AMERICAN WOODWORKER

JUNE 1995 #45

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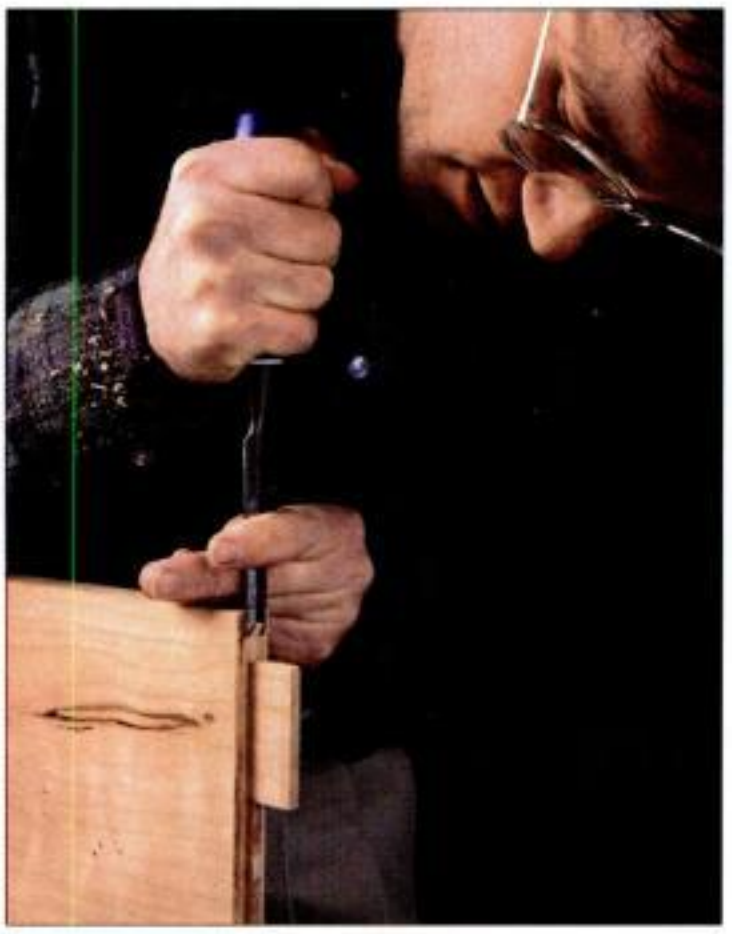
AMERICAN WOODWORKER

Issue No. 45 June 1995



Page 58 Making Breadboard Ends

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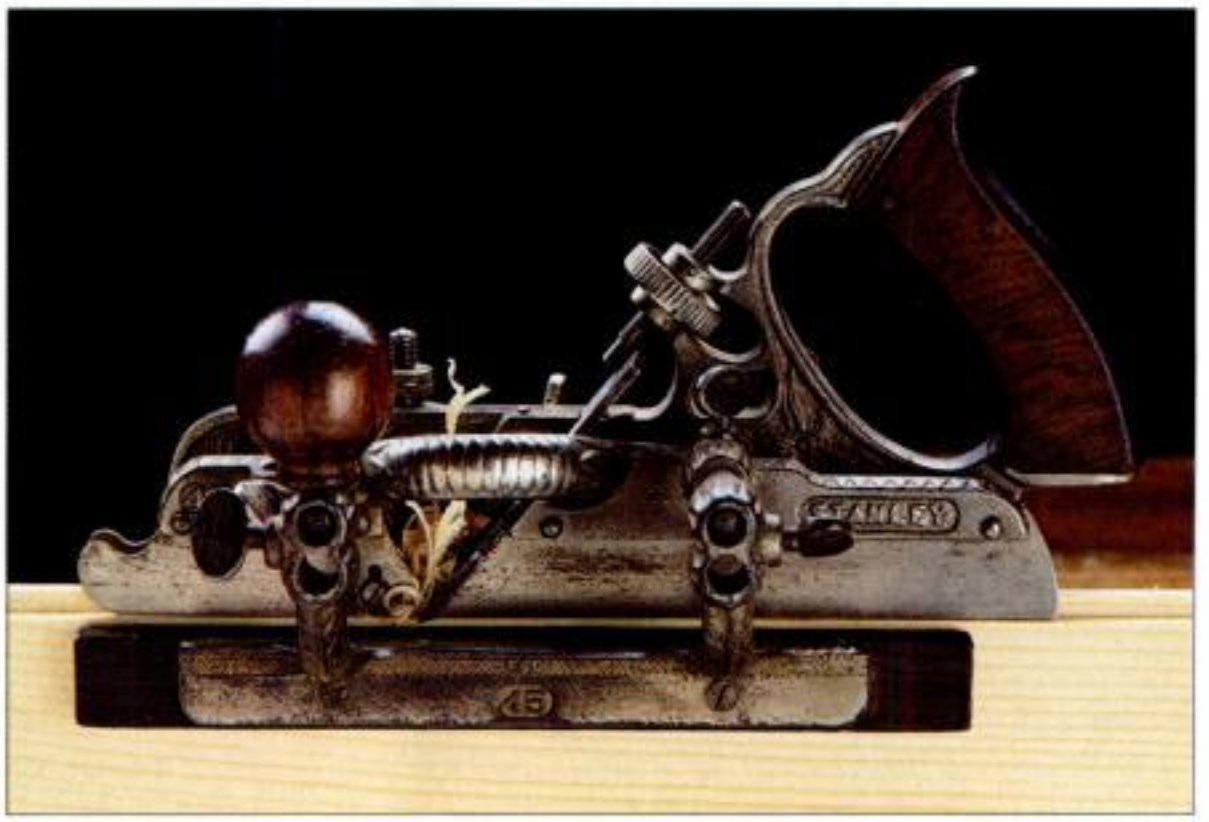

Page 42 Planes for Tongue and Groove

DEPARTMENTS

FEATURES

A RODALE PRESS PUBLICATION

On the cover: *This Colonial tavern table was built by Matthew Burak, who makes traditional furniture in Danville, VT. See page 28.*

COVER PHOTO BY PAUL ROGERS/STOWE, VT

A WORD FROM THE PUBLISHER

INSPIRING IDEAS

One of the nicest fringe benefits of my job as the publisher of AMERICAN WOODWORKER is that I get to see a lot of great woodworking. Each year I go to dozens of furniture shows, gallery openings and exhibits—the best work by the best woodworkers in North America and Europe.

I always come away from these shows full of ideas, charged up and inspired to try new things in my own work—ready to take a few risks. I'll often experiment with details I saw at a show: a clever drawer stop, perhaps, or a different edge treatment from my old tried-and-true. I'm not talking about *copying* someone else's design; that's plagiarism, an ethical no-no. I'm simply borrowing an idea, turning it around in my mind for a while and then putting my own personal spin on it to make it my own.

But the biggest thrill of all for me is the burst of inspiration I get that sends me straight to the shop. When I see how creative other people can be, I can't wait to give my own ideas a try.

Good woodworking ideas are all around you: in magazines, books, and catalogs; at museums, antique stores, furniture exhibitions; even on TV shows. You can never tell when inspiration might strike, and it's prudent to be prepared. A pocket-size notebook is handy for jotting down ideas.

So, if you want to improve your woodworking, study the work of people who are better than you. You can learn a lot just by looking.

Of course, studying with an excellent woodworking instructor is another great way to improve your skills. I'm pleased to welcome two prominent woodworking instructors as contributing editors to AW.

Peter Korn is a well-respected name in the woodworking world. Peter is the founder and director of the Center for Furniture Craftsmanship in West Rockland, ME, where he also teaches woodworking. Previously, Peter ran the world-renowned woodworking program at the Anderson Ranch Arts Center in Snowmass Village, CO. In addition to his teaching credentials, Peter is a talented designer/craftsman and the author of *Working With Wood: The Basics of Craftsmanship* (1993, Taunton Press, Newtown, CT 06470). His article on breadboard ends appears on page 58 of this issue.

Lonnie Bird teaches woodworking at the University of Rio Grande in Rio Grande, OH. Lonnie's specialty is period furniture, and you've seen his excellent work in the pages of AW for the last two years. He'll continue to provide us with knowledgeable period-furniture articles as well as useful information on shop machinery and techniques.

David Sloan
Editor & publisher

DEADLINE FOR ENTRIES

June 1, 1995 is the deadline for entries in the 1995 AW Excellence in Craftsmanship Awards Competition.
See page 94 for details.

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) 967-7692

EDITOR & PUBLISHER
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EXECUTIVE EDITOR
ELLIS WALENTINE
MANAGING EDITOR
TIM SNYDER
ASSISTANT EDITORS
PAUL ANTHONY, ANDY RAE, DAVE SELLERS, JOE WAJSZCZUK
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The Audit Bureau Member

LETTERS

Reviewing the Router Table

Last April I finally completed the router table featured in AW #24. I used Baltic birch plywood and black walnut, and I gave the project a hand-rubbed oil finish. It was so pretty, my wife tried to convince me to bring it into the house. I prevailed, sure that I'd have the ultimate table till I died. But no—you had to do me one better. Now if I build your newest version ("Revolutionary Router Table," AW #44) my wife will be on my case for not giving her the one I made. You could well be named in a divorce action. Thanks for a fine magazine.

Ken Oakley
Brunswick, GA

About your router table: Could I overload an electrical circuit if I plug in a 9-amp vacuum as well as a 12-amp or 13-amp router?

Pete Masterson
Biloxi, MI

For safety reasons, I'd strongly suggest mounting your router table's on/off switch vertically instead of horizontally. A horizontal switch can easily be caught by your clothes, accidentally turning on the router. This actually happened in my shop class; luckily, nobody was injured.

Bruce Wrenn
Apex, NC

In the wiring diagram on page 34, the switch loop shows the hot to the switch using the black wire, and the white wire as the switched hot to the outlet. This is one of the few instances a white wire is used as a hot. The general protocol is to have the white wire provide the hot to the switch, so that the black can provide the hot to the load.

George Szontagh
Houston, TX

Editors reply: The switch, receptacles, wiring and plug used in our router table are all rated for 20 amps. We haven't yet tripped a 20-amp circuit breaker with a router and dust collector plugged into the table's receptacles, but it could happen—especially if you're using the router under load. If you trip a breaker, or blow a fuse, the best strategy is to plug your vacuum or dust collector into a separate circuit.

Vacuum Veneering: How Noisy?

Jeff Jewitt's review of vacuum veneering systems (AW #44) was very helpful. But he didn't talk about how much noise the different vacuum pumps produce—an important issue for woodworkers like me who have basement shops.

Carl Weatherby
Boise, ID

Jewitt replies: The loudest pump is the diaphragm pump from Vacuum Pressing Systems. Its noise level is comparable to that of an electric jigsaw. All of the rotary pumps are very quiet—about as loud as the blower motor on a car heater. Venturi pumps—both manual and automatic—do not generate any noise except for a whooshing sound. However, if you count the noise of the compressor operating, these pumps would be loudest of all.

Mourning WATCO's Demise

I was saddened at the news ("Offcuts," AW #44) that Minwax is discontinuing the WATCO line of finishes. WATCO oil finishes have been mentioned as the finishes of choice for years in numerous woodworking magazines. Many of us have taken these recommendations to heart. I for one have very positive opinions about WATCO, and it disturbs me no end to hear the quote: "Many of our dealers were reluctant to add another line...they didn't know that much about WATCO." Such a statement indicates a complete lack of consumer knowledge—and it surely is not true of dealers—they know WATCO!

Had Mr. Harrison instead attempted to convince WATCO users that Minwax has a better product, he would have found me more receptive to this change. Instead, I'm left with the feeling that some uninformed CEO decided to buy out a competitive product (WATCO) and then discontinue it. Who is the loser but the consumer?

James C. Pelz
Eau Claire, WI

Praise for Pierce

What a wonderful surprise to visit my favorite newsstand and see Cecil Pierce's face beaming out at me (AW #43). I started to correspond with Mr. Pierce after seeing an article about the hand-plane book he was planning to publish. He was kind enough to answer all my letters, and even sent me some pre-publication page proofs to get me started. But the best and most astonishing surprise was when he boxed up a pair of his planes and sent them to me with a short note: "Use them, study them, take them apart, and send them back when you are through." What an amazing act of kindness and consideration to a stranger on the other side of the country.

The only thing missing from your article was a picture of the "specially tapered handsaw" in use. Thanks again for the tribute to a wonderful woodworker and a long-distance friend.

Ike Bay
Portland, OR

I found "Maine Planemakers" fascinating. But as an old machinist, I couldn't overlook the erroneous caption on page

STAY IN TOUCH! ***If you have comments, corrections or news to share, we want to hear from you.***

- To write us, address letters to: **Editor, American Woodworker, 33 E. Minor St., Emmaus, PA 18098.**
- You can fax us at **(610) 967-7692.**
- Too busy to write? Call our Letterline: **(610) 967-7776.**
- For e-mail correspondence, American Woodworker's America Online address is: **AWLetters**
  Through the Internet, use **AWLetters@aol.com**

= Electronic Mail

45. The photo entitled "Flattening the sole" shows a Thompson surface grinder, not a milling machine. The "cutter" is actually a grinding wheel. And, as I learned during my apprenticeship, the "lubricant" is more accurately referred to as "cutting fluid." The error may be attributable to the Bridgeport milling machine vise which has been fitted to the surface grinder's table in lieu of the typical magnetic chuck (which probably doesn't work too well on the nonferrous bodies of Lie-Nielsen's planes!). Please keep up the good work.

John L. Petry
Groton, NY

Thanks for the Super Tune-Up

After reading Tom Burroughs' "Supertune Your Tablesaw" (AW #43) I enthusiastically went out to my shop to put his advice to work on my Taiwan-made cabinet saw. I didn't have an alignment bar as described in the article, so I used one of my blades, taking all measurements off the same saw tooth. After placing a 0.04-in. shim under the back of the top, the saw cuts better than ever. I immediately renewed my subscription. Thanks, AW.

Steven B. Bryson
Whitehall, MT

Steamed About the Gas Can

Concerning your "Ultimate Steam Box" article (AW #43): Using a gasoline can "as is" to boil water over an intense flame is an accident waiting to happen. Paint it green! If Michael Dunbar has bona fide gas cans lying around, an eager student or helper could easily pick the wrong can.

Thomas L. Basti
East Northport, NY

Kudos for AW on AOL

Thanks for going online with AOL (America Online). This network is excellent for communicating with other woodworkers around the country. I have already received good feedback from other woodworkers contacted via the AW/AOL connection. This will be a valuable source of info for future tool purchases.

Bob Warner
WylieKOT@aol.com
Voluntown, CT

Congratulations! Finally, we have a forum for us "wired" woodworkers. I've been waiting for something like this for quite some time. It's great to know that there is a place to turn to for advice, tips and other woodworking issues. And the ability to instantly access back issues of AMERICAN WOODWORKER is also a big plus. I'm sure that your new forum will be a great success. I'd like to thank you and your staff for not only putting out a great magazine but also for making it better by bringing it online. Keep up the good work!

Kevin Dorry
kd2001@aol.com

LETTERS

Raw or Boiled?

In Michael Dresdner's article on milk paint (AW #44), he reports that Michael Dunbar applies a coat of linseed oil thinned 20 percent with mineral spirits to add a sheen and provide some protection from water drops. Is this raw linseed oil or boiled linseed oil?

Karl C. Thomas
Columbia, MD

Michael Dresdner replies: Always use boiled linseed oil; raw linseed oil will take forever to dry. What makes raw linseed oil different from the "boiled" variety (it isn't actually boiled) are the driers added to the latter. In fact, you can convert "raw" to "boiled" simply by adding Japan driers.

Access to Erzgebirge

Since we ran the story on the toys of Erzbebirge (AW #42), a number of readers have inquired about a U.S. distributor of these distinctively handcrafted items. Erzgebirge crafts are available from the House of Tyrol, Box 909, Alpenland Center, Cleveland, GA 30528, (706) 865-3371.

Use Solid-Center Balls for File Handles

Issue #44's "Tech Tips" includes a tip on using a golf ball as a handle for files. Good tip, except that certain types of golf balls (especially old ones) are made of rubber bands wound tightly around a liquid-filled center. I've always been told that this center can be hazardous if it is allowed to gush out. And usually once you start to cut the rubber bands, the ball will unravel anyway. If you choose to make a golf-ball file handle, use a solid, two-piece ball such as a Top Flite.

Jim Molpus
Nashville, TN

Top Dead Center

About your tip on setting jointer knives with a magnet ("Tech Tips," AW #44): The idea of using a speaker magnet is a good one, especially since the price of commercial knife-setting jigs has climbed over the last few years. But your illustration is misleading; it shows a knife being set when not at top dead center. The easiest way to determine top dead center for each jointer knife is to be sure the edge of the knife is directly above the axis of the cutterhead shaft.

Jim Cummins
Woodstock, NY

Corrections

On page 52 of AW #44, the captions describing the membrane presses are switched; the press on the right is made by Mercury Vacuum Presses.

Seems we were left with a little eggnog on our pages in the last issue. The Christmas spirit evoked in the Delta ad on page 7 of AW #44 resulted from an error on our part. Our apologies to readers and to Delta for the misplaced yuletide message.

Q&A

Electronic Speed Controllers

Q Will an electronic speed controller—normally sold for use with routers—also work on my bench grinder, drill press or bandsaw?

Ken Logan
Portland, OR

A No. There are two types of motors which are commonly found in the woodshop: universal motors and induction motors.

Universal motors are small and powerful. They're found on routers, drills, sanders and other portable tools. Their chief identifying characteristic is a set of brushes. Universal motors run fast and provide a lot of horsepower in a small package.

Induction motors are primarily found on stationary shop machinery, including tablesaws, bandsaws and drill presses. These motors don't have brushes, and they are limited to speeds less than 3,600 rpm.

The speed of a universal motor is determined by the applied voltage and the load on the motor. Electronic speed controllers, which work by adjusting the voltage, are designed for use with universal motors only.

The speed of an induction motor is determined by electrical frequency—60 cycles (Hz) in the U.S. Adjusting electrical frequency in this case is usually impractical, so speed changes on induction motors are usually accomplished by mechanical means such as stepped pulleys. Using electronic speed controllers with induction motors can damage the control, motor or both. (For more on electronic speed control, see AW #44, page 72.)

Ed Cowern
District manager
Baldor Electric
Wallingford, CT

Router Table or Shaper?

Q I'd like to be able to do some shaping in my shop, but I can't decide between a small shaper or a large table-mounted router. Can you give me any advice?

Cathy Hobbs
Salt Lake City, UT

A Your decision should be based on the type of work you plan to do and, of course, on your budget.

Table-mounted routers and shapers are both capable of cutting a wide variety of moldings, as well as rabbets, grooves, and other types of joints. But each machine also has specific and unique capabilities.

In many ways, a table router acts as a small shaper, although it is limited in the size of the work it can handle. A router's biggest advantage over a shaper is that the router can make plunge cuts.

A shaper is more of a production tool. Its powerful motor and large spindle and bearings provide the heft necessary for cutting large moldings, entry-door joinery, other architectural woodwork and raised panels. A shaper tends to cut cleaner without burning and its cutting direction can also be reversed, letting you climb-cut to reduce tearout.

A 3-HP router will cost you about $300. Figure another $200 to $300 for a good router table. (See AW #44 for one example.) A good ¾-in. spindle shaper will cost upwards of $800.

Plane Speaking

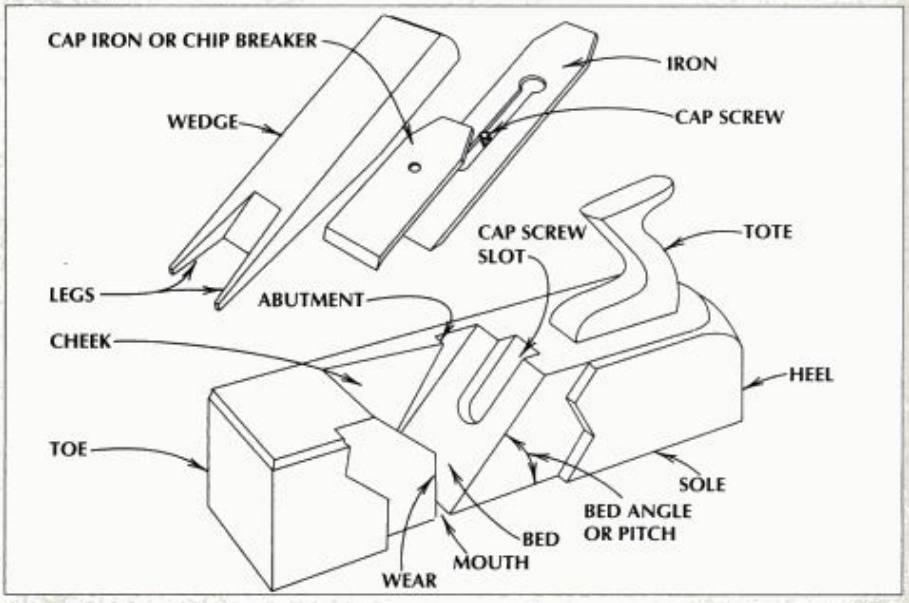
Q I enjoyed reading about Cecil Pierce and the wooden planes that he makes. But I'm a little confused about certain terms that are used to describe plane anatomy—words such as "ramp" and "throat pocket," for example. Are there standard names for the various parts of a wooden plane, and if so, what are they?

Art Livingston
Berea, KY

A Today we're in serious danger of losing the descriptive language that has been used for centuries to describe many aspects of woodworking. Nowhere is this more apparent than in the terminology used to describe wooden hand planes. This working vocabulary was once universal; now we're confusing things by creating new labels unnecessarily or by using the old terms incorrectly.

As shown in the drawing at right, many of the terms of hand plane anatomy derive directly from human anatomy. The plane's body is also known as the stock. The wood chip enters through the plane's mouth and curls up into the throat. The sides of the throat, properly referred to as the cheeks, are cut out to form tapered slots called abutments, which hold the wedge in place.

Michael Dunbar
Windsor chairmaker
Portsmouth, NH



(Avoid the less expensive 1/2-in. spindle shapers—they lack the capacity and power you'll need.)

A table router is very useful in any shop and is perhaps the best initial choice for shaping. As your skill level and budget increase, though, I suggest moving up to a 3/4-in. spindle shaper rather than investing heavily in more router tooling and accessories.

Lonnie Bird
Woodworking instructor
Rio Grande, OH

A Note to the Future

Q I indented a wooden tabletop while writing on it. Can I repair it without damaging the finish?

Jonathan Lee
Fargo, ND

A Blame it on modern pen technology: When we went from writing with the delicate split nibs of the fountain pen to the almost indestructible ballpoint, we put our writing surfaces in danger. (I recall an old pen commercial showing a ballpoint pen fired through a chunk of pine—and still writing!)

Unfortunately, you may simply have to live with your pen indentations. In raw wood, you can "steam up" dents by first placing a few drops of water on them and then heating them with an iron through a damp cloth. This process usually doesn't work through a finish, however. In fact, this type of steam treatment can often have a destructive effect on certain finishes.

On a positive note, try to think of the indentations as "marks of character" that one day may be valuable in themselves. After all, wouldn't one pay handsomely for a table "marred" by Abe Lincoln?

Michael Dresdner
Finishing consultant
Nazareth, PA

Stock Seasoning

Q I have a 36-in.-long rifle stock blank cut from a recently felled apple tree. After sealing the knots and end grain, I wrapped the blank tightly in plastic and put it in a 65°F basement near a dehumidifier that was set to 50 percent relative humidity. What else can I do to keep the wood from checking and to promote seasoning? And how long should it season?

Ken Zimmerman
McPherson, KS

A Sealing the end grain of green wood is a good idea, but wrapping the stock in plastic to slow drying can actually produce defects. The plastic locks in moisture and encourages mold that can permanently discolor the wood. I suggest the following approach:

During the first year, I sticker my wood outdoors under a shed roof. Even

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

many sawmills leave freshly cut stock outside for at least a month before loading it into a dehumidification kiln.

Consider putting your gunstock blank in your garage or under your back porch for at least a few months before bringing it into your basement. Make sure the wood is at least 1 ft. off the ground and that air can circulate freely all around it. Expect a 2-in. by 6-in.-thick blank to take about two years to dry.

Apple is a beautiful wood, but it often comes from small trees. If your stock contains pith or was located near the center of the tree, it will be full of stress. Don't be disappointed if it's difficult to dry without cracks.

Jeffry Lohr
J.D. Lohr Woodworking
Schwenksville, PA

Finishing Honduras Rosewood

Q I recently made a table of Honduras rosewood. The bright orange streaks in the wood still show after finishing. Most rosewood furniture I've seen looks consistently dark. My first question is: Is it standard procedure to stain rosewood? Mine seems to need staining. Secondly: Even after the third coat of lacquer, I can see that the wood pores are still open. Should I have filled them before varnishing?

Richard Ruehle
Findlay, OH

A Staining is purely a matter of personal taste. Generally, we stain woods that are too light or bland for the look we desire. Since rosewood has such dramatic color and figure, it is almost never stained.

Most rosewood furniture these days is made of dark Indian rosewood. Honduras rosewood is lighter and often has the striking orange streaks you speak of—making it a more vivid and, in my opinion, more interesting wood. If it were my project, I'd probably decide to leave it natural.

Concerning your second question: Wood filler is generally recommended for woods that have large, open pores. Almost all of the rosewoods qualify. Before you begin to apply a finish, use any of the wood fillers advertised in finishing supply catalogs. (For example, Behlen's Pore-O-Pack paste wood filler is available from Woodworker's Supply, 800-645-9292.)

Michael Dresdner
Finishing consultant
Nazareth, PA

WHERE TO FIND IT

Woodworker's Guide to Compound Miters. This saw angle reference pamphlet is available from Bridge City Tool Works, 1104 NE 28th Ave., Portland, OR 97232, (800) 253-3332.

Pocket Ref. This eclectic reference guide gives tips on shop math, bit sizes, lumber grading etc. It is available from Woodcraft, 210 Wood County Industrial Park, Box 1686, Parkersburg, WV 26102, (800) 225-1153.

offcuts

A JAMMIN' GOOD TIME AT CANTERBURY SHAKER VILLAGE

Canterbury Shaker Village, in Canterbury, NH, will host the fifth annual Wood Day celebration on May 6. The featured craft this year is musical instrument making, so a jam session is inevitable. Wood lovers will also be treated to demonstrations, tool sales, and the annual opening of Canterbury Village's Carpenter Shop Gallery.

A taste of tradition. *Hands-on demonstrations are part of the fun at the Wood Day celebration.*

Guitar makers Terry Moore and Jay Towne will show off their craft and their musical skills, as will furniture maker/uilleann pipe maker Bill Thomas. Other demos will include woodturning, chairmaking, coopering, boatbuilding, restoration carpentry, and oval boxmaking. And hungry woodworkers won't want to miss Wood Day's famous chicken barbeque!

For more information about Wood Day, contact: David Emerson, 418 Shaker Rd., Canterbury, NH 03224, (603) 783-4403.

WOODSHOP FRANCHISES UNDERWAY

Ever dreamed of running or joining a health-club-type hangout for woodworkers? NYW Workshops Inc. plans to open its first such franchise this year—in Dublin, CA.

Thomas Loker, the company's president and CEO, envisions "fully functional woodshops for people to build any project with their own two hands."

Franchises will sell project kits, tools, hardware and accessories. Each store will also feature a training area where instructors and woodworking professionals will give workshops on tools and techniques. But the centerpiece of each store will be the shop area, where for an annual fee of between $30 and $40, members can use high-end, industrial-quality hand and power tools to work on individual projects in a friendly atmosphere.

The stores are still in the planning stages, but anyone interested in a franchise or in membership is encouraged to call Tim Howell or Tom Loker at (510) 736-3413.

$$$ FOR WOODWORKING WORDSMITHS

The National Association of Home and Workshop Writers (NAHWW) offers two $1,250 Vaughan Scholarships to eligible students in the field of home workshop writing.

Sponsored by Vaughan & Bushnell Manufacturing Co., one of the leading U.S. producers of striking tools, the scholarships were created to celebrate the company's 125th anniversary and to recognize the economic impact of the "do-it-yourself" industry.

College-bound high school seniors and current college students may apply. For more information, write: VAUGHAN-NAHWW Scholarships, c/o Frank Burgmeier Co., 7501 Woodstream Terrace, North Syracuse, NY 13212.

PETITE PUZZLES

What started as a "cottage craft" has become a full-time venture for puzzle cutter Randy Crossman of Rutland, VT. His handmade "XMAN Puzzles" run the gamut from simple animal shapes to one-of-a-kind, 4,000-piece pattern puzzles.

Crossman scrollsaws his puzzles from 1/4-in. cherry plywood. He prides himself on having the smallest interlocking wooden jigsaw puzzle pieces around. For example, each postage-stamp puzzle shown below has 24 pieces.

Crossman's designs are featured in Vermont art galleries and craft centers.

Postage-stamp puzzles. *Randy Crossman scrollsaws these tiny brain-teasers from cherry plywood.*

FUNKY DRAWER PULLS

If you like your work to stand out from the crowd, you'll love these hefty 100% pewter pulls and knobs. They add character to kitchen cabinets, dresser drawers, or even the front door.

Steve and Anita Vaubel say the pulls started as a whimsical offshoot of their family jewelry business. They've done so well that today the Vaubels plan to branch out into home design. They sell more than 80 pull designs, from elephants to Indian chiefs. Pulls come in a variety of sizes from 1 in. to 3 1/2 in. tall. Custom designs are also available.

For more information, call: (718) 875-4858.

Funny faces for furniture. *These handmade pewter pulls and knobs add a whimsical touch to your projects.*

SHOP INSURANCE BLUES

Skyrocketing insurance premiums have created a Catch-22 for many professional woodworkers. Although they can't afford *not* to have insurance, many are discovering they can't afford *to* insure their woodworking businesses against equipment loss or product liability.

Insurance companies cite fire risks from the storage of wood and finishing materials as justification for sky-high rates. Some companies simply refuse to write policies for small professional shops—especially if the shop is in or adjacent to a home.

But a few insurance companies have created special programs tailored to woodshops. If your business qualifies under a program's guidelines, you may be able to insure it at a lower rate than your local broker can offer. (See sidebar at right.)

Amateur woodworkers are not immune from insurance woes. Most homeowners' policies cover a hobby shop in your home or garage. (Call your insurance agent to be sure.) But the policy may not cover you if you sell what you make—even if it's just a few pieces a year. Check with your insurance agent. If you're a part-time professional you may be able to buy a rider for around $100 to cover this "incidental business" use of your shop.

SPECIAL INSURANCE PROGRAMS FOR PRO SHOPS

American Craft Association Insurance Program
• For members of the ACA, covers property and liability. (800) 523-8336

Crafters' Insurance Program
• Covers property and liability for home-based craft businesses. (800) 536-1379

Craftsman Protection Plan
• Covers equipment, materials and goods from damage or theft; does not include liability. (800) 638-2610

Jim's Corner

Offbeat Answers to Common Woodworking Questions

Q: How can you tell when a carbide blade needs resharpening?
A: Every shop should have a smoke alarm. When this goes off, the blade is dull.

Q: Does hide glue last?
A: Ancient Egyptian stools assembled with hide glue are still intact today. Of course, nobody has sat on them for the past 4,000 years, which may have helped.

Q: Can you tell me anything about woodworking with kids?
A: It's highly illegal—stick to working with oak, maple, cherry, etc. like the rest of us normal people. Besides, kids warp and check while drying, and they don't take a good finish.

Jim Cummins is a contributing editor to AW.

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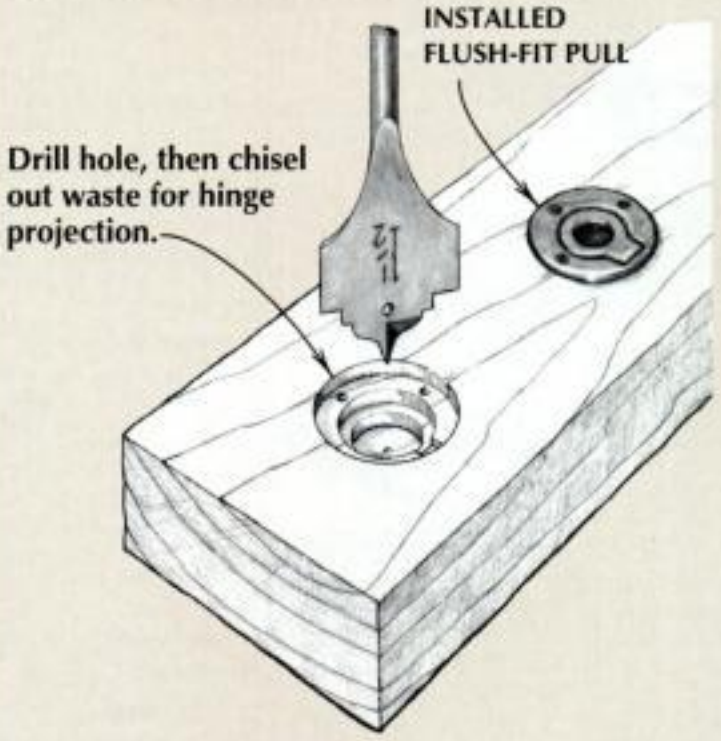
If you have a news item, unusual story or opinion to share, send it to: "Offcuts," AMERICAN WOODWORKER, 33 E. Minor St., Emmaus, PA 18098.

TECH TIPS

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.



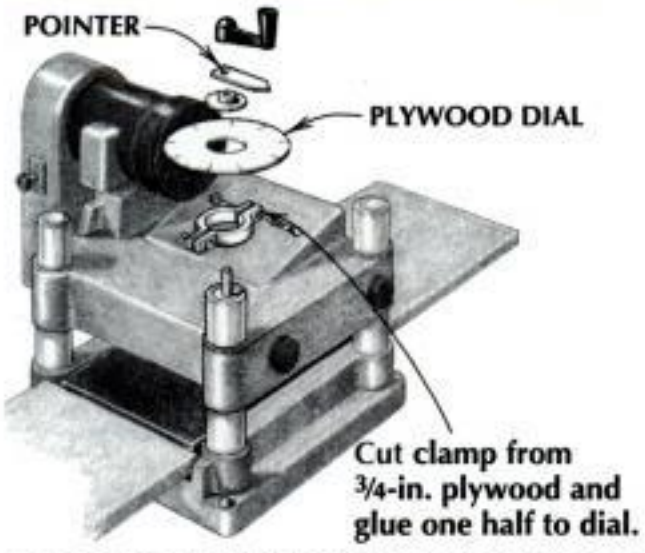
Profiling Spade Bits

Installing flush-fit brass pulls calls for holes of three different diameters, drilled to varying depths. By grinding and sharpening a standard 1 1/2-in. spade bit to the profile shown in the drawing, I can drill this complex recess in one operation. I use the depth stop on my drill press to ensure a flush fit.

Peter Cabot
Boston, MA

Planer Depth Gauge

Thickness gauges on planers are notoriously unreliable, so I made my own, accurate to 1/64 in. First I cut out a plywood dial, the same size as the inside diameter of the adjusting wheel. Then I



made two clamp brackets and glued one to the underside of the dial. You could use the wheel handle itself as a pointer or install one under the wheel nut as I did. Paint the dial flat white for easy reading.

To calibrate the dial, measure the distance between minimum and maximum depth of cut. (Suppose it comes to 5 1/4 in.) Divide by the number of complete turns of the handle. (Let's say 35.) The answer (5/32 in.) tells you how far one complete turn of the handle raises or lowers the knives. Use a compass to divide the dial's perimeter into 10 equal segments. Each one will represent 5/32 divided by 10, or 1/64 in.

Ernest Barta
St. Petersburg, FL

Air It Out

Air left in a can of finish (or glue) can cause a skin to form on top of the liquid. To prevent this I replace the air with an inert gas before closing the lid. Suitable cans of pressurized gas (now ozone-safe) are available at computer supply stores. Just insert the tube into the can, spray the gas into the can for 10 to 15 seconds, then quickly recap.

Ron Alexander
Ocala, FL

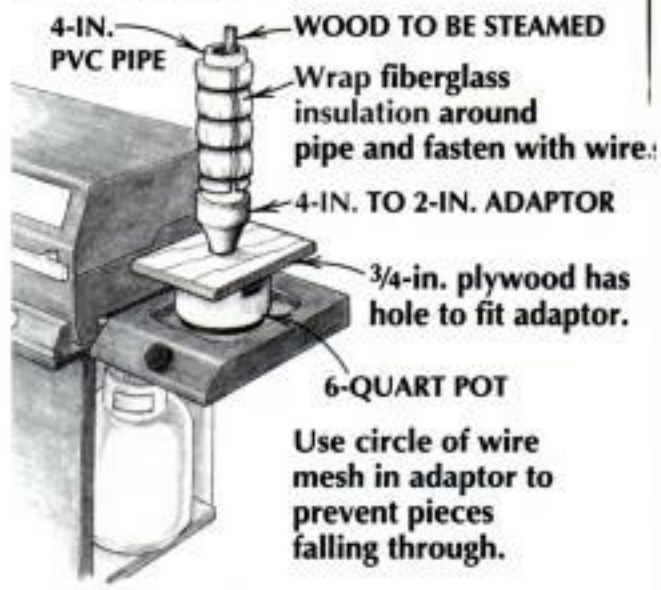
Hand-Friendly Knobs

My hand got tired of trying to tighten the small wing nut on my router, so I replaced the nut with a large plastic knob—one with a metal bushing and internal thread. If this arrangement is too cramped, you can replace the bolt with a longer one and add a bushing to take up the difference in length.

Ben Erickson
Eutaw, AL

Barbecue Steamer

Insulation makes this steamer even more effective than Mike Dunbar's (AW #43, page 68) and it's also cheaper

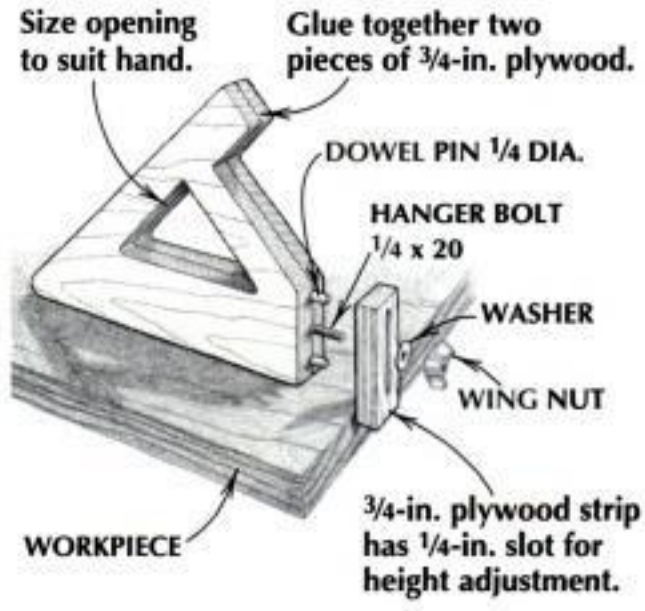


to build. The heat source is the propane-fired auxiliary burner on my barbecue. I can add water from above, but a 6-quart container is good for at least an hour's steaming. A word of caution: Don't use your spouse's favorite pot—a black, tarry residue appears after a few hours of use.

Dale Chapman
Salt Lake City, UT

More on Push Sticks

I appreciate the advantages of Chip Coffin's push stick (AW #39) but find my style of handle works better. Not



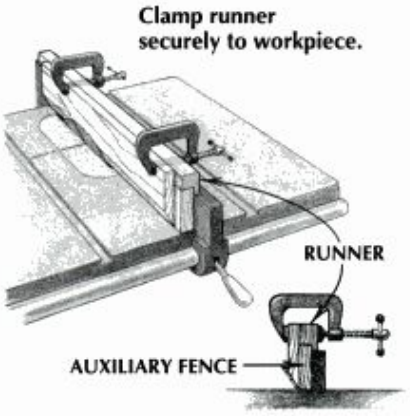
only can I push the stock over the jointer (or past the saw blade); I can also bear down on the stock when necessary. At no time are my fingers anywhere near a cutting edge.

Charles Cox
Yukon, OK

TECH TIPS

Knife Edges on the Tablesaw

Cutting knife edges on the tablesaw is awkward because the edge tends to collapse or slip down into the table insert.

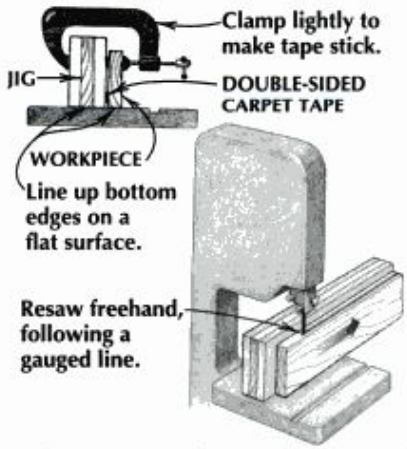


My method works equally well whether the angle is only a few degrees or 45°.

Yeung Chan
Millbrae, CA

Resawing Narrow Stock

When resawing, most people use a fence to keep the stock perpendicular to the table. But with a fixed fence, you're in trouble if the blade has any



tendency to wander. I solve the problem by resawing freehand, with my workpiece attached to one side of a 3-in. by 6-in. by 24-in. block of wood as shown here. This jig also allows me to cut tapers and curves—something you can't do with a fence.

E.S. Martin
Montrose, AL

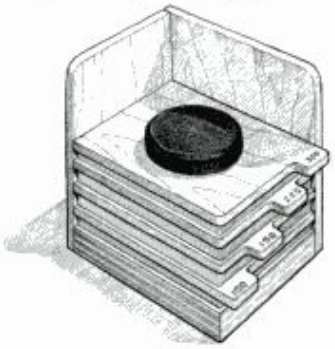
See-Through Patterns

To prolong the life of my paper patterns I trace them onto clear plastic with a black marking pen. I've found that 8-mil all-purpose vinyl covering works best. It's inexpensive and widely available in drug stores. An advantage of see-through patterns is that you can arrange the grain direction to match the project.

Jerry Cozzen
Anchorage, AK

Filing Sandpaper

This sandpaper holder keeps the paper flat and organized by grit—and you can readily check your supply. The base is



3/4-in. plywood; I made the dividers from 1/4-in. plywood. A lead weight, placed on top, keeps everything flat.

Tim Green
Lancaster, CA

Smoothing Edges on Acrylics

Even a sharp carbide-tipped blade will leave saw marks when cutting acrylics. Here's a quick way to get them out.

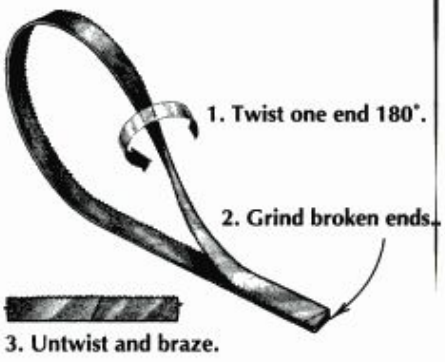
Take a single-edge razor blade, skewed slightly to the direction of travel, and scrape the edge. Then gently chamfer the corners. Strip off the protective paper

and make a light pass with a propane torch. This will remove any remaining marks and leave a polished edge.

Alex Moll
Marysville, WA

Brazing Bandsaw Blades

Here's a foolproof way to grind the broken ends of a bandsaw blade so the brazed joint fits together perfectly. The

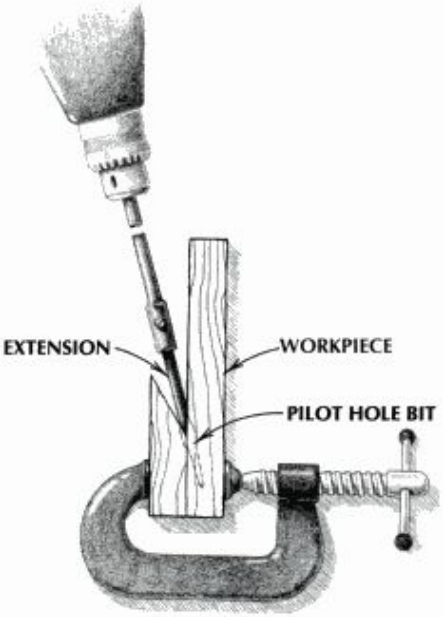


trick is to twist one end 180° before clamping the two ends together for grinding. This way, no matter what angle you grind, you'll find that the ends fit just right when placed end-to-end for brazing.

D.F. Lucas
Jekyll Islands, GA

Drilling Pocket Holes

This simple jig prevents bits from "walking" when you're drilling pocket holes. First I find the approximate drilling angle—say 15°—and double it to get



30°. I then cut a scrap of wood to this angle and clamp it to the workpiece, placing the vertex where I want the drill to enter. Then I drill the hole, bisecting the 30° angle by eye.

The jig is sacrificial, but it's usually good for several holes. It helps to use wood of similar hardness to the stock.

Glenn Sadler
Myrtle Beach, SC

Colonial Tavern Table

Build an Early American Classic Fit for Feasts or Family Repasts

by Matthew Burak

Table manners. *Traditional proportions and details, along with an artificially aged milk-paint finish on the base, give this tavern table the appearance of a fine antique.*

PHOTO BY PAUL ROGERS/STOWE, VT

I've always had an appreciation for architecture and furniture from before the Industrial Revolution, when woodworkers turned out crisp details and fine proportions using hand tools alone. When I moved from the West Coast to northern Vermont in 1979, my goal was to set up a custom woodworking business in an environment that favored restoration work and traditional design.

New England is a wonderful classroom for anyone interested in traditional building methods. Visits to the Strawbery Banke Museum, in Portsmouth, NH, Vermont's Shelburne Museum, and Boston's Museum of Fine Arts provided excellent examples of early American furniture. Historical associations like the Society for the Preservation of New England Antiquities (141 Cambridge St., Boston, MA 02114; 617-227-3956) also contributed to my education. And I discovered some indispensable reference books, most notably Asher Benjamin's *The American Builder's Companion*, Wallace Nutting's *Furniture Treasury;* and the series, *The Architectural Treasures of Early America.*

I found the antique version of this table in the home of Wade Treadway, a friend and fellow woodworker. Research revealed the well-worn piece to be a Colonial tavern table—a sturdy but elegant design that graced homes and inns during Colonial times. I liked the painted hardwood base, with its turned legs and well-proportioned aprons and stretchers.

The table's simple, three-board top, held flat with breadboard ends, rests on the base with distinctively broad overhangs at the ends. Its stance is sturdy but also graceful—yet another example of the well-resolved proportions used by Colonial furniture makers.

My version of the tavern table is faithful to the original in proportion and construction. The only change I've made is to raise the height slightly, recognizing that people are taller today than they were two centuries ago. My table has turned, William-and-Mary-style legs, but you can substitute other leg styles without compromising the table's traditional appearance. I've built versions of this table using Tuscan, Hepplewhite and Queen Anne legs. (See photo, above.) I'll discuss the proportions and construction details in the text that follows.

Nice legs. *The author uses a number of authentic period legs in the tables he makes. The painted William & Mary leg was used in this dining table. To its left: three types of Country Sheraton legs. To the right of the blue leg: a Tuscan dining-table leg, a William & Mary coffee-table leg, and four Queen Anne legs. At far right: a Hepplewhite leg.*

Design Guidelines

While tavern table height (the distance from the floor to the top surface) tends to stay in the 29¾-in. vicinity, other dimensions can change. Let's think about the tabletop first. I don't recommend making a rectangular top for a dining table more than 36 in. wide. Anything greater than 36 in. and you begin to lose the ease of conversation that's often an important part of any memorable meal. Diners seated across from each other have to speak overly loud. If you need more surface area for holding serving trays and bowls, don't compromise the proportions of your tabletop; make yourself a nice sideboard or server instead.

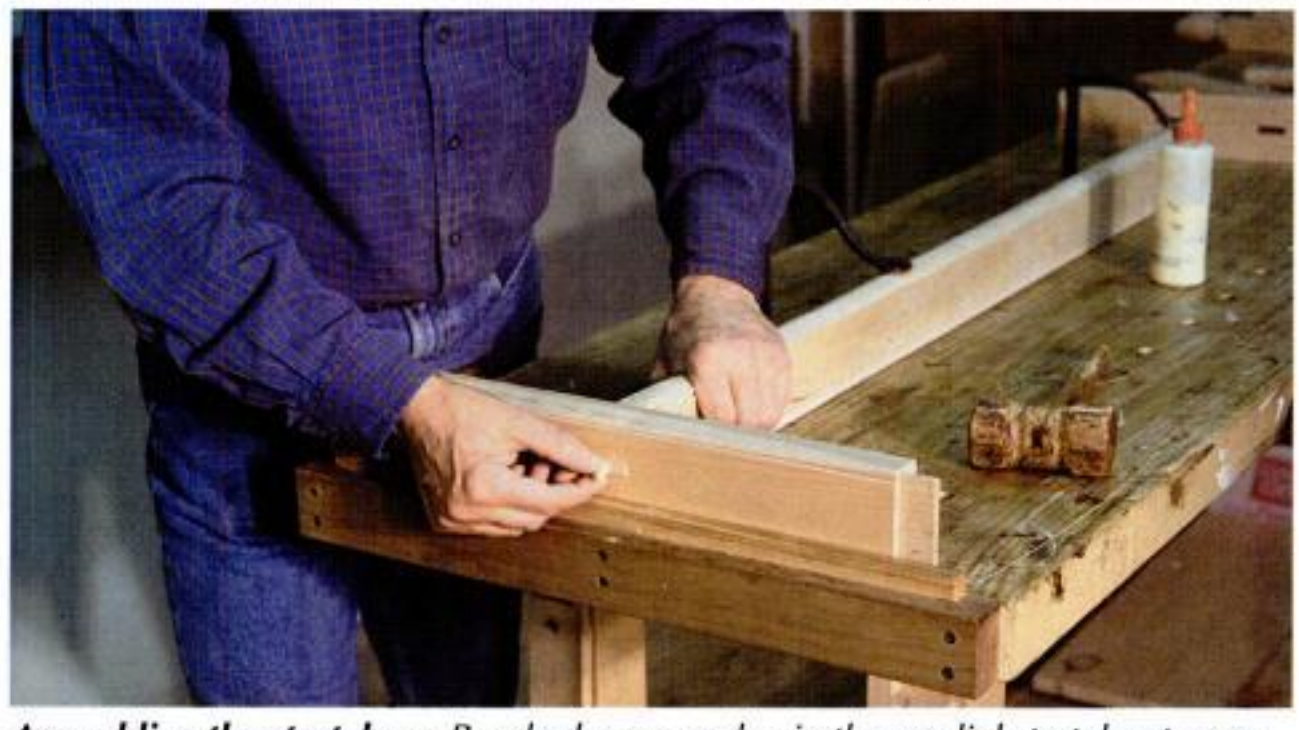
The version of the table shown here will seat six people with plenty of room between place settings. For an eight-place table, I increase the length of the top to 100 in. I also increase the length of the base to 72 in. to maintain the 14-in. overhangs at table ends.

Although I refer to table size in terms of six-person or eight-person capacity, the nice thing about this table is that it offers an unusual degree of seating flexibility—a quality probably appreciated by tavern owners. Along each side, the tabletop overhangs the side aprons by about 5½ in. With the legs and aprons recessed to this degree, it's possible to pack quite a few diners along each side with little risk of bumping knees or chairs against the base. At each end of the table, the generous 14-in. overhang will accommodate the portliest of adults—or, in a pinch, two children.

When special occasions demand, it is possible to lengthen a tavern table by means of "company boards," temporary extensions supported by turn buttons and by struts that extend into the end aprons. (See top photo, page 32.) If you've ever noticed rectangular cutouts in a table's end aprons, this is what they are for.

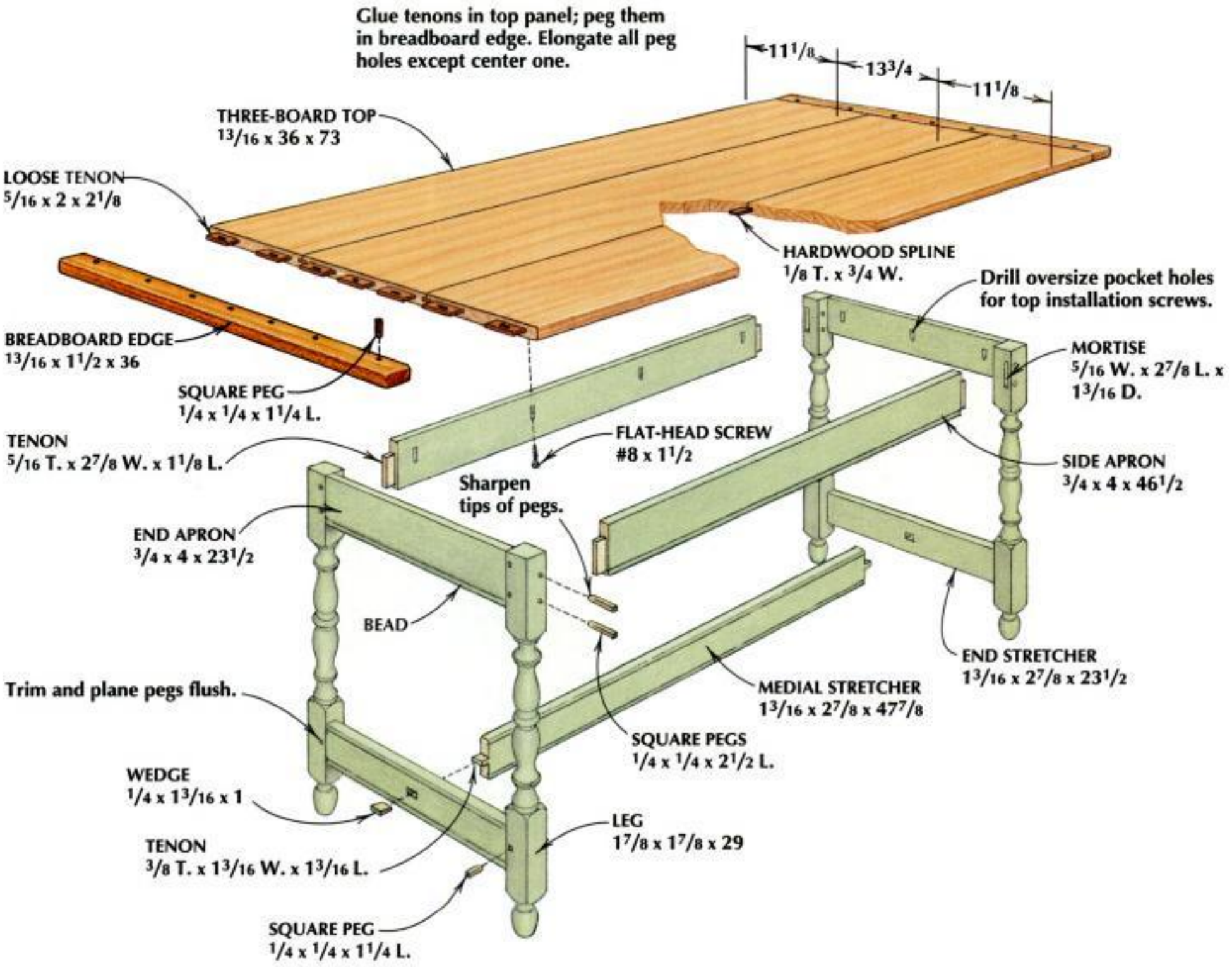
Building the Base

As shown in Fig. 1, the base is an assembly of four legs joined by aprons and stretchers. Pegged mortise-and-tenon



Assembling the stretchers. *Burak glues a wedge in the medial stretcher tenon, which extends through the end stretcher.*

FIG. 1: COLONIAL TAVERN TABLE



Tapping the tenons home. *With one base side assembly flat on the bench, Burak installs the end aprons and stretcher assembly. The remaining side assembly will go on last.*

joints hold everything together. The pattern for turning the legs is shown in Fig. 2, along with joinery layout details.

In my shop we use a mortising machine to mill the leg mortises, but you could also do this work by hand, or with a router and 5/16-in. straight bit. The mortise-and-tenon layout allows for a very slight reveal (about 1/16 in.) where the aprons and stretchers meet the legs. This eliminates the step of sanding joints flush after assembly.

After the aprons and stretchers have been cut to length and tenoned, I bead the edges of these parts. (See Fig. 2, Bead Detail.) The middle or *medial* stretcher is beaded along all four corners. The end stretchers are beaded only along the top and bottom corners that will face out in the finished piece. On the aprons, only the outside bottom corners receive beads.

As shown in the Fig. 2 Bead Detail, I like to use a bead copied from an 18th-century molding plane. This traditional bead is more elliptical than later examples, and it ends in a crisp fillet. I have a special-order shaper knife cut to the bead profile, but you can easily create this corner detail using shop-made scratch stock or a combination plane fitted with beading knife. (For more on making your own scratch stock, see AW #37.)

Once the tenons are cut on the apron pieces, I bring them over to the the drill press and bore pocket holes for screwing the base to the top. The end aprons receive three holes apiece; the side aprons, four. For each #8 by 1½-in. flat-head screw, I drill oversized pilot and shank holes, using an adjustable counterbore bit. We purchase these bits from Norfield Tool & Supply (800-824-6242). The small diameter of the bit is 3/16 in.; the large diameter is ½ in. Most of the antique tables I've seen in this part of the country have utilized this screw and pocket-hole arrangement for holding the top in place.

I begin the assembly process by joining the medial stretcher to the end stretchers. (See bottom photo, page 29.) The through tenons that hold these parts together should be glued and wedged in their mortises. I use a framing square to check for 90° joints; then I set the assembly aside.

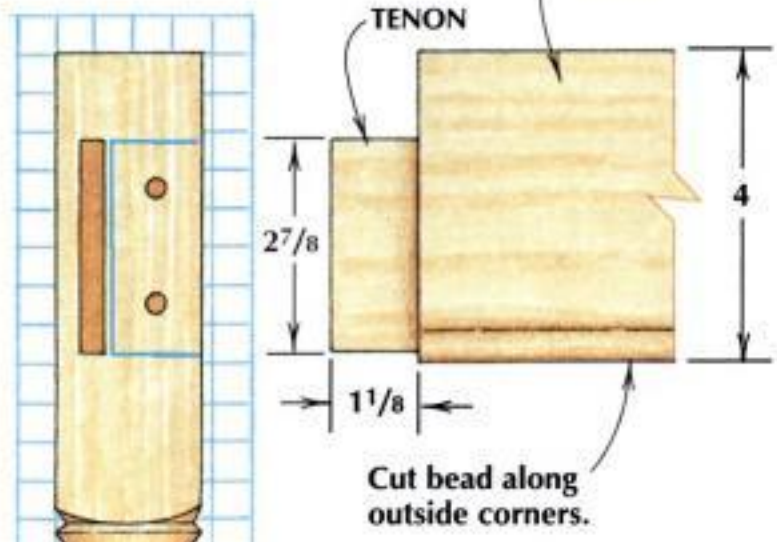
Next, I glue and clamp together a pair of side assemblies. Each contains two legs that are joined together with a side apron. Again, it's important to check each assembly for square as you clamp it up.

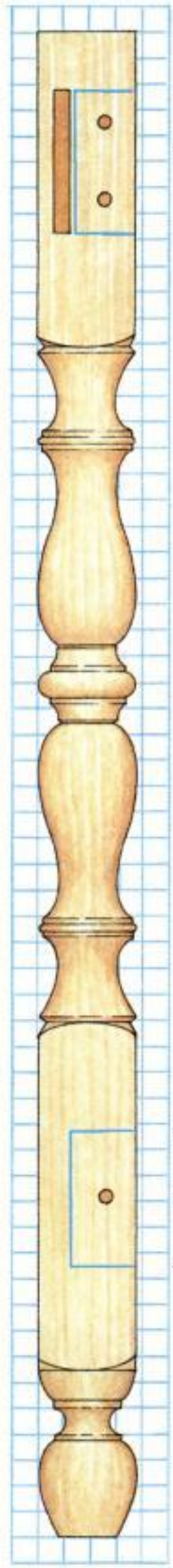
To complete the base, I place a side assembly on the bench with its open mortises facing up. I install the stretcher assembly and the two end aprons, then the second side assembly. Then I clamp, square up, and set the base aside until the glue dries. (See photo, opposite page.)

The base isn't really finished until the mortise-and-tenon joints are pegged. Many Colonial woodworkers used square pegs instead of round ones, and so do I. Even when the base is painted, the square tops of the pegs remain visible—a nice authentic touch. The pegs need to be big enough to fill the round hole, but not so big as to split the wood. My peg stock is square in section, ¼ in. by ¼ in. I drill the holes with a 15/64-in.-dia. brad-point bit.

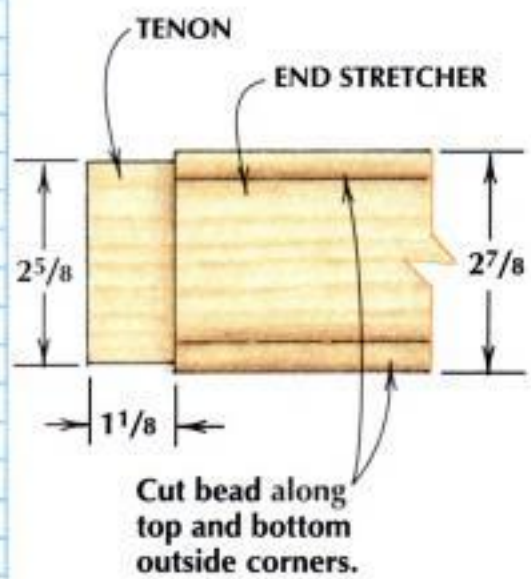
To start and drive each peg easily, you'll first need to sharpen its end. In my shop, we keep a coffee can filled with

FIG. 2: BASE JOINERY DETAILS





BEAD DETAIL
(FULL SIZE)



1 SQUARE = ½ SQ. IN.

Note: *If you don't have access to a lathe, or if you'd like to purchase a set of turned legs for this table, they are available from: Classic Designs, P.O. Box 279, Rte. 2, Danville, VT 05828, (802) 684-2156.*

pegs next to a crank-type pencil sharpener. Dipping the peg in water will also make it drive more easily. Glue isn't necessary. The apron-to-leg joints are already glued, and a square peg driven in a round hole rarely works loose. I orient each peg so its edges are aligned roughly parallel or perpendicular to the joint. On our tables, as on most antiques, the table's "apron" pegs are driven all the way through the legs and left protruding inside the base. On the outsides of the legs, I trim and plane the pegs flush.

Making the Top

In keeping with historical examples, I make the top of each tavern table from just two or three boards that are between 11 in. and 20 in. wide. The joints are splined rather than glued, and they're held together with breadboard ends. The splined construction, combined with the simple pocket-hole arrangement for installing the top, has worked well. I haven't yet had problems with a top buckling or cracking from restricted movement.

I take extra care in selecting top boards; it's a critical signature of any table I build. The table shown here has a yellow birch top, but I also use cherry and tiger maple frequently.

I start by thicknessing the boards, then I joint an edge on each board and rip them to width. After cutting the boards to rough length, I flip and switch them around to discover the best combination of grain patterns. Then I use a spline-cutting bit in my shaper to mill 1/8-in.-wide, 1/2-in.-deep grooves in edges to be joined.

Company boards. *This simple table extension consists of a pair of struts screwed to a board which fits flush with the tabletop. The struts extend into slots cut in the end apron. A pair of wooden turn buttons support the edge of the extension.*

For this work I recommend using a router with a spline-cutting bit rather than a tablesaw. I insert 1/8-in. by 3/4-in. wooden splines in the grooves, join the boards together and clamp the panel securely across its width.

To trim the ends of the panel perfectly flush, I clamp a straightedge guide parallel to each trim line. Then I run the router base against the straightedge, trimming each end flush with a 3/4-in.-dia., up-cut spiral bit.

Top detail. *The tabletop's breadboard edge is pinned in place with square wooden pegs that extend into the tenons. Softened edges and a hand-rubbed oil finish give the top an antique look and feel.*

The breadboard edge detail that I use calls for loose tenons, which fit in mortises milled in the top boards and in the two breadboard edges. (See Fig. 1.) Each of the top's 11 1/8-in.-wide boards gets two mortises per end. The 13 3/4-in.-wide center board receives three mortises per end. In my shop, we use a horizontal mortiser to do the mortising work for the breadboard edge. A good alternative method would be to use a plunge router and an up-cut spiral bit.

I glue the tenons in the ends of the boards, but I let the tenons "float" in the breadboard mortises, which are milled to allow at least 1/8 in. of tenon movement in both directions. After fitting a breadboard edge over tenons glued in place, I drill peg holes in the breadboard—one hole for each tenon, drilled to a depth of 11/16 in. I then remove the breadboard and use a round file to elongate all the holes except the one in the centermost tenon, which stays round. After refitting the breadboard, I tap in the pegs, then trim and plane them flush. For other options with regard to breadboard edge treatment, see page 58.

Finishing Up

Take a look at an antique table and you'll notice how paint and even wood have been worn away in certain places. For example, the medial stretcher on an old tavern table is bound to have its top edges worn down where feet have rested over the years. For customers who want their table to have the look of a real antique, we simulate these symptoms. I use the bandsaw to cut away some of the medial stretcher; then I smooth these "worn" areas with a spokeshave and sandpaper.

To finish the base, we rely on traditional milk paint. (See AW #44, page 66.) To create an antique appearance, I rub paint off to expose the bare wood at corners, along the medial stretcher, and at other points of wear. When the paint has dried, I apply one or more coats of stain to give the bare wood a convincing patina. Applications of stain also give the paint an aged look. ▲

MATTHEW BURAK
builds traditional furniture and runs a woodworking business in northeastern Vermont.

Screws for Woodworking

Pick the Right Fastener for the Job:
A Guide to Heads, Threads, Metals and Coatings

New twists on an old fastener. *Choosing a wood screw is no longer just a matter of picking the right size. Today's manufacturers offer a screw for just about every purpose and application.*

by Paul Anthony

When it comes to fasteners for cabinetry and furniture, it's hard to beat wood screws. We use them to create and reinforce joints and to attach panels, tops, trim and hardware. They're great for making jigs and furniture design mock-ups since they allow for disassembly.

A screw basically acts as a clamp. The head pulls the upper workpiece down as the threads advance into the lower, or *anchor,* workpiece. The concept of the screw is attributed to Archimedes of ancient Greece, but there is little physical evidence of metal screws as fasteners until the 1400s. The earliest screws, with square or hex heads, were attached with nuts. Some 16th-century armor shows screws with slotted heads. It's not known when screws for wood were developed, but we do know that they appear in firearms made in the mid-1500s. These fasteners had widely spaced, hand-filed threads and blunt tips, and they were installed into holes made with a pointed gimlet. By the 1800s, screws were produced on lathes, as many still are in

developing countries. But the most advanced thread-making technology involves rolling wire between two dies.

A woodworker's choices used to be limited to traditional tapered screws and sheet metal screws—still available but less commonly used since the advent of new screw designs. Some years ago, woodworkers discovered the convenience of using hardened drywall screws in cabinetry, jig-making and even furniture. More recently *particleboard* or *production* screws have become the screws of choice in woodshops. These tough fasteners have deep, aggressive threads and narrow shanks, and they come in a variety of head types.

Screws have changed in other ways, too—from new drives to new metals and coatings for almost any application. In this article I'll discuss these developments as well as some specialty drilling and driving tools for screws.

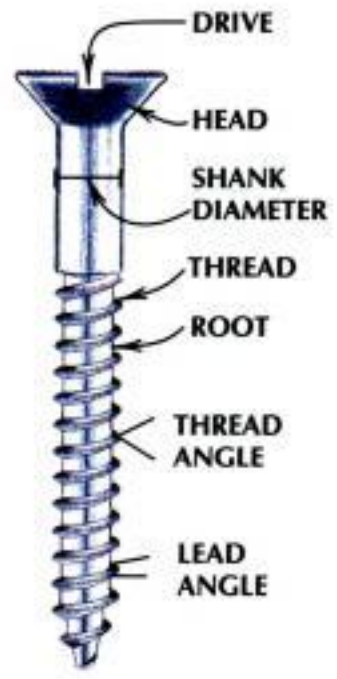
Screw Terminology

Before we get into the characteristics of modern screws, let's cover some important screw terminology. (See Fig. 1.)

Heads come in a variety of shapes for different applications. (See chart, opposite page.) *Drives* are also shown in their most common forms. The *shank* diameter varies in relation to the head and threads (depending on the type of screw). The screw in Fig. 1 is a tapered wood screw: The diameter of its unthreaded section matches the diameter of its threads. The *root* of a screw is the diameter of the shank in the threaded section.

All screw threads serve the same purpose, but they differ in both shape and relation to the screw's axis. The *thread angle* determines the sharpness of the thread. A low thread angle means a sharper wedge and an easier bite into the wood. The *lead angle,* or pitch, is the angle at which the thread travels up the shank. A steeper lead angle means faster travel but slightly less withdrawal resistance. *Thread spacing* also affects driving speed since wider-spaced threads mean fewer revolutions into the wood.

FIG. 1: SCREW ANATOMY



Screw size is designated by two numbers—#8 x 1½, for example—denoting diameter and length respectively. Diameter, or *gauge,* ranges from #0 (about 1/16 in. dia.) to #24 (about 3/8 in. dia.). Tapered screws come as short as 1/4 in. Production screws are available up to 6 in. long.

Screw Joint Dynamics

Screws have to resist both lateral (shear) forces and withdrawal (tensile) forces. A screw joint's lateral strength results not only from the connective properties of the metal, but also from the friction of the pieces pressed together. Several closely spaced, smaller screws will distribute pressure better than one or two widely spaced large screws.

A screw's *withdrawal strength* is determined by its depth of insertion and the density of the wood. As a general rule, when screwing into face grain, one half to two thirds of a screw should penetrate the anchor material. Use longer screws when screwing into end grain. Screw threads tend to shear end-grain wood fibers, reducing holding power by half.

Proper Drilling for Screws

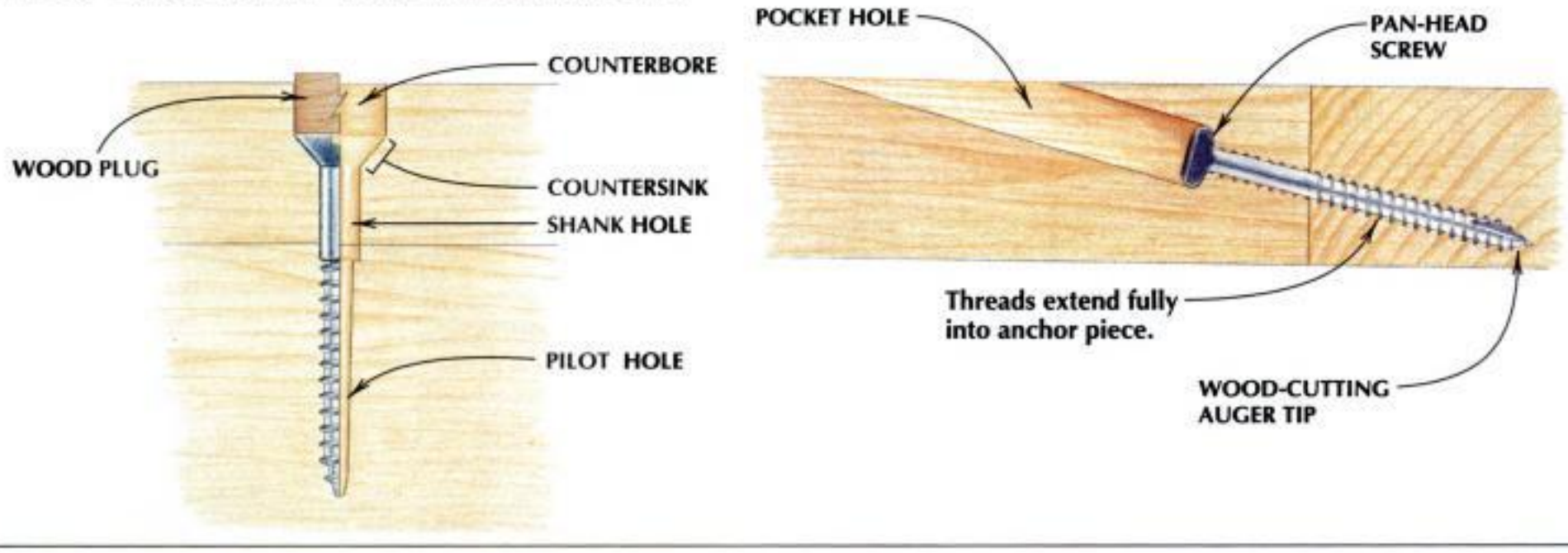
Depending on the screw type, the wood and the application, you may need to predrill up to three holes to install a screw: a pilot hole, a shank hole, and a countersink or counterbore. (See Fig. 2.)

A pilot hole allows the threaded section of a screw to penetrate without snapping the screw or splitting the wood. A pilot hole in softwood should be equal to or slightly smaller than the screw root diameter. In hardwood, it should match or slightly exceed the root diameter.

A shank hole lets the threads slip freely through the upper workpiece. If threads catch in both pieces of wood, they'll maintain any gap between the two, keeping the screw head from pulling the work together. And a screw driven without a shank hole through particleboard, MDF, or hardboard can force material between the pieces, creating a gap. You can prevent this by first clamping the material together at every screw location, but this takes more time than drilling a shank hole.

A countersink is a recess for a flathead, bugle-head, or oval-head screw. It allows the head to sit flush with the

FIG. 2: SCREW INSTALLATION

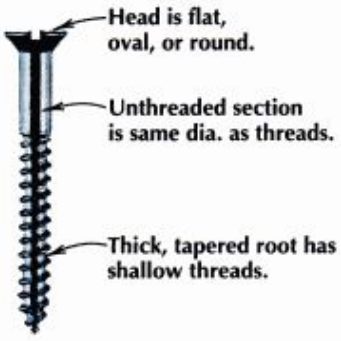


HEADS AND APPLICATIONS

	**FLAT:** Cabinetry, furniture, construction. Use where appearance is unimportant, or counterbore and plug.
	**TRIM:** Finish carpentry, cabinetry. Provides low visibility.
	**BUGLE:** Same applications as flat head.
	**OVAL:** Hardware, furniture, cabinetry. Use where appearance is important. Can be set into decorative cup washer.
	**ROUND:** Furniture and cabinetry, hardware. Provides good bearing for thin materials. Can be used decoratively.
	**ROUND WASHER:** Drawer-front attachment. (Drill oversized shank hole for adjustability.)
	**PAN:** Hardware, furniture, pocket holes. Use where appearance is unimportant, or counterbore and plug.

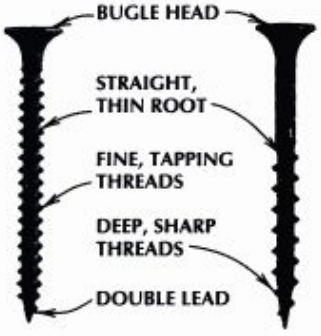
TYPES OF SCREWS

TAPERED WOOD SCREW



PROS: Many sizes available.
CONS: Poor grip in plywood and particleboard.

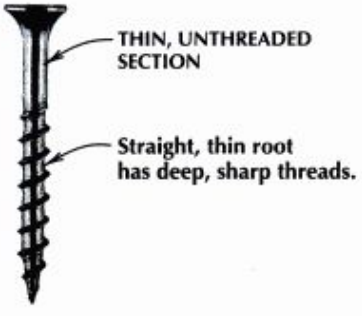
DRYWALL SCREWS



PROS: Cheap. Good grip in plywood and particleboard.
CONS: Prone to snapping. Limited size availability.

PRODUCTION SCREW

Available with all heads listed at left.



PROS: Tough. Good grip in plywood and particleboard. Many sizes.
CONS: Not widely available at local stores.

SHEET METAL SCREW

PROS: Fastens metal and thin wood. Wide size range.
CONS: Poor grip in particleboard.

DRIVES

SLOTTED: Prone to stripping and driver wander.

PHILLIPS: Strips less than slotted drive. Keeps driver centered.

SQUARE: Strips less than others. Clings to proper size driver tip.

COMBINATION: For square driver. Phillips works poorly.

wood surface. A *counterbore* is a deep recess which can be filled to hide the screw head. Also, if you're lacking a long screw to join thick material, a counterbore will effectively reduce the thickness of the upper piece, allowing you to use a shorter screw.

Sometimes you need joints that allow for wood expansion and contraction. When you're attaching a drawer runner to a solid case side, the case side must be allowed to move along the length of the runner. The solution is to make elongated shank holes through the runner. This lets the screws move in the slots while still holding the pieces tightly together.

You can drill pilot, shank, and countersink holes separately or use sets that will drill two or all three of the holes at once. (See chart, page 36.)

Drywall and production screws are designed to let you drive them into some materials without predrilling.

Types of Wood Screws

Tapered screws (see chart, above) come with flat, oval, or round heads and slotted or Phillips drives. They're most commonly available with a bright zinc plating, but you can also get them with a galvanized coating or in solid bronze, brass, stainless steel or aluminum.

Since tapered screws usually require a pilot hole and often a countersink, they can be time-consuming to install. They grip fine in solid wood, but their thick, shallow threads don't hold well in plywood or particleboard.

Tapered screws are readily available in many sizes and metals. Even so, they tend to sit on the shelf these days while we grab drywall or production screws.

COUNTERSINK/COUNTERBORE DRILLS

NON-ADJUSTABLE PILOT-HOLE DEPTH

STANLEY SCREW MATE (non-adjustable)

EAGLE PILOT BIT

ADJUSTABLE PILOT-HOLE DEPTH

WOLFCRAFT SCREW SETTER

ARCO SCREW DRILL

AMANA DICOUNT (carbide)

ADJUSTABLE COUNTERBORE AND PILOT-HOLE DEPTH

STANLEY SCREW MATE (adjustable)

FULLER TAPERED BIT

A bit of help. *Quite a few different bits are available for drilling countersunk and counterbored pilot holes. The most versatile bits offer adjustable pilot-hole depth and stop collars to set counterbore depth.*

COUNTERSINKS

STRAIGHT-CUT SINGLE-FLUTE

SHEAR-CUT SINGLE-FLUTE

MULTI-FLUTE

Be not proud. *These bits cut a countersink or counterbore for recessing screw heads. A single-flute produces a much better cut in wood than multiple-flutes.*

QUICK-CHANGE DRILL/DRIVE SYSTEMS

INSTY-BIT BRAD-POINT SYSTEM

CHUCK-MATE

INSTY-BIT QUICK-CHANGE CHUCK SYSTEM

Time-saving designs. *The Insty-Bit Brad-Point system uses a driver bit sleeve that slips over the pilot/countersink bit. The three prongs on the Chuck-Mate slip between the drill chuck's jaws over a driver tip. The Insty-Bit Quick-Change system uses a chuck similar to quick-release compressor line fittings.*

Drywall screws were developed for "hanging" Sheetrock on metal studs. They have bugle-shaped heads, narrow shanks, Phillips drives, and a black oxide or galvanized coating.

The bugle head was designed to sink into Sheetrock without tearing the paper face. It generally sinks into soft woods and plywood but often resists hardwoods or particleboard.

Drywall screws come in three distinct thread types. A shallow double thread, designed for metal studs, grips well in hardwood but not particleboard. Deep, widely spaced single threads were designed for wood studs and give a strong grip in plywood and particleboard. (See chart, page 35.) A third style (not shown) works in metal or wood and has alternating deep and shallow threads.

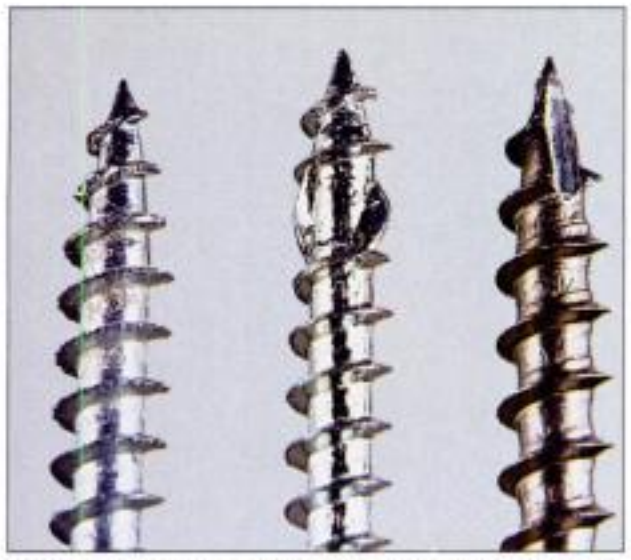
Drywall screws are hardened but brittle. They resist breaking better than traditional screws but can still snap when driven into hardwoods without a pilot hole. You can drive them into the face of particleboard and MDF without pilot holes, but they'll often split the edges of MDF without pilot holes.

Longer drywall screws have an unthreaded section of shank that makes a shank hole unnecessary, provided the unthreaded section runs completely through the upper piece.

Drywall screws are inexpensive and widely available at hardware stores in sizes from #6 x 1 through #8 x 3.

Production, or particleboard, screws are the newest contenders on the market. They're available with all the head types found in the chart on page 35 and all of the drives shown except slotted. They

Self-sinking heads. *Heads made with "nibs" will countersink themselves.*



Wood-cutting threads. *These designs eliminate the need for a predrilled pilot hole in most materials.*

come in many sizes, and you can get them in bronze, brass and stainless steel and with a variety of coatings.

Production screws have narrow shanks and deep, widely spaced threads. Much stronger than drywall screws, they require much greater force to break. They grip plywood and particleboard well, but you'll need a pilot in the edge of MDF to avoid splitting the board.

Some manufacturers offer self-countersinking screws. "Nibs" on the undersides of the heads cut their own countersinks as you drive them in. (See photo, opposite page.) These might be worth the extra cost when driving a lot of screws into hardwood or particleboard.

Special wood-cutting thread designs—employing serrated threads, raised cutting wings, or a kerf-cut tip—help drive production screws into hardwoods faster and easier, even without a pilot hole. (See photo, above.)

Screws with wood-cutting threads and small pan heads are available for use as pocket screws in face frame assemblies. They have square drives which clutch the driver tip firmly as the screw is maneuvered into the pocket.

A couple of notes on production screws: First, don't expect the unthreaded section to correlate to common material thicknesses. For instance, a 2-in. screw (good for attaching 3/4-in. material) doesn't necessarily have a 3/4-in. unthreaded section. But if it does, you can often forgo drilling a shank hole. Second, some suppliers are finally offering 1 3/8-in. screws. These give maximum anchor purchase for face-joining two 3/4-in. pieces—as when making jigs, attaching countertops, and so on.

Unfortunately, production screws aren't yet widely available at hardware stores. See Sources, below, for mail-order suppliers.

Sheet metal screws are also useful in the woodshop. The large bearing surface under the head makes them ideal for attaching thin material and hardware. They have hardened, self-tapping threads, so they're handy for fastening anything to metal. You can use them with elongated slots to allow for wood movement; the generous bearing surface makes them great for holding slotted adjustments. They're commonly available in many sizes at your local hardware store.

Final Thoughts

These days, traditional tapered screws are probably best suited to reproduction or restoration work. Drywall screws are fine for drywall work, but they break too often for general woodworking. Personally, I'm sold on production screws because of their grip, strength, and versatility. With production screws there's a head to suit most purposes, and many come with square drives, which I prefer. I suggest trying screws from various suppliers since metal quality and hardness varies among manufacturers. ▲

PAUL ANTHONY
is an assistant editor of AW.

METALS AND COATINGS

METALS

SILICONE BRONZE:
Good corrosion resistance.

BRASS:
Decorative, soft, fair corrosion resistance.

STAINLESS STEEL:
Corrosion-proof, expensive.

ALUMINUM:
Lightweight, good corrosion resistance. Do not fix to steel.

COATINGS

ZINC PLATED:
Bright appearance, minimal rust resistance.

BLACK OXIDE:
Std. drywall screw coating, negligible rust resistance.

GALVANIZED (ZINC):
Thick coating provides good rust resistance.

CERAMIC:
Thick coating provides good rust resistance.

ALUMINUM AND ZINC:
Thick coating provides good rust resistance.

SOURCES

Production screws and countersinks are available from:

McFeely's
(800) 443-7937. *Circle #604*

TrendLines
(800) 767-9999. *Circle #605*

Woodcraft
(800) 225-1153. *Circle #606*

The Woodworkers' Store
(800) 279-4441. *Circle #607*

Woodworker's Supply
(800) 645-9292. *Circle #608*

Production screws are also available from:

Deerwood Fasteners
Call (800) 438-5146 for local distributor. *Circle #609*

Faspac
Call (800) 847-4714 for local distributor. *Circle #610*

Häfele America
(919) 889-2322. *Circle #611*

IFI Inc.
Call (800) 821-8169 for local distributor. *Circle #612*

Jamestown Distributors
(800) 423-0030. *Circle #601*

Chatterwork

Turn Vibrations to Your Advantage

by Steve Paulsen

Over the past 20 years I've developed a technique for decorating the surfaces of small spindle turnings with intricate geometric patterns, using ordinary turning tools. I call it "chatterwork." These unpredictable designs look like they were cut on a 19th-century Holtzapffel lathe, or painstakingly hand-carved like the bowls of the late English craftsman David Pye. But in fact, the process is fast: Chatterwork is all about 30 *really good* seconds on the lathe.

About Chatterwork

Chatter on a spindle occurs naturally when you turn a piece thin enough. Press a tool to the spinning work, and the work will flex, moving in an ellipse around its axis rather than a circle. Instead of cutting smoothly, the tool skips over the surface.

Most turners have experienced this skipping and try to avoid it. But my technique takes advantage of this peculiarity by controlling the cut. Once you learn a measure of control, you can make symmetrical, chisel-like cuts instead of haphazard defects.

Chatterwork works best on pieces less than 3½ in. in dia., which makes it ideally suited to small spindle work such as stoppers, knobs, dowel caps, medallions, finials and small lids. End-grain surfaces hold sharper detail than side grain, and the denser the wood the better. African blackwood and ebony are my favorites, but you can get good results from domestic species such as old-growth cherry and rock maple.

Eye protection is essential when you're attempting chatterwork, since the thin spindle can break as the piece flexes during the cut, throwing a chunk off the lathe.

Intricate patterns. *The top of Paulsen's perfume bottle has concentric rings of chatterwork. Opposite, chatterwork graces the outside and inside of small bowls and lidded containers turned by the author.*

Getting Started

I use a ½-in. skew and a ⅛-in. parting tool for most of the shaping of my pieces and for chattering the work as well. For very delicate work, I also use two miniature homemade chisels—one straight and one hooked—for gently shaping and creating the chatterwork pattern. (See sidebar, page 41.)

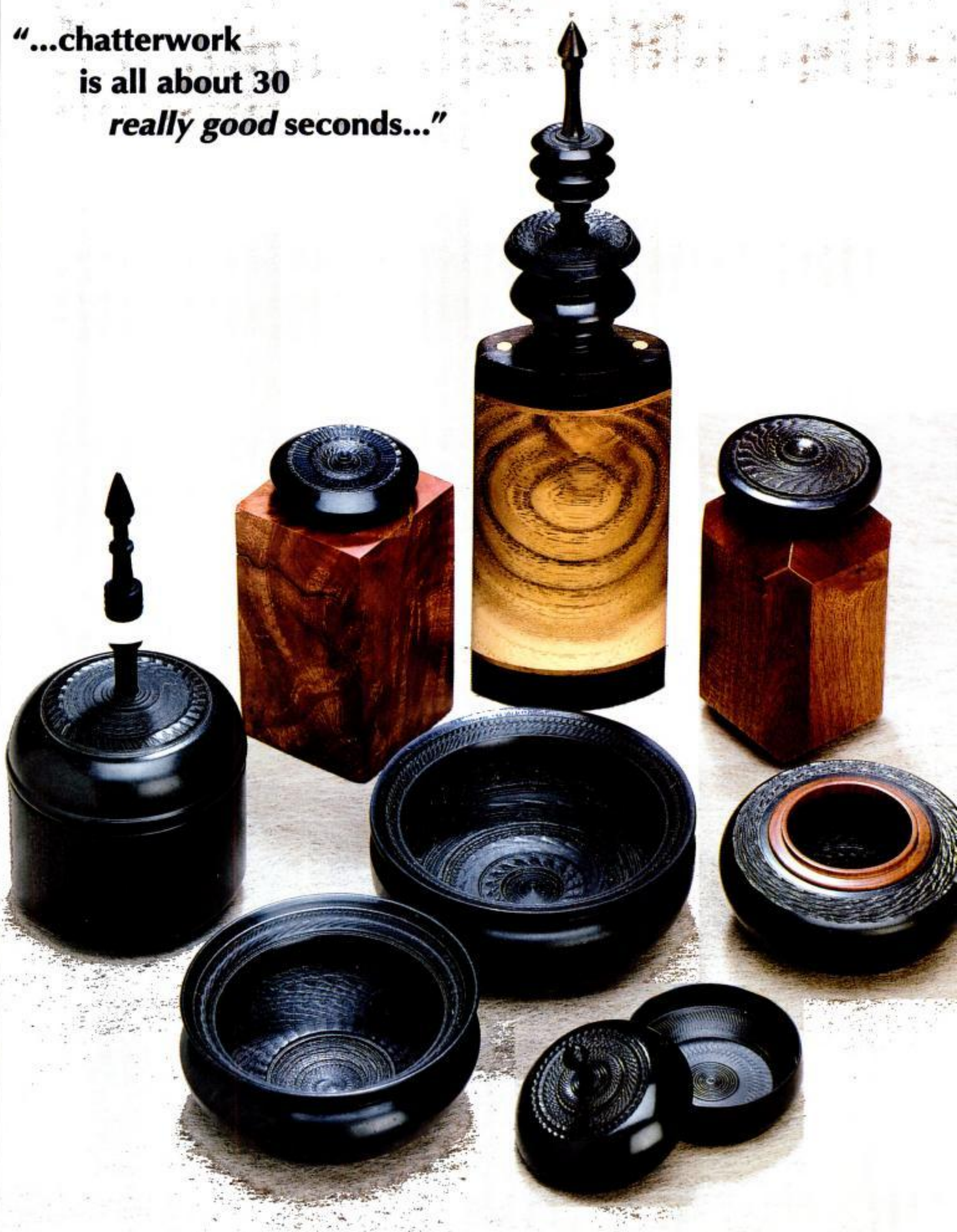
To produce the fine cuts necessary for chatterwork, your tools must be sharp. I grind all of my tools to one of two basic angles: 60° for parting tools and 75° for skews. Next to my lathe is a grinder equipped with two medium-grit wheels, with the parting-tool angle set on one wheel and the skew angle on the other. I'll sharpen an edge every few minutes, then use the fresh burr straight from the wheel.

Good light is essential for seeing the chattered surface. I keep my lathe directly in front of a large window to take advantage of as much natural light as possible, but I also have a selection of fluorescent and incandescent lights, including a spotlight that I'll sometimes direct inside a piece.

Chatter Away

To prepare a piece for chattering, I turn a cylinder between centers, generally staying with stock less than 3 in. long. On one end of the cylinder I turn a dead-straight, ⅝-in.-dia. tenon, which is thin enough to create some flex. Then

"...chatterwork is all about 30 *really good* seconds..."



"Chattering" the inside. *Pulling from the center out, Paulsen cuts a ring of chatter that resembles beaten metal on the inside of a bowl.*

Increasing the flex. *Paulsen reduces the tenon diameter to induce more wobble, prior to "chattering" the outside bottom of a bowl.*

I mount the tenon in a lathe chuck. I make the tenon about 3/4 in. long and insert about 1/2 in. of it into a Jacobs three-jaw chuck that screws onto the threaded headstock spindle of my lathe. (For more on chucks, see AW #43.) The blank should spin perfectly concentrically at this point.

First I turn the basic form that I want, then I sand it to 320 grit and oil the piece, running the lathe at around 200 rpm. Sanding can quickly heat up the thin walls of vessels, causing checks. When I feel the wood getting hot under my fingers, I cool it down and raise the grain at the same time by rubbing the smooth areas with water from a damp rag. Be careful not to wet any chattered areas. When the wood is dry, I knock off the raised fibers with some fine-grit sandpaper.

My next step is to buff any outside surfaces with the piece off the lathe. (I simply oil the interiors of hollow vessels.) Before taking the work out of the chuck, I make an index mark on the tenon that lines up with a previously made mark on one of the jaws of my chuck. This way, I can line up the marks to keep the piece concentric when I chuck it back on the lathe. I polish the piece by spinning it against two linen buffing wheels, the first wheel charged with tripoli and the second with jeweler's rouge. This successive polishing produces a mirror-reflective surface.

Now I'm ready to chatter. Interesting chatterwork doesn't happen with every cut, and there are as many approaches as there are designs. Chatterwork looks best if you give it a "foil," an uncut, polished adjacent area that helps to set off the design.

I start chattering the largest diameters and the areas farthest from the chuck. These are the areas with the most flex. I start chattering at slow speeds—300 to 500 rpm—working with a skew or my miniature straight tool.

To chatter these areas I often use a trailing cut, where I hold the tip of the tool below and to the left of center, pulling it across the surface. (See left photo, above.) I use light pressure with the tool to push the workpiece, causing it to flex on its thin tenon. Sometimes I press and release the tool repeatedly.

A DIFFERENT APPROACH: CHATTERING WITH A FLEXIBLE CHISEL

by Bonnie Klein

There are two reasons why a turning will "chatter": Either the wood moves or the tool moves. To produce chatterwork (see main article), I use the second method by letting the tool movement create a pattern. The tool I use, called a "Chattertool," was designed by turner Dennis Stewart.

Stewart's chatter tool (available from Dennis Stewart, 52180 NW Scofield Rd., Buxton, OR 97109, (503) 324-1111) has a substantial handle with a piece of spring steel mounted in the business end. The overall length of the tool is about 9 in. The length of the tip is adjustable, and once you've set the length, you press the tip against the spinning workpiece and a chatter pattern occurs as the tip "bounces" against the surface.

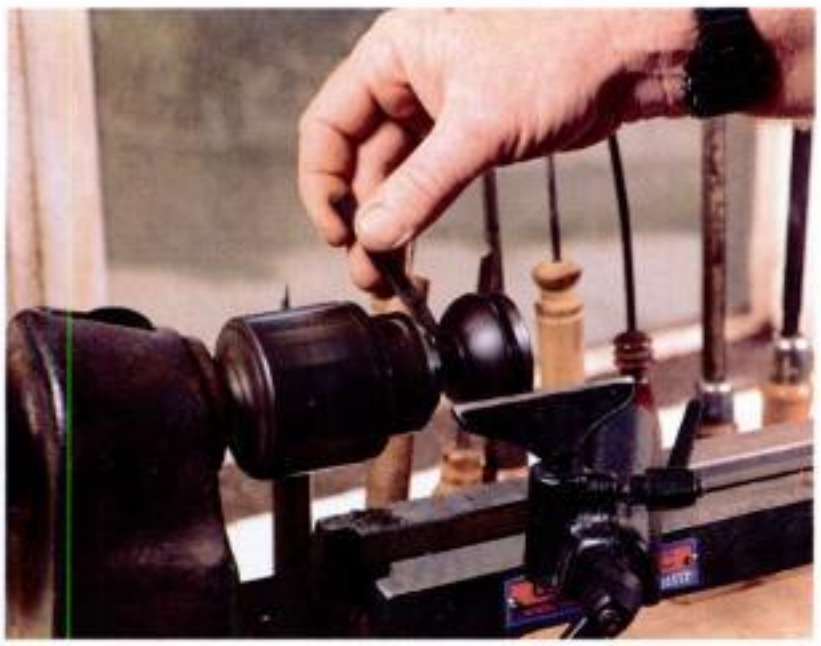
Vibrating chisel. *The tip of this tool flexes as it presses against the spinning work, creating a pattern of chatterwork.*

You can get different patterns by changing the surface speed of the material, the pressure of the tool, and how fast the tool is moved across the surface. I get the sharpest chatter detail on end grain, but I also use it over the entire surface of materials without true grain, such as tagua nuts, bone, antler, plastics and soft metals.

The tip of the Chattertool seldom needs sharpening, but when it does I regrind the edge to the factory-ground 60°, then remove the resulting burr by taking a couple strokes across the top of the tip with 220-grit sandpaper.

The tool works well on large or small work. On 2-in.-dia. work, I generally set the lathe speed between 1,000 and 3,000 rpm. The faster the speed, the larger the chatter pattern. Slower speeds produce finer patterns. As the diameter of the work increases, I increase the pressure of the tool to maintain the chatter rhythm. I find it best to set the tip about 1 1/8 in. long and to let the shank—not the tip—bear upon the tool rest. If the tip is too long or too short it won't settle easily into a chatter rhythm. Holding the tip at 80° or less to the work offers the best opportunity for chatter to result.

BONNIE KLEIN *travels the country turning and teaching; she lives in Washington state.*



Burnishing with wood. *To highlight the designs, Paulsen rubs the chattered patterns with a stick of wood of the same species as the workpiece.*

To vary the chatterwork pattern I might make a shear cut, where the tip presents a low angle to the surface. Here, I push the tool across the surface from above center to cut against the rotation of the piece.

As I'm cutting, I listen to the sound of the tool against the work. A rhythmic, percussive sound tells me I'm getting some chatter. The more musical the sound, the finer the chatter will be. I stop the lathe constantly between cuts, looking for symmetrical patterns, sharp detail, or imperfections (you can't see the chatterwork as it's happening). If I don't like what I see, I'll remove the chatter with light cuts from a skew and try again. For this reason, leave some margin for error in your piece.

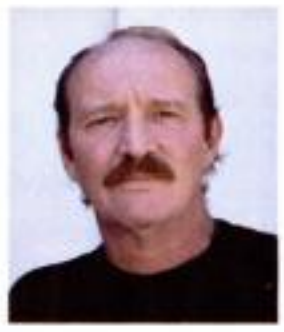
To shape and chatter the inside shoulders of hollow forms, I use the miniature hook tool, pulling the tool away from the center and taking very light cuts.

To chatter the inside bottom of a bowl or vessel, I use the skew or the miniature straight tool in a series of trailing cuts. I may cut a few fine beads, then a series of concentric rings. Sometimes I'll make a light sweep over a wide area to get a pattern that resembles beaten metal.

Once I get a pleasing ring of chatter, I burnish it before moving on to the next area. Burnishing polishes the high points and accentuates the texture. My burnisher is simply a 1/4-in.-square stick made from the same species as the spindle I'm working on. I grind one end of the stick to a point on a belt sander, then I hold the stick against the spinning chatterwork and press lightly. (See photo, left.) A couple of seconds is enough to highlight the area.

As I near the chuck end of the piece, the chattering effect lessens. So I create more flex by increasing the lathe speed to around 1,500 to 3,000 rpm and progressively reducing the diameter of the tenon with a parting tool, taking off about 1/16 in. at a time. Then I chatter the bottom of the piece with the skew or miniature straight chisel by pivoting the tool on the tool rest.

I may turn a couple of rings with the point of the skew to set off the chatterwork design. If the piece starts to vibrate too much, I wrap some masking tape tightly around the spindle to stiffen it. ▲



STEVE PAULSEN
is an artist and woodworker; he lives in southern California.

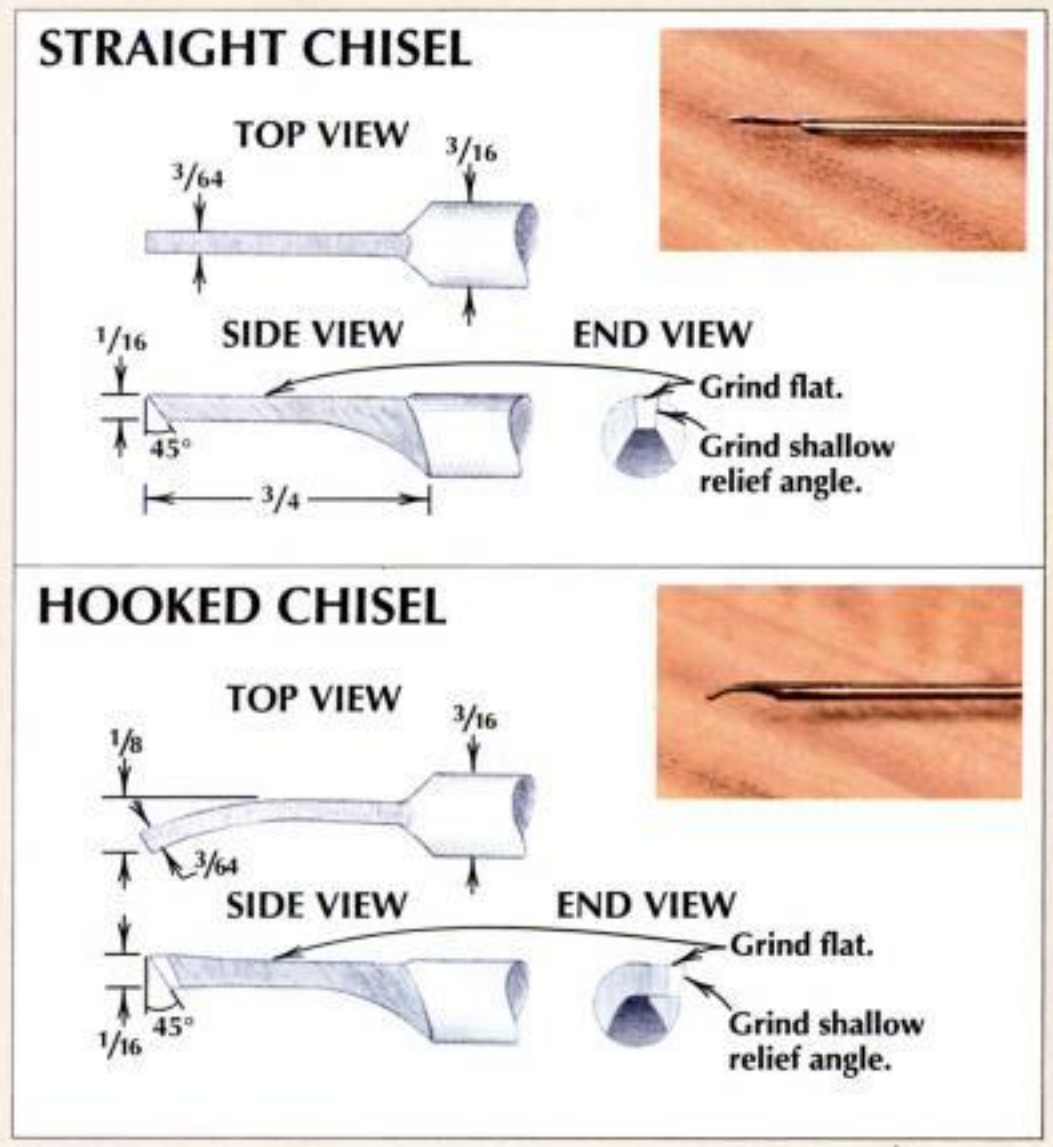
TINY TURNING TOOLS

I turn a lot of small objects on the lathe—tiny goblets, miniature vases—and to shape these delicate pieces I make two types of miniature turning chisels. One chisel is simply a straight-edged tool that I use to remove small amounts of wood at a time. The small tip offers very little resistance to the spinning work, letting me take very delicate cuts in my work. The other turning tool is *hooked,* or bent at the tip. I use it to get around corners, such as the inside shoulder of a hollow form.

I make both tools from 3/16-in. high-speed-steel drill bit blanks (available at most machinists' supply houses). The blanks are 10 in. long, and I fit them with wooden handles. Dry tree branches make good handle stock. I drill a slightly undersized hole in the end of a branch, then I hammer a blank into the hole.

I grind and sharpen the blanks on a medium-grit grinding wheel to the profiles shown in the drawings at right. As I grind the hook tool, the steel heats up. When the tip is cherry red, I quickly bend it into a small curve with a pair of pliers. If the steel resists bending, I use a propane torch to heat it some more until it's soft enough to bend.

The tips are soft from all the grinding, but I don't worry about it. My chisels are designed to take a very light cut, and I sharpen them frequently as I work, so I don't need a long-lasting edge. —*S.P.*



Planes for Tongue & Groove

A Tool Collector Traces the Development of a Specialized Hand Plane

by Ed Hobbs

My interest in antique tools began when I was just a kid growing up in South Carolina. I remember spending hours with an old neighbor everyone knew as Uncle Luke. He had a woodworking shop in his barn where he built all kinds of things, from fine furniture to boats. And he did it all with hand tools.

It wasn't until I graduated from college and moved away that I bought my first antique plane. I picked up an old wooden grooving plane at a flea market, ran my hands over its smooth, well-used contours, and found myself transported back to Uncle Luke's barn. Taking my prize home, I clamped a piece of wood in a vise and was amazed at the straight, even groove I could cut. Even after 150 years, the plane worked just as well as it did on the day it was made.

From that moment on, I was hooked. Today my collection of antique hand tools includes levels, saws, squares, bits and braces—and plenty of planes, of course. In this article, I'll focus on some of the more common American-made hand planes that were designed to cut a tongue-and-groove (T&G) joint. Just by tracing the evolution of T&G planes, we can learn a lot about the development of hand planes in general.

Works like new. *Passed through generations of woodworkers, this century-old combination match plane still cuts a first-rate joint.*

From Wood to Metal

Planes have been around in one form or another since the fourth century A.D., when Roman craftsmen found that by fixing a metal blade in a wooden body, they could gain more control in shaping wood. By the 1700s, planemaking had become very common in Europe. Woodworking in Colonial America was done largely with wooden planes brought over from England and Germany. But it didn't take long for New World woodworkers to begin making their own tools.

Early American planemakers typically used beechwood for the plane body and imported their metal plane irons from England. Planemaking flourished during the 1800s and saw a significant change as plane bodies went from wood to metal. Wooden planes were still available into the early 1900s, but metal-bodied planes offered two major advantages: the ability to better adjust and fix the plane blade, and the elimination of wear on the plane sole.

World War II brought an abrupt end to the development of the metal plane as many manufacturers retooled to produce armaments. After the war, power tools became much more common and woodworkers lost touch with hand tools. Today, as woodworking machinery becomes ever more sophisticated, many woodworkers have rediscovered the beauty and utility of hand tools. The planes shown here are more than just artifacts; they're capable implements that offer pleasure as well as precision to those who use them. (See sidebar, page 44.)

Wooden Match Planes

Casey, Clark & Co., based in Auburn, NY, was one of many planemaking companies that flourished in the mid-1800s. The imprint on the front of the plane on page 44 identifies the maker and also one A. Langdon, of Belmont, NY, probably a tool dealer or merchant. Makers and dealers weren't the only ones to stamp their names on wooden planes. Owners often did the same—evidence that tool-borrowing problems have been around for many years. It's not uncommon to find an antique wooden plane with names stamped all over it.

The pair of T&G planes shown at above left on the opposite page is very typical of early wooden "match" planes. With their cutters and wooden soles profiled as opposites of each other, these

A matched set. *Fitted with steel plates to eliminate wear, these wooden match planes were made by Casey, Clark & Co. around 1880.*

Two in one. *Made during the late 1800s, this wooden combination match plane by Mockridge & Francis contains both tongue and groove cutters.*

planes were used to "match" two boards together with a T&G joint.

Match planes came in two size ranges. The smaller "board match" range was offered for boards from 1/4 in. to 1 1/2 in. thick. A larger range of planes, called "plank match," was sized to fit boards from 1 1/4 in. to 2 in. thick.

The match planes at left above are sized for 1/2-in.-thick boards. They're stamped as a size "68"—even back then, customers could order by catalog number. By the late 1800s, when these planes were made, manufacturers were offering the option of steel plates to eliminate wear.

Two in One

Located in Newark, NJ, the Mockridge & Francis Co. began manufacturing planes in the mid-1830s, a few years before Casey, Clark & Co. But the idea of combining tongue and groove cutters in a single wooden plane body came after the widespread use of separate matched cutters.

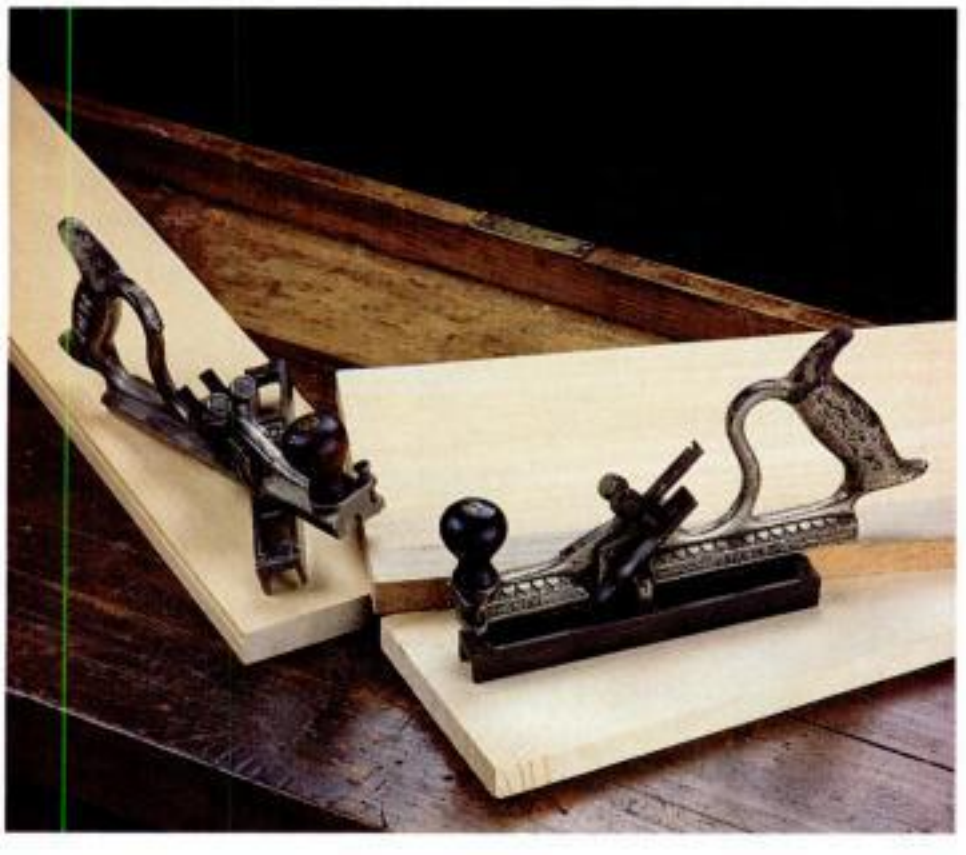
Some planemakers called this dual-cutter tool (see photo, above right) a combination T&G plane; others referred to it as a twin or double-match plane. Whatever the name, the design solved a timeless problem among woodworkers: losing things. With both tongue *and* groove cutters incorporated in the same wooden body, there's no danger of misplacing half of your T&G set.

My combination T&G plane has its cutters facing in opposite directions, the most common configuration for this type of plane. I've also seen combination T&G planes—especially larger plank-match planes—with cutters facing in the same direction.

Stanley's Swing-Fence Planes

Based in New Britain, CT, the Stanley Rule and Level Co. became involved in planemaking in the midst of the transition from wood to metal. In volume and

Swing-fence planes. *Early innovations in metal planes, the Union (left) and Stanley No. 48 (right) planes had swinging fences to align the tool for both tongue and groove cuts.*



Metal combination. *Stanley's No. 148 double-end match plane was introduced in 1905. It featured cutters and handles facing in opposite directions.*

DON'T REACH FOR THAT ROUTER

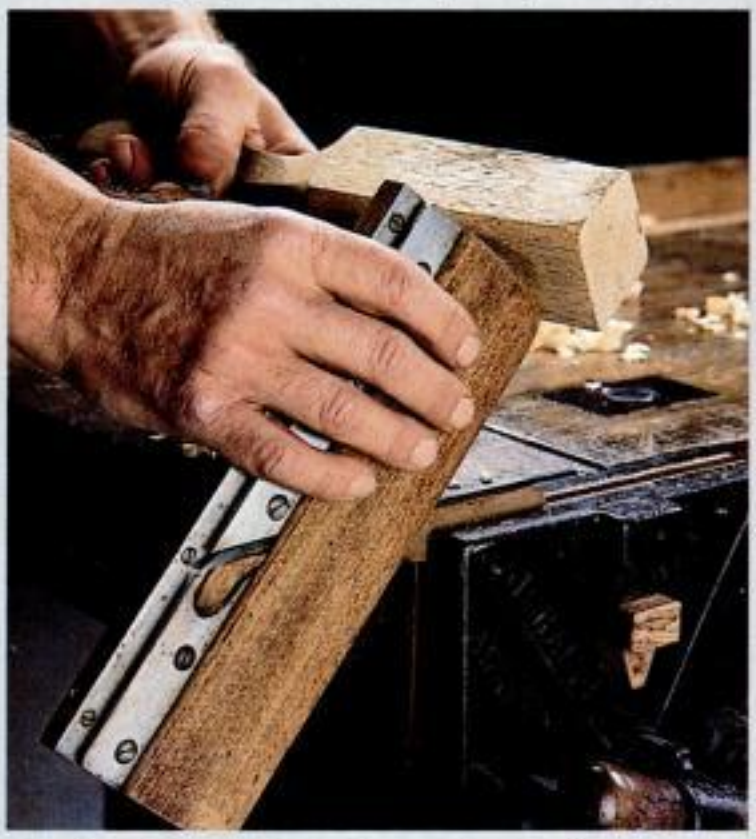
Hand-Planing a T&G Edge Is Quick and Quiet

by Mike Dunbar

People who visit my shop are often surprised at how much work I do with hand planes. "How can a professional furniture maker afford to cut joints by hand," they ask, "when it's so much quicker to use a router or shaper?"

The answer is simple: In many cases, you don't actually save much time by using power tools. In the time it takes you to get out your T&G bits, chuck them up in succession, fine-tune cutting depth for each bit, and mill the joints, I can hand-plane the tongues and grooves in several boards. Often that's all I need for the back of a cabinet.

But speed isn't entirely the point. By hand-planing these joints, I'm creating shavings instead of filling the air with sawdust. And working by hand is delightfully quiet. Without a motor's high-pitched whine, I can carry on a conversation or listen to the radio as I work. Finally, there's something special about using a plane (or any antique tool) that was made generations ago and has undoubtedly passed through the hands of many woodworkers. It's a timeless connection that you simply can't attain using electronic speed control.



Freeing the wedge. *Clamp the wedge in a vise and use a wooden mallet to tap the body of the plane loose.*

If you decide to forgo the router in favor of the T&G plane, here are some helpful hand-planing tips:

•Make sure of matched cutters. Your antique match planes may not have their original cutters. Cut a test T&G joint in scrap stock and grind one or both cutters as necessary to match the tongue with the groove.

•Take care with the wedge. A wooden wedge should not be hammered out. To free the wedge, give the back end, or *heel*, of the plane a sharp rap with a wooden mallet. If it stays fast, clamp the top of the wedge in a vise, and then tap the heel with a mallet to drive the plane body off of the wedge. (See photo.)

•Use clear-edged boards. Knots are fine as long as they don't fall in the path of your cutters. If you haven't hand-planed T&G edges before, practice on some clear pine boards.

•Pay attention to the fence. Always run the fence of the plane against the "good" face of the board. This ensures that the assembled T&G panel will be flush on its good side.

•Take a continuous shaving. Clamp your board securely, with the edge to be planed facing up. Put your body weight behind the plane, and cut the full length of the board. On long boards, you'll have to walk your way through the cut, so give yourself sufficient room. ▲

MICHAEL DUNBAR *is a contributing editor to AW. His book,* Restoring, Tuning & Using Classic Woodworking Tools *(1989, Sterling Publishing Co. Inc., 387 Park Ave. S., New York, NY 10016) has detailed information on using match planes and other traditional hand tools.*

Imprints tell the story. *The heel and toe of this match plane set bear the marks of the manufacturer (Casey Clark & Co.), the tool dealer and at least one owner.*

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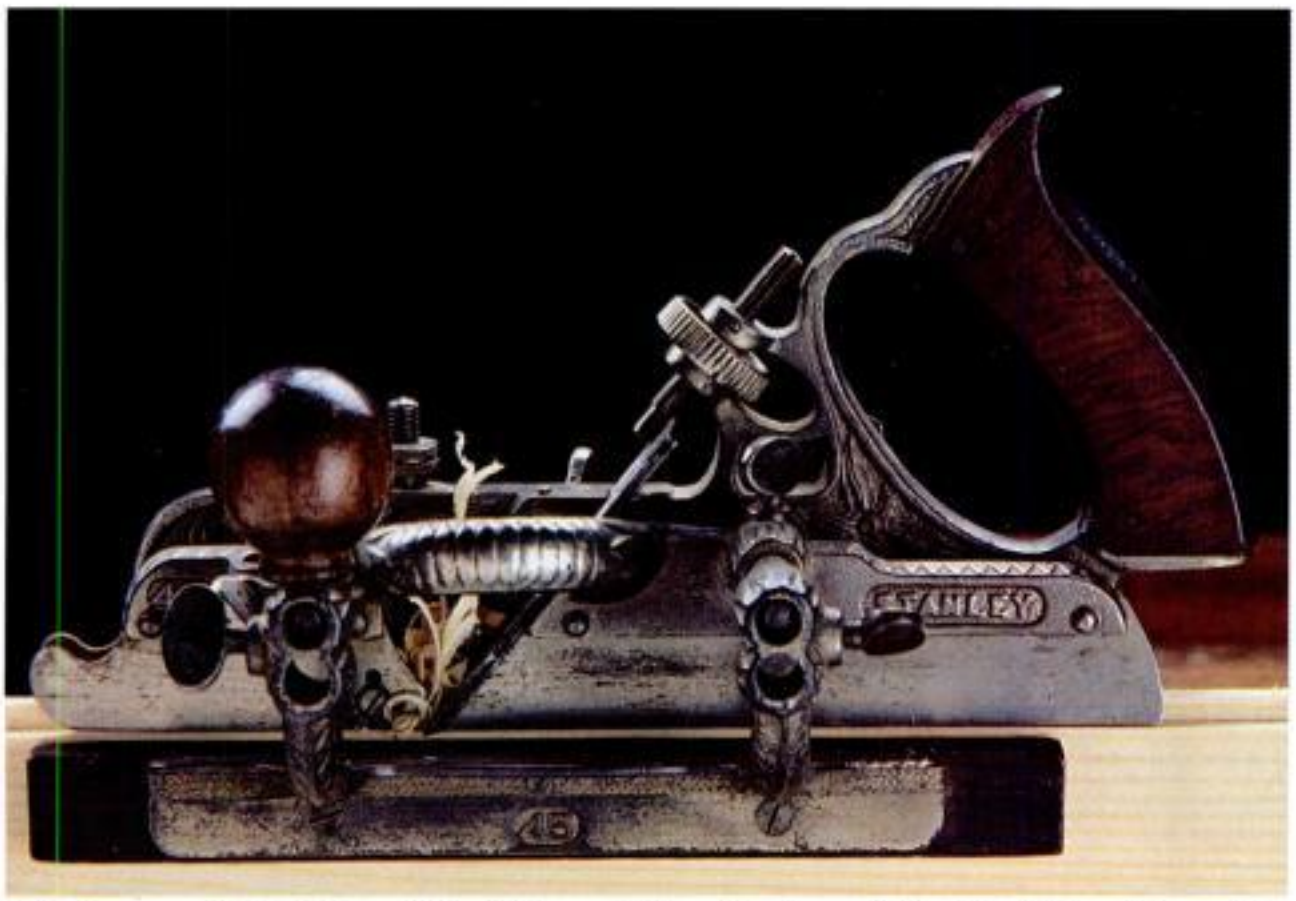
variety, Stanley's output of metal planes was unrivaled. Many Stanley planes were copies or updated versions of models that had been produced by other manufacturers. In fact, Stanley actually bought out a number of smaller planemakers, including Bailey. But Stanley also produced some planes that were truly innovative. The No. 48 and No. 49 "swing-fence" T&G planes belong in this category.

The swing-fence planes pictured on the previous page were developed in the 1870s, when metal plane manufacture was advancing rapidly. The patent for their simple but ingenious design called for a movable fence with an offset pivot point. In tongue-cutting mode, the fence exposes both prongs of the plane blade. Swinging the fence 180° (and locking it with a spring-actuated pin) covers one of the prongs, leaving its mate to cut the groove.

Stanley's 1879 catalog shows both the No. 48 model, sized to cut boards 3/4 in. to 1 1/4 in. thick, and model No. 49, for 3/8-in. to 3/4-in.-thick stock. Price for either plane: $2.50. Nearly identical versions of No. 48 and No. 49 were manufactured by the Union Tool Co. prior to Stanley's acquisition of Union in 1905.

The Stanley No. 45

The best-endowed entry in this hand-plane history is Stanley's No. 45, a plane that could cut far more than just tongues and grooves. Originally billed as a "beading, rabbet, dado, plow, matching and slitting plane," the "45" eventually came to be known as a "multi-plane." Like the more elaborate multi-



The famous "45." *One of the first metal "multiplanes," Stanley's No. 45 could do far more than just T&G work. Numerous profile cutters, along with well-designed fence and depth adjustments, make this plane a versatile performer.*

planes that followed, the 45 sported a number of refinements which allowed it to replace a multitude of single-function planes. It featured interchangeable cutters, precise depth adjustment, depth stops, and secure fences that could be positioned a good distance from the cutter. (See photo, above.)

Stanley began offering the 45 in 1884 and did not discontinue its sale until the early 1960s. Developed at the height of the metal planemaking era, the 45 almost survived the switch to power tools. Today, its closest incarnation is the Paragon Multiplane, available from Garrett Wade (161 Ave. of the Americas, New York, NY 10013, 800-221-2942). With a basic set of 24 cutters, the Paragon is priced around $500, quite a bit more than you'd expect to pay for an antique Stanley No. 45 in good condition. A "worker" 45—as tool collectors call a plane that works fine but may have missing cutters, cracked handles or other signs of age—can go for as little as $100. For twice that amount, a lucky buyer could snag a vintage model.

Two in One, Again

Stanley introduced yet another version of the combination T&G plane in 1905. Neither innovative as the swing-fence plane nor versatile as the multiplane, the double-end match plane was merely a metal version of the wooden combination plane. Stanley made three different sizes of this double-handled plane. Model No. 146 was for boards 3/8 in. to 1/2 in. thick; No. 147 was for 1/2-in. to 3/4-in.-thick stock; and No. 148 (see bottom right photo, page 43) could handle thicknesses from 3/4 in. to 1 in.

Stanley quit making the two smaller models of this plane during WWII and finally stopped making No. 148 in 1958. This is why you'll have an easier time finding the No. 148 plane at flea markets and antique tool sales.

Preserving a Tradition

The variety of planes manufactured today is scant compared to 100 years ago. Modern innovations in tool technology have more to do with electronics than with hand-tool refinements. But long after the latest circuitry has burned out or been rendered obsolete, hand planes will still be doing the same precise, reliable work they've always done. Thanks to those who collect and use antique hand tools, the rich and varied heritage of the hand plane remains alive and well. ▲

ED HOBBS
is an information systems consultant, woodworker and tool collector in central North Carolina.

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Greene and Greene Nightstand

Oriental Elements Make for Bedside Elegance

by Thomas Starbuck Stockton

I grew up surrounded by Japanese and Korean furniture, so the first pieces I built drew upon Eastern influences. After discovering the Orientally inspired work of Charles and Henry Greene (see sidebar, opposite page), I was inspired to design and build this koa nightstand. It incorporates signature Greene and Greene elements such as stepped "cloud lift" motifs, square ebony pegs and a top with breadboard ends. It's a fairly small piece, but you could make it larger. Just keep the same proportions.

The nightstand is a study in contrasts—of surfaces, textures and materials. The sides and back are recessed from the legs while the doors and drawer front are flush. Straight-grained frames surround figured, bookmatched panels. The gently sloping grain of the legs gives them a splayed appearance. The ebony handles wrapped with silver wire lend a touch of elegance.

Interpreting a tradition. *Accented joinery, curved "cloud-lift" frame rails and handmade handles are details inspired by the work of turn-of-the-century architects Charles and Henry Greene.*

Most of the information you'll need to make this nightstand appears in Figs. 1 and 2. Here are some tips to make the construction easier:

Making the Carcase

After dimensioning the parts, cut all of the carcase joints except the upper front rail dovetails. The rails are joined to the legs with "floating" tenons glued into matching mortises, but you could use standard mortise-and-tenon construction. I cut the mortises with a Multi-Router (see photo, opposite page) but you could jig up to rout them or drill and chisel them out.

I routed the stopped panel grooves in the legs but dadoed the grooves in the rails and center stiles on the tablesaw. I veneered the MDF bottom and shelf with koa before dadoing the mating grooves in the lower rails. Then I used these grooves to lay out the notches in the legs. (See Fig. 1.)

To make my loose tenons, I ripped the tenon stock in lengths, planed it to thickness, and then rounded over the edges with a router before cutting the tenons to length. To ease joint alignment, make your tenons 1/16 in. narrower than the lengths of your mortises. Note that you will also need to miter the ends of the tenons that meet inside the legs.

Lay out the cloud lift details on the rails as shown in Fig. 2. I bandsawed the shapes, then spindle-sanded them. I find this as fast and accurate as template routing for one-off work.

Dry assemble the case to check all the joint fits. While the case is clamped up, mark the shoulders on the ends of the center stiles and the upper front rail. Cut the dovetails on the rail, then use these to lay out the dovetail sockets on the top of the legs. This is also the time to fit the drawer runners and kickers.

After disassembling the case, cut the dovetail sockets in the legs and the hinge mortises in the rails. Drill the shelf support holes in the legs.

Next, mortise the legs for the decorative square pegs. Since I don't have a hollow-chisel mortising attachment for

my drill press, I used a hybrid method: I drilled a 1/64-in.-undersized hole on the drill press, then chopped the mortise with a hollow chisel sold for mortiser attachments (available from Grizzly Imports, Box 2069, Bellingham, WA 98227, 800-541-5537).

After sanding everything to 220 grit, glue the side frame-and-panel assemblies, lining up the grooves in the bottom rails with the notches in the legs. When the glue dries, glue up the rest of the case, including the drawer runners and kickers. I pinned the panels in the centers of their frames from the inside with bamboo skewers from the grocery store. To check the case for square, I measured across the diagonals with sticks.

"Multi-Routed" mortises. *The author cuts mortises using a Multi-Router, a machine that lets you rout slots in wood precisely.*

Making the Top

After dimensioning the top pieces to size, slot the center panel and breadboard ends for the splines (see Fig. 1) with a slot-cutting router bit. Stop the grooves in the breadboard ends before breaking through the back ends. The backboard will hide the rear of the center panel slot.

Note the rectangular pegs on the breadboard ends. I first routed the mortises for the pegs on my router table. Then I cut the screw slots in the bottoms of the mortises by drilling overlapping holes. I finished up with a rat-tail file. (See Fig. 4.)

After making the splines, I screwed the breadboard ends to the center panel, offsetting them 3/16 in. at the front. Next, I sanded the joints flush with 120-grit sandpaper. Then I disassembled the pieces and finished sanding them, easing the edges of the breadboard-end joints slightly to create a nice shadow line—another Greene and Greene touch.

Now, reassemble the pieces without glue and rout the slots for the ebony splines in the front edge (see Fig. 4) using clamped-on scrap pieces as a bearing surface for the router base. Note that the slots are deeper in the breadboard ends so the center panel can shrink in width without prying out the splines.

GREENE & GREENE: A STYLE IS BORN

by Susannah Hogendorn

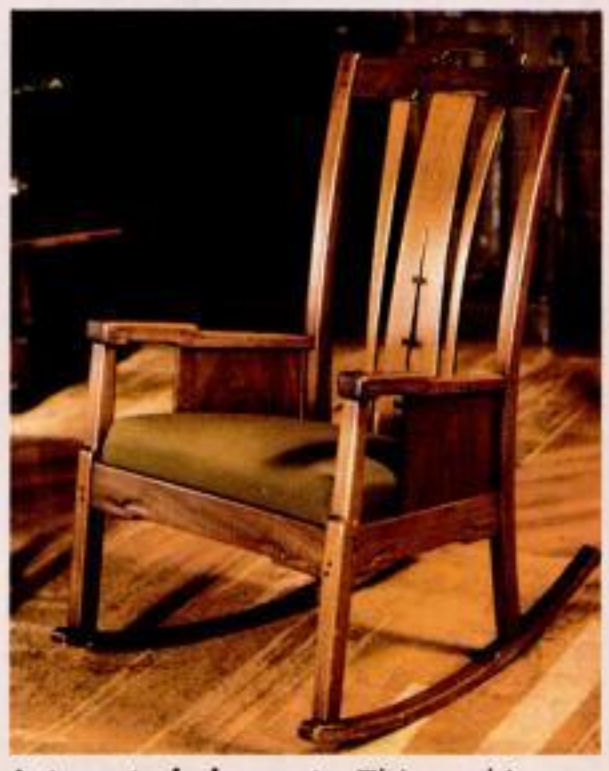
The Greene and Greene style originated in Pasadena, CA, where Charles and Henry Greene practiced architecture in the first two decades of this century. But the brothers' furniture is truly international in flavor, combining design elements from East and West.

The Greenes' design development took a major step forward in 1901 when they first saw Gustav Stickley's magazine, *The Craftsman*. The Greenes were inspired by the clean lines of Stickley's work, and they were eager to join in the growing American branch of the English Arts & Crafts movement. Arts & Crafts philosophy demanded an all-inclusive design method: Architects created not just houses, but everything from landscapes to light fixtures. At first the Greenes furnished clients' houses with Stickley-designed pieces. But soon they were designing their own, using traditional Arts & Crafts elements such as square pegs and protruding tenons.

By 1903, Charles Greene's interest in Chinese and Japanese design began to show in his work in the form of fluid, rounded edges and nature themes. The "cloud lift" motif (see Fig. 2) emerged as gently stepped rails in chair backs. Some pieces sported inlaid trees and flowers of wood, gems and mother-of-pearl.

The Greenes' prodigious output was made possible by their association with another pair of brothers—John and Peter Hall—who led the team of mostly Swedish craftsmen that actually produced the furniture. The Halls shared the Greenes' design vision and strove to reproduce it faithfully.

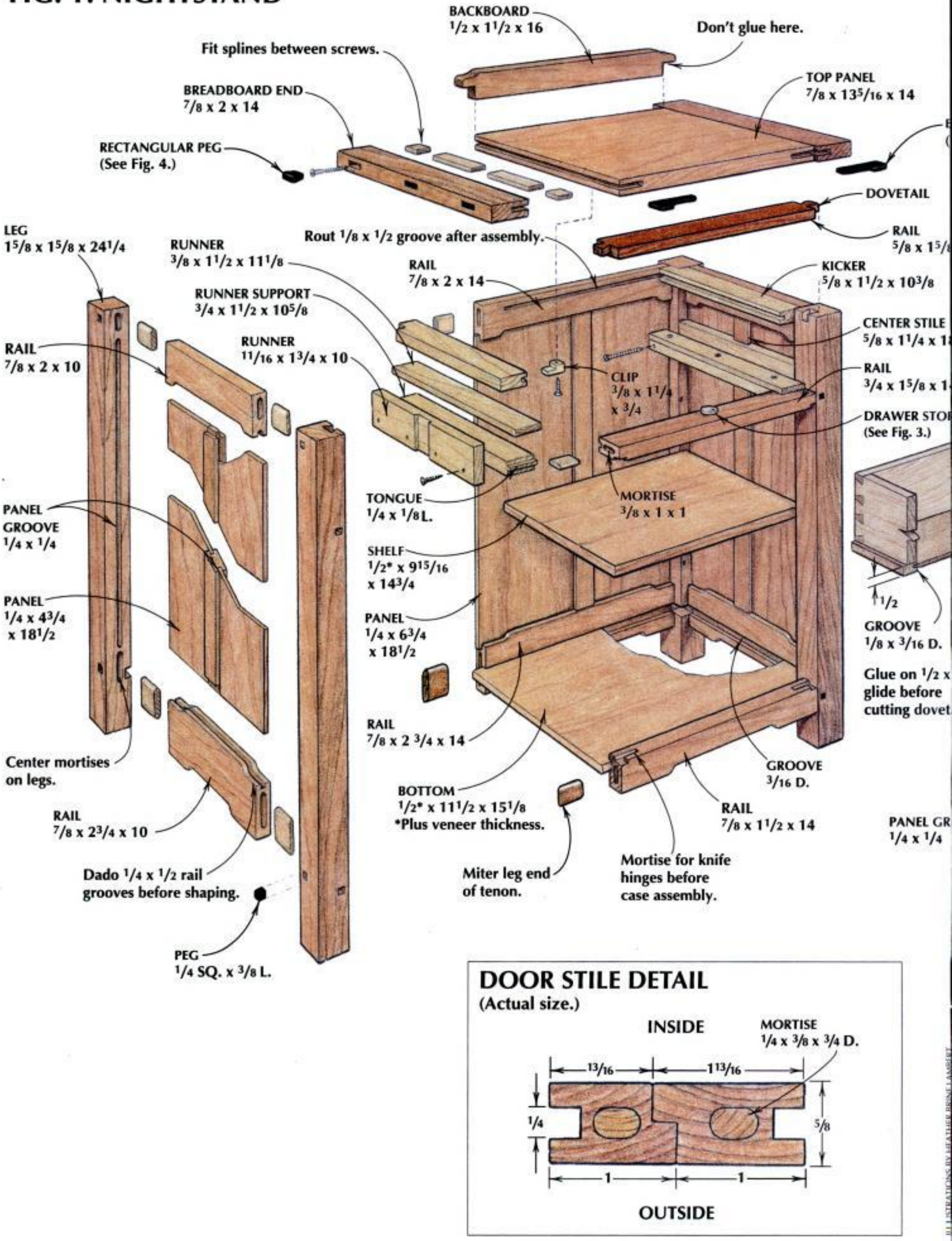
Frank Lloyd Wright once asked Charles Greene, "How do you do it?" Modern-day admirers still ask themselves the same question.



Integrated elements. *This rocking chair combines pegged through tenons, Oriental "cloud lifts" on the arms, and ebony splines.*

SUSANNAH HOGENDORN *is copy editor of AW.*

FIG. 1: NIGHTSTAND



DOOR STILE DETAIL

(Actual size.)

LINE
4.)

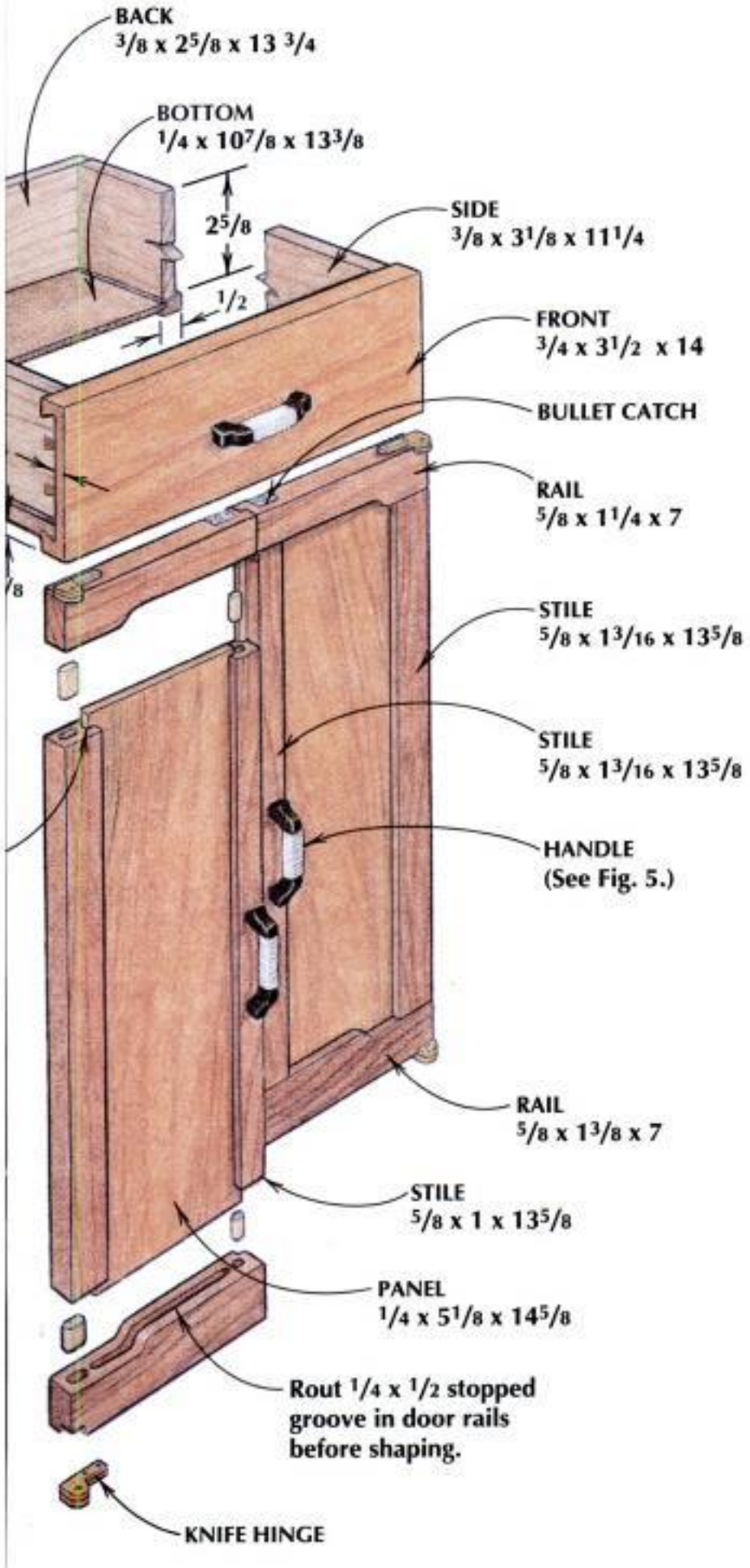
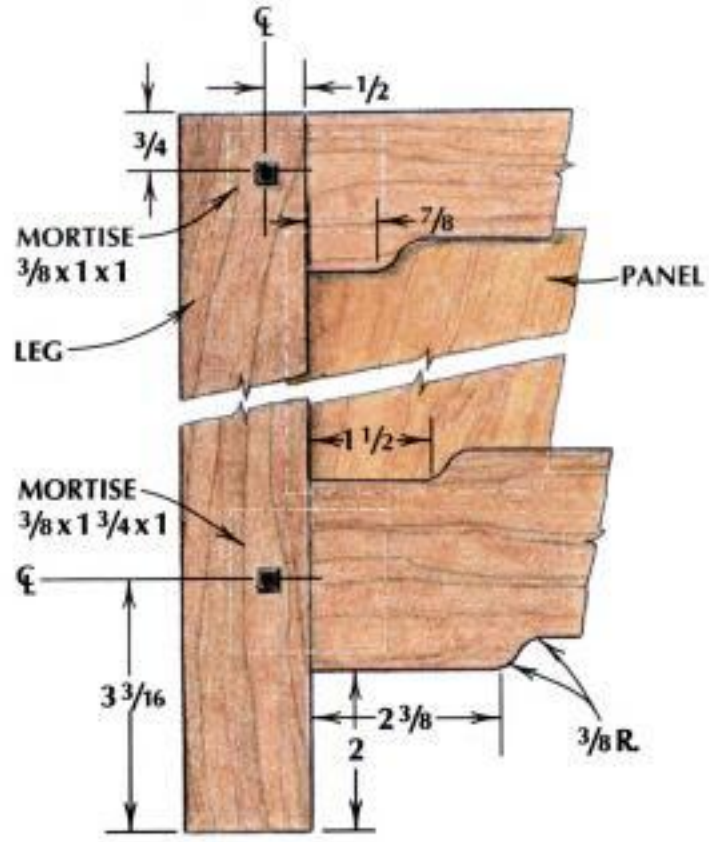
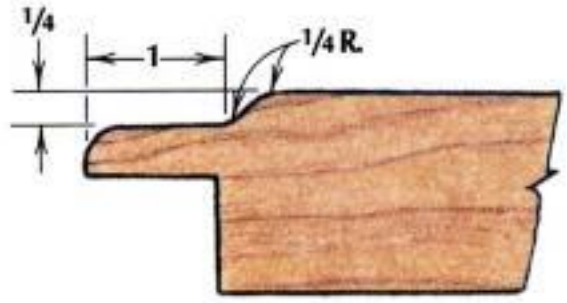


FIG. 2: JOINERY AND CLOUD-LIFT DETAILS

SIDE AND BACK ASSEMBLIES



BACKBOARD



DOOR AND LOWER RAIL

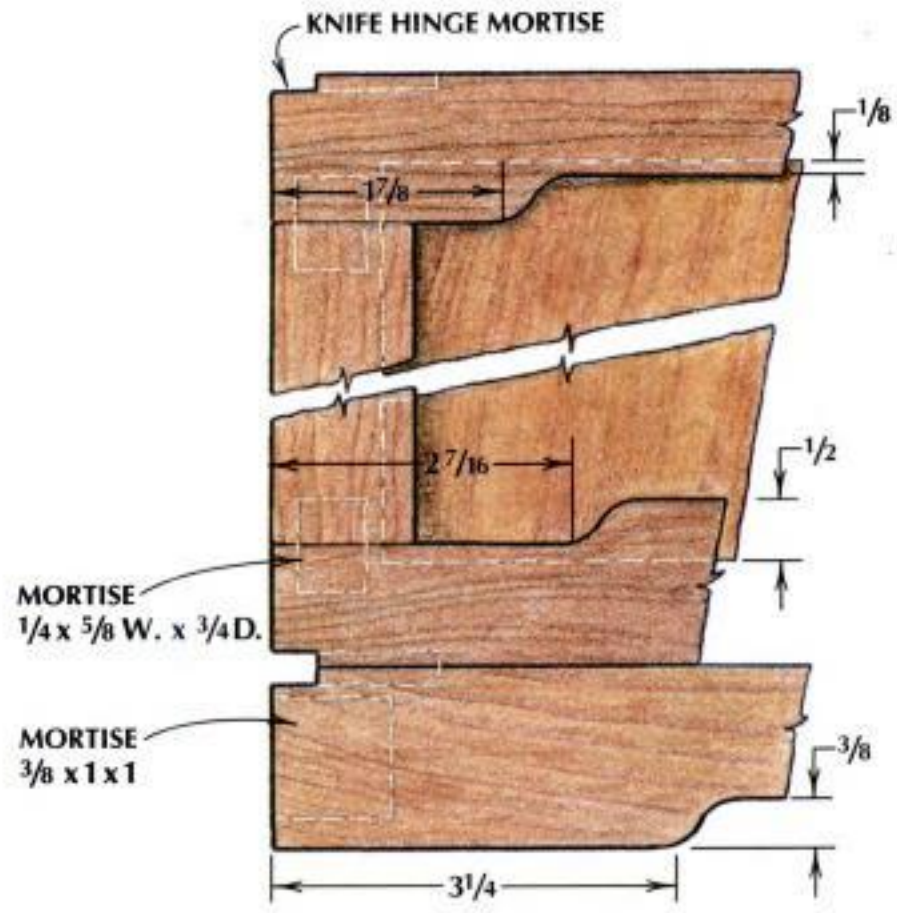


FIG. 3: DRAWER STOP

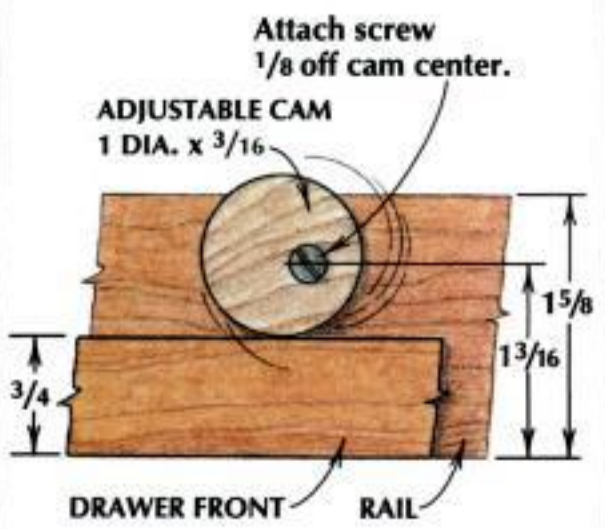
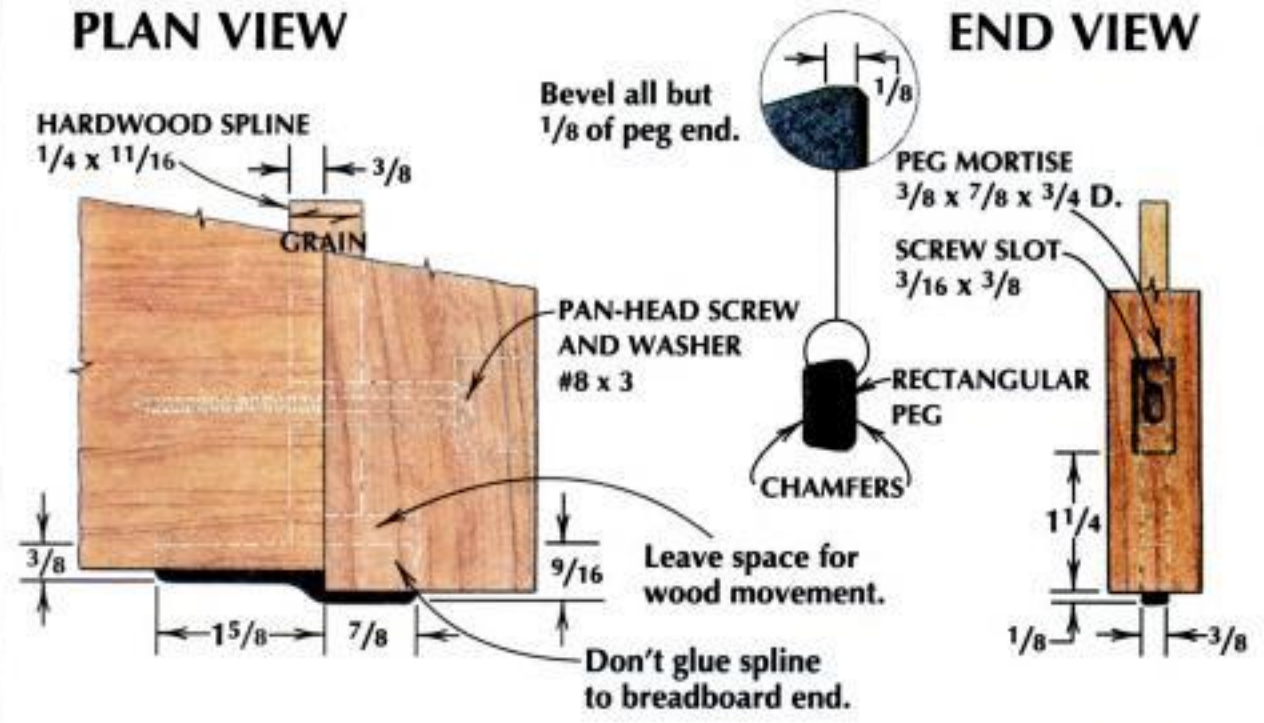


FIG. 4: BREADBOARD END DETAILS



For the next step, I shaped and sanded the backboard and glued it to the back of the center panel.

I didn't install the ebony pegs or splines until I was ready to finish, since they interfere with final sanding. Before installing the top, rout the grooves for the tabletop clips in the case rails. I made my own clips, but you could use commercial ones.

Doors and Drawer

I made the doors with floating tenon construction. Rout the stopped panel slots before cutting the cloud lifts on the door rails. The edges of the rails that butt against the ends of the stiles must be flat and square. You can do this with a plane or a flush-trim router bit guided by a clamped-on straightedge.

I made the drawer sides and back of mahogany. (See Fig. 1.) The projecting sections at the bottoms of the drawer sides were created by gluing 1/2-in.-square glides onto the 3/8-in.-thick sides. The resulting 1/8-in. projections reduce friction and ease fitting. Glue on the glides before laying out and cutting the dovetails. (For more on cutting half-blind dovetails, see AW #29.) Chisel the two center pins flush to the drawer sides after assembly.

Pegs and Handles

Make the decorative square pegs from strips of ebony that friction-fit the mortises. I disc-sanded chamfers on the peg heads while holding the strip against a 45° fence. Then I cut off a peg length and knifed two adjacent chamfers on the opposite end to ease insertion.

I cut the rectangular pegs for the breadboard ends and chamfered them on a block plane held in a vise. Beveling opposite ends as shown in Fig. 4 makes inserting them easier. Then I sanded and glued in the ebony pegs with cyanoacrylate glue, tapping them in until the bottom of the chamfer met the case surface. If you drive a peg in too deep, quickly drive a screw into the peg and pull it out. Glue the shaped ebony splines to only the center panel, not the breadboard end.

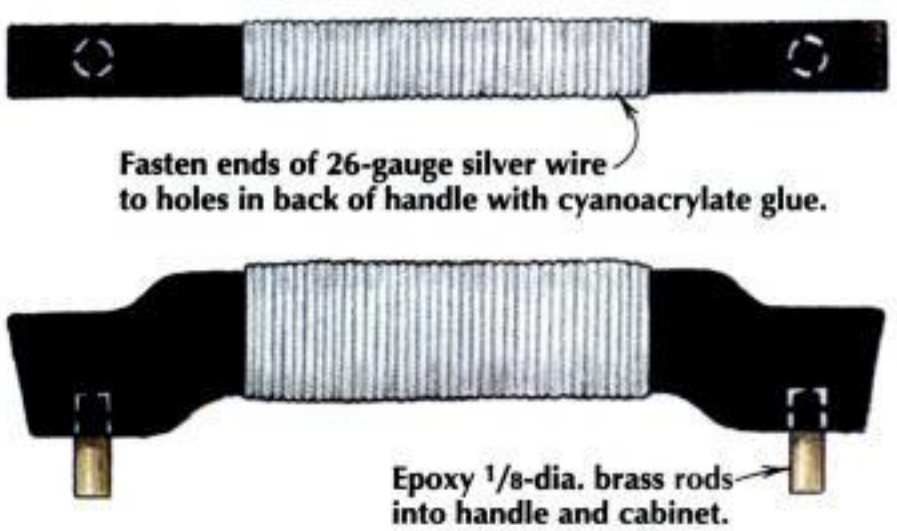
I made the handles as shown in Fig. 5. I drilled the holes for the brass rods with the handle clamped in a vise on the drill press. Then I sanded and finished the handles.

To wrap the silver wire (available at local jewelry supply stores) on the handles, glue one end of the wire into a tiny starting hole in the back of the handle with cyanoacrylate glue. Then, keeping the wire in tension, carefully roll the handle up the length of the wire. Complete the wrap by gluing the end of the wire into another hole in the back of the handle. Install the handles on the doors and drawer front with brass rods and epoxy.

To bring out the koa wood's luster, I finished the nightstand with four coats of Arm-R-Seal over a coat of Seal-A-Cell (both available from Woodworker's Supply, 1108 N. Glenn Rd., Casper, WY 82601, 800-645-9292). ▲

FIG. 5: SILVER-WRAPPED EBONY HANDLES

(Actual size.)



THOMAS STARBUCK STOCKTON
builds and designs custom furniture in Petaluma, California.

Tail Vise Retrofit

Bench Dogs and Wooden Jaws Upgrade Any Bench

by Jeff Greef

Put on the squeeze. *Add European-style stock-holding capabilities to any sturdy workbench with this shop-made tail vise.*

One of the most useful and intriguing features of many European-style workbenches is the tail vise. This ingenious device, with its unique stock-holding abilities, dates back to the very beginnings of cabinetmaking in early 16th-century Europe.

Tail vises were standard equipment on benches built in this country by generations of northern European immigrants, including the Shakers. Today, almost 500 years after it first appeared, the tail vise remains virtually unchanged, although metal screws and guide plates are often substituted for the original wooden ones.

A tail vise offers two big advantages over a front vise: First, there are no vise screws or other parts between or below the jaws, so you can hold workpieces vertically with ease. Second, the tail vise allows you to clamp boards of different sizes on the bench by means of movable bench dogs. This is an invaluable feature for hand-planing, scraping, routing and belt-sanding operations.

The tail vise shown here is based on an old Shaker design. I made it to fit my existing workbench, but you can adapt the design to fit any bench with a sturdy top. My choice of walnut and alder for the vise was arbitrary—early vises were commonly made of rock maple, but any hardwood will do.

I made a wooden screw for this vise. It's cheaper than buying a steel screw, and large-diameter wooden threads hold up well. To make the wooden screw, you'll need a thread box and a tap to match. I got my set from AMT (Fourth Ave. and Spring St., Royersford, PA 19468, 610-948-0400) for about $35. If you like, you can substitute a steel screw (available from Woodcraft Supply, Box 1686, Parkersburg, WV 26102, 800-225-1153).

How a Tail Vise Works

A tail vise consists of three main parts: the movable jaw assembly or "head," the fixed-jaw beam and the end beam. (See Fig. 1.) The head is the part of the vise that moves when you turn the screw. It clamps your work against the fixed-jaw beam—a laminated beam that's attached firmly to the front edge of the benchtop. The end beam is a shorter beam attached to the end of the bench. It extends into the head of the vise to help support and guide it, and it's tapped to accept the vise screw. Both the head and the fixed-jaw beam have bench-dog holes.

There is a circle of forces at work in a tail vise when you clamp something between the jaws. As the screw knuckle moves the head, the screw threads pull on the end cap. The end cap, in turn, pulls on the bolts that secure it to the benchtop. The moving jaw exerts pressure on the end of the fixed-jaw beam, and this pressure is transmitted to the front edge of the bench, completing the circle. Because of the forces involved, it's important to make sure the end beam and the fixed-jaw beam are attached securely to the benchtop.

Making the End Beam and Screw

I made the three main parts of the vise as separate assemblies, beginning with the end beam. I glued up two pieces of alder to make a 3½-in. by 5½-in.

FIG. 1: TAIL VISE CONSTRUCTION

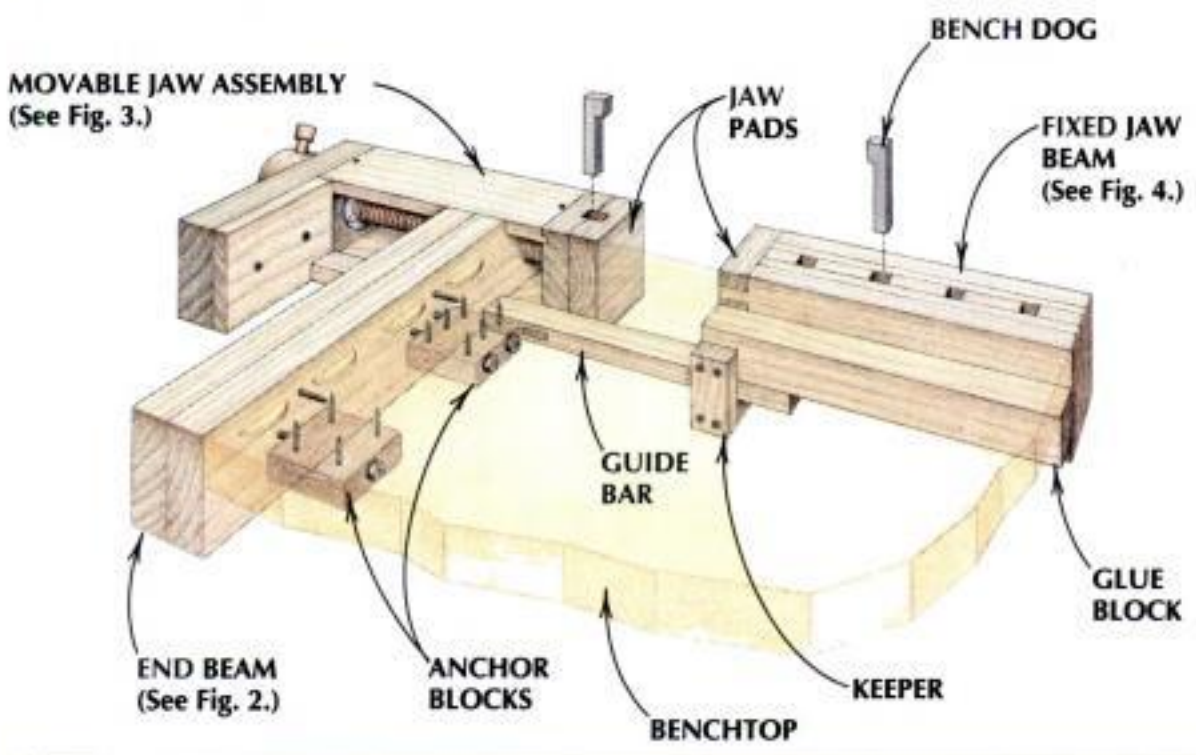
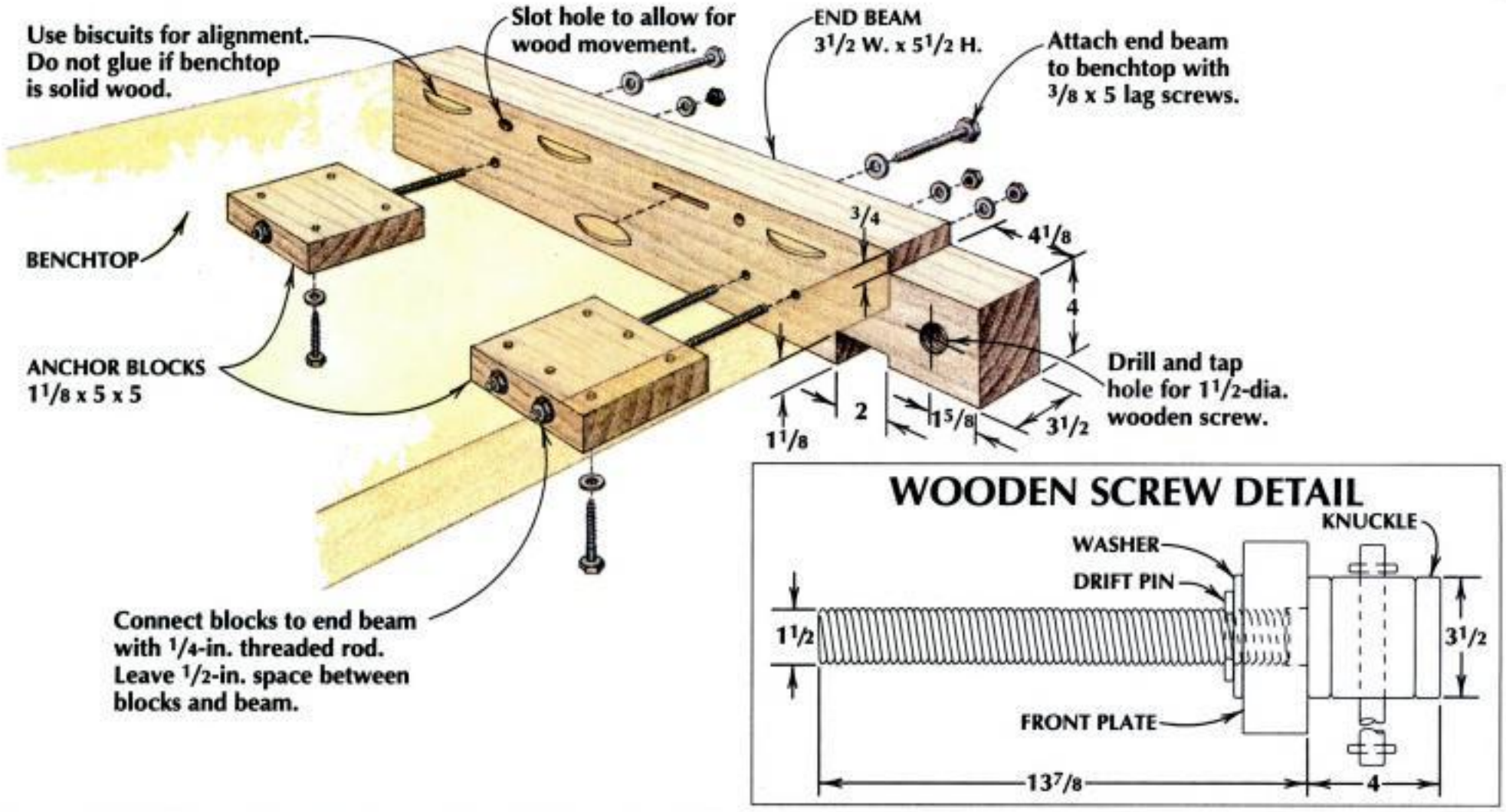


FIG. 2: END BEAM ASSEMBLY



beam, 4⅛ in. longer than my bench is wide, as shown in Fig. 2.

Before cutting the groove and the notches in the beam, I drilled and tapped the hole for the screw. The instructions that come with your tap will tell you the proper diameter for the pilot hole. I used a drill press to insure that the pilot hole was perpendicular to the face of the beam.

To make the screw, I first made a turning blank by gluing walnut blocks for the knuckle around the longer center piece that would form the screw shaft. Make the shaft about 1 in. longer than necessary so if you make a false start when threading, you can just saw off a little of the length and start over.

Turn the shaft on the lathe to the exact diameter specified by the manufacturer of the thread box you use. Then, adjust your thread box to make threads that fit smoothly but not too tightly in the tapped hole in the end beam.

I discovered that starting the thread is the hard part. You have to hold the box perpendicular to the shaft and apply steady downward pressure as you rotate the box. It's worthwhile to cut a test thread on an extra shaft to get the feel.

Thread the shaft of the screw as far down as the box will go, stopping against the knuckle. When you're done threading, trim the screw to finished length—13⅞ in. from the shoulder of the knuckle to the tip. This will allow about ⅛ in. clearance between the tip and the inside of the movable jaw when the vise is assembled.

To attach the end beam to your bench, first make sure the end of the bench is perfectly square to its front edge. You can use splines, biscuits or a tongue-and-groove joint to align the end beam with the benchtop before bolting it on. However, if your benchtop is solid wood, you won't want to use any glue on the end beam because of wood movement. And be sure to reinforce the joint with anchor blocks. (See Fig. 2.) They will keep the end beam from pulling off when the vise is tightened.

Making the Movable Jaw Assembly

The movable jaw assembly starts as a three-sided box, with the guide rail attached to the open fourth side. Begin by selecting straight stock for the various parts and cutting them to the dimensions shown in Fig. 3. Accuracy at this stage will result in a smooth-running vise with jaws that are parallel.

Note that the side plate of the box is 1½ in. narrower than the ends. This allows the top and bottom cover plates to be slipped in later.

Old-timers sometimes dovetailed the side plate and pegged the top and bottom cover plates to help the head resist pulling forces when the vise was used to pull furniture apart. Since I generally use spreader clamps for this job, I decided to make finger joints instead of dovetails.

I cut the finger joints with a dado blade on the tablesaw by holding the pieces against a vertical board clamped to the fence of my tablesaw cut-off box. (For more on cut-off boxes, see AW #40.)

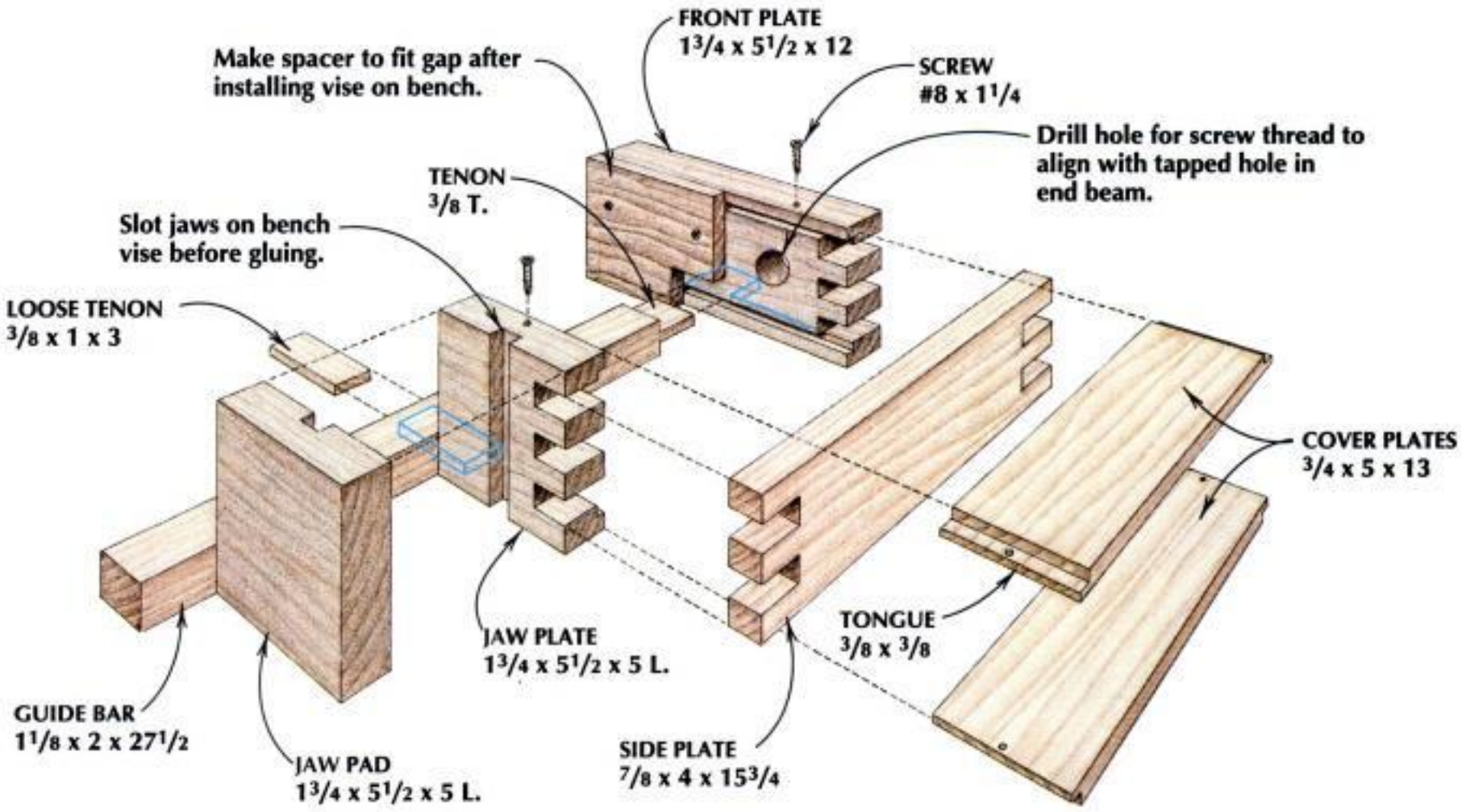
Before gluing the finger joints together, drill the clearance hole for the wooden screw, rout the grooves for the cover plates and chisel the mortise in the front plate for the guide bar as shown in Fig. 3. To bore the hole for the screw in the front plate, I used a spade bit at the drill press. You want a close fit, but don't make it so tight that it binds.

The guide rail is attached to the front plate with a through tenon and to the jaw with a loose tenon. (See Fig. 3.) I used a hollow-chisel attachment on the drill press to cut the mortises, but you could drill them out with a ¼-in. brad-point bit and pare the waste with chisels.

After you have glued the box and guide rail, make the top and bottom cover plates. Be sure to cut their shoulders for an accurate fit between the front plate and the jaw plate, because most of the clamping force will bear on these shoulders.

To make the dog slot in the movable jaw, I cut slots in the jaw plate and the jaw pad prior to gluing up the assembly.

FIG. 3: MOVABLE JAW ASSEMBLY



The parts made so far are enough to press the moving jaw assembly toward the fixed jaw, but they won't pull it away from the jaw. To accomplish this trick, buy a suitable fender washer at a hardware store, and install a drift pin in the screw shaft to hold the washer in place, as shown in the Wooden Screw Detail of Fig. 2. If you can't easily find a metal washer, make one from wood.

Making the Fixed-Jaw Beam

To create the fixed-jaw beam (see Fig. 4), I laminated five layers of wood, with spaces in the center layer for bench dogs. The thickness of your center layer of spacer blocks and the shapes of the blocks themselves will depend on the size and shape of the dogs you plan to use. Thickness the rest of the layers so the finished beam is 5 in. wide, to match the width of the movable jaw. I finger-joined a jaw piece to the outer laminates of my fixed-jaw beam.

The overall length of the fixed-jaw beam should equal the distance from the left end of your bench to the face of the movable jaw when the jaw is closed as far as it will go—just before the drift pin holding the washer on the screw shaft reaches the end beam. If necessary, you can make adjustments later by adding more face material to the vise jaws.

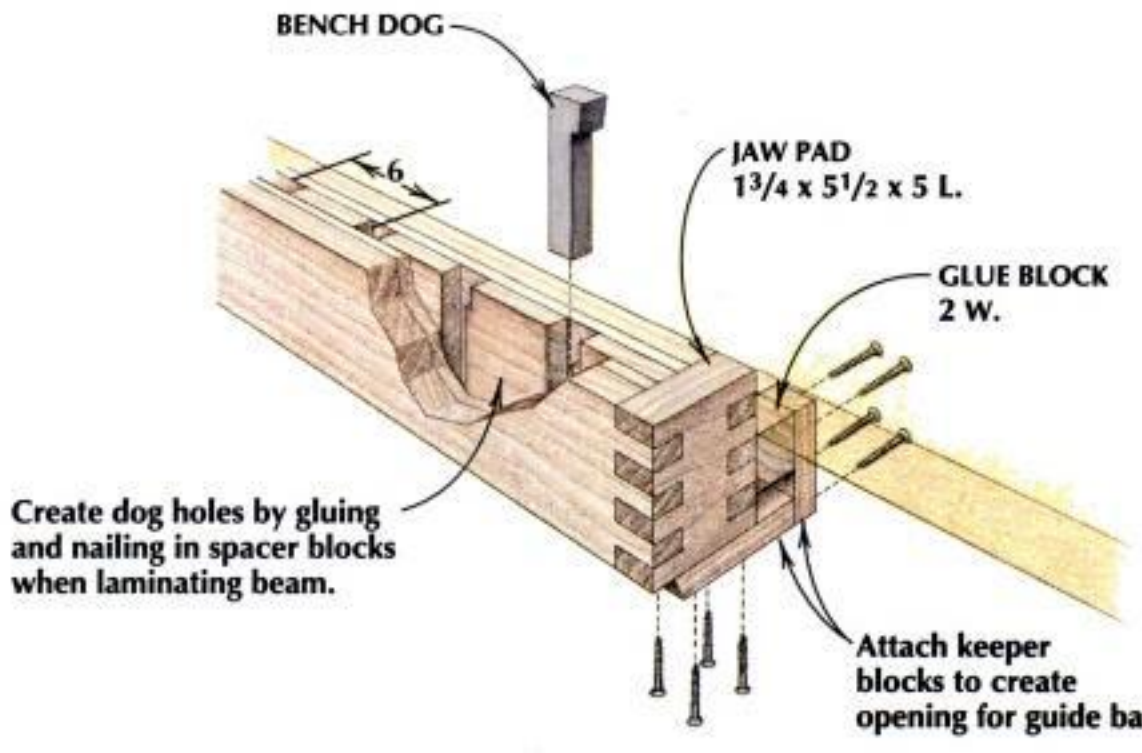
The vise head is positioned and guided by two guide-bar "keepers" and by the screw itself. One keeper is screwed to the underside of the fixed-jaw beam (see Fig. 4) and the other to the underside of the end beam. Design your keepers according to the size and layout of your bench installation.

Notice that one gap remains, between the vise-head front plate and the end beam. I installed an auxiliary plate that almost fills this gap when the jaws are closed, leaving about 1/16 in. of space. This plate provides another gripping surface for light work. Work clamped here twists the vise, so when you really need gripping power, use the main jaws.

Finish the vise to match your bench, and lubricate the screw with wax. Wax doesn't gum up, harden or pick up dust. Any piece of broomstick can serve as a screw handle. ▲

JEFF GREEF *lives in northern California. His book, Make Your Own Jigs and Woodshop Furniture, is available from Betterway Books, 1507 Dana Ave., Cincinnati, OH 45207, (513) 531-2690.*

FIG. 4: FIXED-JAW BEAM



Quality Saw-Blade Sharpening

A Good Sharpening Service Can Keep Your Carbide Blade Cutting Like New

by Matt Ver Steeg

What a kick it is to unwrap a new saw blade and make those first cuts! But maybe after a few sharpenings, that "new" feeling is gone—the blade just doesn't work the way it used to. Or your cuts may have lost that first velvety smoothness. Maybe the blade just sounds different, or maybe it seems to dull faster than it used to. So you start looking at catalogs again, for something with that brand-new feel.

Things don't have to be that way. A quality blade should cut like new throughout its working life, and this might be measured in decades in a small shop. In this article, I'll show you how to tell when your blades need sharpening, how to find a quality saw-blade sharpener, and what to look for in a properly sharpened blade.

When to Resharpen

Most woodworkers recognize when a blade is beginning to dull: It gets noisier, the cutting rate slows down, feed pressure increases and cut quality goes out the window. You can also inspect a blade for dullness by shining a flashlight on the top of a tooth. If you see a bright line of reflection on the cutting edge, it's time for a sharpening. Pushing a blade beyond this point will cost you more than the extra cutting is worth, since you'll subject the carbide to heat damage.

Finding a Sharpener

Not all sharpening shops produce consistently good results. One of the best ways to find a sharpener is to ask the best cabinet shops in your area who they use. Visit a few sharpeners if you can, and look for clean working conditions, good equipment and people who take obvious pride in their work.

Don't hesitate to ask a few questions before you leave a blade for sharpening.

Getting the edge. *A good sharpener relies on know-how and sophisticated equipment to produce sharp, long-lasting edges on your blades.*

Here are some things that I'd want to know in advance:

• **What kind of grinding wheel is used?** You want the results produced by a 400- to 600-grit diamond wheel. A coarse, 120- or 200-grit wheel is faster but gives an inferior edge. (See photos, opposite.) And so-called "green wheels" don't actually sharpen carbide. They merely gouge away the binder that holds the carbide grains in place, leaving the teeth smaller but not much sharper than before.

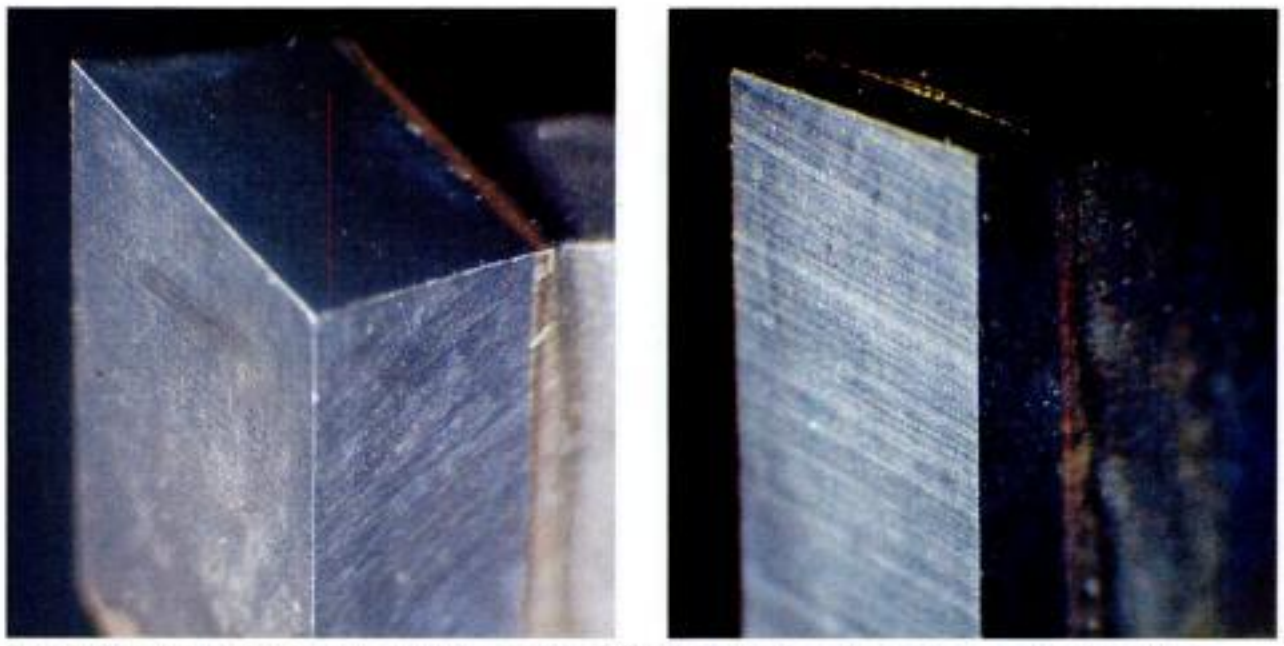
• **Does the sharpener use a "flood coolant" while grinding?** Better grinding machines flood the wheel with a special coolant during grinding, producing a clean, bright surface on the carbide. Dry grinding produces burned or discolored teeth and weakens the carbide.

• **What is the shop's policy on face-grinding?** Properly sharpened teeth retain their proportions throughout the life of the blade, as shown in Fig. 2. Excessive face-grinding wastes your carbide and can drastically shorten a blade's life. Because the sides of a tooth taper back from the face (see Fig. 1) face-grinding also reduces the blade's side

clearance in the kerf and may cause overheating. Many blade manufacturers recommend face-grinding only every third or fourth sharpening.

•**How is the blade cleaned?** A good shop will use an ultrasonic cleaner, a chemical bath and plastic brushes or a special blade-polishing machine. The faster, wire-wheel method erodes carbide and makes face-grinding mandatory.

A good sharpener will generally be willing to talk with you briefly and answer your questions. And if he knows you're an educated consumer, he might take extra care with your blade. But in the end, it's the work itself that provides the proof. The real test is to leave a blade for sharpening.



Smoother is better. *The tooth on the left shows the fine scratch pattern produced by a 600-grit diamond wheel; the one at right has been scratched deeply by a coarser 200-grit wheel. Deeper scratches weaken the edge and lead to faster dulling. Excessive face-grinding has also changed the tooth's proportions.*

Signs of Good Sharpening

When you get your blade back, here are some results you can readily observe:

•**Overall appearance.** Your blade should be clean—with all gum, pitch and superficial rust removed. The teeth should be plastic-dipped for protection.

•**Fine, precise grinding.** The teeth should be clean and bright, with smooth, uninterrupted grind patterns. Even under a hand lens or pocket scope, each tip should appear smooth, not ragged. (See photos, above.) If a tooth looks like it's been groomed with a garden rake, it will break down fast and won't stay "sharp" for long.

•**Minimum carbide removal.** Some sharpeners routinely grind away an excess amount of carbide—sometimes as much as 0.050 in.—to be sure all chips and imperfections are removed in one pass. A good shop takes the time to inspect teeth before grinding, and grinds off no more carbide than necessary. When the sharpener can take 0.004 to 0.012 in. off just the tops of the teeth, he's maximizing the blade's life.

•**The ultimate test.** The final test of a sharpening job is how well the blade performs. If you're satisfied, that's all that really matters. If you're not satisfied, talk with your sharpener and see if he can do anything to improve the blade's performance. And remember to make sure your saw is properly set up and aligned. (See AW #39 and #43.) No blade will perform well on a saw that is out of whack.

Between sharpenings, maintain your blade by keeping it clean, especially around the tips, where a buildup of pitch and resin can cause overheating. Scrub the teeth with a soap-and-water solution and a nylon-bristle toothbrush. Then, after drying the blade, spray it with a rust preventative such as Dri-Cote (available from Woodworker's Supply, 1108 N. Glenn Rd., Casper, WY 82601, 800-645-9292) to protect it. ▲

MATT VER STEEG *runs a sharpening service in Iowa and designs carbide-tipped saw blades.*

ABOUT TOOTH REPLACEMENT

There are two schools of thought on replacing carbide tips that are deeply chipped or broken. Some sharpeners replace every missing or chipped tooth on a blade; I prefer *not* to replace teeth because it often doesn't noticeably improve the blade's performance.

Many sharpeners often grind an extra 0.001 in. or so off the sides of replaced teeth rather than try to match the critical radial and tangential tapers on the sides. (See Fig. 1.) Teeth ground in this way won't cut, and pitch will tend to accumulate on the sides. —*M.V.S.*

FIG. 1: CARBIDE TIP GEOMETRY

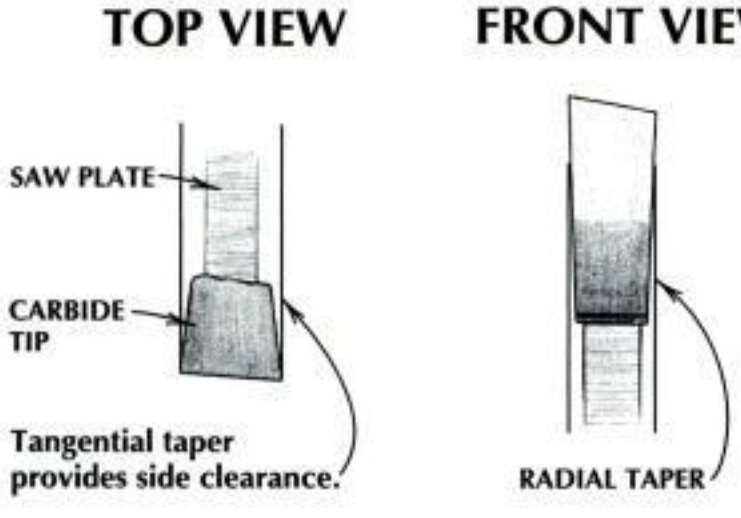
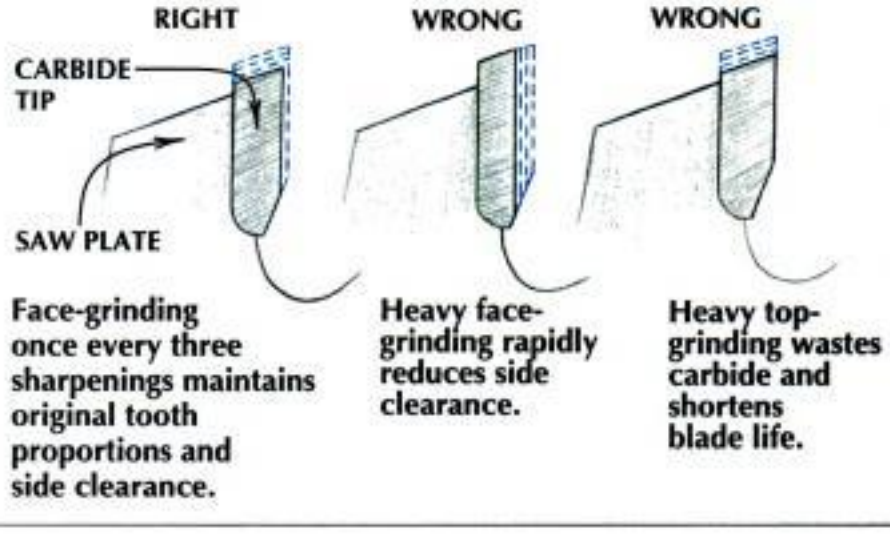


FIG. 2: PROPER SHARPENING



Display Stand

Elegant Support for Your Treasures

Well adjusted. *With its wooden hinge, sliding feet and delicate bamboo skewer, this miniature easel can adjust to hold items of various sizes.*

Why display a beautiful plate or a special photograph on a nondescript, factory-made stand? I know the displayed item really needs to be the center of attention, but to me it seems more fitting for a special memento to have a well-crafted stand made from a beautiful wood.

This idea is what prompted me to design what I call the "easy easel." (See photo, above.) Simple to build, my display stand adjusts to hold a variety of objects—photos, plates, bowls—in all shapes and sizes.

The stand pivots at the top on a wooden hinge. A bamboo skewer (available at most supermarkets) bends as you pivot the stand, providing enough tension so the legs stay put in any position. Two "feet" at the bottom of the stand can be moved in or out to accommodate items of various thicknesses.

The rack shown in the drawing is sized so an 8-in.-dia. plate can be displayed without the top of the stand showing, but feel free to dimension the stand to suit your own collection. This stand is made from walnut; the hinge and dowels are rosewood. Rosewood offers extra durability for the moving parts, but you could also use stock dowel rods to make these pieces.

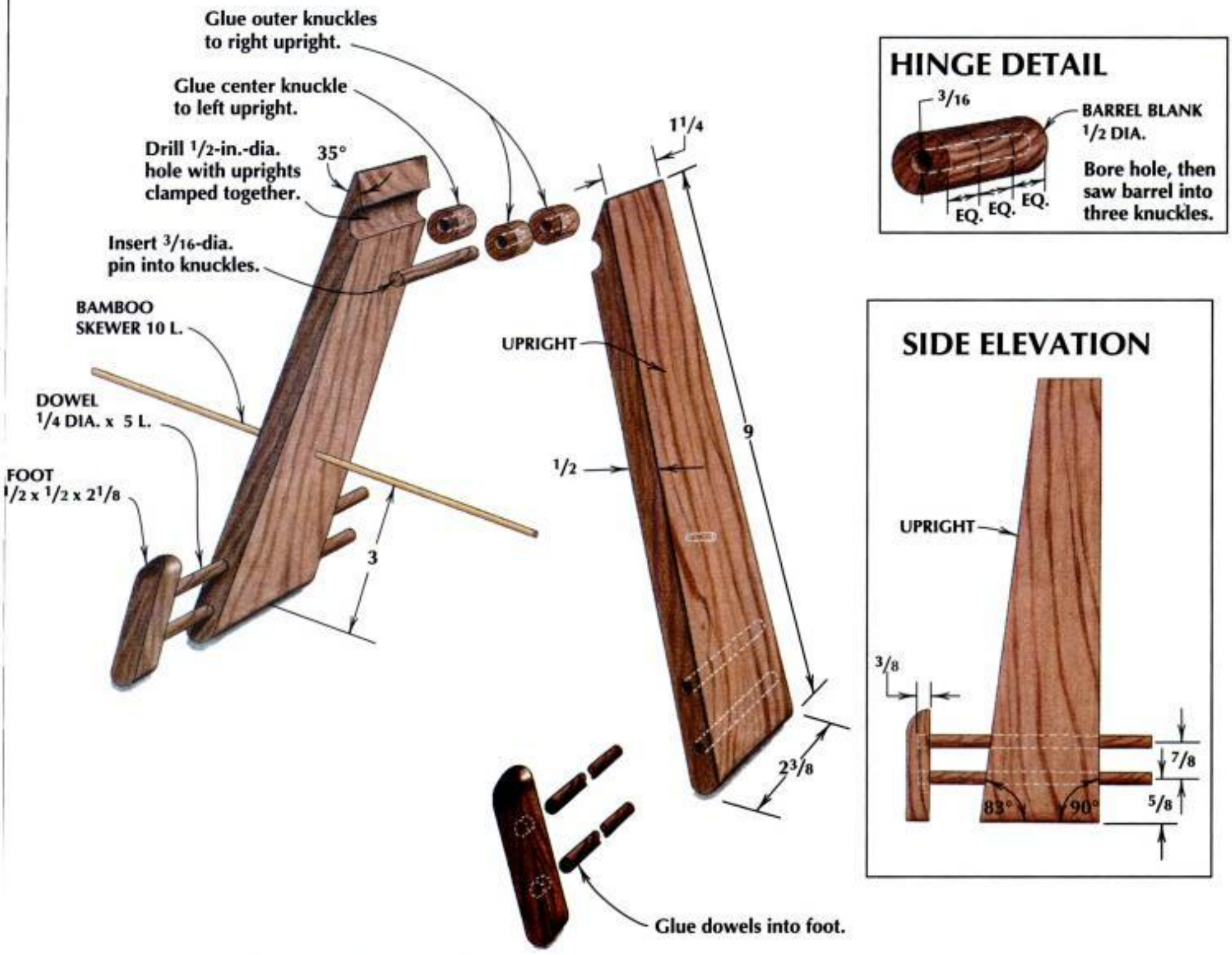
Construction Notes

Most of the woodworking in this project is simple, but a few construction notes—especially about the hinge system—are in order:

•**Bore the hinge barrel blank** using a scrap block as a clamp. (See photo, opposite.) To make the clamp, drill a 1/2-in.-dia. hole in a scrap block and saw a kerf in the block. Clamp the barrel blank in the block and use the drill press to bore through the center of the blank for the pin. Remove the barrel blank from the block and use a fine-tooth handsaw to cut the blank into three cylinders of equal length.

BY JIM TITE

DISPLAY STAND



Get a grip. *To hold the hinge barrel for accurate boring on the drill press, the author made a clamping block with a hole and a saw kerf.*

•**Clamp the uprights together** to ensure hole alignment when you bore the holes for the hinge, the bamboo skewer and the dowels. Then drill all these holes on the drill press. I use a 1/2-in. Forstner bit for the hinge hole. Once all these holes are drilled, separate the two pieces and make a 35° bevel cut at the top of each upright.

•**Round the bottoms** of the uprights and the feet. Use a stationary disc sander to gently round these areas. This way, the stand will sit firmly regardless of the position of the uprights. Glue the dowels into holes drilled in the feet.

•**Glue the hinge to the uprights.** To operate properly, the center knuckle of the hinge barrel must be glued to one upright, while the two outer knuckles are glued to the opposite upright. To ensure good adhesion, coat the appropriate end-grain areas of the uprights with glue size (a thinned version of the glue you'll be using). After the size has dried, give it a light sanding, then spread a thin, even layer of fresh glue over the sized areas, insert the hinge and clamp the two uprights together.

Once the glue has dried, sand the ends of the hinge flush with the edges of the uprights, give the entire piece a final sanding, and finish the project with a few coats of your favorite finish. ▲

JIM TITE
is a professional woodworker and designer in northwest Arkansas.

Breadboard Ends

A Classic Technique for Keeping Wide Panels Flat

by Peter Korn

No cupping here. *Breadboard ends on the author's fall-front desk lid keep the solid-wood panel from cupping.*

Making wide, solid-wood surfaces that will stay flat is a constant challenge for woodworkers. There are three time-honored techniques for doing so: board-and-batten, frame-and-panel, and breadboard construction. (See Fig. 1.) Each method has its pros and cons.

Board-and-batten construction is the easiest way to keep a wide panel flat. Unfortunately, the battens can be an unwelcome design feature in some applications since they project above (or below) the surface.

Frame-and-panel construction has superior dimensional stability and elegance but is more time-consuming to build. What's more, the small gap which must be left around the frame's inside perimeter to accommodate panel expansion makes frame-and-panel an unlikely choice for tabletops and other horizontal surfaces. The gap is a dust catcher and interrupts the work surface.

Breadboard construction creates a flat surface free of raised obstructions or gaps. Two flush end caps attach at right angles to a central board (or glued-up panel) with interlocking joints. The end caps keep the center piece from cupping. While I use breadboard ends less than the other two methods in my own work, there are times when I find them indispensable—for projects as simple as a cutting board and as sophisticated as a slant-top desk lid.

The trick to making breadboard ends is to attach the end caps in a way that leaves the center panel free to shrink and expand across the grain with changes in humidity. Without some provision for movement, the joints will self-destruct or the panel will split. There are many methods to allow for this movement, depending on the width of the work, its intended use, and the level of quality you desire. (See Fig. 2.)

Breadboard Types

Tongue and groove—The simplest way to make breadboard ends is to attach the

FIG. 1: OPTIONS FOR FLAT PANELS

BOARD AND BATTEN

FRAME AND PANEL

BREADBOARD ENDS

end caps with a tongue-and-groove joint. (See Fig 2.) Glue is applied only to the center section of the joint. This keeps the parts locked together, yet allows the center panel to expand and contract freely on both sides of the fixed center area. In humid seasons, the center piece will be wider than the caps; in dry seasons it will be narrower. Rarely will there be perfect alignment along the edge. For this reason, some woodworkers like to break the corners at the ends of the joints to eliminate sharp edges.

The primary shortcoming of the basic tongue-and-groove breadboard is that the ends of the caps may eventually bow outward, leaving gaps along the joint lines. This is especially true for wide work. Nailing or screwing the tongue-and-grooved end caps in place is one way to eliminate this problem, but it isn't the best solution. Metal fasteners tend to wear away the wood around them and become loose. A well-made wood joint offers much greater durability than mechanical fasteners. If you do attach the end caps with screws, make slots in the caps to allow for the center panel's side-to-side movement. (See Fig. 2.) You can conceal the screw heads and slots with plugs.

Sliding dovetail—This elegant-looking alternative provides a mechanical interlock for a strong joint. However, sliding dovetails can be difficult to cut and assemble accurately, particularly over long distances such as the width of a dining table. Also, they can't be used in thin stock since enough wood must remain around the widest part of the dovetailed groove to prevent the end caps from breaking off under stress.

Because of the way they go together, sliding dovetails can be glued only at one end. Alternatively, you can eliminate the glue and simply peg through the center to lock the end cap in place. (See Fig. 2.)

Mortise and tenon—I like to improve the tongue-and-groove breadboard joint with intermittent tenons. The number of tenons depends on the width of the work. For a relatively narrow board—perhaps 12 in. or less—a single, center tenon glued and/or pegged will usually suffice.

The "Rolls Royce" version of this tenoned joint is made by planing the end caps slightly concave along their jointed edges prior to assembly. (See Fig. 2.) When the end caps are clamped tight across the center, their ends are forced into a compression which counteracts any tendency they might have to bow outward later.

Routing the grooves. *To make the grooves and mortises in the end caps, Korn clamps them into a homemade router box, parallel to and just below the top lip of the box.*

For wider work, you can cut additional tenons near the ends of the caps. These outer tenons are not glued. Instead, they are slotted and locked in place with pegs so they can move from side to side as the center panel expands and contracts in width. It's important to allow room for the tenons to move within the mortises. To accommodate this movement, I elongate the mortises by about 1/16 in. on both sides for every 6 in. of panel width.

Fixed-edge tenon—Breadboard ends which allow the panel to shrink and expand around a fixed center, such as those described above, are excellent for cutting boards and tabletops. For assemblies which are hinged, however, such as chest lids and fall-front desktops, it's better to fix the end caps in place at the hinged edge so that all wood movement occurs at the other side. (See Fig. 2.) Keeping the ends of the end caps flush with the hinged edge of the center panel prevents them from prying against the carcase during the dry time of year when they protrude, which could rip out the hinges.

Making Tenoned Breadboard Ends

There are many ways to make the tenoned tongue-and-groove breadboard joint. I find it most efficient to plunge-rout the groove and mortises with a simple router box setup, then make the tongue and tenons with a tablesaw, router and bandsaw.

For example, I'll explain how I made the lid of the fall-front desk on the opposite page. The lid has a tongue 1/4 in. thick by 3/16 in. long, and tenons that are 1/4 in. thick, 1 in. long and 2 in. wide. The tongue-and-groove joint stops short of the ends for a clean, finished look.

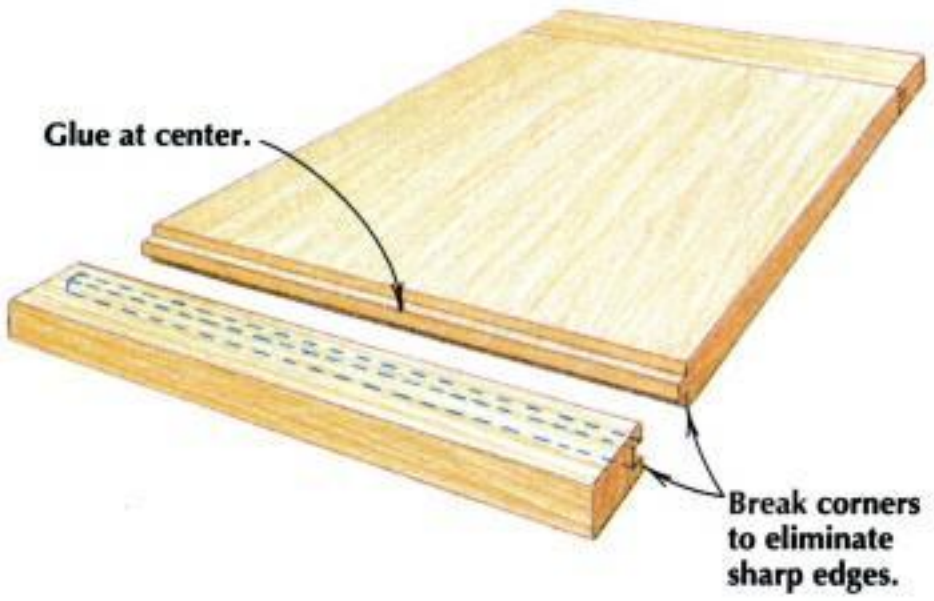
After gluing up the center panel, I thicknessed it and the end caps to the final 13/16-in. dimension. Then, to make the grooves and mortises, I

Ripping the shoulders. *To make the tongues, Korn first cuts clean shoulders by running each panel end against the tablesaw's rip fence. Shoulders are cut 1 in. from the end of the board. A "zero clearance" plywood insert minimizes splintering.*

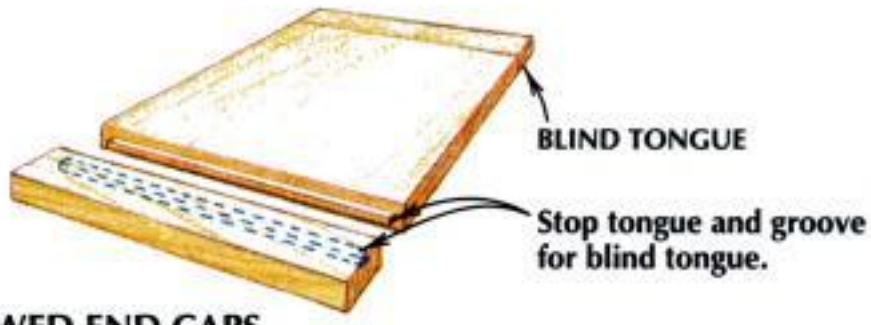
Setting the bit. *Korn uses the grooved end cap to set bit height in his router table, in preparation for routing the tongue on each panel end. If the groove isn't perfectly centered, he sets the bit height against the narrower shoulder.*

FIG. 2: BREADBOARD VARIATIONS

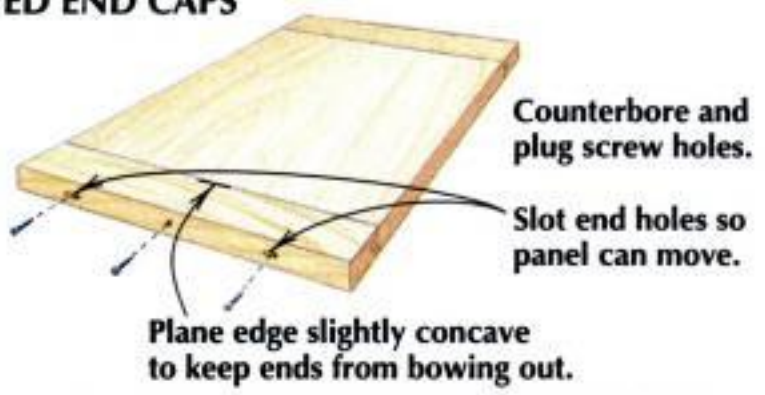
BASIC TONGUE AND GROOVE



BLIND TONGUE AND GROOVE

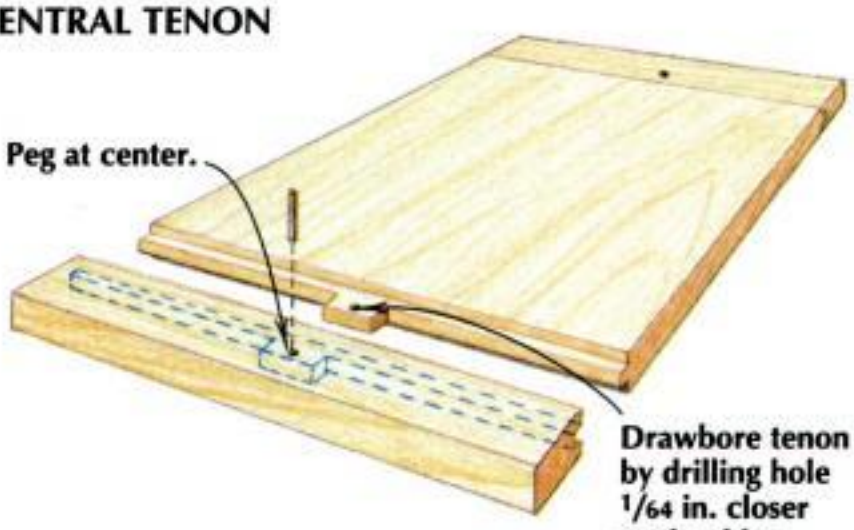


SCREWED END CAPS



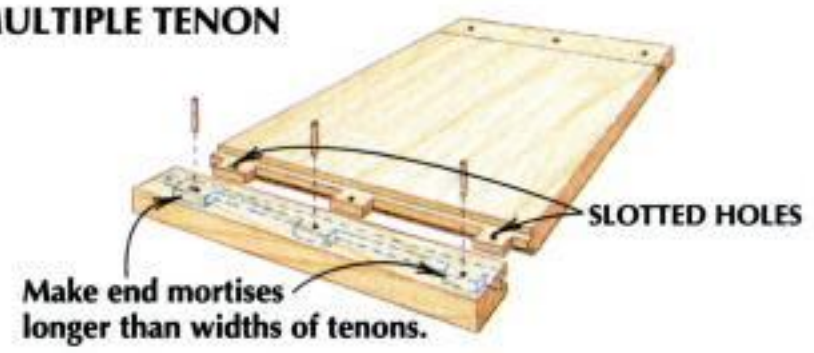
MORTISE AND TENON

CENTRAL TENON

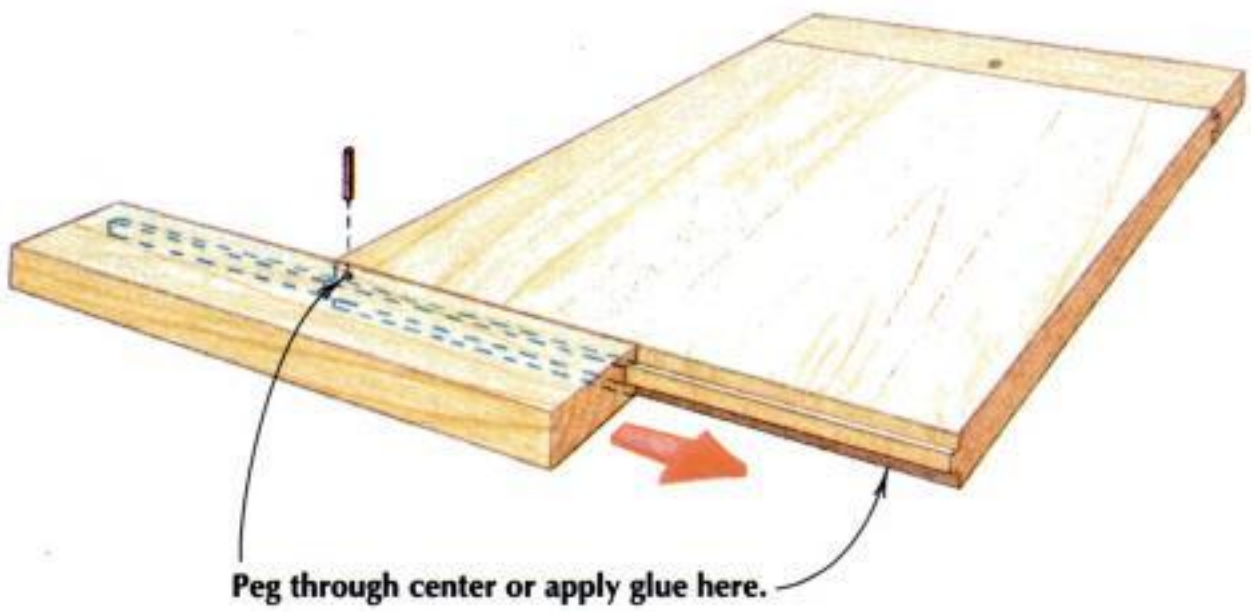


FIXED-EDGE TENON
(For hinged lids.)

MULTIPLE TENON



SLIDING DOVETAIL



clamped each cap into a homemade router box, parallel to and just below the top lip of the box. (See top photo, page 59.) The box gives the router a steady surface to ride upon. I adjusted the router fence to center a 1/4-in. spiral up-cut bit over the end cap. (I've improved the reliability of my router fence by attaching a strip of wood to provide a longer bearing surface.)

For consistency, I preset two of the router's depth stops so I could sequentially rout the 3/16-in.-deep stopped groove and the 1-in.-deep mortises with a single jig setup. I routed the groove in one pass. Then, to make each mortise, I lowered the bit about 3/16 in. per pass till I reached the second preset depth stop. For this piece, I elongated the mortises by 1/8 in. both ways to allow for wood movement.

Next, I trimmed the ends of the center panel to length with a sliding table on the tablesaw. Then I cut clean shoulders 1 in. from the ends of the board by running them against the rip fence. (See bottom left photo, page 59.)

To minimize the splintering action caused by the downward thrust of the saw blade, I substitute a plywood "zero clearance" throat plate for the metal one. I make my throat plate by raising the spinning blade through a plywood blank, with a scrap of wood pressed down on the blank to keep it from flying off. With the work fully supported from underneath as I cut, there is virtually no splintering along the shoulders.

After sawing the shoulders, I went to the router table and set the height of a 3/4-in.-dia. straight bit to the actual shoulder thickness of one of the end caps. (See bottom right photo, page 59.) If the groove in the end cap isn't perfectly centered at this point, I set the bit height against the narrower shoulder.

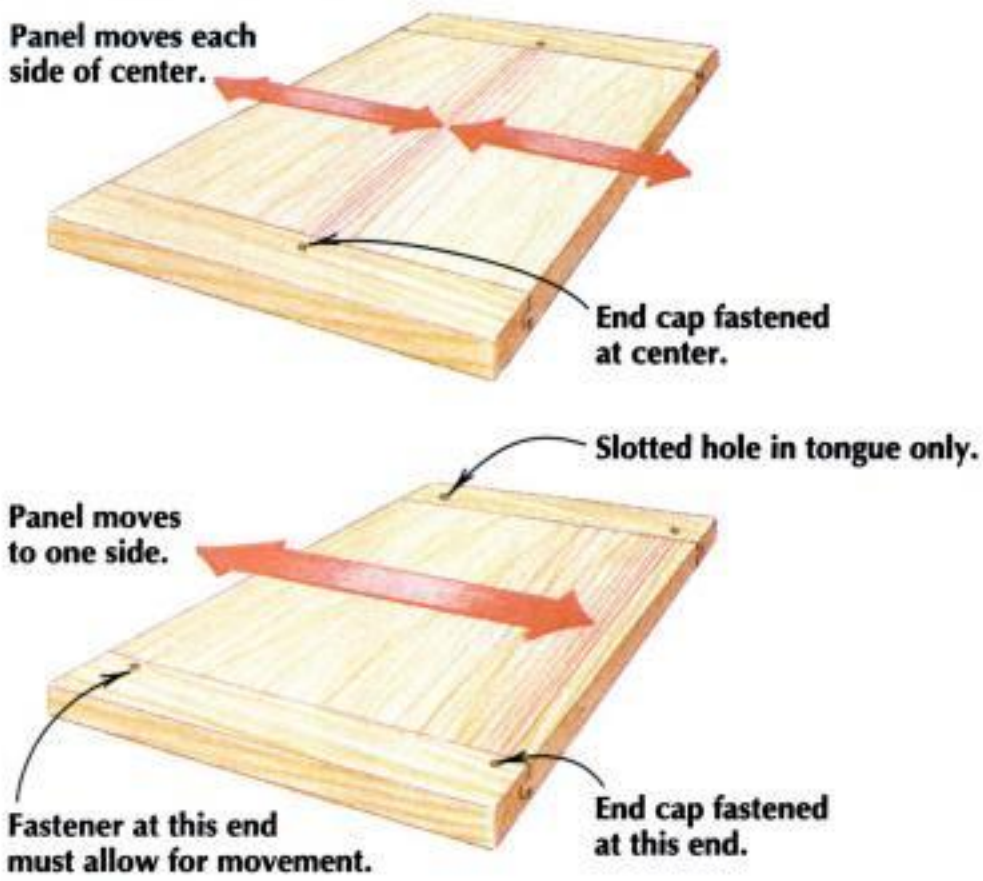
Next, I clamped a long, straight fence on the table, with a cutout surrounding all but about 5/16 in. of the bit for the first pass. (See photo, below left.) I routed both sides of one end of the panel first and test-fitted the tongue to make sure it fit the groove properly (or was just a hair oversize) before attempting the tenon on the other end of the panel.

To rout the full width of the 1-in.-long tongues, I moved the fence two more times, routing both sides of each tongue on each setup. If the tongue comes out a bit too thick for the groove, it's a simple matter to raise the router bit a hair and skim wood off the appropriate side. If you prefer, you could finish the job with a shoulder rabbet plane.

After routing the tongues, I penciled in the tenon locations and the 3/16-in. finished length of the tongue, and then cut both on the bandsaw. I made the tongues a little short of the full depth of the groove, so there would be no chance of bottoming out during assembly. I also trimmed off the tongue where it extended to the edge of the panel, so it wouldn't show in the finished joint. Next, I pared the shoulder ends square with a chisel. (See photo, left.) Before I assembled the joint, I touched up the shoulders with the shoulder rabbet plane.

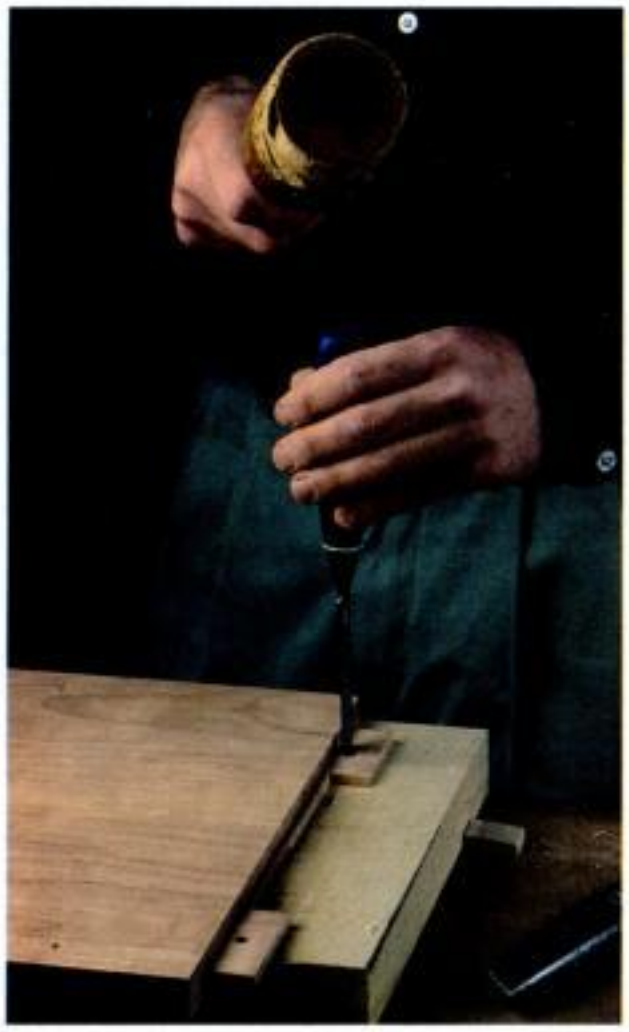
After the caps fit snugly, I removed them and drilled 1/4-in. holes almost all the way through for the pegs. Then I put the caps back on and inserted a 1/4-in. brad-point bit down each hole. Twirling the bit leaves a tiny dimple on each tenon, marking the hole's center.

FIG 3: BREADBOARDS AND WOOD MOVEMENT



Routing the tongue. *Korn routs both sides of each tongue, removing 5/16 in. of wood with each pass before repositioning the fence.*

Paring the tongue. *After cutting the tenons on the bandsaw, Korn pares off the tongue near the edges of the panel.*



Slotting the holes. *The tenons at the lid's hinged edge have single holes for the pegs. Here, Korn elongates the peg holes at the opposite end so the center panel can move freely around the pegs.*

Making the pegs. *To make pegs to secure the end caps, Korn planes maple stock by passing it over a jointer plane held in a bench vise.*

The tenons are "drawbored," which means that I drill the holes in the tenons a little closer to the shoulder than the dimple indicates so the pegs will force the shoulders tight as they're driven home. I drilled single holes through the fixed tenons at the hinged edge. The "movable" tenons have 5/8-in.-wide slots for the pegs. (See photo, above.)

To make these peg mortises I first marked a new centerline on the tenon with a knife and a straightedge, about 1/64 in. closer to the shoulder than the dimple left by the brad-point bit. Then I drilled 1/4-in. holes 3/8 in. apart on this line and carefully cleared out a mortise between them with a chisel. (See photo, above.)

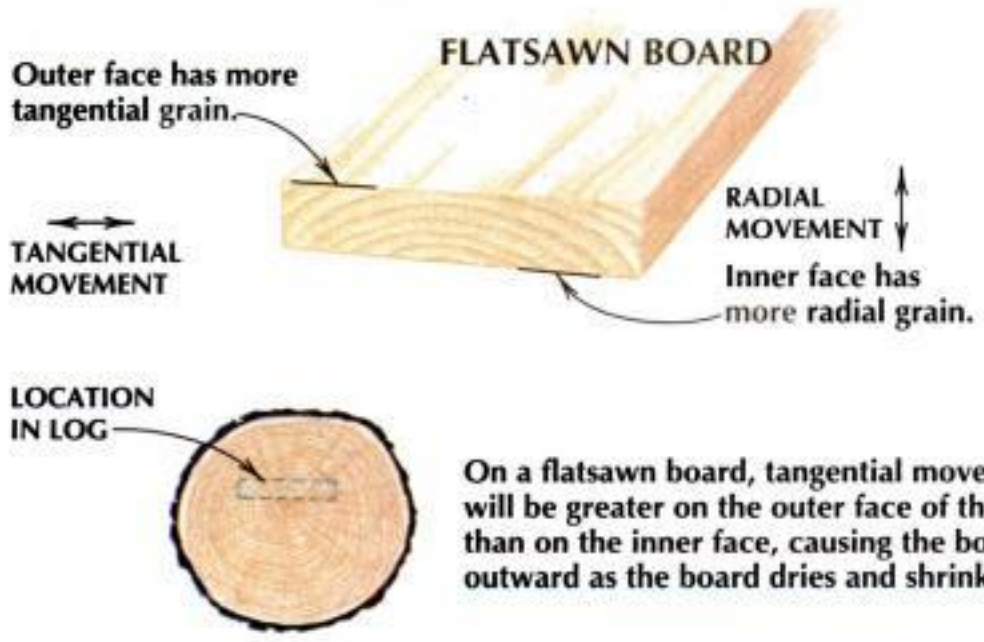
To make the pegs, I could have used a store-bought 1/4-in.-dia. hardwood dowel, but (for some inexplicable and assuredly perverse reason) I like to make my own pegs by hand. So I sawed a 6-in. length of hard maple 1/4 in. square, then I planed the square into an octagon by manually passing it over an upside-down jointer plane held in a bench vise. (See photo, above right.) In the same way, I planed off the corners of the octagon until I had a slightly irregular pin that would stay put in a round hole. I cut four pegs from the handmade dowel, each a little longer than necessary.

To assemble the joints I spread glue on the fixed mortises and tenons, clamped the end caps in place and then drove the pegs home. When driving the pegs in this type of joint, I make sure the caps are securely supported underneath so the pegs won't break out the far side. After the joints are assembled there's no way to tell which end is which, so I'm careful to mark the location of the fixed joints on the exterior ahead of time. Otherwise, I won't know where to put the hinges. ▲

PETER KORN *is a contributing editor to AW. He teaches workshops at the Center for Furniture Craftsmanship in West Rockport, Maine.*

WHY WOOD CUPS

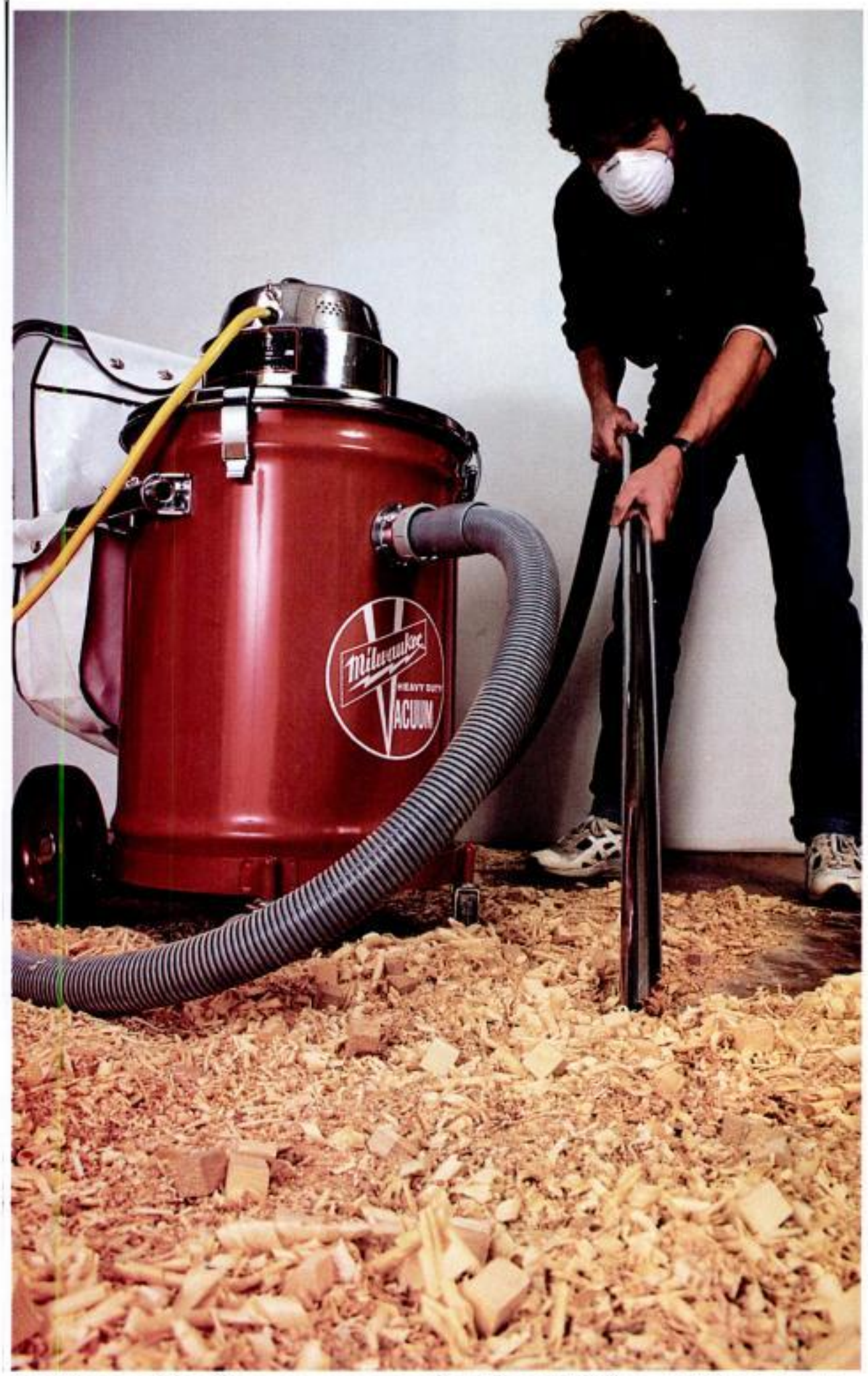
Any piece of flatsawn solid wood will cup over time unless it is restrained. This is because the side of the board which faced the outside of the tree has more tangential grain than the inner face, which has more radial grain. Tangential movement is greater than radial movement when moisture levels change. (See drawing.) When humidity changes, one side of a flatsawn board shrinks or expands more than the other, causing the wood to cup. —*P.K.*



On a flatsawn board, tangential movement will be greater on the outer face of the board than on the inner face, causing the board to cup outward as the board dries and shrinks.

Buyer's Guide to
Shop Vacuums

Find the Best Machine for Your Shop Needs



Healthy appetite. *Shop vacuums are valued for portability and pickup power.*

It's amazing how quickly a workshop can fill up with sawdust, wood chips, offcuts, nails, and other debris. To capture sawdust and shavings at the source, nothing beats a central dust-collection system. But even a well-designed dust-collection setup falls short in corners and crevices. Sooner or later, you need a shop vacuum to do cleanup right.

Unlike dust collectors, most shop vacuums are portable enough to do cleanup work outside your workshop as well. Many units are "wet-dry" models, capable of sucking up liquid and solid material. Others even have detachable motors which can be used like leaf blowers.

Too Many Models

For this buyer's guide, we sorted through more than 100 shop vacuums to come up with a short list of 15 models we felt were best suited to shop use. We included several heavy-duty commercial models of the type used by maintenance and construction crews, and a few designed for hookup to portable power tools. The rest of our test models are high-end shop vacuums for homeowners.

Even among these 15 models we found important differences in terms of price—which ranges from around $90 to well over $500—and performance.

To choose the best shop vacuum for you, consider the features discussed below and the performance ratings and prices shown in the chart on page 64.

Tank Capacity and Composition

The net debris capacities of the vacuums we tested range from 5 gallons to 28 gallons. Note that the *net* capacities given in our chart may be less than the *gross* capacities manufacturers use to describe their machines.

Most of the noncommercial vacuums have plastic tanks, which were tough enough to withstand normal workshop wear and tear. The Delta and the Ryobi have large drum-type fiber tanks for dry pickup only; these are also easier to puncture than plastic. On commercial vacuums, you'll find tanks made of tougher plastic, painted steel or stainless steel.

Pulling Power

Standard manufacturer power ratings—peak horsepower, air flow rate (cfm) and static pressure suction—don't really tell the story when it comes to picking up workshop waste. Our real-world tests,

Bosch 1702

Delta 49-255

Dirt Devil 081600

Eureka 2827

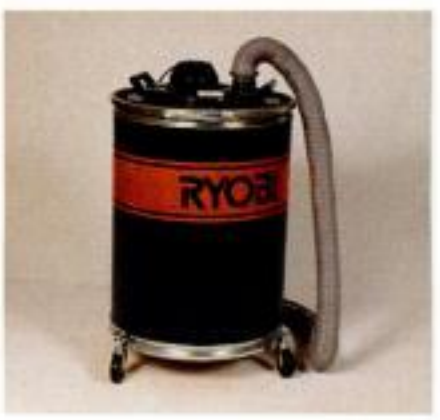
SHOP VACUUMS

		PERFORMANCE RATINGS				SPECIFICATIONS				
Name & Model	Street Price	Mixed Debris	Bolts	Fine Dust	Noise (dB)	Drum Material	Tank Capacity (gal.) Dry	Wet	Rated HP	Amps
BOSCH 1702 (312) 286-7330	$295	●●●●	●●●●◖	●●◖	89.1	Painted Steel	8 1/2	6 1/4	2 1/2	9
DELTA 49-255 (800) 438-2486	198	●●●●	●●	●●●	81.9	Fiber	28	—	1	7.5
DIRT DEVIL 081600 (800) 321-1134	99	●●●●◖	●●●●	●●●	96.6	Plastic	16	16+	5	12
EUREKA 2827 (800) 282-2886	90	●●●●	●●●●	●●	97.8	Plastic	11	11	4	12
GENIE PRO 20-4031 (800) 995-1111	110	●●●●◖	●●●●	●●●	93.9	Plastic	20	17 1/2	4	11.7
HOOVER S6755 (800) 293-4605	140	●●●●●	●●●●	●●●	91.3	Plastic	16 4 9/10	6 4/5+	NA	11.6
JET JV-10 (800) 999-5381	299	●●●	●●●●◖	●●●●	90	Stainless Steel	8 1/2	7 1/2	1 3/4	9.1
MAKITA XSV10 (714) 522-8088	299	●● ●●●**	●●●	●●●	78.1	Stainless Steel	10	9	1 7/10	6.5
MILWAUKEE 8911 (800) 414-6527	369	●●◖	●●●●	●●●◖	81	Painted Steel	9	9	1 3/5	8
PORTER-CABLE 7810 (800) 487-8665	315	●●● ●●●●◖**	●●●●◖	●●●●◖	82.3	Plastic	5	9	NA	9
RYOBI IDV28 (800) 323-4615	130	●●●●◖	●●	●●●◖	86	Fiber	28	—	2	9
SEARS 17700 Contact local Sears.	100	●●●●●	●●●●	●●◖	87.3	Plastic	16	16+	5	11.2
SHOP-VAC QSP-900-84	125	● ●●●*	●●	●●●●	77.2	Plastic	15	13	2	7
SHOP-VAC 870-72 (717) 326-3557	110	●●●◖	●●●◖	●●◖	90.2	Plastic	15	13 1/4	4	11.7
WAP SQ14-AS (800) 237-2368	569	●●◖ ●●●◖**	●●●●●	●●●●●	67	Plastic	14	10 9/10	1 3/5	9.5

KEY
NA = information not available.
— = not applicable.
* = Tested w/opt. 2 1/2-in.-dia. hose.
** = Tested w/generic 2 1/2-in.-dia. hose, available at most hardware stores.
+ = Has tank drain.
++ = Optional at extra cost.
Filter types: CD = cloth disc, CS = cloth sleeve, DPB = disposable paper bag, FS = foam sleeve, PBS = paper bag sleeve, PD = paper disc, PPC = pleated paper cartridge, TL = tank liners.

Milwaukee 8911

Porter-Cable 7810



Ryobi IDV28

Genie Pro 20-4031

Hoover S6755

Jet JV-10

Makita XSV10

Two-Stage Fan	Bypass Fan	Filter Type (primary/secondary)	Hose Size (dia. x l.)	Cord L. (ft.)	Weight (lbs.)	Pros & Cons
Y	Y	TL / FS	1 1/2 in. x 12 ft.	18	40	**PROS:** Flexible hose; large wheels for easy movement. **CONS:** Few standard accessories.
N	N	PBS / CS	2 1/2 in. x 6 ft.	10	24	**PROS:** Large debris capacity. **CONS:** Top clamp awkward; top-heavy; no wet pickup; casters cost extra.
N	Y	PBS	2 1/2 in. x 8 ft.	20	25	**PROS:** Very stable; tool storage bin; detachable blower. **CONS:** Extremely loud; hard to empty because of tank lip.
N	N	PBS / FS	2 1/2 in. x 6 ft.	25	15.5	**PROS:** Very stable; tool storage bin. **CONS:** Extremely loud; poor fine-dust pickup; hard to empty because of tank lip.
N	Y	DPB++ / PPC	1 1/4 in. x 8 ft. 2 1/2 in. x 6 ft.	10	26	**PROS:** Large debris capacity. **CONS:** Very loud.
Y	Y	PPC	1 1/4 in. x 8 ft. 2 1/2 in. x 7 ft.	12	30.4	**PROS:** 2 tanks for quick change from dry to wet; easy dumping; excellent mixed debris pickup; detachable blower. **CONS:** Very loud.
Y	Y	TL / PPC	1 1/2 in. x 12 ft.	18	50	**PROS:** Flexible hose; large wheels for easy movement; hose storage basket. **CONS:** Very loud.
Y	Y	PPC	1 1/2 in. x 12 ft.	18	47	**PROS:** Fairly quiet; flexible hose; large wheels for easy movement. **CONS:** Standard hose clogs with large debris.
Y	Y	DPB++ / TL	1 1/2 in. x 10 ft.	22	48	**PROS:** Flexible hose; very durable construction; tool storage bag; large wheels for easy movement. **CONS:** Hose and attachments cost extra.
Y	Y	DPB++ / PPC	1 1/2 in. x 13 ft.	25	16.5	**PROS:** Very good fine-dust pickup; very stable; flexible anti-static hose; auto start-stop; wheel lock; filter shaker. **CONS:** Small capacity.
N	N	CS / FS	2 1/2 in. x 6 ft.	20	29.5	**PROS:** Flexible hose; large capacity. **CONS:** Top clamp awkward; top-heavy; no wet pickup.
N	N	PPC	2 1/2 in. x 7 ft.	15	23	**PROS:** Best mixed debris pickup; stable. **CONS:** Poor fine-dust pickup.
N	Y	PD / FS	1 1/4 in. x 8 ft. 2 1/2 in. x 6 ft.++	18	22	**PROS:** Quiet; tool storage bin; easy dumping. **CONS:** Poor mixed debris pickup with standard hose.
N	Y	CD / FS	2 1/2 in. x 6 ft.	12	20	**PROS:** Flexible hose; easy dumping. **CONS:** Very loud; top-heavy.
Y	Y	DPB++ / PPC	1 in. x 11 ft. 6 in. 1 1/2 in. x 10 ft.++ 2 in. x 13 ft.++	22	32	**PROS:** Best fine-dust pickup; very stable; very quiet, flexible anti-static hose; variable speed; auto start-stop. **CONS:** Poor mixed debris pickup with standard hose.

Sears 17700

Shop-Vac QSP-900-84

Shop-Vac 870-72

Wap SQ14-AS

using measured batches of mixed debris and steel bolts, gave a better estimate of pickup power. (See sidebar, below.)

If it's just sawdust or liquid you want to vacuum, you'll do fine with the 1¼-in.-dia. hoses found on smaller American-made machines, or even with the 27mm (about 1 in.) hose used on the Wap vacuum. These smaller hoses are easier to maneuver and can be hooked up to many portable power tools.

To suck up the mixed debris you'd find on most workshop floors—sawdust, shavings, small chunks of wood, nuts and bolts—the 2½-in.-dia. hoses are far less prone to clogging. And you'll need the larger hose diameter if you want to hook up your vacuum to a small stationary machine.

A few models we tested come standard with both small- and large-diameter hoses. Others offer an alternative-diameter hose as an option. (See chart.)

With their standard 2½-in.-dia. hoses, the Sears and Hoover models collected mixed debris quickest of all the vacuums we tested. The Milwaukee and Wap units were slowest when tested with 1½-in. hoses, and the Makita's 1½-in. hose clogged most frequently. All the machines we tested can accept a 2½-in.-dia. hose, even when this hose diameter isn't offered as standard equipment. When we retested the Makita, Porter-Cable and Wap models with a 2½-in. hose borrowed from another machine, pickup performance improved dramatically.

The bolt pickup test shows a shop vacuum's relative ability to suck up heavier objects and deposit them in the tank. Most machines can lift a few bolts or screws mixed in a pile of sawdust, but lifting 5 lbs. of bolts is another matter. The Wap, with its 1½-in. hose, outlifted the others by picking up the batch of bolts in 35 seconds. It was followed by the Bosch and Porter-Cable, with 56 seconds each. The Delta, Ryobi, and Shop-Vac QSP earned poor ratings because they couldn't pick up all the bolts.

The suction a vacuum can generate is partly governed by the type of fan it has. A single-stage fan simply has one impeller, while a two-stage fan has two impellers in series. The top performers in our power and weight-lift test had two-stage fans. Another indicator of a quality vacuum is a bypass fan, a separate auxiliary fan dedicated to cooling the motor. (See chart.)

Noise

One frequent complaint about shop vacuums concerns the ear-splitting noise of their motors. Twelve of the 15 vacuums measured over 80 decibels—the sound intensity at which OSHA requires hearing protection in commercial shops.

When checking the decibel (dB) ratings in the chart, note that a 3-dB increase means a doubling of sound intensity. (See AW #26.) The loudest vacuum (the Eureka) was more than 1,000 times louder than the quietest (Wap).

One way to reduce a shop vacuum's noise level is to install a special muffler ($29.95; Beam Industries, 515-832-4620). With duct tape and plastic pipe, you can easily adapt the muffler to fit any of the vacuums. In our tests, the muffler reduced noise by as much as 10 dB—that's 10 times quieter than without the muffler.

Filters

Shop-vacuum filters come in quite a variety of sizes, shapes and materials. (See sidebar, opposite page.) The better vacuums have two filters: a primary filter to capture the bulk of debris, and a secondary filter to collect finer dust. The primary filter helps keep the secondary filter from becoming clogged, which cuts down on air flow. Refer to the chart for filter specifics on each vacuum.

In the chart you'll also find the results of our fine-dust test—a measure of each vacuum's ability to keep fine dust in the tank, instead of blowing it back into the shop. We found that the Wap performed best, followed closely by the Porter-Cable. If your work generates a lot of fine dust—sanding, for example—or if you're especially sensitive to dust, we recommend the Wap or Porter-Cable vacuums.

Other Considerations

Wet-dry conversion—Thirteen of the vacuums we tested can pick up liquids. Conversion from dry to wet pickup usually involves removing paper or cloth fil-

BOLTS, SHAVINGS, DUST & DECIBELS

Testing air flow (cfm), suction (static pressure) and filter efficiency requires elaborate lab equipment, and the resulting numbers are abstract. We wanted to get a handle on the shop vacuums' performance, so we developed "real-world" tests—picking up the debris you'd normally find on a workshop floor.

Mixed debris—This "witch's brew" contained planer shavings, long hand-plane shavings, ¾-in. by ¾-in. wood blocks (cubic and triangular), and sawdust. We timed each model in sucking up 5 gallons of this mix.

Weightlifting—We scattered 5 lbs. of 5/16-in. by 1-in. bolts on the floor and tallied the pickup time for each machine. We downrated vacuums that picked up all the bolts in the hose but couldn't lift them into the tank, and we further downrated vacuums that couldn't pick up all the bolts.

Filter efficiency—We picked up powdered drywall compound to see how well vacuum filters captured fine dust. Poor filters allow fine dust to pass through and blow out the vacuum's exhaust port. A moistened square of black cotton cloth, held tightly over each vacuum's exhaust port, gave us a visible measure of filter efficiency in the form of telltale white powder deposits.

Heavy, chunky and fine. *To test performance and filtering efficiency, we picked up piles of mixed debris, 1-in. bolts, and fine drywall dust.*

Noise—We used a decibel meter calibrated to the A-weighted scale that mimics the human ear. We took readings from five different directions, all 3 ft. away, then averaged the readings to get the final noise rating.

FILTERS FOR SHOP VACUUMS

Dust control. *The Wap vacuum (left) has a pleated paper cartridge filter and an optional disposable bag. The Bosch (center) uses a tank liner cloth and foam sleeve. Right, a paper sleeve fits over a foam sleeve on Eureka's vacuum.*

- **Pleated paper cartridge** filters are easy to install and are generally better at trapping dust than paper sleeves or discs. Most can be cleaned by washing with water.
- **Foam sleeves** are commonly used for wet pickup. They're inexpensive and easy to clean and replace.
- **Paper sleeves** are usually held in place over a foam filter with a rubber band. They're inexpensive, but installation is awkward and the paper can tear easily.
- **Cloth and paper discs** are folded around a foam filter and held in place with a rubber band or plastic ring. These filters are inexpensive and easy to replace, but they tend to be inefficient at trapping fine dust.
- **Tank liners** are large-area filters placed in the top of a vacuum's tank, where they're held in position by a wire "cage." They're easy to install and clean.
- **Disposable paper bags** fit over the vacuum's inlet port, inside the vacuum tank. Once the bag is full, you simply throw it away. Bags cost from $2 to $7, depending on the manufacturer. They're great if you're dealing with fine dust that could be dispersed by dumping.

ters and installing a foam sleeve filter. The Hoover has a unique two-tank system that lets you switch between dry and wet pickup instantly just by moving the hose from one inlet port to another. Some tanks have a drain that makes emptying very easy. Upending the tank isn't necessary; you simply unscrew a drain cock at the bottom of the tank.

Convenience—The Hoover, Porter-Cable, Sears, Shop-Vac, and Wap vacuums are the easiest models to upend and dump. The Bosch and Jet vacuums have to be removed from their pushcarts before dumping—an easier job with the Bosch. On the Makita and Milwaukee, the cart is built in, making them more difficult to dump.

The most stable vacuums are the low-profile Dirt Devil, Eureka, Porter-Cable and Wap. Tall ones with small casters, such as the Shop-Vac 870, Delta and Ryobi, are prone to tip over when you pull on the hose.

The Bosch, Jet, Makita, Milwaukee, Porter-Cable, Ryobi and Wap have the most flexible hoses. This is an advantage when you're moving around in tight areas. All hoses except those on the Ryobi are resistant to crushing. Hose lengths are listed in the chart.

Attachments—The Milwaukee is the only machine that doesn't come with hoses; they cost extra. Delta's vacuum doesn't come with casters and Ryobi includes only one pickup tool. The Porter-Cable comes with a hose and two end fittings. With each of the remaining vacuums, you get a set of standard accessories—straight wands, nozzles and floor sweeps. Optional and replacement accessories are also available.

Special features—A few of the vacuums deserve special mention for innovative features. The Porter-Cable and Wap have an "auto-start, delayed-stop" feature. With a portable power tool plugged into an outlet on the vacuum, the vacuum turns on when you turn on the tool. Shut the tool off and the vacuum continues to run for a few seconds to clean the hose, then it turns itself off. The Porter-Cable and Wap also feature "anti-static" hoses that are electrically grounded to the vacuum. They disperse static charges that can build up when you vacuum dry dust.

The Wap's motor has a variable speed control for optimizing the suction on portable tools. The Porter-Cable has a "filter shaker" to clean the secondary pleated filter without removing it (optional on the Wap) and a foot-operated parking brake.

If you don't have a leaf blower for your yard or sidewalk, you might consider the Dirt Devil and Hoover vacuums. Both have detachable motors that can be converted to blowers fairly easily.

Our Picks

Our Editors' Choice award goes to the Wap SQ14-AS and to the Porter-Cable 7810. With its super-efficient filter, the Wap is the "cleanest" shop vacuum you can buy. It's also the quietest. The Wap scored highest in bolt pickup and did very well in collecting mixed debris when fitted with a generic 2½-in.-dia. hose. Factor in the convenience of the auto-start, delayed-stop switch, variable speed and durable construction, and you've got a top-notch machine for around $569. On the other hand, Porter-Cable's 7810 has many of the Wap's features but costs about $250 less. Both are winners for quality and performance.

The Best Buy award goes to the Sears 17700. This unit is loud and its filter doesn't stop fine dust very well, but it has plenty of power to collect mixed debris and heavy objects. For around $100, it's a great value. ▲

WOOD FACTS

Cherry

by Paul McClure

Colonial American woodworkers called cherry "American mahogany" since it was often substituted for the popular Caribbean wood. (Most mahogany was exported to Europe at the time, making it prohibitively expensive for colonists.)

Cherry belongs to the rose family, which contains some 3,000 species worldwide. Only one domestic cherry—*Prunus serotina* or black cherry—grows large enough for commercial timber. It grows in the eastern U.S. and Canada, and parts of Mexico. In the northern end of its range cherry grows mostly as a shrub, but in moist, rich Appalachian soil it can reach heights of 100 ft. and diameters of 3 to 5 ft.

Appearance

Cherry's heartwood is a pinkish light brown, sometimes with tinges of green. Exposure to air and sunlight eventually turns the heartwood a rich reddish brown. The sapwood is not always sharply demarcated and is yellowish except in old trees, where it is often white. Sapwood doesn't darken over time, so I don't recommend using it in a project unless you want the strong contrast it provides.

Flatsawn boards generally display a very pleasing cathedral figure. Rare quilted cherry has a figure that rivals quilted maple. The medullary rays of quartersawn cherry often appear as a shimmery pattern of flecks.

Cherry has a smooth texture because of its very small pores. It is frequently streaked with gum pockets which resemble pitch pockets in pine.

Workability

Cherry works easily with both hand and power tools, but the gum in the wood causes it to burn fairly easily, especially the end grain. To minimize burning, use sharp bits and a constant feed rate. Sharp planer and jointer knives will generally produce a very smooth surface, but I recommend using an abrasive planer on highly figured and quilted cherry to prevent tearout.

Moderately dense and close-grained, cherry carves and turns excellently and holds very fine detail. It glues up well, but you'll need to prebore for screws to prevent splitting.

Cherry will readily accept stains and finishes, but most woodworkers prefer not to stain it because of the natural patina it develops over time. However, commercially manufactured cherry furniture is often stained to assure uniformity of color in matched sets of furniture and cabinets.

Uses

Cherry is used extensively for high-quality furniture, cabinetry, turning, carving, and architectural woodwork. In its veneer form, it is used for furniture and plywood manufacturing. It is also used for woodenware, brush backs, caskets and gunstocks. ▲

CHERRY

Species and Common Names		*Prunus serotina—black cherry, rum cherry, whiskey cherry, wild cherry*
Growing Region		*Eastern U.S. and Canada; parts of Mexico*
Specific Gravity		*0.58*
Density		*36 lbs. per cubic ft.*
Wood Movement[1]		*Small (less than 3/16 in. per ft.)*
Durability		*Moderately resistant to fungal and insect attack, but not suitable for outdoor use*
Sustainability		*Sustainable at current harvest levels*
Availability		*Hardwood lumber dealers and some home centers*
Size:	Thicknesses	*4/4 through 16/4*
	Widths	*5 to 10 in.*
	Lengths	*8 to 12 ft.*
Cost:	Lumber	*$3.15 to $8 per bd. ft. depending on thickness*
	Veneer	*95 cents per sq. ft.*

QUARTERSAWN CHERRY

FLATSAWN CHERRY

JUST FINISHING

BLEACHING WOOD

Three Ways to Lighten Up

by Michael Dresdner

I like to think of bleaching as the opposite of staining. Stain adds color to wood; bleach subtracts it. Bleach can be used to lighten wood's natural color or to remove stains that were added to it, whether intentionally or accidentally.

There are three common types of bleach, and each is best for a particular job. **Oxalic acid** is the mildest of the three. It's often sold as a deck brightener, to remove the gray color from weathered wood. But refinishers find it particularly useful for removing the dark stains that occur where wood comes in contact with iron. **Chlorine bleach** won't lighten wood, but it will remove aniline dye stains. **Two-part bleach, or "A/B" bleach,** is the strongest of the three types. This mixture not only decolorizes many pigmented stains—it actually removes color from the wood itself.

Two-part bleach *actually removes wood color. The lower right section of this mahogany sample shows the additional whitening effect of a second coat of bleach.*

Caution: All bleaches are hazardous. Always use goggles for eye protection when bleaching. Wear gloves and an apron to protect your hands and clothing. I buy long neoprene gloves and turn the cuffs back so that if I lift my hands up, the bleach will run into the cuffs instead of onto my arms.

Preparing to Bleach

Before you apply bleach, make sure the wood is clean and free of any finish, wax or oil. Bleach can't work unless it can get to the wood, and even a thin finish will block it. If you aren't certain that all residues are gone, play it safe by sanding the surface before you bleach.

Also be sure to remove anything containing iron, such as hardware and fasteners. Since bleaches contain water, they will actually cause stains instead of removing them if iron is present. Even tiny particles of steel wool, left after scrubbing off an old finish, will leave a gray haze or tiny black dots in the wood's pores after contact with water or bleach, especially oxalic acid. Scrub the surface of the wood with a stiff-bristle brush to remove these fragments.

To apply any bleach, use synthetic sponges or brushes that have nylon or polyester bristles. Bleaches will often eat through cotton cloth and natural-bristle brushes, but synthetic-bristle brushes sold for use with latex or acrylic paints are generally safe to use.

Oxalic Acid

Although it will not remove dyes or pigment stains, oxalic acid is ideal for removing the blue-black stains that occur when high-tannin woods such as oak come in contact with iron. It will remove these iron stains without changing the original color of the wood.

Oxalic acid is sold in hardware and paint stores as a white, crystalline powder. To mix it into a bleach, dissolve 2 ounces of powder in 1 quart of warm water. The powder dissolves immediately with very little stirring.

Caution: Wear a dust mask when mixing oxalic acid. The powder is both toxic and irritating to mucous membranes.

Chlorine bleaches *like laundry bleach and swimming-pool shock treatments remove aniline dyes without affecting the color of the wood itself.*

Oxalic acid *is your best bet for removing iron stains that affect high-tannin woods such as white oak.*

To use oxalic acid bleach, flood the surface with the warm bleach solution and let it dry overnight. Wash off the crystalline residue the next day with plenty of clean water. One application is generally enough to remove all the stain, but if it isn't, simply repeat the process after the wood is dry.

Chlorine Bleach

Chlorine bleach doesn't have much effect on pigmented stains, but it will decolorize aniline dyes without changing the color of the wood itself. Liquid household laundry bleach such as Clorox or Purex will work, but for a stronger mixture, buy liquid or granular "shock treatment" for swimming pools. All of these contain the same bleaching agent (sodium or calcium hypochlorite), but the shock treatments are more than twice as concentrated as regular laundry bleach. Whichever form you use, make sure that it's fresh. Chlorine bleaches weaken quickly on exposure to air once the container has been opened.

Caution: Wear a vapor mask when using chlorine bleach.

To use chlorine bleach, flood the full-strength bleach onto the wood, let it dry overnight, then wash the surface with clean water. You may need several applications to remove all the dye, especially if you're using laundry bleach.

Two-Part Bleach

Two-part bleach, or "A/B" bleach, is available in most paint stores. It consists of two strong chemicals (sodium hydroxide and hydrogen peroxide) packaged in two separate bottles. It is a true wood bleach: It will actually lighten the natural color of raw wood. It will also decolorize some pigment and dye stains.

The bleaching action occurs when the two chemicals come in contact with the wood and each other simultaneously. Because they are so reactive, these components have a short shelf life and will get weaker over time, especially after they have been opened. For the strongest bleaching action, always use fresh bleach.

Caution: Be especially careful when you're handling A/B bleach. Both components will burn skin on contact.

To use A/B bleach, follow the instructions on the package. With some brands you mix the chemicals together before application; with others you apply Part A to the wood and follow up immediately with Part B. For very white effects, you may need several applications of bleach, allowing the wood to dry between coats.

Some finishers insist that this bleach works better when it's applied in bright sunlight, although I've never tried it myself. I sometimes kick it into high gear by adding a wash of chlorine bleach to the surface before Parts A and B have dried. Once you are satisfied with the color, wash the wood with lots of clean water to neutralize and remove any remaining bleach. ▲

Flexible Flush-Cutter

Veritas' Flush-Cutting Saw is great for cutting plugs or dowels flush. The saw's flexible blade makes it easy to get a flush cut, even in cramped quarters. The teeth are set to one side only so they won't

scratch the workpiece when trimming a peg or other projecting piece. The saw's Japanese-style tooth pattern cuts aggressively on the pull stroke, and the fine, 22-tpi pitch leaves an easy-to-sand surface. (Price: $14.95) *Veritas, Dept. AWT, 12 E. River St., Ogdensburg, NY 13669, (800) 667-2986.* **Circle #617**

Marvelous Mallets

Michelangelo's Mallets are made with bronze heads that give these tools an elegant appearance as well as an effective heft. They work very well with carving and cabinetmaking chisels. Designed by a professional woodcarver, these mallets are more compact than most wooden mallets, but the heavy bronze head provides surprising force. The well-balanced tool does a lot of work for its size, and the contoured maple handle is comfortable to grip. Michelangelo's Mallets are available in two sizes: a 7 3/4-in. handle with 1 1/2-lb. head, or 8 1/2-in. handle with 2-lb. head. Walnut handles are available at extra cost. (Price: 1 1/2 lbs., $40; 2 lbs., $50) *Calvo Studio, Dept. AWT, Box 4, Gloucester, MA 01930, (508) 281-3227.* **Circle #618**

SHOP TESTED

MULTICO PM20 MORTISER

Until the first affordable hollow-chisel mortiser reached the U.S. market five years ago, dedicated mortising machines were a luxury reserved for large pro shops. Multico's newest mortiser, model PM20, offers significant improvements over their original machine: more power, greater capacity, improved stock clamping and dual-axis head positioning.

Like other small mortising machines, the PM20 mounts on a bench (or an optional steel stand) and its head moves vertically to plunge a square-edged, hollow-chisel bit into the stock. But the PM20's dual-axis head allows you to position the chisel in two directions: along the width of the workpiece as well as along its length. A convenient screw-clamp fixes the workpiece securely on an integral support table.

To cut a mortise, you alternately plunge the chisel and move the head with a pair of levels (see photo) until all the waste is out. Once you get used to the process, it's easy, foolproof, and much faster than on other benchtop hollow-chisel mortisers.

The dual-axis adjustment is great for cutting wide mortises and for workpieces that are hard to reposition. Even with a narrow chisel, you can cut a wide mortise by moving the head forward and plunging a row of holes overlapping the first mortise.

The head travels vertically and across the width of the workpiece on dovetail ways; these provide smooth action and are adjustable for wear. Left-to-right travel is on two steel bars with adjustable stops. A geared-down rack-and-pinion plunge mechanism lets you

A handle on mortises. *With the Multico PM20, you clamp the work, then alternately plunge the chisel and move the "dual-axis" head to cut a mortise.*

exert more downward force than you can with a drill press. A gas-filled cylinder counterbalances the weight of the head for an easier return stroke.

The work support table accepts stock up to 9 in. wide and 8 in. thick—plenty of capacity for furniture or cabinetmaking. The table has three different height adjustments to accommodate various stock thicknesses within the head's 4 11/16-in. vertical stroke. The table is also removable, so you can clamp the machine directly to a larger workpiece. But at 114 lbs., this isn't a portable tool.

Setup was quick and easy. Our only problem was with the work support table, which was awkward to adjust because of its weight. The 3/4-HP motor has plenty of power to cut 1/2-in. mortises in hard maple without bogging down.

The PM20 isn't cheap. At $995, it costs two to four times as much as fixed-bed benchtop mortisers. But if you use a mortiser often, especially for repetitive mortising, we think you'll find that the added accuracy and convenience is worth the extra cost. *Garrett Wade, Dept. AWT, 161 Ave. of the Americas, New York, NY 10013, (800) 221-2942.* **Circle #619**

—Phil Gehret and Fred Matlack
AW Design Shop

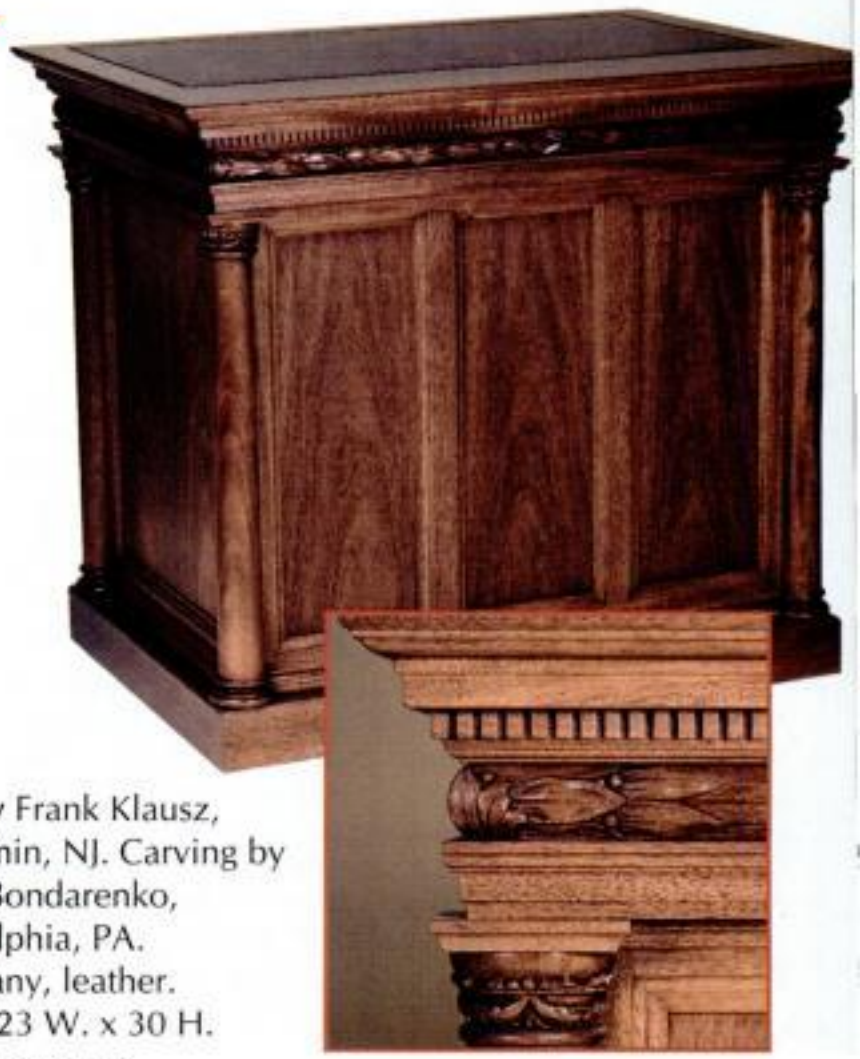
GALLERY

Carving a Niche

When a woodworker takes chisel to wood to embellish a piece of furniture, the results can be subtle and traditional or unexpected and dramatic. With these distinctive sculptural signatures, carvers broaden and inspire a tradition that dates back to the earliest woodworkers. Here's a selection of pieces that suggest the creativity and variety that continues to grow among carvers.

▲ Table by Else Bigton, Barronett, WI.
Butternut.
30 Sq. x 22 H.

PHOTO BY ROBERT MISCHKA

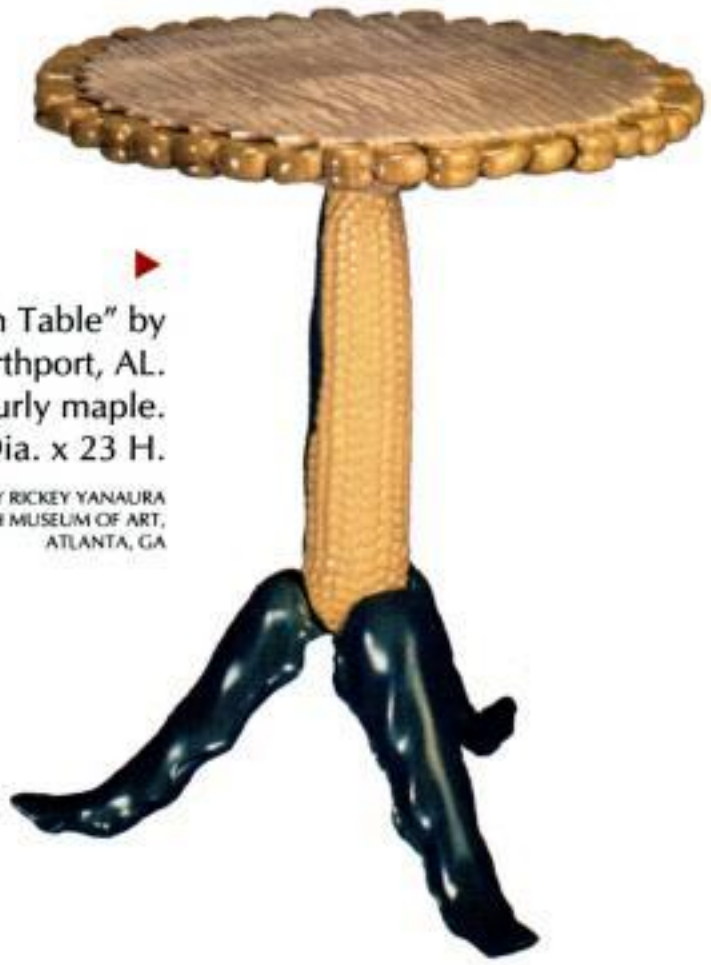


▶ Desk by Frank Klausz, Pluckemin, NJ. Carving by Victor Bondarenko, Philadelphia, PA.
Mahogany, leather.
36 L. x 23 W. x 30 H.

PHOTOS BY FRANK KLAUSZ

▼ Lady's writing desk by Paul O. Lee, Minneapolis, MN.
Mahogany, ash.
38 L. x 19 W. x 46 H.

PHOTO BY MIKE KEEFE



▶ "Corn Table" by Craig Nutt, Northport, AL.
Maple, curly maple.
18 Dia. x 23 H.

PHOTO BY RICKEY YANAURA
COLLECTION OF HIGH MUSEUM OF ART, ATLANTA, GA

◀ "Oceania Bench" by David Cramer, West Redding, CT.
Mahogany, basswood.
51 L. x 24 W. x 48 H.

PHOTO BY KEVIN MCDONALD

▲ "Dragonfly Chest"
by Judy Kensley McKie,
Pritam & Eames Gallery,
East Hampton, NY.
Limewood.
48 W. x 20 D. x 60 H.

PHOTO BY DAVID CARAS

▼ "Ribbed Chest"
by Paula Cooperrider, Scottsdale, AZ.
Mahogany.
42 W. x 18 D. x 22 H.

PHOTOS BY RUSS GOOD

▶ Chest of drawers
by Roberto Lavadie,
Taos, NM.
Sugar pine.
63 W. x 22 D. x 34 H.

PHOTO BY MARTIN LAVADIE

Want to see your work in "Gallery"? Send color slides or color transparencies to: "Gallery," AMERICAN WOODWORKER, 33 E. Minor St., Emmaus, PA 18098. Please include materials, dimensions, name of photographer, your name, address, and phone number. We'll pay you $35 per entry published. If you want your photos returned, enclose a self-addressed stamped envelope.

SHOP SOLUTIONS

Hands-Free Tenoning Jig

Cut Tenons Safely on the Tablesaw With Micrometer-Like Precision

by Joe Wajszczuk

Cutting tenon cheeks on a tablesaw without a tenoning jig is dangerous. This inexpensive shop-made jig, which runs in your saw's miter slot, can safely handle stock up to 4 in. thick and 6 in. wide. A clever stop-arm mechanism allows you to cut tenons of a precise thickness repeatedly, while a notched acrylic plate indicates the exact position of the saw kerf on a short measuring tape attached to the base. To zero the indicator plate, slide the fence until it touches your blade, then screw on the plate with the left side of the notch resting on zero.

To use the tenoning jig, screw a piece of scrapwood against the stop block to prevent tearout, then clamp your workpiece to the fence with the hold-down clamp. Set the blade height and location, and push the jig and workpiece firmly and steadily past the blade. ▲

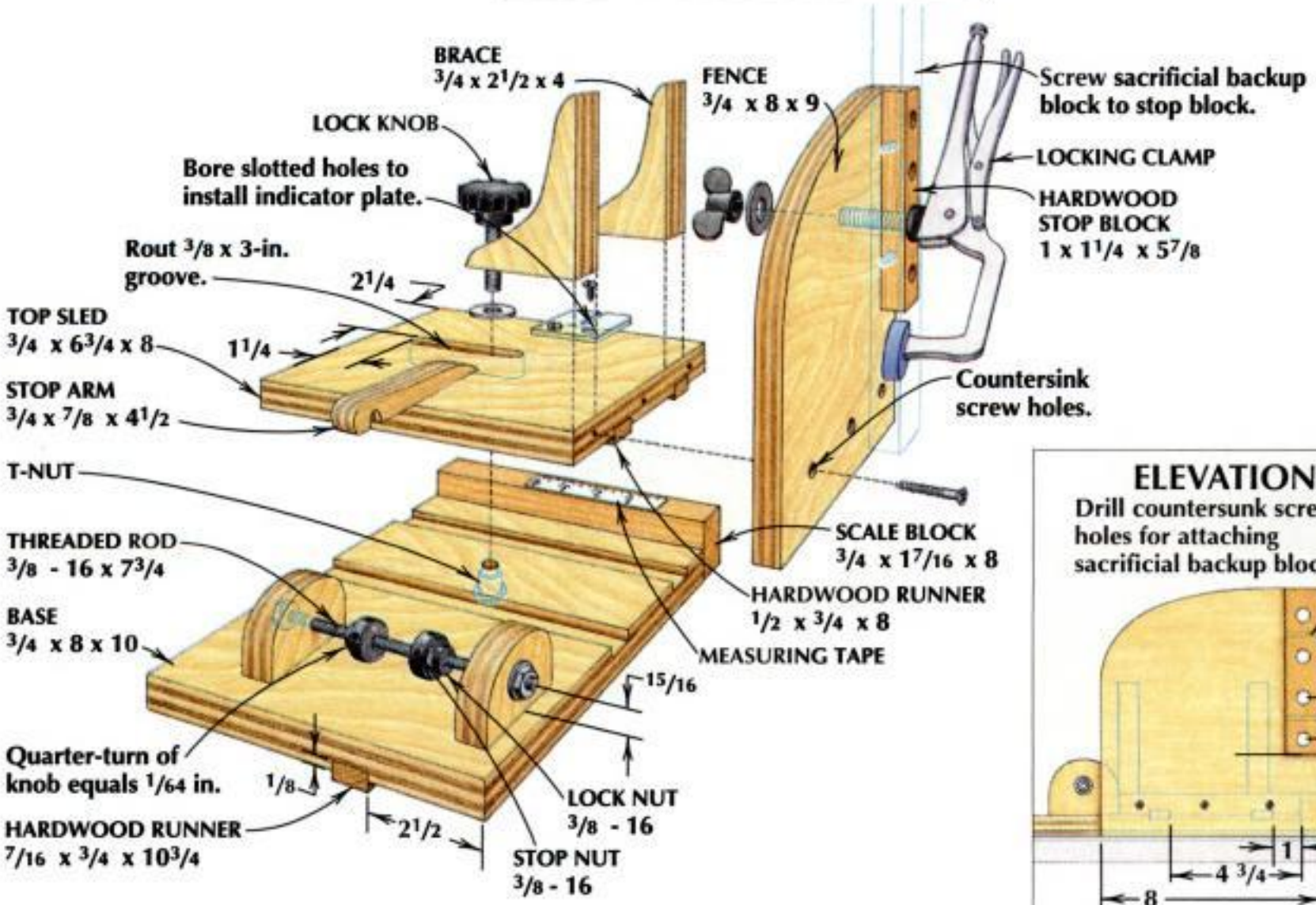
JOE WAJSZCZUK *is an assistant editor of AW.*

SOURCES

Vise-Grip clamps
are available from Woodworker's Supply,
(800) 645-9292.

Lock knobs and stop nuts
are available from Reid Tool Supply,
(800) 253-0421.

Perfect tenons. *Precise adjustment and alignment make this jig an excellent tenoning tool.*



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 CMT 13-piece router bit set, worth $275.