

RODALE'S

AMERICAN WOODWORKER

APRIL 1994 #37

**The
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Router Jig**
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Raised Panels and More!

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How To Pick The Best System
For Your Shop

**Food-Safe
Finishes**

Turn Beautiful Bowls

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RODALE'S AMERICAN WOODWORKER

Issue No. 37 March/April 1994
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 Printed on Recycled Paper



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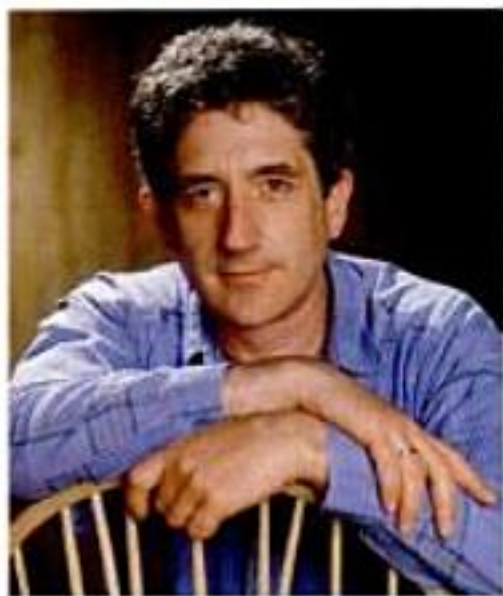
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A WORD FROM THE EDITOR

LEARNING THE ROPES

A couple of weeks ago an interviewer asked me where I learned woodworking. I'm usually quick with words, but I suddenly found myself stammering. "Well, uh... it's hard to say. Lots of places, I guess." A pretty poor answer, judging from the dissatisfied look on her



face, but it was the best response I could manage on the spot. The real story was just too complicated.

I didn't mention my father, who taught me the standards for "smooth," "straight" and "square" and let a 5-year-old play with his tools.

I didn't tell her about my grandfather George, who stood me on a chair so I could watch the hot hide glue bubbling in his old cast-iron glue pot. He made benches and trays and a special wooden wheelbarrow that I'll always remember. His tools grace my workshop today—40 years later.

I didn't bring up my Uncle Jack, a shop teacher and painter who designed and built his own houses—three at last count—plus lots of toys, gadgets and furniture. He has the eye of an artist and it shows in his work. From him I learned that a subtle change in a line or a curve can make the difference between an ordinary design and a great one.

And then there was my junior-high shop teacher. He paddled us with vigor when we misbehaved, but he spurred me on to tackle more ambitious projects than the pump lamps all the other kids were making.

And how could I tell her about Paul

Eshelman and Jake Brubaker, two master woodturners I had the privilege of knowing before they passed on.

These men, and a handful of others, didn't teach me woodworking per se. But by their example as craftsmen, they instilled in me a love for wood and

a respect for good craftsmanship.

Without their influence, I might not have become the woodworker I am today. If I'm very lucky, some future craftsman may say the same about me. What better gift could one give to the world?

New Developments at AW

There have been some new developments behind the scenes at AMERICAN WOODWORKER. I'm proud to announce that Ellis Valentine has been promoted to Executive Editor—the top editorial job on our team. Ellis is a talented woodworker and designer who's been running his own custom woodworking shop for 22 years. Ellis brings a professional's knowledge and insights to the party, and he'll be sharing this column with me in future issues. Please join me in wishing him well!

Please welcome also Kitty Mace, AMERICAN WOODWORKER's new Art Director. And finally, Michael Dresdner has joined our team of Contributing Editors. Michael's well known in the finishing field and his column, "Just Finishing," gets rave reviews from our readers.

David Sloan
Editor & Publisher

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

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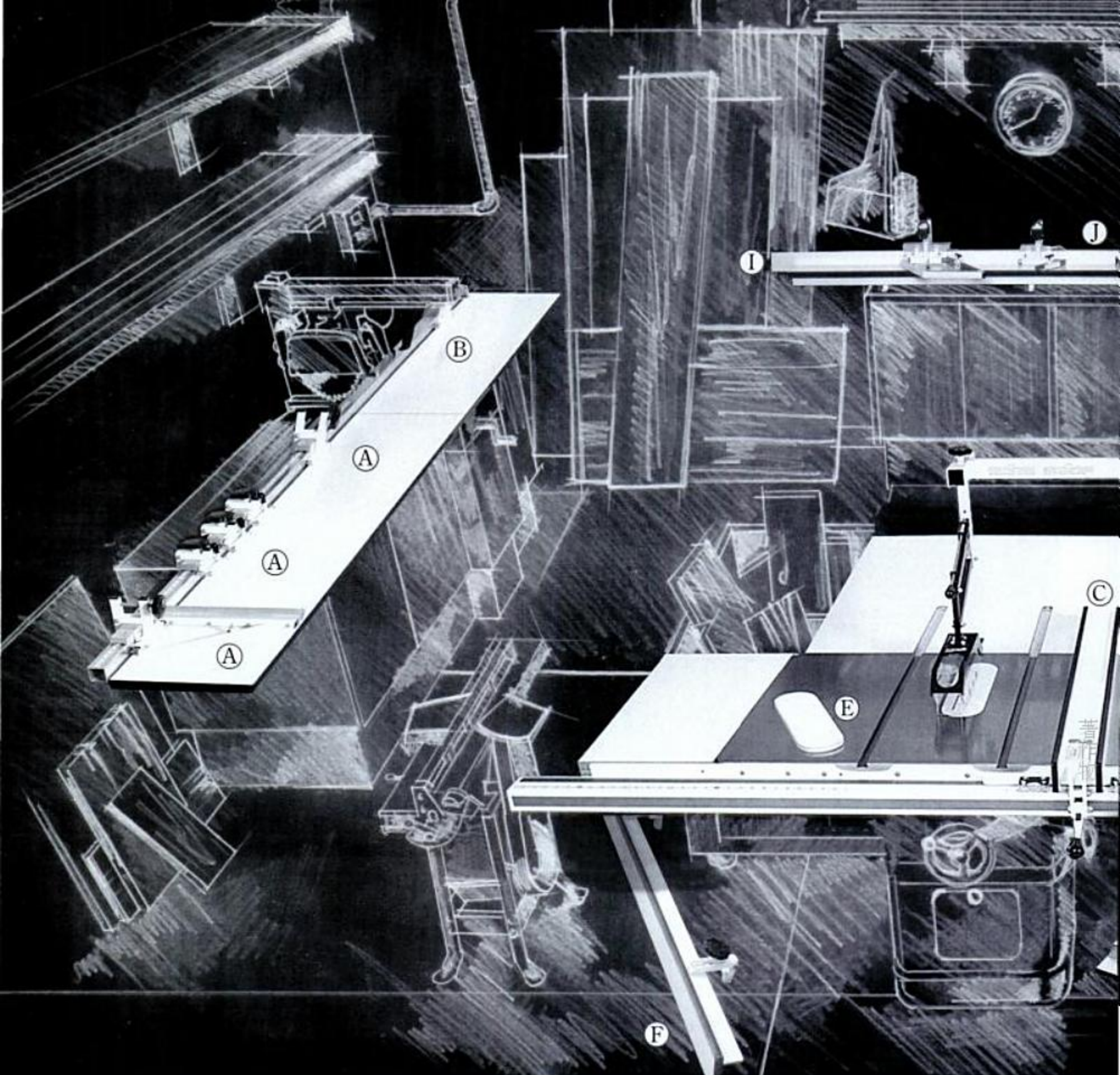
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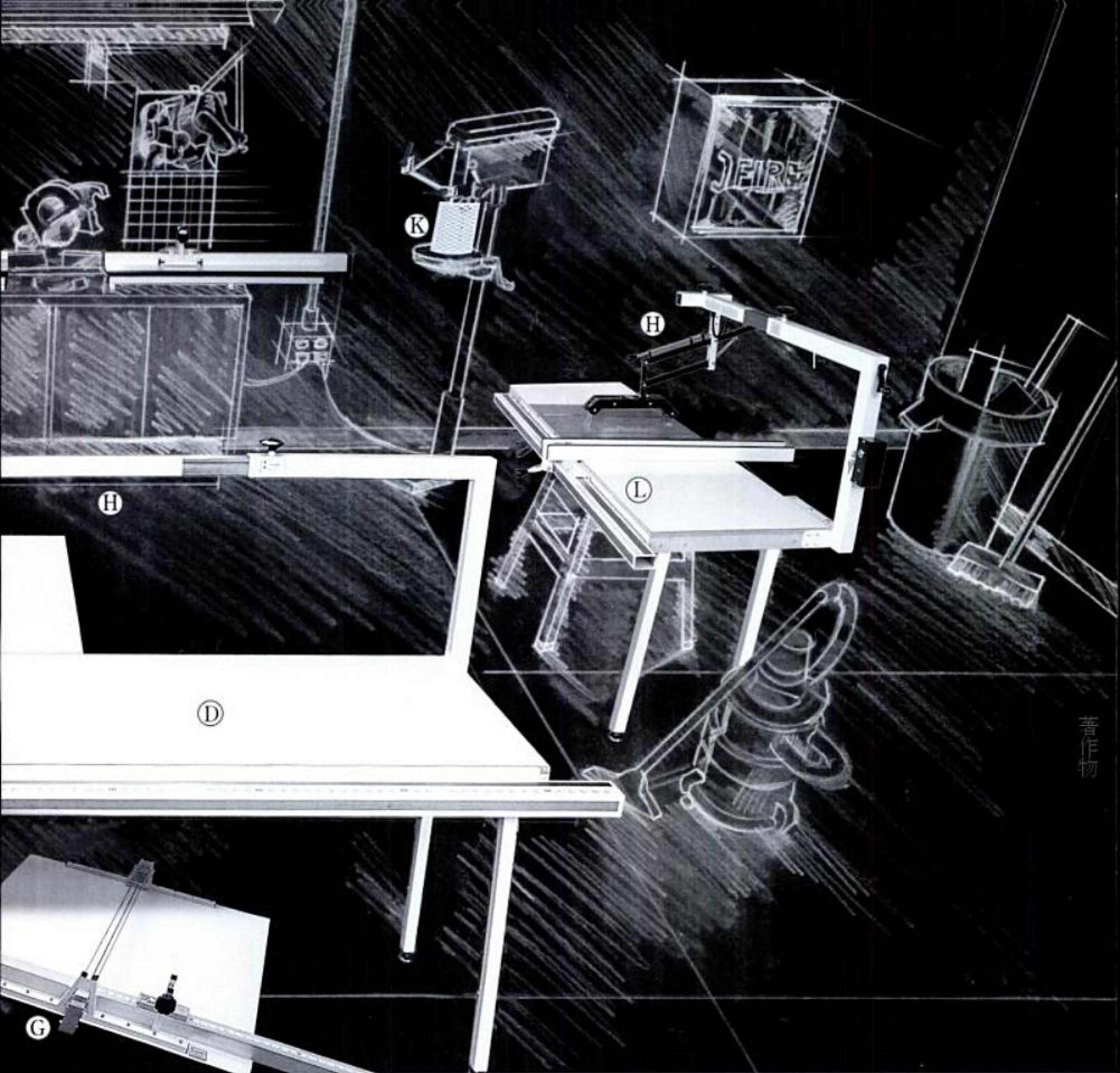
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LETTERS

A Saw Guard Is Essential

I'm reluctant to say it, but I cut my left thumb on the tablesaw recently. Like an idiot, I was tired after doing a contracting job all day and wasn't totally attentive while making multiple rips. I reached across the saw to grab an offcut and sliced and mangled the edge of my thumb.

A guard/splitter assembly probably could have prevented this accident but I removed mine from my saw when I first got it two years ago. I'm not going to use the saw again until I reinstall the guard.

For all woodworkers, the bottom line should be: use the guard/splitter assembly to safeguard you from your own stupidity. Don't get hurt like I did.

Matt Prusik

Morgan, NY

Thanks, Matt, for sharing your story and your good advice.

Test Those Batteries

Re: "Buyer's Guide to Cordless Drills" (AW #35). According to Porter-Cable, if cordless drills see heavy service it is good practice to use a voltage/ohm meter about twice a month to measure available voltage on the battery after a full charge. Should the voltage output fall below the rated capacity (i.e. 11 volts for a 12-volt battery) that likely means one or more cells have gone bad.

The battery may be usable for some time but the charge will not last as long, there will be more strain on the drill, and the possibility exists that you might damage the charger.

A. Craig Evans
Bethlehem, PA

The disposal of cordless products containing nickel cadmium or small lead acid batteries is a subject under legislative consideration in many states

Best Letter Wins a Blade

Got something to say about AW or the world of wood-working in general? Well, say it now and you just might win a prize. We're giving away one of Freud's new quiet blades to the writer who submits the most interesting letter for our next issue. To qualify to win the 10-in., 80-tooth, ATB blade, send your letter, by February 28, to "Editor," American Woodworker, 33 E. Minor St., Emmaus, PA 18098, or telephone your message to us at 610-967-7776. FAX: (610) 967-8956.

and possibly at the federal level. Ryobi cautions consumers that rechargeable batteries should have proper disposal and are not considered household garbage. Consumers should contact the recycling authority in their area for proper disposal of these types of battery products.

Wayne Hill
Ryobi American Corp.
Anderson, SC

Screwy Photo

Re: "Tool Box" (AW #36). I got a great charge out of the photo of the left-hand thread "unscrew" on page 84. I suppose that being in the eastern hemisphere, the company's screws go backwards from ours, in much the same way that whirlpools in the southern hemisphere are the reverse.

Michael Dresdner
Easton, PA

Good guess, Michael. In fact we understand these screws are popular in Washington, D.C., where there's never a shortage of people looking for a way to unscrew screw-ups.



Student Woodworkers

Hats off to AMERICAN WOODWORKER for showcasing the work of student furniture designers in your latest Excellence in Craftsmanship Contest (AW #36). Talented students like the ones you featured need that kind of exposure and encouragement if we want our craft to thrive in the 21st century. How about starting a regular feature on designs by student furniture makers?

Misha Arnett
Summer Haven, AZ

Setting Up a Shop

Can you run an article on shop set-up—location of machines and tools, pros and cons of a basement shop, power location, etc.?

Peter Marchioni
Crown Point, NY

We're glad to oblige, Peter. Look for our special seventh-issue Buyer's Guide (on the stands in October) for tips on setting up a shop and what tools to buy. In the meantime, you can check out page 53 in this issue for information on designing a dust collection system.

Tuning Planes Redux

Re: "Tuning Tips Disputed" ("Letters," AW #36). Jerry Glaser states, "any physics book will tell you that friction is independent of [contact] area." This is true, but the resistance between a plane and a freshly planed board is not caused by pure friction. Two smooth materials in intimate contact will be held together by a molecular force called *adhesion*. Adhesion is proportional to contact area, so Toshio Odate's suggestion to reduce the area when a plane contacts the wood will indeed reduce the effort required to smooth a board.

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CIRCLE NO. 53 ON PRODUCT INFORMATION FORM

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Things you asked us for:

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- Mostly 1/8" kerf 15°, ATB and 20° face hook (easyfeed).
- DOUBLE HARDER and 40% STRONGER CARBIDE.

- Ends blade changing (does rip, combo and crosscut).
- Ends scratchy saw cuts (for the rest of your life).
- Ends second step finishing (jointing or sanding).
- Ends cutting 1/16" oversize to allow for RESURFACING.
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- Side wobble held .001 - others .004/.010 is common! RAISE for THICK woods, LOWER for THIN woods and perfect cut everything! All 5/8" holes, unless otherwise noted.

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12" x 30T x 1" "	162 119	8" x 40T 3/32	136 99
10" x 40T 1/8 & 3/32	156 119	30T 3/32	115 89
30T 1/8 & 3/32	135 99	7-1/4" x 30T 3/32	112 69
		New 6" x 40T 3/32	139 89

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12" x 60T x 1" or 5/8" 1/8" K	198	139
10" x 60T x 5/8" 3/32" K	162	129
9" x 60T x 5/8" 3/32" K	156	119
8" x 60T x 5/8" 3/32" K	150	109
New 8-1/4" x 60T x 5/8" 3/32" K	150	109

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Forrest	Forrest	Y-A	U.S. Saw	Y-A
Dado Ring (Superior)	SD308 (Excellent)	20742 (Good)	800-G-RP (Fair)	20747 (Poor)

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DURALINE Hi-AT

Note: Fine Woodworking (Nov/Dec '88, No. 73, pg. 65) recommends high alternating top bevel (ATB) thin kerfs and large blade stiffeners for smoothest cuts on radial saw, etc.



Jim Forrest, president and designer microscoping cutting edge.



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7 1/4" x 60T 3/32"	\$149 \$129
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9" x 80T 1/8" & 3/32"	207 179
10" x 80T 1/8" & 3/32"	207 159
Special Sale on 10" Only \$159	
12" x 80T x 1" 1/8"	212 181
12" x 100T x 1" 1/8"	253 215
14" x 80T x 1"	232 197
14" x 100T x 1"	266 226
16" x 80T x 1"	262 223
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Delta	9" x 80T x 5/8" 204 119
Ryobi-Makita & all	10" x 80T x 5/8" 207 129
Hitachi & B&D & DeWalt	12" x 80T x 1" 229 139
Ryobi-Makita	14" x 100T x 1" 266 179
Hitachi	15" x 100T x 1" 277 189

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CIRCLE NO. 81 ON PRODUCT INFORMATION FORM

Adhesion only exists between two surfaces that are very smooth. Mr. Glaser's example of sliding a sheet of plywood over a tablesaw does not experience adhesion because the plywood is neither smooth enough nor flat enough to be in tight contact with the table.

Stan VanDruff
Dahlgren, VA

Warped Plywood

I was building a jig for my tablesaw and I needed a fairly large, flat sheet for the base. Well, I looked through about a dozen quarter-sheets of 3/4-in. plywood at my local home center, and I couldn't find a single one that was completely flat.

I'm not that old, but I can remember when you bought plywood if you wanted a flat surface. What ever happened to the days of flat plywood?

Mark Stryker
Jersey Shore, PA

Praise for Word

Your Word from the Editor (AW #35) on "Making Do" is just great. I copied it and sent to my friends. I subscribe to perhaps a dozen woodworking magazines or journals and without question this year you fine people have done the best job with the most interesting projects and articles.

Gil Mathews
Guilford, CT

Latex Paints Aren't a Hazard

Re: "Just Finishing" (AW #31). You have done an excellent job acquainting readers with the complex regulations governing the disposal of leftover paints and coatings. The only clarification we would like to make concerns the statement that "almost all finishing materials, even most water-based materials, are considered hazardous for waste disposal purposes by the EPA." In fact, the EPA does

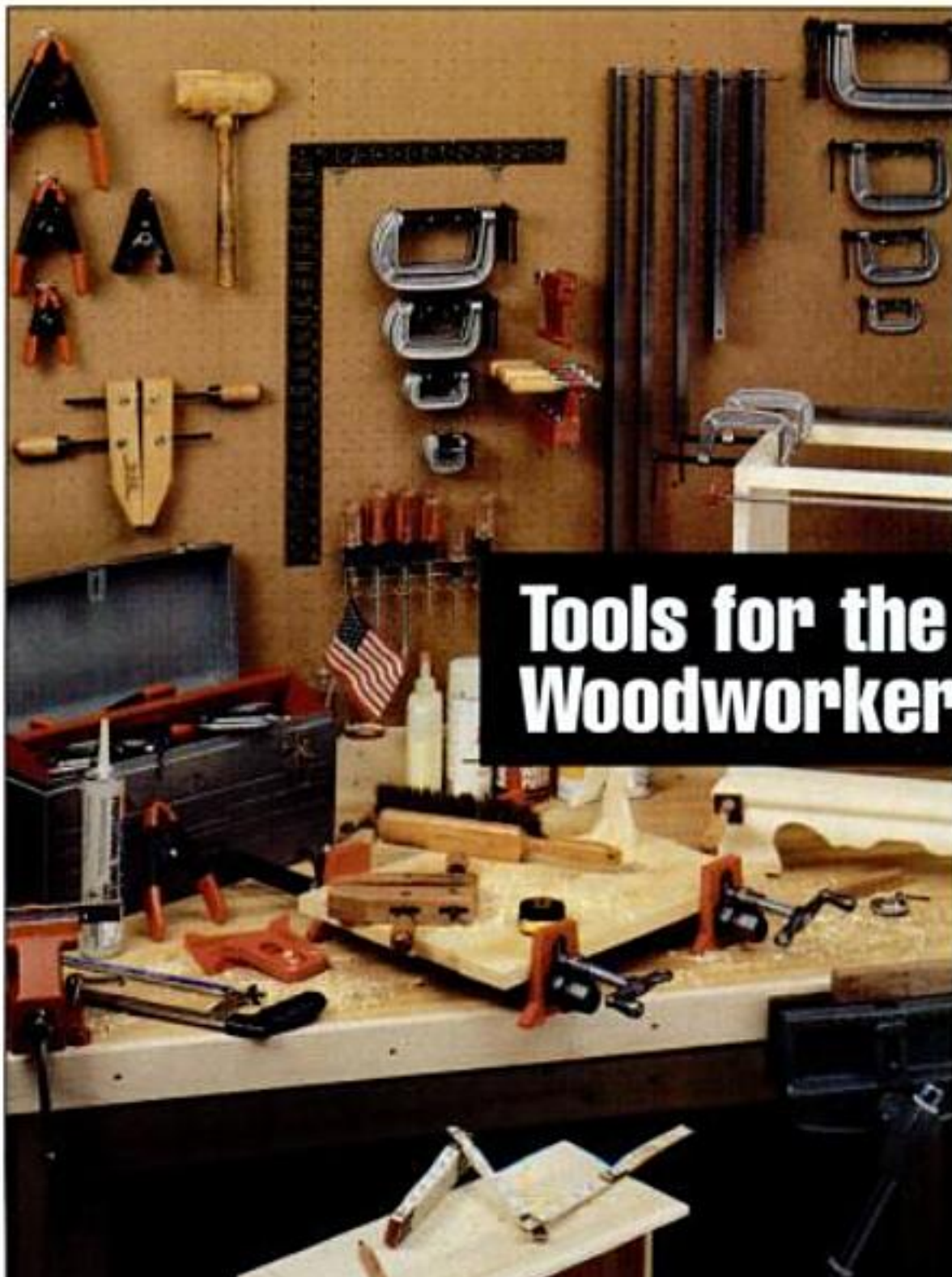
not consider water-based paints such as latex emulsion formulations to be hazardous when they are disposed of as household waste. The only exception to the federal rule would be in the case of a minority of latex paints manufactured before 1990, which contained small amounts of phenylmercuric acetate as an in-can preservative.

State regulations can differ from federal ones, but only three states—California, Washington and Minnesota—consider leftover latex paints to be household hazardous waste.

Marilyn E. Ludwig
National Paint & Coatings Assoc.
Washington, DC

How About Shop Profiles?

Periodically you show portions of shops (i.e. the cover of AW #35). It would be wonderful if we could all see the entire shop and learn from other woodworkers' layouts, tool storage,



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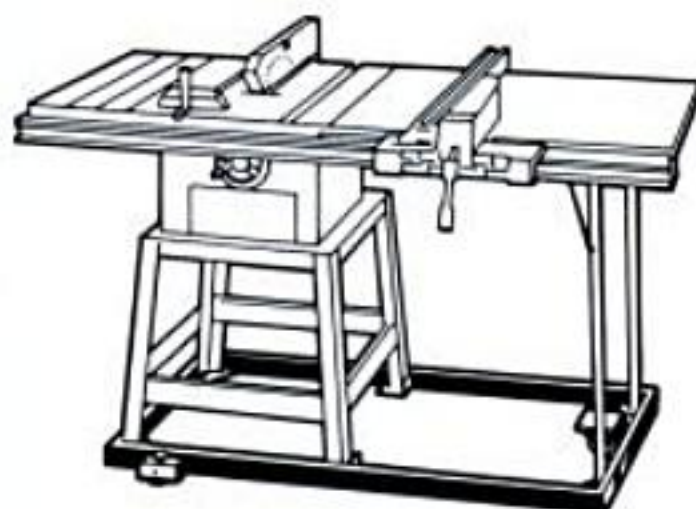
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etc. Perhaps you might consider a series of "visits to shops" with photo spreads. I think readers would learn from this kind of series as well.

Bruce Levine
New York, NY

Using Good Wood Reduces Waste

I believe using the best wood possible reduces waste. When building I look for the longest, widest, thickest boards I can find. The wood must be sound, without defects, knots or erratic grain. Then I use every part of it.

Why should I buy defective, second-rate lumber when half of it will end up in the wood stove, and the balance will be of questionable value? What a waste of a tree!

Kip E. Sorlie
Plains, Mont.

But if we use only the best trees for our projects, all we'll have left is the defective stuff, Kip. It pays to select

the most appropriate wood for each use, including firewood.

Needs Spare Parts

Do you know where I can locate spare parts for my radial arm saw? It was sold under various brand names—Shopmate, Saw Smith, Montgomery Ward, Sears and in Canada as Eaton Tecmaster Professional 2000. It is recognizable by its three spindle outputs for sawing, routing and auxiliary uses.

Phil Spero
Ventura, CA

How about it, readers? Send your letters to Phil, in care of this magazine.

Want To Save Wood? Stop Eating Burgers

The recommendation put forth by all the "save the rain forest" groups, not to use exotic woods, confuses me. Isn't it true that the majority, by far, of the deforestation is due to slash-and-burn cattle farming practices, par-

ticularly in Brazil? Wouldn't a fair (high) price on rain forest woods be more likely to promote better forestry practices than removing the value by prohibiting cutting? Since the majority of the beef is destined for the U.S., wouldn't a better recommendation be to not eat hamburgers?

Douglas Lee
Staten Island, NY

See our June issue for more on the subject of tropical timbers.

Editor Wanted

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This high-backed dining room chair represents one of Frank Lloyd Wright's first known experiments into his now famous prairie school style. Designed in 1904, it is now housed in the Memphis Brooks Museum of Art.



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WOOD WIZARDRY

That "useless" scrap of soft pine sitting in the corner of your shop may hold more potential than you think. Scientists at Princeton University's Material Institute have discovered a way to give low-grade softwoods the strength and density of oak. And if the wood industry shows an interest, these altered softwoods could be on the market within a few years.

The alchemy begins when softwoods such as cottonwood, red alder and fast-growth pine are placed in a pressurized container, then injected with a mixture of alcohol and minerals such as silica or alumina. The pressure forces the mixture into the wood cells, where it hardens, strengthening the cell structure. Scientists claim the end product is as strong as oak: It holds an edge and resists tear-out, and it takes stains and finishes just like regular hardwoods.

The next step, says researcher Daniel Dabbs, is to find a method to mass-produce structurally altered lumber. Dabbs says the federal government is supporting the research for its scientific potential, but at this point there isn't much interest from the wood industry.

SOMETHING FISHY IN SARASOTA

If you think aquatic wood carving means a bunch of guys whittling in their scuba gear, you've got another think coming. The Global Carving Challenge-Aquatic Life features some of the world's finest carvings of fresh and saltwater creatures, and if you're a carver, there's still time to enter this year's contest.

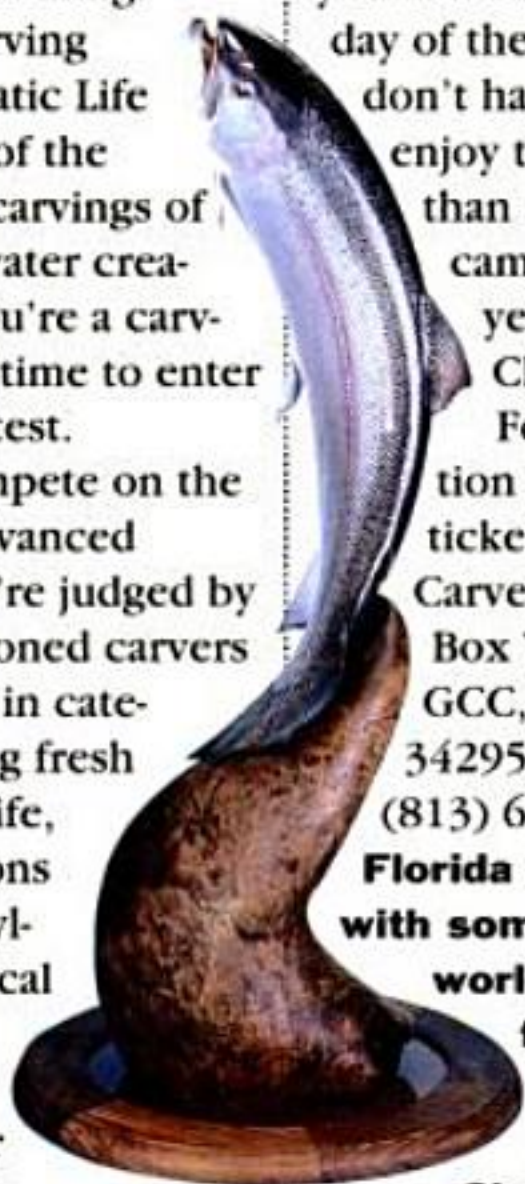
Entrants compete on the beginner or advanced level, and they're judged by a panel of seasoned carvers and naturalists in categories including fresh and saltwater life, with subdivisions for realistic, stylized and mythical carvings. Winners will receive cash or gift certificates.

The 1994 competition, sponsored by Wood Carvers Supply Inc., will take place in Sarasota,

Florida, March 25 to 27. The deadline for shipped entries is March 21, and if you carry your carvings in, you can enter up to the first day of the contest. But you don't have to enter to enjoy the show: More than 1,400 people came to see last year's Carving Challenge.

For more information on entries or tickets, write: Wood Carvers Supply Inc., Box 7500, Attention: GCC, Englewood, FL 34295-7500, or call: (813) 698-0123.

Florida will be filled with some of the world's finest finned creatures at the Global Carving Challenge this March. Shown here is one of last year's winning entries, by Mike Windauer.



WHO NEEDS HAND SKILLS?

We thought we'd seen all the latest woodworking technology—until we spotted this new CNC machine, which apparently turns raw logs into finished doors, at the LIGNA machinery fair in Germany last May. Our suspicion was aroused, though, when the shifty-eyed salesman requested cash in advance. Still, when men dare to dream, can reality be far behind?



CRAFT SHOW SEMINARS

Whether you're a newcomer or a veteran to the craft show circuit, one thing's clear: It's tough making a living out there. So The Rosen Group, which promotes craft shows nationwide, is organizing a four-day conference to help people improve their marketing and business skills.

The event will feature seminars on business computer technology, marketing, lighting and displaying works, accounting and more. It will take place September 15 to 18 at Camp Louise, a mountain retreat in Cascade, Maryland. Cost will be less than \$300, including food, lodging and a copy of the book, *Crafting a Business*. For more information, call Nancy Tabor, public relations and marketing director for The Rosen Group, at 410-889-2933, or write c/o 3000 Chestnut Ave., Suite 300, Baltimore, MD 21211.



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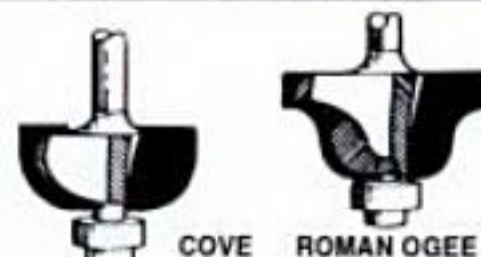
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WEIRD SCIENCE



PHOTO COURTESY OF STARK BRO'S NURSERIES

Need some straight-grained, narrow stock? Search no more! Branchless apple trees, like the one shown here, were developed in England and are now available in this country. Stark Brothers' Nurseries is selling five varieties stateside. The trees grow 7 to 10 ft. tall and can be planted just 2 ft. apart, so they don't take up much space—in fact, they're compact enough to grow on your deck, patio or any other sunny spot. One other benefit: until you're ready to cut them down, you'll have fresh fruit every September.

For more information on branchless apple trees, write: Stark Bro's Nurseries and Orchards Co., Box 10, Louisiana, MO 63353, or call (314) 754-5511.

GREETING CARDS FOR WOODWORKERS



These days there are greeting cards for everyone from the bereaved pet owner to the jubilant divorcee. But a card for woodworkers? Randy McDermid, a writer and designer from British Columbia, is convinced there's money in wood-working project cards, so he's producing them.

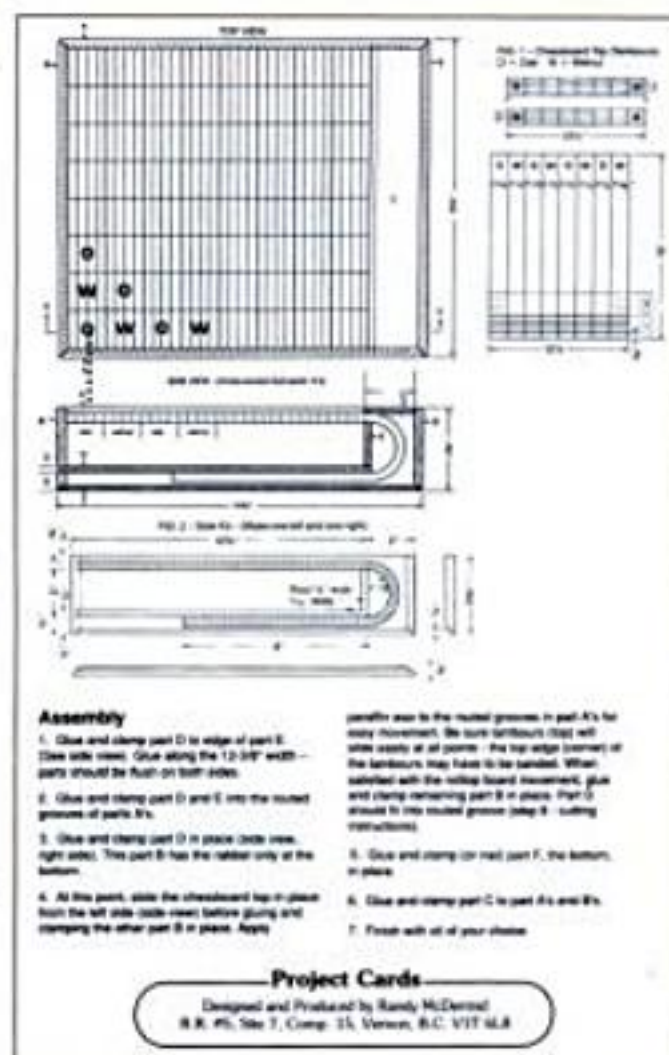
Each black-and-white card has a photo of a wood-working project on the cover, while inside there's a dimensioned drawing, rudimentary construction information, and (of

course) space for a personal message. Designs include a turned vase, a decorative screen and a chess board (see photo), and McDermid also has plans in the works for a baby's cradle. So far, the cards are available in Canada through Lee Valley Tools Ltd., and House

of Tools. Woodworker's Supply Inc. carries them in the States.

Will McDermid find gold in them thar cards? That might be asking a lot, but remember, it wasn't long ago that someone made a million bucks marketing the Pet Rock.

—Offcuts contributors:
Susannah Hogendorn,
Kevin Ireland and
Ellis Walentine



"TURNING" TEENS ON TO WOODWORKING

Albert LeCoff, director of The Wood Turning Center in Philadelphia, is starting a pilot program to introduce young people, their shop teachers and parents to the art of woodturning.

The program, scheduled for March 5 and 6, is a two-part workshop for up to 35 teens, teachers, and parents. On the first day, participants will gather at the George School in Newtown, Pennsylvania, to learn turning techniques from instructors Allen Androkities, Dave Hardy, Kevin Kirwin, and Mark Sfirri. Then they'll reconvene the next day at Ursinus College in Collegeville, Pennsylvania, to view the International Lathe-turned Objects exhibition and attend design workshops with some of the exhibiting artists, including Ed Bosley, Michael Brolly, Michael Kehs, Laura Marth, Dennis Mueller, Lincoln Seitzman and Mark Sfirri.

LeCoff says that while the greatest response has come from the local area, people all over the country have expressed an interest in the workshops. If the pilot program is a hit, he'd like to see it go nationwide. LeCoff hopes his program will show parents, teachers and young people some of the pleasures of working by hand.

For more information or to register, contact the Wood Turning Center at (215) 844-2188. Enrollment is limited, so act now.

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What about the blades?

Crosscut - The Fabulous LU85M - Recommended by Wood Magazine. Cuts wood so smooth, you won't even think about sanding the endgrain. And there's a Teflon coating on the blade body to prevent binding. The teeth? Just what you'd expect. They're ground to an aggressive Alternate Top Bevel and then each carbide tooth is polished to a mirror finish.

Ripping - The Precise LM72M - You have to try it. This blade, like all Freud blades, is laser cut for a stiffer plate and whisper-quiet operation. The rigid blade body and razor sharp flat top carbide teeth will give you a cut with glue line accuracy - even on the thickest materials. The blade is precision balanced and features our Anti-kickback Design - the safest in the industry.

General Purpose - The Versatile LU84M - If the job calls for different cuts on a variety of materials, the Freud general purpose blade is the way to get the job done. It'll rip 4/4 oak and crosscut 3/4" plywood, no sweat. This blade is a clever balance between the large gullet and Flat Top tooth

needed for ripping, with the ATB tooth for cross-cutting. You're sure to appreciate the extra deep gullet for chip removal and our own special Anti-kickback Design that limits the tooth's bite to prevent overfeeding. It's the ideal blade for the radial arm saw because it dramatically reduces the chance of climbing.

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Foxy Joint

Q The leg on one of my Windsor kitchen chairs is loose. I tried to remove the leg to reglue the joint, but the tenon won't come out of the chair seat. There are no nails or pins securing the leg. What kind of joint did the maker use, and what should I do to tighten the leg?

*Dale Bern
Falls Run, MO*

A Since there are no visible fasteners locking the joint together, the leg probably has a "fox-wedged" or "blind-wedged" tenon. (See drawing.) In this type of joint, a wedge is inserted in a slot in the tenon before the joint is assembled. When the wedge hits the bottom of the seat mortise, it's driven into the tenon, spreading the tenon and locking the joint together. Chairmakers often undercut the seat mortises with a gouge to further strengthen the joint.

The easiest way to separate this joint is to steam it apart. To get heat and water to the joint, slip a length of rubber tubing over the spout of a teakettle and direct the steam at the loose joint. This will soften the fibers of the wood, and a sharp rap with a mallet under the seat near the leg will disengage the wedged tenon. If your chairs are old, they were probably constructed using hide glue, and the steam will soften any glue still remaining. (Even with a white or yellow glue, you'll still have luck using this method.)

To reassemble the joint, simply replace the old wedge with a thicker one and reglue.

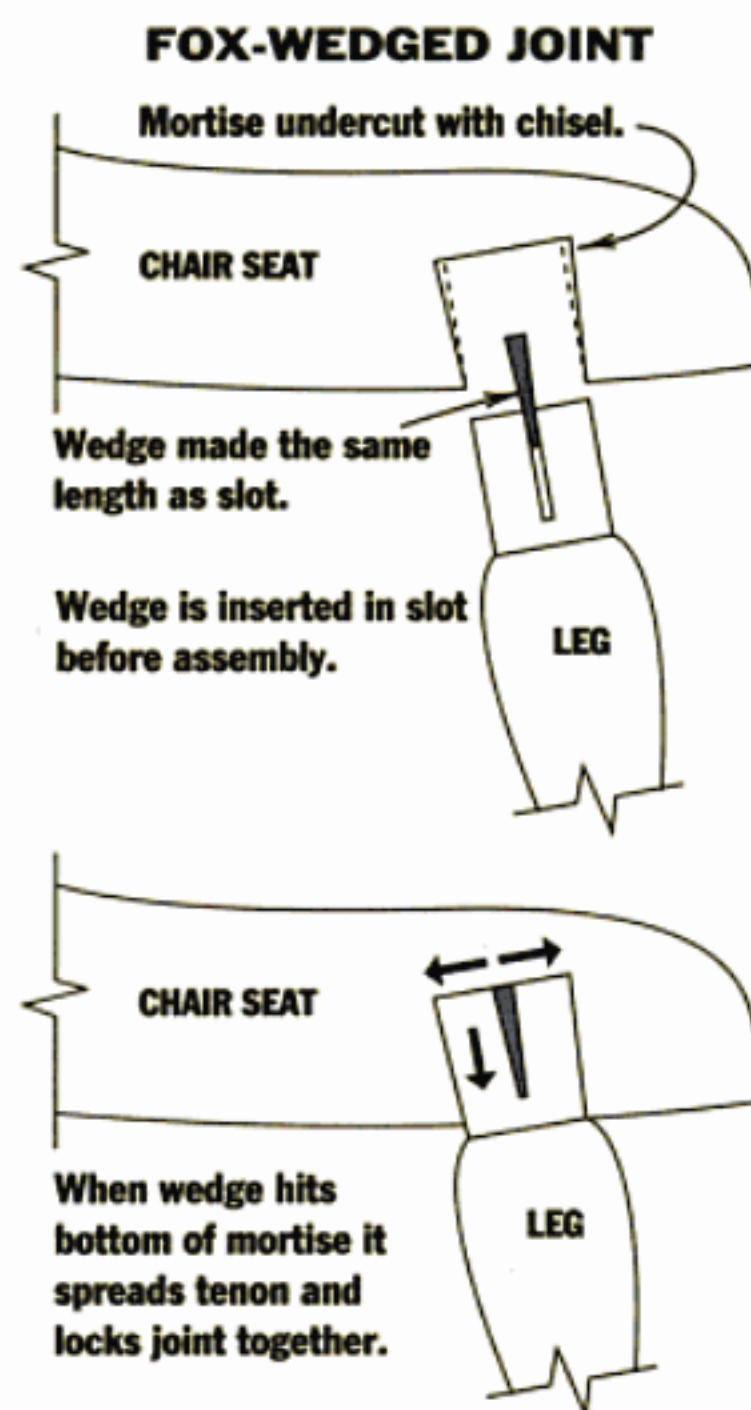
*Don Weber
Furniture restorer and bodger
Mendocino, CA*

Making Curved Aprons

Q What's the best way to make the curved apron (or skirt) on a round table?

*Lou Hall
Pleasant Plains, AK*

A How you make a curved apron will depend upon the kind of table you're constructing. If the desired curve is slight—say larger than 3 ft. in radius—you can bandsaw the curve in sections from thick blanks. This is the simplest method because any joinery can be done while the blanks are still square. However, you'll waste a fair amount of wood, and each end of the apron



will have short grain, which is weak.

Another way to get the same shallow curve is to steam the wood and bend it to shape. This will give you a strong apron because there will be long grain throughout the curve. But the effort involved with steam bending (building a steam box, using bending straps, careful wood selection) makes this most suitable for production situations. Also, steam-bent wood will spring back after it is released from the form, and it's mostly trial and error when gauging exactly how much springback will occur.

A third technique, which allows radii as small as 2 in., is laminating thin ($\frac{1}{4}$ -in. or so) strips together. This produces very strong curves with minimal springback, and less wood is wasted than with bandsawing. You can clamp the strips using a two-part form, but my favorite method is to position the stock over a single form with a $\frac{1}{8}$ -in. sheet of masonite on top to spread the clamping pressure evenly. Then I place this arrangement in a vacuum bag to clamp the work.

*John Dunnigan
Furniture maker and designer
West Kingston, RI*

Bumpy Belt Sander

Q The last time I used my stationary belt sander, it made a thumping noise as the belt contacted the wood. I ended up with a workpiece that was rounded along its front edge, and I noticed a raised area on the belt shaped like a football. I replaced the belt and the machine no longer "thumps." What went wrong with the first belt?

*Sid Popkins
Prescott, AZ*

A This is a common problem on belt sanders that aren't used regularly. The drive roller on your belt sander is slightly crowned (larger in diameter at its center) to keep the belt centered on the roller during use. The crown will deform the belt in one spot if the machine is idle for too long. The belt stretches and takes the shape of the roller, resulting in the football shape you describe.

To avoid the problem, rotate the belt occasionally so that the roller contacts different spots on the belt. If you won't be using the machine for a couple of weeks, you can simply relieve the tension on the belt or remove the belt until the next time you use the machine.

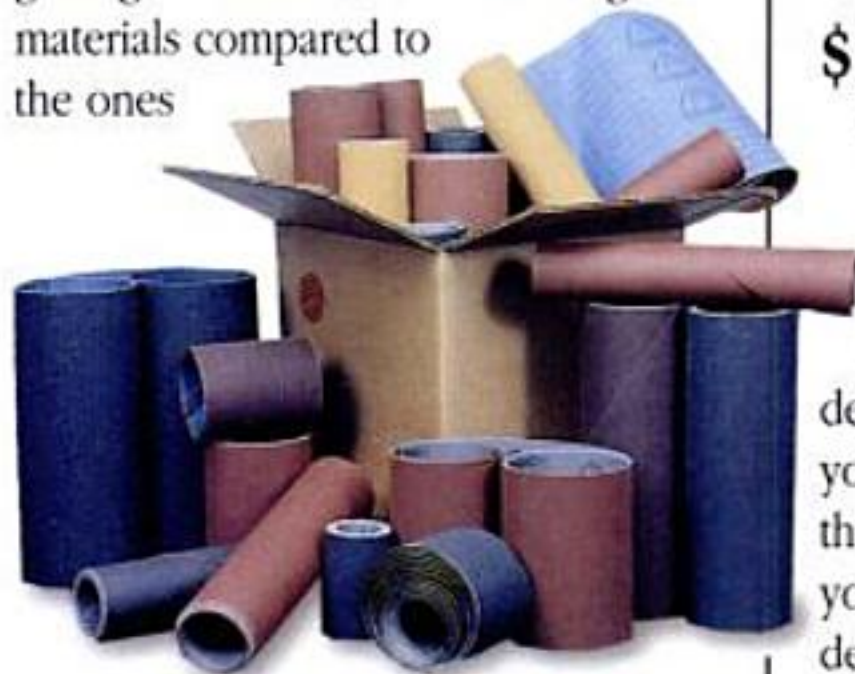
*Walt Morrison
Woodworker
Northport, NY*

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Lining a Chest With Cedar

Q I'm building a veneered chest, and I plan to line it with cedar. Is there a particular species I should use, and what kind of finish should I use to prevent aroma loss? Also, is expansion and contraction of the cedar a concern when it's laid over plywood?

*Jim Gervasi
Rapid City, SD*

A Eastern red cedar (*Juniperus virginiana*) or southern red cedar (*Juniperus silicicola*) will meet your requirement for an aromatic, bug-repelling wood. Port Orford cedar, although it's not a true cedar, will also fill the bill. Some lumber yards sell random-length bundles of 3/4-in. T&G (tongue and groove) cedar as "closet lining." Whichever cedar you choose, leave it unfinished so the aroma will be dispersed continuously into the chest.

When attaching the boards, you'll need to account for wood movement. If you do the lining during the humid summer months, lay the joints up tight. If the stock is dry and you're working during the wintertime, leave a little space in each joint for expansion—1/32 in. per 3 in. of width should do it. To avoid splitting, nip off the sharp nail tips when blind-nailing the tongues on the boards.

*Ric Hanisch
Furniture maker and designer
Quakertown, PA*

Breadboard End Joint

Q What's the reason for making "breadboard" ends? Does a cross-grain glue joint like this have any strength?

*Evan Jones
Mexico, MO*

A A breadboard end is actually a stiffener attached to the end of a solid-wood panel to keep it from warping. If the breadboard were glued across the end of the panel as you describe, the joint would eventu-

WHERE TO FIND IT

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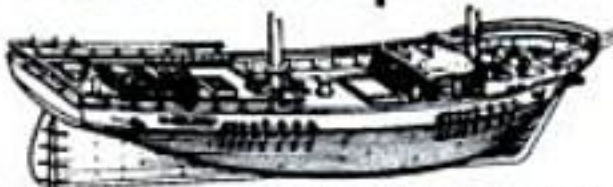
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ally break or cause the panel to split because of seasonal wood movement. However, a properly constructed breadboard joint isn't glued along its whole length, just at the center. This allows the panel to expand or contract on either side of the center.

To keep the ends of the breadboard tight to the panel, you can use any method that allows the panel to move without binding, such as pinning each end through slotted holes or using sliding dovetails. Another method is to hand-plane a slight curve on the inside edge of the breadboard. This way, when the breadboard is attached in the center it will pull the ends in tight.

John Dunnigan
Furniture maker and designer
West Kingston, RI

Shiny Filler

Q To make inconspicuous repairs, I often fill holes and loose knots with a mixture of yellow glue and

sanding dust from the project I'm working on. But glue spots appear shiny when I put a varnish coat over the work. How can I blend these spots with the rest of the wood?

Edwin Mueller
Hermann, MO

A Making a putty from glue and wood dust solves the problem of color matching, since the putty contains wood from the project you're working on. But often the mixture is denser than the wood surrounding it, so it will absorb less finish and take on a different luster. You can see the same effect when you have a very tight, dense knot in softwood, such as pine. The wood will absorb the first coat of finish and look matte, while the dense knot will often look shiny.

There are two solutions to this problem. First, you can make a putty mixture that contains a higher percentage of wood dust. One of my

favorite putty formulas is to add a few drops of 3-pound-cut shellac to wood dust until a thick paste is formed. This mixture dries quickly and is invisible under the first sealer coat, especially if you use shellac as the sealer.

Your second choice is to make the finish thicker, by applying either thicker coats or more coats. Sealing the wood with two coats of varnish, then sanding before the third coat will most likely give you a uniform sheen, even on areas that absorb differently.

Michael Dresdner
Finishing consultant
Nazareth, PA

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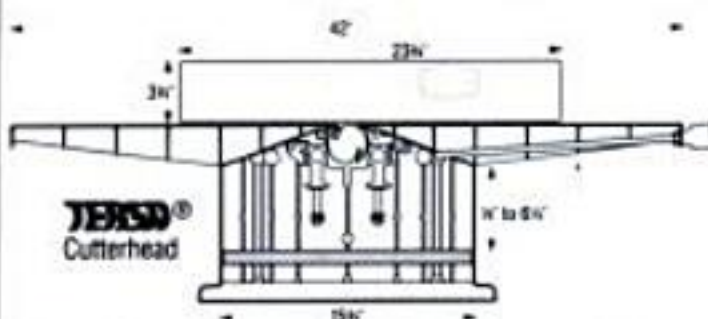
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Jim Mayfield

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Amateurs, professionals, and students* will be judged separately.

**To qualify as a student you must be enrolled in a woodworking school or furniture design school in 1994.*

TO ENTER:

Fill out the form on this page (or a photocopy) and mail it with:

1] A color photograph(s) or slide(s) of the piece(s) you want to enter (up to three pieces). Label photos and slides with your name and address.

2] A description of each piece including dimensions and materials (100 words or less).

3] Include a self-addressed, stamped envelope for return of slides. (Sorry, prints cannot be returned.)

Deadline for entries:
September 1st, 1994.
Finalists will be contacted for further information and winners will be announced in the February

1995 issue of AMERICAN WOODWORKER.

Conditions:

The deadline for entries is September 1st, 1994. AMERICAN WOODWORKER is not responsible for entries lost, delayed or damaged in the mail or elsewhere. Incomplete entries will be disqualified. Decision of the judges shall be final.

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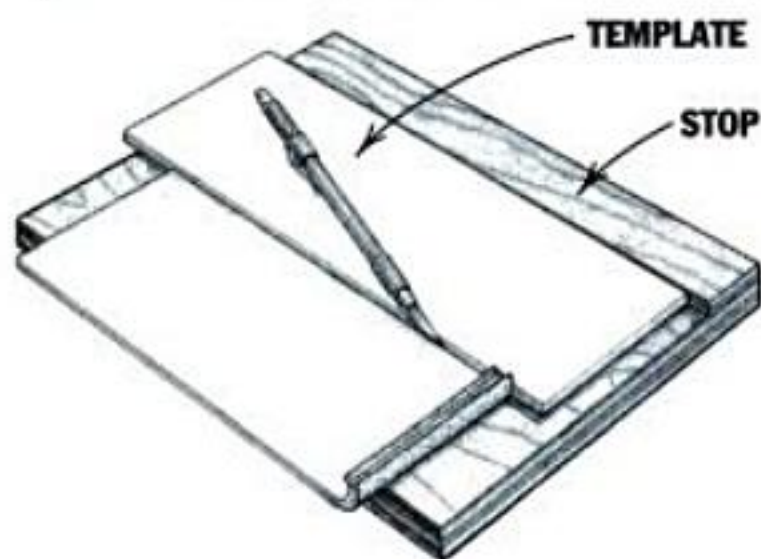
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TECH TIPS

Cutting Sandpaper to Size

I use this handy jig to cut full sheets of sandpaper in half, quarters—whatever I need. I position multiple sheets against the stop, abrasive side down,



and place a template on top that's the same size as the sheet I want. Then I cut the stack of sheets with a razor or mat knife. I used Dupont Corian for the template, but plywood, particle-board or hardboard, edged with plastic, would do the job.

*Phil Brooks
Medford, NJ*

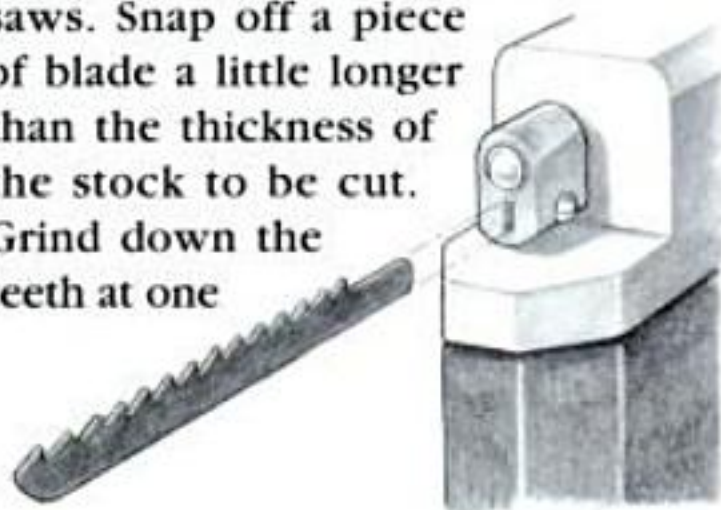
Hot-Wax Finish

When I was growing up in China, I used to make carving knives with wooden handles. I couldn't get varnish, shellac or other types of finish, so I dipped the bare wood in paraffin (candle wax) heated on the stove. The result was a very durable and waterproof finish—I still use it from time to time.

*Yeung Chan
Millbrae, CA*

Recycling Bandsaw Blades

Broken bandsaw blades, if not too dull, work very well in saber saws. Snap off a piece of blade a little longer than the thickness of the stock to be cut. Grind down the teeth at one

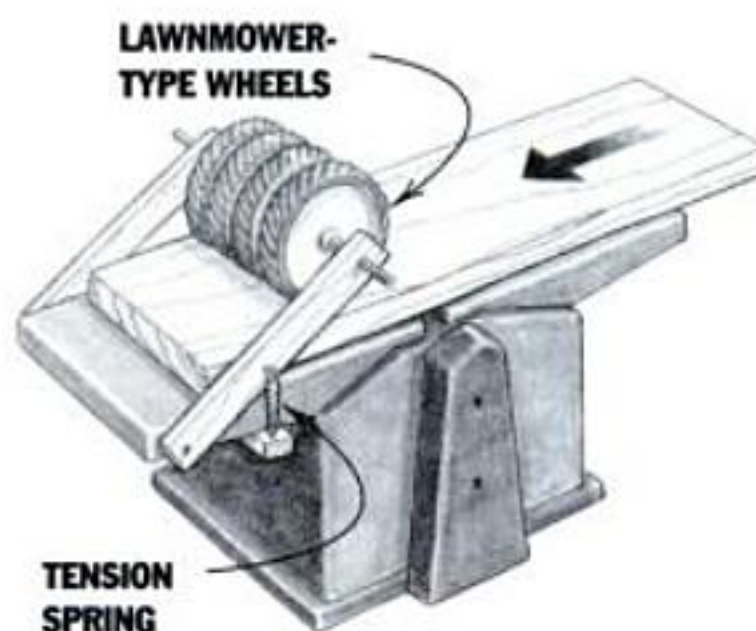


end and shape it to fit the chuck on your saber saw. Make sure the teeth are pointing up toward the chuck so the blade cuts on the pull stroke.

*Howard Moody
Upper Jay, NY*

Making the Most of Your Inca...

My Inca planer-jointer has such a short bed that I find it difficult to hold long boards flat. So I rigged a pivot and four rubber-tired wheels that ride on top of the board. Springs from an old army cot provide downward pres-



sure. An added benefit of this rig is that you can keep your hands clear of the cutter knives.

*James Watson
Atlanta, GA*

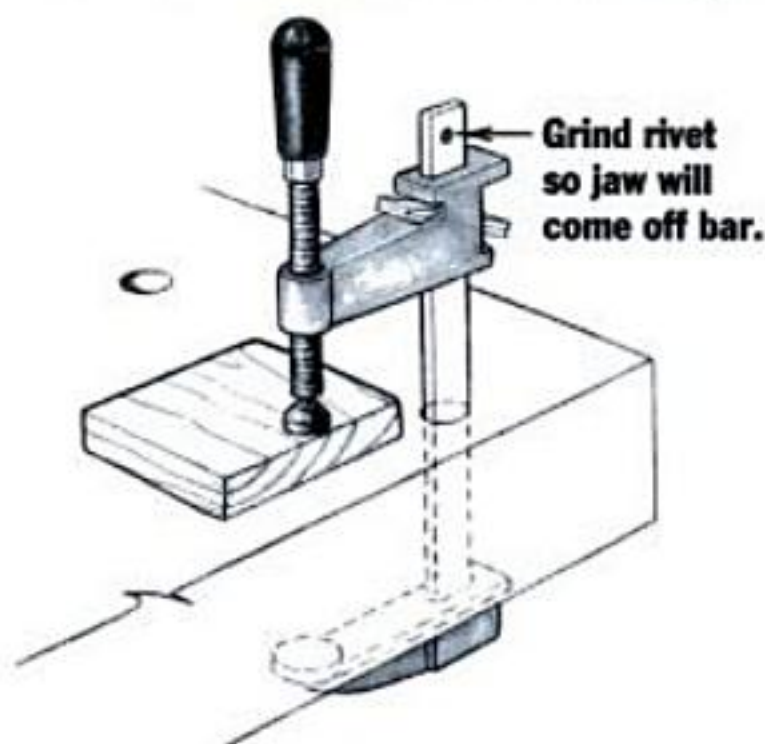
Spinning Your Wheels

When making wheels for toys, I cut the blanks with a hole saw, which leaves the outside edges rough. To sand them I choose a dowel that's slightly larger than the hole in the wheel, then chuck one end in the drill press, and taper the other end with a wood file or coarse sandpaper. Then I push a wheel up the taper until it grabs, and I sand the edge while it is spinning. The larger the wheel, the slower you should run the drill press.

*Ron Pavelka
Orange, CA*

Improvised Hold-downs

Four-in. Jorgensen bar clamps make excellent bench hold-downs. All you

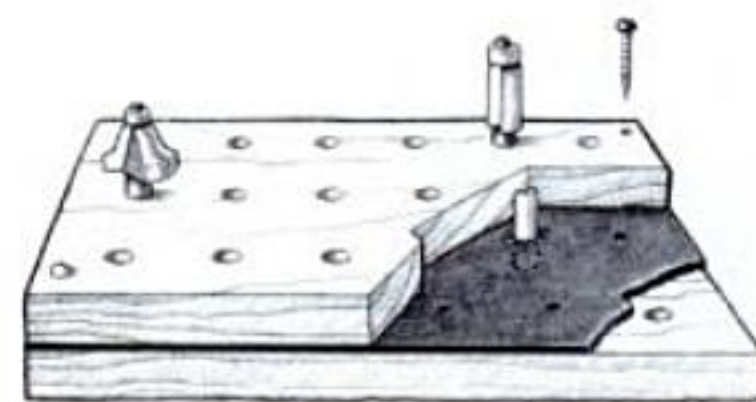


need do is grind off the rivet so the sliding jaw can be slipped off the bar. Then drill holes in the bench at convenient intervals, push the bar through one of the holes, and re-install the sliding jaw. You can put the handle above or below the bench—whichever is more convenient.

*D.E. Brumfield
Lesage, WV*

Bit Retainer

Most woodworkers have at least one solid-wood block drilled to take the shanks of router bits, plug cutters, drills etc. Sooner or later you knock the block over and the bits go flying. To prevent that, I saw the blocks in



half, make a rubber sandwich between the two wood pieces using a scrap of old inner tube, and then screw the wood pieces back together. Perforate the rubber with an awl, and the shanks are held firmly in place.

*Sheldon Pitesky
Los Angeles, CA*

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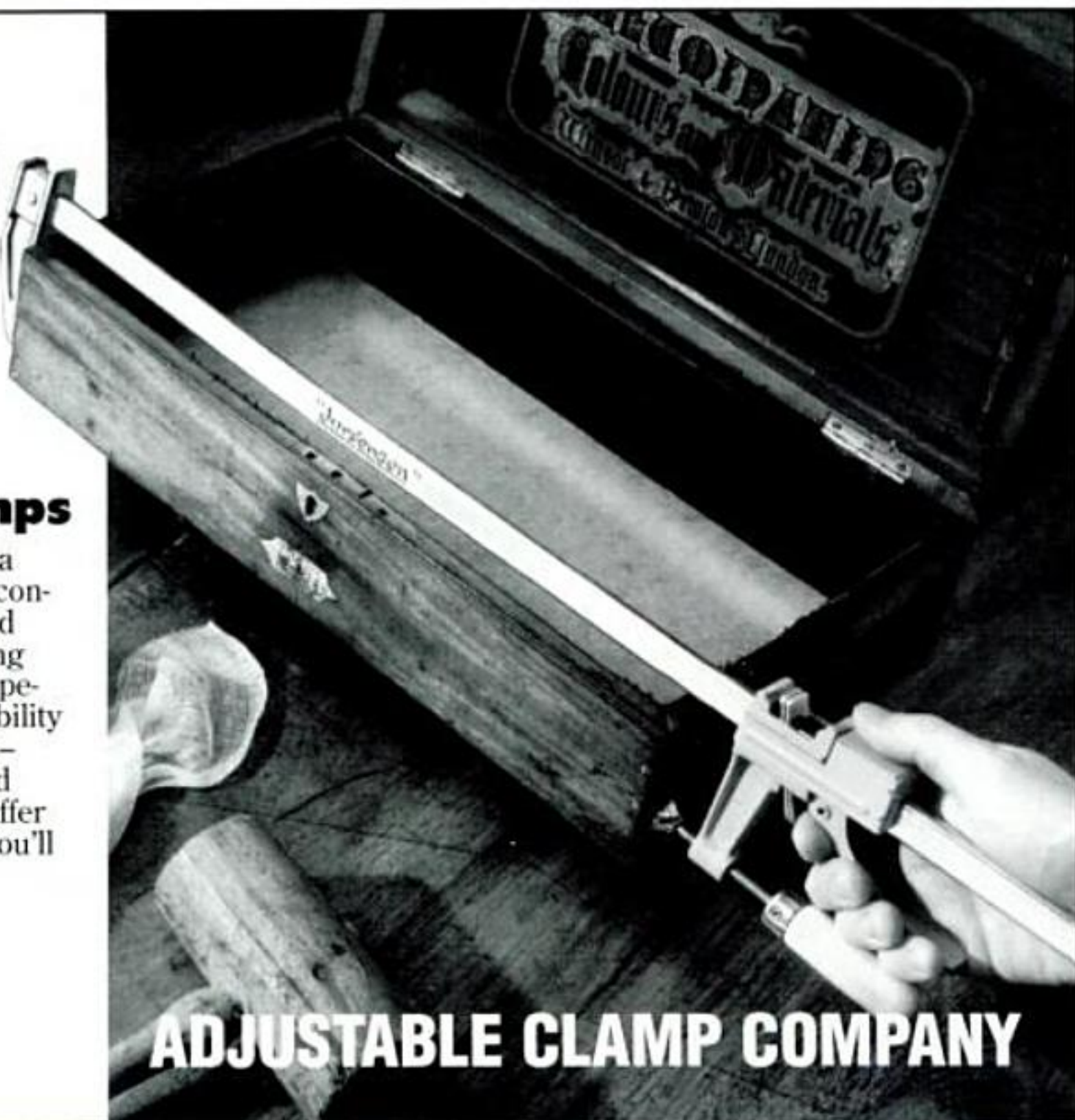
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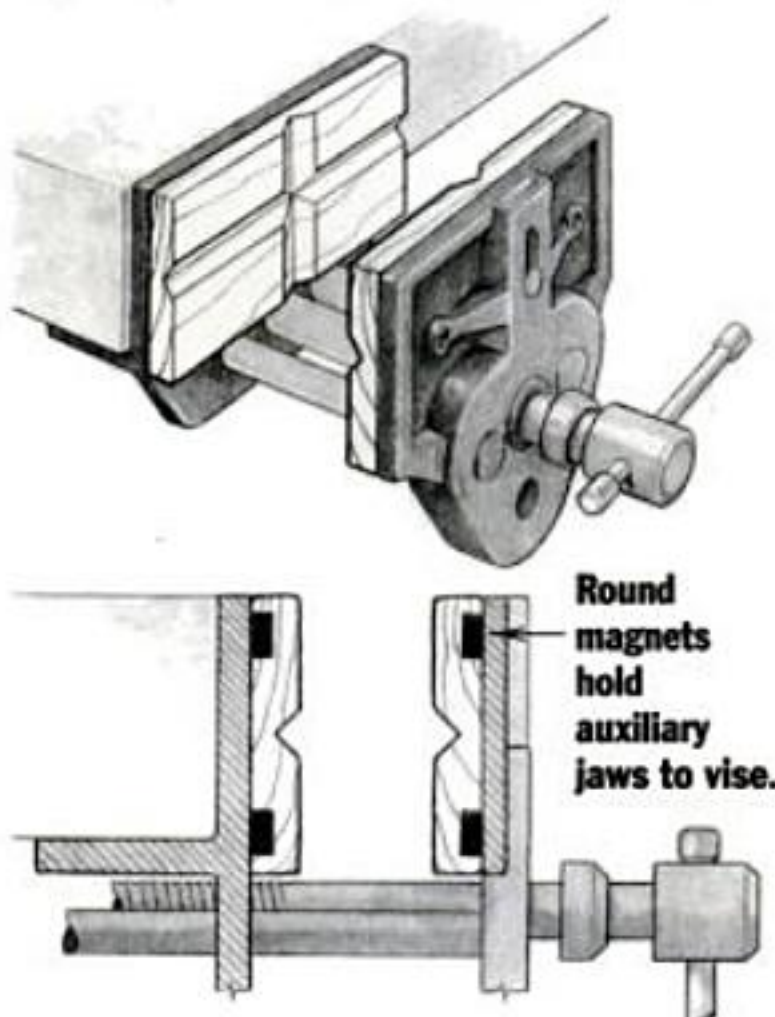


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Magnetic Vise Blocks

I devised these special jaws for holding dowels or turned work in a regular wood vise. I made the auxil-



iary jaws on the tablesaw by cutting two shallow, bisecting "V"s in two scrap blocks. Then, instead of screws I used small round magnets to attach the blocks to the vise. This way I can quickly remove the auxiliary jaws and also rotate them to any convenient angle. I have a second set, with no V's, that I use for my regular work.

*Dick Dorn
Oelwein, IA*

New Road for Old Drivers

I use lots of Sheetrock screws, which are made of hardened steel. Even quality Phillips drivers soon start to skid and I have no way to sharpen them. Instead, I regrind them to fit a particular size of slotted screw, and I



now have drivers for most of the regular sizes. All it takes is a bench grinder, a steady hand and about five minutes.

*Simon Watts
San Francisco, CA*

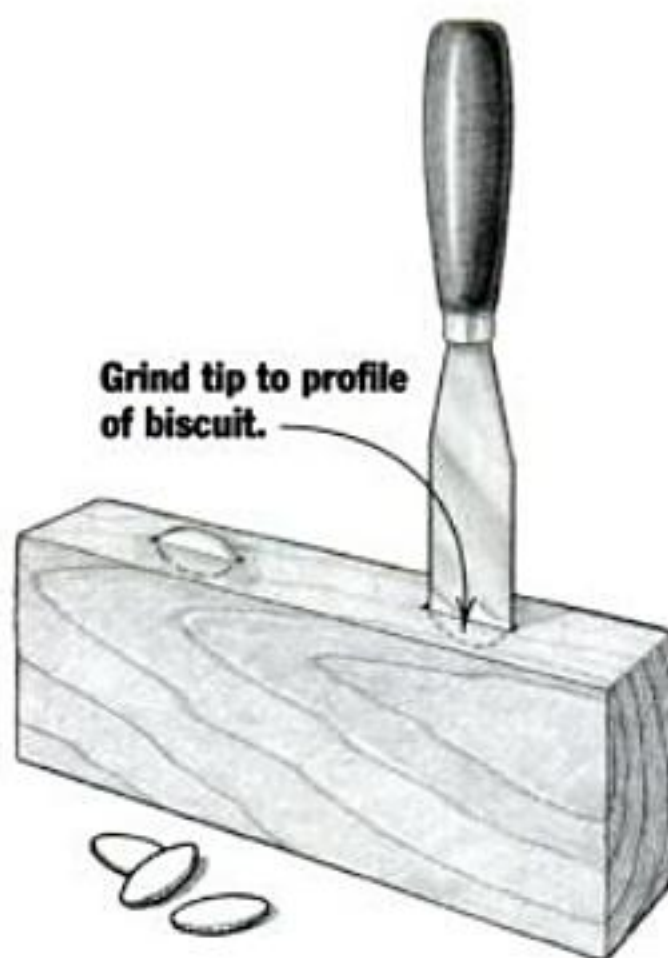
Soaking Saw Blades

I tried Bob Colpetzer's low-tech blade cleaner (AW #31) with excellent results. The only problem was finding the right size and shape of container for the 10-in. circular saw blades. Rubbermaid to the rescue! Their 22-cup, No. 5 Servin' Saver comes in clear plastic, 11 in. dia., 4 in. high. The airtight cover seals in smells, so the ammonia can do its job without leaving an aroma in the shop.

*Dick Applebaum
Tucson, AZ*

Old-Fashioned Glue Spreader

This is a quick, easy way to spread glue when using biscuit joiners. Grind an old putty knife to the profile of a standard biscuit, squirt the slot with



glue and spread it with the blade. Wipe the steel off immediately and you'll have no cleanup problem.

*Thomas Wilson
San Diego, CA*

Freezing Brushes

What do you do with a brush covered with oil-based paints or varnish that you'll need again in a day or two? Rinse it out in earth-polluting petrochemicals? No, there's a better way: Just put the brush in a Zip-Loc bag and stick it in the freezer. When needed again let it thaw (still in the bag) at room temperature. This works for foam, bristle or nylon brushes.

If your spouse is concerned about smelling up the refrigerator, use two bags, one inside the other. To reuse a bag, turn it inside out and let the paint dry.

*Robert Schneider
Los Angeles, CA*

Push-Stick Pointer

Cutting thin stock on the tablesaw can be hazardous. When ripping a number of thin strips, I use a special push stick with a needle-sharp finishing nail inserted in the end. The nail



lets me apply pressure anywhere on the stock (not just at the end), so I can hold the stock firmly to the table while pushing it past the blade. The "pin prick" caused by the nail is so tiny that it disappears in the sanding and finishing process.

*Tim Hanson
Indianapolis, IN*

Skateboard Helper

Now that my two sons have left home I don't have their help around my shop anymore. But they left behind their skateboards, and I've found these useful for moving heavy objects like 3/4-in. plywood. I just stand the edge of a sheet on a skateboard and move it with the greatest of ease.

*Bobby L. Martin
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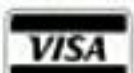
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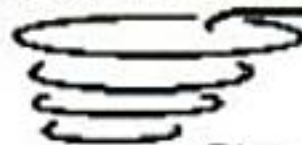
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THE ULTIMATE *Router Jig*

**Our Jig Does Double-Duty as a Horizontal Router Table
and a Slot Mortiser/Tenoning Machine**



PHOTOS BY JOHN HAMMILL

The jig consists of a router mounted to the edge of the tablesaw and a sliding table that holds the workpiece. Here, the operator routs a tenon, swinging the lever to move the workpiece into the bit while sliding the table forward and backward.

Woodworkers have been designing router jigs since the first router reached the market over 50 years ago. But most of these jigs are suited to just one operation, or if they're more versatile, they tend to require time-consuming setups to switch from one function to another. And few of these jigs can handle both mortises and tenons easily.

Our router jig mounts conveniently to the tablesaw, and it handles mortises and tenons, plus a host of other tasks, with ease. You can

cut tenons up to 2½ in. long and mortises up to 2½ in. deep, in stock as thick as 3 in. The jig handles stock up to 5 in. wide for edge mortising and up to 7 in. wide for tenoning and end mortising. And you can use it as a router table to cut grooves, sliding dovetails—even raised panels. Switching from one setup to the next is fast, and you can easily move the jig out of the way when you want to use the tablesaw. Also, since you're using the tablesaw's table and miter grooves, accuracy is built right in.

How It Works

As the cover photo shows, this jig consists of a carriage or "sled" assembly that rides on your saw table, and a router mounting assembly that attaches to the side of the saw table to hold the router in a horizontal position and provide height adjustment.

The carriage assembly, which you use for mortise-and-tenon work, has three pieces: a fixed sled, a movable sled and a sliding fence. (See Fig. 1.) The sliding fence backs up the workpiece, while the movable sled moves side to side by way of a lever to advance the workpiece into the bit. These two parts are attached to the fixed sled, which slides forward and backward in your table saw's miter slots. The sled is dimensioned to fit many common tablesaws. However, if the locations of the miter gauge slots on your saw don't fall within the range shown in Fig. 4, you'll have to make adjustments as indicated.

The router assembly is made up of two main pieces: a leg panel that bolts to your saw table and the floor, and a wedge-shaped router fence that actually holds the router. Both parts are made from plywood faced with plastic laminate for strength and durability.

The router fence pivots on a $\frac{3}{8}$ -by-16 stud to roughly adjust bit height, while an adjusting block that slides in a groove in the leg panel (see bottom photo, page 33) lets you easily fine-tune the height setting.

When you want to use the table saw, you remove the sled, loosen the knobs that hold the router fence in place, and drop the fence and router down and out of the way.

Design and Construction Notes

There's nothing complicated about making this jig, but there are several important points you should note about its design and construction.

- **Recessing the router:** We recessed the router base $\frac{3}{8}$ in. into the router fence to maximize bit depth. (See Fig. 2.) The recess is located 1 in. from the top edge of the fence for rigidity.

- **Slotting the router assembly:** We routed the curved slots in the router fence and the leg panel (see Fig. 2) with a router mounted on one end of a trammel made from a long scrap of plywood. We fitted the router with a

FIG. 1 USING THE JIG

TENONING

STEP 1: Set bit depth for tenon length.

STEP 2: Loosen fence lock knobs, move sliding fence to left edge of movable sled and retighten knobs.

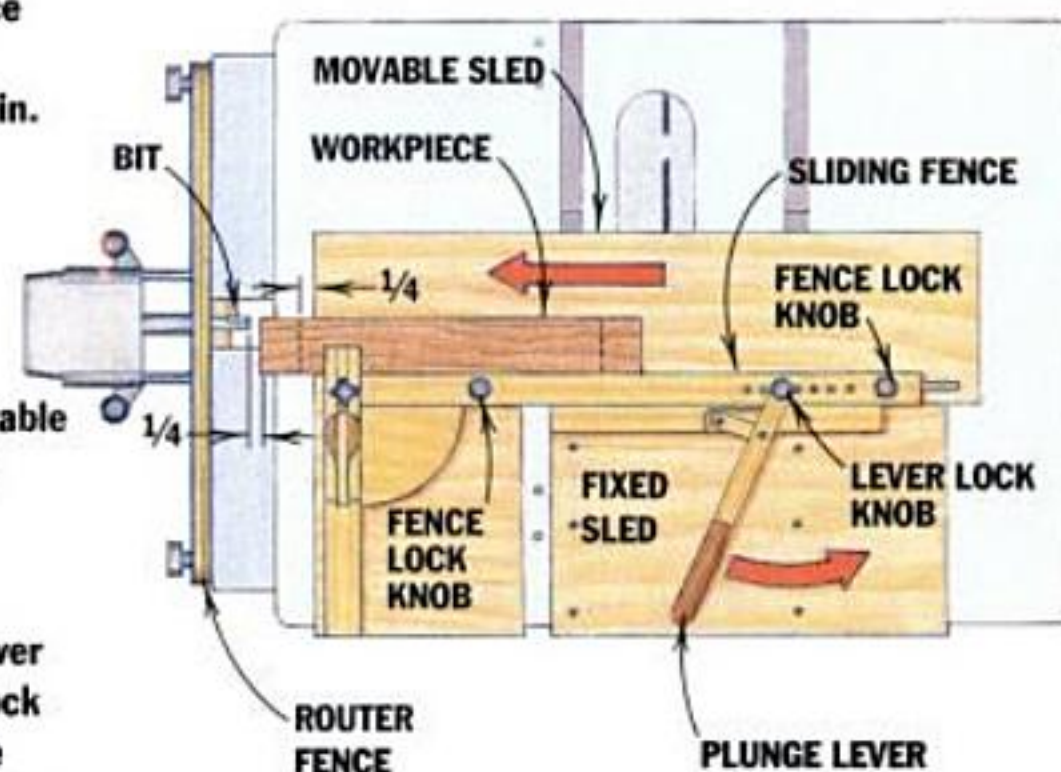
STEP 3: Clamp workpiece so end overhangs sled by tenon length plus $\frac{1}{4}$ in.

STEP 4: Set bit height to cut from underneath workpiece.

STEP 5: Remove lever lock knob and push movable sled and fence left until workpiece is $\frac{1}{4}$ in. from end of bit.

STEP 6: Swing plunge lever to left and screw lever lock knob to the farthest hole it will reach on sliding fence.

STEP 7: To rout, move plunge lever handle to the right in increments while moving sled forward and backward.



EDGE MORTISING

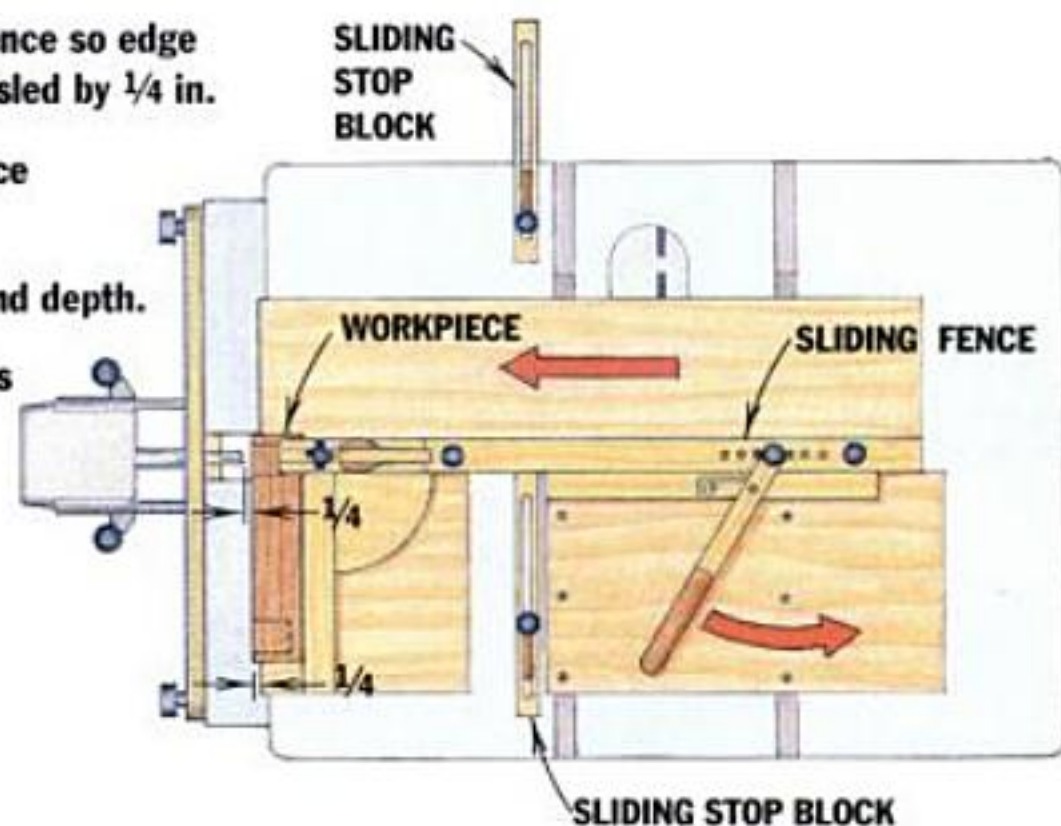
STEP 1: Adjust sliding fence so edge of workpiece overhangs sled by $\frac{1}{4}$ in.

STEP 2: Clamp workpiece to sled.

STEP 3: Set bit height and depth.

STEP 4: Set sliding stops for length of mortise.

STEP 5: Repeat Steps 5 through 7 above.



END MORTISING

STEP 1: Loosen fence lock knobs, move sliding fence to left edge of movable sled and retighten knobs.

STEP 2: Clamp workpiece so end overhangs sled $\frac{1}{4}$ in.

STEP 3: Set bit height and depth.

STEP 4: Set stop blocks.

STEP 5: Repeat Steps 5 through 7 at top.

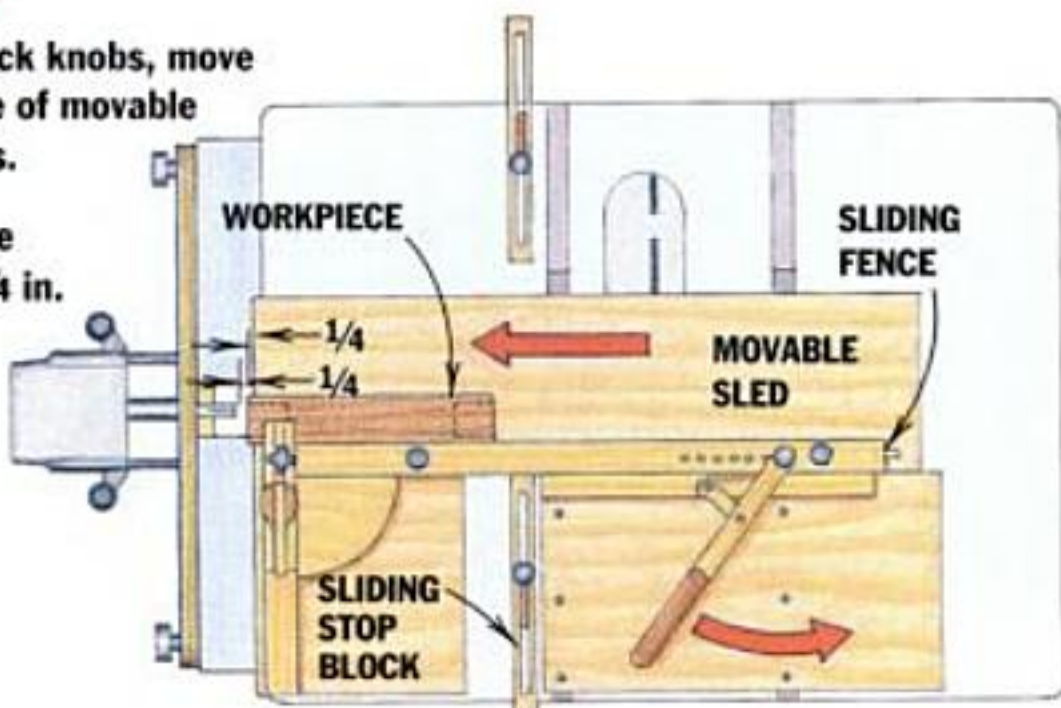
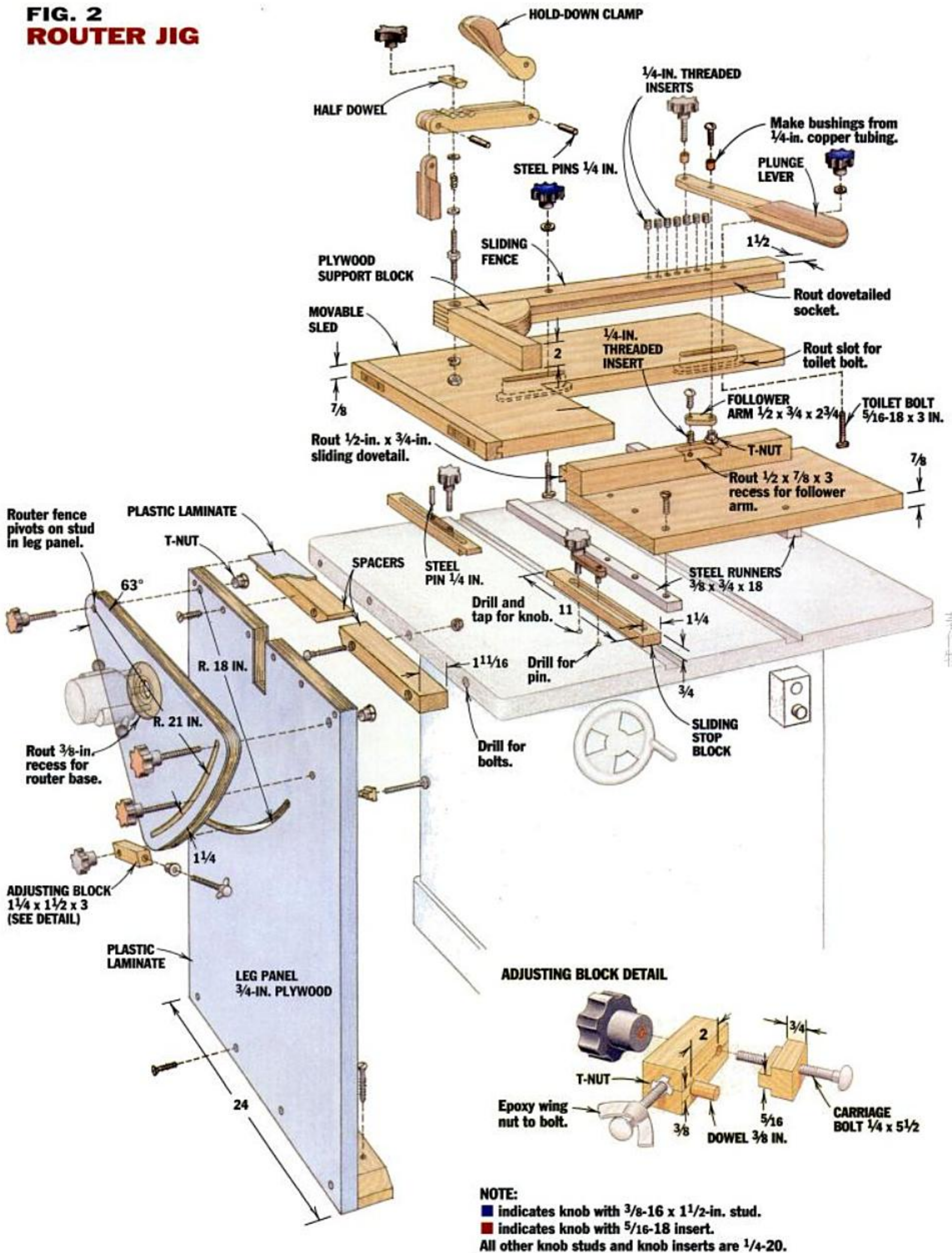


FIG. 2
ROUTER JIG

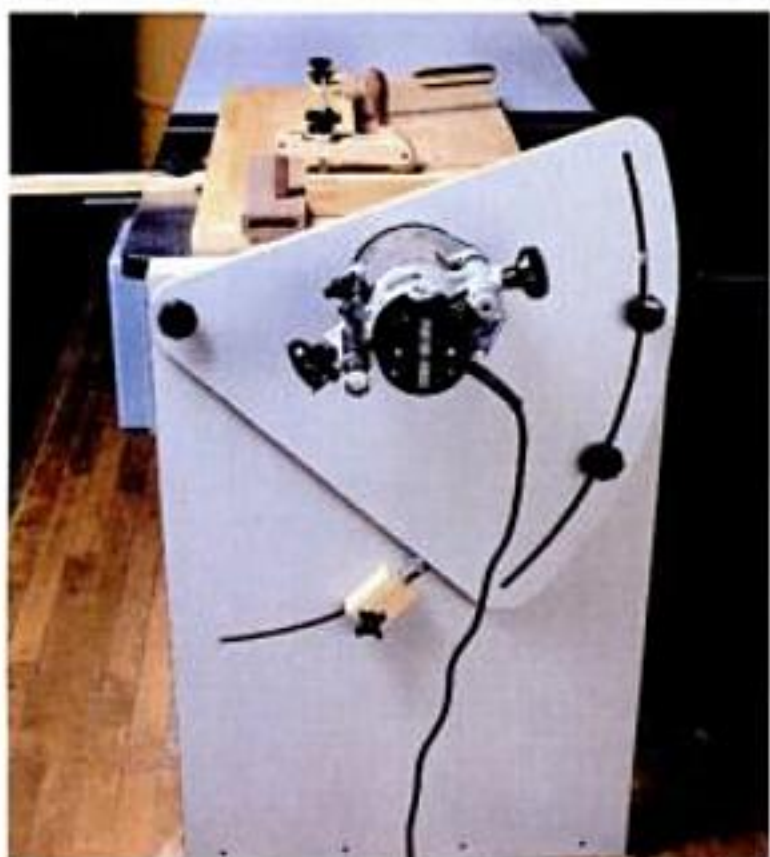




The jig's hold-down clamp pivots so you can clamp stock against either face of the sliding fence.

straight bit, then bolted the other end of the trammel to the router fence's pivot hole (see Fig. 2), and swung the router through an arc, stopping the slot 1½ in. from the ends of the fence. To cut the slot for the adjusting block (see Fig. 2), we reduced the radius of the arc by 3 in., and attached the trammel to the pivot hole on the leg panel.

•**Mounting the leg panel:** For accurate mortises and tenons, the face of the leg panel must be parallel to the



To fine-tune bit height, slide the adjusting block up to the router fence, and turn the wing nut on the stop block.

miter slots and square to the table-saw's surface. We screwed the panel to the spacers (see Fig. 2) and bolted the assembly to the edge of the saw. Then we secured the leg panel to a 2x4 screwed to the floor. (If your tablesaw isn't stationary, bolt a second spacer to the base of your saw and screw the leg panel to the spac-

er.) If necessary, you can add shims between the spacers and the edge of the saw table to make the panel parallel to the saw's miter slots.

•**Choosing sled materials:** When prototyping this jig, we used plywood for the sled. But we found that it bowed when we locked down the hold-down clamp, so we switched to solid maple with a breadboard end to gain rigidity.

•**Making the slide mechanism:** Strive for a slightly snug fit when making the sliding dovetail that joins the fence parts. (It's a delicate balance: If you have slop here, the jig won't be quite as accurate, but if the joint is too tight, it won't slide easily. Waxing the dovetail and socket helps.) We also found we needed a "follower arm" (see Fig. 2) to help the fence slide smoothly.

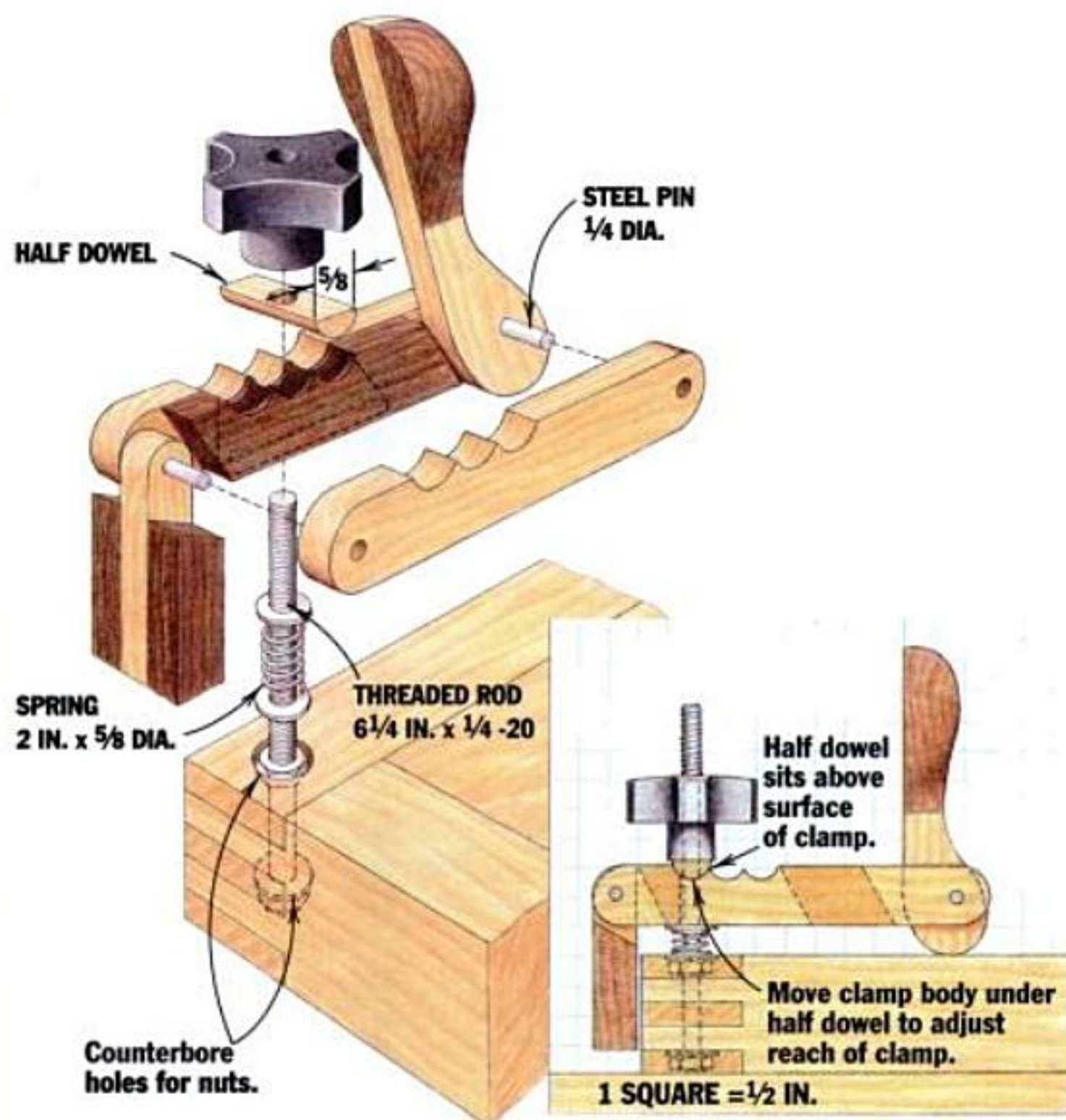
To give the L-shaped fence added strength at the joint, we glued in a laminated plywood support block. (See Fig. 2.) The block also provides

support for the clamp's cam lever, should you want to clamp a workpiece at an odd angle.

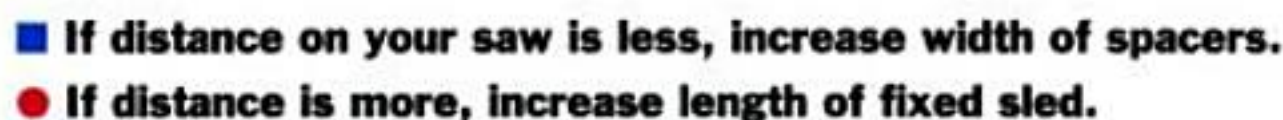
•**Sources for hardware:** The knobs we used are available from Reid Tool (2265 Black Creek Rd., Muskegon, MI 49444, 800-253-0421). Threaded rod, springs and T-nuts are stock hardware store items. Toilet bolts are available from hardware stores and plumbing supply houses.

•**Making the runners:** For stability, we made our sled runners from ¾-in.-thick by ¾-in.-wide flat steel bar stock, which is available from hardware stores or machine shops, or by mail from Small Parts Inc. (13980 NW 58th Court, Box 4650, Miami Lakes, FL 33014-0650, 305-557-8222). Your miter slots may be different than ours, so measure them before buying your steel bar. When attaching the fixed sled to the runners, we slotted the holes in the sled slightly to allow the maple to expand and contract.

FIG. 3 HOLD-DOWN CLAMP



著作物



SHAKER SEWING COUNTER

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A place for everything and everything in its place—that's a maxim any Shaker could understand. This concern for order in their surroundings inspired Shaker furniture makers to create many types of special-purpose furniture, including "counters," or work tables, like the one shown here.

The original was made in 1843, during the "classic" period of Shaker furniture, and is rare in that it was signed and dated by the maker, James X. Smith. Smith entered the community at Mt. Lebanon, New York, at the age of 10 and lived in various families within the community until his death in 1888 at the age of 82.

The original counter was probably used for sewing, since it had a wooden ruler attached to the top. The six drawers provided storage for fabric and notions, while the wide, overhanging top allowed the seated seamstress to work comfortably without bumping her knees.

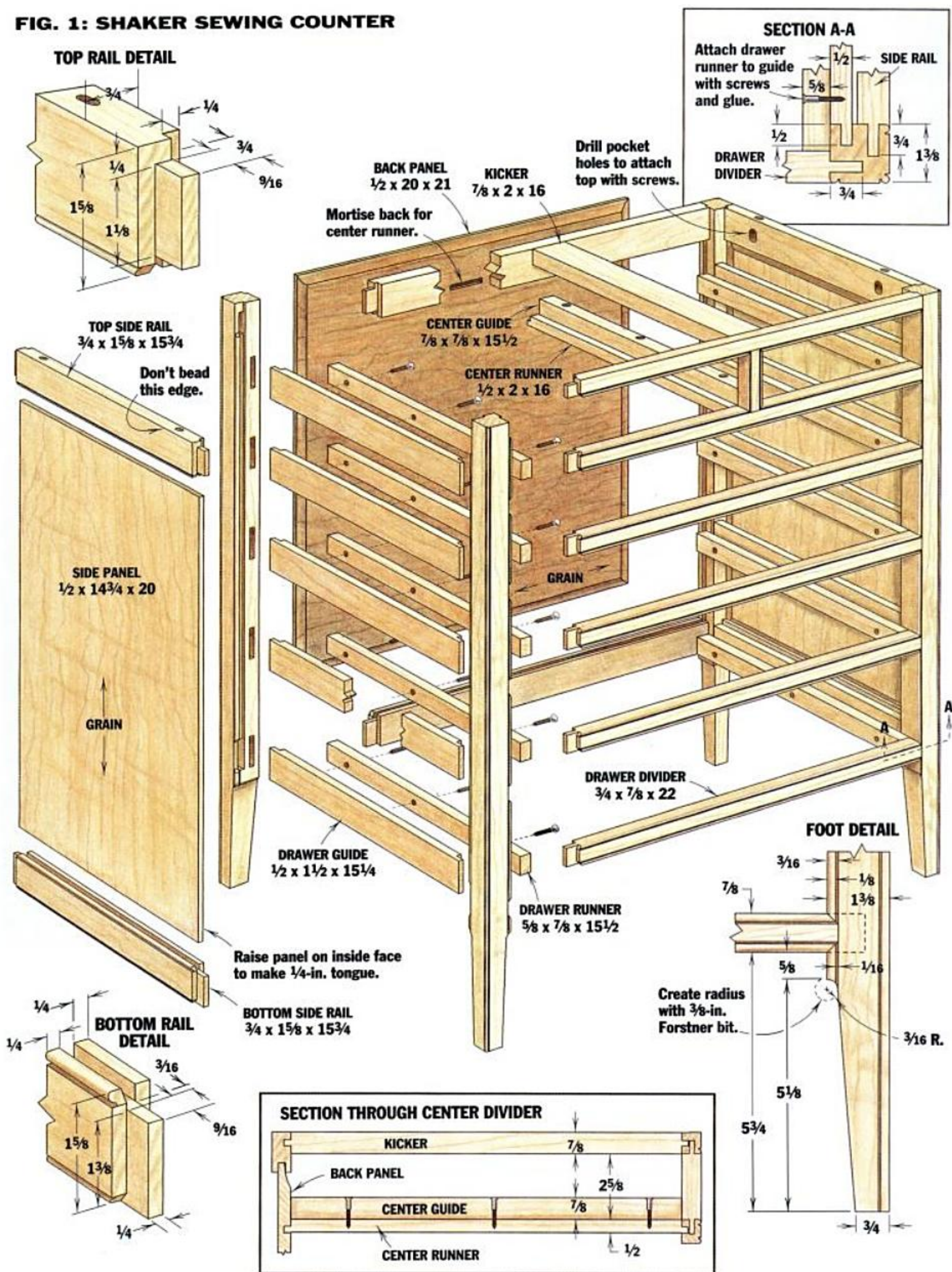
The counter's compact size makes it suited to modern uses as well—it could be used for an end table, bedside table or hall table. And from a woodworking standpoint, it's a good exercise in frame-and-panel carcass construction that you can accomplish with just hand tools and common shop equipment.

BY ROBERT J. TREANOR



Like the Shaker original, this reproduction has both charm and utility.

FIG. 1: SHAKER SEWING COUNTER



著作物

DRAWINGS BY GLENN HUGHES

About the Counter

Although the original was made of cherry with butternut panels, I used maple throughout, except for the drawer sides and bottoms, which are pine. Any hardwood or combination of hardwoods will do, but I recommend a diffuse-porous (no strong growth rings), even-textured wood, such as maple or cherry, for the legs and frame members. These woods hold the fine beads and mitered joint details better than coarser woods.

Shaker case pieces most often had solid sides, but frame-and-panel construction has some advantages. It allows the side and back panels to move with changes in humidity, and it lets you repeat the quirk bead detail on all four sides of the case, not just the drawer dividers. The quirk bead has the same visual effect as a cock bead would on a drawer front, but the quirk bead is cut *into* the frame, not raised above it. (See Fig. 1.)

Making the Carcase

The first step in constructing the carcase was to select straight-grained maple stock for the frame pieces. I milled all the pieces slightly oversize and set them aside for a few days so any wood movement would take place while the stock was still oversized. After the wood had settled, I milled the pieces to final size, planed and scraped them, and sanded them to 220 grit.

Next, I cut the quirk bead along the entire length of the frame members with a molding plane. (See photo, above.) My plane cut a $\frac{1}{8}$ -in.-wide bead with a $\frac{1}{16}$ -in. quirk—a total width of cut of $\frac{3}{16}$ in. When beading the top rails, make sure to cut the bead only along the bottom edge. (See Fig. 1.)

You can also make the bead with a scratch beader (see "Making and Using a Scratch Stock," p. 67), a router, or a shaper. If your frame stock is highly figured, I suggest you use a router table. Climb-mill the bead (move the workpiece from left to right as you face the router fence) to avoid tear-out. Hold on to the piece tightly—the cutter will want to pull the piece out of your grasp.

With the beading done, I laid out the mortise-and-tenon joints on the legs and rails. I cut the mortises with a $\frac{1}{4}$ -in. up-spiral bit in a plunge router,



Author cuts quirk bead with an antique molding plane.

using a simple jig to hold the material for routing. (See photo, right.) After routing, I squared the ends of the mortises with a chisel.

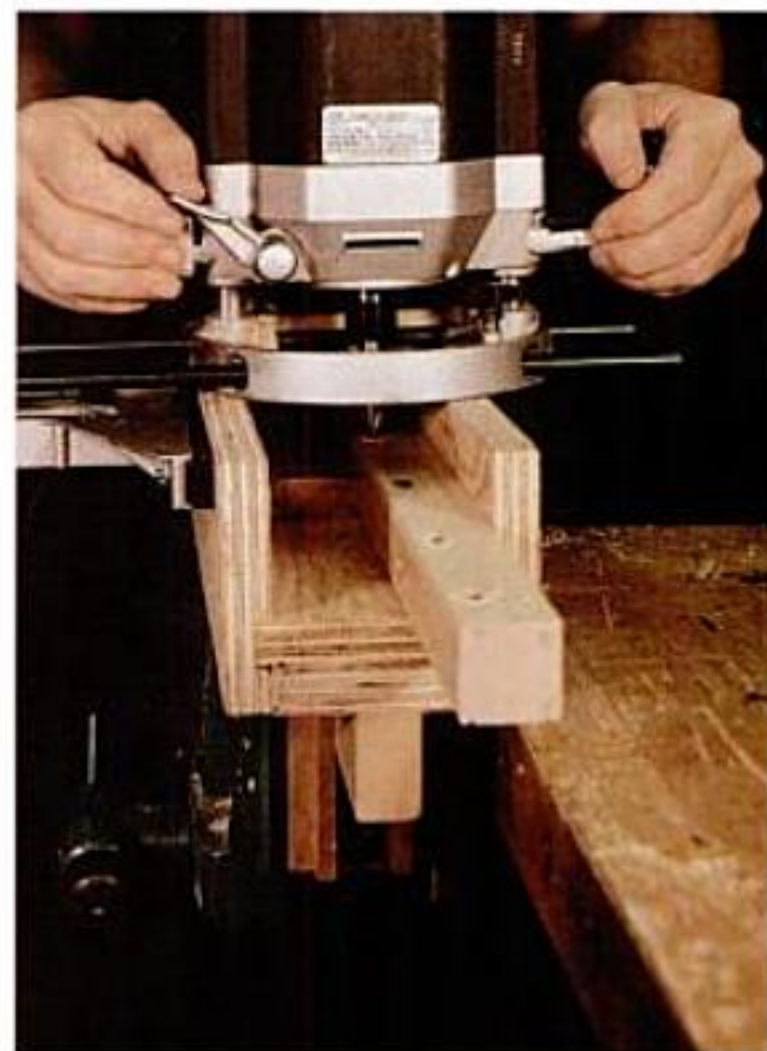
There are 26 of these joints in the frame, so it's important to have your tools and materials organized. If you cut one joint in the wrong place, it will destroy a great deal of time and effort.

Once I'd mortised the legs, I cut full-width tenons on the rails, using a dado head on the tablesaw. The critical measurements here are the shoulder-to-shoulder dimensions on the *backs* of the rails. These will determine the inside spacings of the legs ($14\frac{1}{4}$ in. on the sides of the case and $20\frac{1}{2}$ in. on the front and back). I left the front shoulders $\frac{3}{16}$ in. long so I could miter them into the $\frac{3}{16}$ -in.-wide quirk beads on the legs. (See photos, following pages.) It's wise to make trial cuts in scrapwood so this offset exactly equals the width of the bead. Any discrepancy will show as a gap

on the finished joint.

Mitering the leg beads where the rails intersect is not a difficult job, but with 26 joints, it can be time-consuming. The entire process is done with a backsaw and chisels. (See photos, following pages.)

The back and side panels fit into $\frac{1}{4}$ -in.-wide grooves cut into the legs and rails. I stopped the leg grooves so they wouldn't show beneath the bottom rails. To make the stop grooves, I used a dado head on the tablesaw. These cuts could just as easily be made with a router or shaper.



Author mortises legs with router, using wedges to hold the workpiece in a simple plywood trough.

FIG. 2: ELEVATIONS

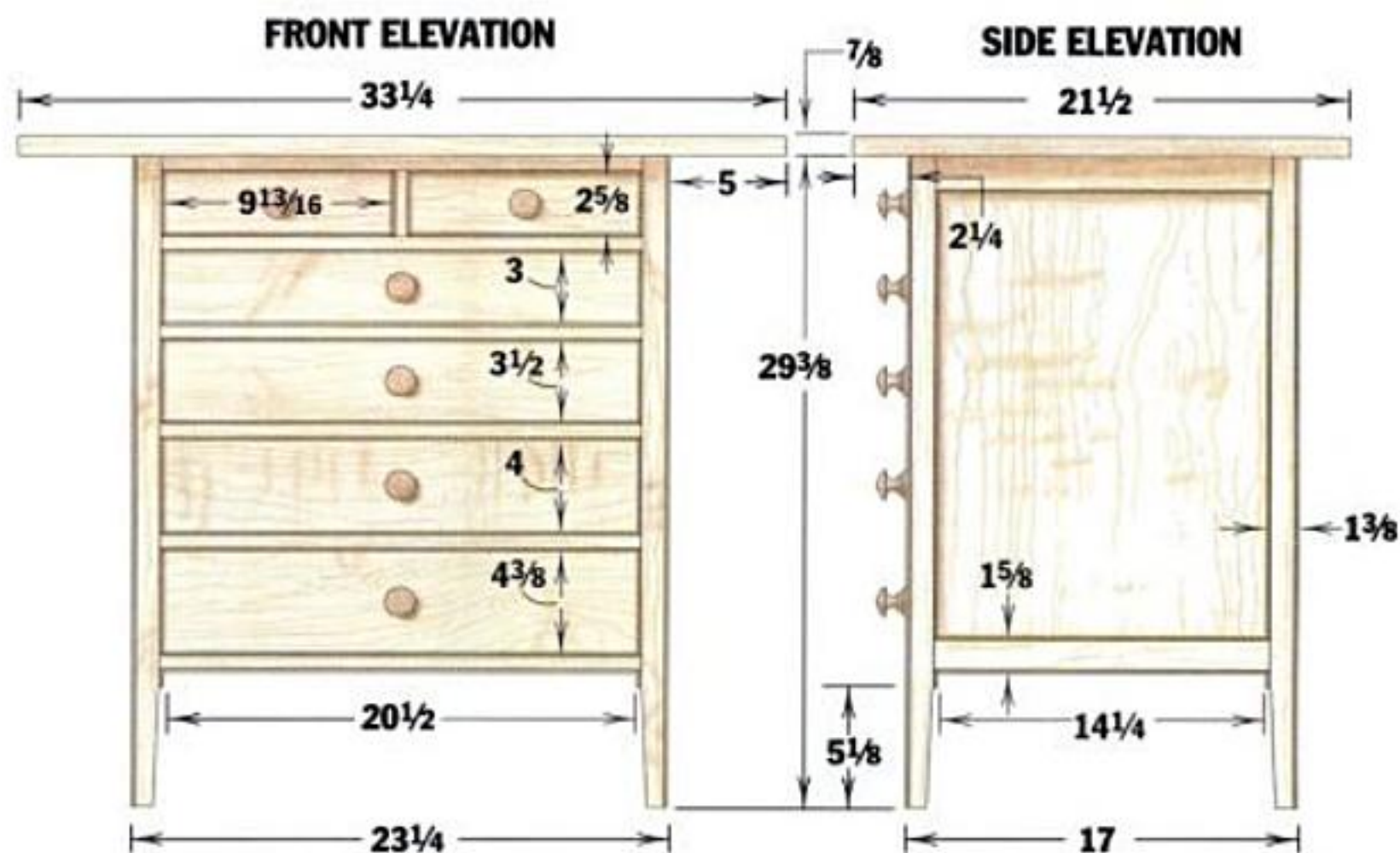
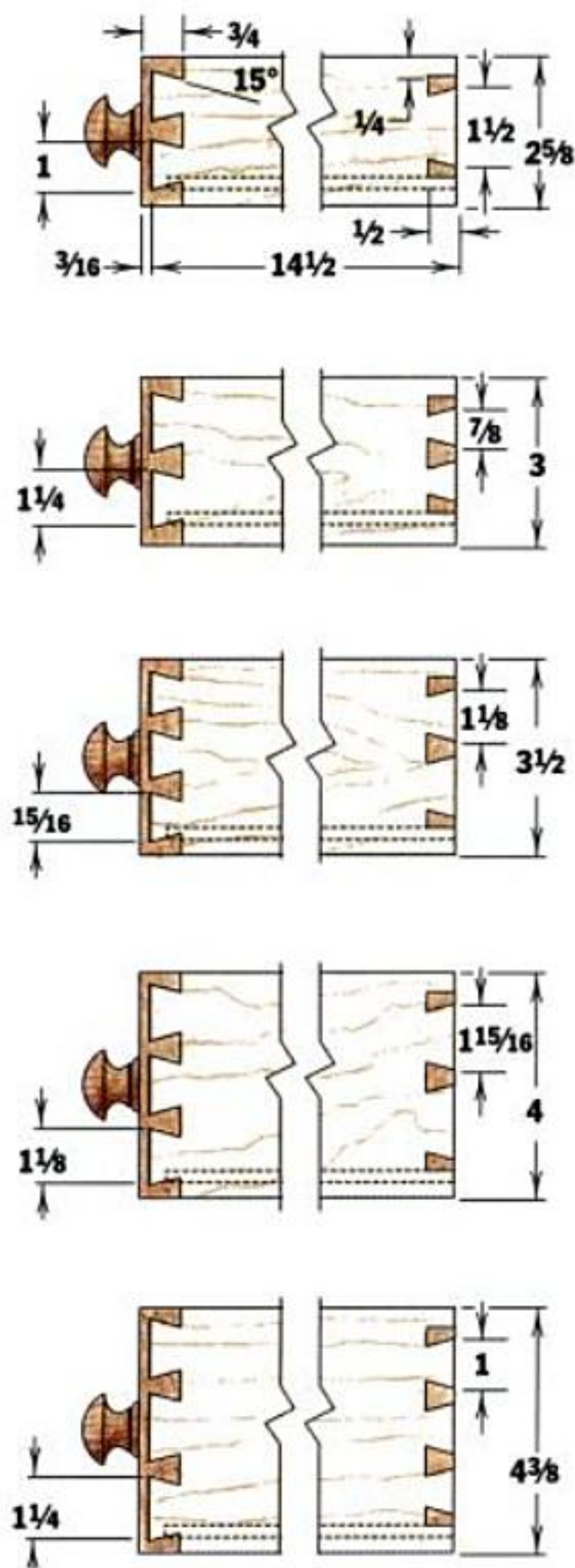
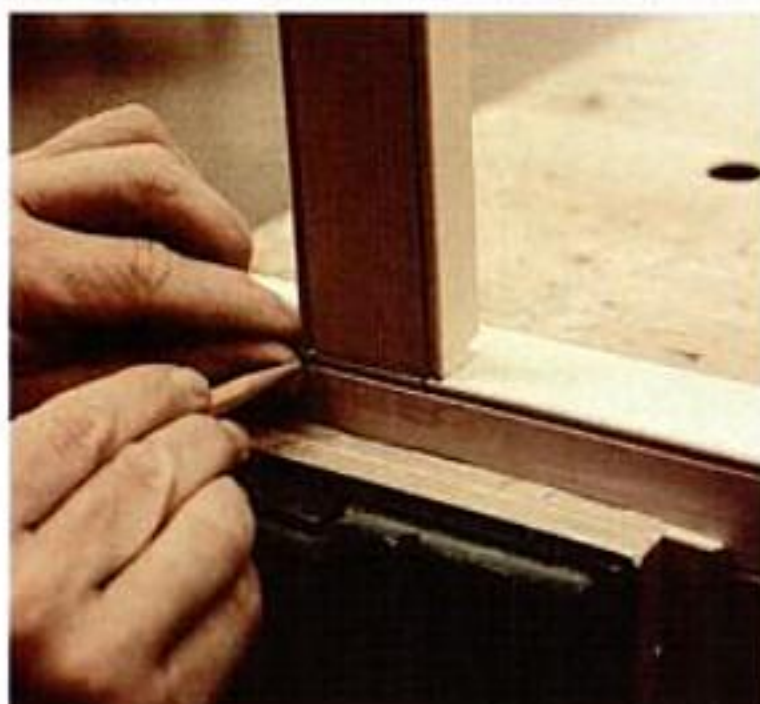


FIG. 3: DRAWER DETAILS



The Shakers would often nail the drawer guides and runners into their cases, but I feel that it's better to attach the guides to the side frames with mortise-and-tenon joints. (See Fig. 1.) This kind of joinery adds a great deal of strength to the case. I

MAKING A MITERED BEAD JOINT



STEP 1: Insert the tenon into its mortise and mark shoulders of quirk beads.



STEP 2: Cut inside your marks to the bottom of the bead with a backsaw.

cut the mortises as before, using my router mortising jig.

At this point it's best to dry fit the frame to make sure everything fits together properly. While the frame is assembled, measure the inside front-to-back depth to determine the lengths of the center runner, drawer guide and kicker for the top drawers. The kicker and runner are attached, front and back, with stub tenons. (See Fig. 1.)

Also at this time, you can take the final measurements for the panels. As on the original, the grain of the side panels runs vertically and the grain of the back panel runs horizontally. Your final panel sizes must allow for expansion and contraction of the panels within the frame. (For more on wood movement, see AW #34.) I made the width of my panels about 1/4 in. under-size to allow for expansion.

Next I made the panels. I selected wood with an attractive figure since the panels are very visible. You may want to resaw thick stock to create book-matched panels. Bear in mind that the resawn pieces are likely to warp somewhat after resawing, so make them thicker than necessary and allow them to stabilize for a few days before planing them to final thickness.

I made the panels oversize and cut them to their finished sizes after gluing them up. Then I reduced the edges to fit in the 1/4-in.-wide grooves in the frame. I raised the panels on the *inside* surfaces—as the Shakers usually did—with a panel-raising bit on the router table, but you could use a tablesaw, a shaper or hand tools. (See AW #8, page 33; #31; and #34.)

The final step in preparing the panels is to scrape and sand them to 220 grit.

The feet on Shaker work tables were often turned, but on this piece the feet are tapered on the inside surfaces. The tapers are radiused at the top to resolve the quirk beads on the legs. (See Fig. 1.) I drilled these radii with a 3/8-in. Forstner bit in the drill press before cutting the tapers with the bandsaw.

Aside from finish-sanding the frame members to 220 grit, the only thing left to do on the frames at this point was to drill pocket holes in the top rails for the screws that secure the top. I made a jig to hold the rails at a 15° angle from vertical (see bottom photo, opposite page), then I drilled the pocket holes on the drill press with a 1/2-in. Forstner bit.

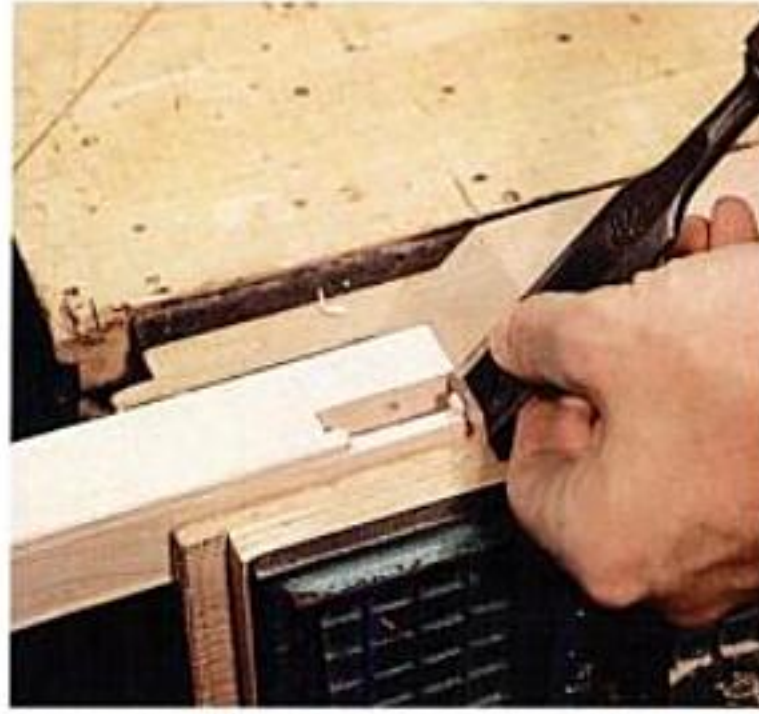
Before gluing up the case, it's good to assemble it one more time to check for errors or misalignments.

The glue-up itself is accomplished in two stages: first the front and back frame assemblies are glued, and then these sub-assemblies are glued to the sides. Use a bar clamp at each joint, and check the clamped frames carefully for squareness. Don't use so much glue in the frame joints that it squeezes into the panel grooves—the panels must be free to move. Clean off any excess glue from around the joints before setting the pieces aside to dry.

When gluing the front and back assemblies to the side pieces, you will appreciate some help because of the large number of parts. Use a glue with a long open time, such as plastic resin (urea-formaldehyde), so it doesn't



STEP 3: Remove waste between the saw cuts with a sharp chisel, being careful not to pare past the bottom of the bead.



STEP 4: Miter the leg beads with a sharp chisel using a simple jig to guide the chisel at 45°. Take incremental passes.



STEP 5: Cut the miters on the rails free-hand, fit the rails and make any necessary corrections.

begin to tack before you get all the joints together. Clamp the case securely, check it for squareness and set it aside to dry. When the glue has dried, even up the tops of the legs and rails with a sharp plane.

Making the Top and Drawers

The top of the sewing counter is fairly wide, but you should try to make it with no more than three boards to be in keeping with the original. I had a nice board of delicately figured maple wide enough to make the top from two pieces.

I left the edges of the top square. A slight round-over would be acceptable, but don't mill a complex profile. If you want to be faithful to the original, you can glue a rim around the top using a ruler as the front rim. Refer to the books listed at right for more about the original counter.

Before starting drawer construction, you must attach the drawer runners to the drawer guides. Mill the runners to size and attach them to the guides with glue and screws. The top surfaces of the runners should be flush with the top edges of the drawer dividers.

I cut all the drawer fronts from a single maple board to keep the figure and color consistent on the front of the counter. The sides, backs and bottoms of the drawers are all made from pine, but poplar or another secondary wood would do.

When laying out drawer parts, I suggest you measure your drawer openings to determine the dimensions of the parts. Make sure to leave some

headroom for them to expand and contract. The deeper the drawer, the more room you should leave, perhaps as much as $\frac{1}{8}$ in. on the bottom drawer. As with the panels, the exact amount you leave depends on the moisture content of the wood, the time of year and other factors. (See AW #34.)

The drawers are made with traditional joinery—hand-cut, half-blind dovetails at the front and through dovetails at the back. (See Fig 3.) I don't recommend machine-cut joints—you'll lose some of the piece's traditional charm. (For more on cutting dovetails, see AW #29.) Before assembling the drawers, drill $\frac{1}{2}$ -in.-dia. holes in the drawer fronts for the pulls.

Turn the pulls (see Fig. 3) in pairs on the lathe, then cut the pairs apart. Finish turning the individual pulls in a drill chuck in the headstock. Cut a thin saw kerf into the tenon of each pull for a wedge. After you apply a finish to the



Drill pocket holes in the top rails with a $\frac{1}{2}$ -in. Forstner bit, using a simple jig to hold the stock at 15° from vertical.

FOR MORE INFORMATION

For more information on Shaker furniture, see the following books:

The Book of Shaker Furniture, by John Kassay (1980, The University of Massachusetts Press, Box 429, Amherst, MA 01004, 413-545-2217).

The Complete Book of Shaker Furniture, by Timothy D. Rieman and Jean M. Burks (1993, Harry N. Abrams Inc., 100 Fifth Ave., New York, NY 10011, 800-345-1359).

Shaker Design, by June Sprigg (1986, Whitney Museum of American Art, 945 Madison Ave., New York, NY 10021, 212-570-3614).

case and pulls you'll glue and wedge the pulls to the drawer fronts.

I finished the case with several thin coats of shellac, rubbing each coat lightly with 220-grit sandpaper before applying the next. I finished the top with a built-up oil finish for wear resistance and ease of repair.

You may wish to explore other finishing possibilities. For example, the Shakers often tinted their pieces by



adding small amounts of pigment to their shellac. I've also painted pieces similar to this with good results. ▲

ROBERT TREANOR makes reproduction Shaker and Windsor furniture in San Francisco.

Craftsman-Style

Coffee Table

This Classic Design Fits Any Decor By Andy Rae

When Gustav Stickley and other furniture designers developed the Arts and Crafts style almost a century ago, they won praise for their utilitarian furniture with its straight lines and lack of ornamentation. These qualities can also harmonize with a modern interior, as this contemporary coffee table shows.

Built by Phil Gehret in the AW Design Shop, our table is made from quartersawn white oak, like most of Stickley's pieces. It features the rectilinear lines typical of Craftsman furniture, but the construction is simpler. (See drawing.)

The base is joined with blind mortises and tenons, and the shelf is secured with screws. If faithful construction is your goal, you can use through mortise-and-tenon joints, and join the shelf to the rails with sliding dovetails.

Design Notes

All the information you need to build the table is shown in the drawing, but there are some additional points worth mentioning:

- When selecting boards for the top and shelf, try to match the stock so the grain and color flow smoothly across the glued-up panels. If you're using quartersawn oak, you'll also want to arrange pronounced medullary rays in a pleasing way.

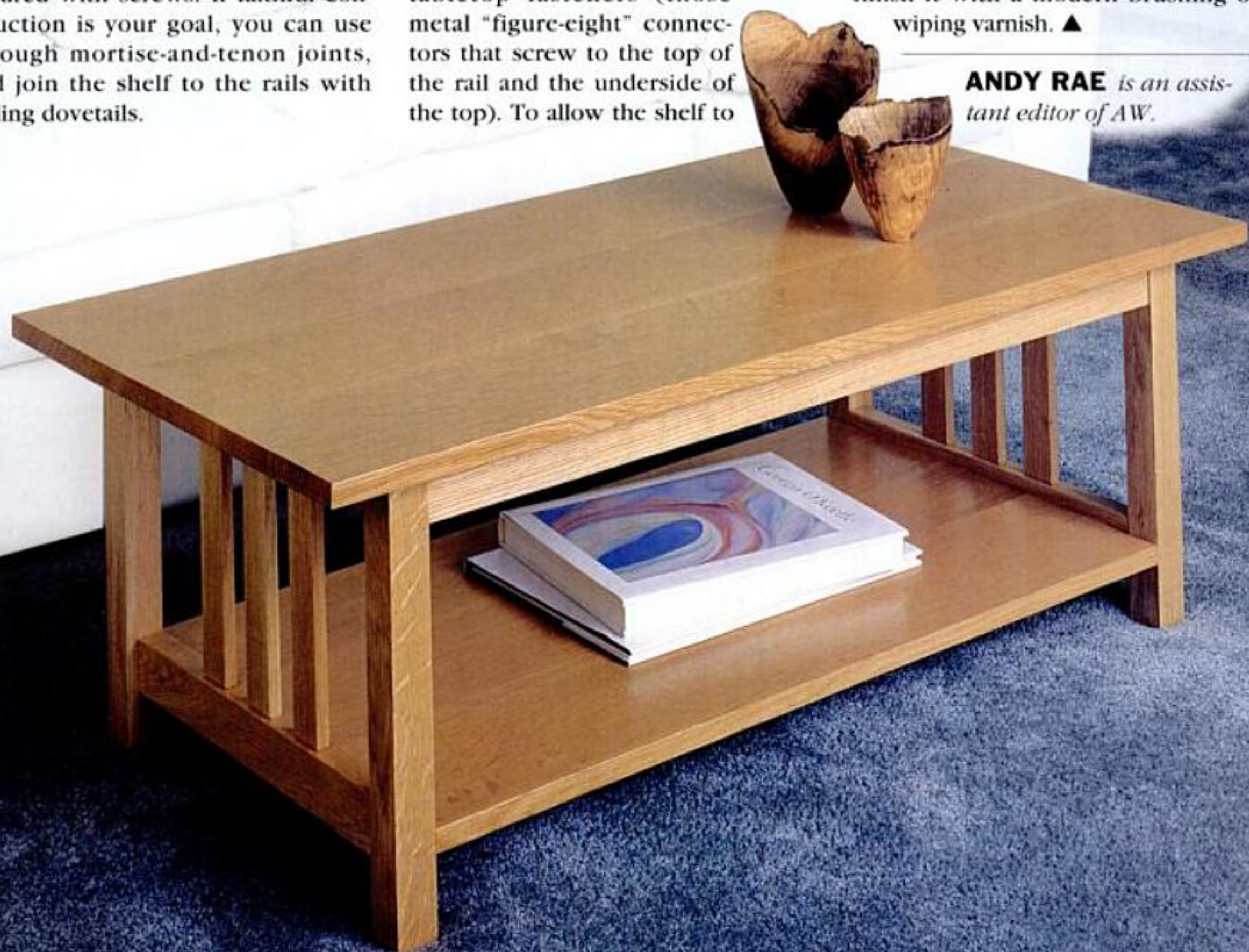
- It's important to allow for seasonal wood movement across the width of the top and the shelf. To keep the top tight to the base yet free to expand and contract, secure it with button blocks (see drawing), or use metal tabletop fasteners (those metal "figure-eight" connectors that screw to the top of the rail and the underside of the top). To allow the shelf to

move, leave $\frac{1}{4}$ in. of expansion space between the legs and the corner notches of the shelf. Also, if using screws for the shelf-to-rail joints, house the screws in cone-shaped or elongated holes (see drawing) so the screws can pivot as the shelf moves.

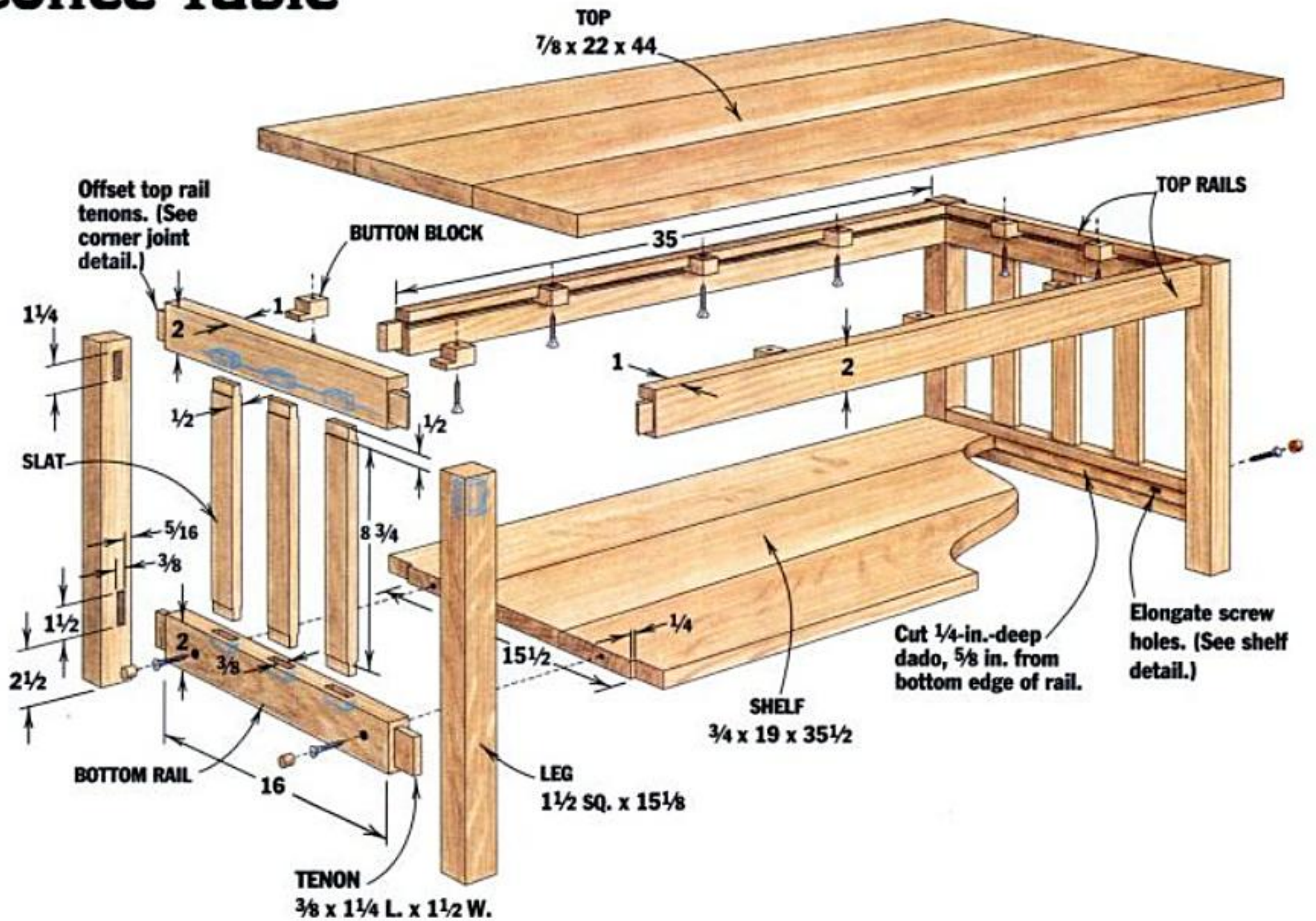
- Since the insides of the rails are flush with the insides of the legs, we offset the tenons outward and mitered their ends to increase the amount of glue surface. (See drawing.)

- Stickley usually fumed his furniture with ammonia to darken it before finishing it with a concoction of lacquer and shellac. (See AW #32.) To achieve a lighter, more up-to-date look, you can leave the wood natural as we did, and finish it with a modern brushing or wiping varnish. ▲

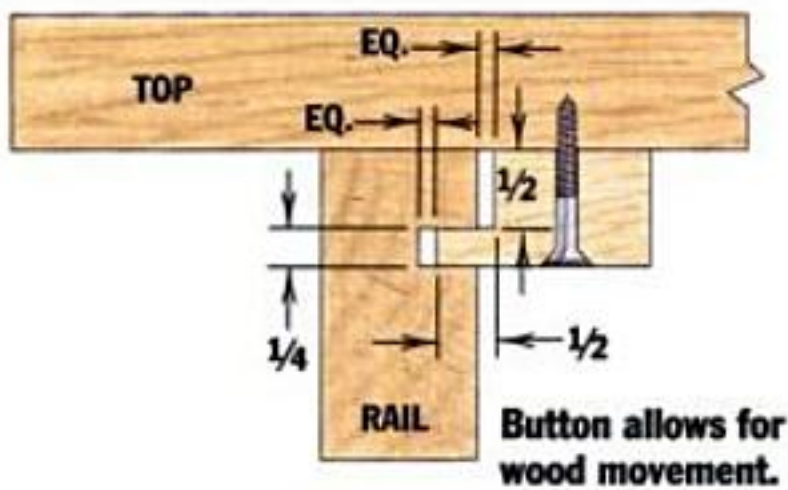
ANDY RAE is an assistant editor of *AW*.



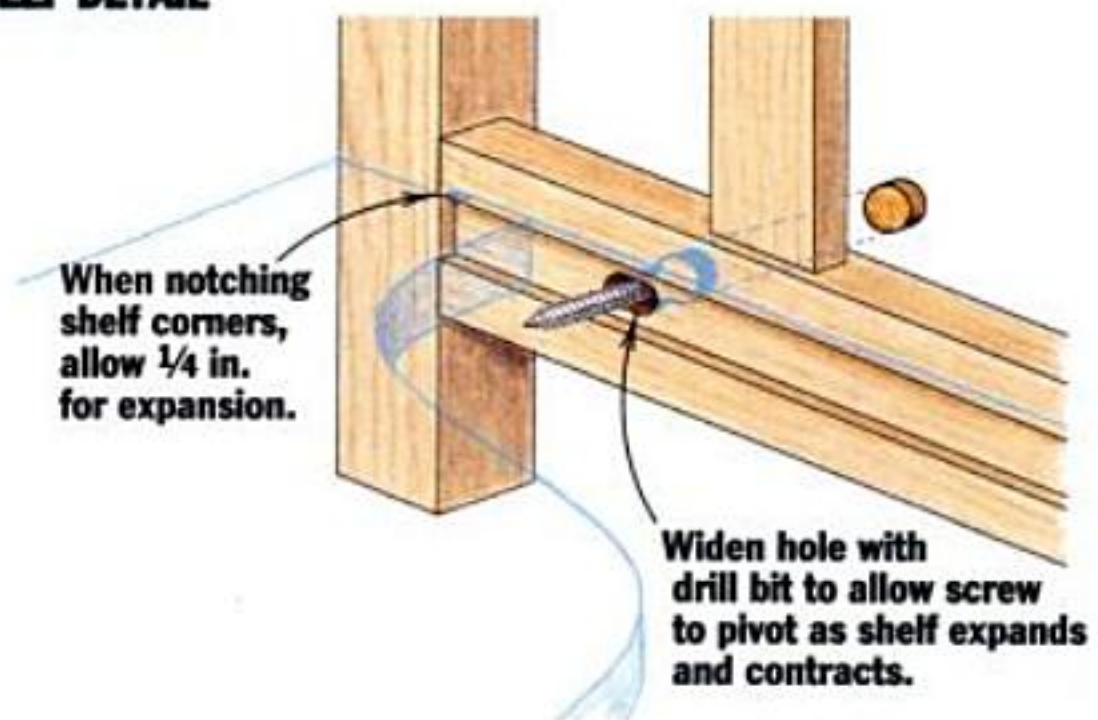
Coffee Table



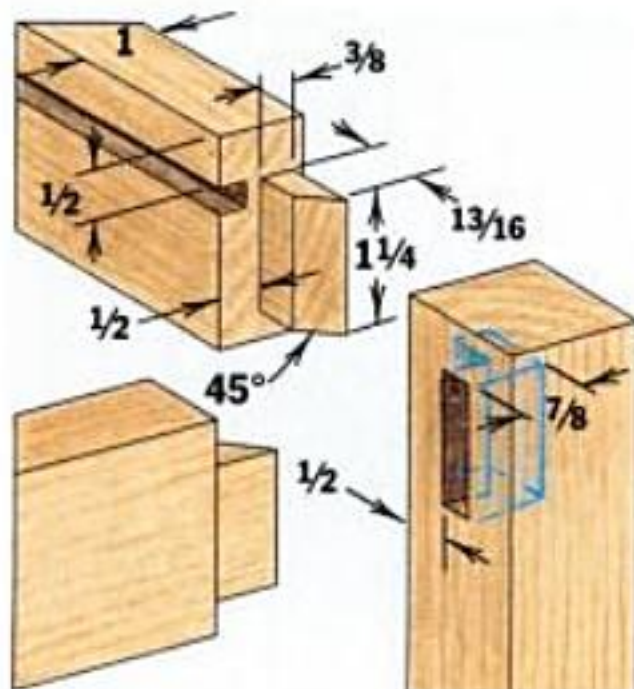
BUTTON BLOCK DETAIL



SHELF DETAIL

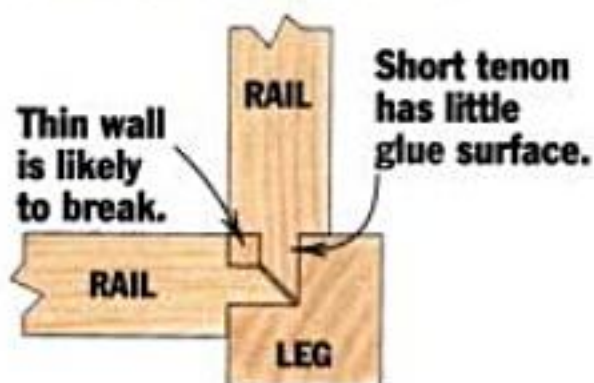


CORNER JOINT DETAIL

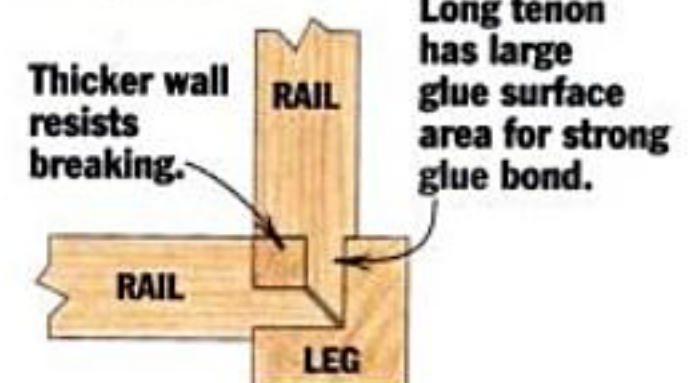


DESIGNING A MITERED MORTISE & TENON

Centering tenons on rails makes joint weak.



Offsetting tenons strengthens joint.



BOWL-TURNING BASICS

So many novice turners, eager to test all their new tools and equipment, rush into turning bowls, itching to get a tangible object on the sideboard with which to impress the family and neighbors. It's natural enough, but later on there tends to be a nagging realization that end grain could have been cut more cleanly, and that heavy sanding is not enough to eliminate the torn grain.

Often the problems originate in an overly ambitious design involving fancy ogee curves, which are never easy, and tight internal curves, which are even less so. As novices we soon learn that turning is not as simple as it looks, and that smoothly cut surfaces don't appear just because you push a tool into the wood, no matter how sharp the edge.

This article guides you through the turning of a simple open bowl whilst introducing a range of basic techniques on which you can

Australia's Premier Turner Shows His Step-by-Step Approach

BY RICHARD RAFFAN



Turning a simple bowl, as the author is doing here, can teach you techniques that also apply to more intricate work.

build. The project is completed in three stages. First you turn the outside profile, fixing the blank to a screw center by what will be the top

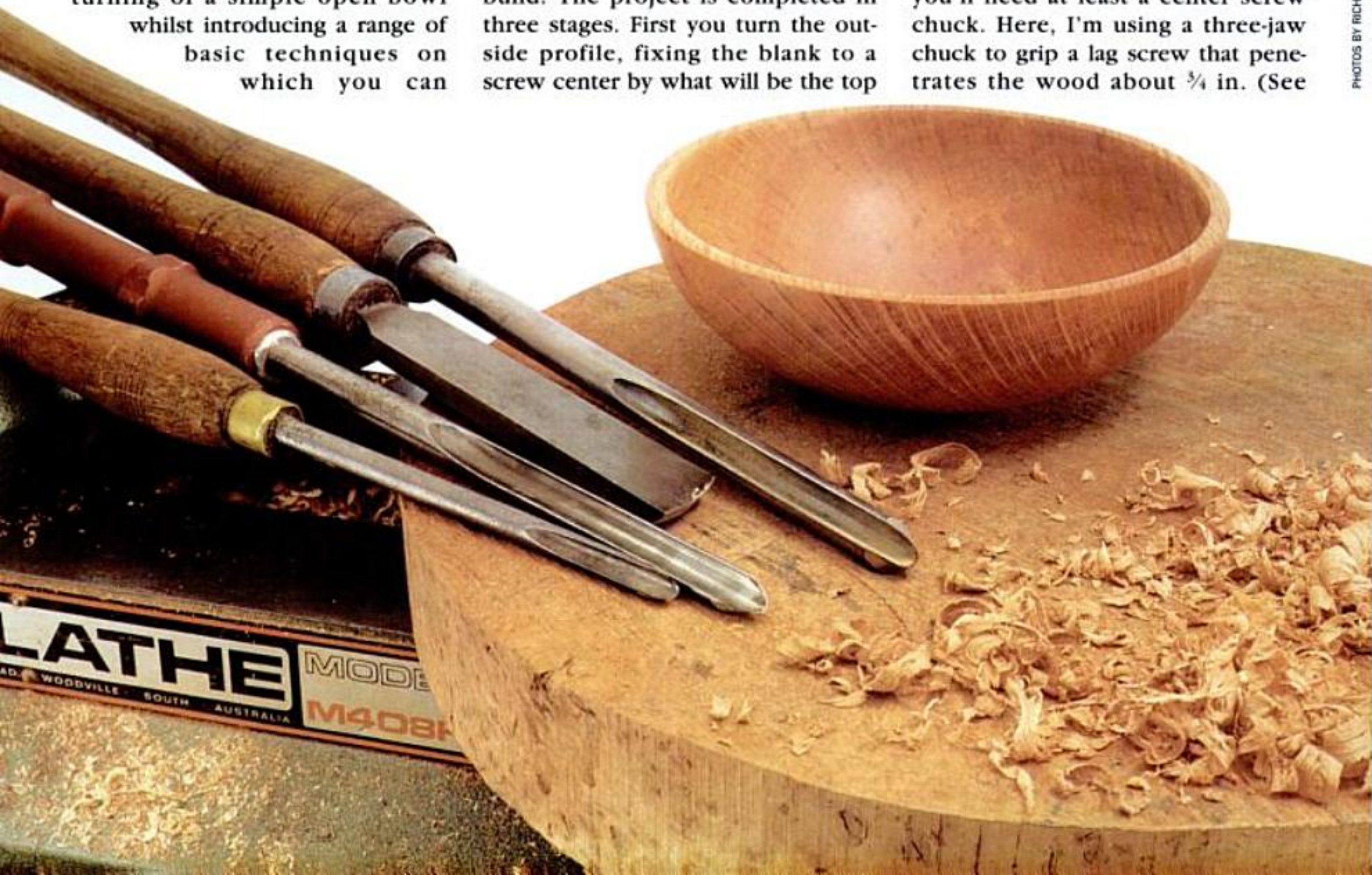
of the bowl. Then your half-formed bowl is reversed and held by the foot for hollowing. And finally you rechuck your hollowed bowl in a jam-fit chuck to finish the foot.

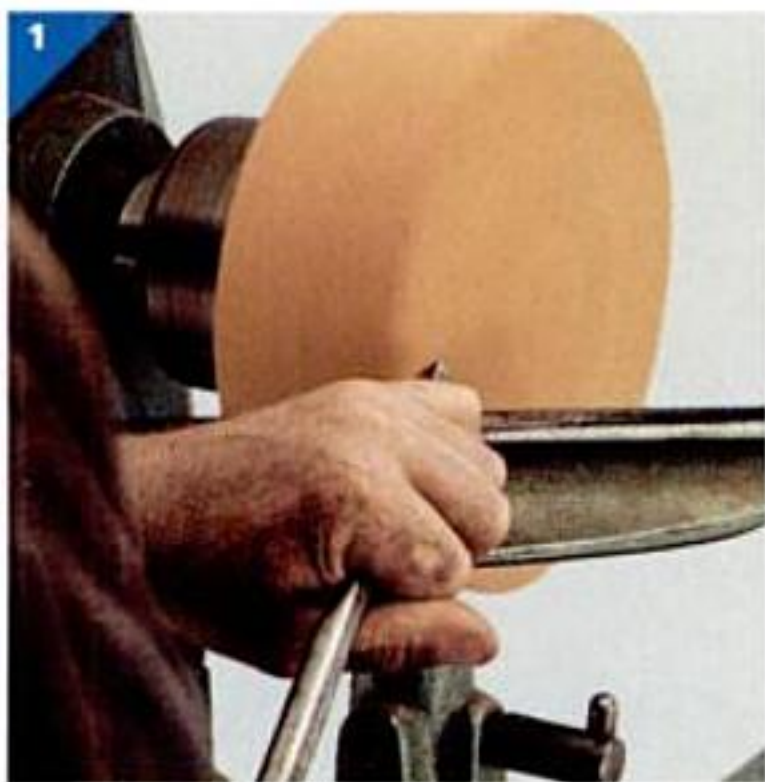
Tools and Materials

You need three basic tools to make the bowl shown here: a long-and-strong, deep-fluted $\frac{3}{8}$ -in. bowl gouge; a heavy, 1-in. scraper with a slight curve; and either a long-and-strong, shallow-fluted $\frac{1}{2}$ -in. gouge or a long-and-strong, shallow-fluted $\frac{3}{8}$ -in. gouge.

The shallow-fluted tool is best on the outside and the deep-fluted best for hollowing. I like gouges ground with rounded shoulders (see lead photo) because as you will see later, they can be used for shear scraping as well as shear cutting.

To hold the wood on the lathe you'll need at least a center screw chuck. Here, I'm using a three-jaw chuck to grip a lag screw that penetrates the wood about $\frac{3}{4}$ in. (See





To rough out the profile, hold the shallow-fluted gouge about 30° up from horizontal. Then raise the handle to pivot the cutting edge into the work and sweep the tool through an arc (left and center). The bevel doesn't contact the wood, as shown at far right.

photo #4.) The chuck's jaws are reversed to provide a stable base for the turning. Usually I use a dedicated screw chuck—either a manufactured one, such as the Craft Supplies screw center faceplate (available from Craft Supplies USA, 1287 E. 1120 S., Provo, UT 84601, 801-373-0917), or a shop-made chuck. (See sidebar, page 46.)

In these photos I'm turning Australian she-oak, but any seasoned wood that is stable and easy to work will do, including cherry, maple, box elder, Oregon myrtle and walnut. Air-dried wood is better to work and less dusty than kiln-dried. Avoid green timber for this project: chances are your finished piece will warp.

Mounting the Blank

Bandsaw a disk 8 in. to 9 in. in dia. and about 3 in. thick, with the grain running across the face. The wood needs to be even-grained and without splits. Initially it's best to avoid blanks which are half sapwood,

because the varying density between heartwood and sapwood causes dangerous vibration.

If you'll be mounting the blank on a screw chuck, flatten the surface of the blank (I use a belt sander) so that the face will lie flush with the chuck's backing plate. If you don't do this the blank will rock as you cut, making precise turning impossible and dangerous catches and flying blanks a near certainty. (The three-point support provided by the three-jaw chuck eliminates this problem.)

Once the surface is flat, drill a center hole and mount the blank on the chuck. Then set the lathe at a low speed, preferably 500 to 800 rpm, and standing away from the line of the blank, switch the lathe on for a few seconds to ensure that vibration is minimal. Your working speed should be between 900 and 1,200 rpm, but if you feel nervous about the speed, slow the lathe rather than risking an accident.

Roughing Out the Profile

An even-grained blank cut round on a bandsaw will run pretty well true, so don't waste time truing the sides of the blank first. Instead, set the tool rest at about center height and across the corner of the blank, and reduce the bulk as quickly as possible by turning away the corner with the ½-in. shallow-fluted gouge.

When you are cutting, tilt the gouge about 30° up from horizontal and rotate it so that the flute lies around 45° off vertical. (See photo #3.) Use the lower edge of the gouge to make a series of cuts which sweep through an arc. (See photos #1 and #2.)

Take care particularly with the shallow gouge that you *never* present an unsupported edge to the wood (see Fig. 1): you *will* have a catch. This is because when there is no support beneath the edge, the downward force of the rotating wood snaps the tool over.



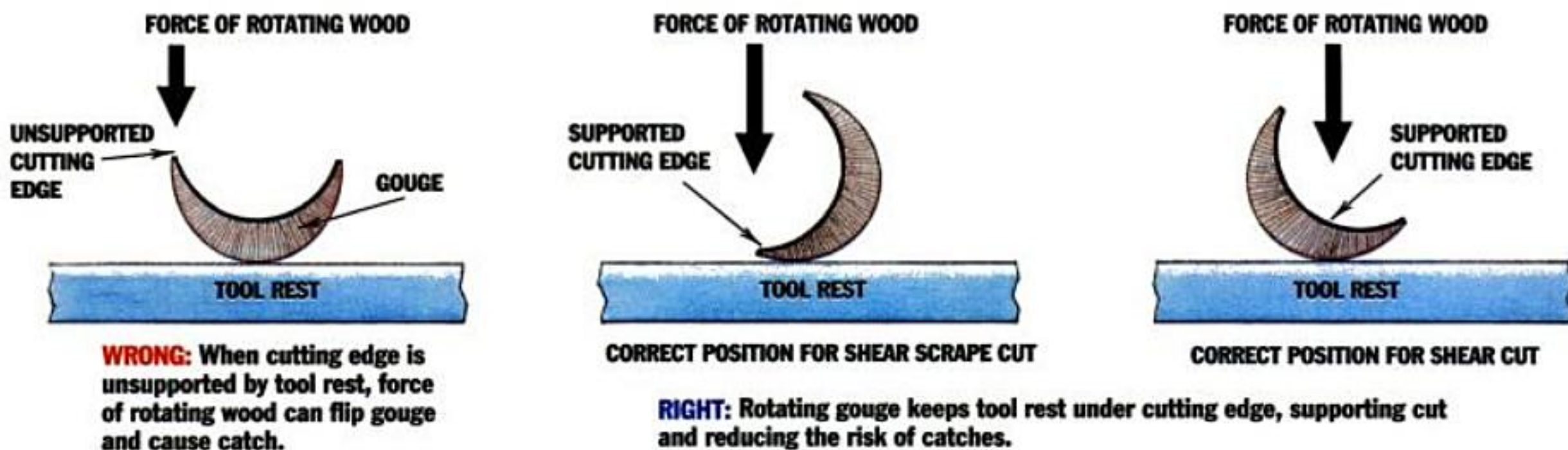
The cleanest roughing cut comes from a back cut, where you shear with the full round shoulder on the inside edge of the gouge.



To true the base, squeeze your hand (left), pulling the tool into the uneven surface to flatten it, then turn the tool around and shear cut toward center (right).



FIG. 1: SUPPORTING THE CUTTING EDGE



Continue to rough out the profile, using a combination of body and hand movements to move the edge of the gouge through the wood. For extra support, keep the tool handle tucked into your side and move your body with the tool. Use your upper hand to pull the tool leftward along the rest, as you swing your body—and hence the tool handle—right toward the lathe bed. For this cut, only the edge of the gouge contacts the wood; the bevel does not. This technique quickly gives you the rough form you want, but the surface will be ridged and some end grain will tear.

You can also make roughing cuts using the deep-fluted gouge rolled horizontal with the flutes facing away from the lathe bed. And the cleanest cut of all is the back cut, using the full round shoulder on the inside edge of the tool. (See photo #4.) I still get a buzz from this back cut, even after 23 years, because when you get it right with the right timber, a continuous ribbon of wood flows into the base of the flute and up the other side to hit you in the face or, if you move your head, whoever is craning over your shoulder!

You will need to stop the lathe frequently as you rough out in order to

move the rest closer. Always spin the blank by hand to make sure it rotates free of the rest before switching on the lathe again.

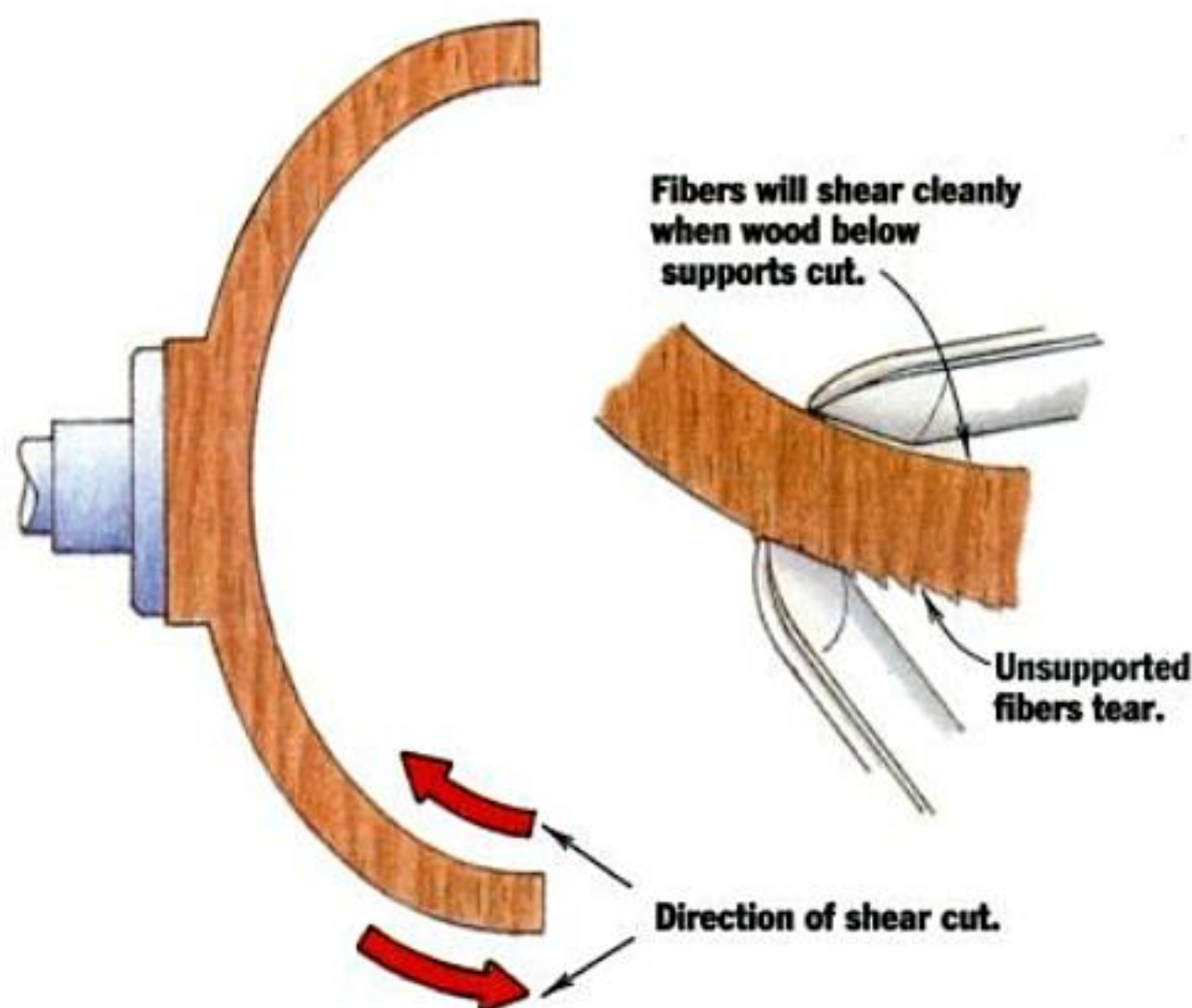
Trueing the Base

Before finishing the profile, you must true the base so it will sit flat when you reverse the bowl blank for hollowing. Start by flattening the perimeter of the base. Do this by using a shear scraping cut, which is a refined version of the profile roughing cuts. Roll the shallow gouge almost on its side (see photo #5), then squeeze your upper hand to pull the edge into the uneven surface and cut until the "tick-tick" noise disappears, indicating that you have a true surface. Once you've established a flat area, you can reverse the tool so the bevel rides on the flat, and then shear cut toward center. (See photo #6.)

For very precise control when shear scraping, have the thumb of your upper hand push against the tool, resisting pressure exerted on the blade by the fingers of the same hand. (See photo #2.) The tension created allows you to move the edge exactly where you want without the tool bouncing on the wood.

This shear scraping cut allows heaps of precision, and you can also use it to remove any small ridges on your profile curve, or on patches of twisted grain. If you take several passes that just stroke the surface, you can make little ridges and torn end grain vanish.

FIG. 2: MAKING CLEAN CUTS





To finish the profile of the bowl, use the shallow gouge, held nearly horizontal, and lightly shear cut from the bottom to the top of the bowl.

How you turn the base will depend on how you intend to mount the blank for hollowing. If you want to glue the blank to a waste block and mount that to the screw chuck for hollowing, then turn the base dead flat. If you own a three-jaw or compression chuck, you won't need to use a waste block, so leave the base slightly concave and turn a foot in the middle for gripping.

Finishing the Profile

To finish the profile, you need to use a light cut to shape a smooth and flowing curve. Hold the shallow gouge nearly horizontal and pointed in the direction you're cutting, with the bevel rubbing the wood. (See photo #7.) Now you have control of the cutting edge, because the bevel shoulder provides a secondary fulcrum from which to control the precise path of the edge as you cut.



To establish hole depth, author bores with a hand-held twist drill. Scribed marks on the drill help him determine the exact depth of the hole.

Starting this cut as you come in from space can be tricky. Pin the tool blade firmly down onto the rest using your upper hand and then, with the flute of the shallow gouge rotated away from the wood at about 45°, bring the point of the tool down through an arc into the wood by raising the handle with your lower hand. The instant that the nose of the tool enters the wood, you have a supporting surface for the bevel. With practice, you can keep the bevel rubbing and carry right on to cut the whole curve in one go.

Caution: Never attempt to use an unsupported inside edge of a shallow gouge in this situation. It will catch. (See Fig. 1.)

It would be good to stop here for a moment and offer a bit of general turning advice: Problems arise in woodturning whenever you push



When reversing the bowl for hollowing on a screw chuck, glue the base of the bowl to a waste block, then screw the block to the chuck.

the tool too forcefully into the wood. The smooth surface you start from is a point of reference against which the bevel should *rub* rather than press. If you get a bumpy surface, chances are that you started your cuts with the bevel *pushing* against an uneven surface. To eliminate bumps, you need to go back to the base of the curve and start again, aiming to go through the ridges and over the dips on a curve of your choice—not the wood's. Don't let the tool wander into the valleys, or you will magnify the problem.

Now back to our bowl. Once the surface is as good as you can get shearing with a gouge, any little ridges can be shear scraped using the shallow gouge on its side.

Don't sand at this stage, because if the job runs out of true when reversed, you might have to re-turn the profile and resand.



To hollow the interior, cut from the larger to smaller diameter, using a shear cut with the flutes facing toward center.



To prevent kickback when starting a cut from space, bring the tool down through an arc into the wood by lifting the handle and pivoting the tool on the rest.



Hollowing the Bowl

If you intend to reverse the bowl onto a screw chuck, glue a waste block onto the bowl base, using the tailstock to hold the waste block in place until the glue dries. I find cyanoacrylate glue with accelerator (available from Craft Supplies USA, 801-373-0917) is fastest. Then turn the waste block to a cylinder and drill a hole in it at center with a hand-held twist drill as shown. (See photo #8.)

The part-turned bowl is now held by the foot. (See photo #9.) Before you begin to remove the center of the bowl, true the face and particularly the rim. Then drill a hole at center to establish the internal depth. If the bowl is running slightly off cen-



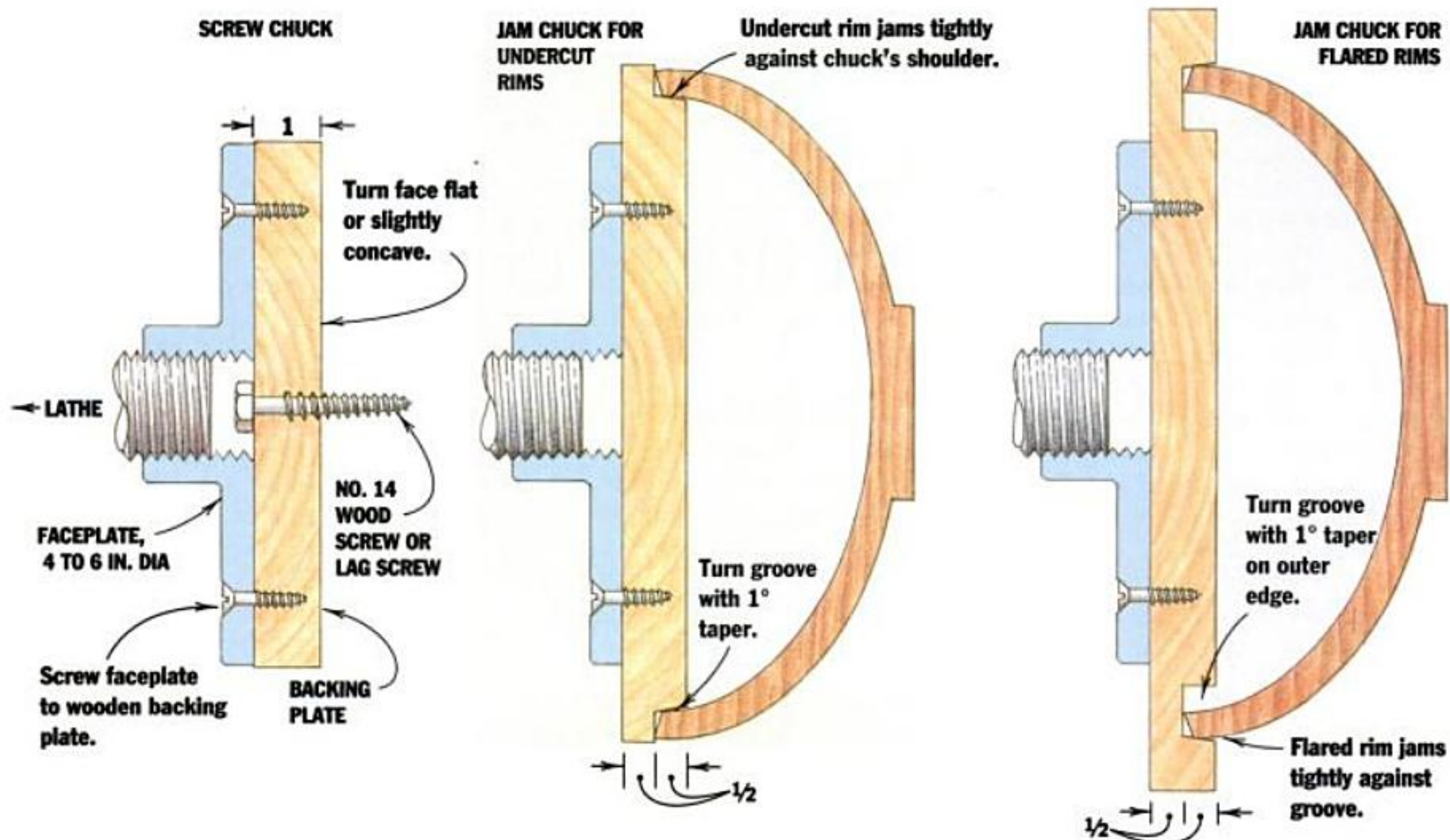
13 Finish the interior with a large scraper, swinging the tool in broad movements.

ter, true up the profile using a *very* gentle shear scraping cut.

To shear cut the interior, you work from the larger to smaller diameter (see photo #10), using exactly the same gouge techniques as those used to turn the profile. Start hollowing an inch or so out from the center, and work toward the center. After you complete each cut, move farther out from the center and take another cut. Try to keep the cuts parallel to the lathe bed and pushing toward the chuck to limit the stress on the chuck. Use as little force or pressure against the wood as possible. Deep-fluted tools are favored here because of their superior strength as you work farther out over the rest.

When starting a cut from space, begin with the tool on its side, so the

SHOP-MADE CHUCKS (SECTION VIEWS)



You don't need to buy expensive manufactured chucks to hold your work on the lathe. Traditionally, turners made their own. Here are three quick chucks that will give you years of good use.

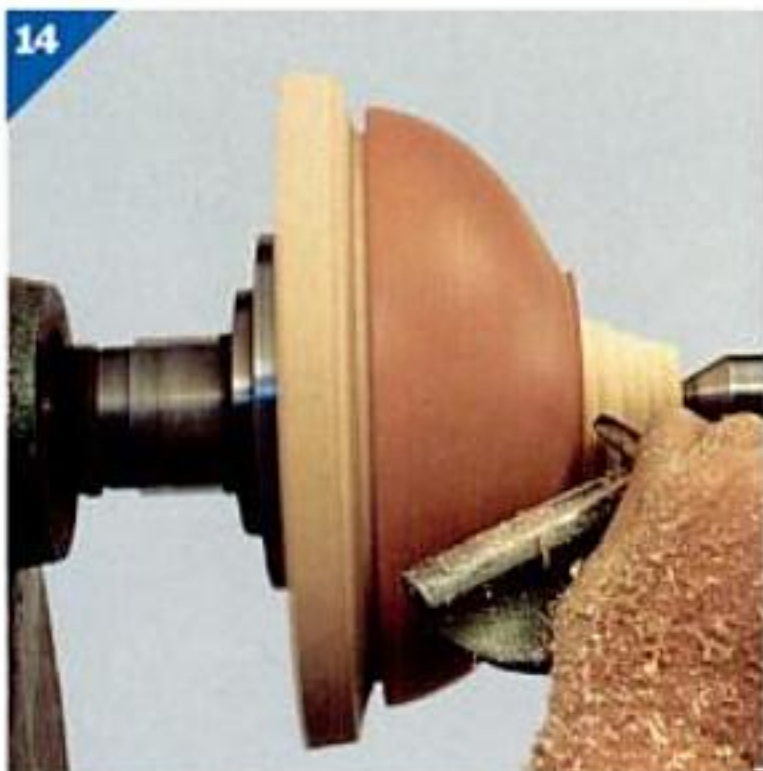
Screw Chuck—The drawing shows how this chuck goes together. To make it, screw a block of scrapwood about 1 in. thick to a faceplate. Then true the face, drill a hole with the wood on the lathe so you know it's

centered, and thread the screw through the hole.

Jam Chucks—I have dozens of jam-fit chucks and use them to hold bowls and boxes so I can turn the bases. To make a jam chuck for bowls that have flared rims, true up a disc slightly larger than the rim of the object you want to hold. Then measure the inner rim diameter of your turning with dividers and transfer the measurement to the disc.

Cut a 1/2-in.-deep groove with a slight taper on its *outside* edge—think in terms of a 1° taper so the turning will fit tightly against the chuck's shoulder.

For a bowl with an undercut rim, you need to turn a groove that has a 1° taper on its *inside* edge. Whilst you can cut these grooves using a skew chisel as a scraper, I prefer to use the 3/8-in. shallow gouge, because it's good practice. —R.R.



14 To finish the base, mount the bowl on a jam chuck, then bring up the tailstock for support and turn away the waste block.



15 For added support while finishing the base, you can use the tailstock to press the bowl into the chuck (left), or apply pressure to the bowl with your upper hand (right). In either case, make light cuts; they'll be less likely to catch.



bevel is vertical as it enters the wood. Bring the tool down through an arc into the wood and as the bevel starts to rub, rotate it slightly left to take a larger shaving. (See photos #11 and #12.) If the tool kicks back, you probably haven't got it on its side or pinned firmly to the rest.

In the event of a kickback, it may be hard to restart your cut, because the gouge will tend to catch each time it encounters the damaged wood. You can get around this by holding a skew chisel on its side and using the long point to scrape a "V" groove which cuts through the damaged area. You'll then have a smooth surface on which your gouge can ride.

On a bowl of this diameter, go for a wall thickness of about $\frac{3}{8}$ in. Thinner walls introduce a host of problems best avoided in very early bowls. Complete the rim and the first inch or so of the interior whilst there is still plenty of support from the wood below.

You can finish hollowing with gouges, but the precise shape can be difficult to control, especially as you work around the curve and into the base. I prefer to use a gouge about three-quarters of the way and then finish the job with a heavy scraper. (See photo #13.) This scraper has a flattish radius which is slightly tighter than the curve I want to make. Although you only use about $\frac{1}{2}$ in. of the scraper's edge at any time, you'll find it much easier to relate a curve like this to a broad tool than to a narrower one.

Keep the scraper flat on a rest set at about center height. Swing the tool in broad movements, going through bumps and across dips. Your cuts should be as light as possible; the goal here is to produce light shavings and fuzz, not heavy chips. Heavy cuts will risk a catch.

Also, it's best to scrape just the base of the bowl and the area you want to fair between the base and the side of the bowl. Don't bring the scraper up high on the rim; you're likely to have a catch as the side of the bowl flexes.

Sanding and Finish

In production it's common practice to use power sanding for speed, but I wouldn't recommend the expense for a single bowl. Use a flexible cloth-backed adhesive for best results, working through 100, 180, 220 grit and finer if you feel inclined. If you intend to use the bowl—which I hope you will—wear and tear will smooth it further.

With the sanding completed, I stop the lathe briefly to apply a liberal slop of cooking or mineral oil to the surface. Then I melt beeswax (available from Craft Supplies USA, 801-373-0917) into the surface by holding a block of wax against the revolving wood. Finally, I hold a cloth against the wood, building up heat which further melts the wax into the grain and removes the surplus, leaving a soft and practical finish which can be either washed or wax polished depending on how you intend to use the bowl.

Finishing the Base

In order to turn the base, you need to make a jam-fit chuck into which you fit the rim of the bowl. (See sidebar.) This chuck will grip the bowl quite easily unless you have a catch, though you might feel more secure bringing up the tailstock for support while you turn away the waste block to get to the base of the bowl. (See photo #14.) The base needs to be slightly concave to sit well. (And it will look and feel better turned and polished rather than flattened on a sander and covered with felt.)

I shape the base with little arcing cuts, using the nose of a $\frac{3}{8}$ -in. shallow gouge with a long, fingernail-ground edge. If you prefer to work without the tail support, take shear cuts whilst holding the bowl on the chuck with your upper hand. (See photo #16.)

If you keep the tail support in place right through, sand and oil everything you can get at and remove the last little bit of rough wood by hand with the bowl off the lathe. Loosen the bowl on the chuck by tapping the back of the chuck with a blunt instrument. The lathe wrench usually comes to my hand, but a hammer can be just as effective. ▲

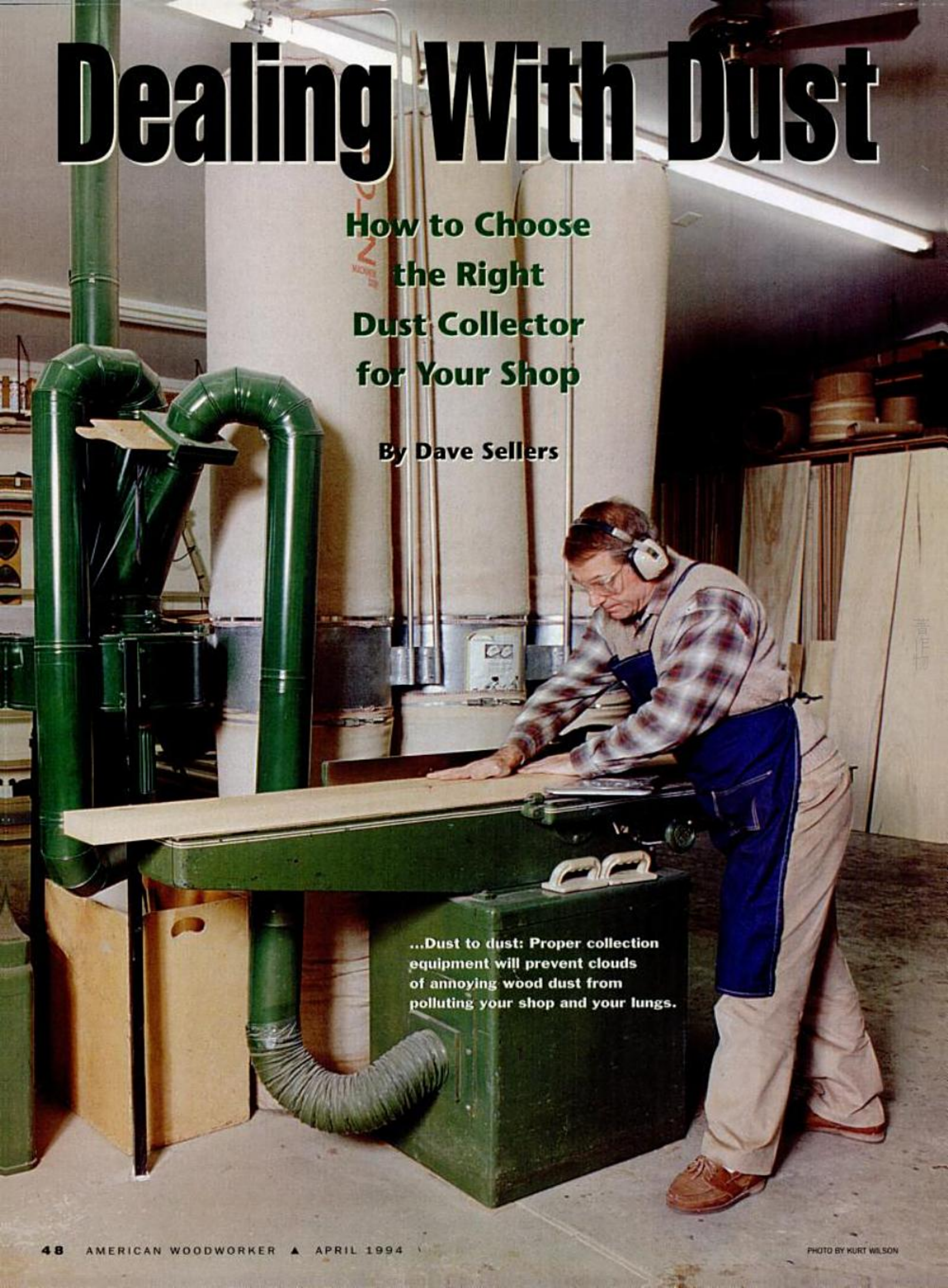


RICHARD RAFFAN lives in New South Wales, Australia and is the author of the *Turning Wood with Richard Raffan* book and video (both from Taunton Press, Box 355, Newtown, CT 06470).

Dealing With Dust

**How to Choose
the Right
Dust Collector
for Your Shop**

By Dave Sellers

A woodworker wearing safety glasses and large earplugs is operating a green planer. A large green dust collector is attached to the planer, with a flexible grey hose leading from the bottom. The workshop background shows various wood materials and equipment.

...Dust to dust: Proper collection equipment will prevent clouds of annoying wood dust from polluting your shop and your lungs.

Though I sweep up my basement workshop and run my old shop vacuum frequently, every surface I can't reach easily has a layer of dust thick enough to write my name in. What's worse, this dust somehow permeates my house all the way to the second floor. It's clear that like many woodworkers, I'd profit from a dust collection system, but until recently I was reluctant to spend the money.

Then a phone conversation I had with noted woodworker Frank Klausz convinced me I'd put off buying a collector long enough. "It's difficult for woodworkers on a budget to justify spending their hard-earned money for a machine that doesn't work wood," Frank observed. "But a good dust collector will make your shop cleaner and more pleasant to work in, help keep your finishing work dust free, and protect your health as well."

Frank's right. A dust collector can make woodworking a lot more enjoyable *and* a whole lot healthier. Wood dust has been implicated in a host of health problems, from frequent colds and dermatitis to sinus problems and bronchitis. (See sidebar, page 52.)

If you've decided to invest in a dust collector, there's good news: There's a wide variety of affordable equipment on the market. But to pick the right unit for your shop you need to look at the amount of dust you generate, buy equipment that's sized to handle that dust, and set up the equipment correctly so it will operate at peak efficiency. To help you deal with these issues, on the following pages I'll talk about the options for dust collection and explain how to size a system for your shop. But first let's talk about the core of the problem, the dust itself.

All Dust Is Not Created Equal

Woodworking machines produce a wide range of debris, from shavings and big chips to sanding dust so small it's invisible to the naked eye. Most dust collectors can generate the high volume of air flow (measured in cubic ft. per minute, or CFM) needed to gather the largest debris. But units vary in their ability to filter out the tiny particles that pose the greatest health hazard. (See sidebar, page 52.)

This variation is tied to the filter bag that comes with the collector. The average filter bag only traps dust down to about 50 microns, with the rest escaping back into the air you breathe. To capture the most dangerous dust—dust smaller than 10 microns (or about 0.00004 in.) in size—you need a unit equipped with a super-efficient dust bag with very fine pores.

Recently some manufacturers have responded to the need for better dust collection by offering filter bags made from knit polyester or felt. These bags, which cost up to \$50 each—or about two to three times more than standard bags—can capture particles as small as 5 microns. (Special-order bags are available that can filter particles as small as 0.3 microns.) (See Sources, page 52.) If you're concerned about capturing fine dust, check the micron rating for the bags that come with the machine you're interested in. The information should be in the ad for the machine, or you can contact the manufacturer directly. If the maker can't supply this information, look for another brand that can.

Types of Dust Collectors

There are four basic options for dust collection: shop vacuums, single stage blower-and-bag collectors, two-stage blower-and-bag collectors, and cyclone pre-collectors. Each machine is portable enough to be used as a roll-around collector, and the last three either can be set in a central spot and connected to your machines with flexible hose or located out of sight and sound and connected to your machines through permanent ducts. (See "Designing a Central Dust Collection System," page 53.) Let's look at the pros and cons of the various collectors:

Shop vacuum cleaners offer dust collection at its most basic level. They're the cheapest type of dust collector you can buy, but they're really best used to *clean up* dust rather than to *capture* it at its source. That's because shop vacuums are designed to move a small volume of air (typically around 100 CFM) through a small hose (usually 1½ or 2½ in. dia.). This generates plenty of suction to pick up dense objects like nails, small blocks of wood and even water. But the low volume of air flow and the size of the hose means they can't handle a large quantity of shavings and chips without clogging up.

SHOP VACUUM

PROS

- ❖ Good as light-duty collector for small tools and machines.
- ❖ Easy to roll around shop.
- ❖ Least costly option.

CONS

- ❖ Can't handle heavy volume of chips.
- ❖ Universal motor is noisy and relatively short-lived.

PRICE RANGE

- ❖ \$50 to \$500



PHOTO COURTESY OF BOSCH

Also, shop vacuums are powered by universal brush-type motors, which are noisier and have a shorter life than the induction motors found on dedicated dust collectors.

In spite of these limitations, a shop vacuum can work well for light-duty dust collection, particularly from portable power tools like routers and random-orbit sanders, and from small stationary tools like scroll saws.

Single-stage blower-and-bag dust collectors are the next step up in cost from shop vacuums. These units are powered by induction motors and move high volumes of air (typically 400 to 1800 CFM) at high velocities. This gives them the power to pick up large quantities of dust and chips. And depending on the volume of air flow they generate and how you use them, they can be powerful enough to run a central dust collection system.

Single-stage collectors commonly have two dust bags, one atop the other. (See photo, page 50.) The easily removable bottom bag collects larger debris, and the top and bottom bags together provide a large filtering area. Some units have two pairs of bags to handle the extra air flow from larger-volume collectors.

Single-stage collectors are available in several configurations, including this unit with a horizontal bag that's easier than most to move around the shop.



PHOTO COURTESY OF WOODWORKER'S SUPPLY

Single-stage collectors are usually mounted on dollies, so they can be rolled around the shop for connecting to individual machines. Generally, collectors with higher-HP motors can move the most air, but this is a murky area since manufacturers' HP ratings aren't always accurate. I'd advise judging a collector by the CFM ratings. (See story on page 53.)

One of the major disadvantages of single-stage collectors is that they draw all dust, chips and debris directly through

the blower at high speed before expelling the waste into the collector's dust bags. (See drawing, below.) This means you have abrasive particles and chips striking the impeller, blower housing and dust bags, causing wear and tear. (You can get around this problem by building a simple plywood "bin" similar to that shown in the drawing of the two-stage collector below.) Also, there's a slight risk that a metal object could strike a steel impeller, causing a spark that could ignite the fine dust in the collector.

Two-stage blower and filter-bag dust collectors cost slightly more than their single-stage cousins, but they operate much the same. The major difference is that before the incoming stream of air and debris passes through the blower, it enters a large drum which acts like a separator. (See photo and drawing, below.) Here, metal objects and larger wood particles are deposited into the drum by momentum and gravity. So, only dust below about 100 microns (about the diameter of a human hair) passes through the fan and

SINGLE-STAGE BLOWER-AND-BAG COLLECTOR

PROS

- ❖ Collects large volume of dust and chips.
- ❖ Can power central dust collection system.
- ❖ Induction motor is quiet and long-lived.
- ❖ Least costly of true dust collectors.

CONS

- ❖ Debris passing through blower can wear or damage blades.
- ❖ Filter bag fills quickly, reducing filtering efficiency.
- ❖ Bulky units may be hard to maneuver around shop.

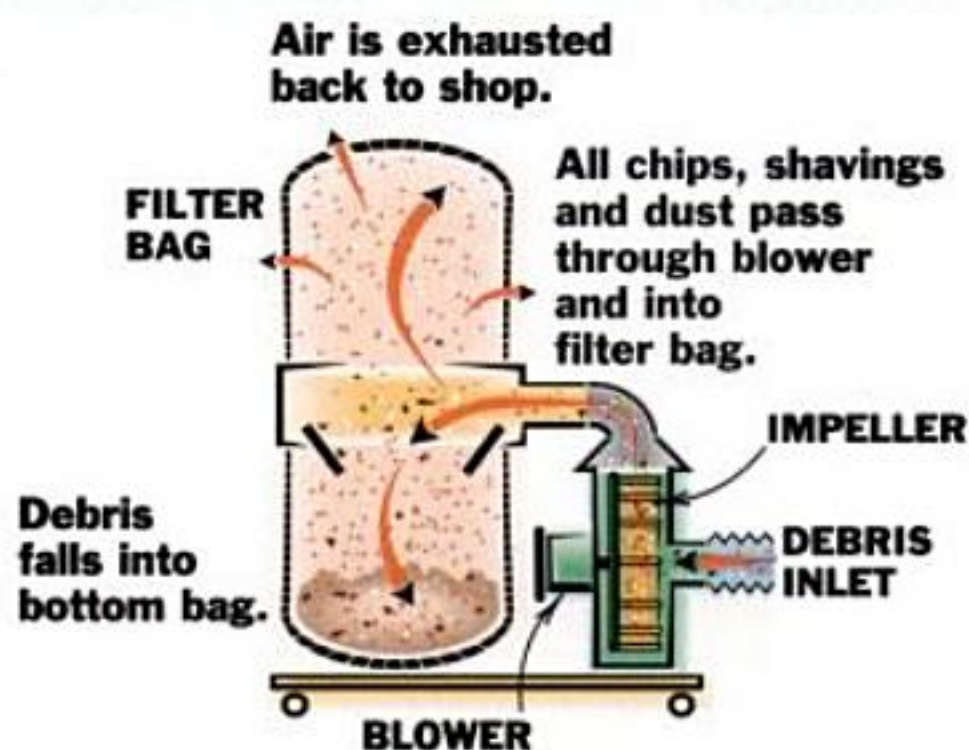


PHOTO COURTESY OF GRIZZLY

PRICE RANGE

- ❖ \$200 to \$600

HOW A ONE-STAGE COLLECTOR WORKS



TWO-STAGE BLOWER-AND-BAG COLLECTOR

PROS

- ❖ Collects large volume of dust and chips.
- ❖ Separates heavy debris before air passes through blower, reducing wear.
- ❖ Can power central dust collection system.
- ❖ Induction motor is quiet and long-lived.

CONS

- ❖ Must lift off heavy blower housing to empty waste drum.
- ❖ Bulky units may be hard to maneuver around shop.
- ❖ Costs more than a single-stage collector.

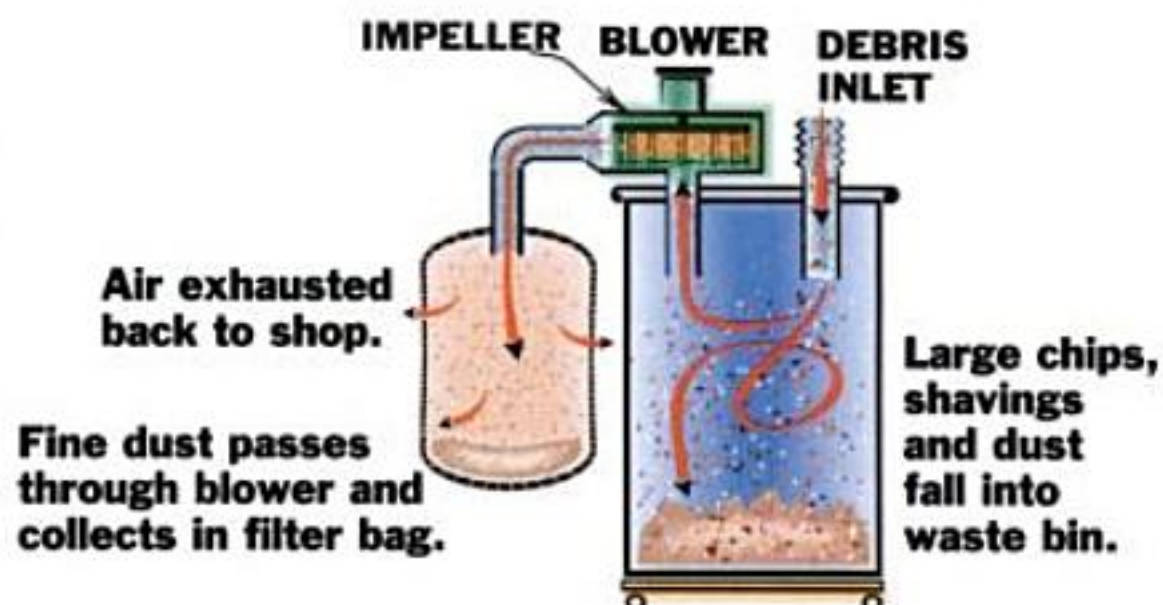


PHOTO COURTESY OF DELTA

PRICE RANGE

- ❖ \$300 to \$800

HOW A TWO-STAGE COLLECTOR WORKS



into the dust bag. This reduces wear and tear on the blower, and since less debris reaches the filter bag, it works more efficiently.

Besides slightly higher cost, the only down side to two-stage collectors is having to lift the heavy blower housing off the waste drum to empty it.

Cyclone pre-collectors (see photo, below) act like super-efficient two-stage collectors and have been used in industry for years. Only recently, though, have they caught on for small shops. (Cyclone pre-collectors are available from AGET, Murphy Rogers, Oneida Air Systems, and Torit. [See Sources, page 52.](#))

In these collectors, the air stream first enters a tall metal "cyclone" housing where the debris is spun around in a vortex as it drops down the cone-shaped sides. (See drawing, below.) This cyclone's action separates up to 98 percent of the debris (by weight) and deposits it in the waste container below. Then the air stream reverses direction to

exit through the top of the cyclone, where only the finest dust (below about 20 microns) passes through the blower and into a filter bag.

Since the bags only have to filter the smallest dust, you can use bags with the finest pores to capture the tiniest particles efficiently (down to 1 micron on Oneida Air Systems' units). The downside to cyclone pre-collectors is they're more expensive and larger than the simpler collectors.

Other Options

Beyond the basic options for coping with dust, there are the following strategies, which aren't strictly dust collection "systems" but still offer some relief from dust.

Recirculating air filters (see photo, below) work constantly to remove fine dust from the air. The units have a blower and a pair of filters, and they are usually installed on the shop's ceiling, near the dust source.

Depending on the unit and the filters, recirculating air filters can capture dust down to 0.3 microns. But they can't capture dust at its source, so you still need to remove large chips and shavings. Also, they filter the dust *after* it enters the air, so you'll end up eating a fair amount of dust before the machine can trap it. For these reasons you're best off using a recirculating filter in tandem with a regular collector.

The systems start around \$300 for a simple two-filter model that's sized for a 400-square-ft. shop. Larger, more

CYCLONE PRE-COLLECTOR

PROS

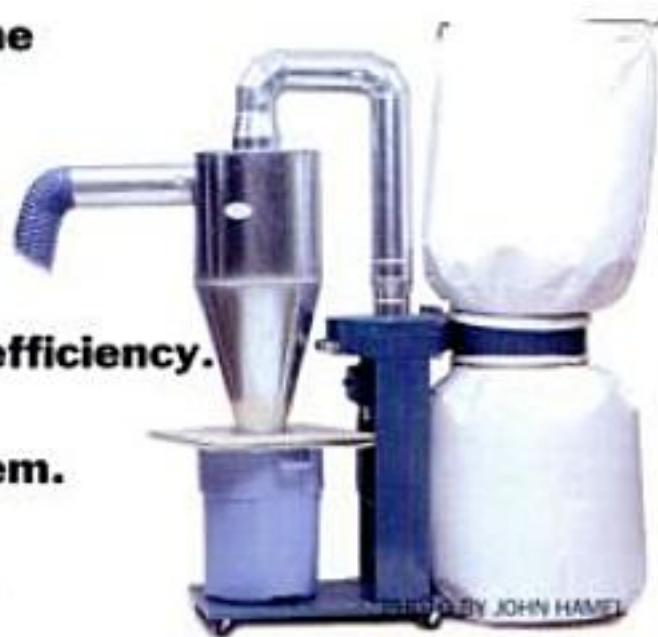
- ❖ Collects large volume of dust and chips.
- ❖ Cyclone captures up to 98 percent of debris, reducing wear on blower and increasing filtering efficiency.
- ❖ Can power central dust collection system.
- ❖ Induction motor is quiet and long-lived.

CONS

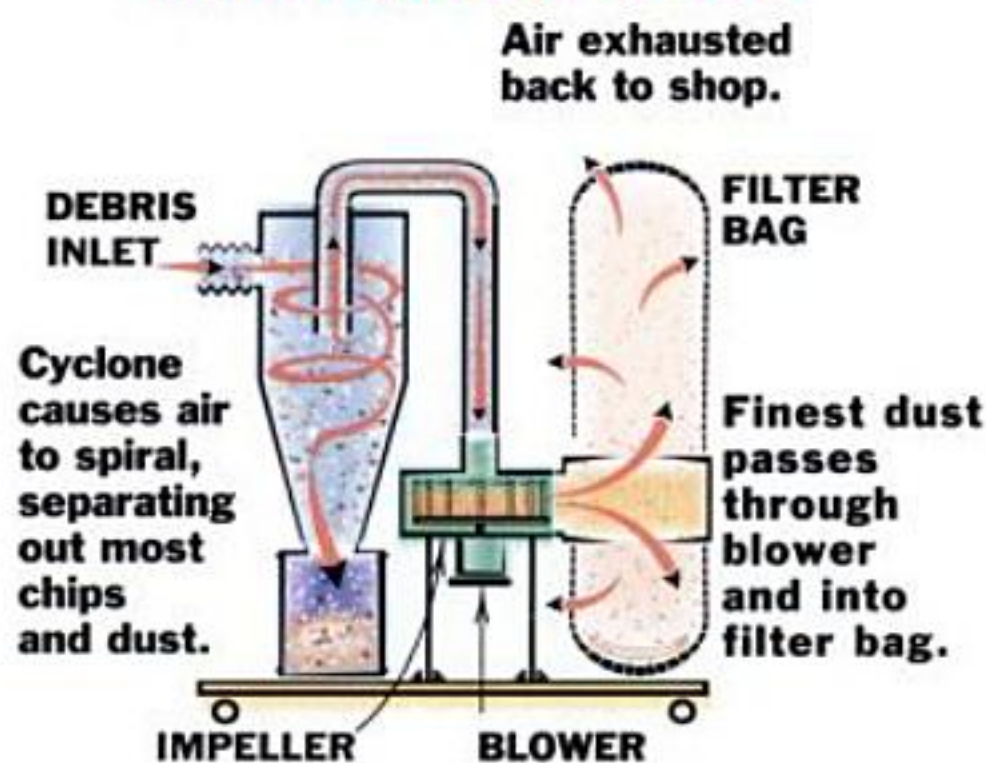
- ❖ Must lift off cyclone to empty waste container.
- ❖ Bulky units may be hard to maneuver around shop.
- ❖ Most expensive option.

PRICE RANGE

- ❖ \$450 to \$1,500



HOW A CYCLONE WORKS



For best dust protection, you can supplement a collector with a ceiling-mounted recirculating air filter, which can remove dust that eludes the standard dust collector's bag.



PHOTO COURTESY OF PENN STATE INDUSTRIES

efficient double-filter units and electrostatic precipitators (devices that use static electricity to attract the dust to charged plates) can cost up to about \$1,200.

Shop-made dust filters—You can make an inexpensive recirculating air filter system from a furnace blower and furnace filters. (See AW #14.) A system like this will only handle the coarsest of dust, but if cost is more important to you than efficiency, this is an option to consider.

Recommendations

So which kind of collector should you buy? I wish I could make a simple, blanket recommendation, but it really depends on factors like how much you can afford to spend, your sensitivity to dust and the type of work you do most frequently. Here are some general recommendations:

- Buy a collector with a large enough CFM to handle your biggest dust-producing machine. (In most cases this is your planer.) If you intend to use more than one machine at a time, or if you plan to expand the system in the future, you'll need to size your collector to handle the total of the CFM ratings of the machines you'll be using simultaneously. (For more on sizing a system, see page 53.)
- I prefer a two-stage collector over a one-stage because pre-separating the larger debris allows the filter bags to

HEALTH RISKS FROM WOOD DUST

By R. Harold Imbus, M.D., Sc.D.

Most woodworkers know that dust is a major nuisance in the shop. But how many realize that excessive exposure to wood dust poses a health risk as well?

Frequent exposure to large amounts of wood dust can lead to sinus and lung problems, or worse. And it's the finer dust particles—those smaller than 10 microns—that are the most hazardous. To put that size in perspective, consider that a human hair is about 100 microns thick, while airborne dust particles smaller than about 20 microns are invisible to the naked eye.

How Dust Affects Us

Our lungs have a built-in cleaning system that works efficiently under most conditions to protect delicate tissues from the damage fine dust causes. The trouble starts when your respiratory system must deal with large amounts of "respirable dust" (below 10 microns). Heavy exposure to this dust can overwhelm the natural defenses and lead to inflammation and swelling of the airways, which cause symptoms such as shortness of breath, increased sputum and coughing, frequent colds, nosebleeds, sinus trouble or bronchitis.

Also, wood dust may contain allergens and toxins such as pesticides, fungi (molds) and chemicals which can trigger allergic reactions. (Many tropical hardwoods can be especially irritating, and Western red cedar can cause allergic asthma.)

How Much Dust Is Too Much?

In an industrial setting, it doesn't take much dust to be considered harmful by OSHA. Their current regulations limit dust concentrations in air to an amount equivalent to about three teaspoonfuls dispersed in an 800-square-ft. shop with a 10-ft. ceiling.

But in the home shop, if you only work a few hours a week and don't do a lot of sanding or other operations that produce fine dust, you probably don't have too much to worry about. On the other hand, if you spend long hours in the shop several times a week doing a lot of cutting and sanding without adequate dust collection, you may be at risk for respiratory disease.

What You Can Do

A dust collector fitted with highly efficient bags will be able to capture much of the dangerous dust down to 5 microns, so this is your best form of protection from the general problem of dust. If you have particular allergies or severe reactions to wood dust, try augmenting your dust collector with a recirculating air filter (see main article), or a PAPR (Powered Air Purifying Respirator), also known as a dust helmet. (See AW #33.) The best of these can filter out dust down as small as 0.03 microns.

I don't recommend cheap paper-filter dust masks as protection, but they're better than nothing if you can get one to fit well. (They don't work with beards.) If you plan to use a disposable mask, choose the kind labeled for toxic dust, instead of one labeled for nuisance dust.

Finally, if you develop any of the symptoms of excessive wood dust exposure listed above, I'd advise you to see a physician knowledgeable in occupational medicine.

DR. IMBUS is a board-certified physician in occupational medicine who acts as a consultant to the woodworking industry.

work more efficiently and not fill up as fast.

- If you're highly sensitive to dust or if you're concerned about its long-term health effects, look for a collector with filter bags that will trap dust down to 5 microns or smaller.

- Whenever possible, buy the largest filter bags available for a collector. (See Sources, below, for extra-large bags.) Many collectors come with undersized filter bags that constrict air flow. A rule of thumb is that the bag's fabric area in square ft. should equal the system's CFM rating divided by 10. (For more information on interpreting manufacturers' CFM ratings, see page 53.)

Once you've chosen a dust collector, you can improve its efficiency by following these tips:

- Empty waste bins and filter bags when they are half-full. The closer a bag is to empty, the more usable filter area it will have and the better it will filter dust.

- Construct dust collection hoods for your machines and place them as close as possible to blades and cutters to help focus suction on the dust.

- Improve suction by sealing the bases of enclosed machines like cabinet saws and plugging holes or seams with strips of old rubber inner tube, weather stripping or duct tape.

- Improve suction on portable power tools by buying and using the optional vacuum ports many manufacturers offer. ▲



DAVE SELLERS is an assistant editor of AW.

SOURCES

Dust collectors are available from the following sources:

AGET

(517) 263-5781
Circle #606

DELTA INTERNATIONAL

(800) 438-2486
Circle #607

ENLON

(800) 888-9697
Circle #608

GRIZZLY

(800) 541-5537
Circle #609

HITACHI POWER TOOLS INC.

(404) 925-1774
Circle #610

JET

(206) 572-5000
Circle #611

MAKITA USA INC.

(714) 522-8088
Circle #612

MURPHY ROGERS

(213) 587-4118
Circle #613

ONEIDA AIR SYSTEMS

(315) 476-5151
Circle #614

PENN STATE INDUSTRIES

(800) 377-7297
Circle #615

POWERMATIC

(615) 473-5551
Circle #616

THE SANDING CATALOG

(800) 228-0000
Circle #617

SHOPSMITH

(800) 543-7586
Circle #618

SUNHILL

(800) 929-4321
Circle #619

TORIT

(800) 365-1331
Circle #620

TREND LINES

(800) 767-9999
Circle #621

WILKE

(717) 764-5000
Circle #622

WOODWORKER'S SUPPLY

(800) 645-9292
Circle #623

Air recirculation systems are available from:

AIR PURIFIERS INC.

(201) 586-3988
Circle #624

CRAFT SUPPLIES USA

(801) 373-0917
Circle #625

PENN STATE INDUSTRIES

(800) 377-7297
Circle #626

TOTAL SHOP

(800) 845-9356
Circle #627

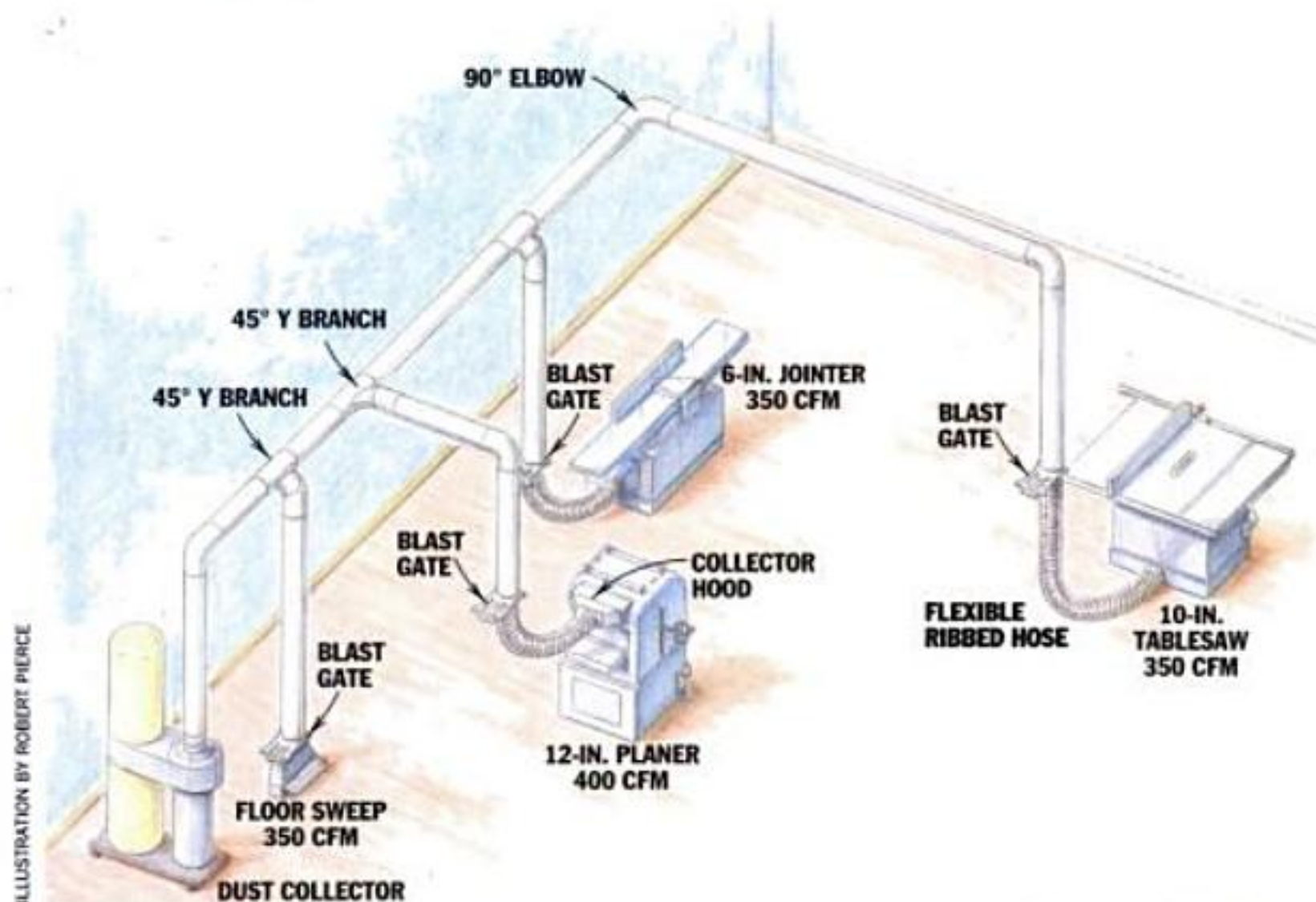
High-efficiency and oversize filter bags are available from:

ONEIDA AIR SYSTEMS

(315) 476-5151
Circle #614

DESIGNING A CENTRAL DUST COLLECTION SYSTEM

BY DAVE SELLERS



A well-designed system: The machine with the greatest air flow requirement (CFM) is closest to the collector; duct runs are as short as possible and are connected with "Y" fittings or elbows instead of "T" fittings. Duct runs are grounded to the machines and the collector. Blast gates regulate air flow at each machine so only the branch in use is open.

A central dust collection system is permanently connected to each machine and conveys sawdust and chips through metal or plastic ducts to a central collector.

Convenience is the biggest advantage of a central dust system. It's always there when you need it. Noise reduction is another potential advantage—the collector can be placed in a soundproof enclosure or even outside the shop. On the minus side, a central system requires more planning, time and money than a roll-around unit. And the installation is fairly permanent—once you've installed all the ductwork, rearranging machines is a hassle.

This article will walk you through the basics of designing a simple small-shop system—ductwork, blast gates, collectors and dust hoods. Entire books have been written about the fine points of engineering a system, and you can jump in really deep if you want to. Let's start by looking at the components you'll need for a system.

The Dust Collector

A dust collector is the heart of a central system. Single-stage, two-stage and cyclone collectors all can be used for a central system. Each type of collector has its pros and cons. (See "Dealing With Dust," page 48.) The important thing is to get one that's powerful enough to handle the load in your particular system.

Dust collectors are rated by the volume of air they can move (measured in cubic ft. per minute—CFM) at a given *static pressure* (measured in "inches of water"). Static pressure is a measure of the resistance to air flow caused by friction and turbulence in the ductwork and fittings. The more twists, turns and junctions your duct setup has, the more power (CFM, not simply horsepower) you'll need to ensure adequate air flow.

One approach to sizing a collector is to go out and buy the most powerful one you can find, figuring you'll have power to spare. A more scientific

approach is to determine collector capacity by making a few simple calculations based on the machines and the ductwork you plan to use in your system. (See sidebar, page 54.) This way, you don't pay for more power than you need.

Reality Check! Manufacturers of industrial-quality dust collectors can provide CFM and static pressure specs for their machines. Unfortunately, catalogs for many "home-shop" dust collectors don't list CFM and static pressure (SP) realistically. They'll list the collector's maximum or "free-flow" CFM with no resistance at all (when it's not connected to a duct system—0 SP), and they'll list maximum static pressure with the inlets blocked so no air can flow (0 CFM). Some don't even list static pressure at all.

The key to a realistic rating is the symbol "@." For example, the rating, "500 CFM @ 8 in. SP" tells you what that blower will deliver under real load conditions. Don't be misled by CFM and SP ratings that were taken separately.

If you can't verify from a catalog or the manufacturer that the ratings are simultaneous, it's safe to assume that the collector will deliver about *half* the CFM listed when it's actually connected to a system.

Ductwork: Plastic or Metal?

Plastic Pipe—Many woodworkers use Schedule 20 PVC plastic drainpipe for ductwork because it's easy to find, inexpensive, and easy to assemble.

The major drawback to plastic pipe (as well as flexible plastic hose) is the danger of static electrical charges, which build up as dust particles rub against the pipe walls. Electrical discharges can ignite the dust in the pipe, starting a fire or an explosion.

WARNING: To avoid the risk of fire, you must ground plastic pipe ductwork or plastic flex-hose ductwork by running a bare copper wire (16 gauge is adequate) inside all pipes and grounding it to each machine frame and the dust collector. The machines, in turn, must be properly grounded. If in doubt, consult an electrician. You can splice ground wires together where two ducts intersect by fishing the ends of the wires through small holes in the pipe, and connecting the wires *outside*

the pipe. Some sources recommend spiraling a second bare copper ground wire around the outside of the ductwork as well, for extra protection.

Metal Pipe—Metal pipe eliminates the grounding hassle of plastic pipe. (Insurance companies require metal pipe in industrial shops.) You still have to ground metal duct to the dust collector and machines, but since metal is a conductor, a short ground wire from the ends of the pipe will do.

Galvanized stovepipe from the hardware store or galvanized heating duct in 24 to 28 gauge are the least expensive types of metal duct. Slightly higher in cost is "snap-lock" galvanized pipe (available from Wilke and from

Woodworker's Supply; see Sources, opposite page). This is convenient because a wide range of fittings are sold by the same dealers.

The premium choice for metal ductwork is 22-gauge "spiral" galvanized pipe (available from Air Handling Systems and Arrowsmith & Lang-Borne; see Sources). Spiral pipe is the only duct material which meets OSHA's requirements for production woodshops. It has smooth internal walls for less friction and is available with a wide variety of (expensive) fittings.

Flexible Hose—Flexible plastic hose is great for connecting duct runs to machines, but keep these runs as short as possible to minimize friction.

Ribbed, flexible hoses produce 50 percent more friction than smooth duct.

Hoods, Fittings, Blast Gates and Switches

Dust Hoods—Mail-order catalogs offer a variety of manufactured hoods for jointers, tablesaws, planers and other machines (see Sources) but some situations require custom-made hoods. A local sheet-metal shop can make what you need, or you can make them yourself from sheet metal or plywood.

Fittings—Dust collection equipment suppliers carry a range of fittings for connecting branch ducts to main ducts and joining ducts of different diameters. Avoid "T" fittings when connecting

DESIGNING YOUR SYSTEM

Design Principles

To design an effective central dust collection system, you need to determine:

- Machine layout and plan for the ducts including the number of fittings and blast gates.
- The proper diameter for the ducts.
- Required dust-collector capacity (CFM).

To properly size your ductwork and collector, you need to consider three variables:

- Air volume, measured in cubic ft. per minute (CFM):

Each woodworking machine requires a minimum air volume to collect chips and debris effectively. Minimum CFM ratings for typical small-shop machines are listed in Table 1.

- Air velocity, measured in ft. per minute (FPM):

Air velocity in the duct should be at least 3,500 FPM to keep wood chips and dust suspended in the air flow, so they don't drop out and clog the duct.

- Air friction, called "static pressure" (SP) and measured in in. of water: Air flow and dust will be slowed by friction from the duct walls and from fittings like elbows and Y's. This friction, or *static pressure*, represents the amount of resistance to be overcome by the dust collector.

To determine the total resistance of your system, you need to add up all the static pressure from the straight duct, fittings and flexible hose. Static pressure for straight duct is given in Table 2. Static pressure for fittings and ribbed hose is given in Table 3.

STEP 1: Determine the minimum required CFM for each machine in your system from Table 1. (See opposite page.)

STEP 2: Sketch the layout of your system, showing the location of the machines, the dust collector, and the ductwork and fittings. Place the machines with the highest CFM rating nearest to the dust collector. Make the duct runs as short as possible, and try to keep the number of elbows, Y's and other fittings to a minimum. Plan for floor sweeps and any machines you might want to add in the future.

STEP 3: Determine the diameter of your ducts. If you will be running only one machine at a time, plug the highest CFM requirement you selected from Step 1 (usually the planer) into the following equation:

$$\text{Dia. (in.)} = \sqrt{\frac{(\text{CFM} \times 183)}{3,500}}$$

Round the result to the closest standard duct diameter (4 in., 5 in., 6 in., etc.). If possible, try to use the same diameter duct for all duct runs.

If you plan to run more than one machine at a time, add up the CFM requirements for the

ducts. Elbows or "Y" fittings create less resistance to air flow.

Blast Gates—Blast gates provide a means of closing off branches of the system when they aren't in use. You can buy blast gates ready-made in aluminum or plastic, or make your own from sheet metal or wood. (See AW #24, page 50.)

Switches—There are lots of options for switches. The power switch on the collector motor will suffice, or you can wire the collector into a nearby wall switch to cut down on steps.

A neater approach is to wire the collector to the machine switches themselves, so the collector starts up when you switch on a machine.

One of the nicest solutions I've seen is to install a low-voltage system that switches on the dust collector motor when you open a blast gate. To do this, you need a 12- or 24-volt transformer, a low-voltage relay and a magnetic switch on the dust collector, and low-voltage micro-switches on the blast gates. (See AW #24, page 50.)

If you're into high tech, you could rig up a radio-controlled switch similar to those used on garage-door openers, or buy such a system ready-made (see "Tool Box," page 84).

Once you have an idea of how you want to set up your system, it's a simple matter of planning it on paper. The sidebar below shows you how. ▲

SOURCES

Components for central dust collection systems are available from the following companies:

AGET Circle #606	(517) 263-5781
Air Handling Systems Circle #628	(800) 367-3828
Arrowsmith & Lang-Borne Circle #629	(800) 544-4283
Cincinnati Fan Circle #630	(513) 573-0600
Delta International Circle #607	(800) 438-2486
Grizzly Imports Inc. Circle #609	(800) 541-5537
Highland Hardware Circle #631	(800) 241-6748
Jet Equipment & Tools Circle #611	(206) 572-5000
The Sanding Catalog Circle #617	(800) 228-0000
Sunhill Machinery Circle #619	(800) 929-4321
Wilke Machinery Co. Circle #622	(717) 764-5000
Woodworker's Supply Inc. Circle #623	(800) 645-9292

machines that will be running together, and plug that number into the equation. Chances are, you'll need to go with a 6- to 8-in.-dia. main duct and smaller-diameter branch ducts. (For complicated systems like this, we recommend consulting with a local dust-system specialist.)

STEP 4: Determine the static pressure loss (friction loss) for each branch in the system. (A branch is the length of duct running from each machine back to the collector, including the common "trunk" duct.)

A) Working with one branch at a time, add up all the lengths of straight duct in the branch.

B) Next, determine the equivalent length of straight duct for each fitting and flexible hose run in the branch from Table 3. (Example: A 4-in.-dia., 45° branch fitting is equivalent to 5 ft. of 4-in.-dia. duct.)

C) Add the fitting and flex-hose equivalent lengths to the lengths of straight duct to get a *total equivalent length* of straight duct for each branch.

D) Finally, multiply the total equivalent length for each branch by the *static pressure per ft. of straight duct* from Table 2. This gives you the total static pressure loss for each branch (measured in in. of water). As a safety margin,

add 1 in. of extra static pressure to the total for each branch, to account for dirty filter bags and internal friction in the collector.

STEP 5: Select a dust collector rated to meet or exceed the CFM requirements of the most demanding machine on the system (usually the planer) at the highest static pressure loss you calculated for any one branch (assuming you'll run one machine at a time).

Example: Step 4 determines that the longest branch in your system has a static pressure loss of 5.27 in. The planer in your shop requires a minimum air flow of 500 CFM (from Table 1). You would select a dust collector rated to move at least 500 CFM at a static pressure of 5.27 in. or above. Oversizing the collector doesn't hurt.—D.S.

TABLE 1

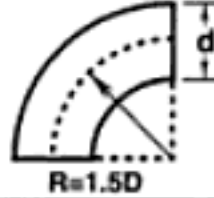
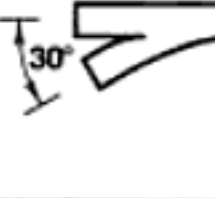
Machine	Required CFM
Planer, up to 12 in.	400
Planer, 13 to 20 in.	500
Spindle Shaper	400
Bandsaw	300
Radial Arm Saw	350
Tablesaw	350
Jointer, 4 to 12 in.	350
Disc Sander, up to 12 in.	300
Stationary Belt Sander	300
Floor Sweep	350
Lathe	500
Drill Press	300
Jig Saw	300

TABLE 2

Static Pressure (in. per ft.) of Straight Duct	
Dia.	@ 3500 FPM
3 in.	0.075 in.
4 in.	0.055 in.
5 in.	0.042 in.
6 in.	0.035 in.
7 in.	0.026 in.
8 in.	0.022 in.

TABLE 3

Equivalent Lengths for Fittings (in ft.)
(Equivalent length for flexible hose = 1.5 x actual length.)

				
Duct Dia.	90° Elbow, R = 1.5 x dia.	90° Elbow, R = 2.0 x dia.	45° Branch	30° Branch
3 in.	5	3	3	2
4 in.	6	4	5	3
5 in.	9	6	6	4
6 in.	12	7	7	5
7 in.	13	9	9	6
8 in.	15	10	11	7

NOTE: Equivalent length for 45° elbows = 0.5 x length for 90° elbows.



With woodworking techniques and machines from the 19th century (see inset), the Blue Ox Millworks proves you can make a living by drawing on the past. Here, owner Eric Hollenbeck puts a massive lathe to good use turning a 10-ft.-long porch support.

FINDING A FUTURE IN THE PAST

BY SIMON WATTS

Eric Hollenbeck Proves You Can Make Money the Old-Fashioned Way: With 19th-Century Machines and Skills

Eric Hollenbeck has two passions in life: one for early woodworking machines and the other for preserving the skills it takes to run them. He and his wife and business partner, Viviana, have combined these two themes beautifully at Blue Ox Millworks, their company in Eureka, California, that specializes in replicating 19th-century wooden moldings, gutters, balusters and the like.

A tour of Blue Ox Millworks is an education in the old ways of industrial



PHOTOS BY PATRICK CUDAHY

woodworking. From a visitors' gangway above, one looks down into a cavernous shop filled with machines from the 19th and early 20th centuries. Here, apprentices and journeymen are turning out decorative parts for Victorian houses, using the same skills woodworkers did 100 years ago.

The machines range in age from a 130-year-old tenoner to a giant 1940s-era resawing bandsaw with a 4-in.-wide blade and a 36-in. throat. Eric salvaged each machine from the scrap pile, and

every one has a unique history. Take the monster at right. Eric found what he thought was a junked "planer" rusting away in some blackberry bushes and spent a year disassembling, moving and setting it up at his site. As he was about to try it out, providence intervened: A stranger walked into the yard, looked over the machine and remarked that it could never plane wood, because it wasn't a planer at all, but a molding machine!

It turned out the stranger—a Mr. Chenelly—had spent his entire working life grinding specially profiled knives for such machines, and rather than see his life's work sold off as scrap when he retired, he'd kept a couple thousand knives. Chenelly agreed to give Eric everything if he would promise to use the knives—a condition Eric gladly met. Today, the knives are part of a collection of more than 3,000 that are custom-cut to match the old millwork profiles Eric and his workers produce.

Like the molder, most of Eric's dozen or so machines are industrial-age giants. There's a huge lathe—17 ft. between centers—a drum sander, planers and jointers, a shaper and an



This massive Hermance molder, vintage 1912, will shape profiles on four sides of a piece of wood at once.

ingenious tablesaw fitted with twin arbors and two saw blades—one for cross-cutting and the other for ripping. A crank of the handle smoothly raises one blade while lowering the other. Right now the machines are powered by individual electric motors, but Eric dreams of reverting to the original line shafts and a stationary steam engine "if," he adds hopefully, "the city will let me."

Everyone who sees the antique machines is amazed by their quality compared to modern units, but for Eric the real difference between present and past is that "the old machinery was built so the worker himself could keep it in running order. He knew what was going on inside."

Eric sees that kind of know-how as an important—and unique—part of his business. For the first time in history, tools and products are so complex that the people who operate them can neither understand nor tinker with them. Such a situation stifles creativity and reduces the worker's input to pushing a few buttons—hardly a rewarding job.

But this isn't a problem at Blue Ox Millworks. Here, workers develop a kind of relationship with each machine. They find pride in producing



Exposed cogs and gears are part of the charm—and danger—of the old machines.



To match 19th-century moldings, Hollenbeck grinds his own cutters using a portable electric grinder clamped in a machinist's vise.



Simple but effective, this hand-operated machine uses leverage and a sharp blade to slice points on the ends of slats for picket fences.

high-quality, accurate millwork free-hand. Eric doesn't allow duplicating machines and templates in his shop. He doesn't think they're necessary if workers let their hands "learn" the pattern of a piece. "When I've turned four identical objects, my hands develop a memory that's perfect—accurate every time," he says. "Once I've got it, I don't ever use calipers again."

Eric Hollenbeck is a self-educated man who started working in the woods when he was 14. When the timber industry fell on hard times in the 1970s, he bought a sawmill to keep going, and in 1976 he added an abandoned 10,000-square-ft. power plant. This became the Blue Ox Millworks.

Eric's big break in the millwork business came in 1983 when he was

hired to restore one of the most famous Victorian homes in Eureka, the Eagle House, now a bed-and-breakfast. For 3½ years he replicated moldings, balusters and all kinds of trimwork that couldn't be produced with today's machines.

Thanks to that job and a modest boom in the construction of Victorian-style houses, the Blue Ox Millworks prospered. As more and more old machines were salvaged and restored, Eric and Viviana realized they'd created a working museum—one that many people would pay to see. A couple of years ago they began to advertise, and now around 3,000 people pass through the Blue Ox Millworks every year (including officials such as Bruce Babbitt, Secretary of the Interior).

The Hollenbecks' long-term goal is to shape the millworks into a kind of Williamsburg West. Like the Colonial village recreated in Virginia, Eric wants Blue Ox Millworks to be a producing museum and school "where people come to learn new skills and to be educated about their own past."

This year that dream becomes a reality. Eric is rechristening the business, the Blue Ox Historical Park, and is initiating an ambitious teaching schedule. Half-day workshops are aimed at visitors who want to try out rather than just watch the old machines. Other programs, running six months to a year, will train future artisans in the old ways of working wood.

This is no small undertaking, but it has great appeal to people like Eric and Viviana, who want to make the best possible use of the resources we already have.

Eric Hollenbeck recognizes that with our current industrial advances we are quickly gaining technologies at one end of the spectrum, but he's also convinced that we are losing them even faster at the other. Stemming the

loss "is what I'm really interested in," he says, "saving these skills for future generations before it's too late." ▲



SIMON WATTS is AMERICAN WOODWORKER's West Coast editor.



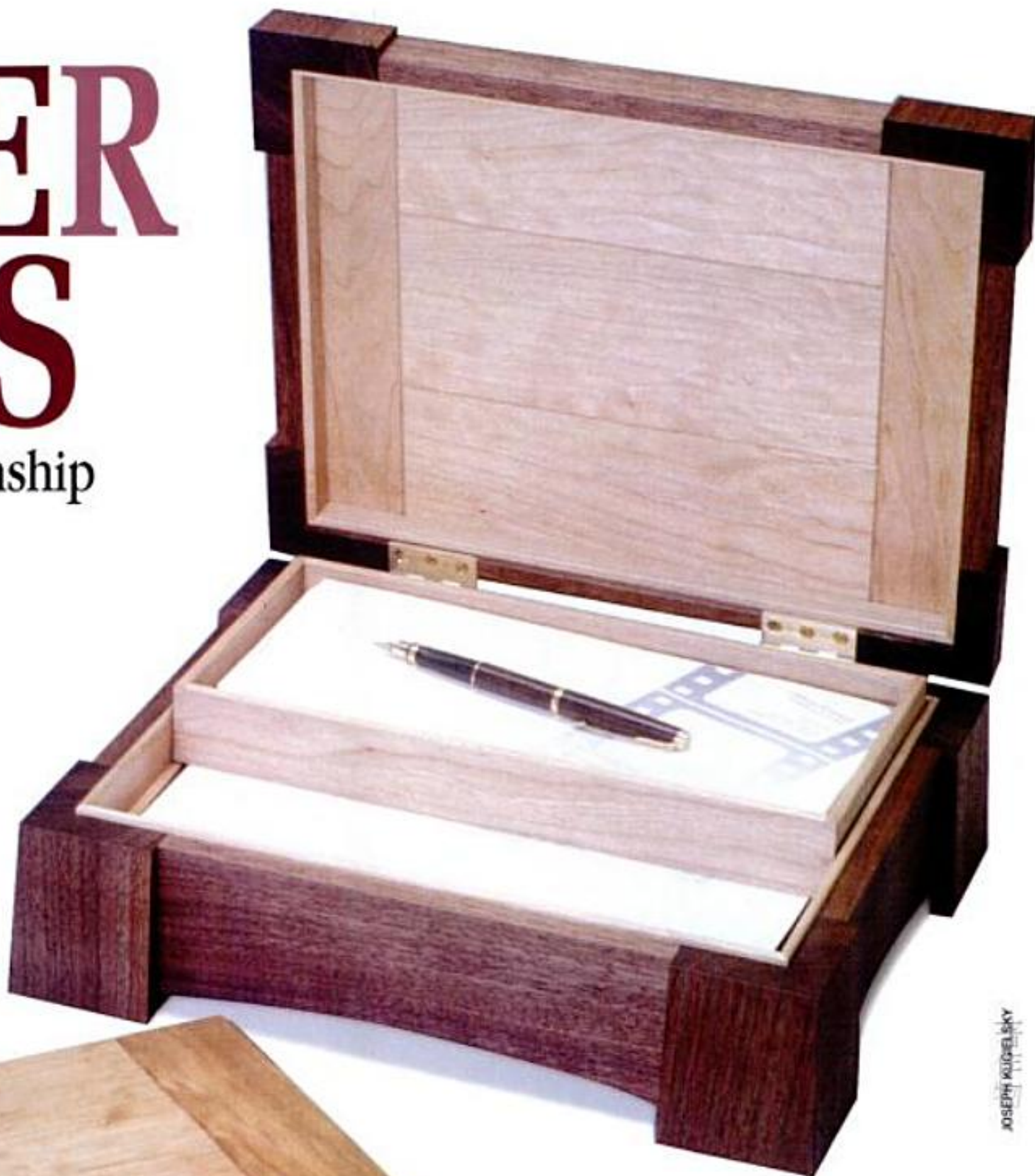
Hollenbeck cuts tenons on an antique tenoner that's covered with cast-iron filigree.

LETTER BOXES

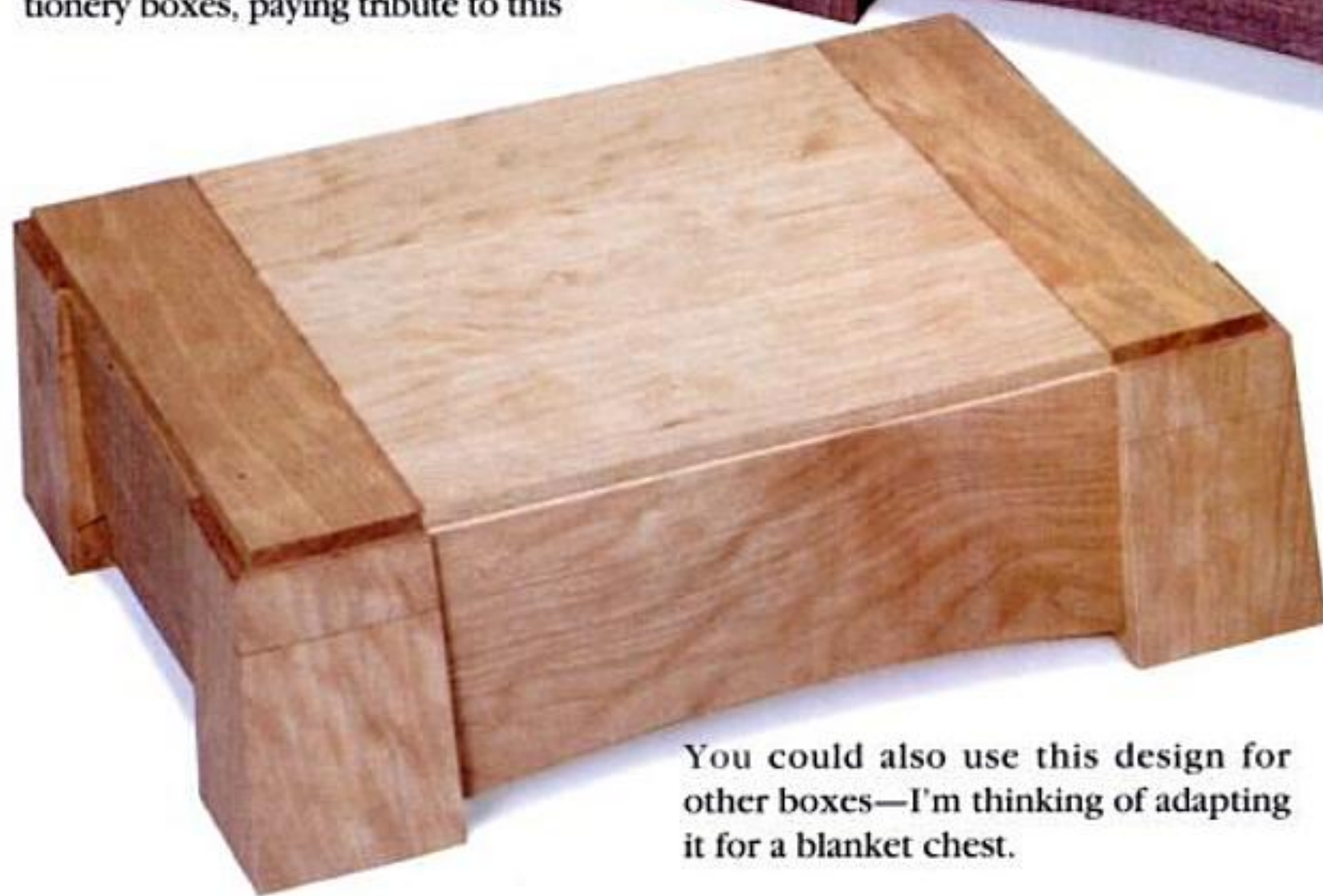
High-Quality Craftsmanship
On a Small Scale

BY ROGER HOLMES

When visiting my wife's parents in England, I've often admired the British flair for building little boxes. Handsome boxes for cutlery, silverware and stationery crowd many English antique shops. So when my in-laws recently celebrated their 70th and 80th birthdays, I decided to make them a matching pair of stationery boxes, paying tribute to this



JOSEPH KUGELSKY



These delicate cherry and walnut boxes are made to hold stationery, but the design can be adapted to everything from a jewelry box to a blanket chest.

You could also use this design for other boxes—I'm thinking of adapting it for a blanket chest.

Design Features

Before you make any shavings, a few comments about the design will make the construction easier to understand.

Corner Joints—I've made a lot of boxes employing the standard range of corner joints—dovetails, finger joints, miters and rabbets. If you're going to join four pieces of wood

end-to-end to form a box, you can't do much better.

But I wanted a different look for these pieces, so I began exploring the possibilities of frame-and-panel construction. What if I made each box side of a single "rail" and two short "stiles," with no panel or second rail at all? Where two "stiles" met to form a corner block, they could be butted or, better yet, mitered. Because these corner blocks would be glued along the grain, the joint would be extremely strong (see Fig. 1)—unlike a standard corner miter, whose end-grain joints are inherently weak and require some sort of reinforcement.

Fiddling around with full-scale pine mockups, I discovered that moving

English art form and recognizing one of our most prized links with the family overseas—the mail. The result is the boxes shown here.

As Fig. 1 shows, these boxes are sized to fit 8½-in. by 11-in. stationery, but stationery sizes can vary widely. You should buy your stationery before building the box, and alter the length and width of the box accordingly.

FIG. 1: LETTER BOX

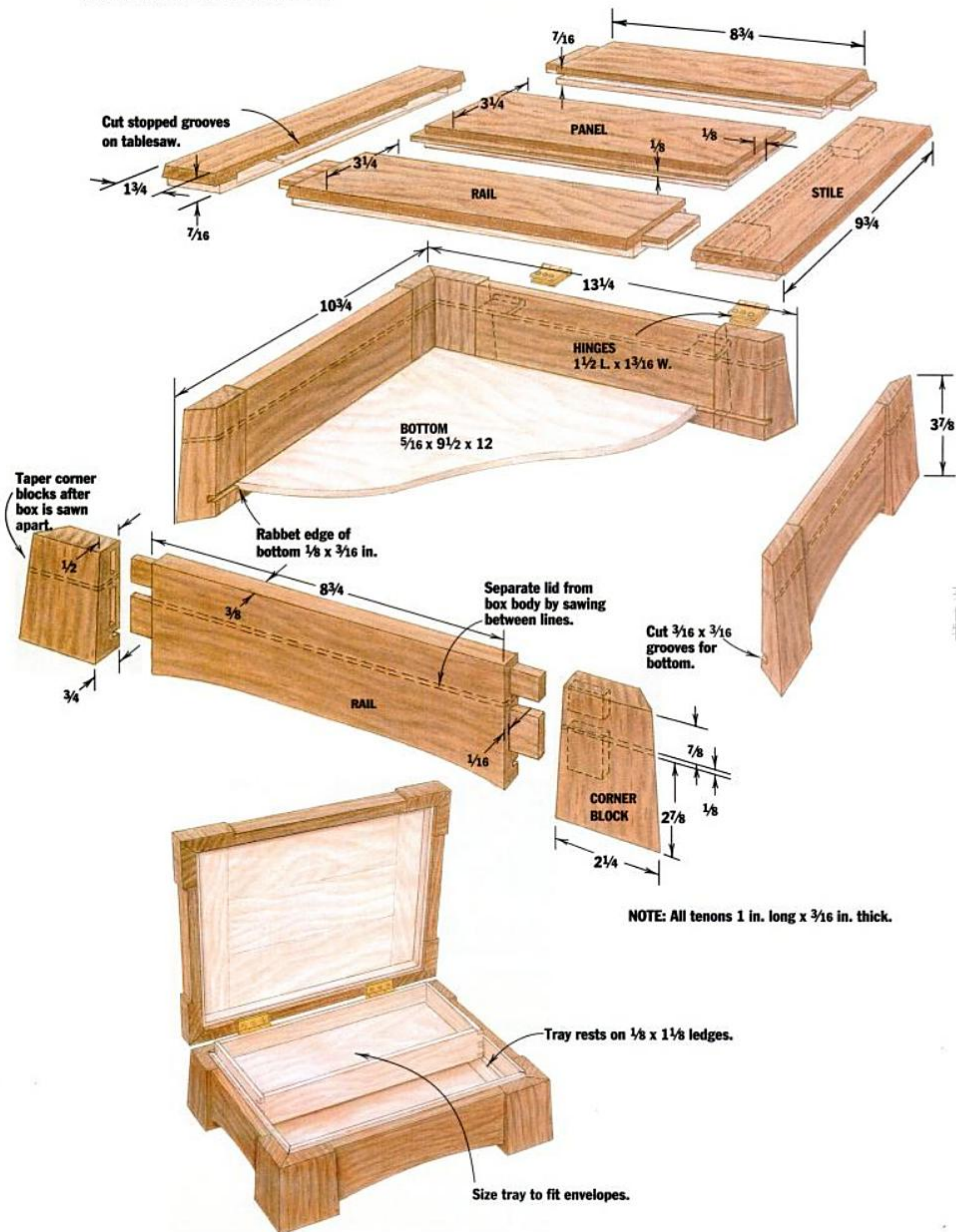
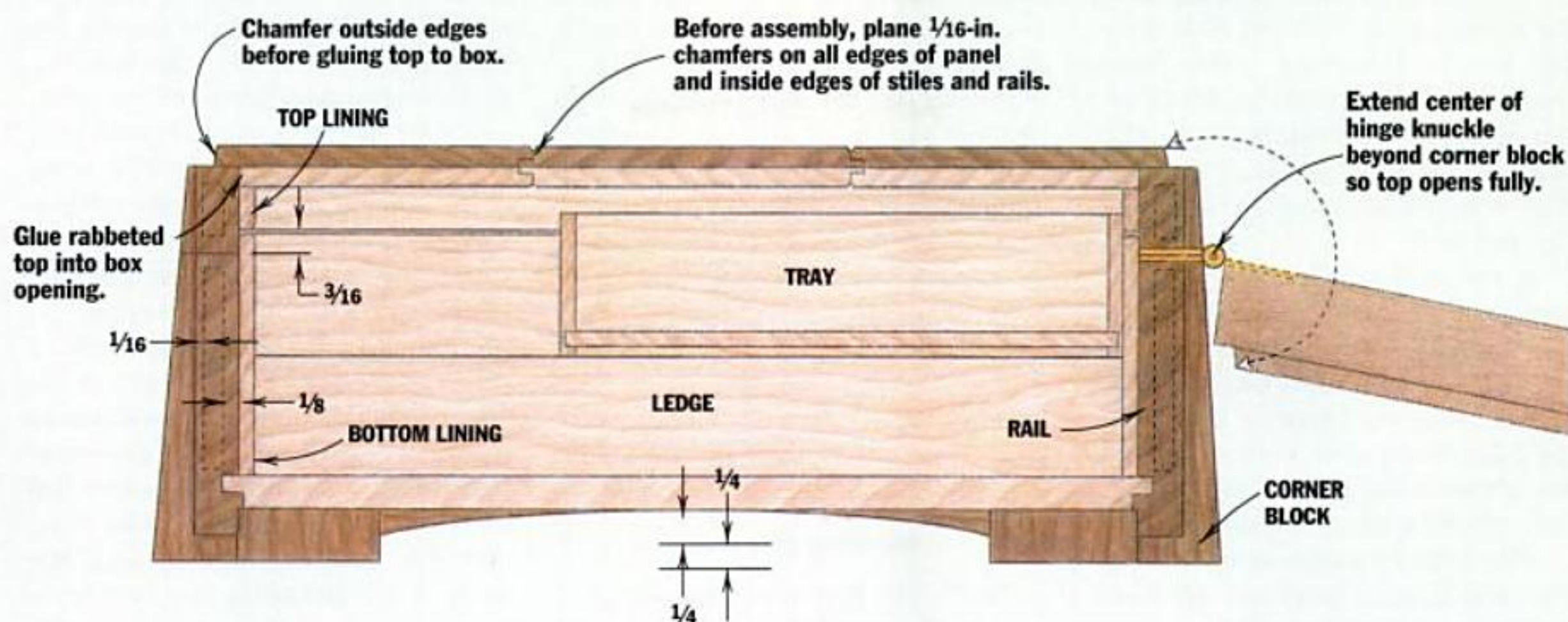


FIG. 2: SECTION THROUGH ASSEMBLED BOX



the rails back from the faces of the corner blocks would enhance the visual impact of the corners, which already stood out due to the change of grain direction from rail (horizontal) to corner block (vertical). Finally, tapering the corner block from top to bottom gave the whole box an architectural feel. (See lead photo.)

The Lid—Box lids seem to come in two basic flavors. One is a flat panel, usually hinged to the top edge of the box. The second, which I chose for these boxes, has depth because it includes the upper portion of the box sides. (See lead photo.) The easiest way to make such a lid is to glue up the entire box (top, bottom and four sides), then cut through the sides to separate the lid from the box.

After choosing the lid style, my next consideration was how to allow for expansion and contraction of the top. A single-piece top of solid wood will always be at right angles to two of the box sides. If glued in place, the top may shrink and split along its width or swell and pop the corner joints.

A veneered plywood top or a solid panel floating in grooves in the sides would have solved the problem, but the look seemed wrong for this box.

I decided to make a frame-and-panel top (see Fig. 1), aligning the joints of the frame with those of the front and back sides of the box, so it would appear as if these sides just wrapped up over the top. The panel floats in grooves in the frame, and the

assembled frame is rabbeted and glued to the top edges of the box sides, minimizing the conflicts of grain direction. (See Fig. 2.)

Inside Linings—I like to line the insides of boxes with thin strips of wood. In addition to looking nice, there's a practical advantage. By extending the linings slightly above the sides of the box, you form a lip that aligns the lid perfectly with the box sides and provides a satisfying snugness when opening and closing.

I decided to make one box from walnut and the other from cherry, and to reverse the interiors—cherry in the walnut box, and walnut in the cherry. (See lead photo.) It would be easy to make the bottom and linings from contrasting wood, but the lid presented a challenge. My solution

was to make the top of the lid from laminations of cherry and walnut. More on this later.

Constructing the Boxes

I began by cutting the cherry and walnut parts to size. First, I cut the corner blocks to size on the tablesaw, leaving the parts about $\frac{1}{8}$ in. oversize in length and width for trimming to exact size later. Then I resawn the side rails from 1-in.-thick stock.

The usual tool for resawing is the bandsaw, but I used the tablesaw in this case because of the narrow width of the parts. (For resawing on the bandsaw, see AW #4, October 1988.) I made the parts a little wider than the finished dimension to allow for the saw kerf that would separate the lid after assembly. I also left an extra $\frac{1}{16}$ in. of thickness to allow for any cupping or bowing that might occur as the stock was resawn.

Resawing the stock allowed me to match the grain around the box. However, the finished rails are relatively short, so to make resawing and planing them easier and safer, I ripped pieces long enough to produce two adjacent rails. Then I hand-planed one face flat before thicknessing the rails on the planer. After thicknessing, I cut each blank into two separate rails.

I followed the same procedure for resawing the pieces for the top laminates, bottoms and linings and for flattening and thicknessing the laminates. Then I glued the laminates together



Make two tenons from one by removing material from the middle with a back-saw, coping saw and chisel.

using plywood cauls and clamps.

Next, I cut the laminated *panel* for each box top to finished dimension, but left the laminated *frame pieces* oversized so the assembled frame and panel would be slightly larger than the outside dimensions of the box. This way, I could trim the top to fit the box body.

At the end of this process I had several small stacks of parts. To counter any cupping or bowing tendency during the weeks it would take me to finish the project, I spaced everything on a flat work table with small stickers about $\frac{3}{8}$ in. square in between, then placed a weight on top.

The joinery came next. The side rails and corner blocks and the frame-and-panel top are joined with small mortises and tenons. (See Fig. 1.)

On the side rails, I made the outer shoulders of the tenons only $\frac{1}{16}$ in. wide, so the inner walls of the mortises in the corner blocks could be as thick as possible. (See Fig. 2.) And to avoid cutting into a tenon when sawing the lid apart, I had to make two tenons for each joint. (See Fig. 1.) The space between the tenons corresponded to where my lid line would be.

I laid out the joints with a mortise gauge and, despite their tiny size, cut the tenons on the tablesaw. First I made the cheek cuts by running the rails end-up against a high, sturdy auxiliary rip fence. (I buried part of the blade in the fence to cut the $\frac{1}{16}$ -in. outside shoulder.) I used a 6-in.-wide backup block to push the stock, and to keep the narrow stock from falling into the blade slot, I made a wooden throat insert, solid except where the saw blade had been raised through it.

Next, I crosscut the shoulders with a miter gauge. Then I formed the two separate tenons on each end of the rails with handsaws and a chisel. (See photo, previous page.)

To cut the mortises in the corner blocks, I first removed much of the waste on the drill press with a $\frac{1}{8}$ -in. brad-point bit, then pared to my layout lines with a sharp chisel. Because the inside mortise walls were so thin, I took care to drill slowly and clear the chips frequently. When paring with the chisel, I clamped the corner block deep in a vise for support. (See photo, above right.) Once my mortises were

cut, I fitted the joints by trimming the tenon cheeks and shoulders with a shoulder plane. I used the same procedure for cutting the top-panel joints.

Then I laid out and bandsawed the shallow curves on the bottom edges of the rails (see Fig. 1), and cleaned up and chamfered the curves with a spokeshave. I finish-sanded the rails' outer faces, which would be recessed from the corner blocks after assembly. To avoid twisting the assembly when gluing up rails and corner blocks with pipe clamps, I was careful to center the clamp screw (and therefore the pressure) on the rails' thickness.

Making the Top

With the box sides glued up, I turned my attention to the frame-and-panel top. The center panel floats to allow for expansion and contraction, suspended in the frame by tongues cut on the panel's edges. (See Fig. 1.)



To support thin mortise walls when paring with a chisel, clamp the corner blocks in a vise.



Clamp the miters using angled blocks to direct clamping pressure.

I cut the tongues and grooves on the tablesaw, standing the panel on edge to rip the tongues. To make the stopped grooves in the stiles (see Fig. 1), I clamped stop blocks on the table-saw's rip fence, lowered each stile onto the saw blade at the beginning of the cut and raised it off the table at the end of the cut. You could also use stop blocks on a router table and rout with a $\frac{1}{8}$ -in. straight or slotting bit.

Next, I dry assembled the parts of the top, clamped the assembly between bench dogs, and hand-planed the surfaces flush. Then I disassembled the top, chamfered the edges that form the V-grooves with a block plane (see Fig. 2), and finish-sanded the faces. When gluing the top together, I was careful to apply only a thin coating of glue to the mortises and tenons to minimize squeeze-out, which is tough to clean out of V-grooves.

Once I'd glued the top, I turned to the box sides. First, I hand-planed the top edges and inside faces of the box sides. Then I cut the bottom edges of the corner blocks to length, running the top edge of each side against the rip fence. (Remember to allow for the width of the saw kerf that will eventually separate the lid.)

Next I rough-cut the miters on the corner blocks using the tablesaw and miter gauge. Then, to support small C-clamps at assembly, I temporarily glued the mitered offcuts onto the outer faces of the blocks, using paper between the glue joints. (See photo, below left.)

My tablesaw isn't accurate enough to produce miters ready for gluing (few are), so I used a finely set hand plane to fine-tune the fit. Then I clamped the box together dry for a final check and replaned the joints that had gaps.

Before glue-up, I used the tablesaw to groove the sides to accept the bottom, then rabbeted the bottom to fit the grooves. Sanding and applying a finish to the bottom after assembly is a nuisance, so I did this next, then clamped everything up dry to make sure of the fit.

I was apprehensive when it came time to glue up the miters because I was used to pulling these slippery glue joints together with clamps stretched from side to side and across the

ends—ending up with something resembling a painter's scaffolding. This time I only needed small C-clamps on the blocks, and because the pressure was applied at right angles to the faces of the miters, there was very little slip-page. (See bottom photo, previous page.)

Once the glue was dry, I removed the glue blocks with a hammer and hand-planed the top edges of the box flat.

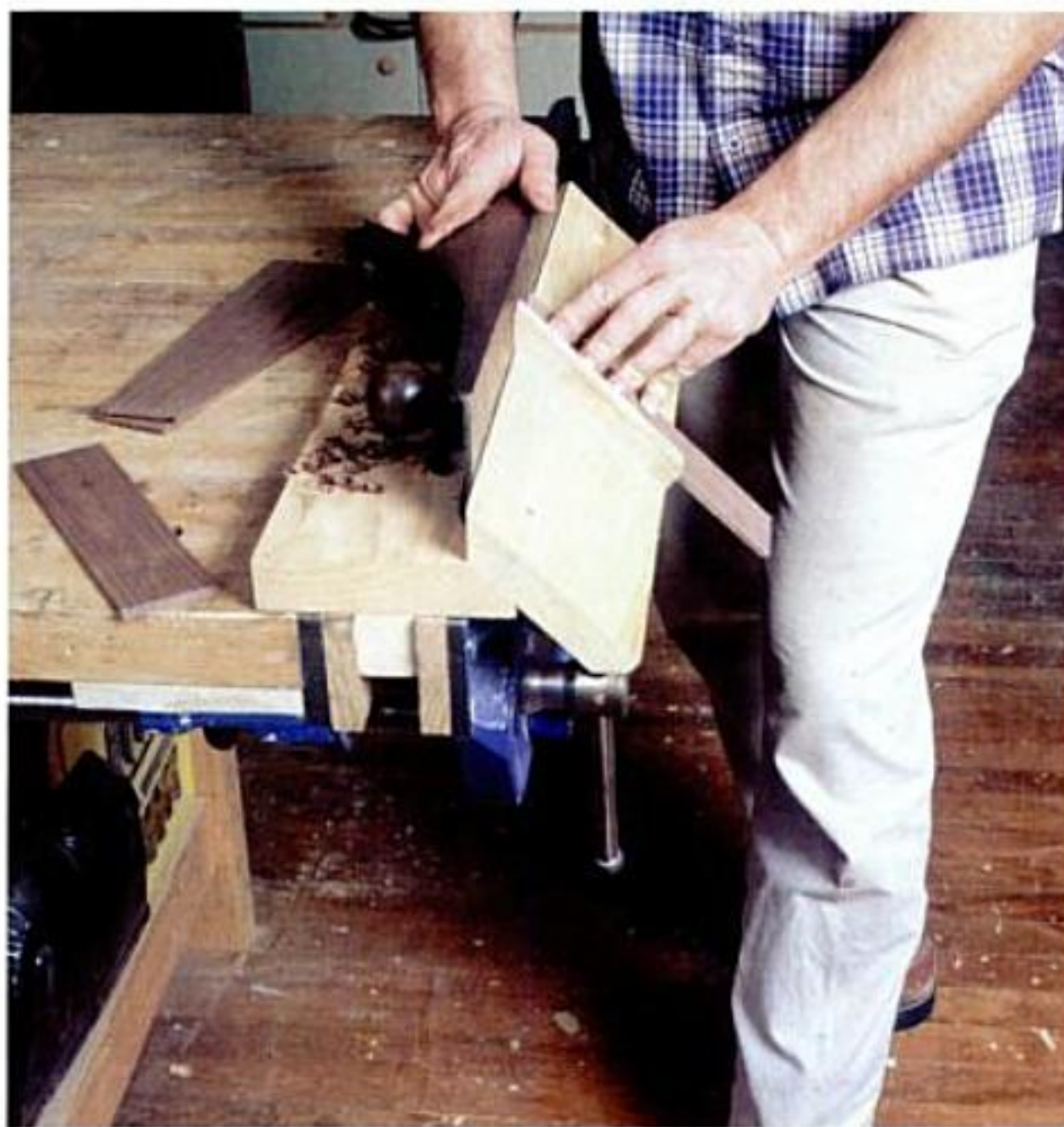
The next step was to glue my frame-and-panel top onto the assembled sides. On the tablesaw, I rabbeted the edges of the top so it wouldn't quite slip inside the box opening. I was careful to make the rabbet *just* to the lamination line to prevent the contrasting wood from showing on the outside of the finished box. Then, with a shoulder plane, I trimmed the rabbet until the panel fit exactly into the opening.

Next, I chamfered the outside edges of the panel with a block plane so there would be a small angled "step" when the top was glued to the box. (See Fig. 2.) Then I spread a small bead of glue along the inside corner of the rabbet and clamped the top in place, distributing the clamp pressure with plywood underneath four crowned battens.

Sawing boxes apart is always nerve-racking—it's hard to push something you've already lavished so much time on into a whirring tablesaw blade. I eased my anxiety by cutting through only the two long sides. Then I lowered the blade and cut the other two sides, leaving a thin remnant joining the lid. This prevented the lid from separating and striking the blade, which would have damaged the lid. I separated the lid with a small backsaw and cleaned up the mating edges of lid and box body with a sharp hand plane, repeatedly resting the lid on the box to check for gaps.

Now it was time to taper the corner blocks. (See Fig. 1.) To keep the lid and box body aligned during this

step, I fitted temporary linings made of scrap pine inside the box body, protruding above the edges to engage the lid. I put the top and bottom



A homemade "miter donkey" holds the box linings at 45° while you shave the miters with a sharp jointer plane.

together and laid out the taper on the edges of a block, then cut close to the line with a backsaw. To steady the box as I sawed, I pushed it against a wooden stop clamped to the end of my bench.

I clamped the box in the vise and removed the saw marks with a hand plane and careful sanding. With the box still in the vise, I worked small chamfers on all the edges with a sharp, finely set block plane. I've found that taking time to execute little details like these chamfers crisply and uniformly makes a considerable difference in the look and feel of the finished piece.

Making the Hinges, Linings and Trays

The design of the box presented a complication for hinging. I wanted to mortise the hinges into the rails, but because the rails are set back from the corner blocks, the pivot point of the hinges is critical. The center of the knuckle must be beyond the face of the corner block or the lid won't open fully. (See Fig. 2.)

Unfortunately, I couldn't find any

hinges that accommodated this requirement. So I bought two pairs of brass hinge blanks (available from Whitechapel Ltd., Box 136, 3650 West Hwy. 22, Wilson, WY 83014, 800-468-5534) and used a hacksaw and files to shape the leaves to size. Then I drilled and countersank the screw holes. Mortised into the rails, the hinges worked like a charm. (For more on installing hinges, see AW #15.)

Box linings are easy to install and they dress up a box nicely. First I hand-planed and finish-sanded the faces of the linings before mitering them. Then, because I don't trust the tablesaw for cutting miters on such thin stock, I used a jointer plane and a shop-built miter jig to do the job. (See photo.)

After mitering the linings to fit the lid and box body, I rounded the upper edges of the box-body linings with a block plane

and sandpaper. Then I installed them dry to make sure the lid closed properly. When the fit was right, I spread a bead of glue in the box and slid the linings into place. Finally, I glued in the ledges to support the tray. (See Fig. 1.)

The trays are sized to hold envelopes, and they aren't complicated, just small. Cutting tiny dovetails like these reminded me how age has taken its toll on my eyesight. Despite the eye strain, it was very satisfying to assemble these little items and slide them smoothly on their ledges.

I finished the boxes with Minwax Antique Oil Finish, brushing it on and wiping off the excess. I look forward, on my next visit to England, to seeing



ROGER HOLMES writes and works wood in Lincoln, Nebraska.

how the colors of the cherry and walnut have grown richer with age. Until then I'll rely on letters to remind me of this project. ▲

an Elegant Joint that Hides the Joinery

Making a Three-Way Miter

by YEUNG CHAN

Growing up in China I had a chance to see and appreciate some of the marvelous Chinese furniture and carvings produced during the Ming Dynasty (1358-1633). The superb craftsmen of that era had no durable adhesives, so they invented ingenious joints with mechanical interlocks to hold the parts together.

One of the intriguing joints which dates from that period is the three-way mitered mortise-and-tenon joint. (See drawing.) Even without reinforcement, this joint is strong enough for light-duty uses. Plus, it offers a very attractive way to join three pieces at right angles—the mechanics of the joint are concealed so all you actually see are three lines where the miters meet.

This joint is often used today for glass showcases, though my ancestors were

more likely to use it when making a stand (see sidebar, page 66) for displaying a scroll or a bonsai plant.

Making the joint shown here requires careful work, but it's not really complicated. All you need is an accurate tablesaw, a router, a 1/2-in. or 3/4-in. chisel and a knife for cutting some splines.

Joint-Making Tips

The drawings show the basic steps in making this joint, but there are a few important points to note about the construction:

- The parts of this joint will fit together accurately *only* if the three pieces to be joined are exactly alike in cross section, so you must mill your stock carefully.
- I recommend using a miter jig (see drawing) to cut the 45° miters. By screwing stops to this jig you can pro-



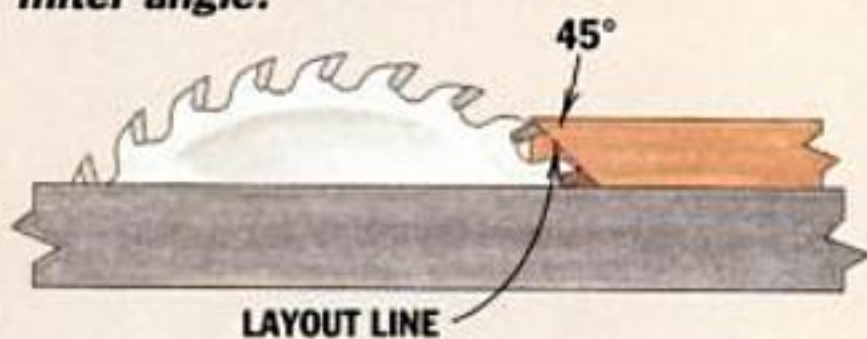
ILLUSTRATION BY LU MATTHEWS

PHOTOS BY KAZ TSURUTA

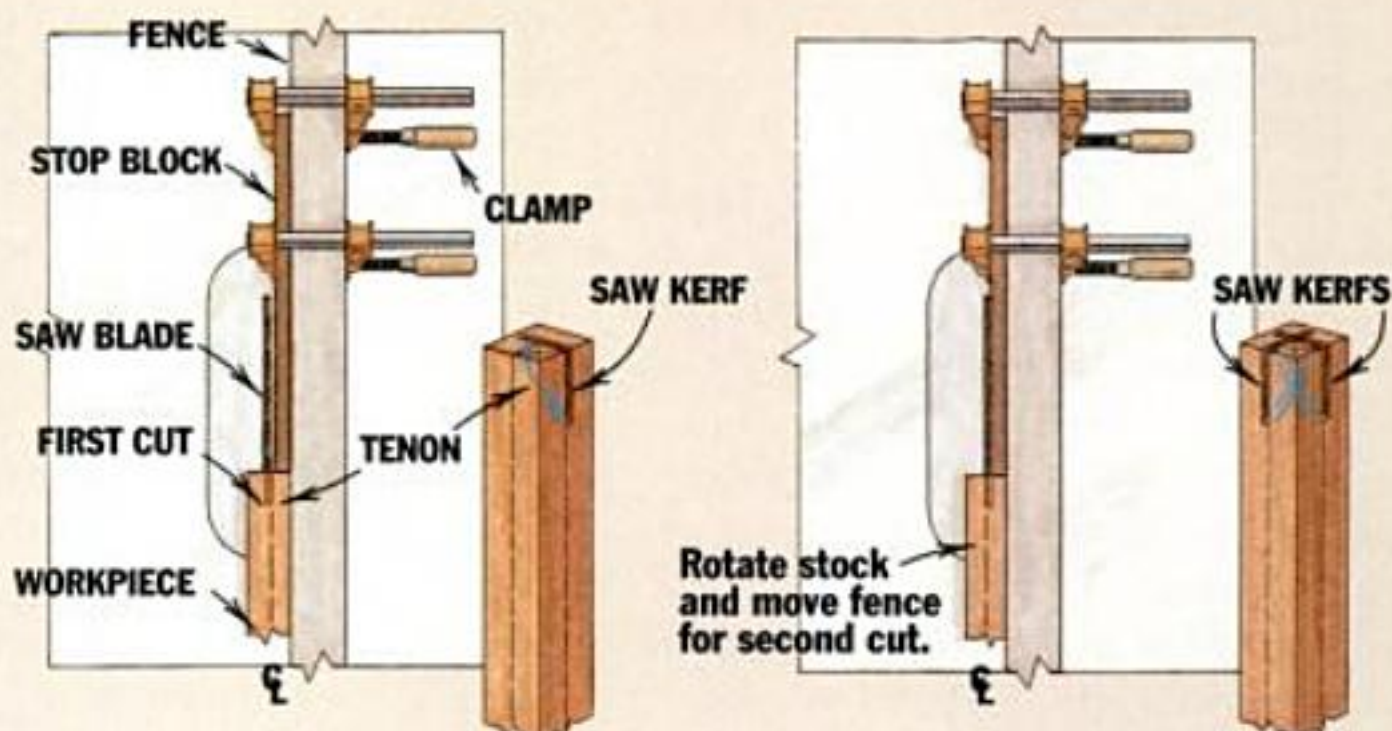
Making the Joint

THE TENON

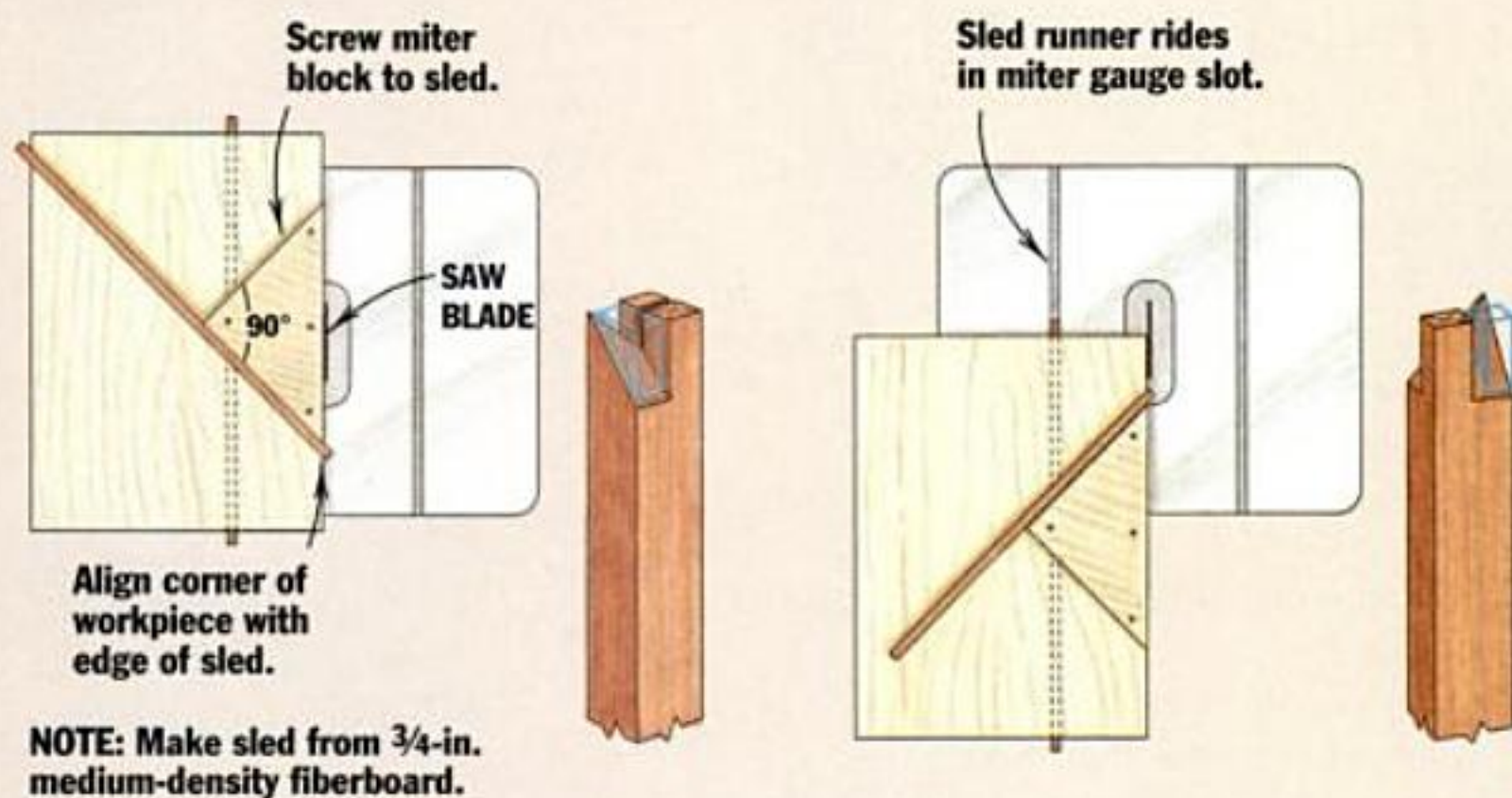
STEP 1: Lay out 45° miters on workpiece and adjust blade height to match miter angle.



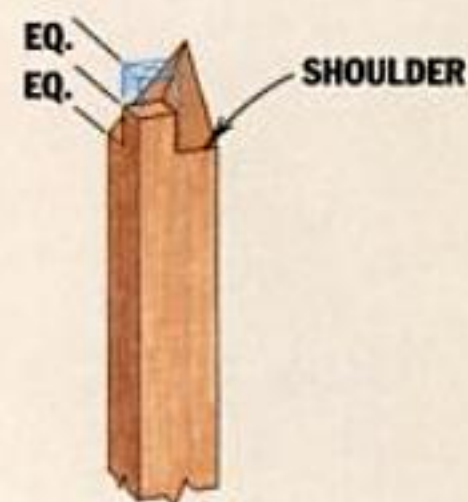
STEP 2: Rip tenon cheeks, using stop block to limit length of cut.



STEP 3: Cut mitered shoulders, using shop-made sled.

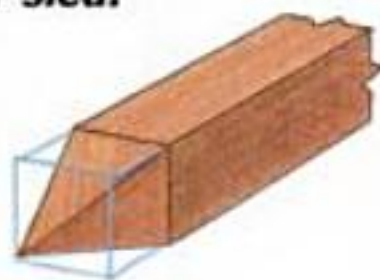


STEP 4: Cut tenon to finished length.



THE MORTISE

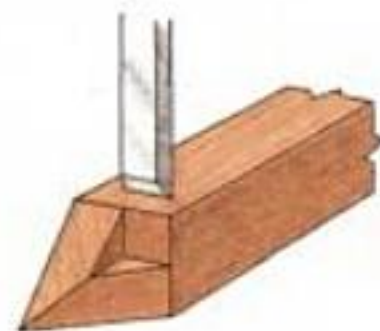
STEP 1: Miter two adjacent faces, using miter sled.



STEP 2: Lay out mortise with marking gauge.



STEP 3: Chop mortise with chisel.

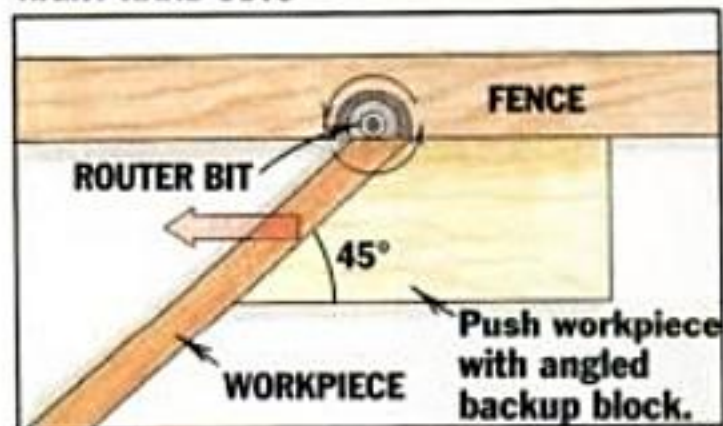


STEP 4: Cut spline groove with 1/8-in. slotting cutter in router table.

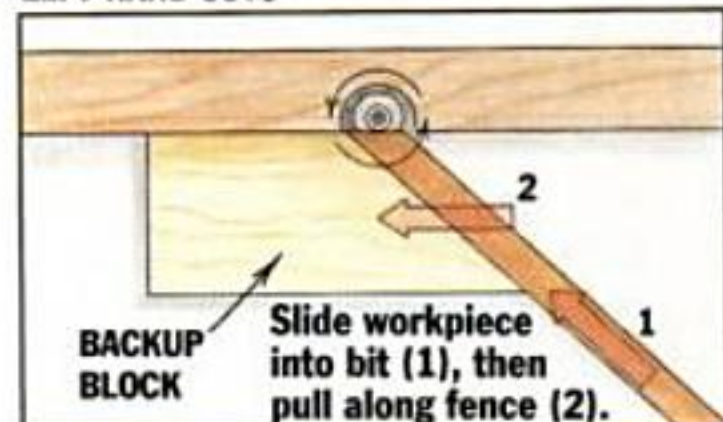


ROUTING THE SPLINE GROOVE

RIGHT-HAND CUTS



LEFT-HAND CUTS



duce any number of identical parts, all cut to the same length.

- Blade height is critical when making the four tablesaw cuts to create the tenon. When ripping the tenon cheeks (see drawing), you need to eyeball the height of the blade so the saw teeth cut into the wood at roughly a 45° angle. (That way the kerf will intersect with the miter cut you'll make next.) And when making the mitered shoulder cuts, you need to set the height of the saw blade at *exactly one-half* the width of the leg to keep the blade from cutting into the tenon. (See drawing.)

- I routed the grooves for the splines with a 1/8-in. carbide-tipped wing cutter in a router table. To do this safely, back up the workpiece with a push

block and make sure you always feed the stock *against* the cutter's direction of rotation. (Otherwise the cutter is liable to grab the wood and pull your hand into its teeth.)

- When making splines, I usually use scrap from the same project so the splines will match the rest of the wood. For maximum strength, cut the splines at right angles to the faces of the miter. You could use lamello biscuits here equally well.

Joint Applications

Glued together, this three-way mitered mortise-and-tenon joint will stand up fairly well to racking and shearing on small or light pieces of furniture. But for large projects you should reinforce the joint. I recently

used this joint on a 72-in.-tall showcase and strengthened it by running screws down through the rails and into the legs. You could also glue corner blocks to the inside corners to increase the strength.

When using the joint on a project, I advise cutting the miters *before* trimming the legs to length. That way, if you make a bad cut, you can simply slide the leg forward and try again. ▲



YEUNG CHAN *escaped from China in 1968. He now lives with his wife and two sons in northern California, where he has a woodworking and design business.*

My Two-by-Four Table



As soon as I heard about the First Annual 2x4 Contest (sponsored by the San Francisco Bay Area Woodworkers Association) I decided to enter. The idea of the competition was a simple one: make a piece of furniture out of an 8-ft. length of 2x4. There were no design restrictions, and the rules allowed any type of fastenings except screws and nails.

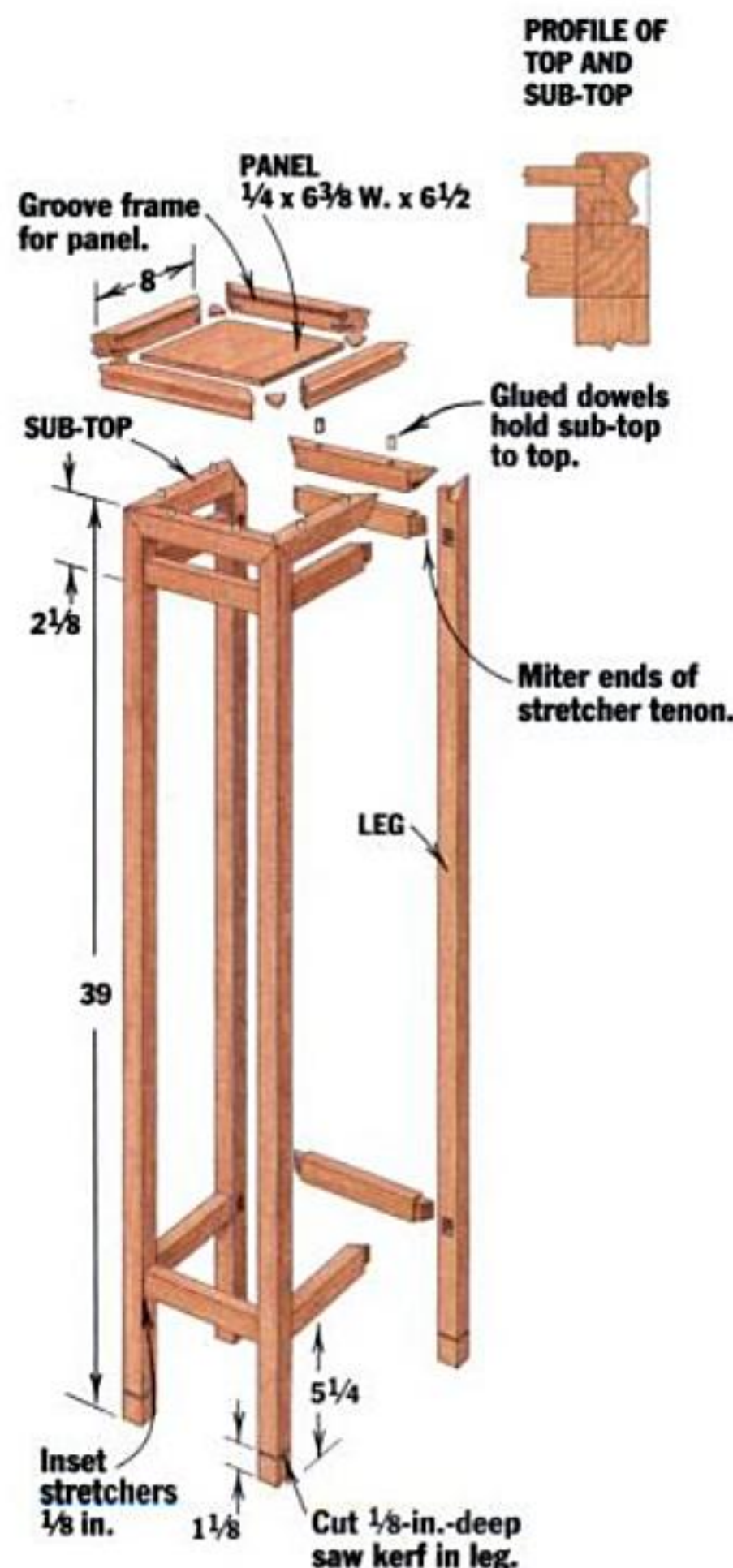
Since I had less than 6 bd. ft. of lumber to work with, my design had to be extremely economical. I finally decided to make the Ming-style table shown here, a slender piece of furniture 36 in. high with a 9-in.-square top. My ancestors would have used such a table as a stand for incense burners, or to display scrolls, flowers or the miniature trees called bonsai.

This first prize winning design has 21 pieces: four legs; eight stretchers; the four rails in the sub-top; the top panel and the four members that frame it. All this had to come out of a single 2x4 (actually only 1½ by 3½ in.), so I had to make a detailed cutting list and plan my cuts carefully.

I simplified some details that are common to Ming-style tables because of the limited amount of wood available. For example, the legs of Chinese tables from this period have a detail at the foot called "Ma-Ti" or "horse's

hoof." Since this would have used too much wood, I substituted a small, 1/8-in.-wide by 1/8-in.-deep reveal near the lower end of the leg. Also, I had to make straight stretchers, though Ming tables usually have stretchers with the middle part arched or raised. The trickiest part of this table is making the three-way miter where the leg meets the rails in the sub-top. (See main story.)

—Y.C.





Scratch stocks are easy and inexpensive to make, and they'll cut decorative moldings like this in a snap.

PHOTOS BY JOHN MCKEITH

Making and Using a SCRATCH STOCK

BY ANDREW WEEGAR

This Simple Tool Scrapes Custom Shapes
a Router or Shaper Can't Match

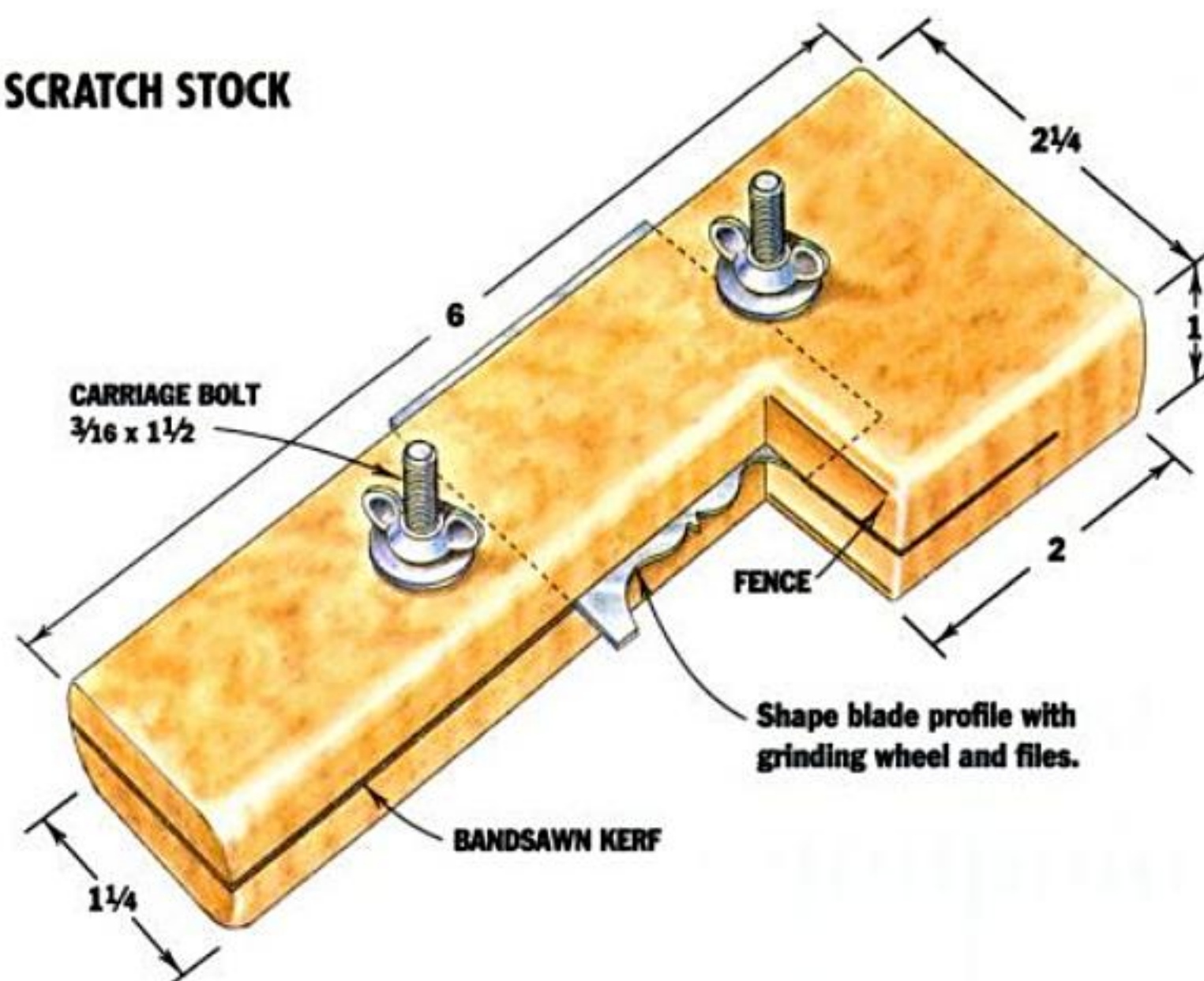
Occasionally when I'm working in my boatbuilding business, I come up against a decorative profile that I just can't duplicate with router bits. When that happens, I don't settle for a profile that isn't exactly right; instead, I gather some scrap hardwood and steel and invest an hour of my time in making a simple but elegant solution—a scratch stock.

Long used by cabinetmakers to duplicate the moldings on period furniture, the scratch stock (sometimes called a scratch router or scratch plane) is a versatile hand tool that should be part of every woodworker's tool kit. You can use it to shape precise beads, flutes, reeds and grooves, and it's particularly useful to people who do restoration work and period pieces, since you can grind a blade to exactly recreate old molding profiles. A scratch



You can make scratch stocks in any size or shape. Here are several scratch stocks and double-end blades, with the moldings they made.

SCRATCH STOCK



stock will also follow curved edges and cut well on small workpieces, and when it's used properly, it won't tear figured wood the way a router or shaper can. Best of all, a scratch stock is easy to make and use.

Making a Scratch Stock

The drawing above shows the basic tool I use for most work. The shape and size of my scratch stocks are dictated by the size of my hands and the type of profile I'm cutting. If

I'm making a scratch stock with a large blade to cut a wide and deep profile, I'll make the wooden body larger to take the stress of heavy use. If I'm only cutting a tiny bead, I can make the scratch stock small enough to fit in the palm of my hand, though I never make one less than $\frac{3}{4}$ in. thick. I smooth the body to make it comfortable to hold and I round over the bottom edges (see drawing), since the scratch stock is angled slightly in use.

I make my scratch-stock bodies

from hop-hornbeam, which is hard and durable, but beech, maple, cherry or ash are also good choices. I bandsaw a kerf entirely through the long arm of the body and halfway into the short arm or "fence" to make a slot to hold the blade. To keep the blade from slipping, I leave the rough saw marks in the kerf.

Many older scratch stocks use screws to pinch the kerf and lock the blade in place. I prefer to use carriage bolts and wing nuts because they're easier and quicker to adjust.

Making the Blade

The key to a good scratch stock blade is to use a piece of steel that's soft enough to file, yet hard enough to keep an edge. I've found that old handsaw blades and scraper blades are good, and they're also about the right thickness. Hacksaw blades are harder and will last longer, but they're more difficult to file.

Once I've found a piece of steel, I simply trace the profile I want on the metal by scratching with an awl or drawing with an indelible marker. Then I grind close to the line with a grinding wheel, dipping the metal frequently in water to keep it from losing its temper. If you find the traced profile difficult to see, make a paper template of the profile and rub-

GETTING MORE FROM YOUR SCRATCH STOCK

Scratch stocks are great for cutting moldings and grooves, but as the blade profiles get larger and more complex, it's hard to keep the tool from wandering and making sloppy cuts.

To solve this problem, I designed a scratch stock with a U-shaped body that registers on both sides of the workpiece for increased accuracy. (See photo below.) The scratch stock shown here will cut three precise grooves for inlaying veneer in a pilaster—a vertical element often seen on bookcases and architectural millwork.

The grooves are all cut at once, rather than worked separately from both edges of the blank as you would using a



This scratch stock (left) registers on both sides of the work to cut three inlay grooves very accurately (right).

a single cutter. This guarantees that the grooves will be exactly parallel and equidistant. Since you make the blade yourself, you can size its teeth to the actual width of the inlay instead of letting a router bit or saw kerf dictate the inlay size.

I made the blade for the scratch stock shown here from a reciprocating saw blade with the teeth ground off, but to get even wider profiles I use thicker steel,



such as old plane or spokeshave irons. I hone both faces of the blade on a water stone. When the blade becomes dull, I sharpen it by simply rehoning the faces, rather than disturbing the cutting profile. — William Tandy Young

MANUFACTURED SCRATCH STOCKS

Scratch stocks have existed for hundreds of years, with the earliest examples in this country dating at least to the 1600s. Even though the majority of these tools were shop-made, several companies offered factory-made scratch stocks starting as far back as the late 1800s. Pictured here are several antique scratch stocks, along with some present-day tools you can buy.

The Stanley No. 66 Universal Hand Bearer was manufactured from 1886 to 1941. It had handles like a spoke-shave and included interchangeable blades. Starting in 1885, three versions of a scratch stock called the Windsor Bearer were made by Poole, Williams & Co. of Windsor, Vermont. These tools featured multiple cutterheads. Versions one and two are shown in the photo at top center and top right. All of these tools are available through

old tool dealers and at auctions, but they may carry a high price for their value as collectibles.

Today, two tool makers have reintroduced manufactured scratch stocks. The Lie-Nielsen Bronze Beading Tool is a solid cast-bronze reproduction of the Stanley #66. It includes straight and curved fences and seven double-ended blades. (Price: \$115, from Lie-Nielsen Toolworks Inc., Rte. 1, Warren, ME 04864, (800) 327-2520.)

The Veritas Beading Tool is made of rock maple with an adjustable fence and comes with a beading blade and five blanks for creating your own blade profiles. Optional blades for common shapes like flutes and grooves are also available. (Price: \$34.95 from Veritas Tools Inc., 12 E. River St., Ogdensburg, NY 13669-1720, (800) 667-2986.)—*Dave Sellers*

Past



Present



Author uses paper template as a guide while grinding the blade blank to create a rough profile.



Bandsawn blocks help keep the file square to the blade when shaping the final profile.

ber cement it to the steel. Then grind the metal to match the template. (See photo, above left.)

To finish the profile, I file it exactly to my layout line. Depending on the shape, I use flat and half-round mill bastard files, triangular files and round chain-saw files to shape the profile. It's important to keep the file square to the blade when cutting. I often use wooden blocks bandsawed

to the profile to guide the file and keep it square. (See photo, above right.) With straight-edged profiles, I make the final strokes by drawfiling—keeping the file perpendicular to the edge—to get the smoothest edge possible.

At this point, some woodworkers hone the faces of the blade on a sharpening stone, but I don't find this necessary. To resharpen a blade,

I just file the profile lightly again, taking care not to alter the shape.

Using a Scratch Stock

To use the scratch stock, I simply tilt it slightly, so the blade cuts as a scraper would, then I scrape back and forth with long strokes. It's important to keep the fence tight against the workpiece, since the grain will want to draw the blade away from the edge in places. If you've filed the edges of the blade sharp, you'll get gauzelike shavings. For the final pass, hold the tool perpendicular to the workpiece.

If you're cutting a deep molding or working in dense hardwood, it



helps to rough in the profile with a molding plane, gouge or tablesaw before using the scratch stock. ▲

ANDREW WEEGAR runs a boat-building shop in Bridgton, Maine, where he specializes in traditional wooden boats and canoes.

CALENDAR

ARIZONA

SHOWS

Phoenix: March 10-13. Fifth Annual Desert Woodcarvers' Award Show and Sale. Phoenix Civic Plaza, 225 E. Adams. (602) 345-9020. **April 8-10.** Arizona Woodworking Show. Arizona State Fairgrounds, 1826 W. McDowell Rd. (800) 826-8257.

CALIFORNIA

EXHIBITION

Los Angeles: Through March 31. "Turned Wood—Small Treasures" Exhibition. Del Mano Gallery. (310) 476-8508.

SHOWS

Pomona: April 15-17. Southern California Woodworking Show. L.A. County Fairplex, Building 6, White and McKinley Aves. (800) 826-8257.

San Francisco: March 18-20. Contemporary Crafts Market. Pavilions at Fort Mason, Buchanan and Marina Blvd. (808) 422-7362.

San Jose: April 22-24. Northern California Woodworking Show. San Jose Civic Auditorium, Exhibit Halls A and B, Park Ave and S. Market St. (800) 826-8257.

WORKSHOP

Eureka: March 28-April 2. Building the Norwegian Sailing Pram: Simon Watts. Blue Ox Millworks Historical Park. (800) 248-4259.

CONNECTICUT

EXHIBITION

New London: March 26-May 29. "Child's Play: Furniture for Children." Lyman Allyn Art Museum, 245 Williams St. (203) 443-2545.

WORKSHOPS

Brookfield: March 5-6. The Adirondack Chair: Joshua Markel. **March 19-20.** Table Workshop: John Marcoux. Brookfield Craft Center. (203) 775-4526.

South Norwalk: March 5-6. Chip Carving Seminar: Wayne Barton. Sign Carving Class: Frank Switaj. The Woodcarver's Shop, 27 Elizabeth St. (800) 547-4454.

FLORIDA

SHOW

Tampa: March 4-6. Central Florida Woodworking Show. Florida State Fairgrounds, Special Events Center, 4800 U.S. Hwy. 301 N. (800) 826-8257.

GEORGIA

SHOW

Atlanta: March 25-27. American Craft Council Fair. Georgia Dome, 1 Georgia Dome Dr. (800) 836-3470.

ILLINOIS

CONFERENCE

Arlington Heights: March 25-26. Third Custom Woodworking Business Conference. Woodfield Hilton and Towers. (800) 343-2016.

SHOWS

Lincoln: April 29-May 1. The Country Peddler Show. Logan County Fairgrounds, Exit 126 off I-55. (616) 423-8367.

Villa Park: March 25-27. Chicagoland Woodworking Show. Odeum, North Hall, 1033 N. Villa Ave. (800) 826-8257.

INDIANA

SHOW

Valparaiso: April 9-10. Duneland Woodcarvers 18th Annual Woodcarving Show. Porter County Fairgrounds and Expo Center, South of Rte. 30 on Rte. 49. (219) 845-2695.

KENTUCKY

SHOW

Louisville: March 11-13. The Country Peddler Show. Commonwealth Convention Center, 221 Fourth Ave. (616) 423-8367.

LOUISIANA

EXHIBITION

Lafayette: March 8-April 8. Lafayette Art Association Annual National Juried Competition. Lafayette Art Gallery, 700 Lee Ave. (318) 269-0363.

MASSACHUSETTS

EXHIBITION

Fitchburg: Through March 27. First National Exhibition, American Association of Woodturners. Fitchburg Art Museum. (508) 345-4207.

WORKSHOPS

Easthampton: April 17. Making a Living as a Woodworker. **April 23.** Laminated Bending. One Cottage Street School of Fine Woodworking, One Cottage St. (413) 527-8480.

MINNESOTA

SHOW

St. Paul: April 14-17. American Craft Council Fair. St. Paul Civic Center, 143 W. Fourth St. (800) 836-3470.

MISSOURI

EXHIBITION

Kansas City: March 19-April 3. Treasures in Wood: Kansas City Woodworkers' Guild Ninth Annual Showing. Crown Center Exhibition Hall, 2450 Grand Ave. (816) 274-8444.

NEW MEXICO

CLASSES

Santa Fe: March 20-April 10. Constructing a Traditional Spanish Chest. **April 9.** Furniture Stripping. Santa Fe Community College. (505) 438-1270.

NEW YORK

EXHIBITIONS

Rochester: Through March 13. "Child's Play: Furniture for Children." Memorial Art Gallery, 500 University Ave. (716) 275-3081.

Schenectady: March 6-May 1. 14th Biennial Northeast Fine Crafts Exhibit. Schenectady Museum, Nott Terrace Heights. (518) 382-7890.

SHOWS

Clifton Park: March 19-20. Third Annual Fine Woodworkers Expo of the Northeastern Woodworkers Association. Shenendehowa High School, Rte. 146. (518) 393-8804.

Hamburg: March 18-20. Greater Buffalo Woodworking Show. (800) 826-8257. **April 22-24.** The Country Peddler Show. (616) 423-8367. Erie County Fairgrounds, International Agri-Center, 5600 McKinley Pkwy.

NORTH CAROLINA

WORKSHOPS

Brasstown: April 3-8. Caricatures in Woodcarving—Doctor: Roy Hellman. **April 8-10.** Caricatures in Woodcarving: Roy Hellman. **April 10-16.** Caricatures in Woodcarving—Old Golfer: Roy Hellman. Willow Furniture Building: Timothy O'Dea. **April 17-23.** Basic Carving—Three Categories of Expression: M.W. Rainey. John C. Campbell Folk School, Rte. 1. (704) 837-2775.

Charlotte: March 12. Veneers and Inlay. Diversified Equipment and Supply, 11223 Blair Rd. (704) 545-5198.

Marshall: March 7-11. Swiss Cooperage. **March 21-25.** Windsor Chairmaking. **April 4-8.** Swedish Woodenware. All taught by Drew Langsner. Country Workshops, 90 Mill Creek Rd. (704) 656-2280.

OHIO

WORKSHOPS

Parkman: Throughout March. Workshops in chairmaking, turning, box making, machine techniques and more. Conover Workshops, 18125 Madison Rd. (216) 548-3491.

PENNSYLVANIA

CALL FOR PROPOSALS

Doylestown: Through May 1. Mid-Atlantic woodworkers invited to submit proposals for an original bench to be installed at the James A. Michener Art Museum. \$5,000 commission. Contact Jackie Wampler, Michener Art Museum, 138 S. Pine St, Doylestown 18901.

EXHIBITIONS

Collegeville: Through April 4. Fifth International Lathe-turned Objects Exhibition. Berman Museum of Art, Ursinus College. (215) 489-4111.

Doylestown: Through March 19. The Turnings of George Radeschi. James A. Michener Art Museum, 138 S. Pine St. (215) 340-9800.

Philadelphia: March 4-11. University of the Arts Wood Department Graduating Senior Show. Snyderman Gallery, 303 Cherry St. (215) 238-9576.

SHOWS

Monroeville: April 8-10. The Country Peddler Show. Pittsburgh Expo Mart, 105 Mall Blvd. (616) 423-8367.

Williamsport: April 14-16. Seventh Annual Woodworking Demonstration and Exposition. Hermance Machine Co., First and Campbell Streets. (717) 326-9156.

WORKSHOPS

Quakertown: March 4-6 and 18-20; April 1-3 and 8-10. Woodturning: David Ellsworth. Limit 4 students. Fox Creek, 1378 Cobbler Rd. (215) 536-5298.

TENNESSEE

WORKSHOPS

Gatlinburg: March 7-11. Techniques for Turned Lidded Vessels: Michael Mode. **March 14-18.** Woodturning: Liam O'Neill. **March 21-25.** Design in Turning: Michael Hosaluk. **March 28-April 1.** Woodturning: Philip Moulthrop. Coopering—Tools and Techniques: Rick Stewart. Arrowmont School of Arts and Crafts, 556 Parkway St. (615) 436-5860. **Smithville: March 26-27.** Refining a Bowl: Betty Scarpino. **April 16-17.** Green Wood Turning. Appalachian Center for Crafts, Rte. 3. (615) 597-6801.

VIRGINIA

SHOW

Norfolk: March 11-13. Virginia Woodworking Show. Norfolk Scope, Exhibit Hall, 201 E. Brambleton Ave. (800) 826-8257.

WASHINGTON

WORKSHOPS

Port Townsend: April 9. Professional Finishes: Julia Maynard. **April 23.** Wood Turning: Helga Winter. Northwest School of Wooden Boatbuilding, 251 Otto St. (206) 385-4948.

CANADA

EXHIBITION

Toronto: March 3-April 3. "Re-visions: Emerging Forms in Furniture." Work of the Sheridan College graduating furniture design class. Arts on King, 169 King St. E. (905) 844-9430.

SHOWS

Chatham: April 22-24. Chatham Wood Show. Kinsman Auditorium and Memorial Arena, 80 Tweedsmuir Ave. at Queen St. (519) 351-8344.

Ottawa: March 4-6. Ottawa Wood Show. (519) 351-8344. **April 14-17.** Eighth Annual Originals Spring Craft Sale. (613) 232-5777. Lansdowne Park Civic Complex, 1015 Bank St. at Holmwood.

Calendar listing is free and restricted to wood-working workshops, seminars, trade shows, etc. Please include address of event and a contact phone number. Send listing at least two months prior to date of event to: "Calendar," AMERICAN WOODWORKER, 33 E. Minor St., Emmaus, PA 18098.

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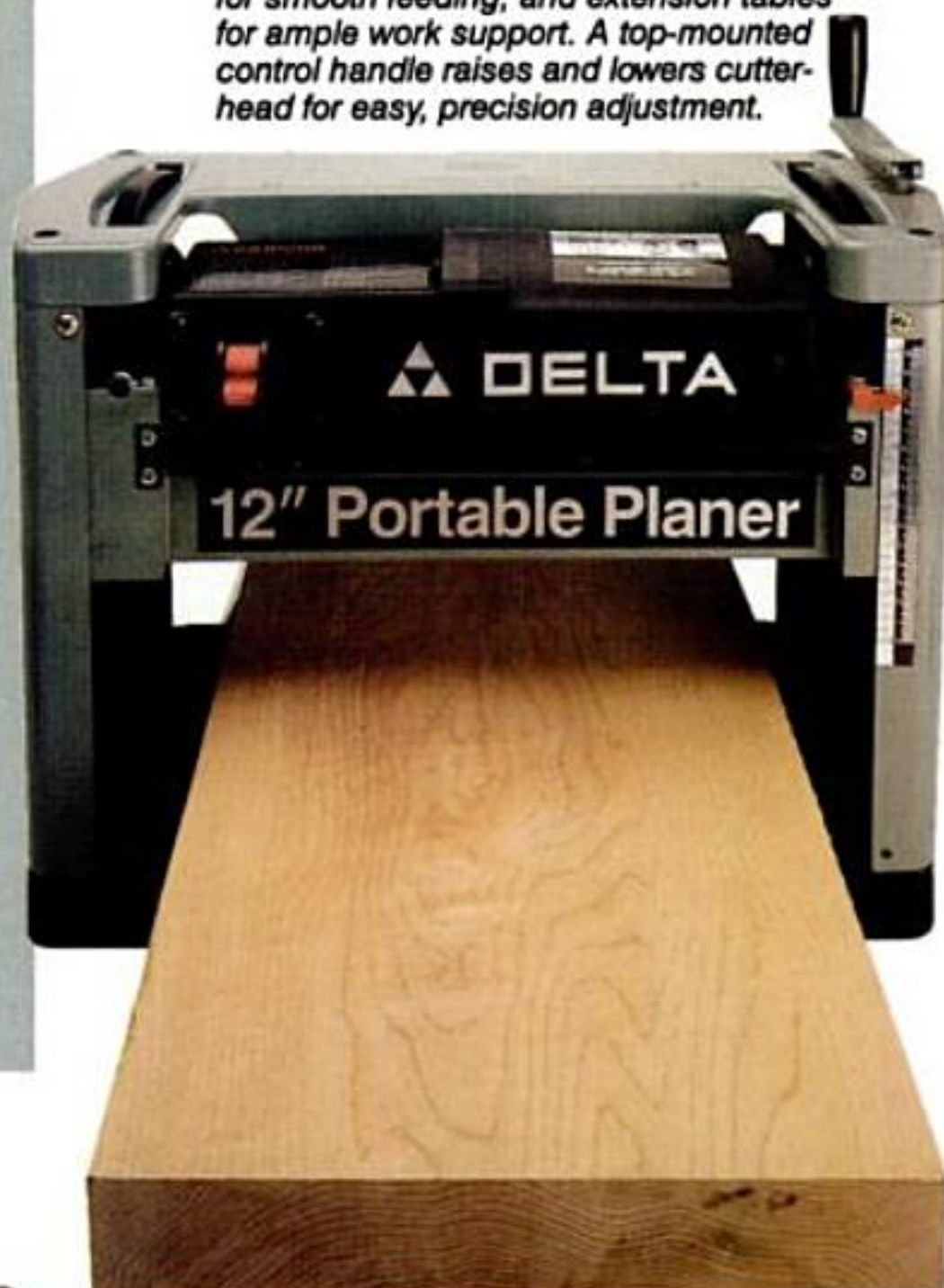
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WOOD FACTS

SUGAR PINE

By Dick Boak

Species

Pinus lambertiana (Western U.S., primarily in the mountains of Washington, Oregon, and northern California)

Trade Names

Sugar pine is commonly known and traded by the same name, which refers to the sweet, sugary substance exuded from fresh cuts. It is sometimes confused with Eastern white pine (*P. strobus*) and Western white, or "Idaho," pine (*P. monticola*).

Appearance

Sugar pine is regarded as the most attractive of the pines. Its heartwood ranges in color from light brown to pale reddish brown, with occasional brown streaks, resin canals or staining. It never darkens to the deep reddish brown of Eastern or Western white pine. The sapwood, which is nearly white with hints of pale yellow, is often discolored with "blue stain" (a fungal growth often found in pine). The medium to wide growth rings have distinct narrow bands of darker late wood. The medullary ray pattern is extremely fine and normally invisible to the naked eye, except where lateral rays intersect to produce an attractive flecked pattern.

Workability

Sugar pine is moderately soft and easy to work, though its texture is somewhat coarser than Eastern or Western white pine. It machines extremely well, with no appreciable differences between the early and late growth. Sugar pine glues easily and has excellent resistance to splitting in nailing and screwing. Sanded surfaces may show pores (especially in the end grain), but pore filler is generally not required for a smooth finish. As with most softer woods, sugar pine does



Sugar pine is prized for its size, workability and lack of defects.

not accept oil stains consistently without a stain controller, but most clear finishes (varnishes, lacquers, oils) produce excellent results. In spite of the its high resin content, the wood accepts paint well.

Technical Properties

With a specific gravity of 0.36 (23 pounds per cubic ft.), sugar pine is light in weight (similar to Western red cedar). It is moderately strong for its weight and has a consistent, uniform texture. It is also stable and odor-free after drying. The tree is reasonably resistant to fungus and insect attack, although some serious losses occur from white-pine blister rust and the mountain pine beetle. The lumber is typically straight grained, defect-free, and devoid of wind breaks or stress cracks, though fire scarring on young trees may appear as black streaks in the mature timber. Without a protective finish, sugar pine does not weather well.

Uses

Sugar pine is widely used for interior and exterior millwork (especially doors, windows, moldings, and trim),

plywood faces, drawing boards, shelving, outdoor signs, furniture, piano keys, and organ pipes. It is also being used increasingly for templates and foundry patterns. Lower grades are used for paper pulp, boxes and crating, and general construction materials such as subflooring, sheathing and roofing.

Sizes

Sugar pine is one of the largest and fastest-growing trees in the U.S. and has a remarkable longevity of 100 to 600 years. Older-growth trees can reach diameters of 48 in. and heights of 180 ft., though some have been reported as large as 11 ft. in diameter and 250 ft. tall. Typical planks are 10 in. to 18 in. wide and 8 ft. to 12 ft. long, and are available in all thicknesses from 4/4 through 16/4.

Sustainability

Like other native timbers of the Pacific Northwest, old-growth sugar pine has been heavily harvested. Standing old growth, though common on protected parklands, is becoming scarcer, and younger trees are being harvested.

Availability

The wood is generally only available through specialty wood dealers and larger lumber retailers.

Cost

There are many grades of sugar pine on the market with substantial variations in price. Kiln-dried clear 4/4 stock ("C & Better") sells for about \$3.50 per bd. ft. in quantities of 500 bd. ft. or more. Expect retail prices to be \$4 to \$5 per bd. ft. Thicker stock and special dimensions command higher prices. Knotty grades can be quite inexpensive, ranging from \$1 to \$2 per bd. ft. ▲

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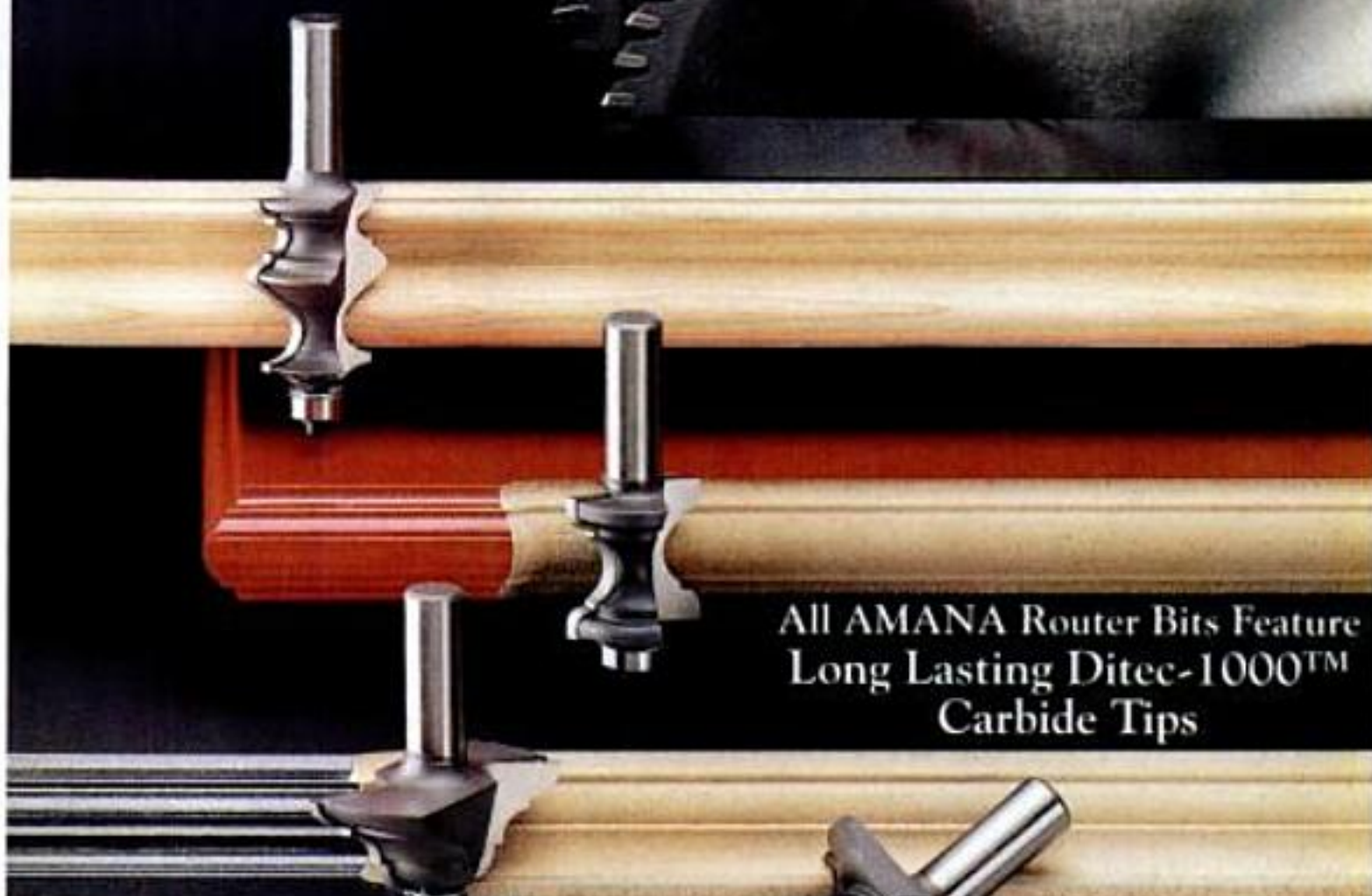
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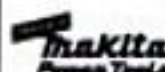
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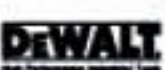
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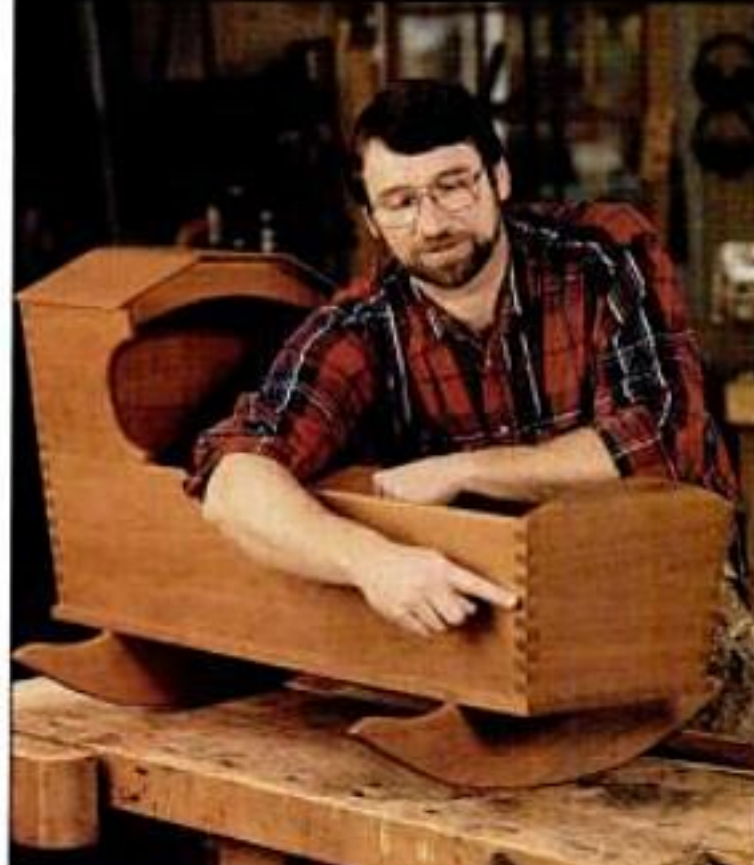
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JUST FINISHING

FOOD-SAFE FINISHES

Nontoxic Treatments For Your Woodenware

By Michael Dresdner



Now and then, our woodworking projects end up in the kitchen or dining room. And when they do, those that come into contact with food—countertops, cutting boards, bowls, spoons, etc.—should have a food-safe finish on them. But there's some confusion about which finishes are food-safe.

One easy way around the dilemma is to buy a finish advertised as safe for contact with food, such as Masters Blend Preserve Wood Finish or Behlen's Salad Bowl Finish. Although these two oil finishes do not carry specific FDA approval, they contain only ingredients that are permitted for contact with food. Masters Blend Preserve is solvent-free and is actually edible even in its liquid state, while the Behlen finish is safe only after the solvent evaporates (about 72 hours).

But there are plenty of common-sense finishing options that use edible or nontoxic materials you can find in the grocery store or tool catalog:

Oils

There are two categories of oils—drying and non-drying—that can be used for finishing wood items. Drying oils, such as tung oil, linseed (or "flaxseed") oil, and walnut oil, actually form a protective film—just like varnish, only much thinner. Non-drying oils will not form a film but instead remain in their liquid state indefinitely. Still, they offer some protection to wood by helping it shed water and dirt. All oils impart depth and color to wood and bring out its character. With use, both types of oil will be wiped or abraded off, so you'll

need to rejuvenate the surface with a fresh wipe of oil when the wood starts to look dry or chalky.

As a rule, oils derived from nuts and seeds will dry and form a film, while mineral oil and vegetable oils (corn, soybean, peanut, etc.) will stay liquid indefinitely. (Note: Despite their name, peanuts are legumes, not nuts.)

Drying oils are ideal for salad bowls, countertops, trivets, serving trays,

ing time. Linseed oil with driers added is called "boiled linseed oil," while the pure material is "raw linseed oil". Driers are sometimes added to tung oil as well, but this is less common. Most metallic driers are toxic, but because they are added in such small amounts (below 1 percent) the finishes are regarded as safe when dry. For items that will routinely come into direct contact with food,



Mineral oil, nut oils, shellac and wax may be used for finishing kitchen implements.



goblets, plates, and even dining-room tabletops. Both of the "food-safe"

finishes I mentioned at the beginning of this column are basically drying oils, but there are other simple choices as well.

The two most common nut oils are tung oil and linseed oil, and both are nontoxic in their natural state. Tung oil dries somewhat faster than linseed oil, but both are slow, drying in days rather than hours. To get around this problem, manufacturers sometimes add metallic driers (sold separately as "Japan driers") that speed up the cur-

I prefer to stick with pure, raw linseed or tung oil.

If your local grocery carries exotic salad oils, you might find walnut oil among them. Like the other nut oils, it will dry to form a film. Both walnut oil and Masters Blend Preserve Wood Finish are pleasant-smelling alternatives to tung- and linseed-oil coatings.

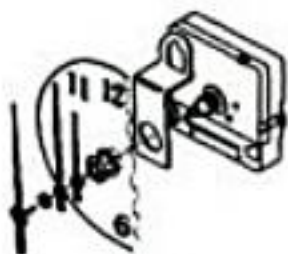
You can apply any of the drying oils right out of the container by rubbing them into the wood with a clean rag. Or, you can thin them first with some mineral spirits to make them dry faster. Wipe off any oil that does not penetrate after about 30 minutes.

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CIRCLE NO. 46 ON PRODUCT INFORMATION FORM

JUST FINISHING

For minimum protection, you'll want to put on at least three coats of oil, allowing at least a day's drying time in between. *Caution: Rags or paper soaked with drying oil can ignite spontaneously. Spread them out one layer thick and throw them away only after they are completely dry.*

Non-drying oils are excellent choices for spoons, salad forks, cutting boards, and butcher blocks—items that get regular, heavy use which would quickly wear off a film finish. Although these oils wash off eventually, they are easily renewed whenever needed. Your best choice for a non-drying oil is mineral oil. Mineral oil is a petroleum derivative sold in drug stores as a laxative. Natural vegetable oils—such as corn, soybean, or peanut oil—will also work, but they have a tendency to become rancid and smell after a while.

To apply any non-drying oil, simply pour a little onto a clean cloth or

paper towel, work it into the wood and wipe off any excess.

Wax

Wax works nicely on chopping blocks, countertops and serving trays. Although it's not as durable as a drying oil, wax is easy to apply and dries quickly. Any furniture paste wax based on beeswax, or carnauba or other plant wax can be wiped onto the wood and wiped off a few minutes later. (Steer clear of automotive waxes though—they are not intended for kitchen use.)

Because wax works best when it is thinnest, one coat is usually enough and the item will be usable within an hour. As with oils, you'll need to add a refresher coat of wax now and again.

Shellac

Shellac shines on nut and candy dishes, serving trays and, of course, sushi tables. For those special presen-

tation pieces that cry out for a true surface finish, yet still need to come in contact with food, nothing beats fresh shellac. Just two or three coats will give you a deep glossy finish that is completely nontoxic once its alcohol solvent evaporates. And unlike the oils, which may take days or even weeks to dry completely, a moderately thin coat of shellac will dry in under a half hour. (For more on shellac, see AW #34.)

Au Naturel

The simplest option is to do nothing at all. The cutting boards and spoons in my kitchen sport no finish at all, and for the most part they hold up beautifully. My favorite cutting board is an unfinished slab of maple that gets scrubbed off in the sink at least once a day. It has served me well for the past 15 years and shows no signs of deteriorating yet. I only wish I could say the same for my hairline. ▲

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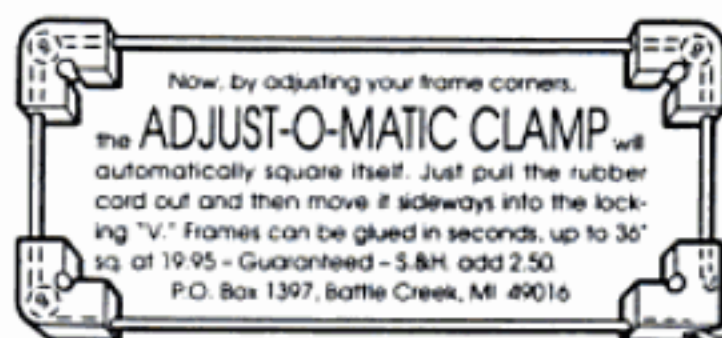
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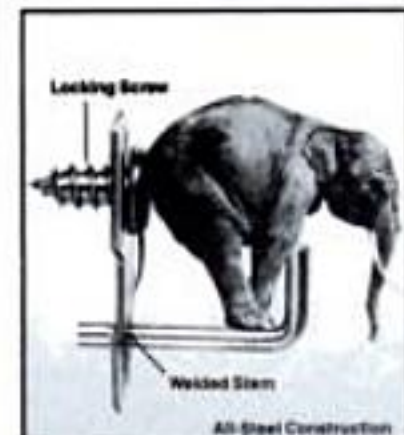
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Delta Sanding Center



There are lots of stationary belt/disc sanding machines on the market, but they tend to be either large industrial models that cost well over \$1000, or small, less expensive ones limited to light-duty work. Delta's new Model 31-280 Sanding Center fills the gap in between with a versatile machine that offers a 6-in. by 48-in. belt sander, a 12-in. disc sander and a power-takeoff shaft you can connect to such optional accessories as a pneumatic sanding drum, a flap sander, a buffing wheel and a flexible shaft for remote work. With all these accessories, you can customize the sander to fit your work.

The Sanding Center is a heavy-duty unit. The belt platen, sanding-disc wheel, work tables and machine base are all made of cast iron, and the unit is driven by a 1½-HP motor.

The machine is designed to be highly adjustable. For bevel sanding, both the belt and disc work tables tilt 45° up and down with positive stops at horizontal (0°). And the tables have milled slots so you can use a standard miter gauge for straight or angle sanding.

You also can tilt the entire belt sander horizontally, vertically, or to any angle in between. And you can remove the upper belt guard for free-hand-sanding curves on the idler drum. An optional 3-in. by 9-in. metal back stop can be installed across the belt as

a work stop or along the edge of the belt as a side fence.

We tested the Sanding Center in our shop for a month and found it to be an excellent performer in many ways. The belt and disc ran smooth and true, giving good control on both delicate pieces and large blocks of wood. The machine never bogged down in normal use. And the controls are well designed and easy to operate—especially the cam-lock belt-tensioning lever, which releases the belt with a simple half-turn.

Standard features such as the sliding pivot pin for sanding perfect circles (up to 24 in. dia.) and two dust collection ports add value to this machine. But for us, the thing that set the Sanding Center apart from similar sanders was the adaptable third work station that the power-takeoff shaft provides.

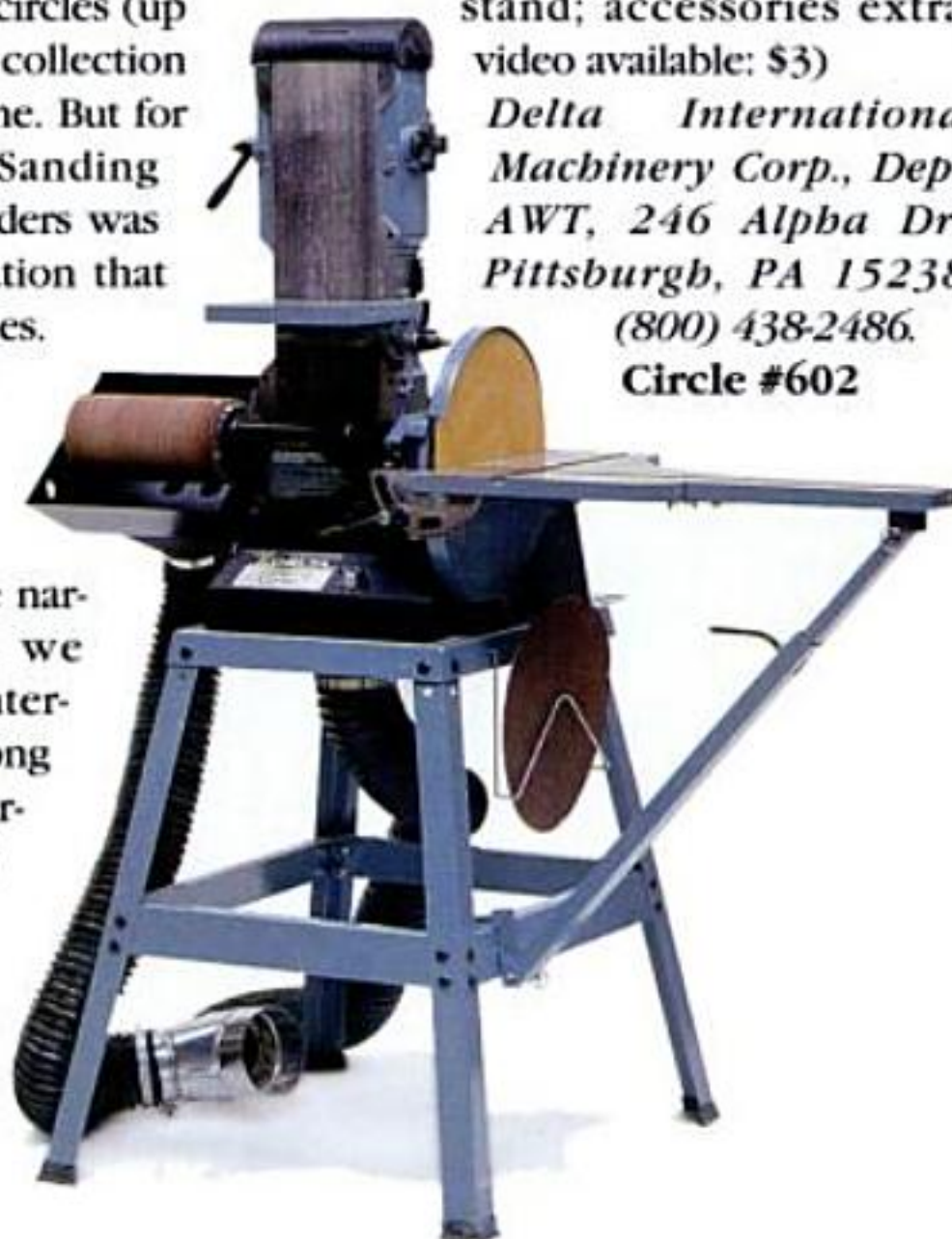
With the pneumatic sanding drum attached to the takeoff shaft, we could freehand-shape curves and contours with ease. With the narrow flap wheel in place, we could work hard-to-reach internal corners. And the 36-in.-long flexible shaft proved the perfect tool for sanding and grinding in tight spots.

We found only a few problems with this machine. The optional dust collection hood for the power-takeoff shaft

limited access to one side of the sanding drum, and dust collection from the disc sander was poorer than from the drum or belt. The flexible shaft had limitations, too: It only turns counter-clockwise, which means it can't be used for right-hand-rotation tools, like ordinary drill bits and burrs.

All things considered, we'd recommend the Delta Sanding Center for woodworkers who want a single machine that can offer different sanding modes along with the power to tackle big jobs. (List price: \$882, including stand; accessories extra; video available: \$3)

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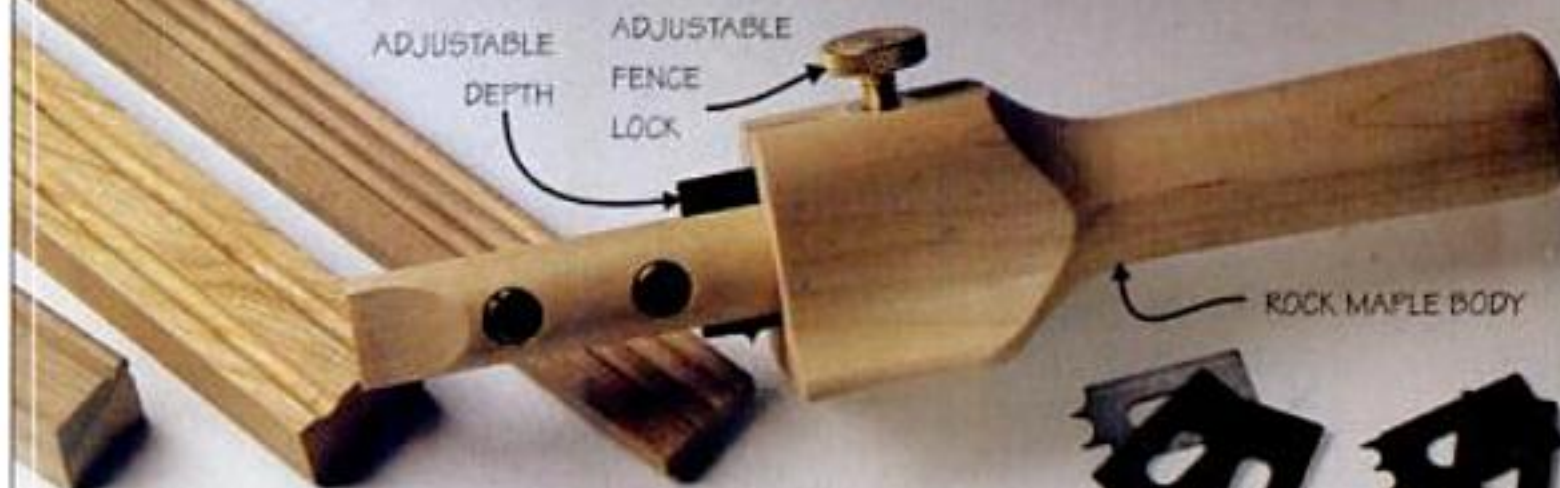
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The DCS-100 Wireless Control System lets you switch on your dust collector remotely from anywhere in your shop, without any additional wiring. The basic kit has three components: a hand-held transmitter, a transceiver and a relay module.

To use the system, you first plug the relay module into your dust collector's regular 110- or 220-volt outlet, then plug the dust collector into the relay. You plug the transceiver into any 110-volt outlet in your shop. When you push a button on the transmitter, it sends a wireless signal to the



transceiver. From there the signal goes through your regular shop wiring to the relay, which switches on the dust collector. You can buy an extra relay module (optional) to switch another machine with a second button on the transmitter. (Price: \$87.50 for kit, \$38.50 for extra relay module)

Fernbrook, Dept. AWT, 83 Pine Rd., Otto, NC 28763, (704) 524-6125.

Circle #603

Custom-Color Your Wood Stain

Wood-Kote's new "Tintable" Jelled Wood Stain lets you create custom tints to match any wood color or decorator paint color. The stain comes in two tint bases (one for light and one for dark colors), to which you add concentrated pigments available at paint and hardware stores. After mixing in the pigment you apply the oil-base stain with a rag, then wipe it off. It dries in two hours and resists



splotching on soft wood. (Price: \$11.35 per quart)

Wood-Kote, Dept AWT, Box 17192, Portland, OR 97217 (503) 285-8371.

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TOOL BOX

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New Tools From DeWalt and Hitachi

Look for an entirely new line of professional cordless power tools from DeWalt this spring. The company will introduce about a dozen models including hammer-drills, drill-drivers, screwdrivers and impact drivers.

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The Hitachi C8FB Sliding Compound-Miter Saw was one of the most popular tools in Hitachi's line, until recent import duties forced the price out of sight. (See "Final Pass," AW #36.) Now Hitachi plans to start manufacturing an improved version of the saw at its Los Angeles facility, lowering the selling price to about \$600, which includes a work-holding vise and slide fence that had been options. Look for the new C8FB2 this spring.

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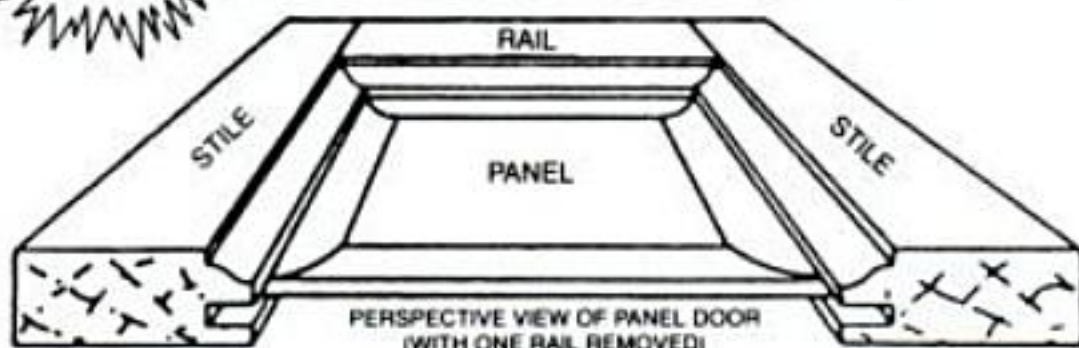
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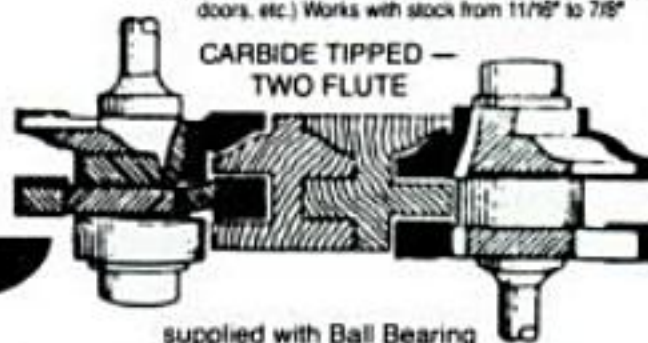
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FIRST-CLASS
Finalists

GALLERY

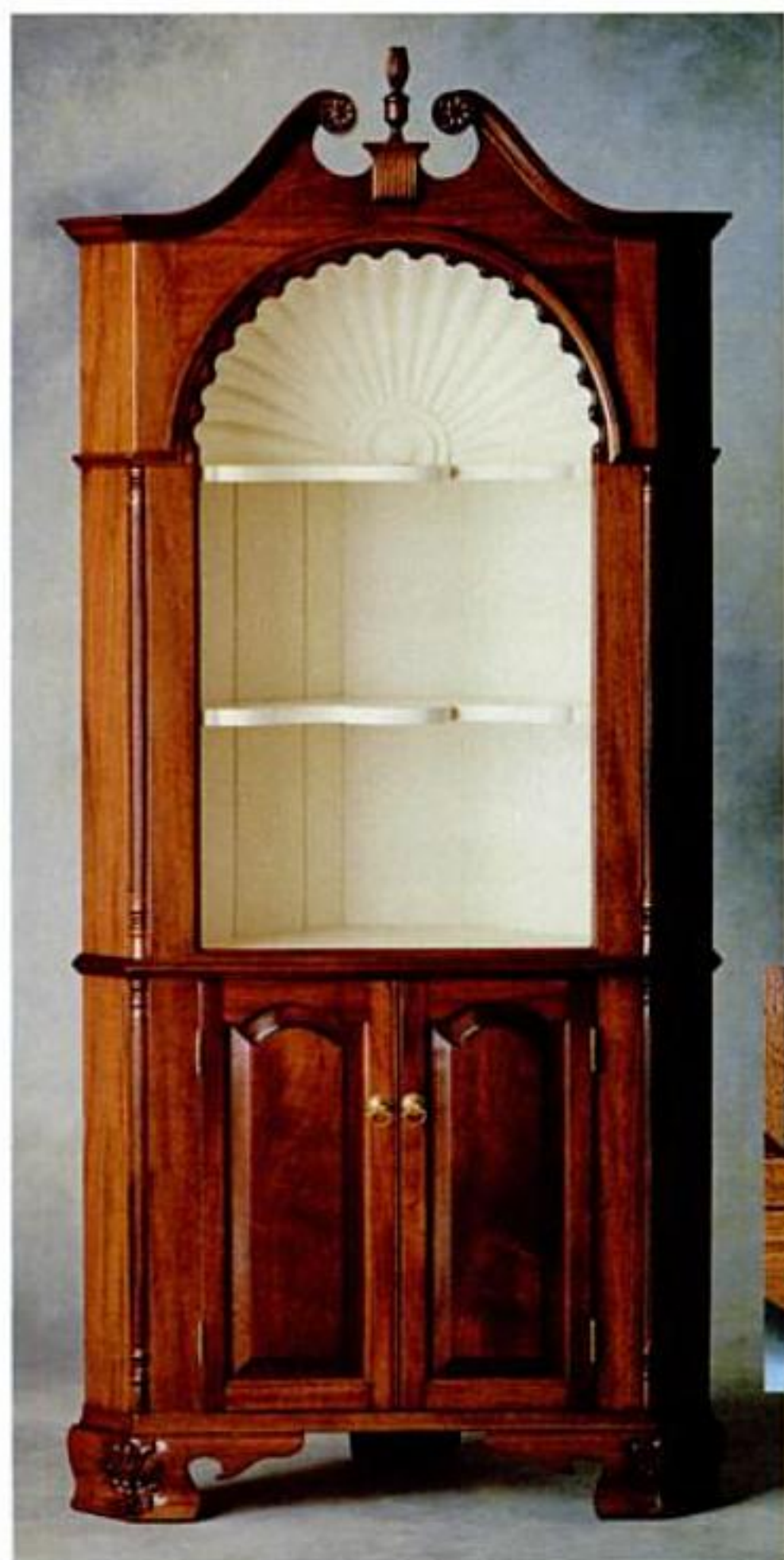
Once again this year the quality of work in our *Excellence in Craftsmanship* contest was so fine we found it difficult to pick the winners. Here is some first-class work from a few of our runners-up. For details on how to enter our 1994 contest, see page 22.

▶ "Moondoggie Divan" by Kristi Leile Hansen, Princeton Junction, New Jersey. Poplar, maple, velvet, acrylic paint. Dimensions: L: 84 in., W: 34 in., H: 39 in.



GILLIAN CLARK

▶ Corner cabinet by Amy Slow and David Bazis, Millersville, Pennsylvania. Mahogany. Dimensions: W: 30 in., D: 19 in., H: 84 in.



BILL SIMONE

▶ Table by David Leach, Rochester, New York. Cherry. Dimensions: W: 12 in., D: 12 in., H: 30 in.



CLAUDIA STATA

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▼ Chair by David J. Koleshis, Uxbridge, Massachusetts. Curly maple, moiré fabric. Dimensions: W: 18 in., D: 19 in., H: 50 in.



DAVID KOLESCHIS



CHRIS KROUP

◀ Drafting table by Chris Kroup, Indiana, Pennsylvania. White oak, birch plywood, walnut. Dimensions: L: 38 in., W: 32 in., H: 8½ in.



DAVID BROWNE



▶ Jewelry box by Jon Ingram, Oregon City, Oregon. Maple, Brazilian rosewood. Dimensions: W: 22 in., D: 13 in., H: 12 in.

▶ "Halltree Revisited" by Dennis Theisen, Westport Point, Massachusetts. Curly maple, walnut, cherry, argon/mercury lights. Dimensions: W: 59 in., D: 19 in., H: 87 in.



DENNIS THEISEN

▶ "Stratocumulus Cabinet" by John Hein, Trenton, New Jersey. Spalted sycamore, walnut, wenge, pear, maple. Dimensions: W: 13 in., D: 10 in., H: 70 in.



JOHN HEIN

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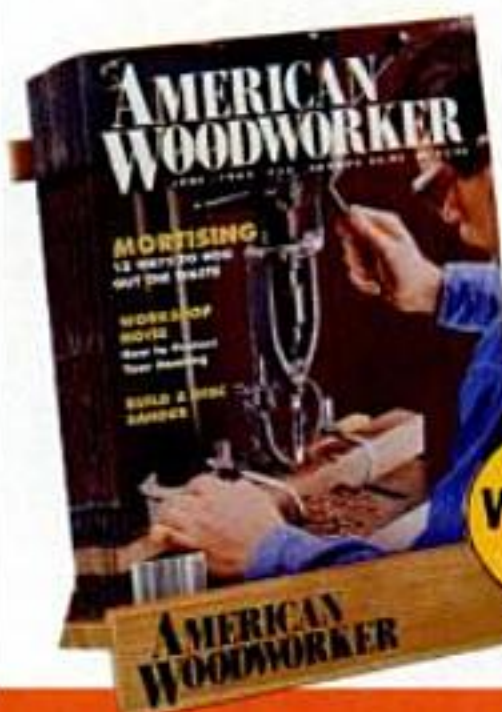
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CIRCLE NO. 48 ON PRODUCT INFORMATION FORM

FINAL PASS

"LOST PRESENCE OF MIND"

We all know the perils of failing to be vigilant when at work. Here, in correspondence between a policy holder and his insurance company, is the story of a guy who failed in a big way.

Dear Sir:

I am writing in response to your request for additional information. In block number 3 of the accident reporting form I put "Lost Presence of Mind" as the cause of my accident. You said in your letter that I should explain more fully, and I trust that the following details will be sufficient.

I am a bricklayer by trade. On the day of the accident, I was working alone on the roof of a new six-story building. When I completed my work, I discovered that I had about 500 pounds of brick left over. Rather than carry the bricks down by hand, I decided to lower them in a barrel by using a pulley which, fortunately, was attached to the side of the building at the sixth floor.

Securing the rope at the ground level, I went up on the roof, swung the barrel out, and loaded it with bricks. Then I went back to the ground and untied the rope, holding it tightly to insure a slow descent of the 500 pounds of bricks. You will note in block number 11 of the accident reporting form that I weigh 135 pounds.

Due to my surprise at being jerked off the ground so suddenly, I lost my presence of mind and forgot to let go of the rope. Needless to say, I proceeded at a rather rapid rate up the side of the building.

In the vicinity of the third floor, I met the barrel coming down. This explains the fractured skull and broken collarbone that I have noted.

Slowed only slightly, I continued

my rapid ascent, not stopping until the fingers of my right hand were two-knuckles deep into the pulley. This explains the lacerations of my right hand.

Fortunately, by this time I had regained my presence of mind and was able to hold tightly to the rope in spite of my pain.

At approximately the same time, however, the barrel of bricks hit the ground—and the bottom fell out of the barrel. Devoid of the weight of the bricks, the barrel now weighed about 50 pounds.

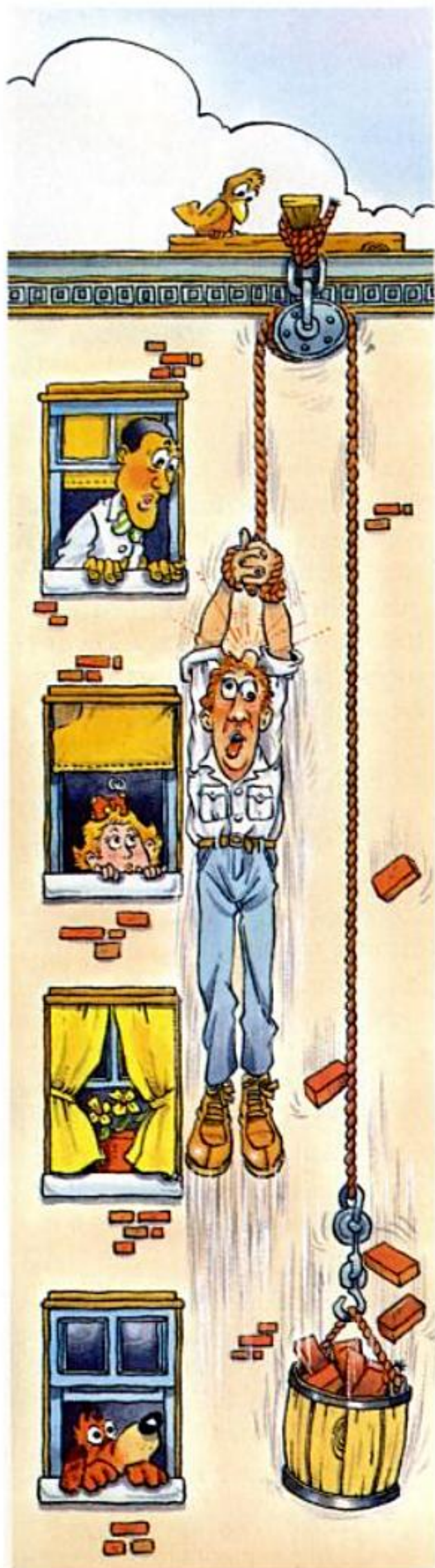
I refer you again to my weight of 135 pounds in box number 11. As you might imagine, I began a rapid descent down the side of the building.

In the vicinity of the third floor, I met the barrel coming up. This accounts for the two fractured ankles and the lacerations of my legs and lower body.

The encounter with the barrel slowed me enough to lessen my injuries when I fell into the pile of bricks and, fortunately, only three vertebrae were cracked.

I am sorry to report, however, that as I lay there on the bricks—in pain, unable to stand, and watching the empty barrel six stories above me—I again lost my presence of mind—I let go of the rope. ▲

Our thanks to Mike Veteto and the newsletter of the Green Country Woodworker's Guild (Tulsa, Oklahoma), where this story appeared.



While other geniuses have been out collecting their Nobel Prizes, ours have been experimenting in the basement again.

They look harmless enough. But send these men to the basement at Ryobi R&D, and they go wild. This year, it all started with the new OSS450 Oscillating Spindle Sander – the first in its price range to combine up-and-down and rotary motion for burn-free finishes on



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EXCLUSIVELY FOR ENLON.

IMMEDIATE DELIVERY IS AVAILABLE FOR ALL ★ MACHINERY.

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Thank you for your support.

6" JOINTER ▶

- 1 H.P., 110/220V
- 3-KNIFE CUTTERHEAD
- 47" BED LENGTH

*EN3101

REG.: \$395.00

SPECIAL:

\$350.00



8" HEAVY DUTY JOINTER ▶

- 1 1/2 H.P., 220V
- 3-KNIFE CUTTERHEAD
- 65" BED LENGTH

*EN3102

REG.: \$700.00

SPECIAL:

\$645.00



2 H.P. DUST COLLECTOR ▶

- 220V, 15 AMPS
- 1,059 C.F.M.
- 2 INTAKES @ 4"

*EN-DC20

REG.: \$305.00

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\$270.00



FREE 4" x 10' P.V.C. HOSE with purchase of any Dust Collector.

20" INDUSTRIAL BAND SAW ▶

- 3 H.P., 220V, 15 AMPS
- BLADE SPEED: 3,700 F.P.M.
- 12" MAX. CUTTING HEIGHT

*EN3506

REG.: \$1,490.00

SPECIAL:

\$1,230.00



22" SCROLL SAW ▶

- 1/8 H.P., 110V
- 1,725 S.P.M.
- DUST BLOWER

EN-SC22

REG.: \$160.00

SPECIAL:

\$149.00



10" TILTING ARBOR TABLE SAW ▶

- 3 H.P., 220V, 15 AMPS
- PRECISION GROUND CAST IRON TABLE
- PRECISION LEVER LOCK FENCE SYSTEM
- STEEL BASE CABINET

*EN3202

REG.: \$970.00

SPECIAL:

\$850.00



1/2" WOOD SHAPER ▶

- 1 H.P., 110V, 16 AMPS
- 1/2" SPINDLE
- REVERSIBLE MOTOR
- CAST IRON TABLE

*EN-WS05

REG.: \$280.00

SPECIAL:

\$265.00



1 1/2 H.P. WOOD SHAPER ▶

- 110/220V, 7,000/10,000 R.P.M.
- 1/2" & 3/4" SPINDLES
- CAST IRON TABLE

*EN3302

REG.: \$560.00

SPECIAL:

\$490.00



3 H.P. HEAVY DUTY WOOD SHAPER ▶

- 220V, 7,000/10,000 R.P.M.
- 1/2", 3/4" & 1" SPINDLES
- CAST IRON TABLE

*EN3303

REG.: \$865.00

SPECIAL:

\$790.00



3 H.P. SLIDING TABLE WOOD SHAPER ▶

- 220V, 7,000/10,000 R.P.M.
- 24" X 9" SLIDING TABLE
- 1/2", 3/4" & 1" SPINDLES

*EN3304

REG.: \$980.00

SPECIAL:

\$895.00



6" X 48" BELT/9" DISC SANDER ▶

- 3/4 H.P., 110/220V
- MITER GAUGE
- ADJUSTABLE TABLE 0-45°

*EN-SN69

REG.: \$216.00

SPECIAL:

\$185.00



6" X 30" EDGE SANDER ▶

- 1 1/2 H.P., 110/220V
- 6" X 80" BELT
- QUICK RELEASE LEVER
- CAST IRON TABLE

*EN3405

REG.: \$450.00

SPECIAL:

\$405.00



12" PLANER ▶

- 2 H.P., 110V, 14 AMPS
- 16,000 C.P.M.
- 2-KNIFE CUTTERHEAD

EN-PN12

REG.: \$390.00

SPECIAL:

\$365.00



15" PLANER ▶

- 3 H.P., 110/220V, 30/15 AMPS
- 2 SPEEDS: 16 & 20 F.P.M.
- 3-KNIFE CUTTERHEAD

*EN-PN15

REG.: \$900.00

SPECIAL:

\$825.00



20" PLANER ▶

- 3 H.P., 220V, 15 AMPS
- 2 SPEED: 16 & 20 F.P.M.
- 4-KNIFE CUTTERHEAD

*EN-PN20

REG.: \$1,330.00

SPECIAL:

\$1,280.00



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