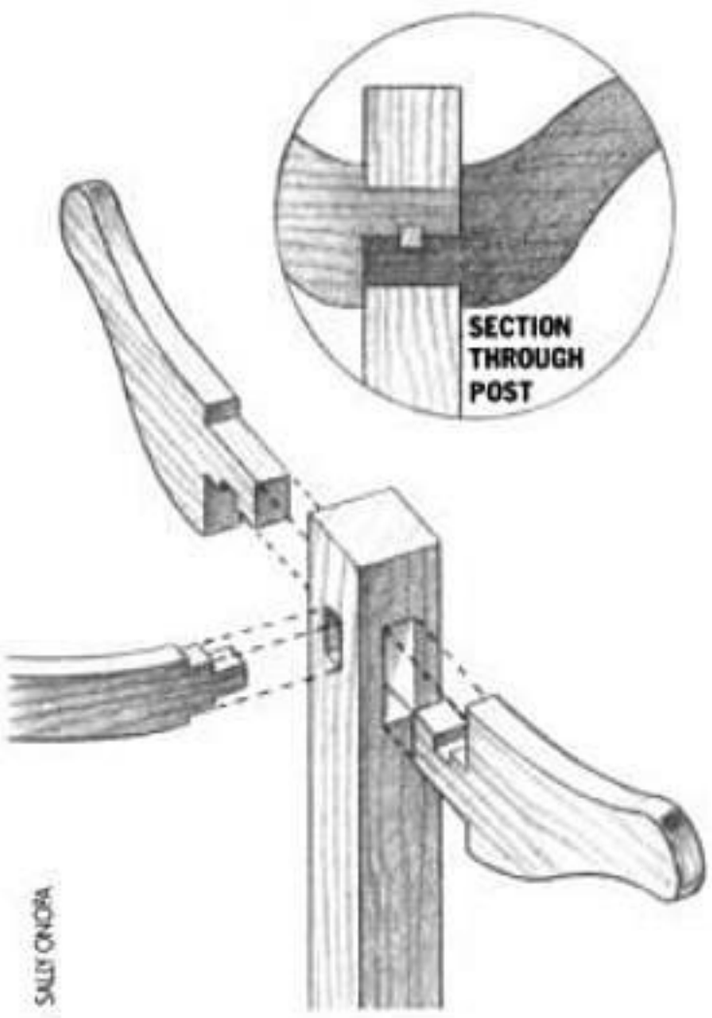
We decided to simplify the system by numbering issues sequentially, beginning with the March/April 1988 issue—the first issue published by Rodale Press. Librarians everywhere will hate us for it.

Rack 'em Up

Nick Engler's quilt rack article (*AW* #15) brought back memories. Back around 1930 my father and I made 20 or 30 oak quilt racks and gave them to our friends for Christmas.

The drawing shows the joint we used to hold the frames together. The mortise that holds the upper arms

goes through the uprights. There is a mortise on the inside of the uprights for the cross-frame. When the arms are fitted into the upright, there is a 1/2-in. square hole in the middle for the end of the cross-frame tenon.



After the joint is glued and the pieces clamped in place, a hole is bored down from the top through all the parts and a long wood screw is screwed in place. We placed a finial on top. The bottom is made the same but without a finial.

VERNE KEN VANCE SR.
Perryville, AR

Followup on Filters

Jerry Busse's article on the shop-built dust collector in the August 1990 issue (*AW* #15) is misleading when he suggests it can reduce health risks. The filtering system he describes does not lessen the hazards of lung damaging dust.

The problem lies in the filter media. Using a standard furnace filter will not remove any of the dust particles below 10 microns in size. Inhaled particles smaller than 10 microns reach deep into the lungs and can enter and sometimes clog the lungs' air sacks. These particles are invisible and stay in the air for hours. The large, visible dust particles (50 microns and larger) caught by the furnace filter would normally be filtered out in the body's nasal passages and throat.

The only way to make Busse's system capable of removing this fine dust would be to use medium-efficiency air filters (ASHRAE atmospheric efficiency of 30% or greater). These filters use a dense, pleated filter media that can remove particles below one micron in size. There is a reduction in air flow and the filter must be well sealed to the box to prevent leaks, but the effort and increased expense is worth it. Most industrial filter suppliers stock these filters in several common sizes. They can even be used in your home's furnace system to remove pollens.

MARKE LANE
Kansas City, MO

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

Splicing Leather Drive Belts

Q. *I bought an old lathe that has a flat pulley meant to be driven by a flat leather belt. I've made a new belt but don't know how to fasten the two ends together. How was it done in the old days?*

ARTHUR JONES
Eau Claire, WI

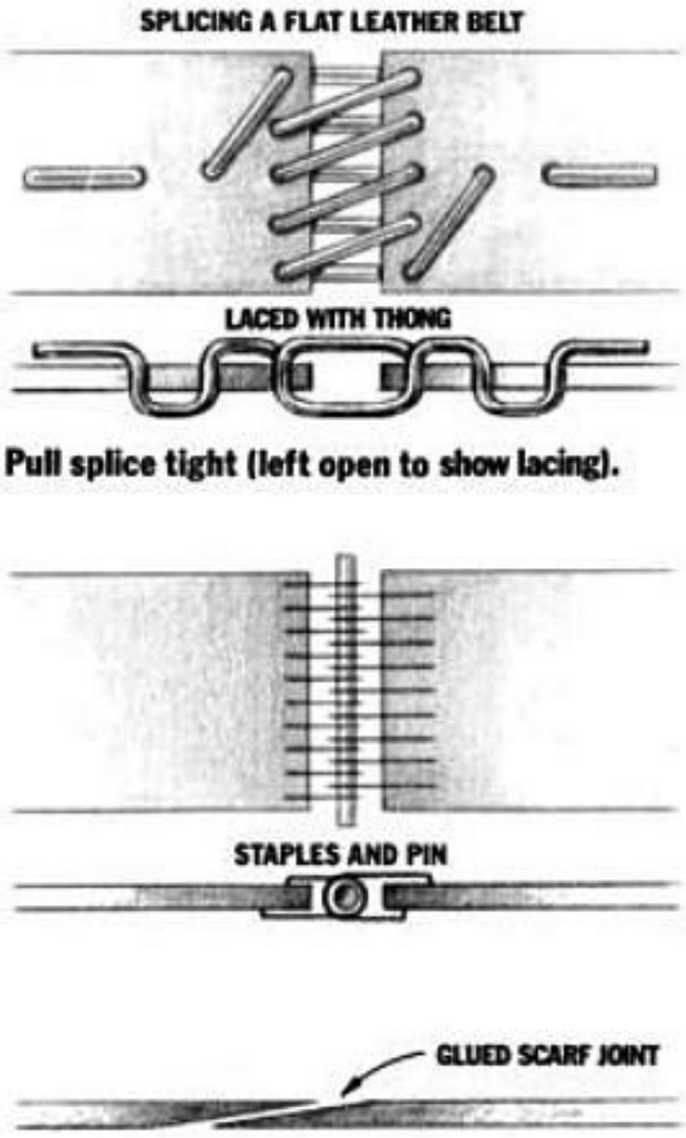
A. The oldest method, and maybe still the best, is to use a strong leather thong laced through holes in the ends of the belt as shown in the drawing. When a new leather belt stretches after some use, it can be tightened by cutting off a short length of the belt and making new holes to lace the thong through. The thong makes a small flapping noise going over the pulleys but will get smoother and quieter over time.

Wire staples in the ends of the belt, held together with a hard plastic or metal pin, is another method. There's a more noticeable "slap" as this splice goes over the pulleys. This is a quick fix and is common in commercial shops. But applying the staples requires a special tool—try calling a belt company or the maintenance department of industrial shops in your area.

"Alligator Belt Lacing™" is a similar product which can be installed with only a hammer (made by Flexible Steel Co., Downers Grove, IL 60515).

A long overlapping scarf joint which is glued with hide glue, contact cement or shoemaker's leather cement is another option. It requires some skill to make this splice, but it's a strong, quiet-running joint.

PALMER SHARPLESS
Spindle turner
Newtown, PA



DRAWINGS BY SALLY ONORA

Grind It, Don't Burn It

Q. *No matter how careful I am when I sharpen a tool on my electric grinder, I always seem to burn a spot on the edge. I use medium-grit and fine-grit silicone carbide wheels. I dress the wheels with a diamond dresser, I cool the tool frequently, and*

I use a real light touch. What am I doing wrong?

BRIAN E. KIRBY
Bay City, MI

A. You're off to a good start by dressing the wheels. As you grind, the space between the abrasive particles fills up with metal. The wheel becomes "glazed," which creates a lot of heat but little material removal. Running a diamond dresser lightly over the face of the wheel brings up fresh, sharp abrasive particles.

I'd suggest you switch to an aluminum oxide grinding wheel. It's better than a silicon carbide wheel for tool steel because it runs cooler. In grinding, finer is hotter, but not necessarily better—your wheel may be *too* fine. I use a 60- to 80-grit wheel on my left arbor and a 120-grit on the right. You'll be removing the grinding marks with a whetstone anyway.

Finally, you may be grinding your tools to too thin an edge. A 30° bevel angle is right for just about all woodworking tools. A thinner edge (less angle) will build up heat quickly when grinding and could burn the edge. I like to grind just shy of the edge, leaving a flat of 1/64 in. or less. This means slightly more work at the whetstone, but I never burn an edge. I hope this advice keeps you cool.

ERNIE CONOVER
Turner and Contributing Editor
Parkman, OH

Storing Water Stones

Q. *I bought a set of Japanese water stones about two months ago. I have a 1200-grit, 6000-grit and an 8000-grit. I'm a weekend woodworker, so I only use them about once a week. What's the best way to store them when they aren't being used?*

BRUCE SMITH
Flagstaff, AZ

A. Water sharpening stones are divided into two types, natural and man-made. It is not necessary to keep natural stones in water. However, man-made water stones, which are made from either synthetic materials or crushed natural materials, are different. The manufacturers suggest keeping the stones in water at all times because repeated drying causes minerals in the water to build up in the stone, reducing its abrasive action. Man-made stones are also difficult to use until they are totally saturated with water, which takes quite awhile with the coarser stones. Many Westerners have had the same experience with a new carborundum stone: it soaks up about 2/3 of a small can of oil before it is ready to use.

In all the time I have used man-made water stones, I have never stored them in water. The first reason is habit. Most of my life I used natural stones, which I stored dry. The second reason is my fear of freezing my stones and shattering them, since I work in a shop that sometimes gets very cold.

The 6000- and 8000-grit King water stones are attached to a wooden base, which presents another problem. When these stones are kept in water, the base sometimes separates

from the stone. Since the stone is quite thin, it cracks very easily without the base. I do soak my 800-, 1000-, 1200- and 1500-grit stones for 10 to 15 minutes before I use them. The 6000-and 8000-grit I use without soaking; I coat the top surface of the stone with a film of water just before using. In over ten years of using man-made stones, I have never seen a change in their quality or abrasive power.

TOSHIO ODATE
Sculptor, Shoji maker and author
Woodbury, CT

Handles for Old Handsaws

Q. *I have two old handsaws that were handed down to me. They're in excellent condition except for the handles, which are broken. I've searched thoroughly and can't find replacement handles. Do you know of a good source?*

JOHN WHITEHEAD
Rosemont, PA

A. I, too, am very partial to old saws. They're better balanced than the new ones and the handles were carefully shaped to conform to the human hand. They had to be: back when a woodworker did most of his cutting by hand, a saw that raised blisters would put him out of work.

I wouldn't bother to look for replacement handles. I'd recommend making new ones yourself. It's not difficult, and you can match the refinements of the old handles. Use the originals (or remnants of them) as patterns for the new ones. Handles were usually made of American beech wood (*fagus grandifolia*), although apple was often used on the highest quality saws.

If your saws still have their saw nuts—the brass fasteners that hold the handle to the blade—re-use them on the new handle. Saw nuts often bear the maker's logo and can be as elaborate as old coins. Remove heavy tarnish by soaking them in lemon juice overnight, and polish them with ordinary brass polish. Don't buff them, as this wears away the details that make the old saw nuts so interesting.

MIKE DUNBAR
Contributing Editor

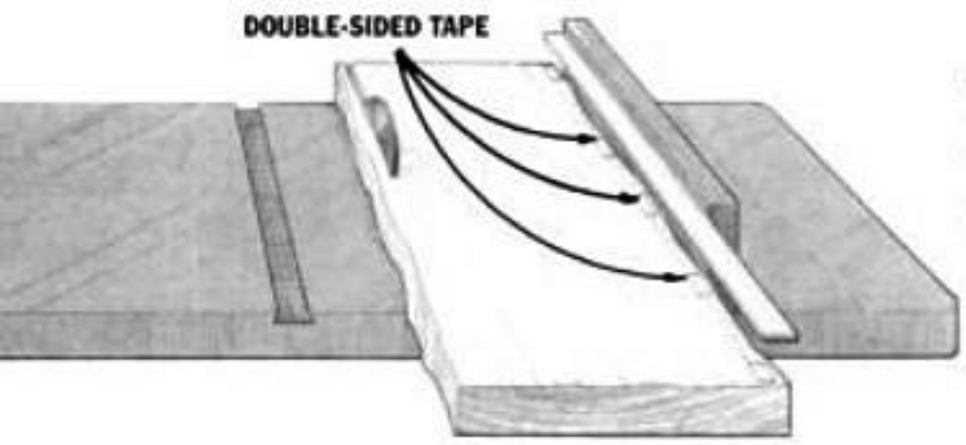
Where To Find It

Low melting-temperature metal filler for casting metal inlays in wood is available from Highland Hardware, 1045 N. Highland Ave. NE, Atlanta, GA 30306.

Lettering guides—thin plastic templates for tracing many different styles of letters and numbers to cut out with a scroll saw are available from Advanced Machinery Imports Ltd., P.O. Box 312, New Castle, DE 19720.

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

TECH TIPS



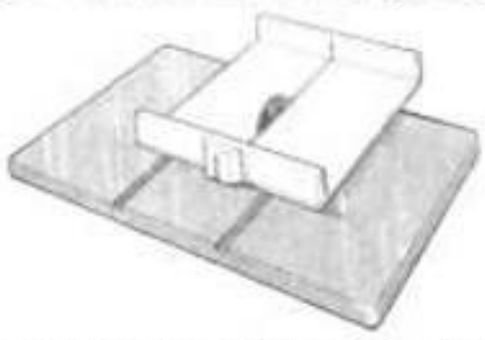
Getting the First Edge Straight

To get a straight edge on one side of a board that has two irregular edges, attach a straightedge to one side with double-sided tape. Then run it through the tablesaw with the straightedge against the fence. The tape won't damage the wood the way nails will.

STAN WATSON
Palm Springs, CA

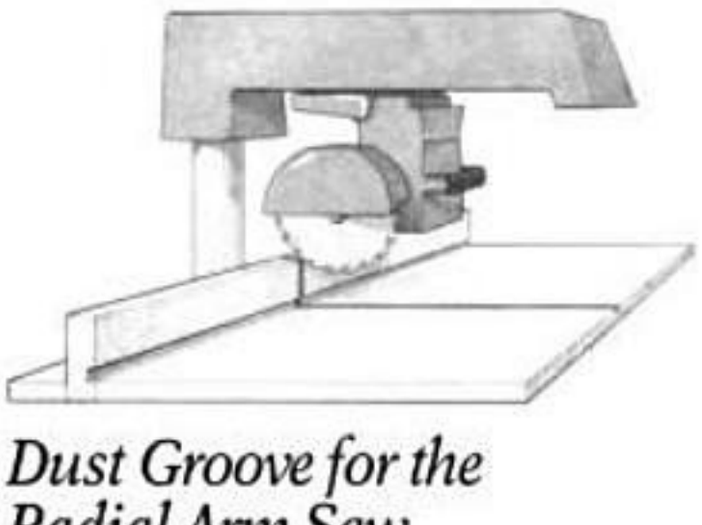
Warning! Blade Coming!

Cutoff boxes, tenoning jigs and similar fixtures can be dangerous if you forget that the blade is going to exit



from the rear of the fixture. Glue a block with angled edges over the slot where the blade comes through. It will alert you to danger if your fingers stray too close while your attention is on the cut.

JOHN KRIEGSHAUSER
Kansas City, MO



Dust Groove for the Radial Arm Saw

Sawdust, piling up against the radial arm saw fence, can mess up the accuracy of your cuts. A groove for dust to escape into can cut down the amount of brushing and blowing needed to get accurate cuts. Be sure the top of the groove is lower than the top of the thinnest stock you are likely to cut on the saw.

DAVID JOHNSON
Apple Valley, MN

Parking a Sander

When using an orbital finishing sander, I find it helpful to have a 12-in. sq. piece of carpet close by. The power can be turned off and the sander safely set on the carpet before it has come to a complete stop.

JOHN HISEY
Bainbridge Island, WA

Bevel-Angle Template

A handy guide for testing the bevel of your edge tools can be made from acrylic plastic. Carefully cut notches for the angles you want, and label them with an engraving tool or by scratching with a nail. A little black paint rubbed over the surface and wiped off will make the letters stand out better. Drill a hole in one end, so you can hang the template.

JOHN ROCCANOVA
Ancramdale, NY

Losing Your Grip?

I put rubbery anti-slip tape (the sort used on stair treads) on push sticks, hold-downs, and even surfaces such as the fence on a plate joiner or the clamps on a dovetail jig.

ROBERT G. BRANDT
Fort Worth, TX

No-Clog Glue Bottle Cap

For years I've been confronted with the problem of keeping the spout of my glue bottle flowing freely. I've solved the problem by drilling a hole through an electrical twist-on connector and pushing a 1½-in. roofing nail through the hole. The connector twists on the glue bottle spout, seals the opening, and prevents glue from hardening around the spout.

LYLE E. BOHRER
Beaumont, TX

The Last Straw

When glue squeezes out on the inside corner of a joint, you can smear it all over trying to wipe it up, risk tearing out wood fibers by letting it

dry first and then chiseling it off, OR you can scoop the glue up with a plastic straw. Push the straw into the corner just enough to make it conform to the joint but not enough to collapse the straw, then slide it along scooping up the glue.

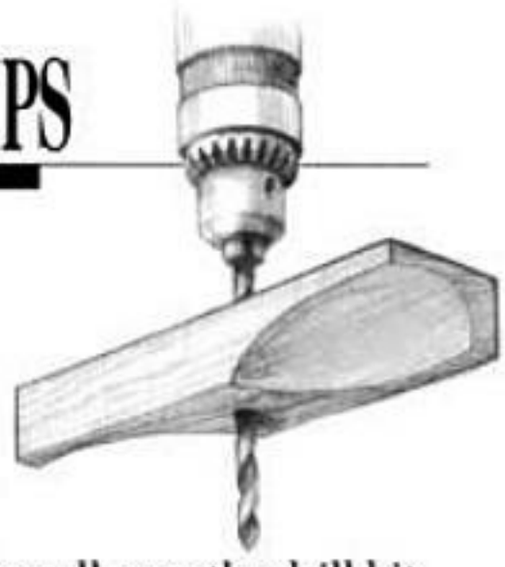
ROBERT L. ESKRIDGE
Vandenberg AFB, CA

CONTINUED

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

DRAWINGS BY HEATHER BRINE LAMBERT

TECH TIPS

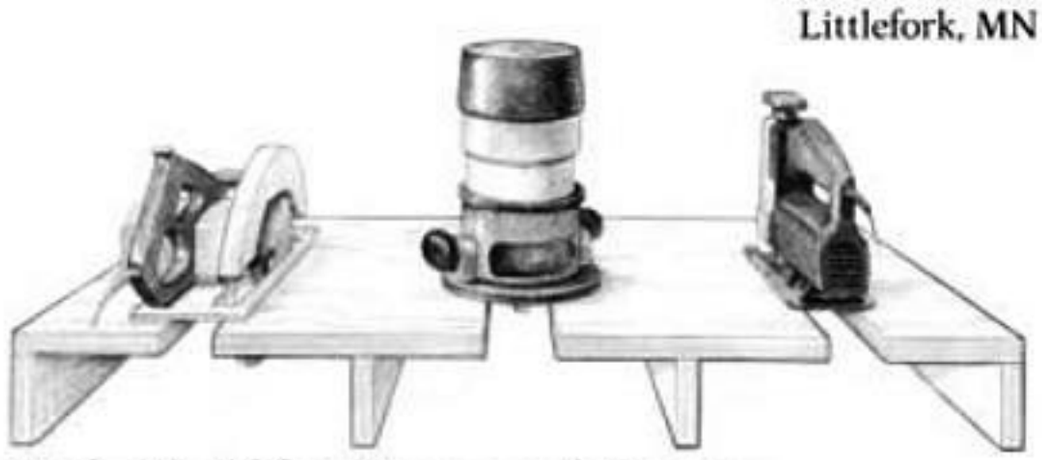


Blow the Chips Away

I make a lot of cribbage boards. Often, the wood chips from the drill press obscure the marks I've made for the adjoining holes. To eliminate the problem, I mount a small, wooden propeller on the drill bit, which blows the chips away.

I shape the propeller with a belt sander and then drill through it at a slow speed, leaving it on the bit a 1/4 in. above my work when the bit is all the way down.

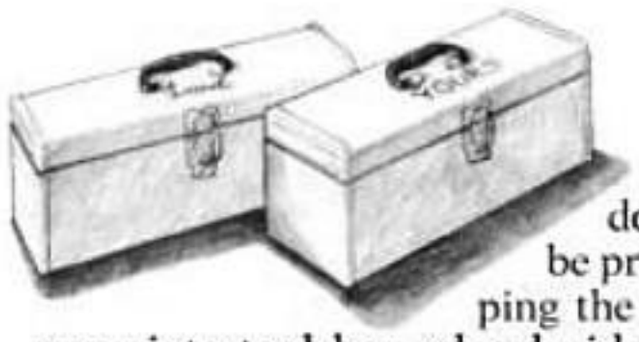
DALE JENNINGS
Littlefork, MN



Safe Shelf for Saws and Routers

A slotted shelf allows tools such as circular saws, saber saws and routers to be shelved in their natural position without damaging blades and bits.

ELEANOR HUBBARD
Knoxville, MD



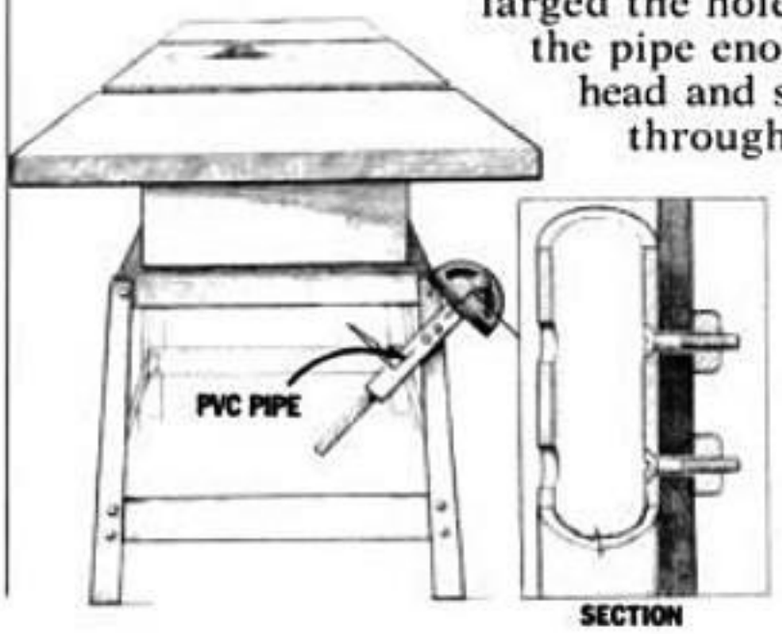
Stop Tool Theft

Most tool theft is a domestic crime that can be prevented by fully equipping the thief. I suggest an appropriate tool box, clearly identified, containing a small claw hammer, tape measure, screwdrivers, pliers, and perhaps a scraper and razor blades. An assortment of nails and household hardware such as picture hangers would not be out of place.

ALVIN SHERWOOD
Round Lake, IL

Miter-Gauge Holder

I needed a handy place to put my tablesaw miter gauge when it wasn't in use. I fastened a 12-in. length of PVC pipe to the side of my tablesaw with 1/4-in. flat-head stove bolts through the pipe and the saw base. I drilled 1/4-in. holes through both sides of the pipe, then enlarged the holes in one side of the pipe enough for the bolt head and screwdriver to fit through. I countersank the inside of the holes on the opposite side of the pipe, so the bolt heads would be flush with the inside surface.



BLAIR HUBBARD
Knoxville, MD

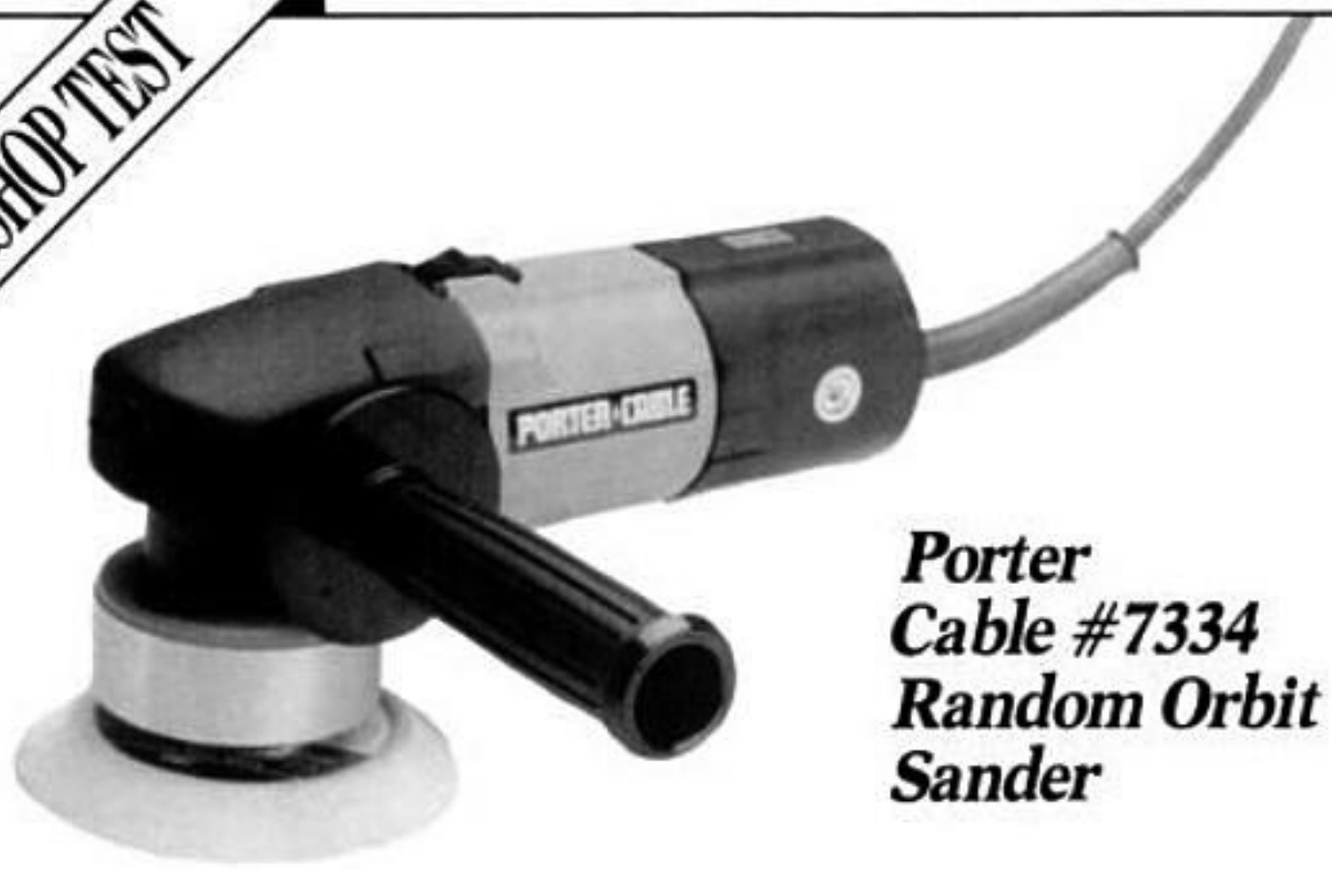
Vacuum Veneer Press

The VacuPress System is an affordable, versatile and convenient alternative to mechanical veneer presses. Simply put your veneered panel inside the clear vinyl bag and turn on the 1/3-HP vacuum pump to evacuate the air inside the bag. The vacuum created in the bag lets atmospheric pressure provide the "clamping" force. This assures uniform pressure distribution on all surfaces. The bag's flexibility allows you to veneer curved panels, too. When you're done the bag rolls up for compact storage. (Price: $760 for 44-in. × 72-in. bag)

■ *Vacuum Pressing Systems, Dept. AWT, 10A South St., Freeport, ME 04032, 207-865-0744.*

CIRCLE NO. 41 ON READER SERVICE CARD

SHOP TEST



Porter Cable #7334 Random Orbit Sander

I was first introduced to a random orbit sander by one of the contractors who works with me on the "This Old House" TV series. He used an air-powered random orbit sander—the kind automotive body shops use. The sanding disk on a random orbit sander attaches to a circular pad that spins around in a completely random motion. This is because the center of the rotating pad is mounted on a counterbalanced eccentric shaft that also rotates in a little circular orbit. Since the sandpaper's swirl marks are random, they don't show up as much as those made by a conventional orbital pad sander.

I liked the way that air-powered sander worked, so I was eager to try Porter Cable's new electric-powered random orbit sander. I started using the sander on one of the projects in my upcoming new book, *Classics from the New Yankee Workshop*, and later found myself using it more and more. Now I use it for practically all of my sanding jobs. I just fell in love with this sander.

The sander uses a 5-in. diameter pad which takes standard 5-in. adhesive-backed sanding disks. With coarse sandpaper it works pretty quickly, but I wouldn't say it removes material quite as fast as a belt sander. I find the sander most beneficial as a *fast* finishing sander. It's great for sanding large areas and glued-up assemblies like stile-and-rail door frames and face frames. When the clamps come off after the glue is dry, you can quickly even up discrepancies in the joints and sand across opposing grain surfaces without worrying about swirl marks. Yet it removes material much faster than a palm sander. The only real disadvantages I've found are that the round pad can't get into corners, and the edge of the sanding disk can nick adjacent surfaces in close quarters.

I usually start off with 120-grit paper and go to 150-grit if I really need a smooth surface. The sander takes care of the whole sanding job—there's usually no need for follow-up hand sanding. I may use 80-grit if I have two badly uneven surfaces and I want to take them down fast. I've found that a finer grit paper on this sander will do the work of a coarser grit on a regular orbital sander. Yet the #7334 doesn't throw out as much dust as a regular disk sander. The self-stick paper is really convenient; since it sticks firmly to the whole pad, it seems to work more efficiently and last longer than regular sandpaper. Here's a tip, though: strip the old sandpaper off the pad right after you're finished working. If you wait too long, it'll be difficult to remove and some of the old adhesive may stick to the pad.

Like any sander, the #7334 has a certain amount of vibration and is pretty loud in use, though I don't find that to be a problem. Because of the random motion, it can sometimes jerk around unpredictably. It's definitely a two-handed tool if you want to use it effectively.

The standard pad is somewhat hard and is a little difficult to get used to. I recommend that you buy the accessory contour pad—it's softer and more flexible, which gives more control, and it's more comfortable to use. Changing the pads is a snap.

Overall, I think the Porter Cable #7334 random orbit sander is a very good tool. It's probably not the best choice for a general homeowner's sander, but I'd strongly recommend it to anyone who regularly does a variety of sanding tasks. I think any serious woodworker or finish carpenter—hobbyist or professional—shouldn't be without one. (Price: $205, contour pad: $14.75)

■ *Porter Cable Corp., Dept. AWT., P.O. Box 2468, Jackson, TN 38302, 901-668-8600.*

CIRCLE NO. 42 ON READER SERVICE CARD —*Norm Abram*

TURNING A CHESS

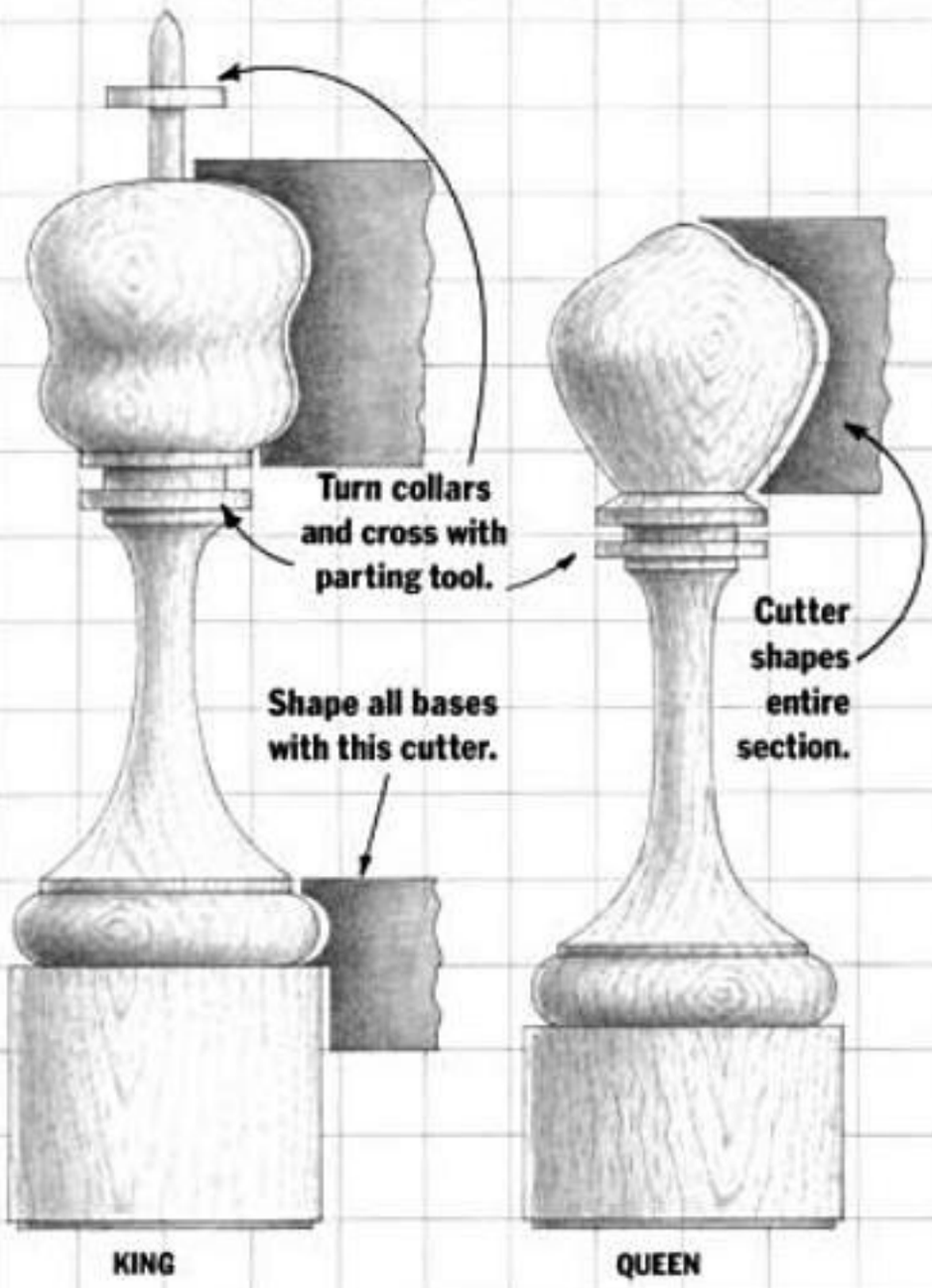
Formed Cutters Make Quick Work of Duplicate Shapes

I've been turning for a long time. For a number of years I went to craft fairs to sell my work. To be successful at these fairs you needed a variety of items with affordable prices. It was my policy to always have something new at each fair. When I hit upon the idea of making a chess set, I challenged myself to find a way to make the chess pieces rapidly. If I turned each piece by hand, the set would have taken an enormous amount of time, and its price would been out of my customers' reach. I wanted the pieces to have liveliness and variety, so I didn't want to use a duplicating lathe. That's when I decided to use formed cutters.

Formed cutters are simply shear-cutting scrapers that you grind to specific profiles from a piece of steel bar stock. Each cutter shapes only a section of the finished chess piece, so while formed cutters make it simple to duplicate a shape again and again, you still have some freedom to vary the pieces. In other words, you can turn out multiple pieces pretty fast, but they

SALLY SHENK LILLMAN

FIG. 1: CHESS-SET CUTTERS



SET

PHOTOS BY FIONA A. WILSON

BY RUDE OSOLNIK

Making a chess set is an exercise in repetitive turning. Formed cutters —scrapers ground to the shape of the piece—make it easy to turn duplicate pieces.

Each piece is shown with respective formed cutters.

Grind steel cutter to form shape.

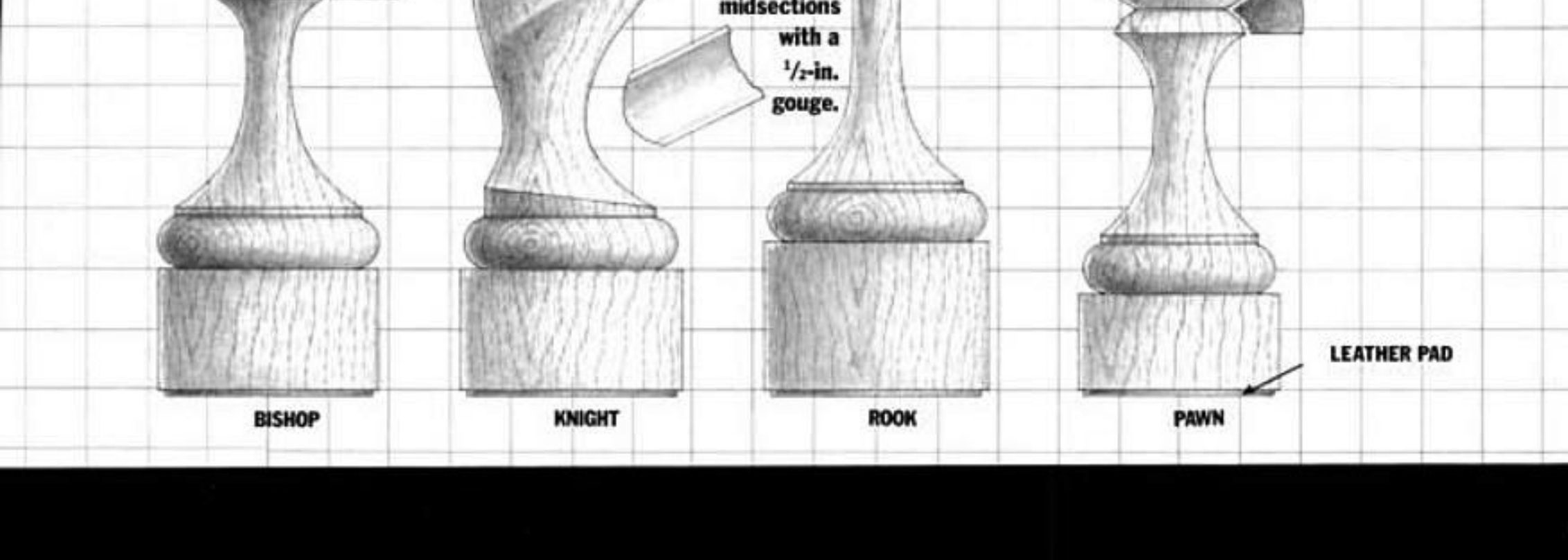
3/8" SQUARES

Shape with skew.

Shape all midsections with a 1/2-in. gouge.

LEATHER PAD

BISHOP **KNIGHT** **ROOK** **PAWN**



DRAWINGS BY KATHY BEAN

still have that pleasant handmade quality.

I designed the chess set you see here so the pieces would be comfortable to hold and easy to move. I made their midsections slim, so they'd have a light look. The knight gave me a bit of a challenge, until I decided to turn his middle section off center. The sidebar on eccentric turning explains how.

In this article, I'll tell you how I make my chess set. Using formed cutters, I can turn out a chess piece in a matter of minutes. It takes a bit more time to grind the cutters, but once you've made them, you can use them again and again.

To make a set of chess pieces, you'll need a grinder and half-a-dozen or so aluminum-oxide grinding wheels in several widths (1/4 in., 3/8 in., 1/2 in. and 1 in.) and grits, which you'll shape to grind your cutters. (See grinding wheels sidebar.) You'll also need a grinding-wheel dresser, a supply of high-speed steel bar stock, calipers, dividers and, of course, a lathe. You'll need two contrasting woods for the chess pieces. The set shown here is made of pink ivory wood and macassar ebony, but you can use whatever woods you like. Walnut and maple are a nice combination.

There are six different chess pieces: king, queen, bishop, knight, rook (or castle), and pawn. (See Fig. 1.) With the exception of the knight, each piece in my set was made with two different formed cutters—one for the top and one for the base. Though the bases of each chess piece vary a bit in height and width, all the bases were made with the same cutter. This gives the chess pieces a nice unity. The base of the knight was also turned with the base cutter, but I shaped the top with a skew.

Formed cutters tend to chatter on small diameters, so I shaped the thin, central portion of each piece with a gouge. This gives the pieces their handmade quality, and besides, I enjoy the freedom of shaping the middle as I choose. I cut the details, such as the collars on the king and queen and a cross on the king's head, with a small parting tool.

FIG. 2: SHAPING THE CUTTERS

STEP 1

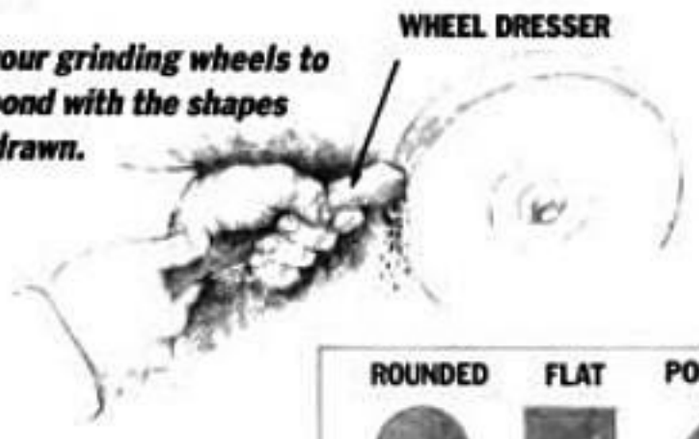
Draw the profile you want on your bar stock.

Shape this part on a rounded grinding wheel.

Shape this part on a flat grinding wheel.

STEP 2

Dress your grinding wheels to correspond with the shapes you've drawn.



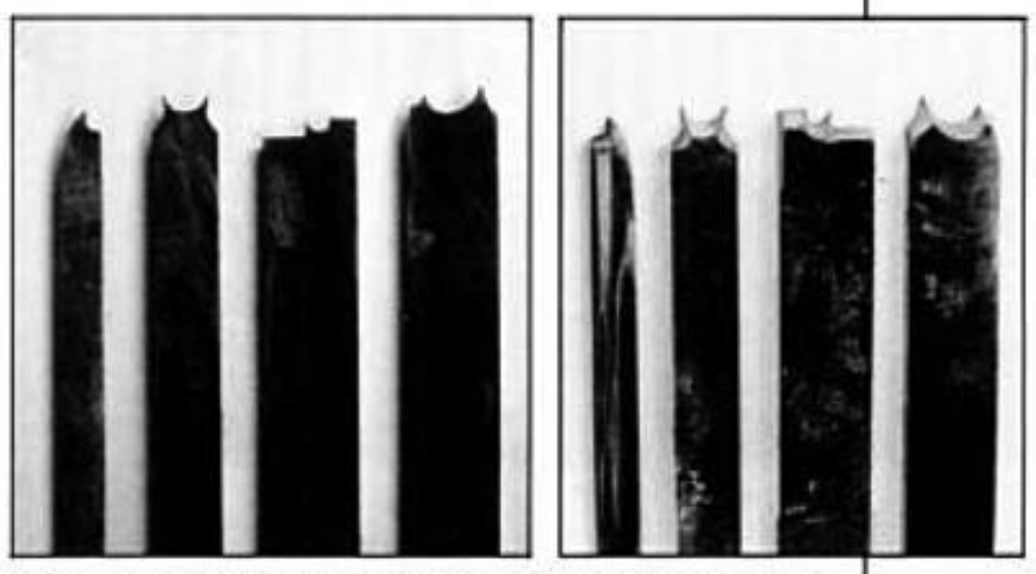
GRINDING-WHEEL PROFILES

STEP 3

Shape cutter on wheels to desired profile.

GRINDING DETAIL

Hold bar stock at an angle to relieve underside.

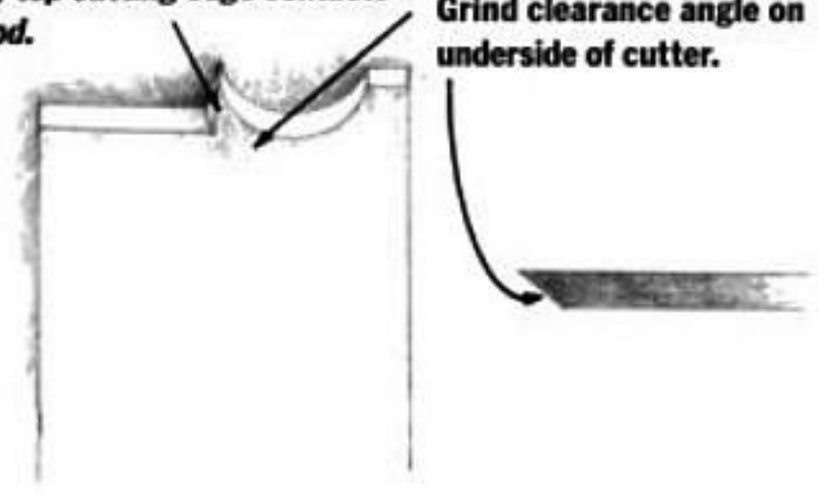


After grinding the cutter profile, undercut the back of the edge to form a clearance angle. Remove as little metal as necessary so only the top edge of the tool contacts the wood.

STEP 4

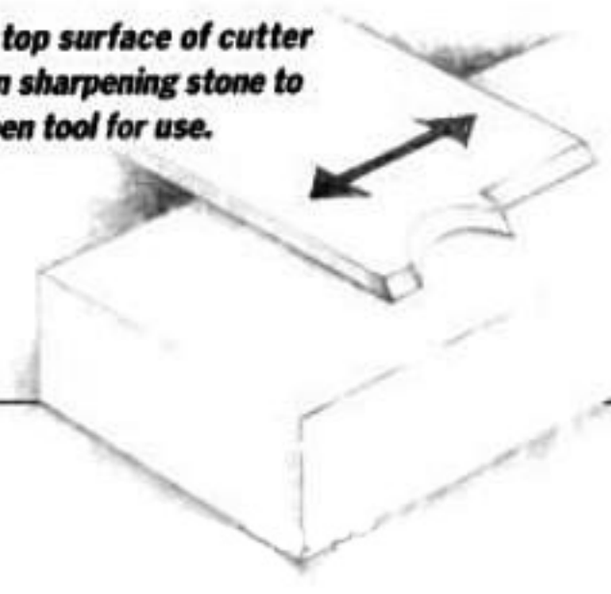
Relieve underside of cutting edge and sides of points so only top cutting edge contacts wood.

Grind clearance angle on underside of cutter.



STEP 5

Hone top surface of cutter flat on sharpening stone to sharpen tool for use.



Making the Cutters

The first thing you do is make the cutters. You'll need to get your hands on some pre-hardened high-speed steel bar stock. (Check a local industrial-supply house). I make my cutters from 12-in. lengths of $^5/_{16}$-in. thick, M3 high-speed tool steel wide enough to cut the section I want to shape. For example, the head of the king in my chess set was shaped with one cutter. (See Fig. 1.) I decided on the height of the king's head first, and then chose a piece of bar stock wide enough to make the cutter. Cutters can be as narrow as you like but should be no wider than the section you are cutting—1½ in. is a width I use a lot.

You could make cutters from carbon tool steel as an alternative to high-speed steel, but it doesn't hold an edge as well. (If you have some mystery steel lying around the shop, you can tell what it is by grinding it. If the sparks are yellow with tails like comets and they fly straight out from the wheel, you have carbon steel. On the other hand, if the sparks are red fireballs that hug the wheel, you have high-speed tool steel.)

To design your cutters, start by drawing your chess pieces out full size on a piece of paper. Then divide each piece up into smaller sections that you can cut with a single cutter. It's a good idea to have the cutter cover a full section, for example, the whole head of a piece. (See Fig. 1.) If you have to make two cutters for the top of a piece, for instance, you may find it difficult to keep the shapes uniform from one piece to the next. Remember, you don't need to make a cutter for the middle section; you'll shape it with a gouge. Once you've designed your pieces, draw the section profiles on the ends of your bar stock. (See Fig. 2.)

Shaping the wheels—Before you can grind the cutters, you need to shape the edges of a few grinding wheels with a wheel dresser. There are three types of wheel dressers—stone, star and diamond. Any of these dressers will work to shape the wheels (available from Garrett Wade and from Gesswein, P.O. Box 3998, 255 Hancock Ave., Bridgeport, CT 06605).

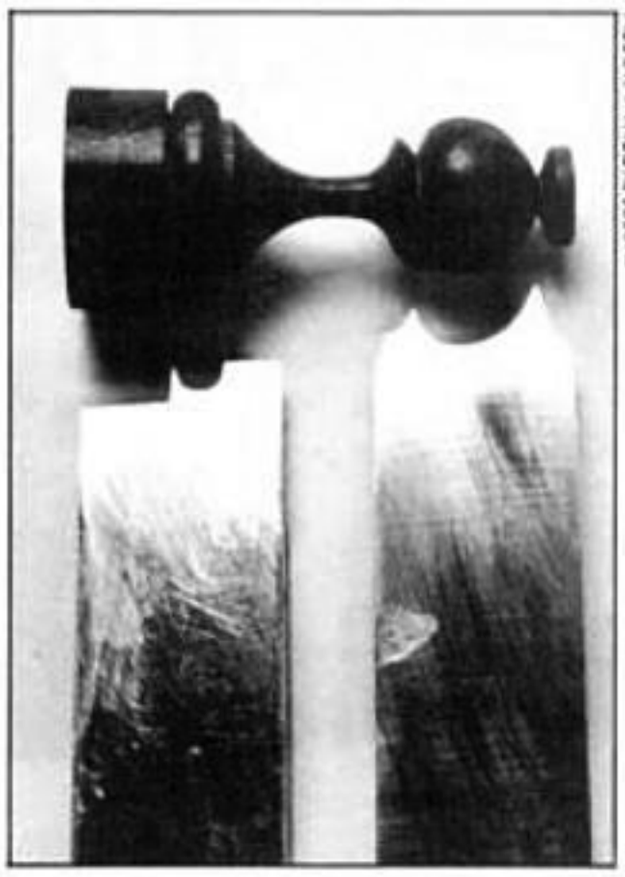
There are essentially three shapes you can achieve on your grinding wheels: curved, flat and pointed. (See Fig. 2.) Use thinner wheels for grinding smaller diameter beads, flats and vees, and thicker wheels for larger diameter beads, flats and vees. If you plan to use the corner of a flat grinding wheel, you'll also need to dress the side of the wheel with a dresser.

I find it's a good idea to have the same shape wheel in at least two grits—coarse and fine. I rough shape the cutters with a coarse 60-grit wheel and do the final shaping with a fine 80-grit or 100-grit wheel. If you don't want to buy that many wheels, you could just get a few coarse-grit wheels, shape them, and after you've rough shaped the cutter, dress the wheel tool once more to bring up fresh abrasive before you do the final shaping of the cutter.

Dressing grinding wheels is a messy procedure that raises lots of abrasive dust. Wear a face shield and a dust mask, and stand to one side of the wheel as you work. If you can, position the hose of a shop vac near the grinder to suck up some of the dust, or you'll be picking it out of your hair for days.

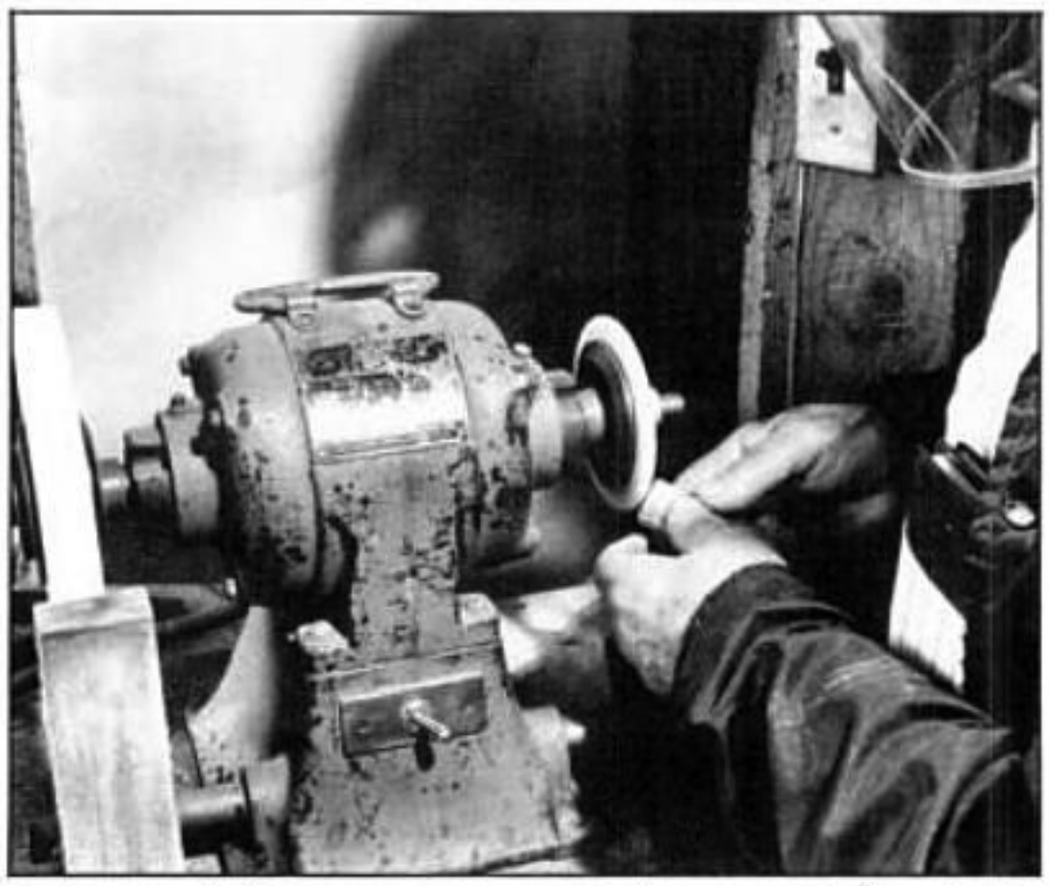
Grinding the cutters—Grinding the cutters is a two-step procedure: first you shape the profile, then you relieve the underside of the edge. Fig. 2 illustrates the process of grinding the cutters.

First, shape the overall profile of the cutter. (Re-



PHOTOS BY FIONA A. WILSON

Each chess piece is shaped with two different cutters—one for the base and one for the top. The midsection is shaped with a gouge.



Before you grind the cutters, you need to shape your grinding wheels with a wheel dresser. Here, a stone dresser shapes the wheel to a point.

When you grind the cutter profiles, start with the rounded areas, and finish with the flats. Angle the cutter downward in back to give the cutter the proper clearance angle.

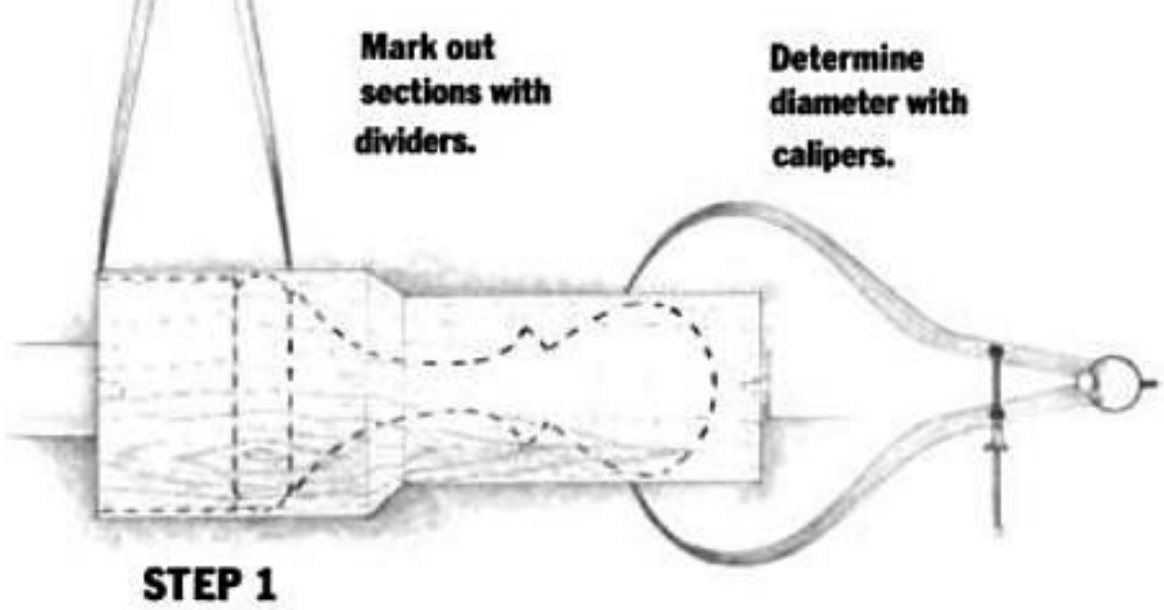
member to cool the steel by dipping it in water from time to time.) Depending on the complexity of the shape, you may have to use several differently shaped grinding wheels.

Once you have the shape of the cutting edge, relieve the underside of the cutter. This underside must be relieved just enough to allow for clearance, so the tool gives you a clean, scraping cut and doesn't burn your wood. (See photos.) The rule of thumb when grinding this clearance angle is to remove as little material as you can, while making sure that only the top edge of the cutter will contact the wood. You may need to try the cutter on the lathe a few times to see if you've relieved enough for clearance.

When you've ground the shape and clearance angle you want, switch to a finer grinding stone to clean up

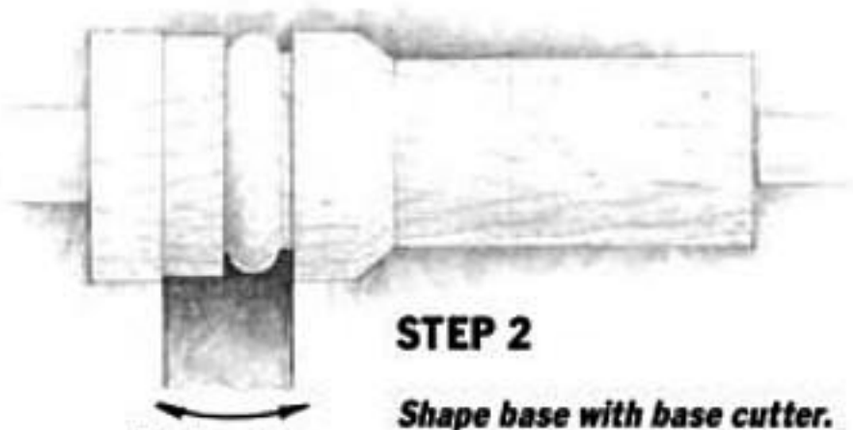
Shape the top and bottom of each piece with its respective cutter, then shape the midsection with a gouge.

FIG. 3: TURNING THE CHESS PIECES



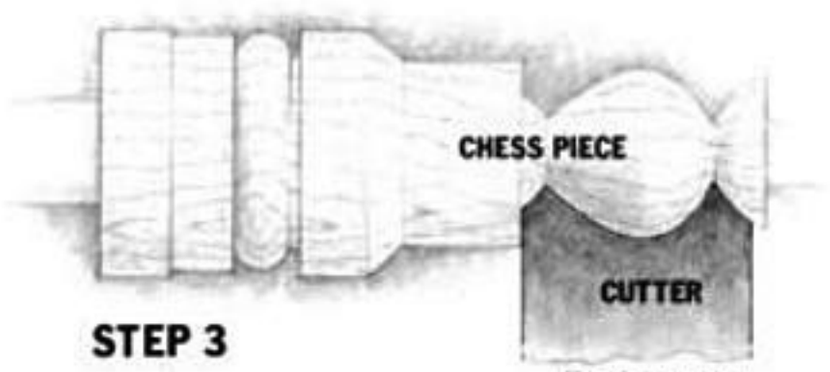
STEP 1

Mount blank on lathe, and rough shape piece to size with a gouge.



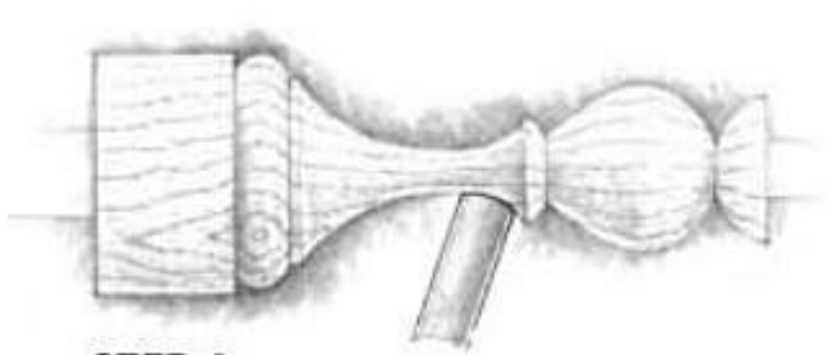
STEP 2

Shape base with base cutter.



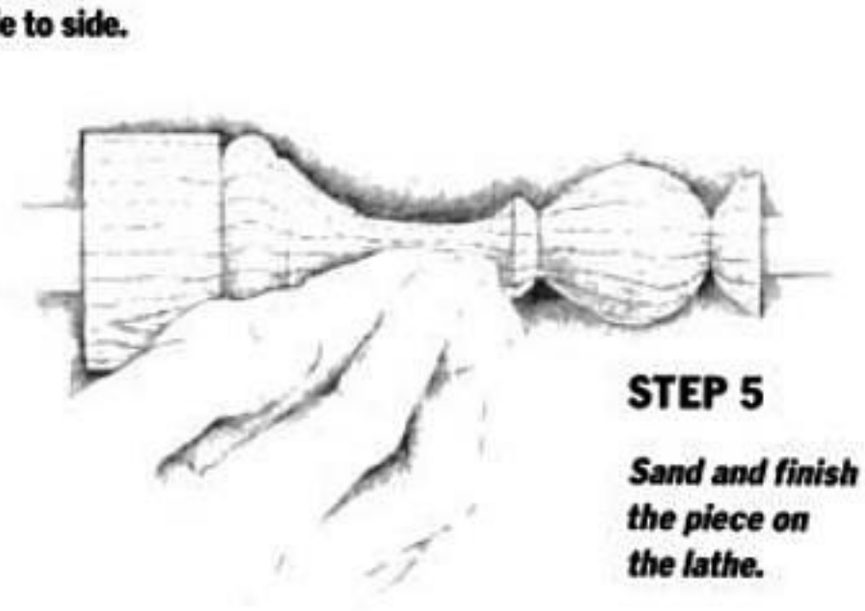
STEP 3

Shape top of chess piece with cutter.



STEP 4

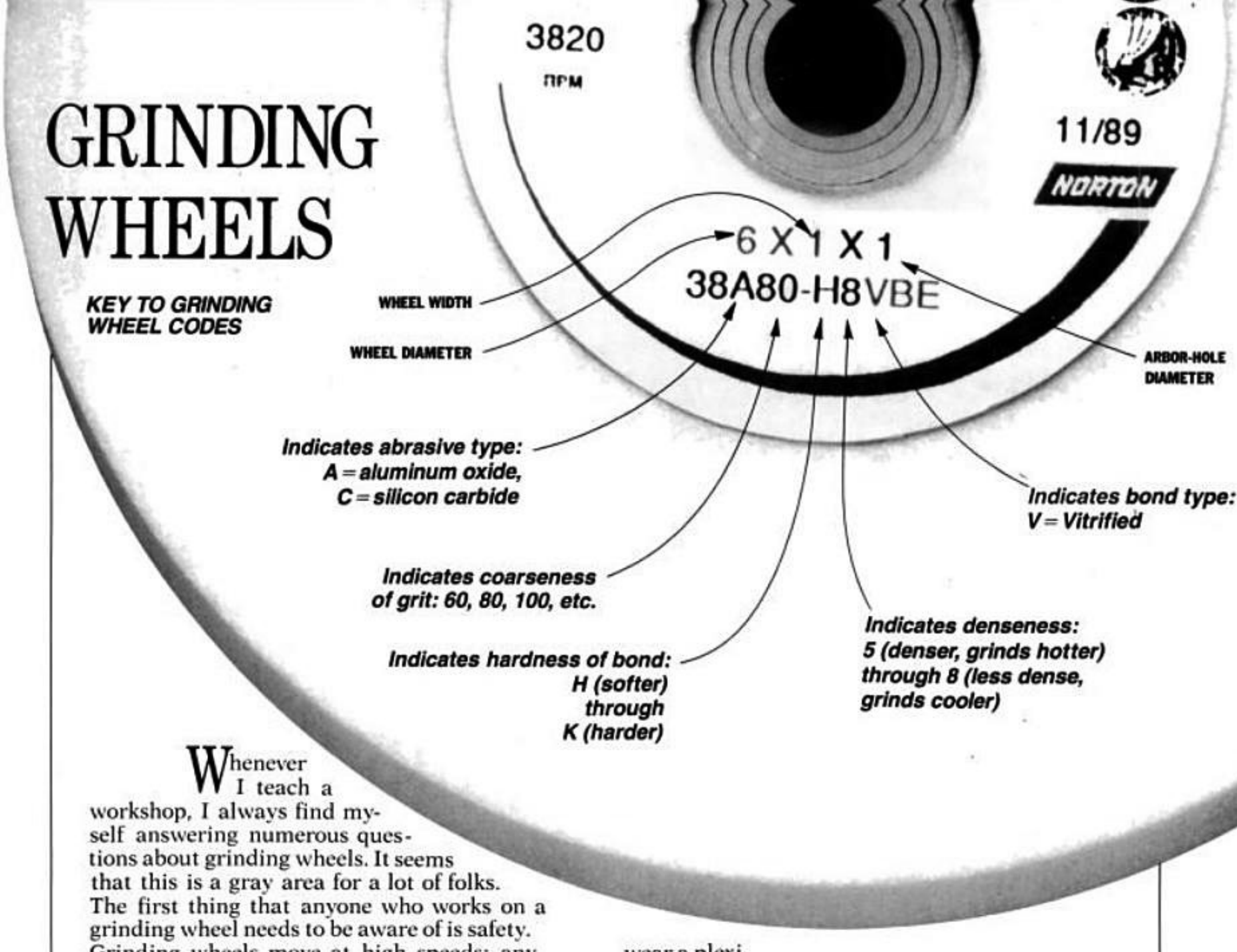
Shape central portion of chess piece with gouge, and clean up flats.



STEP 5

Sand and finish the piece on the lathe.

GRINDING WHEELS



Whenever I teach a workshop, I always find myself answering numerous questions about grinding wheels. It seems that this is a gray area for a lot of folks. The first thing that anyone who works on a grinding wheel needs to be aware of is safety. Grinding wheels move at high speeds; any accident that happens will happen with blinding speed, so it's best to keep a few safety tips in mind.

First off, don't operate a grinding wheel at a speed higher than its maximum rating. To be on the safe side, I operate grinding wheels at half their rated speed or less. This gives me a large safety margin. For example, if your grinder runs at 3450 rpm, make sure the grinding wheels you buy have a maximum rpm rating of at least twice that speed—6900 rpm. If you run a wheel faster than the maximum speed printed on the label, the centrifugal force could shatter the wheel—I've seen it happen. Luckily the fellow it happened to was standing to one side of the grinder. Which, by the way, is rule number two: *Always* stand to the inside of the wheel when turning it on in case it flies apart. Also, always wear a plexiglass face shield when working on the grinder.

Aluminum-oxide wheels are preferred for grinding tool steel, including formed cutters. The pink or white wheels run cooler and stay sharper longer than the gray wheels. Grinding wheels come in both hard and soft varieties (indicated by a letter code on the wheel's label). The rule is, if you're grinding hard metals use a soft wheel. If you're grinding soft metals use a hard wheel. For high-speed steel use a soft wheel.

I get my wheels from industrial-supply houses, because I find they're of better quality than those you can buy at a hardware stores. (Aluminum-oxide wheels are available by mail from Garrett Wade and Lee Valley Tools.) When you buy grinding wheels, be sure to know the shaft diameter on your grinder, then get inserts, if necessary, for the proper fit.—*R.O.*

the edge. Finally, hone the top side of the cutter on a sharpening stone until it's smooth and burr-free. Then you shouldn't need to do anything to your cutter except sharpen it from time to time, by simply honing the top side flat on a stone.

Turning the Pieces

Once you've shaped the cutters, you're ready to turn. Cut your stock to size, and mount the work between centers. I use a spur center in the head-stock spindle and a small rotating-cup center in the tail stock. Turn a cylinder, and with dividers, mark out the length of your sections. Turn as close as you can to the finished diameter so you don't have to remove much wood with the formed cutters.

Working with formed cutters is fairly straightforward. You use the cutter as you would a scraper. With the tool rest below center, hold the edge of the cutter a little below center, with the back end of the tool angled downward. (See Fig. 3.) Cut just below the center line, and make the cut with a gentle side-to-side rocking motion.

CONTINUED

Often, the first time you use a cutter, it leaves scorch marks on the wood, or it cuts a different shape than you'd expected. You may need to simply relieve the bottom of the cutter a bit more, or you may need to modify the shape of the cutter. Plan for some trial-and-error fiddling before you get what you want.

Shape the top and bottom of the chess piece with the respective formed cutters, then turn down the center of the piece with a gouge. See the sidebar on eccentric turning for specifics on turning the off-center midsection of the knight.

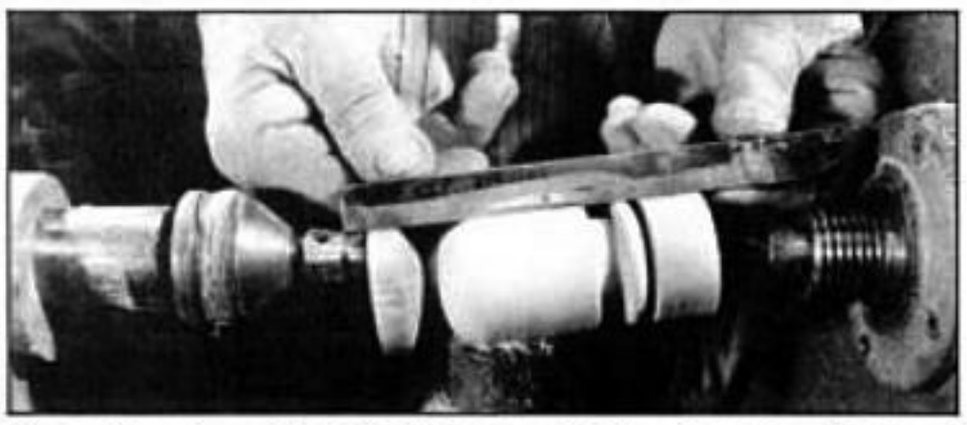
A word about lathe speeds. If you're working with a small-diameter piece (1/2-in. to 3-in. dia.) use a higher speed (2200 to 2800 rpm). For larger diameters, it's better to use slower speeds (1800 to 2000 rpm).

Once you've finished turning a piece, follow with sandpaper and finish. I use urethane oil (available from Craft Supplies USA, 1287 E. 1120 S., Provo, UT 84601, 801-373-0917) to give my pieces a nice satin finish and protect them from dirt.

As a final touch, I always relieve the bottom surface of the chess pieces slightly so they don't rock, and then glue leather pads to the bottoms to keep the pieces from sliding around. If you're using a lightweight wood, you could also drill a small hole in the base for a lead plug to give the piece more weight. ▲

Rude Osolnik is a woodturner and teaches all aspects of wood turning in workshops internationally. He lives in the mountains of Berea, Kentucky with his old dog Lady.

ECCENTRIC TURNING: SHAPING THE KNIGHT

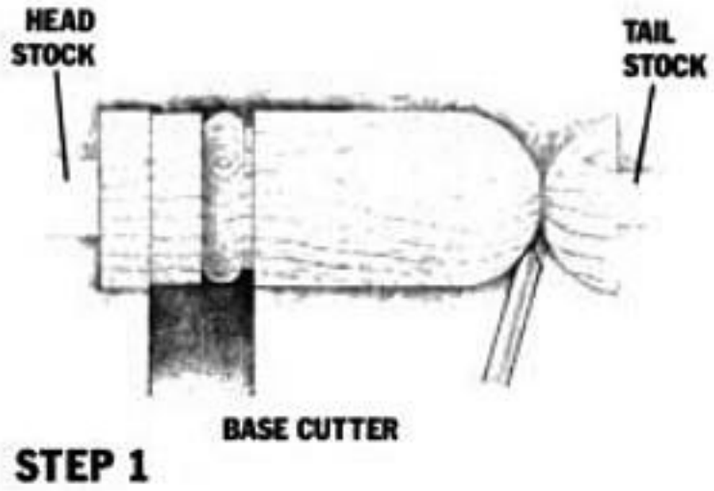


The midsection of the knight is turned off center. Turn the head and base on center, then reposition the tail-stock center so the head of the piece angles downward—the straightedge shows the angle. This makes the piece spin eccentrically as you shape the middle with a gouge.

Eccentric turning is pretty simple. First, you turn a shape between centers. Then you reposition the tail stock center *off center* so the piece spins eccentrically. I used this technique to turn the off-center midsection of the knights in this chess set. It also comes in handy for turning pad feet on cabriole legs.

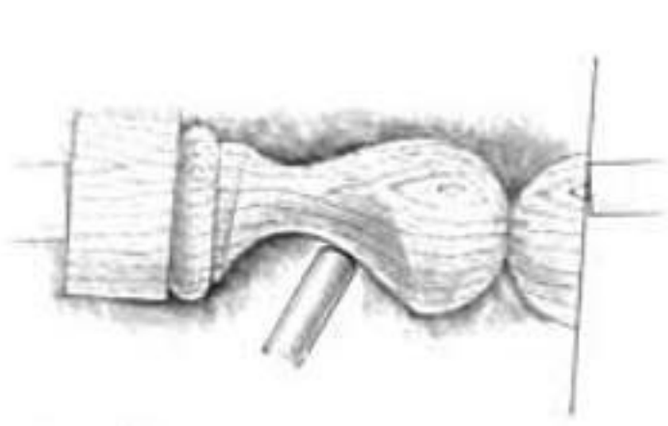
To turn the knight, first mount the piece between centers, as you would any other piece. Turn the base with the formed cutter (see main article), and the top of the knight with a skew.

Reposition the tail center above the original center, about 5/16 in. in from the perimeter of the base. Leave the head-stock center on center. If you hold a straightedge up to the piece, it should touch the tail-stock center at one end and angle upward. (See photo.) It's important to mount the piece off center so that a line drawn between the old and new center points runs perpendicular to the annual rings, as shown. This will result in the annual rings framing the "face" of the knight.—*R.O.*



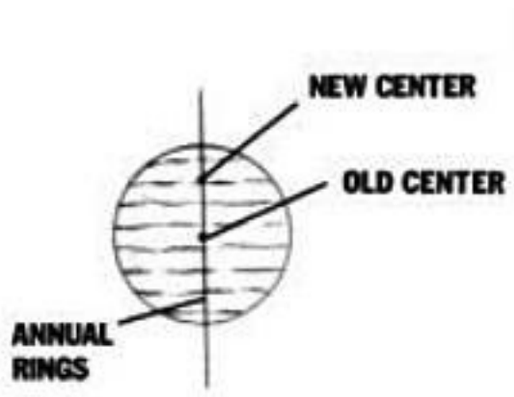
STEP 1

Mount stock in lathe on center, and shape base and helmet.



STEP 2

Reposition knight with the tail stock off center, and turn the central section with a gouge.



For best grain orientation, line drawn between old and new center points should be perpendicular to annual rings.

VENEERING

The Beauty's Skin Deep, But the Benefits Go Right to the Core

BY KARL SHUMAKER

Veeneering opens up a whole new world of figure patterns, like this quartermatch, made of bandsawn veneers.

PHOTOS BY SALLY SHENK ULLMAN

Think of veneering, and two contradictory images come to mind. On one hand, there's bargain-basement furniture—particleboard under a skin of veneer. On the other hand, there's period furniture of the highest quality, skilfully veneered in exotic burls and decorative patterns. Really, the bargain furniture and the high-style work are just two sides of the same coin. Both take advantage of the many different benefits of veneering. The bargain furniture is veneered to cut costs—veneer makes frugal use of wood. High-quality pieces are veneered for a different set of reasons: First, veneering frees the maker from many of the technical problems related to wood movement. Second, veneer is ideal for wood-figure patterning. Sure, you can bookmatch two solid-wood boards, but veneer makes a whole new range of figure patterns possible (not to mention the exquisite arts of marquetry and parquetry; see sidebar on Veneer Patterns).

DRAWINGS BY KARL SHUMAKER

FIG. 1: ANATOMY OF A VENEERED PANEL

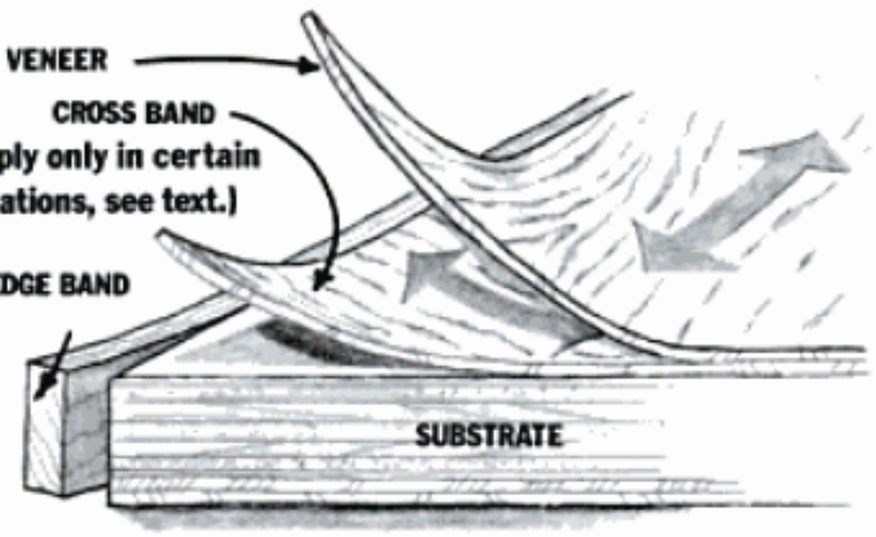
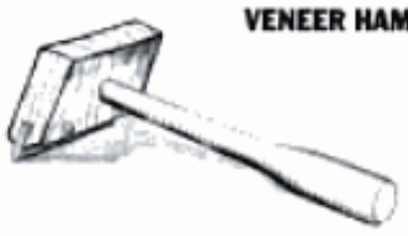


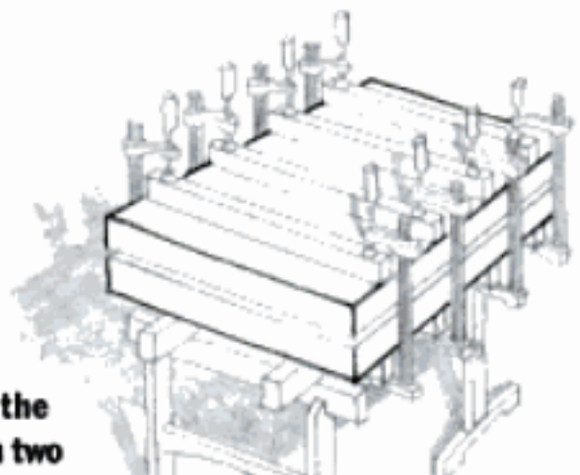
FIG. 2: METHODS OF VENEERING

The veneer hammer is pushed and pulled across the veneer, to stick it firmly to the substrate.



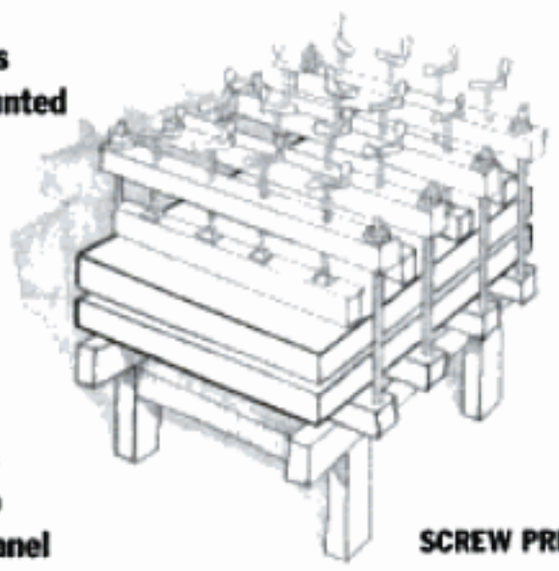
VENEER HAMMER

The caul press clamps the veneered panel between two cauls pressed together by battens and clamps.



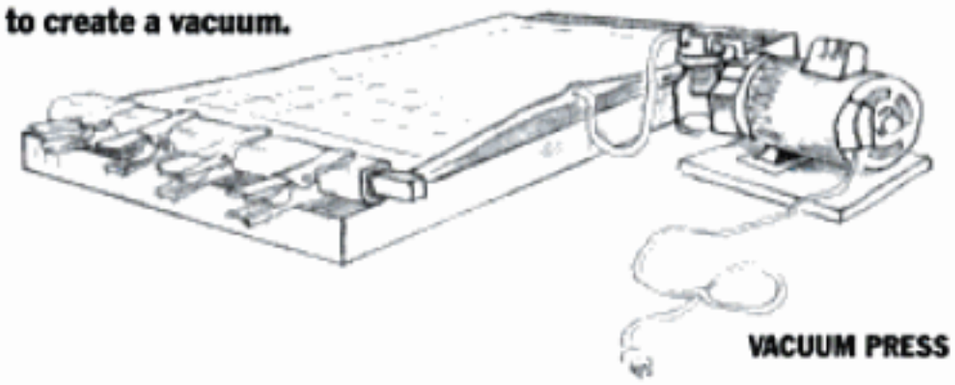
CAUL PRESS

The screw press gets its muscle from screws mounted in a fixed framework.



SCREW PRESS

The vacuum press uses atmospheric pressure to clamp the veneer. The panel goes into a plastic bag, then the air is pumped out to create a vacuum.



VACUUM PRESS

In this article I'll tell you what you need to know to get started with veneering. I'll explain how to veneer a panel using a simple caul press. (See Fig. 2.) In the companion article I'll show you how to make the press.

Veneer Methods

Veneer can be applied to all kinds of furniture parts, but it's most often used on panels. There are lots of ways to veneer a panel. Hammer veneering—a manual technique—is one way. The other methods involve mechanical presses (see Fig. 1).

Hammer Veneering—Hammer veneering, an old technique, involves applying hot hide glue to both the substrate and the veneer, then pressing down the veneer with a veneer hammer before the glue sets. The veneer hammer is not used to strike the veneer, but is pushed and pulled in a squeegie-like fashion to press down the glue-covered veneer. Hammer veneering requires no veneer press, and it's well suited for veneering curved surfaces and small panels. But you have to work fast before the hide glue cools and sets, so hammer veneering isn't very practical for veneering large panels. For these, you're better off with a veneer press.

Press Methods—A veneer press mechanically clamps the veneer flat against the substrate. There are several different types of veneer presses: the caul press, the screw press, and the vacuum press. They all do the job, but they vary widely in price. A caul press is a good choice for the small shop, because it's inexpensive and easy to build.

Materials for Veneering

Before jumping into the nitty-gritty of veneering, let me first say a few words about the materials you'll be needing: substrates, veneers, glue, and veneer supplies.

Substrates—The substrate is the surface to which you glue the veneer. It must be flat, smooth and even in thickness. You'll find several materials that meet these requirements: medium density fiberboard (MDF), hardwood plywood, and lumber core plywood.

Each type of substrate has its advantages. MDF offers an even, smooth surface, but I don't recommend using it for panels that have to span much distance (a large table top, for example) because MDF has a tendency to sag under its own weight.

Hardwood plywood (A-2 grade or better, also called veneer core) won't sag like MDF, but be sure to select a flat sheet in the lumberyard. Even when plywood is stored properly, a sheet can have a natural cup to it. Check for a good sheet by balancing it on edge and sighting along its length. Also, check the edges of the sheet for voids and knots that have fallen out of the core veneers—indications of lower-quality plywood.

Lumber core is plywood with a core of solid wood strips instead of veneer. It's one of my favorite substrate materials. Although it's expensive, lumber core is more consistently flat than other plywoods.

As a general rule, run your hands over the surface of any substrate material you plan on buying. Your hands will often catch bumps and depressions that your eyes will miss. Beware: these hard-to-see blemishes will telegraph through the veneered surface.

No matter which substrate material you buy, store the sheet on edge in your shop to assure that air gets to both sides for 24 hours or more. The substrate must adjust to the humidity level of your shop.

Veneer—You have two options for supplying your

shop with veneer. You can buy store-bought veneer, or you can bandsaw your own veneer, as I prefer to do.

Store-bought veneer (I'll refer to it as "commercial" veneer) comes in a wide variety of domestic and exotic woods. Figure orientation and the width of the sheets depend on how the veneer was cut from the log (rotary cut, flat cut, quarter cut, etc.).

Rotary cutting produces the widest sheets. The log is rotated against a fixed knife which peels off a continuous sheet of veneer. Flat cutting produces random-width sheets no wider than the log's diameter. The log is pushed lengthwise across a fixed knife, which slices a sheet with each pass. The sheets are usually bundled and shipped in consecutive order for matching figure and color (the term for this is sequenced).

Commercial veneer comes in thicknesses from 1/64 in. to 1/16 in. and is sold and priced by the square foot (available from Certainly Wood, 11753 Big Tree Rd., Rt. 20A, East Aurora, NY 14052, 716-655-0206 and other suppliers). Before you buy, have a good idea of the size of the panel you'll want to cover. (Remember to get enough veneer to cover *both* sides of the panel.) Keep in mind that there is a waste factor of 20% to 50% with commercial veneers because you sometimes have to work around "defects" in the wood. Your best bet is to buy more veneer than you need. You can always put the extra veneer to use in smaller projects.

Bandsawing your own veneer is more work, but it allows you to take advantage of that odd but lovely board that is too small to amount to much on its own. By sawing it into veneers you can stretch its beauty out across a panel.

The technique for bandsawing veneer is not much different from conventional resawing (see Sept./Oct., 1988 *AW*) except you'll need to use a 1/2-in. blade and a fence as long as the bandsaw table and nearly as high as the board you're veneering. (See photo.) Stick with sawing smaller widths—a smaller depth-of-cut gives a better quality cut. Though my bandsaw can cut up to 10 in., I rarely saw veneer wider than 4 in. I then join these smaller widths together to make a wider veneer.

With a sharp new blade and a little time spent tuning up your saw, you can cut veneers that are smooth enough to glue to the substrate without having to surface them. A rougher cut will require surfacing before glue-up. Remember, the more wood you lose between cuts, the poorer the pattern match between consecutive pieces of veneer. I saw my veneers 3/32 in. thick and use them right off the saw.

Glues—You can buy self-sticking veneers (*not* the subject of this article), but most veneer work requires glue. Though some people use contact cement to glue the veneer to the substrate, I don't recommend it. Contact cement remains elastic when cured, and the solvents in some finishes can soften or dissolve it, causing the veneer to buckle, creep or even release. In addition, contact cement bonds on contact, making repositioning of the veneer impossible.

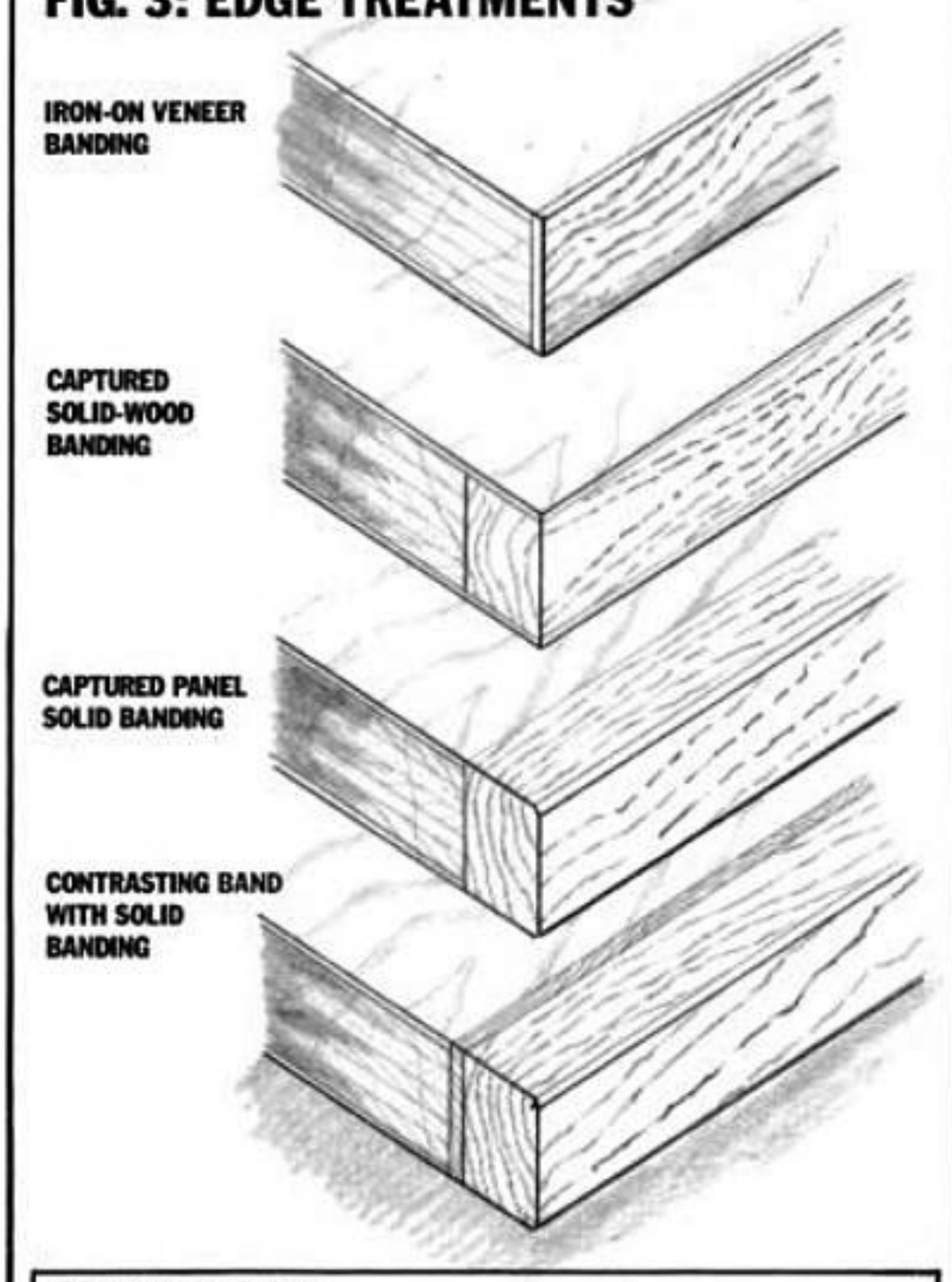
Both white and yellow glue work fine for veneering. I use yellow glue, but white glue has a little slower set time if you need the leeway. For large panels, I recommend plastic resin glue (urea formaldehyde), because it has the longest set time. Epoxy glue, though a mess to deal with, has a distinct advantage over the other glues in that it doesn't introduce water into the wood during glue-up, which means fewer problems with warping.

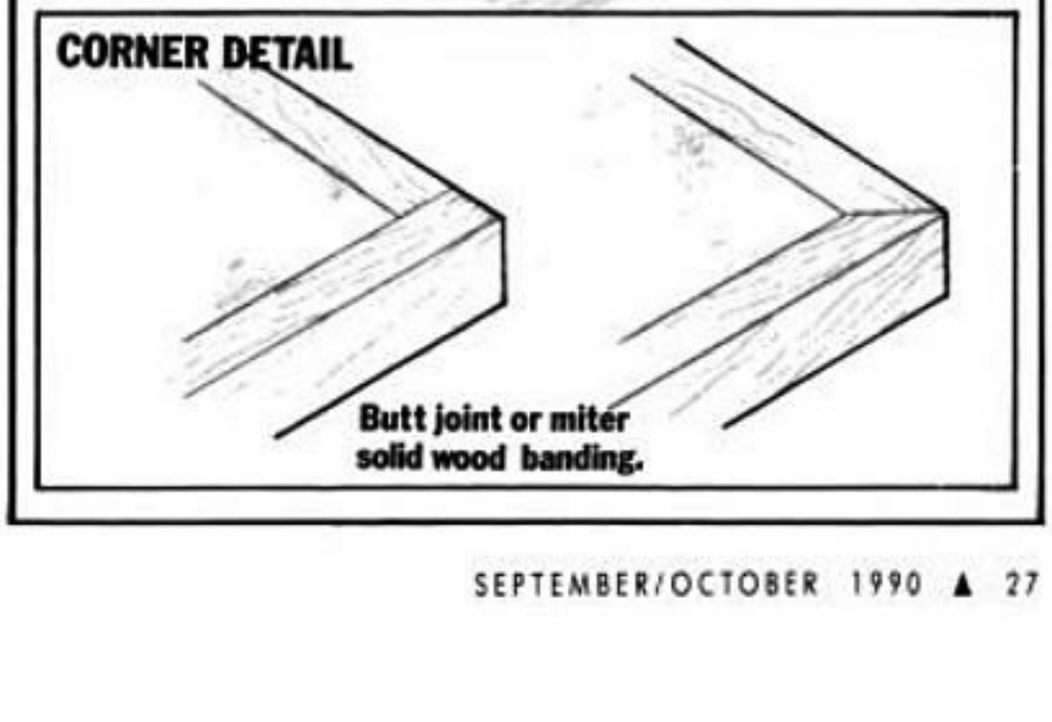
CONTINUED

PHOTOS BY KARL SHUMAKER

Resawing veneer on a bandsaw is a simple task. You'll get the best results if you use a sharp blade and a fence the same height as your stock and about as long as your saw's table. Always use a push pad for a safe, smooth cut.

FIG. 3: EDGE TREATMENTS





Veneer Supplies—To work with veneer, you'll need a few special tools and supplies (available from Constantine's, 2050 Eastchester Rd., Bronx, NY 10461, 800-223-8087). If you're using commercial veneers, to cut them you'll need either a sharp X-acto knife or a veneer saw (a small, fine-toothed, hand saw). Both of these methods work best if you guide the cut against a straightedge ruler. Occasionally you'll need to edge-glue two sheets of veneer. For this you'll need veneer tape and veneer pins (a type of push pin, only necessary if you're working with commercial veneers). Finally, for gluing the veneer to the substrate, you'll need a glue roller. (I find a disposable, 3-in., short-nap paint roller works well.)

Points to Consider

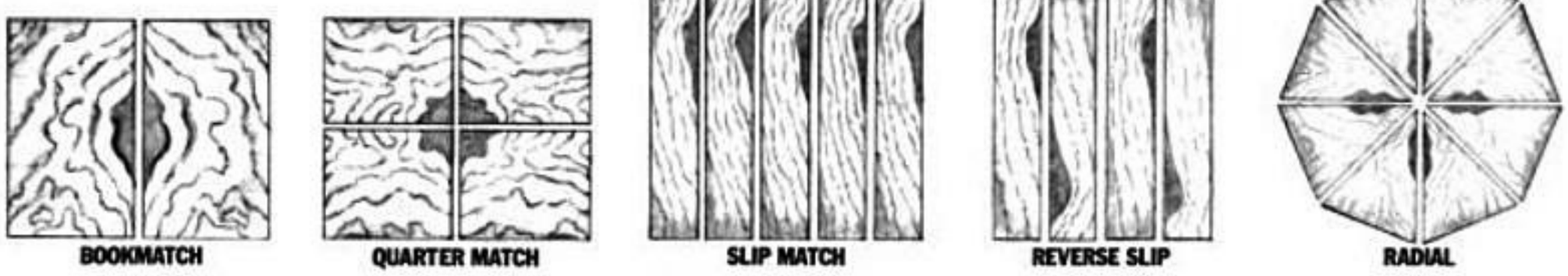
The first rule of veneering is: If you veneer one side of a panel, you must also veneer the other side with a veneer of similar thickness and density. This insures that stresses from glue moisture and humidity changes are the same on both sides of the panel, so the panel has less tendency to warp.

With thin commerical veneers you sometimes need to glue an extra layer of veneer to the substrate before applying the face veneer. This underlayment, referred to as crossbanding, is usually an inexpensive, even-textured, even-grained veneer such as mahogany or poplar. The crossbanding keeps any substrate surface defects or edgebanding lines from telegraphing through the face veneer and also prevents the substrate from showing through cracks or holes in fancy burl or crotch veneers. Choose a crossbanding veneer of a similar color to your face veneer to avoid a contrasting color showing through. Keep in mind, crossbands require a second step in the press.

One other point about commercial veneers. Because of the way they are cut, they have a smooth side and a rough side. Sometimes you can tell by touch, but it can be a bit tricky to figure out. Bending is another test; the veneer bends a little easier with the rough side out. The point is, you want to glue the rough side down to the substrate, since the smooth side will be easier to surface and it will take finish better.

If you're veneering on plywood or lumber core, it's important to run the grain of the veneer perpendicular to the grain direction of the substrate's surface veneer. This applies to crossbanding, too. Face veneer applied *over* crossbanding should have the grain running perpendicular to the grain of the crossbanding. Don't get too carried away with running grain direc-

VENEER PATTERNS



Veneering opens up a whole world of patterns that aren't possible in solid wood. To make these patterns, you need sequenced veneers (consecutive cuts from a plank). As the drawings show, there are many kinds of patterns. Simply laying open consecutive veneers like the pages of a book gives you the renowned "bookmatch" or "butterfly" pattern. In wilder, crazier grained pieces of wood, the bookmatch has a harmonizing and calming effect to the eye, because for every wild swirl of grain on one side of the pattern there is an equally wild swirl on the other side to balance it. To see this effect, hold one edge of a mirror on some wild-figured wood or veneer. (See photo.) Look at the board and the reflected image together, and you'll see the bookmatch. Move the mirror around and see what happens to the pattern.

Veneer patterns get even fancier, as shown in the drawing. Two mirrors (or a hinged mirror), placed on the wood at 90° to each other, can be used to preview the effect of a quarter match. Reduce the angle between the mirrors and you can preview the effect of a radial match.

Slip matching consists of consecutive, vertically figured veneers laid out in sequence side by side instead of opened up like the pages of a book. This pattern is very rhythmical, and very pleasing in the right wood on a piece of furniture whose lines call for linearity—say a tall cabinet or a long, dramatic table.

Sometimes you plan on doing a slip match, but because of a whip in the grain at one end the pattern looks out of balance. This is a nice time to try a reverse slip match. Lay the veneers out in a slip match, then flip every other veneer end for end. The result will usually have a balancing effect on the overall pattern.—*K.S.*

You can preview patterns by holding a mirror up to a wildly figured board. The bookmatch (left) requires only one mirror, while previewing a quarter-match (right) or radial match requires two mirrors.

tion perpendicularly. Sometimes, as with radial patterns (see sidebar) you'll have to break this rule.

Veneering a Panel

The first step to veneering a panel is to cut the substrate to approximate size. To do this, it helps to have a clear idea of how you plan on treating the panel's edges. If the panel will be recessed in a frame, you won't need to cover the edges. If the edges of the panel will be exposed, you'll need to cover them. This covering is called edgebanding. I'll go into detail about edgebanding options later, but don't cut into the substrate until you've determined how you'll treat the edges.

As a general rule, cut your veneer substrate 1/4-in. oversize from your final dimensions. You'll trim the panel to size after you've glued on the veneers. An exception to this rule arises when you use a captured, solid-wood edge banding (see Fig. 3). This type of edgebanding has to be applied *before* you veneer the panel; in such a case, include the thickness of the edgebanding in your 1/4-in. oversize allowance.

After rough sizing your panel, prepare the veneer. Start by laying out the veneers, and have some fun shuffling them around looking for a pattern you like (see sidebar). When you've found the right pattern, number the sheets so you can keep them in the correct order while you edge glue them. Cut the veneers slightly longer than the substrate to make the glue-up easier.

Before you can join them, you must joint the edges of the veneer straight and smooth. If you have a shooting board (see March/April, 1989 *AW)* you can joint the edges with a sharp plane. If not, you can carefully joint bandsawn veneer on the jointer. Commercial veneer is too thin to joint one sheet at a time, so clamp several sheets between two boards and run the whole assembly over the jointer.

To join bandsawn veneers, I set the veneers face-side down on newspaper and apply yellow glue to the edges. Then I push the two edges together, weighting the veneers down to hold them tight while I secure the bond with short pieces of masking tape pulled tightly across the seam every four inches or so (masking tape with some elasticity works best). When the seam is dry, remove the tape and you're ready to glue the veneer to the substrate.

To edge glue commercial veneers, place the sheets face up on a piece of scrap plywood. Using veneer pins, pin the veneers to the plywood along both sides of the seam, space the pins 1 in. away from the seam and every 6 in. along its length. The pins help to keep the seam tight while you tape it up. With commercial veneers it's best to use veneer tape instead of masking tape, because it's easier to remove without damaging the veneer. Tape the seam together by running one long continous strip of tape over the seam. Let the tape dry, then gently flip the veneers over and run a bead of glue along the seam. Let the seam dry before you glue the veneer to the substrate. Leave the tape on until after you've glued the veneers to the substrate. Once you've edge glued the veneers for one side of the panel, edge glue the veneers for the other side. Having prepared your veneers, you're now ready for the glue-up.

Organization is the key to a successful glue-up. Get the press ready so you can easily clamp the battens down when you place the panel between the cauls (a dry run is a wise idea). Cover your bench with paper to catch glue dribbles. Set out a glue roller, masking tape, glue and newspaper. Then stack the veneers and substrate in their proper order. At this point I always check and double check to ensure the veneer surfaces are oriented as I intended.

Poised and ready for action, charge the roller with glue, and do a test roll on scrap paper to check the glue track—it should leave a light but even sheen. The key word here is "even." Open the three layers (veneer, substrate, veneer) as though you were opening the pages of a book. Apply glue to each layer, sticking them together as you go, until you end up with the entire panel glued.

With commercial veneers, apply the glue to the substrate only, not to the veneer (the moisture from the glue will make thin veneers curl). For bandsawn veneers, apply the glue to both the substrate and the underside of the veneer.

Before you place the newly glued panel into the press, wrap short pieces of masking tape around the four corners of the panel to prevent the veneers from slipping in the press. Be sparing with the tape, because masking tape is hard to remove after it has been pressed. Two strips of tape on each corner are enough.

Then, pop your panel in the press with a sheet of newspaper underneath the panel to catch glue drips, and place the upper caul and battens on. Start clamping from the center batten out to the edge battens, to prevent glue pockets and bubbles from being trapped in the center. Once all the clamps are on, test each one to make sure they're equally tight.

Leave the panel in the press for 14 hours. Remove the panel from the press, and if you've used commercial veneers, remove the veneer tape by moistening it and scraping it off. If you're applying crossbanding, you need to allow it to cure after it is pressed before you apply and press the face veneer. Let the panel "cure" for about 24 hours by standing it on edge in a place where air can circulate around both sides evenly. This lets all the moisture from the glue evaporate and minimizes the chance of warping.

Surface your panel to prepare it for finishing. With commercial veneers your surfacing should be minimal—limited to light scraping or sanding. With bandsawn veneers, you have a bit more surface to work with, so planing is fine. Then trim the panel to its final size by passing one edge over the jointer to get a square edge then truing up the other three edges with a sharp blade on your tablesaw.

Edgebanding Options

Edgebanding is a fairly straightforward process. Fig. 3 shows several edge-treatment options. One tip though, when you trim up the edges of your panel on the jointer and tablesaw, you'll notice (if you pass your hand over the edges) that the fibers of the plywood have fuzzed out. I find that I get a tighter seam between the panel and the edgeband if I remove this fuzz by hollowing the edges of my substrate just a tad with a curved scraper.

That's it. Now put that beautiful panel to use. ▲

Karl Shumaker is a professional woodworker in Petaluma, California. He does custom design and one-of-a-kind pieces for galleries. He also is an illustrator for AW.

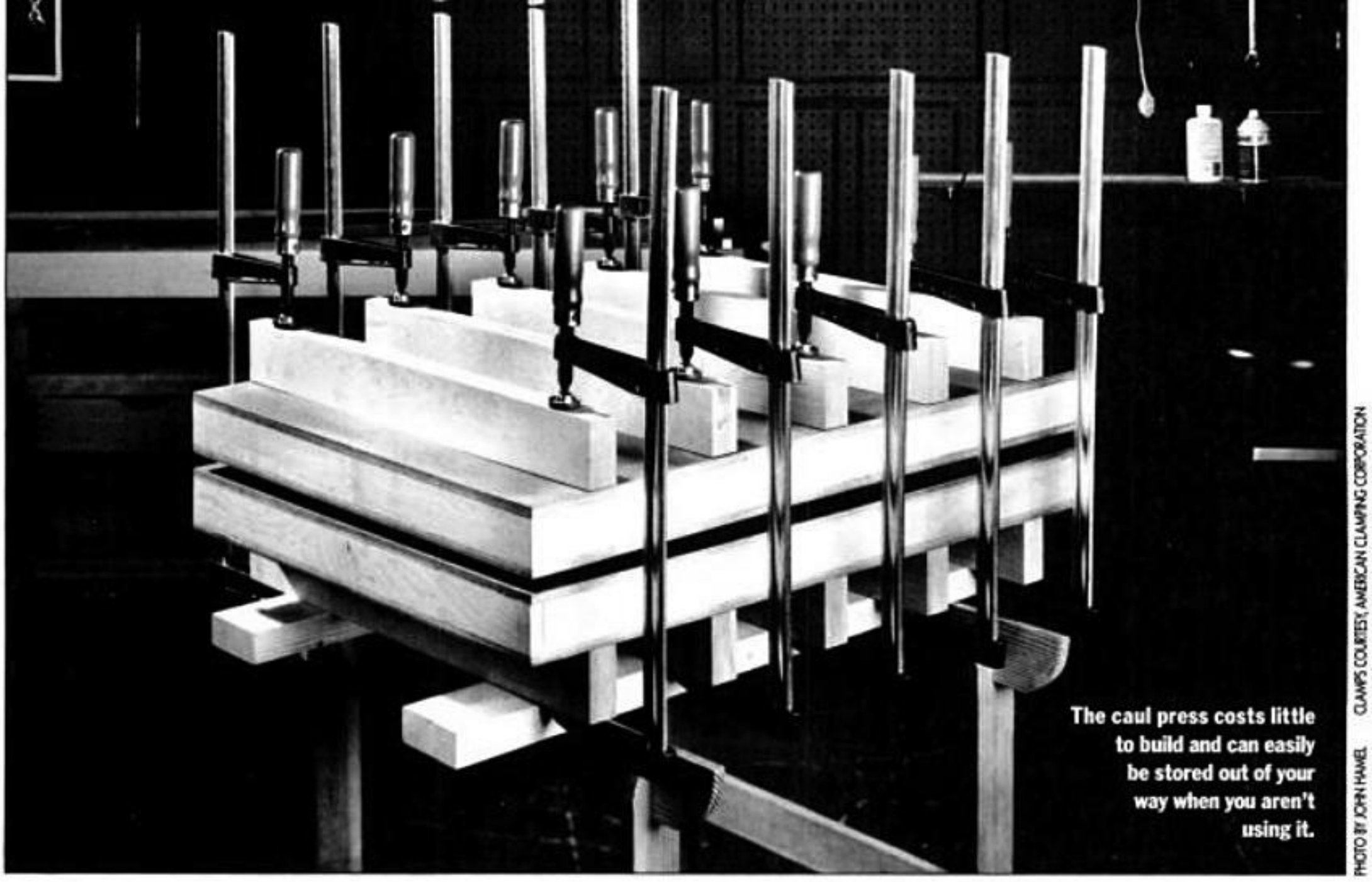


PHOTO BY JOHN HAMEL CLAMPS COURTESY AMERICAN CLAMP CORPORATION

BUILDING A VENEER PRESS

BY KARL SHUMAKER

Professional Results on a Small Shop Budget

Of the three basic types of veneer presses—caul, screw, and vacuum—the caul press is the best suited to my small shop and low-fat budget. As the photo and exploded view show, the caul press consists of two perfectly flat surfaces (cauls), battens and clamps.

In use, the press goes together like a big wooden sandwich—panel goes between cauls, cauls between battens, battens between clamps. The battens transfer the pressure from the clamps across the surfaces of the cauls. If the battens are properly spaced across the cauls the pressure will be evenly distributed to the veneer panel.

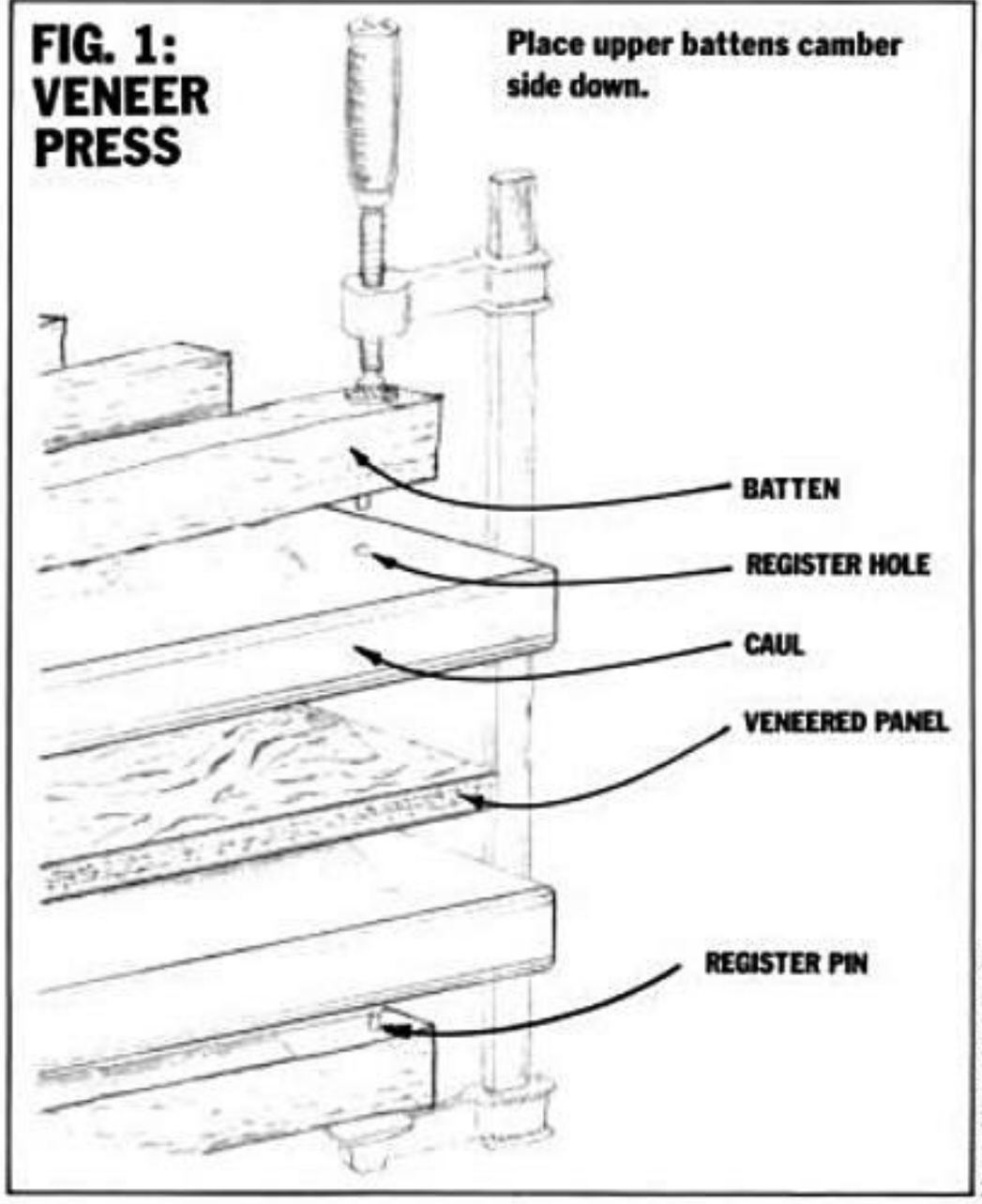
Besides being economical to build, the caul press has two very nice features. First, you can adapt it to any size project you wish to build merely by changing the caul size. And second, it stores away neatly when you're not using it, conserving floor space in the shop.

Start with the two torsion boxes that serve as the cauls. A torsion box is basically a wooden grid frame with plywood and masonite skins over it. A torsion box is tremendously strong and stable and also relatively light in weight.

Building the Cauls

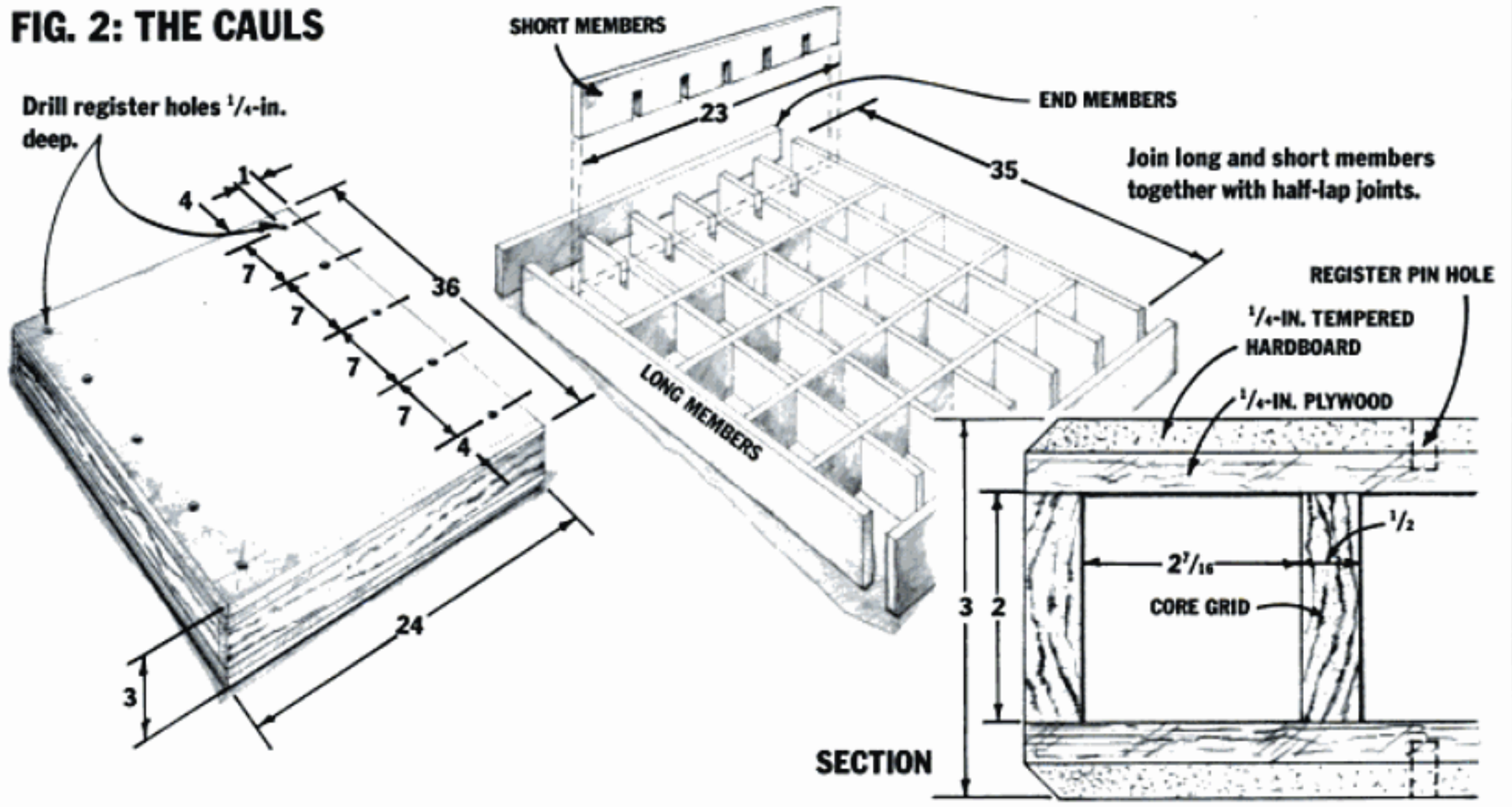
Start with the core grids. (See Fig. 2.) Almost any lighter weight, clear, kiln-dried wood will do for core stock. I used alder, but clear pine or poplar would work as well. Be sure that your stock is flat, uniform in thickness and cut off square; otherwise the torsion box's outer surfaces won't be flat. For best results, dimension the grid stock with a jointer and planer.

FIG. 1: VENEER PRESS



DRAWINGS BY KARL SHUMAKER

FIG. 2: THE CAULS



The core joinery is very simple—half-lap joints connect the long members with the short members. Once you've cut these, glue the grid together.

Next, glue on the torsion box skins—the four pieces of 1/4-in. plywood and the four pieces of 1/4-in. tempered hardboard. To glue the plywood skins to the core, glue one skin at a time by applying glue to the core, pressing it on the skin and clamping it skin-side down on a sturdy, absolutely flat surface. If your work surface isn't flat, your torsion box won't be either. Once you've glued one skin on, repeat the process on the other side.

After this first set of skins has dried, apply a thin coat of yellow glue to the outer hardboard skins and glue them onto the torsion box simultaneously. Gluing them both at the same time will balance the stresses of the glue shrinkage as it dries. You can bet your torsion box would be as flat as a potato chip if you tried gluing them up one at a time.

Making the Battens

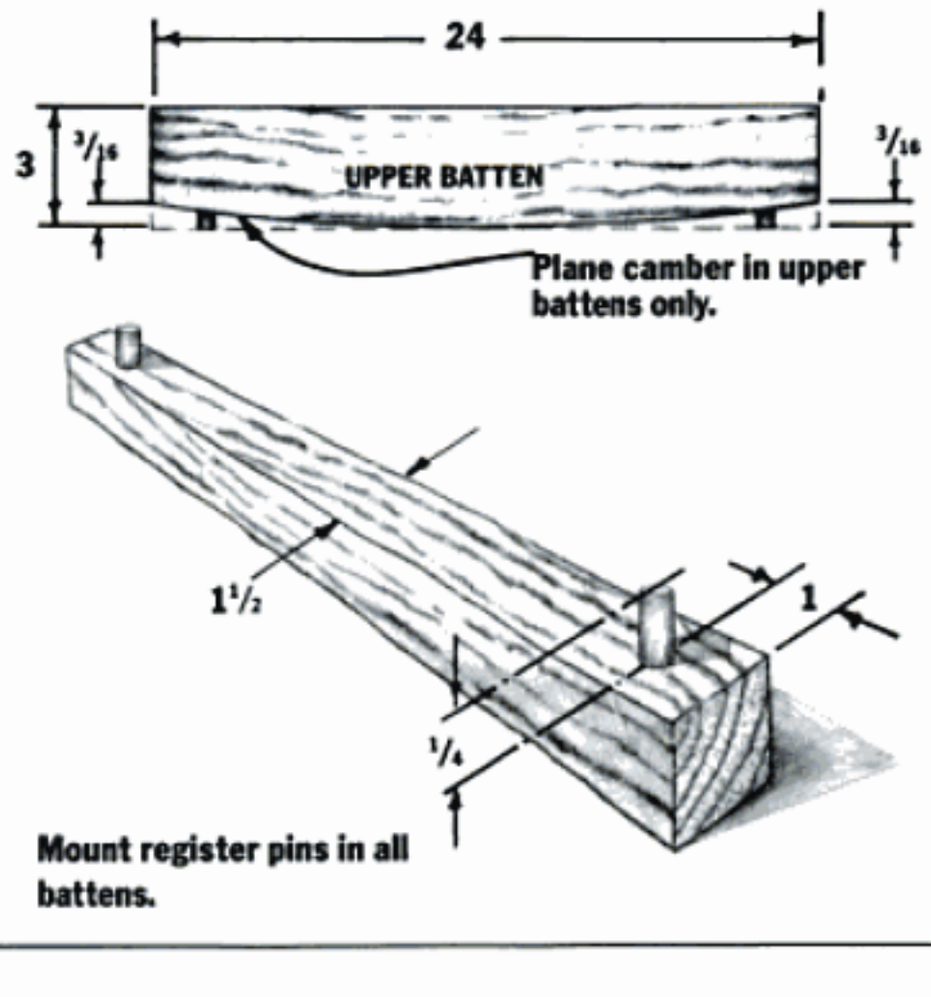
The battens spread pressure from the clamps to the cauls. The battens used on the underside of the cauls are flat, but those on the top of the cauls have a camber (see Fig. 3) to spread the clamping pressure evenly from the center outward. Any dense wood will do. I prefer hard rock maple.

It's important that the clamping pressure is evenly distributed across the entire surface of the veneered panel. I've found, for a 3-in. thick caul, that a batten spacing of seven inches on center is optimal for distributing the pressure evenly. If you change the thickness, the following formula will give you the correct batten spacing:

[BATTEN THICKNESS + (2 × CAUL THICKNESS)] - 1/2 IN. = BATTEN SPACING (O.C.)

Mill ten battens straight and true, then on five of them, plane a 3/16-in. camber from the center to both ends. The camber ensures that the pressure starts in the middle of the panel and spreads to the outside, preventing bubbles or trapped pockets of glue.

FIG. 3: THE BATTENS



Register pins align the battens on the cauls to keep the spacing correct for even pressure and make the clamping process easier. (See drawings.) Don't glue the register pins in the battens, because once you have a nice set of battens in the shop, you'll find many other uses for them beyond the veneer press. The fixed pins will only be in the way. Drill the register holes in the cauls a slightly larger diameter than the pins so there's no danger of the battens binding when they are clamped down.

That's all. Now you're ready to veneer. ▲


LYNCH
809

AEOLIAN WIND HARP

Just Put It in a Window... It's a Breeze to Play

BY RALPH WILKES

You don't have to know anything about music to build and tune an aeolian harp. And you don't have to worry about learning to play it, because the wind will do that for you. Just place the harp in a partially opened window, so the breeze can blow over the strings. The moving air causes the strings to vibrate and produce a variety of strange, but pleasant, musical harmonics that change as the breeze changes.

Named for Aeolus, the Greek god of the winds, this fascinating instrument dates back to the 17th century. Earlier versions of the harp were known in ancient China, India and Europe. This particular harp is patterned after one I saw in a museum. It's simply a long, narrow box with six strings stretched across a bridge piece on each end of the box. The strings are fastened by slotted dowels and tapered tuning pegs, similar to the tuning pegs on a violin. The strings vary in thickness, but they're tuned in unison—all to the same musical pitch.

Making the Harp

First, pick a double-hung window on a side of your house that gets prevailing winds, raise the sash, and measure the width across the opening. Then size your box so its length will be about 1/2-in. shorter than the opening. You can adjust the dimensions of the sound chamber (the long pieces between the bridges) to arrive at the desired overall length.

I made the end blocks from hard rock maple, but you could use any close-grained hardwood. If you can't find a 2-in. thick piece of maple, glue up stock to get the thickness. If you do this, it's best to make the glue joints horizontal, because holes will be drilled in the blocks for the dowels and the tuning pegs. Shape the end blocks to the dimensions shown in Fig. 1. Rabbet the edges of the end blocks with a 1/2-in. straight router bit. Lay out the tuning peg holes and dowel peg holes in the end blocks, as shown. Note that the hole centers for the dowel pegs (nearest the bridge) are drilled so that the strings pass directly through the center of the dowel; and the hole centers of the tuning pegs are drilled with a 5/32-in. offset so the strings contact the pegs at a tangent. Each end block is drilled exactly the same—when they're mounted at opposite ends of the harp, the strings will line up properly with the dowels and pegs.

PHOTO BY JOHN HAMEL PAINTING BY BOB LYNCH

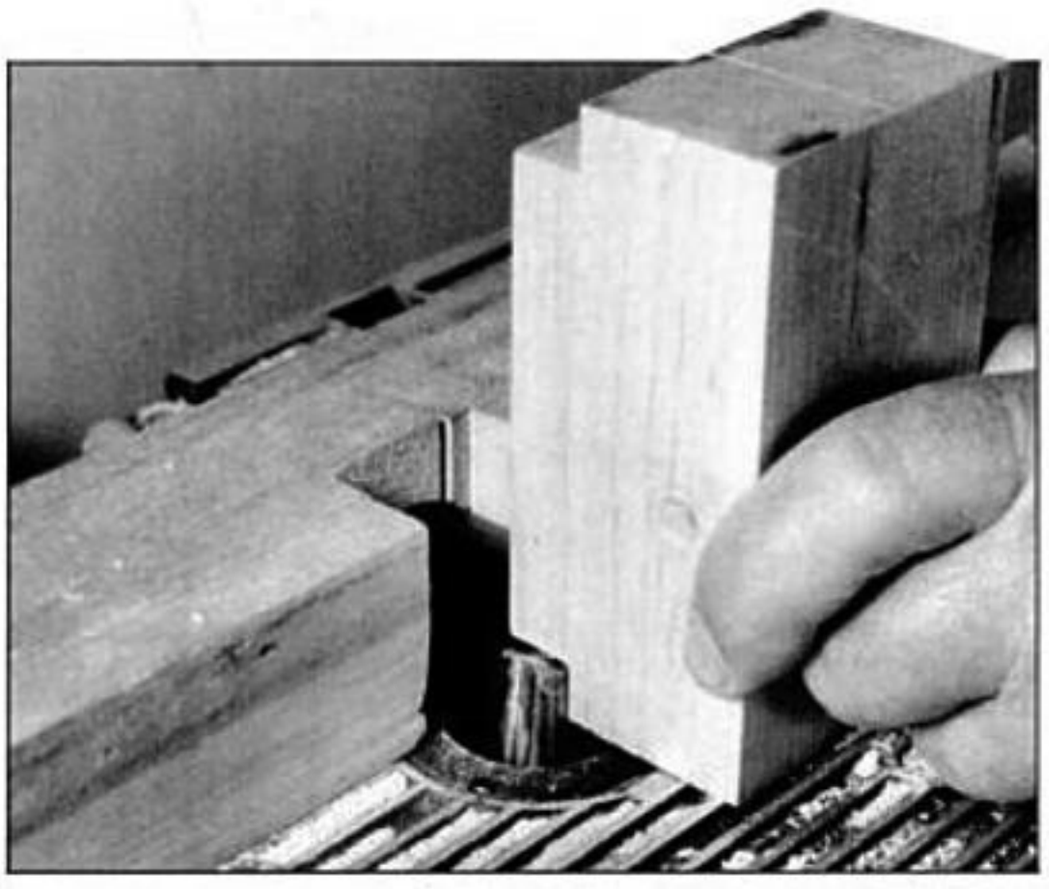
The aeolian harp will make music even if you can't play a note. Just put it in an open window to catch the breeze.

Drill the 1/4-in. holes for the inner row of dowel pegs, as shown in Fig. 1. Make six 1/4-in. × 1 1/4-in. hardwood dowel pegs by cutting the pegs to length, and then cutting a 5/16-in. deep slot in the top end of the peg with a hacksaw blade.

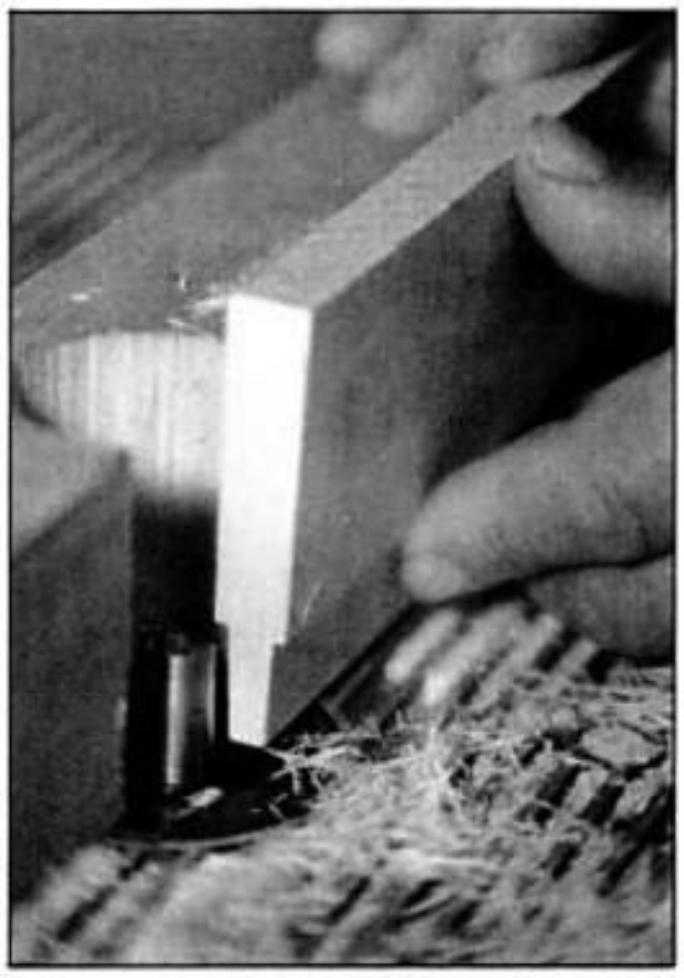
The holes for the tuning pegs are tapered from 5/16-in. dia. at the top to 1/4-in. dia. at the bottom. An easy way to do this is to grind the sides of a 5/16-in. spade bit to match the taper, then use the bit to make the tapered holes. The cutting end of a 5/16-in. spade bit is about 1 1/2 in. long, which is just right for making the tapered holes.

There's an alternative if you'd like to make more precise tapered holes. You can buy a "tuning-peg hole reamer" used to make the holes for violin tuning pegs (available from Stewart McDonald's Guitar Shop Supply, 21 N. Shafer St., Athens, Ohio 45701, 800-848-2273). With this reamer, you can make perfect tapered holes and use store-bought violin tuning pegs (available at most music stores or from Stewart McDonald's). You could also use a repairman's taper reamer (available in good hardware stores) to make the tapered holes, but you'll have to drill a 1/4-in. pilot hole all the way through the end block to use this long tool.

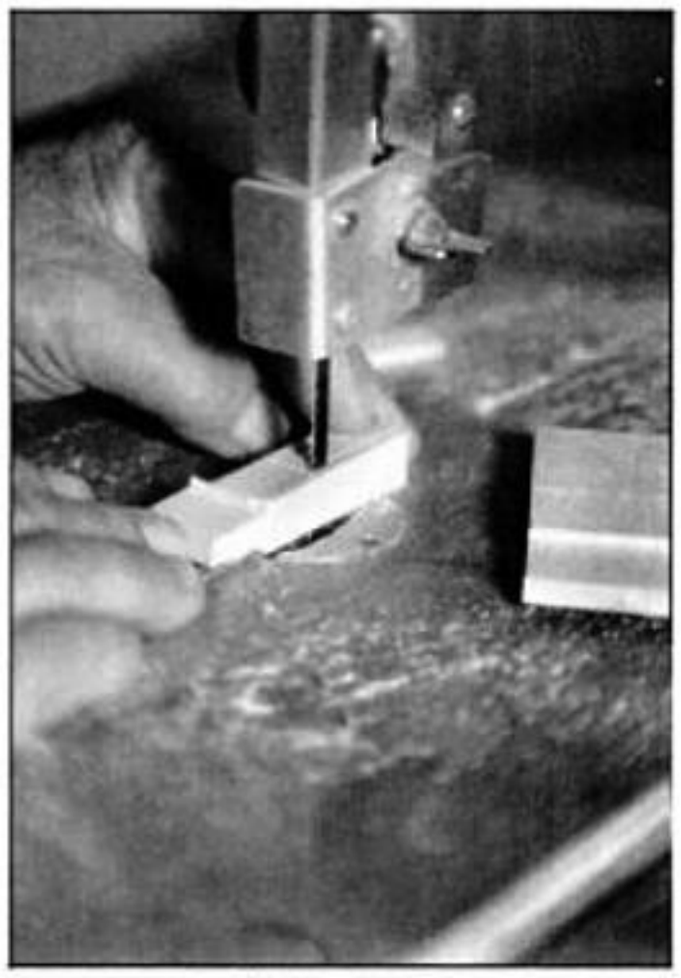
To make your own tuning pegs, rough out a 1/2-



Cut a rabbet around one side of the end blocks with a 1/2-in. straight router bit in a router table.



To make the tuning pegs, first rough out a block on a router table so its cross section approximates the shape of the pegs.

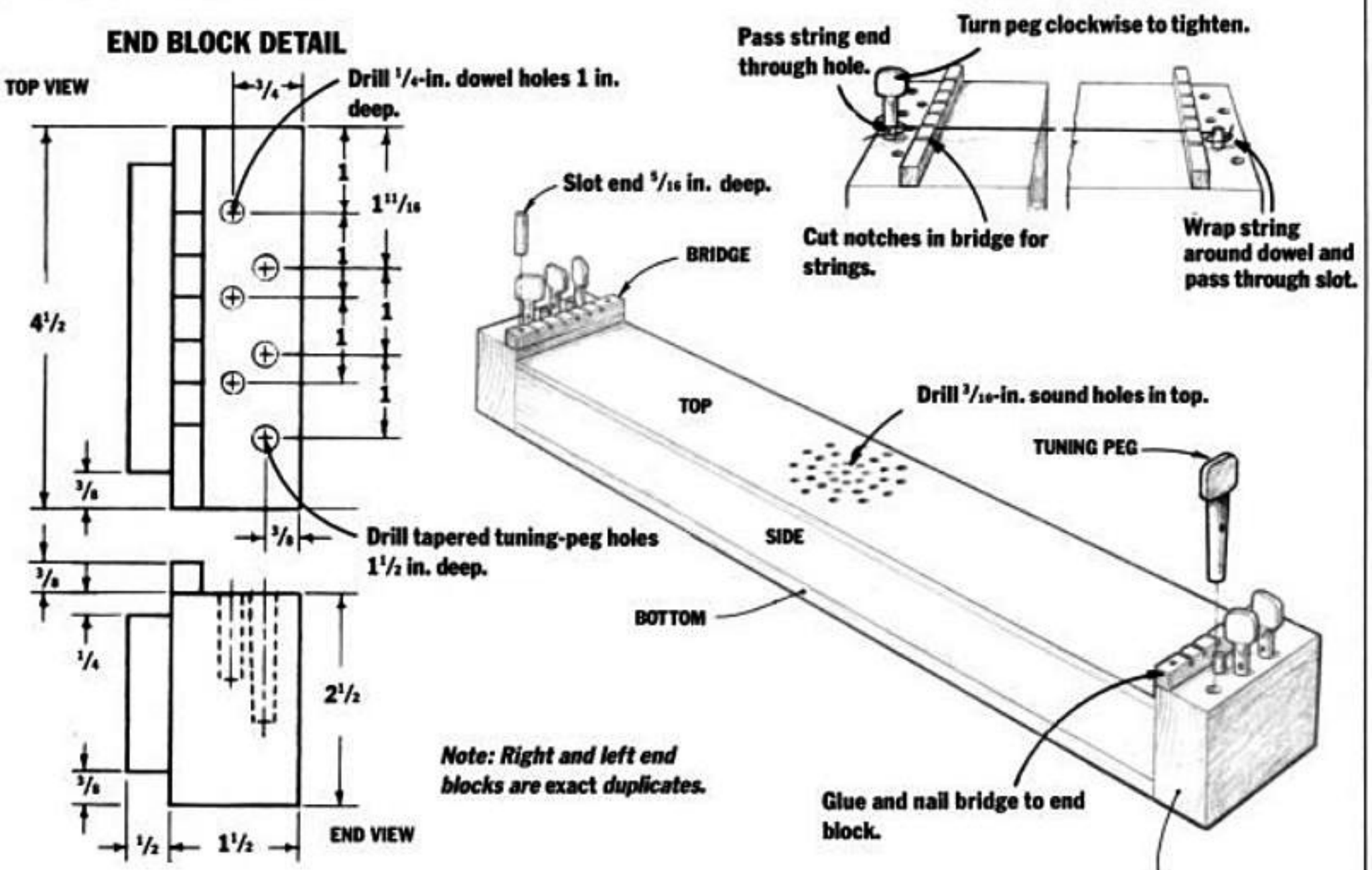


Bandsaw the individual tuning pegs from the rough peg block.

This homemade jig holds the tuning pegs while they are tapered on a lathe. It's easy to remove the pegs to test their fit in the tapered peg holes.

PHOTOS BY RALPH MILKES

FIG. 1: AEOLIAN HARP

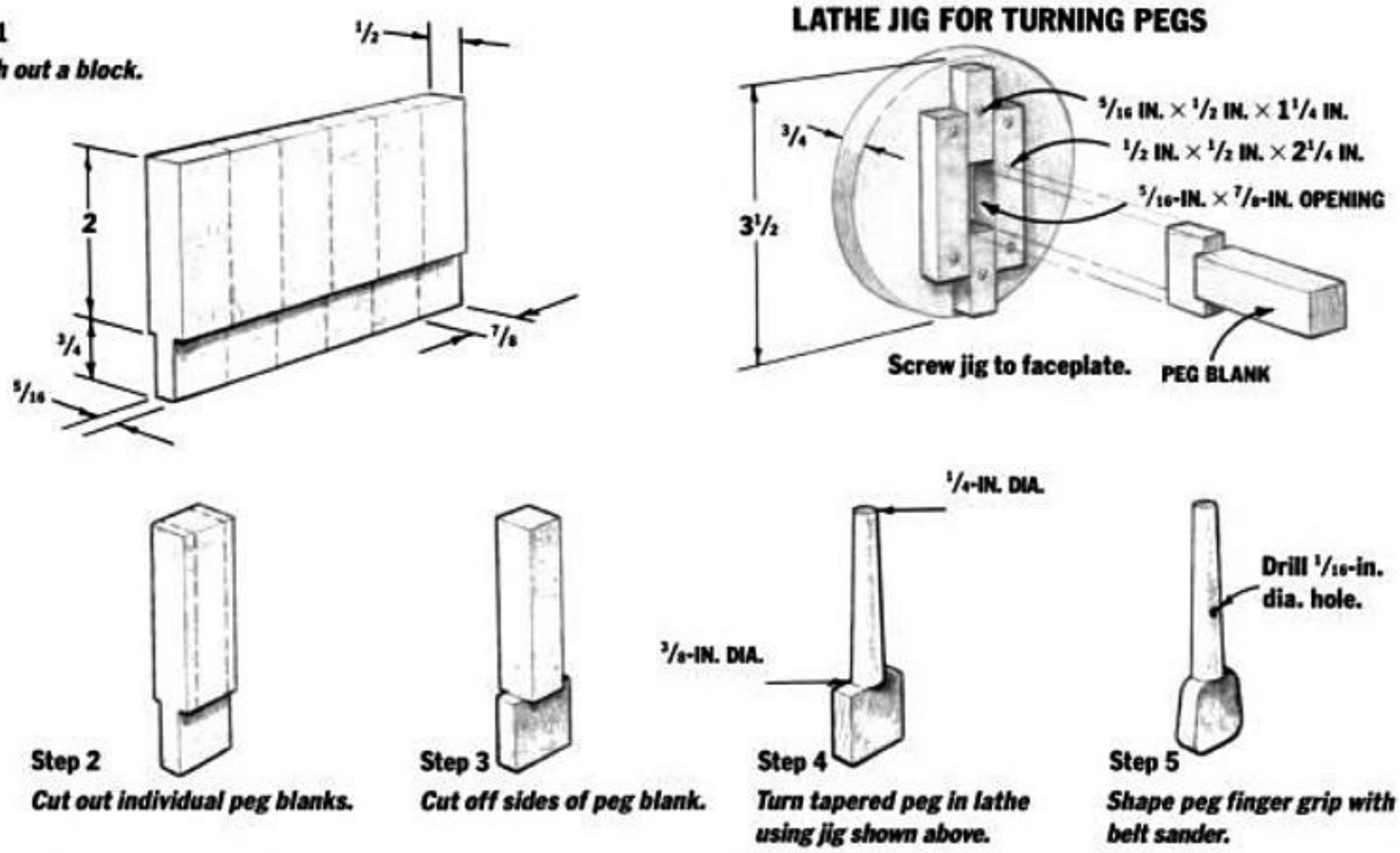


BILL OF MATERIALS

PART	QUANTITY	DIMENSIONS
End Blocks	2	2" × 2 1/2" × 4 1/2"
Top	1	1/8" × 4 1/2" × 24"
Sides	2	3/8" × 1 7/8" × 24"
Bottom	1	3/8" × 4 1/2" × 24"
Dowel Pegs	6	1/4" dia. × 1 3/8"
Tuning Pegs	6	1/2" × 7/8" × 2 3/4"

DRAWINGS BY HEATHER BRINE LAMBERT

FIG. 2: MAKING TUNING PEGS



in. × 2¾-in. × 6-in. hard maple block, as shown in Fig. 2. Shape the bottom end of the block with a ½-in. straight bit on a router table, as shown in the photo. This will form the wide finger grip for the pegs. With a bandsaw, cut out six rough peg blanks from the block, and trim the shank of each peg to ½-in. sq. Now turn each tuning peg in a lathe to the tapered shape, as shown in Fig. 2. I made a simple jig to hold the flat ends of the pegs while turning them in the lathe. The jig permits easy removal, so you can test fit the pegs in the tapered holes. It's important to make the tapered tuning pegs fit well in their holes so a friction fit will lock them in place. If the pegs slip, the harp won't hold a tune. Finish by drilling a 1/16-in. hole through the pegs for the strings to be threaded through—the holes should be about ¼-in. above the surface of the end blocks when the pegs are in place.

Make the two bridge pieces from maple according to the dimensions in Fig. 1. Cut six notches ½ in. apart and about 1/16 in. deep in each bridge with a hacksaw blade. Make sure the notches are aligned with the slots in the dowel pegs and tangent to the tuning pegs. I fastened the bridge with glue and wire brads, predrilling the bridge and end block for the brads, to prevent splitting.

To make the sound chamber I resawed ¾-in. thick pine on a bandsaw to make a ⅛-in. thick piece (after surfacing) for the top, and ⅜-in. thick pieces for the sides and bottom. A top made of spruce (available from Woodworker's Dream, 10 W. North St., Nazareth, PA 18064, 215-759-2064) would probably sound better. Spruce is used in the sounding boards of many stringed instruments .

Drill the 3/16-in. sound holes in the top piece, as shown in Fig. 1. Assemble the sides, bottom and top pieces to the end blocks to make the sound chamber. I used glue and wire brads to join the pieces together. I finished my harp with three coats of satin polyurethane, and sanded lightly between coats. Do *not* apply finish to the tapered part of the tuning pegs or inside the peg holes.

Strings and Tuning

At first, I tried a set of nylon (classical) guitar strings (E-A-D-G-B-E), but I found that the larger wire-wound strings didn't vibrate in the breeze as well as the unwound nylon strings. And it wasn't possible to get the big strings and the little strings tuned to the same note. I replaced the wire-wound strings with three different diameters of monofilament fishing line, which improved the tone a lot.

Each string is mounted in the slot of a dowel peg at one end and through the hole of a tapered tuning peg on the other end, as shown in the drawing. Wrap the loose ends of the string around the dowel peg and tuning peg to give them a grip. To tune the aeolian harp, adjust the tuning pegs so each string makes the same musical pitch—this is called tuning in unison. To test, pluck each string in turn, listen carefully and turn the peg accordingly.

Open a window on the windward side of your house, and set the harp in the opening. Close the window sash so it almost touches the tuning pegs. Try this on a day when the weatherman predicts a ten-mile-an-hour breeze, or stronger. When the harp begins to make music, you can fine-tune the strings while the wind is blowing, to get a pleasant sound.

The sound of an aeolian harp has been described as eerie, mysterious, romantic and strange. See what you think of the sound. ▲

Ralph Wilkes is a retired business manager of Keuka College, in Keuka Park, New York. Woodworking is his hobby, and he's currently interested in making antique reproductions.

NEO-EGYPTIAN COFFEE TABLE

A Centerpiece for Your Sitting Room

BY BEN ERICKSON

A coffee table provides a natural focal point in a room, so it should be distinctive and display your finest craftsmanship. This coffee table has an exotic flavor about it; Oriental, perhaps Egyptian, in look. I made the table from contrasting woods; dark walnut for the legs and lighter cherry for the apron and the top. The top is trimmed with walnut edging on the long edges and "curled" end pieces, also in walnut.

A coffee-table top is so visible that it's well worth the search for boards with exceptionally attractive grain. When you've found the wood that you want, joint and plane the pieces, and edge glue them together. Glue the 1/2-in. wide strips of contrasting walnut edging on the long edges of the top at the same time you glue up the top. I like to use 3-in. or 4-in. wide scrap wood cauls (jointed on the edges) between the edging and the clamps to even out the clamping pressure and cut down on the number of clamps required.

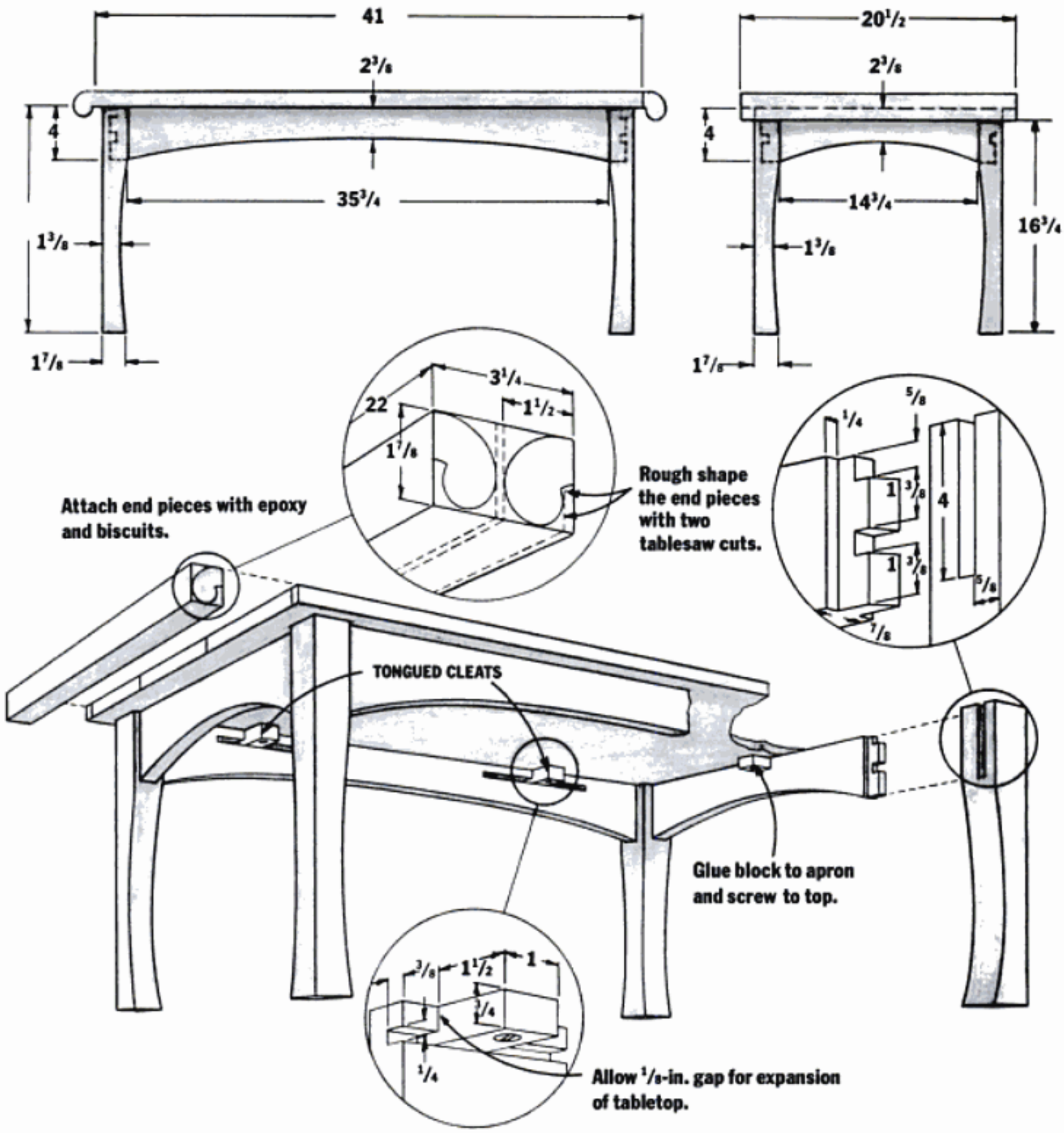
Set the assembled top aside to let the moisture from the glue work its way out for several days before you sand it. If you sand before the glue is completely dry, you'll feel a slight unevenness in the joint later, when it may be too late to correct it.

The legs and aprons come next. First, joint and plane the stock. If you use a thickness planer or thickness sander, surface all of the pieces on the same setting. Don't cut the curves on the legs or aprons until after you've cut the joints.

In my opinion, the strongest way to join the legs to the aprons is the time-honored mortise-and-tenon joint. I used a double tenon with a 3/8-in. deep haunch between the two tenons and another at the top of the joint. (See Fig. 1.) Cut the leg blanks to length, then lay out the mortises, as shown in the drawing.

PHOTOS BY BEN ERICKSON

FIG. 1: COFFEE-TABLE DIMENSIONS



DRAWINGS BY FRANK ROHRBACH

I cut the mortises on a drill press with a ³/₈-in. hollow-chisel mortiser and fence. It makes quick work of a job that I find tedious with a mallet and chisel.

Begin by cutting the 1³/₁₆-in. deep mortises for the tenons, noting that the mortises for adjoining aprons intersect inside the legs. As long as the fence is securely clamped and doesn't move, you can come back to the ³/₈-in. deep mortises for the haunches after the deeper ones for the tenons are done.

You might want to borrow an idea from the metalworking machine shop—the 1-2-3 block. A 1-2-3 block is simply a block of metal that is exactly 1 in. × 2 in. × 3 in. A perfectly useful version for the wood shop can be made from a stable wood such as cherry. Since you'll find dozens of uses for it all over the shop, make it as square and precise as you can. Fig. 2 shows how to use the 1-2-3 block to cut the mortises for this table.

Cut the tenons after you've finished the mortises. I cut the cheeks of the tenons on the tablesaw, holding the work in a tenoning jig. (See May/June, 1989 *AW*). I then cut the shoulders with a fine crosscut blade. Next, I mitered the ends of the tenons, as shown in the drawing, so they don't interfere with each other where they meet inside the leg mortises. Finally, I sawed out the waste to create the haunches.

The tabletop is fastened to the apron with tongued cleats (or "buttons") that fit into grooves in the long aprons, and a fixed block at the center of each short apron. The fixed blocks are screwed to the top and glued to the aprons—they hold the top firmly in place. The tongued cleats are screwed only to the top so they're free to "float" in their grooves. This arrangement allows the top to expand and contract across the grain. You can cut the grooves with a dado blade on the tablesaw or with a router. Be sure that the tops of the cleats are just flush with the top of the apron.

A hollow-chisel mortiser is the fastest, easiest, and most accurate way to cut the leg mortises.

A tenoning jig makes short work of sawing the apron tenons on the tablesaw.

Cut the curves on the legs and aprons after the joinery is complete. Make patterns of the three curves; one for the legs, one for the short aprons and one for the long aprons. You can lay out fair curves for these patterns by marking the center (narrow) dimension and bending a drafting spline (a thin strip of clear, straight-grained wood or Plexiglass) to the desired curve. Spring clamps or weights will hold the spline while you trace the curves on the pattern material. Cut out the patterns.

Position the patterns on the stock, and trace the curves. Saw to the line with a bandsaw or bow saw, and clean up the cut with a spokeshave, cabinet scraper and sandpaper.

If you are making several tables, you can speed up the cutting of the aprons by working to a template instead of to a line traced from a pattern. Make the templates from 1/4-in. plywood several inches longer than the actual aprons. Sand the curves smooth, and stick the templates to the stock with double-sided tape.

Bandsaw to within 1/8 in. or less of the template, and clean up the cut on a router table with a large, 1/2-in. shank flush-trim bit. Make sure the pilot bearing on the flush-trim bit rides against the edge of the plywood template. The pattern should be made longer than the apron to allow the router-bit bearing to ride against the pattern before it contacts the stock.

Round the outside corners of the legs with a 1/4-in. round-over bit, and round the inner edges of the legs and bottom edges of the aprons with a 1/8-in. round-over bit. I find it easier to sand the legs and aprons before gluing everything together.

Assembly can take one of two approaches. You can glue up the two short aprons to the four legs, and when they're dry, assemble these units to the two long aprons. Or you can take the fast approach, assembling it all at once and clamping with a large band clamp.

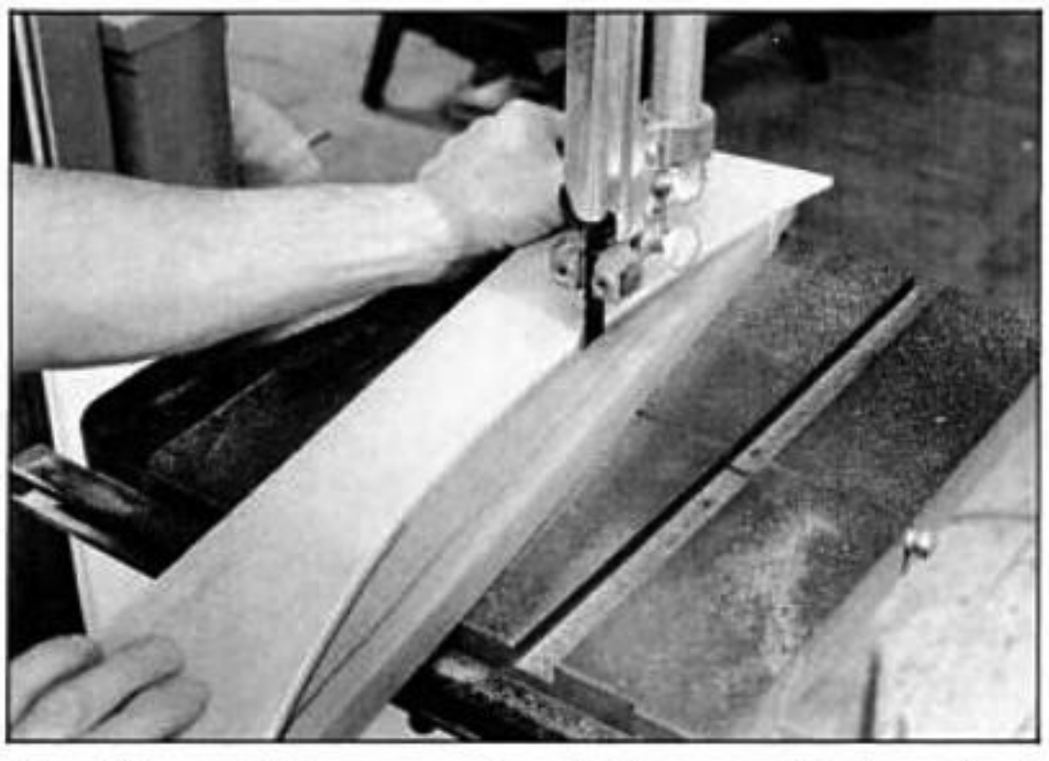
Making the End Pieces

The curled end pieces on the tabletop have the grain running in the same direction as the grain of the top. This eliminates the cross-grain construction problem common with conventional "breadboard" ends.

To make these end pieces, glue up 8/4 walnut to make a blank measuring 3 1/4 in. × 22 in. with the grain running the 3 1/4-in. direction. You'll be able to cut both end pieces from the same blank. Make the blank longer than the width of the top, so you can trim off any splintering left by the shaping process.

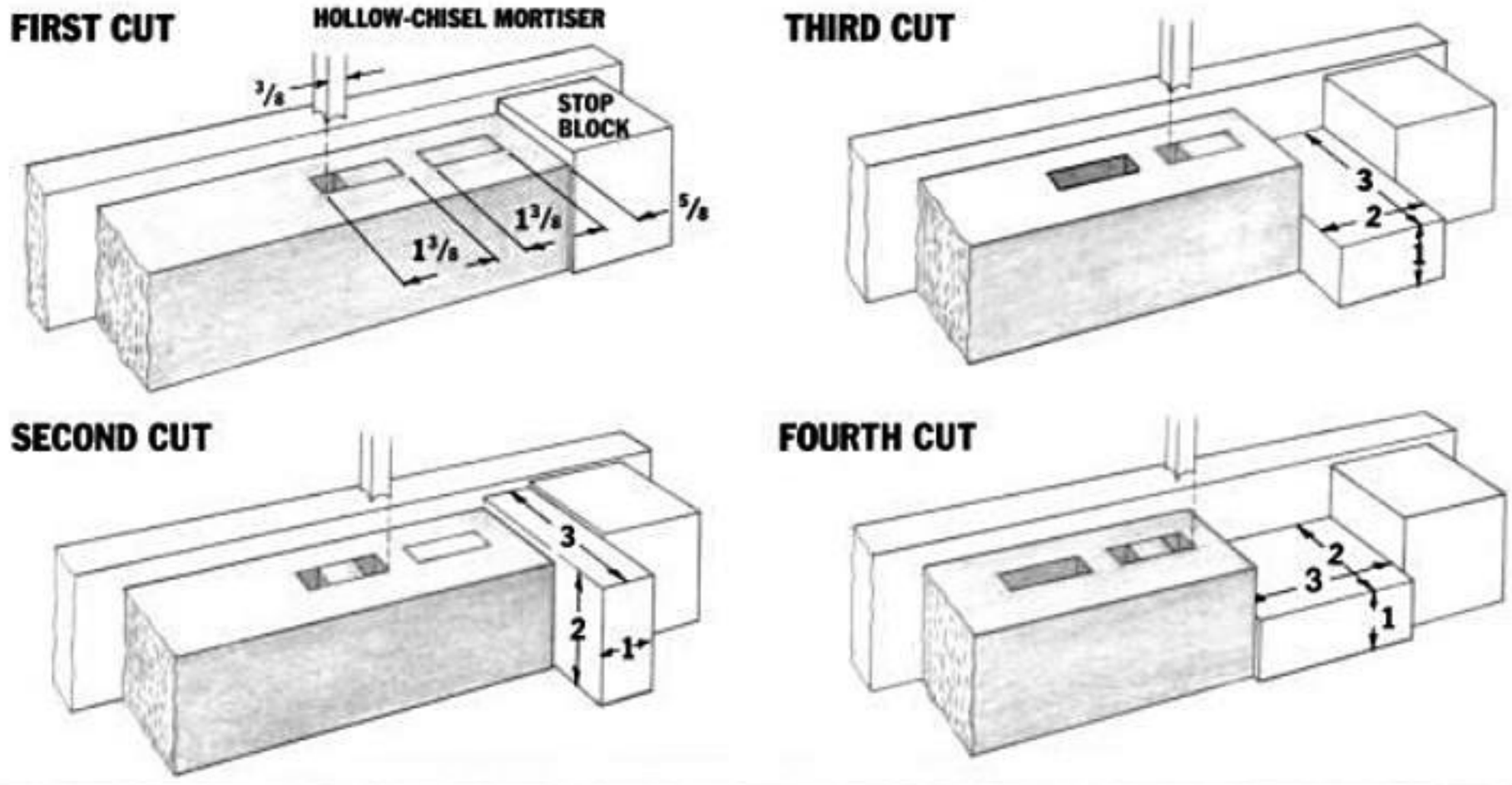
Make a pattern of the curl profile, and trace it on the ends of each blank, as shown in Fig. 1. Rough shape the insides of the curls on the tablesaw by making two cuts, as shown.

Next, set up a 1/2-in. radius round-over bit on the



A template speeds the process of curving the aprons. Bandsaw close to the template (above left), then finish up with a flush-trim bit in a router table (above right). The pilot bearing rides the edge of the template.

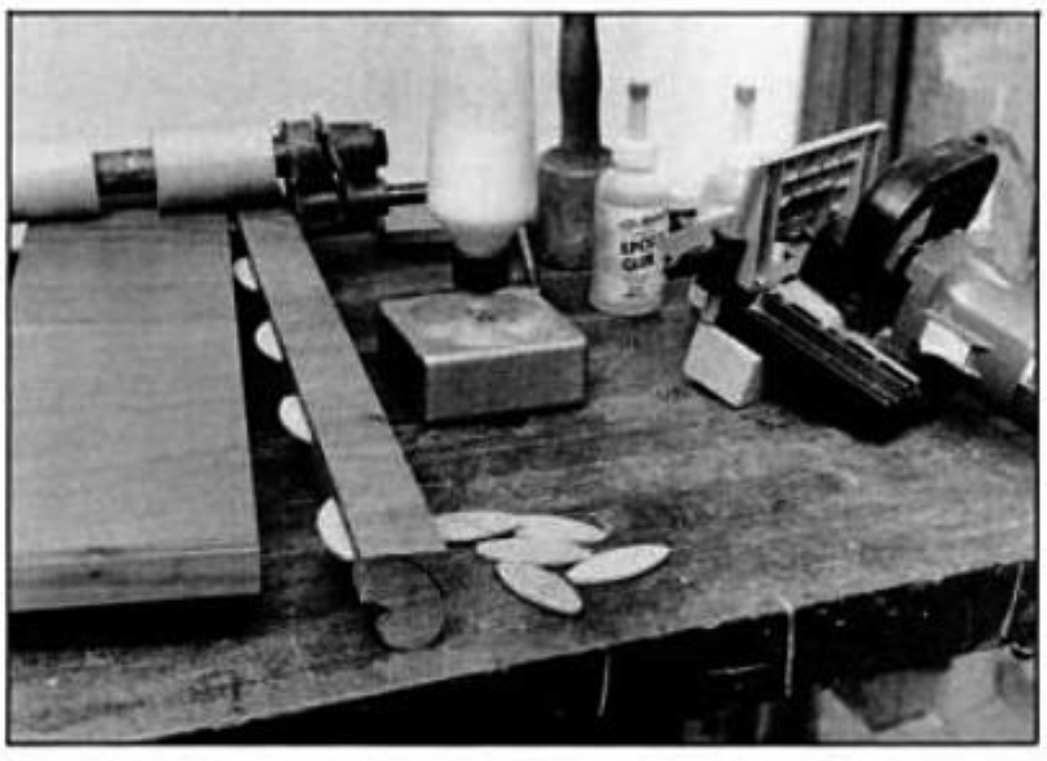
FIG 2: MORTISING WITH A 1-2-3 BLOCK



router table, and shape the inside bottom edges. After shaping these edges, you can cut the two end pieces apart, as shown in Fig. 1. Now round over the outside bottom edge of each end piece with a $^5/_8$-in. radius round-over bit. Don't make the $1^1/_4$-in. radius cut on the top edge of the end pieces until after the end pieces have been glued to the top. If you don't have the necessary router bits, the end pieces can be roughed out on the tablesaw and finished with a hand plane and sander.

Attaching the End Pieces

End-grain to end-grain joints such as the joint between the tabletop and the curled end pieces are difficult to glue. End-grain joints don't have the strength of a long-grain to long-grain joint. In situations such as this, where I have to make an end-grain glue joint, I find epoxy gives me a stronger joint than water-based glues. For mechanical strength, I reinforce the joint with plates (biscuits) on about 4-in. centers. If you don't have a plate joiner, you can cut a slot in both pieces and insert a spline with the grain in the same direction as the top (across the joint). I find the following procedure works well for end-grain glue joints.



Attach the end pieces with epoxy and plate-joiner biscuits.

First, I coat the joint surfaces with epoxy, wiping off the excess before it sets. After it cures, I lightly sand the surfaces to remove any excess glue. This step seals the end grain and helps prevent a glue-starved joint.

I then glue the end pieces to the tabletop with epoxy. I insert the plates and assemble the joint with clamps and a clamping block to pull the end piece on evenly. To make assembly less intense, you can assemble one end, clamp it (not too tightly) and let it cure, and then assemble the other end.

When the glue is cured, round over the top edges of each end piece with a $1^1/_4$-in. radius round-over bit (available from Cascade Tool Co., Box 848, Mercer Island, WA 98040). You can also shape the edges with a saw and a hand plane.

The inner curve on the inside of the joint will need a little work with carving tools to reach its final shape, and the ends of each end piece will have to be trimmed flush with the long edges of the top. As a finishing touch, round over the long edges of the top with a $^1/_8$-in. round-over bit.

Finish both sides of the top with a durable finish such as lacquer or polyurethane, and when the finish is dry, attach the top to the base assembly. Center the base on the upside-down top and install one fixed block on each short apron. Drill for the tongued cleats, and screw them to the underside of the top. Be sure to leave a gap for wood movement between the cleat and the apron, as shown in Fig. 1. Leave a larger gap if you're assembling the table in winter—a smaller gap if assembing in summer. ▲

Ben Erickson is a professional woodworker specializing in mill work, shoji screens and furniture. He works and lives in a restored 1840s house in Eutaw, Alabama.

GETTING THE EDGE

BY ROGER HOLMES

ANGELO CAGGIANO

Smoothest Cuts Start With a Shaving-Sharp Blade

Sharpening edge tools can be a frustrating ordeal for a beginner. I remember my first attempts. Sharpening, as explained in the (very old) books I found at the local library, seemed an arcane ritual. I worked my way through esoteric hand grips, and moved the tool over the stone in patterns intricate enough to confuse an IRS lawyer. But the worst of it was that I didn't know if I had succeeded or not. I didn't know how sharp a sharp edge was supposed to be.

I finally learned, but not until I began work with English master craftsman Alan Peters. The first time I pushed his plane across wood, I realized how far from sharp my edge tools were. From Alan, I learned that sharpening can be a pretty simple affair. It takes time and practice to master, but it doesn't require initiation into a cult. It starts with an understanding of what a sharp edge is. Then you can select, or invent, a sharpening technique that is comfortable to you.

What Is Sharp?

Theoretically, a sharp edge is an edge that isn't there. Like the mathematician's straight line, this ideally sharp edge has length but no thickness. In the world of theory, such an edge would slice through the toughest wood, unhindered and undulled, there being no surfaces to create friction or become blunt.

In the real world, of course, cutting edges have both

PHOTOS BY SCOTT LANDIS

You don't need a lot of paraphernalia to sharpen edge tools. Author Holmes grinds the bevel on a bench grinder. He hones on a fine India stone and a soft Arkansas stone, then strops on a piece of belt leather dressed with rottenstone (the lump of stuff at right).

length and thickness. As the drawing shows, the cutting edge of a chisel or plane iron is formed by the juncture of two surfaces, the back and the bevel. If those surfaces are rough, the cutting edge they form will be rough and irregular. Working wood with such an edge is like shaving with a worn-out razor blade. The smoother these two surfaces are, the more the edge will resemble the ideal—all length and no thickness—and the easier it will slice through wood.

Sharpness isn't all that's required of a cutting edge. If it were, we'd use razor blades for plane irons. A cutting edge must be durable as well as sharp. In addition to the type, quality and hardness of the steel in a blade, durability is affected by the amount of steel immediately behind the cutting edge. A larger (steeper) bevel angle puts more steel behind the edge. More steel gives more support and absorbs more of the impact with the wood.

Given two identical and equally sharp plane irons, the one with a smaller bevel angle will slice through wood more easily than one with a larger angle. But it will also dull sooner. If the bevel angle is too large, however, you'll end up scraping the wood fibers rather than shearing them.

Sharpening edge tools, then, involves just two simple tasks. You must grind an angle between the bevel and back that balances sharpness and durability. Then you must make the back and the bevel as smooth as possible by polishing them with increasingly finer abrasives.

Tools for Sharpening

Grinders—There are all sorts of machines and wheels for grinding edge tools. Aside from cost and ease of use, the main differences between them are whether they produce a flat or a hollow-ground bevel, whether or not they're water cooled and the speed at which they cut.

As Fig. 1 shows, for a given angle a flat bevel will have slightly more steel behind the edge than a hollow-ground bevel. I prefer a hollow-ground bevel, because I think it's a little easier to hone. (I'll explain why later.)

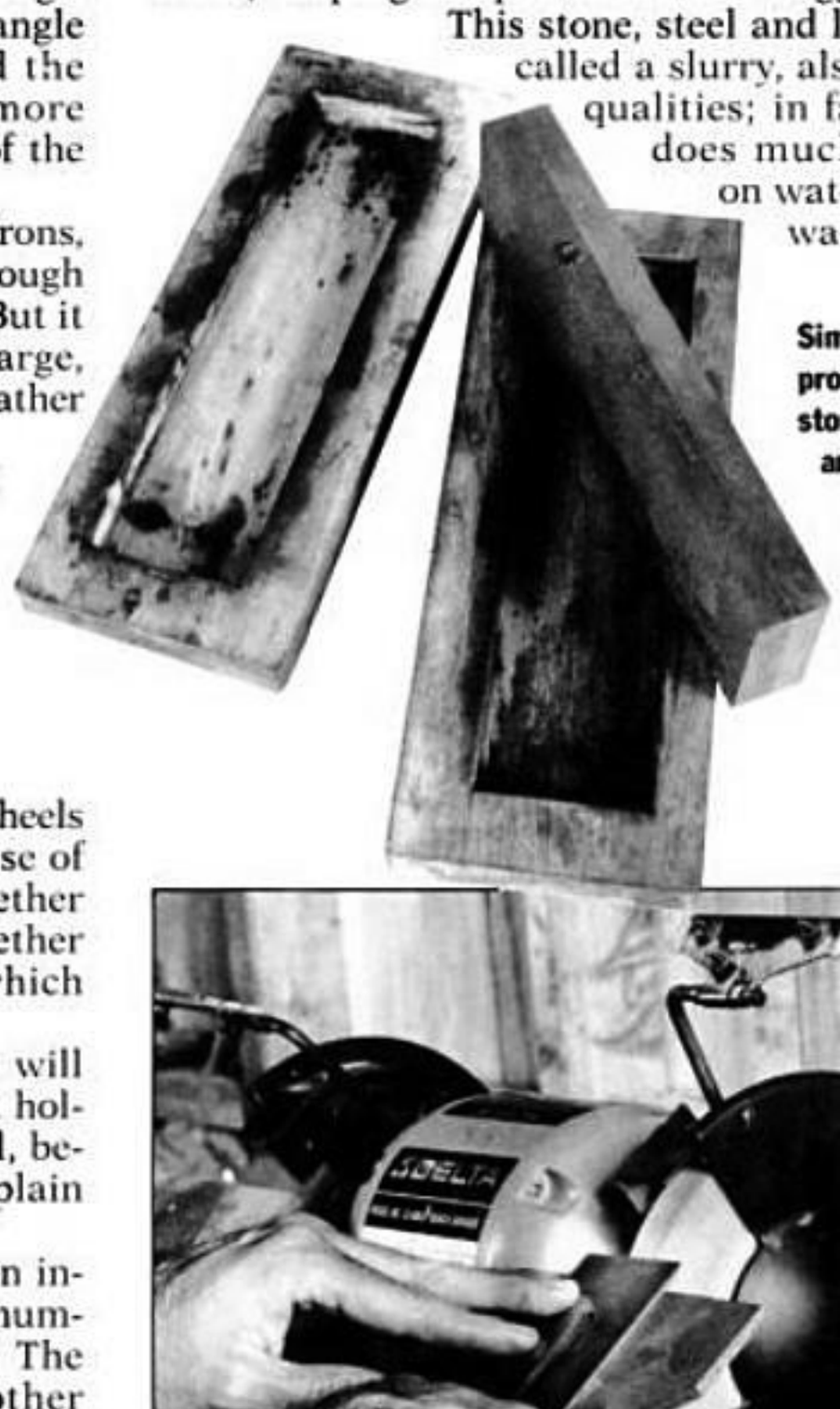
For years now, I've done all my grinding on an inexpensive bench grinder fitted with gray aluminum-oxide wheels 1 in. thick and 6 in. in diameter. The grinder and wheels are cheap, compared to other sharpening setups. My most recent grinder, a Delta, cost about $70; gray wheels for it are under $10 apiece, and they last a long time. There are cheaper bench grinders, but before you buy, satisfy yourself that the machine has enough weight and is built well enough to run with a minimum of vibration.

With the grinder, I can remove steel quickly. But the price I pay for this speed is an occasional burned edge. Heat builds up very quickly in the thin steel near the cutting edge. Burned steel loses its temper. It takes an edge, but the edge won't last. If it's badly burned, you've got to spend awhile longer at the wheel, grinding away the burned part. Sometimes a burned edge indicates that your wheel has become clogged with metal particles. A wheel dresser will bring up fresh abrasive particles and true the wheel.

If you're a beginner, I suggest you start out with an inexpensive grinding setup such as mine, and suffer a burned edge from time to time. As you gain experience and develop a feel for sharpening, you can more profitably look into other systems.

Sharpening Stones—Honing is the process of polishing away the rough ridges and valleys left by the grinding wheel. For centuries, woodworkers have honed their tools on natural stones. Today, synthetic stones, which make use of a variety of materials—reconstituted stone, ceramics, industrial diamonds—are more uniform and often cheaper. They've largely replaced natural stones in all but the finest grits.

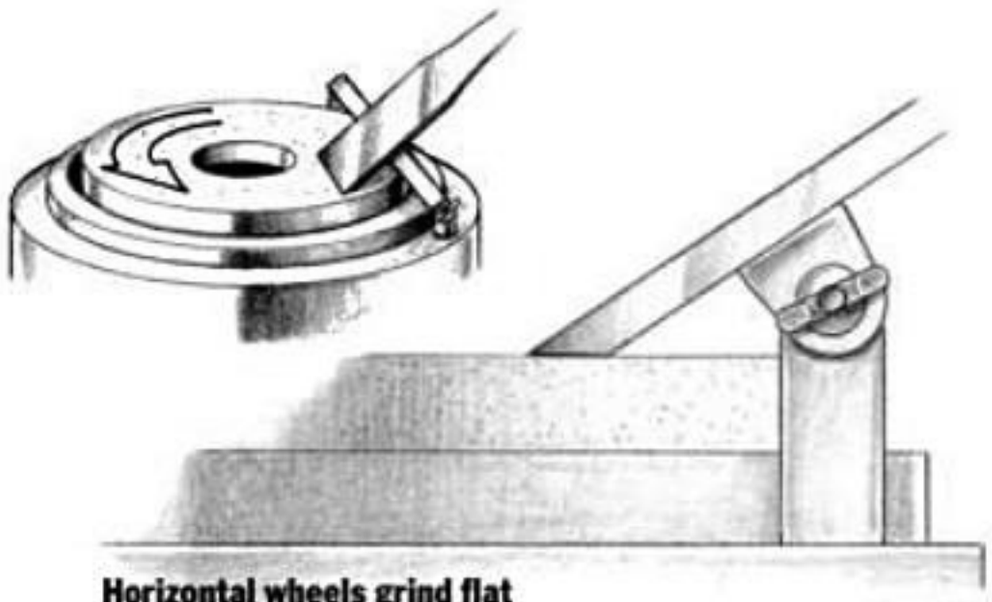
The biggest difference between sharpening stones isn't what they're made of, but what they're lubricated with—oil or water. A lubricant floats particles of steel and crushed abrasive above the surface of the stone, keeping the particles from clogging the pores. This stone, steel and lubricant soup, called a slurry, also has abrasive qualities; in fact, the slurry does much of the work on water stones. Both water stones and



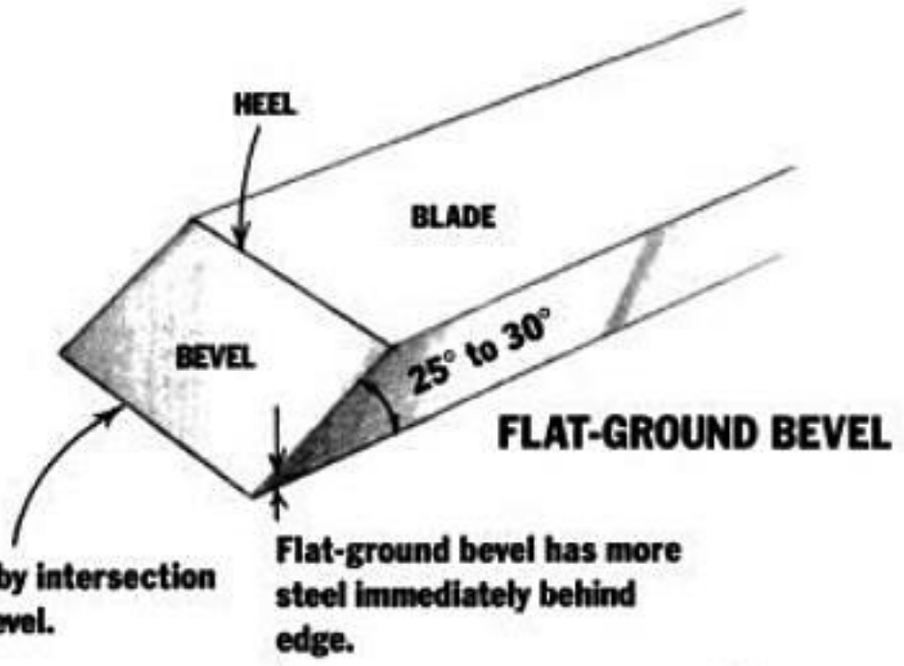
Simple wooden boxes protect sharpening stones from damage and dust. Just trace the stone onto each half and rout or chisel out the waste.

When grinding, engage the wheel carefully, then move the blade horizontally, maintaining contact with as much of the wheel's edge as possible. Very little pressure is needed.

FIG. 1: GRINDING THE BEVEL

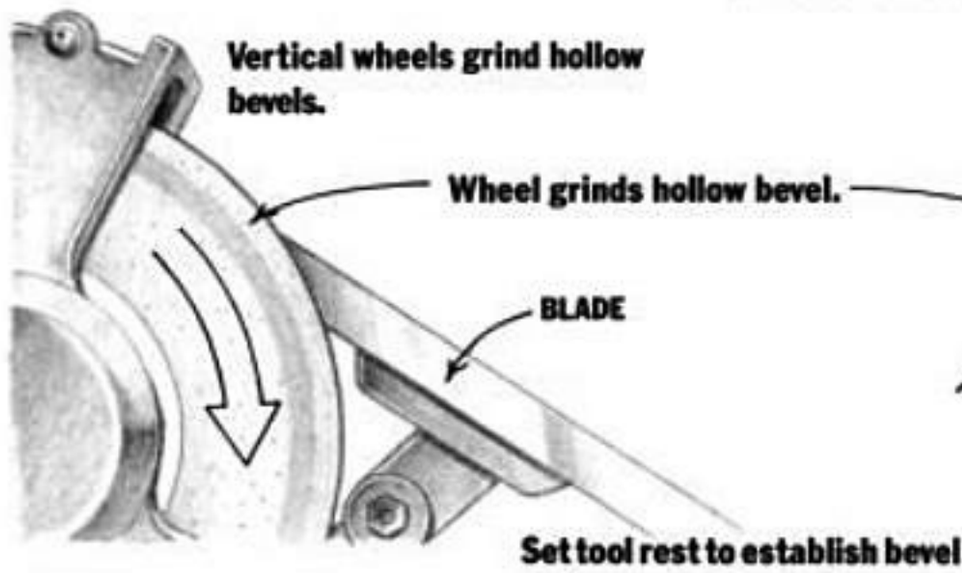


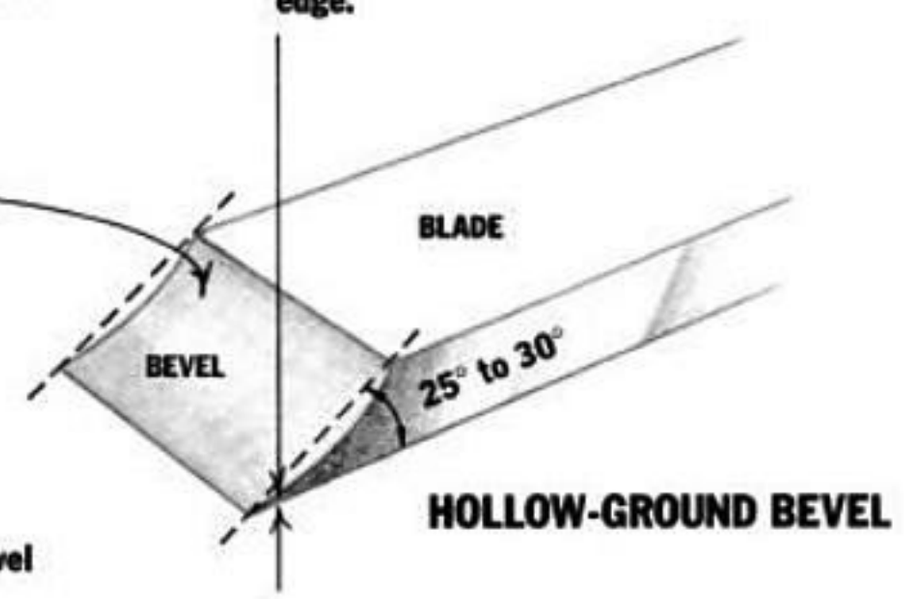
Horizontal wheels grind flat bevels.



Edge formed by intersection of back and bevel.

Flat-ground bevel has more steel immediately behind edge.





DRAWINGS BY SALLY ONCHA

oilstones are messy. You need to wipe your tools and wash your hands after sharpening, or you end up with smudged wood.

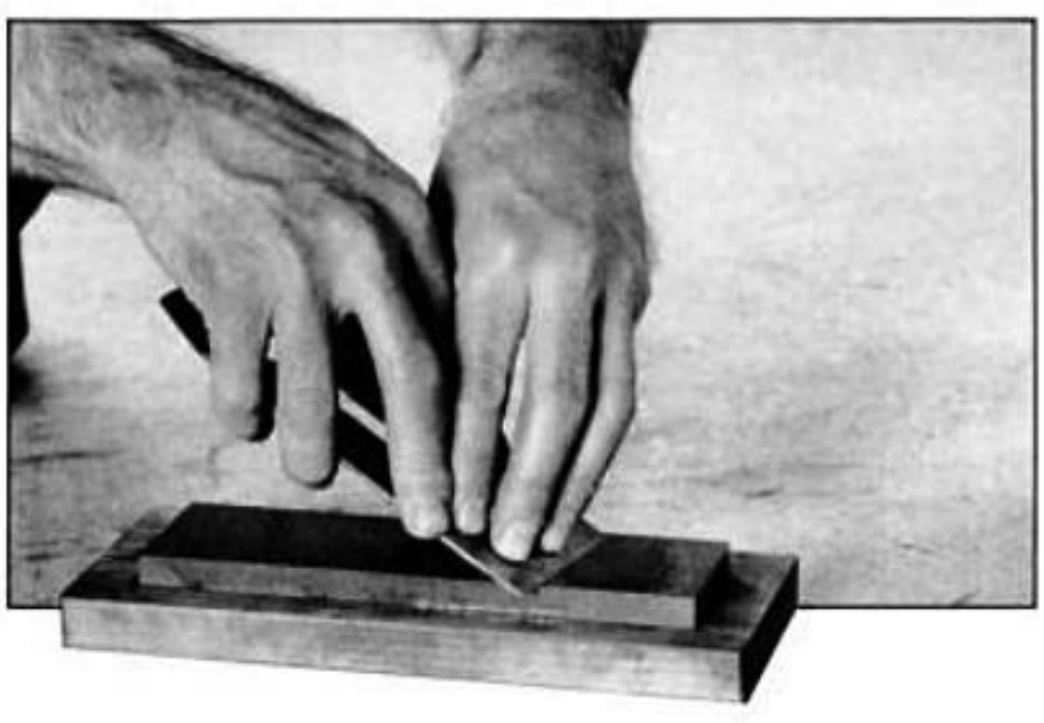
I use oilstones, not because I think they're better than water stones, but because that's what I've always used. Twenty years ago, oilstones were about the only stones you could buy. I've tried a number of different types of stone over the years, but now I do all my honing with just two—a man-made fine India stone and a natural soft Arkansas stone.

My stones are 2 in. wide and between 6 in. to 8 in. long. Larger stones are nice, but not necessary. Ordinary motor oil works just fine for lubrication, thinner is better, but I use whatever weight I happen to be running in the car at the time. (A lighter-weight lubricant — I've even used lacquer thinner—seems to work better for the Arkansas stone, but it evaporates quickly.)

I store my stones in simple wooden boxes, which protect them from dust and damage. A better, but potentially messier, arrangement is to store the stones in an oil bath, which keeps the particles from settling into the pores when the stones aren't in use. My father owned a nifty oil-bath rig in which three large stones, mounted on a shaft, could be rotated through an oil reservoir in the bottom half of the box. These are still sold, though they can be expensive (available from Garrett Wade and Woodcraft).

Strops—After honing, I finish the cutting edge on a leather strop, the same sort of thing a barber uses to tune up a cut-throat razor. My strop is a piece of belt leather, about $\frac{1}{8}$ in. thick and 2 in. wide, that I bought from a shoe repairman. The rough side of the leather

When honing, Holmes holds chisels and plane irons with one hand. To maintain the second bevel angle, he locks the blade, fingers, wrist and forearm into a single unit. If this grip feels awkward, try the two-handed grip below. The upper hand holds the blade while the lower hand helps steady it.



is abrasive enough to do the job, particularly after a little use, which impregnates it with slurry from the stones. You can also dress the leather with a fine abrasive such as emery buffing-wheel compound or jeweler's rouge. Years ago an old man gave me a lump of rottenstone, a very fine abrasive that looks and feels like a heavy crayon. I rub it on the leather from time to time.

Grinding: The First Step

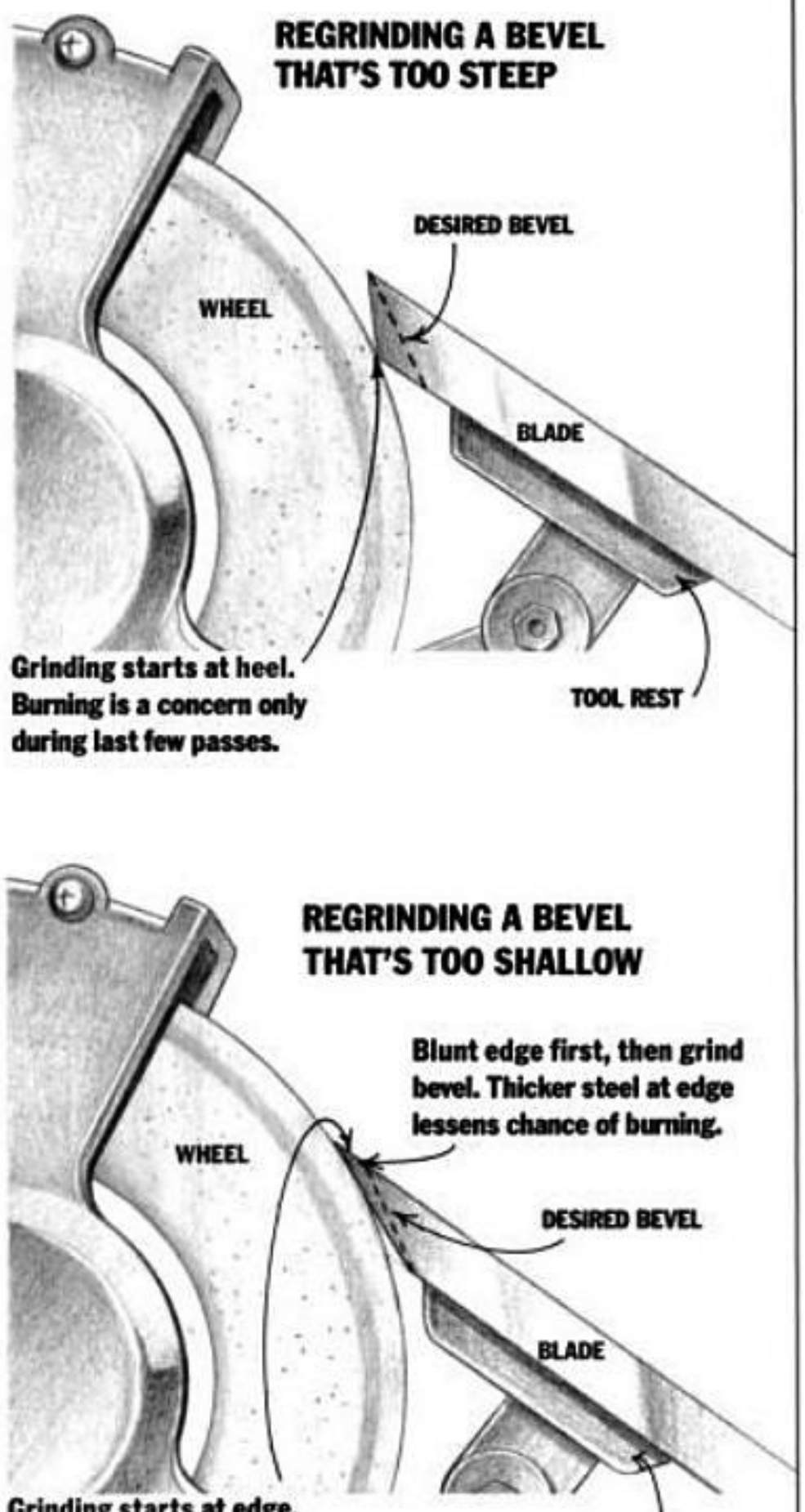
I usually grind my chisels and plane-iron bevels to a bevel angle of 25° to 30°—the factory-ground angle on most new chisels and plane irons. You get into trouble with very shallow or very steep bevels, and I find that bevel angles in this neighborhood are acceptable for most work. (Mortising chisels require a larger "steeper" angle to withstand the force of levering out the chips.) If I'm working pine, I aim for 25°; for harder woods, around 30°. I don't usually measure the angles, I just adjust the grinder's tool rest by eye when I regrind. When in doubt about bevel angles, experiment. Try different angles for different tools and different jobs until you find what works best for you.

I admire people who can grind tools freehand, steadying the tool on an edge of the rest and establishing the angle by eye and feel. I can't do it. I need a steady platform set at the correct angle to guide the tool and establish the bevel. The result is a bevel with a single, clean, hollow-ground surface, not one formed by a mass of overlapping arcs, each at a slightly different angle. The rests on my grinder were too small, so I rigged up the rests shown in the photos. I've also put the grinder at a height that saves my back, positioning the tool rests a little below chest height.

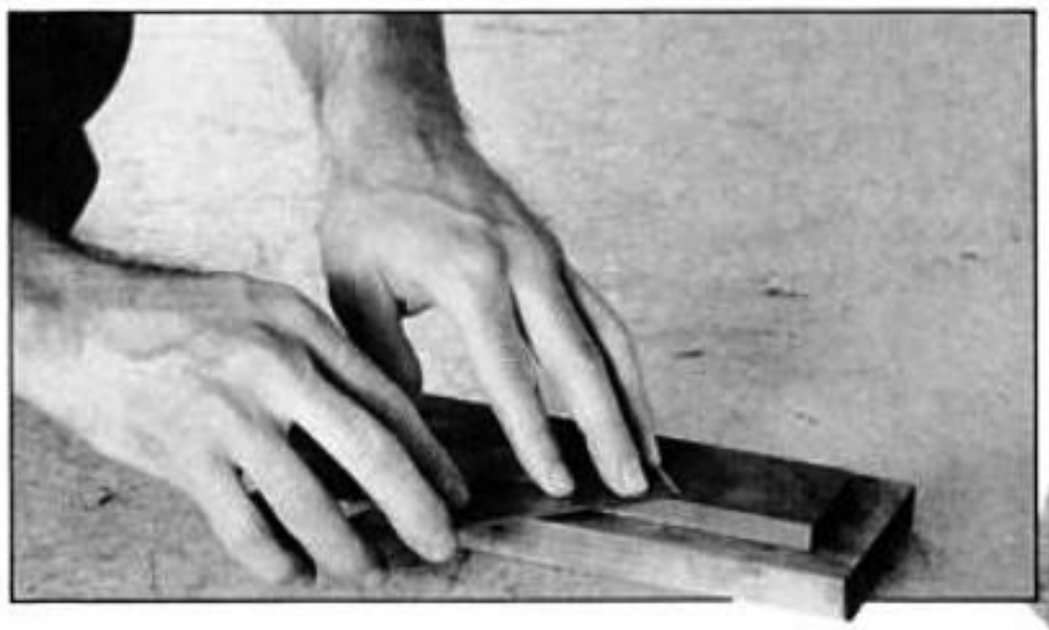
I do almost all my grinding on an 80-grit, gray aluminum-oxide wheel. I so rarely use the 36-grit wheel the machine came with that I'm thinking of replacing it with a 100-grit white aluminum-oxide wheel. (See sidebar to the article Turning a Chess Set, page 23.) This wheel is supposed to cut faster and cooler than the gray wheels. (Unfortunately, it's three times the price, too.)

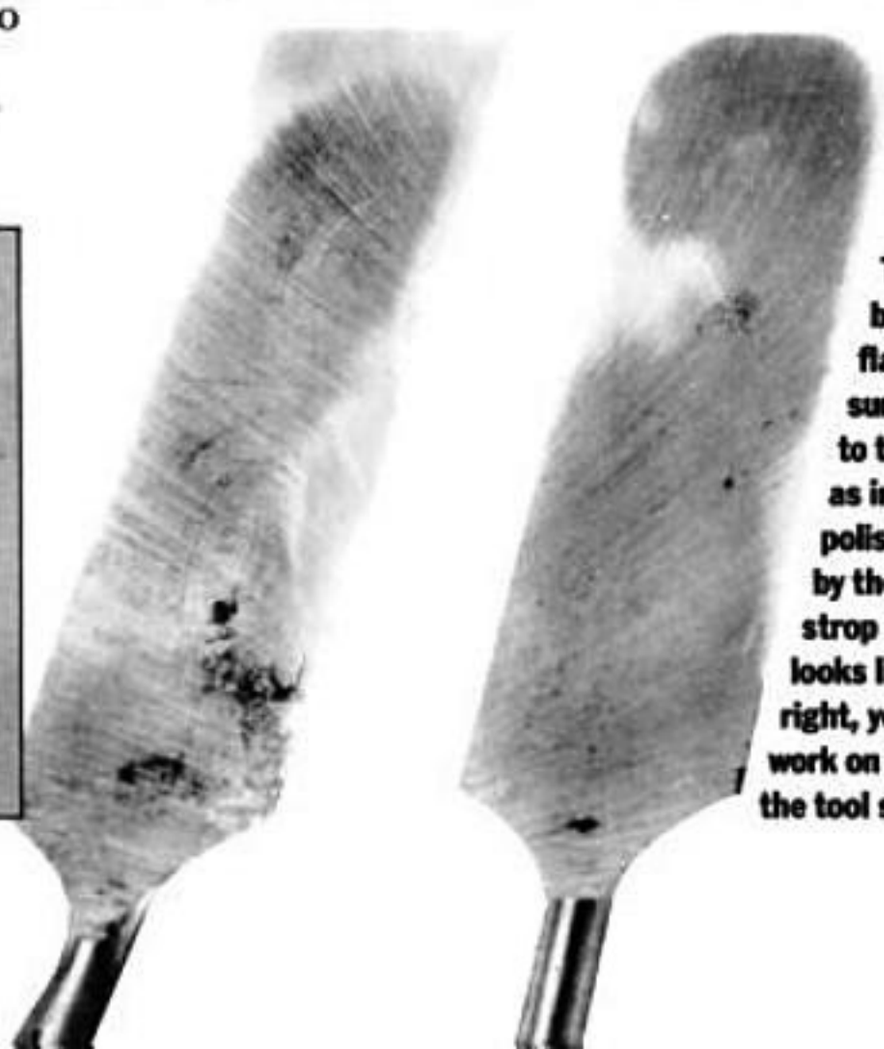
With the tool rest set to establish the bevel angle, grinding is a straightforward task. Move the bevel carefully against the wheel, and move the blade smoothly across the wheel. You need very little pressure against the wheel. It's better to make several light passes than one heavy one that risks burning the steel. I find I'm most likely to remove too much steel or to burn the edge at the beginning or end of a pass, so

FIG. 2: CORRECTING BEVEL ANGLES



After every few strokes on the bevel, flip the blade over and hone its back. Keep the back *flat* on the stone.





The back of the blade should be flat along the entire surface adjacent to the cutting edge, as indicated by the polished surface left by the stones and strop (left). If your blade looks like the one at right, you'll need to work on the back of the tool some more.

I try to be particularly sensitive to the feel of the tool as it engages and leaves the wheel. I try to move the tool so it makes contact across most of the wheel's edge. Though, if I'm working on one part of the cutting edge, perhaps to straighten it, I skew the tool slightly and work near the outside of the wheel's edge. (Remember to dress the wheel and square its edge from time to time with a dressing tool.) Frequent dips in a can of water minimize chances of burning.

When you buy a chisel or plane iron, whether it is new or used, you'll probably need to do some grinding to get it in shape. First, check the cutting edge with a square to see if it is straight and square to at least one of the edges of the blade. Then check the angle of the bevel with a protractor or a template, or by comparing it by eye to one of your other tools. If the cutting edge is slightly irregular or out of square but the bevel is alright, carefully grind off the high spots. If the cutting edge is considerably out of square or irregular, I find it helpful to hold the tool perpendicular to the wheel's edge and grind the edge straight, square and blunt. Then, resetting the rest, I grind the bevel at the proper angle until it meets the back. Because the edge is blunt and therefore dissipates heat more readily, I can remove a lot of steel before the edge thins enough to burn easily.

Burning is the main concern when altering an existing bevel. If the bevel is too steep, just set the tool rest to a shallower angle and grind away. Since the steel is removed from the heel of the bevel first, you needn't worry about burning until you approach the cutting edge on the last few passes. But if the existing bevel is too shallow, steel comes off the cutting edge first, and burning is a possibility on every pass. If the adjustment is slight, this shouldn't pose a problem—you'll only need a few passes anyway. But if you're steepening the angle considerably, blunt the cutting edge as described above, then grind the new bevel to meet it.

Once you've got the tool in shape, subsequent grinding is necessary only when you've honed the edge enough times that it becomes difficult or time-consuming to renew it on the stones. A few light passes on the grinder will usually remove all of the honed second bevel (which I'll explain soon), and you're ready to hone again. Since this "renewal" grinding can be done quickly, I usually hone a blade only four or five times before I regrind.

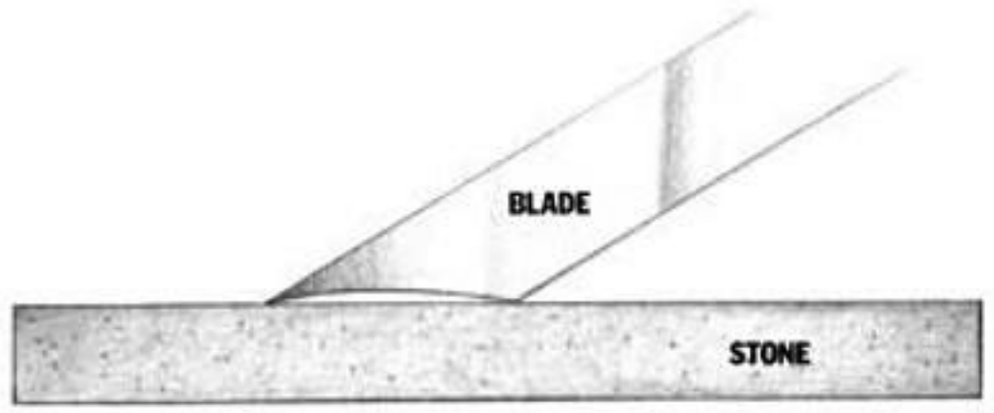
Honing: The Second Step

I hone a second bevel on my edge tools, as shown in the drawing in Fig. 3, in part because the slightly steeper angle of the second bevel puts a little more steel behind the cutting edge. But mainly I hone a second bevel because I find it quicker and easier to do than honing the entire ground bevel.

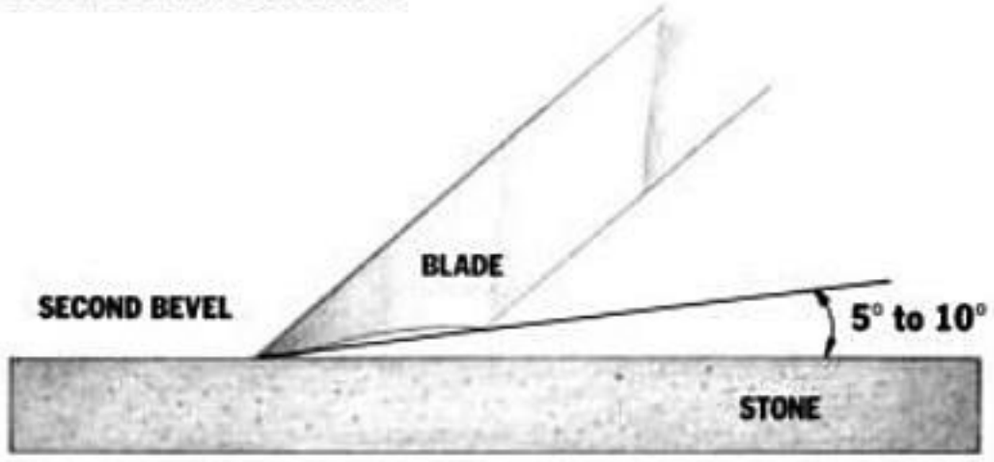
Although I use the tool rest on the grinder as a jig to establish the bevel angle, I prefer to hone freehand. It's faster than using a honing jig, and it really doesn't matter if the second bevel differs by a degree or two each time you hone. With a little practice, you can find and maintain the angle you want by feel.

I hold chisels and plane irons with one hand and steady the stone with the other, as shown in the photo, but you may find it more effective to use the two-handed grip. Either one can get you started. With a little experience, you'll modify the grip anyway, or develop your own. The grip is far less important than what you do with it.

FIG. 3: HONING A SECOND BEVEL



1. *Rest bevel flat on stone.*

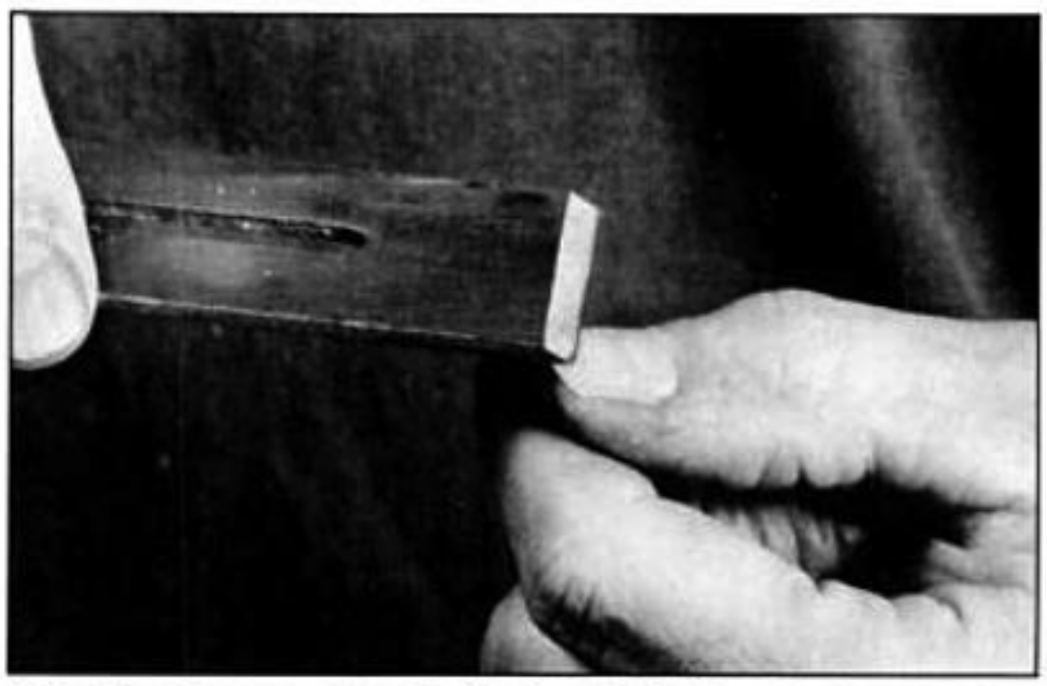


2. *Tilt blade up 5° to 10° and hone. Maintain angle so second bevel is flat.*

DRAWINGS BY SALLY CHICKA

Start by dribbling a little oil on the fine India stone. Grip the tool and rest the bevel on the stone. It's easy to feel when the heel and cutting edge of a hollow-ground bevel are in contact with the stone (which is one good reason for hollow grinding). Then tilt the blade up between 5° and 10° to form the second bevel. Don't bother trying to measure the angle—your eye and sense of feel will get you close enough.

Now, imagining that your forearm, wrist, hand and the blade are a single unit, draw the blade down the length of the stone, pulling from your elbow and shoulder. When you're near the end of the stone, lift the whole shebang (don't "break" your wrist), move it back to the other end of the stone, and do it again. If you have trouble maintaining the angle from stroke to stroke, try a continuous stroke, such as stroking back and forth or tracing a figure eight on the stone. To avoid wearing the stone unevenly, I try to move the strokes around to cover most of its surface. The figure eight accomplishes much the same thing.



To test for sharpness, turn the blade on its back and try to catch the cutting edge on your thumbnail. The sharper the tool, the lower the angle at which the edge will catch on the nail.

Remember: It doesn't matter a whit how you hold the blade, or what sort of pattern you trace with it on the stone. The only thing that matters is maintaining the angle you've established, stroke after stroke. You want a *flat* second bevel, not a rounded one.

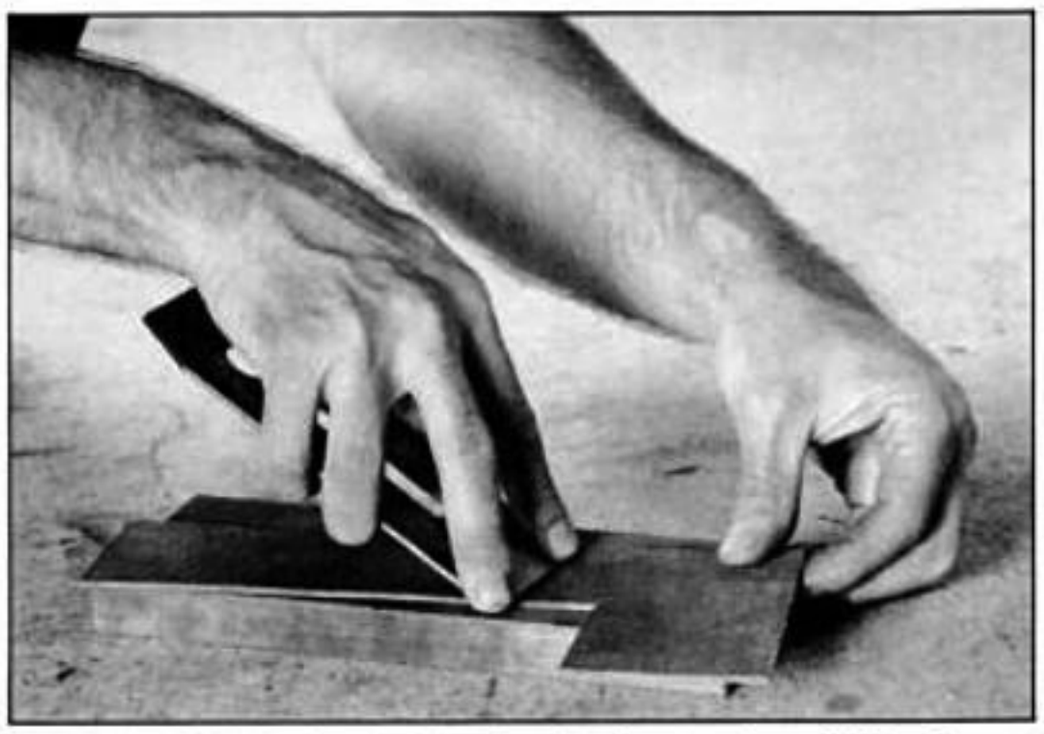
The Back of the Blade—Having spent so much time attending to the bevel, beginners often forget that it takes two surfaces to form the cutting edge. The back of the blade (at least the part of it that's adjacent to the cutting edge) must be polished as smooth as the bevel. And it must be dead flat, so after giving the bevel five or six strokes on the fine India stone, flop the blade over. Hold the back flat on the stone with one or both hands and move it back and forth on the stone, in a figure eight, or whatever. Just make sure to keep it *flat* on the stone.

Wipe off the slurry and examine the back near the cutting edge. What you want to see are tiny scratches left by the India stone along the entire surface adjacent to the cutting edge. Unfortunately, the backs of new plane irons or chisels are seldom flat, and what you're likely to see is a patchwork of scratched and unscratched areas along that surface. If so, you need to go back to the stone and work on the back some more. Flattening the back can be a tedious, time-consuming process. If the back is bad enough, you may want to work on a coarser stone. I find the coarse diamond stones work very well for initial flattening (available from Woodcraft). Fortunately, once you've established a flat surface along the length of the cutting edge, it is quickly extended with each subsequent honing.

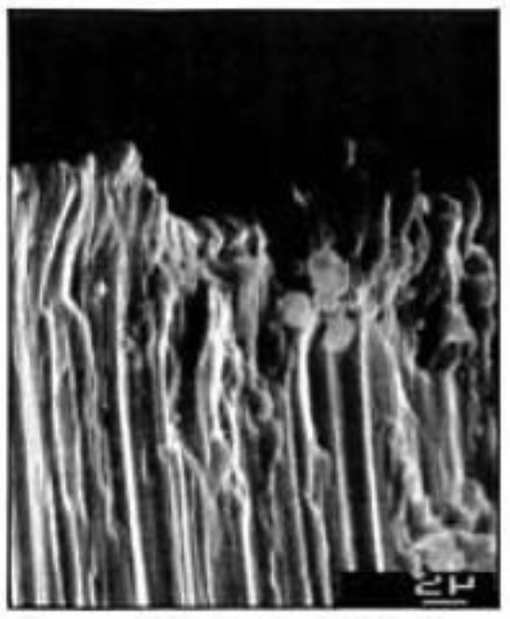
The process of grinding forms a small wire-like burr of steel along the cutting edge. Shifting from bevel to back, as you subsequently work the tool on the stones and the strop, eventually works off the burr.

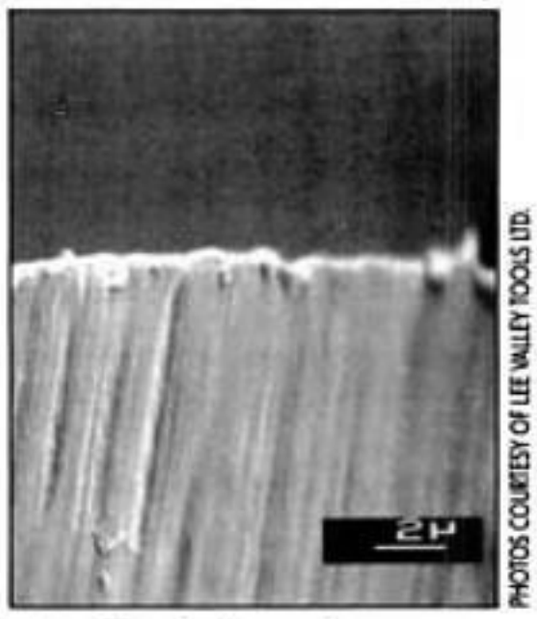
The amount of time I spend on the India stone varies. Three or four groups of four or five strokes on the bevel and a similar number on the back are usually enough to establish the second bevel. While this doesn't always remove the burr, it makes it a good deal more flexible. If I'm touching up the edge on a tool that I haven't had to regrind, I'll start on the India stone and work on it until I've created a smaller burr —one that's more easily felt with a finger than seen.

Next, move to the soft Arkansas stone, and hone on it in exactly the same way. Tilt the blade to establish the angle of the second bevel and stroke away. Flip the blade over, and work on the back. About the same amount of time on the Arkansas stone removes the scratches from the India stone, and usually, the burr. To test the edge, I turn the blade on its back and try to catch the cutting edge on my thumbnail, as shown in the photo. The sharper the tool, the lower the angle at which the edge will catch on the nail.



Finish the job by honing the bevel and back on a strop. Hold and move the blade as you do on the stones.





PHOTOS COURTESY OF LEE VALLEY TOOLS LTD.

The smoothest edge is the sharpest edge. The electron microscope reveals the difference between a new razor blade (right) and a chisel honed on a hard Arkansas stone (left). The bars indicate the size of 2 microns (2/1,000,000 meter) on the actual specimen.

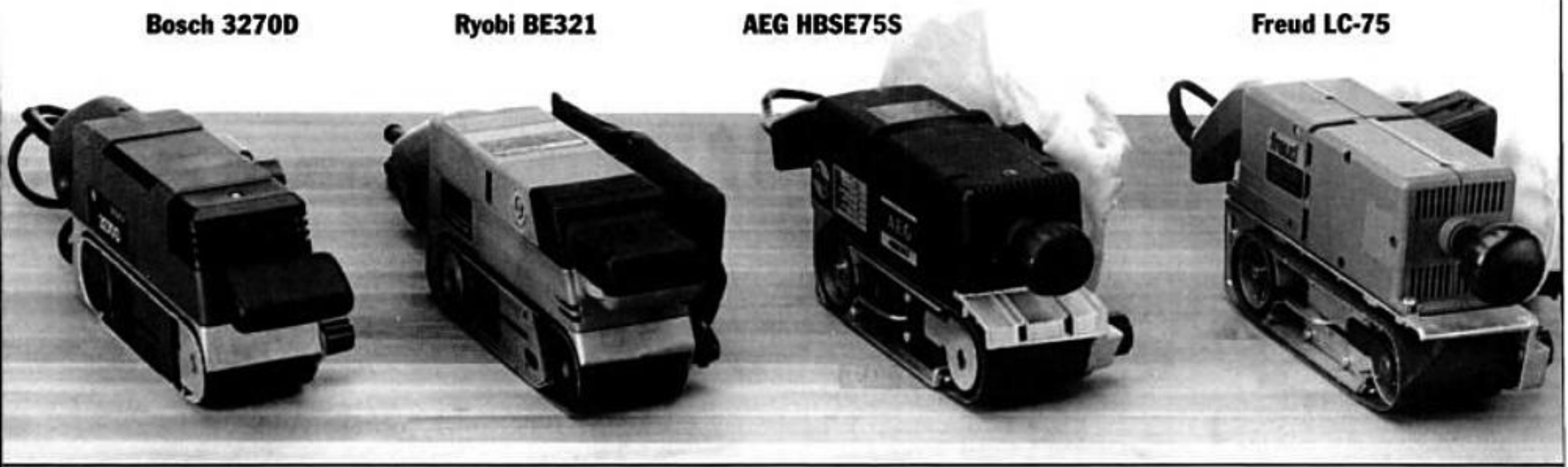
When the edge catches my nail at a fairly low angle, it's time to move to the strop. I place the strop on top of one of my stone boxes. I hold the blade and stroke the bevel and back just as if the strop were a stone, except I pull the tool toward me to avoid cutting into the leather. Because the strop is softer than the stones, there's a temptation to rock the tool up slightly when stropping the back. Don't. Be patient and keep at it. It shouldn't take too much stropping to produce an edge that will shave the hair off the back of your hand.

That shaving edge is the standard for sharpness that I lacked when I first started sharpening. Actually, I suspect that I read about it, but with the edges I was getting, I didn't believe it. Well, it's true. A sharp chisel or plane iron will slice those wispy little hairs right off. And, if you've been working with dull tools, the surface a sharp tool will produce and the ease with which it produces it will surprise you.

If sharpening is as simple as I've said, why, you may well ask, are you having such trouble with it? Because it's always more difficult to learn to do something by reading about it than by having someone show you how. I'm not there to help you when things don't happen the way I've outlined above. And they frequently don't. For example, I sometimes find myself working a tiny wire edge off on the strop, rather than on the stones. And I don't *always* end up with a razor edge. But then, I don't always need one. If I'm rough planing a stack of boards, a sharp edge, rather than a razor-sharp edge, is sufficient. When I'm ready to finish plane the stack, then I want an edge that will trim the hair off my hand.

So, keep at it. Learn to produce a razor edge, and to understand wood, tools and techniques well enough to know when you need one. It may take you hours of grinding and honing. But once you get the hang of it (and you will), it *will* be simple from then on. ▲

Roger Holmes writes and works wood in Woodbury, Conn.



BUYER'S GUIDE TO BELT SANDERS

New Features, Innovative Design, Clever Accessories

BY JIM BARRETT

Portable belt sanders are real workhorses. They can remove large amounts of wood in a hurry, which makes them ideal for removing planer marks or for smoothing large, flat surfaces. Getting a good, smooth surface depends partly on the size, weight, balance, power, handle shape and other design features of the sander. I'll discuss all of these features in this article.

Belt sanders are sized by the width and length of the belt they will accept. The available machines range from small, light-duty 3×18-in. models for fine work and sanding vertical surfaces, up to 4×24-in. brutes for tackling large panels and glued-up stock. Standard sizes include 3×18-in., 3×21-in., 3×24-in. and 4×24-in. Sears and Skil also offer models in non-standard sizes: 2½×16-in. (Sears and Skil), and 4×21-in. (Sears). Generally, tools at both ends of the size spectrum have limited applications; most of the manufacturers I spoke with agree that the 3×21-in. and 3×24-in. sanders are the most versatile for general purpose work. I lean toward the 3×24-in. machines because they sand faster and aren't much harder to control.

The 15 belt sanders I tried out for this article (marked with an asterisk (*) in the *model* column in the chart) are among the most popular models in the manufacturers' lines. I based my selection on several factors. First, I pretty much stuck with the 3×21-in. and 3×24-in. machines. In cases where a manufacturer offers more than one model in these sizes, I chose models that had new or especially useful features or accessories such as an improved design, variable speed, sanding frames, or vacuum attachments. The chart includes many more models that I didn't test.

Anatomy of a Belt Sander

The belt sanders on the market today fall into three groups based on the position of the motor in relation to the sanding belt. Typical representatives of the three groups are shown in the photo on the next page. Conventional belt sanders have a transverse motor (the motor is mounted across the width of the tool.) A newer generation of sanders has an in-line motor, mounted parallel to the length of the body. This gives them a clean, squared-off look. The lower profile lowers the sander's center of gravity and distributes the weight more evenly, making it less tipsy and easier to control. The third group is represented by two machines, the Black & Decker #7451 and the Metabo 0775. These machines have a low profile and low center of gravity, because the motor is between the front and rear rollers, inside the loop of the sanding belt.

The rear roller of a belt sander drives the belt. A lever on the side of most sanders retracts the free-wheeling front roller for belt changing. The Metabo uses a twist knob for belt release. Most sanders have a tracking knob that adjusts the angle of the front roller to keep the belt centered on the rollers. Skil and Sears have recently introduced models with an automatic tracking mechanism, which "reads" the position of the belt and changes the angle of the roller to keep the belt running true. After an initial adjustment, the models I tried tracked perfectly throughout my tests.

TONY SALAZAR

The base of the sander is designed to press the belt flat against the workpiece. It consists of a flat plate called a platen, covered by a replaceable slip plate. The conventional slip plate is a thin piece of stainless steel. The AEG, Freud and Metabo use graphite pads instead of metal slip plates, because the slick graphite surface produces less friction. At least two companies, Bosch and Porter Cable, offer graphite pads that can be retrofitted to their sanders.

Sanding Power

Speed of stock removal depends on the grit of the belt, the speed of the belt (measured in surface feet per minute, abbreviated 'sfpm'), the contact area (the area of the belt in contact with the stock), and the pressure applied by the operator. The faster the belt is traveling, the faster it will remove stock. Manufacturers usually list the no-load (freewheeling) belt speed in their literature. It ranges from 600 to 1550 surface feet per minute (sfpm). I've listed the no-load speed of each model in the chart.

Sanders with longer platens or wider belts have more belt surface contacting the work, so they sand faster, all other things being equal. Increasing the sanding pressure by bearing down on the tool will increase the speed of stock removal up to the point where the belt cannot carry away the dust any faster, or the belt slows down. But since the operator has to pay attention to controlling the machine, it is best if the necessary pressure comes from the weight of the tool itself. Too light a sander wastes motor power and the operator's energy.

Any increase in the speed of stock removal, whether by an increase in belt speed, contact area or pressure, will require an increase in motor power. Heavier sanders, wider belts, longer platens, higher speeds all require more powerful motors. Otherwise they simply slow down, heat up and burn out. Stock removal requires motor power, plain and simple. Amperage ratings are an accurate indication of power, so I've listed amperage in the chart.

Keep all of these considerations in mind as you look over the chart. In general, the sanders with more powerful motors, combined with larger belts and platens, will sand faster.

Features to Look For

So far, I've made some general comments about weight, balance, size and power. These factors affect the overall feel and performance of any tool and hold true no matter who is using it. But other design factors are a matter of personal preference.

Handle size, shape, and placement is subjective, depending not only on the style of handle you're used to, but the size and shape of your hands. For example, the front and rear handles on the Elu sanders are a bit too close together for my large hands. Also, I prefer large, flat, front handles over round knobs, because I believe they provide more positive control.

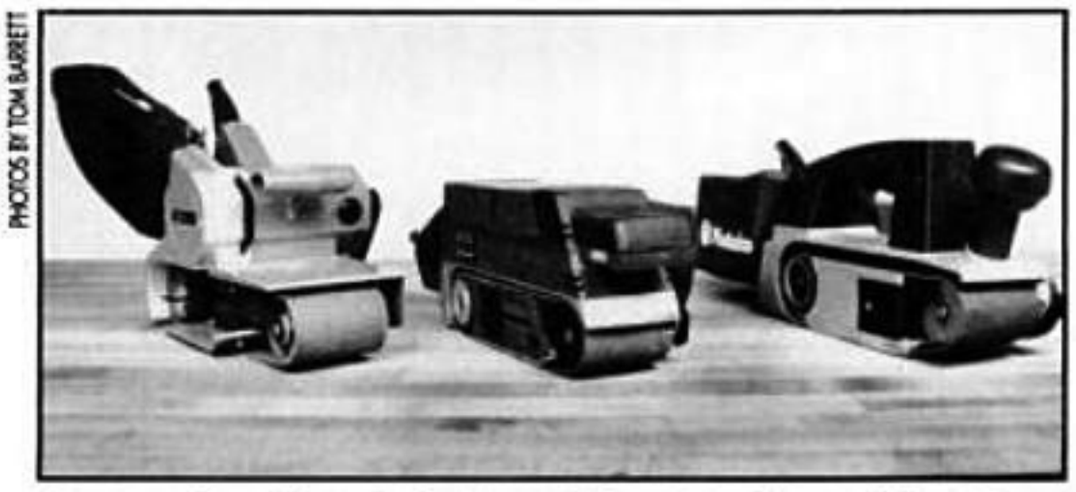
I found the top-handle sanders easier to lift on and off the workpiece and easier to carry around with one hand. They have a nice, comfortable balance to them. But don't expect to use them with only one hand.

The handles on the Milwaukee 5925, Porter Cable 360 and Sears 9HT11715 made them the most comfortable transverse-motor machines for me. Among the in-line machines, the Bosch 3270D, Ryobi BE-321, and Skil 7621 got the comfort prize.

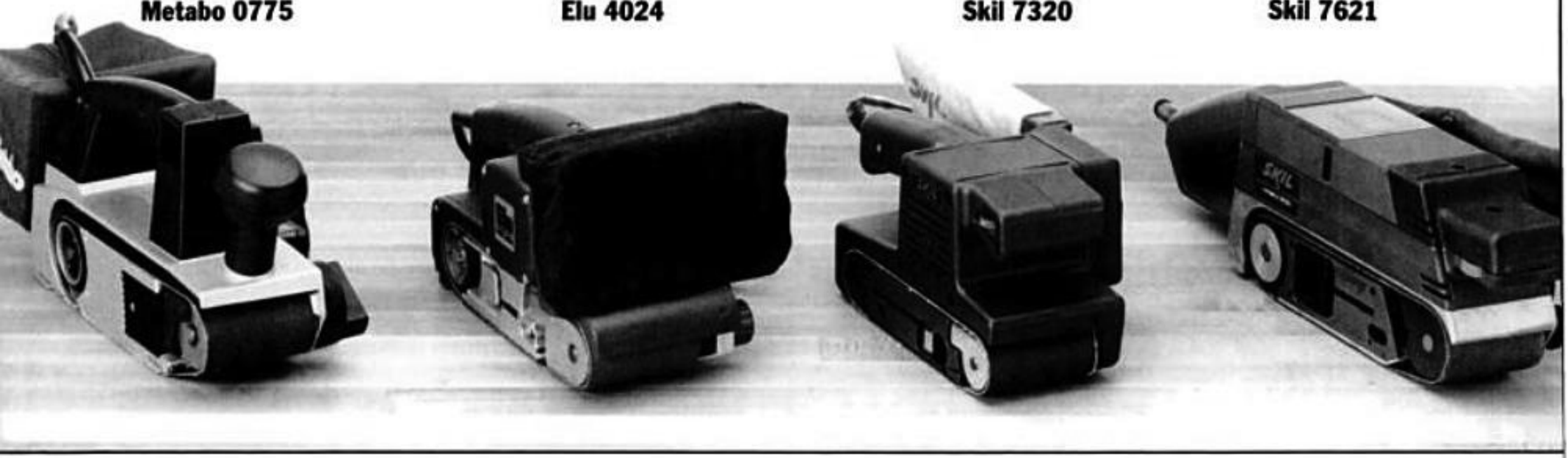
Variable-speed sanders are more versatile than one- or two-speed sanders. You can slow down the speed to control material removal when sanding veneered stock or plywood, and you can select the optimum speed for sanding materials such as plastics and nonferrous metals. The chart indicates which models have this feature.

Control mechanisms should be readily accessible and easy to operate. Unfortunately, making them accessible for right-handed operators often means mak-

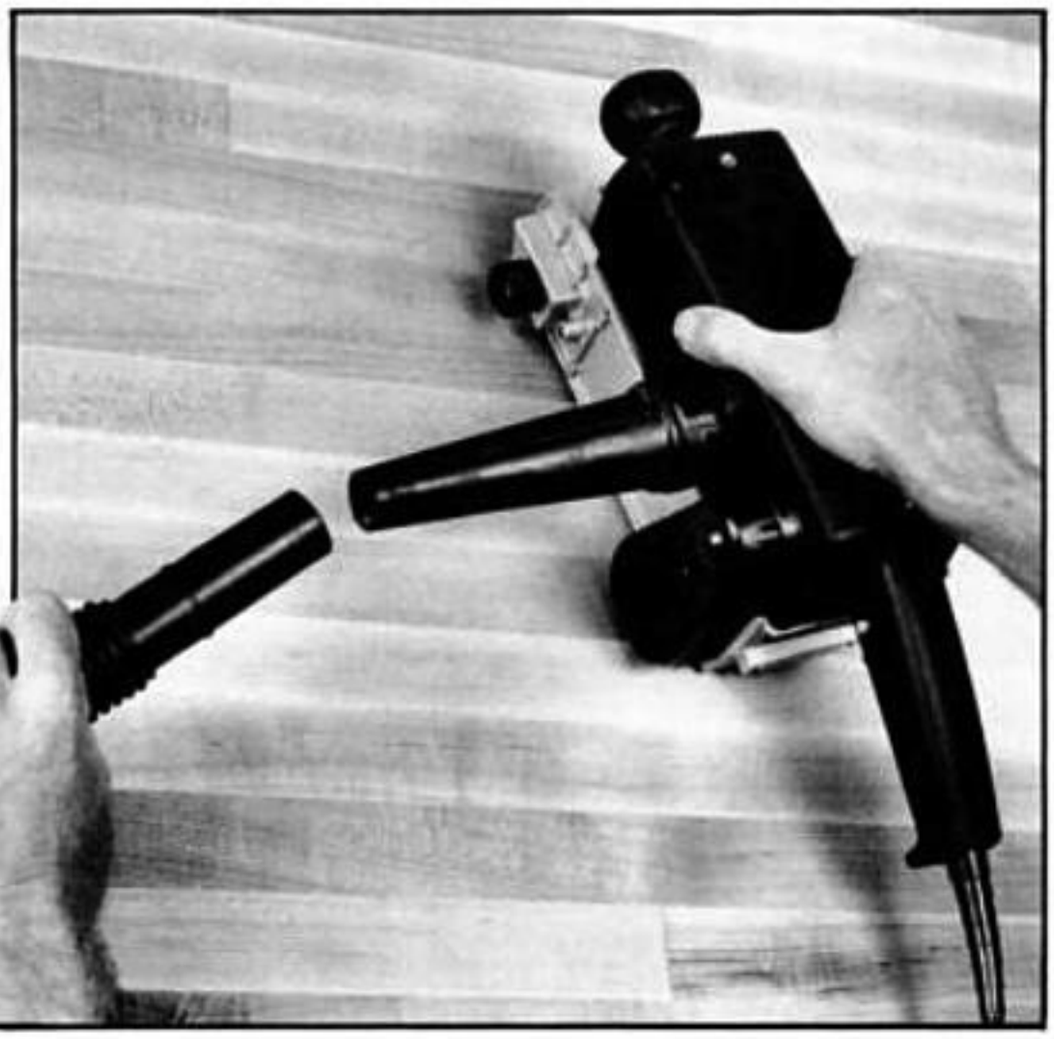
PHOTOS BY TOM BARRETT



Motor position affects the balance of the sander. The available choices include the traditional transverse motor mount (Hitachi SB8T, left), the newer in-line motor mount (Skil 7621, center), and the innovative inside-the-belt motor mount (Metabo 0775, right).



A well-designed sander captures the dust but keeps the dust bag out of the way. The Metabo (left) uses a rear-mounted bag; the Porter Cable bags (right) can be pivoted.



A shop-vac hookup such as this AEG tapered universal-hose connection captures more dust than a dust bag but can be cumbersome to work with.

ing them inaccessible for left-handed operators. If you're left-handed, your best bet will be to try the controls before buying a sander. You'll find that switch lock buttons don't vary much, but speed-control knobs do. On the Skil and Ryobi the knob is on the right side of the front handle, permitting easy thumb operation while sanding right-handed. On the AEG, the knob is to the right of the rear handle, accessible with either hand, but you may have to stop sanding to adjust it. On the Elu models it's on the left side of the rear handle, and you'll definitely have to interrupt your work to change speeds.

Other features to look for: Some sanders are designed to sand flush to a corner on the "open" side of the machine. On others, you can't, because the platen or the motor housing projects past the edge of the belt.

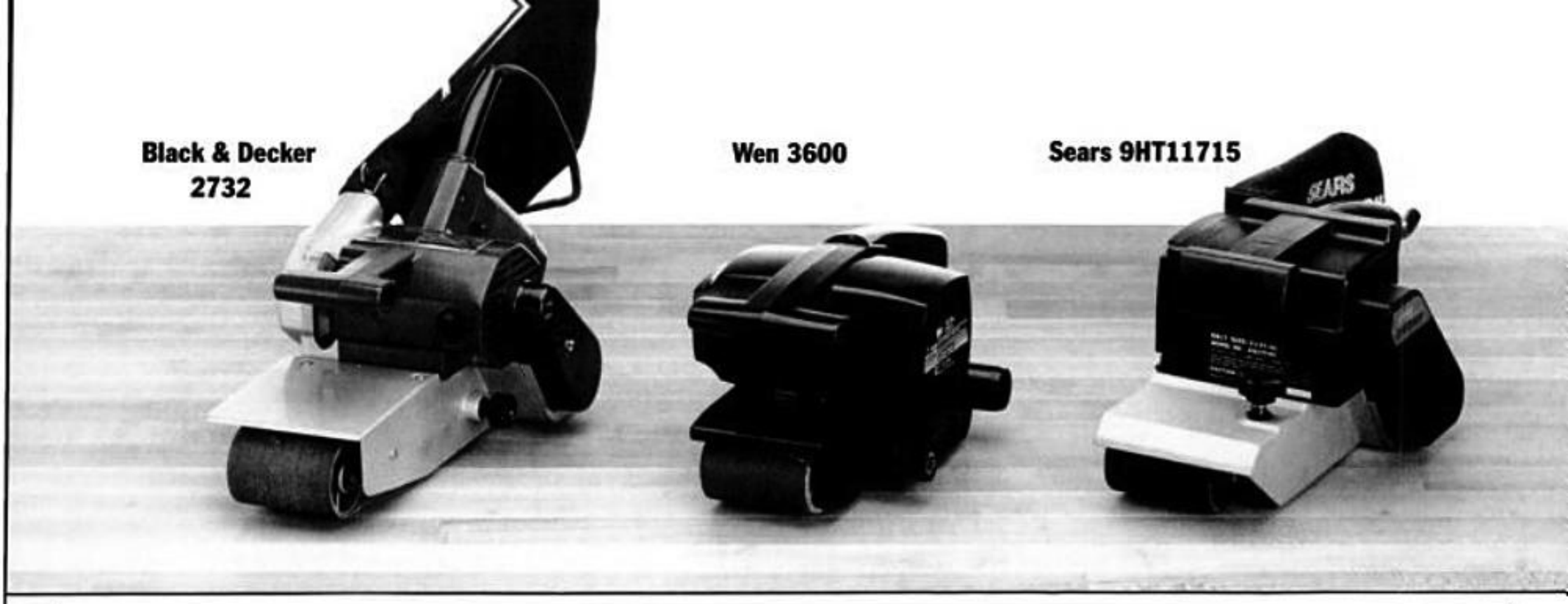
Some sanders have flat tops and handles which enable you to clamp them upside down on your workbench for use as a bench tool. Skil and Ryobi have a special clamp set for bench-mounting their sanders (Ryobi BE-321, Skil models 7313, 7320, 7621).

Although not a "flat-top," the Metabo has a large square hole in the front end of its rear handle for clamping it to a bench. Other sander models feature accessory stands for vertical or horizontal mounting. (See photo.)

Belt sanders should have long, heavy-duty power cords: long so they can't jerk the sander to a stop on a large project, and heavy-duty so they withstand abrasion from being dragged around and from the occasional encounter with a moving sanding belt. Also, check where the cord is connected to the tool. The cords that I find most convenient are those that connect near the top of the rear handle at an upward angle, like on the Porter Cable, making it easier to sling the cord over my shoulder to keep it from underfoot.

Dust Collection: A Must

Belt sanders produce clouds of dust that present a health hazard and mess up the shop. You shouldn't even consider buying a belt sander without some sort of dust collection. Most of them come with dust bags as standard or optional equipment. (See photo.) In fact, my research turned up only three models without them: the Black & Decker 7447, Skil 7102, and the Wen 3600. The Wen has a dust pickup port and accessory hose that fits 1¼-in. tank-type vacuums. Skil has an accessory vacuum pickup frame and hose attach-



MAKE	MODEL	LIST PRICE	BELT SIZE	SPEED	AMPS	MOTOR TYPE	SANDING AREA	SANDS FLUSH?	DUST BAG?	CORD (ft.)	WT. (lbs.)	ACCESSORIES
AEG	HBSE75S*	$269	3×21	660-1250v	7.8	I	3×5¼	Yes	Yes	12	8.4	S,sf,v,f,GP
BLACK AND DECKER	7447	$ 89	3×21	600	3.4	T	3×4½	Yes	No	6	7	
	7451	$231	3×24	1200	5.2	B	3×4½	No	Yes	6	8.5	
	2732*	$295	3×24	1180/1475[2]	8.7	T	3×4¾	No	Yes	8	9.7	
BOSCH	3270D*	$235	3×21	1080	5	I	3×6⅛	Yes	Yes	8	7.9	s,sf,v,gp,f
	1272D	$309	3×24	1550	10.5	T	3×6	No	Yes	8	14	v,gp
	1273DUS	$349	4×24	1150-1550v	10.5	T	4×6	Yes	Yes	8	14.8	v,gp
ELU	4023	$278	3×21	1100	5.2	T	3×5¼	No	Yes	10	6.2	s,sf,f
	4024*	$307	3×21	475-1100v	5.2	T	3×5¼	No	Yes	10	6.2	s,sf,f
	4029	$499	4×24	1250	9.2	T	4×4⅓	No	Yes	10	13.9	sf
FREUD	LC-75*	$290	3×21	1475	9.6	I	3×5¼	Yes	Yes	7.5	10.5	GP
	LC-110	$311	4×24	1475	9.6	I	4×6½	Yes	Yes	7.5	11.6	GP
HITACHI	SB-75	$255	3×21	1175/1475[2]	8.7	T	3×4¾	No	Yes	8.5	10.8	s
	SB8T*	$255	3×24	1175/1475[2]	8.7	T	3×5	No	Yes	8.5	11.4	s
	SB10T	$311	4×24	1150/1380[2]	8.7	T	4×6½	No	Yes	8.5	11.7	s,sf
MAKITA	9900B	$268	3×21	1180	7.8	T	3×5	No	Yes	17	10	
	9924DB*	$282	3×24	1300	7.8	T	3×6⅓	No	Yes	17	10.5	
	9401	$324	4×24	1148	8.5	T	4×6⅓	No	Yes	17	16	s
METABO	0775*	$291	3×21	1300	5.5	B	3×5¾	Yes	Yes	14	10	GP
MILWAUKEE	5925*	$337	3×24	1400	10	T	3×6½	No	Yes	8	13.75	
	5936	$348	4×24	1400	10	T	4×6½	Yes	Yes	8	14.5	
PORTER CABLE	352	$235	3×21	1300	7	T	3×5	Yes	Yes	7	10	v,gp
	503	$535	3×24	1500	9	T	3×5⅜	No	Yes	7	15	gp
	360*	$310	3×24	1500	10.5	T	3×5⅜	No	Yes	7	14.5	v,gp
	362	$325	4×24	1550	10.5	T	4×5⅜	No	Yes	7	16.5	v,gp
RYOBI	B-7505	$219	3×21	1180	8.4	T	3×5¼	Yes	Yes	7	9.6	c
	BE-321*	$244	3×21	775-1148v	5.4	I	3×5¼	Yes	Yes	7	7.9	s,sf,f
	B-7100	$281	3×24	1500	8.4	T	3×7⅝	Yes	Yes	7	9.7	c
	B-7200A	$351	4×24	1148	8.7	T	4×6¾	Yes	Yes	14	16.5	s
SEARS	9HT11715*	$ 76	3×21	1300	7.5	T	3×4⁷/₁₀	Yes	Yes	6	12.7	c,s
	9HT11792	$ 92	4×21	1300	7.5	T	4×4¾	Yes	Yes	10	18	s
SKIL	7102	$ 67	2½×16	600	2.8	T	2½×4½	Yes	No	8	4.5	v
	7313	$ 70	3×18	700	4.5	T	3×5⅛	Yes	Yes	8	5.25	s,sf,f
	7320*	$ 97	3×18	450-700v	4.5	T	3×5⅛	Yes	Yes	8	5.25	s,sf,f
	7621*	$235	3×21	775-1150v	6	I	3×5⅜	Yes	Yes	8	8	s
	7724	$250	3×24	1500	9	T	4×7	No	Yes	8	9.75	
WEN	3600*	$ 79	3×18	1000	4	T	3×3	No	No	6	6.5	v

KEYS TO CHART

Model: * = tested & pictured

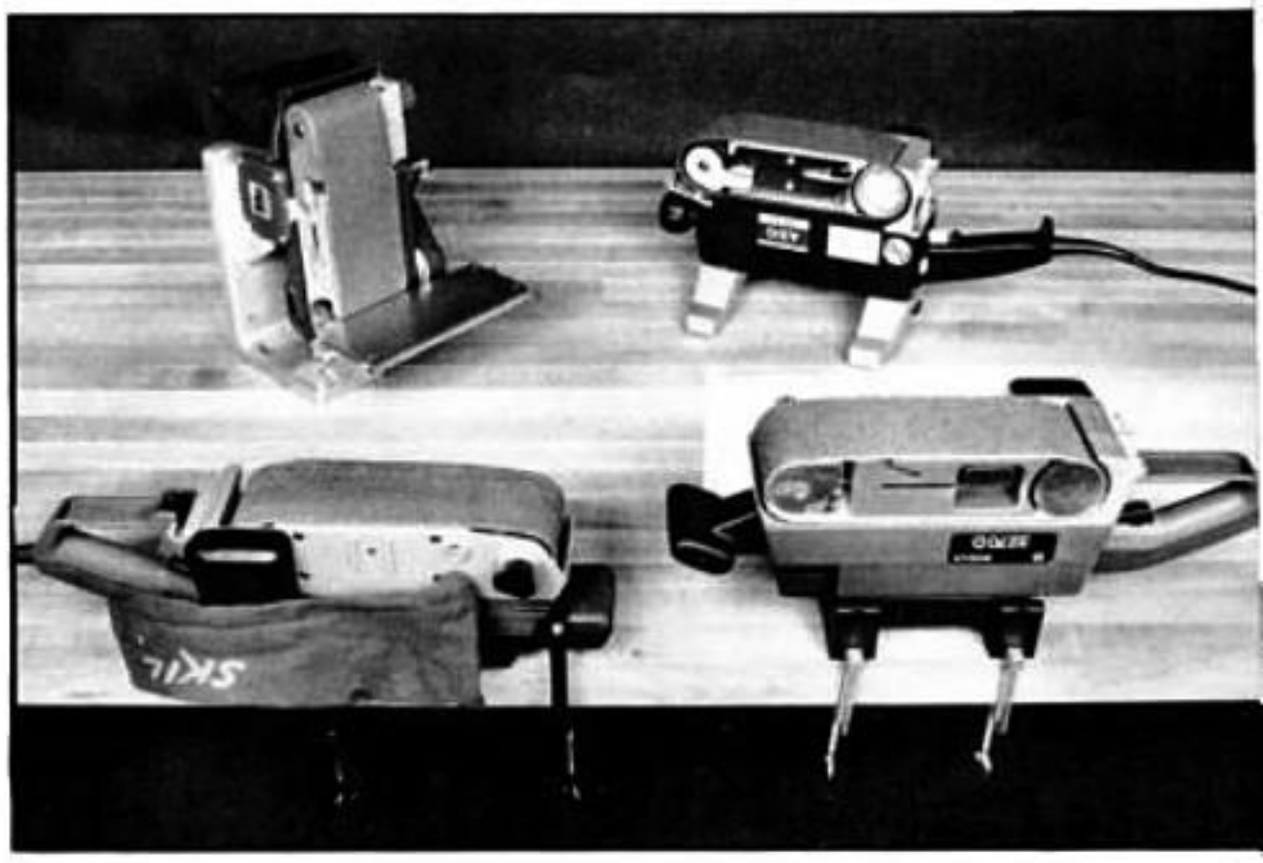
Speed: v = variable speed, 2 = two-speed

Motor: I = in-line, T = transverse, B = between the rollers

Accessories: capital letters = included in price
small letters = available at extra cost

S = stand(s) or clamps for bench mounting
SF = sanding frame
C = carrying case
V = vacuum attachment
F = adjustable side fence
GP = graphite pad

A sanding frame tames the beast; it prevents the sander from tipping, gouging, or excavating valleys in your work. Shown, from left to right, Skil, Elu, Bosch and AEG.



Clamps and stands turn a portable sander into a stationary tool, a useful feature when the stock is smaller than the sander.

ment that clips onto the base of the 7102, but it doesn't fit their other machines. Makita, Milwaukee, Porter Cable and Sears offer a machine that comes with and without provision for dust collection; for example, the Porter Cable 351 (no dust port) and 352 (with dust port). Although some of the sanders that I tried did a slightly better job of bagging dust than others, (the Porter Cable, Milwaukee, Freud, and AEG are especially clean machines) all kicked out a certain amount of airborne dust, so I strongly suggest wearing a dust mask as additional protection.

During my tests, I noticed that the dust bags on most of the transverse-motor machines are positioned to the right of the rear handle and project out past it. The bags on these tools always seemed to be in the way when I used them left-handed. I like the dust bag on the Porter Cable because a metal elbow connection enables you to swing the bag to any position so it won't interfere with the work or block your vision. The rear-mounted bag on the Metabo is also a nice arrangement. The bags on the Elu machines are placed neatly in front of the motor, but they're a bit small. The side-mounted bags on the in-line machines posed no particular problems.

The vacuum attachment on the relatively few tools that have this option (see chart) provides virtually dust-free sanding, with the added benefit that you don't have to interrupt work to empty a dust bag. But there's a trade-off; dragging a vacuum hose around behind the sander makes it clumsy to use on large projects.

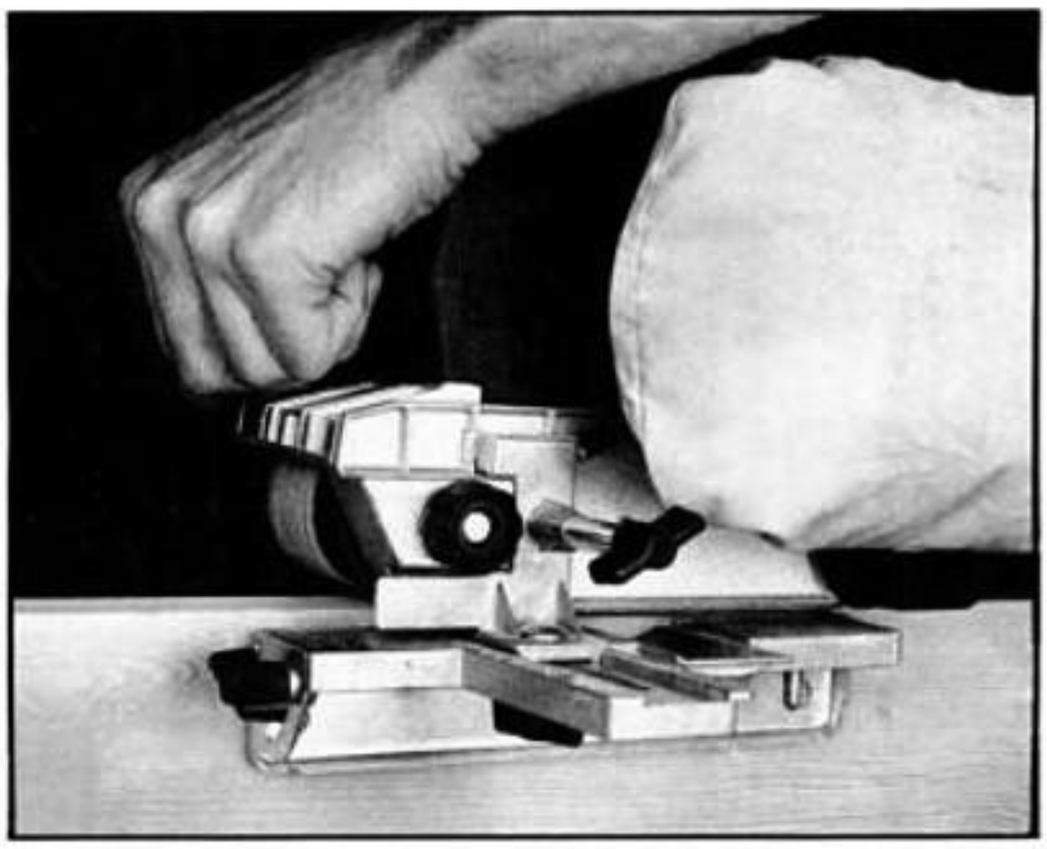
Accessories

Other than dust collection, which I consider essential, the only "accessory" you absolutely need is a sanding belt. Standard sizes are available at just about any place that sells tools. Odd-size belts may be harder to come by; you may need to order them directly from the sander manufacturer.

A sanding frame (see photo) is a useful optional accessory, especially for inexperienced users who have a hard time getting a smooth, flat surface with a belt sander alone. The square frame attaches to the bottom of the sander base, surrounding the belt. It practically guarantees "goof-proof" sanding in several ways. The frame's flat base keeps the sander from tilting or rocking, and it helps prevent the sander from rolling over the edge of a workpiece, rounding it over. The frame makes the sander work much like the sole of a plane, enabling the belt to remove material from high spots while skipping over depressions, resulting in a uniformly flat surface. Sanding frames have depth-adjustment knobs to give you precise control over the amount of stock removed with each pass, so you don't need to worry about sanding through thin veneers if you pause in one spot or apply too much downward pressure on the tool.

The bottom of the frame must ride smoothly on the surface being sanded. The AEG and Bosch units have brush skirts. (The bottom of the frame has dozens of small brushes with accurately trimmed bristles.) The bases on the Hitachi and Elu frames are covered with a slick phenolic plastic material such as that used on some router bases. The Skil frame is all steel. I liked the positive contact and solid feel of the plastic-bottom Ryobi frame, but the brush-bottom frames seemed to ride better over uneven surfaces. Keep in mind that a frame prevents sanding right up to an inside corner and must be removed for belt changing.

Inversion stands and brackets (see photo) enable you to mount the sander on a bench. You can mount the support stands for Elu and Bosch machines either vertically or horizontally, and use them in conjunction with an optional adjustable fence for safely



A side fence such as this AEG accessory guides the sander through tricky jobs such as bevel-sanding a narrow edge.

Stock removal requires motor power, plain and simple. Amperage ratings are an accurate indication of power.

sanding small objects or for sharpening tools. The Sears vertical stand with adjustable work table fits most of its sander models. Horizontal support brackets are standard equipment with the AEG. Hitachi also offers horizontal inversion stands for its sanders.

Adjustable side fences (also called parallel-angle guides) are available for the AEG, Bosch and Elu sanders. The fences adjust from 0° to 45°. They are particularly handy for sanding square or beveled edges. You can use the guides in conjunction with the inversion stands for precision stationary sanding. A non-adjustable 90° side fence is available for Skil models 7313 and 7320. Ryobi offers a fence which mounts crosswise to the belt for benchtop use.

AEG, Bosch, and Elu offer the widest range of add-on accessories for their tools. I'd like to see more models with variable speed, optional sanding frames and adjustable side fences, especially in the 3×21-in. and 3×24-in. size category. Unfortunately, the Skil sanding frame fits only the 3×18-in. consumer model, and the Hitachi frame, the large 4×24-in. sander.

The Final Analysis

After becoming familiar with the tools I tested, I listed the features I liked best. Keep in mind that these include some personal preferences. Taken together, they describe my ideal sander. It would be a 3×24-in. in-line machine with a 10-amp, variable-speed motor, good balance, comfortable handles, the rear-mounted dust bag and twist-type belt-release knob of the Metabo, the automatic tracking of the Sears or Skil, graphite slip plate, flush-sanding capability, and the 14-ft. to 17-ft. cord of the Metabo or Makita. Accessories would include an easy-mount, brush-type sanding frame like that of the Bosch, the two-position inversion stand and adjustable tool rest of the Elu, an adjustable side fence, and a dust-collection hose that fits my shop vacuum. Obviously no such tool exists—yet. But you might find it helpful to go through this exercise yourself; then go back and prioritize the features you want, and make your final choice among the tools that meet the top requirements on your list. If I had to pick a favorite, it would be the Bosch 3270D because of its overall performance and combination of features. The Metabo's power, clean dust pickup and dust-bag placement make it a close second choice. ▲

SOURCES

For the name and address of your nearest dealer, write:

AEG Power Tool Corp.
3 Shaw's Cove
New London, CT 06320

Black & Decker
10 North Park Dr.
P.O. Box 798
Hunt Valley, MD 21030

Robert Bosch Power Tool Corp.
3701 Neuse Blvd.
New Bern, NC 28560

Elu
(See Black & Decker)

Freud USA, Inc.
P.O. Box 7187
218 Field Ave.
High Point, NC 27264

Hitachi Power Tools USA, Ltd.
4487 E. Park Dr.
Norcross, GA 30039

Makita USA, Inc.
14930-C Northam St.
La Mirada, CA 90638

Metabo Corp.
1231 Wilson Dr.
P.O. Box 2287
West Chester, PA 19580

Milwaukee Electric Tools
Subsidiary of Amstar Corp.
13135 Lisbon Rd.
Brookfield, WI 53005

Porter Cable
Young's Crossing at Hwy. 45
P.O. Box 2468
Jackson, TN 38302

Ryobi America Corp.
1424 Pearman Dairy Rd.
Anderson, SC 29625

Skil Corp.
Subsidiary of Emerson Electric Co.
4300 W. Peterson Ave.
Chicago, IL 60646

Sears
Sears Tower
Chicago, IL 60646
(Order through nearest Sears store)

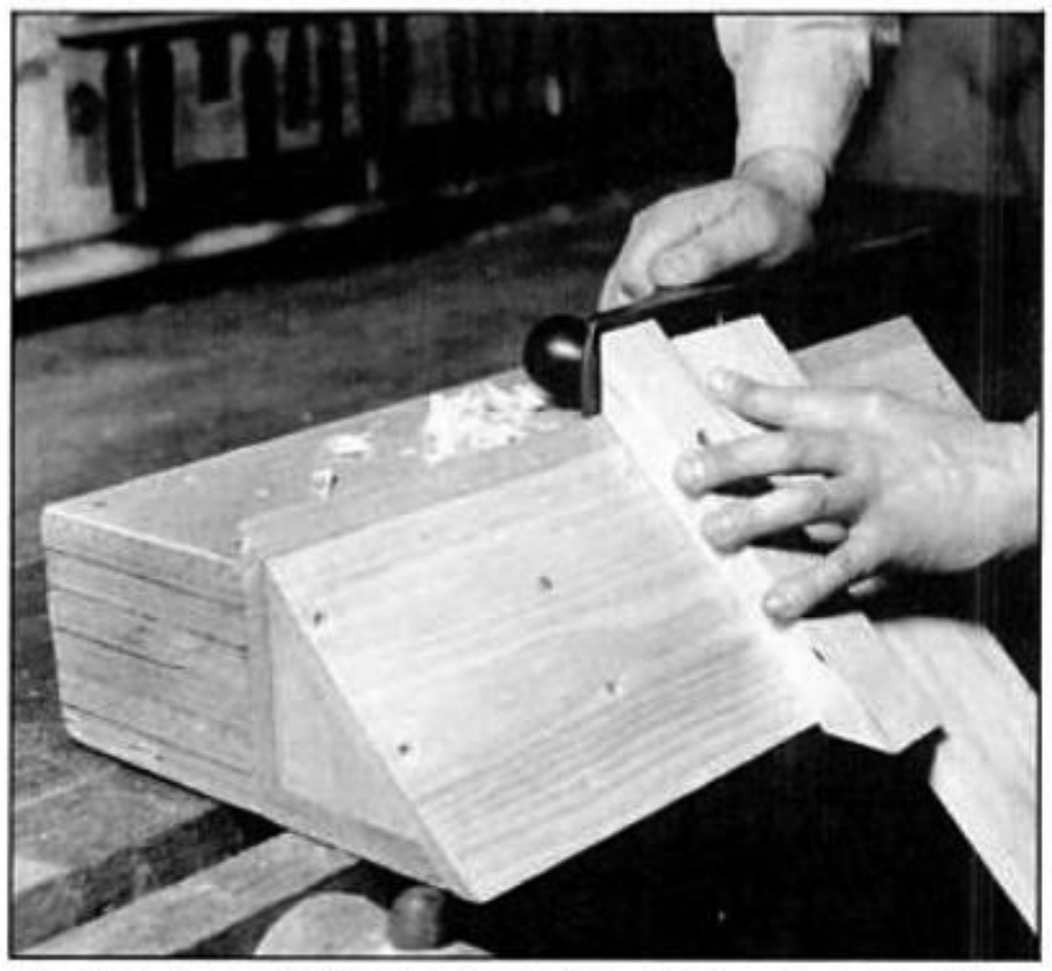
Wen Products, Inc.
5810 Northwest Highway
Chicago, IL 60631

Jim Barrett is a freelance writer specializing in woodworking tools and finishes. He wrote about doweling jigs in the July/August, 1988 AW, *honing guides in the July/August, 1989* AW, *and carbide saw blades in the March/April, 1990* AW.

The miter shooting board helps you trim perfect-fitting miters with a hand plane.

SHOOTING MITERS

Two Hand-Plane Jigs for Gap-Free Corners



The donkey's ear shooting board is for trimming box or carcase miters.

BY MIKE DUNBAR

A shooting board is a jig that allows you to make accurate cuts with a hand plane. In the March/April, 1989 *AW*, I described the joint-and-square shooting board, a jig for squaring the edges and ends of small pieces of wood. There are two other types of shooting boards that you may find just as useful. The first is the miter shooting board, and the other goes by the colorful name of "donkey's ear." These two shooting boards are used for trimming miters so they'll fit perfectly. They are inexpensive, easy to build in the shop and offer a safe, dust-free alternative to machine methods of trimming miters.

The miter shooting board is for trimming flat miters for picture frames or door casings. The donkey's ear is for trimming miters used in the sides of a box or the base for a chest of drawers. The work done on these devices is called "shooting;" when trimmed in this way with a plane, a surface is said to have been "shot."

I suggest that you make the miter shooting board first, so you can use it when making the donkey's ear. The dimensions in Figs. 1 and 2 are for my shooting boards and are suitable for the large pieces I encounter in architectural restoration. Feel free to adapt the dimensions to suit your needs.

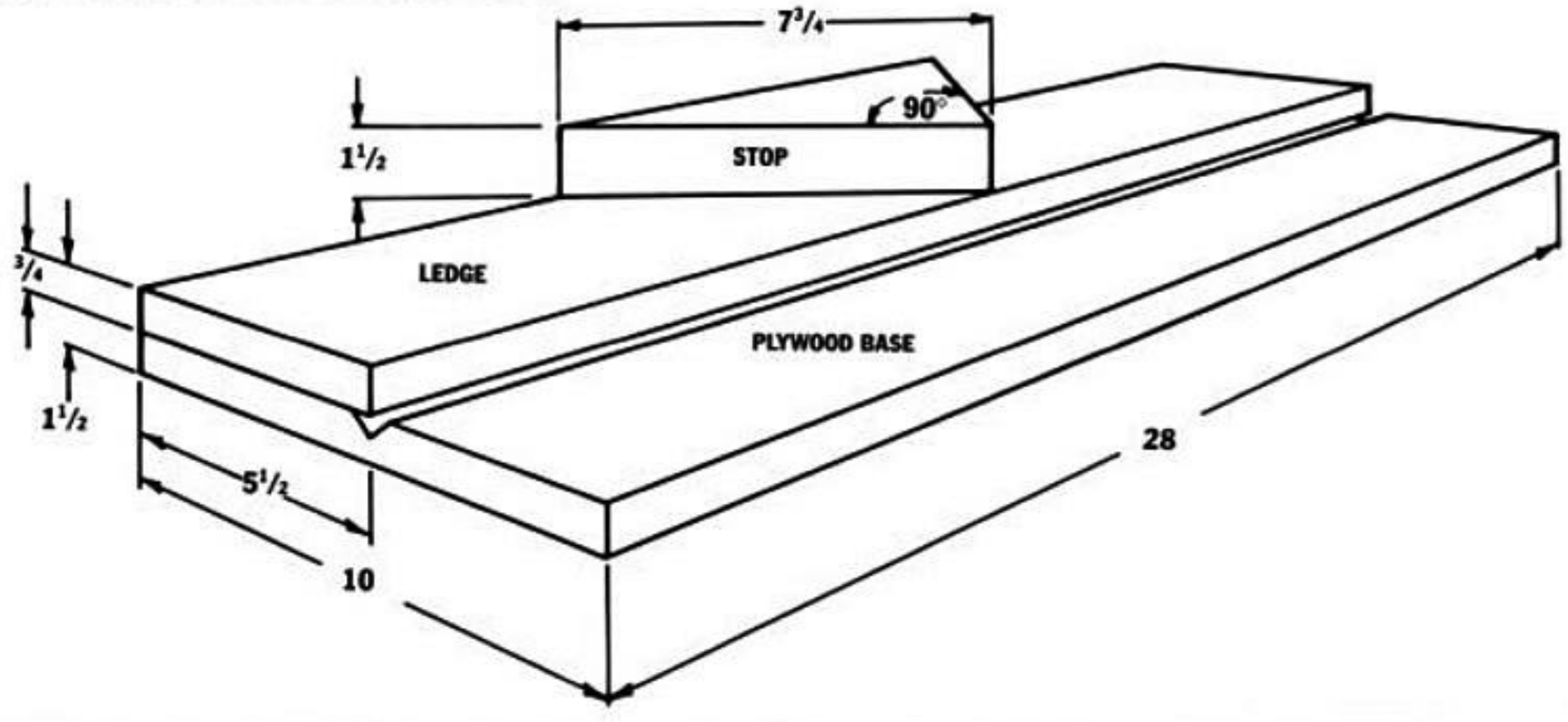
Miter Shooting Board

The miter shooting board is very similar to the joint-and-square. If you haven't already made a joint-and-square shooting board, you may want to dig up the March/April, 1989 *AW*, and look it over. Both shooting boards have the same three key parts; a base, a raised ledge and a stop.

The base is simply a flat board. But if you use a piece of solid lumber, it may warp with seasonal humidity changes. This would affect accuracy. So I made my base of lauan plywood, which is very stable and

PHOTOS BY ANDY EDGAR

FIG. 1: MITER SHOOTING BOARD



DRAWINGS BY FRANK ROHRBACH

has a smooth face. Birch plywood is also good.

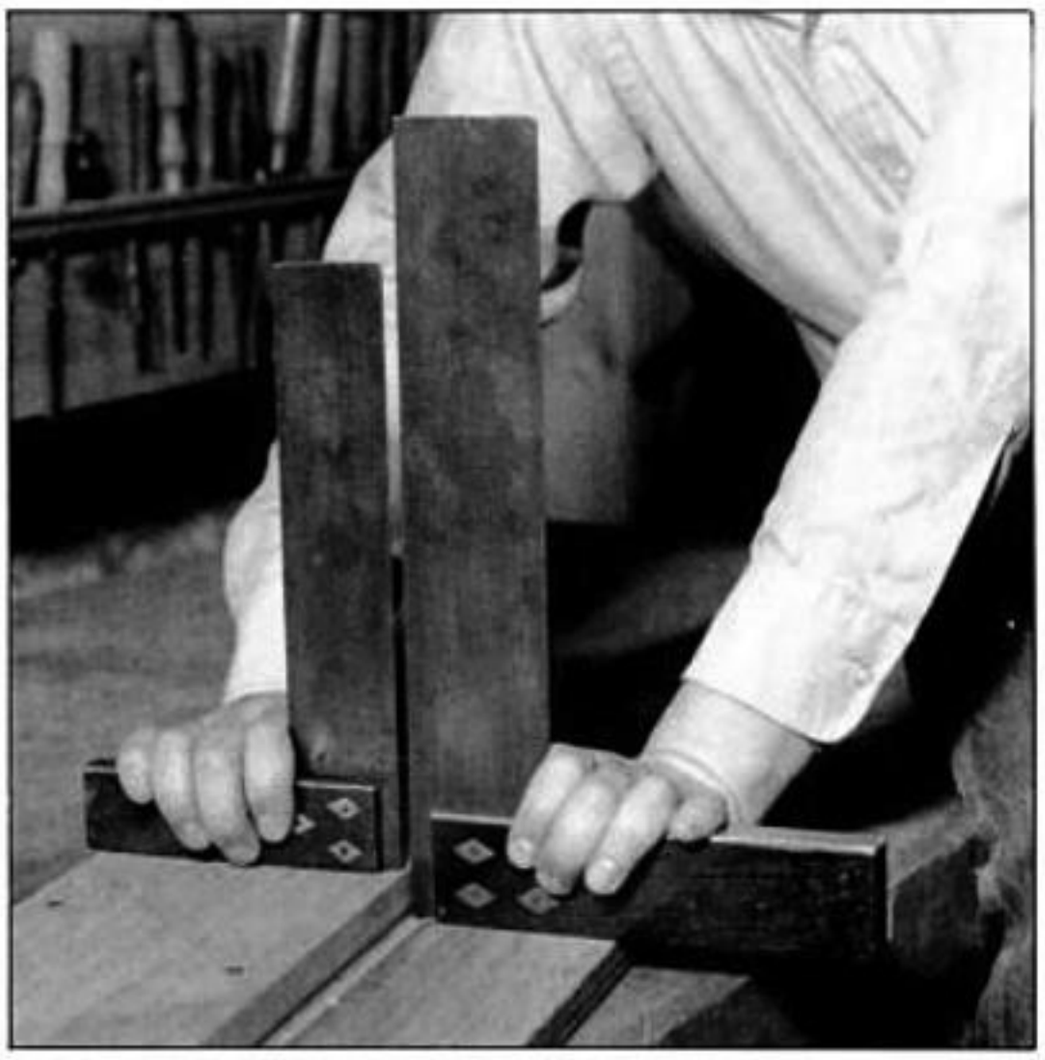
The ledge supports the workpiece while the plane runs along its edge. It's narrower than the base, exposing enough of the base for the plane to ride on. I made the ledge of Eastern white pine. Since you must be able to plane in both directions on a miter shooting board, the ledge cannot be tapered, as recommended for the joint-and-square shooting board.

Dust and chips can gather in the corner formed by the base and ledge and lift the plane out of square. To prevent this, make a V-groove in the base where the debris can settle. I did this by marking where the edge of the ledge came, and then used a rabbet plane, held on one corner of its sole, to cut the V-groove.

Next, I attached the ledge to the base with countersunk screws. The exposed surface of the base and the upper surface of the ledge must be perfectly parallel. I tested them by placing the stock of a try square on each surface, as shown in the photo. When the blades of the two squares are brought together, they should be parallel. If not, adjust the surface of the ledge with a hand plane.

The stop is made out of hardwood. Because it holds the workpiece at 45° to the edge of the ledge, it is important to get it just right. It has to be a perfect right triangle (a triangle with one 90° angle and two 45° angles), with its edges square to its faces. To get the 90° angle, I jointed one edge and squared one end of an 8-in. wide board. I don't own a jointer or a tablesaw, so I did this on my joint-and-square shooting board. Then with a 45° square and a saw, I marked out and cut off the square corner, giving me a block that formed a right triangle.

After cutting out the stop, drill and countersink a series of screw holes along the outer edges of the stop, as shown in the drawing. Mark the edge of the ledge at the halfway point. Place the 90° corner of the stop at this mark, and put in a screw, but only tight enough so that the stop pivots with effort.



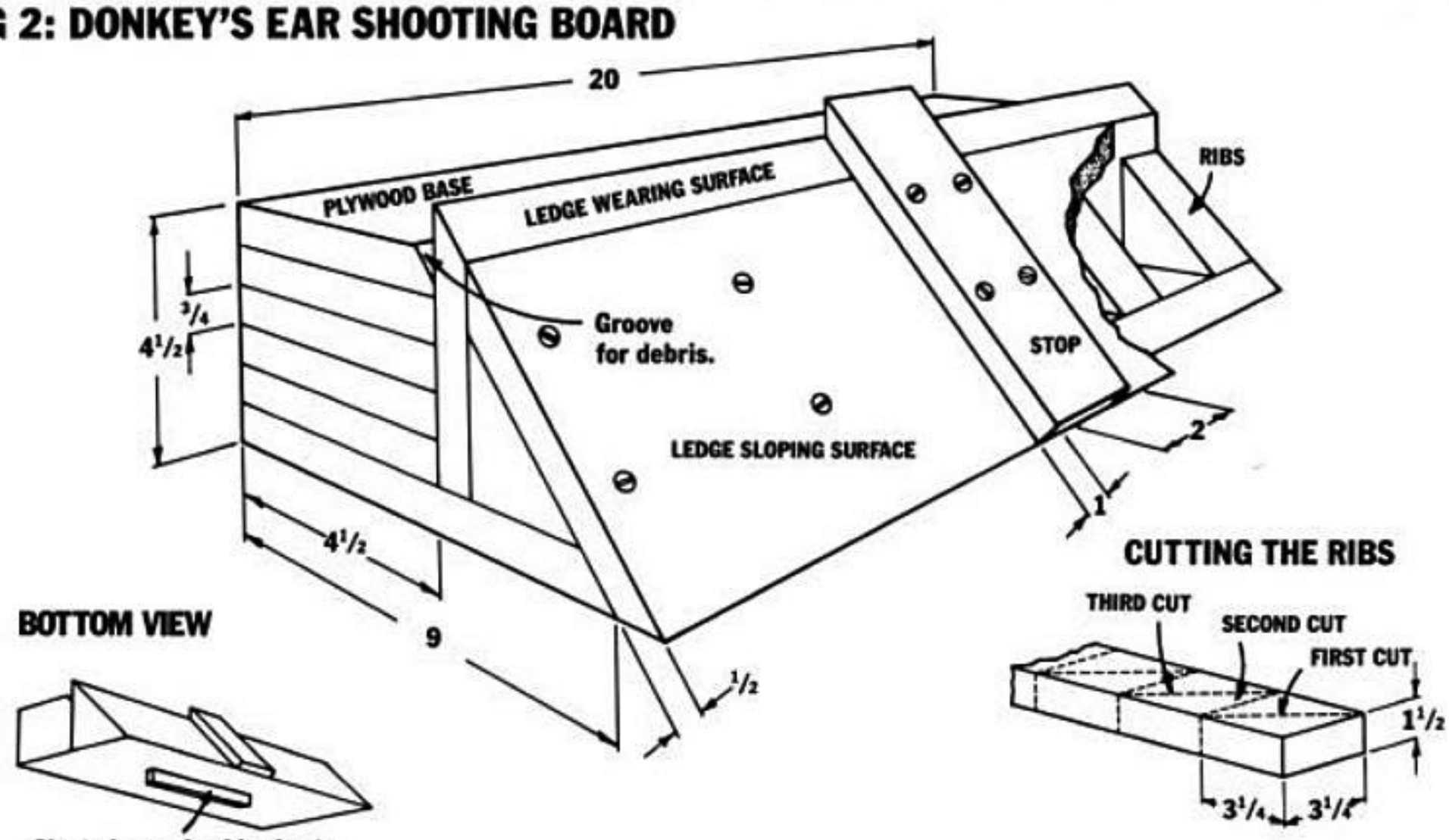
Use two squares to set up the ledge parallel to the base. When the square blades are parallel, the ledge and base are parallel.

Set a 45° square on the edge of the ledge, and rotate the stop until its edge presses against the square. The other side should now also form a perfect 45° angle, but check it to be sure. Finally, drive and tighten all of the screws that hold the stop to the ledge.

Donkey's Ear

Like the miter shooting board and the joint-and-square, the donkey's ear has a base, a ledge and a stop, but these pieces are configured differently. It also differs from the other shooting boards by having a cleat on the bottom by which it's held in a vise.

FIG 2: DONKEY'S EAR SHOOTING BOARD



For accurate shooting, the sides of your plane must be square to the sole. You can grind the plane body on emery cloth on a piece of glass.

There are many ways to make a donkey's ear, and some boards are much simpler in design than mine. I prefer this board because it is heavy enough to withstand the amount of force required to plane across grain. As with the others, my dimensions may be larger than you need.

The base is made of lauan plywood to avoid seasonal warping. In this case, it is built up of five layers, as shown in Fig. 2.

The ledge on the donkey's ear is 45° to the base. It is supported by five ribs, each a right triangle. I used both the joint-and-square and the miter shooting boards to make these ribs. First, I shot both edges and one end of a piece of pine. Next, I mitered that end, creating a triangular rib (the cut-off piece) and a triangular end on the main piece, as shown in the detail in Fig. 2. After shooting the cut surfaces, I cut the triangular end off square, making the second triangular piece. I repeated the process until I had five good ribs.

The ledge itself is made of two pieces of hardwood—the sloping surface and the wearing surface—each having a 45° edge. You can do this on a tablesaw or by hand with a jointer plane. While you are at it, make a 45° edge on the bottom of the base board.

Assembly of the donkey's ear should be simple if you do it in the right order and keep the drawing in front of you. First, screw the ribs to the bottom board from underneath. Next, screw the sloping surface of the ledge in place. The wearing surface of the ledge comes next, followed by the layers of lauan plywood that make up the base. Before attaching the top layer, bevel the upper corner of its inside edge with a hand plane. This will create a dust groove where the layer butts against the wearing surface.

The stop on the donkey's ear is also made of hardwood and is located at the middle of the ledge so that its screws anchor the center rib. Its upper end is mitered so that it conforms to the ledge's upper edge.

The cleat is a rib screwed to the bottom board, and is used to hold the donkey's ear in the side vise. This way of gripping the shooting board is handier than using the tail vise and a dog. The parts you shoot on a donkey's ear are angled downward at 45° and usually project beyond the ledge. Gripping the donkey's ear in the side vise allows the part to clear the work bench and permits you to stand behind the board rather than reach across it.

To position the cleat, park the donkey's ear on your bench, and position it where you think it will be most handy. Then mark where the cleat must be located, so it fits conveniently in your side vise, and screw it there. You can always move it if you want to.

Planes

The plane used with a shooting board must have a straight cutting edge and must be kept razor sharp. I recommend that you keep one plane in this condition, and use it only on your shooting boards.

The type of plane you select depends on the size of your board. I use a Stanley #5 jack plane. You may find a smooth plane more comfortable, and for very fine work a block plane may be advisable.

Whichever plane you use, the sides must be at right angles to the sole. If not, the shot edge will not be square with the part's surface, and you will have gaps in your joints. Check with an accurate square, and if necessary, you can have a machine shop grind your plane body. You can also do the work yourself by grinding the plane body on a sheet of 1/4-in. plate glass with emery cloth adhered to it. While you're at it, check that the sole is flat and the sides are parallel.

Normally, a bench plane's cutting edge is slightly rounded (except on a jointer), so the corners do not dig. When used on a shooting board, a plane's cutting edge must be straight and square with the sides. If it isn't, first flatten and polish the cutter's forward surface on honing stones, then spray it with machinist's layout fluid. Next, hold a try square against the blade just behind the cutting edge, and trace a line square across the blade with a scratch awl. Grind the cutting edge to this line.

The blade will often be used to shave end grain and will have to be razor sharp. I obtain a keen edge by honing on a fine ceramic stone. Adjust the plane's frog so the mouth is paper thin, and set the blade laterally, making the edge perfectly parallel to the sole.

Using the Shooting Boards

Before using either shooting board for the first time, apply paste wax to the base so that the plane slides more easily. Grip the shooting board either between bench dogs or in the side vise. Cut your miters on whatever you prefer—tablesaw, radial arm saw, or miter box—then place the part firmly against the stop. The end of the miter should project just a hair's breadth over the ledge so that as the plane passes, it shaves off a paper-thin shaving. Place the plane's toe (the area of the sole in front of the mouth) against the work, and give the tool a firm, uninterrupted push. Only one or two passes should be necessary to create a perfect miter with a glassy-smooth surface. ▲

Mike Dunbar is a furniture maker and author of books on Windsor chairs, Federal furniture, and antique tools. He lives in Portsmouth, New Hampshire and is Contributing Editor of AMERICAN WOODWORKER.

Standing majestically on six trumpet-turned legs, this high chest is beautifully ornamented with pigmented shellac and gold leaf —a technique called japanning.

HIGHLIGHTS OF AMERICAN PERIOD FURNITURE

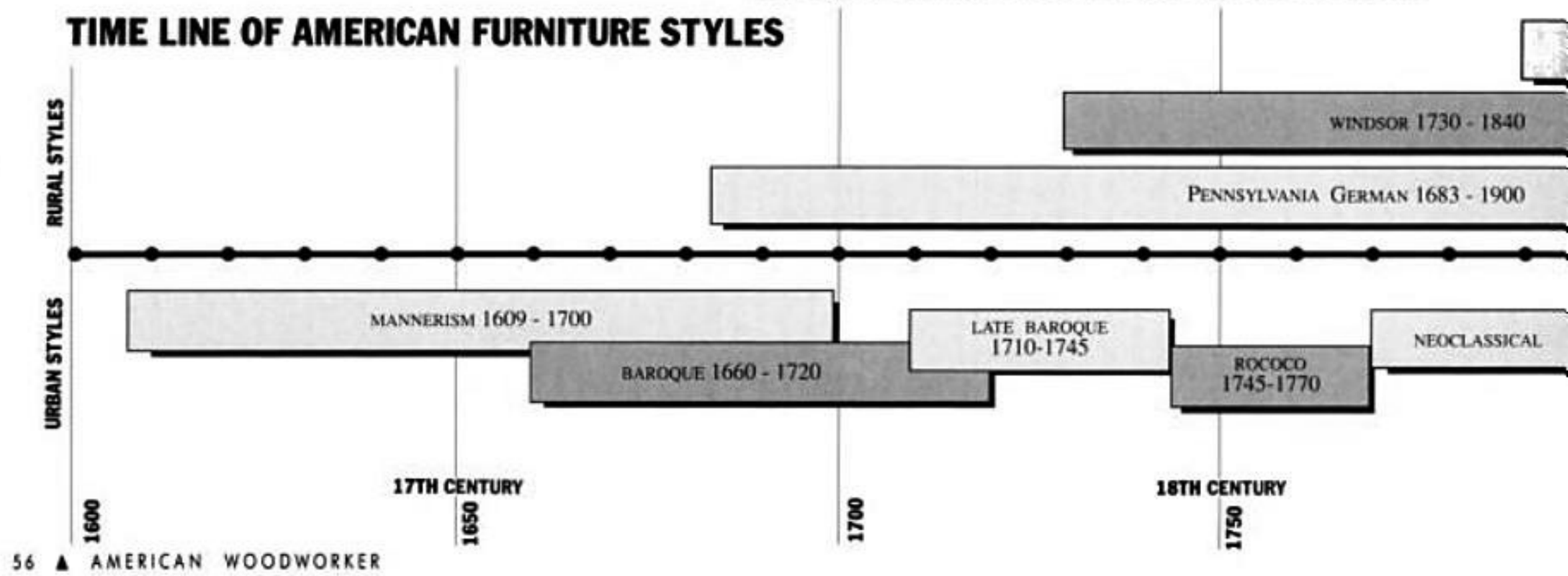
Part II: The Baroque Period

BY DAVID DONNELLY

In Part I of this series (August 1990 AW) we focused on 17th-Century Mannerist furniture, a style that predominated from 1609 to 1700. Toward the latter half of the 17th century the heavy, rectangular aspects of Mannerist furniture gradually gave way to a lighter, more fluid furniture style. Formerly known as the William and Mary style, furniture from this era is now being referred to as Baroque, making it easier to relate furniture styles to other decorative arts of the period.

As we look at the forces of history that swept over Europe, England and America between 1660 and 1720, it becomes apparent that our common name for the furniture of this period—William and Mary—is no longer appropriate. For one thing, this furniture style emerged three decades *before* William and Mary took the British throne. And the term does not acknowledge the fact that the inspiration for this style was far more widespread than the English shores. In any event, furniture historians now refer to this style as "Baroque." This new label sidesteps the inconsistencies

TIME LINE OF AMERICAN FURNITURE STYLES



of the term "William and Mary," and also helps historians draw parallels throughout the decorative arts.

Originating in Italy, Baroque furniture spread in popularity to France and Holland, across the channel to London, and finally to America. In the new world, it captured the imagination of a country that was tired of the rigidity of the earlier Mannerist style. But France was the international style leader at this time due to the elaborate gilded, carved, and ornamented furniture that characterized Louis XIV's reign (1643-1715). In fact, an English pamphlet published in 1663 said that the French "had introduced new modes and new tastes and set us all agog."

When Charles II returned to the English throne in 1660 after years of exile, he re-popularized French and Flemish styles. In addition to these European influences, trade with India and the Far East introduced "exotic" themes. Even Portugal had a stylistic influence, as Charles' Queen, Catherine of Braganza, came from Portugal and brought a dowry that included craftsmen and furniture-makers.

Baroque furniture can be recognized by symmetrical swirls, scrolls, and carvings with a light and graceful effect. The feeling is one of constant motion. Trumpet-turned legs, arched skirts, and twisted turnings are also common design motifs. Authentic Baroque furniture is more emotional and lush than Mannerist furniture. I emphasize the word *authentic* because American interpretations of European originals have always been more subdued and restrained than their European prototypes. Baroque is to Mannerism as a fugue is to a requiem—light and energetic rather than heavy and somber. Baroque's impact on Mannerism was to soften and modify it, rather than simply replace it. Gilding, upholstery, and carving added to the richness of the new style. An Oriental influence, referred to as "the Chinese taste," added an exotic element through japanning. Japanning is the imitative art of Chinese lacquer, in which furniture is ornamented with pictorial scenes using gesso, pigmented shellacs and gold leaf.

PHOTO COURTESY COLONIAL WILLIAMSBURG FOUNDATION, WILLIAMSBURG, VA

The Baroque period introduced new forms, like this daybed, to America. As is typical of many furniture pieces of this age, this daybed has eight legs.

New Furniture Forms Appear

Colonial homes in the late 17th century were quite small, which affected the sizes and styles of furniture they could accommodate. People often ate and slept in the same room, so furniture had to be versatile. For example, a drop-leaf gateleg table could be folded up when not needed. A table-chair could be used as a table or a chair by tilting its hinged top to either a horizontal or upright position.

Several new forms of furniture began to appear in the colonies during this period: daybeds, butterfly tables, lowboys, high chests (an older term for highboy), woven cane or "banister" backed chairs, upholstered

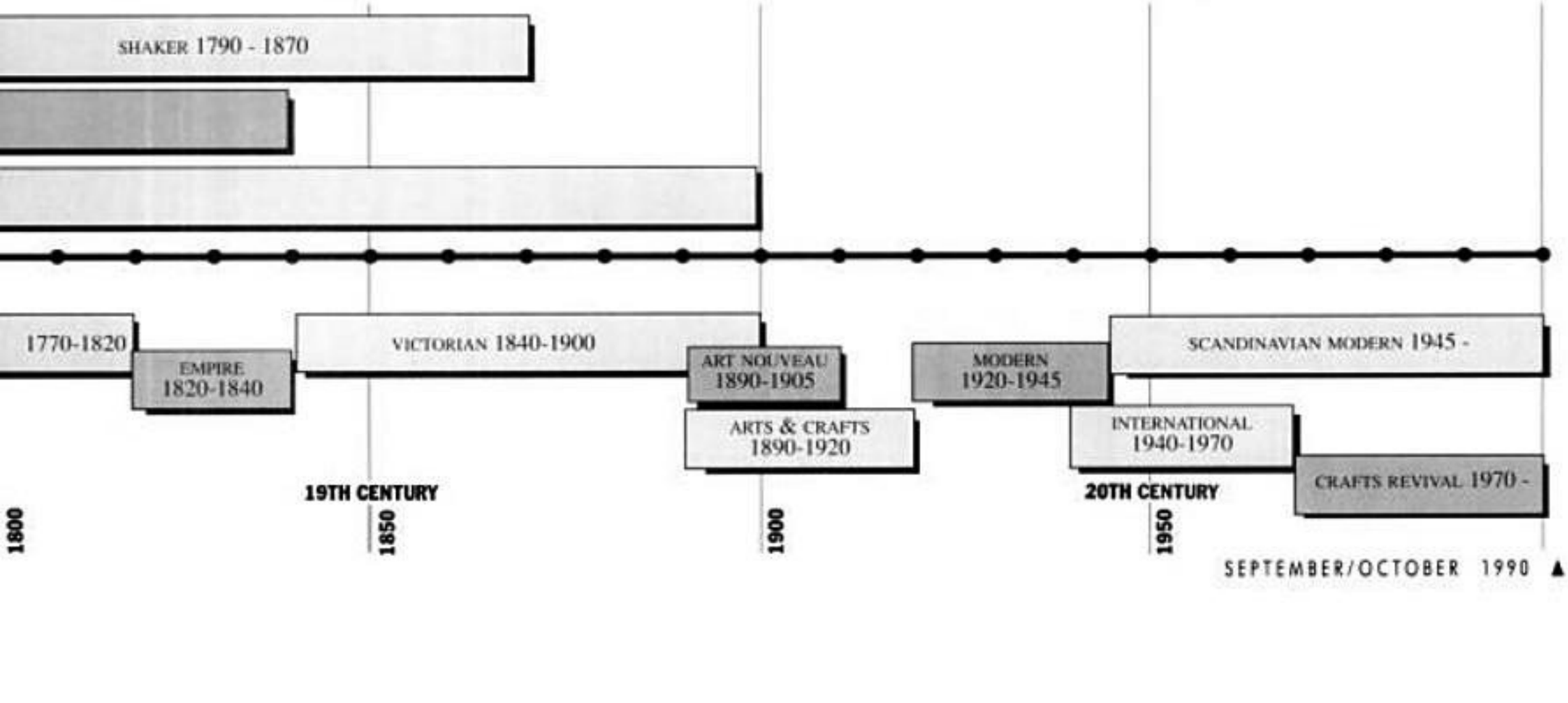


PHOTO COURTESY, COLONIAL WILLIAMSBURG FOUNDATION, WILLIAMSBURG, VA

With the advent of the Baroque style came a new attention to comfort, as can be seen in this Spanish-footed easy chair. Such chairs were commonly used by invalids.

PHOTO COURTESY, THE HENRY FRANCIS DU PONT WINTERTHUR MUSEUM

The playful feet on this drop-leaf table—called the Spanish or paintbrush foot—are a feature common to tables and chairs of the Baroque period.

wing chairs (easy chairs), gateleg tables, desk-on-frames, and various medium-sized tables such as tavern tables.

Oak remained the favorite wood until the end of the 17th century, when it was replaced by walnut. Historically, the *Age of Oak* ended around 1660 and was replaced by the *Age of Walnut*. These designations are English and somewhat arbitrary. Maple, pine, birch, poplar, and cherry were also used extensively. Mahogany appeared infrequently and had yet to reach its glory days. Ash was especially popular for turning. Cane, veneer, and inlay offered new design possibilities. A typical application for veneer was an ash or walnut burl applied in bookmatch fashion to the front of a chest of drawers, with herringbone inlay.

As the colonies developed, immigrants with common national and religious backgrounds congregated together. Swiss, German, and Swedish settlers populated Pennsylvania, New Jersey, and Delaware. The Dutch moved to New York, and the English settled New England and the south. Because craftsmen brought the skills and styles of their homeland, regional variations developed. However, England's style had the dominant influence. Generally, American interpretations of all European furniture forms continued to be simpler than the European originals.

Urban versus Rural

By 1660, many aspects of Baroque-style furniture-making became specialized. Boston at this time had joiners, turners, and upholsterers, and by 1690, cabinetmakers and chairmakers. These crafts eventually expanded to include carvers, japanners, chair caners, and other non-furniture types of woodworkers such as wheelwrights, coopers, and picture-frame carvers.

We see less of this kind of specialization in the rural areas. The rural joiner may also have functioned as brickmaker, mason, wheelwright, weaver, clockmaker, housewright, and farmer. The seasonal demands of farming required that furniture making be a winter occupation.

Urban furniture styles had little influence on rural furniture where function was a primary objective. Even if they had wanted to build furniture in the Baroque style, both the techniques and the costs of the high-style work were beyond the means of many rural joiners. But perhaps even more significant, the urban emphasis on fashion was foreign to the hard-working life style of the rural folk.

PHOTO COURTESY, COLONIAL WILLIAMSBURG FOUNDATION, WILLIAMSBURG, VA

Stretchers are a key element in Baroque furniture, appearing in a multitude of configurations. The stretcher table shown here comes from South Carolina.

PHOTO BY RICHARD CHEEK, COURTESY OF THE SOCIETY FOR THE PRESERVATION OF NEW ENGLAND ANTIQUITIES

The carved crest rail on this banister-back side chair illustrates the carving style of the day. Compared to English chairs of the time, this New England made chair is quite subdued.

PHOTO COURTESY THE HENRY FRANCIS DU PONT WINTERTHUR MUSEUM

Cup-turned legs with curved stretchers, ball and disk feet, teardrop drawer pulls and arched skirt place this dressing table firmly in the Baroque period. Note how the legs meet the case; mortise-and-tenon joinery was replaced by a dovetailed case mounted on a "stand" by means of glueblocks.

Baroque Furniture Traits

Looking at the range of furniture of the Baroque period, we see a few common elements:

Joinery and construction: For all the advances made in the decorative sphere of furniture of this period, many pieces in the Baroque style were structurally flimsy. This is most common in high chests and dressing tables, where the casework was dovetailed together with the delicate legs attached to the inside by means of glueblocks (see photo p. 59). This method was far less sturdy than the mortise-and-tenon joint typically used for this application both before and after this period. Such construction made stretchers an absolute must. Also, with the Baroque style, veneers begin to show up on chests and dressers.

PHOTO COURTESY THE HENRY FRANCIS DU PONT WINTERTHUR MUSEUM

One of the new forms to appear in the Baroque period was the desk. It evolved out of the bureau-cabinet—a fall-front bureau with drawers above and below the desk surface. This desk-on-frame has vase-spool-ball-and-block-turned legs and ball feet.

Turning: An endless variety of spindle turning appeared on tables, chairs, and cabinets. Trumpet-turned legs were the most representative motif of the era. Legs and stretchers on many chests displayed multiple ball, flute or twist turnings.

Ornament: Lush symmetrical swirls and scrolls were carved into chairs, daybeds, and other pieces. The ball foot was common, along with a new style of carved foot often called the Spanish foot. Besides carving, painting became an ornamental technique, with decorative, hand-painted japanning of Oriental motifs on casework. Hardware was often applied as an ornamental accent, with fancy brass escutcheons and teardrop-style drawer pulls.

Shape and form: Whereas chair backs were still rigidly upright, furniture in general softened due to the turnings, carvings, serpentine skirts, and upholstery that began to appear. Also, the number of legs on furniture increased—six-leg high chests, eight-leg day beds, and eight-leg gateleg tables were common.

Around 1720, the Baroque style started to give way to a more fluid, less busy style—the Late Baroque Period (formerly called Queen Anne). This new period—considered to be the *Golden Age of Furniture Design*—will be the subject of our next article. ▲

David Donnelly is a Teleproductions Manager at Boise State University in Idaho. He's an amateur woodworker and the President of the Boise Metro Woodworking Guild.

ROCKING HORSE

BY FRED MATLACK

A Classic Steed for Carpet Cowpokes

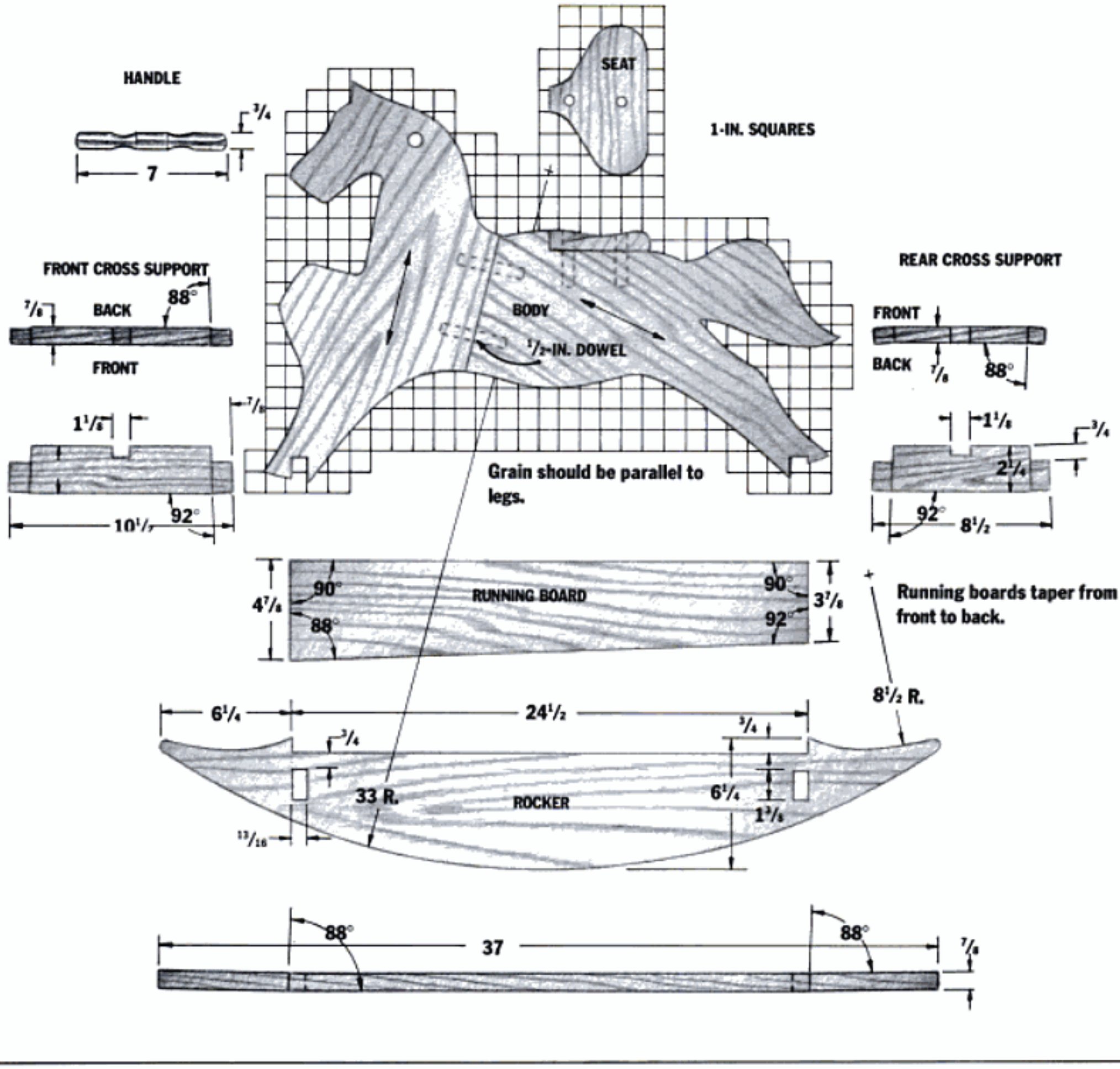
The rocking horse has always been a popular toy, and Nintendo notwithstanding, it probably always will be. The general lines for the rocking horse you see here are patterned after my own childhood mount that dates back to the 1920s. The original rocking horse had a much lighter undercarriage—thin laminated rockers with slats fastened between them.

That old horse of mine had two drawbacks. It was so light it tended to buck me off frequently, and my tiny toes often got caught between the slats. That made my rides on "Old Charlie" a bit of a hazard.

My Grandfather came to the rescue by screwing a couple of boards across the supports to form running boards. That kept my toes out of danger and added much needed extra weight to the base. I borrowed that principle when I built the rocking horse pictured here, making running boards part of the design and cutting the rockers from solid hardwood. The extra

MITCH MANDEL

FIG. 1: ROCKING HORSE

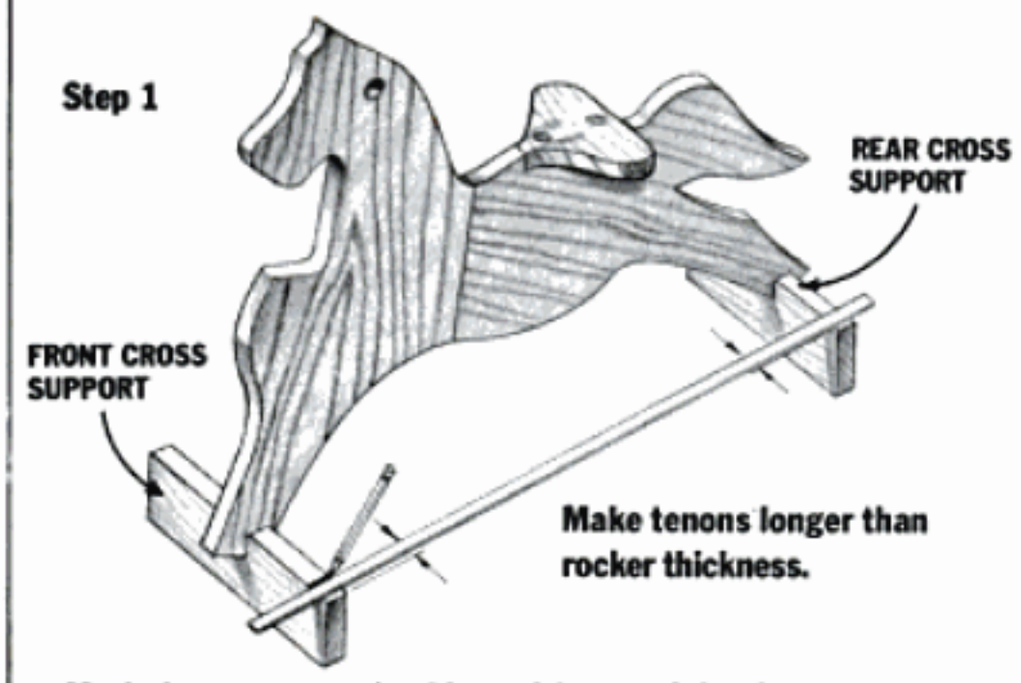


weight of the hardwood makes the horse quite stable, and the hardwood rockers wear better too. I assembled the horse from a collection of oak, cherry, chestnut and maple boards, and the body is white pine. Use your imagination (and your scrap pile) to determine what woods to use. You can always alter the dimensions a bit to fit the wood you have on hand.

The rocking horse is fairly simple to build. You can do most of the cutting with a bandsaw or saber saw. The rockers splay outward at the bottom, and they're farther apart at the front of the horse than they are at the back. To position the rockers that way, you must cut the tenons on the cross supports at a compound angle—the tenons point slightly up and slightly to the rear. (See Figs. 1 and 2.) That way, the corresponding mortises in the rockers can be cut straight through at 90°. The compound tenons are the trickiest part of the construction,and I found it easier to make these joints with hand tools and a cut-to-fit style of working than to go to all the trouble of setting up power tools to do it.

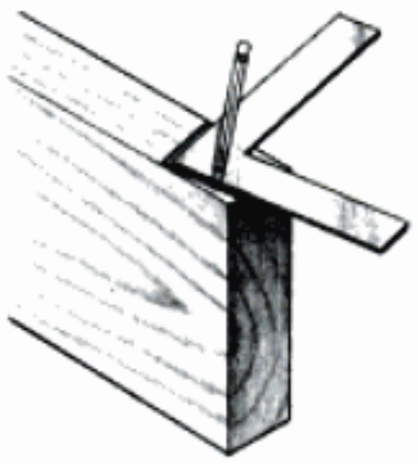
EXPLODED VIEW

FIG. 2: MAKING THE TENONS



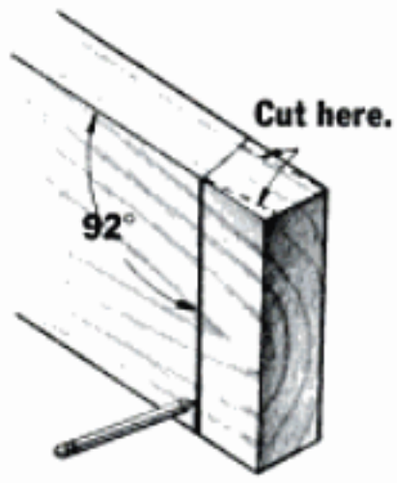
Mark the top tenon shoulders with a straightedge across front and rear supports.

Step 2



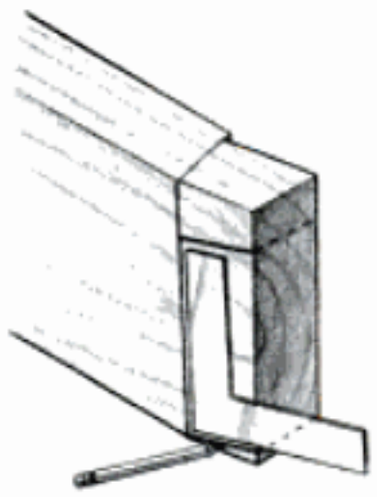
Mark the cheeks of the tenon with a try square.

Step 3



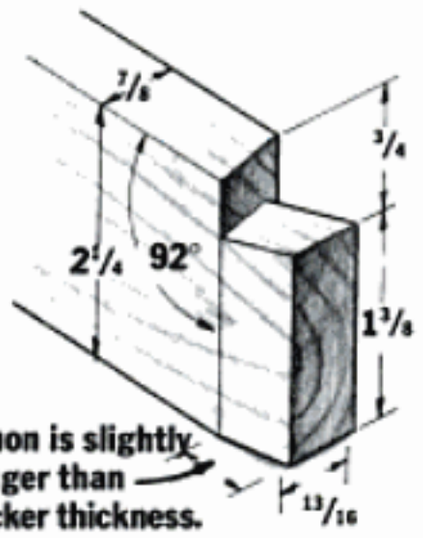
Mark the vertical shoulders 92° from top edge of cross support, and cut out with backsaw.

Step 4



Mark tenon top and bottom with a try square against the shoulder. Cut to the lines.

Step 5



Finished compound-angle tenon.

BILL OF MATERIALS

PART	QUANTITY	DIMENSIONS
Body (rear)	1	5/4 × 12" × 18"
Body (front)	1	5/4 × 12" × 20"
Front cross support	1	7/8" × 2 1/4" × 10 1/2"
Rear cross support	1	7/8" × 2 1/4" × 8 1/2"
Rockers	2	7/8" × 6 1/4" × 37"
Running boards	2	3/4" × 4 7/8" × 24 1/2"
Seat	1	7/8" × 4 3/4" × 7"
Handle	1	3/4" dia. × 7"
Dowels	4	1/2" dia. × 3"
Wood Pins	10	1/4" × 1/4" × 2"

Building the Horse

Start by gluing up two pieces of stock for the body. I used two pieces of 5/4 × 12-in. pine to shape the form shown here. I joined the two boards with a butt joint reinforced with 1/2-in. dia. dowels. For the greatest strength, it's important to orient the boards so the grain of each piece runs nearly parallel to the legs, as shown in Fig. 1.

Saw out the shape of the horse's body. Sand and radius all the edges that will be exposed, but leave the seat area flat and square edged. Cut out the cross supports, but before you cut the tenons on the supports, carefully fit the supports to the horse's legs. When the joints fit, glue and screw the supports to the legs.

Lay out the compound-angled tenons on the ends of the cross supports. First, make pencil marks on the ends of each cross support to establish the approximate length of the tenons. (Make them a little long—you'll trim them later.) To mark the top shoulders of the tenons, lay a straightedge on these pencil marks, spanning from the front cross support to the rear cross support, as shown in Fig. 2, Step 1. Draw a line against the straightedge to mark the top shoulders. These shoulder lines also determine the front-to-back angle of the rockers.

Next, mark the cheeks of the tenons with a try square, at 90° to the top shoulder line, as shown in Fig. 2, Step 2. Then mark the vertical shoulders of the tenons with a sliding bevel set to 92°, as shown in Step 3. This angle determines the outward splay of the rockers.

Carefully saw to these lines with a backsaw to form the top shoulders and cheeks of the tenons. After you've made these cuts, place a square against the shoulders to mark the tops and bottoms of the tenons, as shown in Step 4. Cut out the tenons with the backsaw.

Saw out the rockers, and position them against the ends of the tenons to lay out the mortises. Because you cut the tenons at compound angles, the through mortises in the rockers can be cut perpendicular—straight through the rockers.

After cutting the mortises, glue the rockers to the cross supports. Then cut out the slightly tapered running boards and fasten them in place with glue and 1/4-in. square pins, butting them tightly against the horse's legs. I liked the look of the square pins, but you could just as well use 1/4-in. dowels.

Cut out the seat, and carve it so it's a comfortable saddle shape. Glue it to the back of the horse, then drill through the seat into the body of the horse, and glue in two 1/2-in. dia. dowels to reinforce the joint.

Turn the handle, and glue it into the horse's head. If you don't have a lathe to shape the handle, you could use a spokeshave.

Paint the horse to suit your taste (or your child's), and it's ready to ride. If your "Old Charlie" turns out to be the heirloom I expect it will, it'd be worth the time to turn it over and add your signature to the bottom in a place that years of hard riding won't wear away. ▲

Fred Matlack heads the Rodale Design Group where he practices woodworking, metal working and almost every other craft you can name. His passion is restoring and using antique, pedal-powered woodworking machines.

BOOKS & VIDEOS

BOOKS

Encyclopedia of Furniture Making

by Ernest Joyce; revised by Alan Peters (1987, Sterling Publishing Co., Inc., New York City, NY 10016) 519 pp; paperback, $19.95.

Doubtless, many self-taught furniture makers who came of age in the 1970s have had this experience: agreeing to take on a commission in a rush of enthusiasm, only to find you didn't really know how to do the glue-up of leather to wood required or the exact details of how tambours are made. Surely, many who have shared these dilemmas have also turned to Ernest Joyce's *Encyclopedia of Furniture Making* for help.

We are now offered Alan Peters' revisions in a soft-cover version of this hardback, originally published in 1970. Most of the original virtues remain. It is truly encyclopedic in scope, and its excellent line-drawing diagrams are plentiful and clear. There are useful charts of glues and wood species.

Many of the original annoyances also remain in the revised edition. Products are referred to by their British trade names, making it somewhat difficult for the American reader to find available equivalents. New color and black-and-white photographs indicate some of the changes in design which have occurred since the original edition, but the new works by English craftsmen still veer toward the stodgy and the American works toward the "artsy," at least to my eye.

The black-and-white photos continue to be of substandard quality, despite the fact that the new edition is printed on better paper. The new color section showing pictures of wood types is virtually useless, as everything has come out a slightly different shade of yellow. The money spent on color photos would have been better spent upgrading the quality of the black-and-white ones.

Alan Peters' additions are generally helpful but somewhat quirky. He has added useful information in the tool section on biscuit joiners, but makes only perfunctory mention of Japanese tools. He includes new information on small drying kilns, but neglects to mention the Euro-style hinges, now the norm in many types of cabinetry. Peters has also included good material on the business and office practices of a successful woodworking operation.

This book is *not* a step-by-step how-to book in the manner of the *Tage Frid Teaches Woodworking* series, but no other volume compares to it in terms of breadth and depth of coverage. In many ways it is squarely in the tradition of the volumes issued by Chippendale and Hepplewhite. It offers a compendium of choices of legs, moldings, knobs, edge treatments, joints, veneering patterns, etc., combines this with advice about good structural practice and lets the reader choose.

In either edition, old or new, this book is an essential part of any woodworker's reference library.

JOSHUA MARKEL

Scroll Saw Pattern Book

by Patrick & Patricia Spielman (1986, Sterling Publishing Co., Two Park Ave., New York City, NY 10016) 256 pp; paperback, $12.95.

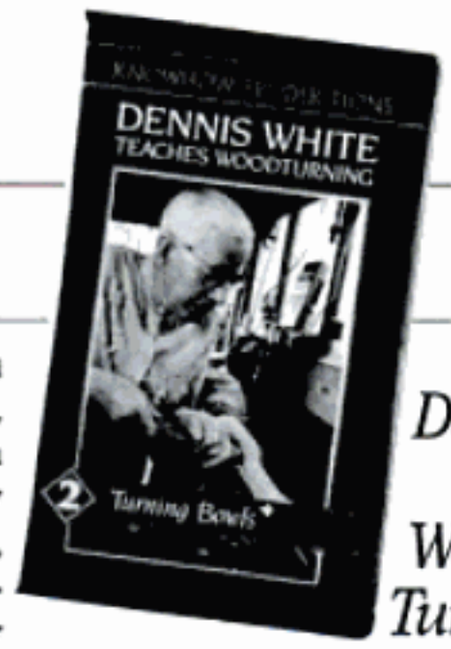
Patrick and Patricia Spielman have taken the phrase "a picture's worth a thousand words" literally in their *Scroll Saw Pattern Book*. A slender, four-page section describes how to use the patterns in the book, and then the reader is turned loose on a lifetime supply of simple patterns.

While the operative word is *simple*, there is a wide variety of patterns. Subjects range from folk art designs to puzzles, from jewelry to utensils—there's even a section with patterns for numbers and letters.

One warning though, keep this book out of the reach of children—they'll think it's a coloring book.

FIONA A. WILSON

VIDEOS



Dennis White Teaches Woodturning: Turning Bowls

Second in six-part series (1987, Know How Productions Ltd., U.K., distributed by Russ Zimmerman's House of Woodturning, R.F.D. 2 Box 242, Westminster West Rd., Putney, VT 05346, 802-387-4337) 85 min.; VHS, $34.95.

Dennis White is an English woodturner who is now in his eighties. He has been turning wood for more than 65 years and just might be England's oldest active woodturner. *Turning Bowls* is the second tape in a series of six that White has made.

Turning Bowls does not treat the viewer as a complete novice. White assumes you have some knowledge of woodturning and of proper use of the lathe. The makers of the tape seem to embrace the notion that a careful study of the video will lead to an understanding of what is happening on the screen. Commentary is kept to a minimum.

The tape starts with White telling the viewer that he does not need a lot of tools—just one bowl gouge ground to a fingernail shape, with no corner to catch, and a bevel longer than is common. Using essentially this one tool, White produces five bowls with three different mounting techniques. Good photography catches a true master at work with the gouge.

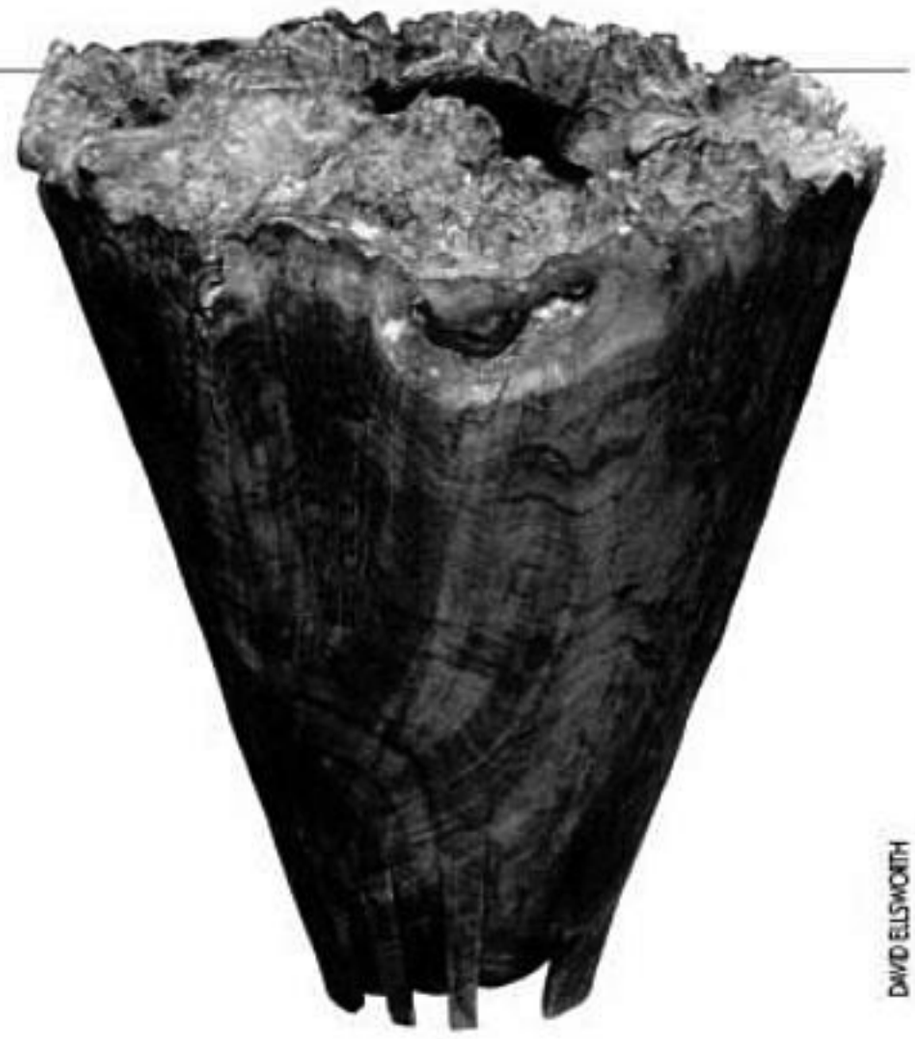
Closeup shots show that White shifts frequently between bevel rubbing and non-bevel rubbing cuts. It is here that viewers might have benefitted from some additional instruction. When is it safe to cut without the bevel rubbing? Would a less skilled turner risk a catch using these techniques? Because of the long bevel on the gouge and high rpms recommended, a dig-in could be scary.

The novel way of grinding the bowl gouge, masterful techniques and good photography make this tape worth viewing. Perhaps because many turners seem to muscle their way through a block of wood, it was refreshing to hear White say, "Take light cuts. . . . Don't force it. . . . and let the wood come to the gouge."

ANDY BARNUM

GALLERY

From castles to creatures to urns, the objects you see here are just a few of the works from a recent exhibition entitled "Pennsylvania Lathe-Turned Objects: Trends, Transitions, Traditions 1700-1990." The show—a joint effort by Philadelphia's Woodmere Art Museum and The Woodturning Center—featured lathe-turned works of the past two centuries. The photos show some of the newer pieces. If you think the lathe is limited to making spindles and candy dishes, take a good close look.

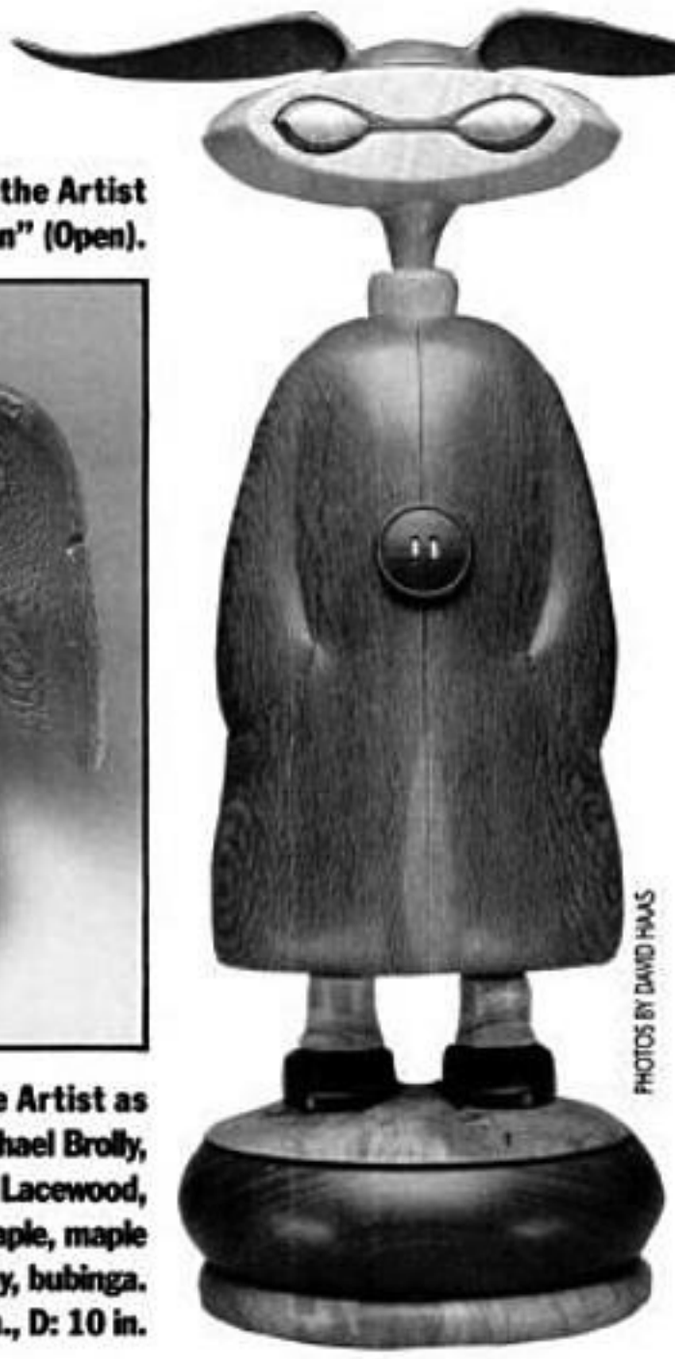


DAVID ELLSWORTH

Vessel with Legs, by David Ellsworth, Quakertown, Pennsylvania. Claro walnut burl, paint. Dimensions: H: 12 in., D: 11 in.

"Self-Portrait of the Artist as a Young Man" (Open).

"Self-Portrait of the Artist as a Young Man," by Michael Brolly, Hamburg, Pennsylvania. Lacewood, mahogany, curly maple, maple burl, purple heart, ebony, bubinga. Dimensions: H: 25 in., D: 10 in.



PHOTOS BY DAVID HAAS

"Woodworker's Jar," by David Hardy, Sellersville, Pennsylvania. Cherry. Dimensions: H: 8 in., W: 4 in., D: 4 in.

ED ROSLEY

Urn, by Thomas Nicosia, Alden, Pennsylvania. Rosewood, satinwood, ebony, mahogany, curly maple, walnut, zebrawood, amaranth. Dimensions: H: 39 in., D: 15¾ in.

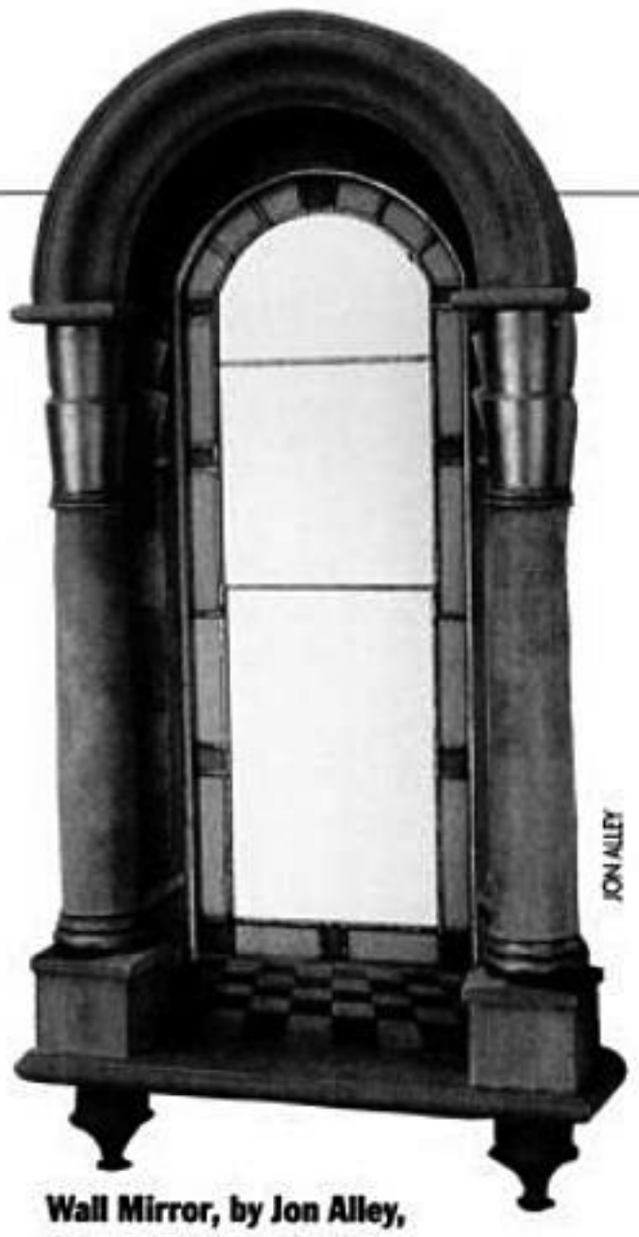
SUSAN PETRY

Lidded Vessel, by James A. Neff Jr., Catasaqua, Pennsylvania. Padauk, basswood. Dimensions: H: 6½ in., D: 7½ in.

GALLERY

ROBERT SALMONSEN

"Familiaris Arboratis," by Robert F. Salmonsen, Warrington, Pennsylvania. Cherry, maple, poplar. Dimensions: H: 17 in., W: 8 in., D: 12 in.



JON ALLEY

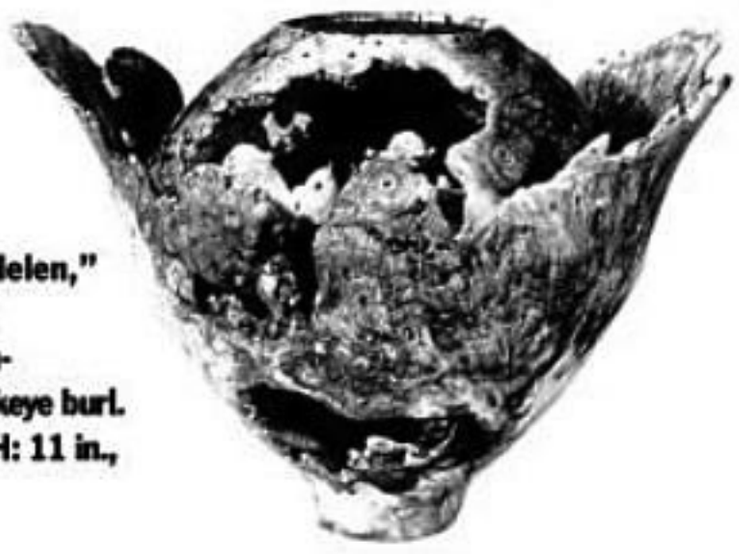
Wall Mirror, by Jon Alley, Churchville, Pennsylvania. Mahogany, gold leaf. Dimensions: H: 29 in., W: 15½ in., D: 5 in.

DAVID HAAS

"Luna Ray," by Michael Brolly, Hamburg, Pennsylvania. Mahogany, curly maple, ebony. Dimensions: H: 8 in., L: 42 in. W: 28 in.

MARK SFIRRI

Face Plate Turned Dining Chair, by Mark Sfirri, New Hope, Pennsylvania. Maple, shedua. Dimensions: H: 32 in., W: 23 in., D: 22 in.



"Mount St. Helen," by Ed Bosley, Berwyn, Pennsylvania. Buckeye burl. Dimensions: H: 11 in., D: 15¼ 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 in. × 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.*

George Nakashima, Woodworker 1905-1990

JACK ROSEN, COURTESY OF BLACK STAR

George Nakashima in his New Hope, Pennsylvania studio. Nakashima pioneered the use of natural tree forms in furniture and often designed a piece around a slab of burl or a plank from a venerable tree.

George Nakashima was a legend among American furnituremakers and a purist when it came to shaping and joining wood. He rejected any technique that compromised the visual and structural integrity of the boards that nature had made available to him. He would not use veneers. Likewise metals and synthetic materials like plastic, which are common in contemporary art furniture, were anathema to him.

His was a spiritual aesthetic that was almost mystical in its applications. The majestic tree had to be respected when the boards that were its legacy were fashioned into chairs and tables. It was the craftsman's task to ensure that these boards were not used frivolously and that they should be allowed to express the character with which nature endowed them.

Some younger woodworkers dismiss this attitude as "tree worship" and, in truth, it did limit Nakashima's design options. It also gave his furniture a rustic look that seems almost naive when compared with the intricately-decorated, historically-elusive pieces that characterize studio furniture today.

But while most mainstream furnituremakers moved beyond this Zen-like attitude toward wood, Nakashima remained philosophically steadfast during his half-century of furniture making. Until his death last June 15 at the age of 85, he preferred to call himself a woodworker; he regarded the term "artist" as pretentious and misleading.

"I think that's what's wrong with the craft movement today. They're all trying to be artists," he remarked last year during an interview at his home and workshop near New Hope, PA. "I don't think craft necessarily has to be great art. I think that's the greatness of craft, that there's almost no distinction between a priceless Sung bowl and something that you just throw away."

Nakashima believed a craftsman could achieve true quality in his work only if he understood the difference between art and artisanry. For him, artisanry was a noble calling. A crafted object should be not only beautiful and useful—made so by applying impeccable workmanship to first-class materials—but should embody a perceptible spirit.

Nakashima's furniture consistently incorporated these ideals, even when he stopped making every piece personally and expanded his workshop to production scale.

For Nakashima, the crafting of a chair or a table began with the purchase of the logs from which its components would be shaped. "You have to understand logs," he said. "You have to know what you're doing because you can lose $5,000 by buying the wrong log, and there's no way to find out except by doing it for 40 years."

When he opened his shop near New Hope in 1944, he took many of his logs off his own land. In recent years, he had to buy logs from other states and countries, but he always insisted on choosing them personally and deciding how they would be sawed into boards. Once those boards were stacked in his shop, he might study them for weeks, months and occasionally even years before deciding on the most appropriate use for each one.

He prized checks and knots as accents that imparted character to tabletops; he stabilized the checks with butterfly keys. He finished his furniture by oiling it because he believed that a hard, glossy surface would distort the grain and natural color of the boards he had so carefully chosen and matched.

These attitudes towards materials and workmanship were inherent in Nakashima's heritage. He was born in Spokane, WA, on May 24, 1905, to Japanese immigrant parents. He trained as an architect and practiced architecture during the 1930s in Japan and India, but eventually became disillusioned with the methodology, spirit, and egotism of modern architecture.

Nakashima established his first furniture workshop in Seattle in 1941 and was further tutored by a *nisei* woodworker during the years 1942-43, when both were interred at a relocation camp for Japanese-Americans. Architect Antonin Raymond, for whom Nakashima had worked in Japan, sponsored his release from the camp, and Nakashima and his family moved to New Hope in 1943.

Throughout his 50 years at the bench, Nakashima worked as both craftsman and designer. His most popular designs quoted American standards like the Windsor chair, but in an organic style that was inimitably his own. Although he laid down his tools some years ago, he continued to supervise every aspect of shop operations until his death.

More than any other woodworker of his generation, Nakashima inspired several generations of craftsmen to emulate the elevated aesthetic and technical standards that characterized his work. His passing closes an era that will stand as an historical benchmark for furniture making in America. While his craftsmanship has since been equalled and even surpassed, his ideals have not.

EDWARD J. SOZANSKI

EDITOR'S NOTE: *Nakashima's daughter, Mira Nakashima-Yarnall, who has assisted her father for the past twenty years, will continue making furniture in his tradition.*