AMERICAN WOODWORKER

OCTOBER 1994 #40

SPECIAL
Cash Back on Tools
See Card on Last Page

ANTIQUE FINISH

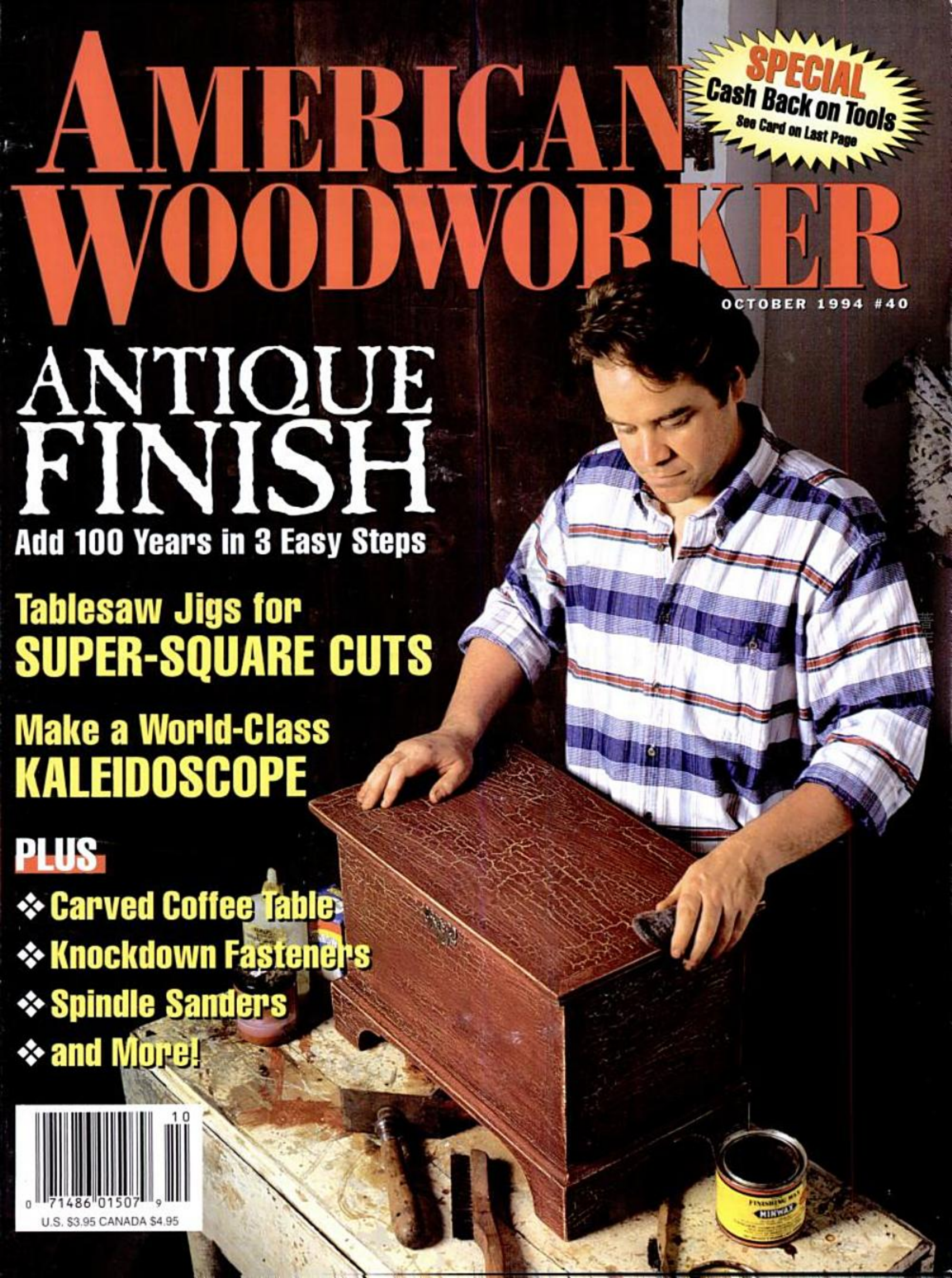
Add 100 Years in 3 Easy Steps

Tablesaw Jigs for SUPER-SQUARE CUTS

Make a World-Class KALEIDOSCOPE

PLUS

- Carved Coffee Table
- Knockdown Fasteners
- Spindle Sanders
- and More!



0 71486 01507 9 10
U.S. $3.95 CANADA $4.95

AMERICAN WOODWORKER

Issue No. 40 October 1994
Cover Photo by John Hamel.

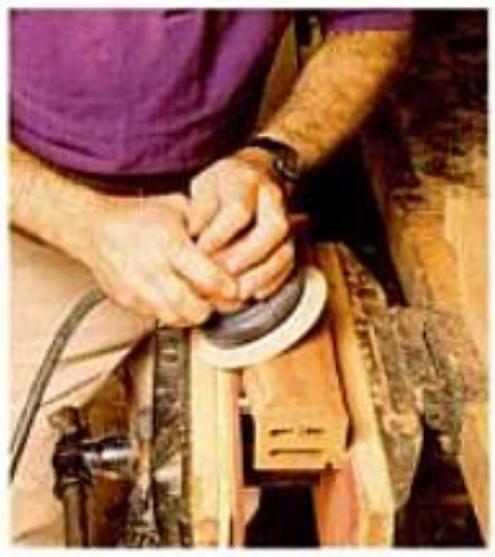
Printed on Recycled Paper

Page 28 Antique Painted Finish

DEPARTMENTS

CONTENTS

Page 31 Cut-Off Boxes



Page 34 Coffee Table

Page 61 Welsh Hay Rake

FEATURES & PROJECTS

A WORD FROM THE EDITOR

SIMPLE PLEASURES

Fate works in strange ways. Who'd have thought I'd be writing this editorial while sitting on the porch of a rustic mountainside cabin in Colorado? But I'm glad to be here.

I made the trek to Colorado to attend the annual conference of the American Association of Woodturners in Fort Collins. Afterward, I came here to the mountains with several turners for two days of camaraderie—and non-stop chat about wood and lathe-turning.

Though turning is a specialty in the woodworking field, I notice that turners have some things in common with other serious woodworkers: their love of wood, their desire to express themselves through their work, and the satisfaction they get when they produce an object of beauty.

Here at AMERICAN WOODWORKER we realize there's a lot more to woodworking than simply following cookbook-style directions to produce replicas of someone else's work. That's why we encourage you to find the styles and techniques that are best for you. Experiment with alternate methods of joinery and finishing, so you'll develop a broader vocabulary of skills that you can apply to future projects.

While you're at it, take some time to enjoy the sensory rewards of woodworking as well. I always appreciate the fragrant smell of freshly cut wood, the tactile quality of a sanded surface, the rhythm of hand-planing a board. Even when I'm on a deadline, these sensations make the job more rewarding.

And finally, think of your shop as a place of refuge. Once inside, you're free to explore the endless possibilities of this craft on your own terms and to savor its simple pleasures.

New Faces at AW

I'm pleased to announce we've added some new members to our staff. Tim Snyder, our new managing editor, is a well-respected author and editor in the woodworking field, with four books to his credit and stints with *Practical Homeowner* and *Fine Homebuilding* magazines. You may also remember him as the founding editor of *Woodworkers' Business News*, a publication for small-shop professionals. Tim brings an extensive knowledge of the craft and a colorful writing style, and we're proud to have him aboard.

Paul Anthony, our new assistant editor, ran his own custom woodworking business in California for 20 years and has served as president of the Sonoma County Woodworkers Association and editor of their excellent newsletter. We welcome his wit and wisdom.

Other new faces include Melanie Powell, our talented new assistant art director, and Paul McClure, an experienced wood technologist, cabinetmaker and teacher who has taken over as editor of our "Wood Facts" column. We wish them all the best of luck.

Ellis Walentine
Executive Editor

PLAY IT SAFE

Woodworking can be dangerous. Safety equipment such as guards, hold-downs, goggles, dust masks and hearing protection can greatly reduce your risk of injury. But even the best guard won't make up for poor judgment. Use common sense and caution in the workshop. If a procedure feels dangerous, don't try it, no matter how many other folks work that way. Figure out an alternative that feels safe. Your safety is your responsibility.

AMERICAN WOODWORKER

EDITORIAL & ADVERTISING OFFICES
33 E. MINOR ST., EMMAUS, PA 18098
PHONE: (610) 967-5171
FAX: (610) 967-8956

EDITOR & PUBLISHER
DAVID SLOAN

EXECUTIVE EDITOR
ELLIS WALENTINE

MANAGING EDITOR
TIM SNYDER

ASSISTANT EDITORS
PAUL ANTHONY
ANDY RAE
DAVE SELLERS

WEST COAST EDITOR
SIMON WATTS

ART DIRECTOR
KITTY PIERCE MACE

ASSISTANT ART DIRECTOR
MELANIE POWELL

COPY EDITOR
SUSANNAH HOGENDORN

OFFICE MANAGER
JULIE MILLER

DESIGN SHOP
PHIL GEHRET
FRED MATLACK

CONTRIBUTING EDITORS
STEPHEN H. BLENK
JIM CUMMINS
MICHAEL DRESDNER
MIKE DUNBAR

ADVERTISING DIRECTOR
DON SCHRODER

ADVERTISING REPRESENTATIVES
RENÉE JAMES
DIANE WALLBILLICH

CLASSIFIEDS
DIANE WALLBILLICH

ADVERTISING PRODUCTION COORDINATOR
DIANE WALLBILLICH

PROMOTIONS MANAGER
JESSICA WALL

PRESIDENT/MAGAZINE DIVISION
JOHN GRIFFIN

CIRCULATION MANAGER
ALAN BAYERSDORFER

SUBSCRIPTION MANAGER
LAURA FOX

DEALER INQUIRIES WELCOME
Sell American Woodworker in your store, risk-free. Call (800) 845-8050 for details.

SUBSCRIPTION QUESTIONS & ADDRESS CHANGES

At AMERICAN WOODWORKER, your satisfaction is important to us. For questions regarding your subscription and all address changes, please write to:

AMERICAN WOODWORKER Magazine
P.O. Box 7591
Red Oak, IA 51591-0591

Please include a recent mailing label with all correspondence.

Or call (800) 666-3111

AMERICAN WOODWORKER (ISSN 8750-9318) is published seven times a year in February, April, June, August, October, November, and December by Rodale Press Inc., 33 E. Minor St., Emmaus, PA 18098, (610) 967-5171. ©1994 by Rodale Press, Inc. J.I. Rodale, Founder; Ardath Rodale, Chairman of the Board; Robert Teufel, President of Rodale Press. SUBSCRIPTION RATES: U.S. one-year, $24; two-year, $48. Single-copy, $3.95. Canada, one-year, $30, two-year, $60 (Canadian funds) GST #R122988611. Foreign, one-year, $35, two-year, $70 (U.S. funds). U.S. newsstand distribution by Curtis Circulation Co., Hackensack, NJ 07610. SECOND-CLASS POSTAGE: paid at Emmaus, PA and additional mailing offices. POSTMASTER: Send address changes to AMERICAN WOODWORKER, P.O. Box 7591, Red Oak, IA 51591. CONTRIBUTOR GUIDELINES: Available upon request. (610) 967-8315. Printed in USA.

LETTERLINE (610) 967-7776

LETTERS

The Missing Bandsaw

In your "Buyer's Guide to Bandsaws" (AW #38), you should have rated 22 machines instead of 21. Missing was the ShopSmith Mark IV. When space is limited, budget is small, and demand is not great, the ShopSmith delivers quality cuts. Mine has, day after day and week after week, for years.

It also would have been nice to see a few Midwestern sources for bandsaw blades. As was pointed out in the issue, all blades are not the same. I've had very good results buying blades made by Contour Saws, Inc. (800-458-9034). Contour blades are sold nationwide through local distributors.

J. Barry
Wheaton Furniture Manufacturing
Wheaton, IL

I'll Do It Myself

I've read and looked and daydreamed over your magazine for years, trying to get my husband to make something. Now that I'm retired, I believe I'll just do it myself. "Gallery" is my favorite section; I'm always amazed at the beauty in people's minds. The fact that women are represented gave me the encouragement to get started.

Mrs. Lawrence Begay
Ganado, AZ

Communal Woodworking

For any woodworker who is frustrated by not being able to afford a fully equipped workshop, I have found a solution through my local community education program. When I moved to Washington state, I was disappointed to find that no shop classes were being offered in my area. So I contacted the local community education office and proposed an open woodshop class. The idea was accepted with great enthusiasm. Before I knew it, we were meeting twice a week for two-and-a-half hours per night in the high school's woodshop. The cost of the class is minimal at $20 for eight sessions.

I have found this a great way to gain access to a well-equipped shop. It also provides a place where woodworkers can share ideas, techniques and plans.

Alan L. Braddock
Kennewick, WA

No Tung In Cheek

I'm still suspicious of tung oil ("Letters," AW #38). From the *Columbia Encyclopedia*, third edition, under "tung oil," I read: "...the oil itself is expressed from the poisonous seeds found in the heart of the tung fruit..." It may still be OK; castor beans, in the same family, are poisonous, but castor *oil* is merely disgusting.

Also, I would want to do some checking before I tried turning talc (page 66, same issue), and I suspect I would be a bit fussier about dust. Talc is closely related to asbestos minerals, although it is not fibrous. I believe I have read somewhere that it is actually no longer used in talcum powder.

On a more positive note, here's a brief postscript to Peter Korn's article on bent lamination (same issue, page 28). I've combined steam bending with laminating for making stempieces for stripper canoes. There are fewer pieces, less breakage, and less springback. These short pieces of wood can be steamed in a microwave oven. Soak first, then heat. If you leave them in too long, the water will boil out and you'll have to start over; but if the timing is right it works beautifully.

Bruce Winterbon
Ontario, Canada

Correction

Re: Makita 2012 Portable Planers. In the last issue ("Offcuts," AW #39), we incorrectly reported that Makita will install free lock knobs on early Model 2012 portable planers.

William Sargent, the author of "Turning Figured Talc" (AW #38), wasn't available for comment as we put "Letters" together. According to Ben Grosz, of the Blue Gem Agate Shop (7315 10th Ave. SW, Alexandria, MN 56308; 612-762-1973), there is a danger of inhaling too much talc dust. But it's the same danger you face when using talcum powder. "The figured dendritic talc I sell to craftspeople is mined from the same deposit that supplies companies like Johnson & Johnson, who make talcum powder," explains Grosz. "We've sold talc blocks to hundreds of people," he says, "and I haven't yet heard any complaints about respiratory problems."

Grosz uses an inexpensive filter mask when working with talc and soapstone, and he suggests that others take this precaution as well. Other talc turners we talked with agreed with Grosz. The slow speed required for turning the material, combined with its density, means that most of the dust ends up on the floor, where it can pose a different hazard: slipping. Wet-sanding the completed shape tends to load the sandpaper, not the air.

Get Straight, Then Square

Re: "Squaring a Square" ("Tech Tips," AW #39). There's an important element missing from your tip on checking a square's accuracy, which involved laying a square along the edge of a board. Any deviation from

TOO BUSY TO WRITE?

Call our LETTERLINE (610) 967-7776

straightness on the board's edge will result in an inaccurate reading. For accurate results, use a metal straightedge or the jointed edge of a well-seasoned board as the standard for straightness.

Richard Finn
Livermore, CA

In Search Of...

I am trying to locate a company named Hawkcraft that used to sell plans (1/20 or 1/21 scale) for heirloom-quality collectible antique cars and trucks. Also, I would like information regarding similar companies.

Randy K. Watson
Antioch, CA

How about it, readers?

Chroming the Bar

Upon reading "Tuning a Tablesaw" (AW #38), I took exception to the method Cliffe uses to correct any "slop" between the miter-gauge bar and the miter slots. Center punching a series of dimples along the bar, called a "Dutch fit" in the machine-shop trade, is at best a temporary solution.

A better remedy is to measure the amount of play between the bar and slot with a feeler gauge, then take these measurements and the bar (minus the gauge head) to your local *hard* chrome plater. A good plater can deposit up to 0.005 in. per side, accurate to 0.0001 in., for a nominal sum. For an additional amount, the plater can vary the amount of chrome deposited along the length of the bar should that prove necessary.

Hard chrome will make the bar almost completely immune to wear. Because of this, you need to be sure to inspect the bar carefully before you deliver it to the plater. The bar should be smooth and free of nicks, scratches and dings, because the chrome will exaggerate any roughness, and these surface imperfections—if bad enough—can damage the miter slot.

Archer Merrick
Norton, OH

The Plane Truth

Re: "Tuning Planes Redux" ("Letters," AW #37). Stan VanDruff admits that friction is independent of area, but then confuses the issue by talking about two smooth surfaces in contact adhering to each other to create an adhesive force which is proportional to their contact area. Such a force *does* exist between gauge blocks, surface plates, optical flats, etc. but these are several orders of magnitude flatter and smoother than anything produced by a hand plane. Adhesion has no relevance to the friction between two pieces of wood.

Jerry Glaser
El Segundo, CA

LETTERS

Spice Box Saluted

I'm aching to start building the Heirloom Spice Box (AW #36). What a gorgeous piece of work.

Maurice Kennett
Charlestown, NH

Left Out

Neither you nor the other woodworking publications nor OSHA (Occupational Health and Safety Administration) seem to care about the dangers posed to left-handers by radial arm saws, belt sanders, jointers, or circular saws—to name just a few power tools.

Marty Loula
Eden Prairie, MN

Since there are two left-handers on the AW staff, we understand and share your frustration. However, tool companies aren't likely to change their ways unless there's an economic reason to do so. The best we can advise is to do as we have and learn to work right-handed when using tools that are dangerous for lefties.

In Praise of Hand Tools

I am a relatively new subscriber and what convinced me to subscribe were your articles about hand tools and how to use them in different projects. Please keep the old tools visible; it's your special *niche*.

John E. Walkowiak, Jr.
Minneapolis, MN

A young person interested in making things today can be excused for believing that a full complement of machines is needed if one's work is to be a success. Hand tools have been relegated to the small-ad section, or secondhand and antique dealers, as though they were relics of the past.

Craft woodworking is a creative activity; the practitioners are artists. Surrounded by noisy, dusty machines, the woodworker does not have the aesthetic environment in which to do good work. Handmade work has a verve and sparkle which machines cannot reproduce.

Years ago I examined what I was doing and went "organic." I haven't regretted it once. It was a renewal of my love affair with wood. Woodworkers should look anew at their hand tools.

John Brown
Newport, Pembrokeshire
Wales, UK

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, or telephone your message to us at (610) 967-7776. FAX: (610) 967-8956.

Q&A

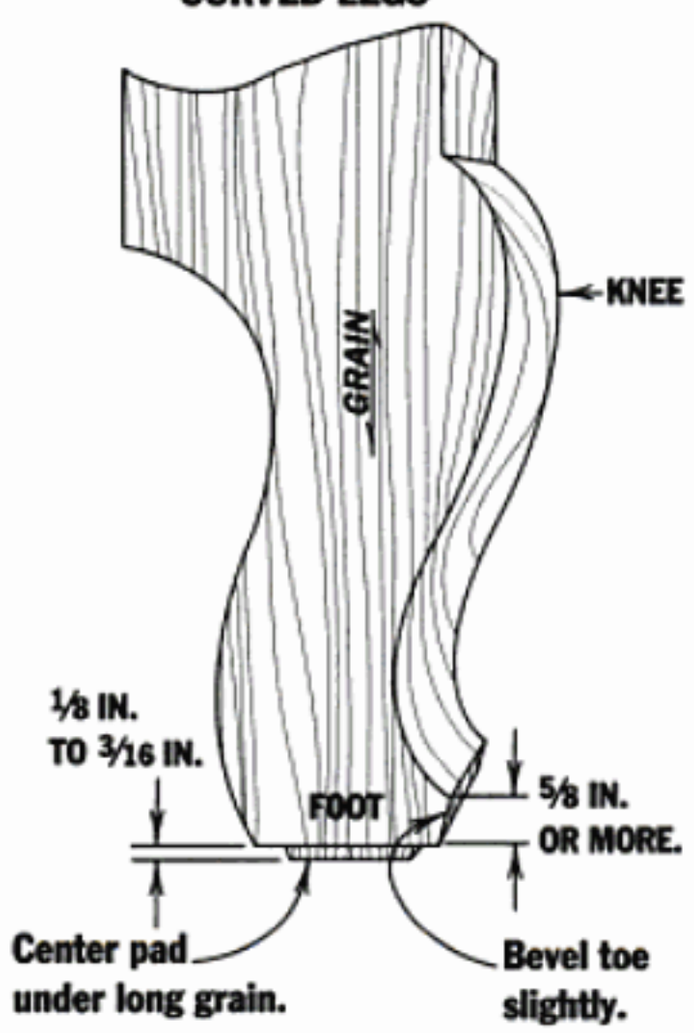
Strong and Beautiful Curves

Q I'm making a sleigh bed with curved legs, and I'm wondering how to design the curved areas for strength, especially the area around the feet. Any suggestions?

Don Johnson
West Valley, UT

A This type of leg, commonly seen on Texas Biedermeier furniture of the mid-1800s, is curved in one plane only, and is subject to stress along the outside bottom edge because there's no wood to back up the short grain. (See drawing.) When designing a curved leg like this, there are several points to keep in mind that will give it maximum strength.

First, the amount of curvature directly affects the leg's ability to withstand a vertical load—especially with a heavy bed or sofa—as well as the horizontal stresses that occur when a piece of furniture is moved around. There are no hard and fast rules here, but you should try to limit the amount of curvature while retaining a pleasing visual effect. For a sleigh bed foot, I suggest keeping the leg a minimum of 2 in. wide at the deepest part of the curve.



Next, keep the toe thick enough—I'd say a minimum of ⅝ in.—to withstand bruising from errant vacuum cleaners or shoes. Then bevel the toe slightly to disguise this thick edge and make the foot appear more graceful.

Finally, add a pad underneath the leg where there's long grain running in a continuous line from the top of the leg to the bottom. You can make a pad either by carving it from the leg itself, or by gluing a disc of wood to this end-grain area with epoxy. The pad keeps the toe off the floor, preventing strain if the furniture is raised at the opposite corner or if the floor is uneven.

Lance Patterson
Furniture instructor
Boston, MA

ILLUSTRATION BY MELANIE POWELL

Avoiding Tear-Out When Jointing

Q When edge jointing, I often have a problem with tear-out. Do you know any tricks?

Fred Beal
Tallahassee, FL

A First, make sure your knives are installed flush with the outfeed table. Then set the infeed table for a light cut, and feed the board with the grain running "downhill" toward the infeed table, pushing the board slowly and steadily. If the board tears out, try reversing the board and jointing in the opposite direction.

If you still get tear-out, your knives are probably dull. There's a trick for keeping "dull" knives sharp: Set the fence about 1 in. from the far end of the knives (away from you), and use this arrangement for face jointing. When you need a super-smooth edge, move the fence back that last inch to expose the reserved spot, and edge joint on super-sharp knives.

Lonnie Bird
Teacher and furniture maker
Bidwell, OH

Drilling Hard Steel

Q I have a length of bandsaw blade that I'd like to fasten to a bow-saw frame. What's the best way to drill mounting holes through such hard steel? A friend who had a similar problem drilling a Japanese saw blade to fit a new handle says to just press hard and plan on ruining the bit.

A. Paul Wheeler
Durango, TX

A There's an old machinists' trick for drilling thin, hardened steel: Chuck the stub of a nail or steel rod in your drill press, then turn on the drill and press the nail onto the work. Friction will develop enough heat to burn a blue spot on the steel, softening its temper. When the spot cools, drill through it with a twist drill.

In your friend's case, he annealed the saw blade with heat from the bit, softening both.

Jim Cummins
Contributing editor

Mica for Lampshades

Q I'd like to build a Stickley-style table lamp, but I can't find that translucent orange mica material for the lampshade. Any suggestions?

Mike Elliot
Springfield, MO

A The lampshade material you're referring to is made of very thin sheets of clear mica "splittings" pressed together into larger sheets with shellac as a binder. This "mica plate" is still manufactured as an electrical insulating material. It's available in 3-ft.-square sheets in several thicknesses, from Tarheel Mica Co. (Box 8,

Plum Tree, NC 28664, 704-765-4535). The 0.025-in.-thick material is ideal for lampshade applications and costs about $15 a sheet.

You can cut mica plate with a bandsaw, a tablesaw or hand shears. To authentically recreate the look of a turn-of-the-century Arts-and-Crafts lampshade, first sand the mica with coarse sandpaper, then tint it with coats of orange shellac until you've reached the color you want. Some lampmakers add flecks of black by dusting the surface lightly with lampblack and brushing off the excess prior to the final coat of shellac.

J. Gregory Kinsman
Arts-and-Crafts furniture maker
Concord, MA

Toughening an Oil Finish

Q I have a table that I've finished with a Danish oil, but since I have small kids, I'm looking for better protection against stains and dings. Can I use a polyurethane over the oil for a more durable finish?

Laura Gill
Fort Huachuca, AZ

A The toughest finish that you can apply over Danish oil is polyurethane, but it can be risky. If the oil isn't fully dry, the polyurethane will not adhere properly. Instead of polyurethane, I recommend a wiping varnish, or long oil, which is more compatible with the softer oil finish on your table.

You can create a hard film finish with a wiping varnish if you build up the finish in thin coats. My method is to wipe on four to five coats of Waterlox Marine Sealer (available from Rudy's, 4086 E. 71st St., Cleveland, OH 44105, 800-248-7839). Allow each coat to dry for 24 hours, and sand between coats. I sand the first couple coats with 220 grit to level any bumps in the finish, then I use 320 grit on the third or fourth coat, and finally I switch to 0000 steel wool for the next-to-last coat. For a faster build, you can use Waterlox Gym Finish, brushing on three to four coats. Gym Finish produces a higher build and gloss, resulting in a look more like polyurethane.

Whichever finish you use, you can

WHERE TO FIND IT

Bins, bottles and other plastic components are available from U.S. Plastics, 1390 Neubrecht Rd., Lima, OH 45801, (800) 537-9724.

Cup casters for tapered legs, square or round, are available from Horton Brasses, Nooks Hill Rd., Box 95, Cromwell, CT 06416, (203) 635-4400.

Valves, knobs, clamps and other specialty jig hardware is available from Carr Lane, 4200 Carr Lane Ct., Box 191970, St. Louis, MO 63119, (314) 647-6200.

leave the final coat "as is" for a glossy effect, or you can wait a week for the varnish to harden, then rub it out to a satin sheen with 0000 steel wool and paste wax.

Frank Klausz
Cabinetmaker
Pluckemin, NJ

All Super Glues Aren't Equal

Q I recently tried to use "super glue" to join wood together. I find that the joints are so weak I can break them easily with my hands. Am I doing something wrong?

Tory Hogendorn
Burlington, NC

A "Super glue," or cyanoacrylate (C.A.) adhesive, can be used to bond almost any materials, including wet wood.

The C.A. I use most often is called "Hot Stuff." It is quite strong, but you should use the right viscosity for the job. I use the thin version mostly for filling small cracks and defects because it penetrates well and sets quickly. I use the medium-viscosity glue for bonding bowl blanks to waste blocks because it fills gaps better and sets more slowly. The thickest, slowest version is almost as thick as honey and can be used for healing significant gaps in wood.

If you're having bonding problems, it could be because the glue is old or that you used too much accelerator. C.A. has a shelf life of about eight weeks once opened. To keep it fresh, store unopened bottles in the freezer. After opening, keep the cap on and try to use the glue quickly.

If you use too much accelerator, it can cause the glue to "boil" out of the joint, which also weakens the glue.

Stephen H. Blenk
Turner
Sequim, WA

Toughening a Lacquer Finish

Q How can I "toughen" a nitrocellulose lacquer finish without stripping the finish?

John Kipila
Emmaus, PA

A You can get a more durable finish with a two-part catalyzed lacquer, but these finishes generally have a short pot life and a "window" within which you must recoat. A better choice is pre-catalyzed lacquer (I've had good luck with Campbell's Magnalac, available at Pratt & Lambert dealers). Pre-catalyzed lacquer is a one-part formulation that handles much like nitrocellulose lacquer. *Caution:* Fumes from any type of one- or two-part lacquer can be dangerous, so wear a cartridge-type respirator when spraying. Pre-catalyzed lacquers are available in gloss, semigloss and satin sheens, or you can add flatteners

to achieve a custom luster.

Before spraying pre-catalyzed lacquer, clean the piece thoroughly with a rag and mineral spirits. Then scuff the surface with 320-grit sandpaper. Next, spray a wet coat of pre-catalyzed lacquer over an inconspicuous spot to test how the catalyzed finish adheres. If you get crazing, small cracks or peeling in the finish, you'll need to spray a sealer coat before using the lacquer. For sealing, I spray on one coat of a lacquer-and-shellac blend called Barrier Coat (available from Mohawk, 5715 State Hwy. 30, Amsterdam, NY 12010, 800-545-0047, $50 minimum). A coat of shellac will work, too.

Once you're sure the two finishes are compatible, spray two light coats of the pre-catalyzed lacquer. I sand the first coat with 220 grit, then sand the second coat with 320 grit. When the surface is smooth, apply a final, heavy wet coat. I like to "finish the finish" by smoothing the dried lacquer with 0000 steel wool, using a lubricant called Wool Lube (available from Mohawk). Saddle soap also works, and neither lubricant will affect the sheen.

Frank Klausz
Cabinetmaker
Pluckemin, NJ

Uneven Glue Lines

Q I recently made up a table top from edge-glued pine stock that I'm certain I sanded smooth and flat. Now that I've applied a finish, the top reflects light unevenly because of depressions along the glue lines between the boards. What gives?

A It sounds like you didn't allow enough drying time after gluing and before sanding. When you glue up with water-based glue, some of the water in the glue swells the boards in thickness on either side of the glue line. This is most pronounced on soft-woods such as pine. As this water evaporates, the boards shrink back to their original thickness. If you sand the surface before this shrinkage occurs, you will inadvertantly remove too much material, and the areas around the glue lines will end up being thinner. Even though these depressions, or "sink marks," are just barely perceptible on the unfinished wood, they are easy to see in the reflection off the finished surface. Unfortunately, your only solution is to resand and refinish the surface.

Walt Morrison
Northport, NY

Got a woodworking question for the experts?
Send it to: "Q&A,"
AMERICAN WOODWORKER,
33 E. Minor St., Emmaus, PA 18098,
or phone your message to us at
(610) 967-7776. Fax: (610) 967-8956.

offcuts

WOODS FOR THE WILD AT HEART

Wood is surely one of nature's finest creations, but who says you can't make an improvement here or there? Certainly not Jim Fray, the man behind "Wild Woods."

The exact process used to color these woods remains undisclosed, but Fray told us this much: His company begins by cutting figured wood. After the wood is kiln-dried, colored acrylic polymers are injected under extreme pressure and heat. The result is a structurally enhanced wood product that's colored to the core.

According to Fray, Wild Woods glue beautifully and need no finish—you can just sand and buff. They can even take stains or finishes, though oil doesn't work well. Fray doesn't recommend Wild Woods for food-contact items.

Almost all of these woods are American-grown; oily exotics don't accept the polymers well. Fray adds that the company often utilizes wood that's too spalted for other uses.

Several colors are available. The company will do custom colors and will also color wood specimens provided by the customer. For more information on Wild Woods, write:

These pool cues by Joe Porper of Canoga Park, CA, feature colored fiddleback maple, spalted maple and maple burl from "Wild Woods."

Wild Woods, Box 104, Monclova, OH 43542, or call (419) 866-0435.

Curly oak

Maple burl

Fiddleback maple

Curly maple

Spalted maple

CRAFT SCHOOL PLANS NEW STUDIO

Widely known for its woodturning classes, the Arrowmont School of Arts and Crafts in Gatlinburg, TN, hopes to expand soon into wood sculpture, carving and furniture making, thanks to a $352,500 challenge grant.

If Arrowmont can match the grant by this December, it will start work on a new, 8,095-sq.-ft. studio to include a turning workshop, a machine room, and a combination carving studio and bench room.

The grant from the Windgate Foundation of Bentonville, AR, is one of the largest ever given to a craft school. Arrowmont has raised about 67% of its goal as of this writing. Contributions are welcome. Write: Arrowmont School, Box 567, Gatlinburg, TN 37738.

A GOOD TURN FROM DAVID ELLSWORTH

Short of taking an intensive seminar, there may be no better way to learn a craft than by watching instructional videotapes. Videos can show complicated processes better than still photos, and you can play them back to catch anything you may have missed. But many woodworking videos are long on slick "production values" and shorter on information.

Now David Ellsworth, the irrepressible master turner, is trying to change all that with "The Ellsworth Library of Tutorial Videotapes for Woodturners," an information-packed series that he produced and edited himself. The first four tapes cover more than 25 turning subjects in depth, including how to sharpen the Superflute gouge, plus many other techniques he's pioneered over the last two decades.

"I decided to produce a whole library of tapes because I wanted to cover a huge volume of material comprehensively," Ellsworth says, "so viewers could learn the whole process and develop their own styles and methods, not just learn to turn an Ellsworth bowl."

There are some surprises, too, such as the 10-minute segment called the "flexion section." Here, Ellsworth demonstrates the daily exercises he uses to extend the muscles which he says are compressed by constant bowl-turning.

For a descriptive brochure and ordering information, write: David Ellsworth, Fox Creek, 1378 Cobbler Rd., Quakertown, PA 18951, or call (215) 536-5298.

Master turner David Ellsworth covers a broad range of turning instruction in his new video series.

CLEANING UP YOUR ACT—AND THE AIR

The Clean Air Act and its amendments hold promise for improving our environment, but compliance with its emissions guidelines can present a number of legal and financial challenges to the small-shop woodworker. Luckily, all 50 states are currently developing assistance programs that offer free help to small businesses.

These services, which vary from state to state, include newsletters, toll-free help lines, educational materials and seminars, resource centers, and free on-site analyses by engineers. On a national level, the EPA is working to ensure that these services are confidential.

In addition to assistance programs, each state has an "ombudsman," or advocate, who acts as a liaison between small businesses and the EPA. Ombudsmen maintain contact with more than 45 national trade associations representing several million small businesses across the nation. They educate tradespeople about the law, and they share the business community's comments and concerns with the government.

To find out about the small business assistance program or ombudsman in your state, call the EPA Small Business Ombudsman Hotline at (800) 368-5888.

THESE CARVINGS ARE REALLY PEACHY

This old man was carved from a peach pit.

Wilbert Clifton Leonberger—or W.C., as his friends call him—has a skill few carvers have perfected: He makes peach-pit art. Early hobos often exchanged peach-pit carvings for food or lodging, and they spread the art as they rode the rails. W.C. says this is why many people first see peach-pit carvings hanging from a railroader's watch chain.

W.C. has been carving peach pits with his bone-handled pocketknife for more than 30 years. He's carved everything from the classic peach-pit monkey head to pirates and the forbidding-looking fellow at left.

When exhibiting, W.C. keeps some extra peach pits on hand to share with others interested in the craft. He does woodcarving, too—in fact, his carving of Abraham Lincoln won a blue ribbon at the Indiana State Fair last summer. But, W.C. says, "After all these years, peach-pit carving still holds a curious fascination for me."

—Shirley Vogler Meister

PHOTO BY SHIRLEY VOGLER MEISTER

WOOD DATABASES NOW AVAILABLE

Two wood databases are now on the market from the ecology group Tree Talk. The first, "Woods of the World," brings together biological, mechanical, environmental and woodworking characteristics of more than 750 wood species and 50 wood products. The database lets you browse information on each species, view scanned images of the wood, or search for any combination of up to 10 variables, such as common uses, woodworking properties, and sustainability. "Woods of the World" also includes a directory of sustainable sources and addresses for all companies with products listed in the database. It is available in both PC and Mac versions, on CD-ROM or floppy disks for $250, and in a condensed floppy-disk version for $150.

A second database, "A Forest of Choices," addresses the issue of sustainability. It brings together hard-to-find references including news clippings, conference proceedings, photographs and video. Specific topics include wood certification, green business, and sustainable design. "A Forest of Choices" also features bibliographies and directories of companies and organizations involved in sustainable forestry issues. It is available on CD or floppy disks for $150.

For more information on either database, write: Tree Talk, Inc., Box 426, Burlington, VT 05402, or call (800) 858-6230.

Offcuts Contributors: Susannah Hogendorn, Ellis Walentine

IN THE NEXT ISSUE

- In November: a special Tool Buyer's Guide issue
- In December: veneering, grain painting, Christmas projects

Jim's Corner

Offbeat Answers to Common Woodworking Questions

Q: What is a moulding plane?

A: Properly spelled "molding, plain," you refer to simple moldings found at local lumberyards. They come in various sizes, depending on how wide a gap in the drywall you're trying to cover.

Q: Which is better, a tablesaw or a radial arm saw?

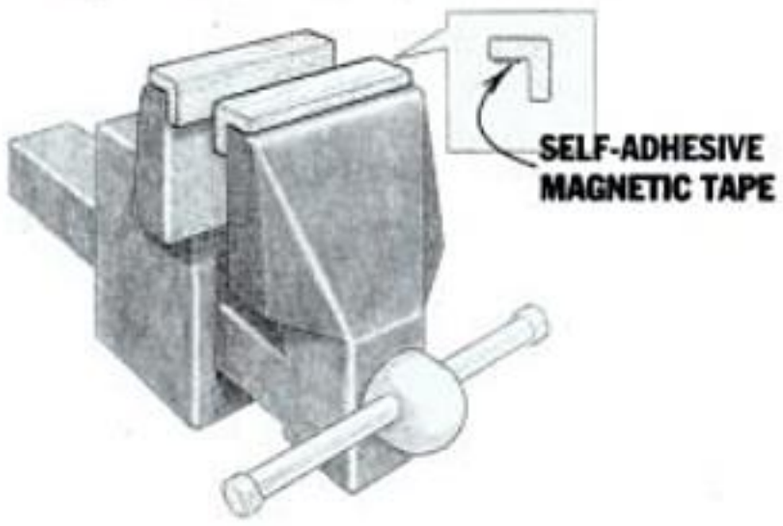
A: God made the world with a radial arm saw. With a tablesaw, it would have been finished by the end of the third day, and coastlines would be straighter.

Jim Cummins is a contributing editor to AW.

TECH TIPS

New Uses for Corner Molding

I've found that sections of ¾-in. wood corner molding are ideal for padding the jaws of a metal vise. Self-adhesive magnetic strips keep them in place. When they get chewed up, it takes only a minute to replace them.



The same molding, with the corner up, makes a useful stand when using several long-handled artist's brushes.

Craig Bentzley
Chalfont, PA

Intercoms for Safety

After a couple close calls in my shop, I realized I needed a quick way to communicate with the house. I thought of extension telephones, but finally opted for a three-unit wireless intercom that I bought at Radio Shack for less than $100. Wireless installation is easy, and now in addition to feeling safer, I can also discuss design details with my wife without schlepping sawdust into the house.

Bernie Kremer
Evans, GA

Flossing the Cracks

A good way to work glue into a crack or split is with unwaxed dental floss. Make a little pool of glue on the upper surface, then pull the floss (and glue) gently down through the crack.

Deanna Driscoll
San Francisco, CA

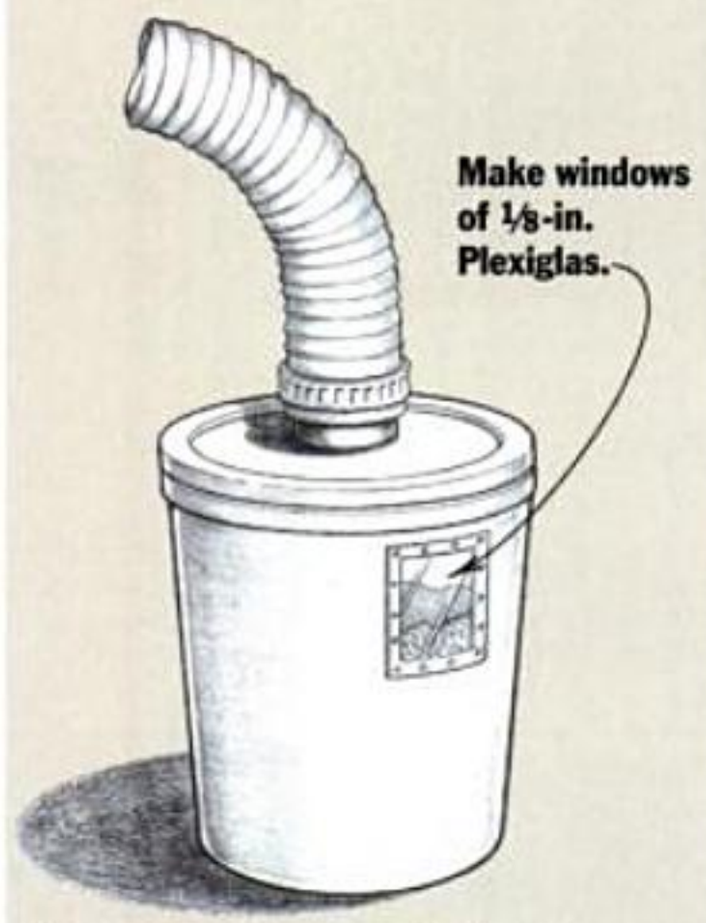
Scrawl Your Walls

To improve the lighting in my shop, I finished the walls with the type of hardboard that comes with a white, slick finish on one side. I soon found another good use for it: I can write notes, construction details and general doodling large enough to be seen across the shop. I found that Sanford's Expo brand dry-erase markers (available at art supply stores) work best.

Douglas Doty
Waddell, AZ

BEST TIP

Robert McMurray, of Mill Valley, CA, wins $200 for this tip, judged by our editors as the best of the issue. For details on how you can win cash for your favorite workshop tips, see the box on page 26.



Dust-Collector Window

I've found that a plastic window in the side of my steel dust-collector drum is a great convenience. With a window, I can empty the drum before it gets chock-full. Cut a 2- or 3-in.-wide slot in the side of your collector's drum as shown. Attach the plastic window to the outside of the drum with sheet-metal screws. A rubber gasket helps preserve the vacuum.

Handy Source for Rollers

Before dishing out $15 or $20 for an outfeed roller, try the local print shop. Ask for "distributor," "ductor" or "rider" rollers. These usually have a built-in shaft, a soft rubber coating and a length of 10 in. or more. What you don't want are oscillating rollers or ones that need a shaft.

Tom White
Latham, NY

Ultimate Glue Brush

The best glue brush I've come across is the "So-Big" paintbrush from Crayola. It's made for children, so it can take abuse—mine is a year old now and still has all of its bristles.

Neal Hakenson
Omaha, NE

All the Better to See You With...

I recently found a new use for those flexible desk lamps in vogue years ago. After removing the bulb holder

and wiring, I attached a large magnifying glass as shown. Now I can have both hands free when working on miniature projects.

Howard Moody
Upper Jay, NY

Sharpening on the Run

If you don't feel like lugging your sharpening stones around from job to job, carry a few sheets of 360- and 600-grit wet/dry silicon-carbide paper with you instead. Lay them on a piece of plate glass or other flat surface and wet them down with a lubricant such as oil, water or kerosene. Then hone

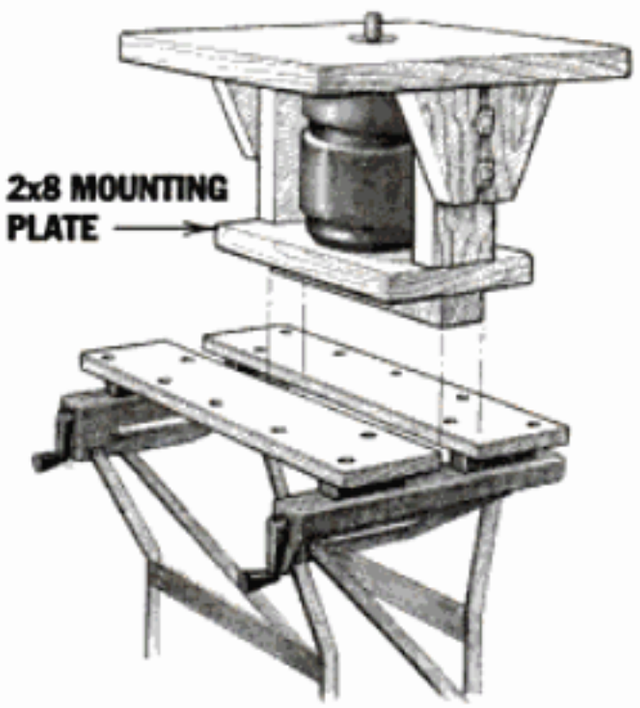
ILLUSTRATIONS BY HEATHER BRINK LAMBERT

your tools just as you would on an oil or water stone. By wrapping a strip of sandpaper around a dowel, you've got an instant slip stone for sharpening gouges.

Howard Ires
Danbury, CT

Workmate Machine Bench

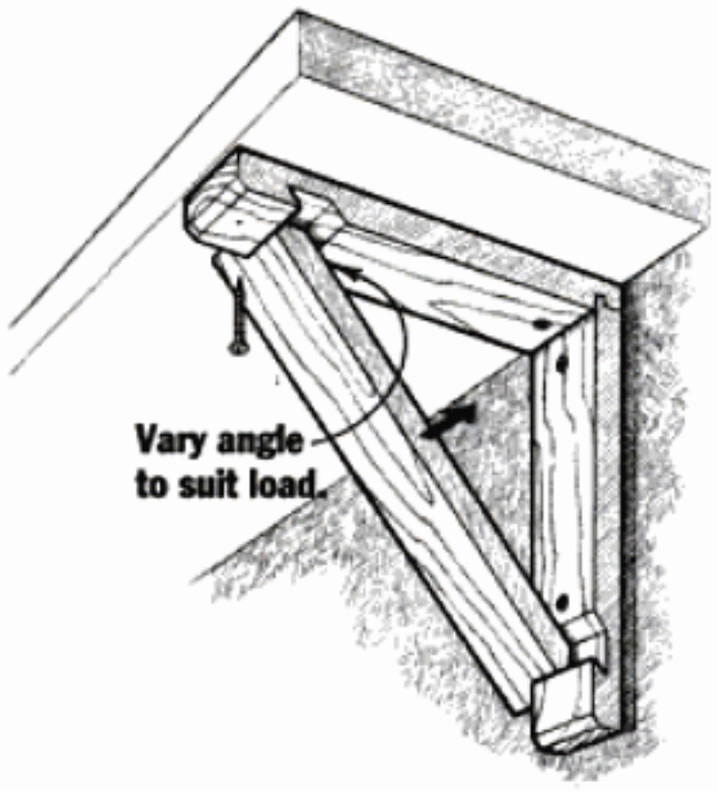
Those of us with limited shop space can't afford the luxury of floor-mounted machines. I attach my benchtop jointer, shaper, 10-in. Ryobi planer,



etc., to sturdy wood mounting plates so they can still be stored compactly. When needed, I lift the machine onto my Black & Decker Workmate, clamp it, and it's ready for business.

Ron Pavelka
Orange, CA

Shop-Made Brackets



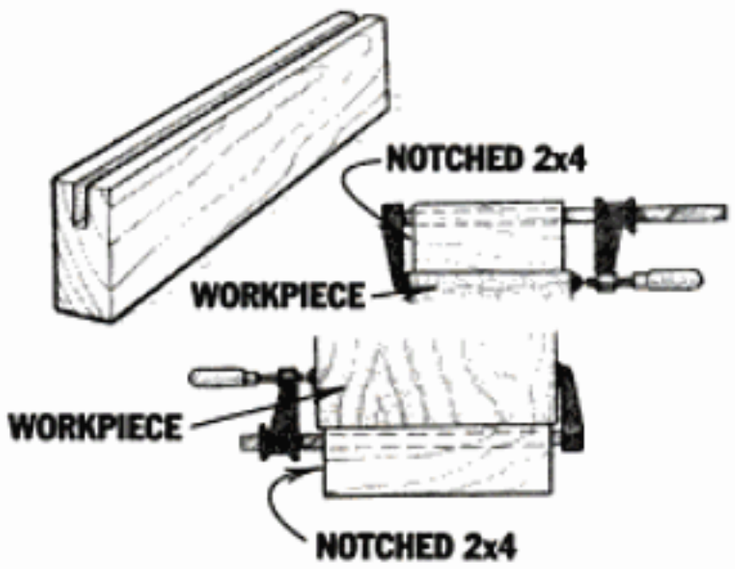
I got tired of forking out $2 or $3 every time I needed some shelf brackets, so I started making my own. For light duty I use 1x2 stock and a low angle, say 30°. With more substantial loads, I might go to 45° or even 60° and use 2x4 stock. Reinforce the lipped box joint shown in the sketch with a couple of drywall screws.

To install, screw the bracket to the wall and then slide in the brace. There's no need for glue—gravity and friction keep it in place. I've used these brackets for shelves, lumber racks, to hang plants, and to support a bench grinder and a small drill press.

Simon Watts
San Francisco, CA

Keeping Clamps Upright

Light-duty quick-clamps often fall over right in the middle of a gluing operation. To prevent this, I cut slots in short pieces of 2x4 as shown. This



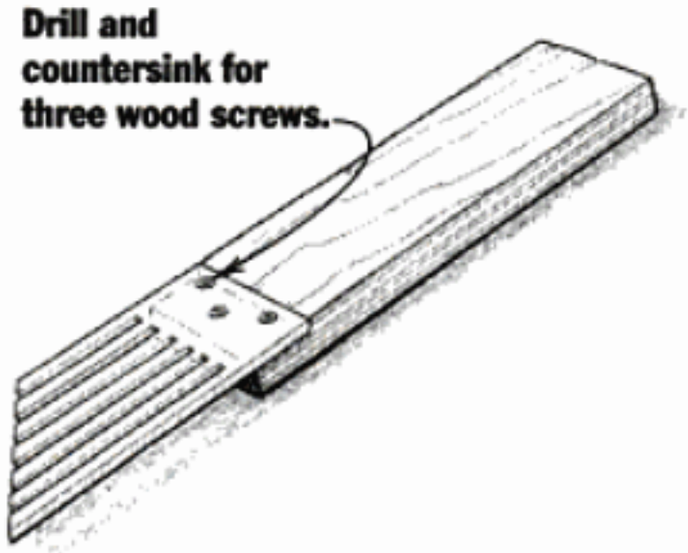
arrangement works equally well whether the 2x4 is resting on the workpiece or on the bench with the work on top. I give each block a thorough waxing so that the glue won't stick to it.

Bob Nichols
Middleboro, MA

Lexan Feather Boards

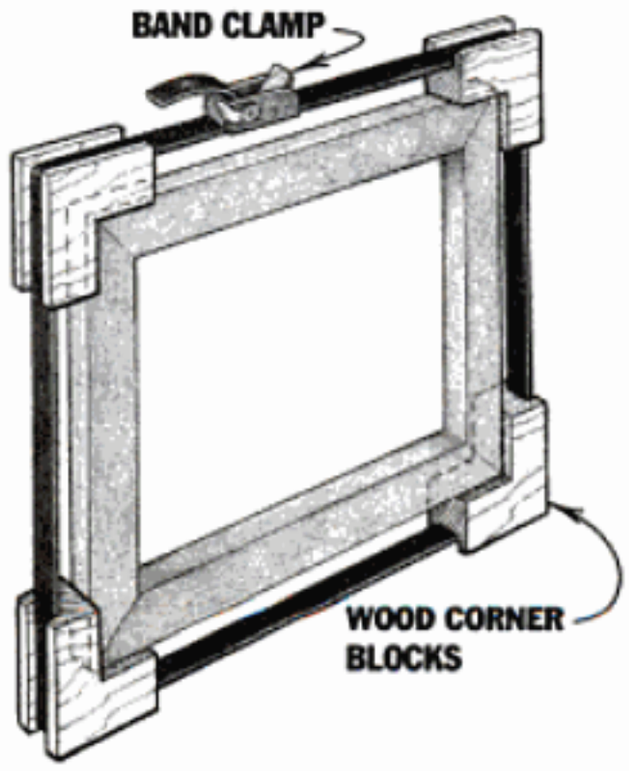
I wasn't happy with any of my feather boards until I made one out of ¼-in.-thick Lexan. This stuff is both flexible and virtually unbreakable. I started with a 3-in. by 8-in. piece, sawed one end at 45°, and then kerfed the angled end on the tablesaw with a fine-tooth ATB blade. I extended the Lexan by adding a length of ¾-in. plywood as shown in the drawing. I liked my feather board so well that I made another one, which mounts vertically on the fence to serve as a hold-down.

Merle Hyldahl
Rochester, NY



Frame Clamp

When I was a kid, my dad had a clever rig for gluing up picture frames—one that I still use. He cut L-shaped corner blocks out of 2x4s and



grooved the backs to take a 1-in. web or strap clamp. To make your own, remember to round the sharp corners of the grooves so the strap will slide easily around them. Be sure to cut the inside corners of the blocks at exactly 90°, so the frame will square itself as you tighten the band.

Ralph Street
Houston, TX

BEST TIP WINS $200

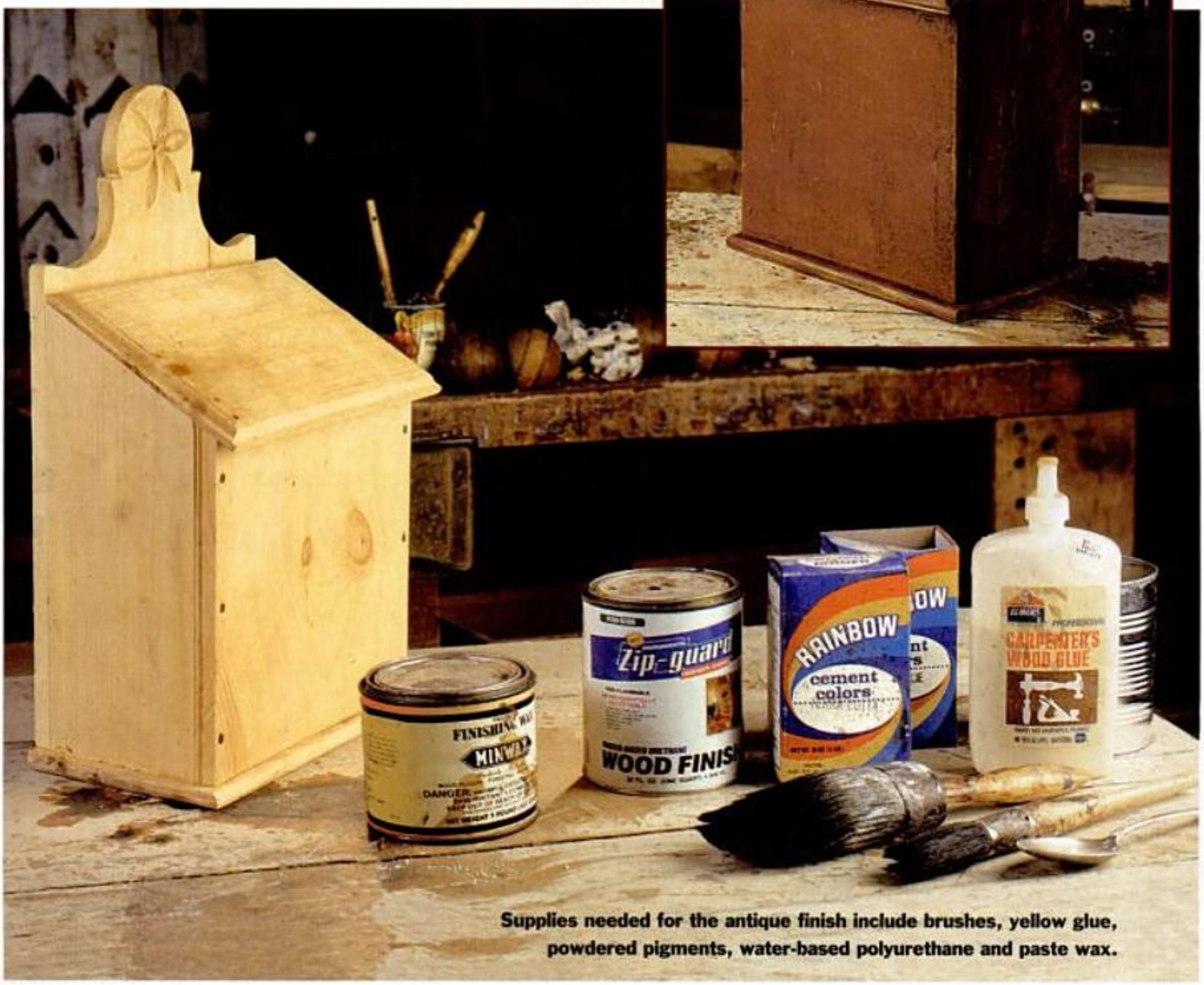
Know a better way of doing something? Designed a clever jig? Send your woodworking tips, along with a sketch or a snapshot to: "Tech Tips," AMERICAN WOODWORKER, 33 E. Minor St., Emmaus, PA 18098. We'll pay $50 for each tip we publish and $200 for the best tip of the issue.

Antique Painted Finish

A Quick and Safe Technique for Instant Heirlooms

By Michael Dresdner

In less than a day, you can "age" a piece 100 years.



Supplies needed for the antique finish include brushes, yellow glue, powdered pigments, water-based polyurethane and paste wax.

PHOTOS BY KURT WILSON

Nestled in the heart of picturesque Bucks County, Pennsylvania, Dan Becker's antique store strives to put the perfect vintage furniture in customers' hands. But since it's not always easy to find just the right antique piece when you need it, Becker also offers his customers some very convincing reproductions. Using his own finish recipes made from safe, easily available materials, Becker creates finishes that add years to his newly made classics.

His three-step crackle finish, shown here on a candle box, consists of a coat of yellow glue followed by a coat of homemade paint and topped off with paste wax containing brown pigment. The entire process takes less than a day, and it is a perfect treatment for plain pine and "white woods," such as poplar or maple, that you'd use on projects you plan to paint. Here's how he does it:

After sanding wood to 320 grit, Becker quickly brushes on a coat of undiluted yellow glue.

To make his own paint, Becker pours water-based polyurethane into a clean can; then he adds powdered pigment.

Step 1: The Glue Coat

To make sure he has a smooth surface for his finish, Becker sands the wood to 320 grit, then dusts it off thoroughly. Working quickly, he brushes on a medium-heavy coat of wood glue with a sash brush. (See photo, top right.) He uses the glue full strength from the bottle, without adding any water. The day I visited, he was using Elmer's woodworker's glue, but he assured me that any white or yellow glue will work equally well.

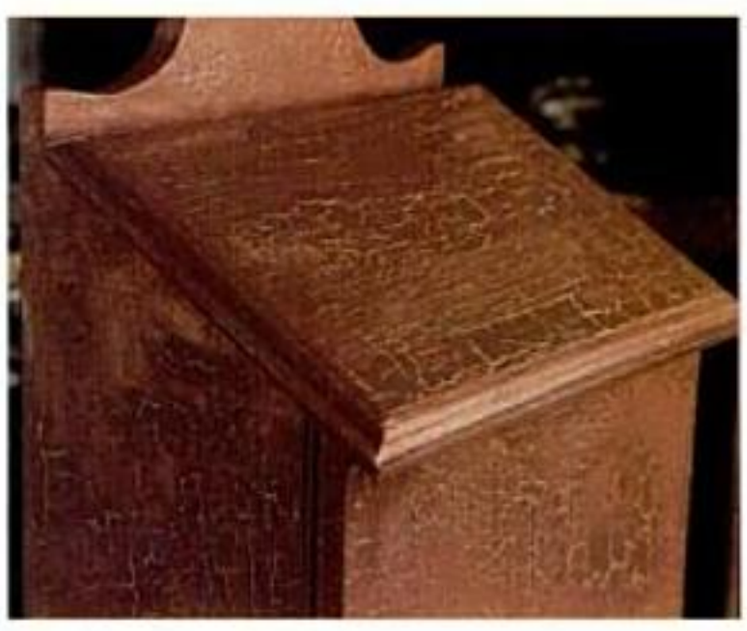
Becker lets the glue dry for four or five hours. He doesn't sand the dried glue, because sanding scratches would break up the smooth surface needed for the paint coat to crackle. Besides, any bits of dust or dirt that he doesn't smooth out later will become part of the rustic look of the piece.

Becker brushes a wet coat of paint directly on the dried glue.

Step 2: The Paint Coat

Becker makes his own water-based paint in a variety of colors by mixing dry powder pigments (see Sources, page 30) into any clear water-based acrylic or polyurethane finish. (See photos, above right.) He made this batch with Zip-Guard Clear Polyurethane, but he has also had good results with Carver-Tripp and Minwax products.

When choosing pigments, Becker prefers the deep, earthy colors typical of rustic finishes. The reddish-brown paint he made for this piece consists of 3 tablespoons of terra-cotta pigment and about ½ teaspoon of black pigment mixed in 12 ounces of clear finish. He stirs the mixture until the powder is evenly dispersed and the large lumps have disappeared. When mixed, the paint should be thick enough and dark enough to color completely in one coat.



As the paint dries, it shrinks and crackles into a random pattern of rectangles and squares.

Becker distresses the finish by scraping the sharp edges with a cabinet scraper (left), then he sands the entire surface with 180-grit sandpaper (below).

Becker brushes the paint directly onto the dried glue. Working quickly, he applies a very wet coat, stopping just short of the point where the paint would drip and run. (See photo, previous page.) Thicker, wetter coats result in larger crackles, while thinner coats yield smaller ones. Becker doesn't worry about getting the finish even, since the variety of crackle sizes adds to the feeling of authenticity. He emphasizes the importance of coloring the wood completely in one pass—brushing it out or recoating will ruin the crackle.

As the color coat starts to dry, it shrinks and crackles into a random pattern of rectangles and squares, with the light-colored wood peeking through the cracks in the dark paint. (See bottom photo, previous page.)

In about an hour or two, when the water-based color coat is dry, Becker goes to work distressing the box to simulate years of wear in those places where it normally would have occurred. He starts by running a cabinet scraper across the sharp edges of the piece, taking the finish down to bare wood. (See photo, top left.) Then he goes over the entire surface with 180-grit sandpaper to smooth the scraped edges and remove the dust nibs and roughness left by the quick paint job.

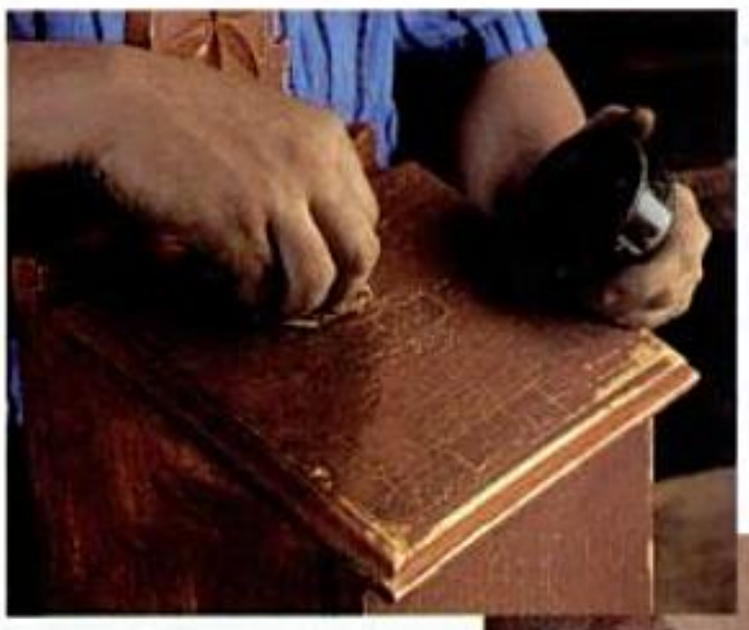
Step 3: The Wax Coat

Once the surface is smooth and sufficiently worn-looking, Becker adds a coat of "dirty" wax to soften the sanding scratches and round out the vintage look. To make his wax, he stirs a spoonful of raw-umber powder into about ½ cup of any common paste wax, such as Minwax or Butcher's Wax. (See photo, left.)

"Dirty" wax is prepared by mixing raw-umber pigment into paste wax.

Then, working with a coarse rag, steel wool or Scotch-Brite, Becker rubs the wax over the entire surface. He works it deep into the crevices in the crackled paint, using a brush for the deeper details. (See photos, bottom left.) He follows up with a clean cloth, wiping off the excess wax and burnishing the edges where years of handling would have raised a shine. The final result is a newly made "antique" that's hard to distinguish from the genuine article. ▲

MICHAEL DRESDNER *is a contributing editor of AW.*



Becker rubs wax onto the painted surface with a rag (left). To reach deeper recesses, he uses a brush (below).

SOURCES

Dry powdered pigments are available at many hardware and paint stores, or by mail from:

Empire Blended Products
250 Hickory Lane, Bayville, NJ 08721
(908) 269-4949 *Circle #601*

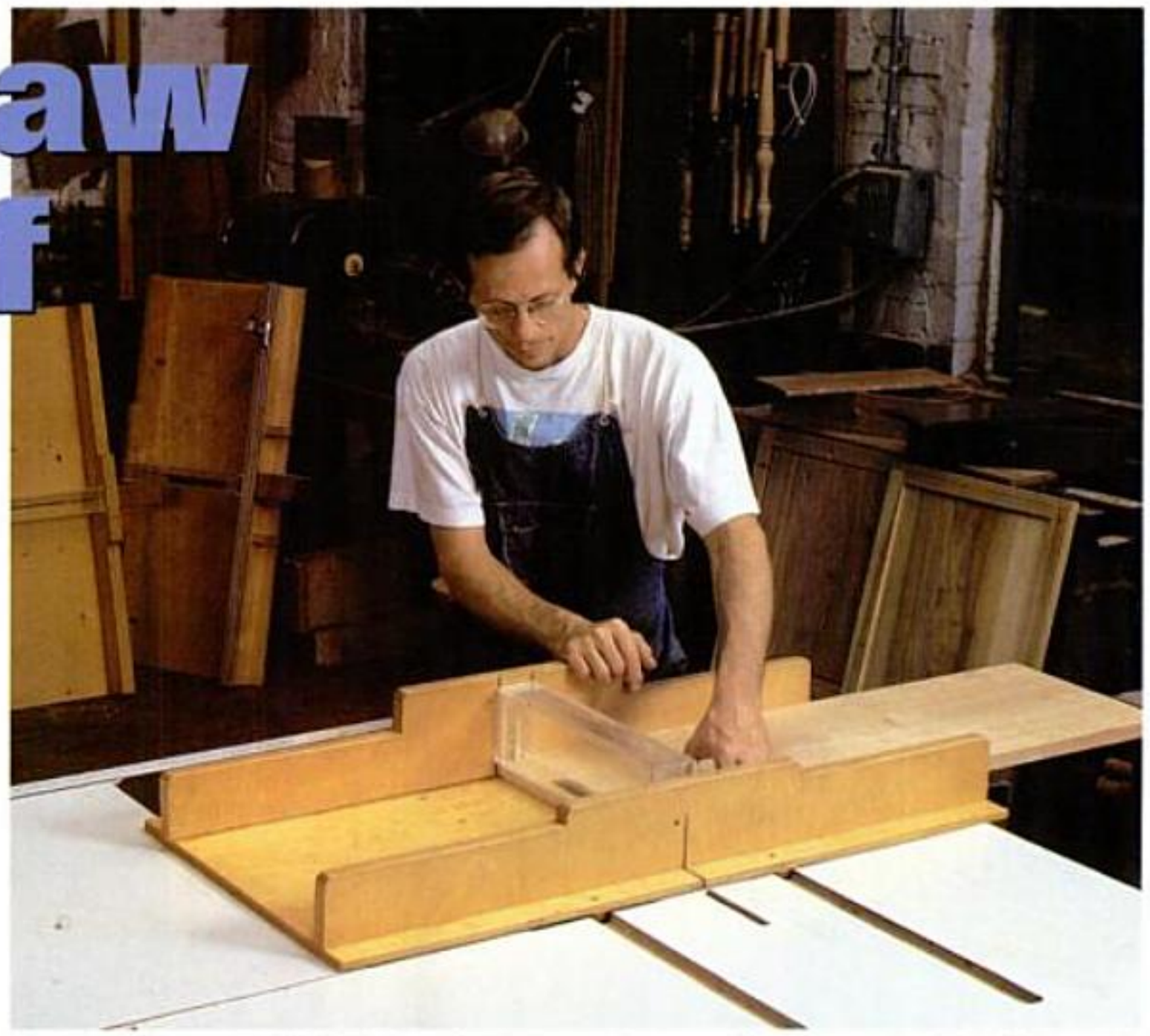
Mohawk Finishing Products
4715 Rte. 30, Amsterdam, NY 12010
(800) 545-0047 *Circle #602*

Garrett Wade
161 Avenue of the Americas, New York, NY 10013
(800) 221-2942 *Circle #603*

Tablesaw Cut-Off Boxes

Make Safe, Precise Crosscuts Even on Long or Wide Stock

By Kelly Mehler



Crosscutting control. **Mehler's cut-off box produces a dead-accurate 90° cut in small or large workpieces.**

What do you do when you want flawless crosscuts in wide panels or long, heavy boards? Getting dead-accurate 90° cuts on the radial arm saw can be difficult, and cutting large workpieces on the tablesaw with the miter gauge is a juggling act, often with results that are unpredictable in terms of accuracy.

The answer for the small shop is a shop-made jig called a cut-off box, or "flying Dutchman," as some woodworkers like to call it. (For a look at a similar jig for cutting dadoes, see sidebar, page 33.)

The cut-off box carries the workpiece over the saw table, and it resembles a shallow box minus two sides. It has two runners fastened to the bottom which slide in the miter-gauge slots on the tablesaw, so the box moves parallel to the blade. A fence on one side of the box is attached exactly perpendicular to the saw blade, so your cuts are perfectly square. And a rear support on the opposite side of the box, along with the fence, hold the base together when it's cut in half the first time the box is used.

I made the box shown here to fit my Delta Unisaw, but a cut-off box will work with any tablesaw if you follow the basic design, which I'll explain.

Designing the Cut-Off Box

You have a choice on how big to make your box: A narrow box means wide workpieces won't fit into the jig, whereas a long or wide box will be heavy to lift on and off the saw. Some woodworkers build just one box with a width capacity around 24 in., which will handle a half-sheet of plywood. My solution is to make several cut-off boxes in various sizes. The box shown in the drawing on the next page handles work up to 14½ in. wide. Feel free to customize a box to a size that suits your work.

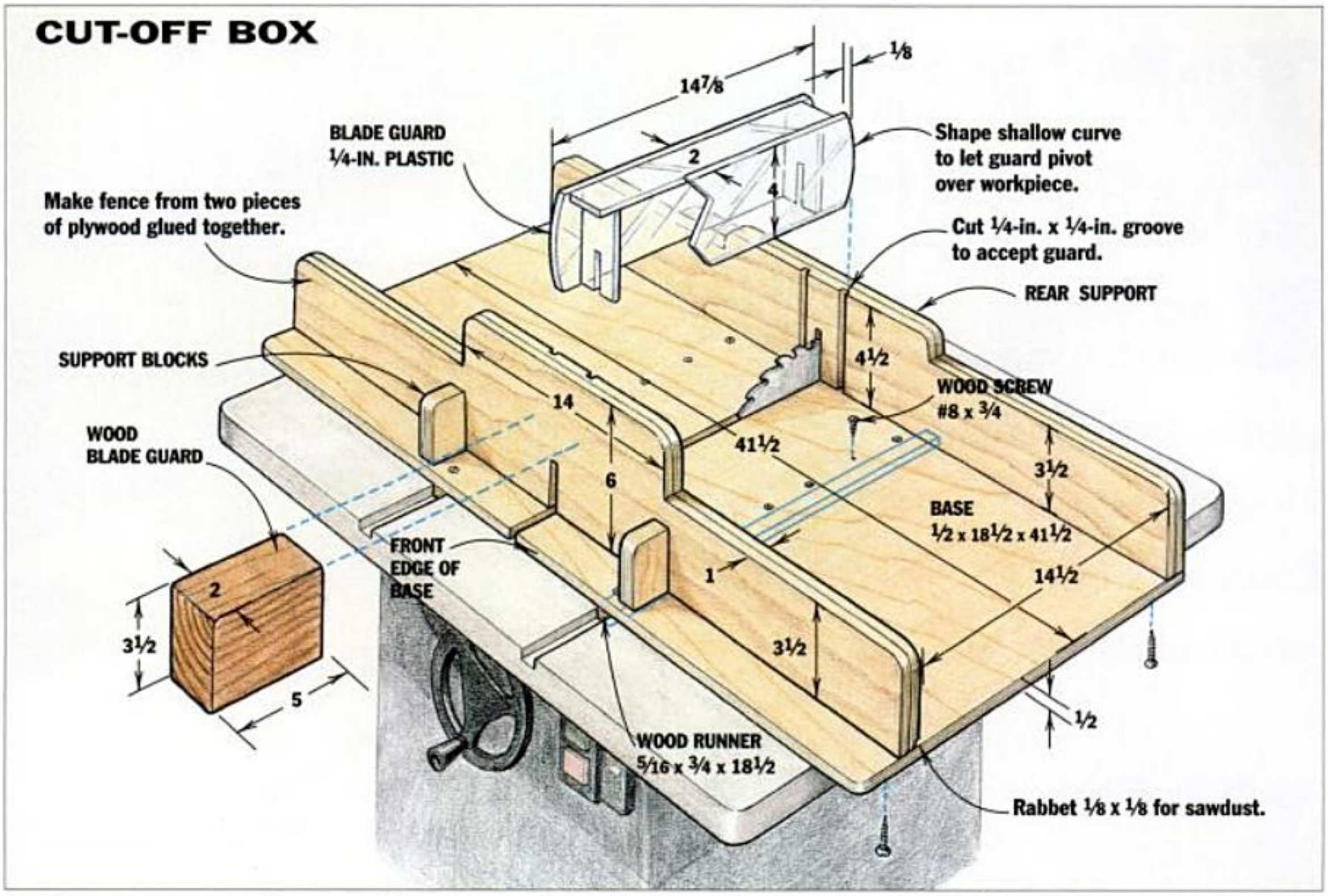
Safety topped my list when I designed my boxes, so I included two blade guards—one clear plastic, the other wood—to keep fingers away from the blade. The clear guard slides in the grooves in the fence and rear support, accommodating thick or thin work, while the wooden guard encloses the saw blade when it passes through the fence.

I chose Baltic birch plywood for the base, fence and rear support. (See

Big capacity. **You can crosscut heavy boards with a side extension table, using a bench hook under the stock. The hook's thickness should match that of the cut-off box's base.**

Speedy repetition. **First make a square cut from one side of the blade, then butt the cut end against a stop block and crosscut to length.**

PHOTOS BY ALBERT MOONEY



ILLUSTRATIONS BY HEATHER BRINE LAMBERT

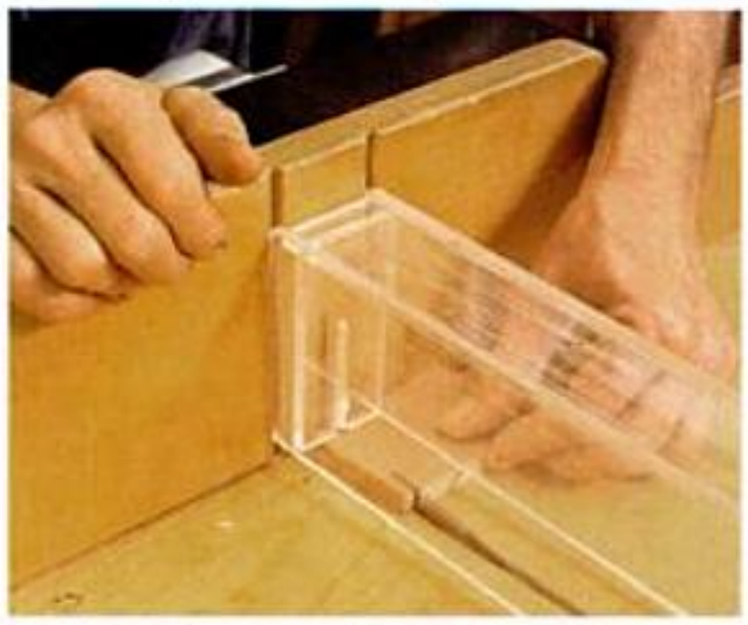
drawing.) But you could use any flat, stable material, such as medium-density fiberboard, for the base and hardwood for the fence. Make the runners from a hardwood, and use Plexiglas or Lexan for the see-through guard. Be sure to use the correct glue for the type of plastic you choose (check the Yellow Pages under "plastic" for sheets and glue, or order these materials from AIN Plastics, Box 151, Mt. Vernon, NY 10550, 800-431-2451).

Construction Tips

This jig is simple to build, but you should make it carefully to ensure your crosscutting will be accurate. That said, here are a few tricks to make the job go smoothly:

• **Making the runners for sliding action:** Size the runners for a snug fit in your tablesaw's slots, and make the runners slightly thinner than the depth of the slots. To attach the runners, first line up the front edge of the base (see drawing) with the front, or "infeed" edge, of the saw table. Mark the base at the center of the miter-gauge slots, and attach the runners at your marks. To get a sliding fit between the slots and the runners, move the box in the slots, then scrape the wear marks on the runners with a sharp chisel until the box slides smoothly without side play.

• **Squaring the fence for accuracy:** Mounting the fence square to the saw blade involves several steps. First screw the rear support in place, then cut through the base on the saw, stopping just shy of the front edge. Use an accurate square to align the fence 90° to the saw kerf. Then trace the fence location on the base, drill oversized holes every 3 in., and screw the fence to the base with one screw in each end of the fence. Add a screw in the middle if necessary to keep the fence straight. Now make a test cut in some wide scrap, check it for square, and adjust the fence if necessary by loosening, then re-tightening, the screws. When the jig cuts squarely, install the remaining screws and double-check with another test cut. Then screw support blocks to the fence and base, and glue the wood blade guard in place.



Clearly safe. A plastic guard keeps fingers out of harm's way and is slim enough for holding small workpieces.

• **Working with plastic:** This stuff is easy to work and can be sawn much like plywood. Just use a fine-tooth blade and wear good eye protection. Assembly is even easier: Simply tape the parts together, squirt plastic solvent glue along the butt joints, wait a minute, and remove the tape.

• **Finishing up:** Apply your favorite finish on both sides of the cut-off box to help keep it flat and true over the years, then wax the base of the jig and the top of your saw. ▲

KELLY MEHLER *is a writer and professional woodworker in Kentucky.*

A BOTTOMLESS BOX

This Jig Looks Like a Miter Gauge and Works Like a Cut-Off Box

By Andy Rae

Most of my cabinetmaking involves a lot of rabbet and dado work, which I do on the tablesaw. Using my dado blade, I mill rabbets by running the stock against the saw's fence. Then, to cut the dadoes to the same depth as my rabbets, I use the "bottomless" crosscut jig shown here. Designed to be more substantial—and safer—than a miter gauge, my bottomless "Dutchman" lets me go straight from rabbeting to dadoing without stopping to change the height of the dado blade.

This jig is essentially an oversized miter gauge with two metal runners. The runners slide in my tablesaw's miter slots and are attached to a fence-and-stiffener arrangement. The whole affair lifts easily on and off the saw at a moment's notice.

PHOTO BY SUSANNAH HOGENDORN

With no back or bottom, this jig is great for dadoing and for crosscutting wide stock.

Fence, Stiffener, and Runners

The drawing below shows how my bottomless cut-off jig goes together. It's nothing fancy. I suggest staying with the overall size shown—heavy, but not too heavy. I made my fence from scrap maple, but any heavy stock will do the job. The stiffener, which is built up from ¾-in. plywood glued together, keeps the runners square to the fence. The runners need to be rigid to ensure accurate cutting, so I suggest using cold-rolled steel bar stock for these parts (available from your local metal supplier, or by mail from Small Parts Inc., 13980 NW 58th Ct., Box 4650, Miami Lakes, FL 33014, 305-557-8222).

Assembling the Jig

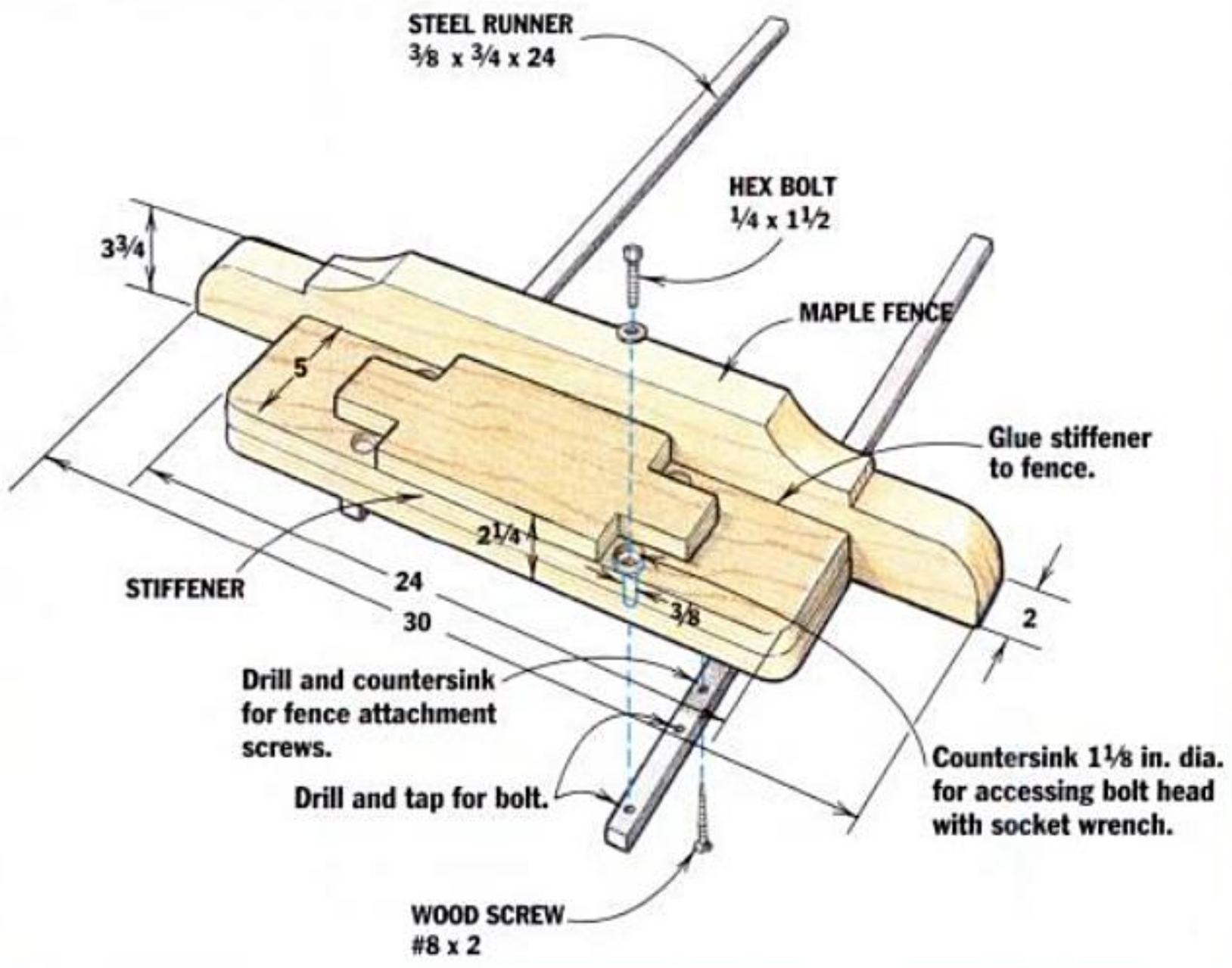
Once the stiffener and fence are glued together, you attach the runners so that the jig slides smoothly and the fence is perfectly square to the blade.

After marking out and drilling bolt holes in the stiffener, position the fence-and-stiffener assembly on the saw table, over the runners. The fence should be perfectly square to the blade, and the ends of the runners should be flush with the edge of the stiffener. Now you can mark the bolt hole locations on the runners. Drill and tap the bolt holes in the runners, and then drill and countersink holes for the screws that you'll drive into the fence later. (See drawing.)

Next, attach the runners to the stiffener, turning the bolts just finger-tight. Placing the jig on the saw table, tweak the fence so that it's perfectly square to the blade, and tighten the bolts. Then drive the two screws through the runners and into the fence to complete your jig.

In addition using my jig for cutting dadoes, I find that it's helpful for all kinds of general cut-off work. You can even make beveled cuts, and you never have to worry about cutting into a base, as you would with some Dutchmen.

"BOTTOMLESS" CUT-OFF BOX



ANDY RAE *is an assistant editor of AW and lives in Pennsylvania Dutch country.*

Carved Coffee Table

Basic Veneering & Bandsawn Curves Give This Living-Room Centerpiece An Elegant Look

This coffee table combines carving, veneering and inlay techniques. Earlier version (below) had softer curves.

By Ellis Walentine

Nineteen years ago, my mother-in-law, an artist, offered to barter one of her paintings for a coffee table. I quickly agreed, and in a couple weeks, delivered the table shown in the photo at left. Of all the furniture I've designed and built since then, I can't think of a single piece that continues to please me as much as that table. Its softly sculpted shape seems to invite touching, and its elegant "bee's-wing" eucalyptus top shimmers in its setting of aged mahogany.

Looking back, I realize the table wasn't very difficult to build. Apart from the mortise-and-tenon joinery and the simple veneer work, the greatest skill involved was carving the compound curves of the legs and rails. The carving was also the most enjoyable aspect of construction, as it called on me to use my eyes and hands together to create the final shapes, using only a bandsaw, a block plane, a spokeshave and some sandpaper.

The table shown above is almost exactly like the original, except that I've made it a bit wider and I've changed the curves of the legs to give it a slightly different stance and personality. Feel free to change these curves or vary the materials to suit your own tastes.

Making the Leg-and-Rail Assembly

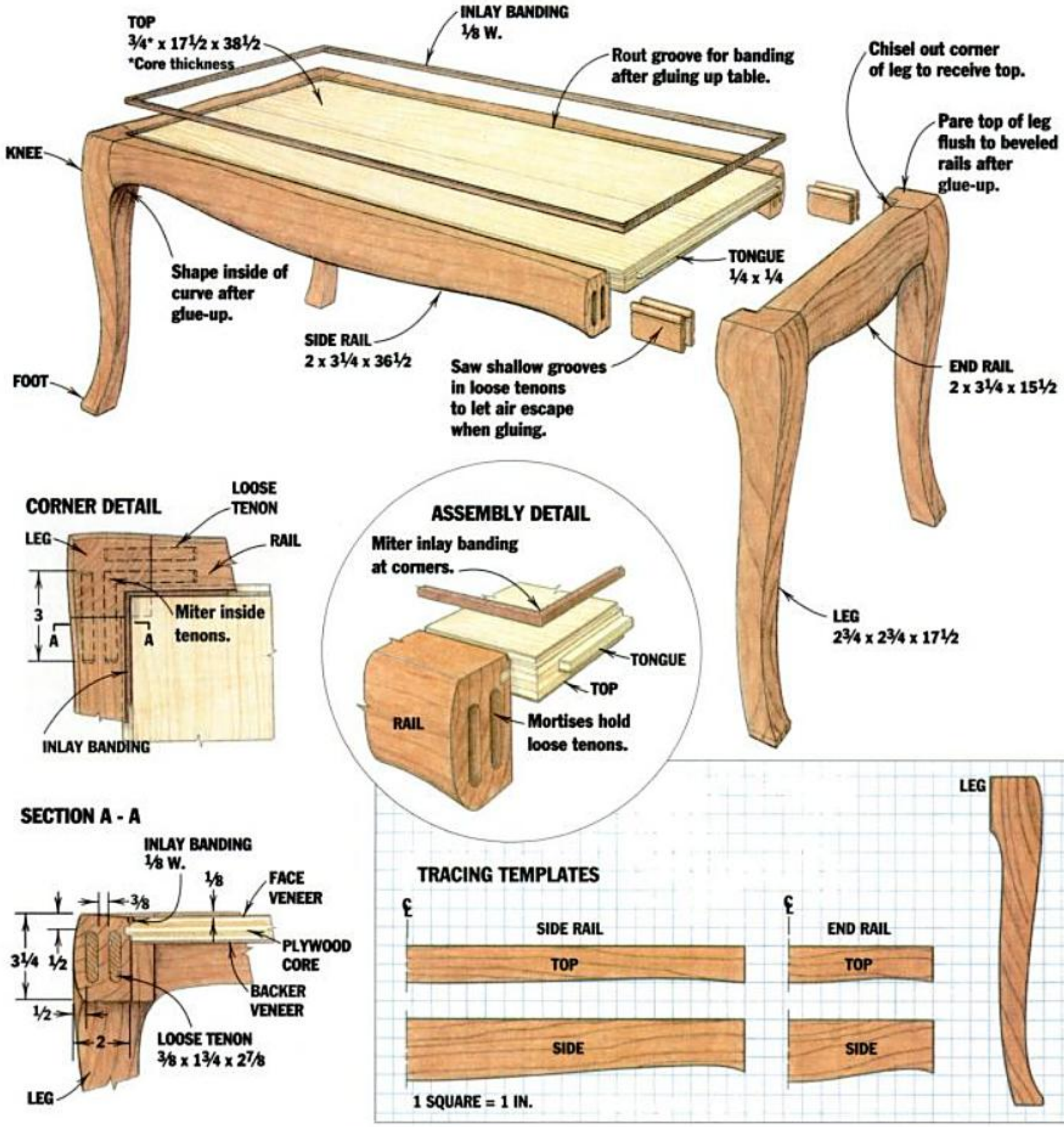
The first step in making the table is to cut and join the legs and rails. Here's the sequence I follow:

Prepare the mahogany blanks. Make sure that the blanks for the rails and legs have square faces and ends.

Mortise the legs and rails. I recommend double-tenon joinery for a couple of reasons: First, double tenons provide twice the glue surface of a single tenon, so they're stronger; and second, double tenons help main-

PHOTOS BY JOHN HAMEL

CARVED COFFEE TABLE



ILLUSTRATIONS BY HEATHER BRINE LAMBERT

tain the integrity of the short grain above the leg mortises. (See drawing.) A single large mortise isolates this weak short grain; if a leg is kicked, the levering action of the tenon is likely to break it out. But in a double-tenon joint, the web of wood between the mortises acts as a bridge to the short grain, making it much more resistant to racking forces.

Instead of trying to cut the double tenons on the ends of the rails, I made loose (or floating) tenons to fit matching mortises in the legs and rails. Loose tenons are as strong as integral tenons, and using them enables you to cut the rails to exact length, instead of calculating the overall length by adding shoulder-to-shoulder dimensions and the lengths of the tenons.

There are many ways to cut the slot mortises. I used a slot mortiser, but you can cut them with a plunge router if you devise fixtures to hold the work while positioning the router bit accurately. (See AW #29, page 58.) I use a two-flute end mill (available from industrial supply houses) or an up-cutting spiral router bit for mortising.

Once you've mortised your legs and rails, make tenons that slip-fit into your mortises. Then preassemble the legs and rails to make sure this framework fits together as it should.

Make tracing templates. These are the patterns you'll use to create the curves in the legs and rails. (See drawing.) To make the templates, I drew each of the five curves full-size

on drawing paper, spray-mounted them to ¼-in. hardboard and cut them out on the bandsaw. I faired the curves with a spokeshave and sandpaper, sighting down each template occasionally to be sure there aren't any bumps or flat spots. When you've finished shaping the templates, butt the rail templates against the leg template to see how the curves flow together, and make adjustments if necessary.

Checking the curves. After you've completed the joinery, preview the curves by tracing the curved templates on the dry-assembled table.

Put the templates to work. Trace the template curves onto your leg-and-rail assembly. (See photo, above.) Then sight along your pencil lines to see how the overall curves look. If you want to make any changes, reshape your templates and then retrace the curves. When you have the look you want, disassemble the legs and rails.

Groove and bevel the rails. (See drawing.) I made the grooves just over ¼ in. deep to allow some headroom for the tongue of the top. I positioned the groove so the veneered top surface would fall ⅛ in. below the tops of the rails, then I cut the bevel on the tablesaw. You could also skip the bevel and make the top flush with the tops of the rails; just locate the groove accordingly.

Square out the corners of the legs. With the legs and rails dry clamped, scribe the inner faces of the rails on the legs with a marking knife and extend your scribe marks onto the tops of the legs. Now disassemble the table and square out the waste with saws and chisels.

Pre-Shaping the Curves

The next procedure is to shape the curves of the legs and rails using a combination of bandsaw and hand-tool techniques:

Bandsaw the curves. Note that each part must be sawn on two faces. After cutting the first profile on a leg or rail, I reattach the cutoff with double-stick tape before I cut the second face. (See AW #35, page 36.)

Shape the rails. With the rails clamped in a vise or between bench dogs, fair the convex curves on the outside faces and bottom edges with a block plane. Then shape the reverse curves with a sharp spokeshave. (See photo, below left.) I like to use my adjustable-sole spokeshave for this because I can adjust it quickly to follow changing curves. Sight down the sharp edge where the curves meet to check for irregularities.

When you've finished fairing the curves on the sides and bottoms of the rails, the next step is to carve the crowned profiles. (See drawing.) First, gauge pencil lines on the top and bottom edges of the rails parallel to the curves—about ¼ in. in at the top and ¾ in. in at the bottom. Then carve the crowns with a spokeshave, working from the centers toward your pencil lines. Feel free to experiment with different shapes and proportions that appeal to you. A clip-on light at bench level will model the curves clearly so you can gauge your progress visually. Stop the round-overs on the bottom edges about 3 in. from the ends of the rails, so you can blend them into the legs after glue-up.

Once you've worked the curves with edge tools, follow up with a random-orbit sander and 180-grit sandpaper. (See photo, below right.) I prefer the random-orbit sander's round pad to the square or rectangular pads of ordinary orbital sanders, because the round pad gets into curves better.

Smooth the leg curves. Carve the leg profiles in the same way as the rails. Leave the sharp curves at the insides of the knees until after glue-up.

PHOTOS BY ELLIS WALENTINE

Making the Top

The veneered top is the centerpiece of this table's design. Making this top isn't hard; all you need are a piece of hardwood plywood or medium-density fiberboard for the core (or "substrate"), a bookmatched face veneer and, to balance the construction, a "backer" veneer of a cheaper wood like mahogany or poplar.

For old times' sake, I chose bee's-

Carving the rails. Shape the face of each bandsawn rail (left) and round its lower edge (center) with a spokeshave. Complete the process with a random-orbit sander (right).

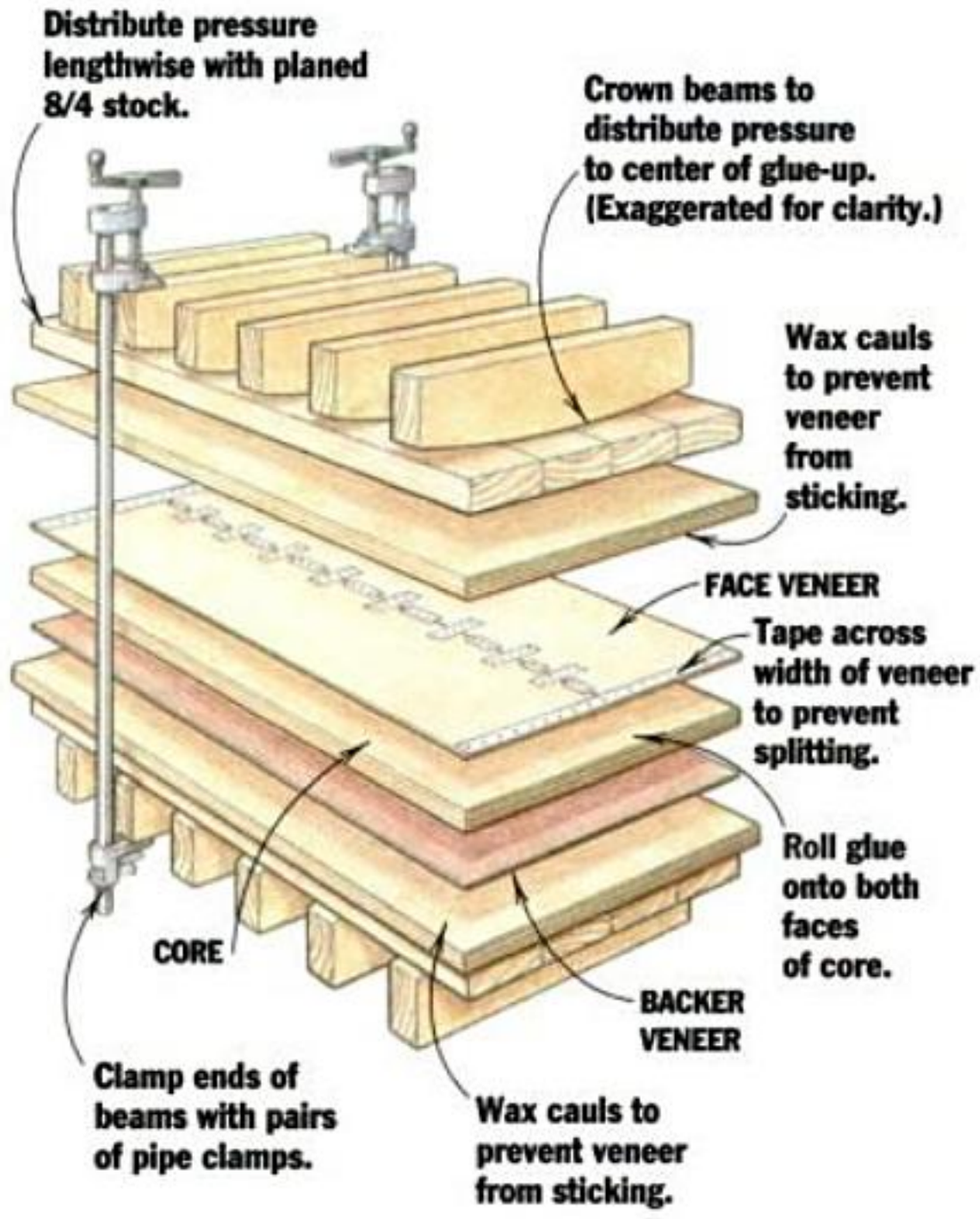
SEAT-OF-THE-PANTS VENEER PRESS

If you don't happen to have a dedicated veneer press or a vacuum-bag veneering outfit, you can still get the job done with common clamps, cauls (platens made of plywood or other man-made board) and wooden beams, as long as you follow two simple principles: Use enough clamps to provide adequate pressure, and distribute the clamping pressure as evenly as possible.

I don't know any hard-and-fast formulas for predicting pressure distribution, but I generally try to build caul thickness roughly equal to half the distance between the beams. (See drawing.) You can improve pressure distribution by placing a layer of planed 8/4 lumber lengthwise between the beams and cauls. To help distribute pressure evenly across the width of the glue-up, bandsaw and disc-sand ¼-in. or so crowns lengthwise on the faces of the beams.

How many beams and clamps are enough? You can get a rough idea of the pressure required if you consider that vacuum presses do a fine job with only about 13 pounds per square in. (psi). If you assume that pipe clamps will deliver about 1,000 psi each and heavy-duty bar clamps as much as 2,000 psi each, you can figure out how many clamps you'd need to approximate the pressure of a vacuum bag.

For this coffee-table top I'd suggest using no fewer than six pairs of beams. Use one ¾-in.-thick plywood caul and a layer of 2x4s or planed 8/4 lumber on each side of the veneer.—*E.W.*



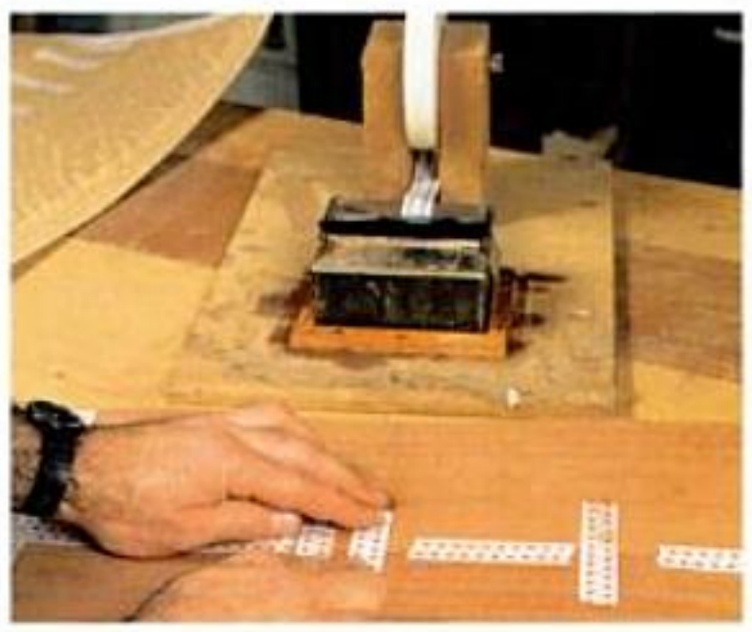
wing eucalyptus for my face veneer, but you can buy many equally dramatic species from retail and mail-order veneer suppliers. (See Sources, page 39.) You'll need two pieces of veneer large enough to make a bookmatched face. Specify sequential pieces so they will match. Also order enough backer veneer (it needn't be matched) to cover the underside of the top. Here's how I suggest constructing the top:

Cut the core to size. I made mine ½ in. longer and wider than the measured opening between the rails, to allow for a ¼-in. tongue all around.

Prepare your veneers. Arrange your pieces of face veneer edge to edge, so you can view the bookmatch effect and select the part of the veneer you want to display. Precut the two pieces to the length of your top blank with a veneer saw (see Sources) or by repeated scoring with a sharp mat knife. You can leave them over-width for now.

For a clean, tight bookmatch, you need to joint the veneer edges. Clamp the two pieces of veneer between two straight-edged pieces of lumber or plywood, with their edges extending about 1/32 in. (See photo, above left.) Joint the veneer edges with a sharp block plane, stopping when the plane's sole touches the clamp blocks.

Jointing the veneers. Plane the edges of the face veneers with a block plane. Veneers are clamped between two straight-edged boards.



Taping the veneers. Author tapes the faces with special perforated veneer tape. Shop-made dispenser is in background.

Tape the veneers together. I use perforated paper veneer tape (see Sources) to secure this edge-to-edge joint. (See photo, above right.) Tape across the seams in several places, stretching the tape as you hold the veneer pieces together. Then apply tape lengthwise over the seams between your first perpendicular pieces of tape. To keep the ends of the veneer from splitting in the veneer press, I usually tape across the full widths of the ends as well.

When you've finished taping, turn the joined pieces over and sand the glue faces lightly with 180-grit sandpaper to remove any roughness and grime. Then blow off the sanding dust with compressed air.

Prepare your veneer press. Whether you use a dedicated press or one contrived from ordinary clamps

Bite your tongue. Author saws off the tongue at the corners of the top to fit the notched legs.

and beams (see sidebar, page 37), wax the inner faces of your cauls thoroughly with a coat of paste wax to prevent the glue (and veneer) from sticking to them.

Glue the veneer to the substrate. I use a 3-in. disposable foam paint roller to apply a uniform coating of yellow glue to one side of the core at a time. As I center the face and backer on the core, I tape the edges with a few pieces of masking tape. The tape keeps the veneer from slipping on its film of glue as pressure is applied.

Tighten the clamps on the center beams first, then work outward to the ends. Now retighten all the clamps. Allow the glued assembly to dry for at least 12 hours in the press before disturbing the clamps.

Clean up the veneered faces. You can sand the paper tape off if you like, but it's easy to remove if you dab each piece of tape with a wet cloth and allow a few minutes for the water to penetrate. Then it should scrape off easily with a cabinet scraper. It's a good idea to trim the edges of the veneer flush with the substrate so they don't catch on something and tear out. I usually scrape veneered surfaces with a cabinet scraper, then sand them to 180 grit with a palm sander, holding it flat to avoid sand-throughs.

Rabbet tongues on the top's edges. Use a router or tablesaw to cut the rabbets, and make sure the shoulder-to-shoulder dimensions are equal to (or just slightly less than) the inside dimensions of the leg-and-rail assembly. The tongue should slip easily, but not sloppily, into the rail grooves. Saw off the tongues at the corners where the top meets the legs. (See photo, left.)

Gluing Up the Table

Glue-up is easiest if you begin with the top upside down on your bench. First glue the end rails to the legs, then glue the two long rails to the sides of the top, and finally glue the leg-and-rail assemblies to the top and long rails. When applying glue to the loose spline joints, brush a liberal coat of glue into each mortise and a thin coat on all the tenon faces. Once the parts are assembled, turn the table upright on your bench for clamping.

You can attempt to clamp this assembly with a single, large band clamp, but I've found that pipe or bar clamps provide more pressure and more control over its direction. Use plastic clamp pads or scraps of leather to keep the clamps from marring the carved surfaces. If your bench is flat, you can use a framing square to check that the tips of the feet are in line with the knees above them. Alternately, you could use a piece of plywood with blocks of scrapwood tacked to it to hold the feet at exactly the right spacing while the glue dries.

Notching the leg. Saw inside your layout marks first (above), then chisel away the waste (below).

The Inlay Banding

The inlay banding (see drawing) serves two purposes—one aesthetic and one functional. Aesthetically, it provides a visual transition between the blond wood of the top and the darker leg-and-rail assembly. Functionally, it bridges any slight gaps in the glue line between the top and the rails. Here's how I suggest inlaying the banding:

Rout the grooves. I used a ⅛-in. straight router bit, guided by a template bushing, to cut the four ⅛-in.-deep grooves. To set up for routing, clamp a straight-edged piece of ½-in. plywood across the top of the table for each groove (see left photo, opposite page), making sure the router bit is centered on the glue line. The top is recessed ⅛ in. from the tops of the rails, so you'll need to place a ⅛-in. shim under the center of your plywood guide strip. The shim will keep the guide strip from deflecting as you move your router along it, changing the depth of cut. Begin and end the grooves about ¼ in. shy of the corners, and remove the rest of the waste at the intersections with chisels. (See center photo, opposite page.)

Make the banding. I made mine from some scraps of rosewood I'd been saving. I planed them down to the exact width of the grooves with my Inca planer, then I ripped them to about 5/16 in. on the tablesaw with a fine-tooth carbide blade. I suspect you can plane stock this thin with almost any of the small, high-rpm planers on the market (follow the manufacturer's instructions), but I wouldn't attempt it with a larger planer unless I secured the stock to a clean piece of plywood with double-stick tape. An alternative method is to rip both the thickness and the width of the banding on the tablesaw using a zero-clearance throat plate. Once I'd ripped the bandings, I cut them to length with a handsaw,

Grooving for inlay. Rout the inlay grooves with a plunge router and a straight bit, using a piece of ½-in. plywood as a template guide (left). Then chisel the corners to complete the groove (center).

Blending the curves. After gluing up the table, fair the inside curves of the legs and rails with a patternmaker's rasp.

then sanded the miters to exact length on the disc sander.

Install the banding. Glue the banding into the grooves with yellow glue, tapping the pieces into place with a small hammer. If the fit is snug, no clamping is necessary.

Details, Details

At this point, there's light at the end of the tunnel. Here's the list of remaining construction steps:

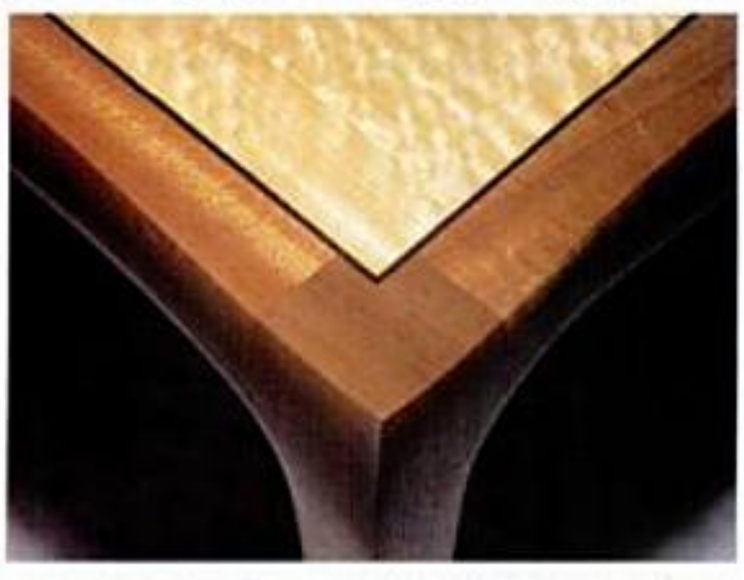
Scrape the banding flush. When using your scraper, make sure to bend it enough to avoid digging the scraper's corners into the veneer.

Shape the tops of the legs. These need to be carved to match the bevels of the rails. This is a bit tricky because you're dealing with end grain. I used the corner of a paring chisel to nibble away at the protruding ends of the legs until I had approximated the final shape. I switched to a scraper to smooth out the chisel marks, then I refined the contours with some 180-grit sandpaper on my palm-grip random-orbit sander. Use a feather touch here to avoid unwanted gouges.

Random-orbit sanders didn't exist when I built the earlier table, and frankly, I was amazed at how well the sander's round pad handled delicate, controlled sanding, even on the subtle contours of the legs and rails.

Shape the inner leg curves. Here, I started with a Nicholson #50 patternmaker's rasp (see Sources) to fair the curves. I cleaned up the rasp marks with 120-grit sandpaper wrapped around a leather pad. When I was satisfied with the inside curves, I used scrapers and 180-grit sandpaper to transition the rounded edges of the rails into the hard edges of the legs.

Finish sanding. Since I planned on applying an oil finish, I sanded the entire table to 320 grit with my random-orbit sander. Then I brushed on two thin coats of blond shellac (for more on shellac, see AW #34) and sanded again with 320-grit paper.



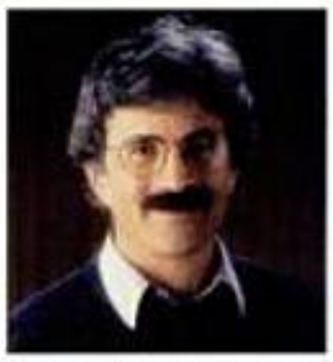
Bridging the gap. Inlay banding provides a visual transition between top and rails.

It's All Over but the Oiling

At the risk of seeming dyed-in-the-wool, I confess I'm still using the same oil finish I used on my mother-in-law's table in 1975: Waterlox "Transparent" (available at many paint stores or by mail from Rudy's, 4086 E. 71st St., Cleveland, OH 44105, 800-248-7839) wiped on with a rag. But I also like General Finishes "Sealacel," a similar formulation (available from Woodworker's Supply, 5604 Alameda Place NE, Albuquerque, NM 87113, 800-645-9292).

I thin the first two coats about 20 percent with naphtha and wet-sand the second coat with 400-grit wet-dry paper. Then I wipe on several more thin coats of undiluted Waterlox, letting each dry for at least six to eight hours before recoating. Finally, I rub the entire surface lightly with an extra-fine nylon abrasive pad and buff with a soft cloth.

Now, I wonder what to barter for this time.... ▲



ELLIS WALENTINE *is executive editor of AW.*

SOURCES

Veneers and perforated tape are available by mail from:

Certainly Wood
11753 Big Tree Rd.
East Aurora, NY 14052
(716) 655-0206 *Circle #622*

Constantine's
2050 Eastchester Rd.
Bronx, NY 10461
(800) 223-8087 *Circle #623*

Veneer saws and patternmakers' rasps are available from:

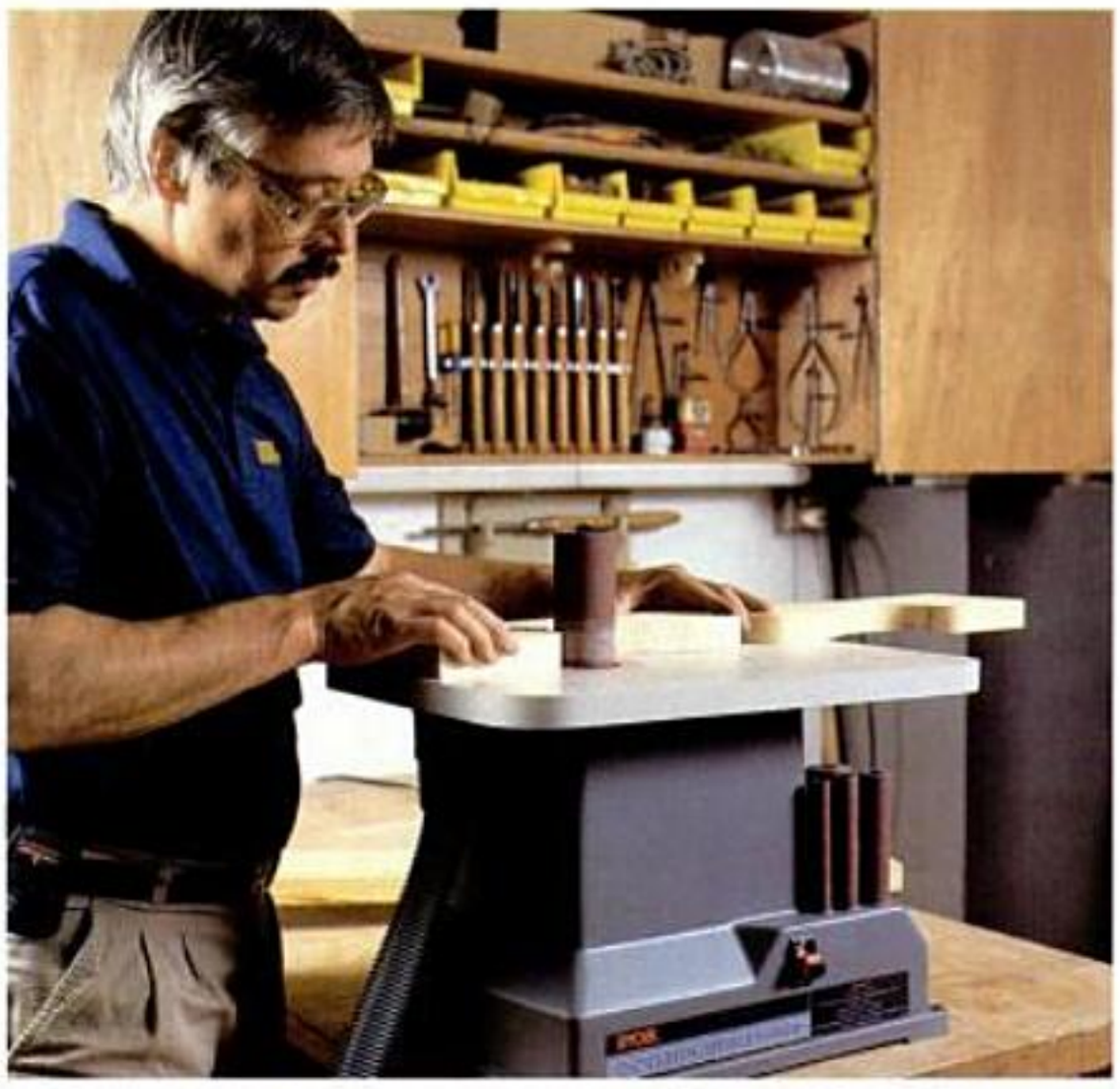
Garrett Wade
161 Ave. of the Americas
New York, NY 10013
(800) 221-2942 *Circle #624*

Highland Hardware
1045 N. Highland Ave. NE
Atlanta, GA 30306
(800) 241-6748 *Circle #625*

Buyer's Guide to Oscillating Spindle Sanders

We Test Eight Curve-Sanding Machines

By Dave Sellers



Up, down and around. These dual-motion machines are unmatched for sanding curves smoothly, and they minimize clogging of the abrasive and burning of the wood.

Oscillating spindle sanders support the contention that looks can be deceiving. These machines certainly don't appear impressive—all you see is a sanding drum projecting up through a work table. But try one out and you'll soon see that nothing beats them for sanding curved and contoured shapes.

The drum on an oscillating spindle sander moves up and down as it spins. This dual-motion action lets you use more of the sanding drum's abrasive surface than you would on a drum that just rotates. The result? An oscillating spindle sander removes stock faster and produces a smoother finished surface. It helps prevent burn marks on the wood, and the oscillating action prolongs abrasive life by minimizing clogging.

For all their attributes, oscillating spindle sanders have only recently made their way into small and medium-sized workshops. This is because these tools have traditionally been too large and too expensive for small-shop use.

Today, a handful of manufacturers have brought a new generation of downsized oscillating spindle sanders to the market at much more affordable prices. In the same way that portable planers brought planing capabilities to legions of small-shop owners, these new sanders promise to "oscillate" your sanding operations without busting your wallet.

To see how these oscillating spindle sanders perform, and to compare the brands currently on the market, we tested seven models that sell from about $175 to $895. (At this writing, Sears planned to introduce an oscillating spindle sander in early fall 1994; see "In the Works," page 78.) We also tried out a unit that converts your drill press into an oscillating spindle sander. (See sidebar, opposite page.)

We checked out each sander's power and construction quality. We also evaluated dust-collection capability and tested how easy or difficult it is to change sanding drums. One general finding stood out as we put these machines through their paces: Oscillating spindle sanders are hands-down winners over conventional drum sanders when it comes to sanding curved work. However, each model we tested had particular strengths and weaknesses. These findings appear with other key specifications in the chart on page 42. But before you dig into the details, let's take a look at how an oscillating spindle sander works.

Sander Anatomy

Oscillating spindle sanders are basically simple machines. A typical sander consists of a work table, a motor, a vertical metal spindle and an oscillation mechanism which produces the up-and-down motion. The machines come with rubber drums of different diameters which hold matching sanding sleeves. The drums and their abrasive sleeves fit over the spindle. All machines but the Vega have table inserts that correspond to drum sizes. This enables you to support the workpiece close to the drum—a distinct advantage when sanding small parts.

The units we looked at ranged from small benchtop machines such as the Ryobi to the substantial Enlon machine, which has the size and weight (340 pounds) of an industrial model. All the sanders run at about the same speed—from 1,700 to 2,000 rpm, with 60 to 75 oscillations per minute. Beyond these basic characteristics, there are some important differences to note.

Power—The key to these sanders' performance is their oscillating motion, but that wouldn't be worth much if they bogged down in action. For our power test, we sanded 6/4 pine and 8/4 maple, using an 80-grit sanding sleeve on the 2-in.-dia. drum

PHOTO BY JOHN HAMEL

Different drums. Mounting schemes vary for different machines. Sanding drums (far left, top and bottom) are the easiest to change. The Enlon (top right) and Vega (bottom right) have separate spindles for each drum size. The Powermatic (bottom center) has a mix of spindles and drums.

supplied with each machine. We smoothed rough bandsawn curves and also tried a "seat-of-the-pants" stall test, pressing the wood against the sleeves with more force than you'd ever use in real working conditions.

Sanding bevels is easier and more precise on a sander with a tilting table.

Although their amp ratings varied from 3.5 to 9 amps, surprisingly all our test sanders had enough power to handle the routine drum-sanding tasks we tried. While it was possible to stall the smaller sanders by pressing very hard against their drums, you'd probably burn the wood if you worked them that hard. So we rated each sander's power with a realistic workload in mind, and they all got high marks. (See chart.)

Changing Spindles, Drums and Sleeves—All the machines in our tests come with different drum and matching abrasive sleeve sizes. (The chart shows which sizes are standard and optional for each machine.) A wide selection of sizes is definitely an advantage, since it gives you more capability to match sleeve size to the curve of your workpiece. Enlon offers the largest variety, with 10 different diameters available. Vega only supplies three.

The ability to switch drum sizes and sanding sleeves quickly and easily is a real convenience. Here we found some important differences among our test units. (See photo, left.) The Clayton, Crouch and Ryobi machines use the simplest scheme: A single metal spindle holds each machine's full selection of drum and sleeve sizes. To change sizes, you just remove a top nut and washer, lift off the drum and sleeve and replace these with another set. You can also leave the drum in place and change only the sleeve, as when switching to another grit.

The Enlon, Vega and Powermatic machines require more work to change drum sizes. On the Enlon, small-diameter sanding sleeves slip directly onto a spindle instead of a rubber drum. To switch to larger sizes, you have to unscrew the spindle with two wrenches and replace it with a different spindle and sleeve. On the Vega machine, you first raise the table, then loosen the spindle with an Allen wrench in order to replace it with another size. The Powermatic Artisan's drum-changing scheme includes both different-sized spindles and different-sized drums, and it's equally time-consuming.

Dust collection is incorporated into the design of all sanders but the Vega. With a shop vacuum hooked up to the Ryobi's dust collection port, sawdust is efficiently sucked down past the table insert.

Overall, we found it much easier to change drum sizes on the sanders

PHOTOS BY DAVE SELLERS

O.S.S. FROM YOUR DRILL PRESS

With its motor-driven crank and push-rod assembly, this kit converts a drill press to an oscillating spindle sander.

Retired machinist Gene Paules invented a setup that adds oscillating action to a drill press fitted with an ordinary sanding drum, which we covered in AW #30. Since then Paules has refined his creation, and he now offers it as a kit.

The kit has a small motor that drives a push rod, which is attached to one of the drill-press spokes. As the rod moves back and forth, the quill moves up and down, creating the oscillating action. You can adjust the stroke length from about ⅛ in. to ⅝ in. by changing the position of the rod on the spoke—a feature not found on any other sander we tested. To switch from sanding to ordinary drilling, you just lift the rod off a special mount on the spoke.

Installation takes about 20 minutes, and the sanding action worked great for us. Since you can change speeds on the drill press, you can slow the sanding drum down to avoid burning the wood, or speed it up when working with a small-diameter drum. And you can save money by using a sanding drum that accepts bulk sandpaper instead of buying ready-made sanding sleeves.

The kit includes plans for making the auxiliary dust-collection table shown in the photo.—*D.S.*

Kit is $169, from G.P. Designs, Inc., 24 Willard Rd., Shelton, CT 06484, 203-929-8158.

OSCILLATING SPINDLE SANDERS

	Name & Model	Clayton 140 (BENCH) (800) 971-5050 Circle #610	Clayton 106 (STAND) (800) 971-5050 Circle #610	Crouch 290-4.5 (STAND) (800) 334-1948 Circle #611	Enlon EN3407 (STAND) (800) 888-9697 Circle #612
					
	Street Price	$625	845	895	565
EVALUATIONS[1]	**Power**	●●●●●	●●●●●	●●●●●	●●●●●
	Construction Quality	●●●●◖	●●●●◖	●●●●◖	●●●●●
	Ease of Changing Drums	●●●●●	●●●●●	●●●●●	●●●●
SPECIFICATIONS	**Drum Length (in.)**	4½	9	4½	5 (1 drum) / 6 (3 drums) / 9 (6 drums)
	Stroke Length (in.)	¾	¾	¾	1½
	Maximum Sanding Height (in.)	3⅝	7¾	3½	4 / 5 / 8
	Drum Diameters[2] (in.)	**½, ¾,** 1, 1¼, 1½, **2,** 2¼, 2½, **3**	**¾, 1,** 1¼, 1½, **2,** 2¼, 2½, **3**	**¾, 1,** 1¼, 1½, **2,** 2¼, 2½, **3**	**¼, ⅜, ½, ⅝, ¾, 1, 1½, 2, 3, 4**
	Table Size & Tilt	14 x 21 No Tilt	17 x 21 No Tilt	17 x 21 No Tilt	24 x 24 45° Down, 30° Up
	Table Material	10-Gauge Steel Plate	10-Gauge Steel Plate	10-Gauge Steel Plate	Cast Iron
	Motor HP/Amps	½ / 9	½ / 9	½ / 9	1 / 14[3]
	Weight (lbs.)	75	105	98	340
	Comments	Sits solidly on bench; all drums fit single spindle; sealed oil-bath oscillation unit; available without table for mounting under bench (Model 135, $545); also available with 9-in. spindle (Model 146, $685).	All drums fit single spindle; sealed oil-bath oscillation unit; also available with 4½-in. spindle (Model 100, $785).	All drums fit single spindle; sealed oil-bath oscillation unit; also available with 9-in. spindle (Model 290-9, $995).	Sturdy machine for heavy-duty work; two wrenches required to change spindles; each drum has own spindle; oil-bath oscillation unit.

[1] **KEY TO RATINGS SCORE:** ● =Unacceptable; ●● =Poor; ●●● =Fair; ●●●● =Good; ●●●●● =Excellent.
[2] Standard sizes shown in colored type. [3] Can also be wired 220V @ 7 amps.

with single spindles (Clayton, Crouch and Ryobi) than on machines that required wrenches to remove and replace spindles.

Construction Quality—You might not think of an oscillating spindle sander as a precision machine, but precision matters if you want a surface that needs only minimum work before finishing. Our quality test included checks for spindle runout (wobble), table flatness, and spindle perpendicularity to the table. We also measured spindle deflection under a 20-pound side load. These results were combined to get the "Construction Quality" rating shown in the chart above.

Excessive spindle runout will cause the sanding drum and sleeve to "chatter" against the work, preventing smooth operation. That's precisely the result we observed on the Vega sander, which had a runout of 0.035 in. The Powermatic unit had the next highest runout at 0.012 in. The runout on the other machines ranged from a low of 0.0015 in. (Enlon) to 0.007 in. (Clayton 140). These sanders worked smoothly, with no objectionable vibration.

If you want a square edge on the part you're sanding, you need a flat table that's perpendicular to the spindle. The Vega's table was crowned about 1/16 in. in the middle.

The Ryobi and Enlon sanders had perfectly flat tables and perpendicular spindles, and the Powermatic,

PHOTOS BY JOHN HAMEL

Powermatic Artisan 14 (BENCH) **(800) 248-0144** Circle #613	**Ryobi OSS450** (BENCH) **(800) 323-4615** Circle #614	**Vega 053** (BENCH) **(800) 222-8342** Circle #615
		
300	175	350
●●●●◖ ●●●● ●●●	●●●●◖ ●●●●◖ ●●●●●	●●●● ●●◖ ●●●●
5½	4½	3
⅞	⅝	¾
3 9/16	3 11/16	2
¼, ½, ¾, 1½, 2, 3	**½,** ¾, **1,** 1½, 2, 3	**½, 1, 2**
14⅝ x 14⅝ 45° Up	20 x 14 No Tilt	12 x 16 45° Up, 10° Down
Cast Iron	MDF w/Plastic Laminate on Both Sides	Particleboard w/Plastic Laminate on Top Only
½ / 9	½ / 3.5	¼ / 6
77	26	40
Unit has high table, works best on low bench; two wrenches required to change spindles.	Best dust collection; all drums fit single spindle; includes mounting holes for screwing to bench.	Largest spindle runout; top-heavy unit; Allen wrench required to change spindles; no table inserts; no dust collection.

Clayton and Crouch machines were only a hair off. The steel tables on these last two machines can be adjusted for flatness by shimming their mounting bolts.

In our spindle deflection test, the Clayton, Crouch and Enlon machines led the pack with readings under 0.010 in. The Powermatic and Ryobi deflected 0.018 and 0.020 in., respectively, while the Vega bent 0.070 (or slightly more than 1/16 in.). If you're planning to do a lot of heavy work in thick stock, we recommend choosing a machine with a low deflection reading.

We weren't able to run the sanders long enough to predict their service life. But we would expect longer life from the Clayton, Crouch, and Enlon machines because these models have oscillating mechanisms that run in an oil bath.

Special Features—If you work with big, curved pieces, you'll appreciate a sander with a **large table surface** that can support the stock while you maneuver it around the drum. (See chart for table sizes.) The Enlon has the largest table in the group, and the Vega's table is the smallest.

A handy feature on the Enlon, Powermatic and Vega sanders is a **tilting table** that lets you sand bevels and chamfers more easily. (See photo, page 41.) The Enlon and Powermatic models have table inserts with elliptical holes to accommodate the drum when the table is tilted. The Vega machine doesn't accept inserts; instead, it simply has an elongated hole in its table.

All machines except the Vega have **dust collection** ports for connection to a shop vacuum. We hooked up a shop vacuum to the sanders during our tests and found that dust collection was effective on all models. The benchtop Ryobi sander worked the best (see photo, page 41), but it made a whistling sound when the vacuum was turned on.

The Last Word

These machines cover such a broad range in terms of size and cost that your best bet will depend on the type of work you expect to do, and on your tool budget.

The Clayton and Crouch machines run smoothly and offer the advantage of easy drum-changing; we would recommend them for any use, from hobbyist to small production shops. But after looking over our test results we picked the Enlon EN3407 as our Editors' Choice. It has power to spare, a tilting table, 10 standard drum sizes, solid construction quality, and an attractive street price of $565. Its massive weight dampens almost all vibration and would only be a drawback if you needed to move it frequently.

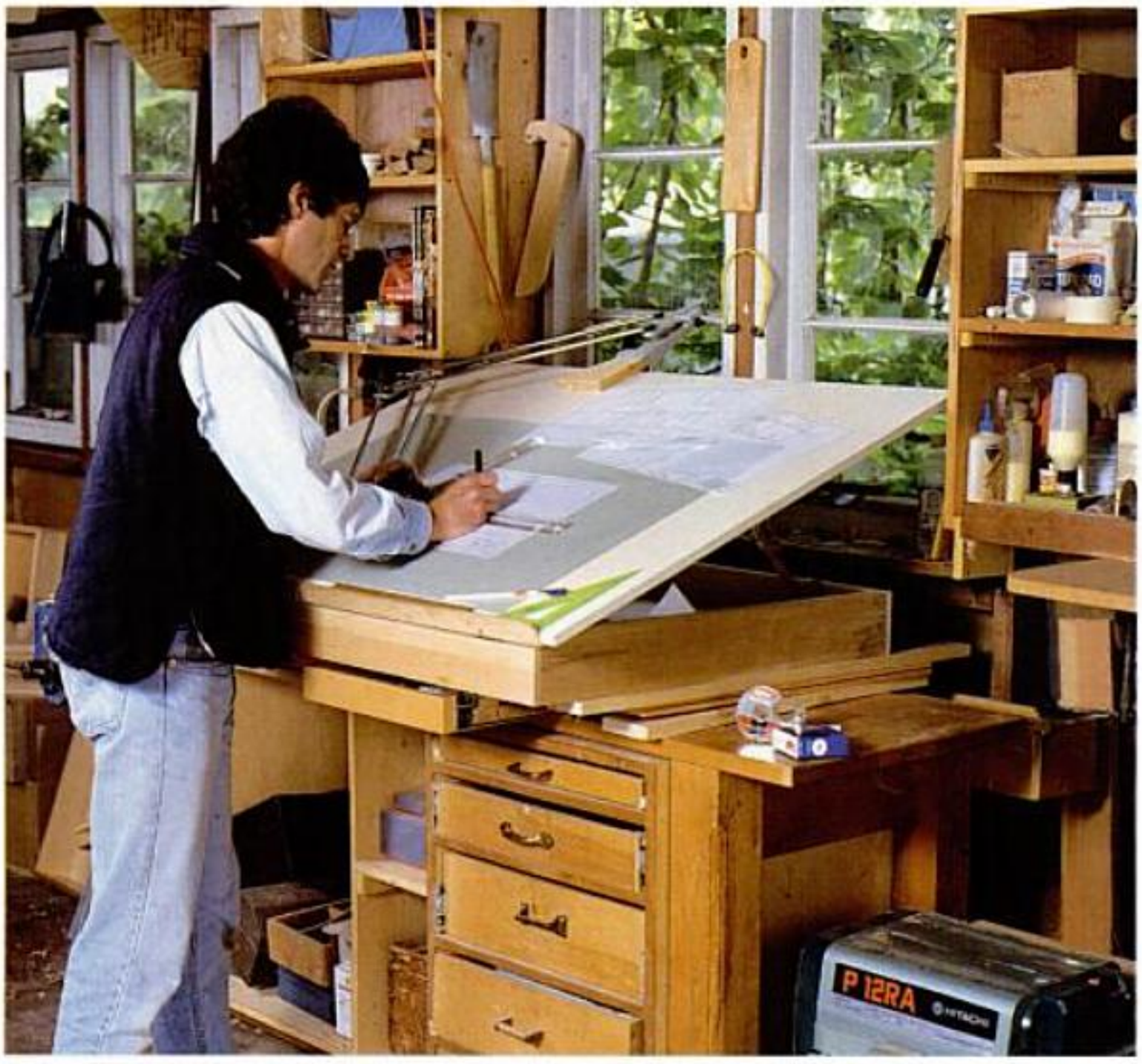
The Best Buy award goes to the Ryobi OSS450, which also scored high in construction quality, power, and drum-changing convenience—all this at the unbeatable street price of $175. ▲

DAVE SELLERS *is an assistant editor of AW.*

FROM CONCEPT TO CUTLIST

For This Shop Veteran, Trouble-Free Projects Start At the Drawing Board

BY JIM TOLPIN



A little time invested in full-size working drawings saves you time, wood and headaches when you start cutting.

PHOTOS BY CRAIG WESTER

Many craftspeople consider the drawing stage of project development to be the most tedious part of woodworking. We are anxious to work with our tools, eager to manipulate fragrant chunks of solid wood into functional and beautiful three-dimensional objects. We often find ourselves exclaiming, "By the time I get these drawings done, I could have built the darn thing!"

But creating a set of plans for an original piece of furniture need not be laborious or time-consuming. With the right techniques and a little bit of practice, the process can not only go smoothly—it can be a whole lot of fun.

I'll start by showing you how to put your artistic visions down on paper. From there, I'll tell you how to make scaled working drawings and full-scale renderings. It is from these life-size drawings that direct measurements can be taken and cutlists developed.

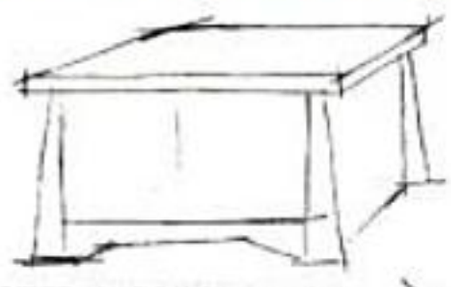
Concept Sketching

This is the fun part, where you get your first look at the project you're going to build. When you sketch, feel free to draw whatever comes to mind or pencil; don't worry about crisp lines, symmetric angles, fair curves or proper perspectives. Don't worry about proper proportion either.

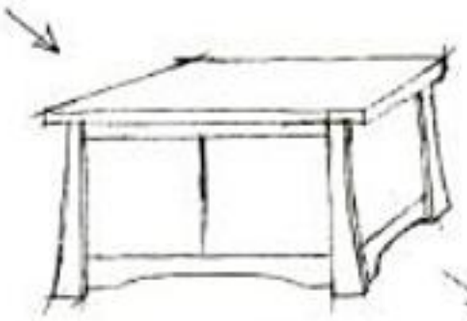
Be prepared to commit a good chunk of time to concept sketching, because it's your best opportunity to work out most of the bugs in the overall look of a piece. Refining the concept now with a series of sketches can save you a lot of time later on. Once you start producing scale drawings, corrections become so time-consuming that you may be tempted to live with a design that doesn't entirely please you.

To create concept sketches, use a soft pencil and easily erasable drawing paper. Don't sketch on sheets of paper taped to a drawing board: The straightest lines and most graceful curves come from a horizontal wrist motion, so you want the freedom to move the paper rather than the angle of your hand.

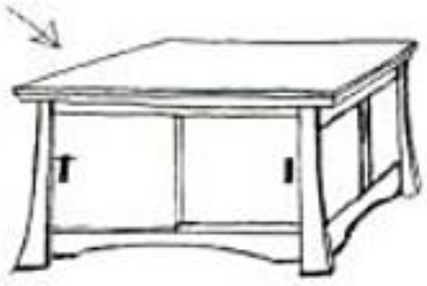
FIG. 1: DEVELOPING A CONCEPT SKETCH



STEP 1: Block out the overall form.



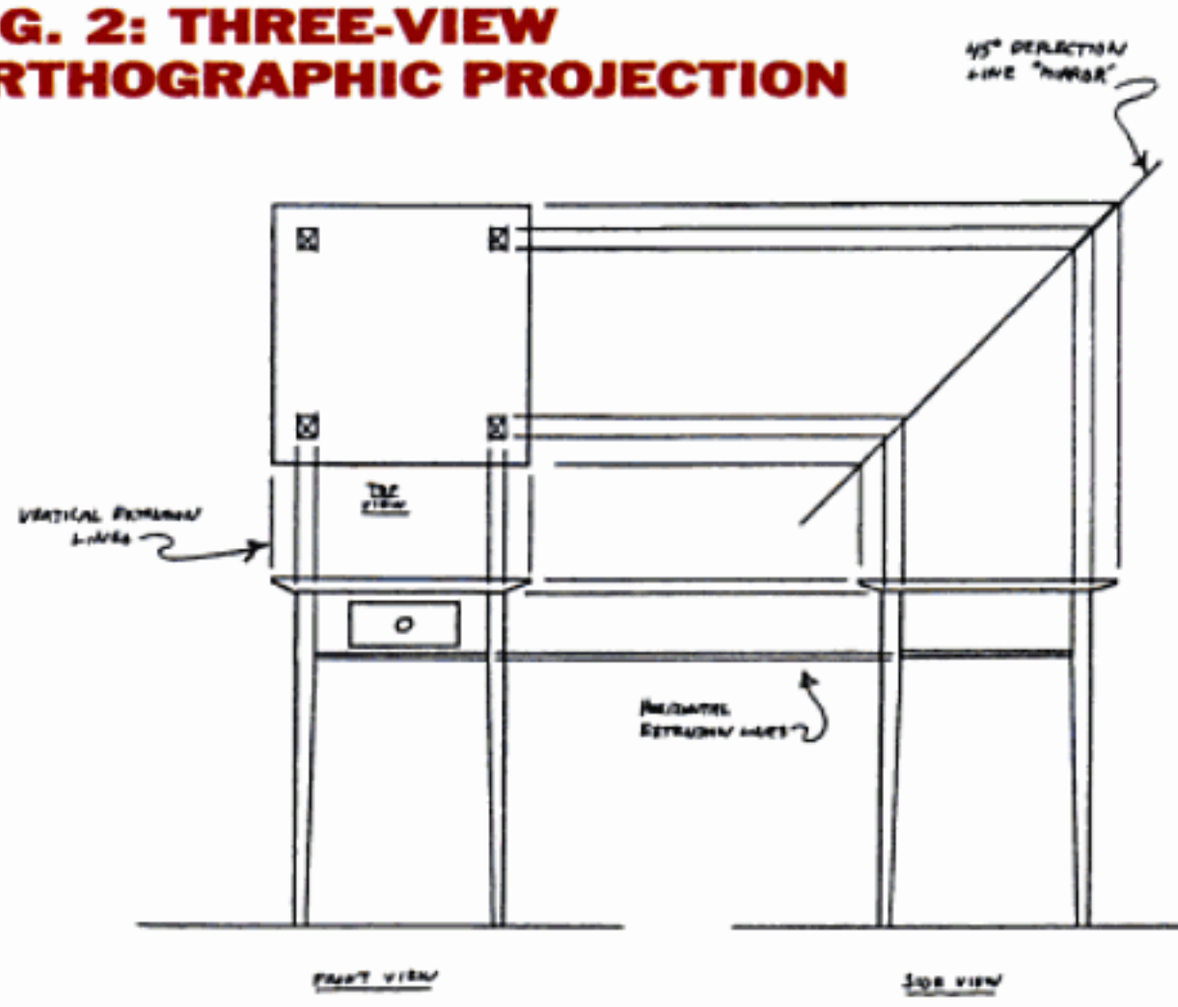
STEP 2: Commit the form with darker lines and begin to fill in the details.



STEP 3: Flesh out the form with the final detailing.

ILLUSTRATIONS BY JIM TOLPIN

FIG. 2: THREE-VIEW ORTHOGRAPHIC PROJECTION



A useful technique when you're sketching a complex project is to first block out the major parts of the form with light lines. Keep erasing and redrawing these lines until the overall proportions of the piece look right to you. Then continue to work on the sketch by filling in the details. (See Fig. 1.)

When trying to decide among a variety of design options, you may find it helpful to create a "what-if" series of sketches. These sketches show the same form enhanced by a variety of different details. Instead of redrawing the basic form over and over again, trace it from the original sketch using a piece of translucent paper such as vellum. Leave out the areas that will be changed in the "what-if" views. Now fill in the new design details and compare to the original sketch.

When you've refined your sketches to the point where you're ready to commit dimensions to the concept, it's time to switch over to drafting. At this point you no longer have need for spontaneity. Instead, you must now produce solid information set out in scaled drawings with numbered dimensions. These will be your working drawings.

Working Drawings

Working drawings define your concept with scaled dimensions. They show you how the various views and details of the piece relate to one another in true proportion. This gives you a chance to fuss about and adjust things on paper before you start cutting into the wood (a less erasable proposition). When everything looks right, you'll use these drawings to create cutlists for the components of the project.

The first working drawing I produce for a project is a three-view *orthographic projection*. (See Fig. 2.) This drawing, rendered at a reduced scale (usually one-quarter of full size), shows face-on views of the front, side and top of the piece as individual views.

To see what these views look like in actual relationship to one another, I next draw an *isometric projection*. (See Fig. 3.) This drawing provides an aerial quarter-view of the elevations assembled together. Unlike a perspective drawing, this type of projection does not distort or foreshorten any of the views. And because all the lines are drawn parallel and to their true scaled dimensions, it is much easier to draw than a perspective.

Except when I'm designing the simplest of projects, I go on from these reduced-dimensioned drawings to produce a full-scale, three-view drawing. Seeing the piece at its actual size, I can now tell with greater confidence if anything is still amiss with the design. In the past, all too often I have found that proportions and details which looked great in a reduced scale simply didn't work when built to their true dimensions.

Drawing a project in full-scale also gives me a way to obtain direct measurements for dimensioning components, molding profiles and joinery. This virtually eliminates the kinds of errors that may creep into a project when I work only from dimension numbers on a reduced-scale drawing.

From Concept Sketch To Three-View Drawing

Don't start drafting until you have a clear mind and a clear table: You'll need plenty of room in both places.

Begin by taping a large sheet of vellum (42 in. wide by 32 in. high is usually adequate) to the drafting surface. Choose the concept sketch (or combination of sketches) whose form and details you wish to commit to the three-view drawing, and tape them to the top of the drawing board

FIG. 3: ISOMETRIC PROJECTION

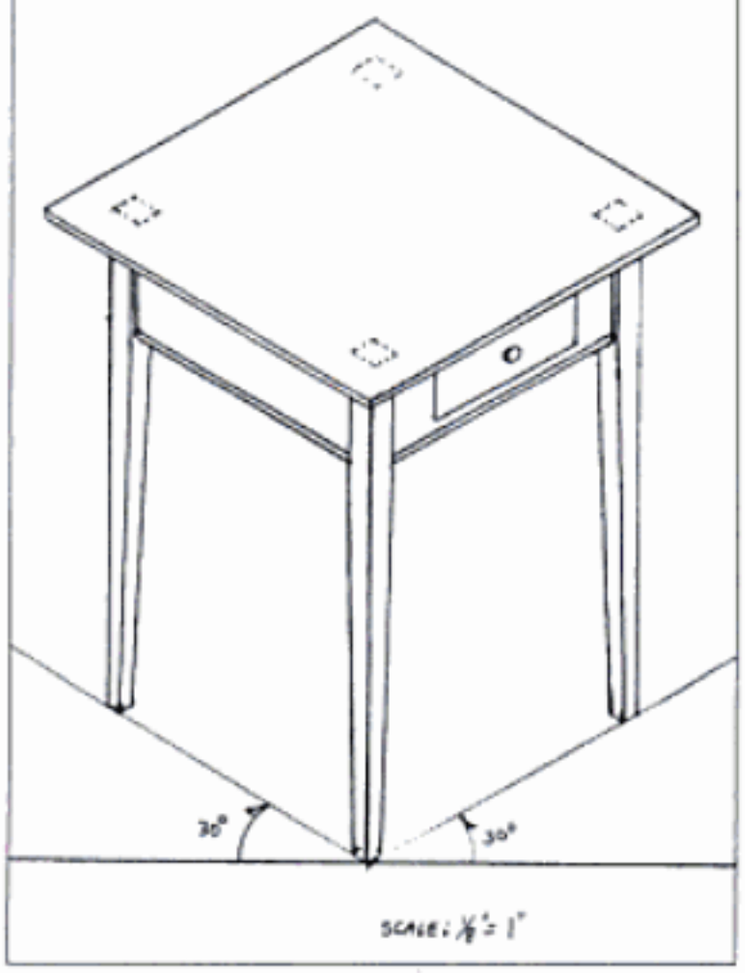
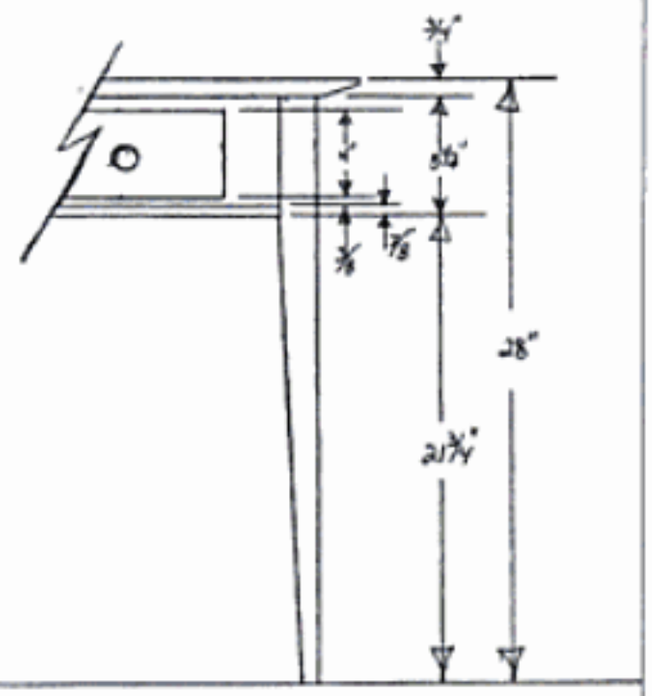


FIG. 4: SETTING IN DIMENSION LINES



Draw overall dimension (here, total height) to the outside of all other dimensions. Keep smallest dimensions closest to the object.

for easy reference.

Quarter scale (¼ in. = 1 in.) works well for most furniture projects. It lets you fit all three views onto one sheet of paper while allowing adequate space to define details clearly. For unusually large projects you may need to downsize to one-eighth scale; in this case, draw complex details to a larger, more legible scale in a separate drawing.

After outlining the three views, fill in any details shown in the concept sketches. I generally don't bother to draw in underlying structures and joint details in three-view drawings if I intend to produce a full-scale rendering of the project later on. But if I *do* want to show the internal structures in the three-view drawing, I'll do this by drawing two sections of the piece, one horizontal and one vertical.

It is absolutely essential to completely describe the three views with dimensions. Work your way out from the smallest elements of the components, to the components themselves, to the final dimension line indicating the overall size of the structure. (See Fig. 4.) Be thorough, so you don't have to constantly dig out a scale ruler when using the working drawing to develop a cutlist or when transferring measurements to a full-scale drawing.

FIG. 5: BILL OF MATERIALS

BILL OF MATERIALS Page 1

Job: *Shaker end table*

Symbol	Part	Quan.	Dimensions (in.) Width	Length	Stock Solid	Ply
A	Top	1	21	21	¾ C	
B	Legs	4	1⅜	27¼	1⅜ M	
C	Aprons	4	5⅛	15	¾ M	
D	Drawer Face	1	4	9	¾ M	
E	Drawer Sides	2	3⅛	16	½ P	
F	Drawer Back	1	3⅛	8⅛	½ P	
G	Drawer Bottom	1	7⅛	15⅛	¼ M	

C = Cherry M = Maple P = Pine

Developing Full-Scale Working Drawings

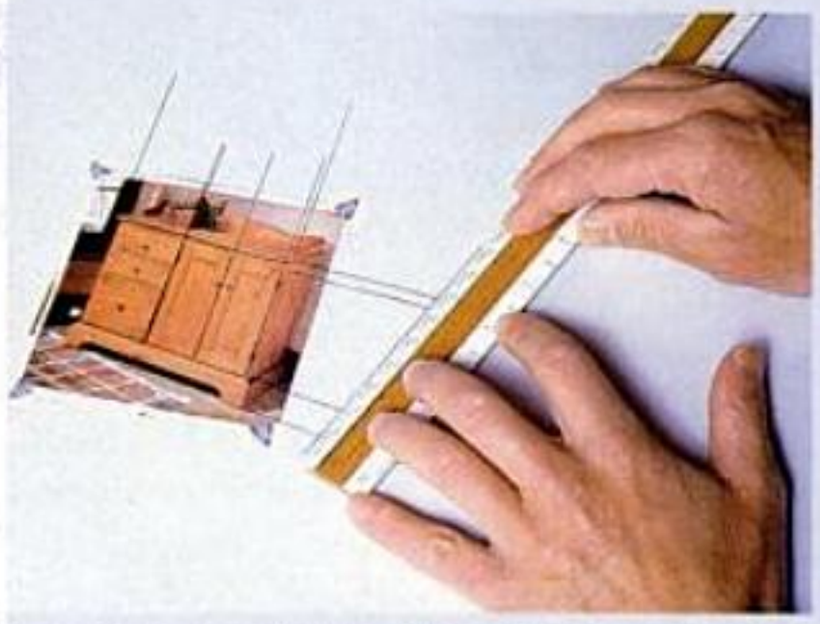
It would be nice if you could take a scaled three-view working drawing and run it through a copy machine to blow it up to full size. Actually, I've tried this, only to discover that the drawing was just not accurate enough. Most machines in use today distort the images by as much as ¼ in. when blowing up a quarter-scale drawing to full size. Until they come up with a distortion-free copy machine, I'll continue to make full-scale working drawings.

Start by taping butcher's paper or rolled tracing paper to a smooth piece of plywood larger than the size of the project. Then, using a long straightedge, lightly pencil in a baseline as close to the bottom of the paper as possible (assuming the baseline represents the floor). Now, place a centerline where you wish to center the front view. Draw the centerline square to the baseline. Use a set of trammel points as a large compass to construct a perpendicular.

WORKING DRAWINGS FROM PHOTOS

It is possible to develop working drawings from a photograph or from a sketch in a catalog. It helps if the photograph was taken from a point slightly above and to one side of the piece. The resulting image then gives you an aerial view of all three sides of the piece.

You must somehow predetermine the overall height, width and depth of the piece. If the photograph or sketch is from a catalog or design book, the dimensions are often given in a caption. Otherwise you'll have to make an educated guess based on standard dimensions for the particular type of furniture. If you're lucky, the photograph gives clues to the piece's overall size. For example, I derived the dimensions for a Stickley bookcase from a picture in a catalog by using the height of the encyclopedias posed on the shelves as a scale reference. I found a scale on my architect's rule that measured the books at about 9 in. (which I assumed standard for these books), and then I used this scale to find the overall width and height of the bookcase. I guessed the depth of the case based on the depth of the books on the shelves.



With a photo taped to a piece of vellum, author uses an architect's rule laid across horizontal extension lines to read off the heights of the doors and drawers. Angling the rule aligns the overall height on the ruled scale with the base and top extension lines.

To dimension a piece from a photograph, tape the picture to the center of a piece of vellum fixed to a drawing board. Then extend the outside height and width lines onto the vellum.

To dimension the heights of elements such as drawer faces and doors, lay an architect's rule across the extended overall height line and baseline. Since you've already determined the height of the piece, find a scale that shows the height between these two lines. You'll probably have to tilt the ruler to get it to read this number on one of the scales. Now draw a line at the angle the ruler makes with the extension lines. Extend the height lines of the doors and drawer face until they intersect the ruled line. Read the height of these elements directly by using the ruler to measure between the intersection points along the ruled line.

To find the width of the elements, extend lines up vertically from the drawing. Now follow the same procedure with the architect's rule as described above. Once all the elements have been dimensioned, you can create a three-view drawing in the scale of your choice. —*J.T.*

Lay out the full-scale's three views. If the project includes an irregular curve, overlay the curve on the scale working drawing with a grid of ¼-in. squares. Also create a 1-in.-square grid on the full-scale drawing in the area where this curve is to appear. Transfer the intersection points of the curve on the ¼-in. grid lines to the 1-in. grid on the full-scale drawing. Then connect the intersection points with an adjustable curve tool or a batten stick.

To show underlying structures on full-scale drawings, I usually draw them in with a pencil of a different color. This is much faster, and less visually confusing, than covering the drawing with dashed lines.

Getting Started With Cutlists

The first step in developing cutlists that tell you exactly how and where each piece of wood is to be cut is to generate a *bill of materials* from the working drawings. Get this information by reading the dimensions written on the scale three-view drawing or by measuring directly from a full-scale drawing.

The bill of materials format is a good way for you to list the parts. Note that each part is represented by a symbol, usually a letter. (See Fig. 5.) After recording each part in the bill of materials, circle the part in the drawing to show that it has been recorded.

Enter the widths and lengths in the bill of materials to the full dimensions of the pieces. This way, you'll allow sufficient material for tenons, tongues and overlaps. Unless you note otherwise, let the length run with the grain of the wood.

FIG. 6: MASTER CUTLIST

MASTER CUTLIST Page 1

Job: *Shaker end table*

B Legs (1⅜-in. Maple) 3⅛ in. W. 27¼ in. L. III	A Top (¾-in. Cherry) 21 in. W. 21 in. L. I
C Aprons (¾-in. Maple) 5⅜ in. W. 15 in. L. III	D Drawer Face (¾-in. Maple) 4 in. W. 9 in. L. I
E Drawer Sides (½-in. Pine) 3⅛ in. W. 16 in. L. II 8⅛ in. L. I	G Drawer Bottom (¼-in. Maple Ply) 7⅝ in. W. 15½ in. L. I

From Bill of Materials To Master Cutlists

Once the bill of materials is complete, double-check the working drawing to be sure all the symbols have been circled. Then compile the information onto a master cutlist.

Depending on the complexity of the project, you may need one master cutlist for solid stock and another for plywood components. The example in the drawing illustrates the way I would make up the master cutlist for the Shaker table project cited in the bill of materials sample. (See Fig. 6.)

In general, collate the components by parts function, listing the length of the parts underneath each width. (See Fig. 6.) Start with the widest and thickest stock, working your way down to the smallest pieces. This works in your favor later on when laying out the boards, as you generally want to account for the largest pieces first. The waste areas are then used for smaller components. Be sure to circle the part symbol on the bill of materials as each piece is recorded on the master cutlist.

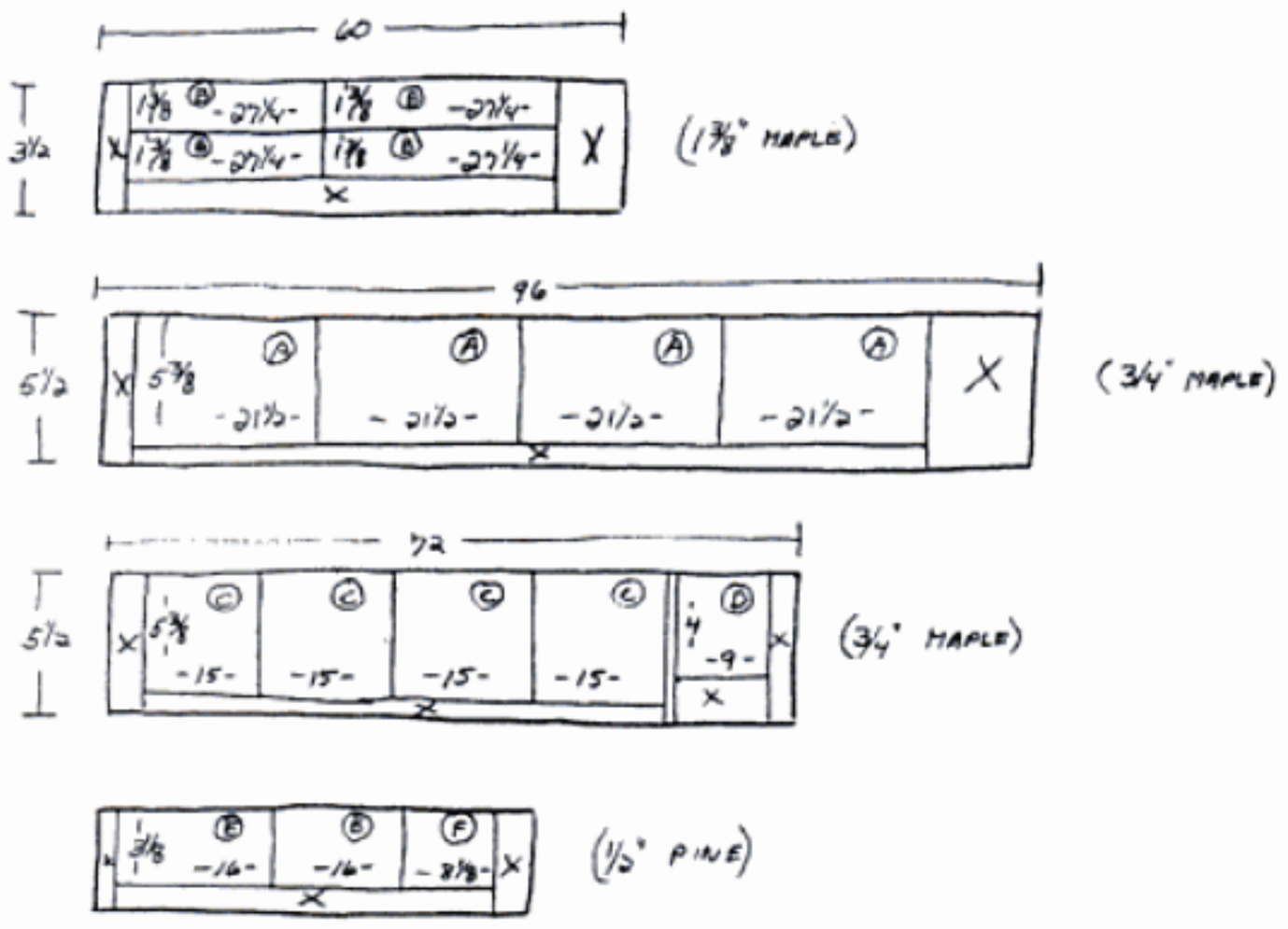
To the right of the lengths listed under each thickness and width I make "scratch" marks to indicate the number of pieces I need of this size. Don't use numerals for this; they could confuse you. As you lay out each piece later in "picture boards," account for it by making a scratch mark to the left of the length number. When the scratch marks are equal on both sides, you'll know you've laid out all the components of that size. Then draw a line through the length measurement.

From Master Cutlists To Picture Boards

After the master cutlists are done, I lay out the sizes of the components on picture boards, graphic pictures of the solid stock or sheets of plywood from which the pieces will be cut. (See Fig. 7.) When you do this, be sure to account for the kerfs (widths of the cuts), and for defects that must be cut around. If you devote some time and a bit of head-scratching to this process, you can minimize the amount of waste material. ▲

JIM TOLPIN *is the author of* Measure Twice Cut Once *(1993, Betterway Books, 1507 Dana Ave., Cincinnati, OH 45207), from which this article is adapted.*

FIG. 7: PICTURE BOARD LAYOUT FOR SHAKER TABLE

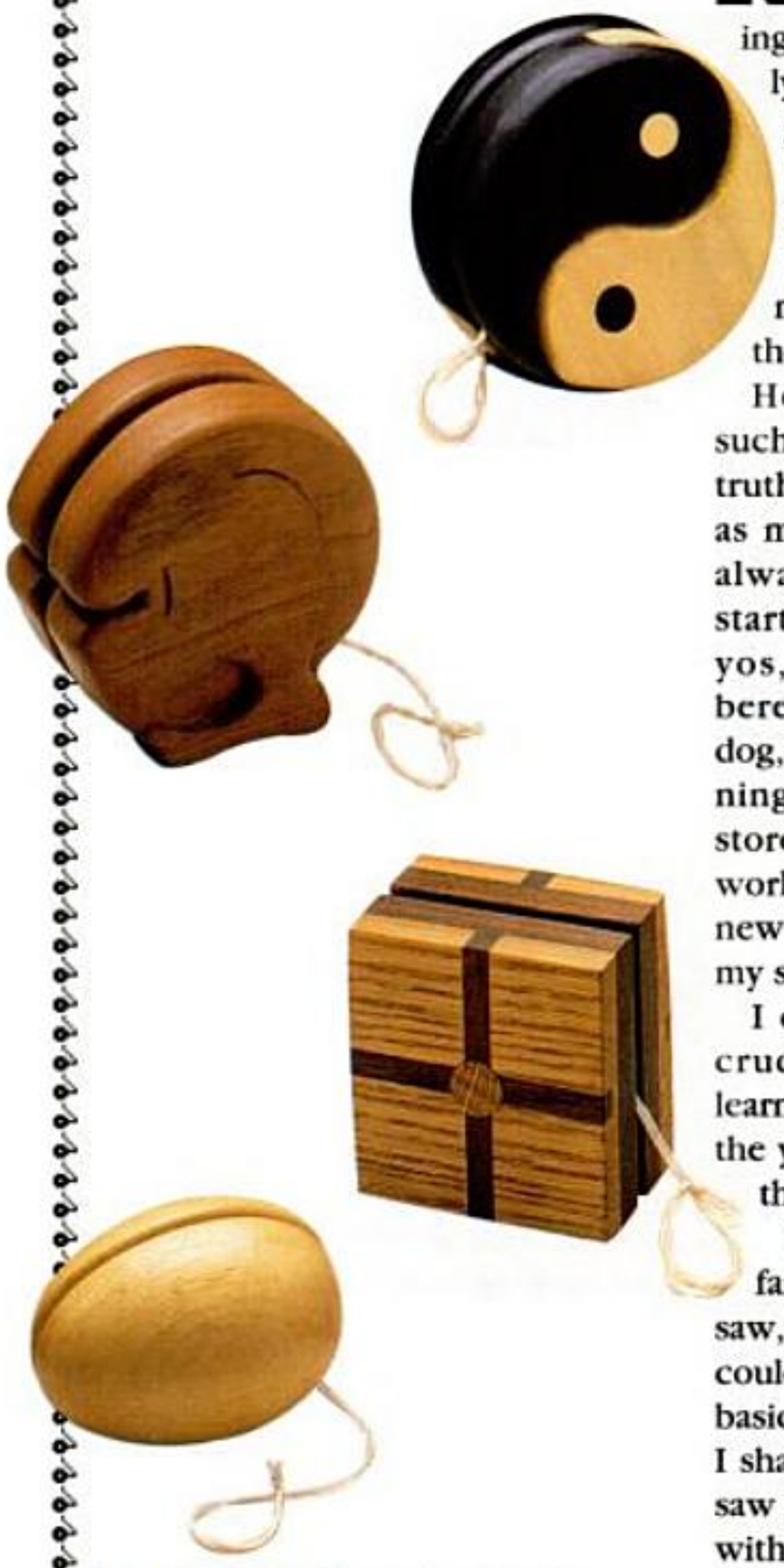


Yo-Yo Madness

Putting a New Spin on a Classic Toy

The "No, No!" Yo-Yo.

By Tom Crabb



A real spin doctor. The author's personal favorites (clockwise from top): Yin & Yang; Dunkin Yo-Yo; The Square Yo-Yo; The Egg Yo; Yo! Dude.

Remember the yo-yo of your youth? It's still around, surviving happily and somewhat amazingly in the world of interactive video games and other high-tech toys. In fact, according to Flambeau Corp., maker of the well-known Duncan yo-yo, there are currently more yo-yos than people here in the United States.

How does one explain such longevity? The simple truth is that yo-yos are just as much fun today as they always were. When I first started making wooden yo-yos, the kid in me remembered the fun of "walking the dog," "rocking the cradle," and spinning "around the world" with my store-bought yo-yo. And the woodworker in me was intrigued with a new way to utilize the offcuts in my scrap pile.

I experimented with a few crude wooden versions and learned that while it's simple to make, the yo-yo is a toy that can be taken to the brink of sculpture.

To make my yo-yos, I use familiar shop tools: bandsaw, tablesaw, drill press, and disc sander. You could also turn yo-yos on a lathe. The basic construction sequence is simple: I shape a block of scrap into a circle, saw it in half, then reattach the halves with a dowel glued into holes in the center of each half.

All the yo-yos in my collection were made following this basic sequence, but I made some interesting elaborations by combining different shapes and wood species.

To get the sweetest action from your yo-yo, there are a few points to keep in mind. Make the body round, and keep the halves the same size for balance. Also, stay with the sizes shown on the opposite page for the dowel's diameter and the outside diameter of the finished yo-yo. Using a dense hardwood such as maple or cherry will give you a slightly heavier and faster yo-yo compared to most store-bought varieties.

Of course, if humor is more important to you than function, you can shape the halves any way you please. My egg-shaped yo-yo *barely* works, and the square yo-yo is even better: It actually attacks your hand.

Before you glue the two halves together, finish-sand the yo-yo so it will feel good in your palm. Then glue in the dowel, and apply a couple coats of your favorite finish to keep the toy looking good over the years.

Now just tie on a piece of yo-yo string (available from Spectra Star, 350 E. 18th St., Yuma, AZ 85364, 800-327-5483), and spin like a pro. ▲

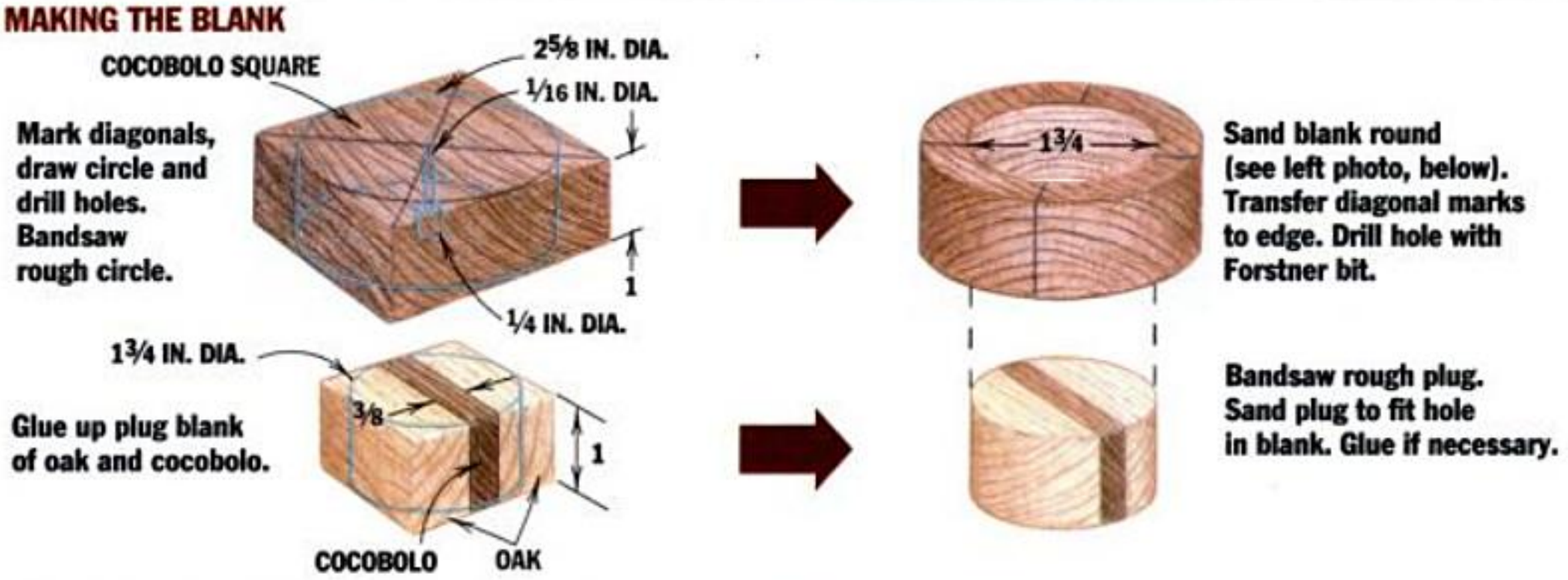
TOM CRABB *is a writer and furniture designer living "around the world" in Virginia.*

PHOTOS BY JOHN HAMEL

Making a "No, No!" Yo-Yo

Made from cocobolo and white oak, this distinctive double-disc has all the qualities of a functional yo-yo, with the addition of a comical theme: When parked with its center strip at a diagonal, it's the international sign for "no smoking," "no parking,"...or "no yo-yo-ing."

STEP 1: MAKING THE BLANK



STEP 2: ROUNDING THE EDGES

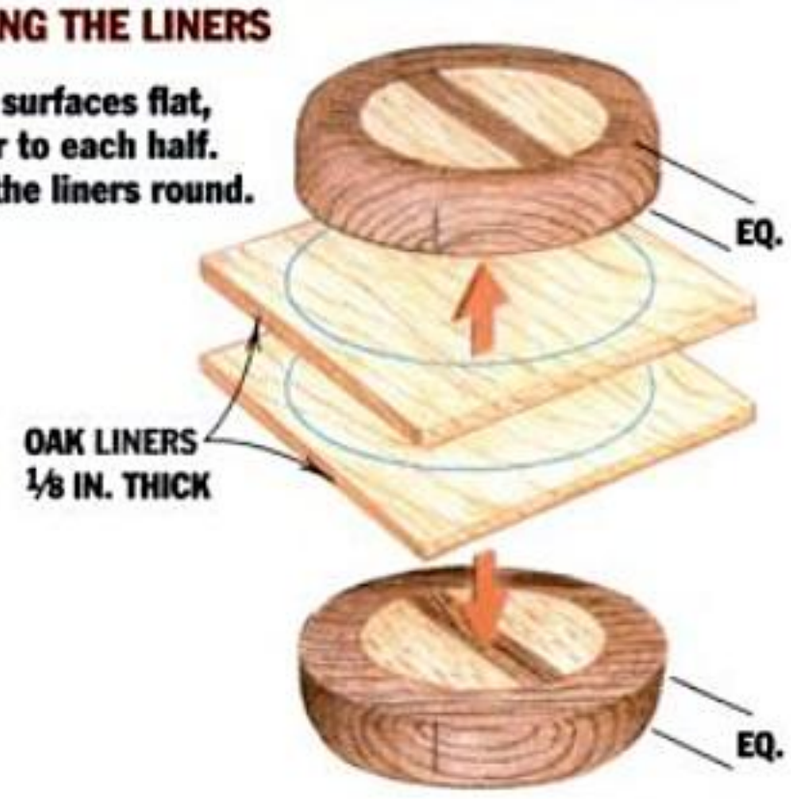
Rout top and bottom edges of blank. (See center photo, below.)

STEP 3: RESAWING THE BLANK

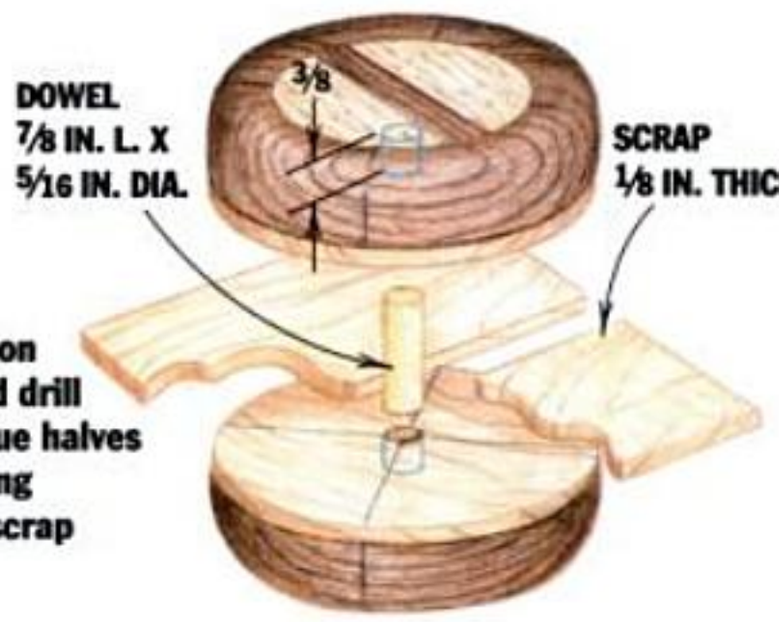
Bandsaw yo-yo in half. (See right photo, below.)

STEP 4: ADDING THE LINERS

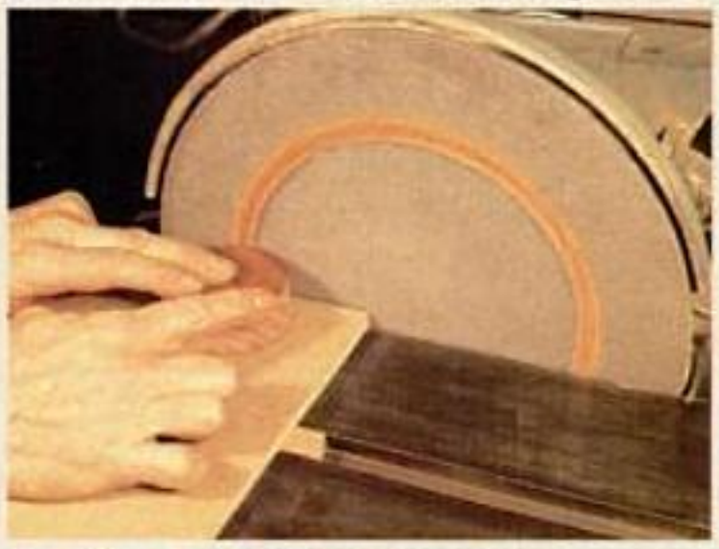
Sand the sawn surfaces flat, and glue a liner to each half. Saw and sand the liners round.



STEP 5: ASSEMBLING THE YO-YO



CRABB'S TECHNIQUES FOR MAKING YO-YOS



Sanding a perfect circle. Author rotates blank against disc sander, using a shop-made jig fitted with a ¼-in.-dia. dowel pin. Pin's center is 1 5/16 in. from the face of the sanding disc.

Rounding the edges. Crabb rotates the yo-yo counterclockwise on the router table, using a piloted ⅜-in. round-over bit. L-shaped fence provides three-point contact to keep work from spinning or kicking back.

Resawing the blank. Crabb clamps the blank with a handscrew to prevent it from spinning. After sawing partway into the disc, he inserts a shim into the saw kerf, adjusts clamp pressure over the shim, and saws the disc apart.

ILLUSTRATION BY MELANIE POWELL; PHOTOS BY TOM CRABB

Connector bolts

Blum KD fitting

Rastex

Haas KD
biscuit fastener

Tite-Joint fastener

Minifix fasteners

PHOTOS BY JOHN HAMEL

Knockdown Fasteners

Connections for Furniture on the Go

By Jim Barrett

For many woodworkers, knockdown fasteners represent a "Tinkertoy approach" to construction. After all, they argue, isn't the art of crafting crisp, tight joints what woodworking is all about?

Well, sure. But knockdown fasteners have an important quality that even fine craftsmen can appreciate: They make joinery reversible, and that's a necessity when you're making furniture and cabinetry meant to be taken apart and reassembled easily.

For example, if you're building shelving units and desks for people on the move, such as college students and apartment dwellers, knockdown fasteners are perfect. They also come in handy when constructing seasonal garden furniture, modular wall units, and temporary displays, or when you need to do final assembly of a project away from your shop.

There is a wide variety of knockdown hardware on the market. (See Sources, page 53, for suppliers.) And most of these fasteners are simple to install, requiring only a drill to make holes for the body of the fastener (a Forstner bit works well), and a screwdriver or Allen wrench to assemble the parts.

Choosing Knockdown Fasteners

The photos and drawings show a variety of knockdown fasteners which are grouped according to their mechanical operation.

Each type is designed for a particular kind of joint—edge to face, face to face, and so on. However, the type of

Quick-joining device

Trapeze fitting

Furniture connector

Keku fasteners: push-on (left), and suspension (right)

joint shouldn't be the *only* criterion you use when choosing a knockdown fastener. You also need to consider how tight the fastener must hold the two parts. If you need a fastener that can draw parts together in a strong, clamplike grip, then bolt-type and cam-type fasteners are better than surface-mount or biscuit fasteners, which merely hold the parts in position.

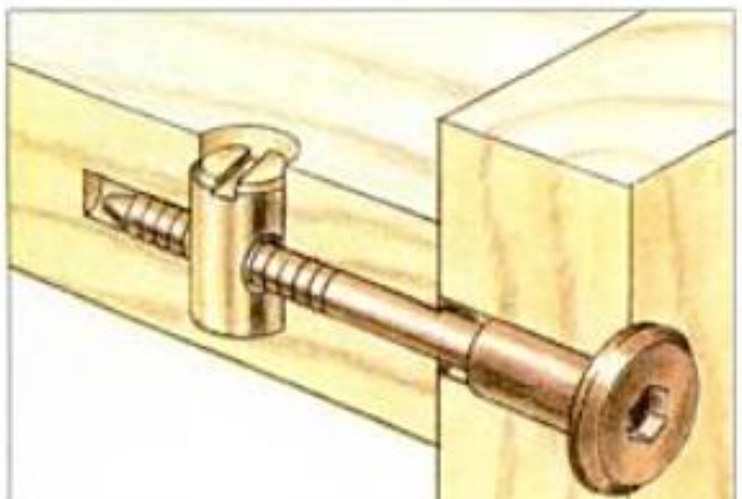
You'll also have to decide if you want a fastener that's inconspicuous when installed. The Minifix fasteners, for example, fit in recessed holes, which can be covered with a "decorative" press-fit plastic cap.

Here you'll find my picks for the cleverest knockdown fasteners and their best uses. I hope this list gives you ideas on incorporating knockdown fasteners in your work. They're really worth trying.

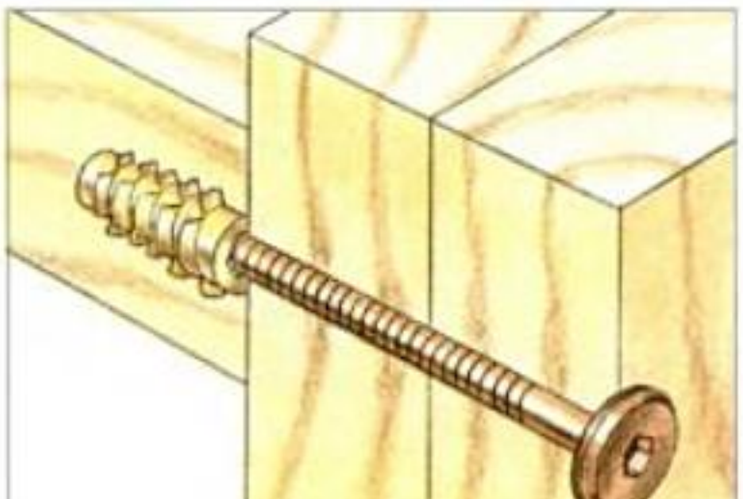
Types of Knockdown Fasteners

Connector bolt fasteners are specially designed bolts and nuts which

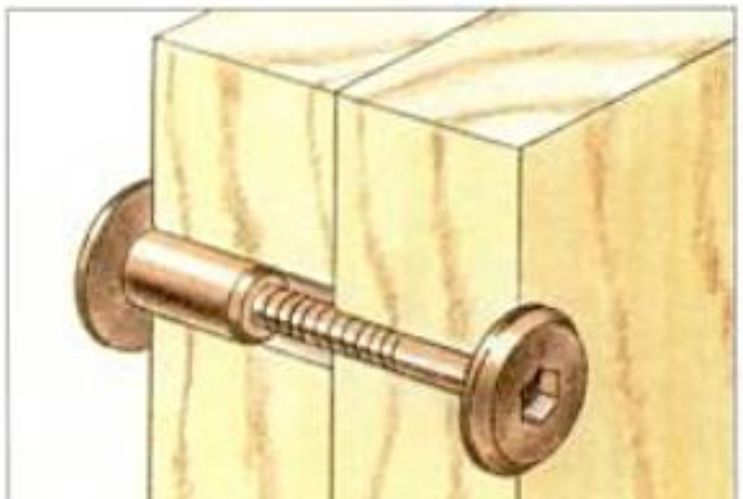
CONNECTOR BOLTS



Connector bolt with cross dowel



Connector bolt with insert



Connector bolt with cap nut

ILLUSTRATIONS BY MARIO FERRO

draw two parts together under tension. They come in different configurations for different uses and can handle a heavier load than other knockdown fasteners.

Most connector bolts have a thin, flat head with a hex socket and either a straight or shouldered shank. (See previous page.) The nut can take various forms, including a flat-headed cap nut which tightens with an Allen wrench. This is good for joining panels face to face, as in tying together the sidewalls of cabinets or bookcases. Also available is a metal cross-dowel nut that fits in a hole drilled perpendicular to the bolt. This makes a strong edge-to-face joint (see previous page) and could be used to fasten bed rails to posts, for example.

Connector bolts also can be used with threaded inserts, though you wouldn't want to try this in soft materials like particleboard where a tight connection could pull an insert loose. Connector bolts and nuts can be made of steel, brass or plastic.

Cam-type fasteners are a good choice if you need to disassemble the parts of your piece rather quickly. They have a "quick-disconnect" feature that unlocks the parts with a simple twist of a screwdriver. These fasteners consist of a cylinder with a slotted cam. As you turn the cylinder, the cam pulls on a rounded head on the end of a bolt to tighten the parts. You'll need a Forstner bit to drill the recess for the cam.

Cam fasteners are good for edge-to-face joints. They will draw the parts together, but not as tightly as connector bolts do.

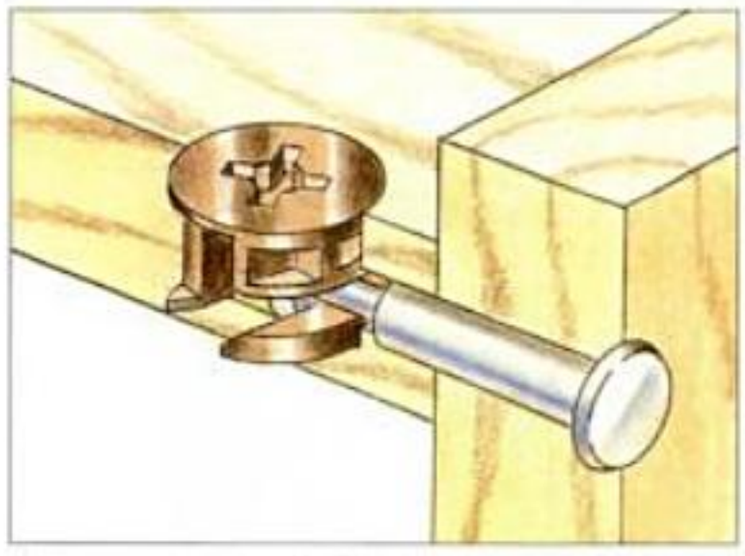
Häfele makes a cam-type fastener system called "Minifix" that accepts several types of bolts, so it's useful for a variety of applications. The capped bolt makes a good edge-to-face joint with the bolt's flat head visible when the parts are assembled. (See above.) The spreading dowel is useful when you want to make a hidden edge-to-face joint. In this case, the end of the bolt screws into a dowel-like brass insert which fits in a blind hole. When you screw the bolt into the dowel, it expands to lock in place. (See above.) The double-ended bolt connects to cams set on each end of a joint. This is useful for edge-to-edge joints. You can even put a spacer piece between the edge joint; for example, you can put a vertical divider between horizontal shelves. A press-fit plastic cover conceals the Minifix cams.

The Rastex fastener is similar to the Minifix spreading dowel fastener, except it has a much larger cam. Also, Rastex uses a plastic insert rather than a brass one. (See above.)

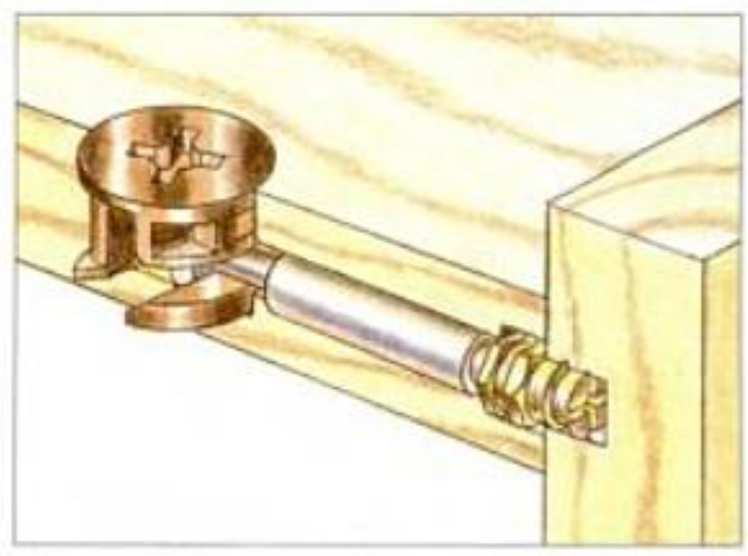
The Blum KD cam fitting operates differently from the others. (See above.) One end of the bolt is a coarse wood screw that threads into a hole drilled in the edge of one part. The other end fits into the face rather than the side of the cam. Turning a screw tightens the cam around the end of the bolt, pulling the joint tight.

Surface-mount fasteners are the easiest to install: You simply screw

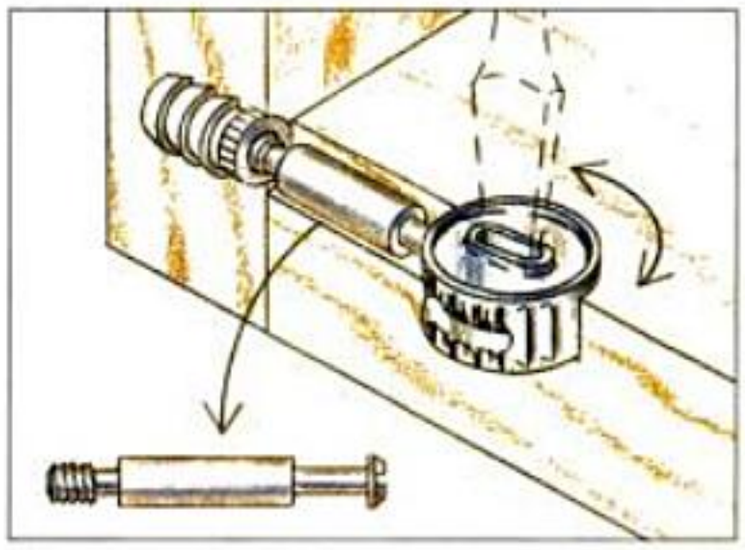
CAM-TYPE FASTENERS



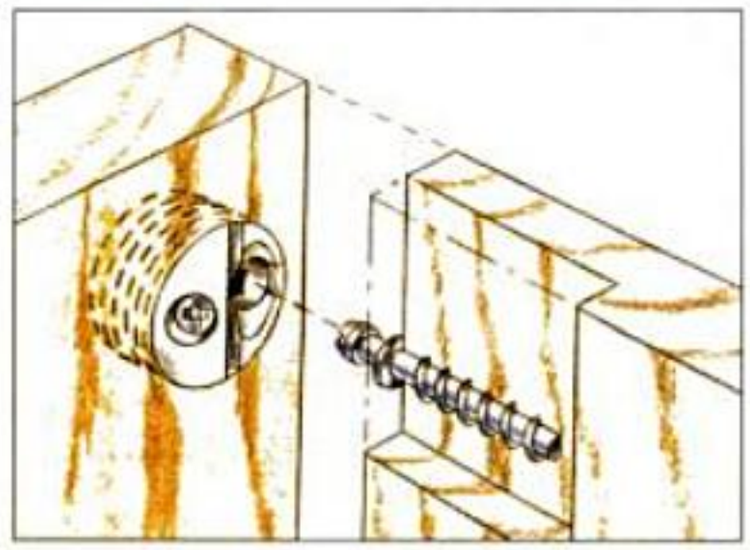
Minifix fasteners with capped bolt



Minifix fasteners with spreading dowel

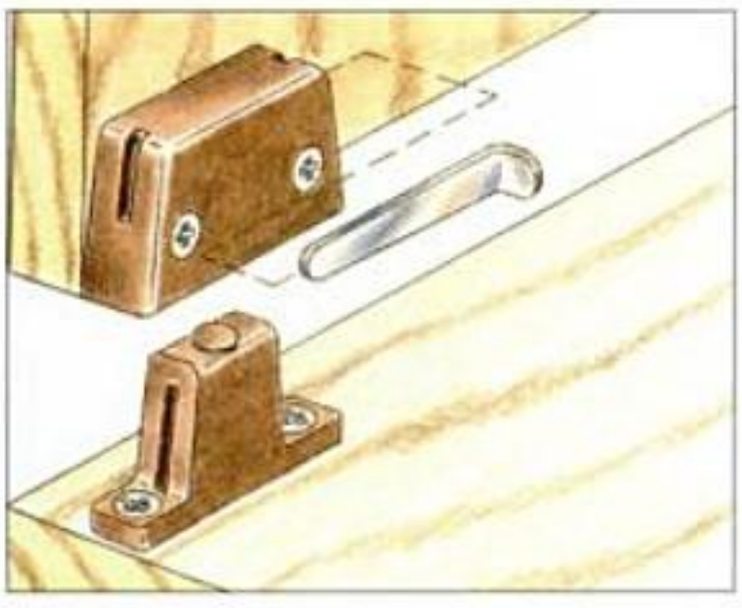


Rastex

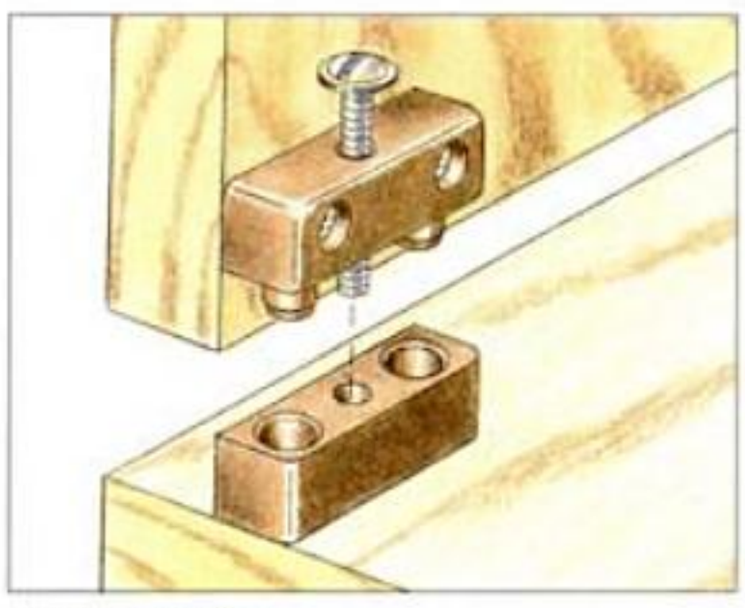


Blum KD fitting

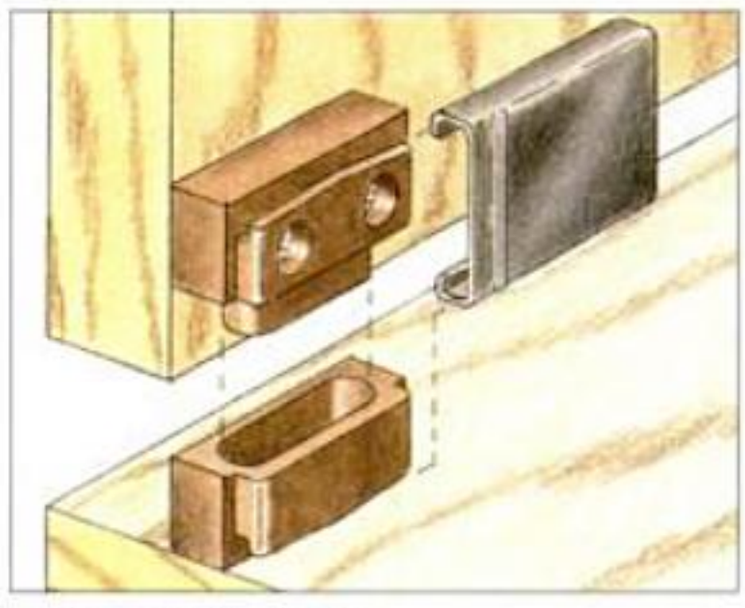
SURFACE-MOUNT FASTENERS



Furniture connector

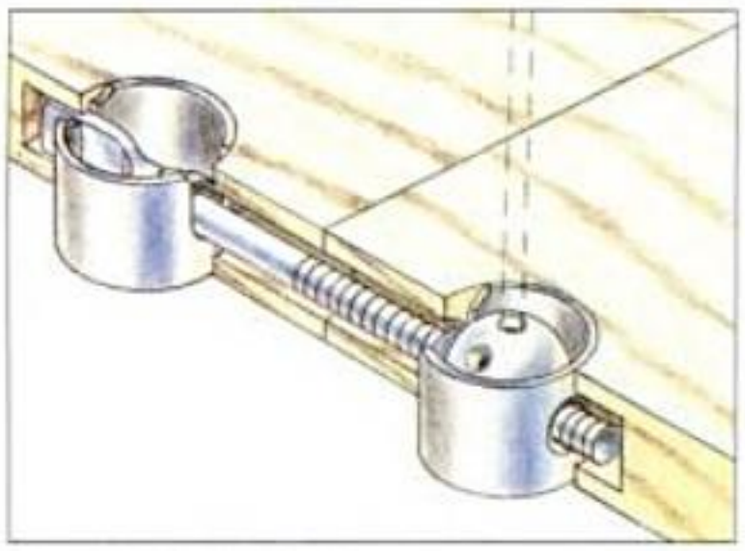


Trapeze fitting



Quick-joining device

COUNTERTOP CONNECTOR



Tite-Joint fastener

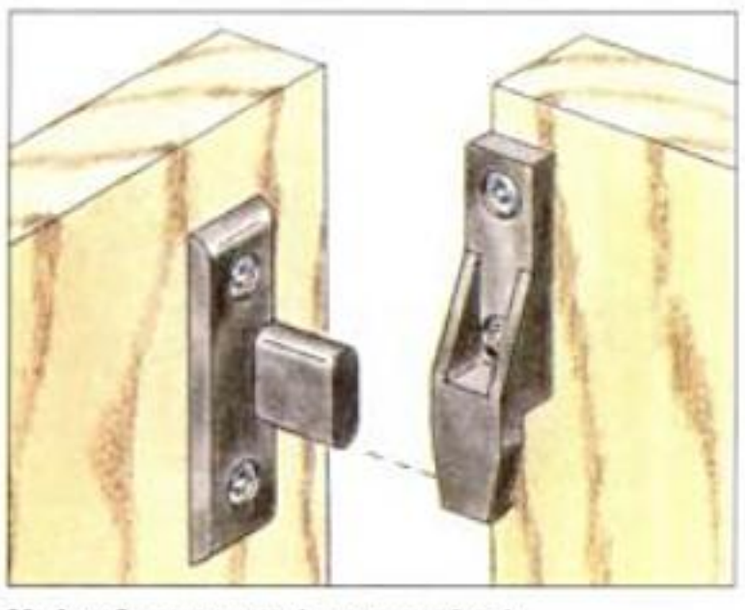
them to the surfaces to be joined. However, they are bulky and completely visible, which may be objectionable to some woodworkers. They're good for edge-to-face joinery, such as joining panels at right angles in knockdown display stands. Surface-mount fasteners hold the mating pieces in position but don't draw them tightly together. They should not be used for joints that are under heavy stress.

Trapeze fittings are interlocking plastic blocks that connect with a single machine screw. (See opposite page.) When you push them together, the small dowel-like projections on one block align it with the mating block, making assembly easy.

The quick-joining device works like the trapeze fitting, except the two halves are locked together with a slide-on cover plate instead of a screw. (See opposite page.)

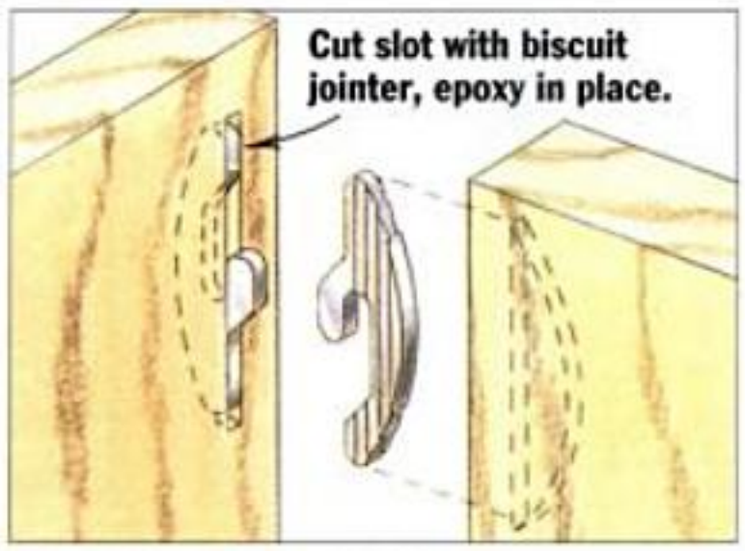
Furniture connectors are similar to the quick-joining fasteners, but they use a flat steel pin to hold the two plastic halves together.

Häfele makes two "Keku" fasteners that are great for mounting removable



Keku fasteners (suspension)

BISCUIT-TYPE FASTENER



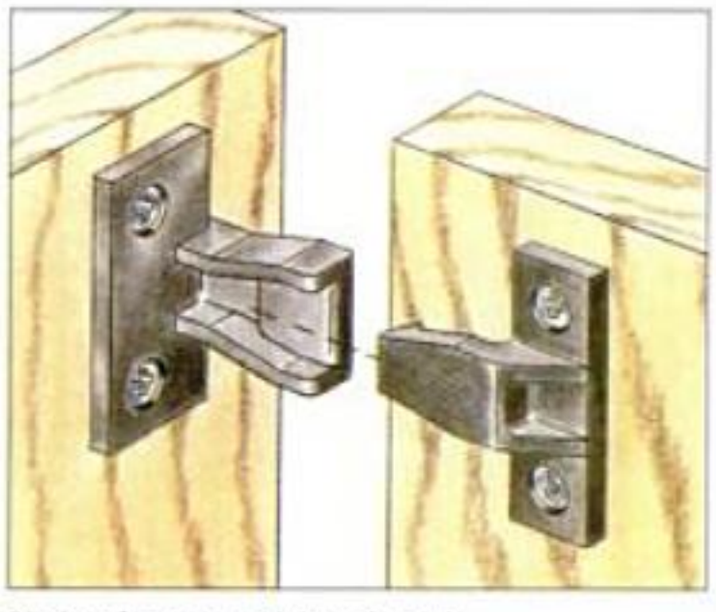
Haas KD biscuit fastener

frames and flush or recessed cover panels over an opening when you need occasional access to the space behind the cover. Trim panels over air conditioning units or electrical gear are examples. You could also use them to install ceiling or wall panels.

Keku suspension fasteners allow you to simply hang a panel in place, and Keku push-on fasteners let you push a panel on from the front. (See below.) Both types of Keku fasteners snap in place with a light friction fit.

Countertop connectors are so named because they're the hardware of choice when you want to butt-join two pieces of plywood or particleboard for a seamless countertop. However, they're useful for edge joining other parts, such as wide boards or panels, including miter joints.

Tite-Joint fasteners consist of two circular metal rings joined by a threaded rod. (See above.) To install the fastener, you drill a blind hole for a ring in the face of each part and rout a groove on the face of each part for the rod. You then draw the two parts together by tightening a nut in one of the rings.



Keku fasteners (push-on)

Biscuit-type fasteners are a fairly new kind of knockdown hardware. You can use them for edge-to-edge joints, such as on table leaves, or for edge-to-face joints like you'd find on knockdown shelving. They're invisible in use.

Biscuit fasteners are made of plastic or metal, and they're available in different types that fit into different-size slots cut with a biscuit joiner. The fasteners hook, slide or snap together. For example, Haas KD fasteners are an interlocking aluminum type that you epoxy into biscuit slots. (See left.) They're comparable in size to a #20 wooden biscuit. When you tap the interlocking fingers in place, the fasteners draw the parts together under light tension and lock them in position. ▲

JIM BARRETT *writes about woodworking tools from his shop in California.*

SOURCES

Constantine's
2050 Eastchester Rd.
Bronx, NY 10461
(800) 223-8087 *Circle #604*

Häfele America Co.
3901 Cheyenne Dr.
Archdale, NC 27263
(800) 334-1873 *Circle #605*

Lee Valley Tools Ltd.
1080 Morrison Dr.
Ottawa, Ontario, Canada K2H 8K7
(800) 267-8767 *Circle #606*

McFeely's
Box 3
Lynchburg, VA 24505
(800) 443-7937 *Circle #620*

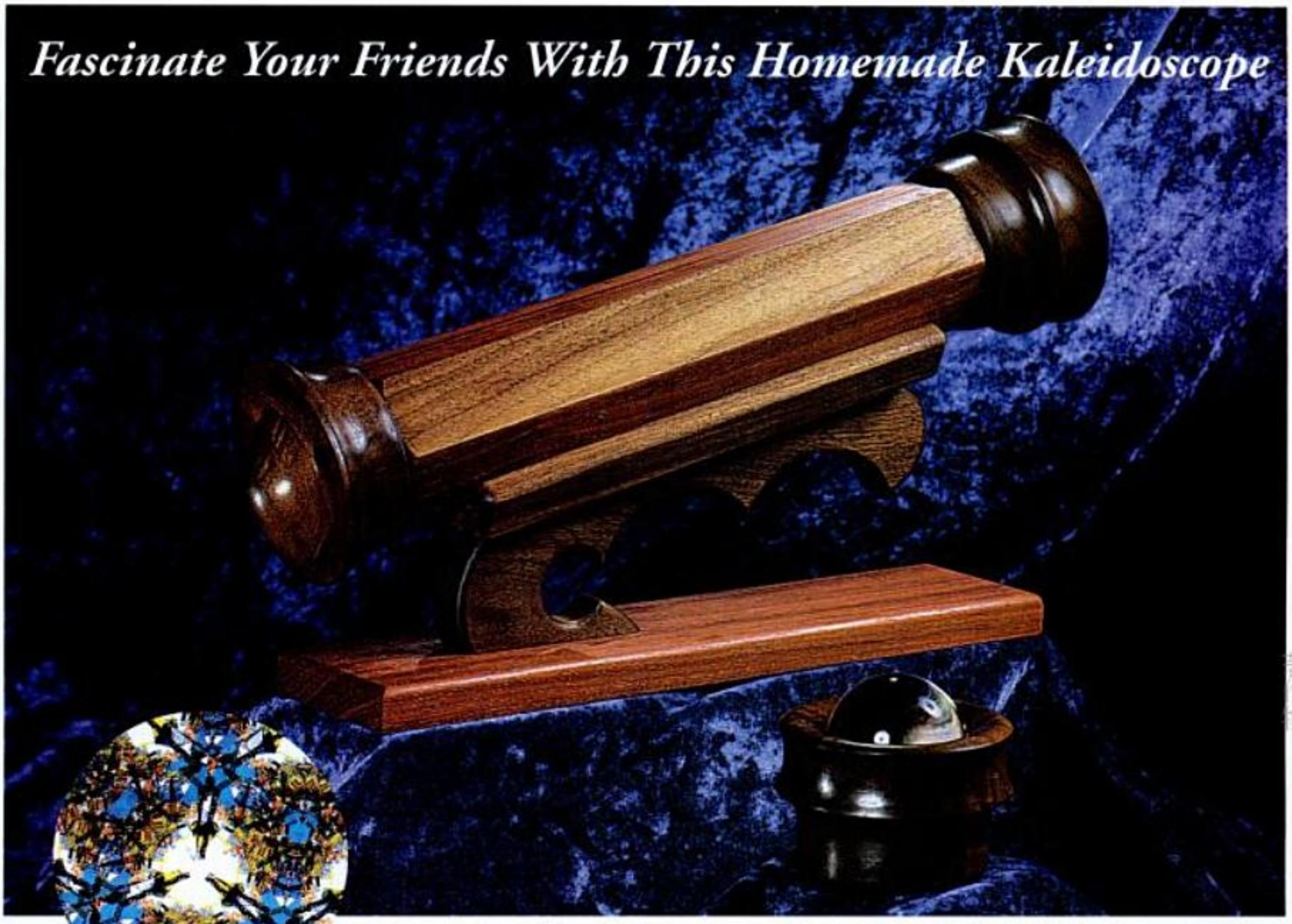
Woodcraft
210 Wood County Industrial Park
Box 1686
Parkersburg, WV 26102
(800) 225-1153 *Circle #608*

The Woodworkers' Store
21801 Industrial Blvd.
Rogers, MN 55374
(800) 279-4441 *Circle #607*

Woodworker's Supply Inc.
5604 Alameda Place NE
Albuquerque, NM 87113
(800) 645-9292 *Circle #609*

Scope It Out!

Fascinate Your Friends With This Homemade Kaleidoscope



PHOTOS BY ROSS HAMILTON

You can build a delightful kaleidoscope like this one with coopering, turning and glasscutting techniques.

By Stephen H. Blenk

Everyone loves kaleidoscopes and the endless number of beautiful patterns they create. And though most of us played with kaleidoscopes as children, few folks realize that these "toys" have a long and distinguished history.

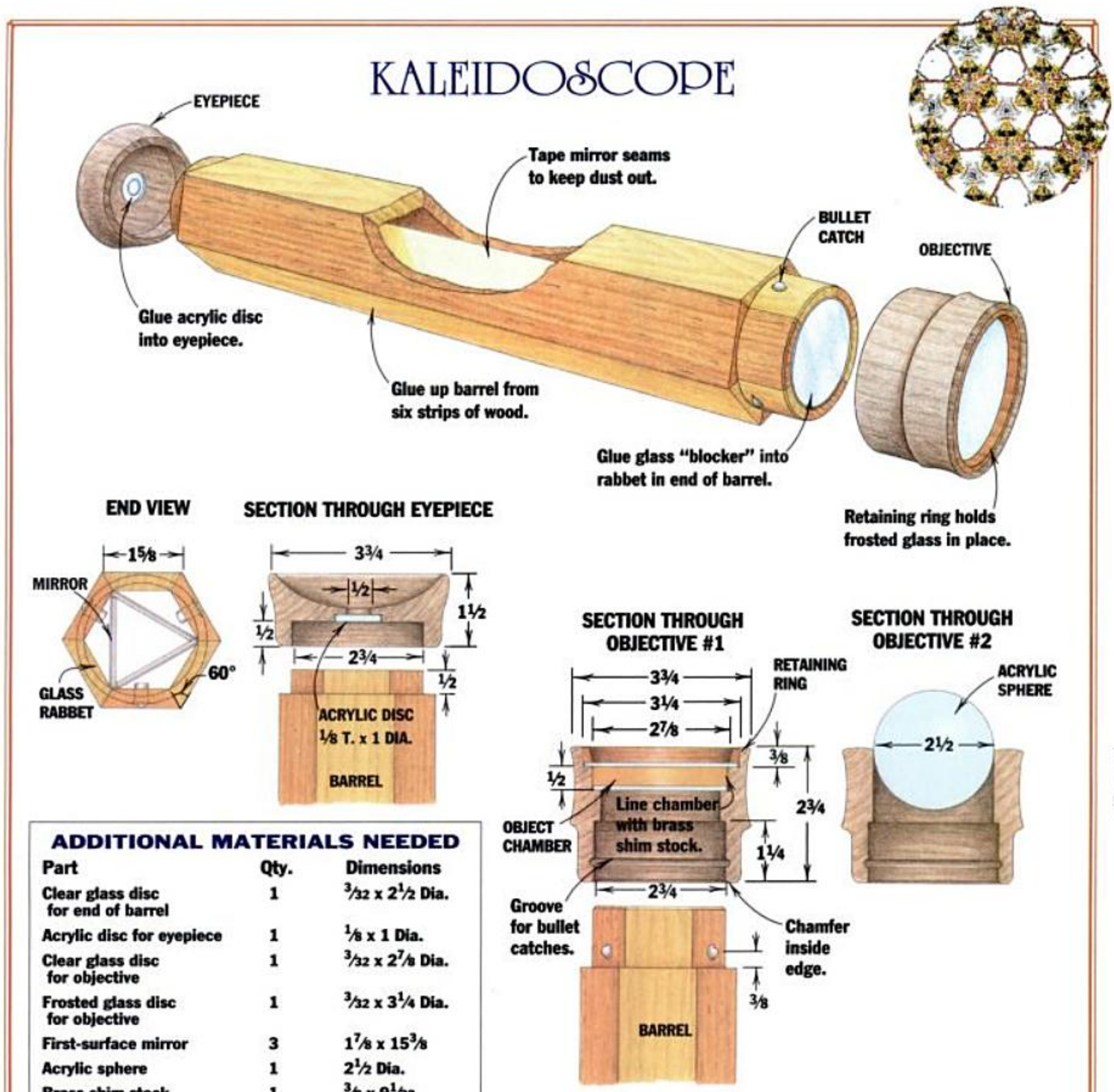
Scotsman Sir David Brewster patented the first kaleidoscope in 1816. Since then, some truly amazing variations of this original "parlor scope" have been built by artisans in almost every medium. Although original antique scopes are now rare and highly prized—selling for thousands of dollars each—elegant kaleidoscopes are still being fashioned today, many of them by woodworkers. (See "Gallery," page 92.)

Making your own kaleidoscope isn't as complicated as you might think, but it can present challenges to woodworkers of any skill level. To build the kaleidoscope shown here, all you need are a few basic woodworking and turning skills, a simple knowledge of glasscutting and a rudimentary understanding of the physics of light. (Don't get scared because I used the "P" word—there's really not much more to this than understanding your own reflection in the mirror!)

About Kaleidoscopes

A kaleidoscope is a simple instrument consisting of three basic assemblies: the barrel, the eyepiece and the objective. The barrel is a tube that holds two or more long, narrow mirrors which face each other at acute angles. (See drawing, opposite.) When you look into the eyepiece of a scope, you're actually looking through the inside of this reflective "prism" at the objective. The mirrors create multiple images of the objective that vary with the number of mirrors and the angles between them.

Now for the physics: You can't just cut up the bathroom shaving mirror for this project—it won't produce a



ADDITIONAL MATERIALS NEEDED

Part	Qty.	Dimensions
Clear glass disc for end of barrel	1	3/32 x 2½ Dia.
Acrylic disc for eyepiece	1	⅛ x 1 Dia.
Clear glass disc for objective	1	3/32 x 2⅞ Dia.
Frosted glass disc for objective	1	3/32 x 3¼ Dia.
First-surface mirror	3	1⅞ x 15⅜
Acrylic sphere	1	2½ Dia.
Brass shim stock	1	⅜ x 9 1/32
Bullet catches	3	¼ Dia.

Misc. items for object chamber as desired.

ILLUSTRATIONS BY FRANK ROHRBACH

sharp enough image. Ordinary mirrors, called "second-surface" mirrors, are silvered on the back side of the glass. To be reflected, light has to pass through the glass on the way in and again on the way out, causing distortion. In a single, direct reflection, this distortion isn't really noticeable. But in a kaleidoscope, where the image is bounced from wall to wall down the mirrored tube, the distortion increases with each bounce, and the image quickly deteriorates.

For the clearest, sharpest images, you must use "first-surface" mirror (see Sources, page 58), the kind used in cameras and microscopes. First-surface mirror produces very little distortion, since the reflective coating is on the front of the glass.

Making the Barrel

The barrel of this scope is made from six strips of wood edge-glued to form a hexagonal tube—a technique called *coopering*. To give the design some character, I like to use alternating strips of two or more woods. I've made scopes from most hardwoods, and I've found that maple, walnut, oak and padauk all work well for coopered construction. I avoid dense, oily exotics; the glue joints tend to open unless you use special adhesives.

Make the strips for the barrel from ⅜-in.-thick by 16-in.-long stock. Rip

each strip to an exterior width of 1⅝ in., with 60° bevels on the strip's long edges. (See drawing, previous page, and photo, right.) It's a good idea to rip and preassemble some test pieces to be sure your bevel angles are accurate; a ½° mistake multiplied by 12 edges will result in a very noticeable 6° gap in your hexagon!

While it's possible to build a kaleidoscope with a longer barrel than the one shown here, there are some risks involved in changing proportions. The longer the mirrored tube, the more reflections of the image you will get. But I've found that if the mirrors are more than about eight times as long as they are wide, the image can become too fragmented. This scope has three 1⅞-in.-wide mirrors, so I made the barrel 15½ in. long.

Making the coopered barrel. The author likes to use contrasting staves for his kaleidoscope barrels. After ripping the contrasting strips, glue them up and clamp with hose clamps.

Before gluing the strips together, dry assemble them to check the fit, and adjust the bevels with a hand plane if necessary. Then lay the strips edge to edge, with bevels facing up, across two pieces of tape. Brush some yellow glue on the bevels, then lift the tape carefully: The hexagon should build itself. I use automotive

MAKING A STEADYREST

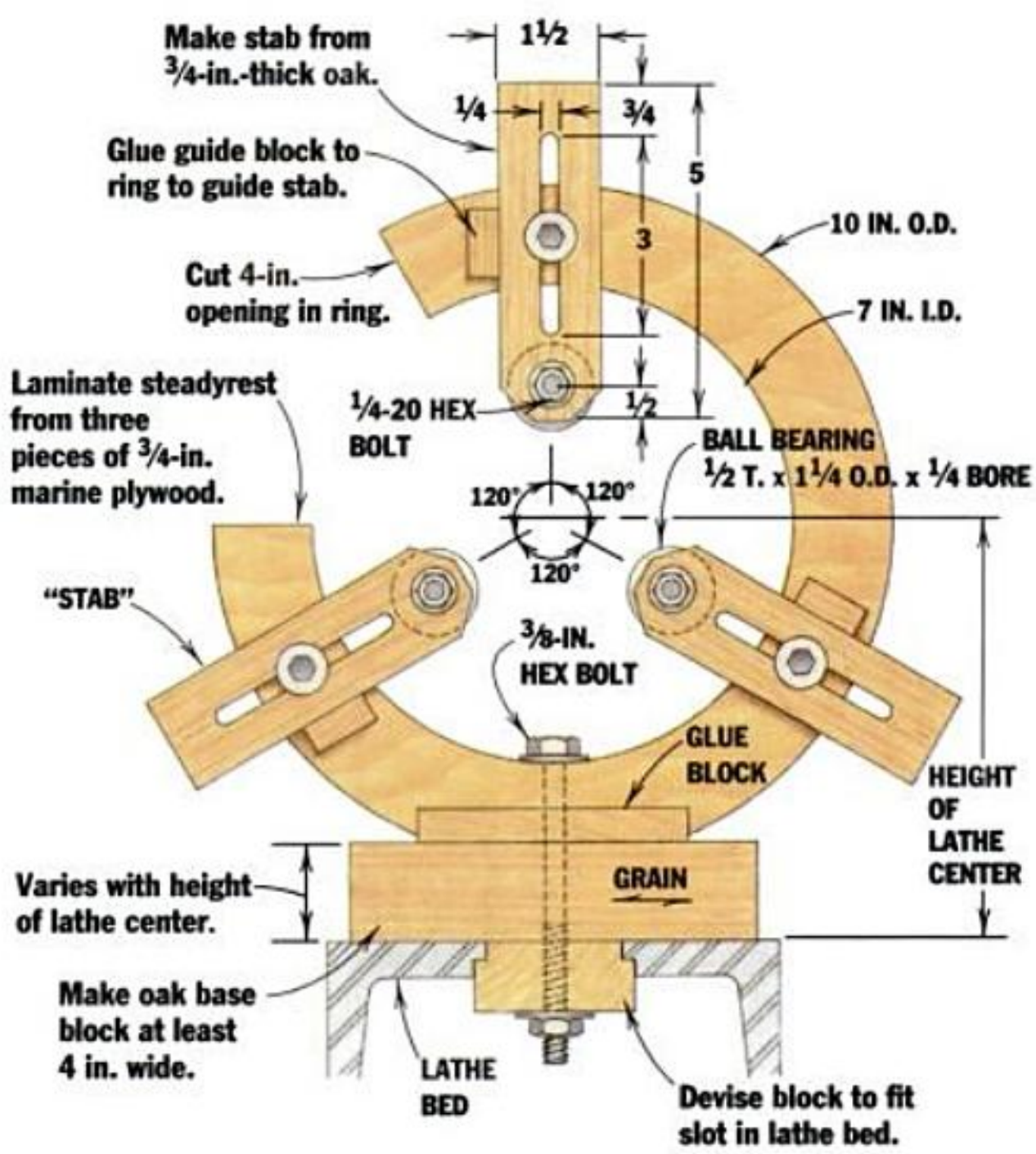
A ball-bearing steadyrest is a very useful lathe accessory. It can provide support for flexible turnings or give you access to the end of a turning, such as the kaleidoscope featured here. But commercial steadyrests are expensive; with a little work you can build your own for a lot less.

This steadyrest will work for any lathe with a flat bed, but you'll have to vary the height of the base block so the rest is centered on the lathe centers, and you may have to adapt the base-block assembly to fit your lathe bed.

Begin construction by bandsawing three 10-in.-dia. discs from ¾-in.-thick marine-grade plywood. Use a protractor to lay out points 120° apart on the outside edges of the discs. Next, saw a 7-in. circle from the center of each disc to form a 1½-in.-wide ring. Remove a 4-in. section from each ring as shown, then glue and clamp the three C-shaped rings together.

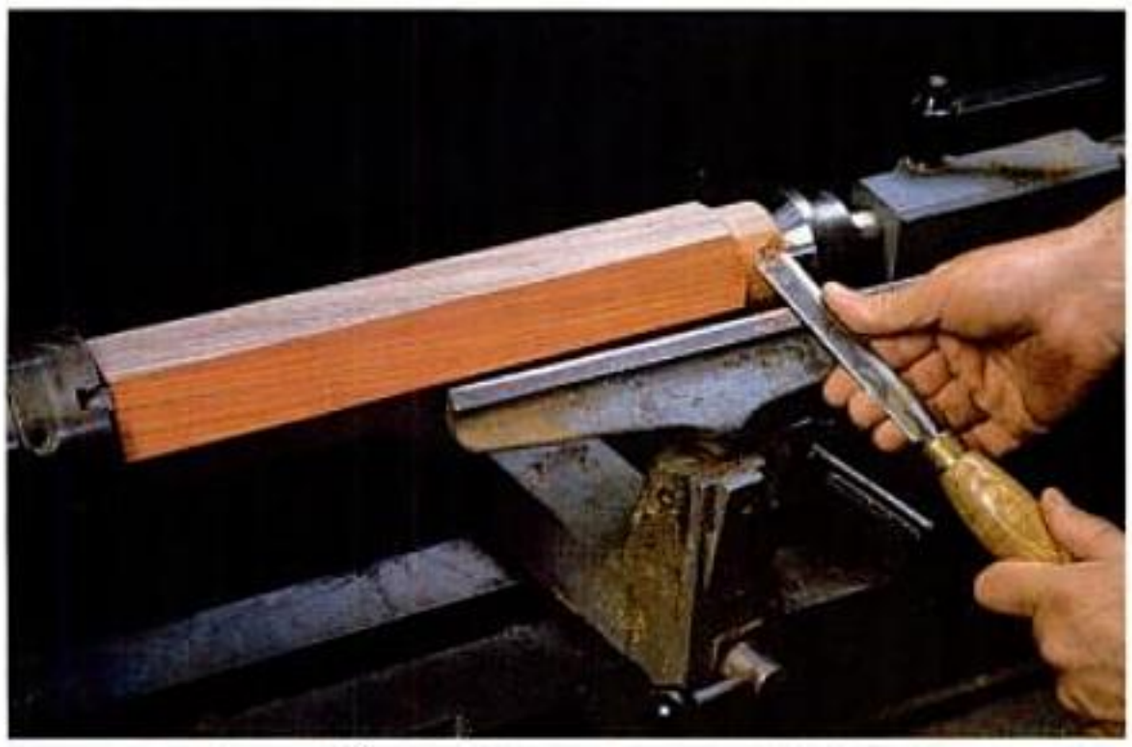
While the glue is drying, cut three pieces of oak for the "stabs," and drill and slot them as shown in the drawing below. Mount the three ball bearings (available at any bearing dealer) to the stabs with ¼-20 by 4-in. machine bolts and washers.

Next, drill ¼-in. holes on the 120° marks for the stab bolts. Sand the bottom of the lamination flat, glue it to an oak base assembly of appropriate height, and reinforce the joint with glue blocks. Then drill the ⅜-in. hole for the bolt that will anchor the steadyrest to the lathe.



Attach the rest to the lathe bed and set the stabs to the center of a round turning. Glue guide blocks to the side of the ring to keep the stabs from rotating, being careful not to glue the stabs in place.

To use your shop-made steadyrest, just loosen the wing nuts, adjust the stabs to the desired diameter and retighten the nuts. You'll find that this rest is a versatile addition to your lathe. —*S.B.*



Turning the barrel ends. With the barrel cut to finished length and mounted between lathe centers, turn the ends to fit the objectives and eyepiece.

hose clamps to hold the joints tight while the glue dries (see photo, opposite page), taking care not to overtighten the clamps and crush the segments.

After the glued has dried for 24 hours, joint each face of the hexagon lightly to remove the excess glue along with any marring from the hose clamps. Then trim the ends of the barrel to finished length on the tablesaw.

The next stop for the barrel is the lathe. See the section views on page 55 for details on turning the ends of the barrel. I install a large, bull-nosed live center in the tailstock, then mount the eyepiece end of the barrel on my three-jaw machinist's chuck with the jaws inside. (See photo, below.) You could use almost any expanding chuck, such as a Nova, but be careful not to expand the jaws too much or you'll split the barrel. If you don't have an expanding chuck, you can make a jam chuck on a faceplate: Just turn a waste block to a friction on the interior of the barrel.

Working at the tailstock (objective) end of the barrel, turn the last 1¼ in. to a diameter of 2¾ in., then chamfer the end slightly. Taper the shoulder back slightly so the points of the hexagon won't interfere with the operation of the objective later. Now, reverse your mounting and turn the last ½ in. of the eyepiece end to the same diameter, this time without the taper.

Since this scope has removable objectives, the objective end of the barrel needs a glass disc to keep dirt from getting into the mirror tube. To provide a place to mount the disc, I carefully turn a ⅛-in.-deep by 2½-in.-dia. rabbet on the inside of the objective end, keeping the lathe speed low and using a three-point steadyrest to hold the outer diameter of the cylinder. (See photo, below.) To build a shop-made version of the steadyrest shown in the photo, see the sidebar on the opposite page. After turning the rabbet, you may have to sand or recut the outside of the cylinder to remove any marring caused by the steadyrest.

To hold my interchangeable objectives in place, I use three bullet catches (available at many hardware stores or from mail-order catalogs) in the turned end of the barrel. (See drawing.) The catches ride in a corresponding groove in the interior wall of each objective case. Although the ends of the bullet catches protrude into the barrel, there is sufficient clearance for your mirrors.

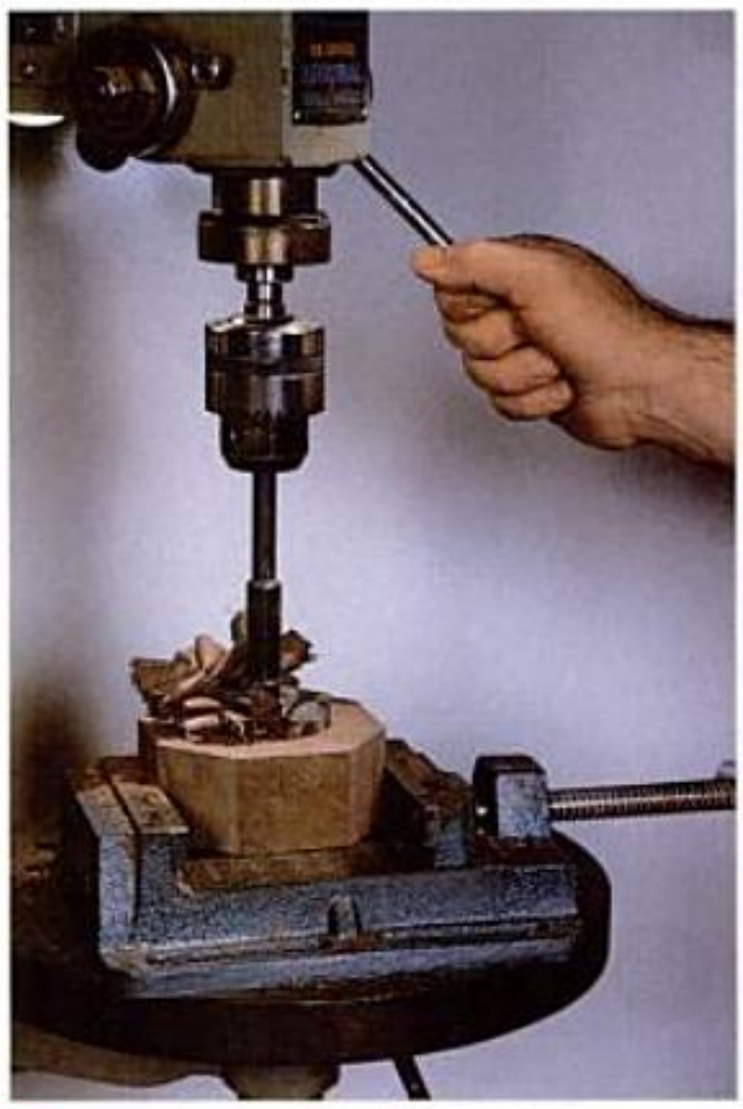
To install the catches, drill appropriately sized holes at equal intervals around the turned part of the barrel, ⅜ in. from the shoulder. Now counterbore for the top flanges of the catches, or they will protrude and prevent the objective case from fitting correctly.

Rabbeting for the blocker. Using a commercial steadyrest, author rabbets the barrel for the glass "blocker" that keeps dust from contaminating the mirrored interior of the finished scope.

Making the Objectives

I usually make two interchangeable objectives for my scopes: one with an assortment of colorful objects sandwiched between two glass discs, and the other with a spherical lens that produces multiple images of the viewer's surroundings.

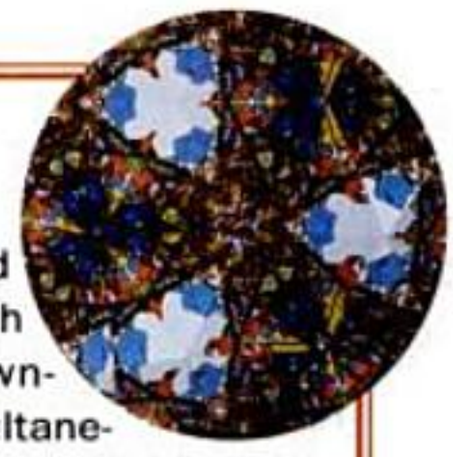
I start each objective case in the same way—by boring a 2½-in.-dia. hole through the center of a 4-in. by 4-in. square of well-seasoned, 3-in.-thick walnut. I use a "planetor" bit on the drill press (see photo, below), although a Forstner or multi-spur bit would also do the job. Planetor bits, used mainly by plumbers and electricians, are available from industrial supply houses or by mail from Craft Supplies USA (1287 E. 1120 S., Provo, UT 84601, 801-373-0917). I like them because they're relatively inexpensive—one shank accepts several different-diameter heads—and they're easy to sharpen. *Caution:* Grind the thread off the lead screw before using a planetor bit on the drill press.



Boring the eyepiece. Author bores a blind hole in the eyepiece blank with a "planetor" bit.

Once you have drilled the holes in the blanks, mount each blank on the lathe chuck and turn the inside of

CUTTING GLASS



Glasscutting is a technique that often comes in handy in the woodshop, whether you're making curio cabinets or kaleidoscopes. And while you can save time and money by cutting your own glass, you need to practice to get precise, predictable results. Even professional glassworkers have a percentage of failures they attribute to the "oops" factor. Practice is the key.

Straight cutting. Score the unsurfaced side of the mirror with a straight cutter dipped in light oil. A wooden straightedge guides the cut.

Most cutting is done with some variation of the basic glasscutter, a tool with a hardened steel wheel (or an industrial diamond) at its business end. To make a cut, you dip the wheel in light oil (the best cutters have oil reservoirs built in) and press it down firmly while moving the cutter across the glass surface. This leaves a continuous scratch, or score line, that telegraphs through the glass, creating a weak point in its internal structure. When you exert a bending force at the score line, the glass breaks along this line.

Rail-mounted cutting. This commercial rail-mounted cutter provides the utmost in accuracy and speed for production cutting.

For kaleidoscopes, you will need two types of cutters: a straight cutter for the mirrors and a circle (or "lens") cutter for the glass discs. (See photos, top and right.) Both types are available in a variety of models from local stained-glass suppliers or by mail. (See Sources.) If you plan to do a lot of straight cutting, you might want to look into a rail-mounted cutter. (See photo, above.)

To make a straight cut, first mark your glass with a felt pen. Make a single pass with the cutter, from one end of the glass to the other, keeping your cutter vertical and guiding the cut with a straightedge. (See top photo.) Never make repeated passes; this will ruin your cutter and also practically guarantees that the glass won't break where you wish!

To make the break, extend the glass so the score line is over the edge of your workbench, then press down firmly on the "waste" side. Another popular method is to grasp the glass with one hand on each side of the score line and twist both sides downward simultaneously. If you try this method, I'd recommend wearing gloves.

I suggest you spend some time practicing with window glass before trying your hand on expensive first-surface mirror. And when you do cut the mirror, remember to score it on the unsurfaced face, and don't remove the protective coating until after cutting.

Cutting circles is a bit trickier than cutting straight lines, and small circles can be quite difficult. To use a circle cutter, simply set the radius for the desired circle and score the glass. Then, invert the glass on a flat surface (gypsum wallboard has just the right resiliency for this) and press against the score lightly from the back side, just enough for the glass to crack along the score. Now turn the glass back over, score the waste material with a straight cutter, and break it away from the disc. Again, practice is the key.

Circle cutting. This "lens cutter" lets you cut a disc without a center pivot point touching the glass.

—*S.B.*

SOURCES

First-surface mirror is available from the following mail-order suppliers:

EMF Corp.
701 Spencer Rd.
Ithaca, NY 14850
(607) 272-3320
Circle #616

Silver Troy Corp.
500 Cortlandt St.
Belleville, NJ 07109
(201) 751-3050
Circle #617

P.G.N.O.
3600 W. Moore Ave.
Santa Ana, CA 92704
(714) 540-0126
Circle #618

Glass cutters and other kaleidoscope supplies are available from:

Warner-Crivellaro, Inc.
1855 Weaversville Rd.
Allentown, PA 18103
(800) 523-4242
Circle #619

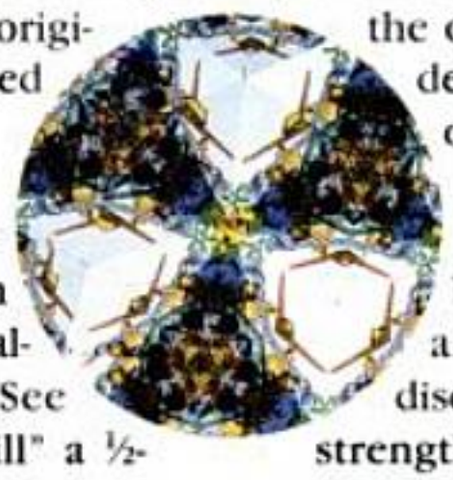
the bore until the end of the barrel just barely fits inside it. Then sand the opening with 220-grit sandpaper until the barrel rotates easily. Finally, chamfer the edge of the opening slightly to allow the bullet catches to enter easily when you're changing objectives.

To mark the location of the bullet groove on the inside wall of the objective case, first install the catches in the barrel, then press the barrel into the objective case and rotate it by hand. Remove the barrel and turn a round-bottomed groove (see photo, below) centered on the mark produced by the tips of the bullets.

Now reverse the mounting and turn the steps in the "business end" of the first objective case. (See drawing, page 55, and photo, above right.) When you have finished the inside, turn the outer surface to any shape that pleases you.

Turning the bullet groove. With the objective held in a three-jaw chuck, the author turns a round-bottomed groove to mate with bullet catches in the barrel.

The second objective case doesn't require turned steps, since it will simply receive a 2½-in.-dia. acrylic sphere in the front of the original 2½-in. bore. All you need to do is turn the exterior.



Making the Eyepiece

Make your eyepiece from another 4-in. square of walnut about 1½ in. thick. (See drawing.) First, "blind drill" a ½-in.-deep by 2½-in.-dia. hole in the center of the blank with your planetor or Forstner bit. Bandsaw the blank to a 3¾-in. round, mount it on a lathe chuck and shape the outer surface. Dish the end to within about 5/16 in. of the blind hole. Then, with a bit mounted in the tailstock, bore a ½-in.-dia. eyehole in the end.

Reverse the eyepiece on the lathe chuck—this time holding it by the outside—and turn a ⅛-in.-deep by 1-in.-dia. recess to hold the acrylic disc that serves as a "blocker" in the eyepiece. This disc seals off the eyehole and keeps dirt out; it also keeps broken glass away from the viewer's eye in the event that a mirror breaks.

To finish up the eyepiece, turn and sand the bore until the barrel slips in, then reverse the mounting and finish-sand the exterior of the eyepiece.

The last wooden component of the scope is the retaining ring for the first objective case. This is the piece that holds the outer plate of glass in place and masks the shoulder underneath.

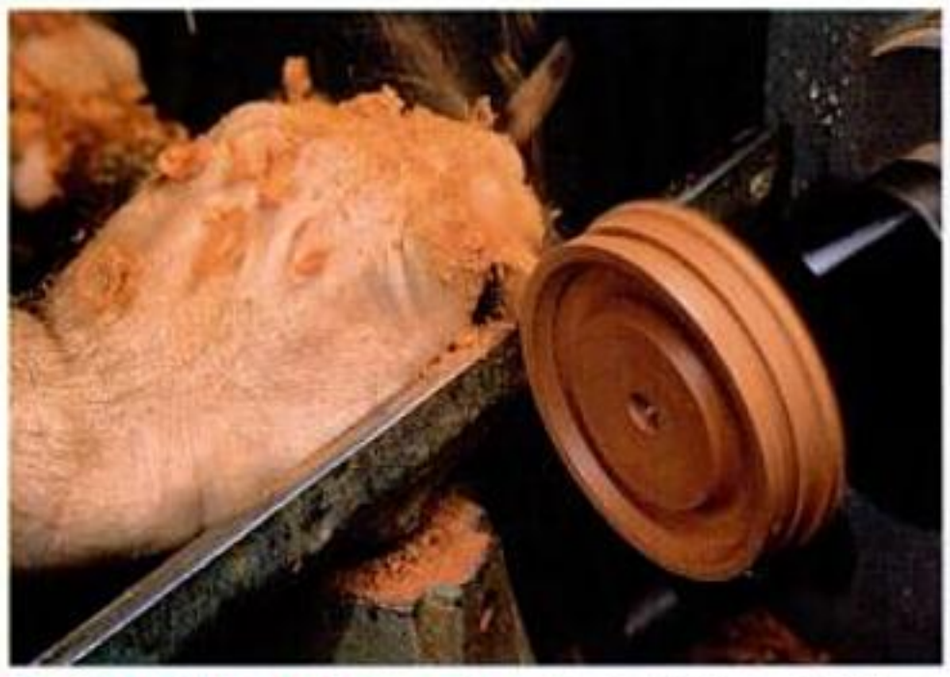
Start the retaining ring by cutting a 1-in.-thick by 3½-in.-dia. disc of an accent wood of your choice. Mount it on a faceplate or screw chuck on the lathe, and turn the outside of the ring to a diameter that just fits in the outer bore of the objective case. Now determine the height of the ring—it should equal the depth of the outer bore minus a 3/32-in. allowance for the disc of frosted "single-strength" glass (see drawing)—and mark this height on the outside of the ring. Turn the inside face of the ring with a parting tool or a small scraper to a depth slightly greater than the height of the ring, removing enough material from the center to provide room for sanding and finishing the inside face. To remove the ring, simply part on your depth mark. (See photo, below.) Touch up any rough edges by hand with 220-grit paper.

Turning the steps. A square-nosed tool is used to rabbet steps for the objective glass.

Once the woodworking is done, I blow off the parts with compressed air to remove any dust, and then I finish them with an oil finish. (I use Watco Natural Oil.) After the oil dries completely, I blow the pieces off again and move them from the woodshop to a clean area until it's time for assembly—sawdust is *not* a recommended part of the assembly!

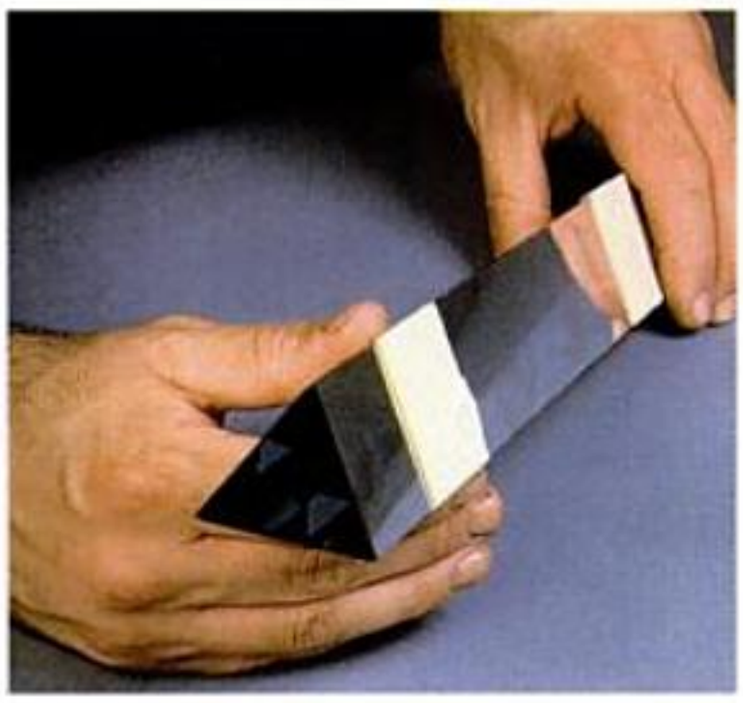
Putting It All Together

Gather together all the parts you'll need to assemble the scope (see "Additional Materials Needed" in the drawing), along with a supply of five-minute epoxy and some 2-in.-wide masking or duct tape. Whether you cut the glass parts yourself (see side-



Parting off the retaining ring. Part off the retaining ring after turning the outside and inside surfaces. A screw chuck holds the blank for turning.

Making the mirror prism. **For easy assembly, lay the mirror strips "coated side up" on two pieces of masking or duct tape.**



Completing the prism. **When correctly assembled, mirror edges overlap, assuring tight seams.**

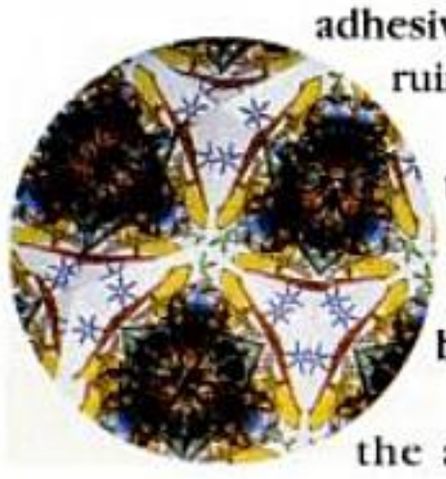
Installing the prism. **Carefully insert the prism into the barrel, adding wraps of tape if necessary to achieve a snug fit.**

bar, page 58) or have someone else do it, make sure you allow some room for wood movement. Here's the assembly sequence I suggest:

STEP 1: Assemble the mirror "prism." To do this, carefully clean the mirrors with a soft cloth, then lay them across two strips of tape (see photo, above left), making sure the silvered sides of the mirrors are facing up. (Most first-surface mirrors have a protective coating, or "peel coat," on their reflective surfaces. If in doubt, touch a pencil point to the surface. If you see a gap between the point and its reflection, you've got the wrong side!)

Form the mirrors into a triangular tube so each piece overlaps the next (see center photo, above), then tape the seams lengthwise, leaving only the ends open. The tape keeps dust from getting onto the reflective surfaces through the seams, and it also helps hold the parts of a broken mirror together in the event of a catastrophe later on.

STEP 2: Install the mirror tube in the barrel, shimming as necessary with wraps of masking tape for a snug fit. Hold the tube in place with a couple of drops of hot-melt glue. *Caution:* Don't use cyanoacrylate adhesive for this; it will ruin the mirrors!

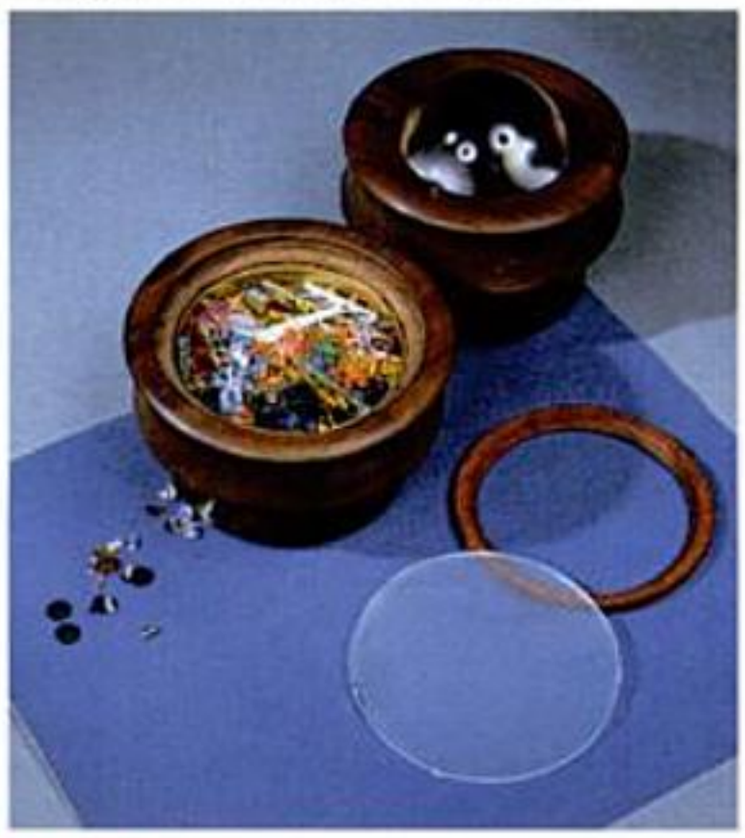


STEP 3: Epoxy the clear glass disc into the rabbeted end of the barrel.

STEP 4: Epoxy the acrylic disc into the eyepiece, being careful not to let any excess glue bleed onto the visible part of the disc.

STEP 5: Epoxy the eyepiece onto the barrel.

STEP 6: Epoxy the bullet catches into the barrel, making sure their flanges are below the surface.



Adding color. **Fill the object chamber with an assortment of colorful baubles and glass bits, then seal it with the frosted glass disc and the retaining ring. Lens objective is in the background.**

STEP 7: Glue the clear glass disc into the objective case with a thin bead of epoxy.

STEP 8: Line the object chamber with the strip of brass shim stock. (See photo, above.) This will prevent your objects from abrading the walls of the object chamber, producing dust in the scope.

STEP 9: Fill the object chamber about three-quarters full with a selection of small, colorful items. Personally, I like to use thin pieces of primary-colored glass, glass beads and found objects such as star washers or bits of lace. To preview your mix, tape the frosted glass disc in place, snap the objective case onto the barrel and look through the eyepiece. Add or subtract items until you like the effect.

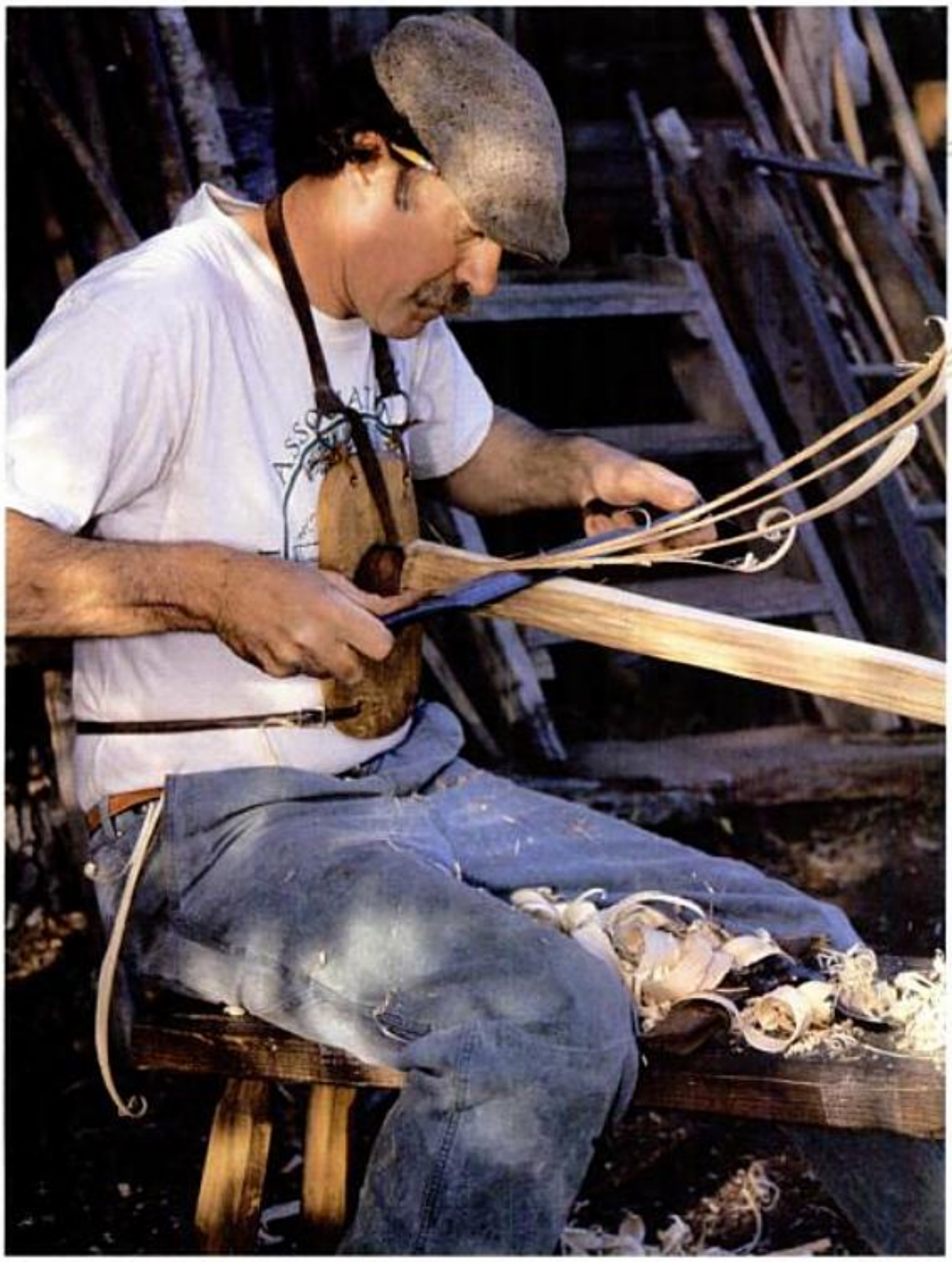
STEP 10: Seal the object chamber by carefully epoxying the frosted disc (made by sanding regular glass) and the retaining ring in place. *Caution:* Don't move the objective case until you're certain that the epoxy is dry; objects will stick to tacky epoxy.

STEP 11: Glue the 2½-in. acrylic sphere (available from local plastics companies or by mail from Comco, 1002 Andover Park E., Seattle, WA 98188, 800-544-1096) into the front of the second case with a few spots of epoxy around the rim. However, be careful not to get epoxy on the viewing surfaces. I recommend cutting a small block of wood to support the sphere at the correct height—with half its diameter protruding—until the epoxy cures.

Now you're ready to have fun with your colorful creation. Build a stand to display it in your living room or "parlor." The smiles that it will produce are part of a tradition that's close to two centuries old. ▲

STEPHEN H. BLENK *is a contributing editor to AW.*

Welsh Hay Rake



Shaping the rake head. A wooden bib protects the author as he uses a drawknife to shape the head's sides.

PHOTOS BY MARK SAFRON

Hard-working heirlooms. Graceful in form and functional in design, these rakes should give many years of service.

Make This Rustic Implement With Traditional Tools and Techniques

By Don Weber

To me, no tool better symbolizes old-country life than the wooden hand rake. It recalls a day when farmers gathered their grains and grasses by hand, and patient homeowners manicured their yards with well-made tools they fashioned themselves.

The style of rake shown here is a traditional tool from the Welsh-Shropshire border of the United Kingdom. It can be constructed using only a hatchet, pocketknife, saw, drawknife and spokeshave, though there are a couple of other specialized tools I'll mention that can make the work go a little faster.

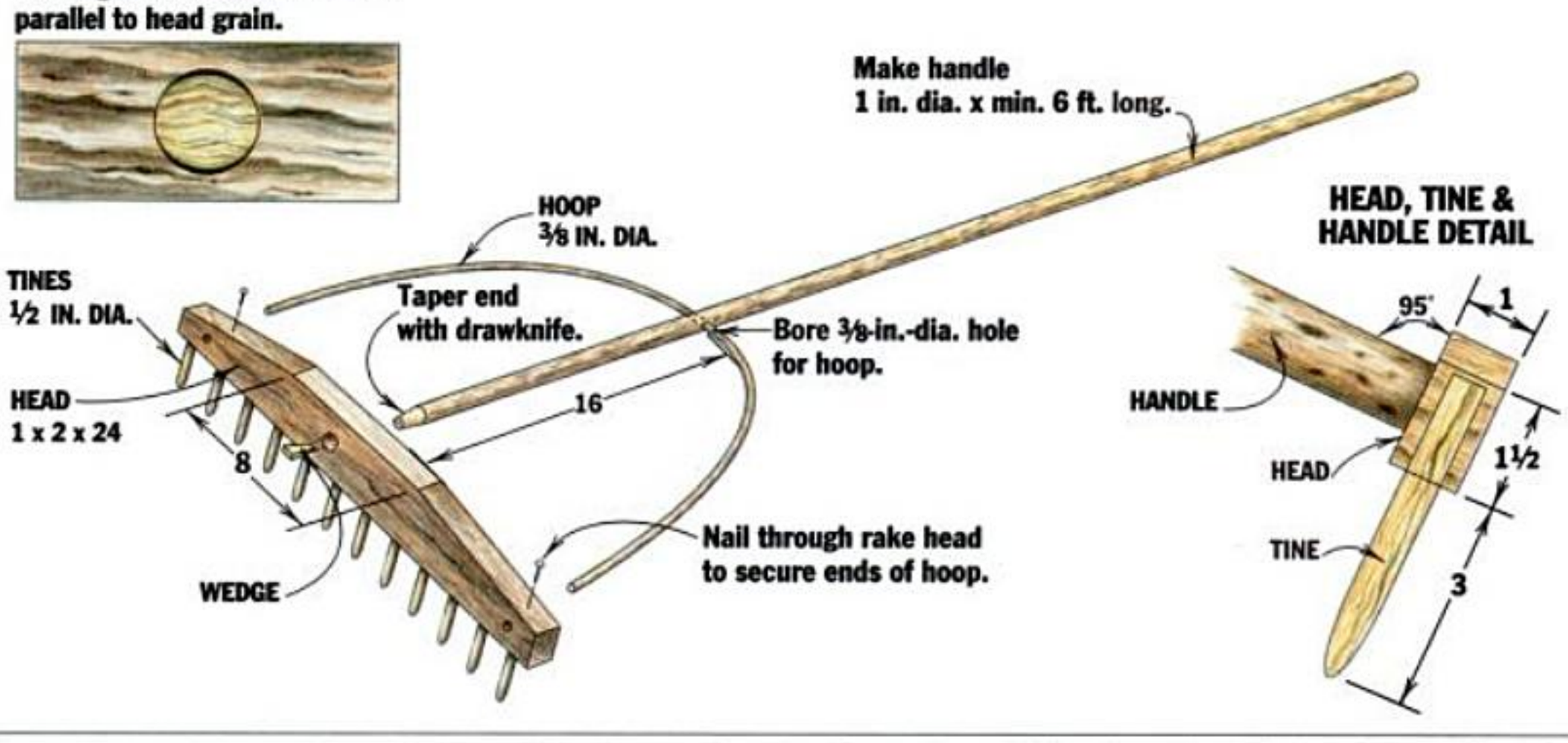
This rake consists of four main parts: the handle, which the Welsh refer to as the *haft* or *stail*; the rake head; the hoop, which helps stabilize the head as you pull on the rake; and the tines. (See drawing, page 62.) All the parts are made from green, straight-grained wood; I use mostly ash and hickory.

Making the Tines

First, select a straight, clear ash log from 6 to 8 in. in dia. Cut several 6-in. lengths off the end for the tines and a section at least 7 ft. long for the handle. Set aside the handle section for now and start work on the tines.

To split, or *rive*, the tines from the blank, I use a froe or hatchet and a mallet. (Froes and the other special tools mentioned here are available from Woodcraft Supply, 210 Wood County Industrial Park, Box 1686, Parkersburg, WV 26102, 800-535-4486.) Tie a piece of string around the block to keep the pieces from flying around as you split it. (See photo, next page.) Then start splitting in the center of the block and work out toward the bark side in ½-in. increments. When you reach the side, turn the block 90° and do the same thing again. You should be left with one tidy bundle of square billets.

WELSH RAKE



ILLUSTRATIONS BY LARRY FREEDMAN

Riving produces stronger tines than sawing, because the wood splits along the grain when you rive. If you saw the wood, you cut through the grain and end up with short-grain wood, which can break off.

The next step is to round the tines. You can use a pocketknife, but this is a tedious and time-consuming job, so I hammer them through something called a tine cutter instead. This is simply a piece of pipe about 6 in. long that is sharpened on one end. (See sidebar, opposite page.)

When you have cut a few more tines than necessary to make your rake, stash them near the wood stove or another heat source to dry. The goal here is to make the tines drier than the rake head. That way, as the head dries, it will shrink around the tines and hold them more tightly in place.

Like dicing an onion. To split out billets for the tines, Weber ties a string around the blank, then uses a froe and mallet to create a grid of 1/2-in.-square "splits."

Making the Hoop

With the tines complete, you can now turn to the hoop. I make my hoops from 4-ft.-long sections of ash or hickory. Again, use a froe and a mallet to split the log in half, then into quarters and so on until you have pieces slightly more than ⅜ in. in dia.

Choose a riven piece that is free from knots and defects, and roughround it with a drawknife and a halfround spokeshave. I hold the workpiece in my shaving horse (see AW #14), but a vise would do in a pinch. When you get the hoop down to about ⅜ in. dia. you could stop, but I like to make the hoop perfectly round in section, so I draw it through a dowel-sizing plate to finished dimension. (See inset photo, page 64, and sidebar, opposite page.)

Making the Handle

From the hoop we step up to the power end: the handle. Straight hickory or ash saplings are best for handles, but they are hard to come by in many places. So it's best to rive the handle just as you did the hoop. Split out a 1½-in. square from the 7-ft.-long log you cut initially, then bring the handle diameter down to a little over 1 in. with a drawknife. You can smooth the handle with a half-round spokeshave, but for a perfectly round handle I use a shop-made rounder plane (see sidebar) or an antique rotary plane called a Stail engine.

Stail engines, which you can still find in secondhand stores and flea markets, work like big, adjustable pencil sharpeners. (See photo, page 64.) The Stail engine has a tapered opening running down the center of its jaws, and these jaws can be adjusted to cut a cylinder from ¾ in. dia. to more than 2 in. This tool is rotated, hand over hand, around the length of the stock, while the handle is held fast in a shaving horse.

After the handle is nicely rounded, saw it to length. At a minimum the handle should be 6 ft. long, but if you're tall you might want to make it longer so you don't have to bend over to use the rake. After cutting, put the handle by the fire to dry, so it, like the tines, will fit tightly when the green rake head shrinks around it.

Making the Head

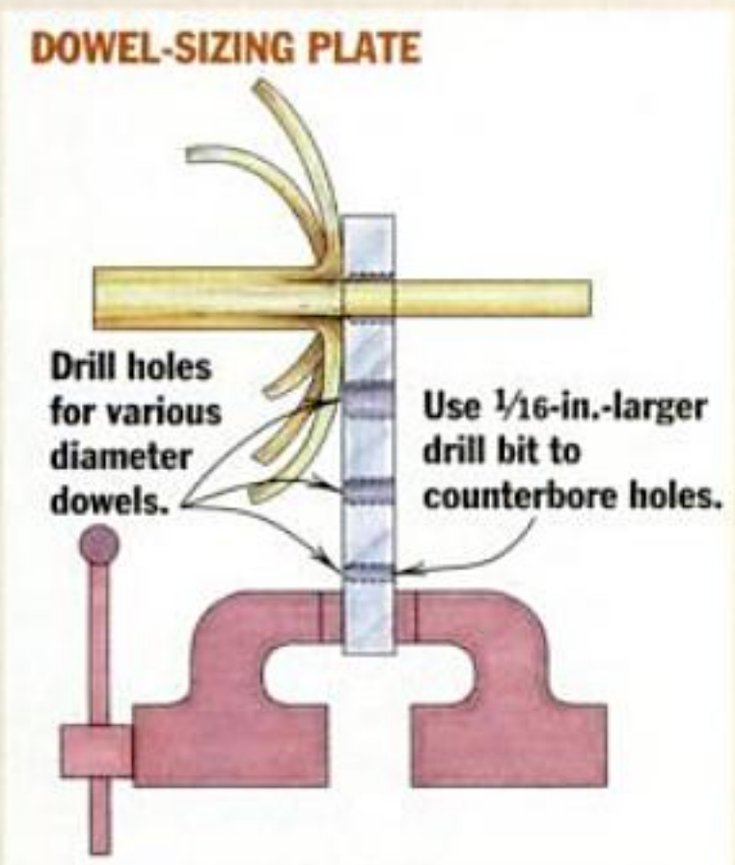
Riven ash is best for the head, and I make my heads 1 in. thick and 24 in. long. Leave the head 2 in. high at the center, but taper it down to 1½ in. at the ends to reduce the weight so that the rake will be less of a strain to use.

I like to taper the sides with a

Three Shop-Made Rounding Tools

I've spent many a satisfying day turning wood on a pole lathe (see AW #8, May/June 1989), but there are times when that fine old machine just can't do the job for me. When I need to round a workpiece that is either too long or too short for the lathe, I use one of these shop-made tools instead.

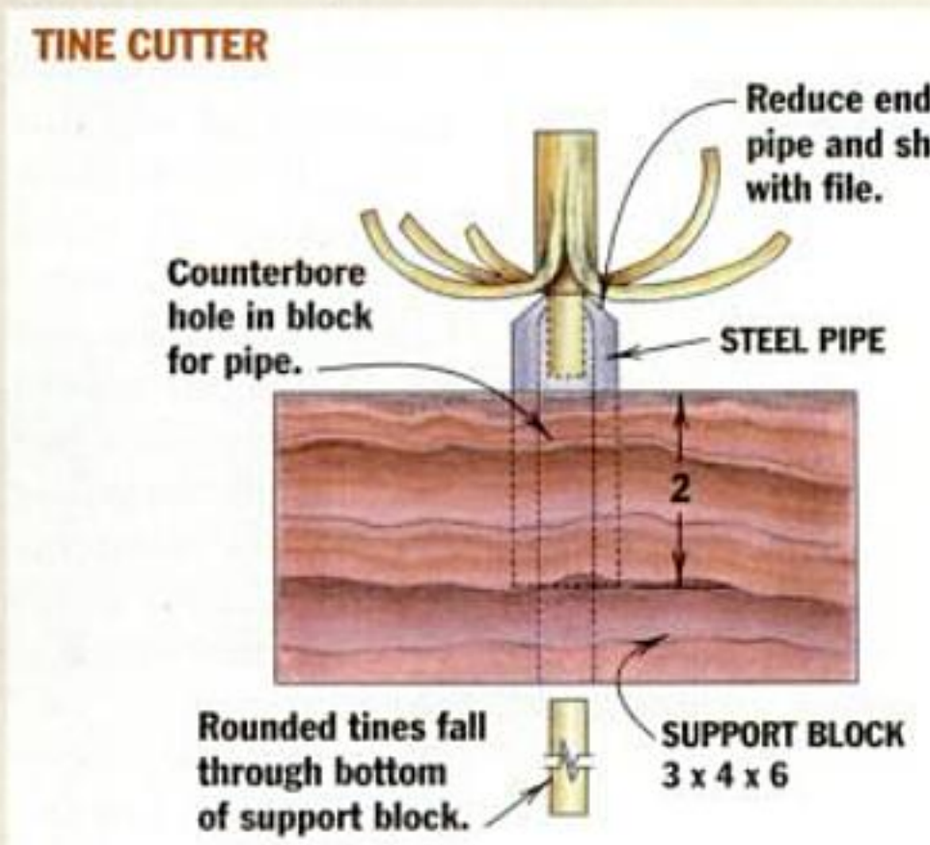
Dowel-Sizing Plate—This is simply a flat piece of scrap steel, between ¼ in. and 5⁄16 in. thick, with a series of holes counterbored in it. The edge of each hole acts as a sharp, circular knife.



To make a dowel-sizing plate, drill a series of holes that match the dowel diameters you want to make, then counterbore the holes to within ⅛ in. of the surface of the steel plate. (See drawing at left.) Each counterbore should be about 1⁄16 in. larger than the original hole. To resharpen the holes, rub the steel plate on a sharpening stone.

To use the dowel-sizing plate, trim your workpiece roughly to size, then drive it through the small side of the plate with a mallet.

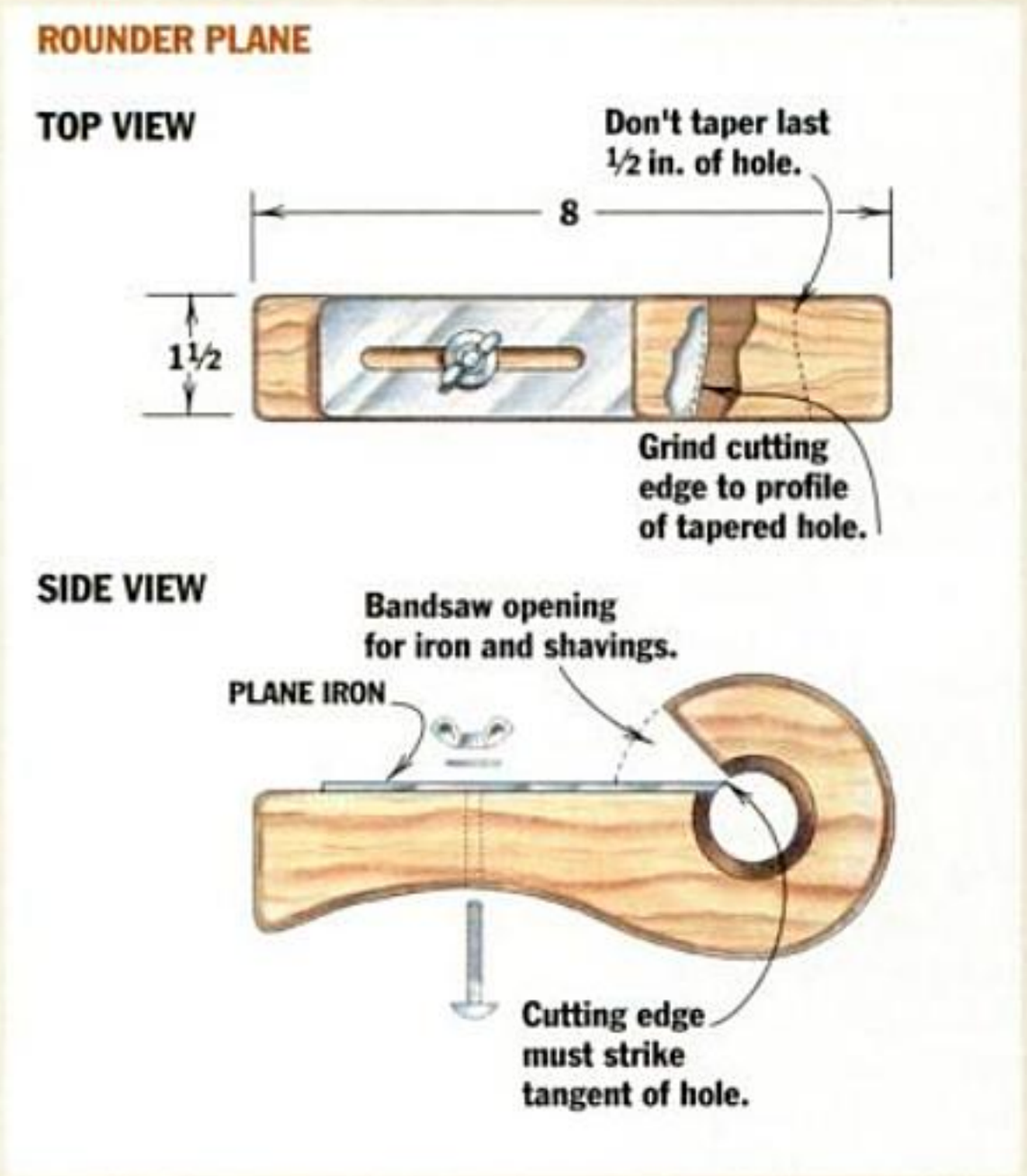
Tine Cutter—A tine cutter has an advantage over a dowel-sizing plate in that it helps hold a workpiece straight as it goes through the cutter. To make one, cut a 6-in. length of black steel pipe and sharpen one end. The sharpened end should be slightly smaller in diameter than the rest of the pipe (see drawing below), so the workpiece won't stick as it passes through. You can reduce the end by heating the pipe on a forge or in a barbecue and then lightly hammering around the end. Use a mill bastard file to sharpen this narrowed end.



Use a tine cutter the same way you use the dowel-sizing plate. Just trim your workpiece to rough diameter, then drive it through the cutter.

Rounder Plane—The rounder plane is often used to round off handles, ladder rungs or tenons. It works like a pencil sharpener and consists of a plane iron set in a solid block of wood that has a tapered hole running through it. The taper stops about ½ in. from the side of the block.

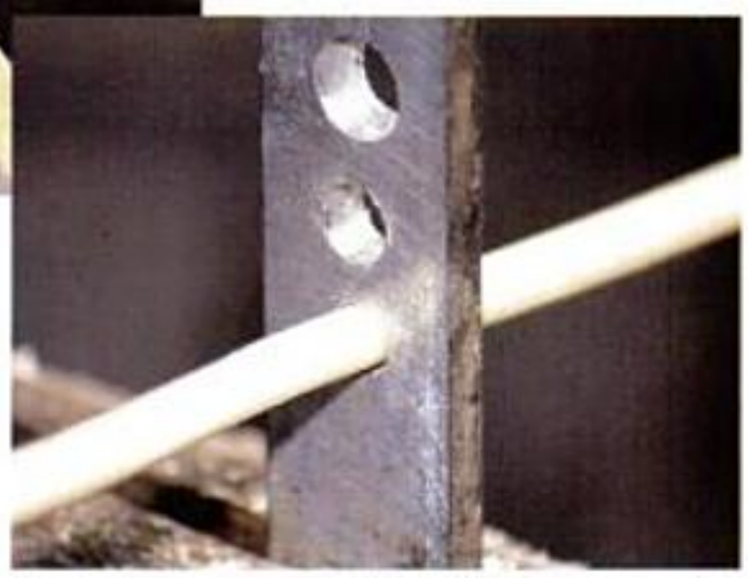
To make a rounder plane, bandsaw a piece of scrap hardwood about 8 in. long and 1½ in. thick to the shape shown in the drawing. At the center of the circular part, use a Forstner bit to bore a hole of the desired finished diameter. Then use a tapered reamer (available from Olde Mill Cabinet Shoppe, 1660 Camp Betty Washington Rd., York, PA 17402, 717-755-8884) to enlarge and taper all but the last ½ in. of the hole. This lets you feed oversized stock into the opening. Next, cut out a wedge-shaped section to accommodate the iron and allow shavings to escape. Fitting the iron into this wedge-shaped opening is tricky: You want the iron's cutting edge to enter near the top of the hole so the blade cuts at a tangent to the workpiece. You may have to shave a bit off the flat on which the iron sits, or shim up the iron to get the cutting edge at the right point.



Grind the iron to follow the taper of the hole, with the last ½ in. or so ground square. Grind the cutting edge to a 20° bevel, then hone a 25° secondary bevel.

To use the plane, clamp one end of your workpiece in a vise, then turn the plane hand over hand down the length of the workpiece. —*D.W.*

Getting the round. At left, Weber uses an antique rotary plane, called a Stail engine, to round the rake handle. Below, he drives a roughly rounded length of hickory through a dowel-sizing plate to shave the hoop to its finished diameter. For more ways to round rough stock, see the sidebar on page 63.



hatchet, though a saw would do as well. First, I make a series of shallow scoring cuts with the hatchet head held at about a 45° angle to the surface. Then I remove the chips by hewing with the hatchet nearly parallel to the surface. Working this way prevents the hatchet from following the grain of the wood and splitting off too much material. After tapering, you can use a plane or drawknife to flatten and smooth the surface.

Finally, chamfer all edges of the head. This reduces the chance the edges will split if you hit a rock or root while raking.

Installing the Tines

With the parts made, all you need to do is drill the holes in the rake head and assemble the pieces. The tines fit in ½-in.-dia. holes drilled on 2-in. centers. You don't want the tines to end up directly under the hole for the handle, so start the tine holes 1 in. from the middle of the head on both sides, and work out toward the ends. The farthest holes should be approximately 1 in. from the edges of the rake head.

Unless you have a doweling jig to guide your bit so the holes are perpendicular to the head, it is a good idea to drill the first hole near the middle of the head, insert a tine and then use that tine as a guide as you drill the rest of the holes. (See photo, right.) The tine holes should go about 1½ in. into the head.

The tines turn oval as they dry, and when you install them, you'll want to align the broad sides of the ovals with the length of the rake head. (See drawing, page 62.) This way, the grain in all the parts is oriented in the same direction and there's less chance the green rake head will split as it shrinks around the tines. Chamfer the tine end if you have trouble fitting it in its hole. When all the tines are driven home, cut them to their final length of 3 in. and shave points on the ends.

Fitting the Hoop and Handle

Bore holes in the head for the hoop and the handle. These holes should be bored slightly off perpendicular (about 95°) so that when the finished rake is in operating position, the teeth lean in toward the handle to keep the rake from bouncing as you drag it toward you. (See drawing, page 62.) The ⅞-in.-dia. hole for the handle is centered on the head, while the ⅜-in.-dia. holes for the hoop are placed halfway between the outermost tines.

To fit the rake's handle, taper the end with a drawknife so it sticks at least ½ in. through the head. Later, this little protuberance will be split and a wedge will be driven in to secure the joint.

Next, while the handle is still jammed into the rake head, measure 16 in. up from the head and bore a ⅜-in.-dia. hole through the handle for the hoop.

It's easier to fit the ends of the hoop in the rake head if you first remove the head from the handle. Then, pass the hoop through the hole in the handle until there is an even amount of hoop on each side of the handle. Bend the hoop, push its ends through the holes in the rake head, and once the hoop is installed, replace the head on the handle.

Pull the hoop through the holes until it is snug. Secure each hoop end by driving a small finishing nail through a predrilled hole in the head, and trim the hoop ends flush. Then lock the handle onto the head by splitting the end of the handle with a chisel and driving in a hardwood wedge.

That's it. A quick cleanup with a cabinet scraper, a coat of raw linseed oil and a rubdown with a handful of wood shavings will protect your timeless wooden rake against the ravages of time and climate.

A final note about removing a broken tine (it happens!). Don't try to drill out the old tine with a bit that is the same size as the tine; you're likely to enlarge the hole in the rake head as you drill. Instead, saw off the tine flush with the rake head and drill a smaller hole (⅜ in. or so) into the center of the broken tine. You should be able to collapse the rest of the old tine with a scratch awl. Make sure you use very dry replacement tines (6 percent to 8 percent moisture content); otherwise, they're likely to fall out as they dry. ▲

Aligning the tines. Drill one hole near the middle of the rake head and insert a tine to serve as a guide for boring all tine holes.

DON WEBER *is a Windsor chair maker and spring-pole lathe turner from northern California.*

WOOD FACTS

PECAN

By Paul McClure

In the 17th century, as European colonists tentatively made their way across the North American continent, Algonquin Indians left their war-ravaged home in Ontario, Canada, migrating as far south as the Mississippi river basin. There they encountered a group of European settlers who were struggling to live off an unfamiliar land. The Algonquins introduced the settlers to a tree that produced food, oil for cooking, and wood well-suited to making handles for tools and cooking utensils. The colonists named the tree after the chief of the tribe, Peccan.

Pecan trees are known to grow for 300 years and reach diameters of 6 to 8 ft. In open orchards, they can reach heights of 160 ft. Orchard-grown trees, cultivated for nut production, do not produce much clear lumber due to their proliferation of branches. In forests, where the trees rarely grow to 100 ft. tall, the pecan tree is often harvested for lumber along with its close relative, hickory.

Appearance

Pecan is a ring-porous hardwood with very wide, cream-colored sapwood and reddish-brown heartwood. It is coarse-textured, like oak, but with smaller, tighter pores. Although the wood seldom displays very unusual figure, I have seen some fantastic fiddleback pecan.

Workability

Hard, heavy, and shock resistant, pecan excels in strength and stiffness. It's also easy to bend. It machines well with power tools but has some tendency to burn if blades and cutters are not sharp or if a constant feed rate is not maintained. Carbide blades and cutters are recommended to overcome the wood's dulling effect on tools.

Pecan can be difficult to work with hand tools. However, it does sand easily, and it glues well. When using screws or other fasteners, preboring is necessary.

Because of its small pores and dense late-wood, pecan doesn't accept stain well and often requires several coats to achieve the desired color. It does accept all finishes, though, and will take an excellent high polish.

Uses

Pecan is used in chairmaking and woodturning, for flooring and architectural paneling, in farm wagon construction, and in laminated frames for fishing nets. Pecan veneer is used widely in production furniture. ▲

PAUL MCCLURE *is a wood technologist living in Colorado.*

Pecan has wide, cream-colored sapwood and reddish-brown heartwood.

PECAN	
SPECIES	*Carya illinoensis*
GROWING REGION	Southeastern U.S.,Texas, Mexico
SPECIFIC GRAVITY	0.75
DENSITY	46 lbs./cubic ft.
WOOD MOVEMENT[1] (FROM 12% TO 6% MC)	Medium (less than ½ in./ft.)
DURABILITY	Subject to decay and insect attack
SUSTAINABILITY	Sustainable at current production levels
AVAILABILITY	Hardwood lumber dealers
THICKNESSES	4/4 (8/4 rarely)
WIDTHS	6 to 10 in.
LENGTHS	8 to 12 ft.
COST	
LUMBER	$2 to $4 per bd. ft.
VENEER	60 cents per sq. ft.

[1] *Indicates wood movement across grain.*

PHOTO BY ROBERT GERHEART

TOOL BOX

New Polyurethane Glue

Gorilla Glue is a new moisture-curing polyurethane glue that bonds well on wet wood, and the manufacturer claims it's waterproof according to European standards. Gorilla Glue stays slippery so you can adjust parts during its full open time of about 20 minutes. Clamping time is one to four hours, and squeeze-out is easy to remove. The glue attains full strength (equivalent to aliphatic resin and plastic resin glue) in 24 hours. It doesn't require mixing, contains no toxic solvents, and the cured glue won't dull cutting tools or clog sandpaper. Gorilla Glue has an invisible glue line that accepts stain. (Price: $19.95 for 18-oz. bottle; 29.95 for 36-oz. bottle) *Gorilla Group, Dept. AWT, Box 42532, Santa Barbara, CA 93140, (800) 966-3458.* **Circle #630**

RYOBI BT3000 TABLESAW

When Ryobi engineers designed their BT3000 Precision Benchtop Cutting System, they created a tool that occupies its own category—somewhere between a 10-in. benchtop tablesaw and a contractor's saw. Unlike most benchtop saws, the BT3000 has a sliding crosscut table and a belt-driven arbor. But instead of the cast-iron construction of a contractor's saw, the Ryobi has a lightweight aluminum table mounted on its sheet-metal cabinet. It weighs a modest 75 pounds.

Don't look for miter slots in the tabletop—there aren't any. Instead, the basic saw has a pair of table modules that can be positioned on either side of the fixed table that houses the blade. One module is the sliding table; the other acts like an extension wing, and is designed to accept an optional mounting kit for a router or jigsaw.

Options abound, supporting Ryobi's contention that this machine is really a "saw system" with components that can be added and repositioned, providing an array of configurations and functions. In addition to expected options like zero-clearance throat plates and a steel stand, Ryobi offers items like a folding extension table, miter clamp kit, fence-rail extensions, and a dust bag. If you really want to get fancy, there's even an air-flotation table designed to work with Ryobi's 28-gallon shop vacuum. In "flotation" mode, the vacuum (used as a blower) creates an air cushion across the table surface, making it easier to maneuver large panels. Changing from cushion to suction turns the table into a vacuum clamp.

Modular components and innovative accessories—including a vacuum-powered "air flotation table"—make the Ryobi BT3000 unique among tablesaws.

So how does it handle? The saw cuts precisely, with enough power to handle 8/4 maple if you nurse the cut by slowing the feed rate. The saw's fence, which locks down on both the front and rear rails, is very solid. Blade tilt and height are set with a single handwheel and control lever—the same adjustment system you find on conventional benchtop saws.

In action, the crosscut table slides somewhat stiffly, but this didn't cause any problems. However, stops on the table limit maximum crosscutting width to 16 in.; and with no miter gauge slots, you can't use a shop-made crosscut jig to increase this capacity.

On the plus side, the crosscut table includes a generous 18-in.-long miter bar that supports stock much better than ordinary miter gauges. And a large, easy-to-read scale lets you adjust the miter bar up to 45° in both directions with great precision.

Dust collection efficiency was very good when we connected the saw's dust port to a dust collector, but dropped off somewhat with the dust bag connected to the port.

Our first air table was dished about ¼ in. in the middle, but a replacement air table worked better, letting us push large plywood sheets past the blade with much less resistance than on other saws. The suction mode clamps a workpiece tightly enough for safe sanding or routing.

Overall we're impressed with the BT3000—not because it's a saw for everyone, but because Ryobi started fresh and designed a new tool with modular components and well-integrated accessories. The BT3000 isn't for production woodworkers or for those accustomed to the stability, durability, and jig potential of a cast-iron saw table. But it's a good bet as a first tablesaw, or if you want to "move up" from a less versatile benchtop machine. The BT3000's router-table option, along with other accessories, make it an attractive choice for woodworkers interested in "growing" a workshop, one accessory at a time. (Price: saw: $550; flotation table: $99) *Ryobi America, Dept. AWT, 5201 Pearman Dairy Rd., Anderson, SC 29625, (800) 525-2579.* **Circle #629**

TOOL BOX

IN THE WORKS

New Oscillating Spindle Sander From Sears

Just as we were wrapping up our "Buyer's Guide to Oscillating Spindle Sanders" (see page 40), we discovered that Sears is set to introduce a benchtop version. Model 22590 has a 20-in. by 20-in. table made of melamine-covered particleboard. It includes 4½-in.-long sanding drums and abrasive sleeves in five diameters that fit on a single metal spindle. It weighs 33½ pounds and has a built-in dust collection port and storage rack for drums and table inserts. Look for it in Sears stores in early fall 1994, for about $150.

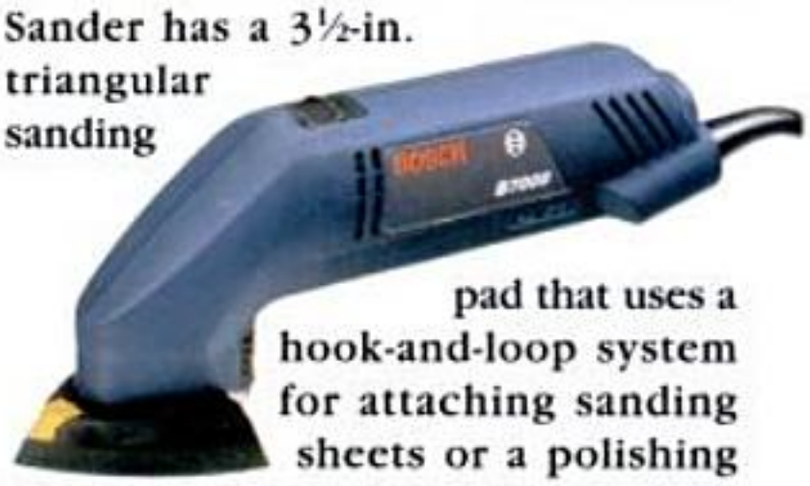
Handy Panel Carrier

Take the load off your aching back by using the Panel Express to maneuver heavy sheet goods around your shop. This small cart is designed to let one person move up to three full-size sheets of ¾-in.-thick plywood (350 pounds maximum load). A self-adjusting brace mechanism conforms to the load to hold it secure. The Panel Express's small size, along with a drop-axle design which lowers its center of gravity, make it easy to maneuver. A pair of 10-in. pneumatic tires roll easily over obstacles. The Panel Express has a foot-operated brake that lets you "park" the unit to off-load a panel. (Price: $299)

Saw Trax Manufacturing, Dept AWT, Box 1170, Kennesaw, GA 30144, (404) 974-0021. **Circle #631**

Detail Sander From Bosch

The new Bosch B7000 Corner Detail Sander has a 3½-in. triangular sanding pad that uses a hook-and-loop system for attaching sanding sheets or a polishing pad. The sanding pad detaches easily, so you can rotate it to position a fresh corner of the abrasive sheet at the front of the triangle. A unique pad extension (included) lets the tool reach into tight corners. A dust collection port lets you hook up a shop vacuum to collect dust through holes



in the sanding pad. (Price: $122)
S.B. Power Tool Co., 4300 W. Peterson Ave., Chicago, IL 60646, (312) 286-7330. **Circle #632**

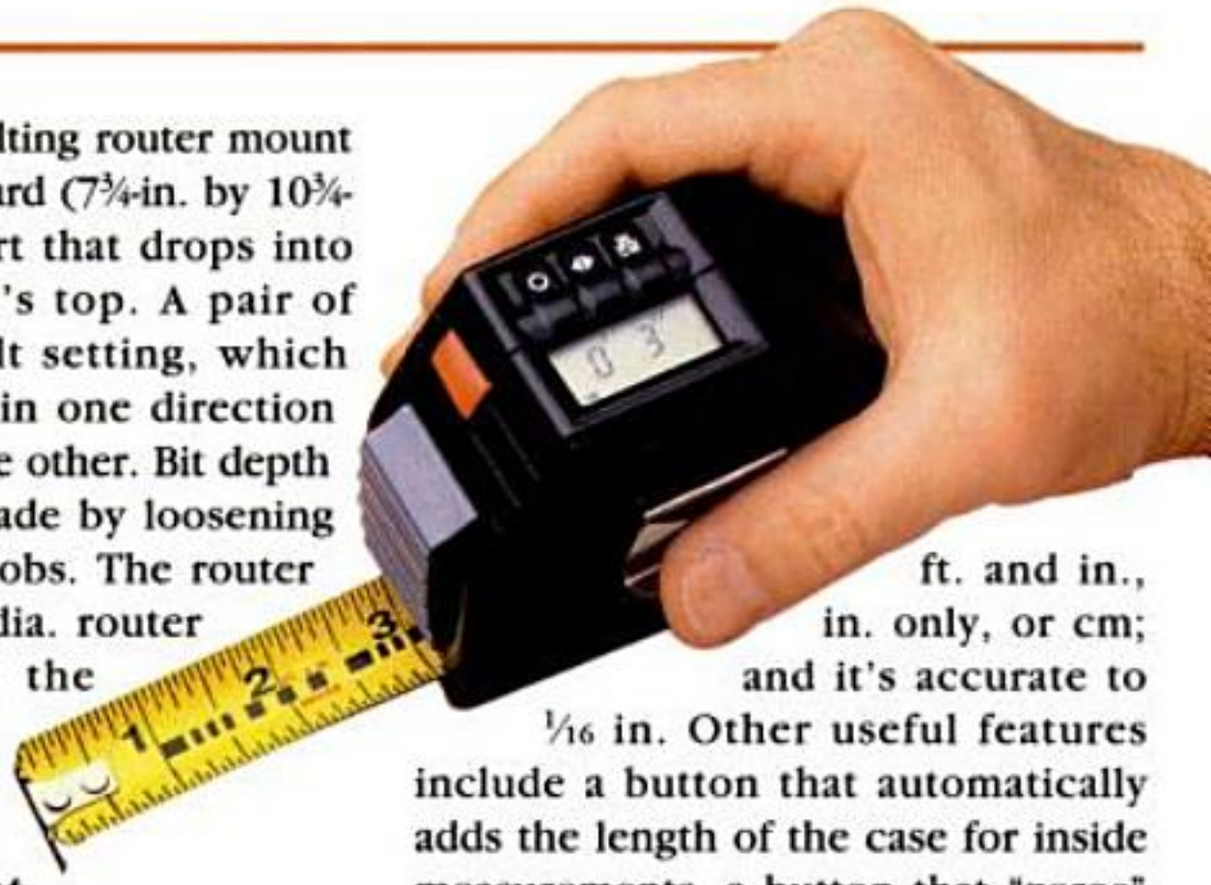
Tilting Router Base

Woodhaven's new Angle Ease fixture adds a new dimension to router-table work by letting you tilt the router and bit to make cuts and create profiles that weren't possible before. The fixture consists of a tilting router mount fastened to a standard (7¾-in. by 10¾-in.) phenolic insert that drops into your router table's top. A pair of knobs lock the tilt setting, which adjusts up to 45° in one direction and up to 10° in the other. Bit depth adjustments are made by loosening another pair of knobs. The router mount fits 3½-in.-dia. router motors (without the base) from most router manufacturers. (Price: $94.99)

Woodhaven, Dept. AWT, 5323 W. Kimberly Rd., Davenport, IA, 52806,(800) 344-6657. **Circle #633**

High-Tech Tape

Starrett's new Digitape tape measure shows measurements on a large, easy-to-read digital display located on the top of the tape case. You can change the display to read in either ft. and in., in. only, or cm; and it's accurate to 1/16 in. Other useful features include a button that automatically adds the length of the case for inside measurements, a button that "zeros" the reading at any extension of the tape, and a "memory" button that saves the reading. The tape's microcircuitry survived our drop test, but this tool is probably better off in the workshop than on the job site. (Price: $30)



The L.S. Starrett Co., Dept. AWT, 121 Crescent St., Athol, MA 01331, (508) 249-5330. **Circle #634**

JUST FINISHING

SEALERS

Choosing and Using These Elusive Coatings

By Michael Dresdner

The term "sealer" is the source of much confusion among woodworkers, because it refers to many types of coatings that do many types of jobs. To add to the confusion, some coatings are called sealers only when they are used in a particular way. The questions most frequently asked about sealers are: "What exactly is a sealer?" "When should I use one?" and "Which sealer is the right one for the job?" Let's start from the top and clear the air.

What Is A Sealer?

Generally speaking, a sealer is any coating that forms a continuous film between the wood and a finish, or between different layers of finishing materials, such as pore fillers, glazes and top coats. (See "Multi-Step Finishes," AW #38.)

Sealers are available wherever you buy finishing supplies. They are typically applied the same way you finish—by brush or spray gun.

Why Use A Sealer?

Here are some of the reasons to use a sealer when finishing. See the chart at right for a ready-reference summary.

- **To encourage adhesion:** Sealers are often referred to as "tie coats" when they're used to improve adhesion of a finish.
- **To help seal in wood resins:** Some woods, such as rosewood and teak, contain resins that prevent varnish and lacquer from drying or adhering. Some sealers, such as shellac and vinyl sealer, form so-called "barrier coats" to seal in these resins and help the top coat stick.
- **To prevent stains from bleeding:** Many stains, including dye stains, tend to "bleed" out of the wood and into the finish. An appropriate sealer can prevent this.
- **To "encapsulate" pore filler:** A sealer used underneath a pore filler can keep the oil in the filler from penetrating deeply into the raw wood. A sealer used over a pore filler can help the top coat adhere to the filled surface and keep it from soaking into the filler.
- **To help top coats build faster:** Some finishes tend to soak in too readily, especially on very porous woods such as pine and fir. Sealers prevent the top coats from soaking into the wood, so they will build faster. Thinned water-based glue is often used to seal the edges of man-made boards such as medium-density fiberboard (MDF).
- **To make sanding easier:** Certain sealers called "sanding sealers" sand more easily than top-coat materials, so you can save time and effort, and begin topcoating sooner.
- **To prevent grain-raising:** Water-based top coats are notorious for raising grain. A preliminary coat of shellac will reduce this grain-raising.
- **To seal in oils and wax:** Some sealers, notably shellac, will keep these substances from contaminating the top coat or preventing adhesion.
- **To help water-based top coats "lay out" better:** Shellac in particular helps these sensitive emulsions resist the "orange peel" and "fish-eyes" that tend to form over the slightest traces of oil, wax or silicone.

PHOTO BY KURT WILSON

Sealers can improve the adhesion and build of finishes by forming a film between the wood and the top coat.

SEALERS AND THEIR USES

	"Tie coat" to improve adhesion of top coat	"Barrier coat" to seal in resins and dyes	"Barrier coat" to seal in wax and oil	Sealing porous wood, end grain or MDF	Sealing over or under pore filler	Easy sanding
Sanding sealer (vinyl, varnish, lacquer or water-based)				●	Over only	●
Vinyl or "catalyzed vinyl"	●	●			Both	
Shellac	●	●	●	●	Both	
Glue size		●		●	Under only	

Which Sealer Should You Use?

Some coatings, such as oil, varnish, brushable polyurethane and shellac, are "self-sealing." This means they don't require a separate sealer for good adhesion on most woods, though you might want to use a sealer anyway, for one of the reasons listed above. Others, such as most catalyzed coatings, require a special sealer designed just for use with those finishes. Always consult the manufacturer's instructions on the finish label for sealing recommendations.

To avoid surprises, it's always a good idea to make up some wood samples and try out your chosen sealer and top coat. For general sealing, here are the main types of sealers and some advice on using each:

Sanding sealer is a top coat—lacquer, vinyl, water-based, or varnish—with easy-to-sand, self-lubricating "stearate" soap added to make sanding easier. Always use a sanding sealer that is made with the same type of finish as your intended top coat.

Sanding sealers are available in both brushable and sprayable formulations. Because the stearates make the film softer, it's best to use only one or two coats of these sealers; a hard top coat applied over a thick layer of sanding sealer will chip and crack easily.

Vinyl and "catalyzed vinyl" sealers work under lacquer and some "catalyzed" lacquers to seal in oily wood resins and bleeding colors. Vinyl sealer also adheres well to many hard-to-coat materials such as plastic, metal and pearl inlay. These sealers are generally formulated for spraying, and some are finicky to use—you need to apply the first coat of top coat within 45 minutes for a good bond—so follow the instructions on the label carefully.

Shellac is a nearly ideal sealer. It works under lacquer, most varnishes, and even water-based coatings, and seals in everything from silicone contamination to bleeding dyes. You can apply shellac with a brush, spray gun or rag. It adheres to almost anything (including glass), it's easy to use, and it enhances the look of wood. Always make sure your shellac is fresh; check the expiration date on the can or mix your own from flakes. (See AW #34.) When in doubt, use shellac.

Glue size, made by thinning white or yellow glue with water, is an excellent sealer for furry or porous woods and end grain. It even helps pore filler do a better job. Use a thicker mixture to seal the edges of MDF. You can apply glue size with a brush or a paint pad. Limit yourself to one coat.

The only problem with glue size is that it tends to lighten the appearance of dark woods such as walnut and rosewood under a finish, so make sure that's the effect you want before choosing glue size. ▲

Different Scopes from Different Folks

Kaleidoscopes, with their mirror-prism interiors, provide through their peepholes a wondrous array of colorful designs. Like lockets, they are prized not only for the pictures they contain but for their own ornament. Here is a look at some real jewels.

▲ "S.F." by Glenn and Ben Straub, Ephrata, PA. Walnut, ash. Dimensions: L: 12 in., H: 15 in.

PHOTO BY BEN STRAUB

▲ "Y-Direct" by Shelly and Randy Knapp, Ontario, OR. Zebrawood, bubinga. Dimensions: L: 12 in., H: 12 in.

PHOTO BY RANDY KNAPP

▲ Hand-held scopes by Tom and Carol Paretti, Prescott, AZ. Wenge, padauk, pao cetim, bird's-eye maple, nara, zebrawood, boire. Dimensions: H: 9 in. Dia: 2¾ in.

PHOTO BY TERRY PEMBERTON

▲ Kaleidoscope by Danny Thomas, Sunbury, OH. Walnut, black walnut burl. Dimensions: W: 30 in., H: 20 in.

PHOTO BY JERRY ANTHONY

▲ "Series 640" by Tom and Carol Paretti, Prescott, AZ. Koa, cocobolo, padauk, Guatamalan rosewood. Dimensions: W: 12 in., H: 10 in.

PHOTO BY TERRY PEMBERTON

GALLERY

Kaleidoscope and cabinet by Danny Thomas, Sunbury, OH. Carpathian elm burl, mahogany, brass. Dimensions: W: 19 in., H: 16 in.

PHOTO BY JERRY ANTHONY

▲ "Personal Revolution" by Shelly and Randy Knapp, Ontario, OR. Box elder, wenge. Dimensions: L: 10 in., H: 11 in.

PHOTO BY RANDY KNAPP

German-mount kaleidoscope by Danny Thomas, Sunbury, OH. Olive ash burl, oak burl, black walnut. Dimensions: W: 12 in., H: 14 in.

PHOTO BY JERRY ANTHONY

▲ Kaleidoscopes by Glenn and Ben Straub, Ephrata, PA. Left: "Phoenix"—Olive ash burl, walnut. Center and right: "Paragon F.T."—Walnut, zebrawood, bird's-eye maple. Scope dimensions: L: 9½ in., Dia: 2 in.

PHOTO BY BEN STRAUB

"Angler" by Tom and Carol Paretti, Prescott, AZ. Bird's-eye maple, bubinga, koa, mahogany. Dimensions: W: 12 in., H: 10 in.

PHOTO BY TERRY PEMBERTON

Want to see your work in "Gallery"? Send 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. We'll pay you $35 if we publish your work. If you want your photos returned, enclose a self-addressed stamped envelope.

SHOP SOLUTIONS

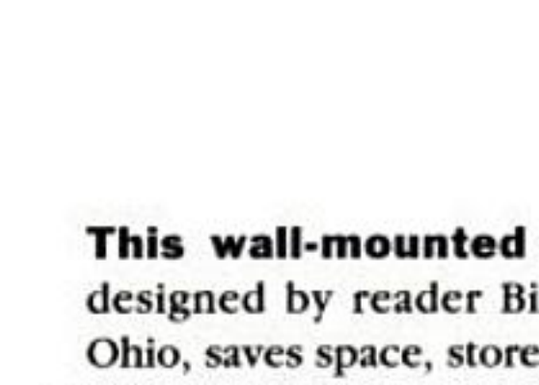
GLUE-UP RACK

Save Space By Gluing Your Panels Standing Up

By Andy Rae

This wall-mounted glue-up rack, designed by reader Bill Baker from Ohio, saves space, stores pipe clamps, and makes it easy to glue up panels.

Baker hangs standard ¾-in. pipe clamps on ½-in.-dia. steel rods that extend between the rack's 2x6 sides. Each rod's clamps need to be the same length. To use the rack, you start at the top rod, swinging the clamps outward and holding them there on a pivoting support board. This arrangement lets you place your work over the clamps at a convenient angle for gluing. You can add extra clamps once the rack's clamps are tightened. When not in use, support boards and clamps swing down and out of the way.



Baker's wall-mounted glue-up rack saves floor space and is kind to your back.

Make your support boards from strong hardwood, so they'll bear the weight of the clamps and the work being glued. To locate the stop pegs, swing a pipe clamp outward at a comfortable angle, rotate the support board 90° to the clamp, then mark and drill for the pegs.

The rack shown here has five work stations for multiple glue-ups. If you want a wider rack, use a larger-diameter rod to keep the rod from bowing.

You can hang the rack on the wall or place it on the floor against the wall. Be sure to attach the rack to the wall so it won't tip over in use. ▲

ANDY RAE *is an assistant editor of AW.*

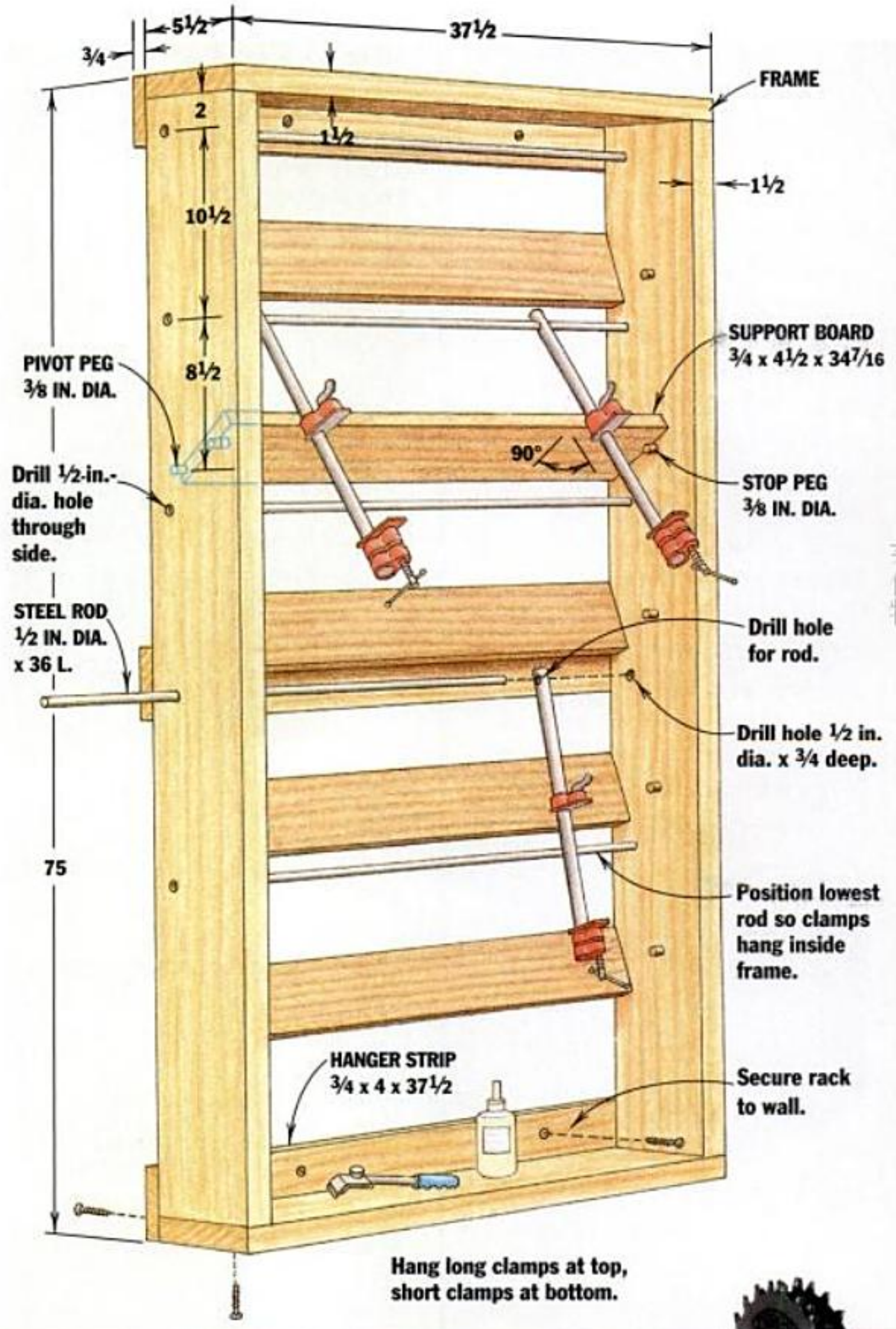


ILLUSTRATION BY FRANK ROHRBACH

PHOTO BY BILL BAKER

Do you have a favorite shop fixture you'd like to share? Send a drawing or sketch with a full explanation to: AMERICAN WOODWORKER, 33 E. Minor St., Emmaus, PA 18098. If we publish your "Shop Solution" we'll send you this Forrest 8-in. dado set, worth $321.