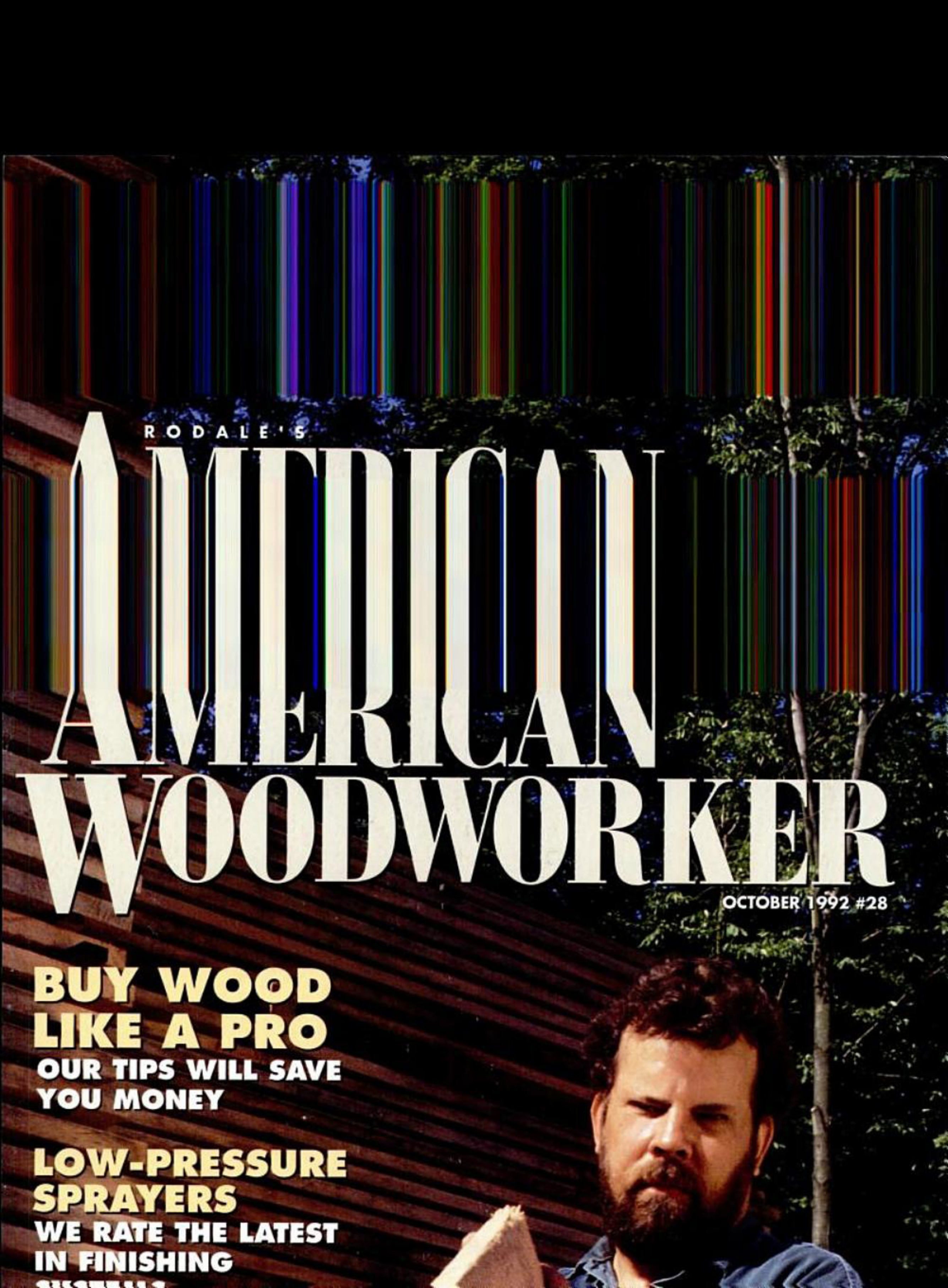




RODALE'S

AMERICAN WOODWORKER

OCTOBER 1992 #28

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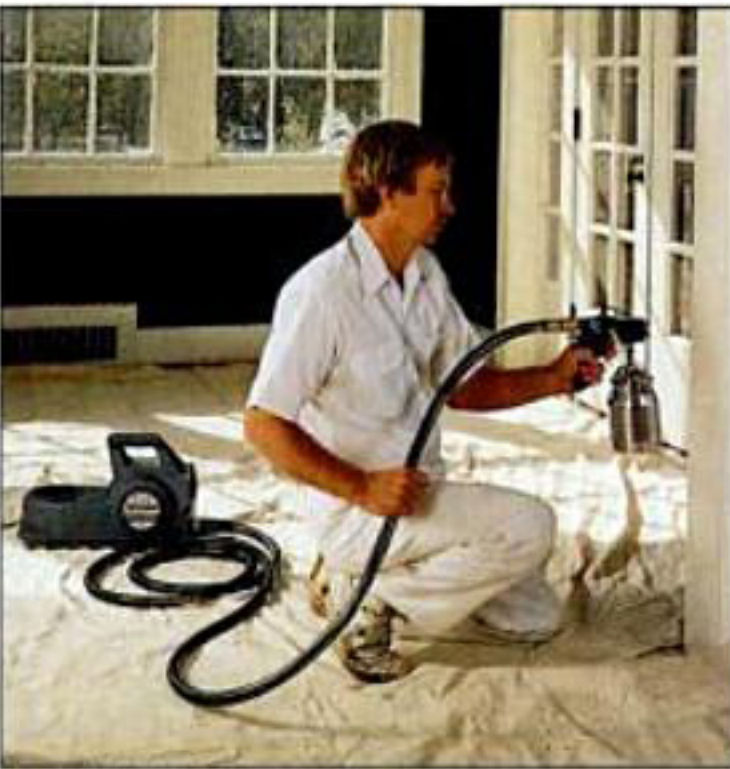
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RODALE'S AMERICAN WOODWORKER

Issue No. 28
September/October 1992
Cover Photo: Mitch Mandel



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A WORD FROM THE EDITOR

AMERICAN WOODWORKER



A CASE FOR HAND TOOLS

My friend Scott, a man of few words, dropped by for a cookout this past summer and I took him downstairs to have a look at my shop. He spotted a row of old wooden planes on a shelf. "You mean to say that you actually use those things?" said the look on his face. I handed him a coffin-shaped smooth plane and clamped up some pine in the vise. "Try it," I urged. He turned the plane around in his hands and took a long, careful stroke. Nothing.

I reached for a hammer and tapped out the blade just a hair. "Ssshhhick!" went the plane as a whisper-thin shaving curled up from the throat. Scott turned the plane over and examined the edge. "It's shiny," was his only remark. And sharp. He took a second pass. Then a third.

I've seen that reaction in woodworkers again and again. Quiet surprise at what an "old-fashioned" hand tool can do; the tactile pleasure of pushing a sharp edge through wood.

Power tools are great. No doubt about it. They've taken the grunt work out of stock preparation and made woodworking accessible to nearly everybody. You don't need skill or

muscles like a linebacker to make a straight cut with a tablesaw or straighten an edge with a jointer.

The widespread use of power tools has made woodworking faster and easier, but we've lost a little something along the way. Power tools tend to separate you from the wood itself—like driving through the desert in an air-conditioned car. As a result, woodworkers who start out with power tools instead of hand tools often don't learn much about the structure of wood and don't understand what's happening at the business end of the blade. When the grain tears out or a router bit "climbs" they may not have a clue as to why.

Hand tools bring you right up close to the wood. The cutting action is slow and deliberate—you can actually see and feel what's happening where the edge meets the wood. Push a hand plane into rising grain and you'll feel the resistance and see the rough surface. Then plane the other direction and notice the difference. The same theory translates to the jointer or planer; feed the board one way you get tear-out, feed it the other way and the cut is glass smooth.

Unlike most power tools, which are easy to master, hand tools require some practice to get good results. The payoff is worth it. They'll give you a better feel for the subtleties of wood that will help you in your power-tool woodworking as well.

Hand tools complement power tools perfectly and can add tactile and visual details that will set your work apart. Run your fingers over a hand-planed surface and you'll understand what I mean.

You'll also gain a new appreciation for the furniture of the past which was made entirely with hand tools. And who knows? You might learn to like working in a quiet, dust-free shop.

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Editor and Publisher

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LETTERS

Don't Destroy History

I have concerns with an article entitled "Drawboring" that appeared in AW, #25. While the technical aspects of making offset holes for the pegs in a mortise and tenon joint are well explained, the author's tale of discovering the phenomena (while dismantling an 18th century drop-leaf table) is upsetting.

The very information this author discovered was obliterated in the process of "wrenching apart old joints." An undisturbed, glueless, pegged mortise and tenon joint from the 18th century is indeed a rare thing. Such workmanship should at least be given serious consideration before a heavy-handed reworking of the structure is carried out.

Too many times we don't stop to think about what we are doing to a surviving example of someone else's craftsmanship. Our furniture heritage is to be preserved and respected in our work and in the pages of publications such as AMERICAN WOODWORKER.

Gregory Landrey
Furniture Conservator
Winterthur Museum
Winterthur, DE

What's Safest Way to Saw?

Re: Tablesaw Safety (AW, #27). Although Ellis Valentine discusses blade speed, there is no mention of the old argument that raising the blade to its highest level will decrease kickback forces, as the blade will have a greater downward force on the wood.

As a teacher of woodworking for more than 20 years, I have heard that a raised blade is more likely to cause injury, but basic physics tells me that the higher the blade, the greater the downward force, and the less force directed toward the operator. What do you think?

Joseph Kleid
Warwick, NY

Most experts say you should keep the blade height 1/8 in. to 1/4 in. above the

work to minimize your exposure to the teeth. The exception is hollow-ground planer blades, which you should extend fully for clearance. Kickback is more dependent on blade sharpness and set, fence alignment and wood condition. For more on tablesaw safety, call the National Safety Council at 1-800-621-7619 and request publication 1-605.

Bandsaw Reprint

In your August "Letters" column, two readers commented on your article, "Tuning A Bandsaw," (AW, #25) and one indicated that this article "was worth more than a year's subscription." It may be of interest to your readers to know that we have purchased reprints of that article from your magazine and we would be pleased to send one at no charge to anyone who requests it. Our address is Carter Products Co., 437 Spring St. N.E., Grand Rapids, MI 49503 (616-451-2928).

Peter Perez
President
Carter Products Co.
Grand Rapids, MI

Mallet Modification

Your article on making a cabinetmaker's mallet (AW #26) really caught my fancy, and I made four with one minor change. My handles are drive-fit with a 3/16-in. birch cross pin halfway up the width of the head.

Incidentally, the wood I used was all more than 40 years old and "reclaimed," so to speak. Three mallets are cherry reclaimed from a nightstand I made in high school in 1946.

James T. Rucker
Houston, TX

Plane-making Book

Your May-June issue was wonderful, especially the smoothing plane article by Mario Rodriguez. The only thing missing was an adjustable throat. Cecil Pierce of Southport, Maine, has a new plane-making book out (Monmouth Press, RR2, Box 7140, Monmouth, ME

04259) and he shows the adjustable throat, though he does not go into detail on its creation.

Ike Bay
Portland, OR

Trouble Brewing in Texas

In your editor's note to B. Jack McDaniel (AW, #27) you said, "But hey, who can blame them for trying to postpone a visit to Texas as long as possible?" What the hell do you mean by that? If it is intended as humor, it ain't funny.

George Hogan III
The Woodlands, TX

This is in response to the editor's note (about Texas) in your August edition. It is obvious that you are unaware of something called The Texas Pride. Our slogan for those who litter fits this answer of yours: Don't Mess With Texas.

I regret that you are such a _____. I enjoyed AMERICAN WOODWORKER until you made that uncalled-for comment. Please cancel my subscription.

Jan Traylor
Bay City, TX

Guys. It may have been a bad joke, but it was just a joke. Please don't circle the wagons; we're friendlies up here in PA.

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LETTERS

Forest Issue Revisited

In his letter on old growth forests (AW, #27) Tracy W. Buhler suggests "courts, politicians and lawyers should decide how much old growth forest should be protected." Forests and the timber industry are too important to be left solely to the lawyers, politicians and courts. Too often they are interested only in a settlement and not in the issues themselves. Lawyers in particular are usually experts only in the law and in very little else. I can think of no group less likely to protect the interests of the timber industry or the conservationists.

The decisions on old growth forests are of interest to all and should be made as a result of sincere and extensive dialogue among all parties—including editors and woodworkers.

James Bown
Newhall, CA

True Grit

Re: "Sanding by Hand," (AW, #25). The article states, "Sandpaper is rated by grit—the number of abrasive particles per square inch of the paper's surface." Anyone who has ever looked at sandpaper knows that this is not the case. The grit number refers to the *size* of the particles, and reflects the number of holes per square inch in the screen used to sort the particles.

Saunders Dixon
West Chester, PA

Planer Review Reviewed

Your article "Portable Planers—A Buyer's Guide" (AW, #25) has missed the mark by some, and quite some again. In no way can I agree with your choice of Makita as the best buy.

The Makita by your own statistics was not as well provided for in motor size as some of the other brands, and in my experience will never match the production of a machine with a larger motor. Makita also features throwaway knives. This may facilitate

Makita Corp.'s income, but for those of us who sharpen our own, or have cost-effective knife grinding available, this is a ridiculous concept.

The major lacking of all these planers, however, is that thickness adjustments are made by raising or lowering the bed. This means you constantly have to readjust the bed extensions or independent outfeed rollers you need with longer boards.

Paul Nuzman
Sacramento, CA

Editor Wanted

We're looking for a full-time editor to join the AW staff. The candidate must be energetic and enthusiastic, have excellent writing, editing and journalistic skills and a knowledge of woodworking. Drawing and photography skills are a plus. Pleasant location one hour from Philadelphia and two hours from New York City.

Send resume with writing samples to:

Personnel Department AW-LTE
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Emmaus, PA 18098

Gristmill Gears

The article on the Wight Sawmill (AW, #27) was most interesting and the photos were great. I'm wondering whether you have ever run an article featuring gristmills. If so, have you ever described the early method of making wooden gearing, the precise techniques for making gears that mesh properly and the methods of carving them exactly so they don't clash.

Murray M. Brown
Warwick, MA

We've never written about gristmills or wooden gears here. Can any of you readers help?

Leave Toys to Other Mags

In the past, some of your readers have written letters saying they would like to see more toys and puzzle plans. The market is already flooded with this type of magazine and it does not need more.

I look forward to reading articles by Mike Dunbar, Craig Bentzley, Roger Holmes and Jonathan Clarke, just to name a few. And I never get tired of seeing old tools, museum pieces and any kind of reproductions. My hopes are that AW continues to produce quality articles by true craftsmen.

Dale J. Horst
Lititz, PA

Practice What You Preach

Re: "Workshop Noise: Listen Up! Machines Can Damage Your Hearing," (AW, #26). The impact of your well-researched and well-written feature is somewhat diminished by your failure to consistently stress the importance of hearing protection in your pages. The most obvious example follows this article, where the user of a disc sander has chosen to forgo the use of hearing protection.

AW should practice what it preaches by ensuring that all photographs and drawings adequately and consistently portray the use of hearing protection.

I am a 35-year-old hearing-impaired woodworker and I never work without hearing protection since I am devoted to preserving the hearing which remains.

Glenn Stern
Forked River, NJ

What's on your mind? We value your comments, complaints and corrections. Send your letters to: "Editor," AMERICAN WOODWORKER, 33 E. Minor St., Emmaus, PA 18098.

Q & A

Aniline Dye Safety

Q *I want to use aniline dye to make a maple chest of drawers the color of red mahogany. Are aniline dyes safe to use?*

*Fred Reich
Boston, MA*

A The answer is a qualified yes. All aniline dyes are synthesized from the chemical aniline, which is derived from petroleum or coal tar. Certain aniline dyes, especially those containing benzidine, have been linked to bladder cancer, but none of the commonly available aniline dyes used for wood contain benzidine or any other known carcinogen.

Nevertheless, you should treat all aniline dyes with caution because we don't yet know everything about these colorants. Avoid direct contact with dyes by wearing gloves and a particle mask when working with the dye powders, and wearing gloves when working with the dissolved stain.

The area of greatest potential concern is using aniline dyes on children's toys. Most dye companies recommend you use Food, Drug and Cosmetic (FDC) grade dyes when the dye might come in contact with someone's mouth (as it would if a child chewed through the finish). FDC dyes (sold in supermarkets as food colors) are safe, however they will fade much quicker than aniline dyes.

*Bob Flexner
Finishing consultant
Norman, OK*

(Editor's note: AW is investigating the aniline dye safety issue carefully and we'll report new evidence as we receive it. If you have any information, we'd like to know about it.)

Sharpening Scraper Planes

Q *I recently acquired an antique Stanley No. 12 1/2 scraper plane. Could you explain how to sharpen and use this tool properly?*

*Wayne Bigelow
Jefferson City, MO*

A The No. 12 1/2, first called Bailey's Patent Adjustable Veneer Scraper, and after 1912 simply Scraper Plane, has a thicker iron than those used in modern cabinet scrapers, yet it's sharpened in much the same way. First clamp the iron in a vise and file a 45° bevel with a flat bastard mill file until you've raised a burr on the back of the iron. The surface of the bevel should be flat and the cutting edge straight and square to the sides.

Next, use a fine carborundum or other finishing stone to refine the surface of both the bevel and the back and to remove any traces of the burr.



Stanley No. 12 1/2 veneer scraper

Now place the iron, bevel-side-down, on the bench, hold a burnisher flat on the back surface, and "draw" the edge by stroking the burnisher along the length of the edge several times with moderate pressure.

To create the critical hook on the edge, reclamp the iron in the vise with the bevel facing you and stroke the burnisher across the bevel several times, gradually rolling the edge back to approximately 15° from vertical. A hook of less than 15° may slide over the surface rather than scrape it.

To set the depth of cut, place the plane body on a flat bench and clamp the iron in place temporarily with the thumbscrew. Tilt the iron forward about 30° and lock the tilt adjustment

nuts at the front of the plane. Place two or three sheets of paper under the sole, staying clear of the throat opening, then loosen the thumbscrew and lower the blade to the bench.

To use the plane, scrape with the grain in long steady strokes, lifting the back of the sole on the return stroke to avoid chattering. A sharp edge will produce very thin shavings, not dust. By experimenting, you'll find the combination of bevel angle, tilt angle, hook size and depth of cut that produces the best results.

*John Kassay
Author/Furniture maker
San Bruno, CA*

Recycled Beams or Fresh Timbers?

Q *I'd like to frame a new building with posts and beams. Should I buy new wood or try to clean up and reuse old barn timbers?*

*Dr. Philip Robbins
Jackson, OH*

A I don't recommend building a new frame from old timbers. It's expensive and somewhat dangerous to dismantle an old barn frame, and it could prove to have little value for your purposes. You probably won't be able to reuse existing mortises unless you're reconstructing the building in its original form, and horizontal, load-bearing timbers will be substantially weaker if they contain old mortises. If you try to plane or saw these timbers you run the risk of ruining blades on old nails and hardware, or even injuring yourself. Also, it's difficult to cut mortises and tenons in old dry wood.

The traditional way of cutting frames is to work with green timbers, partly because they're much easier to cut, but also because air drying could take years, with no guarantees against twisting, checking or warping. Kiln drying, if you could find a kiln that

Q & A

will dry heavy timbers, would be extremely expensive.

There are a few companies that sell old beams of Douglas fir, heart pine, oak and hemlock salvaged from old mills and industrial buildings. They often can bandsaw the material to your specifications and may be able to surface them as well. A bonus is that utilizing these remanufactured timbers provides a small degree of protection for old-growth forests.

More information on timberframing is available from the Timberframers Guild of North America, P.O. Box 1046, Keene, NH 03431 (603) 357-1706.

Brian Murphy
Barn restorer
Ottsville, PA

(Editor's note: You can order a variety of reclaimed timber products from Duluth Timber Co., 218-727-2145; and Jefferson Lumber Co., 916-235-0609.)

Painting Over Clear Finishes

Q I want to paint over my oak veneer kitchen cabinets. Is there a white pigmented finish that I can use without stripping them to bare wood? Can I sufficiently build up the new finish to eliminate the oak grain pattern?

W. H. Zahorchak
Roanoke, VA

A Most custom-made kitchen cabinets are lacquered. Many homeowner-made cabinets are polyurethaned. Factory-made cabinets are often finished with catalyzed lacquer (melamine formaldehyde).

To prepare any of these for a new finish, first clean the cabinets with soap and water or ammonia and water. Then scuff-sand the surfaces with fine sandpaper (220-320 grit) so the new paint will mechanically bond to the roughened surface. Clean off the dust.

READERS' NETWORK

Last issue we threw open a question about making machines safer. Here's what you readers had to say on the subject:

I installed my electrical outlets in the ceiling of my shop to keep them out of reach of my kids. It makes moving machines easier, too.

Ronald Frey
Clay, NY

My dad made a simple push-button foot switch and wired it to an outlet box so you could plug any 115 v. machine into it for hands-free operation.

Hale Orvison
Portland, OR

I made a panic switch for my tablesaw by binging a 1-in. x 2-in. x 24-in. piece of oak from the top of the switchbox so that it hangs in front of the push-buttons. There's a hole in the oak for access to the "on" button, and I can turn the saw off by pressing the lever with my foot.

Andy Rae
Princeton, NJ

Much of machine safety is just common sense. My best advice is to use your damned head.

Denis J. Kigin
Tempe, AZ

This Issue's Question:

I am about to retire and plan to set up a small workshop for hobby work. I'm reluctant to buy both a radial saw and a tablesaw. Which do you think would serve my purposes best?

Jack Wignall
Appleton, WI

Send your opinions to: "Reader's Network," AMERICAN WOODWORKER, 33 E. Minor St., Emmaus, PA 18098.

If the original finish is lacquer (check to see if lacquer thinner will dissolve it) you can apply a water-based enamel or a white-pigmented lacquer over it. Both contain solvents that will bite into the original lacquer making a chemical bond between the new and old coatings.

If the original finish is polyurethane, your best choice for the new finish will be an oil-based paint because the shrinkage and expansion of the layers will be similar.

If the original finish is a factory-applied melamine formaldehyde, you're likely to get eventual layer separation no matter what you apply. It's very difficult to coat over these finishes successfully.

Whether you decide to use an oil- or water-based enamel, you'll get the best results if you first apply an appropriate primer. Primers contain a higher binder-to-pigment ratio so they bond better to the original finish.

I wouldn't recommend trying to fill the heavy grain of oak with paint. To fill it completely will require quite a number of coats, sanded back between coats.

Bob Flexner
Finishing consultant
Norman, OK

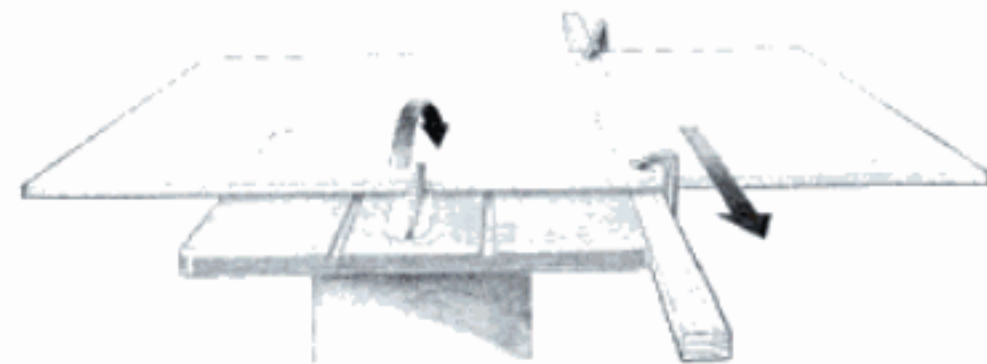
WHERE TO FIND IT

Pool table slate and other slate products are available from Structural Slate Co., P.O. Box 187, 222 E. Main St., Pen Argyl, PA 18072, (800) 677-5283.

Wooden guitar parts, bindings and inlays, luthier's tools and finishing supplies are available from Guitarmaker's Connection, P.O. Box 329, 510 Sycamore St., Nazareth, PA 18064, (800) 247-6931.

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

TECH TIPS



Nail-Pulling Wedge

This wedge is useful when pulling nails—especially large ones. Slide the wedge forward as you extract the nail so the fulcrum stays close to the head. It works equally well with a wrecking bar.

Robert Tupper
Canton, SD

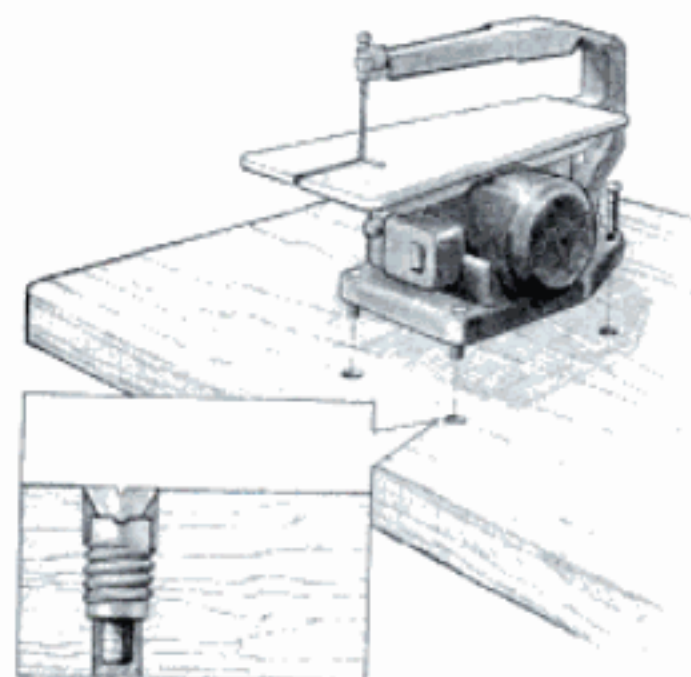


Bench-Top Machines

I have a small workshop, so I have to double up tools in the available space. One of my space-saving moves was to equip my workbench with four threaded insert nuts that let me easily attach or remove my scroll saw. I set them a fraction below the surface of the bench so I can install flat head machine screws to keep dust and chips from filling the holes when the scroll saw is not in use.

This idea works equally well for any benchtop machine that isn't used frequently, such as a grinder or a benchtop mortising machine.

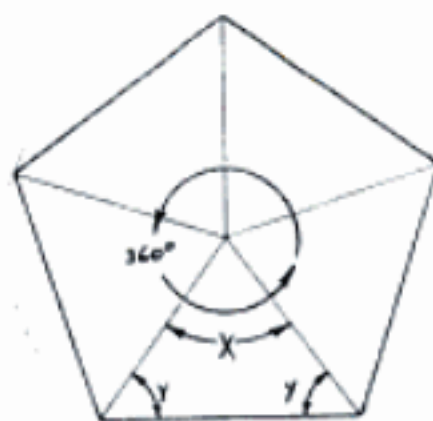
Robert Heil
Rockford, IL



Calculating Perfect Pentagons

When making a five-sided box or frame, it's easier and faster to calculate the angles than to draw them out.

Picture the figure you are trying to make as a series of triangles that come together at a common point, as shown in the drawing. The sum of the interior angles of these triangles will always be 360° . If you divide this figure by the number of sides in the piece you want



to make (in this case five), you will get the number of degrees in the interior angle of one of the triangles (X). In the example in the drawing, the figure would be 72° . The three interior angles of a triangle must always add up to 180° , so the two outside angles (Y) must be $180 - 72 = 108^\circ$. Since these two angles are equal, each one must be 108° divided by 2, or 54° . You can use the same calculation for a figure with any number of sides provided they are equal in length.

David Firth
Amherst, Nova Scotia, Canada

Cutting Plywood

Cutting a full 4 x 8 sheet of plywood on the tablesaw is an awkward job, even with two people. The miter gauge comes out of its slot, and the fence may not have enough travel. My solution is to clamp a 2 x 4 to the underside of the plywood and let it bear against the left-hand edge of the table. It should project beyond the plywood a couple feet on each side. The edge of the table on my Delta Unisaw is 18 in. from the blade, so I place the 2 x 4 exactly 18 in. from where I wish to cut. I find I can safely get a clean, accurate cut each time.

Paul Mueller
San Francisco, CA

Sticking Router Bits

A router bit seizing in the collet is a common problem, but the bit coming loose is worse because it can cause damage to the work and injury to you. I solved both these problems by coating the tapered threads on the outside of the split collet with a thin layer of oil. Since I started using the oil, I have had no problems.

If you try this, be sure not to let oil get inside the collet.

John Hertz
Lansdale, PA

Auxiliary Drill-Press Table

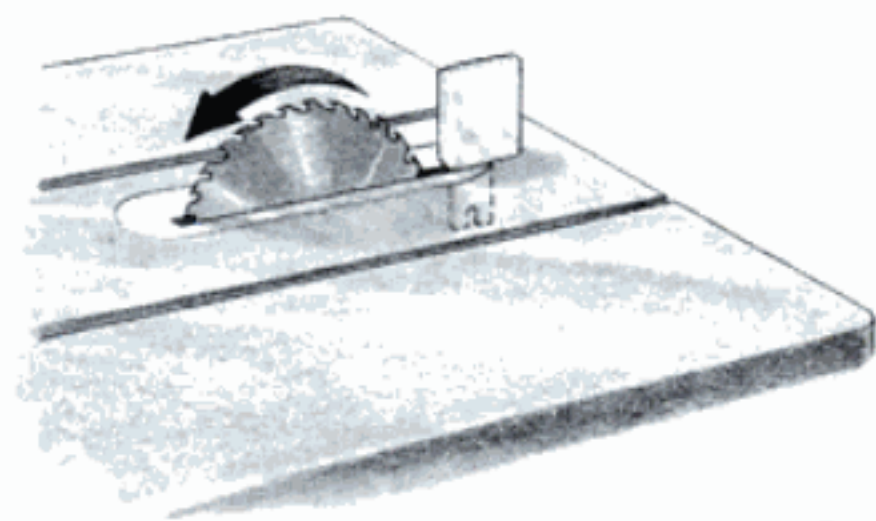
This removable auxiliary table clamps to the support column of a drill press and catches most of the waste, keeping the shop tidier and saving cleanup time. It's also a handy place to put the chuck key, spare bits, and drill-press accessories. A bonus is that it catches mortising chisels,



Forstner bits, and other easily damaged drills that could fall through the hole in the metal table and strike the pedestal or floor.

I made my table from $\frac{3}{4}$ -in. plywood faced with Formica. The slick surface of the laminate makes oil and metal cleanup easy. The supporting bracket is a piece of 16-in. long 2 x 6 fir, which is attached to the table with wood screws. The bracket is clamped to the column with a $\frac{3}{8}$ -in. bolt, as shown.

Kenneth Brown
Virginia Beach, VA



Scrap-Metal Splitter

If you're like me, you run your table-saw without a guard. When you remove the guard, you're also removing the splitter, which prevents kickback by keeping the saw kerf from closing. Rather than run the risk of kickback, I made my own splitter from a discarded $\frac{3}{8}$ -in. aluminum sign.

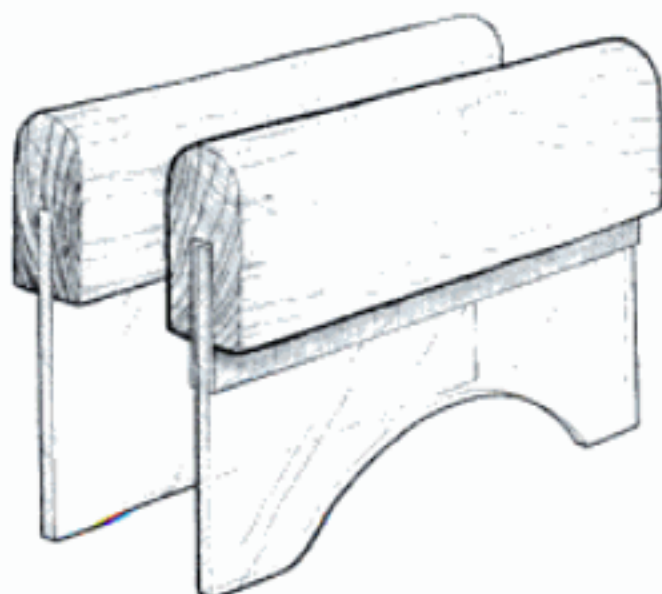
I cut the new splitter to the shape shown in the drawing, filed the leading edge to a slight taper, and cleaned up the burrs. When fastened to the splitter brackets, the splitter should exactly bisect the blade. If necessary, move it sideways by shimming it with thin metal washers. Before starting the saw, turn the blade around by hand, raising and lowering it to make sure it clears the splitter.

Dana Batory
Crestline, OH

Glass Scrapers

Everybody knows that glass is sharp, but few people realize that it can be made into an excellent scraper. I get free scraps of window glass from the local hardware store, and then make a holder for it by sawing a slot in a piece of hardwood. If the kerf is too wide, I bind the edge of the glass with masking tape before inserting it. With a bit of practice, I've found that I can cut freehand curves in the glass to match a piece of trim or molding.

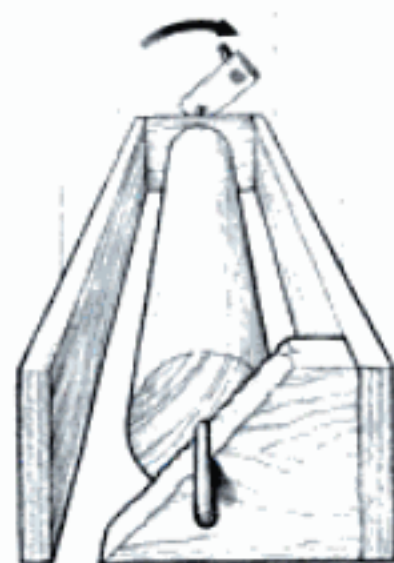
Donald Kinnaman
Phoenix, AZ



TECH TIPS

Routing Large Dowels

I needed a 4-in. dia. dowel rod for a table base. I couldn't find any ready-made and didn't have a lathe to turn it myself, so I decided to rout it. First I glued up a plywood box—no top or bottom—the length of the dowel I needed. I then made a new plywood base for the router with wood strips clamped to the sides. I wanted the router to slide back and forth along the sides of the box.



With that done, I cut my 4 x 4 blank and drilled $\frac{3}{8}$ -in. holes at the centers of both ends. I drove $\frac{3}{8}$ -in. threaded rods into the holes to serve as a pivot. At one end, I improvised a handle.

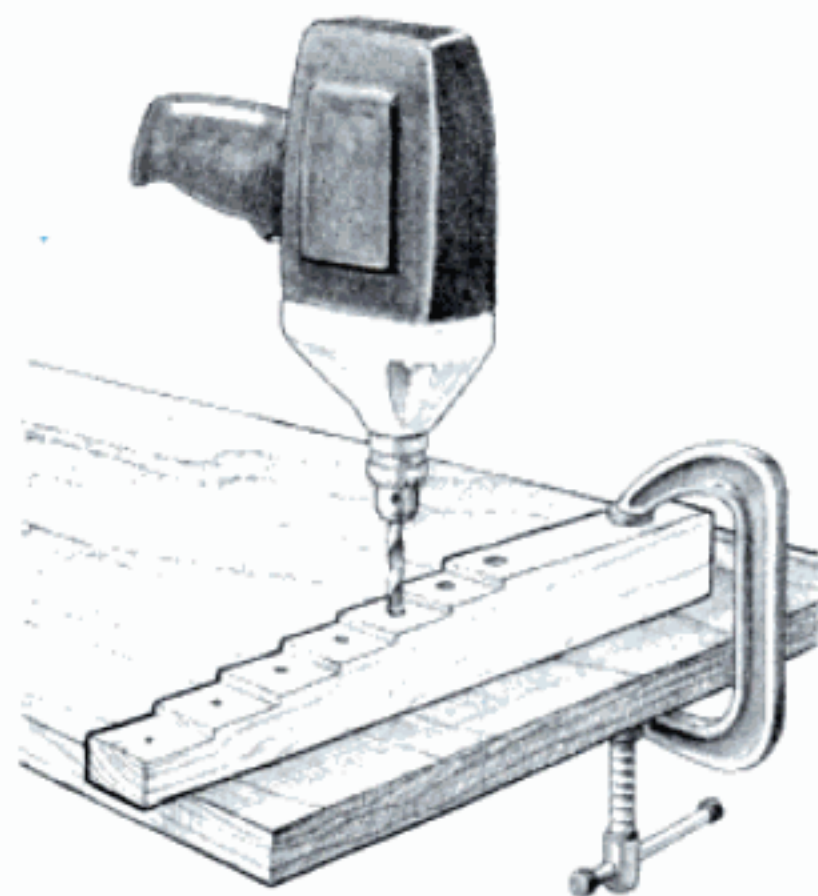
I used a $\frac{3}{8}$ -in. straight bit in the router and pushed it slowly away from me as I turned the handle. It works best to take light cuts and to saw the corners off the blank first.

Yeung Chan
Millbrae, CA

Sticky Fingers

To get the surface clean at the final finishing stages of a project, I wrap a couple inches of masking tape (sticky-side out) around my left forefinger, and if I spot a speck of sawdust or other foreign matter, I pick it up with the tape.

Lane Olinghouse
Everett, WA



Getting the Right Angle

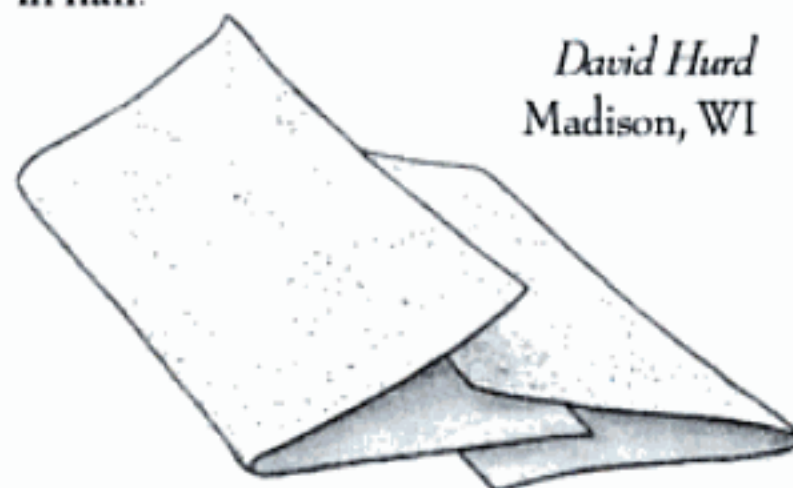
This jig is handy for drilling perpendicular holes without being limited by the throat of your drill press. Use hardwood—or metal if the jig will be used often—but bore all the initial holes on a drill press to make sure they are square to the base. I made my jig to accommodate drill sizes from $\frac{1}{16}$ in. to $\frac{1}{2}$ in.; you can modify that for your needs. Be sure to hold the jig firmly when drilling or, better still, clamp it.

Boles Derenda
West Seneca, NY

Folding Sandpaper

When sanding by hand, I use two quarter sheets of sandpaper folded in half and interlocked. I can then flip the paper over for a finer or coarser grit. When the sandpaper gets worn, I reverse the interlock. I also find that sandpaper folded this way stays in my hand better than a single piece folded in half.

David Hurd
Madison, WI



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 \$50 if we publish your tip.

THE ART OF — BUYING LUMBER

BY DICK BURROWS



Finding good stock among the endless piles at a lumberyard is much easier if you understand a bit about wood grades, yield, and use.

One of my woodworking specialties is the art of cajoling lumberyard workers into letting me sort through their lumber piles, looking for that perfect board for my next project. Sometimes I have to pout and threaten to take my big-time business elsewhere. Usually, though, I get permission simply by promising to restack everything when I'm done.

And so, I've spent many a morning working in another guy's business, lining up about a quarter ton of lumber just to get a few boards that suit me.

I've met quite a few fellow woodworkers during these hunts. Some know exactly what they want, be it wood free of knots, splits, and ugly dark streaks, or that elusive "pretty board." But others bypass all the sorting and just buy the top—read that as most expensive—grade available, whether or not they need it. (See sidebar, Grading Wood, page 24.) There are times when the best grade is the

Knowing the Basics Can Save You a Bundle

best choice, but more often, you can save money and get the perfect wood for your project by using lower grades if you know a few basics about buying lumber.

Finding Diamonds in the Rough

The first thing you need to do is rid yourself of the idea that you have to use top-grade lumber or a perfectly clear board for everything you make. Most furniture makers don't. They use fairly short or narrow pieces that can

be cut from even the lower grades of lumber. You can, too. Just take the time to analyze the size and type of parts you need before you start.

"The average woodworker should be buying more of the common grades for framework and stiles," says lumber dealer Steve Wall of Mayodan, North Carolina. "A lot of people don't realize that the price range for common grades can be less than half the price of select grades."

It's especially cost effective to get thicker components out of lower grades of wood. If you want 8/4 table legs, for example, you can usually cut around the knots to get them out of No. 1 common boards at considerable cost savings.

Wall often speaks to woodworking groups throughout the Southeast. To make his point on how much good wood there is in a common board, he will cut a board apart, and then separate the clear wood from the waste.

The loss in a typical 12-ft. common oak board is pretty minimal, as shown in the photo.

Another thing to consider when buying wood is what you want to build. This might sound overly simple, but Wall says he often finds new customers hunting for an exceptionally long, clear board, something like a clear 14-ft. 1 x 10, to build a coffee table with no component longer than 36 in. Many apparently just total up all the needed components and specify that size board. This strategy is expensive and wasteful and can be aesthetically unwise, too. Often, better boards don't display as much beautiful figure and character as lower-grade ones.

Another fan of less-than-clear stock is Kelly Mehler, a furniture maker in Berea, Kentucky. I worked with Mehler a few years ago and found him very picky when selecting lumber for his Shaker-inspired furniture. Still, he says, "I'm not a big fan of clear stock. The wood is light; you can feel it. Wood with knots is denser, has more character."

Looking Beyond Wood Grades

The question of lumber grades can be confusing, so it's best not to get too hung up on them when picking stock. Grades give you an indication



Even common stock can contain lots of good wood. Here, lumber dealer Steve Wall piles up the clear pieces he was able to cut from one 12-ft. oak board.

of the number of defects in a board, not the board's total quality. (See photo, below.)

Instead of grade, concentrate on the yield, which tells you the grader's estimate of how much clear wood a board contains. Select grades offer a yield of 83 percent or better clear stock. A No. 1 common board yields 66 to 83 percent clear stock, and No. 2 common yields 50 to 66 percent, usually in lengths that are still adequate for small projects. Another common-grade term is log run, which basically means the whole cut-up tree as it comes from the mill. "It's mostly No. 2 common or better. About 20 percent will be select," Wall says.

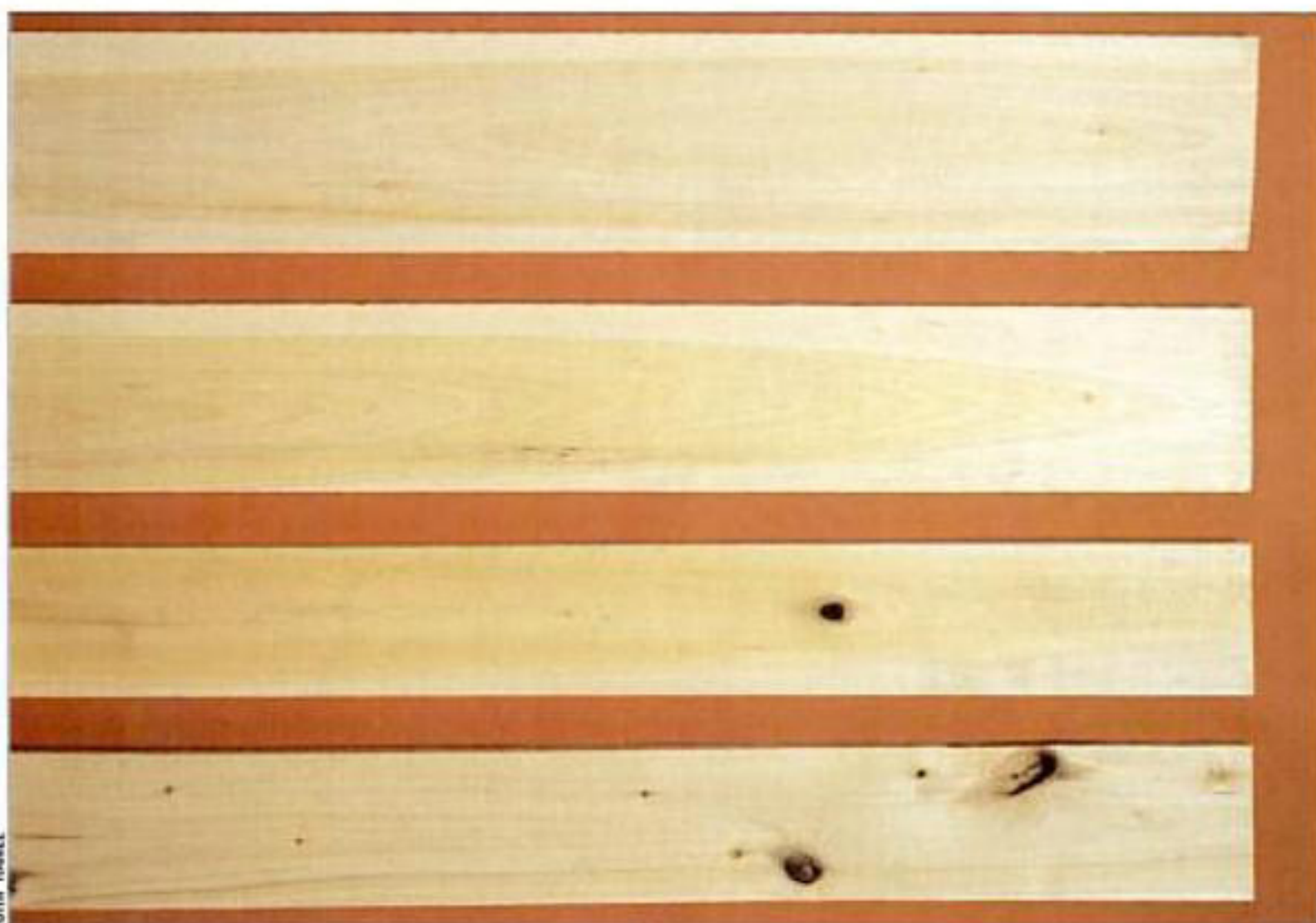
But, how do you figure the amount of wood you need when you have to

work around all those knots? The easiest thing to do is buy 20 to 25 percent more wood than you think you'll actually need. "Working wood is not like slicing loaf bread," says Hil Peel, manager of Wall's lumberyard. Waste is inevitable even if the board is free of defects because you lose to saw kerfs, jointing, and other milling operations. Don't underestimate the waste from kerfs; some carbide blades take nearly 1/4 in. per pass.

And, stay away from the elaborate cutting diagrams sometimes found in project articles. These diagrams are supposed to show you how to cut lots of little parts out of a board, but they can become very restrictive. Peel tells of one woodworker who spent hours making four pages of diagrams and then had to spend another couple of hours searching for boards to fit the diagrams. "I think it's better to buy about 100 bd. ft. and get the stock you need without worrying about cutting diagrams," Peel advises. "Plus, if you buy at least 100 bd. ft., you usually get a quantity discount and can use what's left on the next project."

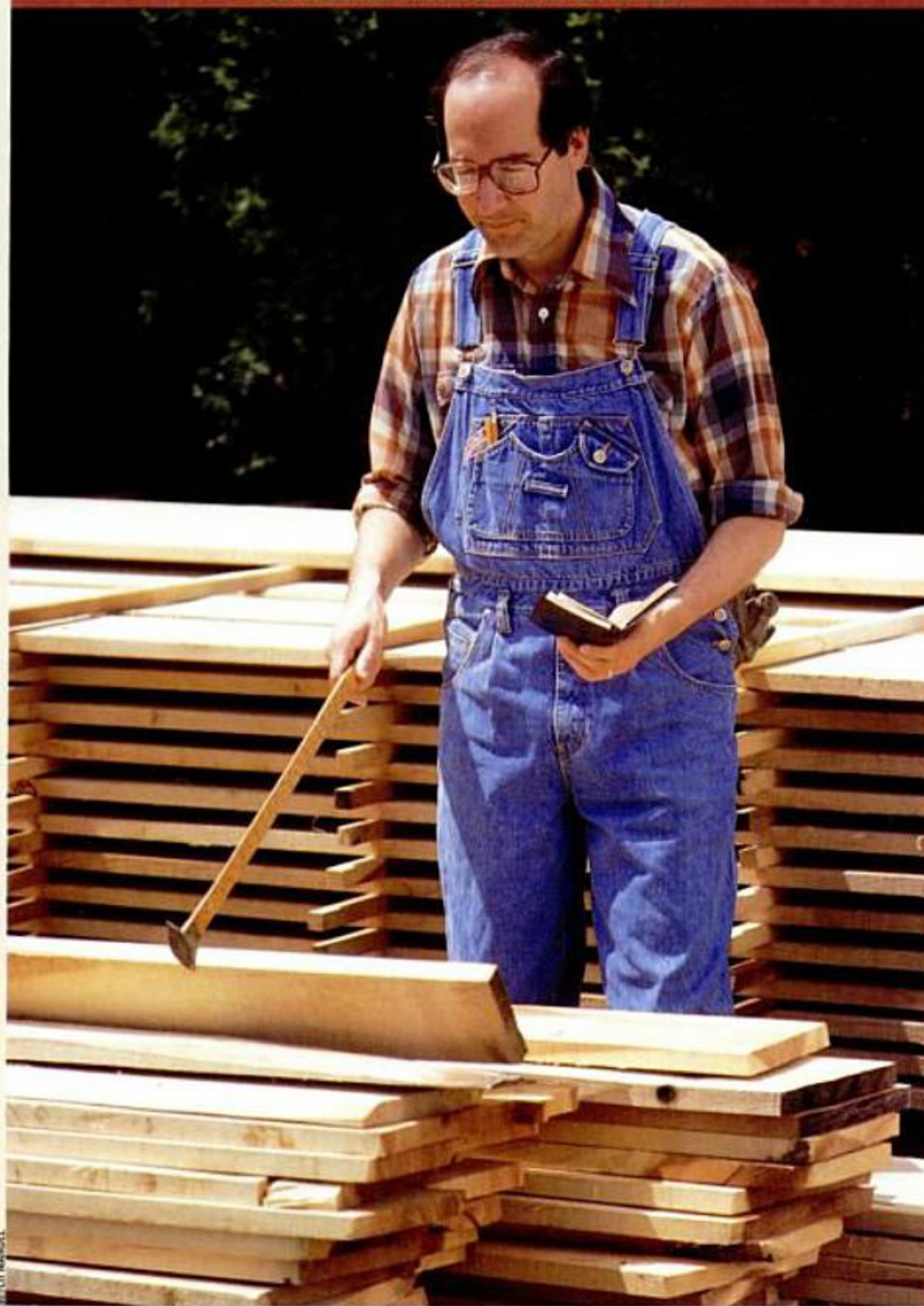
Wood Movement

Once you've chosen your wood, consider how the new environment of your shop will affect it. I like to buy wood at least a week or two before I need it so it can adjust to my shop's humidity level. This generally reduces problems with wood movement from differences in humidity between the shop and the lumberyard. To minimize chances that kiln-dried stock will pick up moisture after it leaves the lumberyard, keep the wood inside in a dry, perfectly flat area. Lumber dealer Wall



Wood grades give you an indication of the number of defects in a board. Pictured here (top to bottom) are pieces of FAS, select, No. 1 common, and No. 2 common poplar.

GRADING WOOD



Wood grading is part art, part science for the pros, but mostly confusion for novices. Not only is the grading system complex, but also the rules applied to hardwoods differ from those applied to softwoods. Plus, each species is likely to be eligible for several exceptions to the general guidelines.

Fortunately, you can take advantage of the grading system without actually knowing much about how a lumber grader does his work. You just have to understand a few basic terms. (See wood-grading chart.)

When a grader evaluates a board, in a way he is actually doing some of the preliminary work for you by gauging the number of defect-free areas, how large they are, and what percentage of the board they make up. Of course, he's not evaluating beauty, figure, and other design variables.

Graders judge hardwoods using standards the National Hardwood Lumber Association (NHLA) has administered since 1897. The grader checks each board with a lumber rule (see photo) to gauge the number of board feet, then uses several fairly complicated systems to determine how many clear cutting units the sawyer can obtain. Typical diagrams for firsts and seconds (FAS) and No. 1 common boards are shown in Fig. 2. The fewer the defects, the higher the grade and value of the board.

Wide boards are much more expensive than those less than 9 in. but are more prone to cupping and cracking in the drying process, so the sawyer must rip them apart for the maximum yield of high-quality

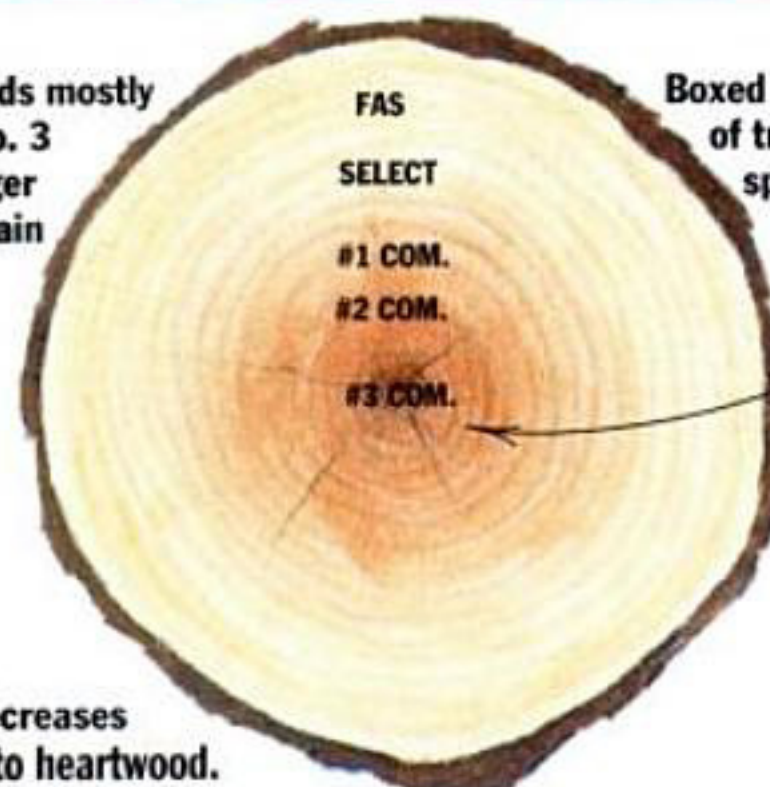


Lumber graders spend an average of 15 seconds grading a board, using a lumber rule like this one to gauge the number of board feet and a practiced eye to define defects.

FIGURE

1 A 12-in. dia. log yields mostly No. 2 common or No. 3 common stock. Larger trees generally contain more FAS lumber.

LOCATING LUMBER GRADES



Quality of lumber decreases as you move closer to heartwood.

DRAWINGS BY GLENN HUGHES

MAJOR HARDWOOD LUMBER GRADES *

Specifications for Each Grade †

GRADE	MINIMUM LENGTH (feet)	MINIMUM WIDTH (inches)	AMOUNT OF CLEAR WOOD IN BOARD (%)	MINIMUM SIZE OF CLEAR CUTTINGS	NUMBER OF CLEAR CUTTINGS
FAS (firsts and seconds)	8 (6 for walnut)	6	83 ¹ / ₃ - 100	3" x 7' or 4" x 5'	1 - 4
Selects or FAS one face	6	4	83 ¹ / ₃ - 100 [§]	3" x 7' or 4" x 5'	1 - 4
No. 1 Common	4	3	66 ² / ₃ - 83 ¹ / ₃	4" x 2' or 3" x 3'	1 - 5
No. 2 Common (utility)	4	3	50 - 66 ² / ₃	3" x 2'	No limit
No. 3 Common	4	3	25 - 33 ¹ / ₃	3" x 2'	No limit

† Grades generally determined on poorer face.
§ On best face; reverse must grade No. 1 Common.

* Source: *A Guide to Hardwood Log Grading*, Forest Service, U.S. Dept. of Agriculture.

lumber. This is one reason hardwoods are sold in varying lengths and widths.

Pine is graded and processed differently because softwoods are used primarily for construction. Rather than expect the builder or manufacturer to process the lumber, the mills do it and produce stock in standard widths and lengths.

"Whatever you do in hardwood grading, do the opposite in pine and you'll probably be doing the right thing," says William O. O'Kelley, chairman of the Haywood Community College wood products department, which runs a sawmill and kiln. "With hardwoods, you try to put a defect on the edge so it can be ripped off. On framing lumber, you put the biggest defect in the middle where it will

have least effect on strength."

Hardwood grades generally are based on the poorest quality face. With pine, the best face sets the grade for boards likely to be used by furniture makers. Many defects are prohibited in some grades of hardwoods, but you can have a little of everything in pine, although the grade drops with the increased number of defects.

Pine graded for construction follows rules that would sound very familiar to a builder. There are bans on defects that would destroy the nailing edge, limits on how much pieces can be out of square, and standards that permit crooking to the degree that it can be removed with the pulling force of a nail.

For additional information, check *Rules*

for Measurement of Hardwood and Cypress, (\$6, NHLA, Box 34518, Memphis, TN 38184, 901-377-1818), *Standard Grading Rules for Southern Pine Lumber* (\$5.25), and *Grader's Manual for Boards and Two-in. Dimension* (\$5) (both available from Southern Pine Inspection Bureau, 4709 Scenic Highway, Pensacola, FL 32504, 904-434-2611).

These technical manuals won't make anyone's top 10 list for exciting reading, but they do contain a lot of interesting information on various species as well as concise definitions for defects and other woodworking terms. The pine manuals offer a rundown on types of knots and how they affect the strength and appearance of boards.—D.B.

OBTAINING CLEAR CUTTINGS

FIGURE 2

CLEAR CUTTINGS IN A TYPICAL FAS BOARD

Cutting No. 1-6 in. x 7 ft.	
Cutting No. 2-6 in. x 6 1/2 ft.	
Cutting No. 3-8 in. x 5 ft.	

CLEAR CUTTINGS IN A TYPICAL NO. 1 COMMON BOARD

Cutting No. 1-3 1/2 in. x 4 1/2 ft.	
Cutting No. 2-8 1/2 in. x 4 1/2 ft.	
Cutting No. 3-4 1/2 in. x 4 1/2 ft.	
Cutting No. 4-6 in. x 5 2/3 ft.	

Wood graders gauge the value of a board by figuring how many clear pieces can be cut from it.

A WOOD BUYER'S GLOSSARY

also advises against putting stickers between layers of kiln-dried wood, saying they promote air circulation and moisture changes.

Moisture can wreak havoc on surfaced stock, and that's a good reason not to buy lumber that way. Wall said some of his customers have been especially discouraged with surfaced stock after seeing how much a species like oak moves and twists shortly after they get the lumber to their shops.

Here's another tip: It's often more economical and easier to mill part of a rough-cut board to produce a project than to process the whole board. If you only need a 3-ft. long piece, it doesn't pay to joint, flatten, and thickness-plane an entire 8-ft. board. Besides, cutting the board into shorter segments can significantly reduce warp in the leftover piece and make subsequent milling operations easier.

Processing your own wood gives you an opportunity to learn more about the material and how it changes with the seasons, says Wayne Raab, head of the woodworking program at Haywood Community College in Clyde, North Carolina.

Raab encourages people to use moisture meters, although the actual moisture level of a piece of wood is not as much of a problem as mixing stock with divergent moisture levels in the same project. "If you mix a piece at 12 percent with pieces at 8 percent, there's a good chance that you're going to have popping joints," he says.

Once you learn to deal with wood movement and to work with the random widths in which hardwood comes, you can build anything. Gluing up narrow stock to make wider boards produces components that are stronger and more stable than many wider boards. For Raab's students, "Working with narrow stock makes them more appreciative of wide, exceptionally beautiful boards and convinces them to hold these special pieces for more decorative work. It helps build an appreciation for material," he says.

Buying by the Log

Furniture-maker Mehler says he finds some of his best wood when buying whole logs. When he goes to a

AIR DRIED—Wood dried without application of artificial heat.

BOARD FOOT—A system of measurement. The standard board foot is 1 in. thick by 12 in. wide by 12 in. long, but any combination of dimensions yielding an equivalent amount of wood counts. Board feet are rounded to the nearest foot and are based on the thickness of the wood before surfacing. Lumber less than 1 in. thick is counted as 1 in.

CLEAR-FACE CUTTING—A board with one clear face (ordinary season checks permitted) and a reverse side that is sound.

CUTTING—A piece of wood free of knots or other defects. It can be obtained by crosscutting or ripping, but not by making diagonal cuts.

HARDWOOD—Lumber from any tree with broad leaves usually shed in the fall (deciduous). Many hardwoods are not that hard. Poplar and willow, for example, are generally softer than pine.

HEARTWOOD—The darker section of wood extending from the pith, or center of a tree, to the sapwood. Unlimited amounts allowed in most wood grades.

KILN DRIED—Wood dried with artificial heat in a kiln.

LINEAR FOOT—A system of measurement in which only the length of the lumber is considered. This method is often used in home centers and similar outlets that mostly market pine.

MOISTURE CONTENT—The amount of moisture trapped in the cells of the wood. Moisture levels for air-dried wood vary according to region. In Arizona, air-dried hardwood may reach 6 percent, in New England about 12 to 15 percent. Generally, hardwoods in the U.S. are dried to 7 to 9 percent moisture content.

SAPWOOD—The growth section near the outside of the log that is generally paler in color than the center. Unlimited amounts allowed in most wood grades.

SEASON CHECKS—Lengthwise separations resulting from stress as wood dries. Season checks usually don't affect grade if they will dress out at standard surface thicknesses.

SOFTWOOD—Lumber from needle-leaved trees, usually evergreens that bear their seeds in cones (coniferous).

SOUND CUTTING—A section of wood free of rot, pitch, shake, and wane. Sound knots, worm holes, and several other defects are allowed.

STAIN—Describes the initial stages of decay in hardwoods. Not usually allowed in most grades unless it will dress out when wood is surfaced to standard thickness.

SURFACE 1 EDGE (S1E) or SURFACE 2 EDGE (S2E)—Rough or surfaced lumber dressed on one edge (S1E) or two edges (S2E). Nominal width can be $\frac{3}{8}$ in. scant of specified width in lumber less than 8 in. wide, and $\frac{1}{2}$ in. less than nominal width in lumber 8 in. or wider.

SURFACE 2 SIDE (S2S)—Surfaced both sides.

THICKNESS—Hardwoods are usually measured according to $\frac{1}{4}$ -in. units of thickness, referred to as quarters. A rough-sawn $\frac{4}{4}$ (four quarter) equals 1 in., $\frac{6}{4}$ equals $1\frac{1}{2}$ in., $\frac{8}{4}$ equals 2 in., and so on. Most $\frac{4}{4}$ is cut about $1\frac{1}{8}$ in. and planes down to $\frac{3}{4}$ in. or $\frac{13}{16}$.

Information derived from materials provided by National Hardwood Lumber Association, Southern Pine Inspection Bureau, Educational Lumber Co., Steve H. Wall Lumber Co.—D.B.

BUYING WOOD BY MAIL

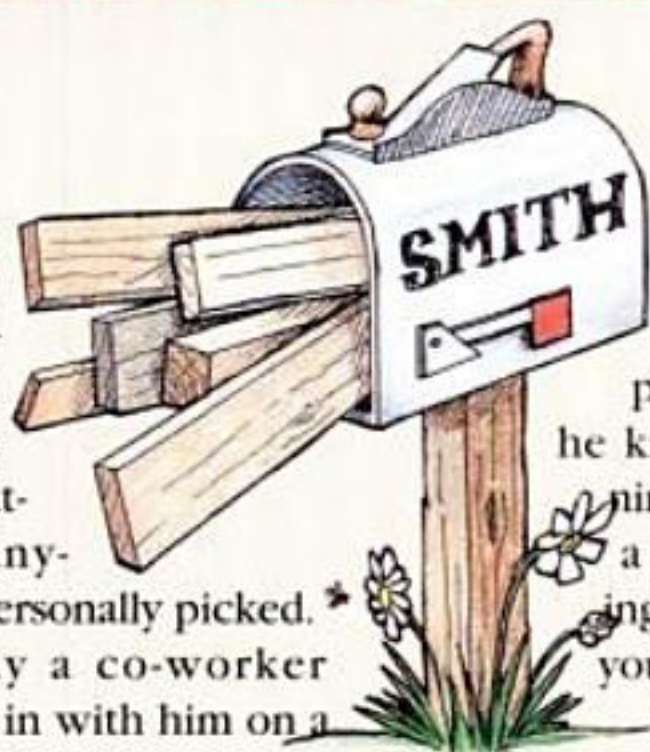
I used to shy away from mail-order lumber, figuring I just wouldn't be satisfied with anything I hadn't personally picked. Then, one day a co-worker asked me to go in with him on a mail-order purchase; he wanted to meet the minimum for free delivery. The price was good, so I took a chance.

The selection I received was pretty good. The boards had defects, but there was plenty of clear stock, lots of interesting color and figure. What's more, working the stuff and finding the parts I needed was fun.

Since then, I've had good luck with purchases from the five or six companies I've dealt with. If the company offers free shipping for a minimum order, I always buy enough to take advantage of that. If I have to pay the freight, I shop around until I find a deal where the cost of the lumber plus the freight is competitive with local sources. Now and then, I get a board that is unusually difficult to work, but that can happen even if I select each board personally. I chalk it up to the witchcraft of wood, not really a problem worth complaining about.

One way I've found to assure a successful purchase is to study the company's catalog and call the customer-service department to discuss any concerns or questions before ordering. If the dealer seems too busy to bother with questions, I assume that's my hint to do business elsewhere.

When you decide to buy by mail, begin by telling the dealer what you are building. "Speak in English, and don't try to be Mr. Professional Lumber Buyer," says James Heusinger of Berea Hardwoods, Berea, Ohio. Talk about grades



might sound good, but it can actually make it difficult for the dealer to provide what you want. If he knows what you are planning, Heusinger says he has a better chance of providing wood that best matches your project.

The two most common ordering problems Heusinger encounters stem from customers too precise about the sizes they need and customers who don't provide enough information about the wood's use. He says his company will try to provide exact sizes if possible. Most of the time, he tells customers that it's best to concentrate on stock that's suited to their project and to size it themselves rather than order specific sizes and end up with lumber unsuited for the planned project.

Once the dealer understands what wood is needed, the customer should ask what it will cost. Sometimes, the dealer can't provide the stock at a price that suits the customer. Heusinger also recommends customers ask up front about how to handle problems: Can the wood be returned? Under what circumstances? What about reimbursement? Does the buyer get a product credit or a refund? Who covers shipping costs, which can be considerable because of the weight of the material?

To help buyers get used to mail-order purchases, dealers often have specials that allow customers to try various hardwoods. One dealer I know offers a 30-pound box of mixed hardwood shorts delivered prepaid in the continental U.S. for \$29.

Heusinger advises hesitant customers to "place a small order and see what happens without taking a great risk." If the first order works out, he advises to order more and start building a good relationship with the company.—D.B.

lumberyard, Mehler looks in the pile for boards from the same tree. He says he can identify these boards because they have similar color and because the knots are in the same general location on each piece. "Even if you have two boards that are clear and pretty but not out of the same tree, you can tell the difference when they are glued up in a tabletop."

Like Mehler, I enjoy buying a whole tree when I can afford that much wood. What I like best is the abundance it offers and the exceptional grain matching that is possible when working with adjacent slices of the log. One cherry log I purchased provided enough wood for a dining room table, a couple of end tables, some molding, and several other items. Not much of the tree ended up in the scrap box—the projects just got smaller. And I sold enough bowls and weed pots I'd turned from the scraps to pay for the whole log. I did do a lot of planing and cutting, but that's part of the fun, isn't it?

If I were trying to turn a profit rather than enjoy my hobby, I would pick graded lumber, buy the minimum grade that would provide the sizes I need, and take care to get thicknesses more suited to my work. Resawing has never been one of my major profit operations, and I often have to do a lot of it when processing whole logs.

The next time I have extra wood, I'm going to enjoy an exercise Raab uses in his classes. Each student has to find a distinctive piece of wood, defects and all, get out a sketch pad, design and then build something that will make that piece of wood special. Working with those beautiful figures and textures was one of the things that drew me to woodworking in the first place. It would be fun to rediscover that kind of enthusiasm. ▲



DICK BURROWS is a free-lance writer and woodworker in Tennessee.

SHARPENING GOUGES

*Getting the Edge With
an Oilstone*

Gouges, those familiar curved carving chisels, are time-honored, versatile tools that are used by craftsmen of all abilities, yet few people seem to know how to put a good cutting edge on a gouge.

The Japanese craftsman sharpens his gouges with regular water stones. He makes a number of grooves in the stone to fit his gouge sizes. Sometimes he uses one groove for two or three gouges, even though they have different radii. The problem with this method is that if you have many gouges, you need many stones to sharpen them.

I prefer the Western method of sharpening gouges free-

hand with oilstones because they are harder than Japanese water stones and their surfaces won't become uneven as quickly. I sharpen the bevel on a medium India stone followed by a hard Arkansas stone or Washita stone, and then I use a hard Arkansas slip stone for the inside face of the gouge. (Slip stones taper in thickness and have two rounded edges of different radii.) When I need to change the bevel angle or when there is a bad nick in the edge, I start with a coarse carborundum stone.

Bench oil stones are available in a variety of sizes. I find a 2-in. x 8-in. stone is big enough for most gouges, but you

B Y T O S H I O O D A T E



Sharpening a gouge on an oilstone isn't hard once you've learned a few simple techniques. Oilstones are best for gouge sharpening. Pictured (inset left to right) hard Arkansas, small Washita, medium India, large Washita, and coarse carborundum. The hard Arkansas slip stone (front) removes the burrs.



To find the bevel angle, place the shoulder of the bevel on the stone and lift the gouge handle until the edge makes contact with the stone.

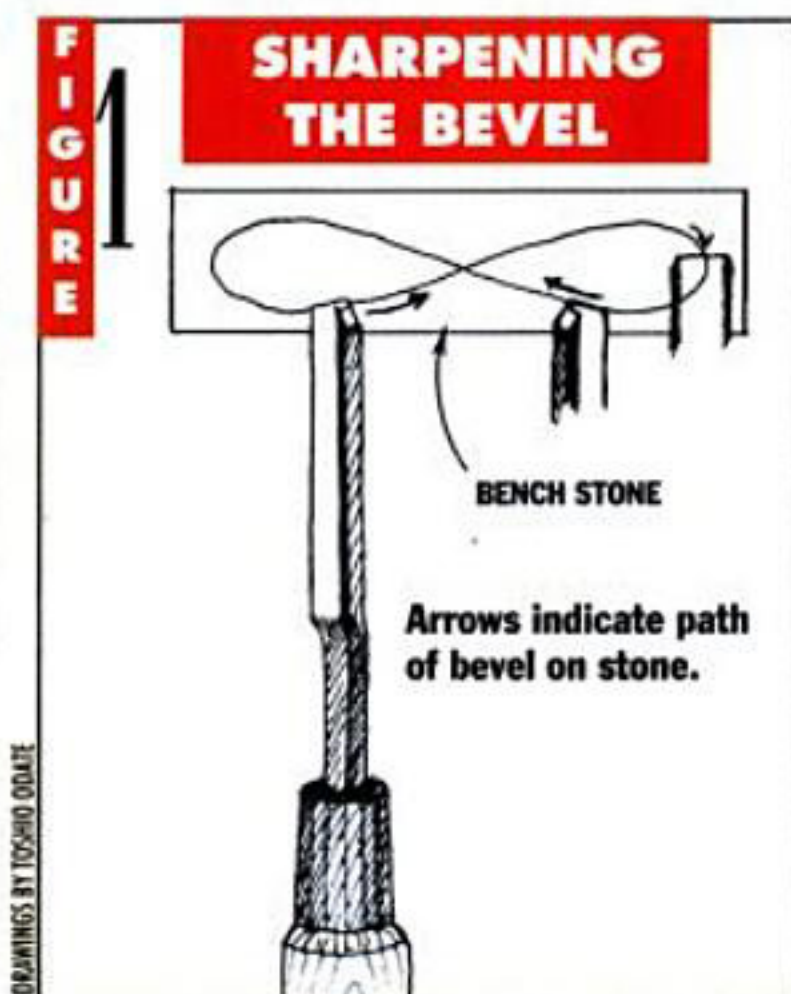
might need a longer stone for very wide gouges.

If the gouge is blunt or badly damaged, I first grind the bevel to approximate shape on a grinding wheel before using the oilstones. A water-cooled grindstone is best, but you can use a regular grinding wheel if you use a light touch. To avoid burning the edge, frequently lift the tool slightly off the wheel to let the moving air cool it. I prefer this method to dipping the tool in water.

The bevel angle, usually between 20° and 30°, depends on the kind of wood you are carving and the steel itself. Harder woods require a more blunt bevel angle than softer woods in order to give adequate strength to the edge. You can gauge your bevel angle by cutting a notch in a piece of cardboard at the desired angle and holding it up to your bevel.

Sharpening the Bevel

To begin sharpening the bevel, place the medium stone on the bench parallel to the edge of the bench. Put some sharpening oil (I use mineral oil)



on the stone and face forward at a 45° angle to the stone. Hold the gouge handle with your right hand and place the shoulder of the bevel on the stone. Put two or three fingers of your left hand on the gouge near the cutting edge and gradually lift the handle with your right hand until the cutting edge touches the stone. (See photo, above.) This way you have less chance of dam-



If you don't have a bench stone, sharpen the bevel with a slip stone.

aging the cutting edge.

The idea when sharpening is to keep the bevel straight from the shoulder to the cutting edge, not rounded over or hollowed out. Once you've found the bevel angle, lock your arms in this position to maintain the angle.

Now with your right wrist, roll the gouge evenly from corner to corner as you press the bevel to the stone with the fingers of your left hand. Move the gouge over the stone in a figure eight pattern while pressing and rolling it. (See Fig. 1.)

To keep the corners of the gouge from digging into the stone, always sharpen so the corners are trailing away from the direction the gouge is moving. (See Fig 1.) As you push the gouge away from you, the left corner is trailing, and as you pull the gouge toward you, the right corner is trailing.

Hard Arkansas bench stones are expensive. If you do not have a bench finishing stone, you can finish the bevel on a slip stone. Rub the bevel on the flat part of the slip stone, moving the stone up and down with one hand while rotating the gouge with the other. (See photo, above.) This combined motion is like patting your head and rubbing your stomach at the same time, but with a little practice it becomes quite natural.

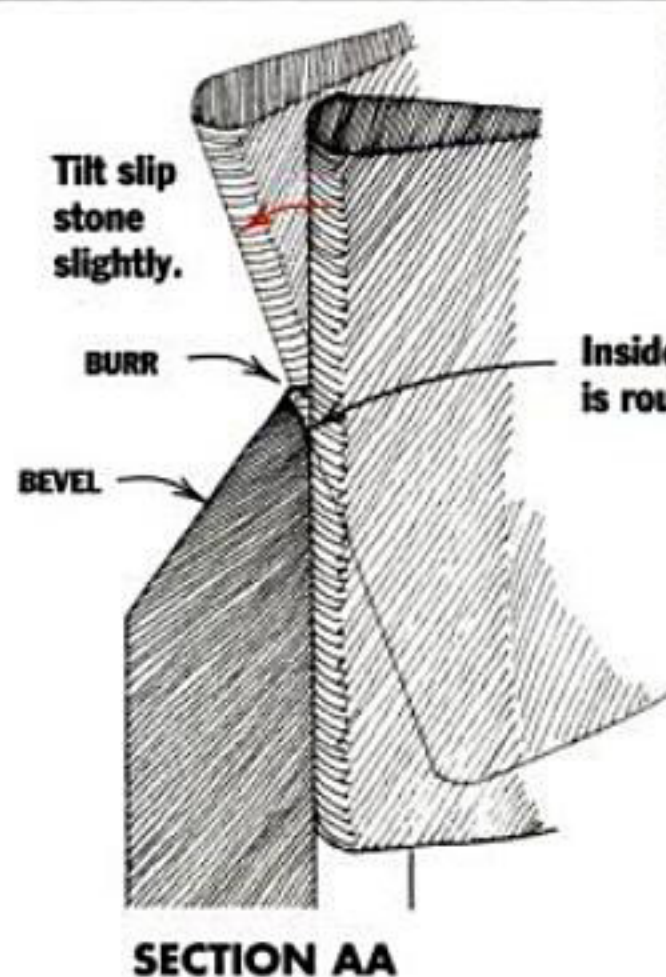
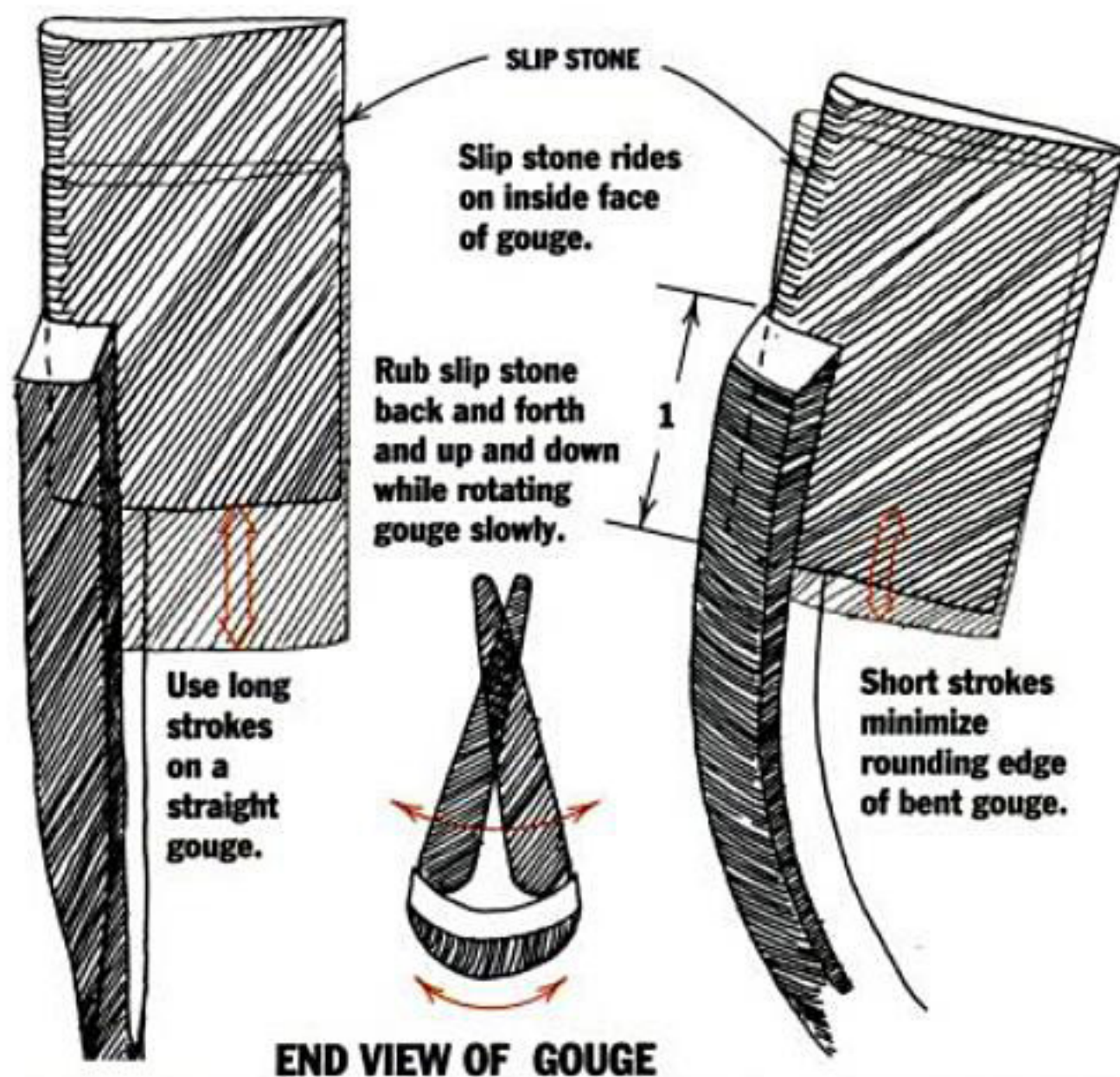
Removing the Burr

The sharpening process for gouges is much like that for plane and chisel blades: First you create a burr on the edge, then you take it off with the finishing stone. With the gouge, the inside face is curved so you have to

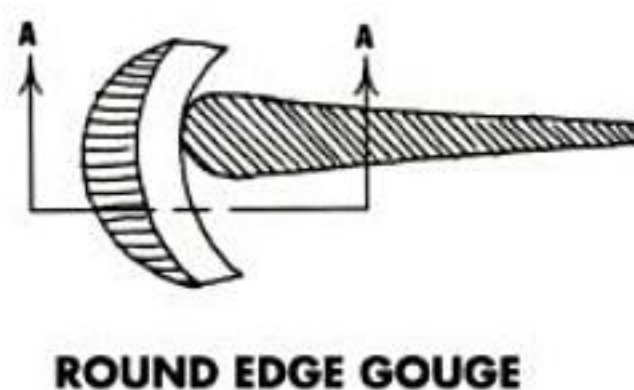
REMOVING THE BURR

STRAIGHT GOUGE

BENT GOUGE



If the inside edge of the gouge is rounded, you will have to tilt the slip stone slightly to remove the burr. This is preferable to grinding the gouge back past the rounded part.



Remove the burr by rubbing the slip stone up and down on the inside face of the gouge while turning the gouge slowly with your other hand.

ting edge and rub it up and down with very short strokes. You can also swing the slip stone left and right from this position. In this way, you minimize the rounding effect. (See Fig. 2.)

Gouges with Rounded Edges

I have often experienced difficulty in removing burrs from new gouges because the inside face is not straight at the edge. The manufacturer grinds the inside of the gouge and then buffs it, rounding the edge slightly. This rounding-over is also a problem with second-hand gouges that have been sharpened improperly. When you use the slip stone with a straight up-and-down motion, the stone doesn't touch the burr. (See Fig. 2.)

Usually, this roundness extends only $\frac{1}{16}$ in. to $\frac{1}{8}$ in. up the face. In this case, you should tilt the slip stone slightly and press just hard enough to take off the burr. Some craftsmen don't like this adjustment, so they grind off the rounded part of the edge. I feel it is a shame to waste even $\frac{1}{8}$ in. of a tool. Besides, I don't think it is very much effort to nurse the new gouge for a little while. ▲

remove the burr with a slip stone.

To do this, hold the gouge in front of you with your left hand, press the rounded edge of the slip stone into the curve of the gouge, then rub the stone up and down and back and forth, again rotating the gouge with your other hand. (See photo, top right.) When you are taking off the burr, you have to alternate between the flat Arkansas stone on the bevel and the slip stone on the inside until the burr is gone and the cutting edge is straight.

Sharpening Bent Gouges

Sharpening bent gouges requires a different technique because of the bend. (See Fig 2.) You sharpen the bevel like a straight gouge, but you can't make long strokes on the inside with the slip stone. If you do, you will create a small round bevel on the inside as the slip stone rides up the bend in the gouge.

To keep the inside edge as straight as possible, position the end of the slip stone about 1 in. to $1\frac{1}{4}$ in. from the cut-



TOSHIO ODATE is a noted sculptor and shoji maker in Connecticut. He is author of the book *Japanese Woodworking Tools: Their Traditions, Spirit and Use* (1984, Taunton Press, Newtown, CT 06470).



DISPLAY CABINET

*Uncluttered Design Lets Your
Treasures Shine Through*

BY ELLIS VALENTINE

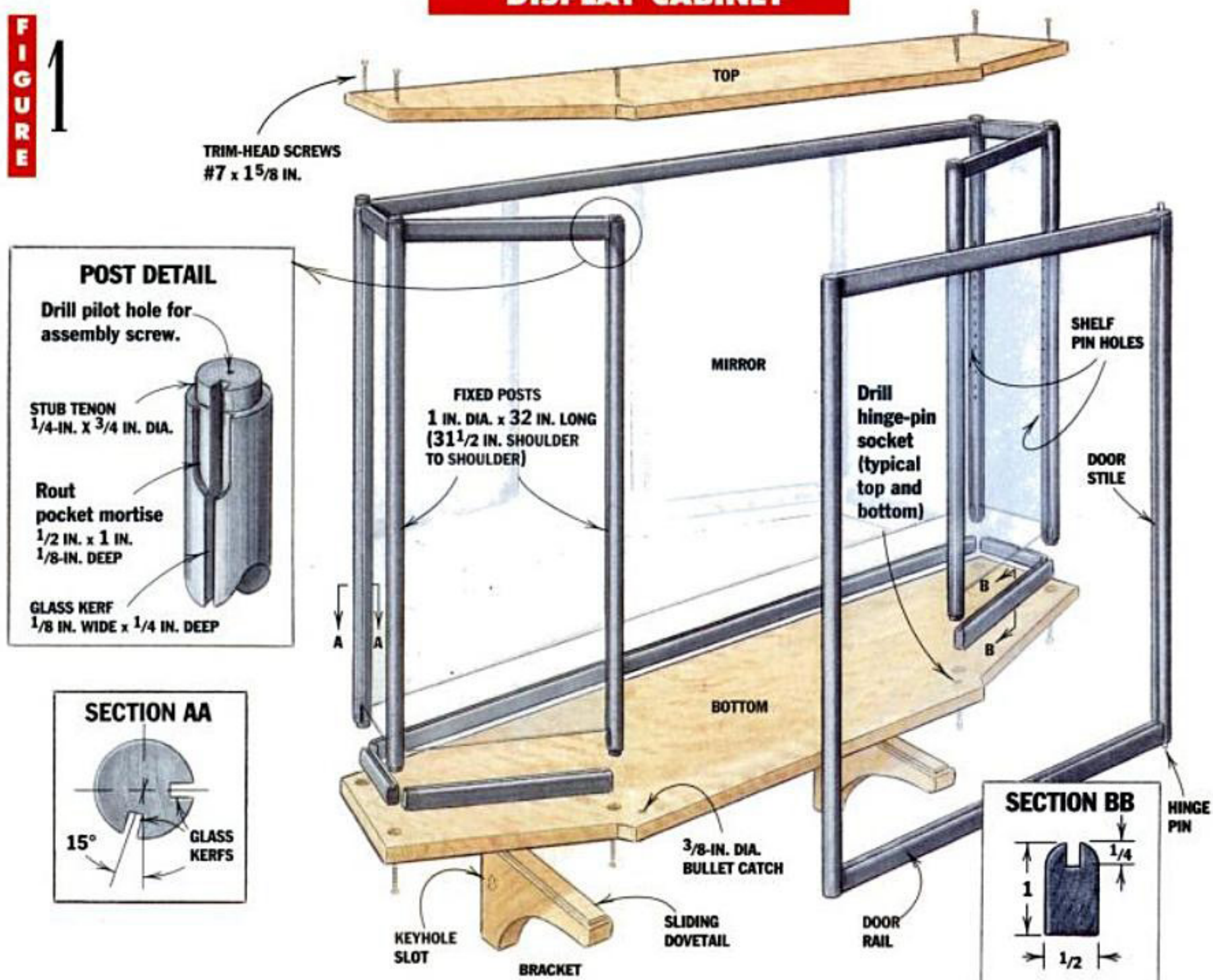
If you're like a lot of people, you have an uncanny tendency to accumulate *things*. Some are priceless, others merely memorabilia from times and places past. Sadly, these precious objects are often doomed to oblivion—hidden away in drawers and boxes—unless you have a decent place to show them off. I built this display cabinet as a solution.

For better or worse, most of the things I design for myself are intentionally simple, consuming vast amounts of neither time nor materials. The trick is to make them attractive and functional. In this case, my aim was to let the knickknacks speak for themselves without much intrusion from the cabinet. My choice was plenty of glass and just enough wood to hold everything together.

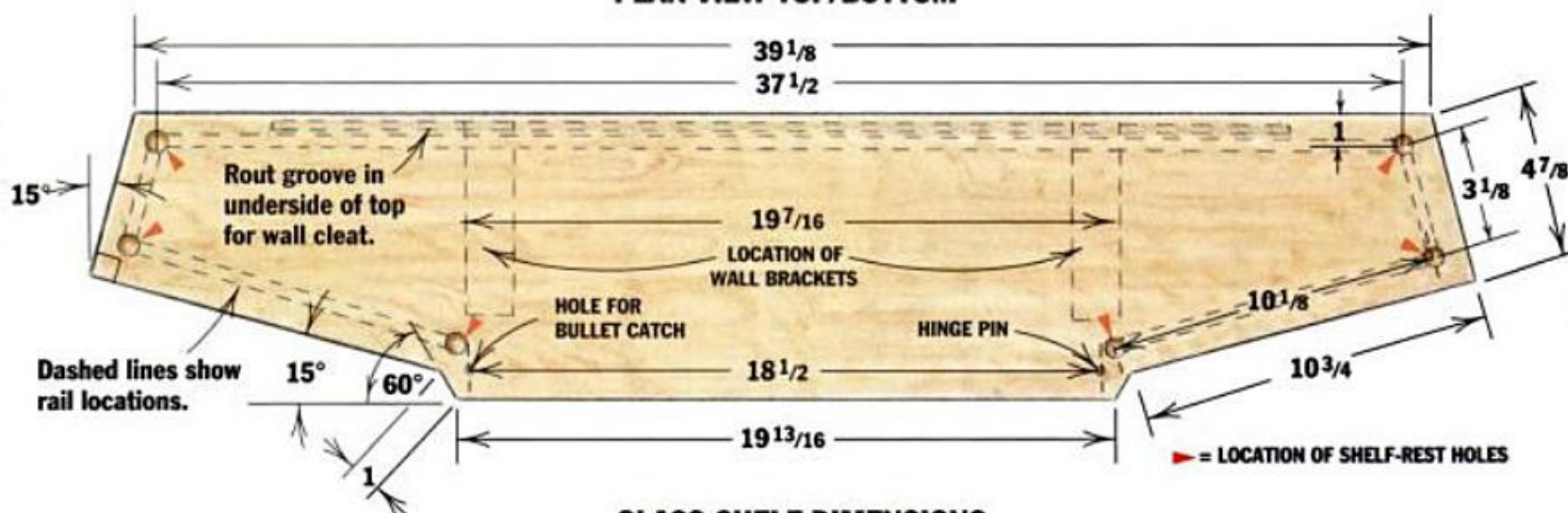
One aspect of designing with glass is that you have to allow for the possibility of breakage: How will you replace broken panes? It would have been much too complicated to

DISPLAY CABINET

FIGURE 1

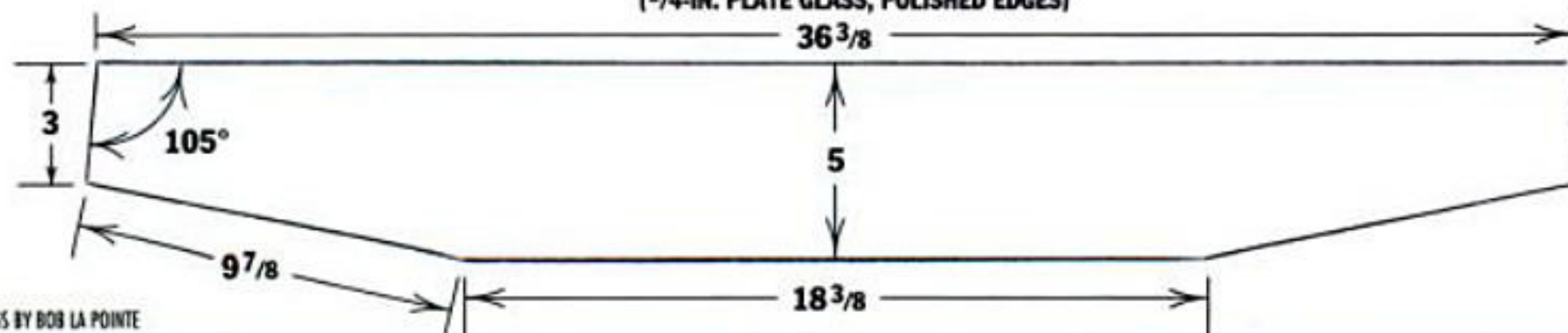


PLAN VIEW TOP/BOTTOM



GLASS-SHELF DIMENSIONS

(1/4-IN. PLATE GLASS, POLISHED EDGES)



BILL OF MATERIALS

PART	QTY	DIMENSIONS
Top / Bottom	2	3/4" x 8 3/8" x 41 1/2"
Fixed Post	6	1" dia. x 32"
Rail	4	1/2" x 1" x 2 3/8"
Rail	4	1/2" x 1" x 9 3/8"
Rail	2	1/2" x 1" x 36 3/4"
Door Stile	2	1" dia. x 31 7/16"
Door Rail	2	1/2" x 1" x 17 3/4"
Bracket	2	1 1/2" x 6" x 6"
Wall Cleat	1	3/4" x 2 1/2" x 30"
Glass	2	1/8" x 2 1/2" x 30"
Glass	2	1/8" x 9 1/2" x 30"
Glass	1	1/8" x 18" x 30"
Glass Shelf	3	1/4" x 5" x 38"
Bronze Mirror	1	1/8" x 37" x 30"

make glass fillets for round stiles, so I made a knockdown cabinet.

Making the Cabinet

You can use almost any hardwood for this cabinet. I made mine from ebony and bird's-eye maple. Just be sure the wood you choose for the vertical posts is well seasoned, fairly straight grained, and free of knots to prevent distortion. It's a good idea to make one or two extra posts, just in case.

Make the top and bottom of the cabinet as shown in Fig. 1. After planing the pieces to finish thickness, band-saw the shapes. You can finish the edges with scrapers and files or make a template and trim them to size with a flush-trimming router bit. If you choose the router method, you need to make a template for only one end since the top and bottom are symmetrical from left to right. You rout one end, flip the board and template, and rout the other end. This way, you are always trimming "downhill" on the grain, eliminating tendency for tear-out.

Once you've finished these pieces, use a plunge router to groove the underside of the top for a wall cleat. Make the cleat from maple, and rabbet a tongue on the back edge to fit the groove in the cabinet.

Next, rout sliding-dovetail slots in the underside of the bottom for the two wall support brackets. (See Fig. 1.) I made a simple plywood template and used a 1-in. dia. template bushing to rout the slots.

Mortise-and-tenon joints and trim-head screws (available from McFeely's, Box 3, Lynchburg, VA 24505-0003, 800-443-7937) attach the top and bottom to the vertical posts. Start this step

by laying out and drilling the 3/4-in. dia. mortises for the post tenons. (See Fig. 1.) Then, with a 5/8-in. bit, drill through the center of each mortise to the other side. Countersink the outer faces of the holes with a 3/16-in. bit.

Next, drill and counterbore holes in the top and bottom for 3/8-in. dia. bullet catches. The catches should extend about 1/8 in. above the face of the wood.

Sand the top and bottom, and chamfer or round over the edges as desired.

Make the wall brackets from 1 1/2-in. stock that complements the other wood(s) you're using. (See Fig. 1.) You can use a French curve to lay out a pleasing profile. Bandsaw and clean up the profile, then rout sliding dovetails on the top edges to fit the sockets in the cabinet. After this, rout a keyhole slot in the back of each bracket for a #10 pan-head screw.

To make the posts, start with slightly oversized blanks, say 1 1/8 in. square and at least 32 1/2 in. long. Sticker them carefully for a day or two to give their moisture content a chance to stabilize. If any pieces warp or bow, you can cut them for the rails later.

Lightly joint two faces of each blank so they're flat and square to each other. Use a push stick to keep your hands away from the blade, but don't apply too much downward pressure on the pieces as you joint them. The object is to take out any remaining bow, not immortalize it. Rip the blanks to exactly 1 in. square on the tablesaw.

Next, cut the glass grooves in the posts on the tablesaw, using a carbide blade with at least 50 to 60 teeth and a kerf width matching the thickness of the glass. I recommend double-strength (1/8-in. thick) glass and mirror

for this project. Get a sample from your local supplier to see if it fits in a test kerf. If there's any resistance or play, try another saw blade.

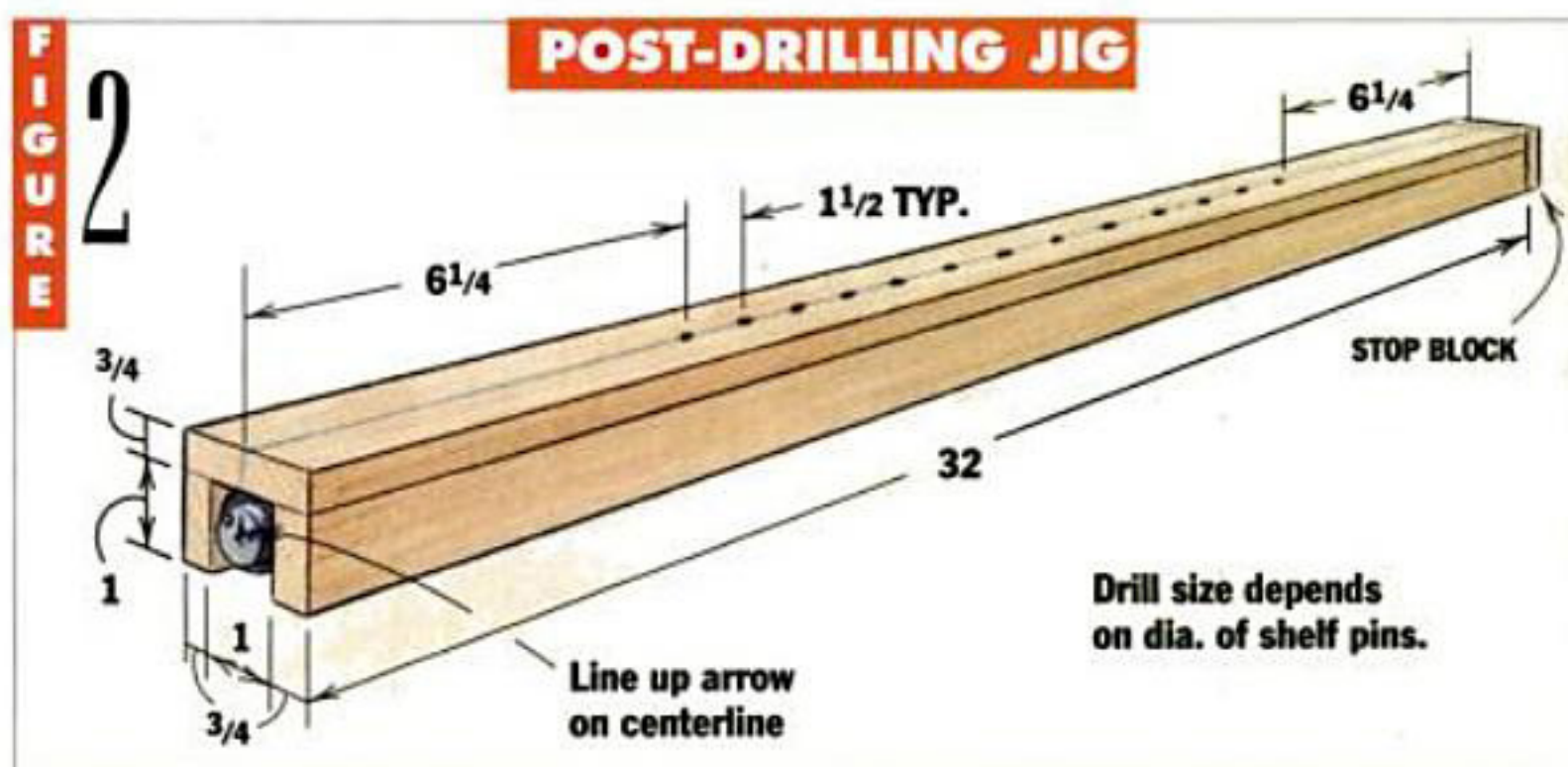
Of the eight posts (counting the two door stiles), four will have two glass grooves and the other four will have one apiece. (See Fig. 1.) All but two of the kerfs run along the blanks' centerlines. The two angled kerfs on the back posts are easy to cut if you tilt the blade to 15° and set the rip fence so the blade is centered on a diameter line. (See Fig. 1, Section AA.) Set the blade a bit higher so the kerf will still be 1/4 in. deep.

To create the posts' round shape, use a router with a 1/2-in. radius round-over bit. Clamp a straight fence to your router table and set the bit to cut exactly tangent to the table and the fence. I used two feather boards to hold the work firmly against the fence and the table. (See photo, below.) It takes four passes on this setup to round a post.

When you've rounded all the posts,



Round the cabinet posts on the router table, using feather boards to keep the flat faces firmly against the table and fence.





▲ Create the stub tenons by rolling the posts slowly against an auxiliary fence on the tablesaw.

trim them to length on the tablesaw or radial arm saw, making sure you hold them firmly and cut them slowly. Remember to leave $\frac{1}{4}$ in. on both ends of the fixed posts for the stub tenons. Cut the door stiles $\frac{1}{16}$ in. shorter than the shoulder-to-shoulder dimension of the fixed posts to provide some clearance.

To machine the stub tenons, set up your tablesaw so the outside of the blade is exactly $\frac{1}{4}$ in. from the fence and raised to a height of just less than $\frac{1}{8}$ in. Then clamp a plywood fence $\frac{1}{2}$ in. behind the top of the blade's arc and rotate the ends of each post slowly into the blade—opposite the blade rotation. (See photo.) Finish sand the posts with 220-grit paper folded around a scrap of soft leather.

Next, make the shelf rests. I wanted delicate-looking rests, so I cut some 16d common nails into $\frac{7}{8}$ -in. long pieces. To provide a soft cushion for the glass shelves, I dipped the rests to a depth of $\frac{1}{2}$ in. in a black liquid-plastic coating used for tool handles (available from Lee Valley Tools Ltd., 1080 Morrison Dr., Ottawa, Ontario K2H 8K7, 800-461-5053).

Now you can drill the shelf-rest holes in the posts. Choose a drill bit a few thousandths of an inch larger than the shelf rests you've made. If your nails are like mine (about 0.165 in. dia.), an $\frac{1}{16}$ -in. bit should work fine, but for a closer tolerance you might choose a #18 or #19 machinist's drill.

Make a drilling fixture to be sure the hole locations are consistent from one post to the next. (See Fig. 2.) Mark the top end of each post with an arrow indicating where the line of shelf-rest holes will be, as shown in Fig. 1. Next, place one of the posts in the fixture so



▲ Glue the door rails to the top and bottom of the cabinet, using spring clamps to secure them.

the arrow points to the centerline and clamp the sides of the fixture to the post. Be sure the bottom end of the post is tight against the stop. Bore the holes to a depth of $\frac{3}{8}$ in. with a drill press. Repeat this operation on each of the six posts.

Make the door rails from the same stock as the posts. Begin by preparing about 10 ft. of finished strip stock 1 in. wide and slightly more than $\frac{1}{2}$ in. thick. (The actual thickness should be equal to the width of a groove produced by your $\frac{1}{2}$ -in. straight router bit.)

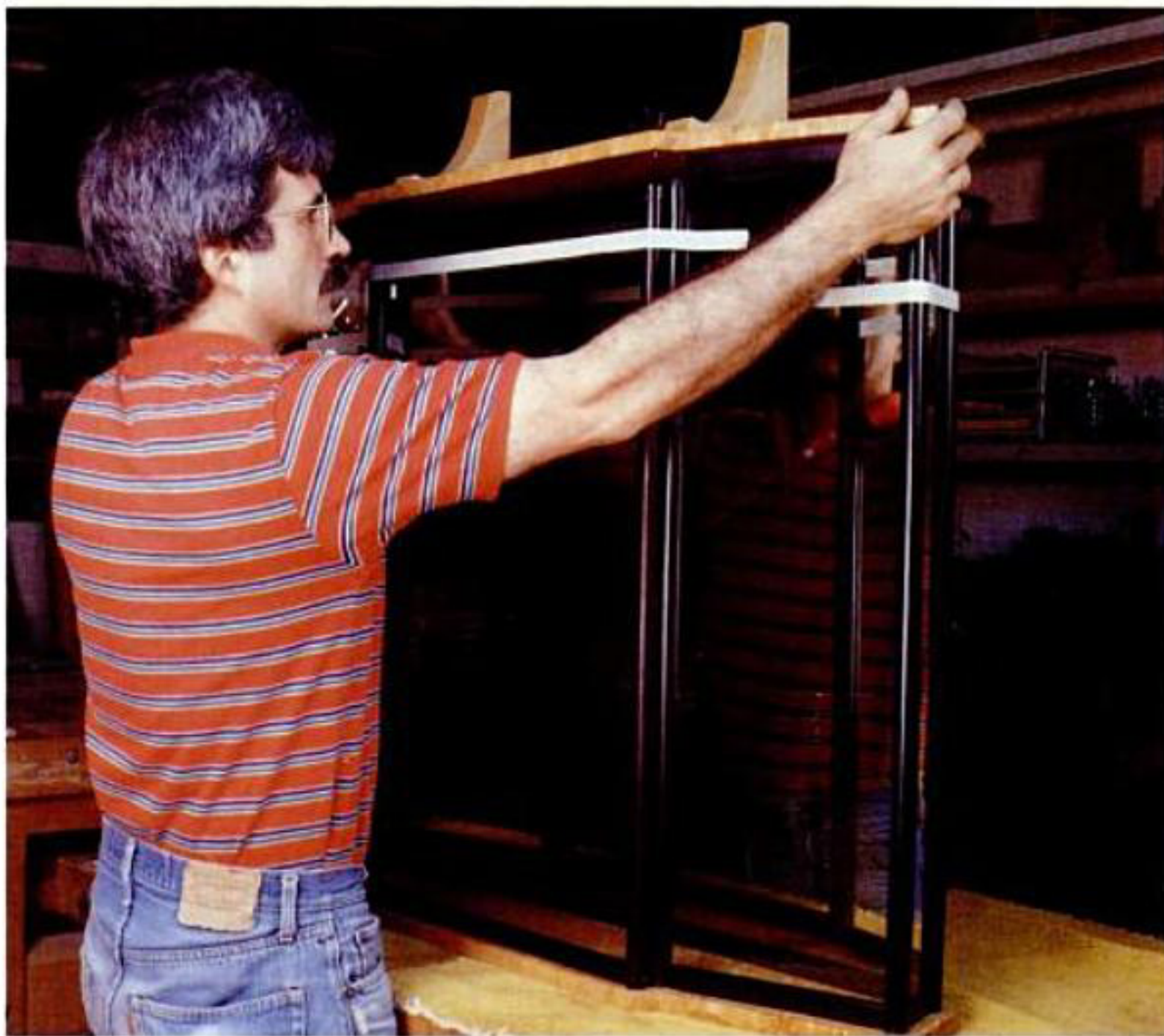
On the tablesaw, plow a kerf for the

glass on the centerline of the edge of each rail. (See Fig. 1, Section BB.) Then, on a router table, round the corners on the kerfed side of each rail with two passes over a $\frac{1}{4}$ -in. radius round-over bit.

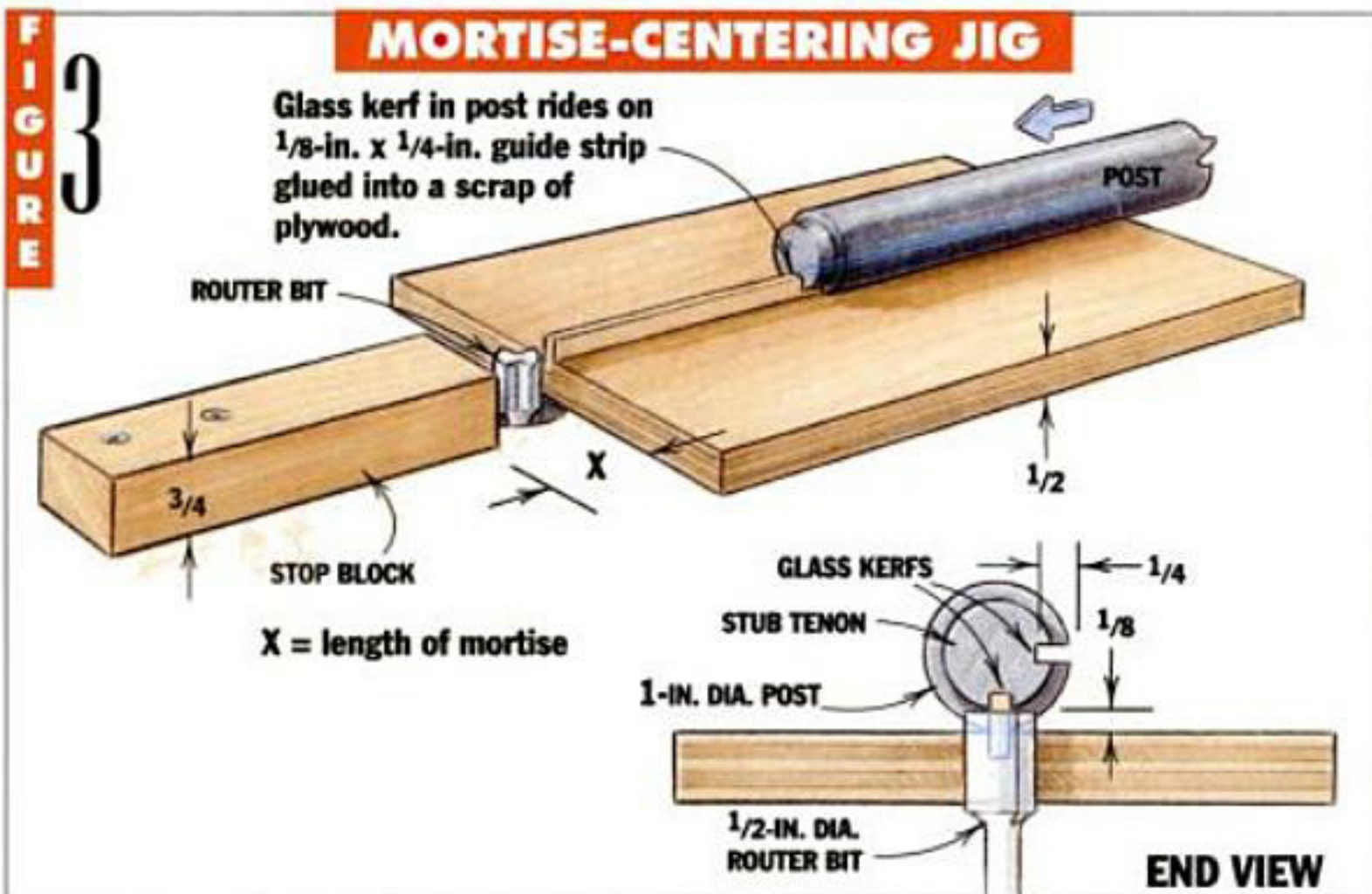
To determine the lengths of the rails, simply measure the distances between the round mortises you cut in the top and bottom. Cut each rail to length with a strip of wood in the kerf to prevent tear-out. Lightly sand all the rails with your sanding pad, then set them aside until the final assembly.

Next, with a $\frac{1}{2}$ -in. straight bit, rout shallow pocket mortises at the top and bottom of each post to receive the rails, as shown in Fig. 1. This creates a clean appearance between the rails and the posts. To keep the mortises centered on the glass kerfs and to prevent grain tear-out, you can make a quick alignment jig by gluing a $\frac{1}{8}$ -in. thick strip of wood into a groove in a scrap of plywood. (See Fig. 3.) Use a rabbet plane to trim the height and thickness of this guide strip so it barely slides freely in a typical glass kerf.

To set up the jig, first clamp it to the table so the guide strip is centered on



▲ Once the glass is in place, carefully assemble the bottom onto the cabinet frame. The rails were preglued for easier assembly.



After drilling a shallow hole in the closing-door stile for the bullet catch, file a ramp to make the catch work smoothly.

the bit and just touching it. Clamp a scrap of wood on the other side of the cutter to stop the mortise exactly 1 in. from the shoulder of the stub tenon. Adjust the height of the router bit until it is barely touching the stub tenon.

Now you can rout the mortises. Feed each post into the bit, sliding the glass kerf on the guide strip. Remember, the door stiles are 1/16 in. shorter than the shoulder-to-shoulder dimension of the posts, so make the mortises 1/32 in. shorter and rip 1/32 in. off the width of the door rails.

Now you can preassemble the fixed posts between the top and bottom of the case. Drill pilot holes in the ends of the posts for the assembly screws, using the clearance holes in the top and bottom as guides.

To construct the door, first drill and counterbore the stiles for the rail-assembly screws, as shown in Fig. 1. Clamp the rails in position between

the stiles, and drill pilot holes in the rails with a 7/16-in. bit in a hand-held drill, using the counterbored holes in the stiles as guides.

The hinge stile of the door pivots on metal pins set into holes in the top and bottom of the cabinet. (See Fig. 1.) I made my pins from 3/4-in. long segments of the same rail stock I used for the shelf rests. Drill 3/8-in. deep holes in the ends of the hinge stile and in the top and bottom for the hinge pins.

Glue the rails to the top and bottom of the cabinet with a thin film of yellow glue, clamping them lightly with spring clamps. (See photo, previous page.) Position them by temporarily installing the adjacent posts as you go.

Allow the glue to dry, clean off any excess, and apply the finish of your choice to all parts of the cabinet. I wiped on a few coats of an oil finish, but suit yourself. Try not to get any oil on the bracket dovetails or sockets.

Assembling the Cabinet

Now you're ready to put the cabinet together with the glass and mirror in place. You may wish you had three hands during this process, but I'm living proof that it's possible for one person to work alone.

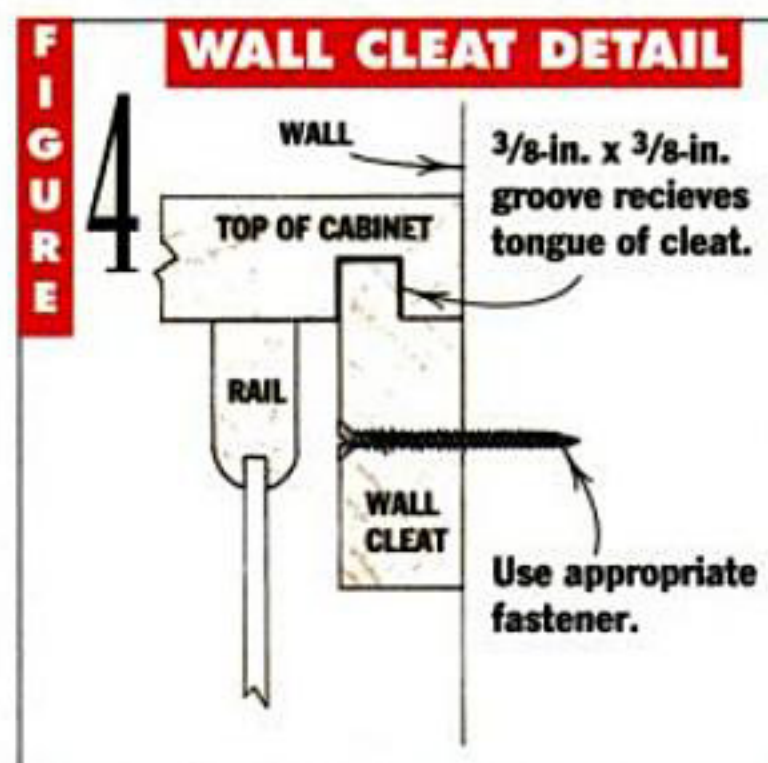
First, glue the brackets into the dovetail sockets in the bottom. Next, screw the door together with the glass in place so it's ready when you assemble the rest of the cabinet. Square up the door if necessary with thin shims between the glass and the rails.

Assemble the cabinet upside down,

inserting the top tenons of the posts into the mortises in the top of the cabinet and anchoring them with the trim-head screws. Carefully slide the glass and mirror into the grooves in the posts. Stand the door in place and secure it to the adjacent posts with masking tape. Then carefully maneuver the bottom onto the inverted cabinet and screw it down. (See photo, previous page.)

Next, press the bullet catches into the predrilled holes. You should open and close the door a few times so the catches mark their paths on the ends of the closing stile. You can then drill shallow depressions with a regular twist drill where the catches come to rest when the door is closed. Finally, on the closing stile, file little ramps sloped to the inside of the door to ease the operation of the catches. (See photo.)

You'll find the cabinet easier to install if you first make a cardboard or plywood template that relates the keyhole screw locations to the top wall cleat. Screw the cleat to the wall, making sure it's level and firmly anchored to studs or masonry. Mark the locations for



the keyhole screws with the mounting template and drive them in to the correct depth for the slots. Lift the cabinet into position and lower it onto the top cleat and the screws. Install the adjustable glass shelves, and you're ready to display your treasures. ▲



ELLIS VALENTINE
is associate editor of AW.

FENCES

High-Performance Add-Ons for Accurate Cuts

BY DAVE SELLERS

No matter what kind of tablesaw you have, its accuracy depends on the operation of its rip fence. And fences that come as standard equipment range from OK to downright awful. Some have limited rip capacity and flimsy construction. Many are fussy to adjust parallel with the saw blade or don't *stay* parallel once set. This can cause saw teeth marks or burn marks on the cut edge, or invite dangerous kick-back. Often the rip measurement scale is inaccurate or hard to read as well.

Fortunately, six companies have developed aftermarket rip fences that are designed to work better than standard ones.

These replacement rip fences have longer rails for greater rip capacity, beefy construction, and positive locking mechanisms to keep them parallel. Setting the fences accurately within $\frac{1}{64}$ in. is no problem with the large, easy-to-read measurement scales.

To see if these aftermarket fences are worth the price (between \$240 and \$410), I tested six brands. I chose models with rails long enough to allow ripping to the center of a 4 x 8 sheet of plywood—generally the most popular rail length. I mounted each on a new 10-in. Delta Unisaw in the AMERICAN WOODWORKER shop, and adjusted it according to the instruction manual.

All six fences are well made. Five are heavy-duty units suitable for production cabinet shops. The sixth, the Accufence, is a lighter-duty product with a few attractive features for a smaller workshop. As upgrades, you'll find



PHOTOS BY MITCH MANDEL

An aftermarket rip fence can improve the performance of a standard fence, enhancing the table-saw's precision.

that any one of them will help you to make smoother, more accurate rip cuts.

I didn't spend enough time with the fences to get a feel for their long-range performance, but their solid construction suggests they'd hold up well.

A **tablesaw fence** gets some rough treatment in a busy shop—bumps from big sheets of plywood and lots of pushing back and forth in a hurry. To get a quantitative standard of comparison for this kind of treatment, I devised two tests.

First, I locked down each fence the way you would to make a cut. Then I used a machinist's dial indicator to measure how much the fence deflected under a sideways load of 10 pounds at the back edge of the saw table. I arbitrarily chose 10 pounds to simulate the loading from very large pieces of stock pressing against the fence. Results are

reported in the discussions of each fence.

Second, I used a dial caliper to see how consistently the fences stayed parallel to the blade after being moved briskly back and forth. All the fences stayed parallel within 0.005 in. after repeated resettings. That deserves high marks for precision in our book.

What really separates one fence from another are features—like how the fence clamps to the rails and how easily it slides across the saw table. Some fences have accessories like stock pushers or hold-downs that fit securely in slots on the fence bar.

Installation time varies too. I thought this would be a snap, but some fences required considerable time to set up and

adjust. But that's no big deal when you're only installing one fence, and it's worth your time to get it right.

With five of the fences, installation requires the time or money to build or buy a right-side extension table to support the fences' long rails. (The Accufence doesn't need an extension table.) I adapted the rails to fit our Delta extension table. You can position the rails to get the amount of rip capacity to the right or left of the blade that suits your work. ▲



Dave Sellers
is assistant editor of AW.

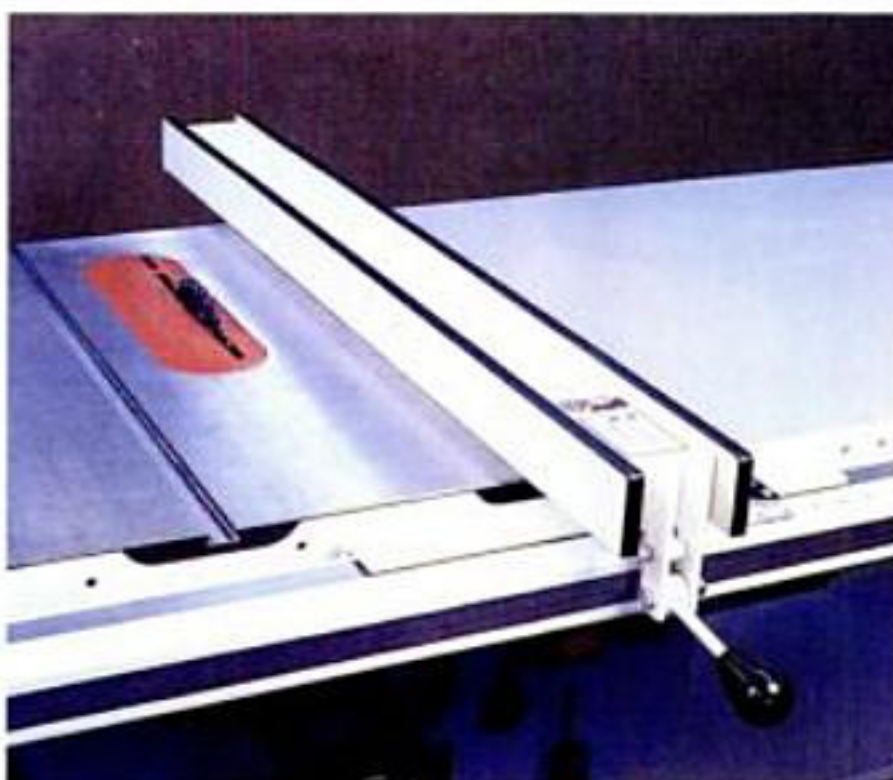
BIESEMEYER MODEL 50

Bill Biesemeyer developed the first aftermarket rip fence about 14 years ago. It was designed for the rigors of production woodworking shops, but it's appropriate for amateur shops as well. It has been a huge success—only a few refinements have been made over the years.

The Biesemeyer is the Mack truck of fences with thick, square steel tubing for the front rail and fence. The fence is 2½ in. high and 42 in. long, overhanging the outfeed end of the saw table.

The Biesemeyer Model 50 fence locks in position by a cam-action clamp that tightens on the front rail only. The fence's far end rides on a small nylon pad, but never touches the rear rail, which is included only to provide solid mounting for the outfeed table and side extension table. A 10-pound side load caused a 0.008-in. deflection at the far end of the fence.

The locking action feels smooth and



Rail Length: 84 in.
Rip Capacity: 50 in. right
12 in. left
List Price: Fence \$345

Biesemeyer Manufacturing Corp.
216 S. Alma School Rd., Suite 3
Mesa, AZ 85210
(800) 782-1831

secure, and when unlocked, the fence lifts right off the rail. Unlocked, the fence skews a bit on the rail as it's adjusted quickly left or right.

Installation required about two hours, including time to drill mounting holes in the saw table. It's necessary to get the front rail mounted at exactly the right height to ensure proper clearance of the fence over the

saw (a guide template is supplied).

Biesemeyer offers extension tables and an auxiliary fence for clamping on jigs and using dado blades or molding cutters (\$119). Other rails with rip capacities to 122 in. are available.

Biesemeyer also offers a less expensive, lighter-weight home-shop version of the rip fence with 52-in. rip capacity (\$279).

VEGA MODEL 50



Rail Length: 72 in.
Rip Capacity: 50 in. right
8 in. left
List Price: Fence \$242.50

Vega Enterprises Inc.
RR 3
Decatur, IL 62526
(217) 963-2232

The Vega model 50 is another fence that locks on the front rail only. It's solid and has the lowest price among those tested.

The Vega's front rail is a round, chrome-plated steel tube that mounts to the saw table with thick aluminum brackets. A rear rail made of square steel tubing provides a surface on which the nylon button on the outfeed end of the fence rides. The fence itself is a 2½-in. x 42-in. square aluminum extrusion. A cam locks the fence against the front rail. To remove the



fence, you simply lift it off the rails.

This fence moved very smoothly and locked tight with ease. The outfeed end deflected 0.007 in. with a 10-pound side load.

I was impressed with the Vega's "microadjust" feature, which consists of a small, secondary locking handle

and a knurled screw that allows you to fine-tune fence position. With this feature, I was able to adjust the fence left or right as little as 0.001 in. at a time.

I found the Vega model 50 the easiest to install of all the fences. It fit the Unisaw's standard mounting holes, and I had the fence operating in less than an hour. The rail-mounting brackets have "jacking screws" to adjust the vertical position of the rails. This is a real plus, as you can set the clearance between the fence and saw table more easily than on most other fences. Slots in the front brackets allow you to adjust the horizontal position of the rail so you can zero out the rip measuring scale.

Vega offers a dual-function accessory called the Finger Saver (\$36). (See photo.) It's a stock pusher that rides in slots in the top of the fence and doubles as a crosscut stop block. A Stock Feed System consisting of a spring-steel feather board and roller wheel is also available, as well as a shorter rail set with 40-in. rip capacity.

DELTA UNIFENCE 34-897



Rail Length: 83 in.
Rip Capacity: 52 in. right
 8 3/4 in. left
List Price: \$410

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

The Delta Unifence is the most expensive fence I tested, but it has unique features that give it real versatility.

The fence is a 43-in. long aluminum extrusion that fastens to a thick, cast-alloy fence "body" that tracks along the front rail. A small nylon foot supports the outfeed end of the fence body. The locking mechanism rides in a slot in the rail, yet you can quickly release it to lift the fence off. (There's no rear rail.) The Unifence has a dual inch/metric rip scale, with two hairline indicators.

The Unifence's versatility comes

from its shape and dual fence positions (see photos). You can position it with a 3 1/2-in. high vertical surface for general ripping, or mount the fence with a short, 1/2-in. high edge for trimming panels faced with laminate—a real plus.

In addition, you can adjust the fence up and down as well as fore and aft, positioning its far end slightly before the blade, for example, to make a stop gauge for repeated crosscuts with the miter gauge. To rip to the left of the blade, you have to remove the fence and remount it on the right side of the fence body—only a 30-second job.

However, the shape of the fence makes it difficult to mount hold-down fixtures on it.

The fence moves smoothly and locks solidly. It's easy to adjust the fence parallel to the blade with accessible nylon setscrews. Under a 10-pound side load, I measured deflections of 0.017 in. and 0.013 in. with the fence in its high and low positions, respectively.

Installation required about an hour on the Unisaw's predrilled holes. On other saws you may need to drill mounting holes. Shorter and longer rail sets are also available.

EXCALIBUR TT45-R50-L12

If the Biesemeyer is the Mack truck of fences, the Excalibur is the luxury sedan. Its suspension system makes it the smoothest to operate of the fences I tested.

The Excalibur fence is a 44 1/2-in. length of anodized, extruded aluminum, 2 1/2 in. high. The rails are also extruded aluminum with T-slots on the back for the mounting bolts.

The fence is suspended on three spring-loaded aluminum rollers (two in front, one in the rear) that ride on the rails. This "triangulated" setup ensures that the fence *always* stays parallel to the blade—even when unlocked. The locking handle has three positions: down to lock the fence, horizontal to adjust the fence, and up to remove the fence completely.

Unlocked, the fence glides effortlessly. The rollers pull in tight against *both* front and rear rails to lock the fence in place. A 10-pound side load resulted in just 0.0005-in. deflection.

Installation took about three hours. I had to drill new holes, then loosen



Rail Length: 78 in.
Rip Capacity: 52 in. right
 14 in. left
List Price: Fence \$399

Excalibur Machine and Tool Co.
 210 Eighth St. S.
 Lewiston, NY 14092
 (800) 387-9789

the Unisaw's cast-iron table and tilt it up to gain access to the inside to put nuts on the rear rail-mounting bolts.

For this system to work up to snuff, the rails must be installed *perfectly straight and parallel to one another*. It takes patience to get this right. On our Unisaw the left table wing protruded slightly beyond the saw table's rear edge. I ended up fussing for half a day shimming the rear rail parallel to get the fence tracking smoothly. Once done, it worked beautifully.

Accessories include a Stock Pusher (\$64.95) (see photo), and a set of



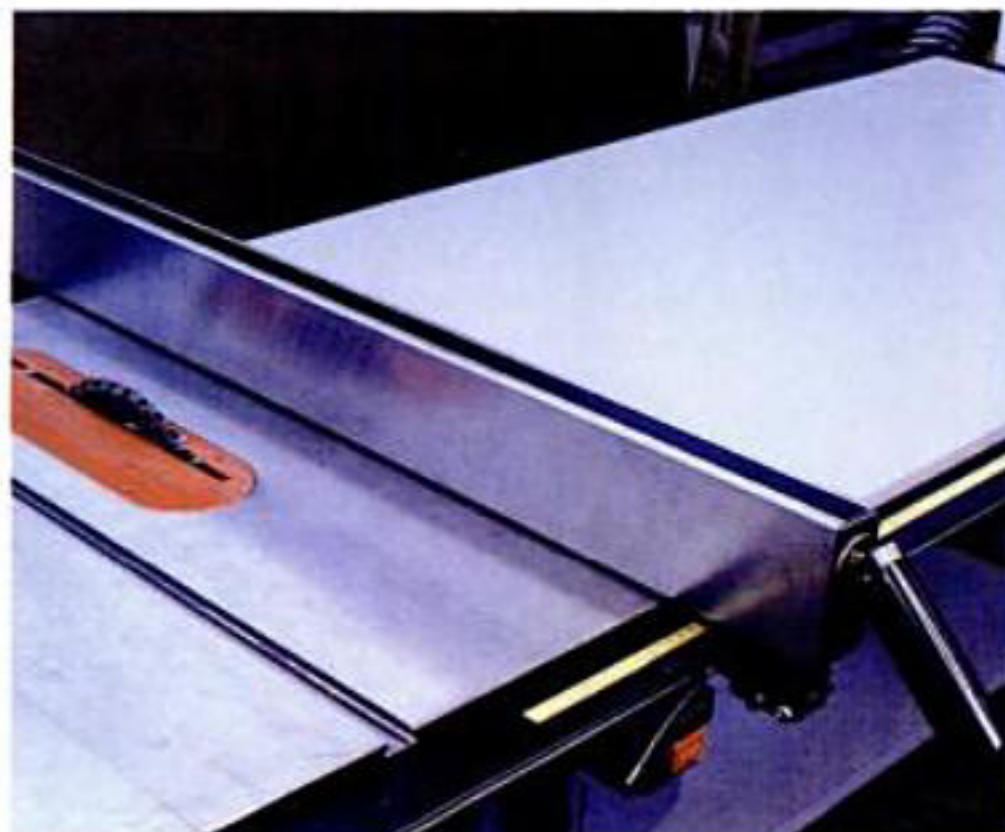
"Shop Helpers" (\$69, one pair) to hold down stock and prevent kickback. A Guide Rail Work Stop (\$25) fits in a T-slot under the front rail. Excalibur also offers a shorter-rail fence for 24-in. ripping capacity.

PARALOK 2

One feature immediately distinguishes the Paralok rip fence from the others: its unique fence-tracking system. The Paralok's 4-in. x 35-in. fence slides back and forth on steel rails mounted on the front and back of the saw table. But unlike the other fences I evaluated, it doesn't depend on the rail to hold it parallel. Instead, the Paralok has a cable-and-pulley system that keeps it parallel to the blade. (See photo.)

The fence is made of stainless steel. You can drill it to mount auxiliary fences or accessories with sheet-metal screws if need be.

The fence moves smoothly on the cable-and-pulley system, with a slight amount of drag noticeable, but no slop. It tends to lean to the side a bit as you push on it. The measuring scale has markings at zero to help you position the fence accurately. I thought the locking handle had the most positive feel of all the fences. It locks solid too—it



Rail Length: 72 in.
Rip Capacity: 52 in. right
 14 in. left
List Price: Fence \$350

Quintec Manufacturing, Inc.
 5128 NE 42nd Ave.
 Portland, OR 97218
 (503) 281-6096

deflected only 0.0005 in. under a 10-pound side load.

Installation took about four hours, but it wasn't difficult. I had to mark and drill holes in the fence rails to match the saw table's mounting holes. Also, stringing and tensioning the 28 feet of braided aircraft cable around the six pulleys and adjusting the fence took some time.



ACCUFENCE



The Accufence, with its lightweight fence and shorter rails, is in a class by itself. According to the manufacturer, it's made for lighter-duty table-saws, and small woodworking shops where space is at a premium.

A clever design allows the Accufence's 51-in. rails to slide on the saw *and* allows the fence to slide on the rails. That gives 32-in. rip capacity right and 28-in. left of the blade. To free up space, the whole fence/rail assembly lifts off the saw so you can hang it on the wall when not in use.

Narrow, pressed-steel extension wings bridge the rails, taking the place

Rail Length: 51 in.
Rip Capacity: 32 in. right
 28 in. left
List Price: Fence \$249 (U.S.)

Trade Master Tool & Machinery
 211 Shearson Crescent, Box 1328
 Cambridge, Ontario Canada N1R 7G6
 (519) 622-0510

of the table saw's original extension wings, which must be removed for installation. The extensions act as *adjustable* supports that can be located wherever you need to support large pieces of stock. (See photo.)



The two extruded aluminum rails ride in four beefy aluminum brackets bolted to the saw table. One rail has an inch rip scale, while the other has a metric rip scale. Each has separate scales corresponding to the full left and full right rail positions. The fence tended to chatter when I moved it up and down the rails, and it deflected 0.013 in. under a 10-pound load.

To install the Accufence, I first had to remove the Unisaw's left extension wing and move the long extension table to the right. Then I had to drill and tap *eight* holes in the saw's table to mount the rail brackets. Installation and adjustment took me about four hours.

UP-AND-DOWN BOOKSHELVES

B Y S I M O N W A T T S

I was looking after my neighbor's apartment and cat when the last big earthquake struck in San Francisco. Assessing the damage afterward, I found his floor-to-ceiling bookcases (filled with record albums and heavy art books) flat on their faces. Worse, there was no sign of his cat. My neighbor wasn't due back for a couple of weeks and the weather was warm, so I spent the next morning rather queasily pulling up books at random expecting to find something furry.

It turned out the cat had been hiding in the motor compartment of the refrigerator, but freestanding bookcases still make me a bit uneasy in this shaky city. Still, I'm practical, realizing where there are books, there is a need for bookcases, so I designed one supported by dowels, as shown in the photo. I just hope there are no cats around when the next quake strikes.

This is not a conventional bookcase, but a series of modular units that can be arranged in different ways according to changing needs. Each shelf has two dovetailed end pieces the equivalent of bookends to prevent things from falling off. These pieces are graduated in height from 9 in. at the bottom to 7½ in. at the top. This trick is often used on chests of drawers

PHOTOS BY KAZ TSUBOTA



Shelves are supported by brass cotter pins inserted in holes in the four fir dowels.



*Modular Shelves
Adjust to Any
Height*

and makes the bookshelf appear less top-heavy.

The shelves are supported by four 1¼-in. dia. fir dowels that have a series of ¼-in. dia. holes drilled on ½-in. centers. The shelves can be arranged at any height since they are held in place by ⅜-in. dia. by 1½-in. brass cotter pins inserted in these holes. Brazing rod of the same diameter would work, too.

Modular Possibilities

The shelves lend themselves to a variety of arrangements. I made a set for my daughter, who chose to rest the bottom shelf on the floor and arrange the remaining shelves at convenient heights for books and oddments.

Another option is to omit the supporting dowels altogether and simply stack the shelves upon each other. In this version, the bottom shelf sits on the floor and each pair of end pieces bears directly on the two below. If you take this route, I would suggest connecting each shelf to the one below it with ¼-in. dia. brass pins set in holes drilled vertically in the end pieces. This will prevent any sideways movement.

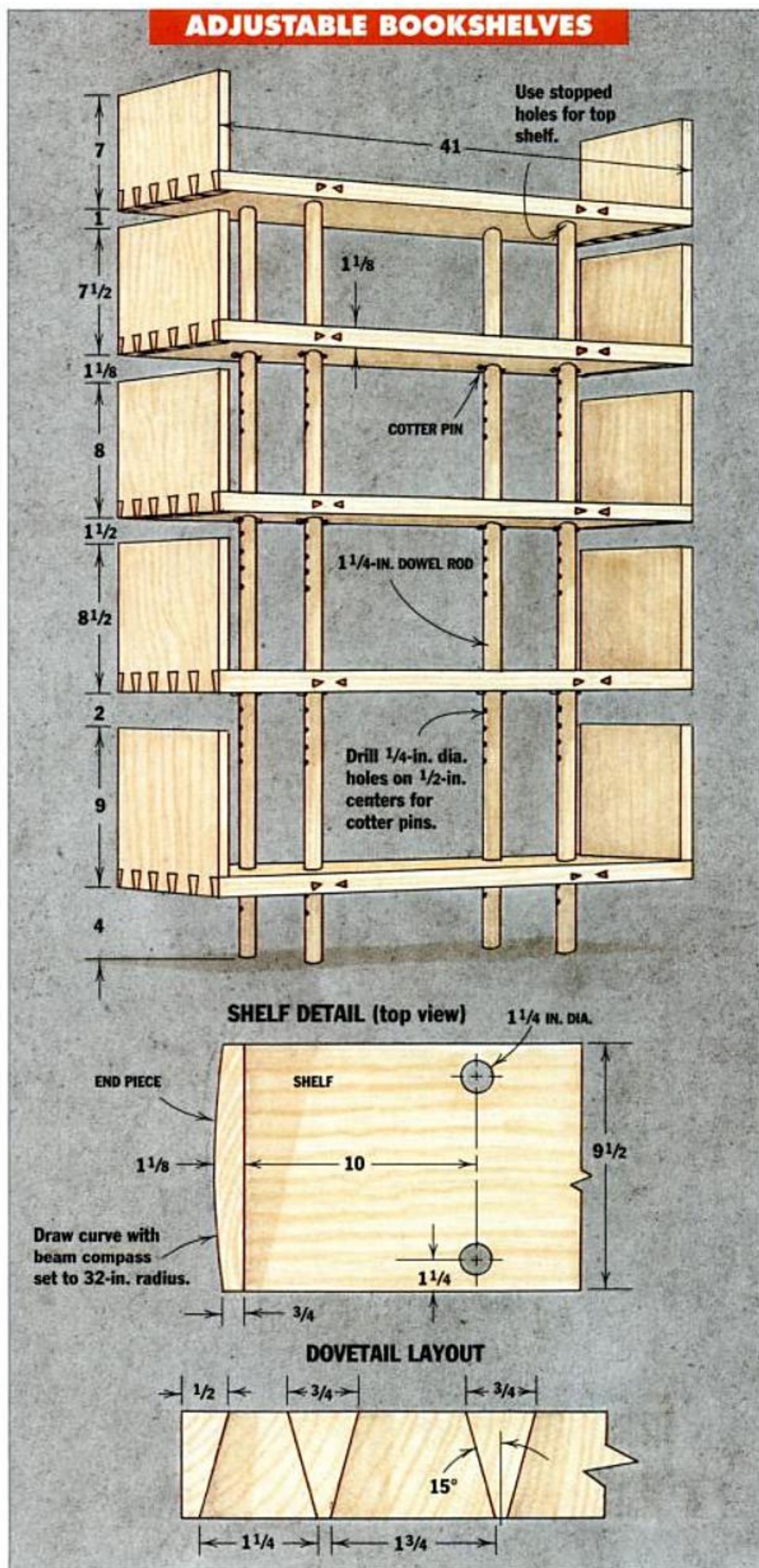
An option I used was to make a single shelf, which can fit the back of a desk to hold books, or be supported on wall brackets to hold books, plants, and so forth. Such a shelf might also work nicely in an entry-way, where caps and mittens can be thrown on top and coats and jackets hung from hooks screwed into the underside of the shelf.

If you make the freestanding bookcase, I strongly recommend you attach it to the wall with metal brackets, even if you don't have the San Andreas Fault running through your backyard. This is especially important if you have small children or climbing cats.

Construction

This is not a difficult piece to make, so I'll just outline the sequence of steps and point out trouble spots.

I made the shelves from Douglas fir, a wood widely available in California and one that matches the fir dowel rods. However, you could use most any species—hardwood or softwood—although I would steer clear of timbers too soft to cut cleanly with a chisel, such as Eastern white pine.



DOVETAILS ON THE TABLESAW

Hand cutting a dozen sets of dovetails in heavy stock can be a real chore. Long ago, I took to cutting the tails on a tablesaw with the stock held vertically and the blade angled. Nobody told me not to. Then it's easy to mark out and handsaw the pins in the usual way. I find this method takes only half the time of hand cutting, and you end up with clean, accurate surfaces that need minimal fitting.

If there is a choice, I always cut the tails in the shorter piece of wood. Holding a long board vertically for sawing can be awkward, even dangerous. (If you're making the bookcase, cut the tails in the end pieces rather than in the shelves.)

Start the dovetails in the same way you would if you were cutting them by hand. Square the stock, set a marking gauge to the thickness of the stock and scribe a line across both sides and the two edges.

Now draw the tails in pencil on the ends (only one end if you're making the bookcase) and square the lines across both faces. Accuracy is essential here. Mark the waste in crayon so you don't saw on the wrong side of the line.

Next, make a new wooden fence for the miter gauge. It should be 2 or 3 in. high so it supports the stock and will not be cut in half by the saw blade. This fence will also help reduce tear-out by backing up the cut. Now set the tablesaw blade to the dovetail angle—usually about 15° . Place the marked board vertically on the table and raise the blade until it is $\frac{1}{16}$ in. below the scribed line on the end of your stock.

Make some trial cuts in a piece of scrap wood until you feel confident to begin. Hold the board vertically



PHOTOS BY SIMON WATTS



Fitting a joint after the tails have been cut on the tablesaw is much less time-consuming than hand cutting the joint.

with the blade on the waste side of one of the marked tails and move the sliding fence over to act as a stop. The cutting process is shown in the drawing.

Some people prefer to clamp stop blocks to the miter-gauge fence rather than use the sliding tablesaw fence. I've done it both ways and found that it depends on what works best with my particular setup.

Using this method, you'll find the saw blade removes most of the waste. The little that remains can be severed with a chisel or cut out with a coping saw and then chiseled. Continue in the usual way, marking the pins from the tails, sawing them out, and chiseling the waste.—S.W.

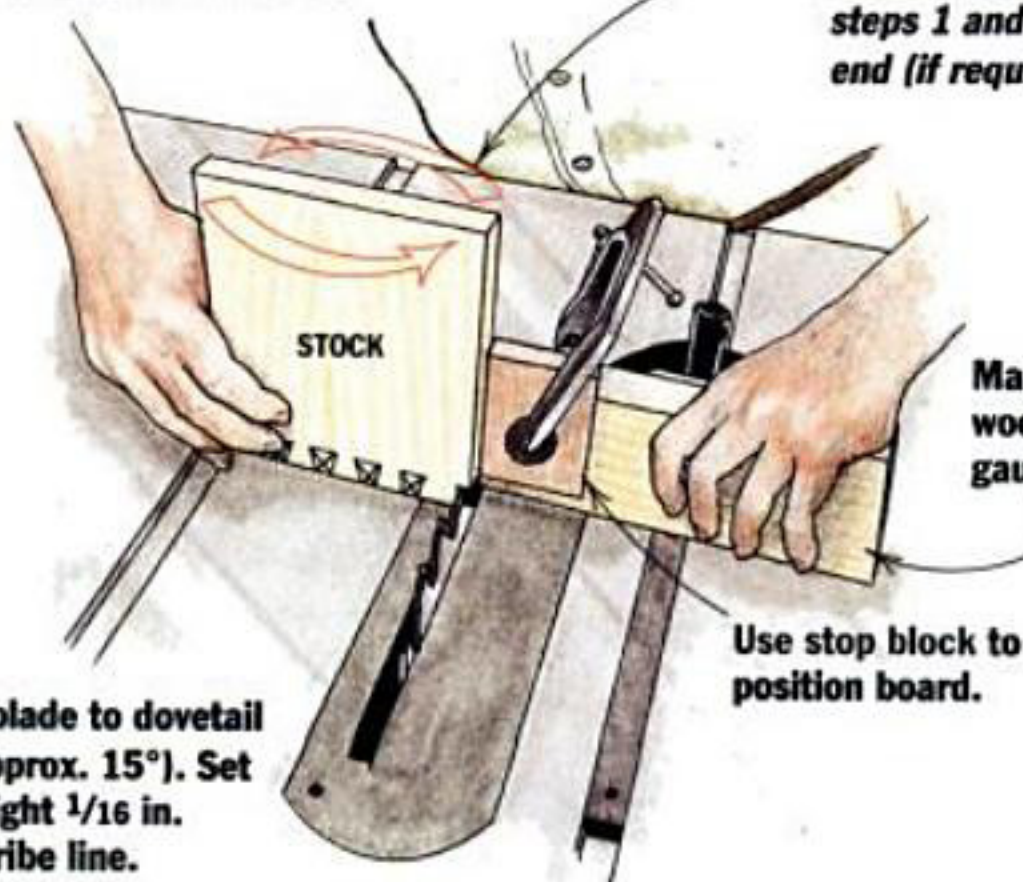
CUTTING TAILS ON THE TABLESAW

STEP 1: Set stop block and cut edge of first tail.

STEP 2: Flip board and cut edge of last tail. Repeat steps 1 and 2 on the other end (if required).

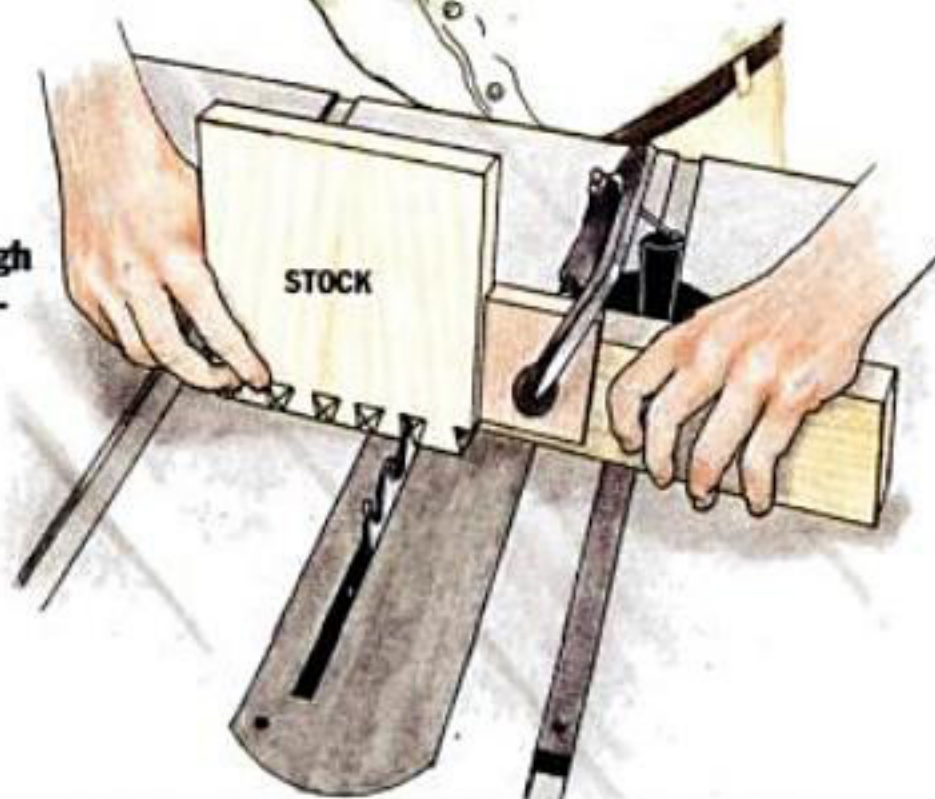
STEP 3: Move stop block and cut edge of second tail. Repeat steps 1 and 2 with new stop block setting until all tails are cut.

Set saw blade to dovetail angle (approx. 15°). Set blade height $\frac{1}{16}$ in. below scribe line.



Make 3-in. high wooden miter-gauge fence.

Use stop block to position board.



The first step is to rip the shelves and end pieces to final width, and then crosscut each piece to its finished length. (See drawing.)

Next come the holes for the dowels. It's essential to exactly align the holes from one shelf to the next. If you don't, you'll have trouble sliding the shelves down the dowel rods.

To keep the holes in line, I used one shelf as a template and marked the four 1½-in. holes on the underside according to the positions indicated in the drawing. I then made the holes with a drill press, using a 1½-in. dia. Forstner bit. Since the bit exited the face side (the top surface), I placed solid backing under the shelf to prevent tear-out. Once I'd finished this shelf, I used it to center the holes in the remaining shelves. Note that the holes in the top shelf should go only two-thirds of the way through the board.

Now mark out and cut the dovetails. The layout I used is shown in the drawing on the preceding page. A fast, accurate method of cutting the tails on a tablesaw is described in the sidebar. (See sidebar, *Dovetails on the Tablesaw*.) It's important that you don't undercut the dovetails and that they fit tightly, because when you cut the curves in the end pieces (see drawing), the insides of the joints will show.

After you've finished the joints but before gluing, I recommend you clean up the inside surfaces with a scraper and sandpaper. You then can apply the finish—oil, wax or varnish—making sure to mask the shelf ends to prevent finish from getting in the glue joints. (See photo.)

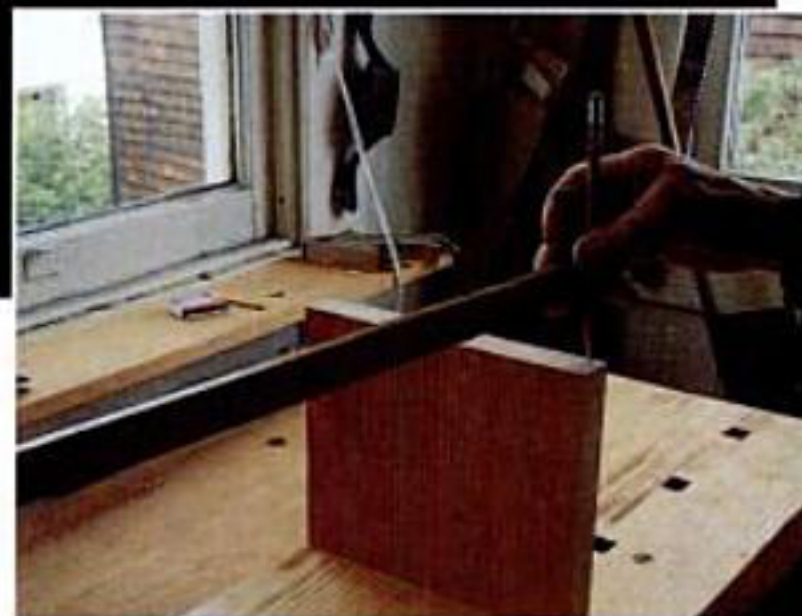
Once the glue on my shelves cured,



When applying a finish before glue-up, be sure to mask off all glue surfaces.



After pulling the joints together with pipe or bar clamps, check that the two end pieces are square to the shelf. Mark out a curve with a beam compass. If you don't have one, improvise with a pencil and piece of thin wire.



I marked out curves on the end pieces. You'll have to skip this step if you don't have a bandsaw with a 10-in. cutting capacity, but if you do, marking curves is easy. Simply use a beam compass or trammel points (see *AW*, #23) set to a radius of 32 in. You could equally well spring a flexible ruler into an appropriate arc, but marking the curve that way requires three hands.

After bandsawing the end pieces, I finished up the curved surfaces with a scraper and sandpaper.

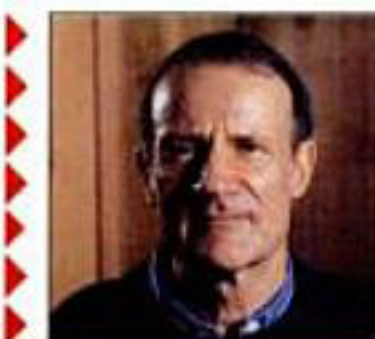
If you have a lathe capable of accepting 4-ft. stock, you could turn the four dowel rods to the exact 1½-in. dia., starting with 1½-in. square turning blanks. Not owning a lathe, I bought lengths of 1½-in. fir dowel (often used as closet poles), which turned out to be a fraction too big for the holes.

If you run into this problem, I suggest you either sand the dowels down to size or enlarge the holes. I chose the latter method and found that a 1½-in. sanding drum in a drill press worked pretty well.

Next, I drilled and very slightly countersunk the ¼-in. dia. holes for the cotter pins. (See drawing.) It's essential you space these holes exactly the same on all four dowel rods; otherwise, the shelves won't seat properly and may

rock. My solution was to cut the dowels to the same length and then use a strip of Masonite pegboard as a template for the holes. I drilled holes on ½-in. centers up the length of the dowels so the shelves could be placed at any height. You might prefer different spacing. With all the holes drilled, I finish sanded the dowels and gave them a good waxing.

My final step was to carve small ornamental triangles on the front of the shelves to each side of the dowel rods. After sealing the bare wood with shellac, I dabbed on yellow acrylic paint, straight from the tube. Once this dried, I removed the surplus paint with a cabinet scraper. I like the combination of the bright yellow with the reddish-brown fir. With another wood, you might like a different color. ▲



SIMON WATTS
teaches wooden boatbuilding in San Francisco and across the country. He is a contributing editor of AW.



"Rhino," 17 in. x 16 in. x 11 in.
PHOTOS BY TIMOTHY FISHER

WOODEN

Creatures Carved With a Chain Saw and Gouge

BY FIONA A. WILSON

It all started innocently enough one day back in 1985 when furniture sculptor Timothy Fisher decided to make a rocking dog for his 2-year-old daughter, Anna. He intended to get right back to his abstract furniture sculptures after he finished her gift. But once clients saw the rocking dog,



Fisher first removes as much waste as possible with a gas chain saw by following a crayon outline drawn on the wood. For finer detail, Fisher switches to a smaller electric chain saw, then finishes with a mallet and chisels.



SIMON WATTS

they began commissioning wooden animals for themselves. And so Fisher's career as a sculptor of creatures began.

Since that first rocking dog, Fisher has carved a veritable zoo of animals, including snakes, birds, rhinos and crocodiles. His sculptures have the vigor found in primitive art, perhaps

because as a child his parents collected African sculptures during the six years his family spent in Africa.

Sculpting in Elm

Elm is Fisher's wood of choice; he finds it both beautiful and sturdy. Also, because of Dutch elm disease, dead trees in 30-in. dia. are plentiful in Vermont where Fisher lives. He admits, "I feel a bit of a vulture, cruising the countryside watching elms die, then swooping down with my chain saw to salvage the wood after the last leaf has dropped."

The same quality that makes elm hateful as firewood (it's very hard to split) is what makes it ideal for Fisher's sculptures because its fibers are intertwined. This allows him to carve creatures from one piece of wood without resorting to joinery to attach arms and legs. (See "Lizoid" creature, opposite page.) He finds that with elm, even when the grain runs across appendages,

the wood holds together well. If a piece does crack, repairing it is simply a matter of glue and a reinforcing dowel. As he puts it, "The secret behind my technique is laziness. I am not especially patient, and I get

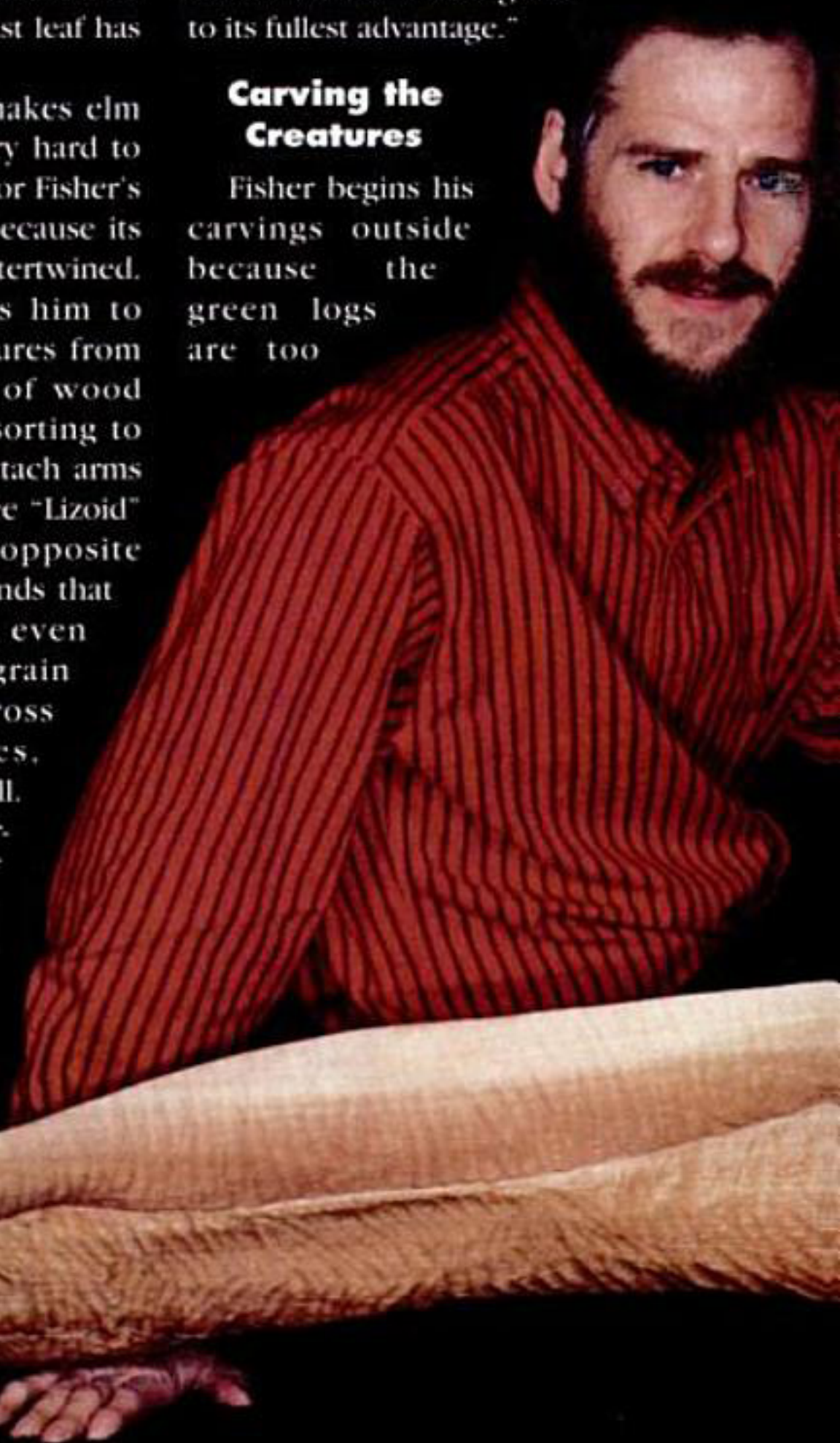


"Elephant," 50 in. x 28 1/2 in. x 15 in.

sick of joinery. This way I seldom do any. The other big advantage to this one-piece sculpture is that it shows off the wood grain to its fullest advantage."

Carving the Creatures

Fisher begins his carvings outside because the green logs are too



BEASTS



"Dog Dude," 38 in. x 21 in. x 11 in.



"Lizoid," 46 in. x 13 in. x 9 in.

heavy to move indoors easily. He draws an outline of the creature in crayon on the log and then roughs out the shape with his Jonsered 24-in. bar gas chain saw.

His goal with these first cuts is to remove as much wood as he can around the crayoned outline, leaving less to do later when sculpting with chisels.

After he's removed the majority of the waste, Fisher moves the sculpture indoors where he hones the creature's form closer to its actual shape with a small electric Milwaukee chain saw.

Fisher then sets to work with mallet, chisels and gouges, carving the creature down to its final form. The majority of Fisher's time is spent hand carving, which is why he doesn't consider

himself strictly a chain-saw sculptor.

When he's happy with the form he's created, he hollows out the creature from the underbelly. This decreases checking as the wood dries and makes the sculpture lighter.

Fisher works the wood in its green state because it's easier to carve than dried wood. He used to let his creatures simply air dry, but he learned the necessity of kiln drying when a client sent a rhinoceros back with a severely split leg. Now he passes each creature through the kiln and repairs any major checks with elm slivers and glue.

Depending on the piece, Fisher either leaves the sculpture rough with chisel marks evident or smooths it with a power sander followed by cabinet scrapers and sandpaper. He finishes the sculptures with Watco oil finish.

Though he's made quite a splash in the adult market, his children are still



Author's son, Nathaniel, sits astride the rocking dog, the first creature Fisher carved.

an integral part of his art. Anna, now 8, is one of his boldest critics and a source of inspiration. Her latest passion for making beaded jewelry has led Fisher to make jewelry for his creatures (note the necklace on "Dog Dude"). And when Fisher's 5-year-old son, Nathaniel, overheard his father saying he wished someone would commission a merry-go-round, Nathaniel did—for himself. Fisher claims, "The pay is poor, but the rewards are tremendous." ▲

FIONA WILSON
is AW's field editor in Ohio.



"Bird," 51 in. x 29 in. x 24 in.





OIL FINISHES

*Four Different Types With
Different Characteristics*

BY BOB FLEXNER

Oil finishes are probably the most popular type of finish. They produce a pleasing close-to-the-wood look, and they're the easiest kind of finish to use. Most woodworkers who use them simply wipe on and wipe off a couple of coats.

You'd think that oil finishes would be as easy to understand as they are to use, but that's not the case. There is more confusion about oil finishes than there is about any other finish.

Four Different Types

The confusion is caused partly because there are four significantly different finishes that are

all marketed as "oil" finishes.

First, there is *straight oil*, which is usually linseed oil or tung oil. The second type is *wiping varnish*—a regular varnish that is thinned with two to three parts mineral spirits (paint thinner) to one part varnish and is sold as an oil finish. The third type is an *oil-varnish blend*, a mixture of oil and varnish usually thinned with mineral spirits. Finally, there is *polymerized oil*—straight oil that has been changed chemically, causing it to perform more like a varnish than straight oil.

These four finishes look different; they range from glossy to flat and from very thin on the wood to moderately thick. They perform differently, too. Some are very effective barriers against scratches, stains, water, and water-vapor (humidity) exchange. Others aren't. These four finishes can also be applied differently. Some can be applied and left to dry without wiping; others have to be wiped almost dry. It all depends on the type of oil finish you're using.

To make sense out of these finishes—how to determine which to use where and how to tell them apart—it's necessary to define each of the four types.

Straight Oil

Oil is a natural substance that's extracted from plants, nuts, fish, and petroleum. Some oils, like linseed oil and tung oil, cure—that is, they change from a liquid to a solid state when exposed to air. These oils can be used as finishes. Other oils, like motor oil, olive oil, and mineral oil, don't cure. They are ineffective as finishes because they remain a liquid.

Oils used as finishes have certain characteristics in common. Compared to other finishes, they cure slowly and to a satin (not glossy) sheen after several coats. They also cure soft. This makes them impractical as a finish unless you wipe off the excess after each application. With straight oil, you can't build a thick, hard, protective film on the surface of the wood as you can with varnish or lacquer. See for yourself. Take a can of linseed oil or tung oil with some cured overspill around the top, push your fingernail into it, and notice how soft it is compared with varnish or lacquer. (continued)

APPLYING AN OIL FINISH: STEP BY STEP

1. Prepare the wood. On new wood, sand to 180-grit or 220-grit. For tabletops, it's a good idea to raise the grain after finish sanding. Wipe the wood with a wet cloth or sponge and let the wood dry overnight. Next, sand lightly with 280-grit or finer sandpaper to cut off the raised grain.

2. Clean the wood. Remove as much of the sanding dust as possible with a brush, vacuum, or compressed air.

3. Choose the finish. Choose the "oil" finish you want to use—straight oil, wiping varnish, oil-varnish blend, or polymerized oil. (See main article.) If you've never used one of these finishes before, choose a wiping varnish for a glossy finish or an oil-varnish blend for a satin look.

4. Apply the first coat. Flood the wood with the finish. You can use a cloth, brush, or spray gun, or you can dip the wood into the finish. Let the finish remain wet on the wood for five minutes or more. If any dry spots appear, apply more finish. Wipe off all the excess finish with a rag before the finish becomes tacky.

5. Remove any "bleeding." Any "oil" finish can bleed back out of the pores. Little puddles form soon after you have removed the excess finish. Continue to wipe these puddles dry until they stop forming. Go back over the wood once every hour or so with a dry cloth until the bleeding stops. (See sidebar, A Remedy for Bleeding, page 50.)

6. Apply additional coats. Allow the first coat to cure overnight. Smooth any roughness that remains by rubbing with 0000 steel wool or sanding with 280-grit

or finer paper. Apply the next coat. (You can combine the two steps by sanding the wood while it's wet with the second coat of finish.) Wipe the wood dry. Apply as many coats as you want, allowing at least one day's drying time between each coat. There's no point in applying more than three or four coats unless you're trying to build a thicker film with wiping varnish or polymerized oil.

7. Build the finish. If you're using wiping varnish or polymerized oil, you may want to build the finish to a thicker film to give the wood better protection or to increase the appearance of depth. To do this, leave each coat wet on the wood's surface—that is, don't wipe off all the excess. Make sure that the space you're working in is relatively dust free. If dust sticks to the finish, sand it lightly between coats with 320-grit or 400-grit sandpaper to remove the dust nibs. Use steared (gray) sandpaper dry or wet-dry (black) sandpaper with mineral spirits as a lubricant. Be careful not to sand through the thin finish.

8. Apply the final coat. No matter which "oil" finish you use, you can make the final coat smoother to the touch and raise or lower the sheen. To smooth the last coat of straight oil or oil-varnish blend, sand it wet with very fine sandpaper (400-grit or finer), and then wipe off the excess.

To smooth and *increase the sheen* of any finish, rub the last coat very hard with a dry cloth or rub the cured finish with a commercial rubbing compound.

To smooth and *reduce the sheen* of any finish, rub the last cured coat with 0000 steel wool. You can lubricate the steel wool with mineral spirits, a non-curing oil, or paste wax to reduce scratching.—B.F.

Linseed oil—Linseed oil is extracted from the seeds of the flax plant. Raw linseed oil is an inefficient finish because it takes many days to cure. To make it more effective, metallic driers are added to the oil. These driers are usually salts of cobalt, manganese, and zinc. They act as catalysts to speed the curing. (Lead is no longer used as a drier because it causes health problems.) Linseed oil with driers added is called *boiled linseed oil* and cures in about a day. Boiled linseed oil is not made by boiling raw linseed oil.

Linseed oil protects wood less than any other type of finish except wax. It's a soft, thin finish, and provides little significant barrier against scratching. It's also easily penetrated by water and water vapor. Water will work through a linseed-oil finish and cause a smudge in five to 10 seconds. Water vapor will pass through a linseed-oil finish almost as

if it weren't there.

It's important to understand the consequences of water-vapor exchange. When the humidity is high, wood takes on moisture from the air and swells. When the humidity is low, wood releases moisture and shrinks. Expansion and contraction brought on by weather changes accelerate splitting, warping and joint failure. Because one of the primary purposes of a finish is to slow water-vapor exchange to reduce stresses in the wood, linseed oil is of questionable value as a protective finish.

Tung oil—Tung oil is extracted from the nuts of the tung tree, which is native to China. Tung oil has been used for centuries in China but was not introduced into the West until the very end of the 19th century. Though tung oil is more expensive than linseed oil, it has established a firm position in the coatings industry because of its superior water resistance. Many high-quality varnishes are made with tung oil. But, contrary to what you might think, straight tung oil alone is seldom used as a finish.

Five or six coats of straight tung oil make a fairly water-resistant finish, but

◀ Straight oils, like tung oil and boiled linseed oil (left), cure slowly and dry soft, providing no resistance against scratches, water, or water vapor. Though often marketed as an "oil" finish, wiping varnish (below) is regular varnish thinned with mineral spirits. Multiple coats can be built up into a relatively thick, protective film.

it's too soft and thin to be resistant to scratches or water vapor. It's also difficult to get a nice-looking finish with straight tung oil. The first three or four coats appear flat and splotchy on the wood and feel rough to the touch. Only after five or six coats, sanding between each coat, can you get an even, satin sheen. But a straight tung-oil finish is never as smooth to the touch as a linseed-oil finish.

Wiping Varnish

Most of the "oil" finishes you see on store shelves are varnishes that have been thinned enough to be wiped on the wood. Many of these wiping varnishes have names that lead you to believe they're oil finishes. They aren't oil, they're varnish.

Varnish is made by cooking one or more oils with natural or synthetic resins (alkyd, phenolic, or polyurethane). Manufacturers use linseed and tung oil, and/or semicuring oils such as soy bean and safflower oil. When oil and resin are cooked together, they combine chemically to form an entirely new substance. This new substance—varnish—cures much faster and harder than oil (again, check the overspill around the caps of your cans of varnish). Varnish also cures with a glossy appearance (unless the manufacturer adds flattening agents to give a satin or flat sheen).

Most important is the hardness. Because varnish hardens, multiple coats of wiping varnish can build up a relatively thick film on the surface of the wood. When varnish is built up, it protects the wood from all but the most severe scratches. It also forms an excellent barrier against stains, water, and water-vapor exchange. Remember that it will take many more coats of thin wiping varnish to achieve the same protection as one or two brushed coats of regular varnish.

Wiping varnishes vary in hardness and water resistance, depending on the types and proportions of resins and oil in the varnish. (See "A Tale of Two Finishes," *AW*, #11, November/December 1989.) But no wiping varnish I know of lists these ingredients on the container. In fact, the words tung oil in the product name are no guarantee that the varnish was made with tung



PHOTOS BY JIM ROBERTSON





oil. Tung oil seems to have become a synonym for wiping varnish.

For wipe-on/wipe-off applications, the quality of the varnish doesn't matter much because the film is so thin. But the quality of the varnish does matter if you intend to build up a thicker film on the surface of the wood. You don't want a soft varnish film on a tabletop, for example. In cases where you want a thicker film, you may want to buy a can of high-quality varnish and thin it with mineral spirits until you can spread it with a cloth.

Oil-Varnish Blends

Oil and varnish (including polyurethane) are compatible and can be mixed. The resulting blend performs with some of the characteristics of each component.

The oil in the finish reduces the gloss of the varnish and makes the finish cure more slowly. Application is therefore easy because you have plenty of time before the finish gets tacky. But the oil also softens the finish, so you can't build oil-varnish blends to a protective thickness as you can with varnish alone.

The varnish component gives the finish more gloss than straight oil alone. That means with an oil-varnish blend, you can achieve a satin sheen with two coats instead of the three to six it usually takes with straight oil. The varnish also makes the finish more protective than with straight oil alone.

Many woodworkers choose to make their own oil-varnish blends. Though the recipes are often shrouded in secrecy, most of these concoctions are made simply by mixing varnish and/or

Oil-varnish blends are simply a mixture of oil and varnish, usually thinned with mineral spirits to make application easier.

ly, making application difficult. Start with equal proportions of varnish and oil (tung oil and/or boiled linseed oil) and vary the formulation from there.

Using tung oil (and no linseed oil) in the mixture makes the finish significantly more resistant to water. But the higher the ratio of tung oil to varnish, the more coats it will take to achieve an even, satin sheen.

Polymerized Oil

When oil is heated to about 500°F in an oxygen-free environment, it goes through a chemical change, which causes it to cure fast, glossy, and hard, much like varnish. Oil processed in this way is called *heat-bodied oil* or *polymerized oil*. Any curing or semicuring oil can be heat treated in this manner to change its characteristics. The primary uses of polymerized oil in the coatings industry are for making ink and outdoor paints, but polymerized oil can also be used as a finish by itself.

Polymerized oil alone is not widely used as a finish. It's expensive, it cures too fast for easy use on large surfaces, and it doesn't build to a thick film as quickly as varnish does (tiny cracks develop if the coats are too thick).

Distinguishing One Product From Another

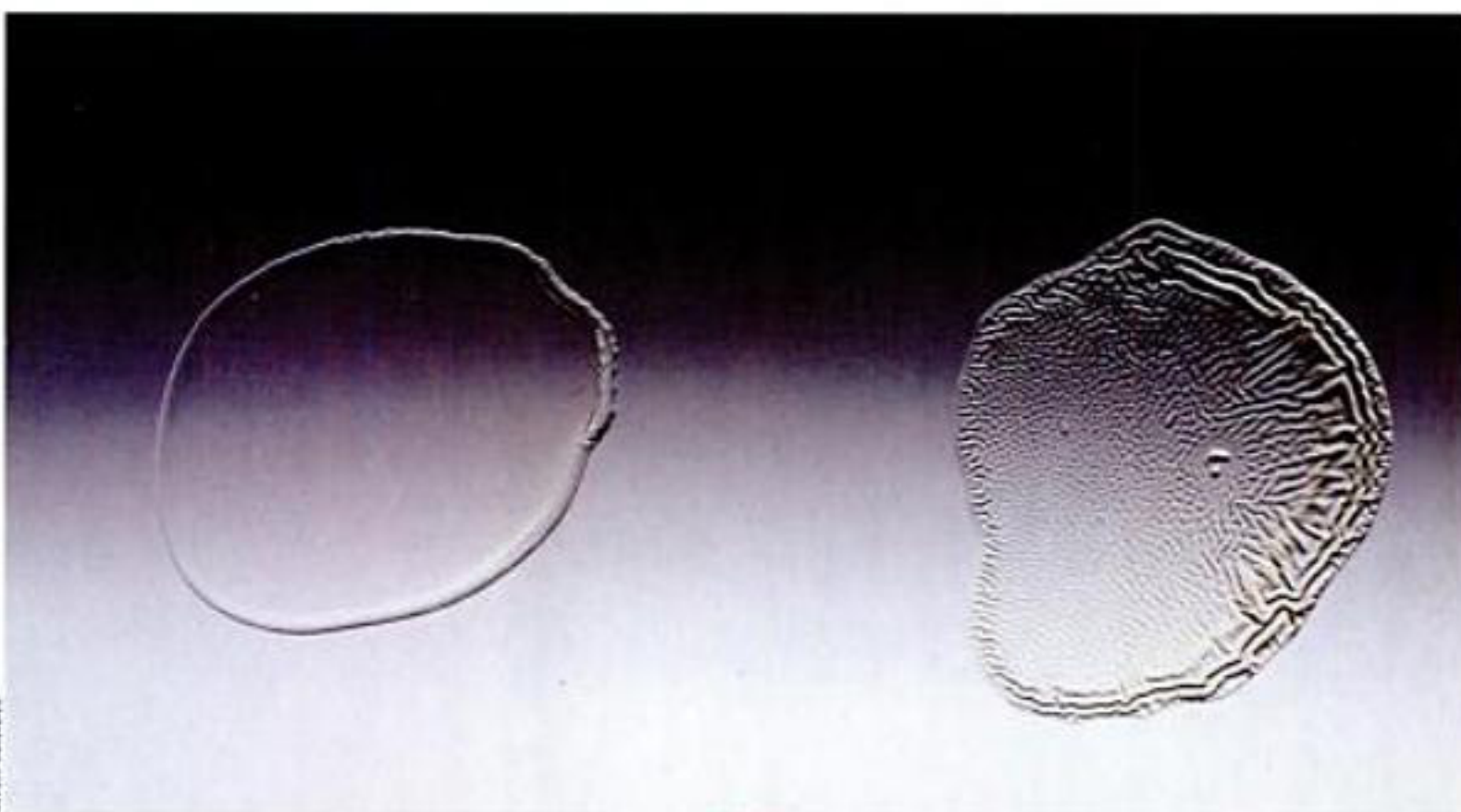
Straight oils and polymerized oils are clearly labeled on the container as "boiled linseed oil, 100-percent tung



Polymerized oil is straight oil that's been heated in an oxygen-free environment to make it cure harder and faster.

polyurethane with tung oil and/or boiled linseed oil. The mixture is then thinned with mineral spirits to make application easier.

The higher the varnish-to-oil ratio, the better the resistance to scratches, water, water vapor, and stains. But if you get the percentage of varnish too high, the finish will set up too quick-



You can tell if you have an oil-varnish blend or a wiping varnish by pouring a little of the finish on a piece of glass and letting it cure overnight. Wiping varnish will cure hard and smooth (left). An oil-varnish blend will cure soft and wrinkled (right).

A REMEDY FOR "BLEEDING"

Oil finishes can "bleed" back out of the wood's pores and form puddles around the pore openings. If you allow the finish to cure, it forms glossy scabs, which are difficult to remove without stripping the finish. (See photo.)

Bleeding occurs mostly with large-pored woods and in parts of the wood where the cell structure allows deeper oil penetration. Bleeding no longer occurs once the pores are sealed (usually after the first or second coat).

To keep scabs from forming, wipe any bleeding off before it cures. Go back over the wood once every hour or so with a dry cloth until the bleeding stops. I usually apply the first coat of finish fairly early in the day so there is plenty of time to get all the bleeding wiped off before quitting time.

Once scabs have hardened, they are difficult to remove. Manufacturers often suggest wiping with mineral spirits, lacquer thinner, or refinisher (which is lacquer thinner). But these solvents won't work because they can't dissolve a cured oil or varnish finish. If you want to remove the finish, it will be more efficient to use a paint-and-varnish remover.

Before stripping the finish, though, try abrading the scabs with steel wool. If you're able to remove enough of



◀ Bleeding is caused by the finish coming back out of the pores and forming little puddles around the pore openings. Bleeding must be wiped off before it cures or scabs will form that will have to be rubbed off with steel wool or stripped off with paint stripper.

the scabs, apply another coat of finish to replace the finish you've removed. I've had good luck combining the two steps—rubbing with steel wool while the surface is wet with more finish.

Of the four types of "oil" finish (see main article), oil-varnish blends thinned with mineral spirits are most likely to bleed. Straight oil seldom bleeds, while wiping varnish and polymerized oil don't bleed easily because they begin to cure so quickly. —B.F.

oil, pure tung oil, polymerized tung oil," etc. Many wiping varnishes and oil-varnish blends, however, are sold with no indication of their type, often sporting terms like oil finish or tung-oil finish on the label.

You need to know how to tell the difference between a wiping varnish and an oil-varnish blend because they perform very differently. There are three indicators to look for: how fast the finish cures, whether the finish cures hard, and whether the finish wrinkles severely when it cures thick.

An oil-varnish blend cures more slowly than wiping varnish does. Depending on the humidity, it can take up to an hour to become tacky, while wiping varnish usually becomes tacky in less than 20 minutes. Oil-varnish blends also cure soft and wrinkle when applied thick on a non-porous surface such as glass. (See photo, preceding page.)

You can test whether you have a wiping varnish or an oil-varnish blend by pouring a little on a piece of glass and letting it cure overnight. After curing, an oil-varnish blend will be soft enough that you can dig your fingernail into it, and it will wrinkle.

Wiping varnishes cure hard and almost totally smooth.

How They Protect the Wood

All four types of "oil" finish—straight oil, polymerized oil, wiping varnish and oil-varnish blends—protect wood in the same way that lacquer, shellac, paint and all other finishes do. They seal the pores and build a film on the surface of the wood. Oil finishes do not protect the wood from the inside,

as you often hear.

While straight oil and oil-varnish blends can't be built up to a significant film like wiping varnish and polymerized oil can, there is some thickness to the finish. You can confirm this for yourself. Put a small puddle of paint stripper on a piece of wood with three or four coats of oil or an oil-varnish blend on it. Wait several minutes, then wipe off the puddle. You'll notice there is a barely perceptible ridge sepa-

"OIL" FINISHES COMPARED					
FINISH TYPE	BOILED LINSEED OIL	TUNG OIL	WIPING VARNISH	OIL-VARNISH BLEND	POLYMERIZED OIL
HARDNESS	Very soft	Very soft	Hard	Soft	Hard
WATER RESISTANCE	Very poor	Fair (five coats or more)	Good	Fair	Good
WATER-VAPOR RESISTANCE	Very poor	Poor	Good*	Poor	Good
SHEEN	Satin	Satin (five coats or more)	Gloss and Satin	Satin	Gloss
COLOR IMPARTED TO WOOD	Dark	Medium	Light	Medium	Light

*Improved with thicker film

OIL FINISHES:

MYTHS AND MISUNDERSTANDINGS

Oil finishes are largely misunderstood. Misinformation from advertising, books and articles has given rise to many myths. Here are some of the most common:

Myth: Vigorously rubbing many coats of linseed oil or a mixture of linseed oil and varnish into the wood produces a finish that's almost impervious to heat, water, stains, and ordinary wear.

Linseed oil finishes are too thin and soft to protect well against heat, stains, and wear. Linseed oil, no matter how it's applied or how many coats are applied, is quickly and easily penetrated by water. Even linseed oil and varnish blends have the same limitations, although to a slightly lesser degree. (See main article.)

Myth: Deeper penetration can be achieved by rubbing an oil finish into the wood.

Even assuming that deeper penetration is desirable, rubbing the finish is no way to achieve it. Rubbing will warm the finish. The warmer the finish, the faster the mineral-spirits thinner will flash off, and provided the finish is kept warm, it will cure faster, too. The faster the curing time, the quicker the pores will be sealed off, which will stop further penetration. You can achieve this same result by warming the finish with a hair dryer instead of rubbing it. If you want deeper penetration, you need to use a slow-curing finish such as straight oil and simply keep the surface wet while the finish penetrates. But it isn't deep penetration that protects the wood—it's building a continuous film on the surface of the wood. (See main article.)

Continuing to rub coats of finish after the first coat has cured makes even less sense than rubbing the first coat. Once the first coat has cured, it has sealed the pores. The next coats of finish can't penetrate the first coat or push the first coat deeper into the wood, no matter how hard you rub.

Myth: Pure tung oil is preferred as a finish by many experienced finishers.

I doubt pure tung oil is preferred by any experienced finisher. It's difficult to get a nice-looking finish with pure tung oil. This myth was probably started by people who were using a wiping varnish that they thought was tung oil because that's what the label said. (See main article.)

Myth: Applying more coats of oil increases the gloss.

This is true about any finish for the first two and sometimes three coats. The first one or two coats penetrate the wood and seal it. Until the wood is sealed, the finish will appear fairly flat. It's only after sealing that you begin to get a build on top of the wood, and with it a certain gloss. But this gloss cannot be increased by applying more coats. To increase the gloss, you'll need to rub the cured finish with a very fine rubbing compound.

Myth: Teak oil is specially formulated to dry better on oily woods.

There are at least three different types of finish that are sold as "teak oil." There is mineral oil, which doesn't cure; there is wax and mineral oil mixed, which doesn't cure; and there is linseed oil and varnish mixed, which does cure. The latter is essentially the same as other oil-varnish blends. (See main article.) None have had anything added to make them better suited for teak or other oily woods.

Myth: The key to achieving a good oil finish is sanding the wood to at least 400-grit before applying the oil.

It won't hurt to sand to 400-grit, but it won't help much, either. The sanding scratches made by 220-grit sandpaper can't be seen by the naked eye once the finish has been applied, so sanding to 220-grit is adequate in most situations. When you sand to 400-grit, you begin to polish the wood and it

develops a higher shine. This makes the wood look more finished before you apply the finish. But it has no effect on the appearance after you apply the finish. If you see sanding scratches after you've applied the finish, they're likely caused by coarser-grit scratches, which weren't entirely removed with the 220-grit. The only benefit you can gain by sanding the wood to finer grits is to make the wood feel smoother. But the difference is very subtle, and you can get the same results by wet sanding each coat with increasingly finer-grit sandpaper as you apply it.

Myth: A mirror finish can be obtained by filling the pores with oil and sawdust.

You probably see this suggestion often. The idea is that sanding the wood while it's wet with oil makes a paste of oil and sawdust, which fills the pores. The problem is you can't avoid wiping most of the oil-laden sawdust back out of the pores when you remove the excess oil from the wood. This is a very inefficient way of filling the pores if that is your intention. Using paste wood filler would be a better method. (See AW, #27.) But the real beauty of an "oil" finish is its sharp delineation of the pores. This is lost when you fill, or even partially fill, the pores. If you want a filled look, you should use a film finish such as shellac, lacquer, varnish or water-based oil, which will give you much better protection in the balance.

Myth: Oil finishes should be maintained with lemon oil.

Lemon oil, a very light mineral oil with a lemon scent added, is a very short-lived maintenance product. It is a furniture polish that will help pick up dust, add temporary shine to a dull surface, and reduce scratching until it evaporates—which it will do within a few days. Thin oil finishes should be maintained by periodically applying more "oil" or paste wax.—B.F.

SAFETY CONSIDERATIONS

Any finish that contains solvent or oil is a fire hazard, so follow these guidelines.

Never heat a finish over an open flame or electric burner. If you want to warm a finish, put the container in a pan of hot water.

Never leave oily rags in a pile. When finishes cure, they absorb oxygen and generate heat. A pile of oil- or varnish-soaked rags can spontaneously combust. To avoid this danger, always dispose of

used rags in an approved, fire-resistant metal container or hang them over a branch or fence to expose them to the air and prevent them from heating up. When the finish cures (the rags will become stiff), you can safely toss them in the trash.

Safety for food or mouth contact—Some manufacturers market their “oil” finishes as food-safe, but none have FDA approval. In fact, within each of the four types of “oil” finishes, the ingredients (all approved by

the FDA) and the formulations are almost identical. It's most likely that all commonly available “oil” finishes are safe for food utensils once the solvents have evaporated and the finish has cured. Nevertheless, if you are concerned, I suggest you stick with one of the brands that claims to be safe for food contact. That way, you have the assurance that the manufacturer stands behind the product's safety.—B.F.

rating the finished wood from the stripped wood.

If you want the finish to protect the wood, it's important that you achieve a continuous film on the surface of the wood—that is, a film with no voids in it. Voids most likely occur in the pores or at the sharp edges where the pores meet the wood's surface. Finishes like varnish, shellac, and lacquer are thick enough to easily bridge right over the pores when you brush or spray them on the wood.

“Oil” finishes are too thin to span these voids. Therefore, it's important that you apply the first coat or two wet enough on the wood to soak in and fill the pores. Otherwise, the thin film won't bridge across the pores and there will be voids in the finish. It takes two and sometimes three or four coats to achieve a continuous film. You can tell you have a continuous film when additional coats no longer improve the sheen.

Maintaining and Repairing the Finish

Because the film of finish is so thin, an “oil” finish requires some maintenance. Even slight wear will create voids in the film, leaving bare wood exposed to spills. The best way to maintain an “oil” finish is to recoat it whenever the finish begins to look a little dry or show wear. Recoating can be done with the same finish you used originally, or with any other “oil” finish. All four types are compatible.

An “oil” finish can also be maintained with paste wax. Paste wax will raise the sheen of a dull surface and

reduce scratching significantly by making the surface slick. But once you've used wax, you must remove it with mineral spirits before applying another coat of finish. “Oil” finishes applied over wax will cure softer and smudge more easily than without the wax.

Woodworkers often cite the ease of repairing “oil” finishes as one of their primary advantages. Repairing thin finishes is often successful precisely because of their thinness. (Lacquer and shellac are just as easy to repair if the finish is thin enough.) When you wipe another coat of finish over the surface, it penetrates and darkens all scratches. Unless the scratches are severe, the new coat often disguises them, even though the scratches haven't disappeared. The finish has merely blended in the color.

Other types of damage are a little tougher to repair. Water smudges usually raise the grain of the wood, creating a different texture than the surrounding wood. Applying a coat of finish to the smudge seldom removes it from view. It usually helps to rub the surface with steel wool or sand it lightly with 400-grit to 600-grit paper and apply more finish. (You can also use the steel wool or sandpaper while the surface is wet with finish.) If this doesn't remove the smudge, continue applying more coats of finish to the damaged area until the sheen matches that of the surrounding area.

Color differences can be caused by heat or spills staining the wood or by the removal of the wood's patina or the original stain. The only way to remove heat or burn marks is to sand

through the damage. You can sometimes bleach out spill stains with oxalic acid or household chlorine bleach. (See AW, #4, September/October, 1988.) You can sometimes fake patina with stain or bleach, and you can sometimes replace the original stain successfully. However, all of these problems can be difficult to repair to perfection.

Pros and Cons

To sum up, “oil” finishes have a lot of advantages—easy application, a natural close-to-the-wood look, and easy repairability. These desirable qualities are directly related to the thinness of the finish. On the flip side, oil finishes are so thin that they don't provide much protection for the wood (unless you build many coats of wiping varnish or polymerized oil to a thicker film). Before deciding to use one of the “oil” finishes, weigh the convenience against the reduced protection you'll get when compared to lacquer, water-based, or regular varnish. ▲



BOB FLEXNER

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MITERED

MUSIC BOX

BY JIM CUMMINS



When my boy James was born about nine years ago, he proved to be an easy keeper and a good sleeper. Each eventide after we'd settle him down, he would pull the big red ring on the plastic music box hanging from his crib, and it would play him to sleep with the tinkling notes of "Hickory Dickory Dock."

The box eventually fell apart, but I saved the movement because its tune evoked those bygone days.

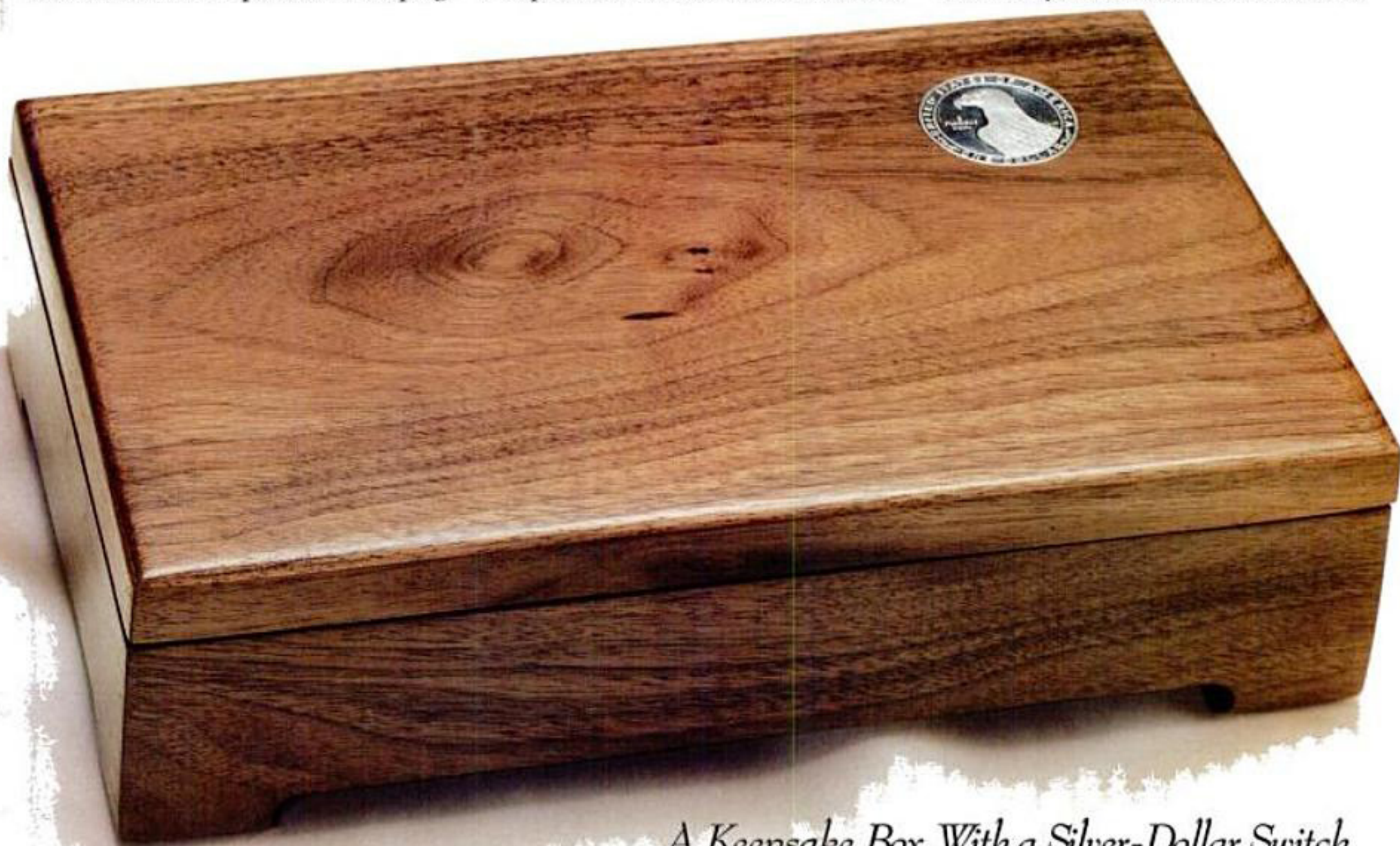
This year, with my boy old enough to collect treasures like baseball cards and gravel, the time seemed ripe to put that movement to work again. I decided to build him a music box that could also hold some keepsakes. In keeping

with an old tradition, I wanted to inlay a coin minted in the year he was born. Ultimately, I came up with a way to use an Olympic silver dollar as part of a rotary switch to turn the music off and on. (See sidebar, A Switch With A Twist, page 55.)

My first step in constructing the box was to choose an appropriate soundboard. Just as a tuning fork or a violin needs a soundboard to amplify its vibrations, so does a music box movement. My movement's original soundboard was plastic, but because I'd built and repaired a number of musical instruments over the years, I had scraps of various-tone woods on hand. I experimented and found that the

harder and denser the soundboard, the crisper the sound. As if to mock my efforts, however, the loudest, clearest, and best-sounding notes occurred when I laid the movement on my benchtop, a 4 x 8 sheet of plywood reinforced with a nailed and glued grid of 2 x 4s. "Stradivari," I mused to myself, "if you had only known. . . ."

The soundboard I eventually chose is vertical-grain (quartersawn) cedar, the same stuff you'd find in a shingle or old siding. I made the box itself from walnut, using all-mitered construction. With this method, you miter every edge of every side of the box, glue it up, then cut it apart to form the body and lid. If you've never made a box this



A Keepsake Box With a Silver-Dollar Switch

PHOTO BY JOHN HAMEL

way, give it a try. (See AW, #14, for more on boxmaking.) The process is slick and fast, provided your machines are set up properly.

Constructing the Box

First, thickness your wood to a uniform dimension. Mine is $\frac{1}{2}$ in., but this dimension isn't important; just be sure all the wood is the same. You can use mitered construction with any thickness. The top of my box is 7 in. wide because that is the width of my planer, and it's 11 in. long and 3 in. high because that looked about right.

After you've thickened the wood and ripped it to width, carefully cut the pieces square to length. Now tilt and lock your tablesaw at 45° and verify the setting on some test cuts.

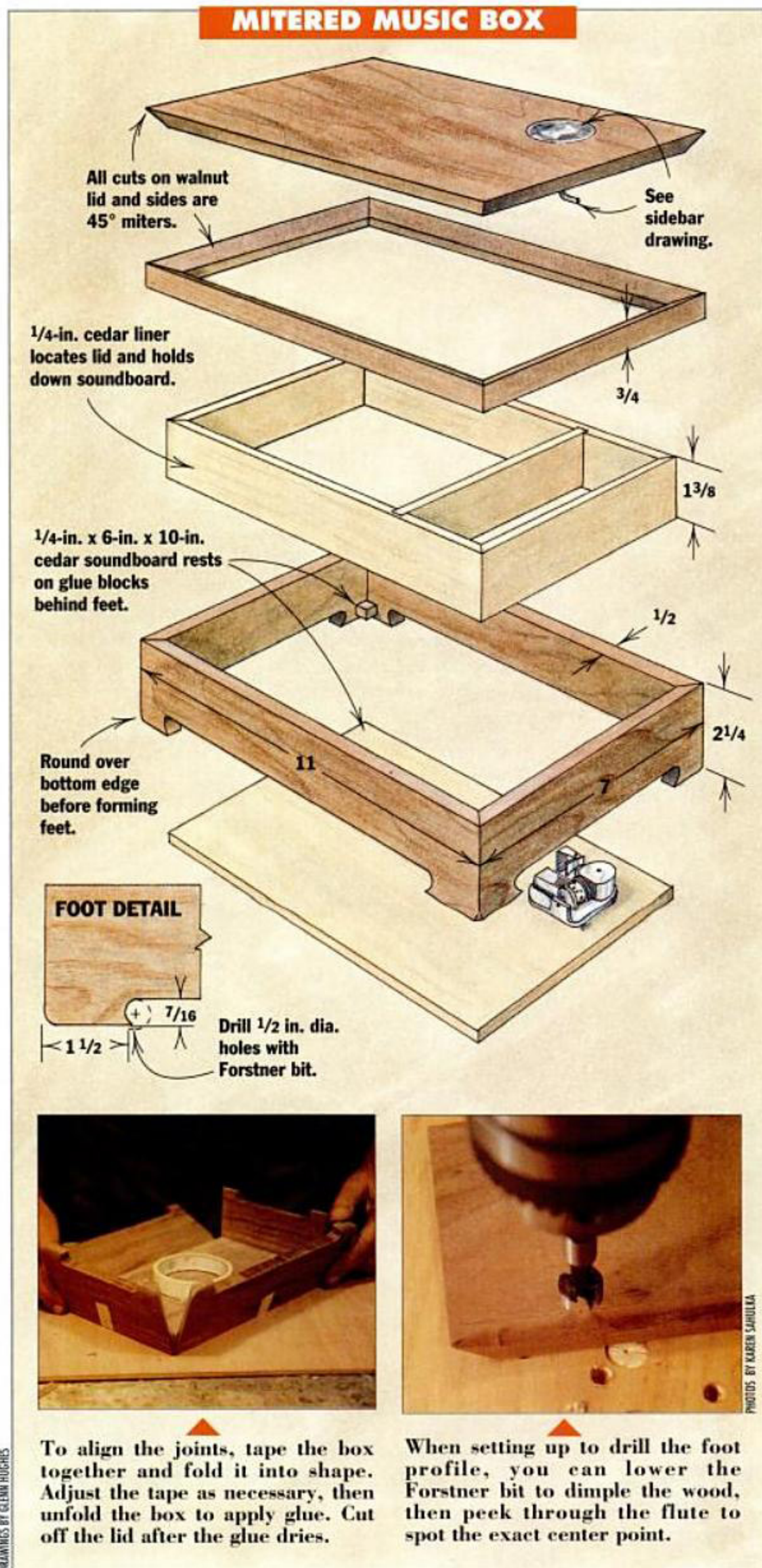
Set your fence so the work will pass between the fence and the blade, and miter one end of a short side. If the work is long enough, you can use the miter gauge in conjunction with a fence. For short work, use a square back-up block to provide stability. Without moving the fence, turn the piece around and miter the other end.

Don't move the fence until you have mitered every 7-in. piece of wood in the box. This is the whole trick in all-mitered construction. While any of us can reset a fence within a couple of thousandths, that's not good enough for this job. Similarly, when you've set your fence for the 11-in. or 3-in. cuts, don't move it until they are all done. If you want the box to end up 3 in. high, allow a little extra height for the saw kerf that will separate the lid from the body.

Test fit your box by taping it together, as shown in the photo. If it isn't airtight, you need to spend some time on machine maintenance. Your planer may be out of whack, your tablesaw blade not parallel to the miter-gauge slots, the fence not square, or the miter gauge not at 90° .

Drilling the Feet

The feet are not only decorative, but also raise the box to let the sound come out the bottom when the box is closed. To make them, first round over the bottom edges of the sides with a $\frac{1}{4}$ -in. round-over bit. This is best done on a router table with a fence because the points of the mitered corners will slip

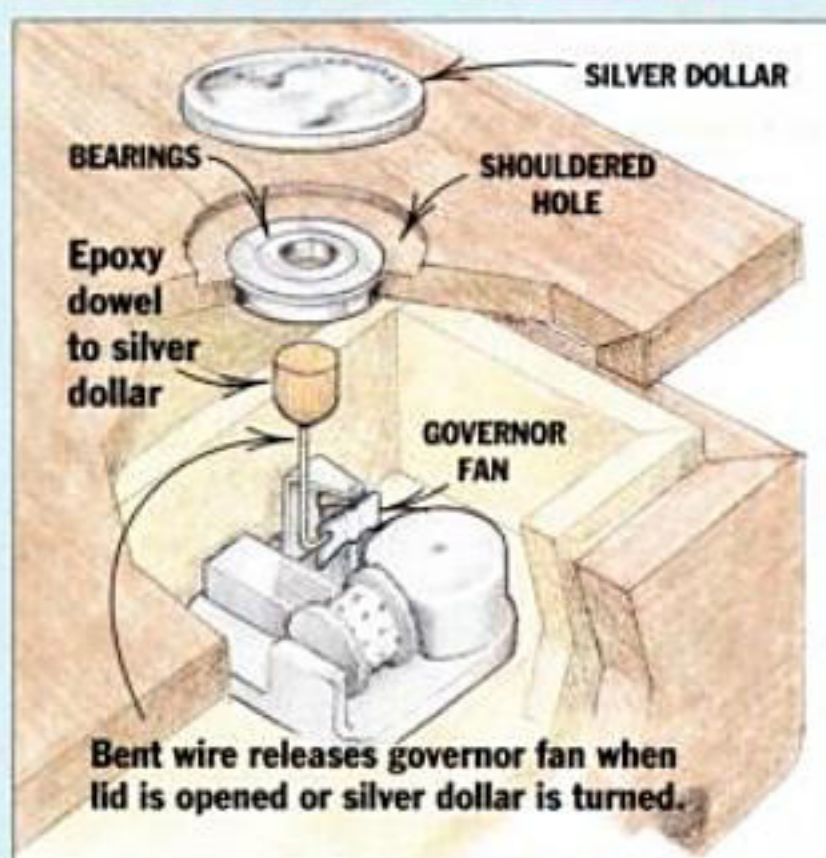


A SWITCH WITH A TWIST

My music box started out with a two-cent rotary switch made from a couple of pennies with BBs sandwiched in between to act as bearings, but the movement wasn't as smooth as I wanted. Ultimately, I replaced the BBs with a set of 1/2-in. ID, 1 1/4-in. OD bearings I found in a plastic bin at the local hardware store.

I used a piece of copper wire as the trip mechanism. It's press-fit into a dowel, which fits snugly in the center of the bearings and is epoxied to the coin. The wire engages the governor fan that controls the speed of the music box movement.

You can turn the music



off and on by opening the lid or by turning the coin with your fingertips to activate the switch when the box is closed.

The drawing (above right) shows an optional trip mechanism to the

copper wire. This switch consists of a piece of 14-gauge copper wire that runs down a shallow kerf cut in the back of the cedar liner. The top and bottom of the wire are bent. One end fits between the two halves of a hinge and the other engages

the governor fan.

When the box is closed, the hinge pushes the wire down so it stops the fan. When you open the lid, a ball-point-pen spring lifts the wire away from the fan, starting the music.—J.C.



SOURCES

Music box movements and switches are available by mail from the following suppliers:

- ▶ KLOCKIT, Box 636, Lake Geneva, WI 53147, (800) 556-2548.
- ▶ MURRAY CLOCK CRAFT LTD., 510 McNicoll Ave., Willowdale, Ontario, Canada M2H 2E1, (800) 268-3181.
- ▶ NATIONAL ART CRAFT CO., 23456 Mercantile Rd., Dept. T-90, Beachwood, OH 44122, (216) 292-4944.
- ▶ PRECISION MOVEMENTS, 4251 Chestnut St., Box 689, Emmaus, PA 19049, (215) 967-3156.
- ▶ WORLD OF MUSIC BOXES, 414 Main St., Avon-By-The-Sea, NJ 07717, (908) 988-0198.

under the pilot bearing if you try to use the bit freehand.

Next, cut the feet. First, create the inside curve on each foot with a 1/2-in. Forstner bit. As shown in the drawing, I located the center of the hole 1 1/2 in. from the ends and right on the edge of

the arc created by the round-over bit. When you've drilled all the holes, bandsaw the waste in between.

Hinge the box together again with tape to hold the pieces in alignment for gluing, then unfold the pieces flat to apply glue to all the joints. Lightly hold the sides together with a band clamp, invert the box, and place a weight on the top to secure it until the glue dries. If you don't have a band clamp, tight masking tape will do.

Gluing edge grain to end grain can cause problems because the pieces of wood will expand in different directions as humidity changes with the seasons. I figured, in this case, I could get by with this cross-grain construction since the top of the box was a narrow, well-dried piece of wood and I intended to keep the box indoors.

After the glue dries, cut off the lid. I did this on the tablesaw and ran the top of the box along the fence to keep the cuts square and in alignment. You might want to tape spacers in each kerf to keep the lid from wobbling when you cut the last edge.

The soundboard rests on four little glue blocks set behind the feet and is

held down by mitered, slip-fitted inserts that also help keep the lid in position. (See drawing.) The inserts are not glued; friction will hold them in place.

Now you can drill the soundboard for access to the winding key underneath and install a switch of your choice. I've suggested two possibilities in the sidebar. You'll find others in catalogs from suppliers. (See Sources.) Lid stays, locks, compartments, false bottoms, and other variations are all optional. If you don't want to bother with a music movement at all, it's a nice little box without one. ▲



JIM CUMMINS writes, edits, and putters around in his picture-frame shop. His videos *Small Shop Tips* and *Making Boxes* are available from the author, 33 Rock City Rd., Woodstock, NY 12408.

HVLP SPRAYERS

BY A. HARVEY MEYER

A Look at 11 Low-Pressure Systems for a High- Performance Finish

I coughed and choked into my respirator as I emerged from the dense lacquer cloud that hung thick across the shop. Upstairs, my mother shouted, afraid that I had suffocated in the haze.

That's how I remember my first experience spraying lacquer with a high-pressure, compressed-air system. It was frustrating and dangerous. My second experience wasn't much better: I worked in the garage with the door open and spent the rest of the afternoon and the next day cleaning up

the overspray and polishing the dried lacquer flecks off the car. It was years before I sprayed lacquer again.

Fortunately, the new high-volume, low-pressure (HVLP) spray systems on the market have eliminated the overspray problems I had and have made spraying at home practical and safer.

With HVLP, you get an extremely efficient portable system that gently broadcasts a fine mist of finish that goes where you spray it. Conventional systems, by contrast, rely on high-pressure compressed air that delivers the



▼ **CROIX CX-5, CX-12:** The CX-12 (left) is an ideal system for production work. One unique feature is a small, built-in compressor that pressurizes the finish cup to provide more control over fluid movement. It is more system than anyone needs for a home shop, but its ease of use makes it ideal for anyone who wants a system with all the top features.

The smaller CX-5 (below) is half the price of the CX-12 and is an excellent two-stage sprayer for the small-shop or occasional user.



CROIX CX-12

CROIX CX-5

▼ **APOLLO 700+:** Apollo is the oldest manufacturer of HVLP systems in the United States and offers 11 different models. The 700+ is one of the company's midpriced systems. It's a high-quality two-stage system but lacks an air-volume control knob. I found the gun uncomfortable over long periods because the trigger feels too wide. The quick-connect couplings make it easy to attach and remove the gun.

*An optional Teflon-coated cup makes cleanup easy.



finish with such force that it bounces (oversprays) all over you, the work, and the work area.

Because they operate on low pressure, HVLP systems are typically two to three times more efficient than compressed-air spray systems, and that saves money. When General Motors switched one of its plants to HVLP, it saved enough in four days to cover the \$60,000 cost of the conversion.

This high efficiency also reduces air pollution and makes many spraying jobs easier. You can spray inside a cabinet, for instance, without having the finish bounce back into your face. And when you combine an HVLP system with one of the new water-based finishes, you don't have to worry about fumes as you would when spraying with solvent-based lacquer.

For this article, I tested 11 HVLP systems with price tags of less than \$1,200. I tried to select a range of sprayers that would satisfy the needs (and budgets) of most small-shop finishers—from the basement hobbyist to the full-time professional.

How an HVLP System Works

The first HVLP systems were developed in the 1920s as accessories for high-priced vacuum cleaners, and even today many of the sprayers aren't



▲ ACCUSPRAY 23i:

Accuspray 23i features a three-stage turbine that is relatively quiet. The spray gun and the air cap are lightweight plastic-composite material. The gun has separate knobs for controlling pattern and material flow, making it very similar to guns for conventional compressed-air systems.

much larger than a shop vacuum. At the heart of the sprayer is a turbine delivering warm (about 135° to 145°F), dry, clean air at pressures of 2 to 10 pounds per square inch (PSI) and volumes of 50 to 200 cubic feet per minute (CFM). Compressed-air systems, by contrast, operate at 20 to 65 PSI and 4 to 7 CFM.

Since the turbines move air constantly, HVLP systems don't need the bulky storage tanks found on compres-

CUSTOMIZING YOUR HVLP SPRAYER

If you do a lot of spraying and want to soup up your basic HVLP system, check out the accessories offered by the various manufacturers.

These include remote cups, which allow you to spray without the burden of a heavy finish-filled container on the gun; pressurized paint tanks for handling large quantities of finish; 45° connectors, which make hose connections at the gun more comfortable; and special valves to control fluid flow.

One add-on I've found to be outstanding is the Lex-Aire air booster (\$275). It can improve the performance of most of the turbines I tried, though it won't fit the Apollo or the Wagner FineCoat.

The booster works in conjunction with a 2-HP or larger compressor, and when you start to spray, this booster adds compressed air to the air at the output end of the turbine. The added volume of air from the booster lets a two-stage turbine easily do the work of a three-stage system. This can be important if you're spraying very viscous finishes or need to move a large amount of finish.

*NOTE: If your booster setup exceeds 10 PSI at the air cup, you may be out of compliance with HVLP regulations in some states.

Remote cups are also convenient accessories. In my home shop, I spray with a remote 1-quart cup connected to an air compressor supplying 3 to 7 PSI. This allows far more control of the material and enables me to do things with the gun that are impossible with the cup connected to it. For example, I can turn the gun sideways and only partially trigger it to spray the edges of a table.

You can make other, even simpler modifications to an HVLP system by buying different-sized nozzles and air caps to customize the gun for each finish you use.—A.M.

S P E C S O N H V L P

Manufacturer	Model #	Turbine Stages	Noise Level (1-10)	Mfr. Turbine Rating	Pattern Control Location/Pattern Size*
Accuspray Inc.	23i	3	9	5 PSI at 85 CFM	rear of gun 1/2" to 10"
Amspray	690	3	9	6 PSI at 90 CFM	side of gun 2" to 10"
Apollo Sprayers	700+	2	9	4.5 PSI at 105 CFM	adjusts, at air cap 3/4" to 12"
Campbell Hausfeld	HV2000	2	8	4 PSI at 54 CFM	none 1 1/2" to 10"
Eagle Spray	ES-1000	2	8	5 PSI at 90 CFM	rear of gun 1/2" to 10"
Lex-Aire Products, Inc.	LX50A	2	8	4 PSI at 60 CFM	adjusts, at air cap 1/4" to 15"
Fuji Industrial Spray Equipment, Ltd.	Super	3	8	5 PSI at 100 CFM	adjusts, at air cap 1/4" to 15"
Croix Air Products, Inc.	CX-5	2	8	3.9 PSI at 94 CFM	adjusts, at air cap 1/2" to 13"
Croix Air Products, Inc.	CX-12	2	9	5 PSI at 105 CFM	adjusts, at air cap 1/4" to 15"
Wagner Spray Tech Corp.	Fine Coat	1	10	not available	none 1/2" to 9"
Wagner Spray Tech Corp.	CS 8000	3	8	6 PSI at 80 CFM	adjusts, at air cap 1/4" to 15"

* Gun held 4" to 8" from work.



▲ **EAGLE SPRAY ES 1000:** This two-stage system is probably the best value out of those I tried. It uses the Accuspray gun and stainless-steel internal parts. The only complaint I have is the lack of an air-control valve. I would definitely add one at the hose end.

sors. They also don't have the condensation and oil-contamination problems sometimes associated with high-pressure spraying systems.

HVLP turbines aren't very complicated. There's a motor and blower for the smallest, or single-stage, systems.

Larger systems designed for production use and/or high-viscosity finishes generally have larger motors and more blowers. A three-stage system, for example, has three blowers working together to increase pressure.

If you spray mostly small projects with light-bodied materials like lacquer, a single-stage unit will work well. For furniture and cabinets, you'd be better off using a two-stage machine. And if you spray heavy-bodied materials, like polyurethane, you will either have to thin your finish, beef up a two-stage unit with an air booster (see sidebar, Customizing Your HVLP Sprayer, page 57), or invest in a three-stage turbine system.

Other than turbine sizes, the chief differences between the HVLP systems are their guns. Most systems have guns with pressurized cups, which hold the finish. Pressurized air forces the finish through a small tube and into the gun, where it is atomized as it passes through a fluid nozzle and air cap—the wing-shaped device on the front of the gun. The air cap can be either screwed



▲ **CAMPBELL HAUSFELD HV2000:** This system is self-contained, with the case also providing storage for the gun and accessories—a nice feature for occasional users. It includes an extra needle set for heavier viscosity finishes (a nice touch). The gun doesn't have a pattern control but does have an easy-to-reach air-volume control.

onto the gun or attached with a quick-connect mechanism that resembles a bayonet-type lock. I prefer the quick-connect models because they are faster to attach and the fluid is less likely to spill out.

Most of the guns are equipped with

SPRAYERS

Quality of Atomization (1-10)	Hose Length	Air Volume Control	Gun Cup Type	Price as Tested
10	25 ft.	on hose	1-qt. screw on	\$895
7	26 ft. including 6-ft. no-kink hose	none	1-qt. quick connect	\$890
8	24-ft. flex hose	none	1-qt. screw on	\$895
6	15 ft.	on gun	1-qt. quick connect	\$289
10	20 ft., including flex	none	1-qt. quick connect	\$760
9.7	20 ft.	on hose	1-qt. quick connect	\$725
9.8	25 ft.	on hose	1-qt. quick connect	\$795
9.7	20 ft.	on hose	1-qt. quick remote	\$495
9.7	20 ft, 54-in. whip	on hose	2 qt. remote	\$1,195
6	12 ft.	none	1-qt. screw on	\$179
9.7	25 ft.	on gun body	1-qt. quick connect	\$885



▲ **AMSPRAY 690:** This lightweight system is the one I'd choose for portable commercial use. The pattern-control knob is on the side of the gun where it is easy to manipulate. Lefties will be pleased the knob is accessible from either side of the gun. It lacks an air-control valve.

a bleeder passage to let air escape constantly, even when you aren't depressing the trigger. This bleeder action is necessary to move air through the system and prevent overheating.

The volume of air also explains the size of the hose, which is about 1 in.

dia. and much larger than those on compressed-air systems. Some people complain about the bulky hose at first, but I find it is easy to manipulate if you drape it over your back and down along your arm.

Fine-Tuning the Spray

To get the best results from any spray system, you need to regulate the flow of air and/or fluid through the gun, the atomization rate of the finish, and the gun's spray pattern. Each of the HVLP systems I tested offers various ways to fine-tune spray quality.

You have to experiment with the control functions offered by your system until you get top performance with the finish you're using.

First, HVLP units have a valve at the end of the air hose or on the gun body itself to control air flow. This adjustment is very important in regulating atomization and spray patterns, and I urge anyone with a system that doesn't have this to add it as an accessory.

You can also adjust atomization by changing the gun's nozzle or the wing-



▲ **FUJI SUPER:** This system includes an excellent three-stage turbine and some handy features like a hose-end air valve to cut back unneeded volume and an air-cap ring that allows you to return to a particular pattern setting. Although the trigger is a bit wide for optimum comfort, the gun atomizes beautifully and has a full range of features.

shaped air cap. Air is released through holes on both sides of the wing and mixes with the finish to increase atomization. The smaller the air cap, the greater the air pressure and atomization.

Some systems have an adjustment



◀ The **Wagner CS8000** system is a three-stage machine, offering the only non-bleeder gun. Instead, it has an air bleeder on the turbine, which makes the turbine slightly noisy but the gun much quieter. The gun was very comfortable to use and one of my favorites.

WAGNER FINECOAT: ▶

This single-stage sprayer is the lowest-priced HVLP system on the market. It has no adjustments for air volume or spray pattern, but that didn't stop me from achieving a factory-quality finish.



RUNNING HVLP OFF YOUR COMPRESSOR

For those of you who own larger compressors (3 HP or more), an alternative to HVLP spraying exists. Conversion air systems (CAS) take normal compressor air, with pressures up to 60 PSI, and convert it to HVLP.

The big advantage to these systems is price. You can get a system with guns that equal the best available for HVLP at a savings of \$200 to \$300 over a conventional HVLP system. This savings doesn't come without cost, though. CAS units are less efficient than turbine air in total energy use. You will need a compressor delivering no less than 11 or 12 CFM at 60 PSI for even the lightest applications. Some guns, for example the Binks Mach 1 (available from Binks Manufacturing Corp., 9201 Belmont Ave., Franklin Park, IL 60131, 708-671-3000), use as much as 22 CFM. I recommend a 7½ HP compressor to run it.

A plus with CAS systems is that they often do not require the bulky air hose necessary on a turbine-driven HVLP

system. Most CAS units convert the high-pressure air at or in the gun.

A minus for these systems is that you're working with a compressor and storage tank that might contain contaminants. For more exacting spraying with a CAS unit, you will need to filter your air to protect against contamination.

The horsepower rating of compressors, especially those offered in consumer lines, is often overrated, so if you go the conversion route, be sure you check your actual compressor output to see if it will meet the CAS gun air capacity requirements.

That said, CAS guns are of excellent quality, and all those that I've used perform as well as the better HVLP guns. One gun, the Graco 1265 (available from Graco Inc., 4050 Olson Memorial Hwy., Minneapolis, MN 55422, 800-367-4023) is particularly outstanding. And it's the most miserly air user of all the CAS guns.

Other excellent guns are available from Accuspray, Binks, Croix, Lex-Aire, DeVilbiss, and Kremlin.—A.M.

knob at the front or back of the gun that lets you control the size of the spray pattern. On other systems, you adjust the spray pattern by rotating the air cap itself.

Finally, all units have another valve to control fluid flow. Again, you should experiment with different settings until you get the spray quality you want.

Evaluating HVLP Sprayers

In preparing this article, I evaluated 11 models designed for the small shop. With each system, I sprayed both a 50-50 mixture of lacquer and thinner and an uncut water-based finish. I checked the atomization by spraying water into the air in front of a light. I adjusted the system until I got the best possible pattern of fine and evenly dispersed droplets and then used the settings to spray horizontal flat panels.

All 11 systems produced good-quality finishes, but with some machines I had to thin the mixtures, or slow down as I moved the gun across the workpiece, to get the best results. Manufacturers offer several sets of nozzles and air-cap sizes for different finishes. (See sidebar, Customizing Your HVLP Sprayer.) Experience will quickly teach you when to change fluid sets (nozzles and needles) or air caps.

I found all the systems were well made, and I would not hesitate to purchase any one for home use. Also, every system, including the least expensive, gave me the ability to shoot a finish equal or superior to commercial-grade furniture finishes, although the smaller sprayers tended to be slower. Although I wouldn't relish the job, I could have sprayed a car with the lower-priced models and gotten a decent result. If I had to do several cars each day, though, I'd upgrade my equipment.

In comparing the sprayers (see chart), I used a 1-to-10 rating system with 10 being the best in the group. In addition to spray features, I rated noise levels. HVLP turbines sound like shop vacuums; the quieter systems rated higher marks because noise can be bothersome after a couple of hours.

Recommendations

So which machine should you buy? Here are my recommendations, but



◀ **LEX-AIRE LX-50A:** The gun on this two-stage sprayer has a port for attaching a pressure gauge—a nice feature. This lets you track air pressure so you can find the best PSI rating for each job and finish. Lex-Aire offers an extensive selection of accessories. I especially like the air booster, which improved the performance of most of the systems I tried.

keep in mind that the ultimate decision will depend on how you intend to use the sprayer and how much money you want to spend. Other than value for the buck, price was not a consideration in my choices.

That said, I'd suggest that if you're an occasional user, your best buy would be the Croix CX-5, followed by the Campbell Hausfeld HV2000 and the Wagner FineCoat. For the intermediate user, my first choice is the Eagle Spray ES 1000,

then the Wagner CS8000 and the Lex-Aire LX-50A. The top machines for the advanced user would be the Croix CX-12, Fuji Super, the Wagner CS8000 and the Accuspray 23i.

Keep in mind that these are recommendations for base systems only; intermediate or advanced users will probably want to add accessories to suit their needs ▲

A. HARVEY MEYER
is a professional finisher and cabinetmaker in Virginia.

SOURCES

- ▶ **Accuspray, Inc.**, Box 391525, Cleveland, OH 44139, (800-321-5992).
- ▶ **Amspray**, Box 86, Harrison, OH 45030, (800-443-4500).
- ▶ **Apollo Sprayers**, 1030 Joshua Way, Vista, CA 92083, (619-727-8300).
- ▶ **Campbell Hausfeld**, 100 Production Dr., Harrison, OH 45030, (800-543-8622).
- ▶ **Croix Air Products, Inc.**, 520 Airport Road South, St. Paul, MN 55705, (800-328-4827, ext 1240).
- ▶ **Eagle Spray -Kace Technology**, Box 513 Milltown, NJ 08850, (800-966-5223).
- ▶ **Lex-Aire Products, Inc.**, 34 Hutchinson Rd., Arlington, MA 02174, (800-537-2473).
- ▶ **Wagner Spray Tech Corp**, 1770 Fernbrook Lane, Minneapolis, MN 55447, (800-328-8251).
- ▶ **Fuji Industrial Spray Equip. Ltd.**, 65 Martin Ross Ave #5 Toronto, Ont. M3J 2L6 (416-650-1430).

SPRAYING WITH HVLP

It will take practice to master HVLP spraying, particularly if you have experience with a high-pressure, compressed-air system, because the techniques are a little different.

As with any spraying system, the viscosity of the finish determines how you spray it. In general, the higher the viscosity, the more air and the larger the nozzle and air cap you will need. Follow the manufacturer's recommendations for thinning.

Once your viscosity is correct, adjust the pattern shape and size by spraying onto a piece of paper or cardboard. HVLP spray guns operate best 4 in. to 8 in. from the work, as opposed to the 6 in. to 12 in. with conventional guns. Adjust your finish flow so you get a full, wet coat without sags or runs. At this point, you may get an orange-peel surface from too much air. If this occurs, cut back on your air volume, and re-adjust your finish flow if necessary. The first time you spray, it may take four or five minutes to get your adjustments fine-

tuned, but with a little experience, you'll be able to get the time to 20 or 30 seconds. You can practice by filling the finish reservoir with water and spraying on paper until you get used to the system.

Refining Your Technique with HVLP

I find HVLP systems are much better than compressed air for spraying water-based finishes, especially in cold or humid weather. If you spray lacquers, particularly in the summer, you'll need to add a retarder or flow-out additive to the lacquer. Turbine air is so much drier and warmer than air in compressed systems that lacquer sets up before it can flow out.

Because HVLP systems lay down about twice as much finish on the workpiece as conventional spray systems, you will have to move faster and/or drastically cut back on your fluid flow when using an HVLP sprayer.

As you depress the trigger, begin spraying across the surface. Start with

the gun away from your body and work toward yourself. This will enable you to spray without dropping dust, hair, or other debris in your work. Set up an exhaust fan to remove vapors. Flammable finishes require a fan with an explosion-proof motor (available from McMaster-Carr Supply Co., 600 County Line Rd., Elmhurst, IL 60126, 708-834-9600). A fan that moves 200 to 300 CFM is usually adequate.

The last spraying tip involves getting a super-fine finish with the last coat. If you use the fluid nozzle and needle recommended for the viscosity you are spraying but change the air cap to the next smaller size, you'll end up with finer atomization. The overspray mist will increase slightly, but you can counteract this by angling the gun slightly (about 5° to 10° from perpendicular), away from the wet area, and spraying full, wet coats, overlapping each succeeding coat by 50 percent. A few days of practice should have you spraying with the best of them.—A.M.

WOOD FACTS

L A C E W O O D

BY DICK BOAK

SPECIES NAMES

Cardwellia sublimis (Northern Australia, Queensland)
Grevillea robusta (Southern Australia, Africa, India, Sri Lanka)
Platanus hybreds (United Kingdom)
Platanus acerifolia (United Kingdom)
Roupala spp. (Brazil)
Panopsis rubescens (Pará, Brazil)

TRADE NAMES

Lacewood, silky oak (Queensland)
European plane (United Kingdom).
Also sometimes marketed as: London plane (United Kingdom), English plane (United Kingdom), harewood (United Kingdom), leopard wood (Brazil).

VISUAL APPEARANCE

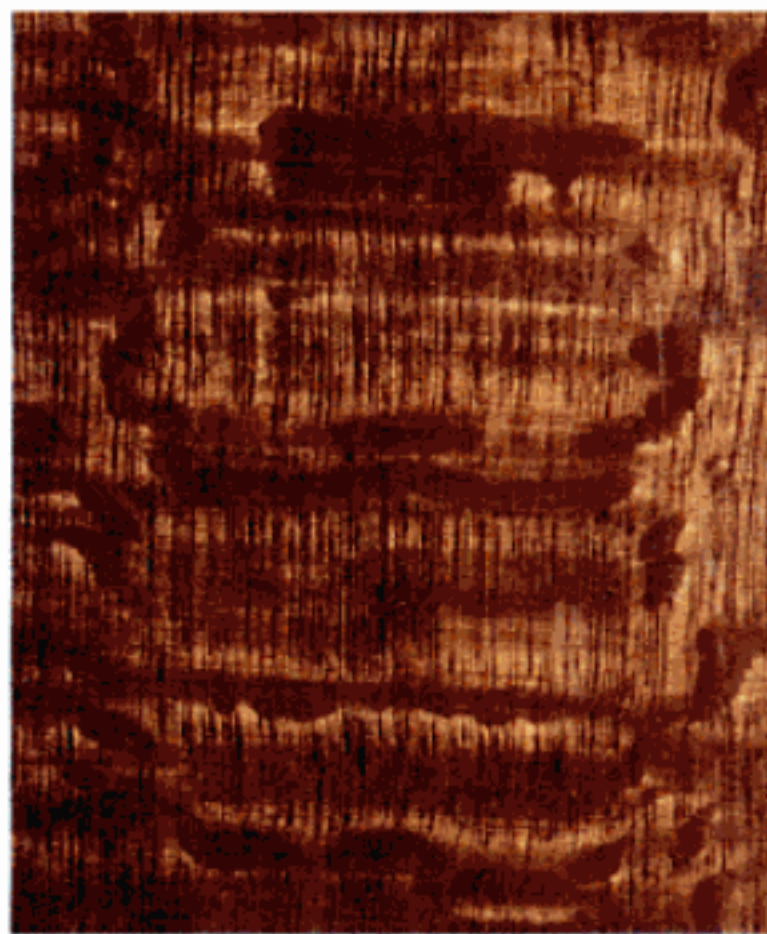
Lacewood, often called silky oak, has a light- to medium-toned mahogany or cherry background coloration with highly figured patterns similar to those found in quartersawn oak. This attractive figure is consistent because of the flaked silvery grain and large, regular medullary rays.

TECHNICAL PROPERTIES

Lacewood is a medium-weight wood with a specific gravity of .53 to .63, depending on the species. Grain lines run straight except where diverted by figured rays. Boards are typically clear and uncommonly free of defects and knots. A pore structure does exist and often displays slightly darker longitudinal gum lines. Texture is medium to coarse. The more stable quartered and rift cuts are preferred because of the desirable figure. Flat-sawn planks are prone to warping and cupping.

WORKABILITY

You can expect some difficulty in machining. The cellular walls that



Because of prominent medullary rays, quartersawn lacewood can display extraordinary, almost flamed, figuring that is similar to quartered white oak, hence its nickname, silky oak.

surround the medullary rays are prone to chip-out and must be given some special attention during cutting and routing. Because of the wood structure's varying density, hand-applied stains may appear splotchy when applied. Alcohol-based spray stains work better.

TOXICITY

There is no evidence that most species of Lacewood are toxic. However, the *Grevillea robusta* species is known to cause poison ivy-like allergic reactions.

APPLICATIONS

Because of its unusual figuring, lacewood is considered a popular exotic among makers of jewelry boxes, small treen ware, marquetry, paneling, and furniture trim. Some craftsmen also use it in decorative architecture.



As the cut approaches rift (45°), the medullary rays emerge as distinct ovals in neat, ordered patterns. Flatsawn boards display considerably less figuring than those that are quartersawn or rift cut.

SIZES

Typical boards run 3 in. to 9 in. in width. Rough lumber of 4/4 size is generally available, while 8/4 and other odd sizes are fairly rare.

AVAILABILITY

Ironically, Australian lacewood, the variety that popularized lacewood's use, is no longer available because Australia has banned exportation. Brazilian lacewood, sometimes referred to as leopard wood, is the primary species now marketed in the U.S. and it is not considered endangered.

COST

Wholesale costs (100 board feet or more) range from \$2.50 to \$5 per board foot, while the wood retails from \$6 to \$10 per board foot. Highly figured boards often sell for higher prices.

PHOTOS BY ELLIS WALENTINE

JUST FINISHING



BY MICHAEL DRESDNER

A wise old finisher once told me the secret to a perfect finish is adroit touch-up work, and I've since learned how right he was. While it is almost impossible to finish a piece of woodwork flawlessly, the good news is that hiding the defects is fairly easy, whether they are spots of putty on new wood or the chips and dents that accumulate with time and use.

In simple terms, touch-up involves filling a spot where wood or finish is missing with a tiny painting that matches the surrounding grain pattern. Despite how difficult this may sound, you need only some technique, not great artistic talent, to hide defects convincingly. (I can vouch for this. I have refined touch-up skills, but I'm no artist. When I recently drew a kangaroo for my daughter, my loving family identified it as "some sort of duck or something.")

Filling the Defect

Begin the touch-up process by reconstructing the surface. If the defect is a chip or a dent, fill it with wood putty, drops of finish, or burn-in stick. Burn-in sticks are made of hot-melt resins (available in different colors or clear) that you melt into a void or dent with a heated knife. Whatever you use, once the defect is filled, sand it level with the surrounding surface, keeping the sanded area as small as possible.

It is best if the fill is a shade lighter than the wood's lightest background color since it is easy to darken a spot but almost impossible to lighten it.

The size of the repair is also an issue. You can effectively touch up



PHOTOS BY ELLIS WEAVER

Begin touch-up by filling the defect with wood putty and sanding it level with the surrounding wood. Paint in grain lines with pigments mixed in padding lacquer or shellac. A red-sable brush works best. If necessary, adjust the tone with a dilute mixture of pigment and finish, then seal with a coat of clear finish.

TOUCH-UP

A Little Putty, Little Paint—Make the Job What It Ain't

small spots, but large ones are bound to show. If the area is larger than a half dollar, consider splicing in a matching piece of wood rather than using filler.

Touching Up

Once you've filled the defect, you're ready to begin touch-up. Everything you'll need is listed on the opposite page. On your palette, mix a color that matches the large grain lines of the wood, and paint the grain in first. (See photos.) Connect your lines to the grain on either side of the patch. Try to match the pattern of the surrounding wood as closely as possible. Short, delicate strokes from a fine-point brush best imitate wood grain. Mix concentrated, intense colors that can be applied in thin layers. That way, you won't end up with a raised lump of extra finish in the area of the patch.

When you've finished painting the grain, the patch will be darker than before, but it still might be lighter than the surrounding wood or the wrong tone. To blend it perfectly, you'll need to apply a thin, nearly transparent overlay of color that will act like a filter of colored cellophane on a camera lens, tinting but not obscuring the view. To prepare the overlay, first find the hue you want by experimenting with combinations of pigments, mixing them in

a few drops of your shellac or lacquer with a brush, then diluting the mix with more vehicle to make it nearly transparent. Layer this thinned mixture over the patch very gently with a brush to avoid smearing your painted grain lines. For more information about mixing pigments, I recommend a book called *Blue and Yellow Don't Make Green*, by Michael Wilcox (Rockport, MA: Rockport Publishers, 1990).

SOURCES

Touch-up powders, burn-in sticks, padding lacquer, and other finishing supplies are available by mail from:

WOOD FINISHING SUPPLY CO. Inc., 100 Throop St., Palmyra, NY 14522, (315) 597-3743 (also carries red-sable brushes).

CONSTANTINE'S, 2050 Eastchester Rd., Bronx, NY 10461, (800) 223-8087.

GARRETT WADE, 161 Ave. of the Americas, New York, NY 10013, (800) 221-2942.

STAR FINISHING PRODUCTS, 360 Shore Dr., Hinsdale, IL 60521, (800) 323-5390 (Note: \$50 minimum mail-order purchase. Call and ask for a distributor in your area.)

JUST FINISHING

THE RIGHT STUFF

A good basic touch-up kit should include the following supplies. (See photo.)

Colors: You can use almost any coloring materials for touch-up, including artists' oils and acrylics, but most finishers prefer finely ground pigment powders. These inert powders *mix* easily in any clear finish—varnish, lacquer, shellac, etc.—but don't *dissolve*, so unlike dye powders, they will not bleed into subsequent coats of finish.

Pigment powders for touch-up are ground especially fine and sold by the ounce. Most suppliers offer pigment blends named according to wood species, but chances are you'll have to mix and match, so buy



A "color box" is a handy way to organize and store your pigments. Also useful are a glass palette, red-sable brushes, and padding lacquer or shellac.

a variety. Alternately, you can match almost any wood grain with a basic selection of white, yellow, red, blue, black, raw umber, burnt umber, raw sienna, and burnt sienna. I keep mine in a "color box," a short piece of wood with a hinged lid and some 1-in. deep holes for pigments.

Palette: I mix colors and finish on

a reusable palette made of a scrap of glass or mirror with the sharp edges sanded smooth. Clean it with solvent before you put it away (alcohol for padding lacquer and shellac).

Vehicle: I generally mix touch-up pigments in shellac or a commercially available padding lacquer rather than the actual finish material. Both are thin enough to handle well, mix easily with powdered pigments, and are compatible with a wide range of finishes. Use solvent alcohol for thinning and cleanup.

Brushes: When it comes to brushes, only red sable will do. You'll find brush sizes #00 through #2 to be useful for different grain effects. Available at art supply stores and some mail-order suppliers, these brushes are rather expensive, but nothing I've tried matches the springy, sharp point of a good red-sable brush for painting fine grain lines.

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TOOLBOX



HIGH-TECH ROUTERS

With its new EVS series routers, Bosch has solved a half dozen nagging router problems—like keeping plunge posts clean and installing template guides. Each router has a six-position speed control that adjusts rpm from

12,000 to 23,000, and a flip-down chip shield that gives you easy access to the collet to change bits. You can make microfine depth adjustments from any

plunge position. Other features include flexible plastic bellows that keep dust off the plunge posts, a unique lever-action quick-change system that allows you to install any of 11 template guides in an instant, a dust extraction system that attaches to the base for use with shop vacs, and a new router edge guide that lets you fine-tune adjustments with a dial and works on curved as well as straight surfaces. Model 1613EVS has 2 HP and ½-in. collet capacity, while the 1614EVS has 1½ HP and ¾-in. collet capacity. Single speed versions of these two models round out the series. (Price: 1613EVS \$320; 1614EVS \$255)

Robert Bosch Power Tool Corp., Dept. AWT, One Hundred Bosch Blvd., New Bern, NC 28562, (800) 334-4151.

CIRCLE NO. 604 ON PRODUCT INFORMATION FORM



Imagine a machine that can cut spiral flutes, make mortises at compound angles, taper a chair leg and more, and you'll get some idea of the versatility

of the Woodchuck Indexing System.

This clever machine gives you some of the capabilities of the lathe and all the versatility of a router fitted with a collection of shop-made jigs, allowing you to perform operations that wouldn't be possible with either of those machines alone. Like a lathe, Woodchuck works best on long stock such as posts, spindles and pedestals. And it excels at operations on multi-sided blanks like octagons.

The tool gets its name from the large indexing plate on a headstock that allows you to rotate your stock to *indexed* positions and lock it in place for routing. You clamp the workpiece horizontally between the headstock and tailstock and move your router on a bed above, with the bit projecting down into the work. Then you guide the router over the stock by hand.

In addition to the operations mentioned above, you can chamfer edges, true a rough blank into a perfect square in minutes and cut beads with perfect symmetry. You also can produce straight or tapered sliding dovetails on

The Woodchuck Indexing System

TESTED BY DANIEL WESTBERG



round or multisided stock. And with a plunge router, you can cut mortises at compound angles as used in chair construction. You can even use the Woodchuck to make clock gears.

The Woodchuck works with most routers and will accept stock up to 33 in. long and 9 in. in diameter. (An optional extension package increases stock capacity to 80 in. long.)

The system comes with four indexing plates that provide 16, 20, 24 or 36 indexed positions. Two fences and stops on the bed adjust to guide the router for different operations.

You can also operate the Woodchuck in a freewheeling mode, rotating the stock by hand to make circular cuts as on a lathe. To make tapers, you raise or lower either the headstock or tailstock to angle the workpiece with respect to the router bed. An optional Concentric Spiral Upgrade (shown in photo) lets you make flutes or beads in a spiral pattern.

I found the Woodchuck simple and straightforward to use. For me, the learning curve for setting up and running the machine was relatively quick. The indexing operations worked smoothly and the machine's ability to repeat settings was excellent—you can make four table legs with *exactly* equal dimensions, for example. This precision reminded me of the accuracy of the metalworking machines I used to work with. I used the Woodchuck on several projects and found it saved me a lot of time that I'd usually take to build special router jigs.

You'll have to use your own measuring scale to position the fences and stops, and I found myself wishing the Woodchuck had measurement scales already in place.

I was most impressed with the machine's flexibility. With so many different ways to adjust the tool and orient the work, I discovered new techniques just by using it. I'd recommend the Woodchuck to anyone who wants to do high-quality joinery on round or multisided posts and spindles. (Price: Woodchuck Indexing System \$395; Optional Concentric Spiral Upgrade \$199)

Phantom Engineering Inc., Dept. AWT, 1122 S. State St., Suite 21, Provo, UT 84606, (800) 279-4570.

CIRCLE NO. 601 ON PRODUCT INFORMATION FORM

TOOLBOX



IMPROVED PLANER

Ryobi, the company that introduced the first portable planer, has come out with a new model that takes bigger

stock and lets you more quickly change and adjust the knives. The new AP12 model accepts stock 12 $\frac{1}{4}$ in. wide and 6 in. thick, and it features a more powerful motor rated at 14 amps. The knife system, called "Rapid Set," uses double-edged knives you can reverse and resharpen. The planer weighs 63 pounds, and you can get a portable support stand as an option. (Price: \$885)

Ryobi America Corp., Dept. AWT, 5201 Pearman Dairy Rd., Anderson, SC 29622, (800) 323-4615.

CIRCLE NO. 603 ON PRODUCT INFORMATION FORM.



RANDOM ORBIT PALM SANDERS

If you've used a random orbit sander, you know that most of them are aggressive tools that require a two-handed grip. Here are a pair of

lightweight (3.2 pounds), palm-grip random orbit sanders from Porter Cable that are easier to handle and run more quietly. Called Quicksand, the sanders have 5-in. dia. sanding pads. Model 332 uses pressure-sensitive adhesive "stick-on" sandpaper disks, while Model 333 offers a "hook and loop" system for attaching sandpaper. Model 333 also has a dust collection canister. (Price: Model 332 \$109; Model 333 \$125)

Porter Cable Corp., Dept. AWT, Box 2468, Jackson, TN 38302, (901) 668-8600.

CIRCLE NO. 605 ON PRODUCT INFORMATION FORM

VERSATILE BENCH CLAMP

If you've ever had a hard time clamping stock in the center of your benchtop, you'll appreciate T-Clamp and Tool Trak. They work together to form a sliding bench holdfast. Tool Trak is an extruded aluminum channel with a sliding T-nut that mounts flush with a benchtop in a slot you cut with a router. T-Clamp is a curved aluminum bar that you fasten to the T-nut with a bolt and wing nut. You can move T-Clamp anywhere along the length of the track, or use it in a stationary position by screwing the bolt into a T-nut mounted permanently in your benchtop. Tool Trak is available in 12 in., 24 in. or 36 in. lengths. (Price: \$24.95 for 24 in. Tool Trak; \$14.95 for each T-Clamp)

Alpha Pioneer Inc., Dept. AWT, Box 560993, Orlando, FL 32856, (407) 851-1990.

CIRCLE NO. 606 ON PRODUCT INFORMATION FORM



QUICK CHANGE FACEPLATE

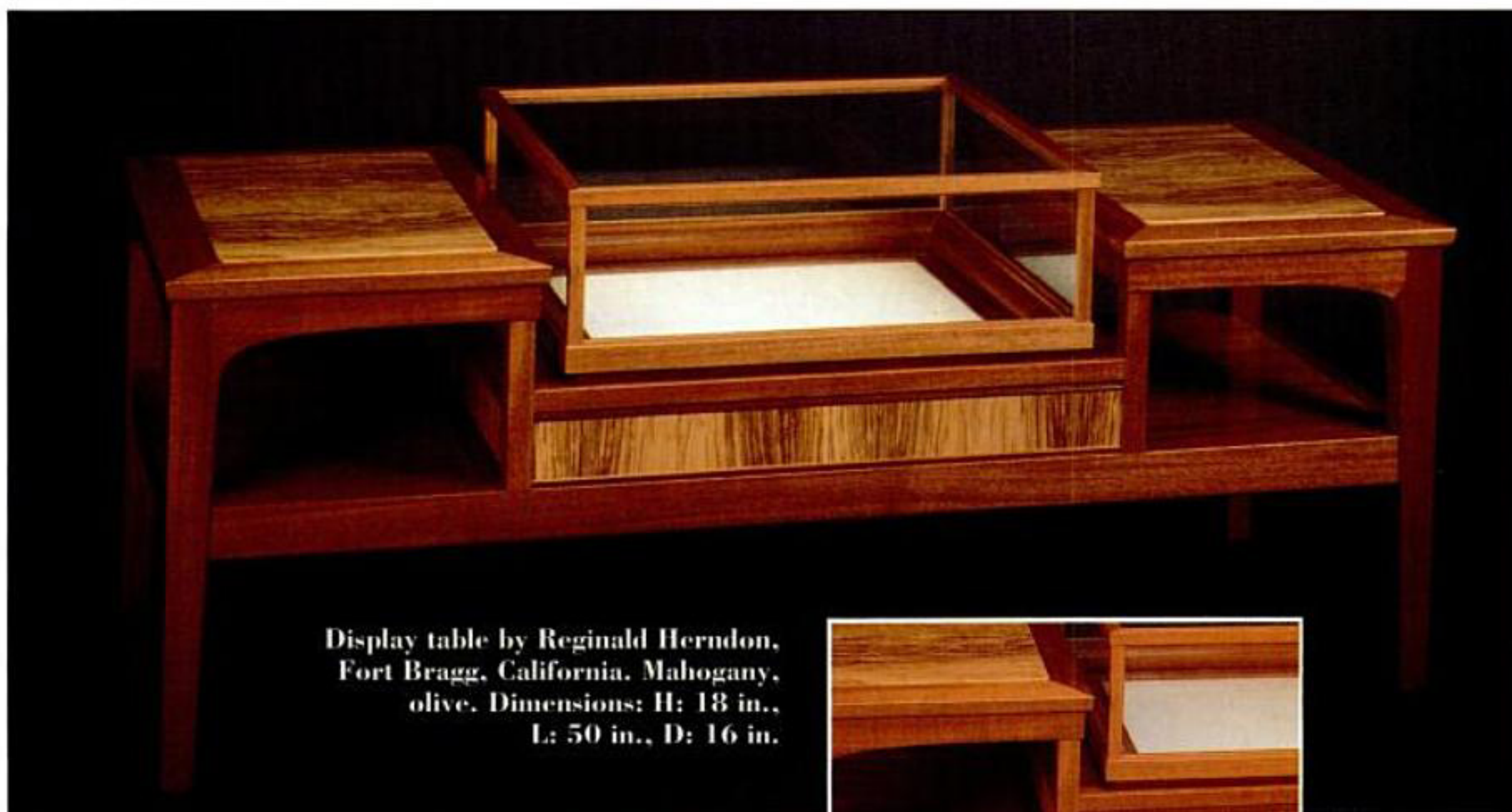
Here's a versatile new two-piece lathe faceplate system that lets you keep several pieces in progress and remount them without the hassle of recentering a faceplate every time. The Read Faceplate System consists of a central hub and one or more 4-in. dia. disks. The hub screws onto the lathe's headstock spindle, then the disks screw onto the hub. You can buy several disks—so switching jobs is as simple as unscrewing one disk and mounting another. This works great for rough turning a piece, setting it aside to dry, then remounting for final turning. Hubs are available to fit most lathes, and each hub is drilled and tapped for a screw center to convert it to a screw chuck. (Price: \$27.50 for each hub; \$7.50 for each disk; five disks for \$35)

Read Tool Design and Manufacturing Co., Dept. AWT, Rt. 2, Box 207, Monticello, FL 32344, (904) 997-4980.

CIRCLE NO. 610 ON PRODUCT INFORMATION FORM



GALLERY



Display table by Reginald Herndon,
Fort Bragg, California. Mahogany,
olive. Dimensions: H: 18 in.,
L: 50 in., D: 16 in.



GEORGE POST

Wildflower brooches by Michael Sage,
Redwood City, California. Assorted woods.
Dimensions: H: 1 7/8 in., D: 3/4 in.



GEORGE POST

Colored series by Michael and Liz
O'Donnell, Caithness, Scotland. Scottish
sycamore. Dimensions: large bowl, H:
5 1/4 in., D: 8 in.; small bowls, H: 4 in.,
D: 4 in.; goblets, H: 4 in. to 5 in.

JOANNE R. O'DONNELL

GALLERY



WALTER L. OWENS

Bunk bed by
Walter L. Owens,
Bloomington, Indiana.
Red oak, walnut.
Dimensions: H: 89 in.,
L: 86 in., W: 44 in.

Dresser by John Shipstad,
Coos Bay, Oregon.
Mahogany, padauk.
Dimensions: H: 32 in.,
L: 48 in., D: 22 in.



JOHN SHIPSTAD

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

FINAL PASS



Doug Aspinwall (left) and Roger Thompson celebrate the end of their 3,426-mile bike trip.

Cycling for Charity

Forty-seven days after they started, Doug Aspinwall, a woodworker at Gatehouse Furniture Studios in Holyoke, Massachusetts, and Roger Thompson, vice president of Biesemeyer Manufacturing, completed their cross-country bicycle ride for charity.

The riders, who were sponsored by AW, raised more than \$23,000 for the Bicyclists Education and Legal Foundation, the Woodworkers' Alliance for Rainforest Protection, the National Cancer Society, the American Heart Association, the American Lung Association and the National Multiple Sclerosis Society.

Computer Forum for Woodworkers

In the old days, woodworkers could sit around a potbellied stove and share wisdom and observations. Now Ma Bell and a group of computer people have found a way to make that same sort of connection electronically.

Woodworkers who have access to a computer and a modem can tie into the Crafts forum on the CompuServe network and get in touch with its several thousand members 24 hours a day.

The forum deals with a variety of crafts, with special subsections for woodworking as well as tools and



Dream Workshop Winner

After picking out \$5,000 worth of free Delta tools, Bob Bassett (left) of Downey, California, thanks Delta representative Mark Warhola and salesman Bill Suppe of Buena Park Lumber, his local supplier. Bassett won the tools in AMERICAN WOODWORKER's \$5,000 Dream Workshop Sweepstakes.

equipment. Members can discuss machine safety, choice and use of finishes, tool reviews—just about anything concerning woodworking. And, if you throw out a question, you're likely to generate a lot of good advice. About once a month, the forum schedules a formal conference. This fall, there'll be one on using computer-aided design for woodworking, says Assistant Systems Operator Kathy Morgret of Tullahoma, Tennessee.

Connecting to CompuServe can cost from \$6 to \$22.80 per hour, depending on how fast your modem is. There is no additional charge for the Crafts forum. For information on CompuServe or the forum, call (800) 848-8199.

Vintage Veneer Auction

The Woodworkers Alliance for Rainforest Protection (WARP) will auction nearly 1 million sq. ft. of mostly hardwood veneers this fall in Chicopee, Massachusetts. Proceeds will help WARP develop an information phone line and a testing program of lesser-known species.

The veneers vary from 5 to 25

years of age and include more than 50 tropical and temperate species. Most of the veneers are thicker than new veneers, and many species are no longer available commercially.

The auction will be held Sept. 17-19 at the Westover Industrial Airpark. For a list of the auction items and directions to the site, send a stamped, self-addressed envelope to WARP Veneer, Box 133, Coos Bay, OR 97420.

LAST CHANCE TO ENTER

September 30, 1992, is the deadline for entering the AMERICAN WOODWORKER's Excellence in Craftsmanship Awards Competition. You still have time to enter and win up to \$1,000 in cash. Call (215) 967-8315 for details.

COMING NEXT ISSUE

COMBINATION MACHINES

NASTY BOXES:
STOCKING STUFFERS THAT BITE
QUEEN ANNE TILT-TOP TABLE