SHOP TESTED: WE RATE 13 BENCHTOP PLANERS

CRAFTSMANSHIP AWARD WINNERS

AMERICAN WOODWORKER™

DECEMBER 1996 #56

How to Make Drawers with a Perfect Fit

Super Jigs for Sliding Dovetails

5 Great Gift Projects

Build this Blanket Chest

$3.95 US $4.95 CANADA

12>

0 71486 01507 9

TABLE OF CONTENTS

Issue No. 56
December 1996

Features

38
Connecticut Blanket Chest
An authentic reproduction of an 18th-century classic
By R.S. Wilkinson

44
Waterstone Pond
This sharpening station will keep your stones ready to go
By Frank Klausz

46
An Introduction to Chip Carving
All you need are two knives and a comfortable chair
By Wayne Barton

50
Top Drawer
How to make a drawer with a piston fit
By Ian J. Kirby and John Kelsey

56
A Simple Wall Mirror
Dress up a basic frame with curves, pegs and carving
By Gary Rogowski

60
Sanding Blocks
Sand faster and better for next to nothing
By William Tandy Young

64
SHOP TESTED Benchtop Planers
We rate 13 machines—including 6 brand-new models

70
Turned Ring Box
A tiny container that's easy to turn and tricky to open
By Steve Blenk

73
Cornish Knot Puzzle
Make this brainteaser with a drill press and a Forstner bit
By John Cauley

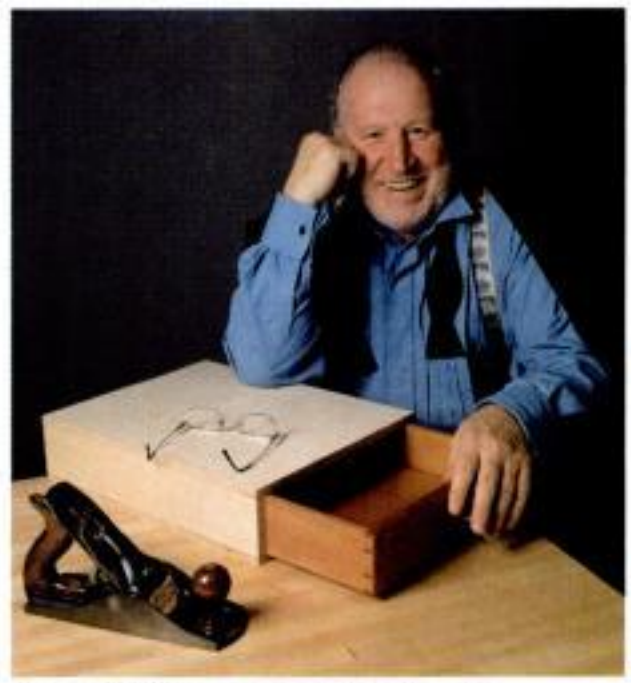
76
AW's 1996 Excellence in Craftsmanship® Awards
Winners of our fifth annual competition

80
Sliding Dovetails
Rout these locking joints with a pair of simple jigs
By Frank Klausz

82
Retempering Tools
How to bring edge tools back from burnout
By Mike Callihan

Page 38 *Build this heirloom blanket chest*

Page 64 *Shop test: Benchtop planers*



Page 50 *Drawermaking magic*

Page 73 *Cornish knot puzzle*

On the cover: An American classic. *This reproduction blanket chest is an heirloom you'll treasure forever. See page 38 for plans.*

PHOTO BY JOHN HAMEL

AMERICAN WOODWORKER™

A RODALE PRESS PUBLICATION

TABLE OF CONTENTS

Departments

6 A WORD FROM THE EDITOR

8 LETTERS
Flip-up bench stops

16 Q&A
Finishes that won't yellow

24 OFFCUTS
Wild walking sticks

30 TECH TIPS
Circular sawing made simple

86 WOOD FACTS
Douglas fir

90 JUST FINISHING
Nitrocellulose lacquer

98 TOOLBOX
Hottest new tools from two big shows

114 GALLERY
AW Excellence Award finalists

120 SHOP SOLUTIONS
These sawhorses do double duty

Page 8 *Adirondack feedback*

Page 114 *Contest finalists*

Page 98 *Best new tools of '96*

AMERICAN WOODWORKER

EDITORIAL & ADVERTISING OFFICES
33 E. Minor St., Emmaus, PA 18098
Phone: (610) 967-5171 • FAX: (610) 967-7692

EDITOR & PUBLISHER **David Sloan**

EXECUTIVE EDITOR **Ellis Walentine**

MANAGING EDITOR **Tim Snyder**

ASSOCIATE EDITORS **Paul Anthony, Andy Rae**

ASSISTANT EDITORS **Susannah Hogendorn, Joe Wajszczuk**

PRODUCTS COORDINATOR **Dave Sellers**

WEST COAST EDITOR **Simon Watts**

CONTRIBUTING EDITORS **Lonnie Bird, Stephen Blenk, Jim Cummins, Michael Dresdner, Mike Dunbar, Frank Klausz, Peter Korn**

ONLINE HOST **Jim Cummins**

ONLINE SYSTEMS PRODUCER **Julie Miller**

DESIGN SHOP **Fred Matlack**

ADMINISTRATIVE ASSISTANT **LaVerne Walker**

ART DIRECTOR **Kitty Pierce Mace**

ASSOCIATE ART DIRECTOR **Melanie Powell**

ADVERTISING DIRECTOR **Don Schroder**

NATIONAL ACCOUNTS MANAGER **Robert F. Izard**

MARKETPLACE/CLASSIFIED **Ian Tauber**

AMERICAN WOODWORKER SHOW™ MANAGER **Jonathan I. Frank**

ADVERTISING PRODUCTION COORDINATOR **Lisa Unruh**

PROMOTIONS COORDINATOR **Shelley Drozd**

PRESIDENT/MAGAZINE DIVISION **John Griffin**

VICE PRESIDENT, SINGLE COPY SALES **Richard Alleger**

DIRECTOR, RETAIL SALES **Chuck Tripp**

NATIONAL MARKETING DIRECTOR **Diederik Terlaak Poot**

VICE PRESIDENT CIRCULATION **Edward J. Fones**

CIRCULATION MANAGER **Keith Follweiler**

ASSISTANT CONSUMER MARKETING MANAGER **Lynn Hower**

DIRECT SALES MANAGER **Charlotte M. Walker**

ATTENTION RETAILERS: **To carry this title in your store, call the Direct Sales Department at (800) 845-8050.**

AMERICAN WOODWORKER (ISSN 1077-7997) is published seven times a year in February, April, June, August, October, November, and December by Rodale Press Inc., 33 E. Minor St., Emmaus, PA 18098; (610) 967-5171. ©1996 by Rodale Press, Inc. J.I. Rodale, Founder; Ardath Rodale, Chairman of the Board; Robert Teufel, President of Rodale Press. SUBSCRIPTION RATES: U.S. one-year, $23.88; two-year, $47.76. Single-copy, $3.95. Canada, one-year, $31.88, two-year, $63.76 (Canadian funds) GST #-R122988611. Foreign, one-year, $35, two-year, $70 (U.S. funds). U.S. newsstand distribution by Curtis Circulation Co., Hackensack, NJ 07610. PERIODICALS POSTAGE: Paid at Emmaus, PA and additional mailing offices. POSTMASTER: Send address changes to AMERICAN WOODWORKER, P.O. Box 7591, Red Oak, IA 51591. IN CANADA: Postage paid at Gateway, Mississauga, Ontario; Canada Post International Publication Mail (Canadian Distribution) Sales Agreement #738867. Send returns and address changes to AMERICAN WOODWORKER, 100 Armstrong Ave., Georgetown, Ontario L7G 5S4; GST #R122988611. CONTRIBUTOR GUIDELINES: Available upon request, (610) 967-8315.

The Audit Bureau Member

Printed in USA.

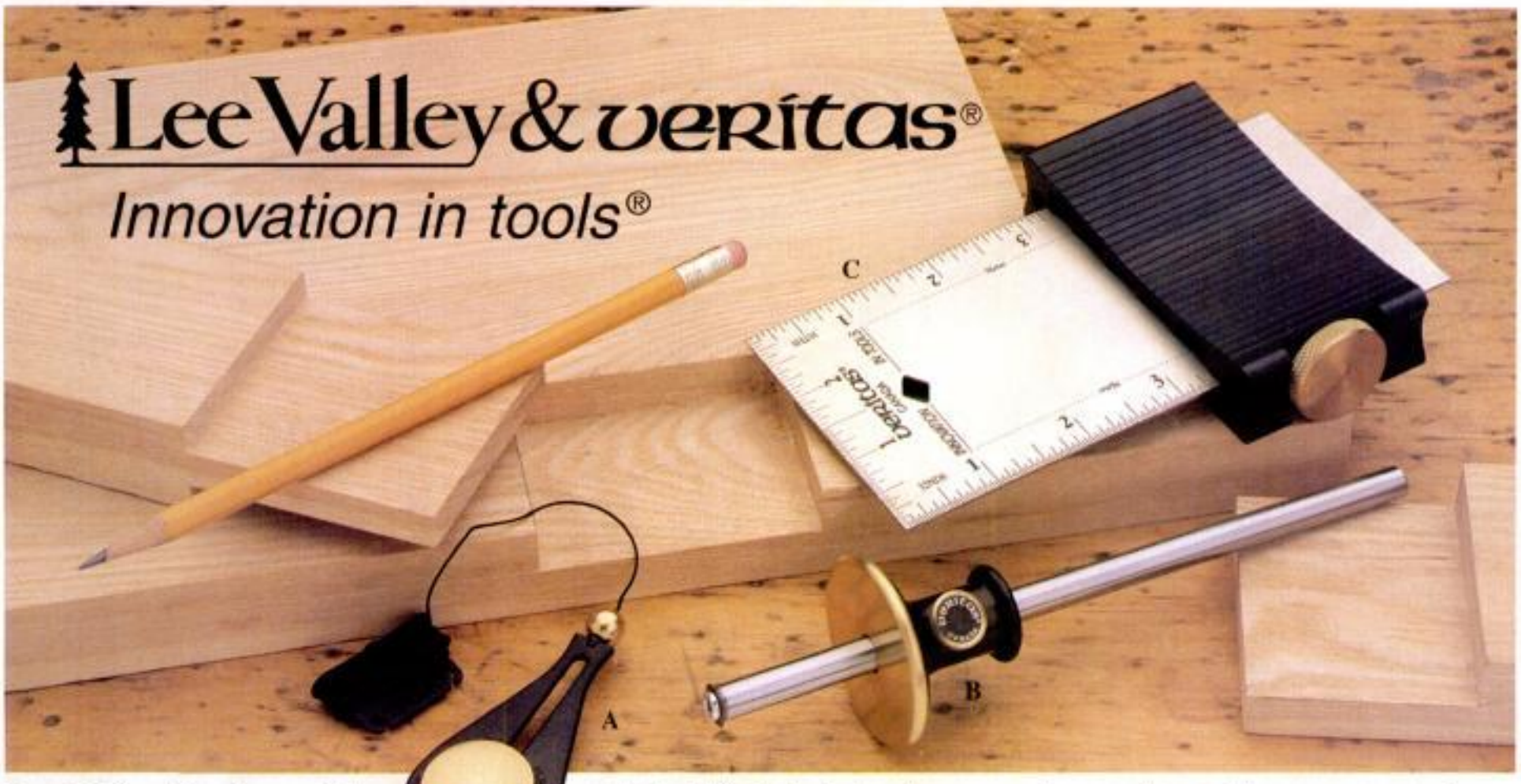
SUBSCRIPTION QUESTIONS & ADDRESS CHANGES

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

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

Please include a recent mailing label with all correspondence.

Fax: (712) 623-5731
Or call: (800) 666-3111



Lee Valley Tools and its manufacturing arm, Veritas® Tools, bring you the newest products from their research and development activities.

The following 3 pages are a sample of what you can expect in the full-color, 236-page Lee Valley catalog.

A. Veritas® Flat-Bob

Some concepts are embarrassingly obvious once you see them in practice. So it is with the Flat-Bob. The most common use of plumb bobs is next to a wall, yet round plumb bobs roll around endlessly, making it nearly impossible to get an accurate line. The Flat-Bob doesn't roll and, because it has a very low center of gravity, it stabilizes rapidly. Because it is thin, the point is easily visible from above, again not the case with a regular bob. The body design also makes accurate marking much easier. You can press it against the wall as you mark a line dead center through the body slot.

It comes with a small windlass that holds the 8′ of braided nylon cord (no endless twirling, like twist cord!) and makes it easy to both adjust the cord to any length as well as have it hang exactly plumb from a nail. The cord windlass snaps into the body slot to keep the cord from unwinding or tangling. There is also a tip cover to protect the point when the Flat-Bob is in a toolbox.

Whether you use this in construction, for plumbing cabinetry, or for wallpaper jobs, it can easily pay for itself the first day. All brass fittings on a precision molded ABS body. 3 3/4″ long overall.

AW05 Veritas® Flat-Bob **$9.95**

B. Veritas® Wheel Marking Gauge

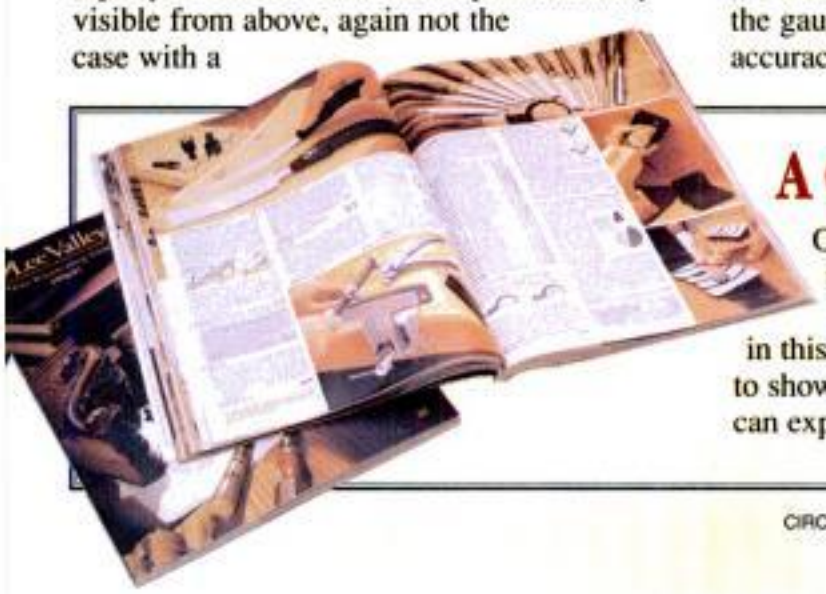
The two main problems with a standard marking gauge is that the gauge has to be tilted just right to avoid pin chatter and, even then, the pin has a tendency to follow the grain of wood, throwing off your line. Our wheel gauge solves both problems. The hardened-steel cutter will perfectly scribe at any point of its circumference and, since the wheel is both sharp and bevelled only on the inside, it cuts through grain and forces the gauge face against the stock, maintaining accuracy. Because it cuts rather than tears, it leaves a clean mark even on cross grain. The gauge is particularly easy to set since it has an internal "O" ring to keep light but constant friction on the stem. The anodized aluminum head has a thick (1/8″) brass face and a brass thumbscrew. A very comfortable gauge to use.

AW08 Veritas® Wheel Marking Gauge **$18.95**

C. Veritas® Sliding Square

This is a cabinetmaker's layout square. Laying out mortises and tenons, letting in hinges, transferring locations – all of these can be done faster and more accurately with this square than any other. The joy is that you always have ample reference face against your work without having to flop the square. You can also work in two axes at once, e.g., measuring in 2″ and over 1 1/2″ is simple, substantially reducing the possibility of error. The stainless-steel blade is 3″ wide and 6″ long, graduated on both edges (to 4″) and across the end. It has a matte finish, which not only makes it easy to read by eliminating glare, but lets you record dimensions on it with a pencil. The diamond cut-out in the blade holds a pencil tip in position and makes it particularly easy to draw lines parallel to an edge. The locking mechanism is the traditional notched pin used on combination squares. The opposed bearing surface is a hardened steel rod, imbedded in the anodized aluminum stock.

AW10 Veritas® Sliding Square **$21.95**



A Catalog Of Solutions

Our 236-page, full-color catalog has the widest selection of woodworking hand tools in the market. The copy in this ad is taken directly from the catalog to show you the detailed information you can expect to find about each tool.

To Order: 1-800-871-8158

or fax: 1-800-513-7885

Our catalog is $5 (refundable with first purchase) or free with any purchase from this three-page ad.

N.Y. residents, add sales tax.

Outside U.S.A., call: 1-613-596-0350 or fax:1-613-596-6030

CIRCLE NO. 501 ON PRODUCT INFORMATION FORM

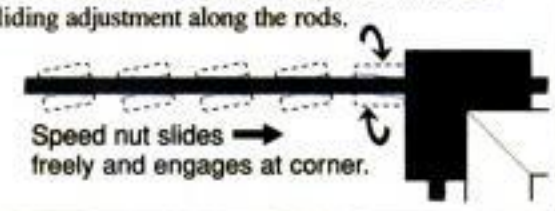
A. Veritas® 4-Way Speed Frame Clamp

The fastest-adjusting frame clamp on the market. Completely knurled for good grip, the 4 speed-clamping nuts* are designed to let you make fast adjustments, yet hold securely when you tighten them. They are cross drilled to slide easily on the rods until they come up against a corner clamp; then their threads engage. To release them, you just have to back them off a turn or two and they are then free sliding again. The clamp includes 4 corners (strong, glass-filled nylon with brass inserts), 4 speed-clamping nuts, eight 24″ long 1/4 -20 threaded rods, and 4 coupling nuts. The rods and coupling nuts have a black-oxide finish. Maximum capacity is 47″ square or 71″x 23″ rectangle.

AW12 Veritas® Frame Clamp Set **$24.95**

***Speed-Clamping Nuts**

These nuts are quick-adjusting because they are cross drilled (at first glance the hole appears to be off-center). This unique design allows you to move them along a threaded rod without turning them; their threads do not engage until they meet the clamping corner (or any obstruction). Then you tighten them. The threads disengage when you loosen the nuts, allowing the same free-sliding adjustment along the rods.



Veritas® Chair Doctor™ Glues

Chair Doctor glue does exactly what the name implies; it fixes chairs. If a chair has a loose rung, an injection of Chair Doctor glue will first swell the rung and then bond it in position. The secret is the low viscosity. It will soak into the end grain of wood, swell the wood and then freeze the wood in the swollen state as it cures. A film of dry glue lines the wood cells, preventing contraction. The glue can penetrate the narrowest of cracks.

Chair Doctor comes in a 2 fl oz bottle with a slim applicator tip that lets you place the glue accurately. Chair Doctor Pro includes 4 fl oz of glue, 1 syringe, and 3 sizes of blunt-tip needles. Usually, you let Chair Doctor glue seep into a loose joint, but for many loose joints, you can actually slip our finest needle alongside the tenon to the base of the socket, then inject it full of glue. For difficult repairs, you can drill a tiny hole and inject glue into a joint. With a syringe, it is easy to do a number of joints quickly and neatly. Even better, everything cleans with water so the needles and syringe are reusable.

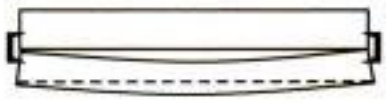
B. **AW16** Chair Doctor™ Pro, 4 fl oz **$6.95**
C. **AW15** Chair Doctor™ Glue, 2 fl oz **$4.95**

D. Pinch Dogs

Pinch dogs are used for assembly and for clamping. Traditionally, they were used by upholsterers as all-purpose gluing clamps. Regardless of the shape of the two pieces, as long as the dog was tapped in across the glue line, it would hold everything tight until the glue set. Patternmakers used them for column assembly. Cabinetmakers used them for assembly, clamping, and jigging. Pricing had driven these tools out of the market, but we are now having them made in substantial volume, allowing major price reductions. Sizes indicated are overall width, tip to tip. Available in individual sizes or as a set of 18 (6 each of 3 sizes).

AW20	1″ Pinch Dog, pkg. of 6	**$ 4.95**
AW21	1 3/4″ Pinch Dog, pkg. of 6	**$ 6.75**
AW22	2 1/2″ Pinch Dog, pkg. of 6	**$ 8.75**
AW23	Set 18 Dogs (all of above)	**$18.00**

A very specialized use for pinch dogs is when you are ripping lumber to straighten it. Two dogs can be used to hold a crooked board to a straight one.



Lee Valley & veritas®

Veritas® Tools Inc. is the manufacturing arm of Lee Valley Tools Ltd. The intense research and development activities of the retail firm, Lee Valley, naturally led to the creation of Veritas® Tools Inc., the manufacturer.

Lee Valley Tools Ltd., 12 East River Street, Ogdensburg, N.Y. 13669

Guarantee – We pledge to you the best service we can provide with personal attention and the best value on every order. If you are not satisfied for any reason, just return your purchase within 3 months by insured parcel post to our Ogdensburg, N.Y., address. You can choose to either exchange the product, or receive a complete refund (including our regular shipping charges); we will also refund your return insured parcel post costs.

E. Forstner/Saw Tooth Bits

Made exactly to our specifications, these bits took over a year to develop and refine. Bits up to 1″ diameter are forstner pattern and have 3/8″ round shanks. Above 1″, bits are saw tooth pattern and have hex shanks – a key feature for anyone who has tried to keep large-diameter bits from slipping in a chuck.

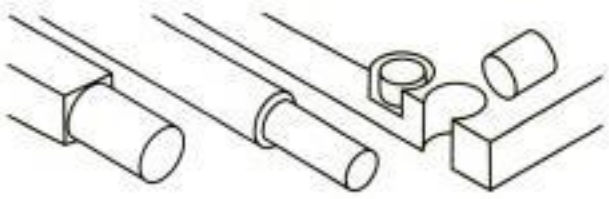
The rim on the forstners is proud of the chippers by only .005″, reducing rim heat. The saw tooth styles are true saw tooths, not forstner bits with rim notches. The teeth have a skewed shear-cut design to prevent fiber pull and to give clean holes. Both styles have slightly sloped chipping bevels so that bits ride a cone of wood to keep them boring straight. Center brads can then be shorter, increasing bit versatility in thin material. Finally, bits have been finished with extra-fine grinding wheels to reduce friction.

Overall length is 3 1/2″ for bits up to 1″, 5″ for bits from 1 1/8″ to 2″, and 6 1/2″ for bits over 2″. These are the best value we have in bits.

AW96	Set of 7 Forstners†	**$ 21.95**
AW97	Box of 13 – 1/4″ to 1″	**$ 44.75**
AW98	Box of 16 – 1 1/8″ to 3″	**$145.00**
AW99	Box of 29 – all bits	**$179.00**

F. Dowel, Plug and Tenon Cutters

For straight plugging operations, nothing works better in the 1/4″ to 1/2″ sizes than our Snug Plug® cutters. But for larger plugs or for cutting dowels and tenons, these are the best you can get. Not only are they made to very tight tolerances and will therefore cut accurate tenons and plugs, but we spent nearly two years in a design and test process to get the cleanest possible finish and the least heat build-up while cutting.



Although they run cooler than any other rim hold cutter, you still have to be careful. Cutting softwoods is okay, but care has to be taken in hardwoods to avoid overheating. Regardless, the convenience of being able to cut tenons and plugs up to 3″ diameter makes it all worthwhile.

Plugs 1″ long or less automatically side eject. Total available depth of cut is 2″. Cutters up to 1″ dia. have 1/2″ round shanks, above 1″, 1/2″ hex. For use only in a drill press.

AW55	Set of 4 Cutters*	**$29.95**
AW56	Boxed Set of 6 (3/8″ to 1″)	**$49.95**

Individual Bit Prices

Size	Forstner Bits			Dowel/Tenon		
1/4″	AW61	$ 3.10	†			
5/16″	AW62	$ 3.40				
3/8″	AW63	$ 3.50	†	AW30	$ 7.25	*
7/16″	AW64	$ 3.70				
1/2″	AW65	$ 3.75	†	AW31	$ 7.75	*
9/16″	AW66	$ 4.00				
5/8″	AW67	$ 4.25	†	AW32	$ 9.25	
11/16″	AW68	$ 4.30				
3/4″	AW69	$ 4.40	†	AW33	$ 9.75	*
13/16″	AW70	$ 4.60				
7/8″	AW71	$ 4.80	†	AW34	$10.50	
15/16″	AW72	$ 5.00				
1″	AW73	$ 5.20	†	AW35	$11.50	*
Size	**Saw Tooth Bits**					
1 1/8″	AW80	$ 5.70		AW36	$12.25	
1 1/4″	AW81	$ 5.90		AW37	$12.75	
1 3/8″	AW82	$ 6.10		AW38	$13.50	
1 1/2″	AW83	$ 6.70		AW39	$14.25	
1 5/8″	AW84	$ 7.20		AW40	$14.75	
1 3/4″	AW85	$ 7.70		AW41	$15.25	
1 7/8″	AW86	$ 8.00		AW42	$15.75	
2″	AW87	$ 8.40		AW43	$16.75	
2 1/8″	AW88	$ 9.70		AW44	$17.75	
2 1/4″	AW89	$11.75		AW45	$18.25	
2 3/8″	AW90	$13.00		AW46	$18.75	
2 1/2″	AW91	$14.50		AW47	$19.25	
2 5/8″	AW92	$15.50		AW48	$19.75	
2 3/4″	AW93	$16.75		AW49	$20.25	
2 7/8″	AW94	$17.75		AW50	$21.00	
3″	AW95	$19.25		AW51	$21.50	

A Catalog Of Solutions

Our 236-page, full-color catalog is filled with detailed information (like above), plus many technical tips. Smaller seasonal catalogs contain extensive technical bulletins.

To Order: 1-800-871-8158
or fax: 1-800-513-7885

Our catalog is $5 (refundable with first purchase) or free with any purchase from this three-page ad.

N.Y. residents, add sales tax.
Outside U.S.A., call: 1-613-596-0350 or fax:1-613-596-6030

CIRCLE NO. 501 ON PRODUCT INFORMATION FORM

Woodworkers Have It Made

Skip the mall and head to the workshop!

We woodworkers really have it made—especially when the holidays roll around. While weary shoppers struggle in traffic jams spending hard-earned cash on mass-produced merchandise, we can relax in our workshops, making gifts that people will treasure for years to come.

(Okay, some of us are pulling all-nighters in our basements, frantically rushing to finish presents we promised to make but didn't start until the last minute! If we're lucky, the finish will be dry enough to handle when the kids wake up at 5:00 Christmas morning!)

In any case, this issue is packed with great gift suggestions, from a deceptively simple "Cornish knot" puzzle made from dowel rod, to an heirloom furniture project—a painstakingly researched reproduction of an important 18th-century Connecticut blanket chest.

Turners will love Steve Blenk's clever ring box, a baffling little container for rings or other small items. All it takes are a few cubic inches of wood and a couple hours of lathe time.

Or, you can decorate your way to a beautiful gift with chip carving. Master carver Wayne Barton shows you how to carve those delicate designs with just two inexpensive knives.

Another treat is Ian Kirby's "Top Drawer," step-by-step instructions for making a drawer that fits like a piston yet slides home with just fingertip pressure.

Whatever your aim or pleasure, I think you'll find plenty of inspiration in this issue, and lots of good reasons to sit out the end-of-year buying frenzy.

From all of us at AMERICAN WOODWORKER, have a relaxing holiday season and a happy and productive new year.

Ellis Walentine
Executive editor

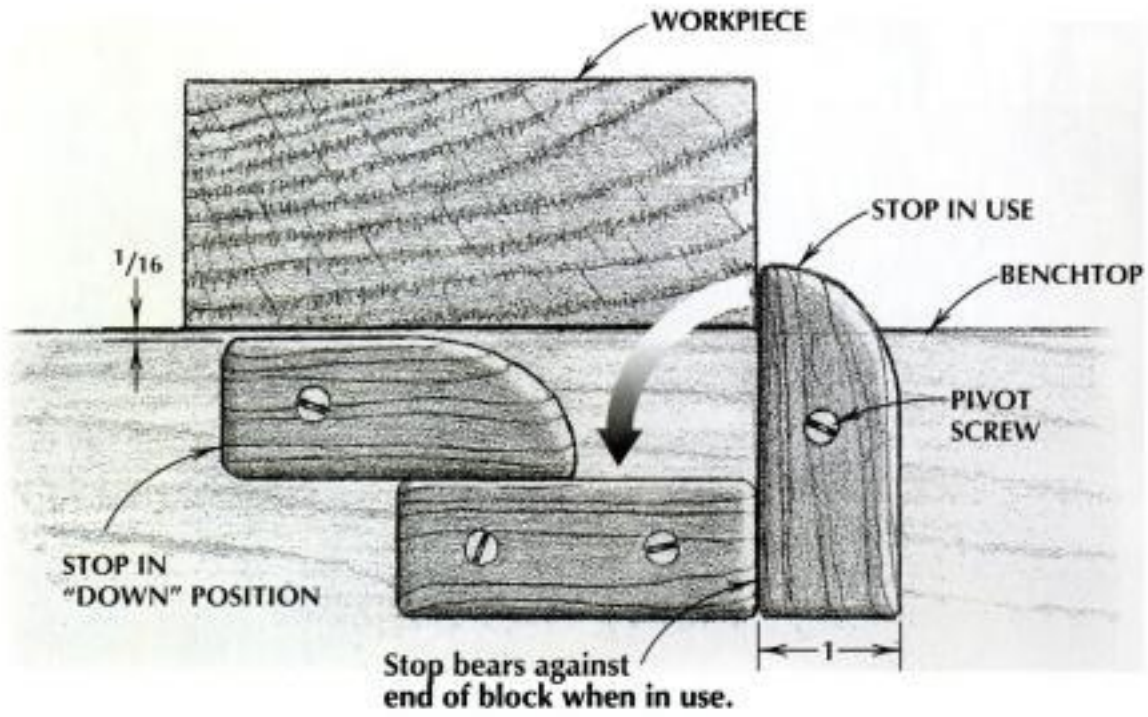
PLAY IT SAFE

Woodworking can be dangerous. Safety equipment can greatly reduce your risk of injury; so can common sense and caution. Remember, if a procedure feels dangerous to *you*, don't try it—find a safe alternative. Your safety is your responsibility.

Flip-Up Stops

In the photos showing how to build Andy Rae's Adirondack chair, I noticed some intriguing stops screwed to one end of Rae's workbench. (See AW #52, page 28, top right photo.) I'd appreciate some information on these stops and how they work.

Eric Neilsen
Milpitas, CA



Andy Rae replies: I learned about these useful stops when working with contributing editor Frank Klausz. There are two stops shown in the photo; both can easily flip up above the bench surface when needed, then flip down out of the way. When in use, either stop bears against a central block that's screwed to the end of the bench. (See drawing.) One stop is for pushing against, as when you're cutting with a Western handsaw. The other works the opposite way, holding the work when you need to cut on the pull stroke, as when you're using a Japanese saw. I made my stops from some rosewood scraps 3/8 in. thick and 1 in. wide. Other strong hardwoods will work equally well. To make your stops work smoothly, place a nylon washer over the shank of each pivot screw, between the stop and the bench.

Feedback on Scrollsaws

I enjoyed your review of floor-model scrollsaws (AW #54) and thought I might be able to provide a little input. About eight months ago, I purchased an Excalibur scrollsaw to replace a 10-year-old saw that I outgrew. I've been using the Excalibur for at least 10 hours per week.

The Excalibur's "parallel link" arms just about eliminate blade breakage. I recently completed two wall clocks made of 3/8-in.-thick ash, walnut, and red oak. Each had more than 300 internal cuts and I can remember breaking only four blades. Two of the blades broke after only a few seconds, so I suspect they were defective. On the rare occasions when a blade breaks, the foot switch (which was included free with the saw) allows me to stop the saw before damage to the workpiece can occur.

It takes me less than 10 seconds to insert and retension the blade for an internal cut and less than one minute to change blades, so the blade-changing system really works well, as you reported in your test.

The other feature I really like is the saw's direct-current (DC) motor. I sometimes like to saw at speeds of just 100 strokes per minute, and I can cut at this speed with no noticeable loss of power. The DC motor is such an asset that I do not think I would purchase a scrollsaw without one. Thanks for publishing a great magazine!

Tom Bourg
Baton Rouge, LA

Good Storage Solutions

Paul Anthony's article on wood storage (AW #54) gave me just the motivation I needed to organize the growing pile of lumber in my basement workshop. I built a rack similar to Anthony's, with one small modification. I added a piece of 1/4-in. plywood under each row of supports to store small pieces. Building the storage rack did create a new problem: Now I have much more floor to sweep. Thanks for a wonderful magazine. Keep those great tips and plans coming!

Andy Highberger
Marysville, OH

A Marriage Saved

Not long ago, my wife went out with some of her friends, leaving me at home with her father and brother. We ordered a few pizzas for dinner, placing the extremely hot boxes on our dining-room table. After dinner, we removed the boxes to find some horrible white spots in the table's finish. We tried to wipe them off, but couldn't. Thinking quickly and shuddering at the thought of my wife's reaction to the situation, I logged on to America Online and went to the AMERICAN WOODWORKER page.

Sure enough, after a quick look through the message boards, I had my answer. A quick application of alcohol (to the table, not me) and a little

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

- To write us, address letters to: **Editor, AMERICAN WOODWORKER, 33 E. Minor St., Emmaus, PA 18098.**
- You can fax us at **(610) 967-7692.**
- Too busy to write? Call our Letterline: **(610) 967-7776.**
- For e-mail correspondence, send letters to: **AWLetters@aol.com**

= Electronic Mail

rubbing with a clean rag cleared up the problem—and not a moment too soon. As I returned the bottle of alcohol to the medicine cabinet, my wife walked through the door. Yes, AMERICAN WOODWORKER saved my marriage. And for that, I thank you.

Dwight Gibbs

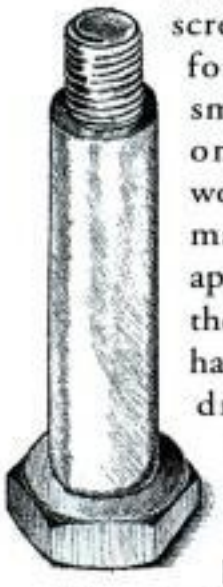
Sliding Compound Correction

In your Buyer's Guide to Sliding Compound Miter Saws (AW #53) you mention Hitachi's model as the first to be introduced, in 1986. Delta introduced the first SCM saw in 1982. The Sawbuck Frame and Trim Saw was introduced at the National Association of Homebuilders Show in Las Vegas in November of that same year. It was an immediate success, and it dominated the market through the mid- to late eighties. Sawbuck II has since replaced the original Sawbuck and still serves the market with not only highly accurate crosscut capabilities, but the largest crosscut capacity (16 in.) available.

Mark Strahler
Vice President, Marketing & Sales
Delta International Machinery Corp.
Pittsburgh, PA

More on the Mortising Jig

Your self-centering mortising jig (AW #54) is a good design. To make it even better, I suggest using hex-head shoulder screws at all pivoting points, instead of the machine bolts specified in the article. I've used these screws in tool and die work for over 30 years. The smooth, unthreaded shank on a shoulder screw will work more smoothly than a machine screw in pivoting applications. Only the tip of the screw is threaded, and it has a reduced diameter. (See drawing.) Use washers beneath the screw head and nut, just as you would with a machine bolt. Shoulder screws are sold as "axle bolts" in most hardware stores. But you can order them in a wide variety of sizes from Reid Tool Supply Co. (800-253-0421).

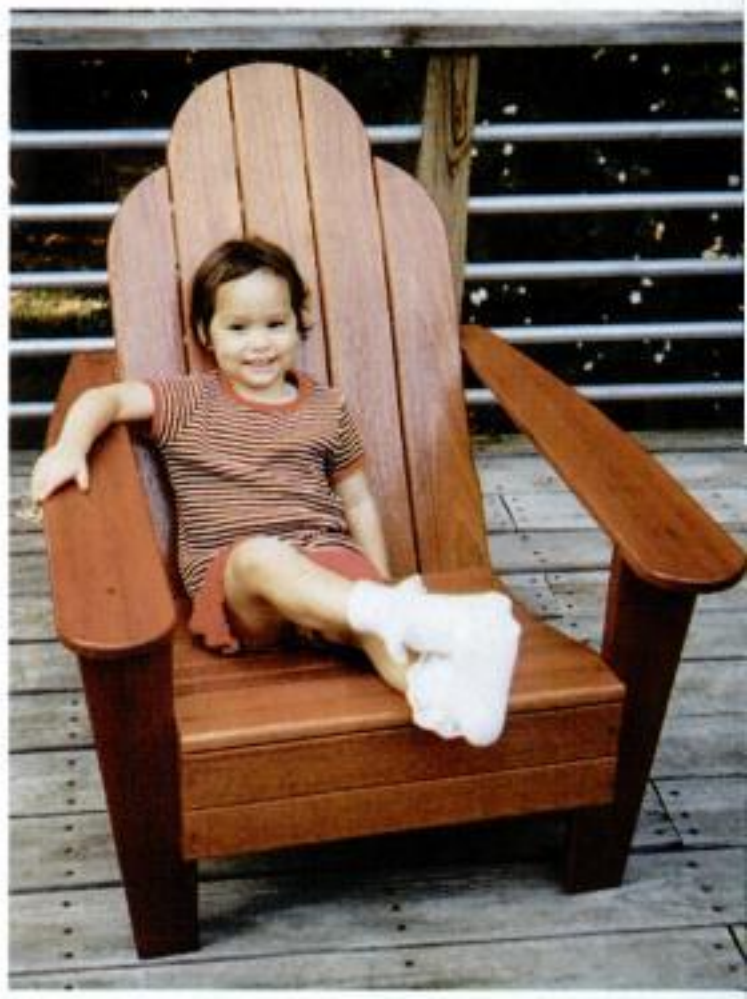


Kenneth Peterson
Paynesville, MN

Easy Chairs

I'm fairly new to woodworking, and I was interested in making an Adirondack chair. Your June issue (AW #52) was very timely. The first chair took me the better part of a week to complete. Then I took your advice and made pattern jigs for routing the curved parts. The second chair was done in about eight hours. I guess that I learned a few things in the process. As you can see, my 3-year-old daughter, Elizabeth, likes to steal Daddy's seat. Thanks for the inspiration.

Sam Rieder
Decatur, GA



Thanks, Dad. *Rieder's chair was built from plans in AW #52.*

I built an Adirondack chair based on your article. It's a great design, and your instructions were thorough enough that even I (a rank amateur) turned out a chair to be proud of. Thanks.

Bob Hanson

Humidor Hubris

Unbelievable timing! I just spent the last week and a half going through every woodworking magazine I own, looking for information on cigar humidors. You can imagine my delight when I found your August issue in my mailbox. I certainly appreciate your clairvoyance, as well as your excellent articles.

Les Needham
Pittsburgh, PA

New Esherick Web Site

I enjoyed the write-up on Wharton Esherick in your August issue (AW #53). Esherick fans will be interested in the extensive new web site devoted to the life and works of this woodworker. The address is:

http://www.levins.com/esherick.html

The site includes a room-by-room photo tour of Esherick's home and studio.

Hoag Levins
Haddonfield, NJ

More on Minimizing Lathe Vibration

I'd like to add some advice to your response on Jerry Richards' lathe vibration problems. (See AW #54, page 20.) Check the pulleys to see if they run true. If tightening the setscrew doesn't help, replace the wobbly ones. If your lathe has a Reeves drive, check for machining burrs in the pulley fingers. Filing at about 45° to the pulley surface—just enough to remove these burrs—will help to smooth the belt's ride.

And speaking of belts, check yours for lumps on the sides of the belt where the joint was made. Even a small lump has to ride through tightly machined spaces in the pulleys. I removed a couple of lumps on my belts using some sandpaper wrapped around a firm sanding block—and it made a big difference.

John Eickstadt
Union, IL

Woodworkers with Wandering Eyes

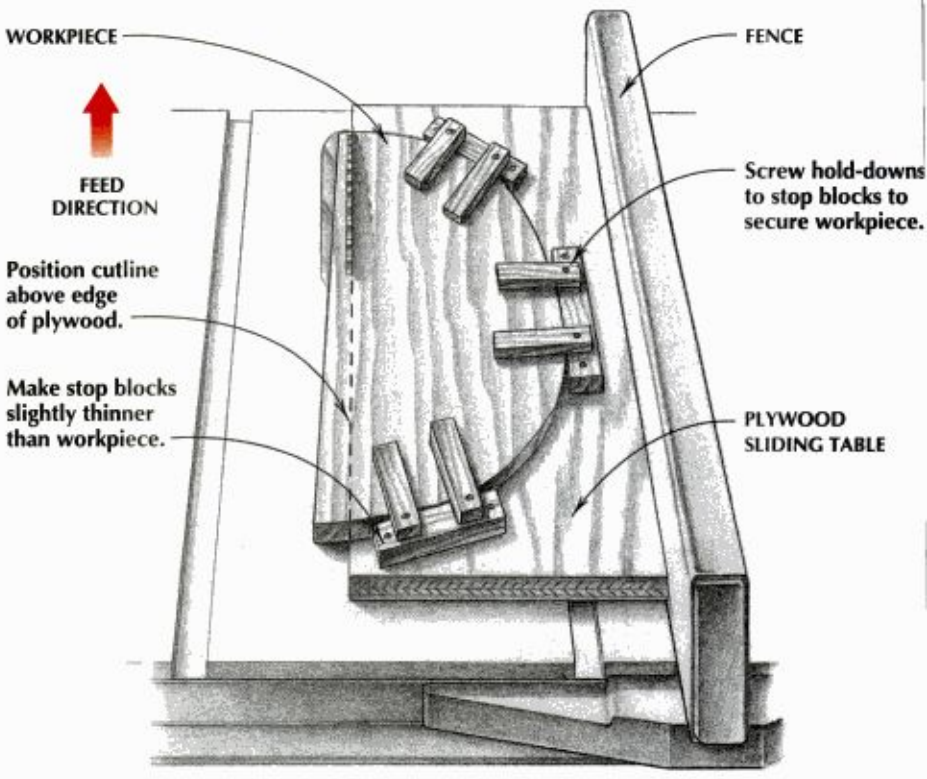
I didn't realize that my husband was a bigamist until I read the piece by Celeste perrino Walker ("Final Pass," AW #54). We are obviously married to the same man.

Susan A.M. Blenk
Sequim, WA

Straight-Cutting Jig For Irregular Stock

Q I've built a wall cabinet with an irregular door opening that resembles a "D." The curved edge fits the opening exactly, and now I have to make a straight cut for the hinges along the left edge. There's no true edge to run against my tablesaw's rip fence and after all this work, I hesitate to make the cut freehand. Any ideas?

Frank Hurst
Vernon, NH



A I once saw a boatbuilder solve an even trickier problem with an "instant" saw fixture like the one shown here. Simply rip a piece of plywood larger than your door, and place the door on the plywood with your intended cutline directly above the edge. Clamp the door to the plywood with tabs and stop blocks as shown, and make the cut.

You could also clamp the door to the plywood with toggle clamps or simply lay a few long scraps over the door and screw them to the plywood.

Jim Cummins
AW contributing editor
Woodstock, NY

An Amber-Free Finish

Q I just completed an art deco entertainment center. I want to bring out the beauty of the grain on the quilted maple doors and still keep it as natural-looking as possible. I'd really like to avoid the yellow-brown color that oil finishes impart. Any suggestions?

Jerry Reed
Stafford, TX

A Sad to say, there is a real catch-22 with finishes: The finishes that best bring out the depth of the figured maple will also impart some amount of color. You must decide where you are willing to make the trade-off.

If you want to keep quilted maple at its whitest, your best choice is a waterborne finish. However, waterbornes are the least effective when it comes to making the grain stand out. Oils (tung, linseed, etc.) are the best materials for bringing out the figure but they will also impart an amber color.

Your best middle-of-the-road choice is a water-white lacquer. It will enhance the figure nicely (though not as well as oil) and will keep the maple white (though not as well as a waterborne). If you're willing to sacrifice a small amount of clarity for depth, I suggest applying one thin coat of boiled linseed oil, allowing the oil three to five weeks to cure, then following with several coats of water-white lacquer. The oil will "pop" the grain nicely, without adding much amber. Successive coats of lacquer won't substantially affect the color.

Michael Dresdner
AW contributing editor
Tacoma, WA

Peel-and-Stick Veneer: Keeping It Stuck

Q Last March, I used peel-and-stick veneer and 3/4-in. veneer-core birch plywood to build a set of kitchen cabinets. I finished the cabinets with three coats of Minwax antique oil. By the middle of July, the veneer started bubbling, and it now overlaps two edges by about 1/32 in. What should I do differently to ensure that this problem doesn't happen again?

Frank Iselin
Westfield, NJ

A Your finish may have penetrated through the paper backing of the veneer and kept the adhesive from bonding properly to the substrate. The pressure-sensitive adhesive that's used on peel-and-stick is susceptible to any type of penetrating finish. The veneer may show no signs of lifting or creeping initially, but once there's a change in humidity, the veneer will start to expand and lift off the substrate. I have found this to be true with burls and some flat-sawn veneer, but I rarely see this problem in quartered veneer—probably because it is more stable.

I have run many tests with peel-and-stick veneer over the years and have found that it works best on small pieces and on pieces that are not exposed to great changes in humidity. It's also best

to use a topcoat finish, such as an oil-based varnish or polyurethane. Apply one light coat as a sealer so the finish will be less likely to penetrate.

One more tip: When purchasing peel-and-stick veneer, inspect the protective backing sheet. Bubbles in the sheet may indicate dried-out or insufficient adhesive in that spot. The best thing to do is return the sheet for a new one.

Sal Marino
Technical consultant
Constantine's
New York, NY

Carbide Cleaners

Q Someone told me that using oven cleaner to clean carbide saw blades isn't a good idea. Why not?

Oscar Glynn
Austin, TX

A There has always been debate in the woodworking and sharpening communities regarding the use of oven cleaner to remove pitch and gum residue found around carbide teeth. Sodium hydroxide (lye) in oven cleaner has been found to react with the cobalt binder that holds the carbide particles together. Therefore, cobalt-stripped grains of tungsten carbide will erode more rapidly, and the cutting edge will dull.

However, I have not found sodium hydroxide to appreciably damage either the carbide teeth or the binder. By comparison, a blade has more carbide loss due to corrosion created from cutting MDF or particleboard.

Sodium hydroxide is effective, but it is also extremely caustic—it will burn you. Be sure to wear rubber gloves, an apron and safety goggles when using oven cleaner. A safer method, which I prefer, is to scrub the teeth with dishwashing soap solution and a nylon-bristle toothbrush.

Matt Ver Steeg
Professional sharpener
and blade designer
Des Moines, IA

WHERE TO FIND IT

Small pieces (up to 15 in. by 72 in.) of Corian are available from Art Specialties, Box 215, Depew, NY 14043, (800) 724-1002. A catalog and a booklet, "How to Work with Corian," are available by request.

Synthetic ivory, mother-of-pearl and tortoiseshell for turnings and inlay are available from Woodcraft Supply, Box 1686, Parkersburg, WV 26102-1686, (800) 225-1153.

Hot-melt adhesive in 24-in.-wide sheets for veneering is available from The Woodworkers' Store, 21801 Industrial Blvd., Rogers, MN 55374-9514, (800) 279-4441.

Leather belting for vintage machinery is available from Sutherland Leather & Felt Co, Inc., 2963-W Industrial Row, Troy, MI 48084, (810) 280-0450.

Imperfect Plane

Q I just picked up a Stanley Bailey No. 4 hand plane at a flea market. It appears to be in very good condition in every respect. However, stamped into the side of the body is the word "imperfect." I assume it came from the factory this way, but for the life of me, I can't figure out why.

What kinds of defects were allowed in planes sold with this stamp?

Scott Braun
New York, NY

A Tool inspectors used to be very picky. Anything less than a top-grade tool received the "imperfect" or "second" mark. Some planes were marked down for the hardness of their soles, minor voids in the casting, or for frogs that did not seat parallel to the throat. Many failed for cosmetic reasons—nicks and dents that could happen naturally in any workshop over the years. Rarely do these imperfections seriously affect the usefulness of the tool.

To some collectors, an imperfect tool can be worth more than a perfect one. If you are lucky enough to find one still in the original box, you're better off selling it and using the proceeds to pick up a better tool.

John Walter
Editor
The Stanley Tool Collector News
Marietta, OH

Cure for Stalling Saw

Q My 1½-HP contractor's tablesaw stalls frequently when I do a lot of ripping. I realize that it's less powerful than a cabinetmaker's saw, but shouldn't I be able to rip ¾-in. oak?

Dr. David Miller
Rutland, VT

A Ripping does require more power than crosscutting, but still, it shouldn't consistently stall the motor. First, make sure the splitter is lined up to prevent the kerf from closing in on the blade. Next, try using a thin-kerf blade. These thinner blades remove less waste and therefore require less horsepower. If the motor still stalls, try raising the blade ¼ in. higher than normal. Fewer teeth in the wood will make for a slightly rougher cut, but your saw will be less likely to bog down because of the reduced friction.

When I was still using a contractor's saw, I replaced the arbor and drive pulleys with machined twin-belt pulleys. The twin-belt system transferred the power from the motor to the arbor more efficiently. It also made for a smoother-running saw.

Lonnie Bird
AW contributing editor
Rio Grande, OH

WOODWORKING QUESTIONS?

Send them to: "Q&A," AMERICAN WOODWORKER, 33 E. Minor St., Emmaus, PA 18098. Or e-mail them to: AWQA@aol.com

offcuts

Bits and pieces of woodworking news

Wild Walking Sticks

For David Stehly, carving is as relaxing as a walk in the woods. And that's where he gets the inspiration for his beautiful wildlife walking sticks.

Stehly hand-picks his stock—mostly yellow-poplar and maple branches, which are easy to find in the woods of his native Pennsylvania. For tools, he uses "anything that will work wood." He's more particular about his finishes: He uses only oil stains and clear varnishes, so the natural wood grain shines through.

David Stehly carves a snake walking stick from a single tree branch.

PHOTO BY SUSANNAH HOGENDORN

Stehly sells his work, but it's really a labor of love. He puts hundreds of hours into each piece, painstakingly striving for authenticity. He consults field manuals so he can capture every detail. Why such effort for a single stick? As Stehly sees it, "A tree is a magnificent living thing—each has its own personality. To take a piece of a tree and turn it into a work of art gives me deep satisfaction."

AW SCORES AT IWF

This year's International Woodworking Machinery and Furniture Supply Fair (IWF) drew more than 47,000 manufacturers, vendors and woodworking sightseers from all over the planet. AMERICAN WOODWORKER showed up in force, too. At the AW booth, contributing editor Frank Klausz wowed crowds with his dovetail demo—cutting perfect dovetails by hand in less than five minutes. For a look at the hottest new tools from the show, see page 98.

Frank Klausz explains dovetail joints at IWF.

PHOTO BY LISA UNRUH

What's up at AW Online

Free CAD software! Now there's an easy way to try out woodworking design software—in our CAD software library. With "shareware" selections, you can try out commercial programs before you buy them. "Freeware" programs are yours to sample and keep. If you already have a favorite CAD program, you can also upload it for others to try.

Supercharge your search! Thanks to a new search engine, it's faster and easier than ever to search for specific articles in our online library. Just type in the keyword you want to look for, and the engine will pull up every online article in which the word appears. Simple connector words let you broaden or limit your search. It's like having a reference librarian at your fingertips.

AMERICAN WOODWORKER Online is part of the America Online computer service.
Call (800) 764-4400 for free software and 15 free hours of online time.

See your work online! The "reader uploads" area of AW Online makes it easy to upload images of your own work. This jewelry chest was built and uploaded by Judy Krawski.

offcuts

BLASTS FROM THE PAST

A battered box arrived one day from contributing editor Mike Dunbar. Inside lay a treasure-trove of old woodworking magazines dating back to the mid-1930s and early '40s.

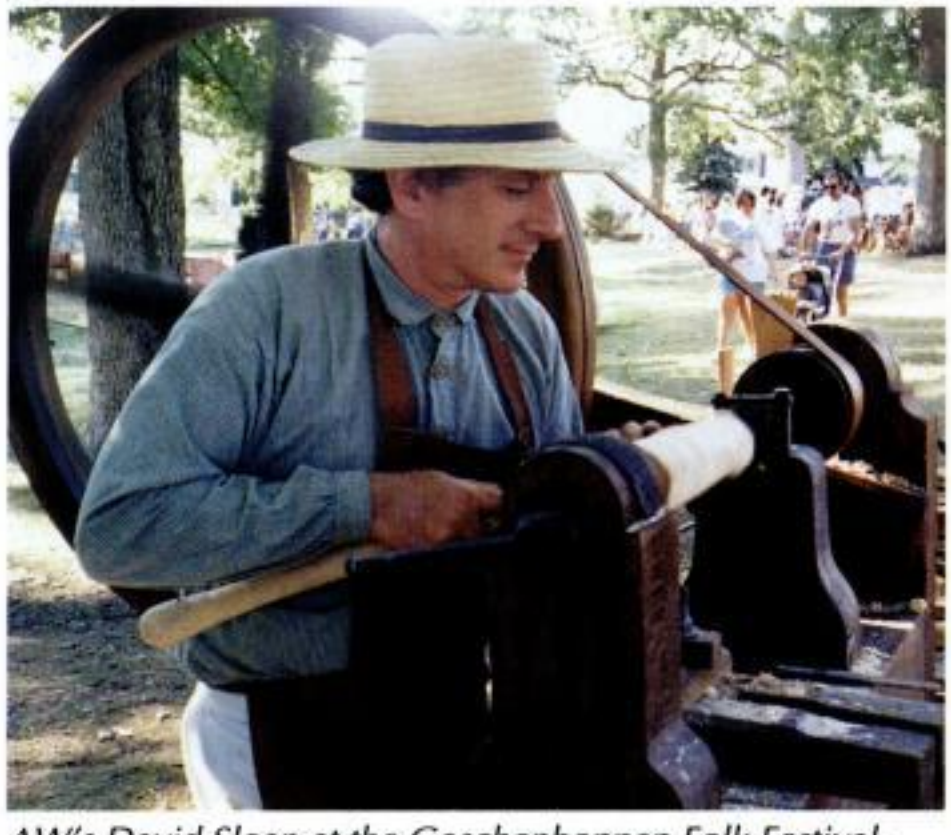
The holiday issues had fabulous projects—pipe racks, bookends and a patriotic "God Bless America" scroll-saw pattern. But best of all was the "Honeymoon House Trailer" built by a reader for his honeymoon trip. Made out of parts from a 1926 Chevy, the trailer had a bed, a pull-out dressing room, even a kitchenette—complete with an icebox and running water!

Tool ads were fascinating, too—you could buy a tablesaw for less than $40.

Here are a couple of our favorite pages; they're from *Popular Home Craft* magazine.

OLD-TIME TURNING

No, that's not Pa Ingalls— it's AW editor & publisher David Sloan! The second weekend in August, he dons old-fashioned garb and mans a treadle lathe at the Goschenhoppen Folk Festival, in East Greenville, PA. Sloan is one of many craftspeople at the annual festival, which revives old Pennsylvania German traditions. Sloan's lathe, a mid-19th-century original, is the only one we know of that has a flywheel over the operator's shoulder.



AW's David Sloan at the Goschenhoppen Folk Festival.

WIN $50
Funniest Shop Stories

Send us your funniest-ever woodworking blunder, and tell us what you learned from it. (Surely you learned something!) If we decide to print it, we'll pay you $50. Send your story (maximum 200 words) to:

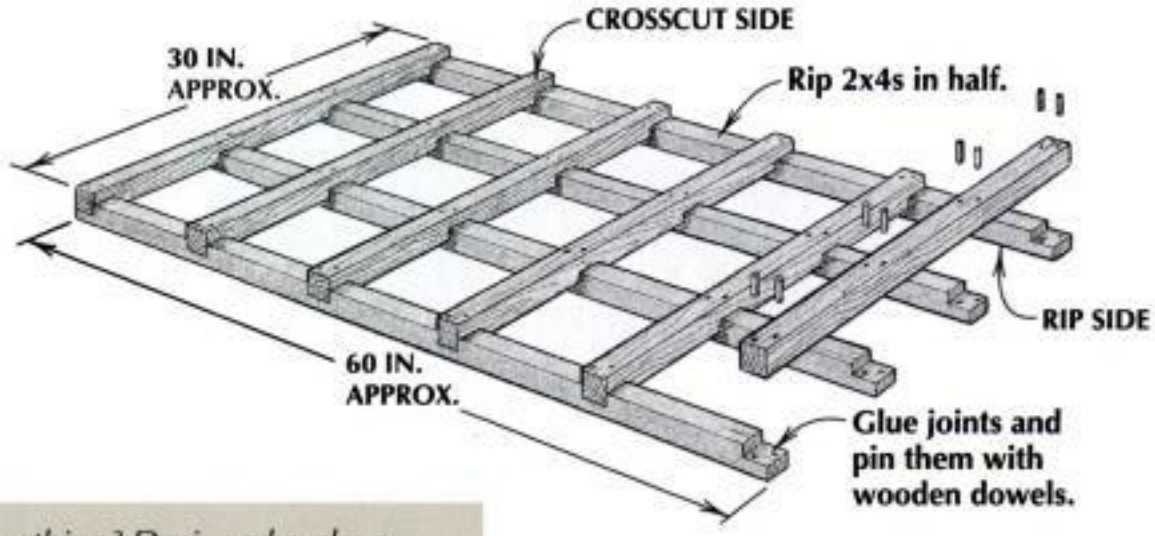
Shop Stories
"Offcuts"
AMERICAN WOODWORKER
33 E. Minor St.
Emmaus, PA 18098

Sawing Rack

Best tip of the issue

This is a handy rack for cutting sheet materials with a circular saw. Use one side for crosscutting and the opposite side for ripping. The notched grid design provides clearance for the blade in either mode. You can use the rack on the floor, or lay it across a pair of sawhorses. Topped with a sheet of plywood, the rack can serve as an assembly table.

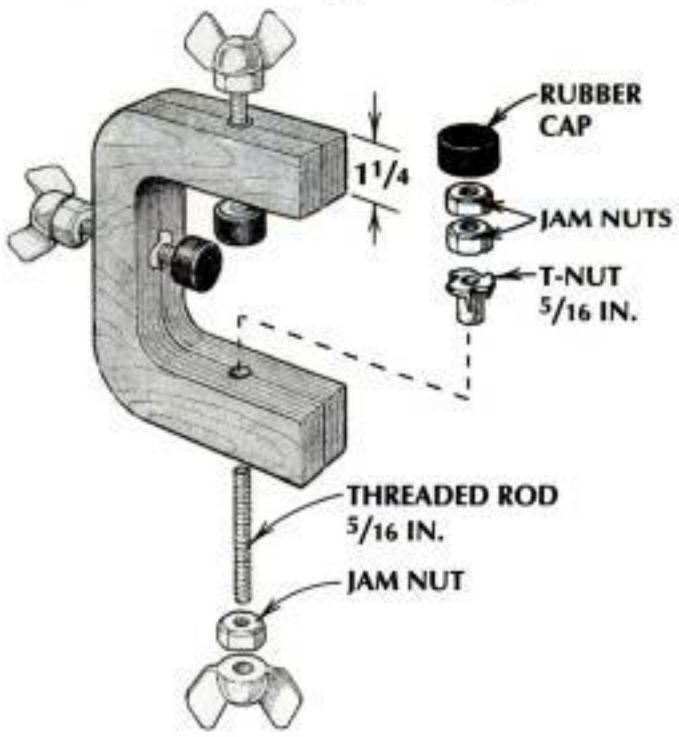
Carol Reed
Ramona, CA



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

Shop-Made Edging Clamp

Edging clamps are useful items but run around $10 or more apiece, so I prefer to make my own. Glue two pieces of 3/4-in. hardwood plywood together and

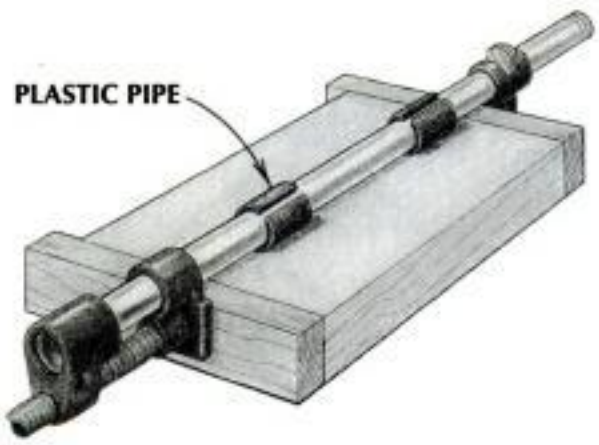


then bandsaw the "U" shape shown in the drawing. Drill holes for the three 5/16-in. T-nuts, and then make up the 5/16-in. clamp screws as shown.

Eric Worden
Halifax, Nova Scotia

PVC Pipe Guards

Iron pipe clamps can easily mar softer woods or react with the glue to stain the wood. My solution is to cut 3-in.-long sections of plastic PVC pipe, slit them, and place them around the pipe.

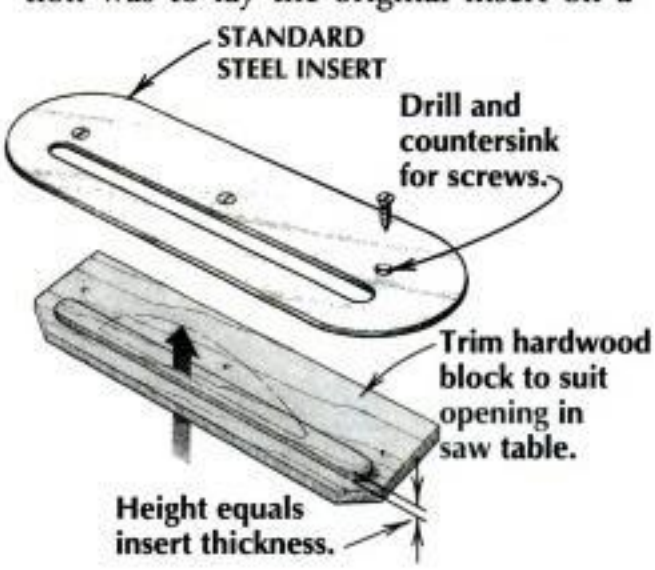


If you have several short lengths, you can space them to accommodate different widths of stock.

Michael Burton
Ogden, UT

Zero-Clearance Insert

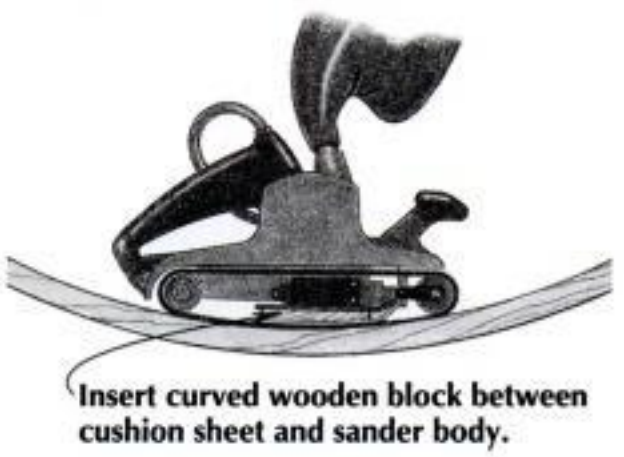
I needed a zero-clearance tablesaw insert, but the one that came with my saw was too thin to duplicate in wood. My solution was to lay the original insert on a piece of 1/2-in. hardwood and trace the outline of the plate and its slot. After trimming the piece to fit in the table, I put a 1/2-in. straight bit in my router, set the depth equal to the thickness of the original insert, and removed the excess stock as shown. To cut a new slot, I screwed the piece to the insert, turned on the saw and slowly raised the blade through the throat plate.



Tim Turney
Roseville, CA

Sanding on a Curve

Sanding concave surfaces with a portable belt sander sounds impossible, but here's how it's done. Insert a curved block of wood between the cushion sheet and the sander body—*not* between

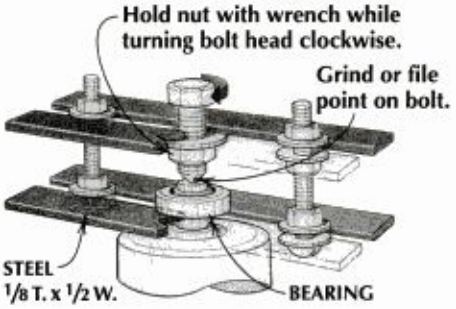


the belt and the steel platen. Tension in the belt keeps the block securely in place until released. The flatter the curve, the better this idea works.

Robert Tupper
Canton, SD

Shop-Made Gear Puller

I needed to replace a bearing on my shop vacuum, but my only gear puller was too large for the job. Instead of going to a machine shop, I improvised the puller shown here. I used steel because the clearance between the bearing and the motor was small. For other applications—removing a pulley, for example—hardwood strips would work equally well.



Harvey Thurston
Pierrefonds, Quebec

Sanding Station For Small Work

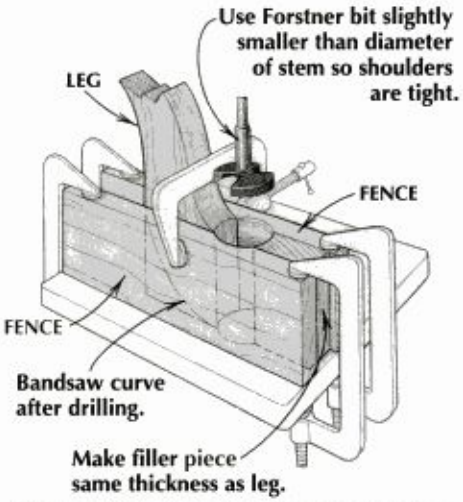
To maintain sharp corners and flat surfaces, I sand small parts on sandpaper mounted on a 14-in. by 21-in. piece of hardboard. I glue sheets of 60 and 100 grit on one side (rubber cement works fine) and 150 and 220 grit on the other. Since there's always abrasive on the underside, the sanding board can't slide around on the bench.

William Woell
Moorhead, MN

Tripod Leg Jig

A new design called for tripod legs fitted to a round stem. How to cut a matching curve in each leg? My solution was to clamp a pair of fences to the drill-press table as shown here.

Place one leg between the fences, butt a piece of scrap against the end of the leg, and clamp the whole assembly.

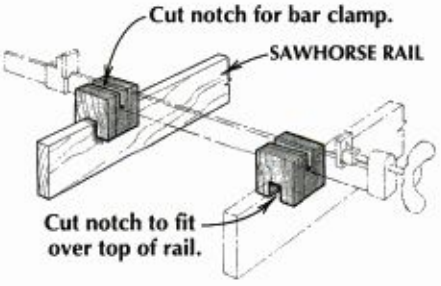


After drilling and removing the first leg, you can line up the other legs with the edges of the hole in the fence for a guaranteed identical cut.

Yeung Chan
Fort Bragg, CA

Bar-Clamp Supports

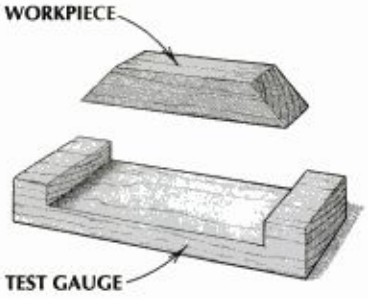
These support blocks are a great help when gluing flat panels or other large assemblies. Set a block on the top rail of your sawhorse and drop a bar clamp into the other slot. You could make them from solid wood, but a glued-up block of plywood is less likely to split.



David Welter
Fort Bragg, CA

Identical-Parts Gauge

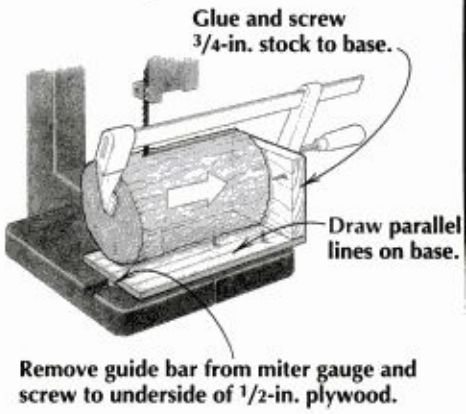
I recently made a number of identical boxes with mitered corners. To make sure the parts were the same size, I came up with the simple jig shown here. I cut the pieces slightly oversize and then trimmed them on my disc sander with the fence set at 45° until they fit the gauge exactly.



Charles Beiderman
Williamsburg, VA

Log-Squaring Jig

I am a carver and needed a safe way to square logs on my bandsaw. After removing the guide bar from my miter gauge, I made the jig shown here. I drilled holes through the jig so I could run drywall screws into the edge and the end of the log. After making the first cut I turn the log flat side down and make a second cut. For the third cut, I line up the sawn corner with one of the parallel guidelines drawn on the base of the jig. Then I repeat this procedure for the fourth cut, to produce a squared blank.



If the ends of the log are stepped or cut crooked, it's best to clamp the log with a bar or pipe clamp before making the first cut.

Steve Lavalle
Lubec, ME

Hot Water Stripping

Our shop recently had to strip an old linseed oil finish from a large walnut dining table. Chemicals were unacceptable and scraping proved difficult. We found that after soaking one or two square feet at a time with hot water, we could use steel scrapers to remove the finish. We removed the gummy shavings from the scraper burr by running it over a block of wood. A bonus: The edge on the scraper lasted longer than when using it dry.

Jesus Michel
Oakland, CA

By the book. *This chest is a 7/8-scale reproduction of an 18th-century classic. The author improved on the original design by allowing for expansion and contraction of the top.*

Connecticut Blanket Chest

Build a piece of history

by R.S. Wilkinson

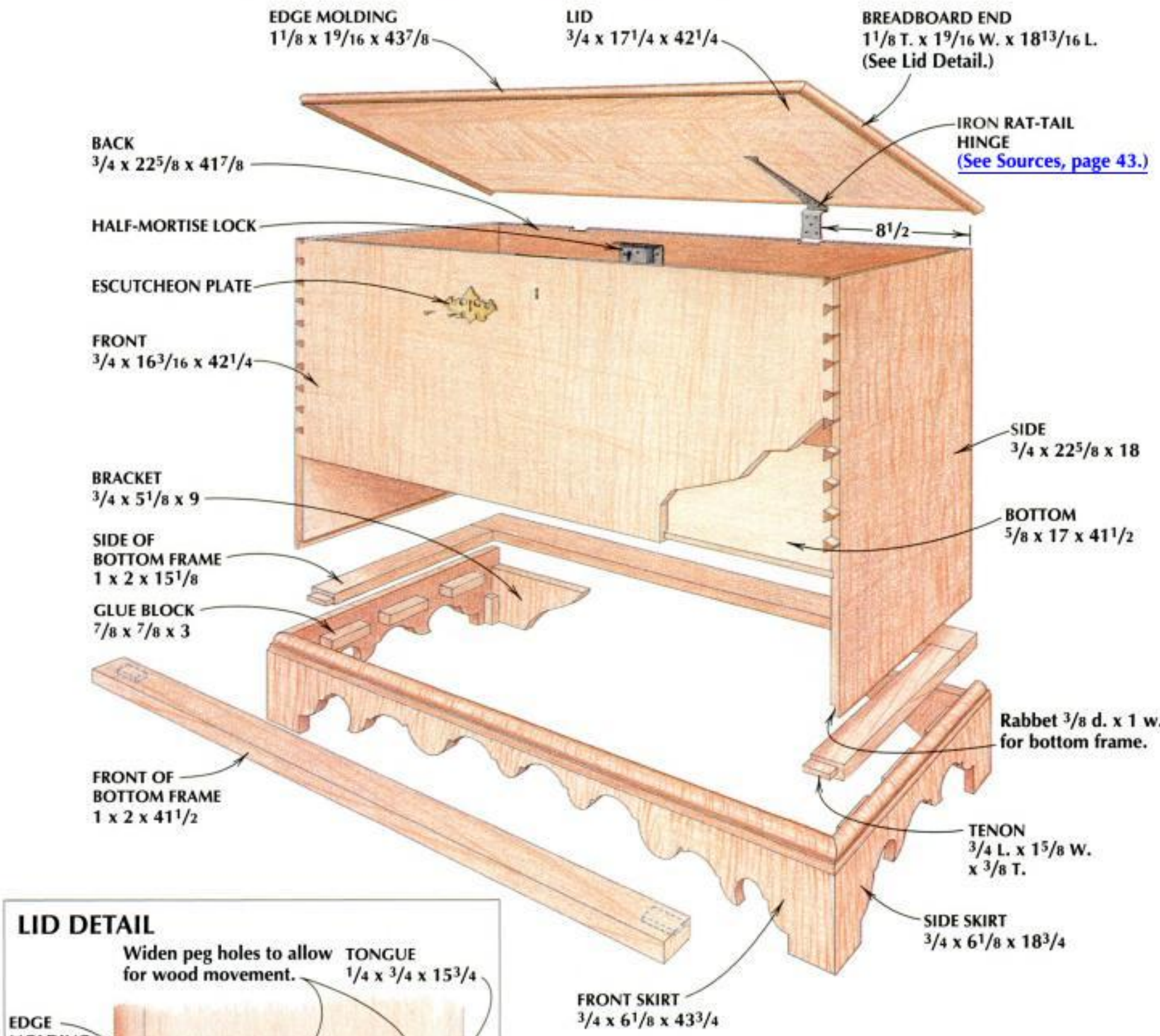
As a furniture maker specializing in 18th-century reproductions, I'm always interested in learning more about the woodworkers who practiced their craft two centuries ago. When the Lyman Allyn Art Museum (New London, CT) ran an exhibit of work by 18th-century artisans from nearby New London county, I bought a copy of the show catalog to get a closer look. The photos, drawings and dimensions in this book provided enough information for me to build exact reproductions of the originals, including this blanket chest.

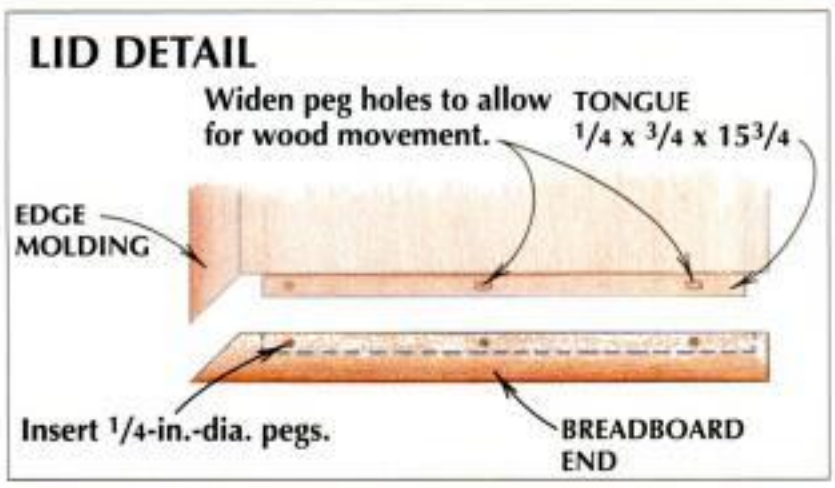
My blanket chest is a copy of one built by John Wheeler Geer of Preston, CT, around 1785. Made of tiger maple and poplar, the chest has through dovetails on its front corners, half-blind dovetails in back, and a scrolled skirt that is mitered to the case beneath a single drawer. The drawer and the lid both lock with period locksets, and the drawer opens with a pair of bail-type pulls. (See Fig. 1, and Drawer Construction, page 42.)

I made two minor changes in my reproduction. I scaled the chest down to seven-eighths of its original size to better meet my needs. And I opted to treat the lid molding differently. Geer simply attached it with glue and nails; I made the molding detail part of the top's breadboard ends. This revision allows the top to move, while also helping to keep the lid flat.

FIG. 1: BLANKET CHEST

Beautiful wood, traditional joinery, a scrolled skirt and period hardware dress up a simple six-board chest.





Pre-Construction Preparation

Some of the most important steps in any project occur before you pick up a saw. I like to start a project like this by making full-size drawings. This helps me work out construction-related questions on paper before they become expensive mistakes in the wood. Full-size drawings are also essential for duplicating the exact curves of the original, such as on the moldings and skirt.

Planning where a board will be used is as important as choosing the right stock in the first place—it makes the difference between a good piece and a great piece. On the chest shown here, I made the front and sides from a single, 16 3/16-in.-wide board. By cutting the sides and drawer front from the same board, the grain seems to wrap around the chest. Since the chest will sit against the wall, poplar is an acceptable secondary wood for the back; it moves similarly to maple.

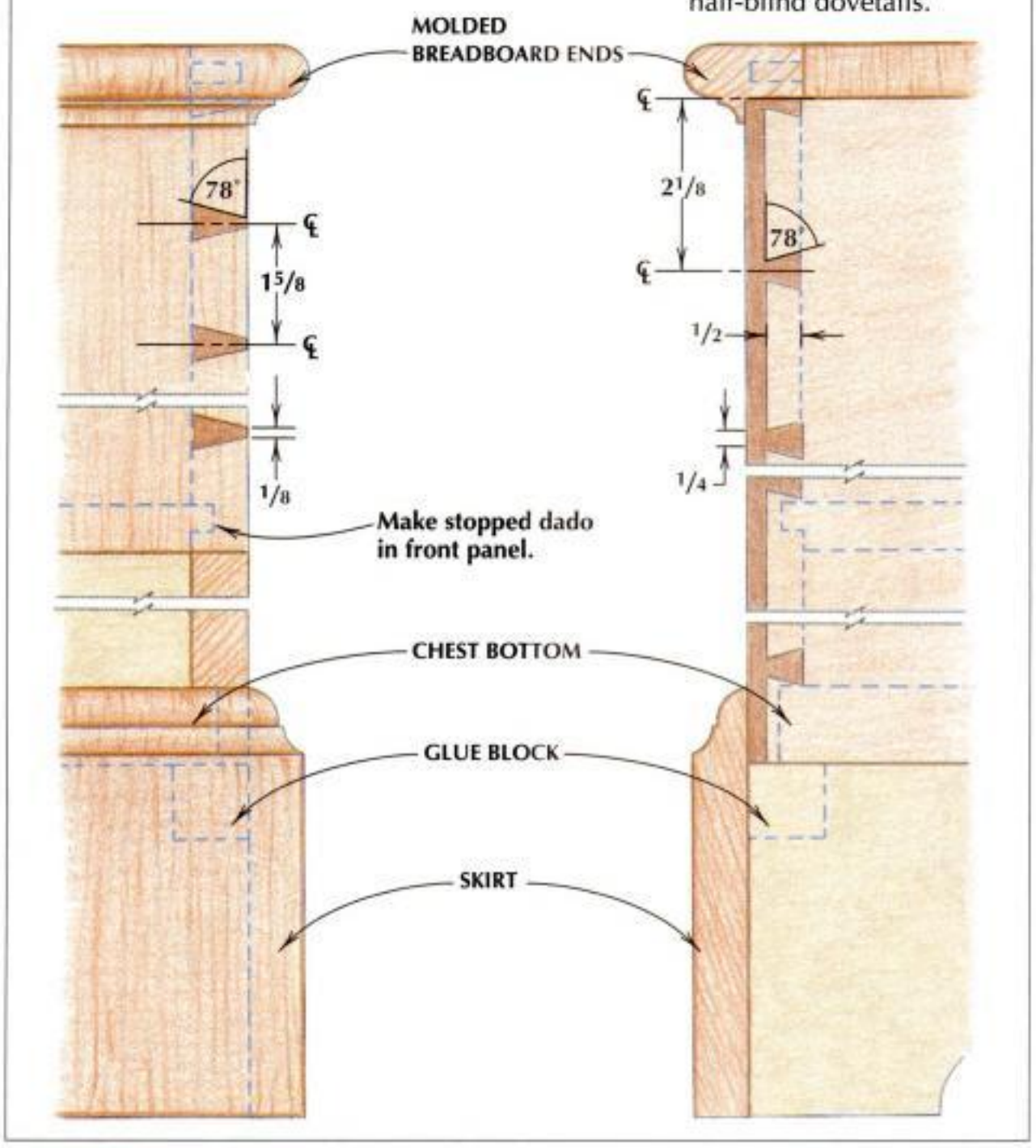
I cut my stock to rough width and length, then thickness just the boards I need for the case, bottom and bottom frame. I prefer to leave stock roughsawn until I need it. Milled lumber can cup or twist if it's left sitting around, forcing you to flatten it again.

Case Joinery

To begin the case, glue up the boards to make the sides, back, and bottom of the chest. Lightly plane out any mill marks,

FIG. 2: CASE JOINERY

Below are case joinery details at front and back corners. Also note the relationship of skirt, side and lid.



then cut these parts to size. I cut the front 1/16 in. longer and each side 1/32 in. longer than their finished lengths. This allows me to cut the dovetails 1/32 in. deeper than necessary and then plane them flush after assembling the case.

Next, rout the dadoes for the chest bottom in the front, sides and back. The back and sides can have through dadoes, but the front requires a stopped dado to keep this groove hidden once the case is together. (See Fig. 2.) After cutting the dadoes, rabbet the sides and back panels for the bottom frame.

Now lay out the dovetails on the front panel, as shown in Fig. 2. Like Cecil Pierce (see AW #54), I like to cut the tails first and use them to lay out the pins. The same sequence applies when dovetailing the back to the sides. Dry fit the front, sides and back to make sure these parts join properly.

While the assembly is together, measure for the chest bottom and the bottom frame. I always take the season into account when measuring for bottom panels. In February, it's wise to leave an extra 1/8 in. of space on the sides to allow for expansion. In August, I try for a tighter fit because the bottom will shrink by Christmas. By comparison, the bottom frame doesn't have a cross-grain problem like the bottom of the chest; it should fit snugly in its rabbet. (See Fig. 1.) Cut the mortises and tenons for the bottom frame and glue it together.

I prefer to mortise the front panel for the lock assembly before gluing the case together. Use the lock to lay out the two-tiered mortise. (See sidebar, page 43.)

With a case this large, glue-up can be tricky. It takes a few minutes to spread glue on a corner's-worth of dovetails. To avoid problems with glue setting up too soon, I modify old-fashioned hot hide glue to extend the working time. I use 251-gram-weight glue flakes (see Sources), add 15% urea by volume, and soak the mixture in water for an hour before heating to a working temperature of 140° in my glue pot. If you don't have a glue pot, you can use any glass container and heat it on an inexpensive beverage warmer. (See AW #54, page 30.) The urea extends the glue's open time to about 25 minutes. Ready-made liquid hide glue also offers a long working time.

Glue the sides to the front first, then slide the bottom into the dadoes in these parts. Remember not to glue the bottom; it needs to float. Attach the back last. Pull the case joints tight with clamps and scrapwood clamp blocks. (See top right photo, opposite.) Wipe off any squeeze-out with a damp rag.

The Skirt

To maintain a continuous grain pattern as the skirt wraps around the chest, I cut the three skirt pieces from a single board. Dimension the board, then plane or scrape away any mill marks before cutting the molding detail along the top edge. (See Top Edge Detail, opposite.) Miter the ends of the front board, then cut the side skirt boards to finished length. Once these cuts are made, you can transfer the skirt pattern onto the boards.

I cut the skirt's curves on my bandsaw, using a 1/4-in., 4-tpi (teeth per in.) skip-tooth blade and cutting just shy of the line. You could sand out the skirt profile, but I prefer to remove the saw marks the same way Geer would have. First, I use a spokeshave and a drawknife to cut a small chamfer along the inside edge of the skirt; this prevents tearout. (See bottom photos, opposite.) Then, working from the front, I pare down to the line using a combination of chisels and gouges, working across the grain. The gently undulating edge is just what you'd find on a fine antique—a distinctive maker's mark that no machine can reproduce.

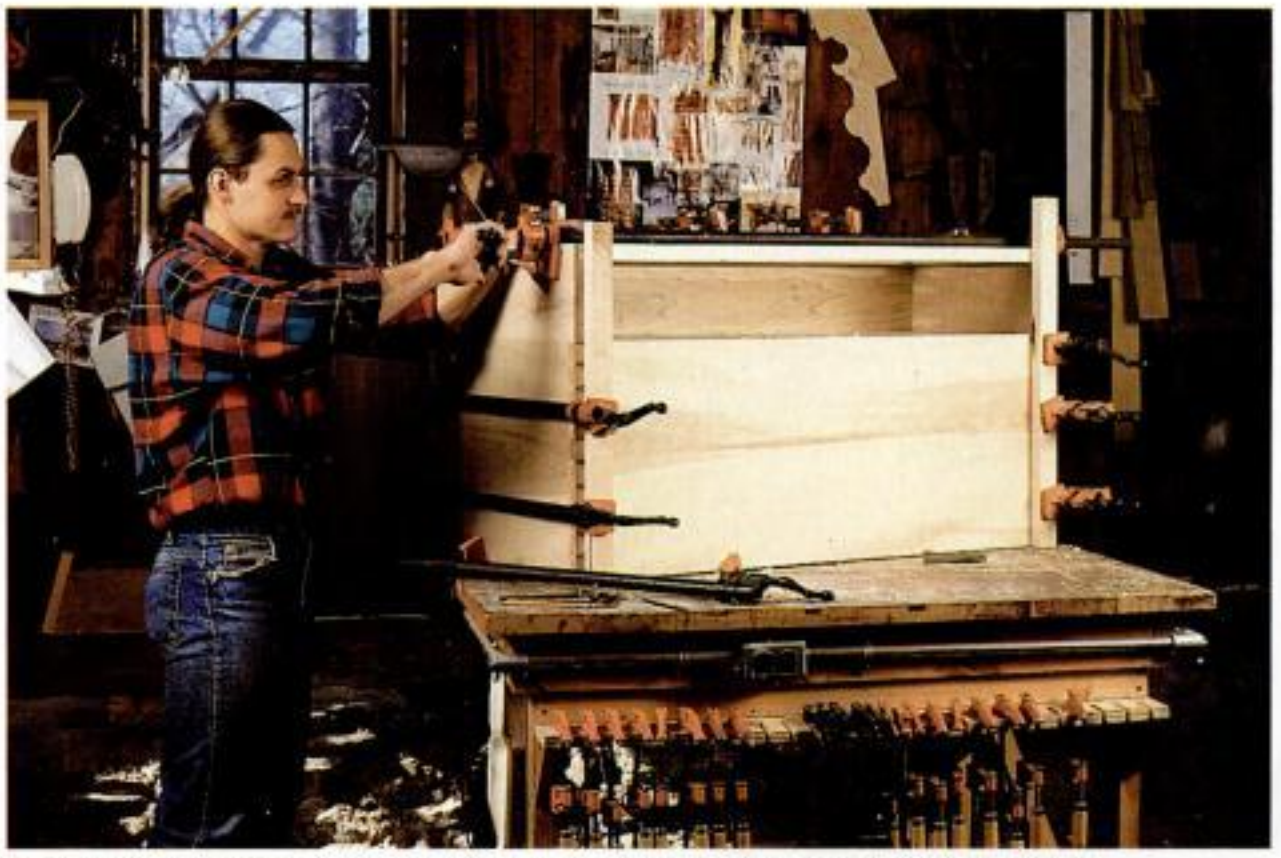
To protect areas of short grain, it's a good idea to attach glue blocks to the back side of the skirt pieces. (See Skirt Details, opposite.)

Now attach the skirt to the case. Glue the front skirt to the case first and allow the glue to dry; then attach the side skirts one at a time. I find that dealing with one corner at a time is considerably easier than struggling with a three-piece glue-up.

Once the skirt is glued in place, add the glue blocks between the inside of the skirt and the bottom frame to reinforce the skirt molding. Glue the back brackets and corner glue blocks to reinforce the corner joints (See Fig. 1.)

The Lid

Joint and thickness the two boards for the lid and edge-glue them together. Plane and scrape the lid as necessary before cutting it to its final dimensions. Next, cut a tongue on each end of the lid, to receive the breadboard ends. (See Lid Detail, page 39.)

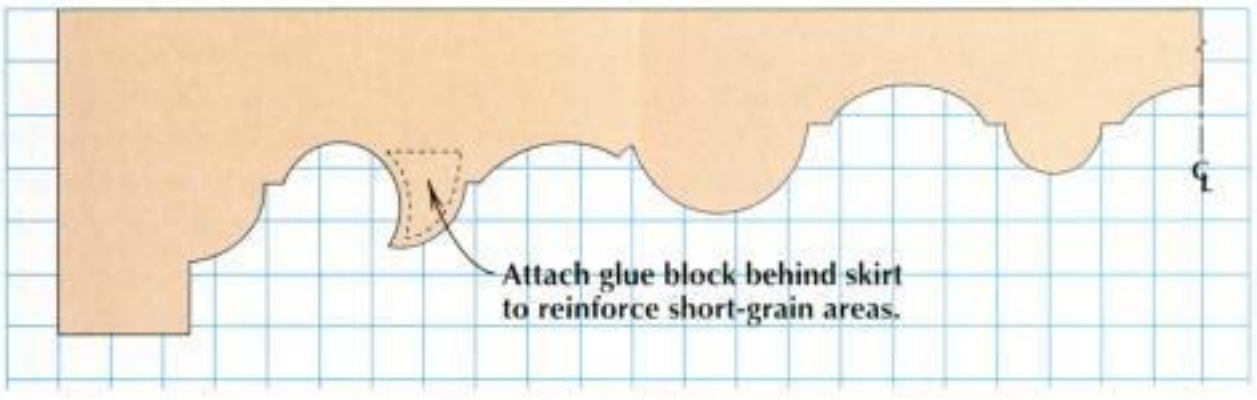


Pulling it together. *Slow-setting hide glue is a good choice for a time-consuming glue-up. Clamping cauls pull pins and tails tightly together.*

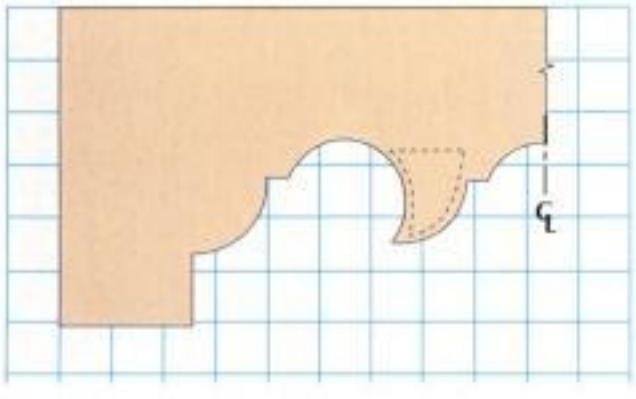
MAKING THE SKIRT

To remove saw marks from the skirt profile, first chamfer the back edge of the pattern with a drawknife or spokeshave to prevent tearout. (See photo, near right.) Next, working from the front, use a combination of chisels and gouges to pare up to the pattern line. (See photo, far right.)

FRONT SKIRT



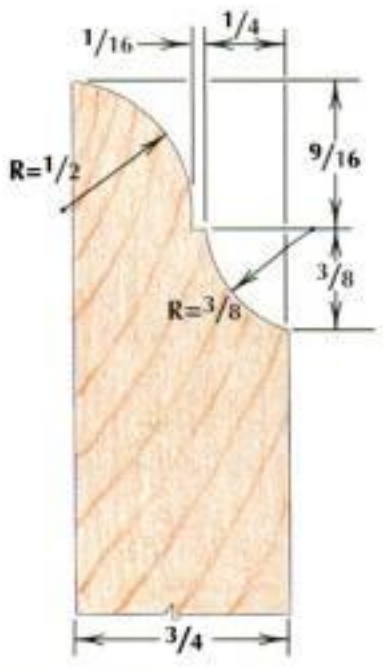
SIDE SKIRT



1 SQUARE = 1 IN.

TOP EDGE DETAIL

You can rout this edge profile with two bits—a 1/2-in. roundover bit and a 3/4-in. core box bit.

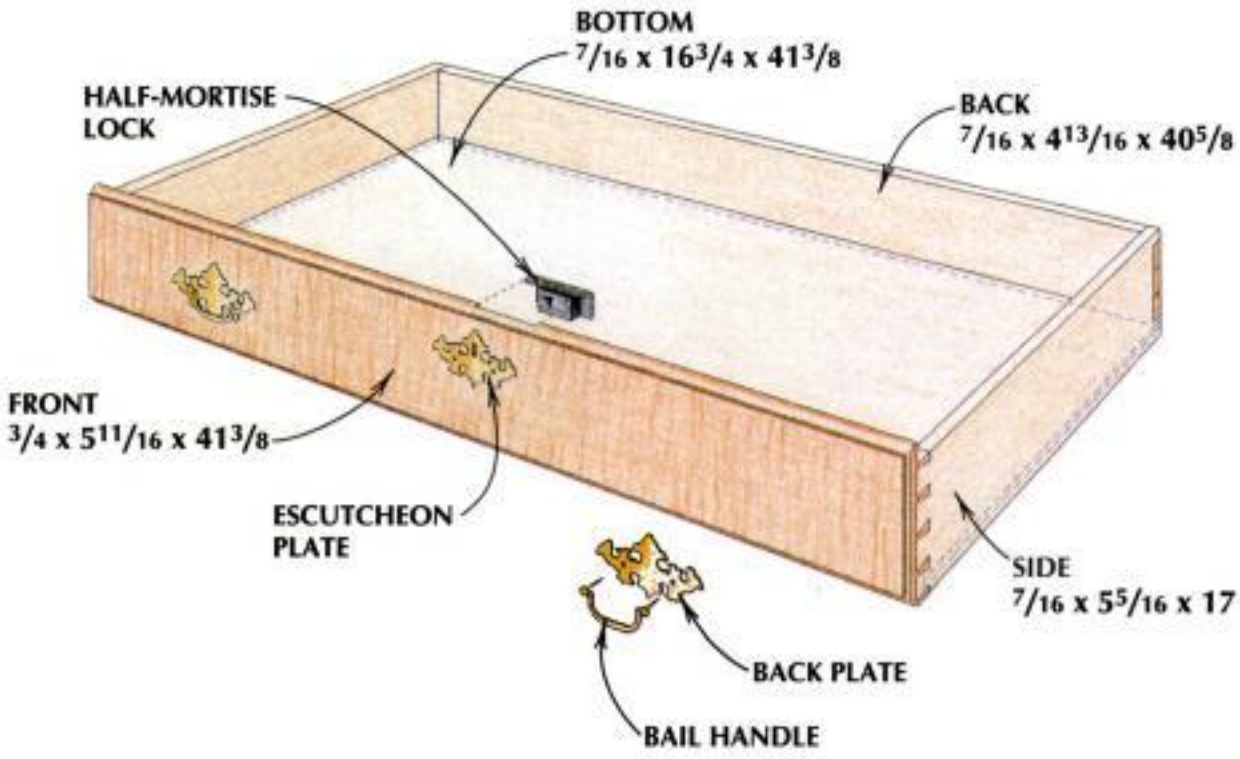


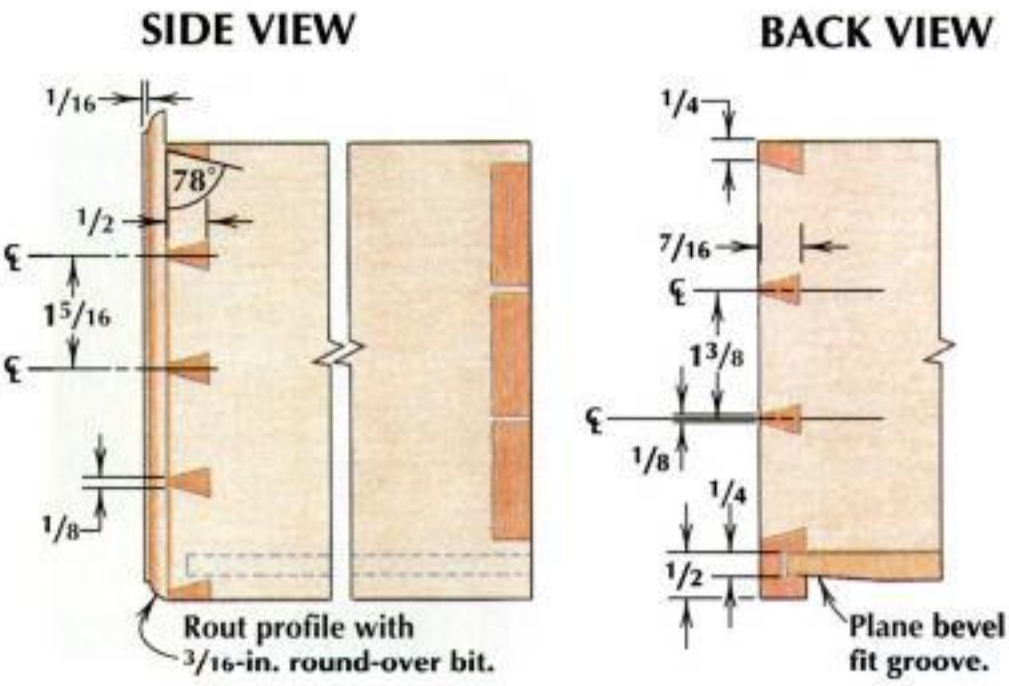
DRAWER CONSTRUCTION

Begin the drawer by dimensioning stock for the sides, front and back. Next, rout the rounded overlay detail on the front of the drawer using a 3/16-in. round-over bit. Rabbet the front's top edge and ends, then dado the front and sides for the bottom panel.

The drawer sides join the front with half-blind dovetails and the back with through dovetails. Geer cut the back tails "backwards;" I chose to reproduce this detail. (See photo, below.) As with the case joinery, I cut the tails first, then use them to lay out the pins.

Wrong-way tails. *John Wheeler Geer, the original craftsman, cut the tails on the backs of drawers instead of the sides—perhaps as a maker's mark.*





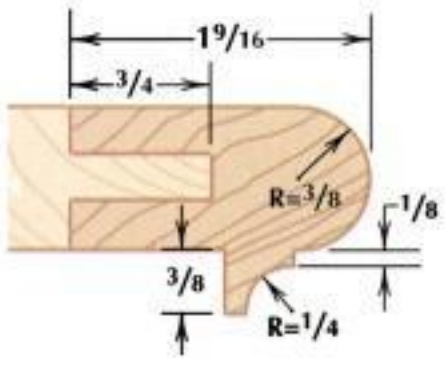
To make the lid molding, take an 8-ft. length of the hardwood you're using, and rip it to 1 9/16 in. wide by 1 1/8 in. thick. Rough-cut the molding stock into three pieces: one 4-ft. length for the front, and two 2-ft. lengths for the ends. Mortise the end pieces to accept the tenon on each end of the lid.

Geer relied on molding planes to shape the moldings. I came up with a modern alternative, using a tablesaw, a router and three bits. Follow the six-step sequence below to create the three pieces of molding.

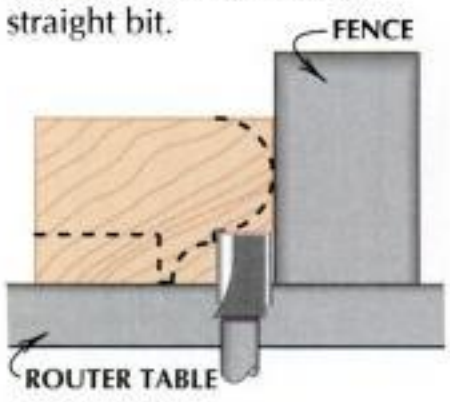
Like the skirt, the lid molding is a three-piece assembly that is mitered together at the corners. First, miter and glue the front piece to the front edge of the lid. Then cut and test fit the end pieces. Before gluing these joints, drill three holes in each end for 1/4-in.-dia. wooden pegs. (See Lid Detail, page 39.) After drilling the holes, remove the ends and elongate the two rear holes in the

MAKING THE LID MOLDING

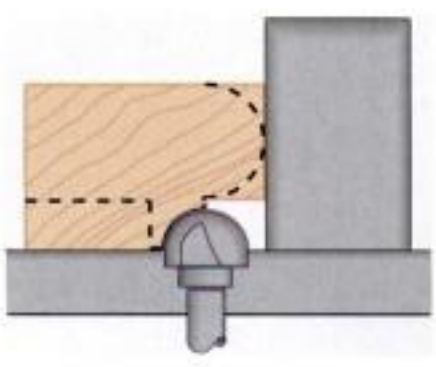
You don't need a set of 18th-century planes to make period moldings. I cut the molding profile for the chest with just a tablesaw, a router and three different bits. Remember to make the mortise for the breadboard ends before creating the molding profile.



STEP 1: Rip and plane the molding stock to 1 1/8 in. by 1 9/16 in. Rabbet the outside edge with a 3/8-in.-dia. straight bit.



STEP 2: Rout the bottom outside edge with a 1/2-in.-dia. core-box bit.



PHOTOS BY SCOTT VAN SICKLIN

INSTALLING A HALF-MORTISE LOCK

The lock on this blanket chest requires a two-tier open mortise that's time-consuming but not difficult to cut. (See photo, right.) To lay out the mortise, hold the lock in place against the inside of the front, and tap the back plate with a mallet. This will cause the locating pin to make a slight indentation in the wood. Drill a small hole for the locating pin to align the lock.

Scribe around the body of the lock and chisel out the recess for the body. Then scribe the outline for the back plate, chisel out its recess, and deepen the body recess so that the back plate fits flush with the wood surface. Then complete the keyhole and drill pilot holes for the lock's installation screws. To cut out the keyhole, first drill out most of the waste, then use a coping saw to remove the wedge-shaped piece between the holes.

Mortising the lock. *The lock fits into a two-tiered mortise. First, mortise for the body of the lock; then carefully mortise for the back plate.*

SOURCES

Hardware—escutcheons (Esc-C-36), pulls (C-36), iron hinges (H37-C50) and locks—is available from Ball & Ball Hardware, (800) 222-7277. *Circle #607*

251-gram-strength hide glue is available from Bjorn Industries, (704) 364-1186. *Circle #608*

Urea is available at drugstores.

Liquid hide glue and shellac flakes are available from Woodcraft, (800) 225-1153. *Circle #609*

Behlen's aniline dyes are available from Garrett Wade, (800)-645-9292. *Circle #610*

tenons. This allows the top to move while still remaining tightly pinned to the breadboard ends. Once this is done, glue and clamp the miter joints, install the pegs and plane them flush. Spread glue only on the mitered end and the first half of the tongue. To finish the lid, drill holes for the strap hinges and install the mating lock hardware.

The Finish

My strategy is to approximate the 200-year-old patina of Geer's chest as closely as possible. I could use boiled linseed oil and wait a couple of centuries, but instead I mimic the patina with dye stain and then apply shellac. Dye stain is an excellent way to add color without obscuring nice figure. I know that dyes fade over time, but I'm betting that the maple will balance this out by developing a patina of its own.

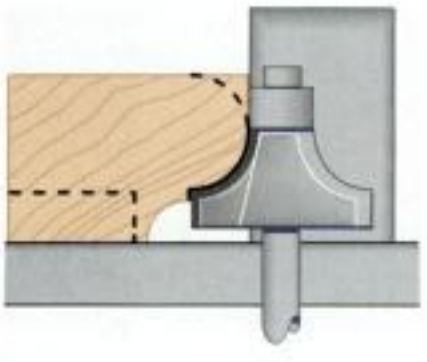
Raise the grain twice on the outside of the chest, and sand with 220-grit sandpaper. Then brush on a half-strength concentration of Behlen's Colonial Maple Ultra Penetrating dye. (See Sources.) Alcohol dyes can leave lap marks if you're not careful; the trick is to work quickly and try to get everything coated before one section dries. Let the dye dry for a day before applying shellac.

I mix my own shellac. This ensures freshness and lets me control the color by combining different grades of flakes. To make enough shellac for this chest, mix 3 ounces each of button lac and orange shellac with 1 quart of denatured alcohol.

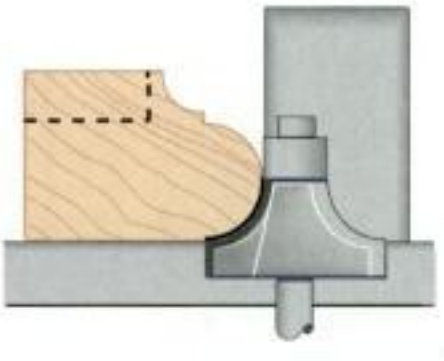
Avoid excessive brushing on the first couple of coats—it can draw the dye out of the wood and leave streaks in the shellac finish. Let the first coat dry completely before applying the second. You can buff the second coat lightly with 0000 steel wool if necessary, but be careful not to rub through the finish. Apply five more coats of shellac, sanding between the third and fifth coat with 320-grit stearated paper. After the final coat, rub the chest down with 0000 steel wool and apply a coat of paste wax. Installing the hardware is the last step—and the most satisfying. ▲

R.S. WILKINSON *is a student in the Smithsonian Institution's Furniture Conservation Training program.*

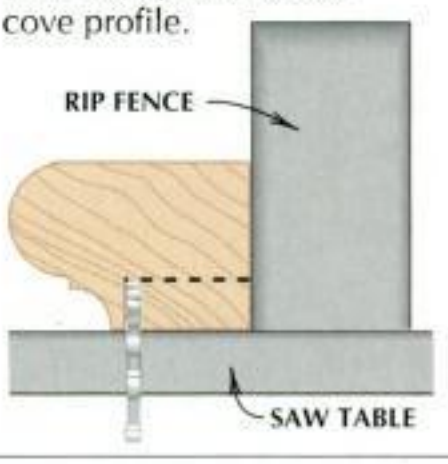
STEP 3: Rout the bottom edge of the bullnose with a 3/8-in. round-over bit.



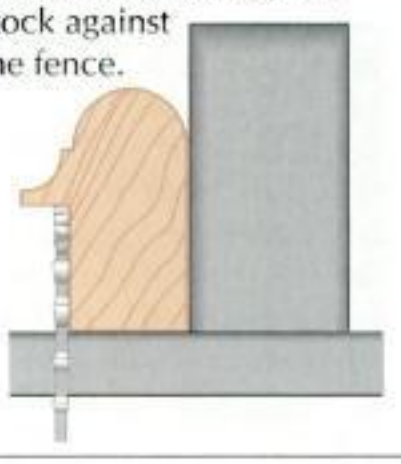
STEP 4: Lower the bit, flip the stock, and rout the top edge of the bullnose.



STEP 5: Rip a 3/8-in.-deep groove on the tablesaw to form the lip behind the cove profile.



STEP 6: Finish the lip edge on the tablesaw. Use a featherboard to keep the stock against the fence.



Watertight container. *Klausz's wooden box keeps his waterstone wet for sharpening.*

Waterstone Pond

Build a watertight wooden holder for your sharpening stones

by Frank Klausz

Sharpening with waterstones is a lot easier if you have a "pond" to hold the stone and enough water to keep it wet and clean in use. And your bench will stay clean, too. I learned to make this simple box while working as an apprentice in my father's workshop in Hungary. The box is completely watertight, but no glue or caulk is required to make it that way. Good joinery does the trick, along with a little bit of magic based on wood compression and expansion. In Europe, many generations of woodworkers have used these same techniques to build wooden baby bathtubs and washtubs.

I use white pine for my box, but any type of pine other than yellow pine will work fine. Clear stock is preferable, since leaks can develop around knots. If you want to store more than one stone, you can increase the width of your box. The inside of my box is about 2 in. longer than my longest waterstone. This leaves room for a pair of wedges that hold the stone in place.

The joinery is simple. The four sides are held together with tapered sliding dovetails. The bottom is nailed to the sides. To make the sides watertight, the dovetails need to be cut accurately. I recommend cutting the joints with a router and dovetail bit. To simplify routing, I use two jigs to guide my router: one for the dovetail socket, the other for the dovetail. (See the article on page 80.)

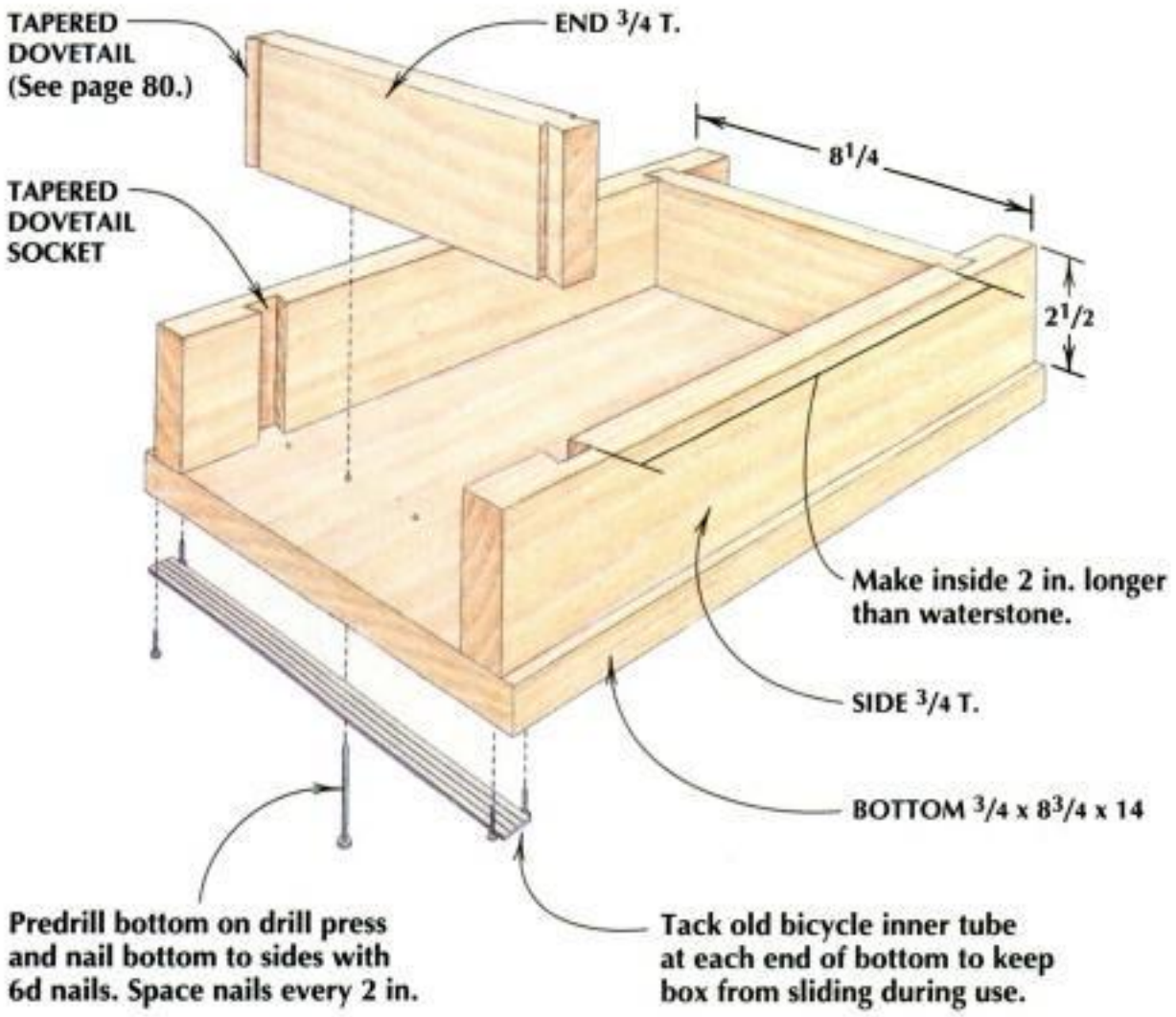
The key to making the sliding dovetail joints watertight is to make each tapered dovetail fit tightly—but not too tightly—into its mating socket. You should be able to assemble the joint about three-quarters of the way with hand pressure, then complete it with a few firm taps from a hammer.

The base of the box is simply nailed to the side assembly. The butt joint is watertight largely because of the resilient nature of wood. By compressing the

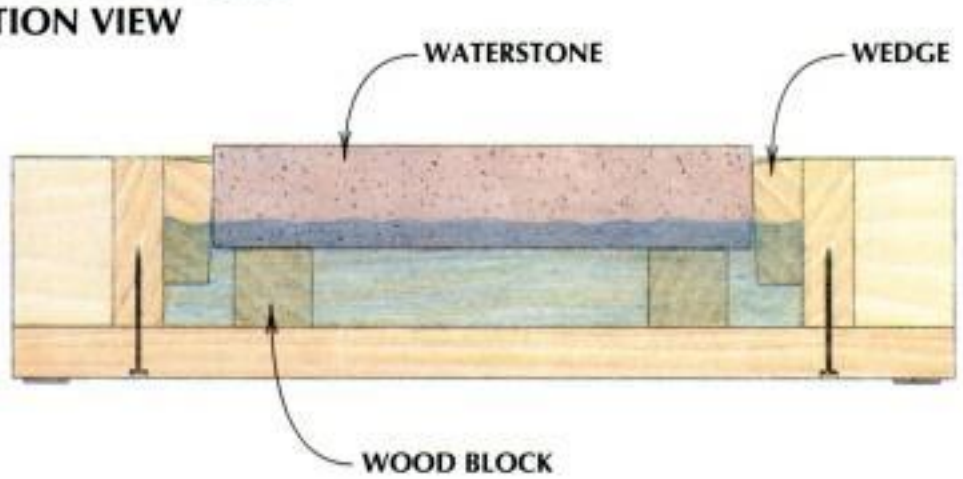
PHOTOS BY JOHN HAMEL

WATERSTONE POND

No glue is necessary when assembling this box. Once the box is filled with water, the joints swell, making the box watertight.



USING THE POND
SECTION VIEW



wood fibers on the bottom of the box's sides, I create a wood "gasket" that seals the bottom against the sides once the box is filled with water. (See sidebar, right.)

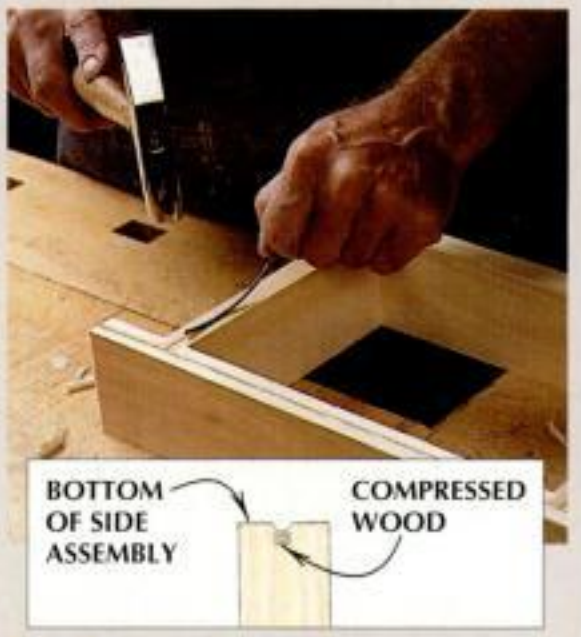
Putting the pond to work—Cut two wooden blocks and insert them under your waterstone so that the stone is raised slightly above the edges of the box. Then bandsaw two wedges and push them into position to lock the stone between the sides of the box. (See Using the Pond, above.)

To use the sharpening station, set the box on a sturdy surface—a bench works fine—so the surface of your waterstone is roughly level with your waist. This height gives you good control and lets you use your upper body weight to bear down onto the tool you're sharpening. I keep my stone wet and clean during sharpening with a homemade mop, which I make by folding a rag and tacking it to the end of a dowel. ▲

FRANK KLAUSZ
is a master cabinetmaker and a contributing editor to AW.

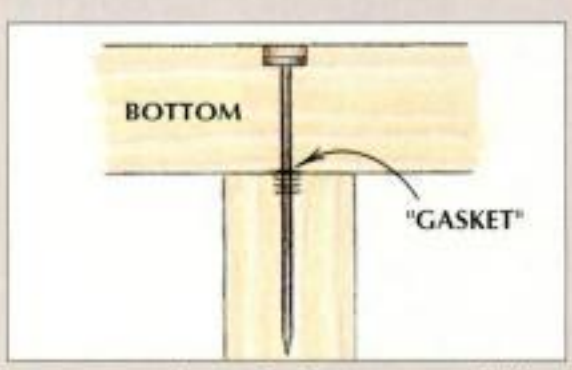
MAKING THE WOODEN GASKET

A wooden "gasket" seals the bottom of the box against the sides.



Step 1: Compress the wood. Use a hammer and a piece of wire from a paint-can handle to tap a groove along the bottom edges of the assembled sides. Make sure the grooves meet at the corners.

Step 2: Plane the edges. Plane the bottom edges until the grooves just disappear. Keep the assembly flat by planing all four edges evenly.



Step 3: Nail on the bottom and fill the box with water. In a couple of hours, the compressed wood will swell, forming a "gasket" that seals the sides tight to the bottom.

An Introduction to

Chip Carving

All you need are two knives and a comfortable chair

by Wayne Barton

Pleasing the eye. *Chip carving transforms a basic box with pattern and texture. With a little practice, you can learn to chip carve the floral and caning designs shown here, as well as many others.*

For centuries, woodworkers have embellished boxes, ornamental plates and furniture with chip-carved designs. The appeal of this simple form of carving is easy to understand. With only two knives, a few basic techniques and a little imagination, you can transform a drab, flat surface into a delightful composition of texture and pattern.

Chip carving involves incising designs into the wood. Each waste section is cut out by angling knife cuts inward toward each other. If done properly, this creates "chips" that lift cleanly out of the wood.

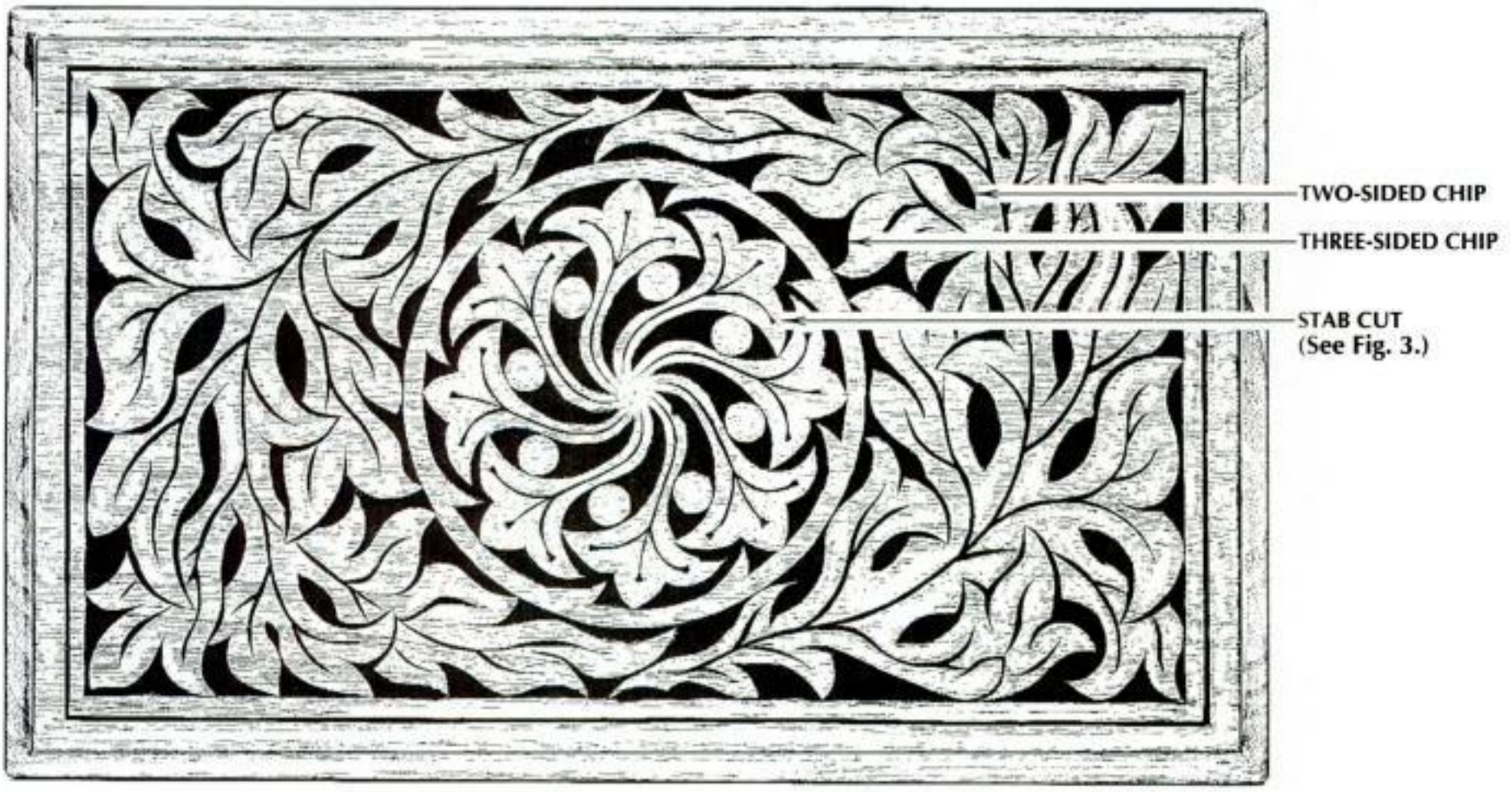
Many chip-carving designs are based on simple geometric patterns, such as the crosshatch "caning" pattern seen on the side of my butternut box. But chip carving also lends itself to flowing motifs such as the one shown in the center of the box lid—a rosette of flowers and berries surrounded by leaves. Although this design requires wider and deeper cuts than those on many chip-carved patterns, it's not as difficult to carve as it might look. By practicing the few cuts I'll show you in this article, you'll be able to carve this box lid design as well as the caning. Master these basic cuts and you'll be able to try your hand at any number of published or original designs.

A two-knife craft. *Chip carving involves only two knives. The "cutting" knife (top) does most of the work. The "stab" knife creates wedge-shaped impressions.*

PHOTOS BY JOHN HAMEL

FIG. 1: LEAF AND FLORAL ROSETTE PATTERN

This pattern is excellent for learning chip carving. It includes a rosette of flowers and berries surrounded by a sea of leaves. A thin border frames the entire design.



Wood Selection and Layout

I carve primarily in basswood or butternut. Although both woods hold detail nicely, I highly recommend basswood for beginners because it's easier to cut. I sand the wood to 100 grit in preparation for layout and carving.

To lay out the design shown on the box lid, enlarge the pattern in Fig. 1 to match the size of your workpiece. (A photocopier works well for this.) Transfer the design to your sanded workpiece. I use graphite paper (available from art supply stores) rather than carbon paper because graphite paper cleans off much more easily.

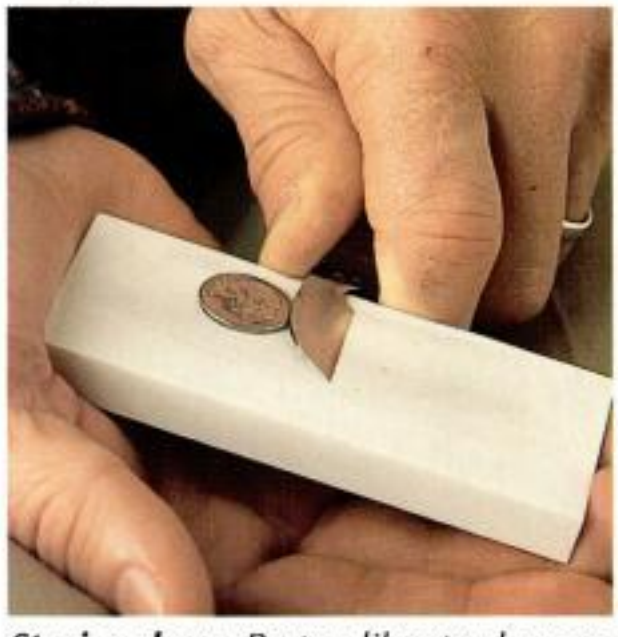
To lay out the caning pattern, simply draw a diagonal grid of 3/16-in. squares onto your workpiece as shown in the photos on page 49. I use a soft, grade "B" lead pencil when drawing directly onto wood. A narrow border around the caning frames it nicely.

Tools and Techniques

Of the two knives used in chip carving, the cutting knife is the workhorse. On this box, I use it almost exclusively. I only use the stab knife to create the wedge-shaped impressions at the ends of the flower veins in the rosette. (See Fig. 1.)

Keep your carving knives razor-sharp. Accuracy, enjoyment and safety are all compromised if your edges are dull. I know it's time to hone a knife (see photo, below) when carving starts to require more effort or when the wood isn't cutting cleanly.

For chip carving, I like to sit in a comfortable chair with the workpiece on my lap. This gives me good cutting leverage and allows me to turn the work easily. Good lighting is also important. I suggest placing an incandescent light below eye level, to prevent glare on your workpiece.



Staying sharp. *Barton likes to sharpen on ceramic stones because they stay flat, don't require lubrication, and clean up easily. A dime provides a reliable angle gauge for sharpening.*

To hold the cutting knife, wrap your index finger around the handle at the base of the blade, gripping the knife handle firmly with your remaining three fingers. (See photos, next page.) Lean the knife sideways, at about 65° to the work surface. Plant your thumb solidly, splaying its tip outward and pressing its inner knuckle against the knife handle. When cutting, maintain this fixed relationship between your thumb and index finger; never pull the knife toward your thumb as if you're peeling potatoes. The idea here is to guide the knife with your entire hand without changing the position of your fingers. Power the knife mainly with the grip of your back three fingers; don't pinch the handle unnecessarily hard between your index finger and thumb knuckle. Cut like this and you'll have safe, positive control.

Free-Form Designs

Curvy designs like the flowers and leaves on this box look challenging, but they're all made with just a few elementary cuts.

Two-sided cuts—First, practice cutting out the two-sided waste sections as shown in the top photo on the next page. The trick is to gradually plunge the knife deeper as you pull it along. When you reach the widest part of the section, start pulling the knife out of the

Making a two-sided chip. *Leaning the knife at 65°, make two opposing cuts that meet at the bottom, to create a V-shaped chip that lifts from the wood.*

wood as you approach the end of the cut. With a little practice, you'll learn how deep to cut. Use the width of the section as a guide; the wider the section, the deeper the cut. By maintaining a consistent 65° knife angle for all cuts, the walls of a section will always meet in the center at the bottom.

Three-sided cuts—Next, practice three-sided cuts, such as the one in the photos below. Note that I'm left-handed; right-handers will need to reverse the cut direction shown. To follow a cutline, look at the line just in front of the cutting edge, not at the blade itself. Your eye will pull the knife along nicely.

There's a trick to getting the knife around tight curves: While maintaining its 65° lean to the side, stand the knife up. This minimizes the amount of blade trying to turn the corner. The tighter the curve, the higher you'll need to stand the knife.

When you're removing smaller waste sections, you will find that one pass of the knife on each cutline will usually remove a chip cleanly. When you're making deeper cuts—particularly if they're across the grain—you may have to make multiple passes. If so, be sure to maintain the 65° knife angle on all subsequent passes. Beginners often tend to increase the angle of the blade, creating too deep of a cut.

Sometimes, larger chips don't lift out cleanly, but leave bits of wood clinging to the bottom. No problem. Just go back in with the knife and cut them out, cleaning up the walls of the section afterward if necessary.

Carving Linked Sections

Chip-carving designs are usually based on two-, three- or four-sided waste sections. This is because cuts from these sections will all meet nicely at the bottom, creating chips that lift neatly from the wood.

But in free-form chip-carving designs such as this, you can also link sections at narrow points. This allows greater design flexibility.

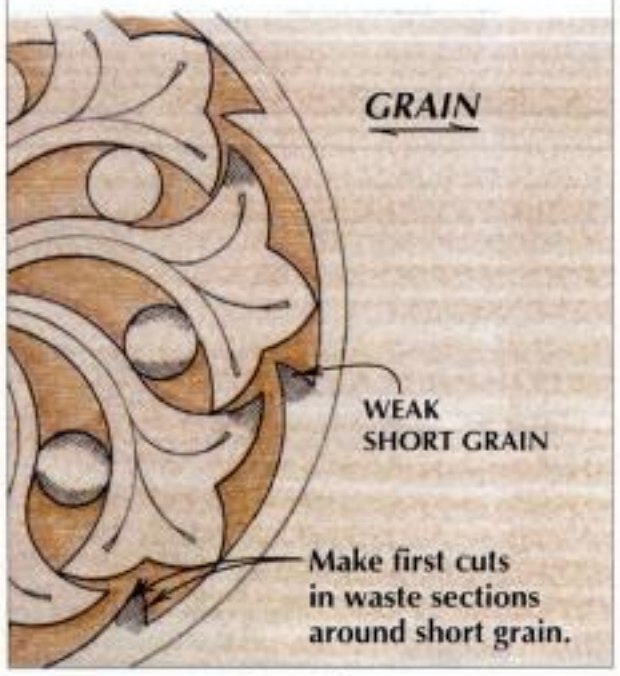
Linked sections often include projecting areas that contain short grain. When this occurs, make your first cuts around the delicate short-grain area. Otherwise, it may snap off if the chip prematurely breaks free from the pressure of an adjacent cut. (See Fig. 2.)

MAKING A THREE-SIDED CHIP

Easy as 1-2-3. *All the walls of a chip are cut with the same basic procedure. Cut around short grain first. (See Fig. 2.) Start the cut at an intersection, leaning the knife 65° to its side. Plunge deeper as you approach wide areas, and shallower toward narrow areas. If any bits of wood remain after you've freed the chip, get rid of them with a cleanup slice.*

FIG. 2: PREVENTING SHORT-GRAIN BREAKS

Delicate short grain can snap off if a chip breaks free prematurely. To prevent this, make your first cuts around the short-grain areas.



Carving Detail Cuts

For detail cuts such as the veins in the leaves and rosette flowers, simply make narrow, shallow cuts.

For the wedge-shaped indentations at the end of the flower veins in the rosette, plunge the stab knife straight down into the wood and rock it slightly toward its cutting edge. (See Fig. 3.) This detail helps define the flower and provides delicate contrast to the deeply carved sections.

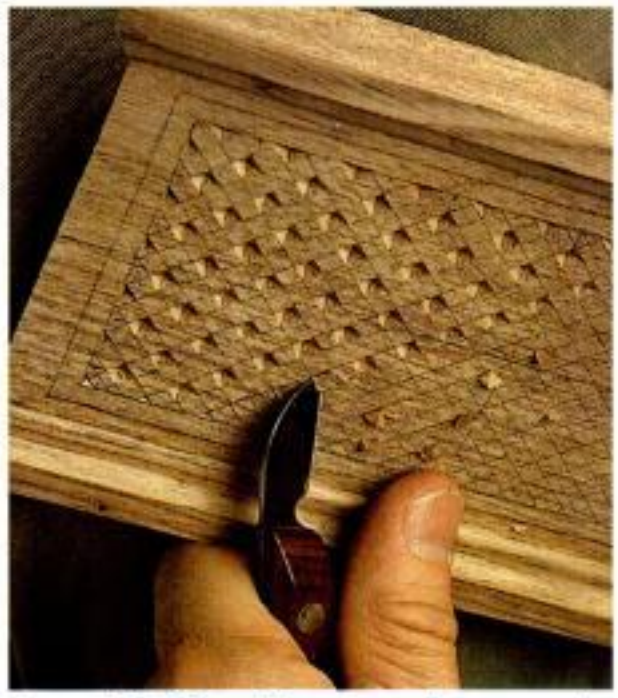
When cutting a thin borderline such as the one that frames this design, you don't need a straightedge if you simply cut slowly and carefully. Remember to keep your eye on the line just ahead of the knife.

Carving Caning Designs

To carve the caning pattern you see on the ends of this box, begin by making a series of four-sided chips as shown in the left photo above. Place the tip of the knife at the corner of a square, leaning the blade about 65° in the direction of its cutting edge, as shown. Then plunge the blade, cutting toward the center of the square. For economy of movement, I generally make similar cutlines in series before repositioning the workpiece to make the next series of cuts.

To complete the caning pattern, connect the squares with channels, as shown in the right photo above. Then frame your finished pattern with a thin border.

CARVING THE CANING



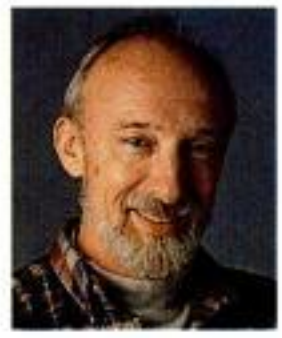
Pyramid chips. *To cut each square in the caning pattern, lean the blade 65° in both directions and work toward the center of the square.*

Creating the "weave." *For a woven effect, connect every other square with shallow, V-shaped channels.*

Creating Your Own Designs

A beginner can easily design any number of rosettes or geometric patterns using only a compass and a ruler. Books and videos on chip carving provide many ideas, suggestions and patterns. (See Sources.)

You can also create your own free-form designs, but limit each waste section to two, three or four sides, to ensure that cuts will meet at the bottom of the section. If you like, you can link different sections at a narrow point as shown in Fig. 1. I suggest limiting the widest sections to 3/8 in. A wider—and therefore deeper—section can be very difficult to cut. ▲



WAYNE BARTON
has written three books on chip carving. He operates the Alpine School of Woodcarving, Ltd., in Park Ridge, IL.

FIG. 3: MAKING STAB CUTS

To create wedge-shaped impressions, plunge the stab knife straight down, then rock it backward.

SOURCES

Chip-carving knives, sharpening stones, books and videos are available from:

Alpine School of Woodcarving, Ltd.
(847) 692-2822 *Circle #601*

Garrett Wade
(800) 221-2942 *Circle #602*

Highland Hardware
(800) 241-6748 *Circle #603*

Lee Valley Tools
(800) 871-8158 *Circle #604*

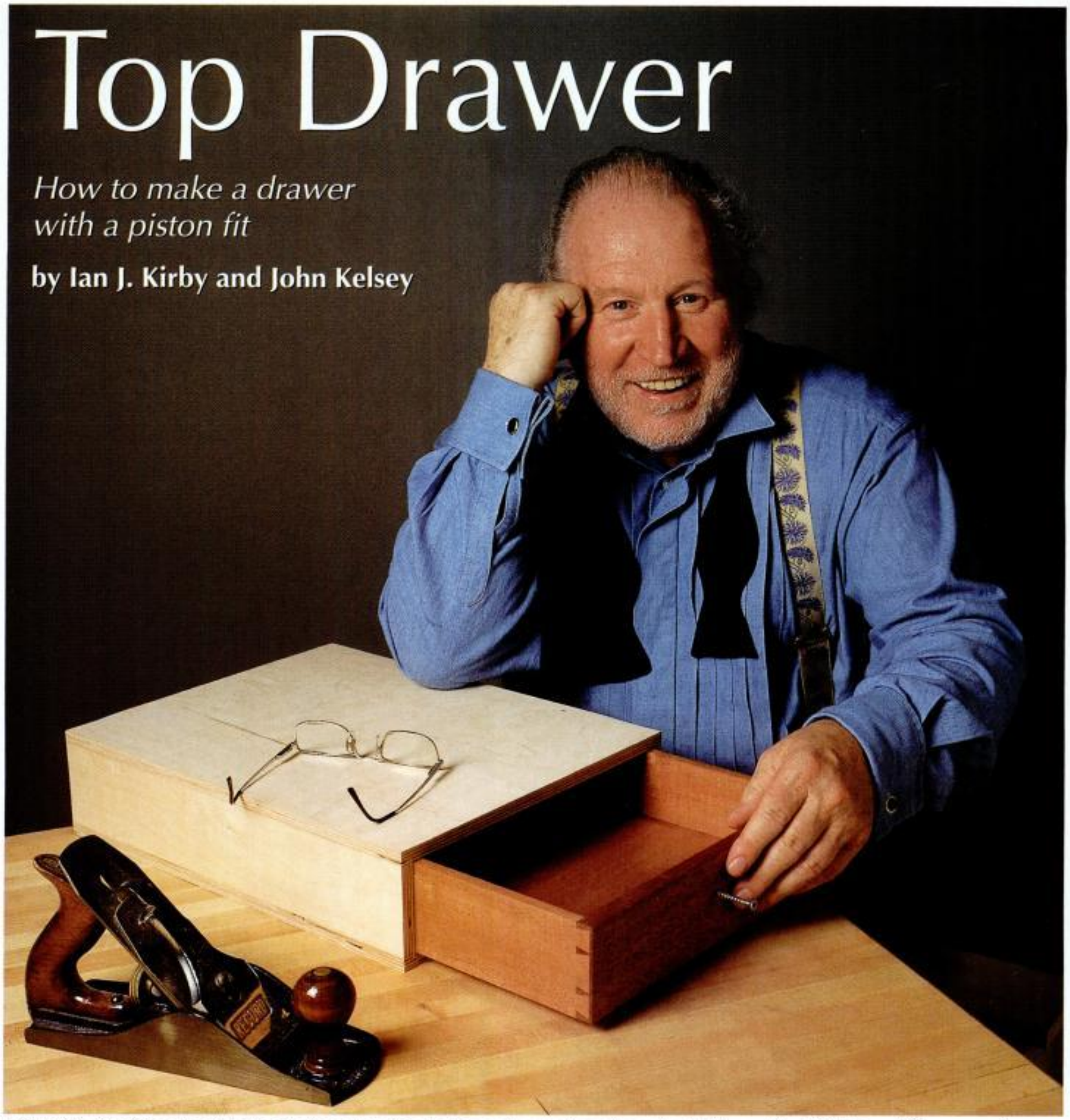
Woodcraft
(800) 535-4482 *Circle #605*

Woodworker's Supply
(800) 645-9292 *Circle #606*

Top Drawer

How to make a drawer with a piston fit

by Ian J. Kirby and John Kelsey



Piston fit. *Traditional solid-wood drawermaking is the only way to get an absolutely perfect fit. To try it for yourself, make this study project. The elegant spiral-steel knob is customary on study drawers.*

When it has been designed and made with no compromise, the traditional solid-wood drawer fits like an automobile piston and works with a Rolls-Royce feeling of quality. The secret is to fit the parts to the opening *before* you join them.

The classical method of making a drawer relies on accurate layout, and planing to fit. A sharp bench plane takes a shaving that's about half a thousandth of an inch thick, precision unobtainable with any other woodworking tool. Once you have planed the drawer front to fit the opening, you don't want to make it any smaller in the process of fitting the joints. Instead, you cut the dovetail pins, which are on the ends of the drawer front, a bit *shorter* than the thickness of the drawer sides. This allows you to plane the long grain of the sides precisely down to the end grain of the pins, at which point the drawer has no choice but to fit.

All the parts of the drawer, including the bottom, are made of solid wood. To minimize wood movement, it's important to choose evenly grown, quartersawn material. Whatever the species, the material must be a hardwood, and it must be quar-

PHOTO BY JOHN HAWKE

tersawn. Flatsawn or riftsawn wood simply does not have the necessary stability, nor does any softwood.

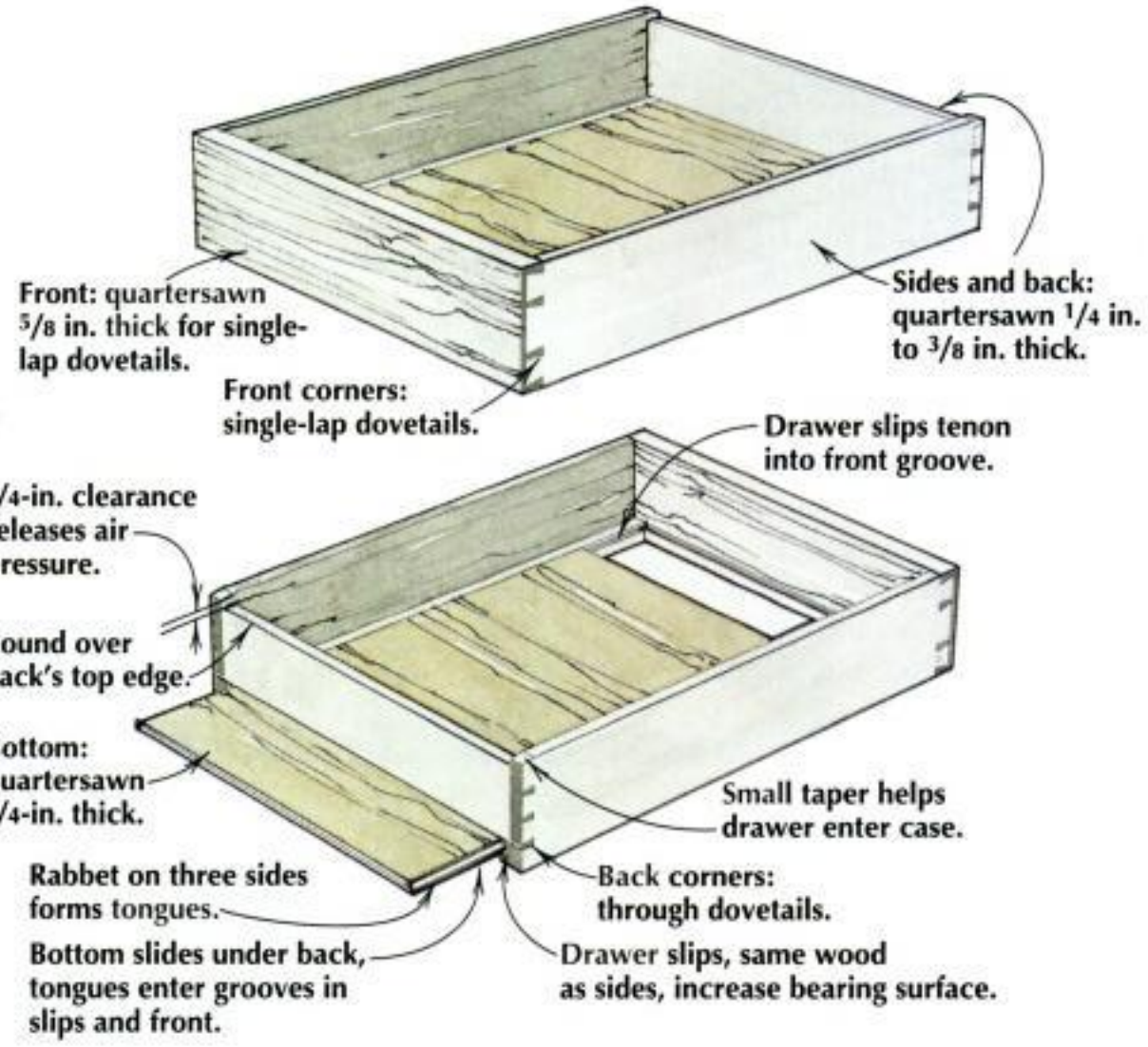
The grain direction of the bottom runs from side to side, so the wood can expand from front to back. The drawer bottom has a rabbet on three sides, to fit grooves in the drawer front and slips (see Fig. 1) which are glued to the sides. The slips not only increase the drawer's bearing surface; they also permit a very thin drawer side and contribute a beautiful detail to the inside of the drawer.

A drawer like this is not a casual undertaking. It's neither quick nor easy—nor is it cheap: You have to allow about a day of bench work per drawer. It's too rich for many applications, when a routed drawer with a plywood bottom and metal slides is technically and aesthetically appropriate. The fitted solid-wood drawer is a luxury for your finest work.

To learn this method of drawermaking, tackle a sample drawer as a deliberate study project. Fill the drawer with Italian rifflers, unpaid bills or your espresso-bean collection, and you'll have it for reference whenever you want to solve a drawer-making problem. Best of all, it will always remind you of an important station on your journey toward woodworking mastery.

FIG. 1: TRADITIONAL DRAWER

Whether it's alone in the case, alongside other drawers, or in a stack of drawers, the traditional drawer can be made the same way. Shallow drawers use space better than deep ones, which fill up with inaccessible clutter or dead air.



STUDY PROJECT

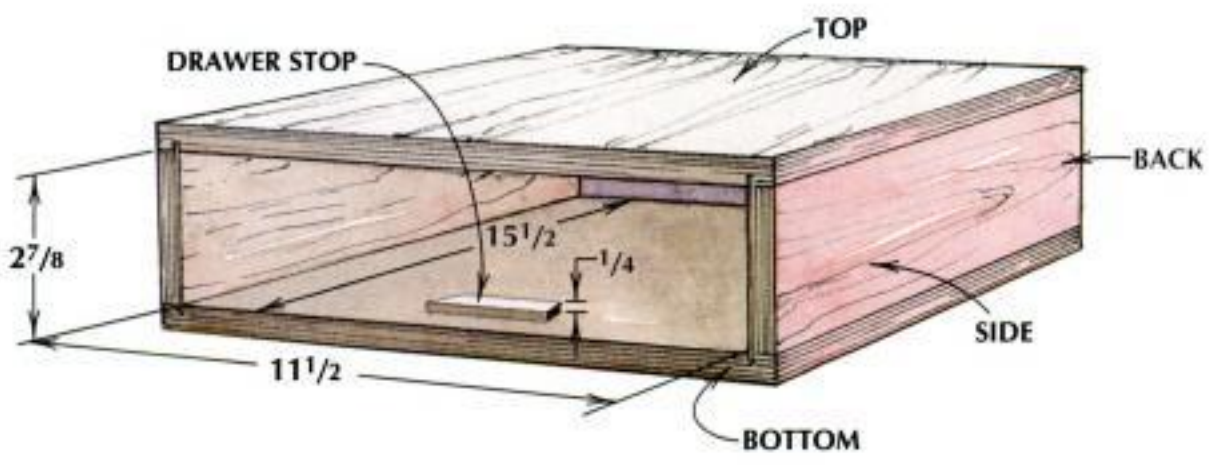
STEP 1

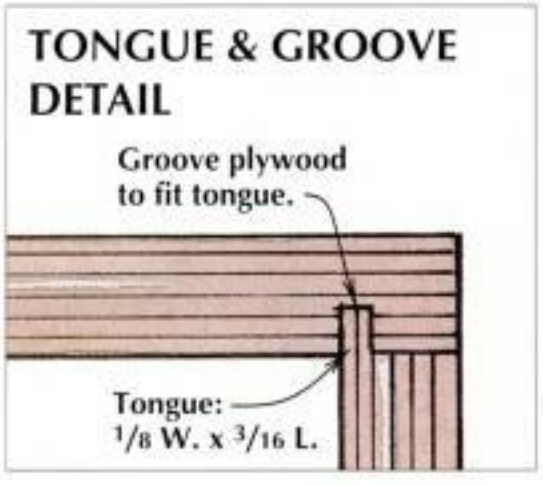
Make the plywood case.

All drawer openings are rectangular holes. However, for first-class work, it's critical that the opening be truly square, and parallel or even a tiny bit wider at the back. "Tiny bit" means 1/64 in. or less, and more is *not* better. The case dimensions are shown below. You can change them to suit yourself, though you shouldn't try to make a big drawer the first time out. The case shown has a tongue-and-groove corner joint, detailed as discussed in our previous article on joints for man-made boards. (See AW #53.) Clean up the outside of the case and remove any interior dribbles of glue that might interfere with the drawer.

FIG. 2: CASE FOR STUDY DRAWER

Make the plywood case of 1/2-in. Finnish or Baltic birch plywood. Join it with a barefaced tongue, with a solid-wood spline, or with biscuits. Locate the drawer stop so it exactly positions the drawer front relative to the front of the case.





STEP 2

Fit the drawer front.

Fits like a cork. *The two-shaving taper planed on the edges of the drawer front is so small you can barely see it against a try square. But it's just enough to allow the front to enter partway, and go no farther.*

To prepare the drawer front, begin by making a *face side* on the wood. A face side is flat in length and width, with no twist. Now, establish a *face edge,* which is straight and square to the face side, and plane the wood to thickness. These are your reference surfaces: Face sides always go to the inside, and face edges always go downward. Next, crosscut the right-hand end of the front and mark it with a quadrant. (See photo, left.) Saw the length and width to less than 1/8 in. larger than the opening—that is, within planing distance. Offer the wood up to the drawer opening. Now:

- **Match the face edge to the case.** If the bottom of the opening has a little curve from one side to the other, plane the face edge to match.
- **Fit the right end.** The opening might not be truly square. With a very sharp bench plane—not a little block plane—trim the square end of the wood to match the case. Then take another one or two shavings off the inside edge, so the wood has a minuscule taper toward the face side.
- **Fit the left end.** Plane the left end to match the shape of the case and minutely taper it toward the inside, so the front enters halfway. There is a point of no return: Go too far, and the drawer front will be too short.
- **Fit the top edge.** Plane the wood so the drawer front just enters the case. Take one or two extra shavings toward the face side.

Plug the drawer front partway into the opening. (See photo, left.) It should fit like the cork in a bottle of wine.

STEP 3

Fit the drawer back and sides.

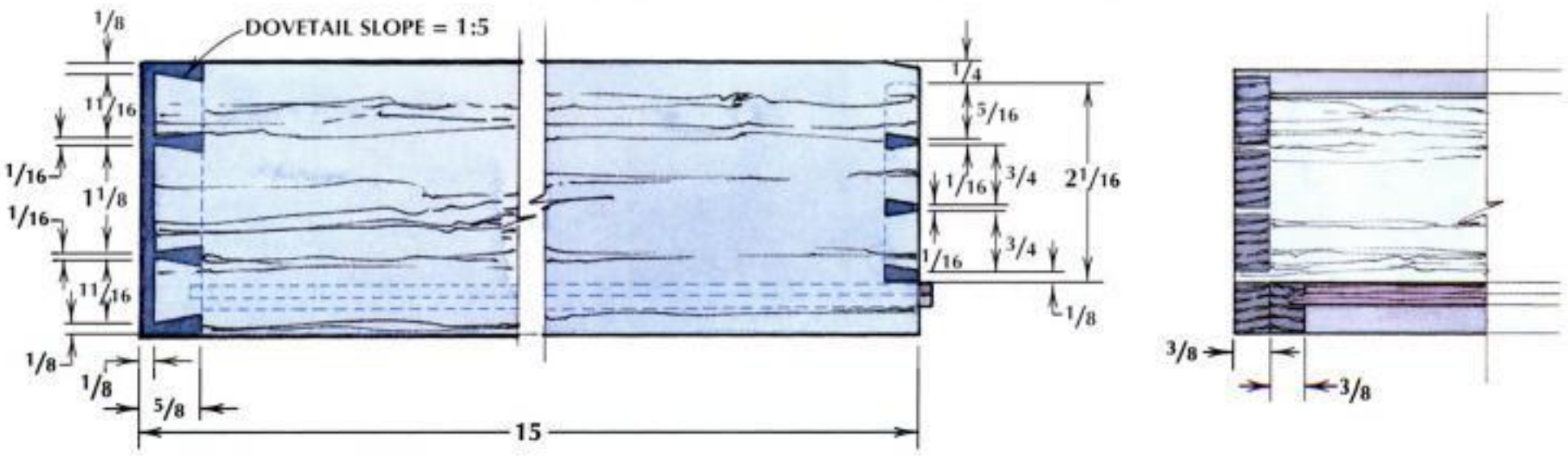
Prepare and mark a face side and edge on each drawer side and on the drawer back. Crosscut the sides square and to their finished length. So there's no confusion, quadrant-mark the outside bottom front corner of each drawer side, as shown. (See photo, right.) When there's more than one drawer, number the pieces inside the quadrant. Plane the top edge until the drawer side goes halfway in.

The drawer back fits the opening from side to side, but it sits up on the drawer bottom, and there should be 1/4 in. of clearance at the top as well. (See Fig. 2.) Register the back's top edge with the top of the case opening, and fit the ends as you did the front. As you plane the drawer back, remember that its face side goes to the inside of the drawer. When it's in the front opening, the face side looks at you.

Facing confusion. *The face side mark, on the inside of the drawer side, points toward the face edge, which goes downward. Draw a quadrant on the outside bottom front corner to eliminate any confusion.*

FIG. 3: STUDY DRAWER DETAILS

These proportions yield an elegant drawer joint, but you can vary them to suit yourself. The drawer bottom slides under the drawer back. Plane the parts to fit the opening before you join and assemble the drawer.



STEP 4

Join drawer front to drawer sides.

Single-lap dovetails join the drawer front to the drawer sides. Since the joint will be revealed every time someone opens the drawer, take the time to make an accurate, nicely proportioned joint. (See Fig. 3.) While this article isn't about dovetailing, here are some notes:

- Smooth-plane the inside of the drawer before you lay out the dovetails.
- When you scribe the length of the joint onto the inside face of the drawer front, set the cutting gauge about 1/64 in. less than the thickness of the drawer side (see photo, below), so the sides will stand slightly proud. After glue-up, you'll "shoot" the completed drawer into the opening by planing the sides down to the end grain of the drawer front—which you already fit to the opening in Step 2.

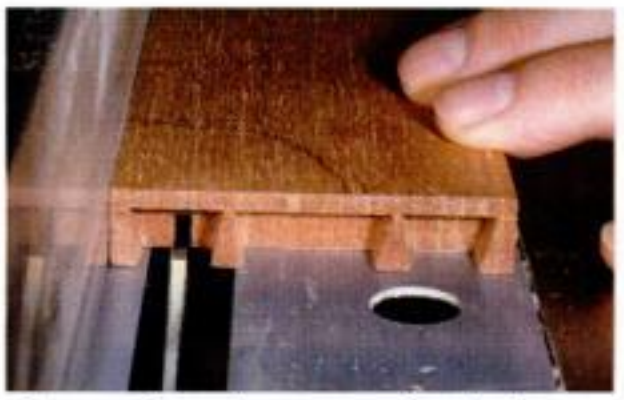
Although it might seem inefficient, it's best to complete and fit each joint in turn, instead of doing the same operation on more than one joint at a time. This avoids confusion and keeps your focus on accuracy.

A hair short. *Set the cutting gauge to just less than the thickness of the drawer side (above). This is the length of the dovetail pins—scribe it inside the drawer front (below). The difference between this length and the full thickness of the sides gets planed off when you shoot the drawer.*

STEP 5

Run the bottom groove in the drawer front.

Lay out and saw a groove across the inside of the drawer front, for the bottom. Locate the groove so the underside of the drawer bottom is about 5/16 in. up from the bottom edge of the drawer front, to allow room for the drawer stop. (See Fig. 2.) Note that the groove must run through a tail socket, not through a dovetail pin. Saw the groove on the tablesaw, to the thickness of the carbide-tipped blade.



Groovy. *Saw the groove for the bottom in the drawer front. This groove also anchors the tenons on the front ends of the drawer slips.*

STEP 6

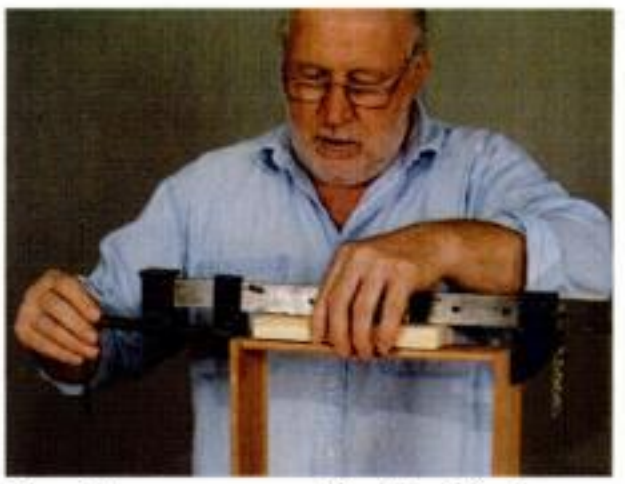
Join the drawer back and sides.

Through dovetails join the drawer back to the drawer sides. Figure 3 shows a typical layout. When you mark the length of the pins on the drawer back, set the gauge to just less than the thickness of the sides, as you did with the front of the drawer. Complete the back by rounding over its top edge with your plane.

STEP 7

Assemble and glue the drawer.

You've already fit each joint individually, so there is no reason the whole drawer won't go perfectly together. In the workshop, in fact, you would glue it up at this point. For study purposes, however, put the four parts together dry. Nip each side home with a single bar clamp (see photo, right), then take the clamp away. Since the faces of the drawer sides stand a hair proud of the ends of the dovetail pins, you don't need clamping blocks. If any of the joints resist going home, find and correct the interference.



Precision squeeze. *Nip the joints closed with a single bar clamp. The block of wood lifts the clamp so it bears directly on the broad tails.*

Now take the drawer apart. Before you glue up, clean the inside surfaces by sanding lightly with 280-grit paper. This is also the best time to finish the interior, traditionally with a buttery mix of beeswax dissolved in turpentine. Keep the wax off the joints and off the bottom half-inch of the sides, where you will glue the drawer slips.

Use your knife to spread glue on the mating surfaces of the dovetail joints. Then start the joints, tap them down with a hammer, and again nip them home with the single clamp. Remove the clamp, sight across the drawer to ensure that it is flat, and measure the diagonals to see whether it's square. If it's off, push it into line. Then leave the drawer alone, unclamped, while the glue sets.

Check for flat. *Sight across the drawer sides to be sure they are parallel and in the same plane.*

Check for square. *Measure the diagonals. When they're equal, the drawer is square.*

STEP 8

Make the drawer slips and bottom.

The dimensions of the drawer slips depend on their profile. Of the several choices shown in Fig. 4, the flush slip is the simplest to make but the most exacting to fit. Cut the slips from the same quartersawn material as the drawer sides, and saw the groove in each slip.

For the bottom, glue up quartersawn wood about 1/4 in. thick. When the glue dries, smooth-plane the bottom and saw it square and to finished width, allowing 3/16 in. for a tongue at the front and about 1/4 in. extra at the back. (See Fig. 3.) Note: The *length* of a drawer bottom is in the direction of the grain, whereas the length of the drawer itself is measured from the front to the back.

The drawer bottom has a rabbet on three sides, forming tongues. With flush slips, the side tongues are on the underside and the front tongue is on top. Lay out and cut the side rabbets one at a time, making sure they fit the grooves exactly. (See photo, below.) You can rout the rabbets, cut them on the tablesaw, or plane them with a shoulder plane.

Chasing rabbets. *Rabbet one edge of the drawer bottom and fit the slip, then knife the inside width of the drawer. Now you can lay out the final length of the bottom and the other side rabbet.*

STEP 9

Fit the slips and bottom.

Fit the drawer slips onto the drawer bottom, and plane their top surfaces flush. (See photo, below left.) Hold each slip in position to lay out the little tenon that will anchor it in the front groove (see Fig. 4 detail), then saw the tenon.

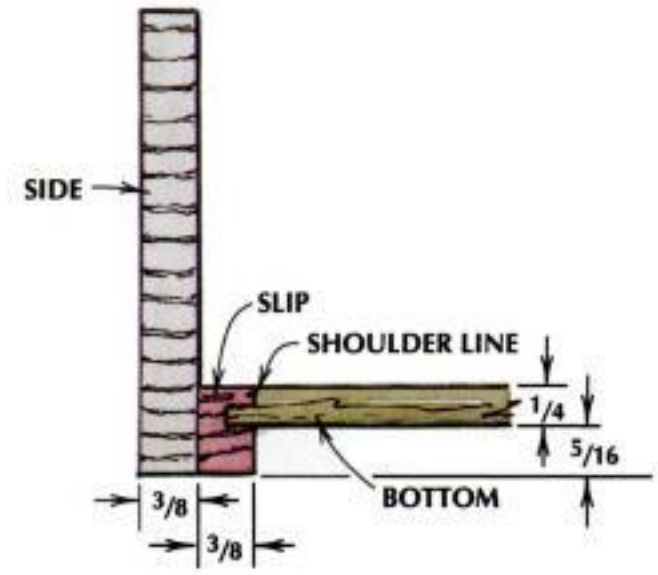
Before you glue the slips to the drawer sides, wax their top surfaces. The wax will resist any glue squeeze-out, so it will pop right off the wood. When you glue up, use a straightedge to make sure the slips are straight, not bowed up or down. (See photo, below right.)

Slide the drawer bottom all the way to the front. You may have to adjust the fit of the side tongues. Now you can see how to lay out and shape the rabbet at the front edge. After you've fit the front tongue, slide the bottom out and trim the slips flush with the back of the drawer.

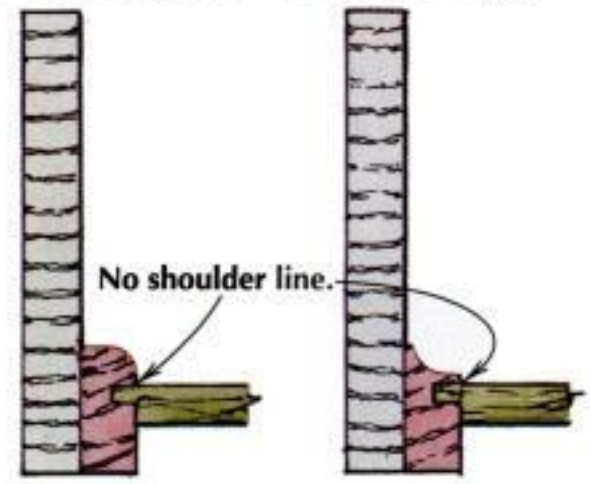
FIG. 4: DRAWER SLIP PROFILES

Drawer slips add an elegantly functional detail to a fine drawer. The flush slip is the most difficult to fit because its shoulder lines show. The profiled slips have no visible shoulder lines.

FLUSH SLIP



ROUND-OVER SLIP COVED SLIP



DRAWER SLIP TENON DETAIL

The drawer slip has a little tenon on its front end, which fits the groove in the drawer front.

Level the slips. *Fit the drawer bottom into each slip in turn and plane their top surfaces flush.*

Clamp the slips. *Glue and clamp the drawer slips to the drawer sides. Use a ruler to keep the slips straight.*

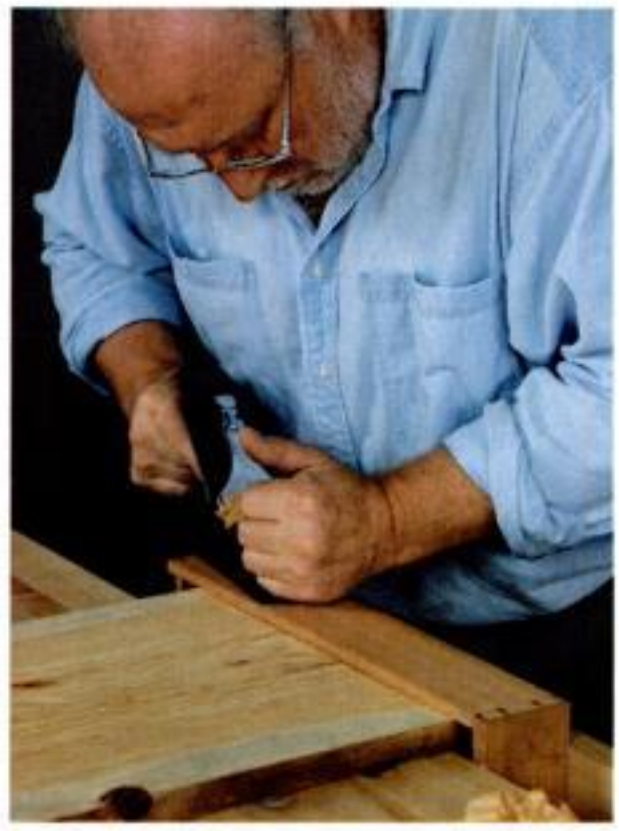
STEP 10

Shoot the drawer.

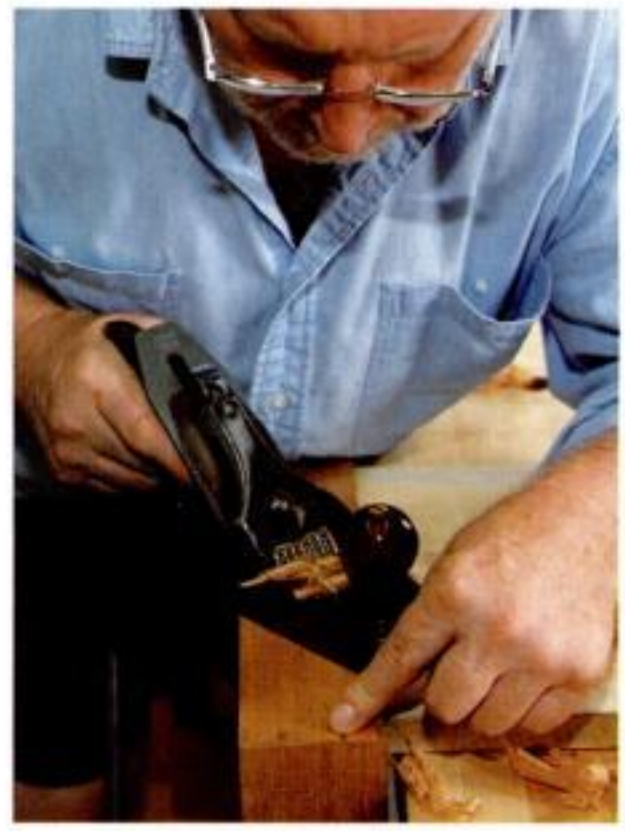
Before you can shoot the drawer into the case, you have to plane the bottom of the drawer slips flush with the drawer sides. Use a long jointer plane, and check your progress by laying a straightedge across the bottom of both slips.

Try to enter the drawer. You should be able to insert either back corner, but not the full width.

"Shooting the drawer" means planing the sides down to the level of the dovetail pins. Support the drawer side on a wide plank draped across the workbench (see photo, near right), and grip its front or back in the vise. Plane the drawer side from end to end. Feel the dovetail pins with your fingertips to gauge how much farther to go. (See photo, far right.) When you've planed both sides down flush, the full drawer should enter the case, though it will be a very tight fit.



Shoot the drawer. *Plane the drawer sides just down to the level of the dovetail pins. Grasp the drawer front in the vise and support the side on a wide board across the benchtop.*



Feel your way. *While you may not be able to see how far to plane, you can feel the difference between the dovetail pins and the drawer side. Stop planing when they are flush.*

STEP 11

Do the final fitting.

The last steps are to ease the fit and, once the drawer enters fully and easily, to plane the front parallel to the case opening—flush, inset or proud as it suits you. Before you remove any more material from the drawer sides, plane a tiny chamfer on their outside corners. Then check the fit and proceed a shaving at a time, until it's just right. Working the drawer in and out (see photo, right) will burnish any high spots, so you can see exactly where it needs relief. You'll be amazed at the close fit you can achieve.

To make a drawer stop, cut a small block of wood to less than the thickness of the drawer's bottom clearance. Glue it inside the case, positioned so the drawer front stops where you want it to be. (See Fig. 2.) On study drawers, the usual and customary knob is an unadorned wood screw, perfectly centered. ▲

A tight fit. *Run the drawer in and out to locate the high spots, and plane them off. When it fits right, the drawer should close with a fingertip's pressure, and the soft whoosh of trapped air.*

IAN J. KIRBY
is a furniture designer, woodworker and teacher with studios in Connecticut.

JOHN KELSEY
is a writer and occasional woodworker in Connecticut.

Wall Mirror

Template-routed curves, decorative plugs and a carved detail dress up a simple frame

by Gary Rogowski

Wonderful to behold. *With its basic joinery and simple carving, this easy wall mirror makes an elegant gift.*

A project can be simple to build without looking ordinary. That's what I like about this wall mirror: Despite its basic joinery, its form and detail give it an uncommon appeal. A template-routed curved top rail, some decorative plugs and a simple incised carving help it to stand out.

Design and Layout

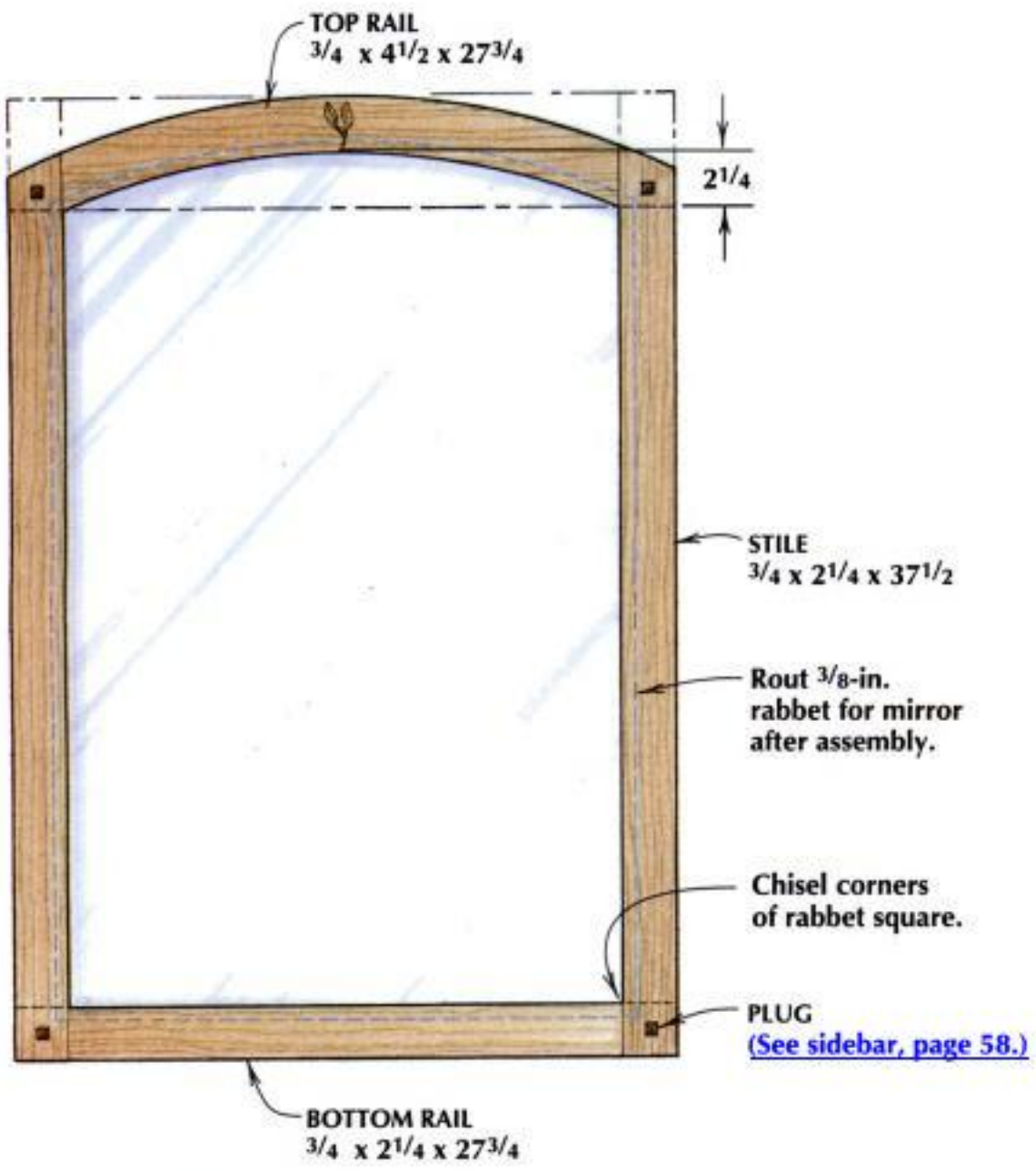
With a curved frame like this one, I like to draw my design out full-scale on a piece of brown butcher paper. The frame dimensions are given in the drawing opposite.

To lay out the curves for the top rail, I use a strip of oak about 1/2 in. wide by 1/8 in. thick. On my drawing, I mark the tops of both stiles and the midpoint of the outer curve. I bend

LEAD & PLUG SIDEBAR PHOTO BY PAUL PEARSON

WALL MIRROR

To join the frame members, cut the half-laps first, then template rout the inside curve of the top rail. Rout the outer curve after glue-up.



the strip to line up with the three points, hold it in place with something heavy at each point, and trace the outer curve. Then I slide down 2¼ in. and trace the inner curve.

A Template for the Top Rail

I make a template of the top rail from a piece of ¼-in.-thick hardboard. A template serves a couple of useful functions: It's easier to make a smooth curve on hardboard than on the wood itself, and if I want to build the piece again, I have the pattern.

I rough-cut the template on the bandsaw, then sand close to my lines using my homemade spindle sander. To develop the final form, I use a spokeshave, checking the curves by hand and eye.

Wood Selection and Preparation

Now I'm ready to prepare the wood. I used Honduras mahogany with wenge plugs for this frame. But I've also made frames from cherry, white oak, and ash, and I've used any number of contrasting plantation-grown exotics for the plugs.

Half-Lap Joints

Half-laps are one of the simplest ways to make a frame. (See photo, below.) They offer good gluing surfaces and strength while easily accommodating curved frame members. The laps on this frame start out 2¼ in. square—except for the top rail, where they start out 2¼ in. long by 4½ in. wide. I cut the curves later on.

Anatomy of a half-lap. *The mirror frame is joined with half-laps. Here, the stile will overlap the cheek of the rail. After assembly, you can add a dowel pin and decorative plug.*

Cutting half-laps is easy with a router or a tablesaw—just set up for half the thickness of the stock, and you can cut all the joints identically. Whichever tool you choose, do some test cuts in scrap to make sure the half-laps are the right thickness.

A tablesaw method—I cut all the half-lap shoulders first, using a combination blade and a simple crosscut box. (See top left photo, page 58.) A stop, clamped to the fence of the crosscut box, ensures accurate cuts.

Next, I trim most of the cheek waste free on the bandsaw. This way, I don't have to worry about these offcuts flying around on the tablesaw. I save the offcuts and use them as clamping pads when I assemble the mirror frame. For smooth gluing surfaces, I finish-cut the cheeks with a tenoning jig on the tablesaw. (See top right photo, page 58; for a simple tenoning jig, see AW #54.)

A router method—You can also cut half-laps on the router table. When I do this, I still remove most of the waste on the tablesaw and bandsaw first; then I use my largest-diameter bit, set to cut at half the thickness of the stock. Set the fence just under the full width of the half-lap. This way, you won't cut into the shoulder and create tearout. A chisel cleans up the tiny bit of wood that the router misses.

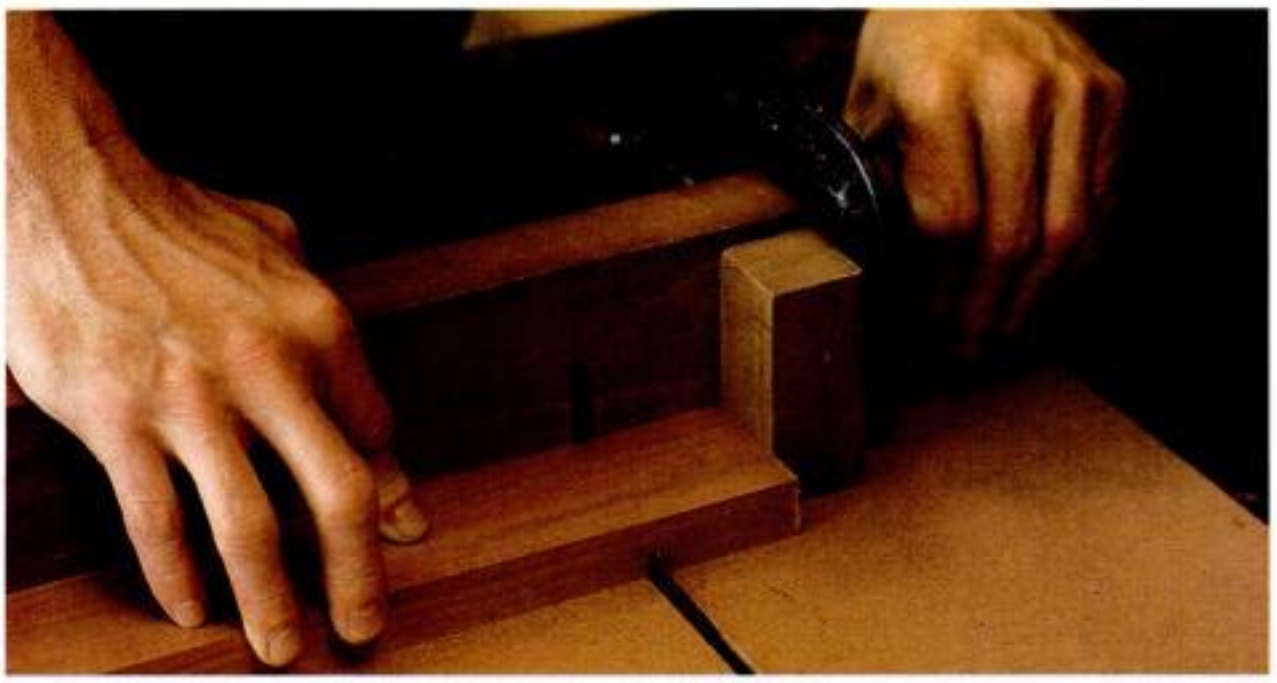
Cut the joint in several passes across the router bit. The final pass is done with the end of the board tight up against the fence. To keep these narrow pieces stable, gang two pieces together and send them across the bit as a package; you could also use a wide backer board. Make sure to keep your fingers away from where the bit exits the joint.

Routing the Inside Curve

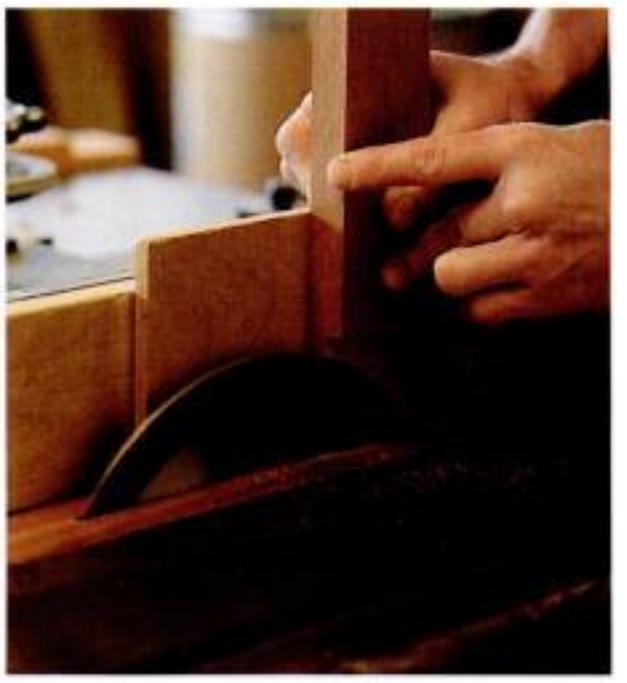
After you've cut the half-laps, it's time to rout just the inside curve of the top rail. (See bottom left photo, page 59.) I cut the outside curve later on, after assembly, because a straight top edge is easier to clamp.

Completing the inside curve takes two cuts—first on the bandsaw, then with the router. I trace both template curves on the rail, and bandsaw the inside curve close to my pencil line. Then I attach the template to the rail with double-faced

MAKING A HALF-LAP JOINT



First the shoulder. *Cut each half-lap shoulder at 90° using a tablesaw crosscut jig. A stop block aligns the shoulder cut. Set the blade height to slightly less than half the material thickness.*



Then the cheek. *After bandsawing each cheek close to size, cut the lap to thickness with a tenoning jig.*

tape and rout the inside curve with a 1/2-in.-dia. flush-trim bit in my router table.

Be careful of tearout when you're routing "uphill" on the curve. I take small nibbles at first to see how the wood is cutting. I also stop routing before the end of the curve, and clean up the high spot with a spokeshave or file instead. Alternatively, you could stop the cut halfway across, flip the template and rout in from the opposite end. This method is good for wild-grained or very hard wood, but it's also slower.

Finally, I scrape or sand the whole curve clean; then it's time for assembly.

DECORATIVE PLUGS WITH A PURPOSE

I like to accent my mirror frame with decorative plugs. But they're not just for looks: Each plug hides a dowel which strengthens the half-lap joint. This technique also works for mortise-and-tenon joints. *Note: I pin my joints after glue-up, but before I install the mirror.*

You could simply dowel the half-lap, but dowel is frequently warped and can create gaps in the finished joint. So I use a plain 3/16-in.-dia. dowel for the joint itself, and top it with a homemade, 1/4-in. decorative plug. (See drawing, below.) The plug can be any shape you like; I make mine round or square.

Step 1: Drill the holes for dowel and plug. Drill the outer hole first, 1/4 in. dia. and 1/4 in. deep. This hole is for the plug. Then drill 3/8 in. deeper with a 3/16-in.-dia. bit, for the dowel.

For a square plug, square up the plug hole with a 1/4-in. chisel. Close-to-square is good enough here; in Step 2 you'll taper your plugs to take up any slop.

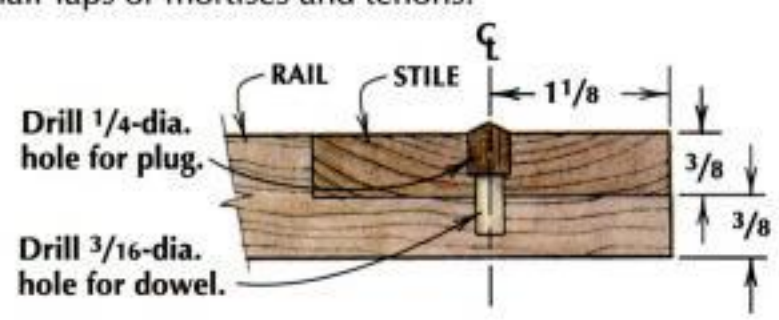
Step 2: Prepare your plug stock. Round plugs have a contemporary look. You can cut them 1/4 in. dia., using a tapered plug cutter on the drill press. Square plugs have a traditional, hand-crafted look. For these, rip an 8- to 12-in. length of plug stock, about 1/32 in. oversize in section. Then cut the plugs to length with a backsaw—each about 1/8 in. longer than the hole depth. Sand slight tapers into all four sides of each plug, so it will fill up the hole sweetly with no gaps. I use my stationary belt sander and a light touch.

Step 3: Dowel and plug the joint. Dab some glue in the hole, and hammer home a 3/16-in.-dia., 3/8-in.-long piece of dowel. (I use birch dowel, and I use an undersize piece of metal rod to seat it below the plug hole. In a pinch, you could seat the dowel with a screw or a bolt.) Add another dab of glue, and hammer in the the plug.

You could plane and sand the plugs flush with the frame. But I like to leave round plugs just 1/16 in. or so proud and dome the surfaces with first 120-, then 180-grit sandpaper. And I facet square plugs with a chisel, paring in toward the center with my chisel bevel pointing down. You can do this in a random pattern, or you can clean them up precisely to form a perfect peak. —*G.R.*

DOWELED & PLUGGED JOINT

This two-part technique adds strength and beauty to half-laps or mortises and tenons.



CARVING

I do the simple incised carving on this frame after assembly, and after all the surface and edging work is complete. You can draw the leaves on the frame freehand, or you can draw on carbon paper and trace the pattern onto the wood. (See Carving Detail.)

With the frame clamped to my bench, I carve the shapes about 1/8 in. deep, using a #12, 3mm V-gouge. (See photo, right.) For fine, clear lines, keep your gouge well honed, and carve in both directions to account for the changing grain.

I use a #1 straight chisel to define and round the leaf carvings. That way, they appear to jump off the frame once the finish is applied.

Carving the detail. *Carve the leaf detail with a #12, 3mm V-gouge. Come in first from one direction and then from the other, to avoid going against the grain.*

Assembly

I always do a dry run before glue-up, to make sure all my joints are accurate. Half-laps are simple to make, but they require a variety of clamps to glue up properly—bar clamps to pull the shoulders tight, and C-clamps to pull the cheeks tightly together. (See right photo, below.) I use the half-lap offcuts as clamping pads; since they're the same size as the joints themselves, they distribute the pressure evenly.

After the glue has dried, I remove the clamps and plane any proud surfaces flush with a smoothing plane. If you're careful, you can also do this leveling and smoothing work with a belt sander and clean up the scratches with a random-orbit sander.

The next step is to cut and rout the top rail's outside curve. As with the inside curve, I cut away most of the waste on the bandsaw, then attach the template and rout the curve to its final form.

Any other edge work can be done now as well, such as rounding the edges or routing a decorative edge. I just bevel the edges 1/8 in. with a block plane or a spokeshave—a nice but restrained detail.

Before you install the mirror glass, you can add plugs to the half-lap joints. My method, explained in the sidebar at left, adds beauty and strength to the joints. You can also carve the frame as simply or elaborately as you wish. My carving detail is shown above.

Next, I rout the rabbet for the mirror and square the rounded corners with a chisel. Light scraping and sanding takes the mill marks off all the inside edges.

Template routing the top rail. *With the hardboard template taped securely to the work, rout the inside curve using a flush-trim bit in the router table. You'll rout the outer curve later, after glue-up.*

Assembling the frame. *Pipe clamps pull the shoulders tight while C-clamps and wooden blocks apply even pressure to the cheeks.*

Mirror, Mirror...

A mirror frame isn't subject to much wear and tear, so I keep my finishing simple. I use a clean rag to apply a 50-50 mix of Watco Oil and gloss spar varnish. I rub out between coats with 0000 steel wool. With another rag, I wipe off any excess finish that remains after a few minutes. The frame gets a total of three coats, with a day or two of drying time between coats. This offers plenty of protection and gives a nice sheen to the work.

For the mirror glass, I give a paper template to my local glass supplier. I put a same-size piece of 1/8-in. hardboard over the back and secure the two layers with glaziers' points. Braided picture wire and #6 by 5/8-in. Phillips r.h. screws help to hang the mirror on the wall. ▲

GARY ROGOWSKI *is a professional furniture maker and teacher in Portland, OR.*

SANDING BLOCKS

For beautiful surfaces, back up your abrasives with simple shop-made blocks

by William Tandy Young

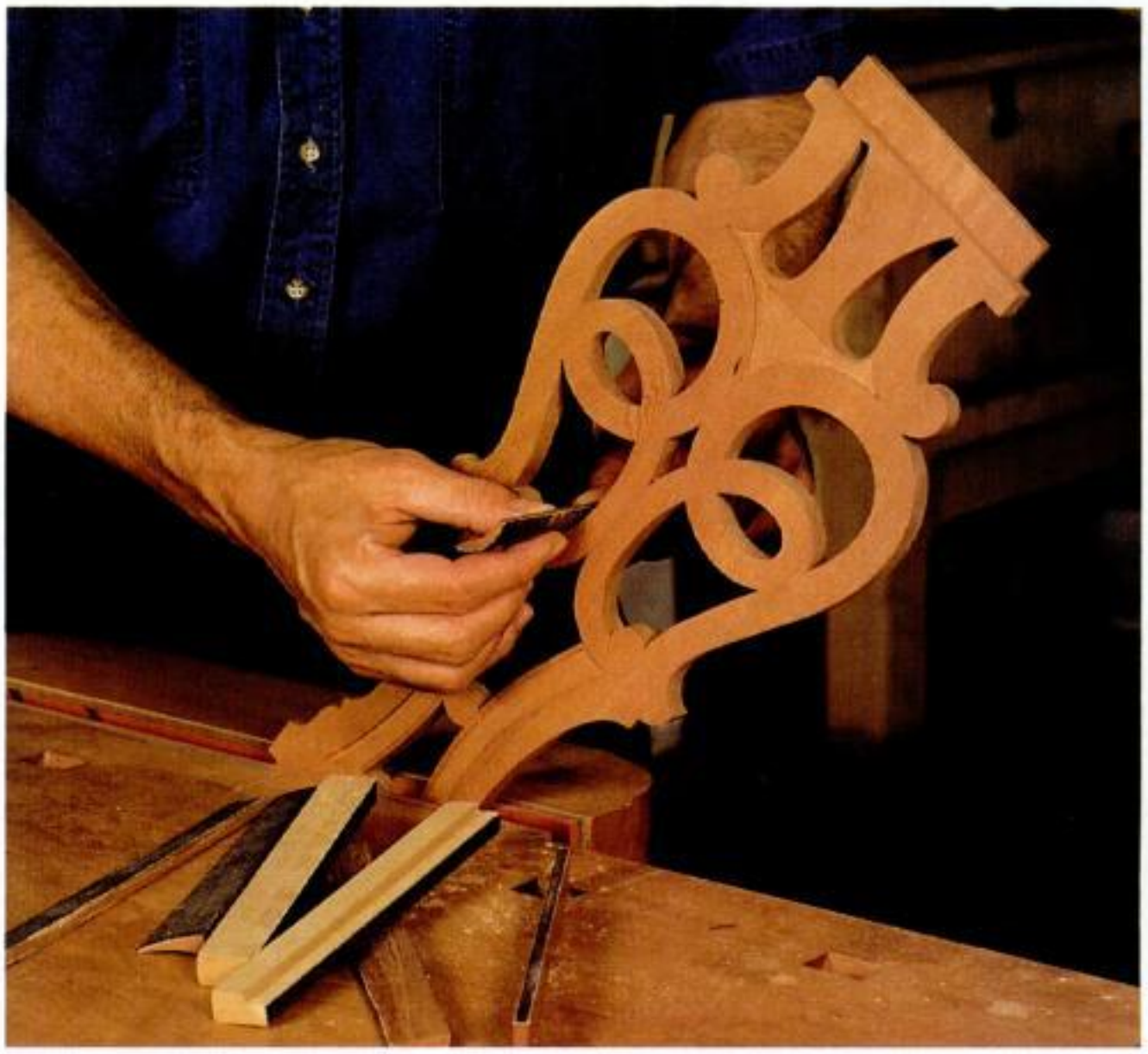


PHOTO BY JOE WASZCZUK

Smarter sanding. *Custom-made sanding blocks are easy and inexpensive to make, and they'll reward you with faster, finer results.*

I'm all for power sanding. Unfortunately, there are times when you'll have to sand something by hand. There's no denying that hand-sanding is tedious. But if it's done well, the control hand-sanding allows can make a dramatic difference in the appearance of your work, giving you results that you couldn't duplicate with *any* random-orbit sander.

My formula for effective hand-sanding is simple: Pick the right sandpaper for the job, and back it up with a good sanding block. I select my sandpaper by matching the sanding assignment to the right grit size and abrasive type. (See chart, page 63.) To hold the paper as I work with it, I rely on a wide selec-

Good backup. *The composition of a block affects the paper's performance. After 30 strokes, sandpaper backed with ceiling tile (left) shows less wear and finish buildup than sandpaper backed with a maple block (right).*

tion of sanding blocks. I've found that blocks make a big difference in how well you're able to sand. In this article, I'll show you how to make sanding blocks from a variety of low-cost and no-cost materials.

Good Block Basics

While I do use a few store-bought sanding blocks, mostly I prefer to make my own. I find that my favorite blocks are made from scrap materials. I've experimented with rubber, cork, ceiling tile, erasers—even street-hockey pucks—all with surprisingly good results.

A good sanding block provides firm but resilient support for the sandpaper. This helps the abrasives cut effectively without loading up. If you can keep sawdust and finish from becoming trapped in the spaces between abrasive particles, your sandpaper will last longer and work better. (See photo, above.) Leave the hunks of rock maple in your scrap pile. Hard, unyielding blocks will wear out your paper in record time and leave your work looking scratched instead of sanded.

Size is important. I don't like hefty sanding blocks—a big, heavy block encourages you to apply too much pressure when you sand. This can keep you from gaining a feel for how the abrasives are working. Without that sensitivity, you're just muscling grit and grinding wood—and your finished surfaces will show it. To maintain feel and control when hand-sanding, I prefer to use small-sized blocks. With much of my work I can get away with blocks sized to handle one-sixth of a sheet of sandpaper (4 in. by 4½ in.) or even less.

Making Your Own Blocks

Sanding blocks don't need to be elaborate. I'm not interested in blocks equipped with clips or clamps for holding sandpaper in place. The key to making a good block is to find the right material and then simply cut it to size. I try to make my blocks about an inch narrower than the sandpaper, so I can wrap the paper up the sides and still get a grip on it. My material choice usually depends on the sanding task.

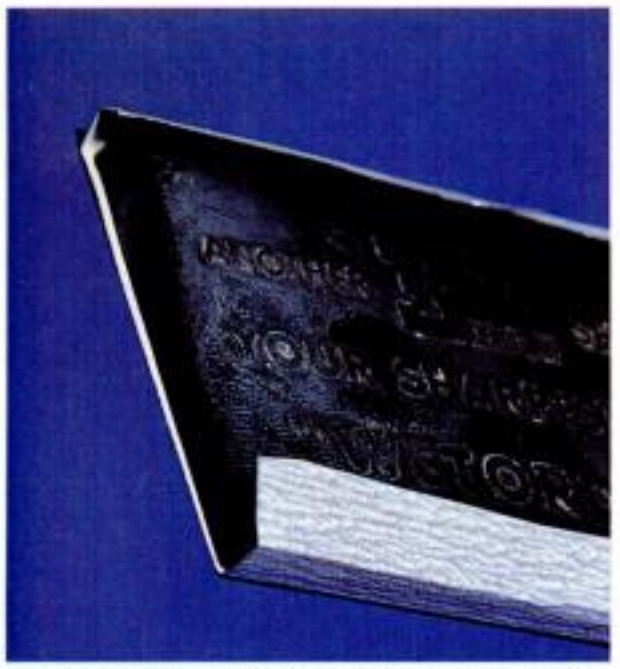
To sand flat areas of bare wood, I prefer relatively soft blocks. Ceiling tiles, sheet foam and felt will all make good sanding blocks. (See photo, right.) I cut these materials on the bandsaw or tablesaw. Other soft materials, such as cork, sponge and sheet rubber, are easier to cut with a utility knife and a straightedge.

After cutting a block to size, I like to bevel the ends. A beveled

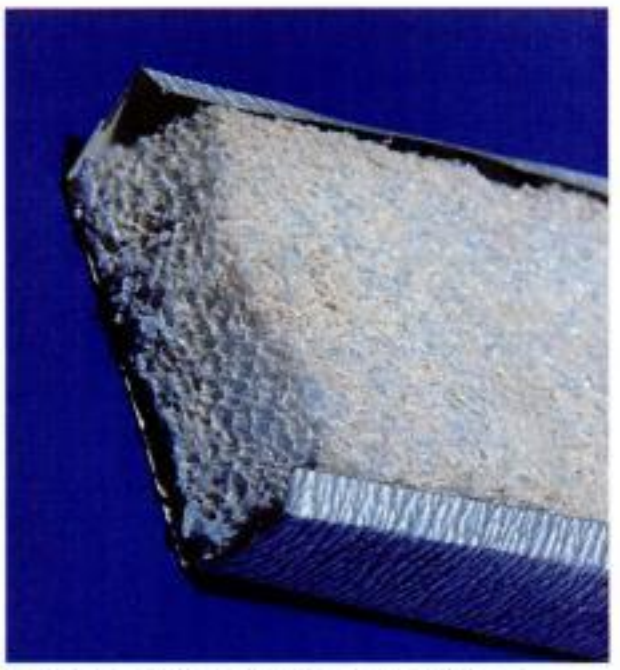
A wealth of low-cost materials. *You can make great sanding blocks from common materials.* ***A:*** *packing foam.* ***B:*** *felt block.* ***C:*** *cork.* ***D:*** *ceiling tile.* ***E:*** *wallboard.* ***F:*** *household sponge.* ***G:*** *sheet rubber.* ***H:*** *drafting eraser.* ***I:*** *foam hockey puck.*

PHOTOS BY JOHN HAMEL

BLOCKS FOR FINISHING



Wet sanding solution. *Rubber blocks maintain their shape and firmness during wet sanding.*



Flexible support. *Foam packing provides good backing for sanding irregular surfaces.*

Not just for sandpaper. *Use a felt block to back steel wool for more consistent results.*

end allows me to sand neatly into corners and other tight spots. Ceiling tile can be easily beveled on a belt or disc sander. I also use my power sander to "dress" or restore the working faces of ceiling tile and balsa blocks after they've become dinged or worn out of true.

To sand contours and molding profiles, I need to use a harder material that can hold the shape of the curved work. Balsa wood and basswood make good contoured blocks. These woods are easy to cut on the bandsaw and shape with a disc sander.

For sanding finishes, the right block is even more important. Finishes tend to gum up sandpaper very quickly. For dry sanding a coat of sealer or lacquer, I use a felt block. For wet sanding, look for blocks that won't swell, warp or disintegrate. Surprisingly, household sponges and rubber drafting erasers work well. (See photos, above.)

The toughest finish-sanding task is leveling a new coat of finish on an old piece of furniture. Old tabletops are often cracked and warped, with surfaces that bend and twist well out of plane. To follow these irregularities carefully while still sanding the finish thoroughly, I use blocks made from 3/4-in.-thick Styrofoam™. The foam used to pack computers, stereos and other electronic equipment works great. These blocks flex and give easily but still back the paper adequately enough for accurate sanding.

Sanding blocks are not just for use with sandpaper. I also use them to back steel wool when I'm rubbing out a sprayed lacquer finish on a tabletop. I can see a real improvement in rubbed surfaces when I give steel wool the added control of a backing block instead of simply pushing it around with my bare hand.

Specialty Blocks

Occasionally, I'll invest some extra time to make blocks that are a bit more elaborate. The idea behind these blocks is still the same—to do sanding right, and do it as little as possible.

Sanding sticks—Sanding sticks are very handy for smoothing curves and getting into tight corners. (See photo, below left.) They work much like metal files, but leave a smoother surface that

BLOCKS FOR CURVES & CONTOURS

Sanding sticks. *Shop-made wooden files are great for tight curves and corners.*

Form follows function. *Extra foam padding makes standard-size blocks fit a variety of specialty tasks.*

Shapely blocks. *Elaborate blocks can be carved to fit wide moldings. Use smaller blocks for single elements.*

needs only a brief hand-sanding with a finer-grit paper before it's ready for finish. To make the sticks, shape strips of wood by hand or on the belt sander and glue a heavy-weight sandpaper to the shaped profile with contact cement. I prefer to use cloth-backed paper on my sanding sticks because it lasts longer than the paper-backed variety.

Composite blocks—Some woodworkers like to make composite sanding blocks by laminating sheet cork, leather or rubber to wooden blocks. I get similar results with less work, by simply wrapping sheet felt or thin foam around a wood block without gluing it down. The extra foam padding helps blocks conform to fit a variety of profiles. When the sanding task is done, I toss the block and the backing material into a box with my other blocks so I can combine materials as needed for other sanding tasks.

Profile blocks—For sanding delicate moldings, such as small beads and coves, the block has to fit the molding or else you'll sand out the crispness. (See bottom right photo, opposite page.) I shape the block to the reverse of the workpiece profile using router bits or hand tools.

When I have an elaborate molding to sand, I'll often make up separate profile blocks for each element of the molding, such as the bead, cove or fillet. Then I wrap paper around the block and sand one molding element at a time. This advantage to this method is that it keeps the details as crisp as possible. After sanding a number of different moldings in this way, you'll accumulate a versatile supply of common profile blocks to choose from.

Another way to make a sanding block that's matched to a particular contour is to use a new product called Sandform. Available from Woodworker's Supply (800-645-9292), this two-part putty preparation can be formed to fit an existing contour before it hardens into a sanding block. ▲

WILLIAM TANDY YOUNG
makes and restores furniture in Massachusetts.

Different abrasives for different jobs. *The brown-toned sandpaper on the left is aluminum oxide—good for rough sanding on raw wood. Stearate-coated aluminum oxide (gray) does well for final sanding on raw wood, and between finish coats. Silicon-carbide paper (black) can be used wet or dry; it's best for sanding finish.*

SAND LESS, SAVE MONEY

My goal is always to sand as little as possible. I have three strategies for doing this. First, I prep my work with hand tools. The time spent using planes and scrapers is repaid in less overall sanding time. Second, I use only one or two grits per job. Third, I quit at the lowest grit level I can. Using these strategies, I can accomplish most sanding jobs with a limited selection of sandpaper.

After hand tools, I typically start with either 120- or 150-grit aluminum oxide, and finish with 220-grit paper. On scraped or planed surfaces that will receive a sprayed clear finish without stain, I sometimes stop at 180 grit. For smooth sanding on bare wood, I like to use a stearate-coated aluminum-oxide "A" weight paper, such as 3M Fre-Cut™. It outperforms and outlasts common aluminum-oxide and garnet papers. Although stearated paper has caused problems with waterborne finishes in the past, I have yet to experience any problems from the stearate coating.

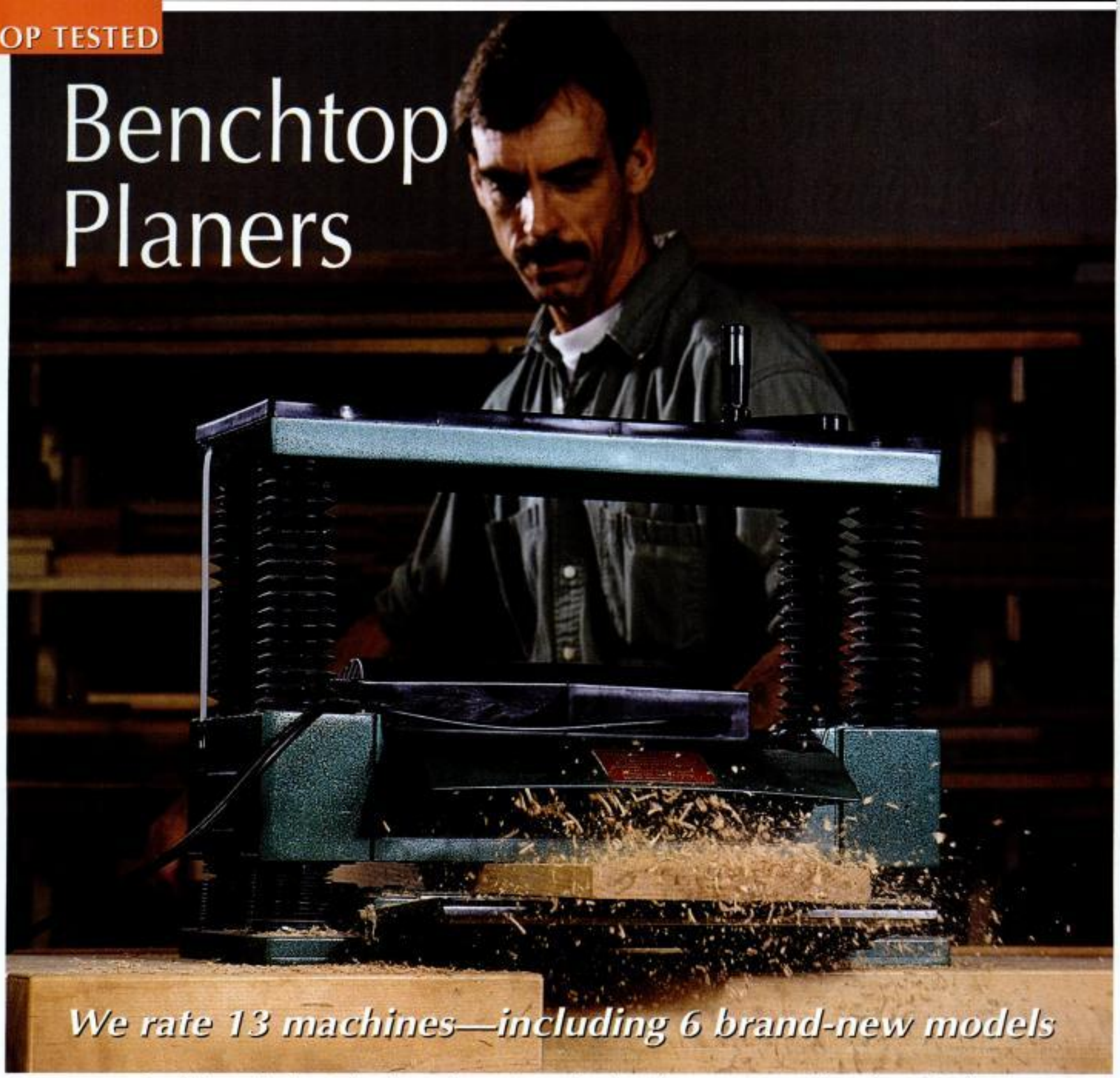
For finishing work, I use Fre-Cut™ paper in grits from 280 to 400, and silicon-carbide wet-or-dry paper in grits from 220 to 1,200. Since I'm primarily sanding finishing materials with these grits, the paper tends to load up more when I'm dry sanding. To keep finish from gumming up the paper, try scuffing the paper on a carpet scrap. Wet sanding doesn't load the paper up as much, so I wet sand finishes whenever possible. —*W.T.Y.*

A BASIC SANDPAPER SUPPLY

TYPE OF SANDING	GRITS NEEDED	SANDPAPER TYPE
Rough sanding raw wood	60, 80, 100	Garnet or aluminum oxide
Smooth sanding raw wood	120, 150, 180, 220, 240, 280	Stearated aluminum oxide
Sanding finishes	320, 400 320, 400, 600, 1,200	Stearated aluminum oxide Silicon carbide (wet-or-dry)

Benchtop Planers

We rate 13 machines—including 6 brand-new models



Small-shop planing. *A benchtop planer can surface boards up to 12 in. wide and 6 in. thick, producing stock that's uniformly thick and ready for final sanding or scraping.*

Most woodworking starts with boards of uniform thickness. For hundreds of years, woodworkers had no choice but to produce these boards with a hand plane—flattening one side of a board, scribing a line along its edge, then planing the other side. Quiet, romantic work? Sure. But sweaty and slow? You bet.

Today, power planers can make fast work of accurately thicknessing stock. Stationary thickness planers have been around for a long time. But these heavyweights take up lots of floor space, and they can cost from $800 to well over $3,000. It's no wonder that benchtop planers drew plenty of interest when they were first introduced about 10 years ago. These planers are light enough to lift onto your workbench when you need them, and small enough to stow when the job's done. And all but one of the planers in this review are priced under $500.

The big question is: How good are these low-cost, lightweight planers? To find the answer, we tested 13 machines, including new models from AMT, Delta, Jet, Star, Sunhill and Tradesman. All of these planers will handle boards up to 12 in. wide and 6 in. thick; and they'll mill stock down to about 1/8 in. thick.

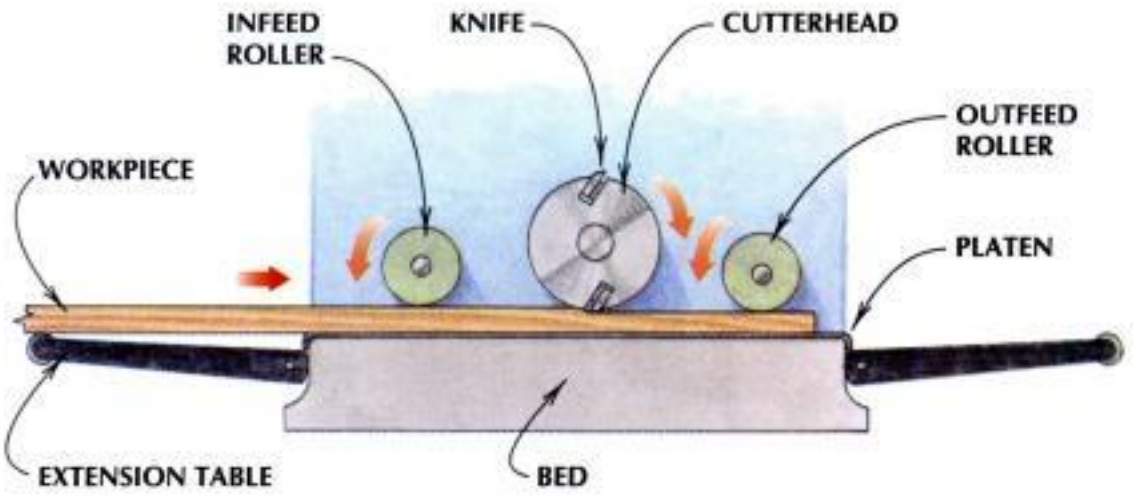
In our tests, we evaluated accuracy and quality of cut on different woods. We gauged ease of operation, portability and dust-collection efficiency. We also assessed ease of knife adjustment and replacement.

We discovered that all of the planers can produce satisfactory surfaces. But some give better results than others. And specific features make some models easier to use. Read on to find out how these machines work, what features are most important and which machines rated highest in our tests.

PHOTOS BY JOHN HAMEL

HOW A PLANER WORKS

To thickness a board, a planer's spring-loaded feed rollers pull the workpiece under a fast-spinning cutterhead. A flat bed and extension tables support the workpiece.



How They Work

All of our test planers share the same basic anatomy. The heart of a planer is its cutterhead assembly. Mounted above the planer bed, this assembly includes the motor, a cutterhead that holds two planer knives, and a pair of rubber-covered feed rollers. (See drawing, above.) The rollers pull the wood through the cutterhead at about 26 linear ft. per minute. The bottom face of a board, which must be flattened on a jointer or with a hand plane before you feed it into a planer, slides across a pair of bed rollers or across a thin, stainless-steel platen that rests on the bed. Infeed and outfeed extension tables provide extra support for long stock.

On most benchtop planers, the cutterhead assembly is mounted on two large, threaded screws and supported either by four guideposts or by the machine's stamped steel frame. Turning a crank moves the cutterhead up or down, to adjust for stock thickness and depth-of-cut. Only the Hitachi is designed differently. Its cutterhead remains fixed, while the planer bed moves up or down.

Except for the Japanese-made Hitachi, all of our test planers were manufactured in Taiwan. In fact, many of them are made by the same factory there—Chiu Ting. The Penn State, Reliant and Woodtek appear to be identical except for color and labels. And the AMT, Jet, Star and Sunhill—which represent a relatively new design on the market—all strongly resemble each other.

What's Important?

Quality of cut tops the list. Your planer should produce boards of uniform thickness, with a surface that requires only light sanding or scraping before finishing.

Right out of the box, all of our test machines produced acceptably smooth boards that varied no more than 1/64 in. across their width. The new Delta 22-560, the Grizzly, and the Hitachi had the smoothest cuts of the bunch.

The Tradesman produced the most *scalloped* surfaces—small, parallel ridges across the width of a board. (See right photo, below.) We discovered that the cutterhead's two knife recesses weren't machined to equal depths. Resharpening the Tradesman's knives should narrow them enough to allow for proper adjustment and a good cut.

Snipe is an all-too-common aggravation with both benchtop and stationary planers. This miscut—which planes the

The best and the worst. *Low-angle light shows the smoothest surface, made by the Hitachi planer (left), and the roughest surface, made by the Tradesman (right).*

ILLUSTRATION BY SALLY ONOPA

BENCHTOP OR STATIONARY?

Here's how to decide which type of planer is right for you

If you're in the market for a thickness planer, you'll have to decide between buying a benchtop model or a stationary one. Answer these key questions and you'll be able to make the right choice.

- **How big?** Benchtop planers will surface boards up to 12 in. wide. Stationary models are available with width capacities up to 20 in. (See AW's 1997 Tool Buyer's Guide.) If you frequently need to plane wide, glued-up panels, consider a stationary planer. Also, larger machines have the stability to handle long, heavy stock that can cause a benchtop planer to tip. If you want to handle this heavy stuff with a lightweight planer, force it to act like a stationary model by bolting it down.
- **How rough?** A stationary planer is the way to go if you're planing a lot of roughsawn boards: It has the power to remove more wood in a single pass, so you'll get from rough to smooth quickly. Also, stationary planers are less likely to bog down when the thickness of a board increases slightly—an irregularity common to roughsawn lumber.
- **How smooth?** Benchtop planers may not have the muscle of their big brothers, but they can produce smoother surfaces. Higher cutterhead speed does the trick. If you want boards that require a minimum of sanding or scraping, you can't beat a benchtop planer.
- **How often?** If you don't need to plane boards every time you go out to the workshop, a benchtop planer offers an obvious advantage: You can stow it out of the way until it's needed. Like other benchtop tools, benchtop planers are great if you have limited space in your shop.
- **How expensive?** Price priorities are at the bottom of this list, but they could easily be at the top of yours. If you need thicknessing capability but can't afford a stationary machine, invest in a benchtop model. It will serve you well until you're in a position to trade up.

AMT 4651

DELTA 22-540

DELTA 22-560

GRIZZLY 1017

Benchtop Planers

Brand & Model	Street Price	PERFORMANCE RATINGS: Quality of Cut	Snipe	Controls	Knife Changing	Portability	OVERALL RATING 1 2 3 4 5	SPECIFICATIONS: Max. Capacity T x W (in.)	Amps	Weight (lbs.)	Knife Type,* Rplcmnt Cost/Set	Dust Hood, Cost
Delta 22-560	$429	5	4.5	4.5	5	5		6 x 12	15	65	DED, $27.50	Optional, $14.75
Hitachi P12R	795	5	5	4.5	4.5	4		6 5/8 x 12 1/4	15	62	SE, $60	Optional, $80
Grizzly 1017	399	5	4.5	4	4	4.5		6 x 12	14	80	SE, $40	Optional, $20
Ryobi AP-12	399	4	4.5	4.5	5	3		6 x 12 5/16	14	63	DED, $30	Optional, $40
Jet JWP-12-4P	380	4.5	4	4	4	3		6 x 12 1/2	15	68	DE, $35	Optional, $30
Delta 22-540	380	4.5	3.5	4	4	3.5		6 x 12	15	68	DE, $25	Optional, $20
AMT 4651	375	4	4	4	4	3		6 x 12 1/2	15	68	DE, $21	Not available
Star S3712	365	4	4	4	4	3		6 x 12 1/2	15	68	DE, $30	Included
Sunhill CT 340	389	4	4	4	4	3		6 x 12 1/2	15	68	DE, $38	Optional, $25
Reliant NN912F	390	4	3	4	4	3		6 x 12 1/8	16	63	SE, $25	Optional, $30
Woodtek 900-853	349	4	3	4	4	3		6 x 12 1/8	16	63	DE, $40	Optional, $30
Tradesman 8312	369	3	3.5	3.5	4	4.5		6 x 12 1/2	15	78	SE, $25	Optional, $20
Penn State Super 125	360	3.5	3	4	4	3		6 x 12 1/8	16	63	SE, $22	Optional, $15

KEY: Ratings: 5 = excellent, 4 = good, 3 = fair, 2 = poor, 1 = unsatisfactory. *Knife type: SE = single edge, DE = double edge, DED = double-edge disposable.

RELIANT NN912F

RYOBI AP-12

STAR S3712

HITACHI P12R

JET JWP-12-4P

PENN STATE SUPER 125

Comments
Pros: Excellent cut, negligible snipe; no knife adjustment required; solid extension tables; cutterhead assembly lock. **Cons:** Difficult-to-read scale.
Pros: Excellent cut, negligible snipe; depth-of-cut gauge; solid bed; easy knife adjustment. **Cons:** Most expensive model.
Pros: Excellent cut, little snipe; side handles. **Cons:** Extension table flex; poor scale; heavy.
Pros: Solid extension tables; best extension table adjustment; no knife adjustment required. **Cons:** Expensive dust hood.
Pros: Above-average cut. **Cons:** Extension table flex.
Pros: Above-average cut. **Cons:** Considerable snipe; no extension table adjustment.
Pros: Good cut. **Cons:** Extension table flex; no dust hood.
Pros: Good cut; nice price, includes dust hood. **Cons:** Extension table flex.
Pros: Good cut; solid extension tables. **Cons:** Loose-fitting platen.
Pros: Good cut; light weight. **Cons:** Considerable snipe; extension table flex
Pros: Nice price; light weight. **Cons:** Considerable snipe; extension table flex; expensive replacement knives and dust hood.
Pros: Versatile crank placement; side handles; depth-of-cut gauge. **Cons:** Extension table flex; knives wouldn't adjust properly; depth-of-cut gauge worked poorly.
Pros: Nice prices on machine, replacement knives & dust hood; light weight. **Cons:** Considerable snipe; extension table flex.

TESTING AND RATING THE PLANERS

Testing got underway as soon as we unpacked each machine. Editors wrote down impressions and discussed 'pros' and 'cons' as we went through the setup process. We checked for proper knife alignment and extension table adjustment, took test cuts from heavy to light, and commented on how difficult or easy it was to make necessary adjustments. We also did plenty of lifting and shifting to assess portability. This shakedown process enabled us to establish the performance ratings discussed below.

Performance Ratings

These ratings relate to five specific features and qualities—the ones that are most important in choosing the right planer for your shop.

Quality of cut—After setting up the planers to produce their best possible cuts, we ran pine, oak and maple boards through each machine. The quality of cut rating refers to the overall smoothness of the planed surfaces we obtained.

Snipe—Snipe relates to quality of cut. But it deserves a separate rating because it can seriously affect the quality of the workpiece, and because we found significant variations in snipe among our test machines. (See sidebar and main text, page 68.) We measured snipe with a dial caliper.

Controls—This is a measure of user-friendliness. We rated factors like the smoothness of crank or handwheel operation, and the accuracy and readability of depth scales.

Knife changing—This rating indicates how easy it was to remove, replace and reset the knives.

Portability—We hoisted each machine from the floor to a bench and then to a vehicle, noting how easy it was to grasp and lift.

Overall Ratings

These bar graph ratings provide a reliable measure of overall quality and value, and show how the planers compare. They're generated by combining the performance ratings with several other factors: fit and finish, ease of setup, cost of replacement knives, and extension table solidity and adjustability.

SUNHILL CT 340

TRADESMAN 8312

WOODTEK 900-853

Checking extension-table height. *Use a straightedge to set extension-table rollers level with the bed.*

end of a board slightly thinner than the rest of it—is noticeable even at several thousandths of an inch.

Snipe has several causes. One of the most common is accidentally levering the end of a board up into the cutterhead by letting its opposite end drop below the planer-bed level. Snipe can also result from a cupped or warped board flexing in the machine.

Another cause of snipe—one that you can't correct—is a very slight lifting or dropping of the cutterhead as the board moves underneath it. Benchtop planers are prone to this kind of snipe because their relatively lightweight construction allows some flex in the machine. (See sidebar, below.)

Snipe less than about 0.002 in. is easy to sand or scrape away, so we rated it as "excellent" in the chart. The new Delta 22-560 and the Hitachi sniped the least. The worst offenders were the Penn State, Reliant, and Woodtek.

The bed and extension tables determine how smoothly and uniformly stock slides under the cutterhead. The beds on all of these planers are either fitted with rollers or covered with a thin platen of stainless steel to reduce feed friction. Both methods work fine, but platens need to be cleaned and waxed periodically to work effectively.

A platen also has to sit flat on its bed. We found that loose-fitting platens can lift up and trap wood shavings underneath, raising the platen slightly at its edges. You can solve this problem by epoxying the platen to the bed.

Extension tables, when adjusted level with the planer bed, help keep long work from levering up into the cutterhead and increasing snipe. But the extensions on most of the planers flex under the weight of heavy boards. Notable exceptions are the solid extensions on the Sunhill (shown at left), Delta 22-560 and Ryobi. The Ryobi tables are by far the quickest to adjust.

The Hitachi is the only planer with a long, solid bed instead of extension tables. Because the bed adjusts instead of the cutterhead, you'll have to readjust the height of any outfeed rollers every time you adjust the bed.

Different types of knives are used in these planers. The important differences here are in cost and convenience, not in performance; all the knife types cut well.

Two of the planers we tested—the new Delta 22-560 and the Ryobi—use double-edge, disposable knives. The big advantage with disposable knives is that they're so easy to change. You simply pop the knife into place over locator pins and tighten the locking nuts. Resharpening disposable knives is not recommended because it throws off proper knife alignment.

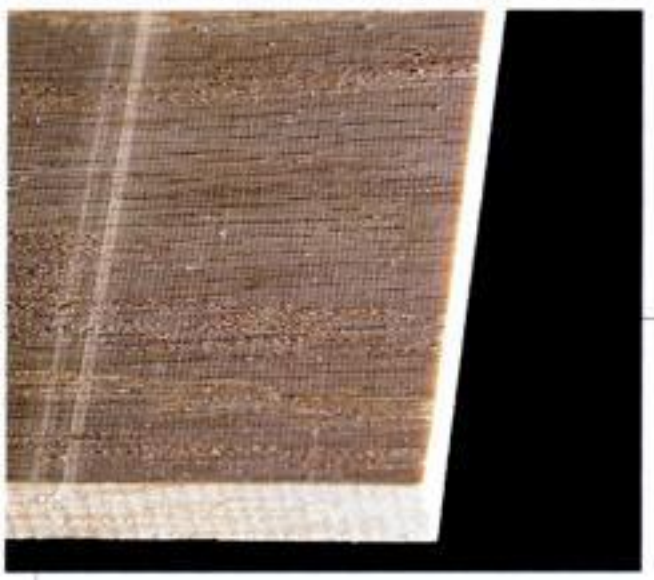
The other 11 planers in our test have resharpenable knives. Resharpening a set of knives will run you around $15—about half the cost of a new set of disposables. (See chart.) But you can expect to spend a little extra time changing knives. Resharpenable knives don't just pop into place like their disposable counterparts; they need to be aligned using the jig that comes with the planer.

The AMT, Delta 22-540, Jet, Star, Sunhill and Woodtek planers have double-edge resharpenable knives, while the Grizzly, Hitachi, Penn State, Reliant, and Tradesman have single-edge knives.

The controls on planers are fairly simple. Height-adjustment handwheels or cranks control depth-of-cut. The Tradesman's crank can be installed on either side of the machine—a handy feature for southpaws.

Height-adjustment scales will get you in the ballpark, but don't rely on them for accuracy. The pointer on each model will adjust slightly to line up accurately with its scale, but we found the scales on the AMT and Tradesman badly misaligned. The Hitachi's accessible, clearly graduated scale was our favorite. The Grizzly is the only planer with its scale located on top of the machine—a nice feature if you plan to set it on the floor, or on a low stand. But the distance between the hairline and the scale makes the setting difficult to read.

The Hitachi and Tradesman each have a depth-of-cut indicator which shows how much you're taking off in one pass.



Snipe. *Most planers cut the last few inches of a board a few thousandths of an inch thinner than the rest of the board. Snipe is obvious when placed under a glancing light as shown here.*

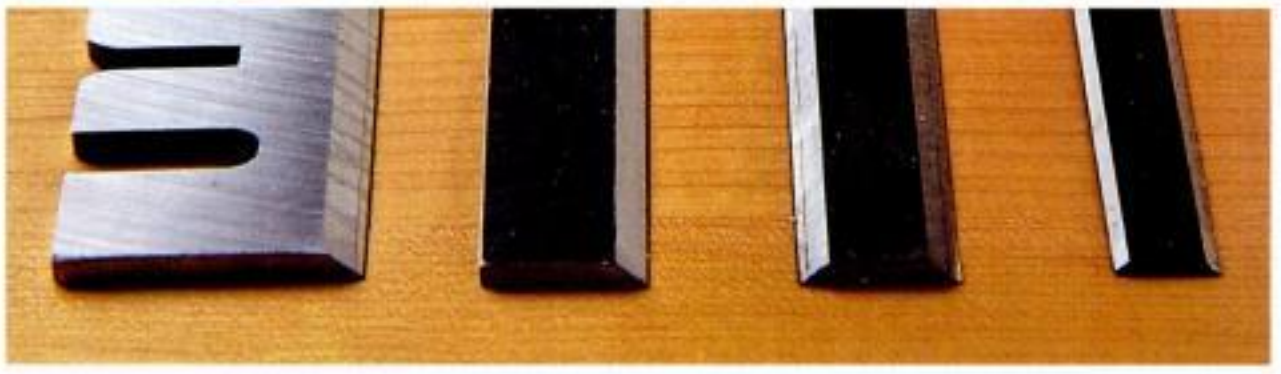
MINIMIZING SNIPE

Benchtop planers are prone to overbiting at the ends of boards—a condition called *snipe*. Here are a few ways to reduce or eliminate snipe:

- **Flatten the bottom face first.** Jointing or hand-planing the bottom face of a board—standard procedure for planing a board—creates a flat bearing surface that prevents the board from twisting up into the cutterhead.
- **Level the rollers.** Adjust bed rollers and extension-table rollers to bed level or slightly (less than 0.003 in.) above. Set auxiliary supports to the same level.
- **Gang-feed.** Butt boards end-to-end as you feed them. This way, only the first and last boards will have snipe.
- **Take light final passes.** Cuts of 1/32 in. or less produce less noticeable snipe.
- **Add a margin of safety.** If all else fails, start with a board about 6 in. longer than you need and cut the sniped sections off after planing.
- **Keep a clean machine.** Occasionally clean the bed, extension tables and feed rollers with paint thinner. Wax the bed.

◀ ***Knife adjustment.*** *To adjust a knife, hold the supplied setting gauge against the cutterhead with the knife touching the gauge. Then tighten the gib bolts with a wrench.*

▼ ***Knives.*** *Hitachi's knife (left) dwarfs the single-edge knife used on the Grizzly, Penn State and Reliant. AMT, Delta 22-540, Jet, Star, Sunhill and Woodtek use double-edge knives (right center). Delta 22-560 and Ryobi have double-edge, disposable knives (right).*



Bad impressions. *Chips trapped between the feed rollers and the wood can cause pockmarks, particularly in soft wood. Dust collection helps prevent this.*

We liked the Hitachi's accessible, smooth-operating indicator (see photo, below) but found the Tradesman's version stiff enough to impede smooth feeding of boards into the planer.

The new Delta 22-560 has an innovative lever lock designed to stabilize its cutterhead assembly. Recommended for use on final passes, the lever clamps the cutterhead assembly firmly between the frame sides. Though the lock may contribute to the Delta's excellent quality of cut and negligible snipe, the machine could cut well even with it disengaged.

The Tradesman sports a knob that locks the cutterhead assembly to the frame at one corner. Although this may limit cutterhead movement during heavy cuts, it didn't seem to make any difference locked or unlocked.

Portability is determined by handle placement, machine size and weight. We preferred models with side handles, which let you carry the tool near your chest rather than at your side like a suitcase full of stones. The AMT, Jet, Star, and Sunhill—all middleweights—have top handles which also serve as rollers for returning stock to a partner. The Grizzly and Tradesman, both heavy machines, have side handles. (The Tradesman's top rollers are not handles.) The Hitachi is relatively easy to carry by its bed. The Delta 22-560, a fairly lightweight machine with bottom grips and a padded top handle/roller, is the easiest machine to move around.

Depth-of-cut gauge. *Hitachi's depth-of-cut indicator shows how much you're set to cut in one pass.*

Dust collection not only protects your health, it can also improve surface quality. Chips caught between the feed rollers and the wood can cause indentations, as shown in the right photo above. Dust collection greatly reduces this problem.

Dust hoods are optional on all of these machines except the Star, which includes a hood standard, and the AMT, which doesn't offer one. The optional hoods cost anywhere from about $15 for the Delta 22-560 and the Penn State to a whopping $80 for the Hitachi. (See chart, page 66.) Dust hoods for all of the machines except the Ryobi and Grizzly have 4-in.-dia. ports for easy connection to a standard dust collector. The Grizzly and Ryobi hoods have smaller outlets that connect easily to a shop-vacuum hose. We anticipated clogging problems with the smaller hoses, but dust collection worked fine on all of the machines.

Noise is a fact of life with planers. All of our test models were very loud—hovering around 100 decibels in use. Plan on wearing good ear protection.

Recommendations

Our Editors' Choice award—for the best performance, regardless of price—goes to the Hitachi and the new Delta 22-560. Both of these machines produced excellent surfaces with negligible snipe. We liked the Hitachi's solid build, beefy knives and depth-of-cut indicator. The Delta got great marks for quality of cut and portability, and for its innovative cutterhead assembly lock.

We picked the Grizzly as our Best Buy award winner—the best value for the price. Top-notch performance and rugged construction tipped the scales in Grizzly's favor. The Star finishes a close second, thanks to its good overall ratings and low price. ▲

SOURCES

Benchtop planers are manufactured or imported by the following companies. Companies marked with an asterisk (*) sell direct through the mail.

*__AMT__ (800) 435-8665 *Circle #621*
__Delta__ (800) 438-2486 *Circle #622*
*__Grizzly__ (800) 541-5537 *Circle #623*
__Hitachi__ (800) 546-1666 *Circle #624*
__Jet__ (800) 274-6848 *Circle #625*
*__Penn State__ (800) 377-7297 *Circle #626*
*__Trend-Lines__ (__Reliant__) (800) 767-9999 *Circle #627*
__Ryobi__ (800) 525-2579 *Circle #628*
*__Star__ (888) 678-8777 *Circle #629*
*__Sunhill__ (800) 929-4321 *Circle #630*
__Tradesman__ (800) 243-5114 *Circle #631*
*__Woodworker's Supply (Woodtek)__ (800) 645-9292 *Circle #632*

LOCKING RING BOX

A tricky turned box for baubles

by Steve Blenk

We woodturners are a tricky lot, and this little ring box is a great puzzler you can add to your list of lathe-turned "riddles." It's really a sort of "box within a box," and it can be a lot of fun to watch someone who hasn't got the secret try to open one!

These boxes aren't difficult to make; you can easily turn out several in an afternoon. The ring boxes shown here are pocket-sized—about 3/4 in. thick and 1 3/4 in. dia. But you can make your own versions just about any size.

I like to use a self-centering chuck for a project like this because it makes the turning work much faster and easier. (For a review of self-centering chucks, see AW #43.) If you don't have one of these accessories, you can still turn out a box using shop-made jam chucks. To drill the two holes in the box body, you'll need a 3/8-in.-dia. twist bit and a 1 1/4-in.-dia. Forstner bit.

Start with a blank 2 in. square and about 5 in. long. Choose a very hard, dense, dry wood. I especially like to use cocobolo, rosewood and other exotics. Find a piece with straight grain so you'll be able to align the grain in the two pieces.

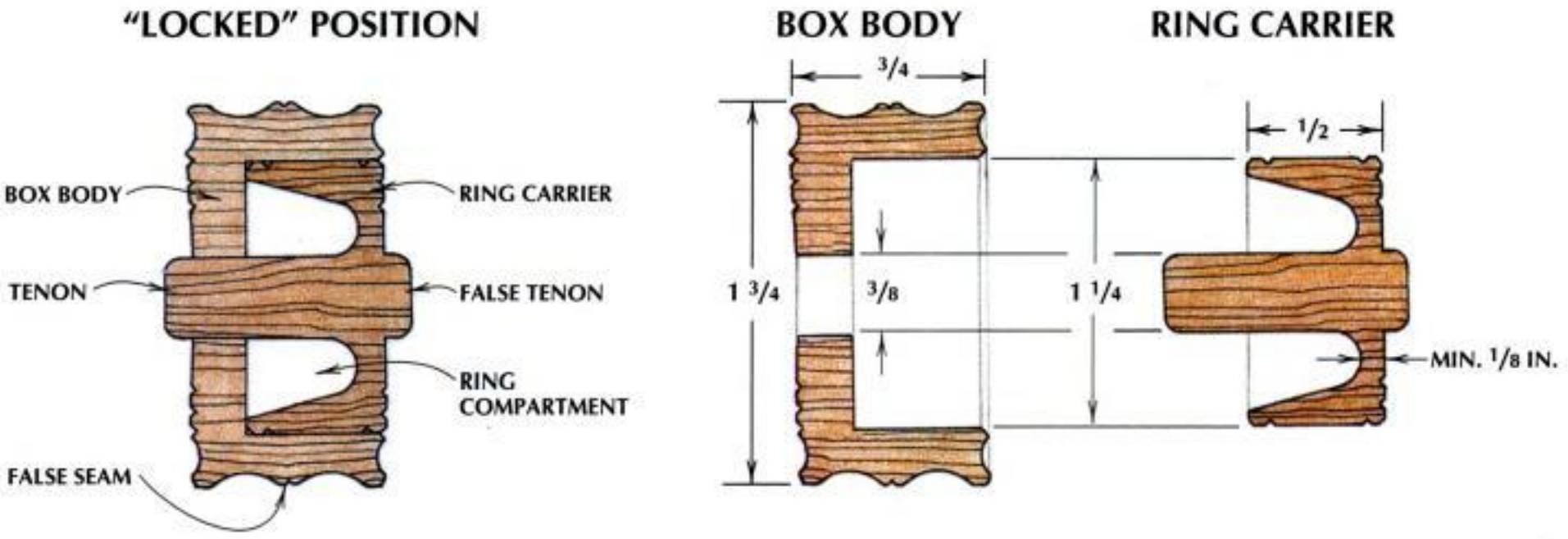
With the blank mounted between centers, turn as large a cylinder as you can. Then part it in two, about in the center, and mark the two parted ends. You'll turn the box body from the end of one blank; the ring carrier will come from the other blank's end.

Pretty safe. *Rings and other tiny valuables stay hidden in this turned, two-part box until you learn the secret to getting it open. The author made this box from cocobolo.*

PHOTOS BY PAUL PEARSON

LOCKING RING BOX

Section views through the "locked" box reveal the simple deceptions that can make the box difficult to open: a false tenon, a false seam and similarly detailed ends.



Mount the first end in your chuck—this will become the box body, or outside part. Using a parting tool, face the end grain off square to the axis. The next step is to bore two holes in the box body. I do this on the lathe, chucking my bits in a Jacobs-type chuck that's mounted in the tailstock. If you don't have a Jacobs chuck, you can bore the holes on the drill press. The important thing is to make the holes concentric.

I bore the 1 1/4-in.-dia. hole first, using the lathe's slowest speed and boring to a depth of 1/2 in. Then, without releasing the tailstock from the bed (to avoid an off-center bore), I replace the Forstner bit with a 3/8-in.-dia. twist bit and bore the hole for the tenon. Bore at least 1 in. beyond the depth of the larger hole. Except for final sanding, this completes the chamber that will hold the ring carrier. Now part off the box body about 1 in. from the end. (See top photos, next page.)

Turning the ring carrier is a bit trickier. (See middle photos, next page.) Mount the other blank in the chuck, with the parted end facing out. Turn down a tenon with a diameter just slightly (1/64 in.) greater than 3/8 in., and with a length of about 1/2 in. Make sure the tenon's sides are parallel, not tapered. Round over the tenon's end. Now turn down the outside diameter of the blank to a little bit (1/64 in.) more than 1 1/4 in. Make this section of the turning about 3/4 in. long.

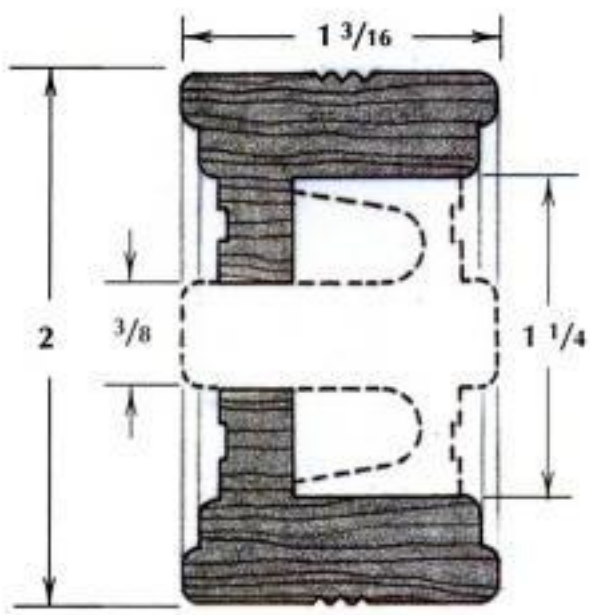
Here's where the careful fitting starts. Carefully bring the tenon down to fit snugly in the 3/8-in.-dia. hole in the box body. Aim for a fairly tight friction fit; you'll be able to loosen it up later, after the finish has been applied. Once the tenon is sized, turn the larger diameter of the ring carrier to fit snugly in the box body's 1 1/4-in.-dia. hole. The box body should now slip snugly over both diameters of the ring carrier. Trim the tenon so that it shows as a rounded, 1/8-in.-high button when both pieces of the box are together.

The fussy work is done. Now it's time to decorate the box and create the deceptions that will make it difficult to open. (See bottom photos, next page.) Finish turning the ring carrier first. I like to embellish the outside diameter of this piece with a pair of tiny beads. Then I use a small round-nose scraper or bowl gouge to hollow out the ring carrier to a depth of about 3/8 in. Take care not to let the end grain grab your gouge as you hollow. Keep your cut light, and maintain good contact with the bevel of the gouge. Avoid making the ring carrier's walls too thin. (See drawing, above.) The tenon diameter inside the compartment isn't critical, since this section doesn't have to fit the hole in the box body.

Now part off the ring carrier. Be sure to leave its bottom at least 1/4 in. thick—1/8 in. for the false tenon, which you'll make next, plus at least 1/8 in. for the finished wall thickness. Assemble the box and mount it in your chuck with the large diameter of the ring carrier facing outward. Work this face of the box flush, except for the false tenon, which is 1/8 in. high and 3/8 in. dia. Shape this part to match the protruding tenon on the opposite end of the box. Finish up the

VARIATION ON A THEME

By recessing the tenon and false tenon inside the thickness of the box body, you can create a ring box that sits flat. This box was turned from ebony.



ILLUSTRATIONS BY HEATHER BRINE LAMBERT

MAKING THE BOX BODY

Boring work. *With a Jacobs chuck mounted in the tailstock, bore the large and small holes in the box-body blank.*

Parting off. *The box body's chamber and tenon hole are roughed out, so the outer section of the box can be parted free.*

MAKING THE RING CARRIER

Matching diameters. *Turn the ring-carrier section of the box with tenon and outside diameters to match the holes drilled in the box body.*

Hollowing out. *Use a narrow gouge or scraper to hollow the ring chamber. Keep wall thickness at least 1/16 in. and bottom thickness 1/4 in. or more.*

DECORATION AND DECEPTION

A false tenon. *With the box assembled, turn the 3/8-in.-dia. false tenon on the end of the ring carrier to mimic the true tenon.*

A solid seam. *With the box body wedged on a wooden jam chuck, detail the outer edge with a simulated parting seam.*

end with the tip of a skew or the corner of a flat scraper, cutting some details to hide the seam between the mating parts. A series of small "V" cuts works well to disguise the joint, and I like to make a cove cut on the outer face of the outside ring for variety. Chatterwork is also a possibility here, as the face is end grain. (See AW #45.) Sand the face to a 400-grit surface in preparation for finishing. But don't apply finish yet, or the pieces will stick together!

Reverse the box in the chuck so you can detail the opposite face of the box body. Try to match the faces as closely as possible, but remember that they can only be seen one at a time. Sand this face to a 400-grit finish as well, then remove it from the chuck.

Remove the ring carrier so you can apply finish to both faces of the box body. I chuck the box body in the lathe and spin at 800 to 1,000 rpm while applying padding lacquer. French polishing is also a good choice for a project like this. (See AW #44.) When you're done finishing the box body, insert the ring carrier just partway into the box body and finish the face of the ring carrier.

Once the finish is dry, I smooth the ring-carrier tenons and both holes in the box body with 400-grit sandpaper. This is the time to produce the final fit: tight enough to hold, but not so stiff that you have to strain to free the inner piece. Be careful not to remove too much!

Detailing the outer edge of the box body is the last step. Turn a waste tenon to use as a jam chuck, and mount the box body as shown in the bottom right photo. Smooth the outer edge and create the false joint where the two "halves" of the box should part. Apply finish, place a ring inside, and challenge someone to open it! If you want to be truly devious, try this: Part the box body completely through (before boring it out), then glue it back together with the grain intentionally misaligned. Make your false seam at the parting line, and you'll even have other turners convinced that this *must* be the way the box opens! ▲

STEVE BLENK
is a trickster, turner and AW contributing editor who makes his home on the coast of Washington state.

PHOTOS BY STEVE BLENK

Cornish Knot Puzzle

Make this British brainteaser with a drill press and a Forstner bit

by John Cauley

On a recent trip to the British Isles, I came across a curious item at a craft show. Called a Cornish knot puzzle, this assembly of six wooden dowels had a pleasingly simple appearance. But when I got the thing apart, simplicity was quickly overtaken by vexation, followed by fascination. I fiddled with the puzzle's five notched dowels for two hours before I was able to slip the straight dowel into its locking position, thus solving the puzzle. (See photos, right.) I was hooked.

These puzzles make wonderfully entertaining gifts, and as soon as I got back home, I set about solving a different kind of puzzle: how to cut the overlapping, offset, semicircular notches that make the parts fit together. After some experimentation, I found a way to do the work using a special jig for my drill press and a sharp Forstner bit. Once you make the jig, you'll be able to turn out puzzles for just pennies—a single puzzle requires less than 20 in. of dowel stock.

Before getting into the jig's construction, it's important to mention a few details about the dowel stock you use. You can buy birch dowel rod at hardware stores and home centers, but I prefer to use dowels made from denser, more colorful hardwoods. Woodworker's Supply (800-231-2748) has a good selection of dowel rod made from rosewood, walnut, cherry and other hardwoods.

No matter where you get your dowel rod, it may not match the diameter of your Forstner bit, and this can cause fitting problems when you assemble the puzzle. To ensure matching diameters, you can always turn your own dowel rod.

Making the Drilling Jig

I made the drilling jig from a single blank of hardwood measuring 3/4 in. thick, 2 1/2 in. wide and 11 in. long. I sawed V-grooves in the blank on the tablesaw, with the blade tilted to 45°; then I cut the blank in half to form the jig's top and bottom pieces. (See Fig. 1.) Save the triangular waste pieces from ripping the grooves and use them to make the four stops. Glue these stops in place as shown in Fig. 1.

SOLVING THE PUZZLE

Knot so simple. A single solid dowel slides home to lock the puzzle together and hide the intricate orientation of notches in the five remaining dowels. Numbers on the dowels correspond to the notching details explained in Puzzle Parts, on the next page.

PHOTOS BY PAUL PEARSON

PUZZLE PARTS

This six-piece puzzle is made from 3/4-in.-dia. dowel stock that is notched to fit together. All six pieces are 2 1/2 in. long. Two rules govern the size and orientation of notches:

1: Notch radius and depth = dowel radius (3/8 in.)

2: Adjacent notches are offset 3/8 in. and bored at right angles. To drill the notches, use the jig shown at right.

PIECE 1

- One centered notch
- One offset notch (to left)

PIECES 2 & 3

- One centered notch
- Two offset notches

PIECES 4 & 5

- One centered notch
- One offset notch (to right)

PIECE 6

- No notches

The jig aligns the dowels. *Screwed to an L-shaped fence, a pair of hold-downs clamps the two halves of the jig that keeps the dowels aligned for drilling.*

Once you've made the jig, you need to drill a 3/4-in.-dia. hole exactly in the center. I clamped an L-shaped fence to my drill-press table, positioning it so that my Forstner bit was centered on the centerpoint of the jig's top half. (See photo, above.) Screw a pair of toggle clamps to the fence or use C-clamps to hold the jig firmly while you drill all the notches.

Drilling the Dowels

You'll need six 2 1/2-in.-long dowels for this puzzle. As shown at left, pieces 2 and 3 are identical; so are pieces 4 and 5. So there are only three different notch configurations.

The jig is designed to drill the dowels in pairs. I drill pieces 2 and 3 together, then pieces 4 and 5. When drilling the notches in piece 1, you'll need a "waste" dowel to place in the jig.

Always drill the centered notches first. Use the spacer discs to center the dowels in the jig, as shown in Fig. 2. Then, position the top block over the bottom block and clamp the jig against the L-shaped fence.

After you've drilled the centered notches, you'll need to use a pair of alignment blocks to set up for drilling the offset notches. These small, V-shaped blocks fit in the jig's grooves. Create each alignment block by making two 45° cuts with a handsaw and a simple mitering jig. To test-fit a block, lay it in the jig and place a notched dowel over the block. If the dowel sits firmly on the block and on the jig itself, the block is the correct length. Once you've cut the two blocks to the correct length, sand one end of each block so it won't interfere with the dowels when placed in the jig. (See photos and Fig. 2, opposite.)

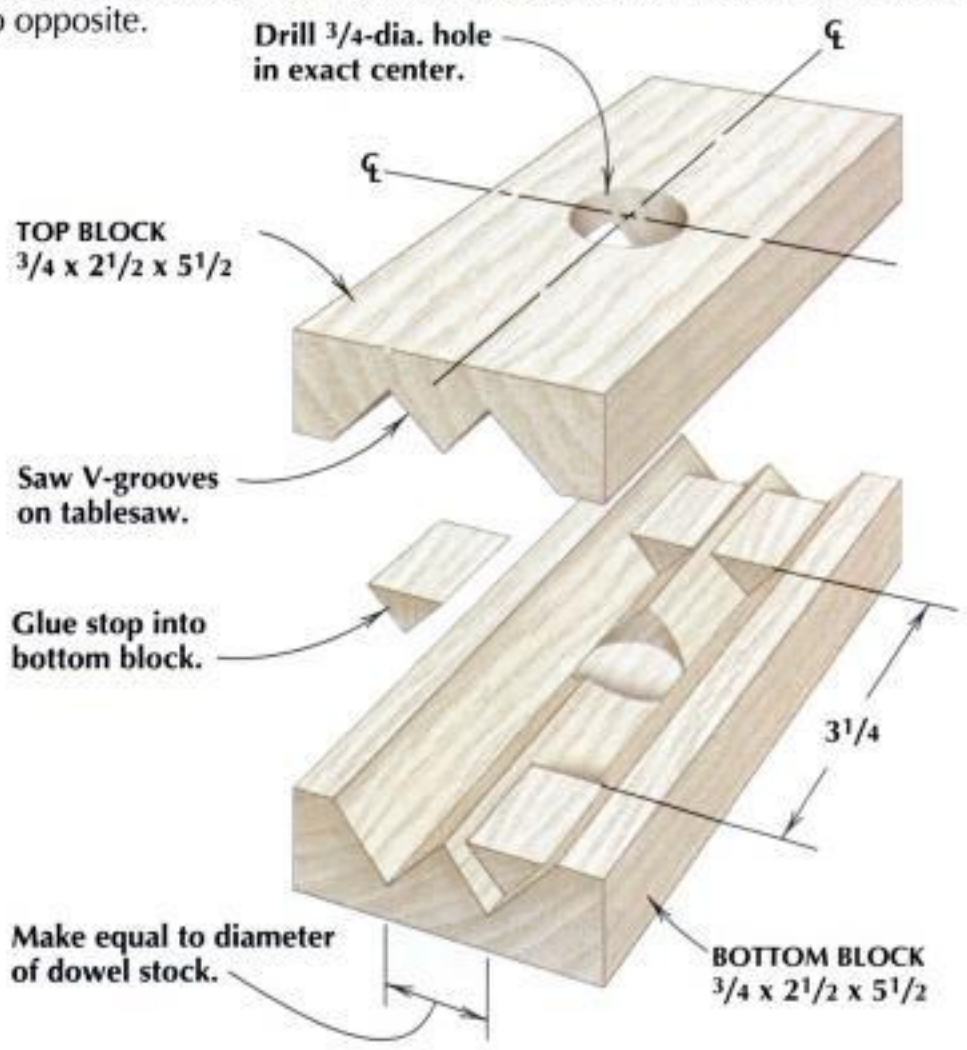
Place your spacer discs in pairs against the stop to position dowels for drilling offset notches. Then place an alignment block under the centered notches in each dowel, to orient the next notches at 90°. (See Fig. 2.) Don't worry when you drill through the ends of the alignment blocks—they'll still align the next series of dowels correctly.

Once you've cut all the notches, try assembling your puzzle. If the dowels fit too tightly, you can enlarge your notches by sanding them with some sandpaper wrapped around a dowel. When the sixth, uncut dowel slides into the puzzle with a slight amount of friction and holds the puzzle firmly together, you're there. Now pull out the sixth dowel, hand the pieces to a friend, and say the magic words: "It's easy. Give it a try." ▲

JOHN CAULEY
is an amateur woodworker and a compulsive puzzler.

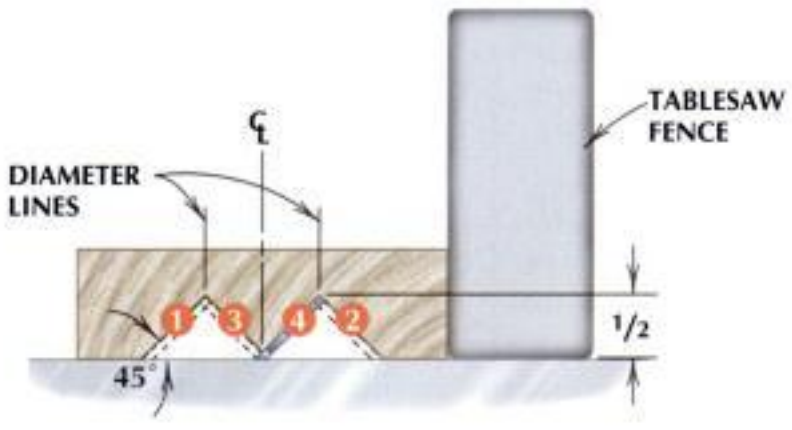
FIG. 1: MAKING THE DRILLING JIG

This jig aligns two dowels at a time. Make the V-block as a single piece. (See Cutting the V-Grooves, below.) Then cut it into top and bottom blocks. Glue in the stops, make the spacer discs and alignment blocks, and set up your drill press as in the photo opposite.



CUTTING THE V-GROOVES

Lay out the dowel diameter lines, measuring from the centerline of the block. Set the blade height and move the fence so the tip of the blade falls exactly on the diameter line.



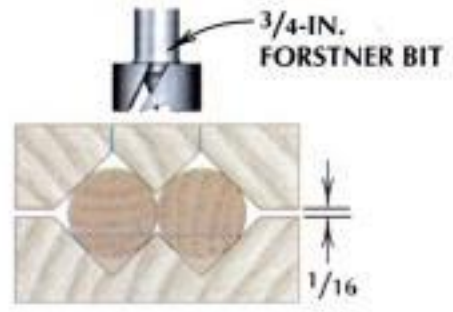
Making alignment blocks. *Use a shop-made mitering jig to saw these tiny, V-shaped dowel sections. Use an offcut to orient the dowel for the second cut.*

Using an alignment block. *The dowel's centered notch fits over the alignment block to ensure a right-angled offset notch.*

FIG. 2: USING THE JIG

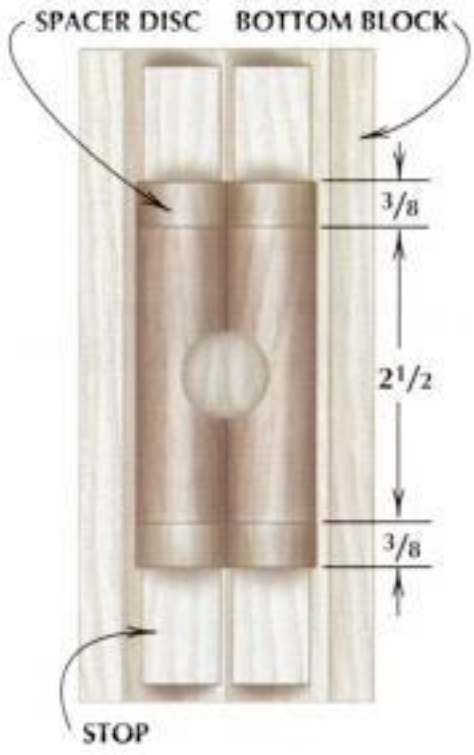
Dowels are drilled in pairs, sandwiched between jig blocks.

SECTION VIEW



TOP VIEWS

Drill all the centered notches first, positioning spacer discs between dowel ends and stops.



To drill offset notches, rotate the dowels 90°, place alignment blocks in the drilled notches, and position the spacer discs in pairs, as shown below.

American Woodworker 1996 Excellence in Craftsmanship® Awards

In the past five years, AW's annual Excellence in Craftsmanship® awards have encouraged hundreds of craftspeople—pros and amateurs alike—from all over the world to submit examples of their best work. This year was no exception. Once again, we were impressed by the quantity and quality of the entries.

Picking the winners is no easy task, considering the tremendous variety of work. To select the winning entries in the amateur, student and professional categories, AW editors judged each piece on three criteria: design excellence, degree of difficulty, and quality of workmanship.

AMATEUR

First Prize
Secretary
Ed Stuckey
Detroit, MI

Ed Stuckey enjoys making reproduction furniture, but he doesn't copy period pieces slavishly. "I like to give myself the same design freedom that the original makers had," he explains.

An amateur furniture maker for 25 years, Stuckey likes to challenge himself with every new project. This 92-in.-high curly cherry secretary is his most difficult piece to date.

For this design, Stuckey married the top and bottom cases from two different late-18th-century pieces, modifying the bonnet, waist and some of the carvings to suit his taste. He worked from photographs and examined period pieces in museums and antique shops.

The secretary took Stuckey 800 hours to design and make. He shaped the bonnet molding using an overhead pin router and templates. Half-blind dovetails join much of the casework. The compartment dividers are dadoed into the case sides rather than slipped in as a prebuilt unit. Twelve coats of shellac top off an aniline dye stain.

Second Prize
1931 Model A Ford Coupe
George Gartner
Billings, MT

George Gartner has been doing carpentry and woodworking projects for many years. But when the 56-year-old engineering technician began making toys and downsized versions of vintage automobiles about four years ago, he relied on plans and patterns found in books or bought by mail. "I didn't really have the confidence to design something from scratch," he explains.

After building a few projects by the book, Gartner started working on his own designs. Now he generates his own patterns for antique cars. To create a set of working plans, Gartner studies photographs and takes notes at car shows and auto museums.

Gartner's Model A was made from a variety of woods, including cherry,

First-prize awards. *First-prize winners in the three award categories— amateur, student and professional—each receive an engraved Excellence in Craftsmanship® Award in addition to the $1,000 cash prize. Second-prize winners receive a cash prize of $300, and third-prize winners receive $200 each.*

Here are the winning entries in our 1996 competition. To get a look at some of the other excellent runners-up, turn to "Gallery," on page 114. We extend our congratulations to the winners and hearty thanks to everyone who sent us photos of their best work.

Please note: Now's the time to start planning for our 1997 Excellence competition. The deadline for entries is June 6, 1997. See page 106 for details and an entry blank.

mahogany, maple, walnut, blue mahoe, bubinga, poplar and ash. Gartner used natural wood tones—not stains—to delineate different parts of the car.

Completing the Model A took about six months of intermittent work. "When I was younger, I never had the patience for this kind of thing," Gartner admits. "Now, I just do a little bit at a time.... You have to devise jigs to do a lot of the intricate work," he says. "The wheels are the toughest parts."

Third Prize
Rocking Horse
Brian Stanley
Yorba Linda, CA

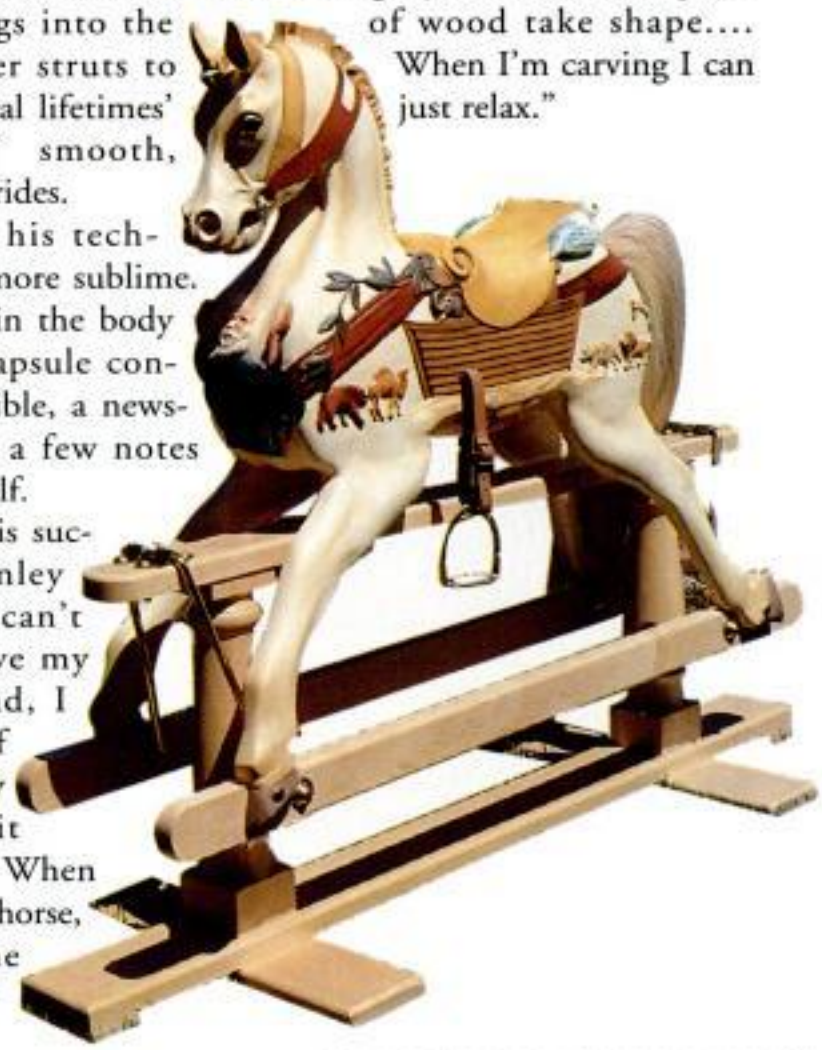
Ten years ago Brian Stanley, a model ship maker, made a rocking horse for his children. Since then, Stanley's attention has turned to carving and carousel animals. Not bound by traditional design, Stanley chose to decorate his horse with images from the story of Noah's ark.

Stanley has a simple goal in his design: His work must withstand the weight of the 174-lb. craftsman. For example, instead of doweling the legs to the body, he cuts 1-in. by 3-in. by 5-in. tenons on each leg and mortises them into the body. Similarly, he epoxies 1 1/8-in.-dia. sealed ball bearings into the side swinger struts to ensure several lifetimes' worth of smooth, squeak-free rides.

Some of his techniques are more sublime. Sealed within the body is a time capsule containing a Bible, a newspaper, and a few notes about himself.

Despite his success, Stanley admits: "I can't draw to save my life. Instead, I get a piece of wood or clay and push it into shape. When I did this horse, I made one side in 2-in.-thick clay with just enough detail to get an idea of how it would look. Then I used it as a pattern."

Stanley looks forward to the possibility of turning pro. "I can't tell you how much joy it brings, just to see that piece of wood take shape.... When I'm carving I can just relax."



STUDENT

First Prize
"Falling Leaf" Sideboard
Brian Condran
Martinez, CA

At age 39, Brian Condran decided that he wanted to make furniture. A friend told him about "this old guy up north somewhere." He was referring to none other than James Krenov, noted author, furniture maker and resident dean at the College of the Redwoods.

Condran built this cherry sideboard in his second year at the school. The sides of the cabinet and the door and drawer fronts all curve to follow the compound curve in the legs. "Curved casework isn't a big thing at the College," notes Condran. "so I was surprised when Jim said he liked the sketch I showed him." Inspired by the master, Condran made curved-bottomed planes to shape the concave and convex door and side panels. He even designed and built a foot-powered scrollsaw to cut the delicate flower marquetry.

Since graduation last May, Condran has already rented space inside a local woodworking shop. "I hope to design and execute my own ideas, then find people who can afford them and, hopefully, appreciate them."

Second Prize
Sheraton Sideboard
Nik Meller
Los Angeles, CA

When it comes to studying woodworking, Nikolaus Meller might argue that you can't get too much of a good thing. Before enrolling in the two-year woodworking program at Boston's North Bennet Street School, Meller completed a rigorous three-year apprenticeship in Munich, Germany.

The son of German parents who lived in New York City for most of his childhood, Meller returned to Germany to take advantage of the government-run apprenticeship program there. "It's a very traditional education that integrates academic study with woodworking skills and business exposure," he explains.

PROFESSIONAL

First Prize
"Ambo" Lectern
Randall Rosenthal
East Hampton, NY

Randy Rosenthal's workshop is just a few minutes' walk from the ocean on the eastern tip of Long Island, NY. His intricately carved lectern faces another ocean, serving as a centerpiece in Seattle's recently restored St. James Cathedral.

Rosenthal began his artistic career wielding brushes rather than chisels and gouges. His water and wave paintings have been exhibited in the U.S. and overseas. But he was coaxed into woodworking by noted architect Norman Jaffe, who needed some sculptural friezes for a multimillion-dollar house he was designing.

Rosenthal prefers to create a sculpture from a single block of wood, doing most of the work with a varied assortment of flexible-shaft tools, bits and abrasive discs. "The sawdust really flies when I'm in the middle of a project," he says. "People who catch me in the act are usually shocked."

To create this lectern, the 49-year-old craftsman glued up 2-in.-thick slabs of mahogany to form the rough shape of the piece. The carving work was done directly on the face of the lectern, allowing Rosenthal to carve a highly relieved pastoral scene that seems to spill from its borders.

Second Prize
"Library Table of Sciences"
Paul Schürch
Santa Barbara, CA

Paul Schürch underwent three formal woodworking apprenticeships in three countries—Switzerland, England and Italy—before finally settling in California to pursue his furniture-making specialty: marquetry. "In marquetry, you need to make very precise cuts to fit all the pieces together," he notes. "Otherwise, you get gaps." As the son of a Swiss engineer, it's no surprise that his furniture reflects the precision of a well-crafted timepiece.

The winning table was commissioned by a long-standing client with a passion for astronomy and scientific instruments. To oblige, Schürch inlaid images from

"I chose to build the sideboard as my final student project at the Bennet Street School because its details reminded me of the Biedermeier pieces I worked on in Europe," says Meller. "I also wanted the challenge of making coopered doors and turned, reeded legs."

Meller's sideboard has door and drawer fronts made with bookmatched walnut crotch veneer. The walnut veneer is framed with inlaid holly stringing and herringbone mahogany veneer; the three ivory keyhole escutcheons were carved from broken piano keys.

Third Prize
Federal Sideboard
John Motsis
Boston, MA

Ever since his first high-school woodshop class three-and-a-half years ago, John Motsis has been planning for a future as a furniture maker. Now in his second year at North Bennet Street School in Boston, he says he realizes that the learning process will take a lifetime.

Motsis made this elegant hall table of mahogany—with inlays of bubinga, holly, fiddleback mahogany and dyed black veneer. The design is based loosely on Federal-period motifs (ca. 1800), including square-section, tapering legs and handmade inlay bandings. Motsis used hand tools to shape and inlay the delicate bellflowers and

holly stringing in the legs, and he hand-planed the individual fan sections to fit.

Motsis says this project has taught him a greater appreciation of inlay work, which consumed almost 80% of the total construction time. But the experience was worth it. "It's like leaving your mark on the world; it's a very spiritual thing."

the cosmos, as well as geometric symbols for earth, air, water and fire.

Using medium-density fiberboard as the core material, Schürch veneered almost every square inch of the table, gluing three layers of cross-banded veneer to the core to keep the delicate marquetry panels stable. He selected matched sheets of white ash root and walnut for the predominant veneers, then inlaid dots of silver, brass and pewter. More dots were added from sapphire, opal, tiger's eye and marble.

The marquetry on the top of the table features a 72-sided polyhedron made from more than 180 pieces of veneer. The geometric image is startlingly realistic. "Rendering into three dimensions is the most exciting aspect of the work I do," he explains.

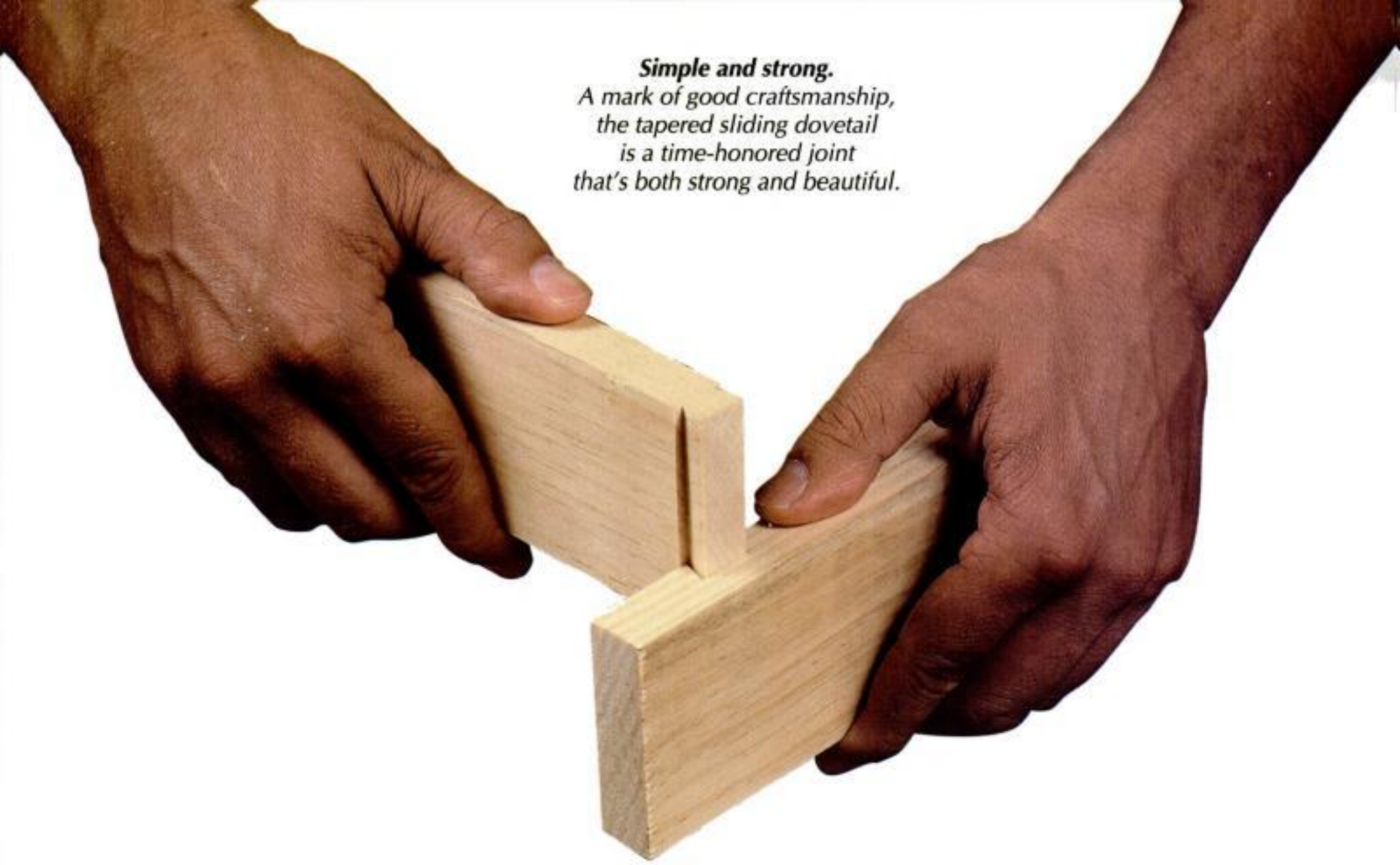
Third Prize
Kaleidoscope
Jerry Beall
Newark, OH

After years of making wooden stringed instruments and clocks for a living, Jerry Beall decided to try making "world-class" kaleidoscopes. Initially conceived as a profit-making venture, the kaleidoscope's complex construction and aesthetic beauty inspired Beall: "I wanted to push the envelope," he confesses.

The prizewinning scope is the second in a series of eight. All the wood, brass and internal glass parts and optics were custom designed and fabricated by Beall—right down to the knurled screws and nuts. The scope's end is mounted on ball bearings for smooth operation. Inside, there are pieces of colored glass, semi-precious stones and small

glass tubes filled with colored liquid. Both ends are attached with rare-earth magnets, making them easy to disassemble for cleaning.

Beall's biggest challenge was developing a precise way to join the curly maple and brass parts so they'd look great and operate smoothly while also accounting for wood movement. As he explains, "It's a task that required all my technical experience to pull off."



Simple and strong.
A mark of good craftsmanship, the tapered sliding dovetail is a time-honored joint that's both strong and beautiful.

Tapered Sliding Dovetails

Get a perfect fit with two easy-to-make jigs

by Frank Klausz

The sliding dovetail is a wonderfully strong joint. Used in casework to hold partitions and shelves to cabinet sides, or in drawer construction to attach fronts to sides, the angled parts of the dovetail make a mechanical connection that resists pulling apart. If you taper the socket and the dovetail, the connection becomes even stronger since the taper helps wedge the dovetail tightly in its socket.

Many woodworkers turn to the router to cut this joint. With a single dovetail bit, you can rout both the socket and the dovetail. While you can use the router table or a straightedge to cut these parts, both methods usually involve a lot of fussy trial-and-error setup to achieve the crucial snug fit. If there's any play between the parts, the entire joint can loosen. To avoid this tedious setup work, I use a pair of jigs that, once tuned, will produce perfectly fitting sliding dovetail joints time after time.

I made the two jigs shown here specifically for routing the sliding dovetails in my waterstone pond. (See article, page 44.) These jigs will handle stock ¾ in. thick by about 3 in. wide. You can size the jigs to handle thinner, thicker or wider stock, but the design isn't suitable for routing workpieces over 10 in. wide. Both jigs are sized to fit my laminate trimmer because I like the way these small, lightweight routers handle. But you can easily adapt the design to suit your own favorite router.

The drawings show how the jigs work. On the socket jig, a U-shaped cutout in the jig's base guides the base of the router. (See Fig. 1.) On the tail jig, the router base is guided by a pair of fences. (See Fig 2.) The guiding edges of both jigs taper to produce corresponding tapers in the socket and tail pieces.

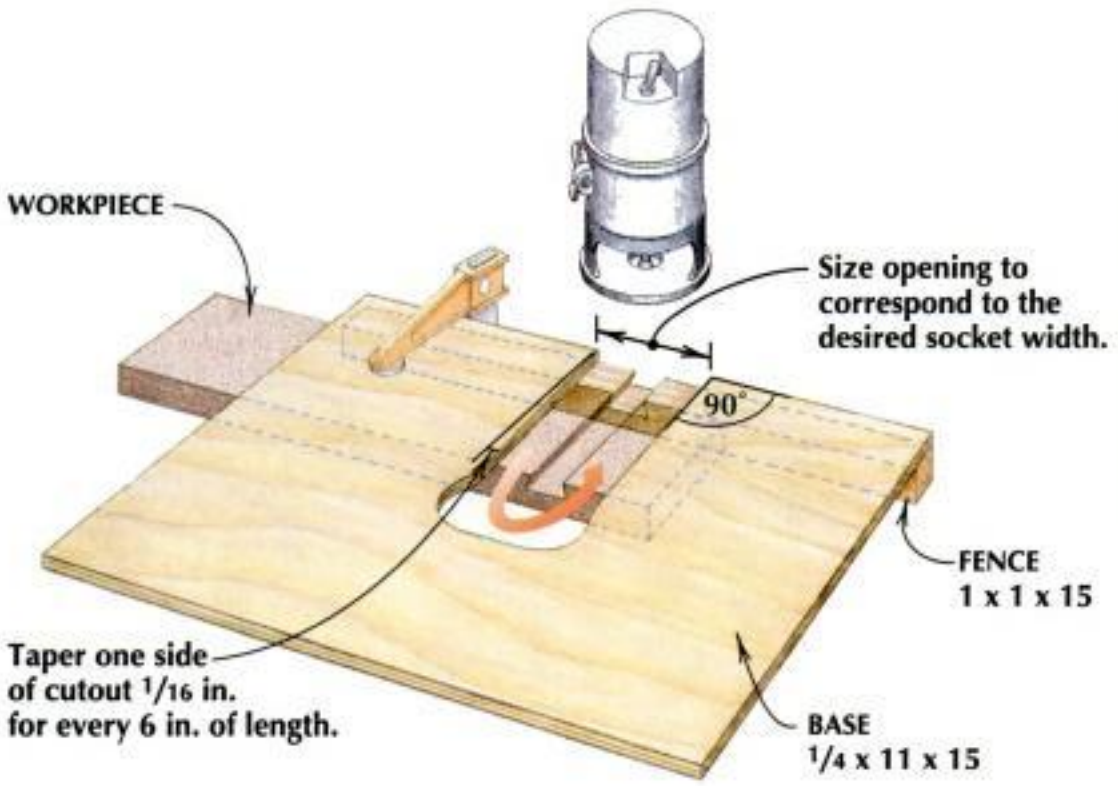
Make the socket jig first, and rout a test socket in some scrap. Then make the tail jig, but just tack this jig's fences temporarily in place. Cut a test dovetail in some scrap, moving the router as shown in the drawings. Adjust one of the fences to fine-tune the amount of taper until you can assemble the joint about three-quarters of the way with hand pressure alone. Having to tap the last quarter of the joint together tells you that the fit is just right.

When you're satisfied with the fit, screw the fences in place. Now you're ready to create a timeless joint in almost no time at all. ▲

FRANK KLAUSZ *is a master cabinetmaker and a contributing editor to AW.*

FIG. 1: MAKING THE SOCKET JIG

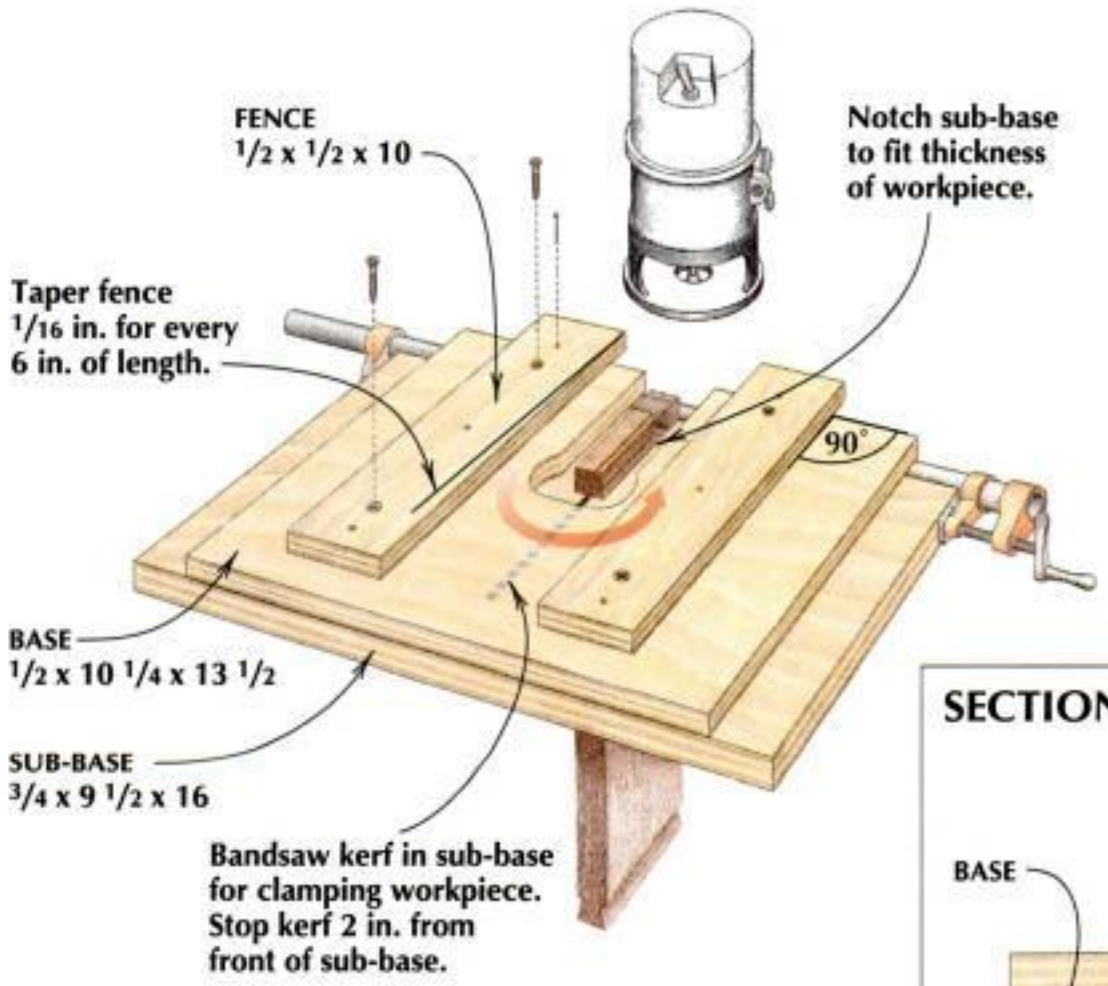
The sides of the U-shaped cutout guide the router base. Clamp the workpiece and the jig to your bench. Rout the socket by moving the router in a counterclockwise direction.



Tapered socket. *Rout the socket by guiding the router base against the sides of the cutout. A clamp secures the jig and workpiece to the bench.*

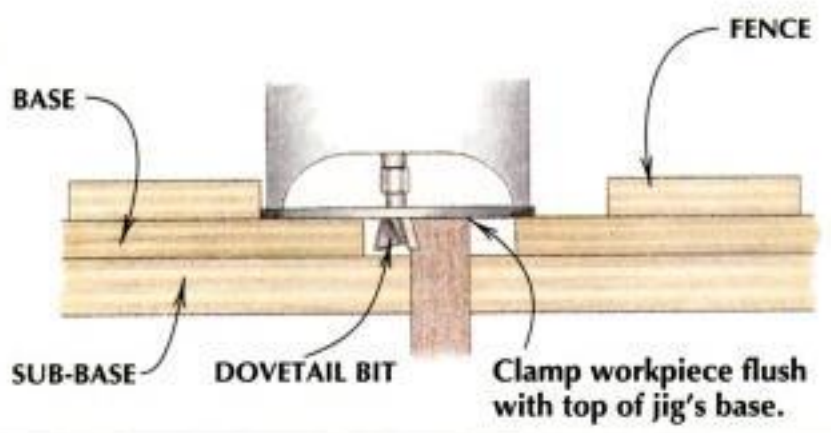
FIG. 2: MAKING THE TAIL JIG

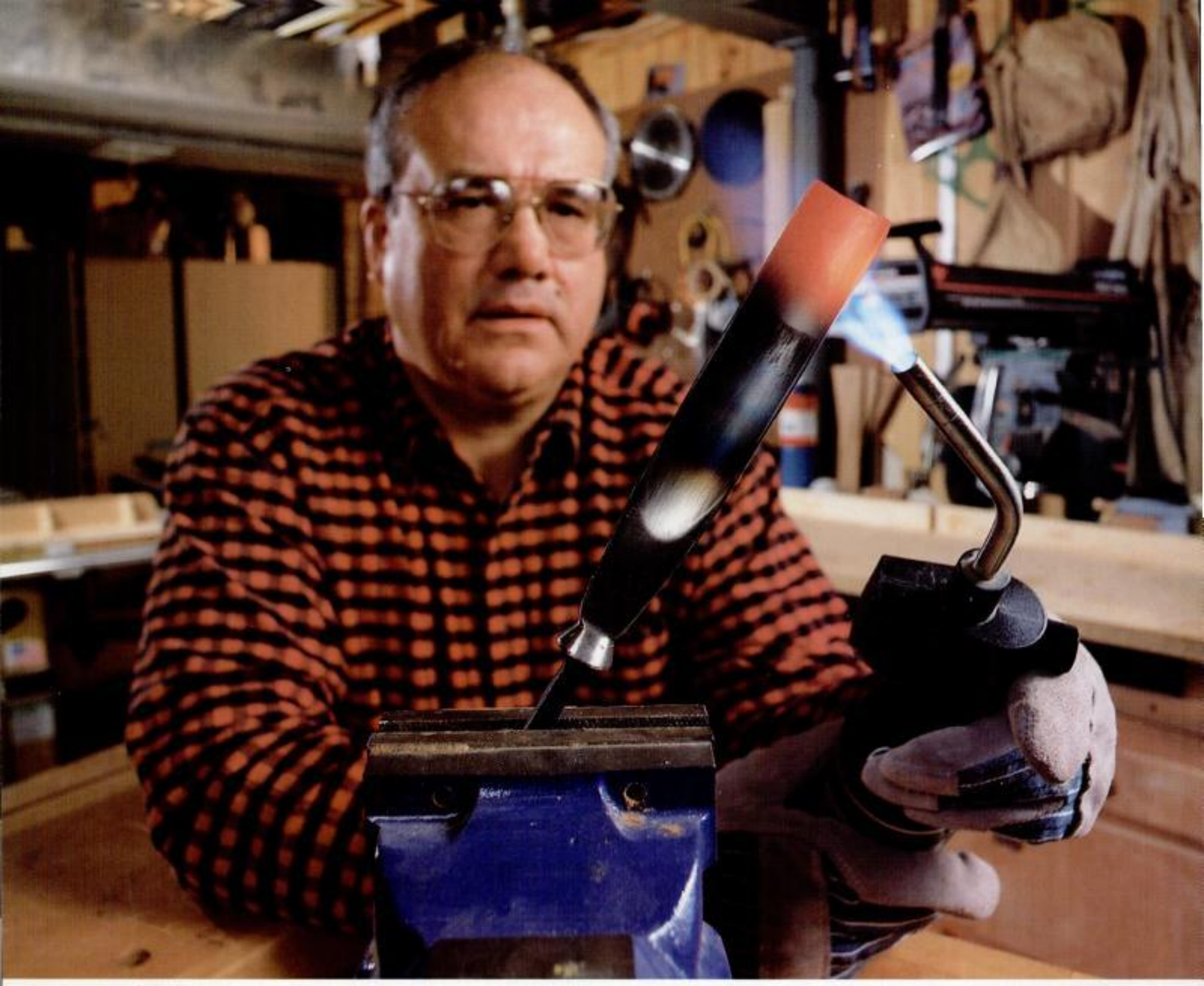
A pair of fences guides the router base. Clamp the workpiece in the sub-base so that the workpiece end is flush with the router base. Move the router counterclockwise to rout the tail.



Tapered dovetail. *Rout the sides of the dovetail by guiding the router base against the fences, maintaining contact at all times.*

SECTION THROUGH JIG





Healing by annealing. *The author heats the end of the cutting tool to a cherry-red color to soften, or "anneal," the metal. This is the first step in the retempering process.*

RETEMPERING TOOLS

REGAINING THE CUTTING EDGE

by Mike Callihan

Chisels and gouges are indispensable tools for most woodworkers. So when we destroy a tool's hardness, or *temper*, by burning it on the grinder, we're likely to lose our own tempers as well. Although burned cutting edges can usually be prevented by frequent water-cooling while sharpening, the occasional overheated edge is inevitable.

You'll know you've burned the metal if it turns blue. If the damage seems very slight, you can try grinding back the cutting edge about 1/8 in. and resharpening. But if the tool won't hold a sharp cutting edge, it needs retempering.

Fortunately, it's not difficult to retemper the high-carbon tool steel from which most chisels and carving tools are made. Retempering requires a good heat source and a little patience. The process involves three heat treatments: *annealing*, *hardening* and *tempering*. Annealing softens the metal and removes internal stresses in preparation for hardening. Hardening restores the metal's hardness but makes it too hard and undesirably brittle. Tempering reduces the brittleness and restores the hardness to a more desirable level, toughening the hardened metal and increasing its shock resistance.

Retempering doesn't require a lot of equipment. You'll need a propane torch, some dry sand, and a vise to hold your work. Eye protection and gloves are also important for this work.

Annealing

To properly anneal steel, you heat it to a cherry-red, then let it cool very slowly.

Before annealing, remove the tool's handle if you can. To remove a wooden handle, clamp the tool's shank in a vise and drive the handle off with a punch. Protect a non-removable plastic handle from heat by wrapping the upper section of the shank in a very wet rag.

Clamp the tool in a vise and direct a strong flame an inch or two down from the cutting edge, letting the heat conduct itself upward toward the edge. Work in low light so you can see the steel begin to glow as it heats. It should reach cherry-red in less than five minutes. (See lead photo.) If it takes longer, you can speed the process with another torch.

If you're unsure if the tool is hot enough, check it with a magnet while it's still cherry-red. Properly heated steel won't attract a magnet. But don't keep heating *after* it has turned cherry-red, or you might permanently damage it.

When the tool is hot enough, quickly bury the blade in dry sand to cool, as shown in the photo at top right.

Once cooled, the metal should be soft enough to sharpen easily on the grinder. (Moderate overheating now won't affect the final tempering.) Your goal is to prepare the tool so that final honing can be done right after tempering.

Hardening

The next step is to reharden the steel by heating it to a cherry-red color again. This time, though, you want to cool it rapidly by dipping, or *quenching*, it in oil or water.

Oil works best for smaller tools; it's a less severe quench than water. Too severe a quench can induce stress cracks. Almost any kind of oil will do. I use 30W motor oil, but even cooking oil will work.

Heat the metal as you did when annealing it, then plunge the cutting edge about 2 in. into the oil. (See center photo, right.) Don't quench the upper section of the shank; it should cool very slowly to remain soft and shock resistant. Stir in a sweeping figure-eight pattern to keep fresh oil in constant contact with the steel. Otherwise, a gas pocket might form next to the steel, causing uneven cooling. After the bubbling and smoke subside, set the tool aside to cool.

Caution: When oil-quenching, wear eye protection and gloves, and hold the oil in a lidded metal container. Oil can ignite during quenching. If it does, smother the fire with the metal lid.

Now, try to cut the steel with a good file. If the file skates off the metal, your tool is properly hardened. If the file cuts, your tool probably requires a more severe quench. Repeat the hardening process, using water this time. For an even more severe quench, use a saturated saline solution, adding salt to water until no more will dissolve after it's stood for an hour. Whatever your quenching medium, plunge and stir the tool in it as you did with the oil.

Tempering

For proper tempering, you'll need to observe subtle changes in the steel's oxidation color, so work in a brightly lit area. Prepare for tempering by removing all the oxidation and combustion residue from the steel. Use progressively finer Carborundum finishing paper to polish the hardened steel to a bright shine. The brighter the shine, the easier it will be to read the color changes for tempering. Finish up with at least 600 grit—preferably finer. I like to finish with 2,000-grit paper from the auto supply store. Clean the surface with soapy water or denatured alcohol, and avoid touching the metal afterward.

Adjust your torch for a soft flame and *very slowly* heat the steel, playing the flame over the entire surface. The metal will turn pale yellow, then light yellow, then a pale straw color and finally straw-yellow. Done correctly, tempering even the smallest tool should take at least five minutes, preferably more. Remove the heat immediately when the straw-yellow color reaches the cutting edge. (See bottom photo, right.) Let the steel air-cool.

The cutting edge should now be hard enough to hold a sharp edge, but tough enough to resist chipping. Hone it with sharpening stones, and you're ready to go back to work. ▲

MIKE CALLIHAN *is a mechanical engineer and woodworker who makes and restores hand tools in Wisconsin.*

Slow cooling. *After annealing the metal, bury the blade in dry sand to cool it very slowly.*

Quenching to harden. *After reheating the tool to a cherry-red color, quench it by stirring it in oil. This rehardens the end of the tool.*

Tempering. *To toughen the metal and make it less brittle, temper it by heating it very slowly until it turns straw-yellow.*

Douglas Fir

by Paul L. McClure

In 1824, British botanist David Douglas was sent to the west coast of North America as a plant collector for the British Royal Horticultural Society. Among the native plants and trees he brought back to England was the fir which now bears his name.

Douglas fir grows across the western U.S. and Canada and is one of the most important American commercial timbers. It's not a true fir but a member of the pine family. It can attain a height of over 200 ft. and can reach a diameter of 10 ft. The largest trees may be 1,000 years old.

Appearance

Douglas fir's heartwood is a reddish tan and is sharply demarcated from the narrow band of white sapwood. The wood's clearly delineated grain pattern alternates between light-colored earlywood and darker bands of latewood. The earlywood is soft and fine-textured, while the latewood is dense and coarse.

Flatsawn boards from this straight- or wavy-grained wood commonly display "cathedral" figure. Quartersawn boards, sold as "V.G." (vertical grain) fir, yield a fine, closely spaced pinstripe figure. The rotary-cut Douglas fir veneer commonly used to make construction plywood has a garish, swirling figure.

Workability

Douglas fir is brittle and tends to split and splinter. It can be difficult to work with hand tools. Flatsawn grain tends to tear out during hand-planing, but quartersawn surfaces plane well.

The wood machines well with sharp cutters, but edges often splinter when routed. To reduce this problem, make several shallow passes or make "climb" cuts (routing opposite the usual direction). Take light passes when climb-cutting, and maintain a firm grip on the router. Keep the router moving to prevent burning.

Scraping produces a more uniform surface than sanding. Sanding removes the soft earlywood much easier than the latewood, leaving an undulating surface.

Douglas fir accepts fasteners easily but requires preboring near the ends of boards to prevent splitting. It glues well and easily accepts stains, dyes and clear finishes, but paint might not adhere well.

Uses

"Doug" fir is very strong for its weight and is used extensively in construction. Kiln-dried V.G. lumber is used for cabinetry, architectural trim and flooring. Fairly resistant to decay, it is used for everything from telephone poles and fencing to mine timber-framing.

Most construction-grade plywood in the U.S. is made of Douglas fir. Some hardwood ply has a Douglas fir core. ▲

DOUGLAS FIR

Vertical-grain, or "V.G.," Douglas fir

Species and Common Names
Pseudotsuga menziesii—Douglas fir, red fir, Douglas spruce, red spruce, Oregon pine, British Columbian pine, red pine

Growing Range
Canada south to Mexico, west of the Rocky Mountains.

Specific Gravity
0.53

Density
33 lbs. per cubic ft.

Wood Movement[1]
Tangential (flatsawn): medium (13/64 in. per ft.)
Radial (quartersawn): small (1/8 in. per ft.)

Durability
Moderately resistant to fungal and insect attack

Sustainability
Sustainable at current harvest levels

Availability
Western lumberyards and mills. Not commonly available in the eastern U.S.

Size
Thicknesses: 4/4 through 16/4. Widths: 2 to 12 in. Lengths: 6 to 20 ft.

Cost
Lumber: $2 to $4.50 per bd. ft. depending on thickness and width
Veneer: Not commonly available

[1]*Indicates wood movement across the grain from 6% to 12% moisture content.*

Nitrocellulose Lacquer

The "old standby" finish

by Michael Dresdner

Nitrocellulose lacquer has long been a favorite of wood finishers because of its beauty, ease of spray application and repairability. In spite of increasing government regulations against its use, it is still one of the most widely used finishes for cabinetry and furniture.

Available in sheens ranging from high gloss to dead flat, lacquer forms a clear, slightly amber film that imparts great clarity and depth to wood. It is easy to apply and dries quickly. Unlike many oil varnishes and waterborne finishes, lacquer can be applied even in unfavorable conditions, such as high humidity, by adjusting its drying time with additives. It also has excellent rubbing-out characteristics and is easy to repair if damaged.

Like any finish, lacquer has its drawbacks. It's only moderately resistant to abrasion, alcohol, water and heat, so it isn't well suited to high-wear surfaces such as kitchen tabletops. And its toxic, flammable solvents demand health and safety precautions. Because the solvents are also air-polluting, government regulations restrict the use of lacquer by large manufacturers in many areas.

PHOTO BY PAUL ANTHONY

Spray or brush. *Nitrocellulose lacquer is easy to apply with a spray gun, though in damp, hot or cool conditions, you may need to alter its drying time by adding thinner or retarder. Lacquer made for brushing (right) dries more slowly.*

The Nature of Lacquer

Lacquer forms a film solely by the evaporation of its solvents. Each coat redissolves the previous coat, which means you don't have to sand between coats to ensure adhesion.

A coat of lacquer is so thin when dry—just a *mil* (0.001 in.) or two—that it hugs the wood, showing every detail and pore. If you want a closed-pore lacquer finish on open-pored woods, you'll have to apply pore filler first. (See "Just Finishing," AW #27.)

Applying Lacquer

There are two ways to apply lacquer: with a brush and by spraying. Spraying is easier and generally results in a much better finish.

Brushing lacquer can be difficult because the finish often begins to dry before the brush marks level out. Adding retarder to slow the drying time can help; I'll discuss that below. Or you can use a preformulated, slow-drying lacquer such as Deft™ (available at many paint stores).

Spraying is the best way to apply lacquer. Both conventional and HVLP guns work well. With a conventional gun, I spray at 30 psi (lbs. per sq. in.) air pressure, using a spray cap with a 0.070-in. (1.75mm) fluid hole. With an HVLP gun, I prefer a smaller 0.050-in. (1.25mm) hole.

Caution: Lacquer and thinner are highly flammable. If spraying indoors, work in a well-ventilated spray room with explosion-proof fixtures. The fumes are also toxic, so wear a NIOSH-approved respirator when mixing and spraying the finish. Avoid breathing the fumes from the drying finish.

For your first coat on all but the densest woods, use a "sanding sealer"—a mixture of lacquer and stearates. Sanding sealer builds faster and sands easier than straight lacquer, but the stearates are soft and slightly opaque, so apply only one or two coats. Too thick a layer can invite chipping of the harder top coat and rob the finish of clarity.

Thin your lacquer or sealer to the consistency of skim milk, or even thinner if you're using a small touch-up gun. Stir the mixture thoroughly before spraying.

Spray each coat just thick enough to get the wood wet and shiny. Applying thicker coats may cause *blush*, discussed under Troubleshooting, below.

In ideal conditions—70° to 80° F and 40% relative humidity—lacquer dries to the touch in about 15 minutes and is ready to recoat within an hour or two. Even so, I recommend spraying no more than three coats per day. Plenty of drying time between coats keeps underlying coats from shrinking after the top coats cure.

You'll want at least four coats for a durable finish, but you can add more to get a thicker or flatter finish. Although lacquer doesn't require sanding between coats for adhesion, I sand with 220-grit "self-lubricating" (stearated) sandpaper between coats if there are any dust nibs.

Cleanup

Between uses, I submerge my gun's nozzle and air cap in clean thinner in a closed jar. I often leave the unused, mixed lacquer in the gun cup if I'm going to use it within about a week.

For a thorough cleaning, remove and soak the air cap, fluid nozzle, needle and cup in clean lacquer thinner. Don't soak the gun itself, or else the packing around the fluid needle will break down. You can clean the fluid passages with a small bottle brush or pipe cleaner soaked in thinner.

Repairability

One of lacquer's great benefits is its repairability. Since lacquer redissolves itself, you can respray a damaged area and blend the new lacquer right into the old. Small touch-ups can easily be done using an aerosol can of lacquer. (See photo, page 90.) Repairs can be rubbed up to match a gloss finish or rubbed down to match a satin finish. Lacquer also accepts burn-in sticks well.

Troubleshooting

As user-friendly as lacquer is, things can go wrong. Here's a troubleshooting guide to help you correct any problems:

Blush—When it's warm and humid, moisture can be pulled into a wet finish, resulting in a cloudy appearance called *blush*. To correct blush, add a slower-drying solvent, called a *retarder,* to the next coat of lacquer. An ounce or two of retarder per quart of lacquer will do the trick.

Dry spray—Spraying too small an amount of finish will result in a coat that looks and feels rough like sandpaper. Turn down the air pressure or adjust your gun to spray a smaller fan pattern for a wetter coat.

Orange peel—If your lacquer isn't thinned enough or if your gun's fluid aperture is too large, you'll sometimes get a pebbly surface that resembles an orange rind. The easiest solution is to sand the finish to flatten the surface a bit, then add more solvent to the lacquer for your next coat.

Fish eyes—Silicone, used in some lubricants and polishes, can contaminate wood, creating areas of low surface tension that cause puckered depressions in lacquer called "fish eyes."

You can eliminate fish eyes by adding one drop per quart of an anti-fish-eye additive (available at paint stores under names such as "Fish Eye Flowout" and "Sili-chek") to subsequent coats of your finish. If you use it with one coat, you must use it with every coat. Afterward, clean your gun thoroughly with lacquer thinner. You can prevent silicone contamination entirely by sealing the surface first with fresh shellac. ▲

Join Michael Dresdner live on America Online Sunday from 9:30 p.m. to 10:30 p.m. eastern time for answers to your finishing questions. Keyword "wood" takes you to AMERICAN WOODWORKER Magazine Online. Click the "Shop Talk" icon to enter the chat room.

Toolbox Special Edition

New Products from the National Hardware Show & International Woodworking Fair

The AW editors are constantly prospecting for new tools, materials and accessories. And every year, we strike gold just as summer turns to fall. That's when The Hardware Show in Chicago and The International Woodworking Machinery and Furniture Supply Fair in Atlanta take place. Both events have miles of aisles packed with new products. Here are some hot ones that caught our attention.

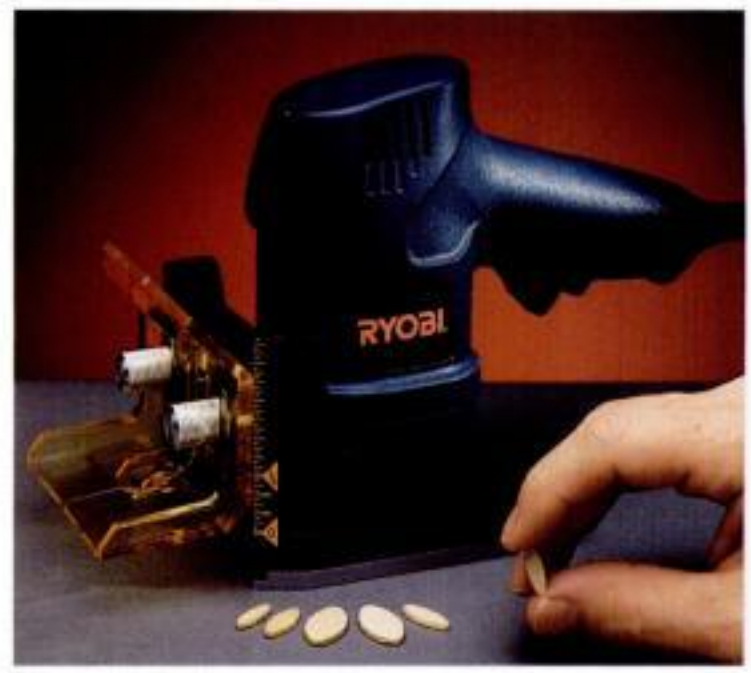
List vs. retail prices: The retail price is close to the street price you'd pay at a home center or through a catalog. But some tools are so new that retail prices haven't been established. For these tools, we've given the higher list price provided by the manufacturer.

Dial-a-Width Dadoes

■ Freud's new Dial-a-Width Dado set is the most innovative dado set we've ever seen. You can adjust dado width without removing the cutter from your saw's arbor, and the adjustment is extremely precise. The set makes it easy to "dial in" dado widths to match the odd thicknesses of sheet goods. Dadoes are super-smooth, too—just what you'd expect from a premium stack set. (List price: $389 for 8-in. dado set) Freud USA, Inc., (800) 334-4107. ***Circle #633***

Big Jaws

■ The large metal jaws on Gross Stabil's new Parallel Clamp stay parallel as you apply clamping pressure, to distribute the pressure evenly on flat surfaces. Replaceable plastic jaw caps prevent marring. Available in seven lengths. (List price: $52.90 for 24-in. length) Gross Stabil Corp., (800) 671-0838. ***Circle #634***



Little Biscuits

■ Ryobi's new model DBJ50 Detail Biscuit Joiner makes it easy to create biscuit joints in small projects like jewelry boxes and picture frames, where regular biscuits won't work. The tool's see-through fence lets you keep the workpiece in view. The blade will cut slots for Ryobi's tiny "Accu-biscuits," which come in lengths of 5/8 in., 3/4 in. and 1 in. (Retail price: $69) Ryobi America Corp., (800) 323-4615. ***Circle #635***

Irregular Angle Clamp

■ Bessey's ES Irregular Angle Clamp is designed for angled glue-ups that foil conventional clamps. To make it work, you clamp the two ball-and-socket assemblies to joining pieces, then pull the joint together with a Bessey bar clamp. (Price: Ball-and-socket assemblies, $49.50; complete sets, including bar clamps, also available) American Clamping Corp., (800) 828-1004. ***Circle #636***

Tool-Free Jigsaw

■ DeWalt's new DW321K jigsaw is the first model that requires no tools to change blades or make angle adjustments. Like other high-end jigsaws, this one has variable speed control and orbital action. In addition to pivoting for bevel cuts, the baseplate can slide forward or back, so you can tailor the blade clearance to the cutting task. (Retail price: $164, including case) DeWalt Industrial Power Tools, (800) 433-9258. ***Circle #637***

Cordless Jigsaw

■ Milwaukee forges ahead in the cordless market with their model 6267-21 jigsaw. Powered by a 12-volt, 2-amp-hour battery, the saw can cut up to 35 ft. of 3/4-in.-thick ply on a single charge. It has Milwaukee's popular Quik-Lok™ blade-changing system. The cordless saw kit includes a fast charger, 2 batteries and case. (List price: $530) Milwaukee Electric Tool Corp., (800) 414-6572. ***Circle #638***

Affordable Dust Helmet

■ Racal's Power Visor offers full face protection and air filtration at a very affordable price. A battery-powered fan is built into the helmet to circulate filtered air over your face. The lightweight unit is comfortable enough for extended wear. (Price: $129) Racal, (800) 682-9500. ***Circle #639***

Diamond Sharpener for the Drill Press

■ The Versa Grinder is designed to sharpen carbide router bits and shaper cutters using a diamond wheel chucked in a drill press. Precision adjustments for shear and hook angles are easy, and you can remove exactly the same amount of material from each cutting wing, ensuring proper geometry and balance. (Retail price: $199.95) Woodworker's Supply, (800) 645-9292. ***Circle #640***

Mini-Bits

■ Amana's new Model Maker carbide-tipped router bits cut tiny profiles that are perfect for jewelry boxes, dollhouses and other small projects. The MRS-1000 set of 12 bits includes plunge-type bits as well as bearing-piloted bits. All of them have 1/4-in.-dia. shanks. (List price: $179.50, including wooden case) Amana Tool Corp., (800) 445-0077. ***Circle #641***

3-in-1 Sander

■ If you don't have the space or budget for a shelf-full of specialized sanders, check out Black & Decker's Total Task Sander. By interchanging differently shaped pads, you can switch between regular orbital sanding, random-orbit sanding or detail sanding. The model RO600 sander features through-the-pad dust extraction into an on-board bag or a shop-vacuum hose. (Retail price: $70) Black & Decker, (800) 762-6672. ***Circle #642***

Affordable Stock Feeder

■ Sunhill's model M3 "Baby" Stock Feeder brings the benefits of power feeding to small-shop machines and budgets. The M3 has many of the important features you'd find on expensive, full-size feeders: urethane rollers, variable speed (6 to 40 ft. per minute) and reversing control. It's great for use on shapers, router tables and tablesaws. (Price: $230) Sunhill, (800) 929-4321. ***Circle #643***

Vacuum-Powered Fence

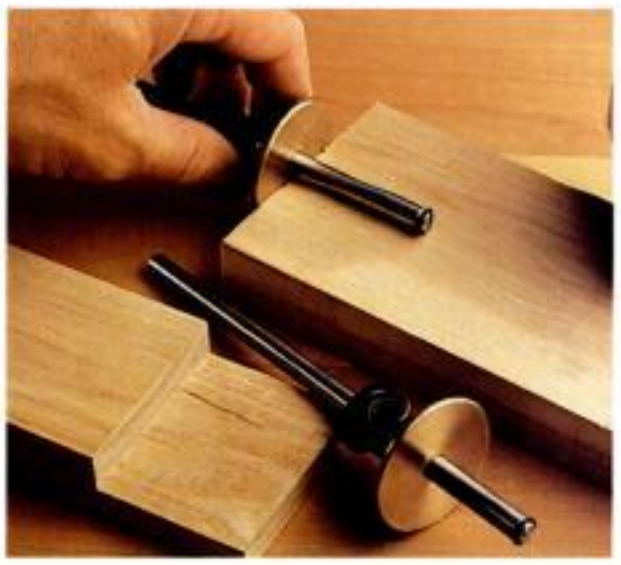
■ Attach the Vac-U-Fence to your tablesaw's rip fence and you'll be able to rip stock securely without using hold-downs and featherboards. Suction is provided by a shop vacuum (not included with the fence). Holes in the fence allow the vacuum to pull the stock against the fence as you feed it through the blade. It's great for ripping very thin pieces safely and accurately. (Retail price: $179 for clear finish; $195 for colored finish) RRR Safety Products, (520) 327-1998. ***Circle #644***

Jet's New Cabinet Saw

■ Jet's new Xacta Saw™ earned high marks in our cabinet saw showdown. (See AW #49.) Now Jet offers a version with a left-tilting blade, just like the highly rated Powermatic 66 cabinet saw. The Xacta Saw Left™ weighs almost 50 lbs. more than the Xacta Saw Right™, thanks to a cabinet made of heavier-gauge steel. Both models come with Jet's new Xacta Fence System. (Retail price: $1,699 Left; $1,399 Right) Jet Equipment & Tools, (800) 274-6848. ***Circle #645***

Better Marking Gauge

■ The Veritas Wheel Marking Gauge relies on a hardened steel cutting disc instead of a pin, for scribing clean lines that won't tear the grain. With a thick brass face and thumbscrew, the gauge looks and works great. (Price: $18.95) Lee Valley Tools, Ltd., (800) 871-8158. ***Circle #646***



Report to the BOSS

■ Delta's new Benchtop Oscillating Spindle Sander (a.k.a. The BOSS) sets a new standard for benchtop oscillating spindle sanders. It has an 18-in.-dia., cast-iron table; a ¼-HP, direct-drive induction motor; and a spindle that accepts drums from ½ in. dia. to 3 in. dia. A built-in fan draws dust through a slotted table insert and deposits it in a dust bag, or you can hook up a shop vacuum for greater efficiency. (Price: $195 for model 31-780) Delta International Machinery Corp., (800) 438-2486. ***Circle #647***

TOOL TRENDS

News & overviews from the trade show floor

Still More Power For Cordless Tools

Manufacturers continue to up the ante for power and run time in cordless tools. Bosch, Wagner, Porter-Cable, Ryobi and Makita have all introduced 14.4-volt cordless drills. The new drills aren't just more powerful; they're designed for better balance and greater comfort than their predecessors.

- Bosch, Makita, Hitachi and Milwaukee have increased the capacity of their Ni-Cad battery cells to 2 amp-hours for maximum run time.
- If holding a cordless drill for long periods makes your arm tired, check out Hitachi's belt pack, which holds a pair of 12-volt batteries tethered to the drill with a short cord.
- Also newsworthy: a new cordless reciprocating saw from Milwaukee and a cordless chainsaw from Makita.

New Fences

Delta's recent purchase of Biesemeyer shook up the world of aftermarket tablesaw fences, fueling a flurry of new product development. The result: No fewer than eight manufacturers have come out with new fences.

- Models from Jet, Powermatic, Vega and Voss technologies are based loosely on the Biesemeyer design.
- Delta's new Precision Saw Guide fence looks like a smaller version of the Unifence.
- New models from Grizzly, Excalibur, and Modulus lock to both front and rear rails.
- Prices range from $275 (for Grizzly's Shop Fox Fence) to $479.95 (for the Modulus SSF-100). Watch for a complete Buyer's Guide to these new fences in an upcoming issue of AMERICAN WOODWORKER.

Excellence Award Finalists

Our fifth annual Excellence in Craftsmanship® competition packed our mailbox with entries. Picking the winners was quite a challenge. (See page 76.) And the contest brought such a variety of creativity and craftsmanship to our door that we just had to show more. So here's a sampling of work from some of the finalists. For details on how to enter our 1997 contest, see page 106.

"Rowing Shell" single scull by Terry A. Smith, Greenville, NC. Professional. Spruce, ash, cherry, brass, copper, leather. L: 17 ft. W: 24 in. H: 12 in.

PHOTO BY HENRY STINDT

"Juggler" sculpture by John Vliet, Truro, MA. Professional. Poplar and paint. W: 32 in. H: 72 in.

PHOTO BY JOHN VLIET

Das Schloss von Zeit ("The Castle of Time") clock by Dan & Raymond Wilckens, Kansas City, MO. Amateurs. Walnut, cottonwood and redheart. W: 36 in. D: 18 in. H: 76 in.

PHOTO BY KELLY BLOSSER

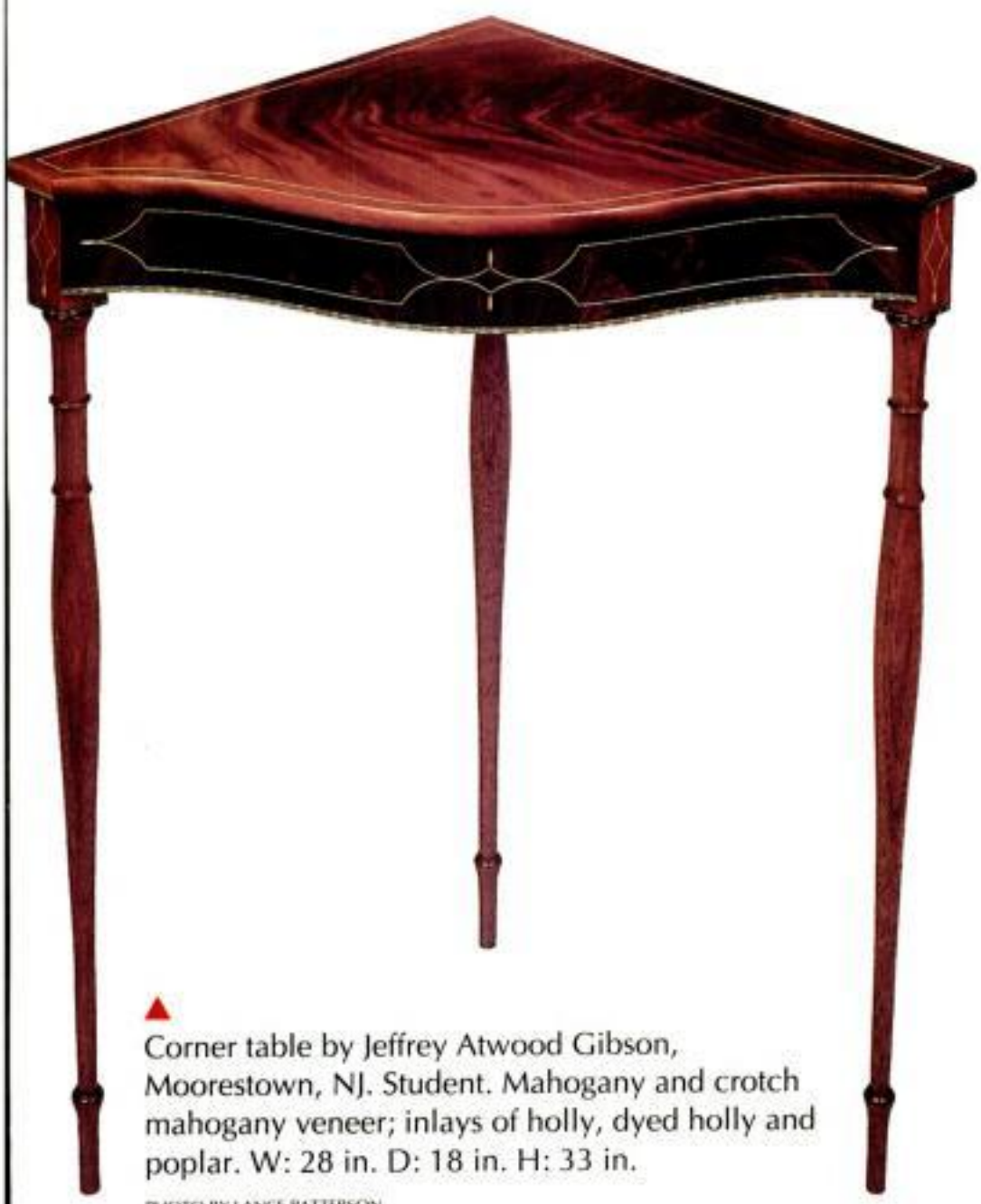
Want to see your work in "Gallery"? Send color slides or larger transparencies to: "Gallery," AMERICAN WOODWORKER, 33 E. Minor St., Emmaus, PA 18098. Please include a title, a brief description of techniques used, materials, dimensions, name of photographer, your name, address, and phone number. We'll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

◀ ▼
"Scarab Chair"
by David J. Marks,
Santa Rosa, CA. Professional.
Wenge, maple and fossilized
walrus-tusk ivory.
W: 24 in. D: 24 in.
H: 37 1/2 in.

PHOTOS BY DON RUSSEL

▲ ▼
"Pinecone Cabinet" by Ashoke Chhabra,
Altadena, CA. Amateur. Pinecones, walnut,
poplar, padauk and birch.
W: 62 in. D: 18 in. H: 91 in.

PHOTOS BY SAT CHHABRA



▲
Corner table by Jeffrey Atwood Gibson,
Moorestown, NJ. Student. Mahogany and crotch
mahogany veneer; inlays of holly, dyed holly and
poplar. W: 28 in. D: 18 in. H: 33 in.

PHOTO BY LANCE PATTERSON

Double-Duty Sawhorses

An adjustable beam rises to meet the task at hand

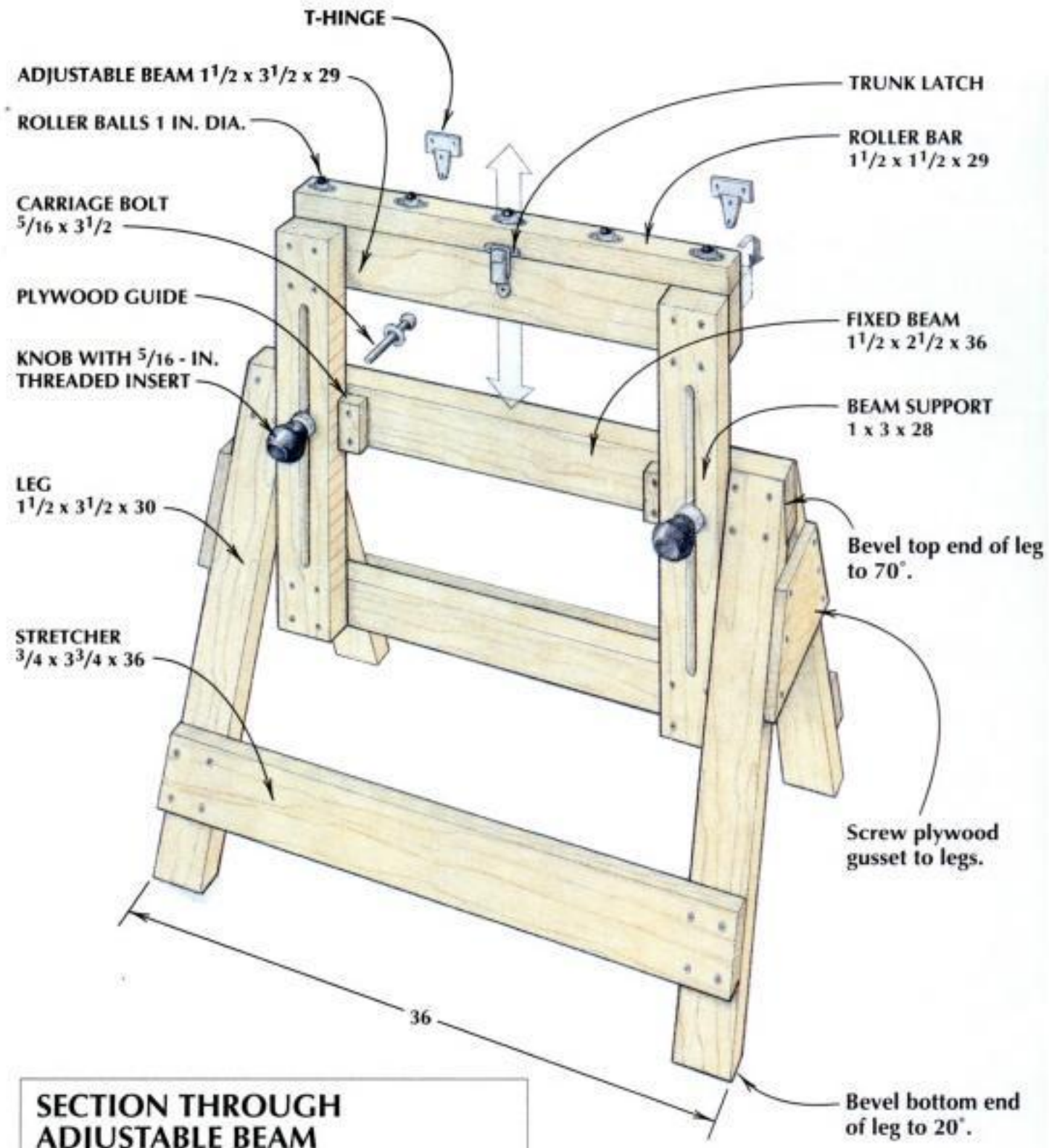
by Paul Szalach

In my small shop, sawhorses have to do more than just provide sawing support at a single, fixed level. With a few minor alterations, I've made the simple sawhorse into a shop workhorse.

The key to this increased versatility is an adjustable-height beam equipped with a hinged roller bar. Flip up the bar, and these horses serve as infeed and outfeed tables to cut large panels or long boards without a helper. Fold down the roller bar, and the adjustable beam enables you to do assembly or finishing work at the most comfortable height.

When they're not needed, the horses will stack out of the way. To save space, you can easily adapt the adjustable crossbeam to fit a folding horse. (See "Six Great Sawhorses," AW #52.)

I recommend building the sawhorses first and then adding the sliding components. I built my horses from some 2x4s and 3/4-in. plywood, and assembled everything with screws and glue. Mark the beam supports in 1-in. increments so you can raise or lower the support evenly. ▲

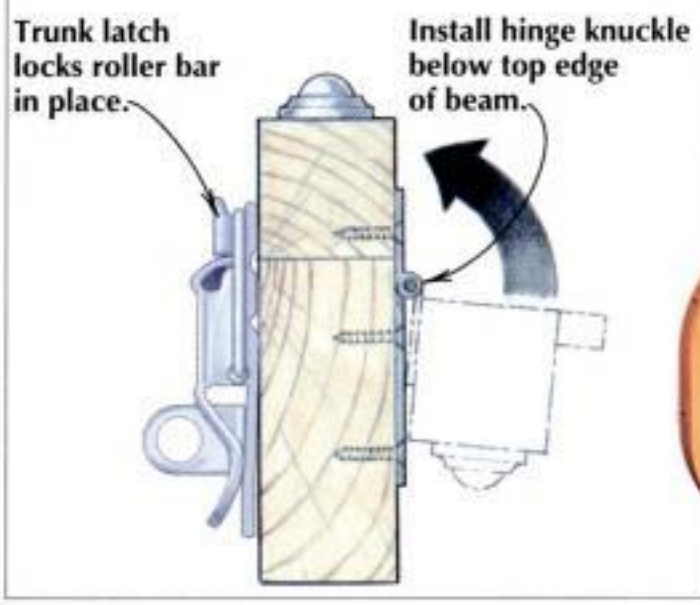


PAUL SZALACH
is a portfolio manager and amateur woodworker from New York state.

SOURCES

1-in.-dia. roller balls and knobs are available from Woodcraft, (800) 225-1153. *Circle #611*

SECTION THROUGH ADJUSTABLE BEAM



BEST SOLUTION WINS!

Do you have a shop jig or fixture you'd like to share? Send a photo or sketch with a full explanation to AMERICAN WOODWORKER, 33 E. Minor Street, Emmaus, PA 18098. Next issue's contributor will receive this CMT Dado Set, list price $268.