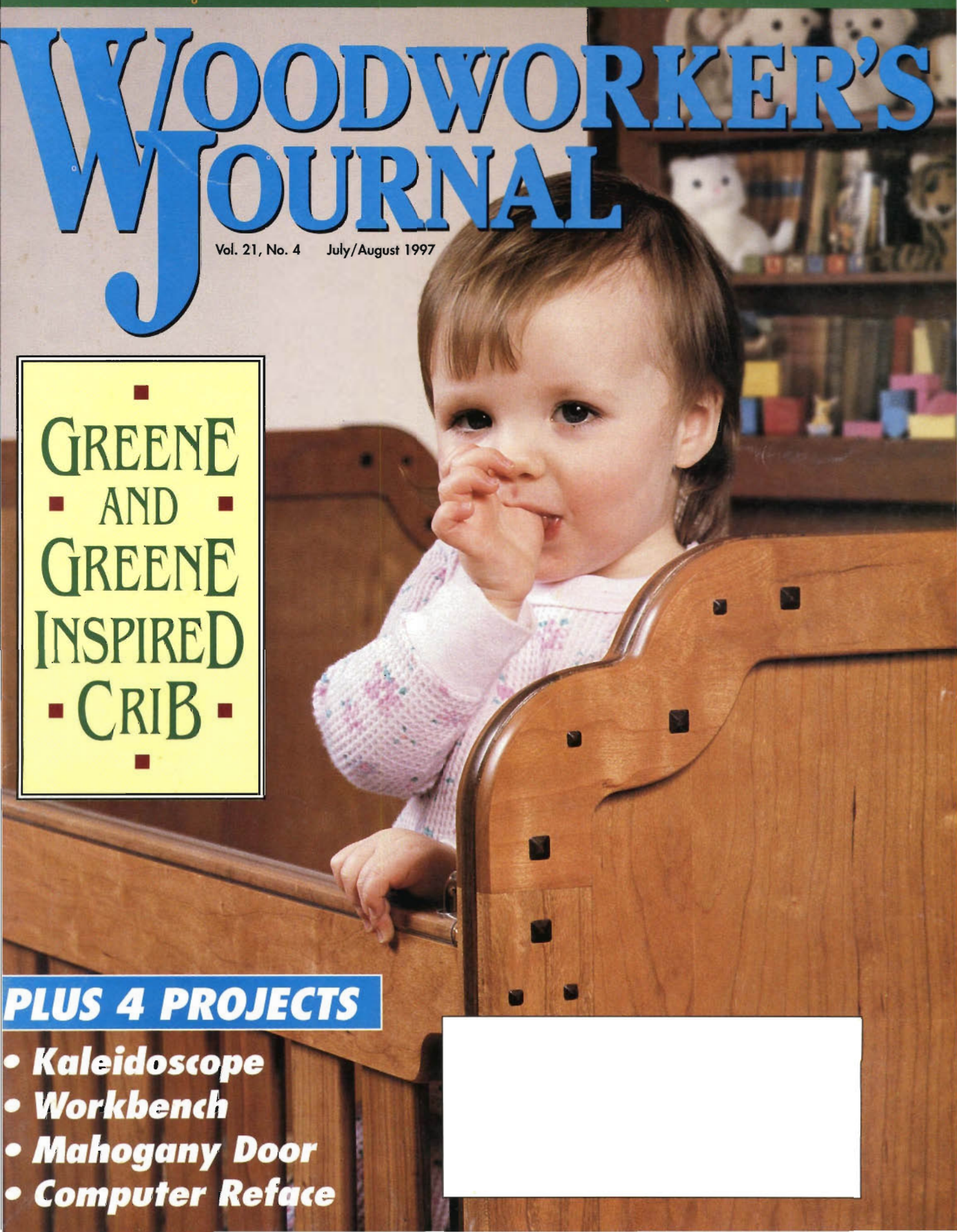
TOOL TESTS: POLYURETHANE GLUES; OPEN-END DRUM SANDERS; EUROSHOP C-300

WOODWORKER'S JOURNAL

Vol. 21, No. 4 July/August 1997



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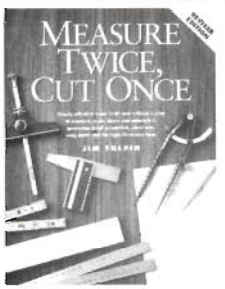

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12"X30TX1"	$162	$119	$107	$ 95
10"X40TX1/8" or 3/32"	$156	$119	$107	$ 95
30T 1/8" or 3/32"	$135	$ 99	$ 89	$ 79
9"X40T	$146	$109	$ 98	$ 87
30T	$125	$ 99	$ 89	$ 79
*8-1/4"X40TX 3/32"	$136	$ 99	$ 89	$ 79
8"X40T 3/32"	$136	$ 99	$ 89	$ 79
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**6"x40T 3/32"	$136	$ 89	$ 80	$ 71

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OUR $79 - $89 30T & 40T OUTPERFORMED (E-EXCELLENT) 23 other 40T & 50T premium blades both foreign & domestic on Ply, Melamine, MDF and Oak/Rip!

Fine Woodworking Magazine test Oct. 96 page 43

After installing your blade and 5 in. stiffener the vibration in my saw went down another 20%. I ran several pieces of hardwood through the saw, both crosscut and ripping, and was amazed at the smoothness. It was like cutting butter, maybe smoother. I have never had a saw blade that cut this smooth.

Rick Price

CHOPMASTER FOR SLIDING COMPOUNDS & MITER SAWS

New specs, 5° Neg. Pts. & flat, runs out less than .002 for perfect, tight, smooth, splinter-free miter joints.

TAKE EXTRA 10% – 20% OFF COMBO SALE!

NEW SIZES AVAILABLE	LIST	SALE
Delta Sidekick 6-1/2"x40Tx5/8"	$149	$ 89
Sears 8-1/4" & Delta 8-1/4"x60Tx5/8"	$170	$ 99
Hitachi 8-1/2"x60Tx5/8"	$179	$109
DeWalt 8-1/2" & Ryobi 8-1/2"x60Tx5/8"	$179	$109
Delta 9"x80Tx5/8"	$204	$119
Ryobi–Makita & all 10"x80Tx5/8"	$207	$129
DeWalt, Makita, B&D, Hitachi 12"x80Tx1"	$229	$139
Ryobi–Makita 14"x100Tx1"	$266	$179
Hitachi 15"x100Tx1"	$277	$189

For good general purpose cuts use Woodworker II 30T & 40T or Woodworker I. Use small stiffener where possible.

THE ONE BLADE THAT LEAVES A SMOOTH-AS-SANDED SURFACE!

SAVE ANOTHER $45 to $90 AFTER USING SHARPENING COUPONS

WOODWORKER I – CROSSCUT — 7 1/4" – 14"

For TABLE and RADIAL SAW – 10% to 20%

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10"x60Tx5/8" 3/32"K	$162	$129
8-1/4"X60T	$150	$109
8"X60T	$150	$109
7-1/4"X60T	$150	$109

OTHER SIZES AVAILABLE – 7 1/4" – 14"

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	LIST	SALE	10%	15%
6" D. 5/8" Bore **NEW**	$299	$269	$242	$229
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10" D. 5/8" & 1" Bore	$389	$349	$314	$297
12" D. 1" Bore	$499	$449	$404	$382

(Bore up to 1-1/4" Add $25 — Plus $5.50 S&H)

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5/8" HOLES. Boring up to 1-1/4" $7.50 extra. Larger holes–time basis. Shipping $4.50.

Faster feed rates & absolute splinter control. Stops splintering on OAK/ BIRCH PLY VENEERS & MELAMINE.

SIZES AVAILABLE	LIST	SALE
7-1/4"x60Tx3/32" K	$149	$129
8"x80Tx1/8" & 3/32" K	$202	$169
9"x80Tx1/8" & 3/32" K	$207	$179
10"x80Tx1/8" & 3/32" K	$207	$159
12"x80Tx1-1/8"K	$212	$181

Other sizes available

Above 1" bore standard.

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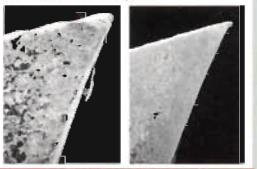
CARBIDE IS THE HARDEST OF THE C-4 GRADES AND 40% STRONGER, NOT WEAKER! FOR 50% TO 300% LONGER LIFE.

Standard C-2 Carbide (below, left) and FORREST **still sharp** Oxidation and Corrosion Resistant Sub-Micron C-4 Carbide (below, right). Each shown after cutting 3,500 feet of MDF. Similar results obtained cutting particle board, melamine, and plywood.



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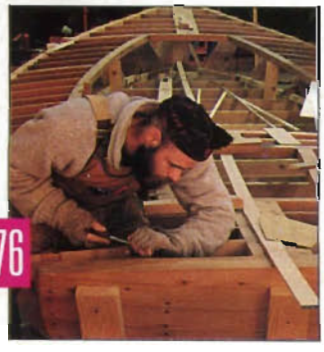
WOODWORKER'S JOURNAL

Vol. 21, No. 4 July/August 1997



PROJECTS

FEATURE

TOOLS AND TECHNIQUES

DEPARTMENTS

Cover photograhy: Studio Alex

SHOP TALK

I always find it exciting to watch our in-house projects develop from a rough idea into a design-in-progress, through its construction, and ultimately to the finish stage. That's especially true of the baby crib we present in this issue, starting on *page 34*.

If you've ever tried designing a piece of furniture or even adapting an existing design, you'll know that decision after decision challenges you at every step of the way. Our crib, for example, started out as just a crib. It evolved into a Mission-style piece about a fourth of the way through, then emerged what seems like a long time later as the Arts-and-Crafts version you see here, appointed with the very distinctive Greene-and-Greene accents.

Besides the satisfaction of producing a beautiful piece, we gained other rewards along the way. While researching turn-of-the-century furniture styles, for example, we learned how designs developed and changed during the Arts and Crafts movement. That intensely creative era makes for an interesting contrast to our current time at the opposite end of the 1900s. We raise our T-squares to those early designers—Gustav Stickley, Leopold and John George Stickley, Charles and Henry Greene, Harvey Ellis, Charles Limbert, and Frank Lloyd Wright, to name a few—for their daring leadership.

Executing this dramatic piece has given us a new appreciation for the simple beauty of Arts and Crafts styling and its characteristic use of the raw wood. It was a unique era in furniture design, and we don't see much in the way of modern-day counterparts. If you're moved to build the crib or make use of the decorative techniques we show on *page 24*, we'd like to hear from you. Also, let us know if you'd like to see more projects like this in the future.

On another matter: The electrical system that illuminates the Craftsman-style outdoor lantern featured in our March/April '97 issue was a low-voltage, outdoor-rated unit. We used a 12-volt, 88-watt transformer with timer and a 12-volt, 50-watt RV-marine bulb. Transformer prices start at around $20, and other wattages are available. You can buy these parts at a well-stocked hardware or building-supply center. Our thanks to Peoria reader Ed Reid for noting this omission.

Charles Sommers

WOODWORKER'S JOURNAL

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Why Do Some Woodcrafters Make Big Money While Others Struggle?

Hello, we're Rick and Amy Gundaker, the "Woodchuckers". We've been self employed as woodcrafters for the past thirteen years.

When we first started crafting, we really struggled just to cover our cost. We'll never forget those first craft shows. We were amazed at how some crafters were always busy selling and restocking their crafts, while many other crafters, like us, hardly sold anything. It wasn't until we learned how those successful crafters produced and marketed their crafts that we started to make some *Real Money*.

It didn't take us long to develop some quick and easy methods of our own for cutting, painting and selling our woodcrafts. In less than a year from the day we started, we were making enough money from our woodcrafting business to pay all of our personal bills, including our home mortgage. What a great feeling that was!

You, too, can make the extra money you need while enjoying your hobby. Using your basic woodworking skills, you can create great gifts and turn your woodshop into a part-time or full-time money maker. We know it can be done because we did it, and we've helped many other woodworkers make money, too!

The following are excerpts from letters we've received from woodcrafters we've helped.

"The crafts I make sell for $1.00 to $75.00. I am averaging from $400 to $600 a week, and I'm booked six months ahead. Thanks to your help."

J.R. of Muncy, PA

"My wife is a school teacher. I made her one of your cute designs to set on her desk. Other teachers saw it and she sold eleven of them before the day was over. Keep up the good work."

C.M. of Baltimore, MD

If these woodworkers can do it, you can, too!

When we sat down to develop an easy step-by-step decorative woodcrafting program, we had so many proven marketing methods, painting and woodcrafting tips and shortcuts to share with you, we ended up with two fact-filled programs. One, called *"Woodchucker's Workshop"*, is an 82-minute video, and the other is our fact-filled guide, *"Woodcrafting for Profit."*

As an example, in our woodcrafting video we make some of our fastest selling woodcrafts using our money making methods. We'll show you step by step how to lay out, cut, sand, paint and finish each project.

We'll even include a full size, easy-to-follow plan for each project we make in the video.

Plus, we'll show you...

- How to start a profitable woodcrafting business with a small amount of money
- How to choose the crafts that will sell the best
- How to give your crafts that personal touch that will increase your sales by 80%
- How much you should charge for your crafts
- How to cut your sawing and sanding time in half and increase your profits
- Which paints work the best, and which ones not to use
- How to choose paint brushes that will make your painting much easier
- How to avoid the mistakes that we made... and save hundreds of dollars
- and much, much more . . .

There's plenty of room for everyone in woodcrafting. We won't be competing with you and you won't be competing with us. That's why we would enjoy showing you how you can start your own profitable craft business using your basic woodworking skills. You can go as far as you want... *profits are virtually unlimited!*

Here is what we'll send you:

* You'll receive the *"Woodchucker's Workshop"* video with our painting and woodcrafting tips and shortcuts.
* You'll also receive the *"Woodcrafting for Profit"* guide with our step-by-step instructions to help you turn your woodcrafting skills into cash.
* Plus... we'll include thirty-five of our show tested, fastest selling woodcrafts in easy-to-follow full size plans.

Start turning your painting and woodcrafting skills into money today!

We'll send you the Video and our Guide, with 35 full size plans, to examine for 31 days, a full month, with our personal 100% guarantee. If you're not absolutely satisfied, return them within 31 days. We'll promptly refund your purchase price. No excuses. No delays.

This is the fairest way we know to help you get started.

You'll receive the 82-minute *"Woodchucker's Workshop"* video with full size plans and the *"Woodcrafting for Profit"* guide with 35 plans all for only $24.95 plus $5.00 s&h. Pennsylvania residents please add 6% sales tax.

To order, send your name, address, check or credit card number (Master Card or VISA) to: "Woodchuckers", 8042-IH Old Oliver Road, Erie, PA 16509 or call 1-800-526-2657 today!

TOOL-PRIZE DRAWING WINNER!

READER LETTERS

When my mother-in-law offered us a second silver tea set, my wife said, "Why don't you make a tea wagon?" It took me four hours of hunting through 20 years' worth of woodworking magazines that I had been saving, but I finally found it in the July/August '79 issue of *Woodworker's Journal*. I made the table out of a dogwood tree that I had cut down and milled into lumber about 20 years ago. I guess you might say this project went from "tree to tea!"

Desmond Champion-Taylory
Winfield, B. C.

I've been wanting to build the folk-fiddle project in the March/April '90 issue ever since I first saw it. I finally built it, and found that the instructions made it easier to construct than I thought it would be. I glued figured cherry veneer to the back and padauk to the sides to give it a different look. I'm in the process of building a dulcimer now, since I enjoyed making the fiddle so much. I only wish I had paid attention in music class years ago so I could play it. Keep up the good work.

Vince Russo
Hillsboro, N. H.

Enclosed are pictures of the biplane I made for my first grandson, Jeffrey, using the plans from the Jan./ Feb. '94 issue. Rather than paint the plane, I used different woods—oak, pine, walnut, cherry, and birch—and stained them to produce contrasting colors. Jeffrey really enjoys "flying high" thanks to your great plans.

Bob Prather
Aiken, S.C.

Some time ago, I subscribed to several woodworking publications with the idea that I would only keep the best one. After reviewing many, *Woodworker's Journal* won the contest. I am, however, concerned about two photos that appeared in the March/April '97 issue. First, on *page 39*, you showed a picture of a woodworker in sandals. I bet a sharp chisel dropped on those feet would get some attention.

Secondly, and this is a little more personal, someone is shown on *page 73* using a milk crate for support. I spent many years managing milk processing plants and one of our biggest problems was the theft of milk crates. At the last plant I managed, we lost approximately 60,000 milk crates per year at a cost of about $200,000. Almost all of these losses were the result of misappropriation—in other words stealing. Please don't condone this activity by showing any more misused milk crates. Otherwise, I still think your magazine is tops.

Charles H. Niver
Lebanon, Tenn.

Tool Prize

For being selected as the winner of the tool-prize drawing, Desmond Champion-Taylory will receive a Makita model 6233DWAE 14.4-volt cordless drill.

The names of readers whose project photos appear in Reader Letters are entered into a tool-prize drawing for each issue. To become eligible, send us a good photo and description of a project you've built from the pages of *Woodworker's Journal*. Send your submissions to: Reader Letters, *Woodworker's Journal*, P.O. Box 1790, Peoria, IL 61656.

Here is the pine hutch I built based on the plans in the Sept./Oct. '92 issue of *Woodworker's Journal*. I built the whole cabinet out of 1 x 12" pine except for the crown molding and beaded back panels. I have been a subscriber for many years and enjoy the magazine very much.

Laurent Riecke
Ephraim, Wis.

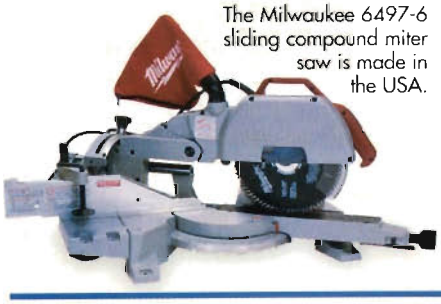
This photo shows my rendition of your Recycling Island featured in the March/April '94 issue. We do not have to separate glass from plastic so two bins were enough. I redesigned the right side to be a storage area with a shelf and a door, and used hidden hinges to match the left side. I chose red oak for the wood and finished it with three coats of Watco Danish Oil.

Arthur Johann
Stroudsburg, Pa.

Correction

Thank you for the coverage on our sliding compound-miter saw in your May/June 1997 issue. There is one error, however, that we must bring to your attention. On the chart on page 86, the country of assembly for the Milwaukee 6497-6 miter saw is listed as Taiwan. To the contrary, this saw is manufactured in our ISO-9001 approved facility in Blytheville, Arkansas, by a team of highly trained individuals committed to building superior quality miter saws. This saw has been designed, prototyped, tested, built, and assembled in the USA since it's introduction in early 1996.

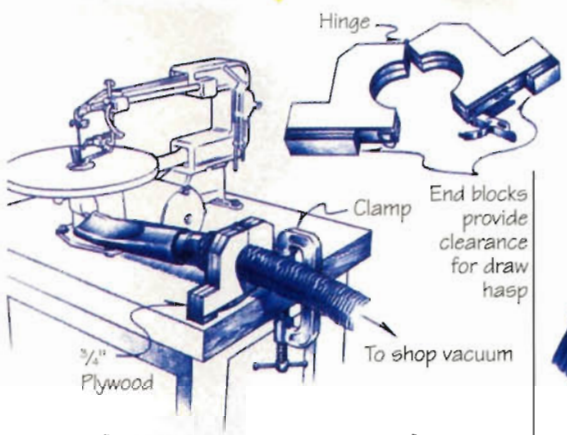
Thomas W. Smith
Product Manager,
Milwaukee Electric Tool Corp.



The Milwaukee 6497-6 sliding compound miter saw is made in the USA.

SHOP TIPS

BEST TIP WINNER!

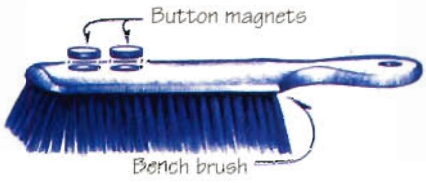


Shop-Vacuum Hose Clamp Aids In Dust Collection

For tools that lack a built-in dust collection port, I made a clamp that holds my shop-vacuum hose where it's needed. Cut the clamp to basic shape from a ¾x5x18" piece of plywood. Bore a hole in the center to match the outside diameter of your shop-vacuum hose, then cut the piece down the center. Hinge the two halves together at the top as shown and install a 1x2¾" draw hasp on the bottom edge. To complete the hose clamp, glue two blocks to this same edge to provide clearance for the hasp.

Whenever you need dust collection, clamp the end of your shop-vacuum hose in this device. Then, secure the clamp to the bench or tool so that the end of the hose picks up the dust.

Joseph Zweck
Madison, Wis.

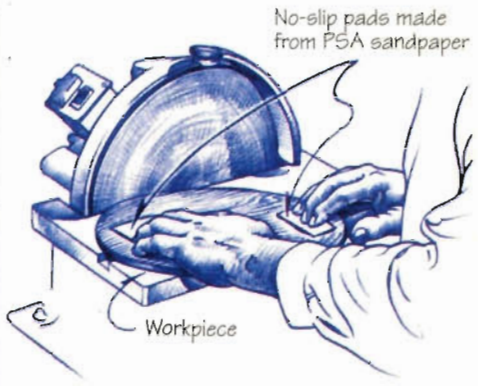


Magnets On Bench Brush Nab Iron Filings

Particles of steel or iron can scratch and discolor wood and also damage tools. To pluck these hidden dangers from my benchtop, I attach a pair of button magnets to my bench brush. To magnetize your brush, bore holes in the back of the handle with a Forstner bit, leaving them shallow enough for the magnets to stand slightly proud of the surface. Then, epoxy them into the holes.

One upside-down pass with the brush clears the bench of any minute iron filings or steel-wool filaments. And, the magnets will hold the brush securely to any stamped-steel cabinet or surface.

Howard Moody
Upper Jay, N.Y.



PSA Sandpaper Improves Grip At Disc Sander

If you own a stationary disc sander, you've probably at one time or another had the machine grab a workpiece and fling it out of your grasp. The dust created by the sander only aggravates the problem by making the workpiece slippery and hard to hold.

To improve my grip at the disc sander, I adhere small pads cut from pressure-sensitive adhesive (PSA) sandpaper. Adhere the pads to the wood, and the abrasive side will give your fingers enough purchase to control the workpiece easily and safely.

Paul Stotler
Leonardtown, Md.

Steam Bend Wood In Your Dishwasher

Recently, I started a project that called for a few small pieces of bent wood. Rather than build a steam box, I took the dish racks out of our dishwasher and ran the wooden parts through one cycle with the machine set on "pot scrub." The wood came out as limber as spaghetti and ready to bend and clamp. In order for this to work properly, however, you also need a wife as understanding as mine.

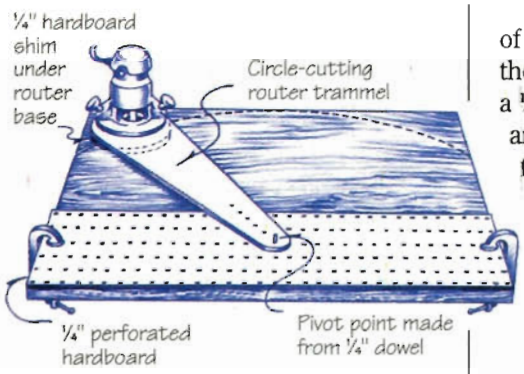
Raven LaBlanc
Oklahoma City, Okla.

Get Paid For Your Advice

For submitting the best shop tip in this issue, Joseph Zweck will receive a Bosch model 1614EVS electronic plunge router. Powered by a 1¼ hp. 7.8-amp motor, the router features a six-position variable-speed switch with speeds from 12,000 to 23,000 rpm. It's electronic variable speed controls provide a soft start and maintain the selected speed under load.

If you have a good shop tip, let us publish it. We pay $50 for every tip published, and you'll also get a shot at winning the tool prize for best tip.

To be considered, your submission must be original, unpublished, and not under consideration by other magazines. Send a description and photos or drawings that help explain the idea to: Shop Tips, *Woodworker's Journal*, PJS Publications, Inc., 2 News Plaza, P.O. Box 1790, Peoria, IL 61656. If you want the material returned, include a self-addressed, stamped envelope. You can also e-mail us at: wwjmag@aol.com

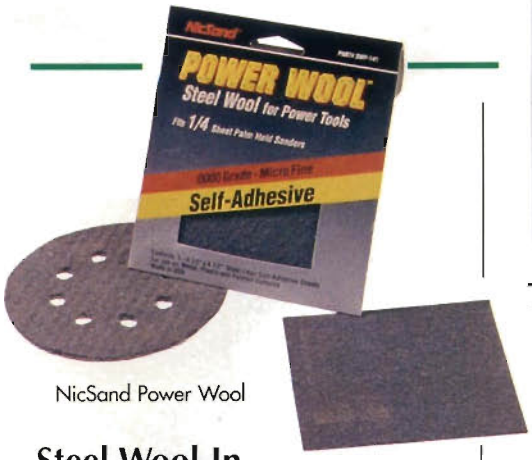


Hardboard Eliminates Hole Made by Trammel Pivot Point

A router trammel helps you cut perfect circles, but it leaves a small nail or screw hole smack dab in the center of your circle. To get around this problem, I clamp a piece of ¼" perforated hardboard to my workpiece with one of the holes positioned directly over the center of the circle. Then, I push a ¼" dowel through the trammel and into the center hole to serve as the pivot point. To keep the trammel parallel with the workpiece surface, I secure a second piece of the same hardboard underneath the router.

Mike Vincent
Littleton, Colo.

PRODUCT NEWS



NicSand Power Wool

Steel Wool In Sheet Form

Steel wool makes a great finishing material, but the traditional pad form severely limits its adaptation to mechanical applications. That's changing, thanks to a new product developed by NicSand, Inc. Utilizing new technology, the firm makes Power Wool, a steel wool in sheet form which adapts easily to fit most types of mechanical pad sanders.

Power Wool currently comes in three grades—X-fine (0), ultra-fine (00), and micro-fine (0000). It can be used on wood, metal, and plastic wherever a steel-wool product is acceptable. The manufacturer claims that Power Wool will outlast sandpaper by as much as 2 to 1.

You can buy Power Wool in 9x11" self-adhesive and hook-and-loop sheets, or precut to fit flat power-sanding tools, including ⅓ sheet, ¼ sheet, and 5"-diameter/8-hole discs. You can also cut the sheets to fit other types of sanders. Prices: Pack of three 5" discs or partial sheets, $3.29; pack of two 9x11" sheets, $4.99. Available at Home Depot, Home Base, Associated Distributors, Pep Boys, and Auto Zone outlets.

NicSand, Inc.
216/351-3333

Table Insert Serves As Router Base

If you've ever thought "there ought to be a better way" as you stopped to remove your router's base in order to mount the router on a table, take heart. Here's a better way—the Veritas router base plate/table insert.

The new 9"-diameter base plate attaches permanently to your router. You can use it as is for freehand routing or install it directly in the table. With the insert installed in the tabletop, the router mounts from below in seconds with no additional assembly or disassembly.

The phenolic base plate comes with a 1½"-diameter center hole counterbored to accept brass inserts and template guides. You center the plate on your router, then drill and countersink the mounting holes to fit it. Veritas provides a kit to help you center the plate and detailed instructions on how to rout the hole and support ledge in the tabletop. If you make an error, they'll send you another plate free. The base plate lists at $21.95.

Veritas Tools, Inc.
Distributed by
Lee Valley Tools, Ltd.
800/871-8158.


Veritas router base plate/table insert

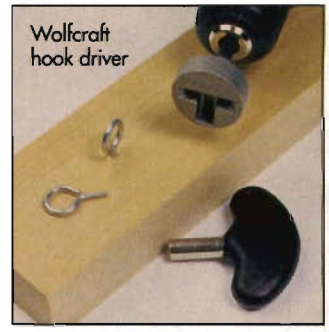

APEX power-drive bits

Industrial-Quality Drive Bits

If you get frustrated working with bad drive bits that wear quickly, camming out in expensive screws and sometimes damaging your project in the process, check out the APEX line of power drives marketed by Cooper Power Tools.

Unlike many low-tech bits, Cooper precision-machines and heat-treats these bits for durability and extended work life. Because of their hardness, they're widely used in aircraft and automobile manufacturing. They come in different lengths and a wide range of drive configurations, including Phillips, slotted, Torx, Tri-Wing, and square recess. Prices vary. Available at major industrial tool distributors.

Cooper Power Tools
803/359-1200


Wolfcraft hook driver

Hook Driver Solves Problem

Driving hooks of various shapes and sizes to hang plants, lighting fixtures, or outdoor swings just got a lot easier thanks to this new tool from Wolfcraft. With the hook driver, you can drive virtually any type of hook you can buy. Its ¼" hex shaft fits standard driver and drill chucks. A custom-molded handle comes with the driver for applications that require manual driving. Price: $4.99. Available at hardware and home supply centers.

Wolfcraft
630/773-4777

DeWalt 12½" portable thickness planer, model WD733

Feature-Laden Thickness Planer

If you're in the market for a benchtop planer, make sure you check out DeWalt's new DW733. This machine uses four cornerpost supports and a new head-lock to hold the cutting head securely against the posts to minimize snipe. A 15-amp motor powers the unit. You'll also find tool-steel knives that can be resharpened, a turret-type depth stop similar to those found on plunge routers, a magnified depth scale, and a stock-removal scale that indicates how much material is being removed on each pass. The new planer will be available this summer.

DeWalt Industrial Tool Co. 800/433-9558.

Black & Decker Build-a-Set

Nifty Accessories Carrier

Now that cordless drills can go anywhere, we have a new problem: how to make our growing supply of drivers, sockets, and bits equally portable and keep them organized. Designers at Black & Decker have a solution—the Build-a-Set accessory storage system.

You can carry this compact, 6x3x8" bit-organizing case wherever you go. Although the case has room to store a number of accessories on the inside cover faces, it also accepts up to four extra holder pages that provide serious capacity. Each page snaps in and out.

You'll find Build-a-Set at hardware stores and building supply centers that carry Black & Decker tools.

Black & Decker Corporation 800/544-6986

Power Oscillating Drill

Sears' new 8½" benchtop drill press is one of the first to offer integral oscillation sanding, grinding, and polishing. Simply lock the mandrel of a spindle-sander drum in the ½" chuck, lock in the small drive belt, and you're ready to sand. The ⅓-hp unit offers five drilling speeds (620 to 3100 rpm) and five oscillating sanding speeds (13 to 62 strokes per minute) and has 1¾" of quill travel for drilling and ½" of travel for sanding.

The drill comes with a 6¼ x 6½" cast-iron table fitted with a 2" dust-collection port, a cast-iron base with built-in storage and bench-mounting holes, four table-insert rings, and a sanding drum mandrel. Price: $149.99.

Craftsman drill press/oscillating sander, #21331.

Sears Craftsman 1997/98 Power and Handtools catalog. 800/377-7414

CLUB SPOTLIGHT

Western Ohio Woodworking Club

Dayton-based group packs plenty of purchasing power

A sampling of the projects built in recent years by members of the Western Ohio Woodworking Club.

The deep hardwood forests of western Ohio have fostered several centuries of talented woodworkers. But it wasn't until 14 years ago that the current generation of craftsmen banded together to form the Western Ohio Woodworking Club. Now 250 members strong, this Dayton-based organization keeps members busy with a full slate of social, educational, and recreational activities.

One of the biggest benefits of membership, according to club president Jim McCann, is the group's joint-purchase program. Members Bill Thompson and Max Marshall, who head up the program, travel to Chicago every August to wheel and deal for woodworking tools and materials at the National Hardware Show. "The club can put in orders for dealer-sized quantities and get dealer-sized discounts," says McCann. "In the past 10 years, our club members as a group have purchased more than $250,000 worth of goods."

Meetings and Seminars

The club organizes meetings a bit differently from most other woodworking groups. Rather than mix business with pleasure, the club's steering committee convenes once a month to take care of administrative matters. The entire club, however, meets every other month for a six-hour Saturday session of woodworking presentations. These meetings usually feature two or three presenters and leave plenty of time for questions after each speaker. To keep in touch between meetings, the group also gets together for a monthly luncheon and holds an annual picnic in the summer.

Besides the bimonthly meetings, the club hosts two in-depth woodworking seminars each year, one in the spring and one in the fall. These typically last for a full day or two. "We bring in nationally known woodworkers and also use some of our home-grown talent for these events," says McCann. Recent guests have included craftsman Kelly Mehler from Berea, Kentucky, woodworking instructor Marc Adams, and club member Nick Engler, who has authored several woodworking books.

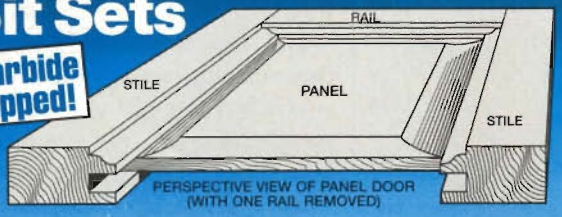
As if these activities weren't enough, the club also conducts open-shop days. One Saturday a month, members with unusual or interesting workshops open their doors to fellow members. Scott Phillips, host of the American Workshop television show and a club member, recently invited the group to tour his woodshop/television studio. George Reid, the club's best-known octogenarian and a respected authority on antique restoration and reproduction, also opened his shop, which houses a considerable collection of vintage woodworking machinery.

A Cap On Membership

For most of the club's 14 years, members have held their bimonthly meetings in the carpentry shop at Miami Valley Career Technical Center, a vocational training facility for high-school students. As this relationship grew, the club began donating tools to the center's woodworking program. "Since we're a non-profit organization, we zero out our budget at the end of the year," says McCann. "And every year or two, if there is any money left

Continued on page 14

Save 55% on MLCS Raised Panel Door Bit Sets



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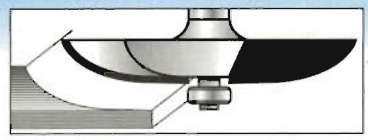
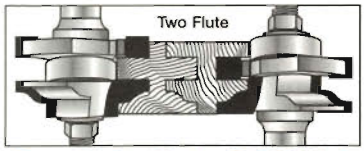


✶Raised Panel Router Bit



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✶Ball bearing included

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#1331 3/4" Dia. of Circle $21.00

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#1340 1/2" Dia., 1" Cutting length. $15.00
#1341 3/4" Dia., 1" Cutting length $17.00

5 ROUND OVER
#1314 (1/8" Radius) $11.00
#1315 (3/16" Radius) $11.00
#1394 (1/4" Radius) $13.00
#1316 (5/16" Radius) $14.00
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6 FLUSH TRIM
#1337 3/8" Dia., 1" Cutting length. $8.50
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7 RABBETING KIT
Change ball bearing guides and select 4 depth of cuts: 3/8", 7/16", 5/16", 1/4". Set: 1/4" shank rabbeting bit, 4 bearings (3/8", 1/2", 5/8", 3/4") and hex key.
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Set #	Description	Shank Size	Price
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Continued from page 12

over, we use it to help the school with their tool purchases."

The carpentry shop, however, limits the seating capacity for meetings, which has forced the club to cap its membership at 250. Even though it takes three to five years to get in, the waiting period doesn't seem to dim the enthusiasm of the 30 or so people on the list. "Many of the people we sign up are still a few years away from retirement and just starting to gear up for woodworking," says McCann. "By the time they get into the club, they're better prepared to take full advantage of all our activities."

Toys For Hospitals

Like many such groups, the Western Ohio Woodworking Club runs a volunteer toymaking program to help out kids in need. According to McCann, members make about 400 toys a year and donate them to the nearby Children's Medical Center and the Wright-Patterson Air Force Base Medical Center. Some members design and build toys individually, while others get together in groups to mass-produce one or two items.

This year, the group crafted a batch of lap desks, then filled them with crayons and art supplies for their bed-bound beneficiaries. One of the Medical Center's all-time favorite toys, a walnut and ash wagon made by members Al and Patty Combs, gets a regular workout wheeling kids around the halls of the hospital.

Annual Showcase Of Talent

If you are interested in seeing first-hand some of the work created by members of the club, you'll find their projects prominently displayed at the annual Artistry In Wood show, held the weekend before Thanksgiving at Dayton's Hara Arena.

To get information on joining the club, contact Jim McCann at 7744 Sweet Potato Ridge Road, Brookville, OH 45309, telephone 937/884-7670.

The Dremel Contour Sander. It does jobs your hands won't touch.

The new Contour Sander from Dremel means an end to hand sanding. The quick-change contours are available in eighteen unique shapes and can be easily customized so there's nary a nook or cranny you can't sand. It's compact, lightweight, and with variable speeds up to 8,500 strokes per minute, it does jobs fast and easy. Even tough projects you'd never have tackled before. Get the versatile new Dremel Contour Sander at major hardware and home center stores. For more information and your nearest retailer call Dremel at 1-800-437-3635.

SHOP TEST

EUROSHOP C-300

ONE PACKAGE, FIVE DIFFERENT MACHINES

One doesn't often see a combination machine in a woodworking shop in the U.S., but you'll find plenty of them in professional use throughout Europe. The EuroShop C-300, imported from a manufacturer in Europe by Old World Machinery Co. of San Clemente, CA., combines a tablesaw, jointer, planer, shaper, and mortiser in one machine. Three 220-volt, 3-hp motors power the various tools. The tablesaw and shaper drive off their own motors, while the jointer, planer, and mortiser all share the third. (See the chart on *page 20* for machine specifications.)

Before you try to uncrate a EuroShop C-300, enlist additional help. Maneuvering this 1,125-lb. machine off the shipping skids is no easy feat, and the two major subassemblies—the sliding cut-off table and the mortising table—weigh a lot by themselves and can be cumbersome to install.

After assembly and cleanup, I got out my straightedge and feeler gauge and found most of the cast-iron surfaces machined to good-to-excellent tolerances. On the tablesaw top, I detected a slight front-to-back bow (.008") and a small side-to-side crown (.006"), *but both* fall within acceptable variances and won't affect cut quality. The jointer and mortising tables on our machine also proved very flat, both showing less than .002" of variance across their widths.

Tablesaw Has Scoring Blade Attachment

The C-300's tablesaw accepts blades of up to 12" in diameter, giving it a generous depth of cut: 3 ¾" at 90° and 2 15/16" at 45°. But you needn't ditch your collection of 10" blades. The EuroShop accepts them too, and the optional scoring-blade attachment works only when paired with a 10" blade *(photo A)*. One notable shortcoming of the saw arbor: you can't mount a dado head on it.

It took a while to figure out how to attach the scoring blade attachment, and the instruction manual didn't help much. Anyone not familiar with this accessory probably will have to call the dealer for help. However, once mounted, it did a great job of preventing splinters and tearout when sawing sheet goods. Adjusting and aligning the scoring-blade proved simple, quick, and accurate. It's an expensive option—about $235—but I was pleased to see it offered. It makes the EuroShop that much more of a professional-grade machine.

The sliding table travels on a pair of 76"-long machined steel rails and is a joy to use: rock-solid and silky smooth *(photo B)*. Wipers on the ball-bearing guides keep the rails free of sawdust. The telescoping crosscut fence has two adjustable stops and seven miter-locking positions. There's also a cam-type clamp on a sturdy steel post to secure workpieces to the table quickly and positively. *continued on page 18*

Editor's Note

This is the second combination machine review. For information on the Robland X31 machine, see *page 16* in the May/June '97 issue.

Continued from page 16

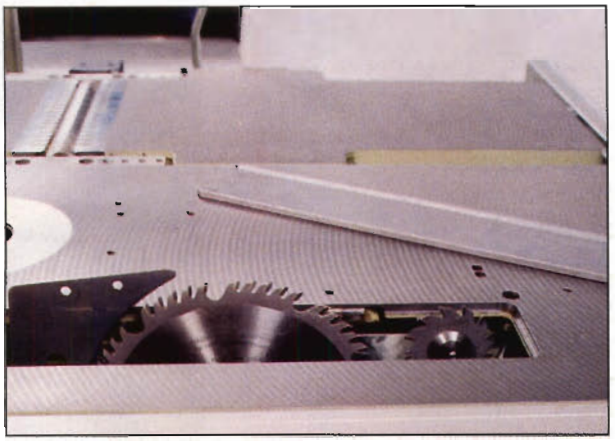


Photo A: The small scoring blade cuts a shallow kerf ahead of the main blade to minimize chipping and tearout in sheet goods.

The handwheels that tilt and elevate the saw blade turn smoothly and easily. The elevation mechanism, however, does not lock in place and as a result tends to creep downward, especially when the blade is tilted.

Two Separate Fences

Rather than share a fence, as do the tablesaws and jointers on some machines, the EuroShop comes with two separate fences: a rip fence for the tablesaw and a taller one for the jointer. Having both eliminates the tedium of resetting the fence over and over again if you're jointing and ripping a lot of boards.

The tablesaw's square steel-tube rip fence extends the full length of the table, providing support right to the end of a long rip. The edges of the EuroShop's rip fence are radiused, however, and may pinch the edges of thin stock between the lower edge of the fence and the tabletop. When necessary you can eliminate this shortcoming by bolting a wooden auxiliary fence to the steel tube.

Jumbo-Sized Jointer And Planer

If you've ever wanted to turn big timbers and roughsawn boards into accurately milled stock, the EuroShop's 12" combination jointer/planer can do it. The knives on the cutter head were not set when I unpacked the machine. But the manufacturer includes a gauge that straddles the cutter head, and the knives are spring-loaded, making accurate knife-setting quick and simple. The standard machine comes with a three-knife cutter head, but you can order a four-knife version as an option.

Both the planer and jointer have accurate, easy-to-read depth-of-cut scales. The EuroShop planer also comes with a feed-roller shutoff lever that disconnects the drive system during joining operations should you get something caught in the cutter head or experience other unexpected trouble.

Photo B: The EuroShop C-300 we tested came with the medium-size table. It can also be ordered with a larger or smaller table.

To joint or plane long stock, you have to walk around the mortising table to retrieve the workpiece. This isn't a problem if you machine only a few pieces. But, if you're gearing up to do a lot of work, I suggest removing the mortising table. This table is heavy, but you can unbolt and remove it in just seconds.

The jointer comes with a spring-tensioned pivoting-

type guard like those found on most jointers sold in the U.S. However, you may need to remove it occasionally to rip wide panels or crosscut long stock because the jointer tables sit flush with the tablesaw table and the guard sits on top of the tables.

The jointer fence handles angled work with two possible options. For 45° and 90° angles, the fence mounting can be changed to either face. For minor angle changes, a pivoting protractor head can be used.

Precise Thicknessing

To use the planer, you unlock and tilt the jointer tables up and to the side, then flip over the dust-collection hood and crank the planer bed up to the desired height *(photo C)*. Elevating the bed from the maximum to its minimum height (9 ⅛") requires a lot of tedious cranking. However, this extra-fine adjustment ratio pays off when you want to skim off a few thousandths of an inch.

Walking around the flipped-up jointer tables to retrieve stock is a bit bothersome. But this design limitation is one you'll also encounter on other combination machines.

The EuroShop comes with aluminum noise-reduction inserts mounted on the jointer infeed and outfeed tables just above the cutterhead. They do a fairly good job of muffling the howl that emanates from the cutter-head opening when using the machine along with a powerful dust collector.

Horizontal Mortising

The mortising table moves on sleeve bearings. The action was stable, smooth, and accurate *(photo D)*. The guide handles are positioned where they won't bump into angled or wide stock. To hold the workpiece, you borrow the cam-clamp from the tablesaw's sliding table.

The cast-iron mortising table has no provision for stops or fences other than a short milled lip on the table front. I built my own auxiliary

continued on page 20

Continued from page 19

top and clamped it to the top surface. The ⅝"-diameter mortising chuck is an extension of the jointer/planer head so it rotates opposite the direction required for router bits. It requires using special bits or end mills which can be ordered from Old World Machinery or Whiteside Machine Co. (See Sources at the end of the article.)

Shaper Takes Router Bits and Shaper Bits

The EuroShop shaper offers four operating speeds that are set by repositioning the belt on a step pulley. Moving the belt on the pulley proved fairly easy. An arbor-locking bar eliminates the need to raise the spindle all the way to the top when changing cutters. You do, however, have to get on your knees and open a side panel door to insert the bar.

The arbor accepts only 1¼"-bore shaper cutters (the largest and most expensive size). The machine comes with an excellent router-bit collet for ½"-shank router bits *(photo E)*. The shaper motor can also be reversed. The arbor's top speed—9500 rpm—is fast enough for most large and medium-sized router bits. The shaper's low-end speed (1,900 rpm) works well with drum-sanding attachments. To rout or shape end grain, workpieces can be guided perpendicular to the shaper fence using the tablesaw's sliding miter table.

In setting up the shaper to use, I found that the table inserts around the shaper arbor fit a bit too tightly. I filed the edges of some inserts, but this was an easy enough job. (I'd rather have a tight fit I can fix than a loose one I can't.) Otherwise, the shaper ran smoothly and performed well. I also liked the shaper fence hold-down and hold-in bars because they can be flipped up and out of the way as a unit by loosening a single knob.

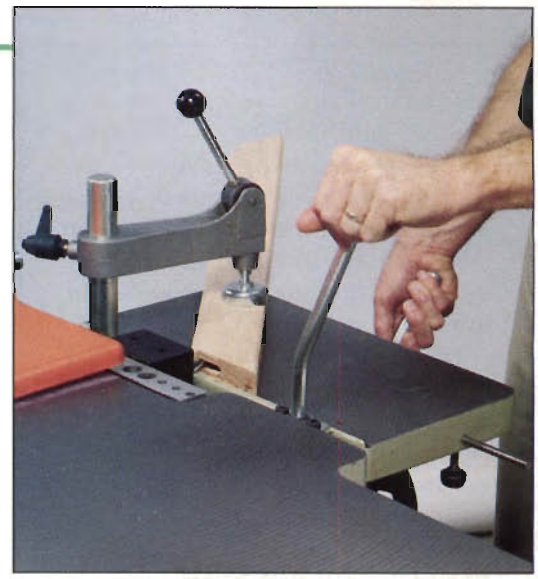


Photo D: Two long but unobtrusive handles guide the mortising table front to back and side to side. The workpiece clamp is borrowed from the tablesaw.

Switches and Mobility

The main control panel on the EuroShop C-300 sits directly in front of you as you stand in front of the tablesaw. Changing the power from one machine to another requires three steps. First, select the machine you want on a rotary switch. Next, connect the main power switch. Then rotate the on/off switch. If not changing machines, you simply turn the on/off switch to on. For safety and convenience, shut-off switches have also been placed on two other sides.

The optional mobility kit for this half-ton machine, priced at about $140, is well-designed and easy to use. The two main wheels are positioned under the machine out of the way. This allows backing the long edge of the jointer up against a wall without turning the machine. The

continued on page 22

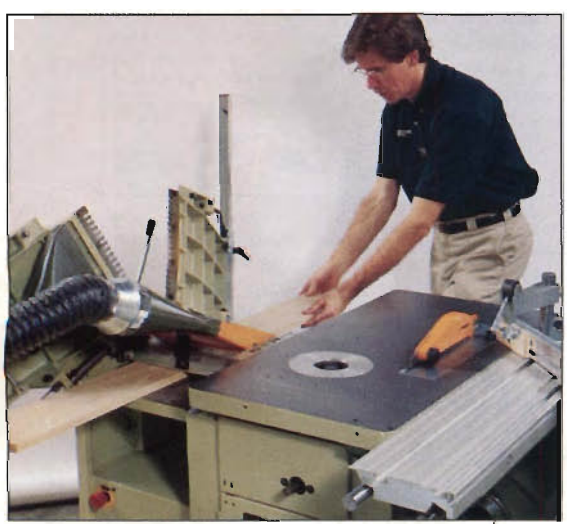


Photo C: To reach the thickness planer, flip up the two jointer tables. Then, crank up the bed and reposition the dust collector.

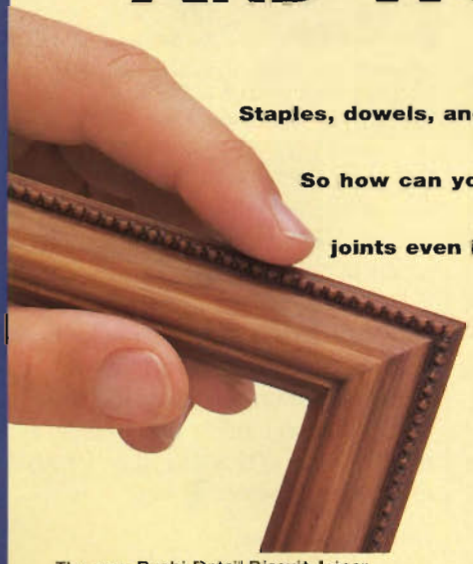
EuroShop C-300 Specifications

Tablesaw	
Max. blade diameter	12"
Blade RPM	4,000
Max. cut depth–90°	3¾"
Max. cut width (with sliding table)	31½"
Max. rip capacity (right of blade)	31"
Jointer	
Table width	11 13/16"
Table length (infeed plus outfeed)	58 12"
Head RPM	6000
Number of knives	3 or 4*
Planer	
Width	11 13/16"
Max. height	9"
Max. cut depth	13/16"
Stock feed rate	23 fpm
Head RPM	6000
Shaper	
Spindle diameter	1¼"
Vertical travel	5⅜"
Max. cutter dia. (recessed)	7"
RPM	6000
Mortiser	
Table size	8⅜ x 17"
Table travel, left to right	6 7/16"
Table travel, up and down	4"
Depth of cut	4½"
Chuck capacity	⅝"
Chuck RPM	6000

* A 4-knife head is optional

THE NEW RYOBI DETAIL BISCUIT JOINER

THE DIFFERENCE BETWEEN WOODWORKING AND WOODNOTWORKING.

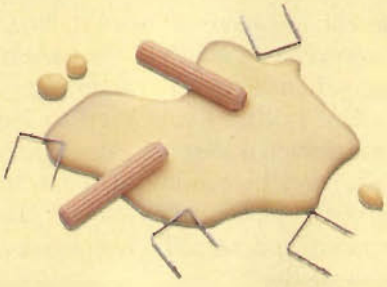


The new Ryobi Detail Biscuit Joiner uses miniature "Accu-biscuits" for neat, tight, professional joints.

Staples, dowels, and glue won't do. Standard-size biscuits won't fit.

So how can you make neat, tight, professional joints even in small stock? With Ryobi's new Detail Biscuit Joiner, that's how.

Standard biscuits stick out of small joints, and the mis-match shows, even after you trim the excess.



This compact powerhouse cuts smaller slots and uses miniature "Accu-biscuits™" to fit where standard biscuits don't. And its price is as small as its biscuits. But the Detail Biscuit Joiner is big on performance, from its beefy motor to its die-cast base and see-through fence. So see the new Ryobi Detail Biscuit Joiner at your local home center. It'll get your wood working like never before.

Ryobi "Accu-biscuits" (actual size).

The Ryobi Detail Biscuit Joiner does everything that a bigger tool does, and fits in small joints where a bigger tool won't.

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Continued from page 20

steering handle also serves as a lever to raise the machine so you can flip up the wheels. Then the machine will sit on steel feet giving it a solid base.

My Conclusions

A couple of things annoyed me. For one, the machine comes with only two handwheels, but there are five places where you need them. To switch operations to a different machine, a handwheel must be taken off its stem at one location and moved to the new location. The wheels, secured by O-rings, remove easily enough, but a full compliment of handwheels would make life easier.

This was a major hassle while setting up the machine and testing different operations. In more routine use, however, one switches wheels less frequently, making it less annoying.

The ratchet levers used to loosen and tighten some parts, also frustrated me. I find them awkward to use, and in several places they were closely spaced and actually interfered with one another.

None of these shortcomings, however, detracts from my overall impression of the EuroShop as a first-rate machine. The quality of the castings and machine work was uniformly excellent, and the fit and finish clean throughout. The extras, like the scoring blade and the tablesaw's 12" blade

Photo E: The shaper spindle accepts 1¼" shaper cutters or, fitted with the collet shown at right, ½"-shank router bits.

capacity, gives a home woodworker advanced capabilities that once could be had only on machines costing thousands of dollars more.

Depending on the options and accessories ordered, the EuroShop C-300 costs between $6,000 and $7,000. As a one-time layout, that may seem steep, but given the quality, capabilities, and performance of this machine, I consider it a terrific value. WJ

Tested by: *Dick Coers*
Written by: *Tom Jackson*
Photographs: *Randall Sutter*

SOURCE

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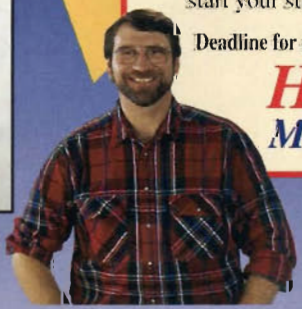

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MAKING DECORATIVE PLUGS AND INLAYS FOR ARTS AND CRAFTS STYLE FURNITURE

Using a plunge router and plywood templates, you can grace any project with these signature accents

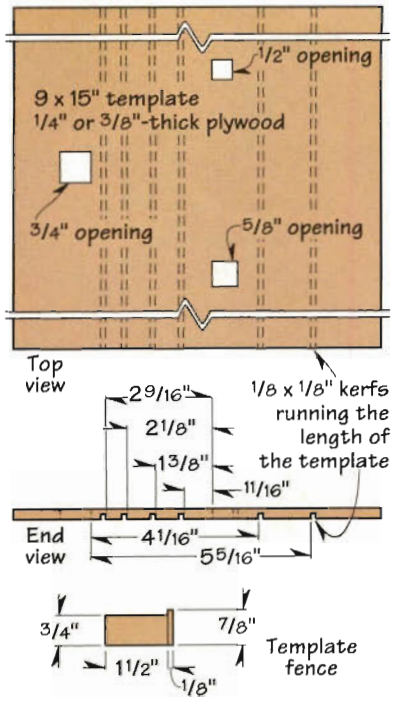
Ebony pegs unmistakably mark a Greene and Greene furniture piece. The noted furniture designers used these accents as a decorative variation of the pegged mortise-and-tenon joint and as plugs to cover screws and other fasteners. To focus attention on their designs, Charles and Henry Greene specified that the pegs be trimmed slightly proud of the surface and then rounded over with a light sanding. Their use of accented joinery had a major influence on other turn-of-the-century furniture.

In building our Arts and Crafts-style crib shown on *page 34*, we devised a way to make plugs in the Greene and Greene style. Our technique, however, calls for a router and other modern tools to mass-produce the 98 plugs and two inlay strips specified for the project. We also dressed up the plugs a bit by sanding them to a crisply defined, pyramid-like profile. Four distinct facets make each plug more visible and fit in nicely with the hardware and other design elements of the era. These plugs do not run clear through the joints as some old-style pegs did, so you can position them anywhere on a piece without complicating the joinery.

Our plugs and inlay strips glue into ¼"-deep holes that you rout using plywood templates—one template for the three different plug sizes and the other for the long inlay slot. You'll need a plunge router, a ⅛" straight or spiral bit, and a ⅜"-o.d. guide bushing.

Make the two templates from ¼"- or ⅜"-thick plywood. Just be sure your guide bushing is shorter than the plywood's thickness and that the bit will protrude far enough to rout ¼"-deep holes. If necessary, cut or grind some length off the end of the bushing.

Figure 1 Plug routing template



To align this many plugs accurately your template's openings must be cut perfectly square and parallel with its edges. This requires a tablesaw with a good rip fence. Run some test cuts on scrap stock to make sure your fence parallels the saw blade. If it doesn't, fine-tune the saw. (For help with procedures, see "Fine-Tuning Your Tablesaw" in the March/April '96 *Woodworker's Journal*.)

Cut the Openings In the Plug Template

First, cut an accurately squared plywood or particleboard template blank about 9x15". Lay out the three square openings on the blank and run all lines out to the edges as shown in *photos A* and *B*. Note: Cut the openings ⅛" larger on each side than the holes that you'll rout later. This compensates for the router guide bushing.

Lay the long edge of the template against the fence, marked face up. Lock the fence in position so that when you plunge-cut up through the template, the kerf just touches the inside of one of the layout lines for the ½" opening. Lower the blade below the tabletop and secure the template with a hold-down.

Turn on the saw, then raise the blade until it cuts through the top face of the template and just touches the two layout lines perpendicular to the line you are cutting (photo A). If you miss the marked line slightly, don't worry. You'll take the next measurement off your rip-fence cursor, not the layout lines.

Lower the blade and turn off the saw. Without moving the rip fence, reposition the template, then plunge-cut the first line for the ⅝"-square opening. This will give your ½" and ⅝" openings a common line along one edge, which will come in handy later as a reference point for aligning the template.

Note the position of the cursor on your fence. To cut the second kerf for the ½" opening, move the fence over from the original cursor position ½" minus the thickness of your saw blade. Then, make your plunge cut. Do the same, with adjusted measurements, to make the second cut for the ⅝" template opening. Reset the fence and repeat the procedure to cut the two parallel lines for the ¾" opening.

Turn the template 90° and reset the fence to cut the lines that run perpendicular to the first six lines you cut (photo B). Again, use your rip-fence cursor to gauge the distance between pairs of lines. On this second set of lines, overcut just enough to free the small square waste section in the center of the opening. To avoid weakening the template, keep overcutting to a minimum.

Index the Fence For The Plug Template

To use the template, you'll need to affix a fence to its underside. That way you can hold the fence flush against the outside edges of the crib parts as you rout the plug holes.

To make the fence, joint one edge of a scrap piece of 1x2 the same length as the template. Then, glue a piece of ⅛x⅞" stock to the jointed edge so that

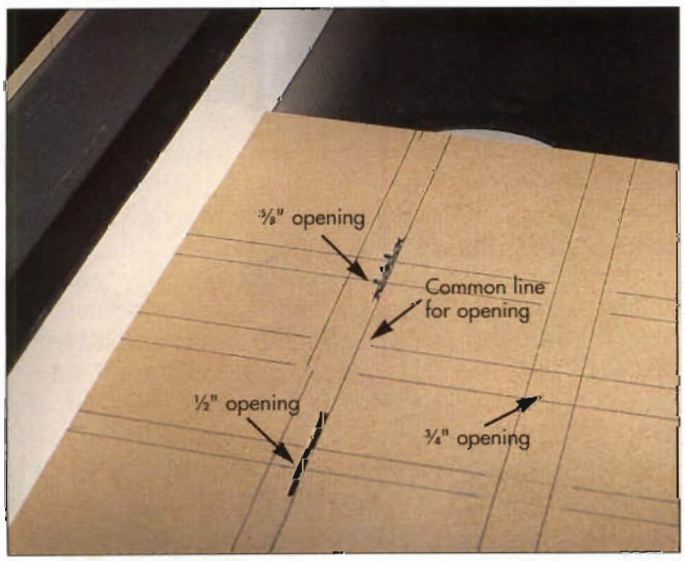


Photo A: For square cut-outs, start by plunge-cutting parallel lines on the template using the tablesaw.

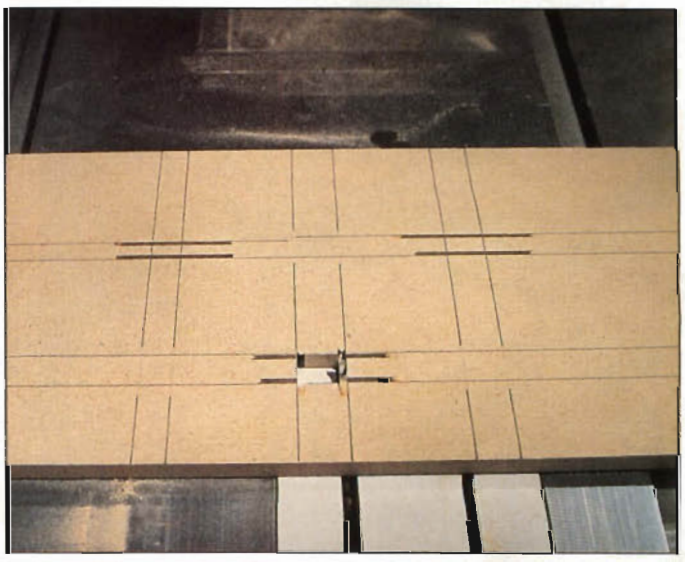
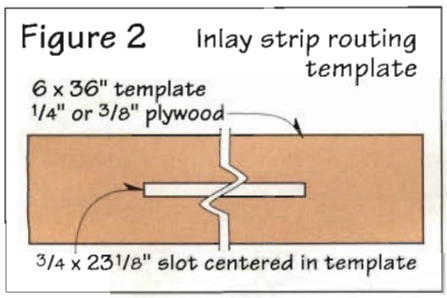


Photo B: Overcut the second set of parallel lines on the template just enough to break the waste free from the openings.



you have a ⅛x⅛" lip protruding above the 1x2", as shown in *figure 1.*

Next, cut ⅛x⅛" kerfs along the full length of the template's underside where shown. These kerfs will accept the lip on the fence, enabling you to index the template at various distances from the edge of the crib.

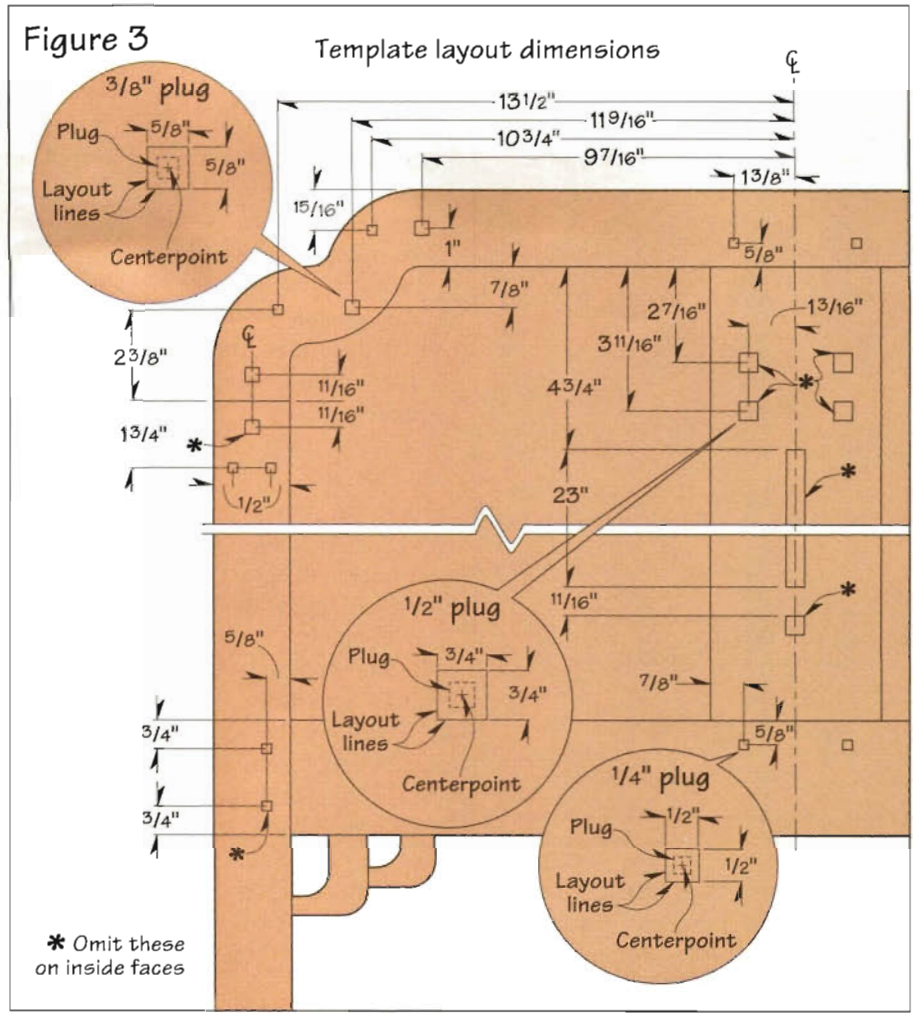
Make a Template For the Inlay Strip

While you're still on the tablesaw, cut the template for the long inlay strip, as shown in *figure 2.* Start with a piece approximately 6x36". Don't skimp on the width; a narrower template may flex sideways.

Lay out the opening on one face of the template, again carrying all the pencil lines to the outside edges of the plywood. Then, plunge-cut the opening using the tablesaw technique we described earlier.

Pencil In Your Layouts

Now that you've made the templates, lay out the locations for all plugs and inlay strips on the crib end panels, as shown in *figure 3.* Draw the centerlines first, then come back and draw in the appropriate template opening locations for each plug by measuring an equal distance right and left of the centerline. Note that the ¼" and ⅜" plugs go on both faces of both panels, but the long inlay strip and ½" plugs go only on the outside face of each panel. (See the End Frame drawing of the crib on *page 36.*)



When drawing these lines, don't pencil in the actual plug sizes. Instead, draw your lines to position the appropriate opening of the template, which will always be ⅛" larger on all four sides than the plug and its hole. (See *photo C.*)

Since the template and fence control the lines running parallel to the grain of the pieces, these layout lines need not be measured to pinpoint precision. Your cross-grain lines, however, must be measured and marked precisely. One exception: On the center stile plug locations, the template controls the lines running perpendicular to the grain. Be sure to accurately measure and mark the lines running parallel to the grain on these pieces.

After you've marked your lines, draw an "X" over the plug-hole area to be routed out. Keep your attention focused as you mark these lines. You've invested a lot of time in these crib panels and you don't want to make a mistake now.

Note: If you now measure from the edge of the crib to the outside lines running parallel with the grain, you'll notice that most (but not all) of these distances correspond to distances between the openings and kerfs on the bottom of the template. To get the fence positions that were too close together for kerfs, we used the existing kerf/fence settings with scrapwood spacers between the fence and the crib as follows:

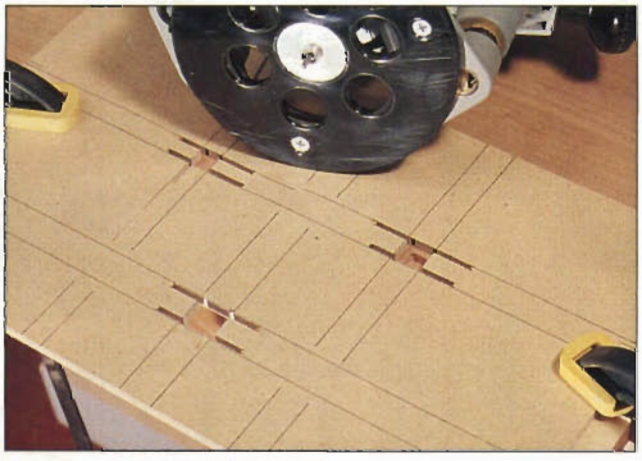
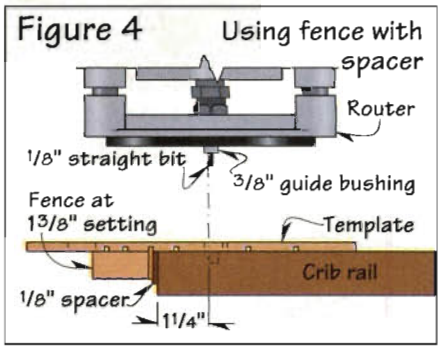
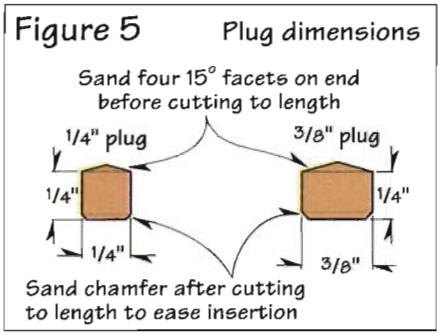


Photo C: The layout lines mark the position of the template opening. Because of the bushing, the router cuts a smaller hole.





For the layout lines that are located 1¼" from the outside edge, we used the 1⅜" fence setting plus a ⅛" spacer, as shown in *figure 4*. To get the 1⅛" distance, use the 1⅜" setting plus two ⅛" spacers. For the ¼" setting, use the 1⅜" setting plus a 1⅛" spacer. For the ½" plugs, use the 5 5/16" fence setting plus two ⅛" spacers to get the 5 5/16" distance.

Machine the two ⅛"– and one 1⅛"–thick spacers as long as the template and slightly wider than the fence is thick. Check the thicknesses of your spacers with dial calipers or some other accurate measuring device.

Rout the Holes and Grooves

After completing the templates and layout, clamp the fence to the template, clamp the template to a long piece of scrap, and give the system a test run. Rout one hole using each of the three openings to ensure that the bushing travels freely and that you get clean, accurately sized holes with 1/16" corner radii. Also, rout at least one hole at each fence setting and also try out the spacers to verify the template's accuracy. Note that on the ½" plugs, you rotate the template 180° and place the fence on what had been the inboard edge of the template.

When you're satisfied with the template and setup, attach the template to the crib and rout the plug holes ¼" deep. Rout all of the holes that use the same fence setting before moving the fence. Move the router in a clockwise motion, and blow out any chips or dust that might interfere with the bushing. Check that each hole is clean and complete before you unclamp the template. Note: To rout away the waste material in the center of the long inlay, switch to a ⅝" bushing and a ¼" router bit after outlining the shape with the ⅜" bushing and ⅛" bit.

Don't worry about chiseling the corners of the plug and inlay holes square. We found it easier to radius the plug edges to fit the hole profiles.

Prepare the Plug Stock

For the plugs, cut three pieces of walnut that are about ½ x 1 x 32". Plane two of them to ¼" thick, the third to ⅜" thick, sneaking up on the final thickness. Trim off the snipe, test-fit the pieces in their holes, and then rip the pieces to a width equal to their thickness. Round the edges using a 1/16" round-over bit or sandpaper.

Crosscut the three lengths of plug stock into 8"-long strips. Using a fine-grit abrasive, sand four 15° facets on both ends of each 8" strip *(photo D)*. As shown in *figure 5*, the resulting profile should resemble a flattened pyramid. Don't worry about sanding the first facet perfectly. Just sand each subsequent facet until they meet at a point on the top.

Make two carrier boards from ¾" plywood (one for the ¼" plug stock, one for the ⅜" stock) to hold these strips securely as you cut them on a power miter saw *(photo E)*. Cut a full-length groove in each carrier board about 2" from one edge, making it slightly wider and deeper than the thickness of the stock. The groove should be wider than the thickness of the plug stock by about the thickness of a piece of paper.

Position the carrier board so that the miter-saw blade comes down about 1½" from the right end. Next, set the saw's depth-of-cut stop so that the blade cuts through the groove but not through the carrier board. Clamp the carrier board to the saw's table and cut a kerf across the top face of the carrier board. Now, mark a line ¼" from the right edge of this kerf.

Slide the plug stock into the groove in the carrier board with the shoulders of the pyramid on the marked line. Then, cut a plug to length from both ends of each piece of stock. Shape the

Photo D: Using the miter gauge as a guide, touch the ends of the plugs lightly to the sanding disc to create four triangular facets.

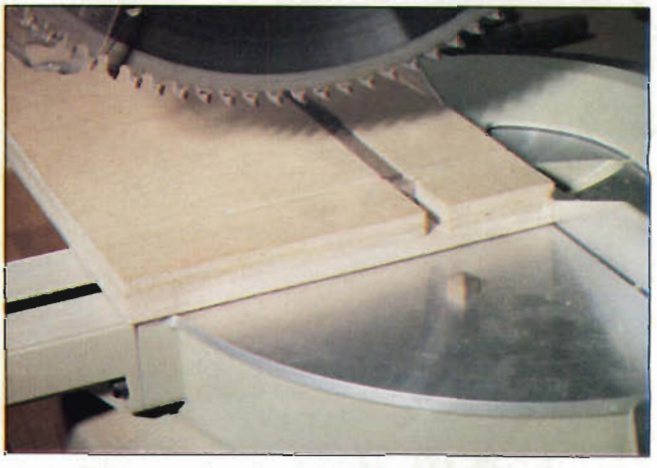


Photo E: Use a carrier board to cut the ¼"-long plugs safely.

Special Techniques

Continued from page 27

now square-ended strip of plug stock again on the sander, then crosscut another pair of plugs. Continue sanding and crosscutting until you've made the needed number of plugs (60 of the ¼" plugs, 28 of the ⅜" plugs, 10 of the ½" plugs) plus a few extra.

Note: We purposely oversized these plug strips by 3" to 4" in length to keep your fingers a safe distance from the miter-saw blade. Toss the short stubs in the scrap bin—don't try to cut them.

Machine the Inlay And ½" Plugs

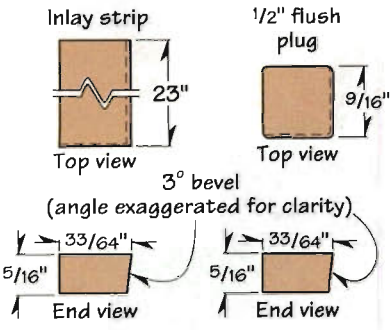
Unlike the ¼" and ⅜" plugs, with their end-grain pyramids standing proud of the surface, the ½" plugs and long inlay strips present face grain to the viewer and get trimmed flush with the cherry face. We also tapered the edges on these pieces so you can tap them snugly into their openings. (See *figure 6.*)

Machine three slightly oversized pieces of walnut (5/16 x 5/16 x 25"): two for the long inlays and the other to make the ½" plugs. Next, tilt your tablesaw blade to 3° from perpendicular. Along one edge of one strip, bevel-rip a short, 1½"-long section. Test-fit this section in one of the inlay grooves. The strip should stand slightly proud of the surface, wedging tightly in the groove without bottoming out. *(See figure 7.)*

Adjust the fence as necessary. When the strip fits correctly, bevel-rip one edge of all three strips to this width. Next, crosscut one end of each strip at this same 3° bevel, then cut the other end square to fit the slot's length. Now, round the corners to match the 1/16" radius on the groove corners using a file or sandpaper.

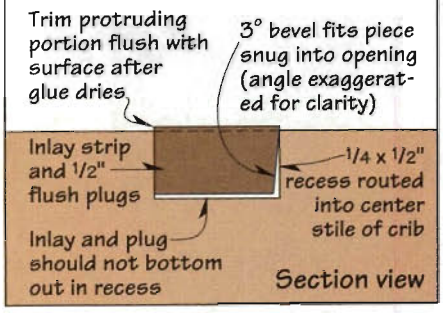
To make the ½" plugs, build a carrier board for the remaining walnut strip as you did for the smaller plugs. Cut these plugs so that their length equals the width you ripped earlier. However, bevel-cut the leading end of the strip at 3° from perpendicular, then reset the

Figure 6 Inlay strip and 1/2" flush plug dimensions



Note: 33/64" widths are approximate, cut to fit snug in groove

Figure 7 Fitting the inlays and 1/2" flush plugs



saw to vertical and cut the other end square. (This yields two adjacent beveled edges for a better fit.) Sand or file a 1/16" radius on all four corners of your first plug, test the fit, and adjust as necessary. Cut 10 plugs.

Glue In the Plugs And Inlays

With your plugs and inlays cut, chamfer the bottom edges of the plugs to ease insertion. Then, working one hole at a time, glue and tap the plugs in tight. (We used a small, thin piece of scrap as a spatula to apply the glue to the walls of the hole. Don't apply glue to the plugs themselves—that will only result in excessive squeeze-out. Remove any squeeze-out with a chisel before it hardens.

After the glue has dried, lightly sand the protruding tops of the 1/4" and 3/8" plugs. Use a hand plane to trim the long inlay and 1/2" plugs flush with the middle stile, then scrape or sand out any plane marks.

Project design: Dick Coers
Written by: Tom Jackson
Photographs: Randall Sutter, StudioAlex

No kid should grow up without this visionary experience

KALEIDOSCOPE

Even though the House of Mirrors and other old-fashioned optical trickery have given way to digitized visual effects, children never seem to tire of this toy. Designer Dave Moretti's updated version bounces a fisheye image off triangularly opposed mirrors, creating a multifaceted display without relying on any moving parts. You can put one together in an afternoon from just about any hardwood you find in the scrap bin.

Before You Start

Dave built his prototype from cocobolo, but any fairly stable and richly grained hardwood—mahogany or teak, for instance—would work just as well. He prefers straight-grained stock because it machines smoothly and makes for better grain continuity when the eight sides are arranged to form the octagonal tube.

Construct the tube first, then size the mirrors to fit snugly inside it. You may have trouble locating a few of the parts, so the designer has agreed to supply a project kit. (For mail-order information, see the Source listed at the end of the article.)

Construct the Tube First

Surface your hardwood stock to ¼" thick, removing an equal amount of material from both faces. From it, rip and crosscut two 5x12" snipe-free pieces. At the same time, prepare two same-sized pieces of scrap to use for testing your tablesaw setup.

Move the tablesaw rip fence to the left side of the blade (if the blade tilts to the right). Using an accurate angle gauge, tilt the blade to 22½° from perpendicular, then lower it to an appropriate height for cutting the ¼"-thick stock. Bevel-rip one edge of both pieces of your same-sized scrap, then set the rip fence to cut a 13/16" width.

Turn the scrap stock end for end, but don't flip it over. Place the beveled edge against the fence, then bevel-rip a strip. Next, flip the offcut stock end over end, again placing the beveled

edge against the fence with the wider face up. Bevel-rip another strip, then repeat until you've ripped eight strips from the two scrap pieces.

Lay the eight strips in a row with the wider faces up. Butt the edges together squarely and align the ends flush. Tape the full length of each seam with masking tape, then test-fold the assembly into an octagon and tape the last joint. Check the assembled tube to make the eight sides form a true octagon and the joints close.

If the sides don't form a true octagon, adjust the blade tilt and cut another set of test pieces. When you get a satisfactory test-octagon, bevel-rip your good stock at that setting. Next, assemble and tape the pieces, then flip them over and apply a bead of glue to the beveled edges. Fold the sides into an octagon again, tape to hold the shape, and let the glue dry overnight.

Remove the tape and scrape off excess glue. Square one end of the tube, then crosscut the opposite end to 10 15/16" finished length. Next, cut a 14"-long scrap square to fit snugly through the tube. Slide the tube onto the square, then chuck this two-piece assembly into your lathe.

Turn one end of the tube to 1 7/8" diameter, forming a 1/4"-long rabbet. Note: This rabbeted end will seat in a recess in the ball cap, which you'll bore with a 1 7/8" Forstner bit. To ensure accuracy, sneak up to this final diameter as you turn. (We bored a 1 7/8" hole in a scrap and used it to test-fit the rabbet.) Make sure the rabbet shoulder is square.

Bill of Materials

Kaleidoscope

Part	T	W	L	Mtl.	Qty.
A Sides	1/4"	13/16"	10 15/16"	C	8
B Eyepiece cap*	7/16"	1 15/16"	1 15/16"	C	1
C Ball cap*	1 1/8"	2 5/16"	2 5/16"	C	1

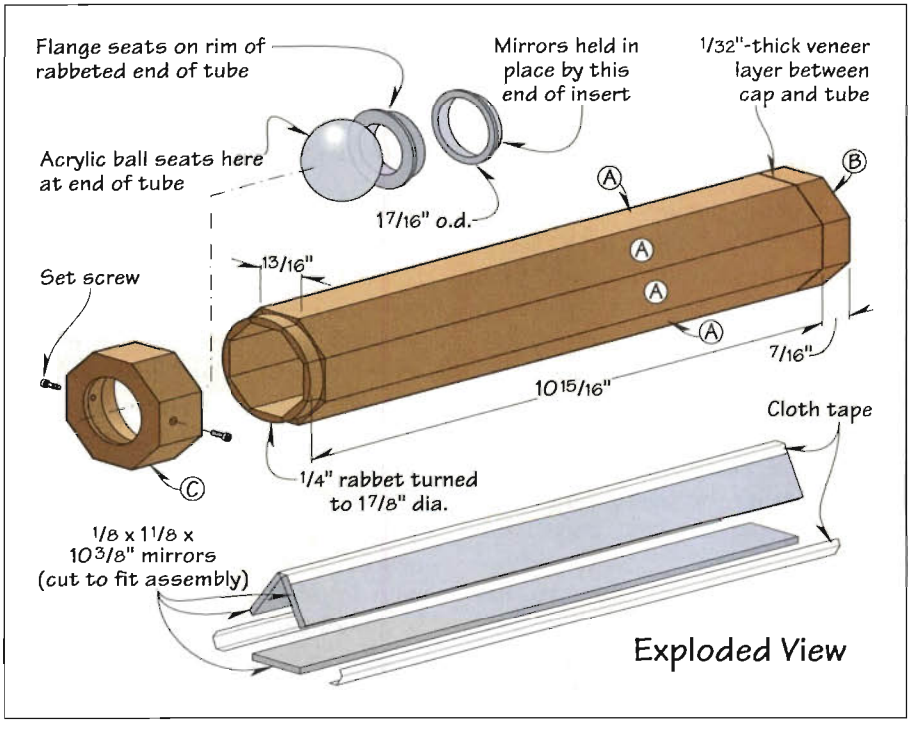
*Part cut to final size during construction. Please read all instructions before cutting.

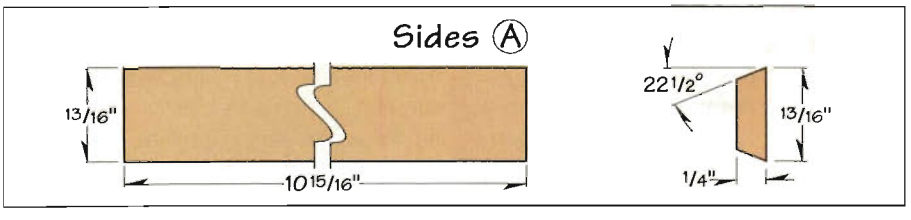
Material List

C–cocobolo

Supplies

2x2" scrap of maple, holly, or other light-colored veneer; 1/2" adhesive cloth tape (first-aid type); 1/8"-thick mirror (3 strips, cut to fit); hardening oil finish. (For other supplies, see Source at end of article.)



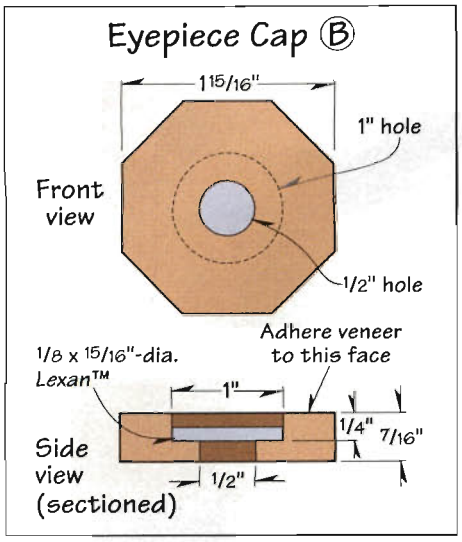


Make and Assemble The Eyepiece Cap

Measure the actual outside diameter of your tube. From a piece of 7/16"-thick stock, cut a square slightly larger than this diameter. (Our tube measured 1 15/16", so we cut a 2" square.) Choose an outside face, then draw diagonals on this face to locate the center. Now, glue a piece of contrasting veneer to the opposite face. (We used maple.)

Center the unrabbeted end of the tube on the cap blank, then trace its outline with a pencil. Bandsaw the cap to this shape, keeping the saw blade wide of the line. Next, bore a centered 1" hole 1/4" deep into the inside (veneered) face to accept the Lexan™ eyepiece. (See the Eyepiece Cap drawing on *page 00*.) Using this same center, bore the 1/2" viewing hole through the piece. Note: Use a backing board to minimize tearout on the outside face. Then, lightly break the edge of the hole on this face.

Lay out a 15/16"-diameter disc on the Lexan blank, then bandsaw and sand the eyepiece to shape. Epoxy the eyepiece into the recess in the cap using a quick-set formula. Next, epoxy and lightly clamp the veneered face of the eyepiece cap to the unrabbeted end of the tube. Note: The epoxy joint shows

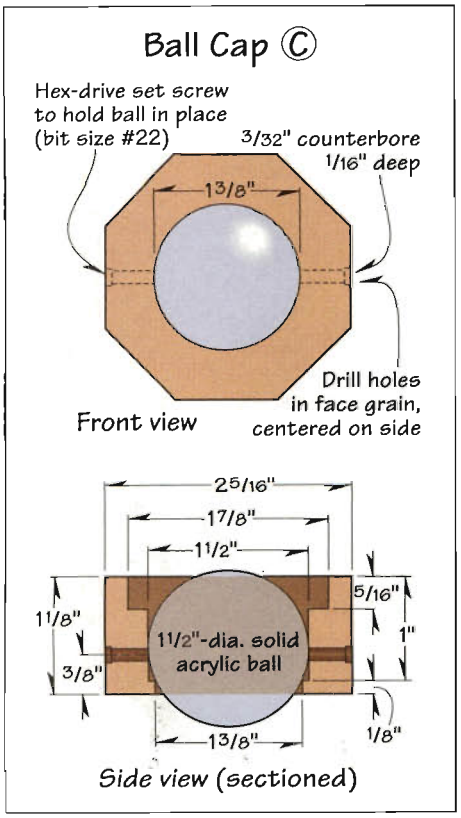


as a black line, but the end-grain joint requires this adhesive. It also helps set off the contrasting veneer layer.

Using a stationary belt sander and a fence, sand the tube to make the eyepiece cap edges flush. Note: As you sand, hold each of the eight sides firmly against the fence to ensure that the perpendicular side stays flat on the abrasive. Finish-sand the sides to 220-grit, then lightly break the edges.

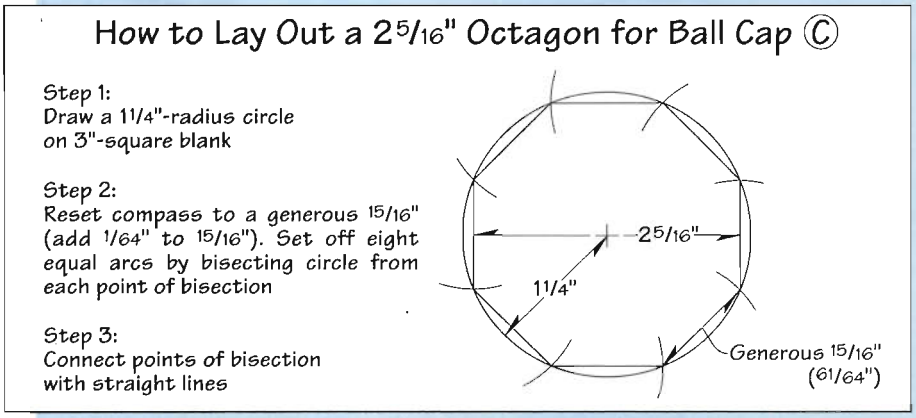
Prepare the Ball Cap

Surface a piece of stock to 1⅛" thick, then cut a 3" square from it.



PRO TIP

To lay out a 2⁵⁄₁₆" octagon, first draw a 1¼"-radius circle on the 3"-square blank as shown in the drawing *below*. Next, reset your compass to a generous ¹⁵⁄₁₆" (add 1⁄₆₄" for a total of ⁶¹⁄₆₄"). Center the compass point anywhere on the circle, then bisect the circle with the pencil. Move the compass to this point of bisection, then strike another arc. Repeat this procedure, working around the circle until you've divided it into eight equal arcs. Then, connect the points of bisection with straight lines.



Locate the centerpoint, then lay out a 2⁵⁄₁₆" octagon on this center. (For help, see the Pro Tip *above*.) Next, bandsaw the octagon to shape, keeping the blade just wide of the line. Sand the eight facets to the line. (See the Ball Cap drawing *below*.)

Chuck a 1⅞" Forstner bit into your drill press, and lay a handscrew clamp flat on the drill-press table. Clamp the ball cap blank in the handscrew so it lies flat on the table, then lay this assembly on a hardwood backing board. Center the blank under the bit, then clamp the handscrew and backing board to the table. Now, bore a centered hole 5⁄₁₆" deep in the blank. Without moving or unclamping the blank, change to a 1½" Forstner bit and bore a 1"-deep hole.

Change to a 1⅜" Forstner bit and bore through the remaining thickness of the ball cap. Next, unclamp the cap and locate its two long-grain edges. Lay out hole centerpoints for the hex-drive set screws on these edges where shown on the Ball Cap Side View drawing *left*.

Drill a 3⁄₃₂" counterbore 1⁄₁₆"-deep at both points. Switch to a #22 bit and drill the two screw holes all the way through the cap.

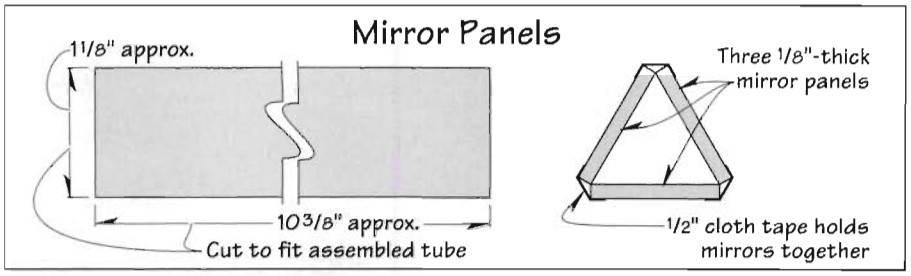
Using an allen wrench, gently drive the set screws into the holes to thread them. Remove the screws, then finish-sand the ball cap to 220-grit and break the edges. Lightly break the outside edge of the 1⅜" hole also.

Assemble the Mirrors, Then Put It All Together

Cut and fit cardboard patterns for the triangular mirror. To do this, start with three 1¼ x 10½" strips of stiff ⅛"-thick hardwood. Insert them into the tube so they form a triangular tunnel. Cut the strips to fit, sneaking up on the final width and removing an identical amount of width from each.

Next, assemble this cardboard tunnel using masking tape. Note: Leave small gaps between the edges when taping to allow clearance for folding. The tunnel should fit snugly in the tube but still slide without crushing the cardboard edges.

To determine length, butt the taped tunnel firmly against the eyepiece cap. Extend it far enough so that the two nylon inserts hold it snugly at the opposite end. When you have a satisfactory fit, take the strips and kaleidoscope assembly to a glass dealer. Have the dealer cut three mirrors to fit.



Clean the three mirror strips, then lay them facedown on a clean, lint-free piece of cloth. Align the ends and space them as necessary for folding using small strips of scrap. Tape the edges full-length using ½"-wide cloth adhesive tape. (We used white first-aid tape.) Now, fold the mirrors into a triangle (reflective surfaces inside), tape the last joint, and check the ends to see that they still align. Temporarily cover the mirror ends to keep out dust.

Mask the mating areas on the ball cap and tube, then apply finish. (We brushed on two coats of a hardening Danish oil finish to the outside, allowed each coat to penetrate for 15 minutes, then wiped the parts dry.)

After the finish has dried, carefully insert the mirror assembly into the tube. Next, stand the tube on its eyepiece end and position the two nylon inserts as shown on the Exploded View. Clean the acrylic ball thoroughly with a soft, lint-free cloth, then place it on the outer insert in the mouth of the tube.

Apply a thin film of glue to the tube rabbet. Carefully fit the cap over the ball and twist it onto the rabbet, aligning its edges with the tube sides. Remove any glue squeeze-out. After the glue has dried, install the set screws, driving them in far enough so that they grip the ball firmly and sit slightly shy of the cap surface. WJ

Photographs: eS Originals, Nancy Marek, Randall Sutter
Project design: David Moretti
Kaleidoscope Model: Cara Cantwell
Written by: Doug Cantwell

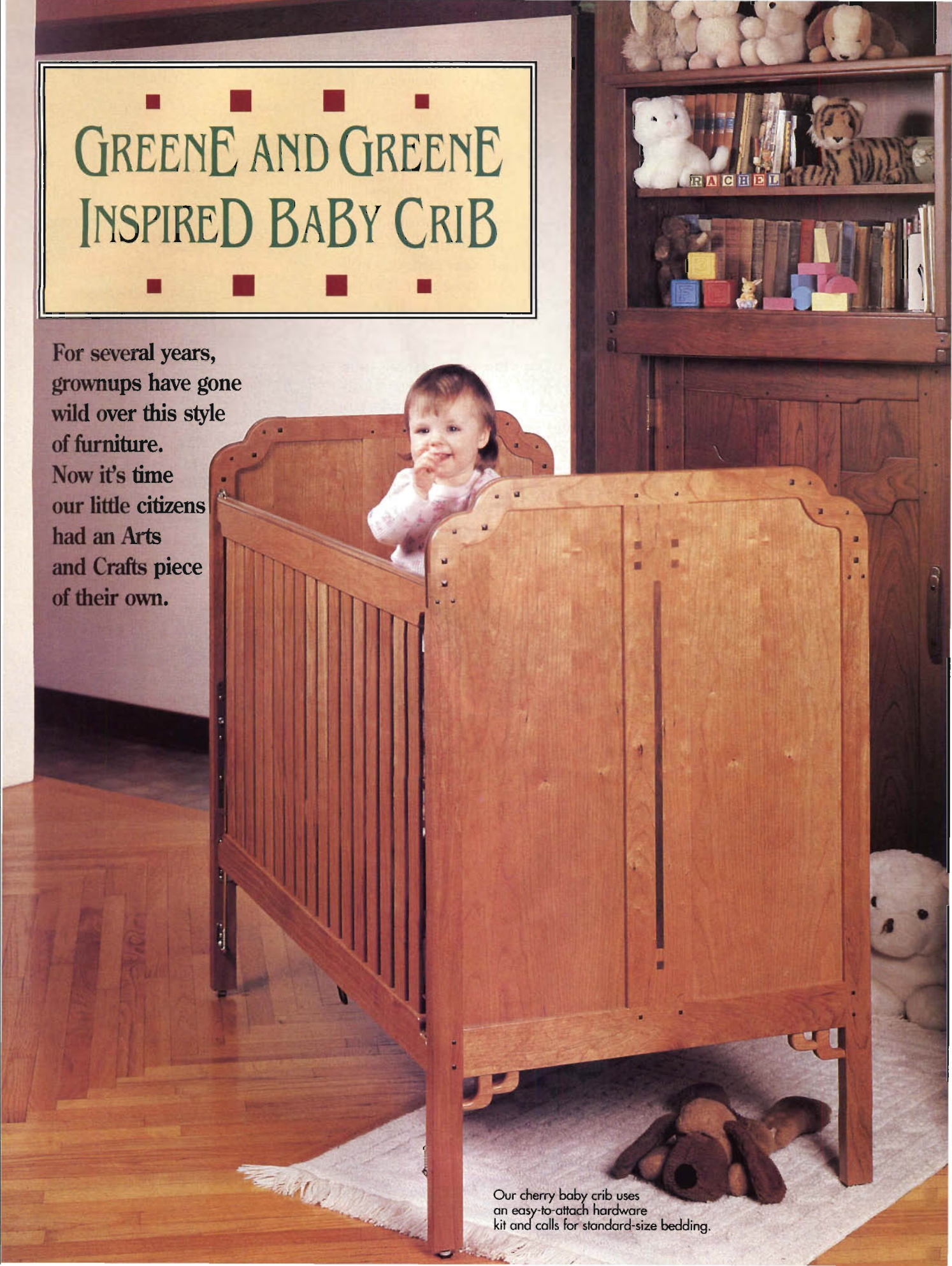
Sources

Parts Kit. Includes 1½"-dia. acrylic ball; ⅛x1x1" Lexan eyepiece; two nylon inserts; two #6x⅜" hex-drive steel set screws. Price: $12.95 ppd. (No credit cards or C.O.D.s, please.) Order from:

Aspen Kits
221 Plymouth Rd.
Westbrook, CT 06498

Greene and Greene Inspired Baby Crib

For several years, grownups have gone wild over this style of furniture. Now it's time our little citizens had an Arts and Crafts piece of their own.



Our cherry baby crib uses an easy-to-attach hardware kit and calls for standard-size bedding.

The first heyday of Arts and Crafts furniture together with its current revival encloses the 20th century like a pair of bookends. America's interest in this furniture style originally caught fire in the early 1900s as a reaction to the dehumanizing effects of the Industrial Revolution and as a celebration of simple furniture for the common man.

Unfortunately, hand-crafted furniture proved expensive to build, and the division of labor dictated by the assembly line left ordinary people without the skills to craft their own home-grown pieces. So, mass-produced goods won the day.

Now, as we near the end of the century, with the digital revolution in full swing, people are once again harking back to the simple beauty of wood expertly shaped by human hands. This time, however, home woodworkers and small cabinet shops are leading the way. The Greene and Greene-inspired crib we present here was designed for just such an audience: skilled, often self-taught, and greatly appreciative of the art and craft of woodworking.

The cloud-lift rail, contrasting spline joint, and projecting pegs exemplify the detail the Greenes designed into their furniture.

Bill of Materials

	Part	T	W	L	Mtl.	Qty.
Crib Ends	A Legs	1 3/16"	2"	41"	C	4
	B Bottom rail	1 3/16"	3"	26 1/4"	C	2
	C Crest rail*	1 3/16"	5 1/2"	30 1/4"	C	2
	D Center Stile	1 3/16"	4 1/2"	31 1/8"	C	2
	E Panels*	1/2"	11 5/8"	31 7/8"	CP	4
	F Bottom brackets**	7/8"	2"	3 3/4"	C	4
Crib Sides	G Side rails	13/16"	3"	50 1/2"	C	4
	H Slats	3/8"	2"	25 1/2"	C	34

*Parts cut to curved profile during construction. Please read all instructions before cutting.

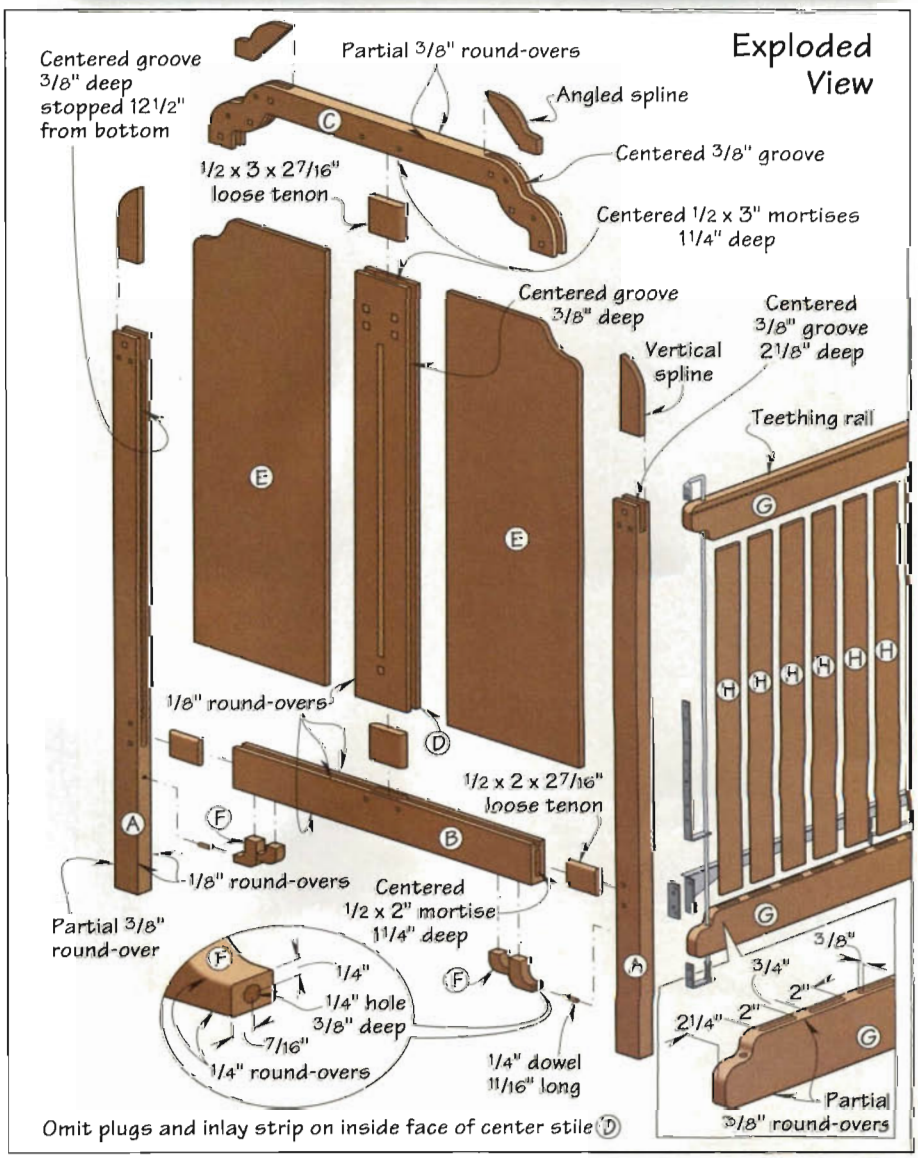
**Parts cut from a larger piece.

Materials List

C–cherry
CP–cherry plywood

Supplies

1/4" dowel stock; walnut stock for the splines and decorative plugs and inlays; polyurethane finish; hardware kit (see Source at end).



Before You Start

This crib, like most Arts and Crafts furniture, demands a high caliber of workmanship to construct. Although the Bill of Materials may be short and the joinery straightforward, it is not a beginner's project. The sculpted top crest rails call for exacting work to transition from straight to curved lines. Laying out the decorative walnut plugs and inlays also gets involved, so we present them in a separate article. (See *page 24*.)

To make this crib you'll need a router and several bits, a bandsaw, scrollsaw, a mortising jig, a dado head, and a tablesaw with an accurate fence. If you've been looking for a good excuse to buy an oscillating spindle sander, this would be it. We also suggest that you start early—especially if there's a little one on the way and imposing a deadline for you.

Prepare the End Frame Parts

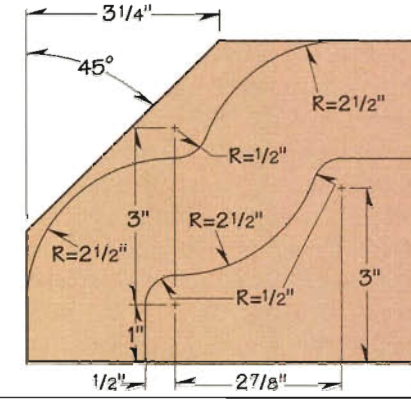
Step 1. From 6/4 cherry, prepare the solid wood parts of the crib's two end frames: the legs (A), bottom rail (B), crest rail (C), and center stile (D) as dimensioned in the Bill of Materials. Leave the crest rail as a rectangular blank for now. To ensure flat, square parts, face-joint the stock first, then plane it to thickness. Joint one edge, rip the opposite edge to width, and then crosscut the pieces to length.

Step 2. Miter the top corners of both crest-rail blanks at 45° as dimensioned in *figure 1* to remove the corner waste.

Step 3. Build the fixture shown in *figure 2* and screw it to a saddle that slides on your tablesaw rip fence. Mount a ⅜" dado head on your tablesaw and set up the fixture.

Step 4. Mark the outside faces of the crest rails and legs, then keep these faces against the fixture when making the following cuts. Cut the three centered ⅜"-wide grooves 2⅛" deep on the crest-rail blank as shown in steps 1, 2, and 4 and 1⅜" in step 3 of figure 2. Next, replace the angled cleat on the fixture with a vertical cleat/backing board as shown (step 4), then cut a ⅜ x 2⅛" dado across the top end of all four legs.

Figure 1 Crest-rail profile



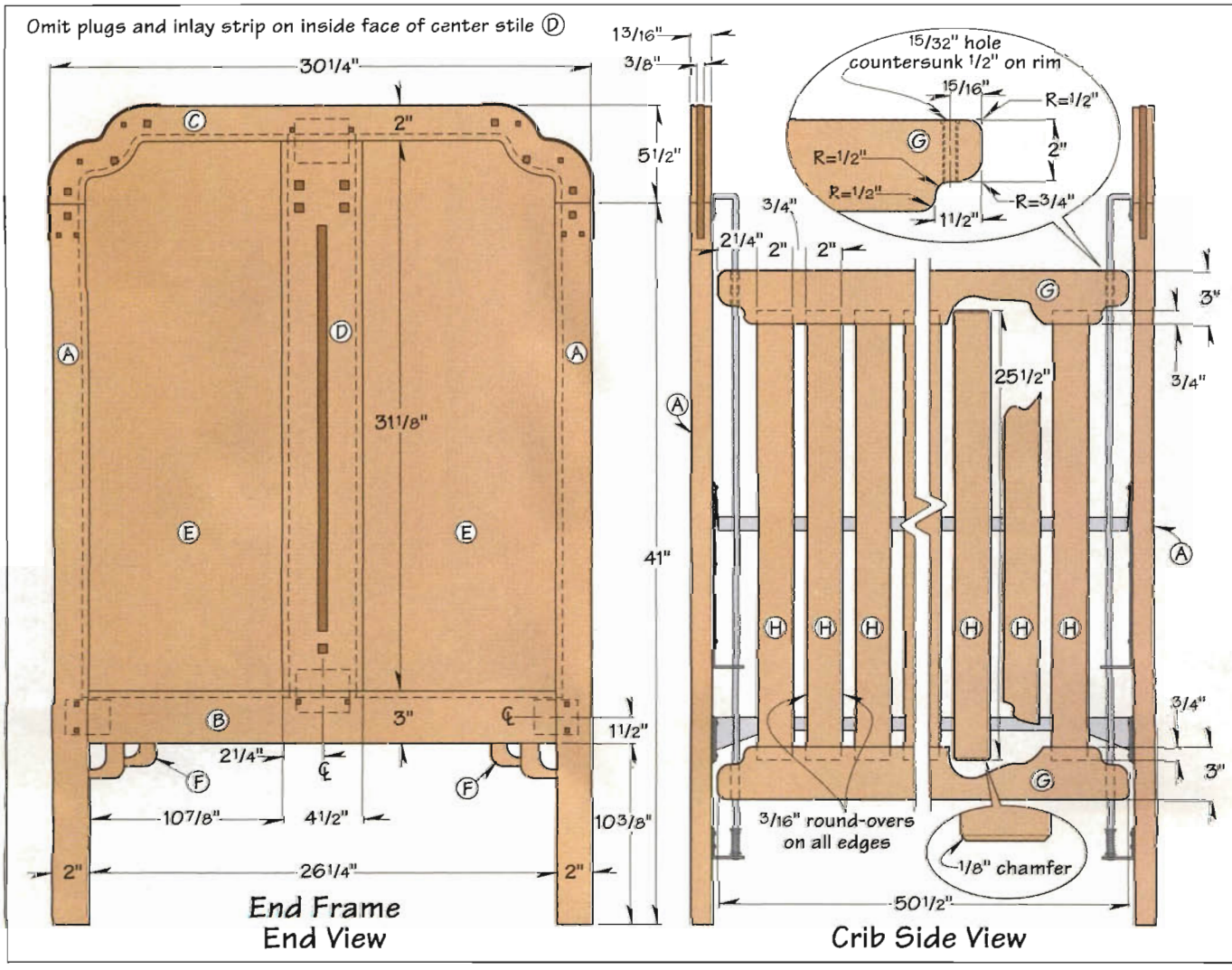
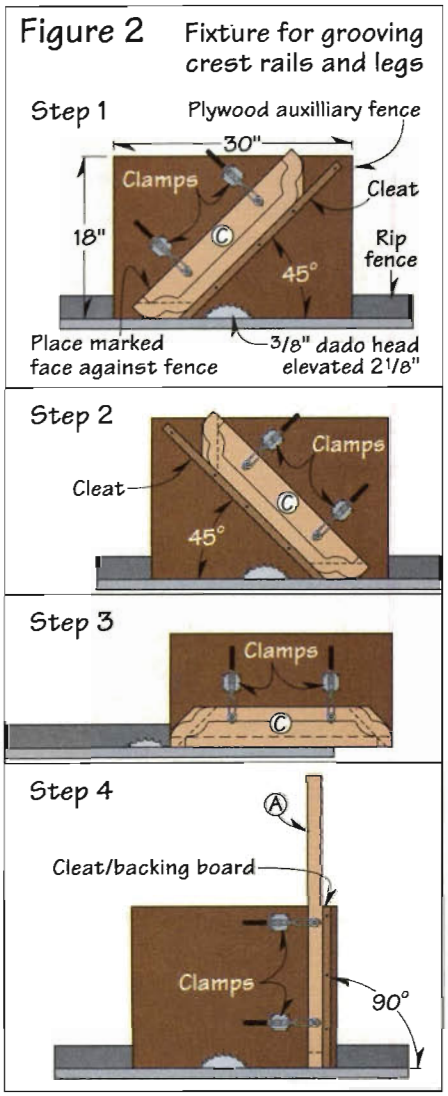


Figure 2 Fixture for grooving crest rails and legs



Rough Out the Plywood And Cut the Grooves

Step 1. Lay out the four panels (E) on a sheet of ½"-thick cherry plywood. (You could also form the panels by laminating two sheets of ¼" cherry plywood back to back.) Lay out the panels so the grain and color appear consistent from panel to panel. Mark, then rip and crosscut the panels to rough size, and leave the corners that will be later cut to the crest-rail profile square for now.

Step 2. Measure the thickness of your panels (ours measured 7/16" thick). Set the dado head to this width plus enough to form a snug-but-sliding fit in the groove. Cut full-length, centered grooves for the panels along the edges of the center stiles and bottom rails. See the Pro Tip *above* for more information.

PRO TIP

To cut a perfectly centered groove in a leg or edge of a part, position the fence so that it is the correct distance from the right edge of the blade, but set up your dado head at a width that is slightly less than the desired width of the groove. Then, cut the groove in two passes by making the first cut with one face against the fence then rotating the part and making a cut with the other face against the fence.

Shape the Crest Rail

Step 1. Using the dimensions in figure 1, draw a full-sized crest rail on a piece of ½" Baltic birch plywood to use as a template. Make all of the template's straight cuts on the tablesaw, including the short straight sections that align with the vertical edges of the legs (photos A, B). Bandsaw the curved sections, staying wide of the line. Then, sand to the line using a spindle sander. Note: Carefully feather the curved lines into the straight lines. Don't oversand the curves—you want a smooth transition from curve to straight edge. Also, make the template symmetrical. It should measure exactly 2" across at any point—straight or curved—along its length and the curved sections must be perfect mirror images of each other.

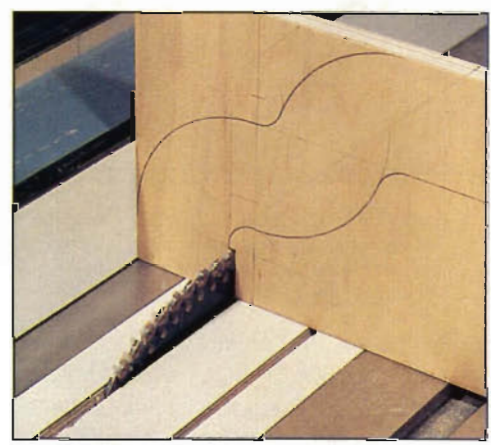


Photo A: With the fence set 2" from the blade, cut the short straight vertical line at the bottom of the crest-rail template.

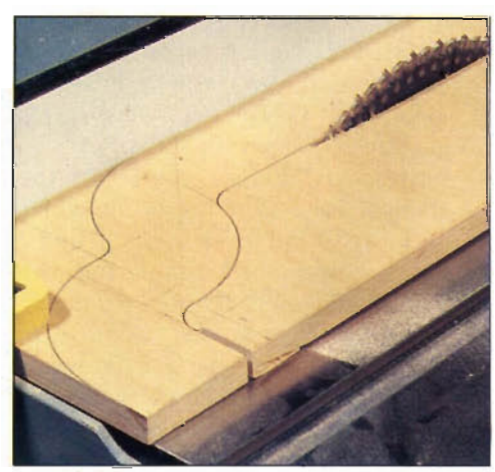


Photo B: Without changing the fence setting, lower the blade and then plunge-cut up through the template to accurately position its lower edge.

Step 2. Trace the template outline onto the two cherry crest-rail blanks. Bandsaw the rails to shape, staying just outside the line.

Step 3. Adhere the plywood template to a bandsawn crest-rail with double-faced tape. (To make certain the template wouldn't move, we squeezed the template and rail together in a vice to set the adhesive.) Rout the rail to shape using a 1¼"-long pattern or flush-trim bit and your table-mounted router. Rout the second rail the same way.

Finish the Grooves and Make the Mortises

Step 1. Mount a ¼"-slotting cutter in your table-mounted router and elevate the bit to match the height of the grooves you cut earlier on the center stiles. Rout the centered stopped grooves in the legs and the continuous grooves in the crest rails. Note: To cut these grooves, make one pass, then flip the piece over and make a second pass. (To avoid chip-out, see the Pro Tip on *page 38*.)

Step 2. Lay out and cut the centered mortises on all parts where detailed on the Exploded View and End View drawings. (We used a spindle mortising machine. A router and mortising jig will work as well.)

Step 3. To make the loose tenons fit the mortises, cut two 16"-long strips of cherry: one ½x3", the other ½x2". Radius their edges using a ¼" round-over bit in a table-mounted router. Then, crosscut four 2 7/16"-long tenons from each strip.

PRO TIP

Cherry wood chips easily when routed with slotting and rabbeting bits. To minimize this problem, start the grooves with a "climb" cut.

To make a climb-cut, you feed the workpiece against the spinning router bit in the wrong direction. Instead of using the customary (and safer) right-to-left feed on a table-mounted router, feed the stock from left to right.

To minimize the risks with this procedure, take these precautions. One, make very shallow cuts—about 1/16" deep—by using a large-diameter bearing or by burying most of the bit in the fence. Two, be prepared for the workpiece's inclination to self-feed.

For normal cuts, you push the stock across the table against the bit's rotation and encounter resistance. In a climb cut however, the workpiece moves in the same direction as the bit spins which tends to grab the workpiece and propel it forward. To avoid this, use push sticks, downward pressure, shallow cuts, and a slow feed. After making the climb cut, rout the grooves to full depth using normal right-to-left passes.

Step 4. From scrap, cut four 3/8 x 1 5/8 x 4 1/2" pieces as temporary splines for the crest rail-to-leg joints. Note: The 3/8" thickness is approximate—you'll need to plane the final pieces to create an unforced slip fit in the 3/8"-wide grooves.

Test-Fit and Assemble

The End Frames

Step 1. Dry-assemble and clamp the end frames—without the plywood panels—using the loose tenons and the temporary crest-rail splines.

Step 2. Cut the plywood panels to a length and width that will fit in the grooves, but leave the top outside corners square for now. Scribe faint pencil lines 3/8" in from the side and bottom edges. Next, lay the panels under the clamped frames and align these pencil lines with the edges of the bottom rail, leg, and stile. Now, trace the inside crest rail outline onto the panel corners.

Step 3. Remove the plywood panels from under the clamped frames. Set a compass to 3/8" and extend new profile lines on the panels 3/8" outside the lines you just traced. *(Photo C)*. Then, bandsaw the panels to shape, cutting along but just inside the outside lines.

Step 4. With the end frames still clamped, rout a 1/8" round-over on the inside edges of the legs, the inside edges of the crest rail, the center stiles, and both edges of the bottom rails. At the square inside corners (where the bit won't cut), file and sand the edges round. Next, rout a partial 3/8" round-over on the outside edges of the crest rails, and legs. Note: To rout the 3/8" round-over, set the bit so that its bearing rides just above (and doesn't fall into) the groove at the crest-rail-to-leg joint. Be extra careful that this joint doesn't slip while routing.

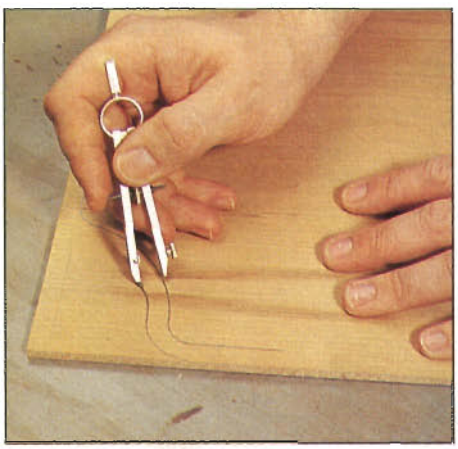


Photo C: Using a compass set at 3/8", extend the profiled line on the plywood panels. The area between the lines will fit into the groove in the bottom edge of the crest rail.

Step 5. Before removing the clamps, finish-sand the inside edges of the crest rail-to-leg joints. Using a flat sanding block, sand the two parts flush where their edges meet.

Step 6. Remove the clamps, then finish-sand the panels and the inside edges of all parts. Note: Stay away from the previously sanded crest rail-to-leg joint. Lightly break all groove edges; also break the panel edges to ease assembly.

Step 7. Dry-assemble the frames with the panels and loose tenons to check for fit and preset your clamps to approximate length. Continue to use the temporary splines in the crest-rail joints.

Step 8. When you're satisfied with the fit, cut a full-length clamping caul from 6/4 scrap to match the outside profile of the crest rail. Then, glue and clamp the frames in the following sequence: middle stile to bottom rail; panel to the middle stile/bottom rail assembly; legs to bottom rail; crest rail to panel and middle stile. Glue the panels on all four edges. Insert—but *do not* glue—the temporary spline in the crest-rail joint. After setting the clamps, pull the splines out about 1/4" from the bottoms of the joints so that they don't get glued to the panels. Also, make sure the legs are flush with the crest-rail edges. Glue up the second end frame the same way.

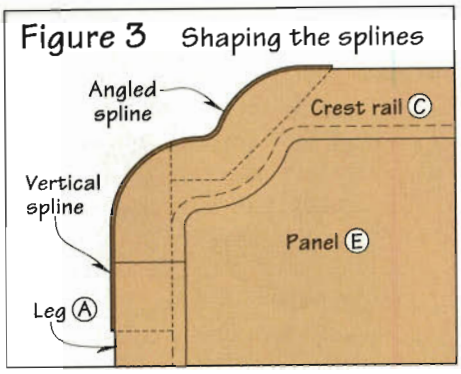
Make the Crest-Rail Splines

Step 1. After the glue has dried on the end frames, remove the temporary splines from the crest-rail joints and sand the outside edges of the crest-rail-to-leg joints flush.

Step 2. Plane a length of walnut spline stock (a scant 3/8"-thick) so it slides with little friction into the 3/8"-wide crest-rail grooves. From the walnut, cut four 1 3/4 x 5 3/4" and four 3 1/2 x 8" blanks. Caution: Glue will cause the cherry and walnut to swell during assembly. A too-tight spline could break the fragile short grain on the end of the crest rail.

Step 3. Slide a vertical (5 3/4"-long) spline into a crest rail/leg joint until it bottoms out. (See *figure 3.*) Trace the profile of the crest rail onto this spline, scribing it 3/32" proud of the rail by placing a 1/8 x 3/32 x 2" piece of scrap between the rail and the pencil as you follow the rail profile. Remove the spline, bandsaw it to shape cutting wide of the line, then sand to the line (*photo D*).

Step 4. Re-insert the vertical spline in the slot. Trim the angled (8"-long) spline to bottom out in the slot and against the vertical spline. Next, trace the crest-rail profile on this spline using the 3/32" spacer, then cut and sand it. Trim the point where the angled spline exits the top of the crest rail using a vertical cut. Make the three remaining



crest-rail joint splines the same way. Now, rout or sand a 1/16" radius on the exposed edges of all splines.

Step 5. Glue the splines in the slots. (We brush-applied glue sparingly to the inside slot surfaces to avoid squeeze-out.) Clamp if necessary to ensure that the splines bottom out in the slots and that you have uniform reveal between the splines and the crest rail. Clean up any squeeze-out thoroughly before it dries using a wet rag and chisel. Then, clamp the splines across the faces of the cherry and clean up any new squeeze-out. (We used an old toothbrush to scrub away glue residue.)

Step 6. Finish-sand the spline edges to give them a soft, worn look. Sand all joints flush. Next, rout holes for and install the decorative plugs and flush inlays. For information on this step, see *"Making Decorative Plugs and Inlays for Arts and Crafts Furniture"* on *page 24*.

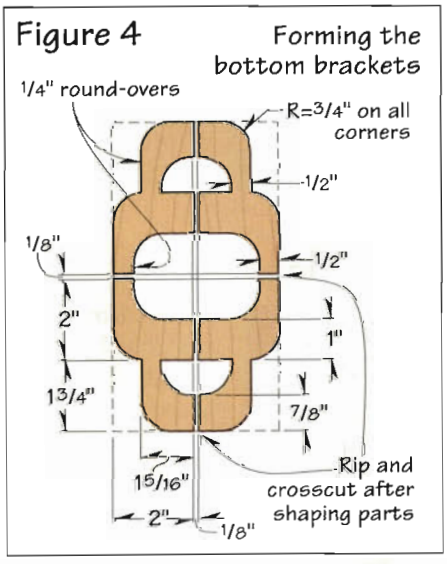
Make the Bottom Brackets

Step 1. To make the decorative bottom brackets (F) as shown in *photo E*, first machine a piece of cherry to 7/8x4 1/8x7 3/4". On one face, lay out the four curved profiles *(figure 4)* with the grain oriented parallel with the long axis of the piece. Bandsaw and scrollsaw the curved lines, staying wide of the lines. Then, sand to the line, making sure you remove the saw marks on the curves.

Step 2. Round-over (1/4") all inside and outside edges. On the corners that are too tight for the router bit to complete, use a file and sandpaper to finish the radius.

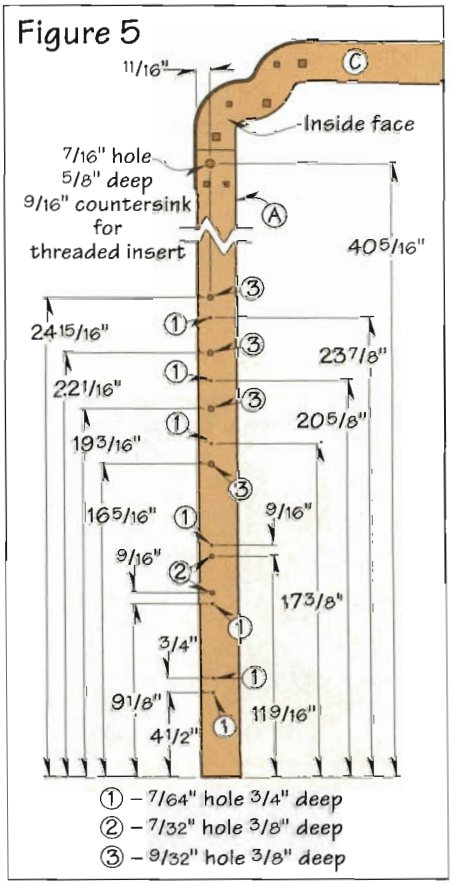
Step 3. Rip and crosscut the segments to make four identical brackets. Drill a 1/4" dowel hole 3/8" deep in each bracket where detailed on the Exploded View drawing. Finish-sand the brackets.

Step 4. Using a dowel center in the bracket holes, mark centerpoints for the mating dowel holes in the legs. Drill 1/4" holes 3/8" deep at these points. Prepare four 1 1/16" lengths of 1/4" dowel and glue them in the bracket holes. Then, glue and clamp the brackets to the legs and bottom rails. Note: Clamp the brackets in both directions, and keep the un-doweled ends centered on the rails.



Attach the Leg Hardware

Step 1. Lay out and drill the hardware mounting holes on the inside faces of the legs where dimensioned in *figure 5*. (For a mail-order supplier of the kit we used, see Source at the end of the article.) Measure the diameter of the threaded inserts in your hardware kit and size those four holes accordingly. (Ours required 7/16"-diameter holes.) Caution: Chamfer the insert holes with a countersink to aid installation and reduce chip-out. Drive the inserts carefully to avoid damaging the crest rails.



Step 2. Attach the hardware to the legs.

Prepare the Side Rails And Slats

Step 1. Make the four side rails (G) and 34 slats (H) as dimensioned in the

Photo D: An oscillating spindle sander, shown here cleaning up the bandsaw marks on the walnut splines, comes in handy for several operations in this project.

Photo E: For safety, shape the decorative bottom brackets on a larger piece of stock, then rip and crosscut it to make four individual brackets.

Bill of Materials. (We resawed and planed roughsawn 4/4 cherry for the ⅜"-thick slats.) Note: The ⅜" thickness is approximate. Thickness your material to match the mortise cut by your mortising bit. Rout a 3/16" round-over on all long edges of the slats.

Step 2. Drill holes for the plastic bushings through the side rails where dimensioned on the Side View detail. (We drilled a test hole in scrap first to verify the hole size for a snug fit without epoxy.)

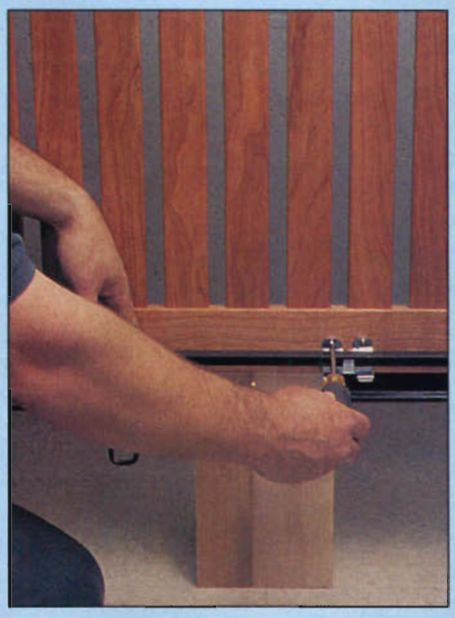
Step 3. Mark the rail-end profiles as shown in that same detail, then bandsaw and sand them to shape.

Step 4. Lay out and cut 17 matching mortises centered in both sets of side rails where dimensioned on the Exploded View. Work carefully—these joints will be very visible so strive for an exacting fit of the slats in the mortises. We used a spindle mortising machine. A plunge router and mortising jig may also be used. Or you could cut a centered ⅜" groove along the edge of each rail, insert the slats, then insert precut spacers between the slats.

Step 5. Partially round over all rail edges as shown in *figure 6*. (We set the

Installing the Hardware

Apply wax to the threaded inserts, then drive them with a piece of double-nutted threaded rod chucked in your drill press or a cordless drill. You'll need to exert maximum downward force on the insert. Turn the drill press chuck by hand or use the slowest speed on your cordless drill.



To install the latch mechanism, Dick cut a spacer to hold the crib side at the proper closed height. He then located the gateshoe on the rail where it would freely engage the S-bar and the trip rod.

The plastic teething rail snaps into the saw kerfs. Just place it over the top rail and gently squeeze down to force it into place.

To install the gateshoe (latch assembly) at the correct height, first cut a spacer to hold the side the correct distance off the floor as shown at *left*. Check to make certain you have ¼" between the top rail and the vertical steel guide rod so the crib side can be lifted enough to release the S-bar (latch).

Position the gateshoe on the inside face of the bottom rail and parallel to its top edge so that the inside lip of the shoe aligns with the spring-loaded catch on the S-bar. For final placement, move the gateshoe laterally toward the ends of the crib so the catch engages the S-bar but clears the coil spring under the trip bar.

Reading Up on Arts and Crafts Design

While designing this baby crib, I spent a lot of time studying the work of Greene-and-Greene and many other craftsmen and designers from the turn of the century. Along the way I also spent a small fortune on books, but if you want to work in this tradition, I think it's important to see and understand the history.

The most in-depth source I found on the Greene brothers work is the book: *Greene & Greene, Furniture and Related Designs,* written by Randall Makinson, and published by Peregrine Smith Books, Salt Lake City, Utah. Most of their work has been and continues to be held privately but this book has hundreds of photographs and sketches that the brothers made as well as construction and cutaway drawings that provide valuable information.

Another book that covers the legacy of Greene and Greene, as well as the careers and work of Gustav Stickley, Bernard Maybeck, the Roycroft shops, Harvey Ellis, Frank Lloyd Wright, and others is *American Arts & Crafts, Virtue In Design,* written by Leslie Greene Bowman and published by Bulfinch Press/Little, Brown and Company, 34 Beacon St., Boston, MA 02108. This book devotes roughly equal space to the subjects of furniture, metalwork, ceramics, and glass.

For great photographs of Arts and Crafts style room settings, I recommend *In The Arts and Crafts Style* written by Barbara Mayer and published by Chronicle Books, 275 Fifth St., San Francisco, CA 94013. Almost all the photographs show furniture pieces and other hand-crafted objects in complementary architectural settings.

Two other books I should mention are *The Wright Style,* written by Carla Lind and published by Simon & Schuster, 1230 Avenue of the Americas, New York, NY 10020; and *Mackintosh Architecture,* edited by Jackie Cooper and published by St. Martin's Press, 175 Fifth Ave., New York, NY 10010. Although Wright and Mackintosh were primarily architects, they both had a profound influence on craftsmen in a number of different fields.

Dick Coers Designer/Craftsman

router-table fence flush with the bit's bearing to keep it from dropping into the mortises.) Note: On the profiled rail ends, either guide the router by hand over the bushing holes or temporarily plug the holes with dowels to support the bit's bearing.

Step 6. Cut a ⅛" kerf ⅛" deep in the rails where shown on the Exploded View to hold the plastic teething rail *(photo F)*.

Assemble the Sides, Then Apply Finish

Step 1. To ease slat insertion into the rail mortises, rout a ⅛" chamfer on both ends of each slat. (We used our table-mounted router and chamfering bit.)

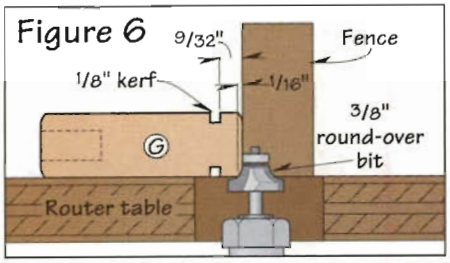
Step 2. Finish-sand the rail edges and the slats. Note: Use a profiled-sanding block that matches the slat shape and avoid oversanding—you don't want any flat spots. Sort the slats into two groups for best color and grain.

Step 3. To assemble a crib side, first clamp the bottom rail upright to the bench. Brush a light coat of glue in the mortises, then insert a slat in each mortise. Brush glue in the mating top-rail mortises, then position the rail on the slats. Tap lightly with a mallet to set the slats, and clamp as you work from one end to the other to prevent the rails from seesawing off the slats. Measure the assembled side at several points along its length to check for parallel and measure diagonally to check for square. Allow the glue to dry. Remove any glue squeeze-out. Assemble the second side the same way.

Step 4. Finish-sand all parts, double-checking for glue squeeze-out around the slats and inlay plugs. Apply a child-safe clear finish. (We applied four thin coats of Minwax Wipe-On polyurethane and rubbed out the final coat with #0000 steel wool. This produces a very thin film not likely to chip or flake off.) Attach the crib sides to the crib ends following the hardware instructions. (See "Installing the Hardware" *opposite*.) WJ

Project design: Dick Coers
Photographs: Randall Sutter, StudioAlex
Written by: Tom Jackson

Figure 6



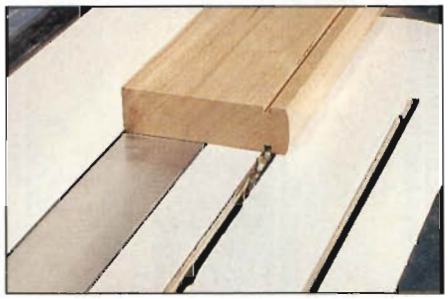


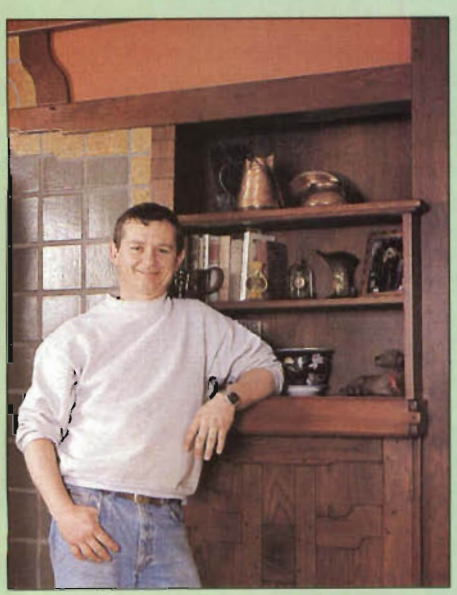
Photo F: The clear plastic teething rail provided in the hardware kit snaps snugly into a ⅛" kerf you cut on the tablesaw.

SOURCES

Crib Hardware Kit. Includes adjustable-height mattress spring frame, teething rails, and spring-release mechanism. Visible parts are nickel plated. Catalog no. 30858. Price: $69.99 plus s/h. Order from:

The Woodworkers' Store
800/279-4441

THE ARTS AND CRAFTS STYLE ALIVE AND WELL ON THE PRAIRIE



Steve Stenger of Prairie Woodworks applies furnituremaker's skills to his own home.

When it came time to find a suitable site for photographing our Arts and Crafts-style crib, we immediately thought of Steve Stenger. Steve and his partner Ron Skidmore, operate Prairie Woodworks in Downs, Illinois, and have earned a reputation as top-notch designers and builders of Arts and Crafts furniture. As it turned out, Steve's was the perfect house.

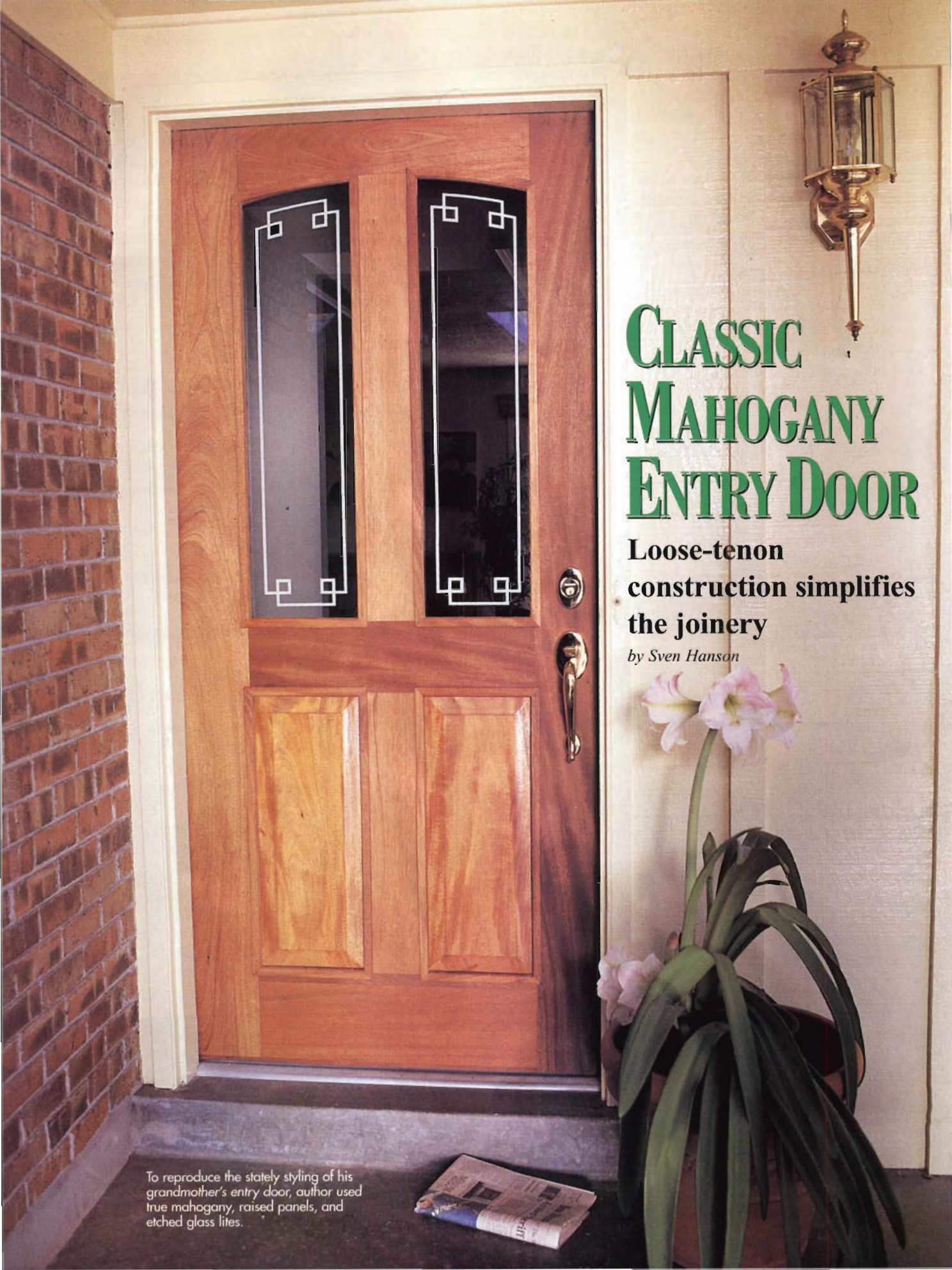
Walk into the Stenger home and you see Arts and Crafts details that only a dedicated woodworker would take the time to execute. The baseboards and crown moldings are not mitered at the corners—they're finger-jointed. Look toward the ceiling and you'll see hand-forged steel straps surrounding the beams. Under your feet, the oak flooring follows a meticulously-laid chevron pattern. In the fireplace backwall, cut tiles match the graceful cloud lift profiles of the adjoining cherry trim.

Like Frank Lloyd Wright, the Greenes, and other early 20th-century designers, Steve emphasizes strong, architectural lines in his furniture—and furniture-like craftsmanship in his architecture. In the Midwest, this style came to be known as Prairie. It's enjoying a resurgence of popularity, thanks to cabinetmakers like Steve and Ron who help carry on the tradition here on the same prairie where it all began.

You can see Prairie Woodworks furniture at Sawbridge Studio galleries in downtown Chicago and Winnetka, Illinois. In addition to Steve and Ron's work, Sawbridge carries custom-made furniture and crafts from other fine Midwest artisans. They're well worth a visit if you want to see more current interpretations of Prairie style and Arts and Crafts.

Sawbridge Studios
406 North Clark Street, Chicago
312/828-0055
1015 Tower Road, Winnetka, Ill.
847/441-2441

Prairie Woodworks
Downs, Ill. 309/378-2418



Classic Mahogany Entry Door

Loose-tenon construction simplifies the joinery

by Sven Hanson

To reproduce the stately styling of his grandmother's entry door, author used true mahogany, raised panels, and etched glass lites.

About the Design

An entry door may loom large, but break it down into its components, and you find that the frame has just seven parts. Four panels cover the rest of the surface, and 32 pieces of molding hold them in place.

To simplify construction, I decided to make loose-tenon joints. Instead of machining overlength frame members to make integral tenons, I simply cut mating mortises in the rails and stiles and used tenons made from separate stock.

If your door sits unprotected to the elements, you'll save a lot of grief by choosing a weather-resistant wood. If the entry has an overhang that protects the door from direct exposure to sun and rain, you may use any of the more stable hardwoods.

A word of caution: Red oak may look beautiful, but it expands and contracts more than most other woods with changes in humidity. This wood also has open pores that make it tough to seal against the elements. White oak, on the other hand, has closed pores so it's a far better choice for entry doors, wine barrels, and wagons. Unfortunately, it also weighs a ton.

For my door, I used true mahogany *(Swietenia macrophilia)*. It offers excellent stability and decay resistance, has beautiful grain and finishes easily. Its natural color (with a clear oil finish) projects both warmth and stateliness. Unlike white oak, a mahogany door weighs little enough that a reasonably fit woodworker and one able-bodied helper can hang it without needing a team of oxen and tackle.

I elected to make the top and middle rails the same width as the stiles. This proportion looks good and it simplifies stock preparation. I made the bottom or "kick" rail 50 percent wider. This extra width strengthens the door and raises the lower panels out of range of menacing feet.

If your stock won't yield 6"-wide frame members, you can go as narrow as 5". In that case, you'll want to scale down the width of the dividers proportionately. Also, you'll need to buy a lockset with a shallower backset so you can still center it (approximately) on the stile. As you calculate this, remember that the molding will reduce the stile's apparent width.

I've used standard 36x80" entry door dimensions here, but don't assume that they'll work for your opening. Standards were often deviated from, and older door frames may have additional eccentricities, depending on whether the house has settled or been remodeled. To be safe, measure the door it will replace and add ⅛" to the width and length. You may also have to reduce the 1¾" door thickness to fit the jamb, or alter the jamb to accommodate this thickness.

I used slow-set epoxy adhesive to join the frame members. It fills gaps admirably and, with proper technique, makes joints that will stand up to baking sunshine and drenching rain.

First, Prepare the Frame

Step 1. Face-joint and plane rough-sawn 8/4 stock for frame parts (A, B, C, D, E, F) to 1¾" thick. Select two 7' lengths for the stiles (A) and joint one edge of each. Rip the opposite edge to finished width. (I made mine a full 6".) Square one end of both stiles, then crosscut them to 80" long.

Step 2. To determine rail length, subtract the combined width of the stiles from the desired overall width of your door. (I subtracted 12" from 36" for an even 24".) Joint and rip the three rails (B, C, D) to width from your 1¾"-thick stock, then square and crosscut them to length using a stop block for accuracy. (See the Front View drawing on *page 44*.)

Bill of Materials

Door

Part	T	W	L	Mtl.	Qty.
A Stiles	1¾"	6"	80"	M	2
B Rail–top	1¾"	6"	24"	M	1
C Rail–middle	1¾"	6"	24"	M	1
D Rail–bottom	1¾"	9"	24"	M	1
E Divider–top*	1¾"	5"	36⅜"	M	1
F Divider–bottom*	1¾"	5"	24"	M	1
G Moldings–long* **	¾"	¾"	36⅞"	M	16
H Moldings–short*	¾"	¾"	10"	M	12
I Moldings–curved*	¾"	¾"	10⅜"	M	4
J Panels–bottom*	¾"	9½"	24"	M	4

*Parts cut to final size during construction. Please read all instructions before cutting.

**Multiple lengths required. Length listed is for longest part needed.

Material List

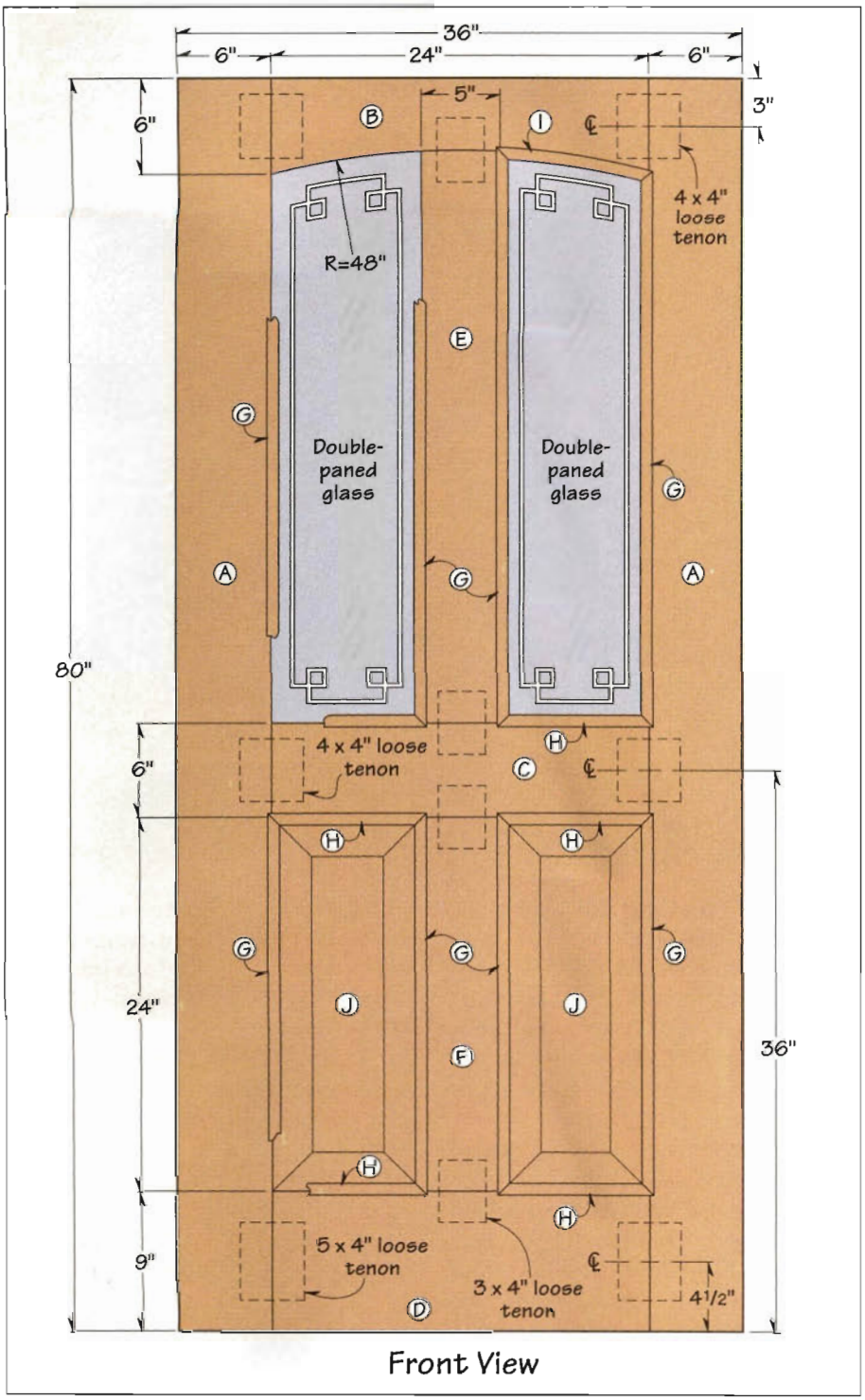
M–true mahogany

Supplies

Slow-set epoxy; 1" brads; #6x1¼" brass ovalhead wood screws; brass lockset with 2¾" (approx.) backset; 3–brass loose-pin hinges; 2–double-paned glass lights; exterior (marine-type) oil finish. (To mail-order hardware and finishing products, see Sources at end of article.)

Editor's Note

Sven Hanson remembers his grandmother's door: large and opulent with raised panels below and filigreed glass lights above. Multilayered molding held the panels and frosted glass panes in place, unifying the whole. For years, his child-sized recollections had him convinced that such a door was too large and too complicated to build. But then, a nostalgia-inspired session at the drawing board changed his mind. We present the fruits of that session here.

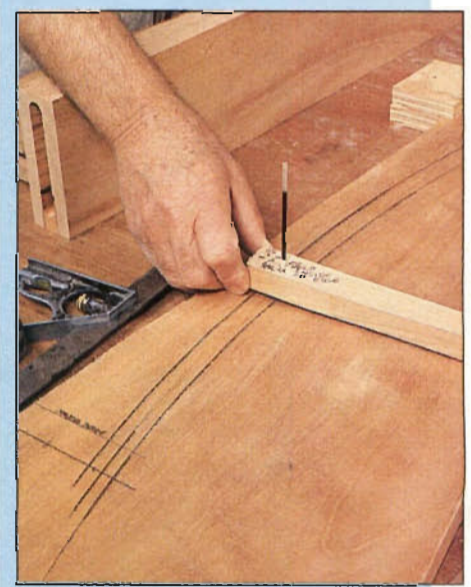


Front View

Photo A: To cut dividers accurately, dry-clamp the stiles and rails, then trace radius directly onto top divider blank.

PRO TIP

The arched top rail and molding add visual interest as well as technical challenges. I laid out the radii using a trammel made from a 50"-long stick. A screw at one end served as a pivot point, from which I indexed three ⅛" holes: the first at 47½" for the inside molding radius, another at 48" for the rail arch, and the third at 48¼" for the outside molding radius. I inserted a ballpoint pen refill in the hole, wrapping it in tape for a snug fit. This made a smooth, dark line that was easy to follow with the bandsaw. (See the photo *below*.)



Author used shop-made trammel to scribe radii on top door rail and molding.

Step 3. From the remaining 1¾" stock (a single piece if possible for grain continuity), rip and crosscut the dividers (E, F) to finished width and rough length (final plus 1").

Step 4. Lay out a 48" radius along the bottom edge of the top rail. (See the Pro Tip at *right* on making a trammel.) To do this, position the trammel pointer so that the arc passes through both lower corners of the rail. Bandsaw the rail to rough shape, keeping the blade wide of the line. Then, sand to the line using an oscillating spindle sander, or smooth the arch with a spokeshave.

Step 5. Dry-clamp the frame parts as shown on the Front View drawing, centering the middle rail 36" above the bottom ends of the stiles. Check for fit and squareness, and adjust as necessary.

Step 6. With the frame still clamped, center the two dividers beneath their respective openings.

Next, trace the top rail radius onto the end of the top divider as shown in *photo A*. Bandsaw and sand this end to the line. Then, crosscut the bottom end of this divider and both ends of the lower one, sneaking up on the final length for a snug fit. Note: Be sure you center top divider on top rail. I scribed guide lines on top rail to help square the parts for laying out.

Mortise and Assemble The Frame

Step 1. Add the dividers to the dry-clamped assembly. Label the mating parts at each joint on the front face. (I label the parts 1-1, 2-2, and so on. On the back face, I write NO at every joint to remind myself to index the mortises from the front face only.) Next, lay out mortise centerlines where dimensioned on the Front View drawing.

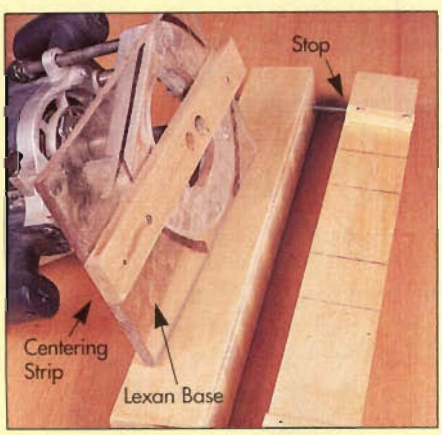
Step 2. Using a *plunge router* and jig, rout 2"-deep mortises where marked. (I used a ½"-diameter, 2"-long spiral up-cut bit. For more information, see "Plunge-Routing the Mortises" in the box *below*.)

Step 3. To make loose tenons, resaw scrap to a scant ½" thick. (I sub-

Plunge-Routing the Mortises

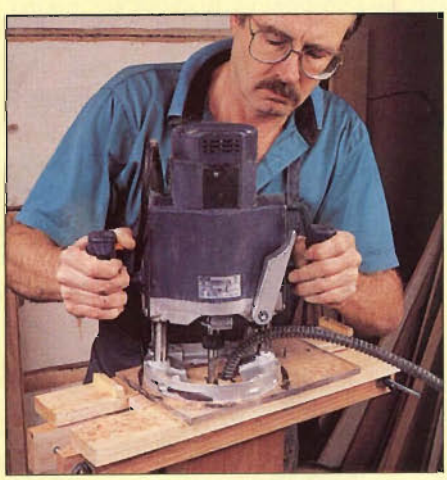
To rout the 2"-deep mortises for this project, I recommend using a plunge router with at least 2 hp and a ½" collet. I've devised a rectangular Lexan™ router base and a shop-built jig to guide it. (See the photo *below*.) I've covered clamping surfaces on the jig with 100-grit sandpaper and waxed the top face with paraffin to reduce friction.

The router base has a center hole that's slightly larger than the ½" bit. To the bottom of the base, I bolt a ½"-thick lengthwise wooden strip, centering it on the bit. I make the strip 1/16" narrower than the gap between the guides, always pushing the strip against the back fence of the guide during routing to keep the mortises properly indexed. This more or less centers the mortise on the work.



Lexan router base, guide, and fixture used by author for plunge-routing mortises. Stops on fixture limit mortise length.

To rout the end-grain mortises, I secure the jig to the work with carriage bolts. (See photo *below, left*.) For the long-grain cuts, I remove the carriage bolts and use C-clamps. Stops at either end of the front platform (nearer the operator) control the length of the cut.


Author attaches fixture to workpiece using carriage bolts, then routs left to right—do not rout on return stroke.

If you don't have a plunge router, the rectangular base and center guide will let you plunge a cut using a conventional router by tilting it up onto the end of the base, then slowly dropping it into the cut ¼" at a time. (A round base doesn't have the stability to do that.) Note: Make the jig stops 1½" thick if you're using a non-plunging router.

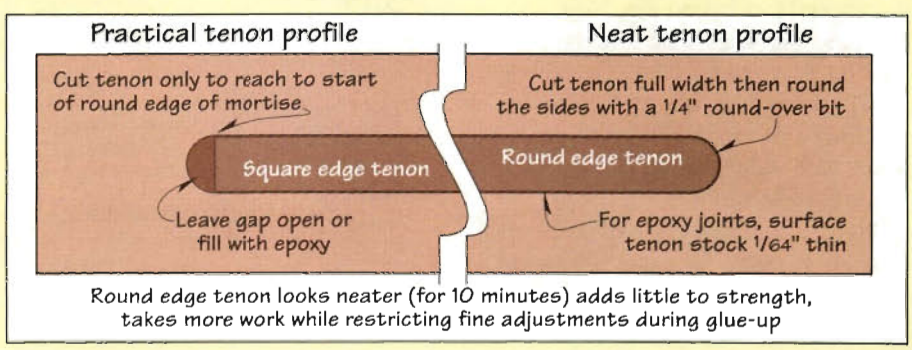
I space the stops to cut a 4"-long mortise. The ½" bit adds a ¼" radius at each end as shown in the drawing *below*, yielding 4½" total length. During setup, I align the jig's centerline with the centerline of the joint. For the wider bottom rail, I extend the mortises to 5" long.

Make the mortising cuts routing from left to right. Cutting on the return pass invites the bit to grab and snap itself off.

If you're a neatness fanatic, you can cut tenons that fill the entire (radiused) length of the mortise, then rout the edges with a ¼" round-over bit to form the edge radii. Or, you can square the mortise ends with a chisel and use square-edged tenons.

For my door, I cut the tenons square and didn't attempt to fill the radiused mortise ends. (See the drawing.) You can fill the entire mortise, either by rounding the tenon or squaring the mortise, but it won't increase the joint strength appreciably, and you'll sacrifice the option of fine-tuning the joint alignment (by sliding the mating parts back and forth slightly during glue-up). I fill in the radiused mortise ends with extra epoxy before assembling.

After routing the end-grain mortises, I remove the carriage bolts and clamp the jig to the edge of the workpiece with C-clamps to rout the long-grain mortises. The alignment procedure remains the same. I double-check my setup before routing to make sure I've indexed the mortise from the front face of the part. After routing, I vacuum or blow out the mortises, double-check their depth, and count them to make sure I've cut all 20 of them.



Round edge tenon looks neater (for 10 minutes) adds little to strength, takes more work while restricting fine adjustments during glue-up

Photo B: Paint the surfaces to be joined with a coat of epoxy to wet them thoroughly. Author used a multi-piece tenon, which doesn't weaken the joint provided you use adequate adhesive.

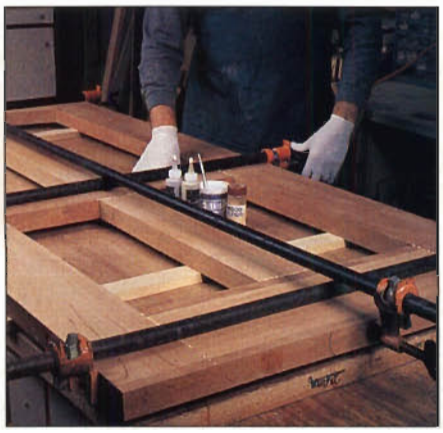


Photo C: Assemble frame on a flat, wax-papered surface, using light to moderate clamp pressure and pads that direct pressure to joint centers. Allow the epoxy to cure completely.

Photo D: To make straight molding stock, rabbet both edges of wide blanks, then rip a ¾" molding strip from each edge.

tract only a hair—not even a full 1/64".) Epoxy requires a slight gap and also clings tenaciously to the relatively rough surface left by a saw blade. Note: If you don't have any wide scrap stock, cut pieces that are half- or even one-third width and fit them edge to edge to make a full-width tenon. Buried in adhesive, multi-pieced tenons won't affect a joint.

Step 4. Start with a 2-oz. batch of slow-set epoxy mixed 1:1. Apply a medium-thick layer to all glue surfaces (except for the mortises and tenons), starting with the end grain. As soon as this batch runs out, mix up another and continue. The end grain often absorbs the first coat and needs another.

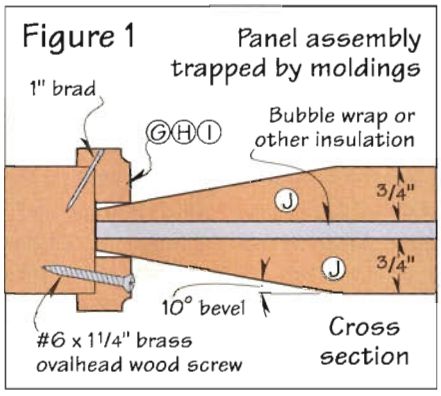
Step 5. Once you've coated all glue surfaces, mix another batch of epoxy. Coat the mortises and tenons, then slide the tenons into the mortises *(photo B)*.

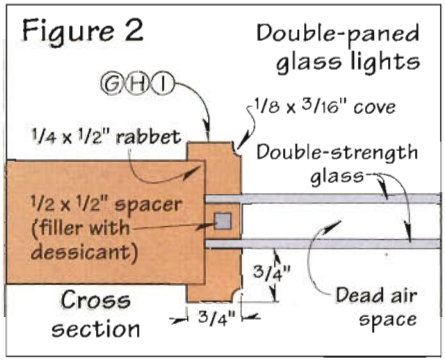
Step 6. Mix up yet another batch of 1:1 epoxy and thicken it a pinch at a time with mahogany dust from the belt-sander bag. Note: Stop adding when the mixture begins to stand up in swirls—you don't want the stiffness of meringue on a lemon pie. Now, recoat the glue surfaces and tenons. If you have leftover, trowel it into the radiused mortise gaps.

Step 7. Assemble the frame parts on a flat, well-waxed surface, then clamp using light to moderate pressure. Use pads to direct pressure to the center of each joint *(photo C)*. Note: To create a strong bond and fill any gaps, leave a thick layer of epoxy (.001–.002") in the joint. Epoxy strengthens slowly, especially at temperatures below 70°F. Leave the assembly clamped until the epoxy has cured completely.

Step 8. Wipe off as much uncured epoxy squeeze-out as possible, using a cloth moistened with lacquer thinner, acetone, or denatured alcohol. (Removing the cured stuff later calls for scrapers, sandpaper, and sometimes even explosives.)

Step 9. From the bottom or side of the door, sight over the face to check for twist. If necessary, place shims under the clamps at the low corners to make the door lie perfectly flat.





Next, Prepare the Panel Moldings

Step 1. While the epoxy cures, make the L-shaped molding (G,H) that retains the panels. (See *figures 1* and *2*.) To do this, surface stock to ¾" thick, then rip enough 2"-wide strips to total 30 linear feet. Note: Sixteen of the molding strips must be at least 37" long. Using a rabbeting bit in the table-mounted router, cut a ¼" rabbet ½" deep along both edges (of one face) on each strip.

Step 2. Carefully rip a rabbeted strip from both edges of each strip *(photo D)*. Next, rout a 3/16" cove on the outside corner of the L where shown in the figure. To do this, install a ¼"-radius cove bit but elevate it to cut only 3/16" deep. Bury all but ⅛" of the bit in an auxiliary fence. Note: A simple 3/16" chamfer would also work here and would be easier to final-fit when it comes time to miter the ends.

Step 3. To make the curved moldings (I) for the arched top rail, cut two ¾x9x24" pieces of stock. With the trammel set up for the 48¼" radius, draw an arc near the top of each board. Then, move the pen to the 47½" hole and draw the inside radius from the same centerpoint.

Step 4. Bandsaw just outside the 48¼" line, then use a block plane to fair this outside curve right to the line *(photo E)*. Next, rout the ¼x½" rabbet along this curve as you did on the straight molding. Now, bandsaw the inside radius of the curved molding, staying outside the line to free the molding from the board *(photo F)*. Fair the

Photo E: After bandsawing outside radius of curved molding stock, use block plane to fair radius to the line.

Photo F: Bandsaw inside radius of curved molding, then fair to the line using a spokeshave.

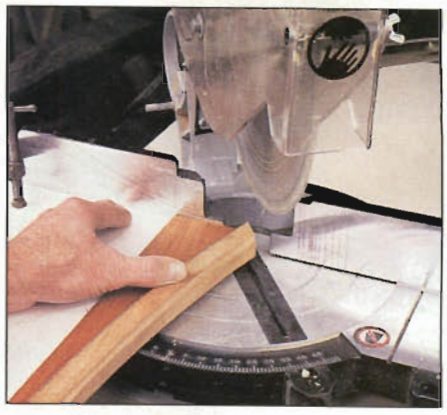


Photo G: Make template to orient curved molding properly, then miter each end to match template angle. Author's miter saw won't cut an angle greater than 45°, so he turns template 90° to fence to compensate.

inside curve to the line using a spokeshave. Then, rout the ⅛ x 3/16" cove along the lower outside corner of the piece.

Miter the Moldings

The miters can trick you because you need to dimension the cuts from the shoulder of the rabbet, as on a picture frame, rather than from the outside edge of the molding. This makes layout a bit more complicated, so I cut the first part of each pair to fit, then use a jig and stop block to ensure accuracy on the mating part.

The arched moldings in the top openings make for even trickier joinery. At one corner, you have an "opened" miter that measures more than 90°; the "closed" miter at the opposite corner totals less than 90°. The challenge is to split the difference at each joint between the straight vertical piece and the curved horizontal piece. Otherwise, the mating mitered ends won't match in width. Also, keep in mind that the two pairs of arched moldings must be book-matched, so you'll need to *reverse* the setups to miter them.

Step 1. Using a tablesaw and miter jig, miter the four straight moldings (G, H) for each lower opening (both front and back faces). To do this, work your way around each opening, starting with one of the short, horizontal moldings. As you finish each set of moldings, mark the location of each piece.

Step 2. For the top openings, miter the curved moldings (I) first. Some simple geometry went into this layout, but I devised a template to save you some calculating. (See *figure 3.*) To make the template, start with a 7x14" piece of ¾"-thick scrap. Center this piece beneath one of the upper openings on the door frame, and align its top edge flush with the top edge of the top rail. Trace the top of the opening—the rail arch and the two vertical edges—onto the template. Bandsaw and sand just the radius to the line, leaving the vertical lines intact. Next, using an accurate gauge, lay out the angles at the template ends as dimensioned in the figure. Note that these angles must intersect the mating frame corners.

Step 3. To miter the first two pieces, adhere a rough-cut length of curved molding to the edge of the template. Set the cutting angle on your miter saw to match the angle at one end of the template. Note: If your miter saw won't (like mine) cut angles this sharp, place a wide perpendicular stop against your miter-saw fence, then position the straight edge of the template against the stop and adjust the cutting angle to allow for this extra 90°. Now, position and clamp the template's straight edge against the fence, then miter this end of the molding as shown in *photo G.*

Step 4. To miter the opposite end of the molding, slide the template down the fence and reset the cutting angle to match the opposite end of the template. Clamp the template, then make the second cut. Next, adhere a second piece of molding stock to the template, and repeat steps 3 and 4 to miter the second molding. (This piece will fit the opposite side on the opposite face of the door).

Step 5. Remove the second molding, then flip the template end over end before mitering the remaining two moldings. To do this, repeat steps 3 and 4, using the reversed template to cut the appropriate miters at the correct ends. (These two pieces will book-match the first two you mitered.)

Step 6. Position one of the four curved moldings in a frame opening. Next, cut the two vertical moldings for the opening to rough length. Lay out

Figure 3 — Template for mitering curved moldings

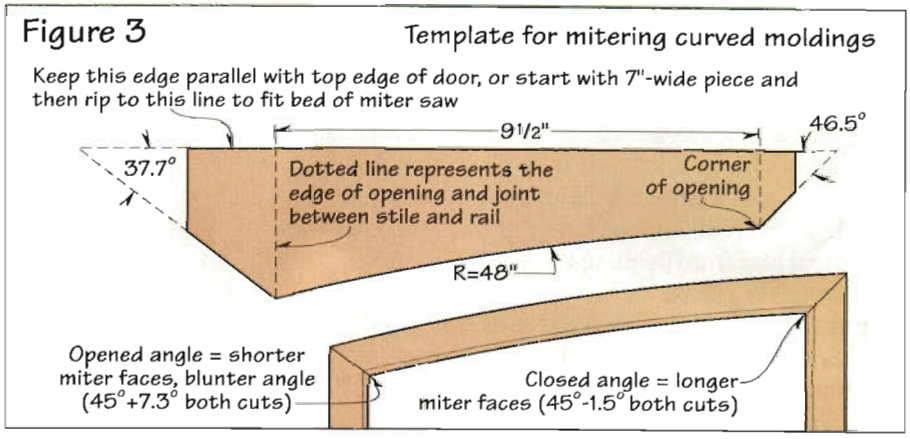


Photo H: Glue and nail outside molding to frame using type II water-resistant glue (or polyurethane glue sparingly, as author did). Pilot-drill holes, drive brads, then set brads and fill holes.

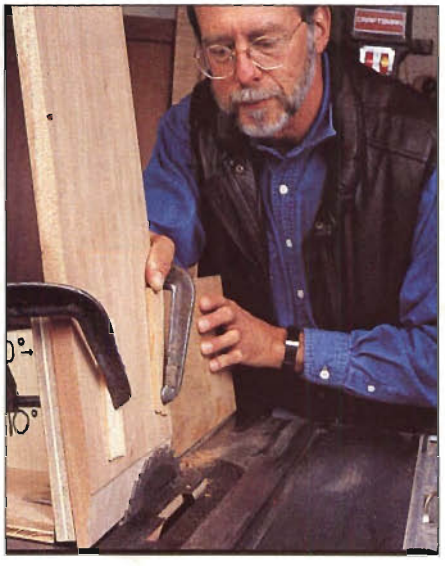


Photo I: Author's tall panel-raising jig has interchangeable blocks that tilt panel to proper 10° angle for beveling.

Photo J: Adhere foam insulation tape around edge of panel back, then cut insulation sheet to fit inside tape. (Author used bubble wrap.) Adhere sheet to bottom panel, then add top panel.

and miter the top end of each to fit the mating end of the curved molding. (I suggest starting a bit wide of the measured angle and "sneaking up" on the final cut.) Repeat this procedure for each of the remaining three openings.

Step 7. Install all mitered moldings on one face of the door using yellow water-resistant (type II) or urethane glue and 1" brads *(photo H)*. I pilot-drilled the brad holes, then set them and filled the holes. A dab of glue on the miters fills small gaps and improves weather resistance.

Make the Raised Panels, Then Pre-Finish the Parts

Note: I install two ¾"-thick raised panels back to back in the lower openings, sandwiching a layer of insulation between them. I also double-pane the glass lights to provide a little more help with the heating bill. (See figure 1.) I attach the interior moldings using only screws so I can remove them.

Step 1. To make the four panels (J), edge-join the stock, then surface it to ¾" thick. Measure the lower door openings, then cut the panels 1/16" shorter in length and ¼" narrower. That might sound sloppy, since panels this size won't expand or contract much across the grain. I settled on this width as a compromise: it should prevent them from falling out when they shrink and also from pushing the joints apart when they expand.

Step 2. Using the tablesaw or router, raise the panel surfaces. I bevel them at 10°—ends first, then the edges—using a tall sliding jig that travels on the rip fence *(photo I)*. A pair of hinges joins the jig base to the supports, which in turn screw into a pair of angled 2x6x6" blocks that are cut to the desired 10° from square. A smaller angle would be easier to sand and fit, but you'd have to allow more room between the moldings for the thicker panel edge.

Step 3. To determine how much space you have for insulation between the panels, temporarily fit a pair of panels back to back into one of the molded openings. Press a piece of molding in place on top, then measure the gap between panel and molding. If the molding won't fit all the way in, you can either plane the back faces of the panels, raise the panels at a steeper angle, or re-rip the drop edge on the molding to make it narrower.

Step 4. Finish-sand the panels, then pre-finish them. I sand the panels to 180-grit, then wipe them with a damp sponge to raise the grain. While the surface is still wet, I rub down the raised grain with a purple Scotch-Brite pad, then vacuum the parts clean. Next, I apply three coats of Waterlox Marine Oil Finish, which is so thick that I usually warm it in a hot-water bath first. If the third coat adds too much gloss for your tastes, you can dull it down after it dries with a fresh Scotch-Brite pad. Note: I use this same procedure for finishing the remaining parts later.

Step 5. Adhere a strip of foam insulation tape around the perimeter of the first panel, allowing it to overhang the edge by 1/16" to ⅛". Apply several strips of double-faced tape to the panel back, then cut a piece of insulating material, such as foam packing sheet, bubble wrap, or bead board, to fit snugly inside the foam-tape border. Adhere the insulation to the panel, then lay the second panel on top, compressing the foam slightly to make a tight-fitting, well-insulated unit *(photo J)*.

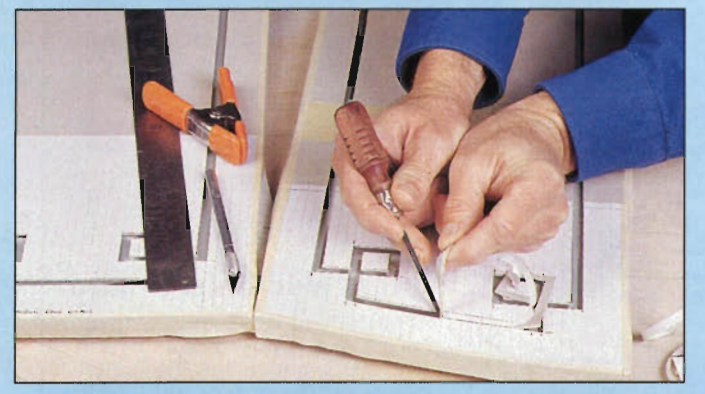
Put It All Together, Then Hang the Door

Step 1. Measure the upper openings in your door frame, then cut plywood templates for the glass lites, leaving a 3/32" gap around all edges. Have a glass dealer cut two pairs of panes from the templates. Select either clear or frosted glass, depending on your privacy and security preferences. (See "Procuring and Etching the Glass Lites" *opposite*.)

Step 2. Fit the double-paned lites into their respective openings, securing them around the edges with thin rubber blocks (available from your glass dealer). Test-fit the second set of moldings (for the raised panels as well as the lites) to make sure they hold the parts securely. If necessary, rerip the drop edge on the moldings to ease the fit. Now, drill evenly spaced shank and pilot holes (for #6x1¼" brass oval-head screws) to attach the moldings to the door frame. Remove the lites and panels for now.

Step 3. Test-fit the door in its frame. Use a belt sander or block plane to

Continued on page 50



To sandblast a design on the glass, apply resist or mat to glass, then adhere your paper pattern. Cut out design using razor knife, then peel away mat to expose the design for blasting.

Building codes specify that glass panes in doors be made of a safe material that either doesn't break or breaks into small fragments. Though nearly unbreakable, acrylic sheet scratches easily and often yellows. Wire glass provides a measure of security but has an institutional look. Laminated glass, which has an invisible layer of plastic sandwiched between thin layers of glass, breaks easily but hangs together.

Most door builders use tempered glass. After cutting standard glass to exact size, the glazier sends it to a treatment plant where it undergoes an extra heating/cooling process that hardens it and also creates internal stresses. The stresses ensure that if it breaks, it will shatter into small, rounded pieces.

Glass can't be cut once it's been tempered, so make templates from ¼" plywood or hardboard and fit them carefully. Vendors charge a bit extra for cutting from a pattern, but if the glass doesn't match the pattern exactly, you don't pay. Installing two panes in each opening with a dead-air space between increases the insulating value about threefold. (See figure 2.)

To size the spacer and make the molding fit snugly around the double-paned lites, measure the gap between inner and outer moldings at several locations. Specify a thickness that will fill the widest gap measured. You'll want to use double-strength glass, which is approximately ⅛" thick, so include ¼" for the two panes. The glazier can choose from a range of spacer thicknesses (usually 7/16" to ¾") to meet your specification.

Thicker spacers are also wider, which means they'll protrude more visibly around the perimeter of the glass. Also, you don't get more insulation by increasing the pane spacing. Beyond a certain point, a wider separation will actually decrease its insulating effectiveness.

A glazier will cut the panes, have them tempered, then assemble them into two intact units ready for you to install.

To enhance the door's dressy look, I sandblasted a filigree pattern on the clear panes. "Etching" both panes creates the best effect, adding a bit more privacy while still allowing you to see who's at the door. The drawings *below* shows the design I used.

Etching the Glass

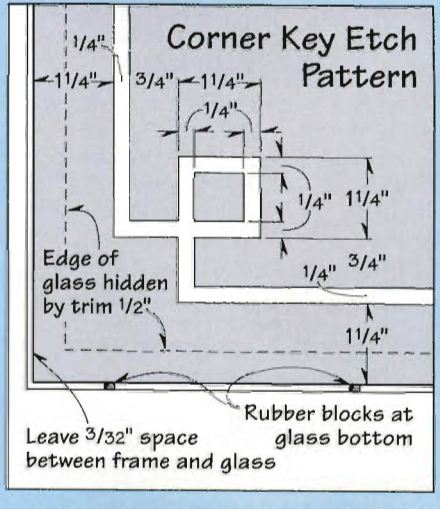
Sandblasting works well for etching glass. For light-duty blasting like this, you can substitute good duct tape (provided the glass is clean) for commercially-available blasting resist.

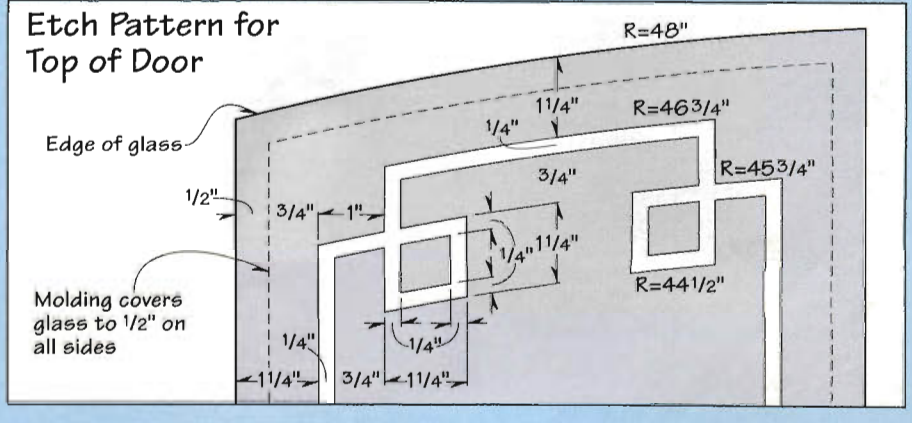
First, lay out the design on paper. Then, spray the masking with adhesive, apply the patterns to the mask, and cut out the design with a razor knife. Also, tape the edge of the double-paned unit to protect the spacers. (See the photo at *left.*) Then, peel away the cut design. Now, blast the glass until it's evenly frosted.

If you don't want to do the artwork yourself, take the design of your choice to a shop that can lay out a design using scanning computers and cut the mats using an automatic cutter. You provide the drawing. They scan it, resize it, then cut a vinyl sheet with a peel-and-stick backing. You apply the entire vinyl sheet to the glass, then remove the precut sections you want to be blasted or etched on the glass.

If you don't have sandblast equipment, check the advertising pages in your telephone book or newspaper. Many sign makers and custom glass artists will do the blasting for you. Prices vary considerably, depending on how much of the work you do yourself.

You can also acid-etch the glass using a kit that's available at most crafts and hobby shops. You lay down a design using vinyl tape or other resist, then paint on a gelled acid. This method doesn't look difficult, although I haven't used it.





Mahogany Door

Continued from page 48

remove any stock necessary to achieve a good fit. Size the door to create an ⅛" reveal on the top, latch-side edge and bottom. You'll also need to plane a 4° bevel along the full length of the latch stile. I've also found that a crisp ⅛" chamfer around the front edge hides noticeable irregularities created in the fitting process.

Step 4. With the door fitted to its frame, lay out and rout the hinge gains. Attach the hinges temporarily. Note: A door typically will sag 1/32" or so at the top outside corner, so I rout the gains an extra 1/32" deep, then shim the lower two hinges (in the frame gains) with thin cardboard. This throws the lower part of the door outward and pulls the outer corner up. If necessary, use extra long screws to attach the hinges to the jamb. On a heavy wooden door, the screws must be long enough to anchor into the framing material behind the jamb.

Step 5. Install a brass lockset worthy of your fine door, centering the knob 36" from the bottom. A word of caution: Read and reread

the manufacturer's instructions before doing any cutting. If you still don't feel confident, test-install the lock on a same-sized piece of scrap first. (To mail-order quality door hinges and locksets, see Sources.)

Step 6. Sand and finish the moldings and door using the same procedure you followed to prefinish the panels. After the finish has dried, install the lites and panels and secure them with the screws and moldings. Recruit a helper to help hang your door. Depending on climate and exposure, renew the door's oil finish (all surfaces) two or three times a year. WJ

Photographs: *By the author*

SOURCES

Waterlox Marine Oil Finish; Scotch-Brite Pads. Order from:

Woodworker's Supply
800/645-9292

Computer Facelift

Encase Your Computer In Wood For That Prestige Look

by Leon A. Frechette

Author's computer before and after he refaced it with cherry. Each computer's design dictates how it can best be clad in wood.

Ever wish your computer had more personality, or at least that it coordinated with the furnishings in your office or den? Manufacturing costs and assembly lines dictate the plain-vanilla appearance of computer hardware. But fortunately, we as woodworkers have the means to dress up our drab-looking machines. And best of all, you can do it in a non-invasive way that won't harm your computer.

Where To Begin

Before you start, carefully read this entire article. I've refaced two completely different computer systems, and what I've learned can help guide you to success on your own project. Refacing a computer requires time, skill, and patience, but the finished product will absolutely turn heads.

Computers may seem to look alike, but rarely do you find two identical units. If you have the familiar three-component system—keyboard, central processing unit (CPU), and monitor—you essentially have three projects (and different construction methods) to harmonize into one complete unit.

Your system's design will dictate the direction to take in construction. So, study your unit and then apply my suggestions as they fit. The techniques will be similar whether your computer happens to be a desktop or tower model, whether it's outfitted with a standard or ergonomic keyboard. Caution: Not every computer component has a design that lends itself to refacing. Also, make certain you don't cover any ventilation ports on the components.

Choosing a Wood

I prefer using hardwood because of the handling and handwork involved. My first prototype, made of southern yellow pine, looks great, but the wood presented some difficulties, mainly because of its varying densities. Also, the pine required careful handling simply because it was so soft. Power tools help, but you'll still have considerable handwork. So, choose the wood carefully. I suggest using a type of wood with which you have considerable experience.

I refaced the computer shown at *left* with cherry. A medium-density wood with fine texture and straight grain, cherry machines nicely, although it will burn and chip quite easily. To compensate, I made sure that my saw blades, router and drill bits, and planer and jointer knives were sharp. You'll need to make numerous compound cuts, so having a compound-miter saw will be helpful.

Start with dry stock and acclimate it to your shop's environment for several weeks. Because the wood will encase heat-generating equipment, I started with drier-than-average wood and kept it away from any major moisture source (except for the finishing products). I sealed all surfaces with several coats of clear finish.

Covering my three computer components required about 35 board feet and cost about $180. Plan on buying at least 35 to 40 board feet, and expect to pay $175 to $225 (depending on the wood you select) to reface a complete system. If you attempt to match grain patterns when gluing, you may need a bit more material. Paxton Beautiful Woods supplied the cherry for this unit. If you have questions concerning specific characteristics of a wood or want help with selection, contact Paxton at the number listed under Sources.

You may find it easier to work with solid wood than with plywood. Thick stock isn't necessary except for the CPU case—leave it ¾" thick, especially if you plan to set the monitor on top of it. For the rest of the parts, ⅜" or ½"-thick stock works quite well.

Since you'll probably have to edge-glue narrow pieces to make wide panels, I advise using a stronger joint than the standard edge-to-edge glue-up. I used Porter-Cable's Tru-Match Bit (#43692), which cuts a strong, nearly invisible joint. If you use a special edge joint, mark the pieces as you work

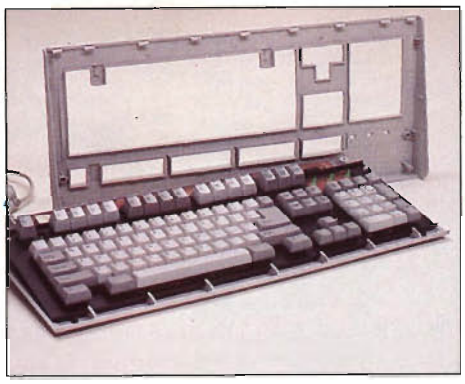


Photo A: If the keys are permanently attached to the cover, the keyboard can't be refaced. To determine this, remove the cover.

them to keep track of the sequence during the glue-up. Yellow wood glue was my adhesive of choice. It has a good wet tack and fair creep resistance.

To prepare your stock, first edge-glue thick material, then plane the glued-up panels to desired thickness. If you need panels wider than your planer will accommodate, see the Pro Tip *below* for a solution.

Check the Keyboard

To determine whether your keyboard can be refaced, remove the screws from the bottom and lift off the case cover. If the keys remain attached to the cover, it can't be refaced. The keys must be attached to the bottom *(photo A)*. Keep in mind, however, that keyboards aren't expensive. Consider buying a new one that can be refaced.

Also, locate the keyboard lights that indicate number, caps, and scroll lock. Some keyboards group them as a separate pop-in plate. If the lights have been molded into the cover, you'll have to cut out that section and recess it into the wooden cover *(photo B)*. Note: Don't cut out this area until you've used the keyboard cover as a template to lay out the cut.

CPU Concerns

I prefer building the wooden cabinet around the metal case because the metal helps contain critical radio interference. Whether you choose to keep the metal case or not, keep your stock thickness close to ¾" thick to support the monitor.

If you don't use the metal case, you must coat the inside of the wooden case with paint containing at least 15 percent copper. This may be easier said than done. After searching for the paint at every paint and hardware store in my area, I finally found one that contained copper but the label didn't specify the percentage. I decided it was easier to build over the existing metal case. This way, I didn't have to bother with the paint or find a new way to fasten the inner workings of the computer to the wooden base.

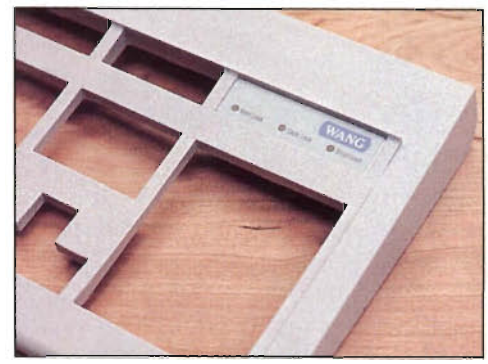


Photo B: The keyboard function lights were grouped in the upper right corner of the keyboard plate on author's computer.

You'll also need to incorporate the switches and lights from the faceplate into the front panel of the wooden case. The faceplate often detaches from the case, but for the present, save it to use as a template. (Do not cut out the light and switch area yet. See *photo C.*)

A word of caution: Once you remove the CPU's cover, avoid touching any of the internal parts. Also, store this part of the computer in a room away from construction dust until you are ready to fit the faceplate.

How To Cover A Monitor

Leave the external case around the monitor too. You will, however, have to detach the pedestal in order to recess it into

PRO TIP

To prepare stock wider than your planer can handle, such as for the CPU case, first edge-glue stock to widths that will pass through your planer. When the glue has dried, plane these panels to thickness. Next, apply masking tape (or any tape that can easily be removed) to both pieces and on both sides up to the glue edge.

Vertical clamps automatically keep glue-ups flat.

Apply glue to the panel edges, join them, and then apply light clamp pressure. Inspect the joints for uniform glue squeeze-out. If any part of a joint does not show squeeze-out, it did not receive sufficient glue. Remove the clamps and apply additional glue to these "starved" areas. Then, reassemble and reclamp.

Let the squeeze-out set—do not wipe wet glue. When the glue skins over, remove the masking tape and scrape off any remaining glue. I prefer to scrape the glue while it is still pliable, not wet. It's easier to remove at that stage.

To prepare for glue-up, place the pieces in the proper order with the correct faces up. Keep the panels flat if you hope to make precise cuts. I use the glue press shown at *left*, which automatically adjusts for thickness and keeps the pieces flat during clamping.

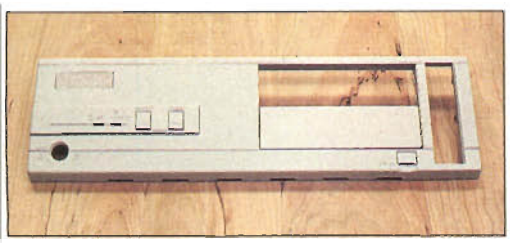


Photo C: On the case's front panel, author cut out the area with the buttons and lights on the left, and the power button in the lower right corner.

a wooden base for mounting. For now, remove the pedestal and set it aside until later.

You'll want access to the monitor in case it needs repair, so determine now just how you'll remove it from the wooden case. Leave enough clearance between the case and frame that you can remove it from the back *(photo D)*. I built my wooden cover in two pieces, but we'll get to those details later.

Make the Keyboard Cover

Remove the keyboard cover from the base and turn it upside down to gauge the thickness of the molded plastic around the keys. (See photo A.) This dimension, which should be ⅜" to ½", will determine the thickness of the stock you need for the key panel. Because of all the cutouts, even ½"-thick material will be weak. The case on my keyboard was ⅜" thick, so I planed my stock to ¼", then glued ⅛" tempered hardboard to the underside for reinforcement.

If you look at the base from the side, you'll notice that it's higher in the back than in the front. You'll need to angle your frame the same way. (See *figure 1.*) Lift the new frame up a little from the bottom of the base so the rubber feet can do their job. The stock also has to be wide enough so that when you cut a ⅜" rabbet into the frame (as described in the next paragraph), the smooth bottom face of the hardboard falls into place correctly. This panel must not interfere with key action once you screw the frame to the wooden key panel.

Note: Driving screws into tempered hardboard will lift the material, forming a small dimple. Placing a little epoxy around it provides added depth and strength for the screws. Cardboard or cork pads can help keep the frame up off the work surface. You can also keep the material flat on the work surface, mark for the depth of the panel, and then cut the rabbet 1/16" to ⅛" deeper, depending on the height of your keyboard's feet.

Once you glue the key panel into the frame, it will sit at the right height. If necessary, use longer screws to attach the base to the key panel. The frame can be butted or rabbet-jointed, and I suggest using the full thickness of your ¾" material (or at least ⅝"). Remember to form the cord cutout in the back.

Glue and clamp the frame, then check it for squareness and flatness. After the glue dries, cut a rabbet on the top inside edge of the frame. I used a table-mounted router and a ⅜" rabbeting bit with a bearing. With this setup, you can keep both hands on the frame to guide it around the bit, and it automatically rounds the corners. Next, cut out the key panel and fit it into the frame.

Drill blade-start holes in each area, then scrollsaw the key slots. Next, place the key panel temporarily into the frame and test-fit it over the keys. If any keys stick, file those areas in the panel until the keys work properly.

Chamfer the inside edges of the key cavities. If your material is thin, do this by hand. Then, complete the inside corners using a utility knife, file, and sandpaper. When you're satisfied, glue the key panel into the frame. Caution: The key panel will probably buckle if you try to clamp across the frame (perpendicular to the grain). To prevent this, I placed two temporary braces in the underside of the frame to keep it from bending.

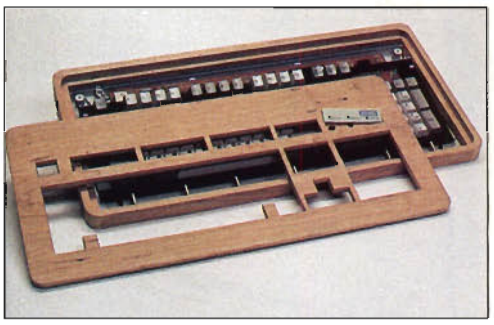


Photo D: Wooden key panel cut out, fitted, and ready to attach to keyboard frame.

Round over the outside corners of the frame to match the inside radius of the rabbet. I used a ⅜" round-over bit. Now, finish-sand the frame. *Photo D* shows the completed key panel before I attached it to the frame.

To install the separate function lights, place the plate (or the part that you cut from the plastic keyboard cover) over the three lock lights. Chisel a recess into the wood for the plate and secure it with epoxy. *Photo E* shows an assembled keyboard.

Next, Build the CPU Case

As mentioned earlier, I elected to built a wooden case over the metal case. For starters, rough-cut the top and two sides at least ½" longer than the case depth. For my desktop unit, I oriented the grain horizontally along the sides and front, and front to back along the top of the case. (See *figure 2.*) Next, rabbet the top inside edges of the two side pieces to accept the top.

Study the faceplate, particularly the molded plastic face. It should be about 1" thick. This dimension dictates your stock thickness. Cut a rabbet along the two edges and top end of the wooden

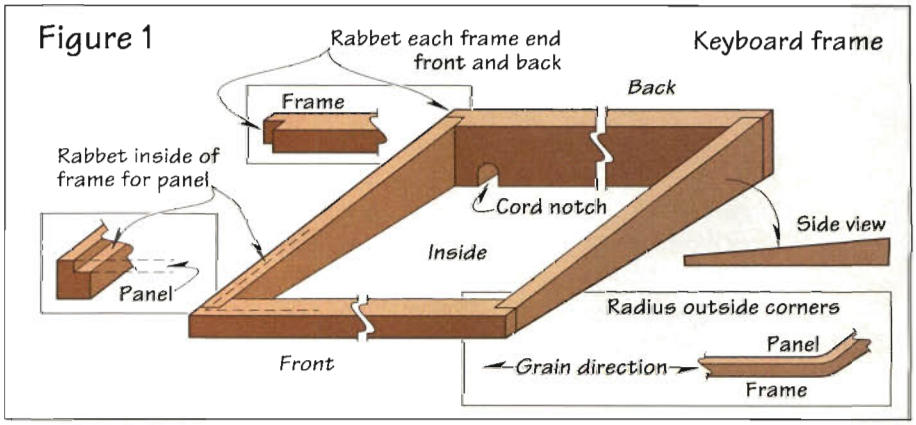


Photo E: Author's refaced keyboard after finishing and assembly.

Photo F: Assembled CPU case. Test-fit all switches before gluing in the plastic plates. Make sure you don't get glue in any of the controls.

Photo G: Author's two-piece monitor cover. The front frame glues to the base, and the monitor sits on a flat spacer. The back attaches with screws.

face (inside face), then glue the parts together. Once the glue has dried, slide the metal case up against the backside of the faceplate and install screws from the inside. (You may need to substitute longer screws.) At the back of the case, drill two holes in the lower corners and install wood screws to secure the back end of the metal case to the wooden case. Make certain these screws do not interfere with installation of the CPU base.

Next, mark the cut outs for the diskette and CD drives and any other switches or hardware. A jigsaw or scrollsaw works well for this. You can rout the backside of the face with a 25° chamfer bit or taper these areas with a file to free up space around the hardware. Take your time with this procedure. If you have several bays with blank covers, consider leaving these areas intact—cutting them out may weaken the face panel. To cover unused openings, make blank wood covers and hold them in place with screws from the inside.

Once you've cut out these areas, fit the case to the CPU's base. Make sure the opening fits over the hardware bays. Locate any cutouts needed for controls, switches, or lights. If the hardware sits too far back in the wood face, you can always adjust by pulling it out. Depending on your unit, you may have to drill clearance holes. If you have to drill over the motherboard, cover it with white paper first to collect any chips. (White paper allows you to see the chips while lifting the paper out.)

You may have to add extensions (wooden dowels) for the switches to make them work properly. Extensions would fit between the backside of the switchplate that will be glued into the wooden face and the actual switch on the CPU. This will depend on how far you recess the plastic plate into the wooden face.

To make sure everything fits properly, check the back of the CPU to see how close the screw holes are on the case and the base. If there is a small gap, then the base's front is hitting the backside of the wooden faceplate. Push in lightly on the faceplate to see if the CPU makes any indentations in the wood. (This works well with softwood). If so, chisel or drill out these areas for clearance. Keep testing and fitting until the case and base make contact at the screw holes.

Remove the plastic faceplate and look at the control panel area. It may snap out, but more likely it will have to be cut out. File and sand the edges, then place it over the wooden faceplate and check to see if the switches will work. If not, chisel a recess for the plastic plate into the wood, then epoxy the plate in place *(photo F)*.

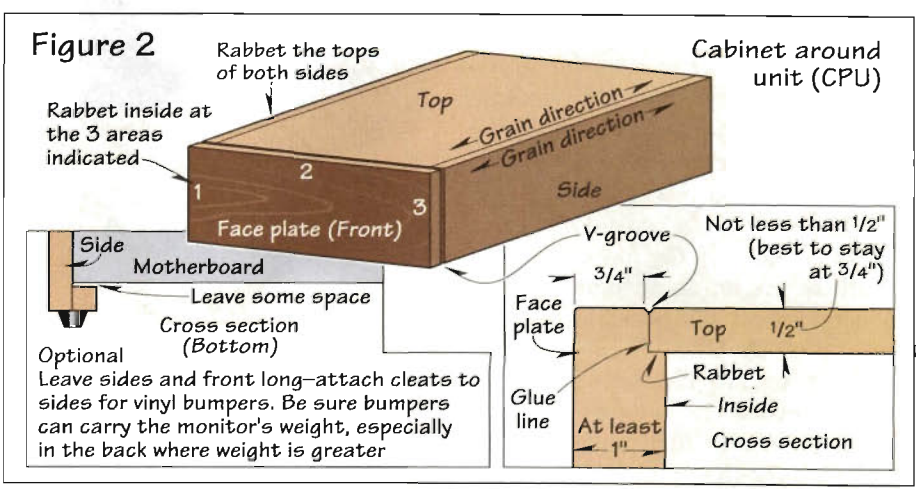
Also, watch where the sides and top meet the faceplate. The glue line around the case at this joint doesn't make for a very finished look. To improve its appearance, rout a V-groove dead center on this seam using a carbide-tipped V-groove bit. (See the figure 2 detail.)

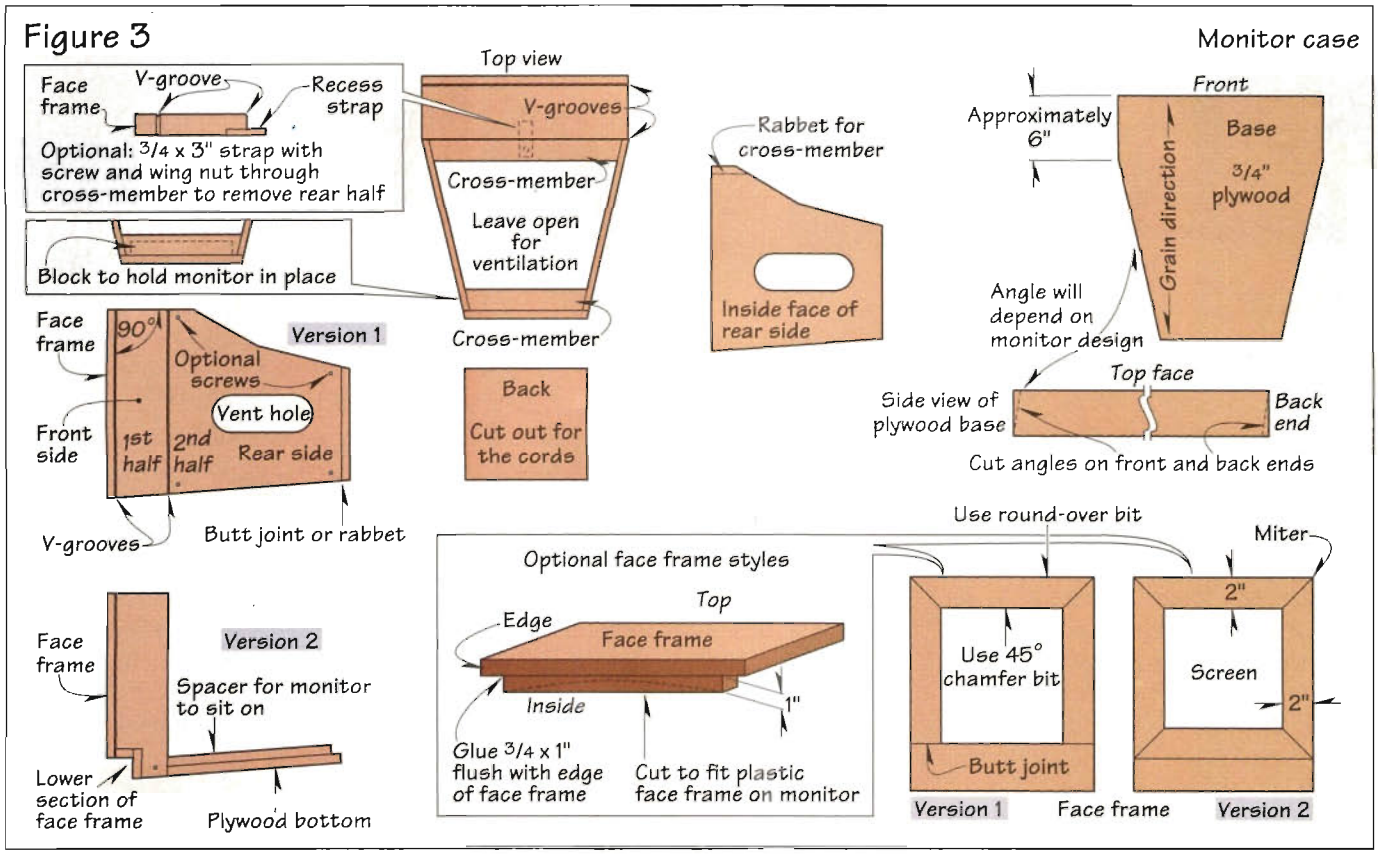
Wrap the Monitor

Remove the monitor's pedestal. Before laying it aside, locate its center and measure the distance from this point to the front of the monitor. You'll use this dimension when you install the new pedestal in the monitor's base. Next, rough-cut a ¾"-thick plywood base piece, sizing it 5" wider and longer than the monitor. (See *figure 3*.) Note: While working with and around the monitor, protect it from dust.

Beginning with the front section, cut the sides (with grain running vertically) and top wide enough to extend to the farthest point of the front bevel on the monitor's face and (at the back edge) to the point where the monitor begins to angle back.

Leave the sides at least 4" longer and cut a rabbet along the ends of the top (end grain). Place the base on stacked 2x material, then center the monitor on the base and ease it forward to ½" from the front edge.





Notice that my monitor sits at a slight angle when off the pedestal and sitting on the plywood base. I cut the sides to follow this same angle *(photo G)*.

Clamp the sides to the base and adjust them until they match this angle. Next, clamp the top in place, keeping in mind that it will be positioned at a 90° angle to the sides. If you stay at this angle, you will not be able to pull the monitor out of the case once it's assembled, so cut a ¾" spacer to fit under the monitor. Then, raise the sides so the top just clears the monitor.

Fitting the Monitor

To remove the monitor, slide out the spacer. The monitor will then drop down for easy removal. Alternatively, raise the sides high enough to remove the monitor as it sits on the spacer. In either case, try for a 2" reveal all around the monitor, including the new case. (You may have to cut the width of the base and the length of the top to accomplish this, then reclamp.) It's possible that the bottom of the face frame may be widened to provide access to the unit's controls. The wooden sides will be fairly close to the monitor, which will help hold the monitor in place.

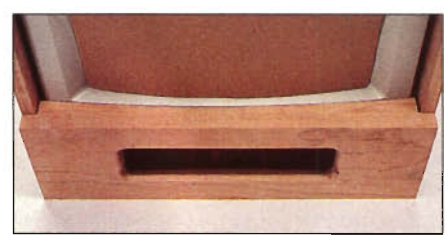


Photo H: Careful fitting of the face frame against the monitor is critical for aesthetics and to secure the monitor in place. Note kraft paper cover protecting monitor screen.

Photo I: Rear view of author's assembled monitor case.

Mark the base, starting at the back edge of the sides, for the monitor's angle. Note: Stay slightly outside the width of the monitor. Then, scribe the inside face of the sides along the underside of the plywood base. Remove the clamps and cut the base and sides to shape. Now, glue and clamp them.

Once the glue on the front half has dried, start on the rear half of the monitor's case. This section can be tricky, because monitors are designed differently, some of them with vent screens on the top as well as the sides. The monitor must have ventilation, so don't cover more than two percent of the venting screens overall.

Position the sides of the rear section against the front section, then clamp. To achieve a good fit, angle-cut the front edges of these sides to fit tightly against the front section's sides. As you did before, scribe the rear sides along the underside of the base.

If you decide to rabbet the cross-members and back instead of butting them, leave the base a bit longer, and the sides both longer and wider, to allow for this. The back and cross-members have to clear the monitor, so glue the back to the sides first, making sure that the top edge is flush with the top edges of the sides.

Next, glue a small block to the inside face of the wooden back (up

Photo J: To make the pedestal base, author first cut hole in top piece to accept the lower base plate, then glued the two ¾"-thick pieces together. The standing piece is routed to fit the upper pedestal section.

against the monitor) to hold the monitor in place. Note: Position the block low enough to clear the cross-member that will be glued in next. Then, glue in the cross-members. Secure the rear half of the case with #6 x 1½" brass screws and washers.

Build up the lower section of the case's front half (if your monitor requires it) to allow for the controls. Before installing this lower piece (on my case, it's the bottom member of the face frame), make the cutout for the switches and dials. Note: Make this piece the same thickness as the remaining frame pieces.

Make the Face Frame

Now, build up the face frame. To do this, cut ¾ x 1" strips that match the inside dimensions of the front opening of the case. Glue and clamp these to the back of the face frame. These allow the face frame to drop into place. Note: You may need to adjust the thickness of these strips, de-pending on the contour of your monitor's plastic face frame, unless you choose to build right up to the monitor's glass surface. This seems unnecessary to me. I suggest building up to the edge of the plastic frame, or to the point where it begins tapering down to the glass.

Bandsaw the face frame to shape, then finish it using a drum sander or the edge of your belt sander. An oscillating spindle sander allows you to see your work as you sand to the mark. Note: This is tedious but critical work, so take your time and trial-fit each piece to the monitor's face *(photo H)*.

Now comes the challenge—cutting the miters. Before you go ahead and cut them to 45° (and quickly discover that this angle doesn't work), cut scrap pieces and use them to determine the proper angle. Once you're satisfied, miter your finish pieces. Butt-to-edge joints work well for installing the face frame.

After the glue has dried, finish-sand the face frame. Then, round over the outside of the frame, using a ¼" or ⅜" round-over bit, and rout a 45° chamfer on the inside edge of the frame to direct the viewer's eye to the screen. Cut this chamfer wide enough to leave about a 1"-wide finish surface.

Give the monitor case the same detailing as the CPU, cutting a V-groove where the face frame meets the sides and where the back half meets the front half. *Photo I* shows a rear view of the completed monitor cover.

Form the Pedestal

The pedestal on my monitor required 1½"-thick stock for both the upper and lower sections. You'll probably have to edge-join the material. If so, consider using biscuits to align and strengthen the joints.

The pedestal's shape will dictate how to fit it into the recess of the stock. Depending on how it was molded, you may have to cut the pedestal to a shape that's easier to work with. Your pedestal base may already have locations marked for screws, or you may need to glue blocks into the base to accept screws, or the entire section may need to be glued into place.

The upper section of the wooden pedestal will fasten to the underside of the monitor's plywood base with four screws (centered on the point where the plastic pedestal was attached to the monitor). Note: You'll need to install this section before the upper part of the plastic pedestal can be installed. Remember to include the thickness of the face frame in calculating the location.

Make sure you secure the upper plastic section of the pedestal to the upper wooden section for stable support. Then, attach the wooden base to the plastic base *(photo J)*.

Other Points To Consider

Adhere heavy-duty 1½"-diameter felt pads to the underside of the pedestal base at each corner.

If the keyboard obstructs the diskette drive on the CPU, glue a pair of ¾"-square cleats to the base of the CPU case (1" from the front and back ends). Attach some vinyl bumpers to the cleats to elevate the CPU. Do not glue the cleats too close to the bottom of the CPU's frame, or you won't be able to remove the case.

Use a drill press rather than a hand drill for precise, perpendicular holes. A Japanese saw or a bandsaw fitted with a fine-tooth blade works well for cutting plastic.

To minimize wood movement, start with dry stock and seal all wooden surfaces with several coats of a quality sealing finish. Also, seal the back face of the hardboard so particles won't get into the keyboard.

Drill four 1" ventilation holes, one in each corner of the monitor's plywood base. Position them approximately 1" in from each side, where they will not be covered after installing the pedestal.

Note: While working on this project, I consulted my brother, Mike Frechette of VETS Computer Services, Inc. If you like the idea of refacing a computer but prefer not to tackle this complex project, you can purchase a refaced system from VETS. (See Sources *below* for additional information.) WJ

***Photographs:** By the author*

SOURCES

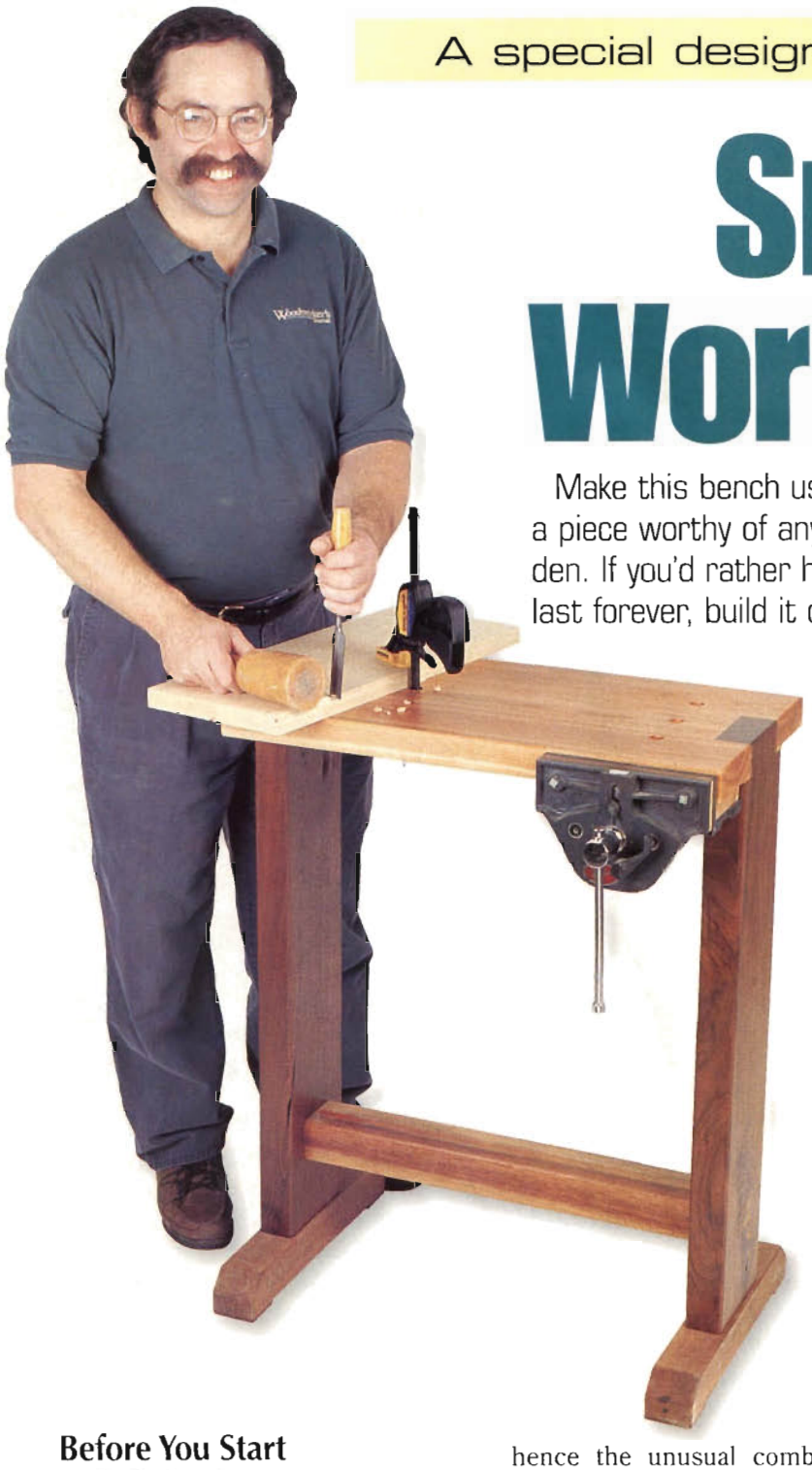
Paxton Beautiful Woods
800/333-7298

VETS Computer Services
904/983-0111

A special design with dozens of uses

Small Workbench

Make this bench using decorative woods, and you'll have a piece worthy of any setting—even the family room or den. If you'd rather have a no-frills shop version that will last forever, build it out of hard maple, oak, or beech.



Builder's Note

I built this bench from leftovers and found materials, and each board has its own story. The 8/4 cherry, for example, was too badly twisted for use in any fine furniture piece. I'd bought the thick walnut years ago but had passed over it time and again because of surface checking and large splits. The mahogany came from shipping crates that probably originated in Brazil. Actually, I call it "mahogany" for lack of a more positive ID—I've never worked wood quite like it. And did you notice the cherry inlay in the stretcher? It's there simply to hide a line of ugly nail holes.

Dick Coers
Designer/Craftsman

Before You Start

We designed our diminutive bench primarily to provide an additional, sturdy work surface in the shop. Our second goal was to make it small enough (and suitably refined) so that we could take it places where one wouldn't normally venture with a workbench: to a hobby room for crafts work, to a kid's bedroom for model-building, even to a booth at the woodworking show.

As Dick explains *in his note*, he made this bench from salvage stock, hence the unusual combination of materials. For your bench, we suggest only that you stick with stable, durable hardwoods that machine and join well. Oak, maple, beech, or ash will probably yield best results. Look to your scrap bin first—this project is an excellent way to use up leftovers. If you don't have large enough pieces for some of the parts, glue up thinner or narrower material.

Basically, we wanted a small bench. Keep in mind, however, that the dimensions specified here were largely determined by the stock Dick had available. Use them as guidelines, and don't hesitate to change them to fit your requirements.

To enhance our bench's versatility, we installed a woodworking vise, bored several holes in the top to accommodate round bench dogs (made from ¾" oak dowel stock), and added a hold-down clamp. You might also find it useful to fit your bench with a drawer or two, a shelf, and/or some tool holders.

Start With the Top and Legs

Step 1. Face-joint and plane enough stock to make the 1¾"-thick top (A). Crosscut these pieces to rough length, then edge-join them to make a rough-dimensioned panel. After the glue has dried overnight, belt-sand the top flat, then trim it to final dimensions. Lay out and bore the ¾" holes for the bench dogs and hold-down clamp where dimensioned on the Exploded View. Note: If you have 15" planing capacity, edge-glue the pieces first, then plane the panel to final thickness after the glue has dried.

Step 2. Face-joint and plane enough stock for two legs (B), then rip them to final dimension. (We left the legs 3" over length in case we made an error cutting the dovetails.) Also, try to get a 5"- or 6"-long cutoff from the end of one leg to use as a test piece when setting up for the dovetail cuts.

Bill of Materials

Bench

Part	T	W	L	Mtl.	Qty.
A Top	1¾"	14⅝"	27⅞"	C	1
B Legs	2 1/16"	6¾"	34⅞"	W	2
C Feet	2⅜"	2⅝"	18"	M	2
D Stretcher	2½"	3¼"	27⅞"	M	1
E Foot Pads	¼"	2⅝"	2⅝"	W	4

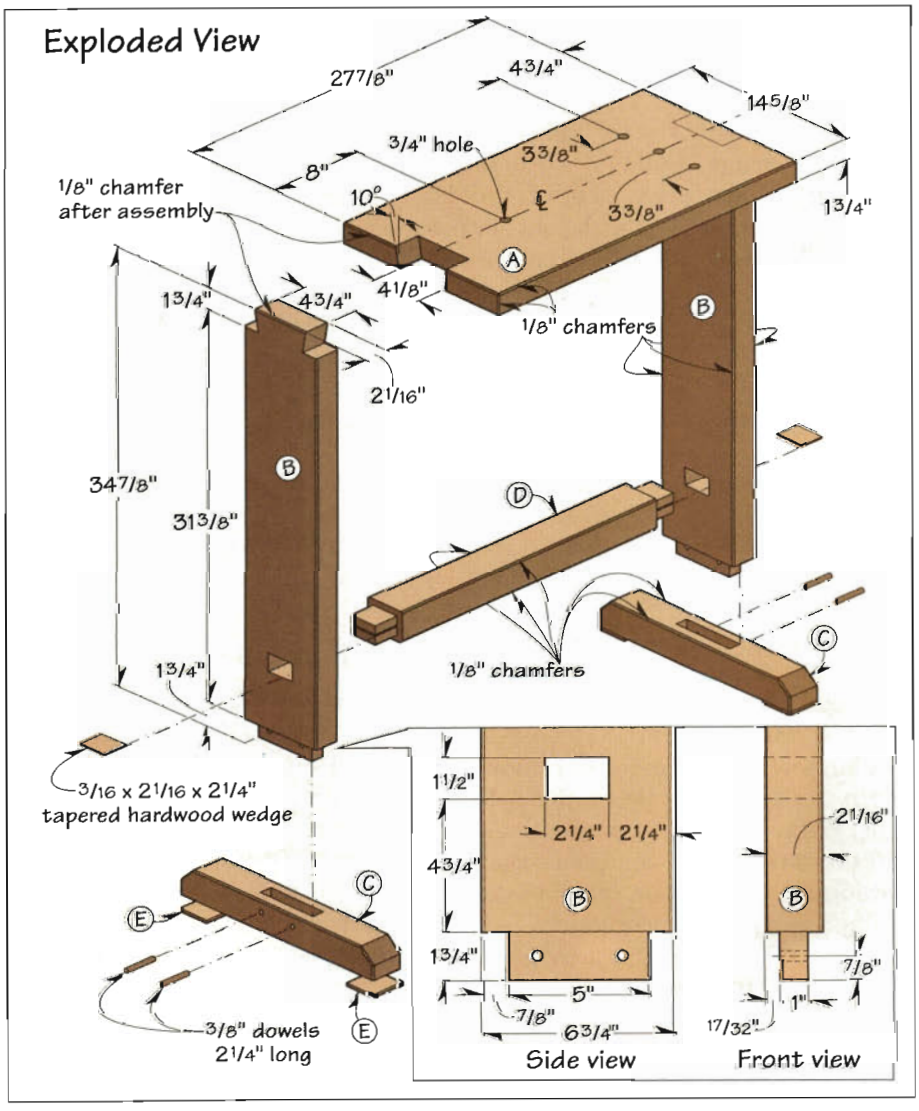
Materials List

C–cherry
W–walnut
M–mahogany

Supplies

⅜" walnut dowel; bench vise and mounting hardware; Quick-Grip® Hold Down Clamp.

Step 3. Using the dimensions shown on the Exploded View, lay out the tail on the end of one leg. Next, tilt your tablesaw blade 10° from perpendicular and elevate it to just a hair more (1/32") than your top's thickness. Once you've set the blade, copy its angle of tilt using a sliding T-bevel. Save this angle to help set the miter-gauge angle for cutting the dovetail pins on the benchtop.



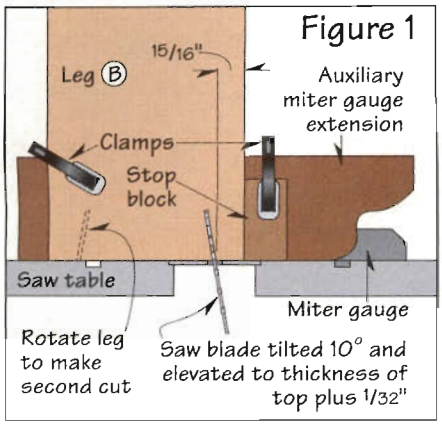
Step 4. Make test cuts for the tail cheeks using your cutoffs from the legs. (See *figure 1.*) When satisfied with the setup, make the same cuts on both legs. Note: For this bevel cut, we used a sliding table on our tablesaw, standing each leg on end. A crosscut box or miter gauge with extension would also work. To center these cheek cuts, we set a stop on the sliding table, placed the leg against it, and made the first pass. Then, we rotated the leg 180°, placed it against the stop, and made the second pass.

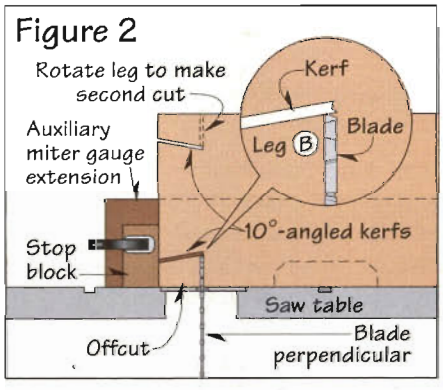
Step 5. To make the tail shoulder cuts, first reset the saw blade to perpendicular. (See *figure 2.*) Adjust the blade height until it almost meets the kerf of the bevel cut you just made. Test the setup using your scrap, then set a stop and make the two shoulder cuts on both legs.

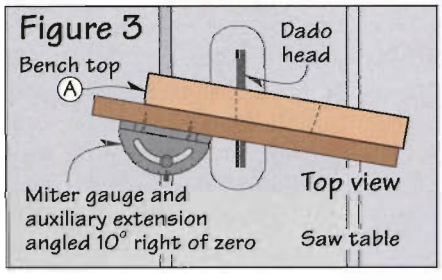
Step 6. Carefully break away the triangular waste pieces you just cut. Then, using a chisel, clean out the small remaining waste in the tail corners.

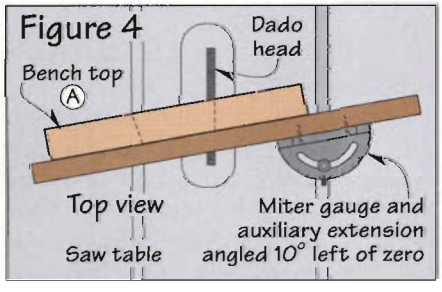
Next, Cut Pins In the Top

Step 1. Check your miter gauge: it must be set accurately at zero because for this operation you'll swing the gauge to both 10° right and 10° left of zero. Next, mount a ¾" dado head on your tablesaw.









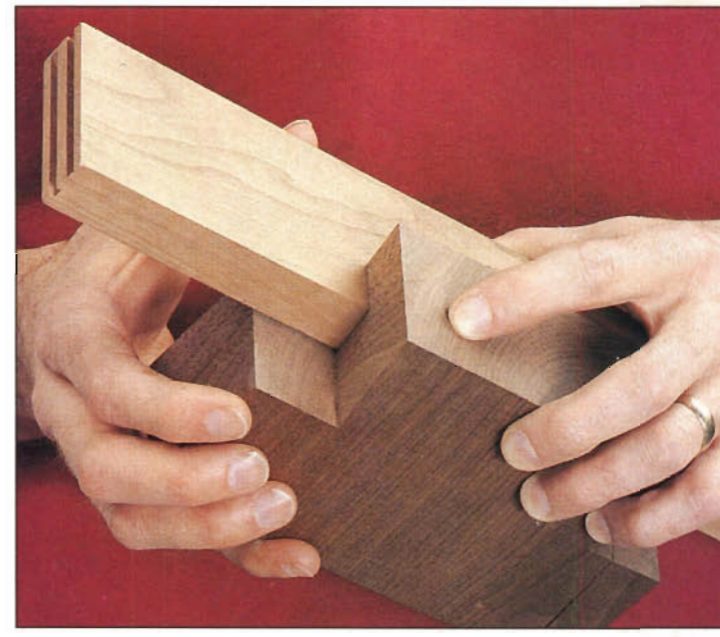


Photo A: Making a test-tail and pin first helps ensure you avoid cutting mistakes and achieve a snug-fitting joint between the leg and benchtop.

Step 2. On a piece of ¾" scrap approximately 3x12", lay out a test socket (pair of pins) on one edge using one of the leg tails as a template. Set the miter gauge at 10° to right of zero (clockwise), then check this angle using the T-bevel you set earlier. (See *figure 3.*) Now, make a pass with the dado head to establish one end of the socket, then make several more passes, working toward the socket's center.

Step 3. Reset the miter gauge to 10° left of zero (counterclockwise), then cut the opposite pin to establish the opposite end of the socket. (See *figure 4.*) Now, finish cutting out the rest of the waste. Trial-fit the test tail in this socket *(photo A)*. Adjust the miter angles if necessary to achieve a snug fit between socket and tail.

Step 4. When you've fine-tuned the miter-gauge settings, position one leg against each end of the benchtop and scribe the layout for the two half-pins that will accept the leg tail. Next, attach a tall extension to your miter gauge to support the top. Using the settings and procedure you just tested, cut a pair of half-pins in each end of the top. (We cut ours a hair deeper than the thickness of the legs so the ends of the top could be trimmed flush.)

Note: To make the cut, place the top on end against the miter-gauge extension. Align the pin line with the outside edge of the dado blade. Clamp the top to the miter gauge, then make the first pass as shown in figure 3. Make several more passes, cutting toward the center to remove the material from between the half-pins. Without changing any settings, flip the top end over end, and start cutting the half-pins on the opposite end using the same procedure.

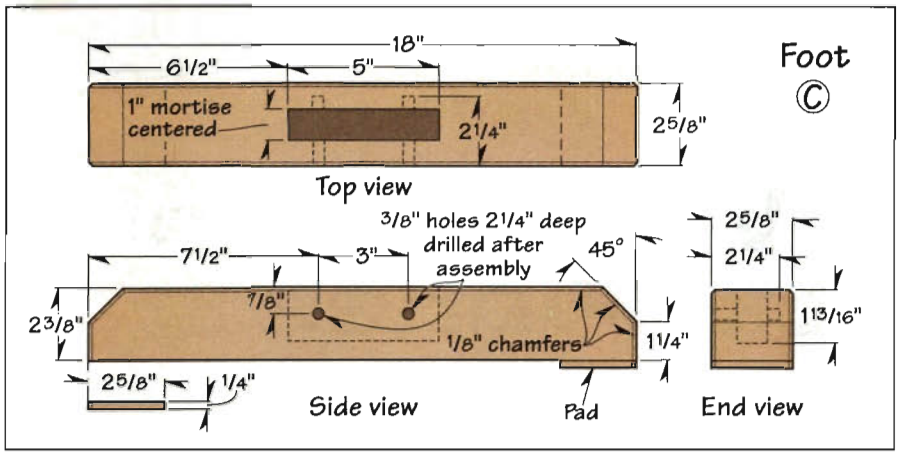
Step 5. To cut the opposite edge of each pin, adjust the miter gauge to the setup shown in figure 4 but back off from the line about 1/16" to make sure you don't overcut the pin. Dado-cut the edge, then cut to the center. Then test the fit of the tail between the pins and pare back to the line (if needed) for a perfect fit. Complete the half-pin on the opposite end the same way. Note: Take your time cutting the pins so you get a tight, but sliding, fit with the tails. The joints should set with only a light tap of the mallet. If your dado head leaves the cuts rough or uneven, clean them up using a chisel or rasp.

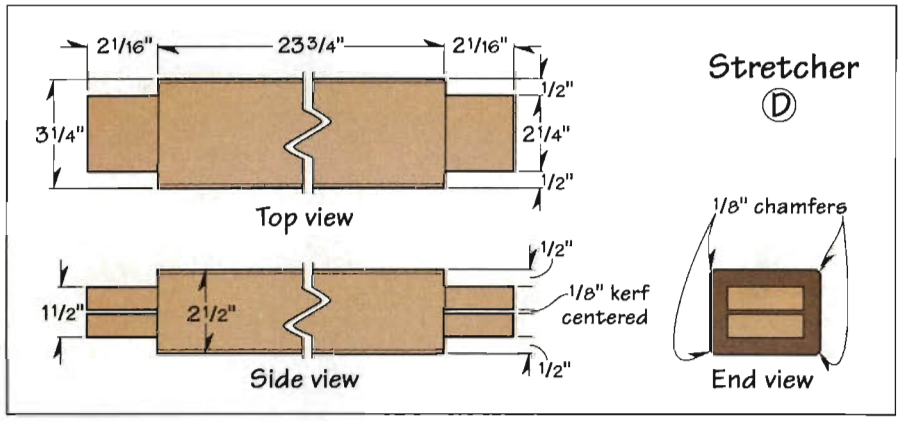
Step 6. Using dimensions shown on the Exploded View, lay out and cut the through mortise in each leg. Note: If you don't have a mortising machine, you can use your drill press and a Forstner bit to remove most of the waste from the mortise, then pare to the line using a large chisel. (We pared from both sides, checking for squareness as we worked.)

Make the Feet And Stretchers

Step 1. Face-joint and plane enough stock to make the two feet (C) and the stretcher (D). Rip and crosscut the parts to dimension. From ¼"-thick scrap, cut four foot pads (E) to size. Set the pads aside for now.

Step 2. Lay out and cut a mortise in each foot where dimensioned on the Foot drawing *opposite*. (We cut the mortises using a spindle mortiser and a 1" router bit, then squared up the corners with a chisel.)





Step 3. Lay out and cut the tenons on the ends of the legs to fit the foot mortises. (We cut ours on the tablesaw, using the miter gauge to make the shoulder cuts and a tenon jig to cut the cheeks.)

Step 4. Lay out and cut a tenon on both ends of the stretcher to fit the leg mortises. (See the Stretcher drawing *above*. We cut the tenons slightly long, then trimmed the ends flush with the leg faces after assembly.) Now, center and cut a wedge slot in each tenon where shown.

Step 5. Bevel-cut the top ends of the feet at 45° where dimensioned on the Foot drawing.

Step 6. Fit your table-mounted router with a 45° chamfer bit and set it to cut ⅛" deep. Rout the edges of the stretcher, legs, and feet (except the feet bottoms). Finish-sand the stretcher, the tops of the feet, and the inside surfaces of the legs. Note: Do not sand the dovetails on the legs.

Step 7. Bandsaw two 3/16 x 2 1/16 x 2¼" hardwood wedges. Sand the wedges to a slight taper.

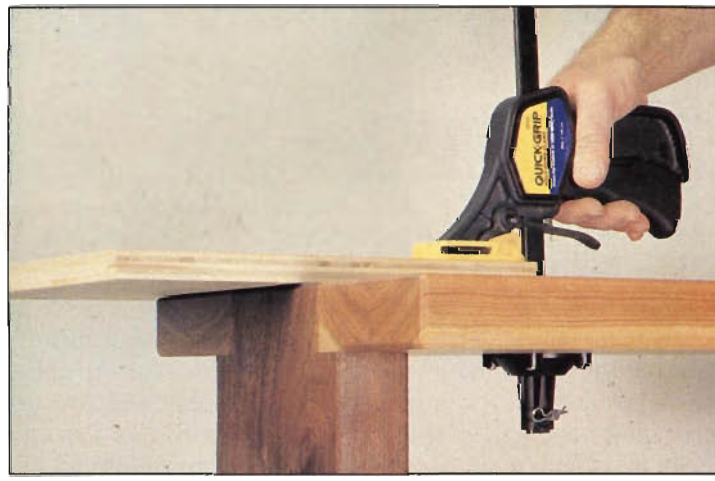


Photo B: Installing a Quick Grip Hold Down Clamp or similar device will increase the usefulness and versatility of your bench.

Assemble the Pieces

Step 1. *Glue one* stretcher tenon into the mortise of one leg. Apply glue to one wedge and drive it into the tenon slot. Now, check this assembly for square.

Step 2. Glue, assemble, and clamp the top to this leg/stretcher assembly. Then, glue and clamp the second leg to the top and stretcher. Drive the wedge into the tenon slot of that stretcher. Clamp the assembly, then check for square.

Step 3. After the glue has dried, remove the clamps, sand the joints flush, and finish-sand all surfaces. Next, using your handheld router, chamfer the edges of the benchtop except where the vise will attach.

Step 4. Glue and clamp the foot pads you cut earlier to the feet. Then, glue and clamp the feet to the legs.

Step 5. Drill two ⅜" holes through the outside face of each foot and into the leg tenon for dowel pins. (See the Foot drawing for locations.) Note: We did not drill all the way through the foot. If you plan to, use a backing block to prevent splintering.

Step 6. Cut and chamfer four 2¼" lengths of ⅜" dowel. Glue the dowels into the holes, then trim and sand the ends flush with the feet.

Finish the Bench And Add the Vise

Step 1. Finish-sand all surfaces that still need it, then apply a finish. (We applied three coats of Minwax Wipe-On polyurethane. This product protects the surface and also makes repairs and refinishing easy.)

Step 2. Mount the vise of your choice, following the instructions provided by the manufacturer. Mount the clamp fixture if desired *(photo B.)* Now, sign and date the bench, because the next generation will enjoy it just as much as you do. WJ

Project design: *Dick Coers*
Photos: *Randall Sutter*
Written by: *Charles Sommers*

TUNING AND USING HAND PLANES: Part 2

Working With Bench And Block Planes

Techniques that maximize performance

by Jim Tolpin

Before you work on polishing other skills, you need to select the right plane for the job. I use one of the longest planes, a 22" to 24" jointer (see *photo A*), to straighten the edges of boards longer than 24". This helps ensure accuracy: the longer a plane's sole, the more effectively it will span (rather than follow) the humps and hollows of the stock, eventually leveling the edge to absolute flatness.

To edge boards shorter than 24", I'll use an 11" to 12" jack plane. This length also works best for surface-planing, provided the board measures a square foot or larger in surface area. I select a 9" or 10" smooth plane for final smoothing work on all boards, unless the workpiece is unusually small or the working area confined. In these situations, I opt for a smaller smooth plane or a block plane. If I have to smooth end grain, I use a low-angle block or jack plane, depending on the size of the piece. These tools help minimize tearout.

Author surfaces a board with 9" smooth plane. Because thickness planers leave milling marks, hand-surfacing still has a viable place in the woodshop, producing a mirror-like smoothness you can't get with sanding.

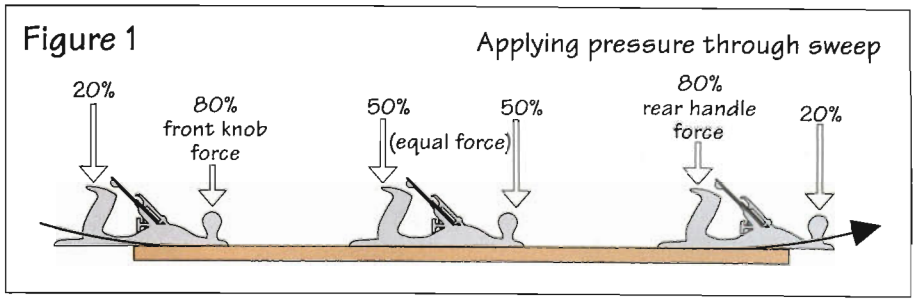
Of course, simply having the appropriate plane in hand will not in itself ensure a smooth and easy planing job. The plane and its cutter must be set up properly. (For tips on this subject, see "Before You Plane" at *right*.)

Editor's Note

In our last issue, woodworker/writer Jim Tolpin explained the physics of hand planes and offered tips on how to recognize and acquire a quality tool. He then walked you through the process of sharpening the cutter to a razor edge and tuning the plane's body and components to get the most out of them.

In this installment, Jim will show you how to use the bench and block plane to quickly and gracefully accomplish the tasks for which they were designed. In his view, a tuned and sharpened plane, handled skillfully, provides one of the most satisfying (not to mention dust- and noise-free) woodworking experiences.

Photo A: Select the right plane for the job. Shown here (front to back): 24" jointer (#8), 14" jack (#5), 14" low-angle jack (#62), 10½" wide-body smooth (#4½), 9½" standard smooth (#4), 9" narrow-body smooth (#3), 5" block, and 3" Kunz palm plane.

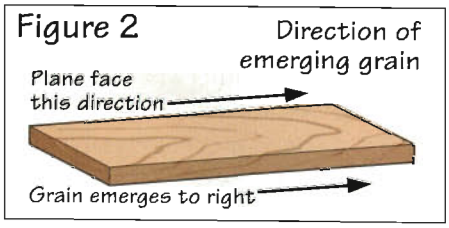


Polish Your Planing Action

Locate the workpiece at the proper height for your body. If it's too high, it will limit your movement and force you to support more of the plane's weight than necessary. Your arms will tire quickly. If it's too low, your back—which is not shy about complaining—will have to strain to keep you in balance. For me, the best planing height falls between my belt buckle and wrist (with my arm hanging at my side).

Clamp the workpiece securely, either upright in the vise for edging or flat between vise dogs for surfacing. As you begin to plane, apply pressure to the tool as if you intend to make the board hollow. (See *figure 1.*) You won't succeed—the plane's sole prevents this. However, this effort will keep you from making the surface convex, a natural tendency that the plane will all too happily oblige.

Always try to plane in the direction of the emerging grain. Determine this direction by looking at the run of the grain along the edge of the board (See *figure 2.*) To observe the run more clearly, sight along the edge from one end.



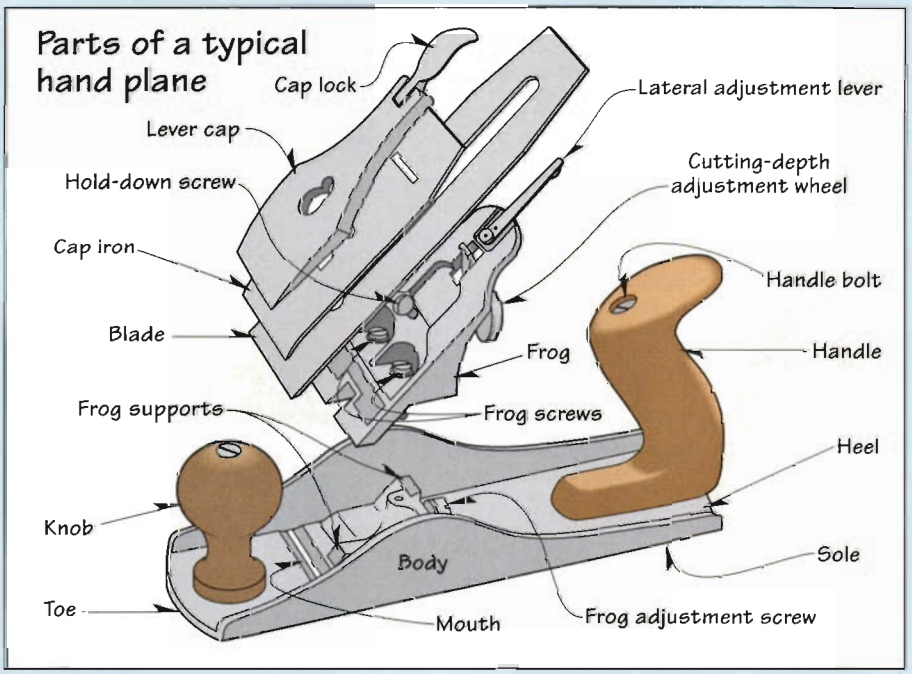
If the edges are roughsawn, sighting can be difficult or even impossible. In this case, I run my finger lightly along a corner to feel which way the fibers exit the board *(photo B).* This trick works on smooth boards too, often more reliably than sighting. (Your forehead, I've heard, is even more sensitive than your fingertips,

Before You Plane

Make sure the blade is ground to the proper bevel angle (25° in most cases) and honed sharp. To minimize down time during large planing jobs, presharpen two or more spare blades and set them up with cap irons.

For rough work, set the cap iron 1/32 to 1/16" back from the blade's edge. For fine work—and most hardwoods—set this gap at 1/64". With practice, you can eyeball these dimensions.

With the blade retracted into the plane body, lubricate the sole and cheeks with wax or a non-petroleum lubricant. Buff with a soft cloth.



Adjust the plane to make a fine (thin) cut. This eases the work because a thin shaving bends much more easily against the arched face of the cap iron, requiring less pushing effort. A thick shaving is also more likely to break rather than bend against the cap iron, increasing the chances of tearout.

To set the blade for a fine cut, sight down the length of the sole. Turn the depth-adjustment knob until you can just see the blade (1/64" or so). Make sure this hairline of blade is parallel to the sole by adjusting the lateral lever as necessary.

Snug the depth-adjustment knob clockwise to eliminate backlash and possible retracting of the blade.

but I wouldn't recommend using it for this purpose.) If the grain direction is still hard to "read," set the plane for a very shallow cut and make a couple of passes in opposite directions. The pass that produces tearout or increased resistance indicates that you're opposing the grain.

Once you pick up the rhythm of planing, lift the plane slightly on the return stroke. Otherwise, the constant backward rubbing of the blade along the stock can dull it prematurely. To minimize drag, especially on resinous wood such as pine, keep the bottom of the plane well-waxed, or spray it with non-petroleum lubricant. Reapply the lubricant as soon as the plane feels sticky or starts to squeak. You'll find, to your pleasant surprise, that relubrication often makes a plane feel sharp again.

To protect the blade from nicks and premature dulling, make a firm habit of laying the plane down on its cheek. For safety's sake, always turn the sole away from you. When you store the plane, shim up the sole to keep the protruding blade from contacting the shelf surface *(photo C)*.

Contrary to most beginners' perceptions, pushing a hand plane along a board requires surprisingly little effort, even on hardwoods. If the going gets tough, it's a clear sign that you, or the plane, are doing something wrong. (See "Troubleshooting Plane Action" at *right*.)

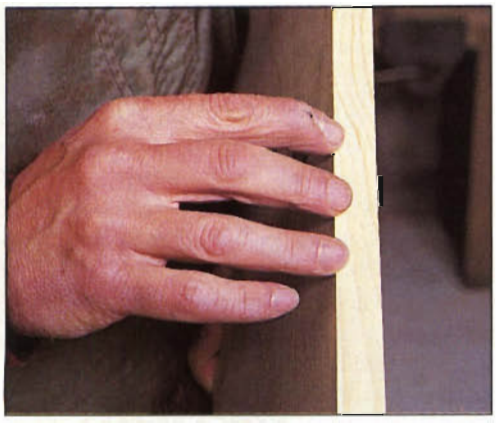


Photo B: To check for emerging grain, run a finger lightly along corner of workpiece. In this board, grain direction is clearly visible, but reading grain with a finger may be essential with roughsawn stock.

Photo C: Place a shim under the sole to protect the blade when not using the plane. Also, lay plane on its cheek whenever you put it down, facing the blade away from you for safety.

Edging With a Plane

One of the hand plane's primary uses is straightening the edge of a board *(photo D)*. This task has traditionally fallen to the "joiner," for nearly all joinery requires perfectly straight edges. Even today, the joiner's skill has not been entirely supplanted by machinery. A power-jointed edge invariably shows a finely scalloped surface. This "washboard" still needs smoothing, especially if the edge will show in the finished product or will be joined to another edge.

Choose a long plane for edging boards. To ensure a truly straight edge, avoid anything shorter than a 15" jack plane. I prefer a smooth sole for edging work, having found that a corrugated sole has an annoying habit of catching on a sharp corner. I reserve the corrugated-sole tools for surfacing work, where the corrugations help reduce drag and make the plane a little easier to push.

To set up for edge-planing, first check the emerging grain as described earlier, then clamp the board upright in your vise so that the grain exits to the left (if you are right-handed). If the board is longer than 3' or so, most bench vises require a second support to prevent shifting of the board. As a quick solution, slide the head of a pipe clamp along a short length of pipe until it fits snugly beneath the workpiece *(photo E)*.

Next, check the edge of the board with a straightedge, marking significant high spots with a soft (#1) pencil. (You should have no trouble locating these areas—a straightedge will rock on them.) With a combination or try square, check to see that the edge is

Troubleshooting Plane Action

If plane is hard to push:
Dull blade—sharpen the blade. (Do this frequently—don't wait for tearout.)
Blade set too deeply—back off the blade depth.
Pitch or rust on base—apply lubricant, clean, and buff.
You're planing against grain—reverse direction.

If mouth clogs with shavings:
Blade set too deep—reduce blade depth to reduce shaving thickness.
Mouth (opening in front of blade) too narrow—back off frog to enlarge mouth.

If plane leaves corrugations:
One edge of blade digs into wood—align blade parallel to sole. If problem continues, grind a ⅛" chamfer at corners of blade, or grind and hone blade in a subtle convex curve (the arc need be only the thickness of a shaving).

If plane leaves ridges:
Blade has a nick—regrind and sharpen blade.

If plane produces tearout:
You're planing against emerging grain—reverse direction. If tearout appears intermittent or in ribbons along surface, the wood contains crossgrain or "roey" grain—switch to a scraper and smooth. If tearout occurs on knots, use a low-angle block or jack plane (a knot is essentially end grain).
Cap iron offset too far from cutting edge—reduce offset.
Throat opening too large—move frog forward.
Blade set too deeply—reduce cutting depth.
Apparent pitch of blade too low—keep plane body parallel to direction of stroke. Avoid using low-angle block plane—reserve for planing across end grain.

Photo D: Author demonstrates proper stance for planning: feet set shoulder's-width apart; lead foot parallel to stroke direction; workpiece secured at belt-buckle height or slightly lower.

square to the face of the board. If it's more than a degree or two off, see my comments *below* on dealing with an out-of-square edge.

Before you start, take a look at your stance. (See photo D.) Your feet should be about shoulder's-width apart, with your forward foot placed roughly parallel to the length of the board. Hold the plane's front knob in the crotch between your thumb and index finger, allowing your remaining fingers to slide along the face of the board. This lets you gauge the angle as you work *(photo F)*.

Begin by planing off the pencil-marked high spots. Remember to take only shallow cuts and to picture yourself trying to plane a hollow in the edge. Otherwise, you'll tend to

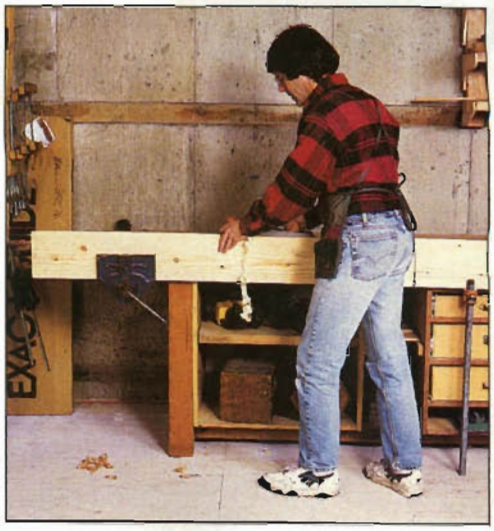


Photo E: To edge long workpieces, secure one end in a bench vise and prop the other end with a pipe clamp adjusted to correct height.

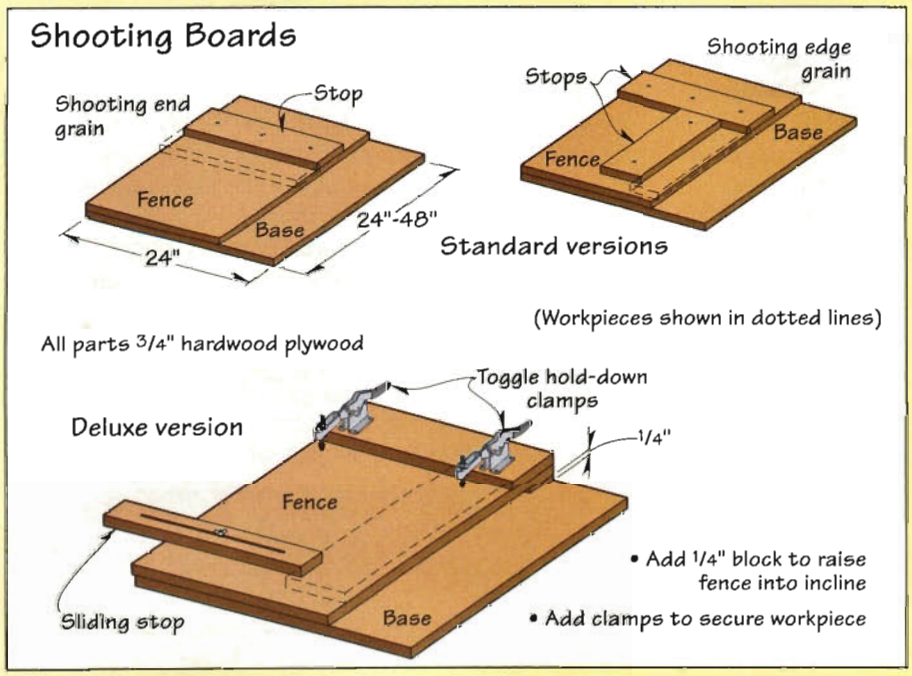
Constructing and Using a Shooting Board

A shooting board works its magic by providing true surfaces for the plane body to ride against while holding the workpiece securely in place. (See the drawing *below.*) You can build a simple shooting board by fastening two flat panels together and adding a stop; or, add a ramped work support and toggle clamp hold-downs to create a more deluxe version. (The ramped support ensures that the full width of the blade is engaged over the length of "shoot.")

While any plane will work on a shooting board, I find that the jack offers the best compromise between weight (for momentum) and ease of handling. The "technical" jack once made by Record is ideal. (See the photo *below right.*) It features higher cheeks and a removable side handle that makes the plane much easier to push.

Whichever plane you intend to use with the shooting board, make sure the cheeks are square to its sole. If they're not, you can still use the plane by tweaking the blade's lateral adjustment lever to make the blade perpendicular to the base of the shooting board. (If the plane body is square, you need only adjust the blade parallel to the sole.)

To use the shooting board, first rub paraffin on the base board and on the sole and cheek of the plane to reduce friction. Using a scrap test piece, double-check the plane to see that it cuts squarely, then tighten the hold-down screw to secure the blade firmly in this position. Next, hold or clamp the workpiece against the stop, allowing the edge (or end) to slightly overhang the raised support. Now, set the plane on the base support and "shoot" at will.



Author's shooting board has toggle clamps and a ramped work support. Here he uses a Record "technical" plane, which has high cheeks and a side handle designed for use with this fixture.

dip at the ends, which will create a convex surface or crown. Don't try to rush things by setting the blade deeper—you'll lose accuracy and make the plane that much harder to push, defeating your effort to speed up the process.

When the vanishing pencil marks indicate that you've removed the high spots, take a few full-length shavings. (This is the fun part.) When the edge reads straight and square to the face, you're done. Now, mark the jointed edge with a cabinetmaker's squiggle.

Planing Out-Of-Square Edges

If you start with a rough edge that's significantly out of square, it will require a bit more prep work. Determine the higher of the two corners on the edge, and mark it with a pencil. Hold the plane square to the face, gauging the angle with your fingers, and begin planing this higher corner.

Photo F: To keep the plane's sole square to the workpiece edge, let your fingers slide lightly against the board's face. This helps keep you "in touch" with the plane's angle as you work.

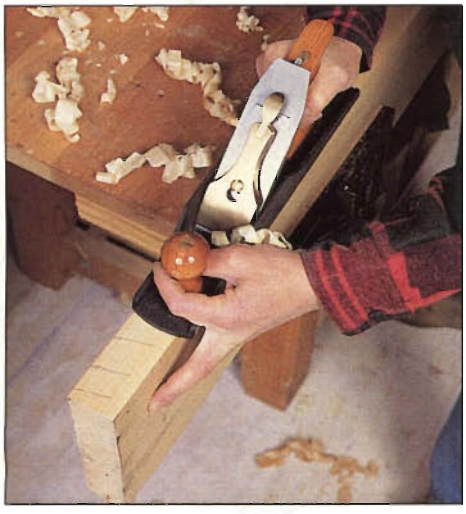


Photo G: To plane an out-of-square edge, hold plane level and start on the board's higher corner. As work progresses, shavings will gradually increase to full width of edge.

It takes a sensitive touch and some practice, I'll admit, to "read" the angle with your fingers. You can cheat, if you wish, and clamp a straightedge to the sole of the plane to guide you. But the old-timers planed edges dead square by feel, and you can too with practice.

As you begin working the higher corner, you should see only a narrow shaving curling its way out of the plane's throat *(photo G)*. Hold the plane square as you continue to make full-length sweeps—the shavings should grow progressively wider until they reach the full width of the board's edge. At this point, the edge should be perfectly square to the face.

If you're working a relatively short piece of stock (less than 24"), consider squaring the edge with a shooting board. This traditional joiner's fixture offers the quickest and most accurate way I know of to obtain a perfectly straight and square edge with a hand tool. (See "Constructing and Using a Shooting Board" *page 65*.)

Jointing Boards

If you are edging a board in order to edge-join it to another, you can save considerable time and aggravation by planing the mating boards at the same time. This trick compensates for any discrepancies in squareness, because two uniformly out-of-square edges, when folded together, become supplementary to one another (totaling 180°) as shown in *figure 3*. You must, however, joint the edges perfectly straight. Otherwise, the convexity error is doubled. A word of caution: Don't rely on clamps to pull convex edges together—the stress may resolve itself later in the form of end-checking.

To joint two or more boards, mark their faces to show the sequence. (I use a series of cross-hatches.) Next, fold the first two together with their good faces out. (See *figure 4*.) Clamp this assembly in your vise and plane both edges at once. You may prefer the jointer plane for this task; it has a wider blade than the jack *(photo H)*. Now, unclamp, check the fit, then set up the next pair of edges.

Surfacing With a Plane

Before power surface-planers came along, woodworkers used hand planes to bring a roughsawn board to a uniform desired thickness. Only the rare woodworker today would willingly endure this highly aerobic, and time-consuming exercise. But because power planers leave fine, washboard-like milling marks, hand-surfacing still has a viable place in the shop. You can sand these machine marks away, but sanding makes lots of noise and dust, and it may not leave a flat surface, unless you use an expensive stationary machine. Even then, the minute scratches and fuzz left by the abrasive tend to cloud and obscure the grain under most finishes, no matter how fine a grit you use.

Hand-planing, however, can produce an almost mirror-like surface that will stand up to close scrutiny even in bright light. Under a carefully applied finish, the scratch- and fuzz-free wood shimmers, drawing your eye deep into its fibers.

To surface a board, set it flat on the bench. If the board rocks, check for debris underneath (which you should remove) and for warp. If you find warp, remill the board, provided enough thickness will remain. Orient the board so the grain emerges to the left (to the right if you're left-handed). Use a straightedge to find the high spots and mark them with a soft pencil.

Continued on page 68

Figure 3

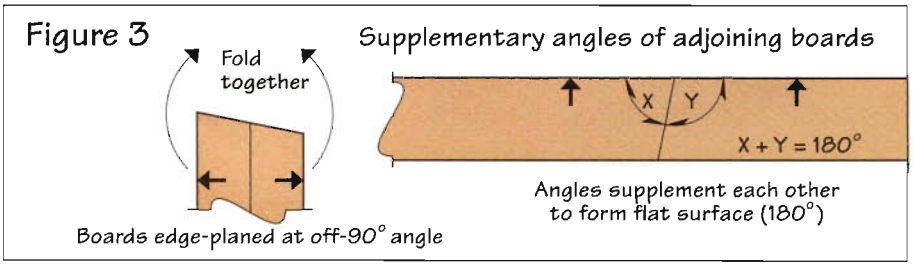


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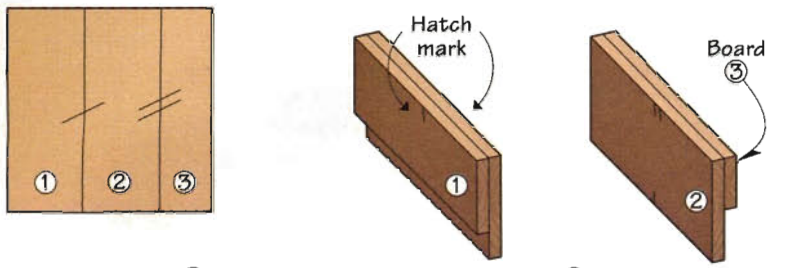
Figure 4 Sequence of steps for jointing three boards



① Arrange boards and crosshatch across joints

② Fold boards 1 & 2 together, hatch marks up and facing out –plane both edges simultaneously

③ Fold boards 2 & 3 together, hatch marks up and facing out –plane edges

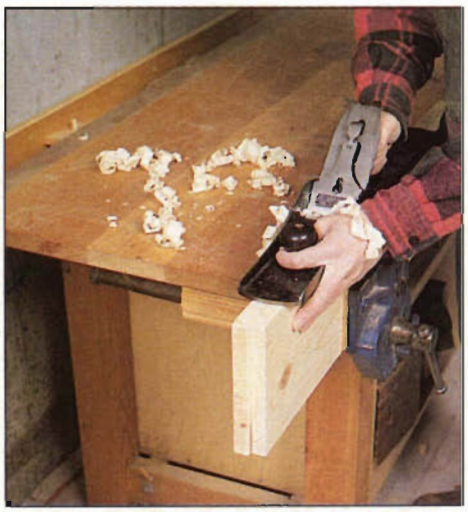


Photo H: To joint boards for edge-joining, stack them with mating edges aligned. Resulting edges, even if not square, will form straight 180° angle when joined. Here, author uses jointer plane for its extra width.

If the board has less than a square foot of surface area, simply hold one end against a stop. This may prove especially handy if the wood has reversing grain, because you can rotate the board end for end as you work to follow the grain. If you secure the board between stops, you can reverse planing direction by pulling instead of pushing the plane, although this technique feels awkward and takes some getting used to.

With a board this small, I'll start with an 11" to 12" smooth plane. If the surface measures more than a square foot, I'll begin with a corrugated-sole jack plane. The extra mass of the jack helps me follow through. Its weight helps keep the plane firmly in contact with the surface, and its extra length helps ensure flatness. At first, I set the blade to take a relatively generous shaving (paper-thin but not gossamer-like see-through) and shoot across the board at a 45° angle, once from one edge, then from the other. (See *figure 5*). This strategy makes for less work—and greater accuracy—than trying to remove full-length thick shavings.

Resist the temptation to increase the cutting depth if the plane skips from high spot to high spot. Instead, concentrate on planing down the high spots, checking your progress frequently with the straightedge. When you've removed the high spots (i.e., when the pencil marks vanish), stop planing diagonally.

Final Smoothing

Once you have the board essentially flat, switch to the smooth plane for final smoothing. Its shorter length allows you to concentrate on areas that need special attention. I grind the blade of this tool to a slight arc to prevent edge-gouging and keep the edge razor-sharp.

Watch the shavings as they emerge from the smooth plane. If they don't come from the throat's center, adjust the blade laterally to remedy the situation. Also, keep your stroke parallel to the grain by avoiding the tendency to hold the plane body askew. A skewed plane may push easier, but it's more likely to cause tearout of cross and reversed grain.

In areas where the grain suddenly changes direction, switch your direction of stroke to avoid tearout. On knots, which are essentially end grain, try skewing the plane to mimic the cutting action of a low-angle plane. Skewing also reduces the plane's effective length, so you can concentrate on just the knot area. With a sharp blade and careful strokes, you should be able to lift a shaving off the entire knot.

Before you make your final surfacing strokes, take the time to resharpen the blade. Now, reduce the cutting depth to produce gossamer, see-through shavings, then take full-length strokes parallel with the edge of the board. This will yield a glass-smooth surface that requires no sanding. Then, take a few sweeps along the full length of the board, overlapping them slightly.

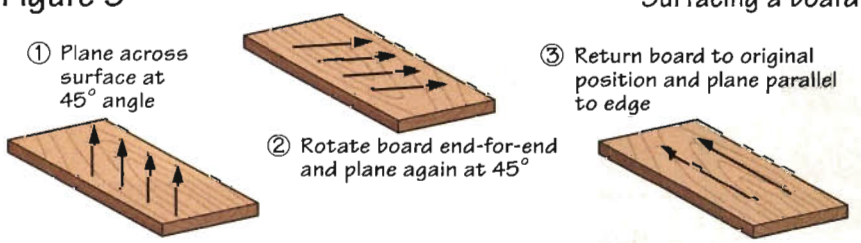
Planing End Grain

The typical plane of choice for end-grain work is the low-angle block. With its blade bedded bevel-side up at 12°, this tool has an effective cutting angle of 37° (12+25°), as compared to the standard bench plane's 45°. The lower incline, aided by the absence of a chip-breaking cap iron, makes the cutter slice—rather than pull and tear—the end-grain fibers. (See *figure 6.*) To further minimize tearout, the mouth opening on a low-angle plane adjusts, allowing you to close down the throat. This helps keep the sole's mass as close to the cutting edge as possible.

But the best plane for end grain, especially for working large areas such as a butcher-block cutting board, is the low-angle jack. The extra length, weight, and handling comfort of this plane make it perform more effectively than the typically diminutive block plane *(photo I)*. Stanley's now-rare #62 low-angle

Continued on page 70

Figure 5 Surfacing a board



Continued from page 68

jack, last manufactured in 1942, fortunately is being reproduced by Lie-Nielsen Toolworks.

Having said all of this about low-angle planes, I'll also admit that you can plane end grain effectively without one. I've found that the standard jack works well, even with its 8° higher pitch. Like its low-angle cousin, it offers more length, weight, and comfort than the low-angle block plane. Also, you can effectively mimic the pitch of the low-angle block plane simply by skewing the jack slightly in the direction of motion.

Whichever plane you choose for end grain, hone its blade to razor sharpness and set it for a very fine cut. You should be able to produce a continuous shaving across end grain just as you do on long grain. If you're making sawdust, sharpen the blade. If you encounter lots of resistance, you've set the blade for too deep a cut.

Photo 1: Low-angle jack plane cuts end grain best. Its top-beveled blade, set at a low incline with no cap iron, slices cleanly. Backing block clamped to workpiece edge prevents tearout.

Figure 6

Cutting action of low-angle plane across end-grain fibers

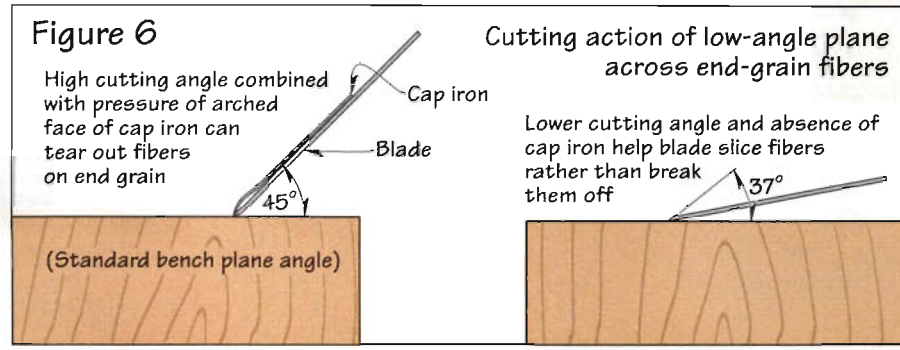
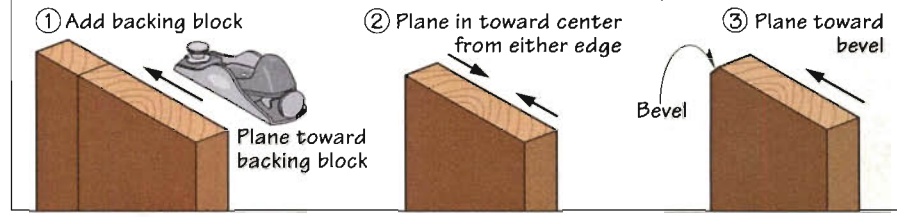


Figure 7

Strategies for preventing tearout



To plane end grain, clamp the board in a vise close to its end (within an inch). This will minimize vibration, which often produces chatter marks. The traditional shoulder vise is ideal for holding the board. You can also capture the board between bench dogs along the face edge of the bench, as I usually do, or wedge the board into a shopmade fixture. To prevent tearout at the far edge of the board (where the plane exits), clamp on a backing block of equal or greater thickness.

As an alternative method for preventing tearout, plane toward the center of the board from both ends. (See *figure 7.*) While this does prevent tearout (provided you don't overshoot), it makes it more difficult to obtain a straight, flat surface. Another trick is to bevel the outfeed edge, although this strategy allows you to plane from one edge only. Unfortunately, it's not always 100% effective. For predictable results, it's worth taking the time to clamp on a backing block. WJ

Photographs: *Craig Wester*

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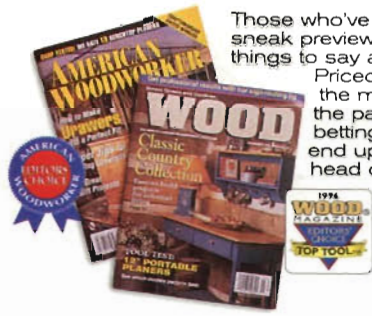

Those who've had a sneak preview have nice things to say about it. Priced in the middle of the pack—we're betting it'll end up at the head of its class.

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SHOP TEST

FIVE NEW POLYURETHANE GLUES

How these products perform

by Bob Colpetzer

The five new polyurethane glues introduced since our last product test.

New Kids On the Block

The five recent releases include Wood Wizard from Locktite Corp., Probond Polyurethane by Elmer's Products, Inc., Excel's new Xpress, manufactured by Recta Vit and distributed in the United States by AmBel Corp., Titebond Polyurethane from Franklin International, and PL Polyurethane by ChemRex, Inc.

The new products are packaged as single-component, ready-to-use adhesives. They're formulated as liquids, except for Excel Xpress, which has a gel consistency and comes in a caulking tube. All contain 100% solids and claim to be completely waterproof. Isocyanates, the activating or catalyzing agents in these glues, react with moisture in the materials being joined to develop a high-strength bond.

If you've used polyurethanes, you know that they expand as they cure. Under clamping pressure, the expanding adhesive is forced into wood fibers. The excess glue that squeezes from the joint foams but does not penetrate the wood to any extent. The uncured squeeze-out can be cleaned up with thinner, mineral spirits, or acetone. As an alternative, you can simply let the squeeze-out cure and then scrape or sand it off. Unlike polyvinyl acetate and aliphatic resin glues, dried polyurethanes do not dull cutting tools or load abrasive papers.

Differences in the formulation of these glues create slight variations in viscosity, open time, clamping time, and cure rate. You'll want to consider these in determining the best product for the application at hand. (To help you make the proper choice, I've listed the differences I observed in the Glue Selection Guide on *page 74.*)

How I Tested the Glues

For my sample blocks, I prepared the same species and used the same dimensions I had used in my previous tests. This required gluing five pairs of ¾x2x6" pieces (teak, red oak, cherry, poplar, and pine) with each glue. In the process, I had a chance to spread, assemble, clamp, and otherwise see and feel the new adhesives.

Once the glued samples had cured, I loaded them into the dishwasher and ran them through three wash-and-dry cycles with the machine set to "Pot Scrubber." All samples survived the three runs. Next, I subjected each sample to a shear test. All samples broke near the glue line, but no glue joint failed.

Editor's Note:

In our May/June '95 issue, we shop-tested the first two polyurethane adhesives to be marketed in the U. S., Excel and Gorilla Glue. Last summer, manufacturers released five new products. Because both of the "original" glues performed so well in our tests, we were anxious to see if the new offerings would stand up to the same rigors.

Four of the five glues are transparent amber in color like the Excel and Gorilla brands. The Excel Xpress looked opaque when applied but produced a white squeeze-out *(photo A)*.

To test glue-line color and visibility, I edge-glued samples of maple and walnut with each product. All glues performed well in this test. On both the light and dark woods, each adhesive produced a nearly invisible glue line. The amber-colored glues left no visible stain on the maple, and the Excel Xpress was unnoticeable on the walnut *(photos B, C)*.

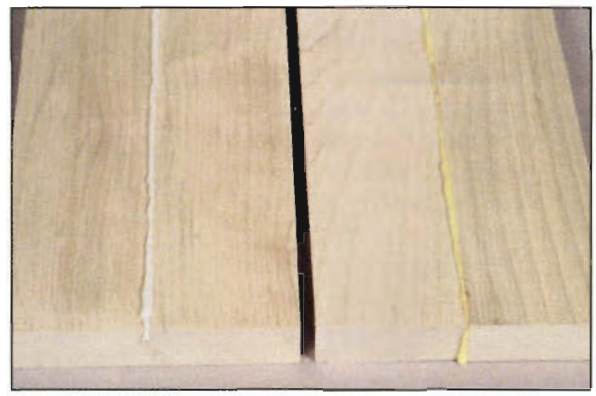


Photo A: Excel Xpress (left) cured as a white foam when squeezed from the joint. Other glue samples were amber in color.

Stainability and Gap-Filling Qualities

Like the two original polyurethanes, the new brands do not accept stain, so you can't be careless about removing those squeeze-out blotches. I did find, however, that the glue line does not show once a stain has been applied. In this sense, they might be called "stainable." It's also true that polyurethane blotches seem to remove more easily than those left by conventional glues, probably because these glues foam up as they cure rather than penetrating the wood surface.

Don't be confused by the manufacturers' gap-filling claims. While these adhesives will expand to bridge minor gaps, the foamed glue has no structural strength. As with other glues, you'll get greater joint strength by carefully machining all parts to a snug fit.

I found that these glues, as claimed, will bond almost any materials—with certain qualifications. Whether you glue stone, brass, steel, or ceramic to wood or to itself, the joints must fit tightly and be free of dirt, oil, and tarnish. And, at least one of the two mating materials must contain enough moisture to activate the glue.

In my tests, I had little trouble bonding any of the above-mentioned materials to wood. When it came to gluing brass or steel to itself, I got stronger adhesion using a two-part epoxy. I did have great success, however, bonding ceramic, stone, and pottery to themselves and to each other. The polyurethanes held as well as epoxy. Because these materials are porous, I could mist one half of the joint lightly with water to provide the curing moisture.

What I Found

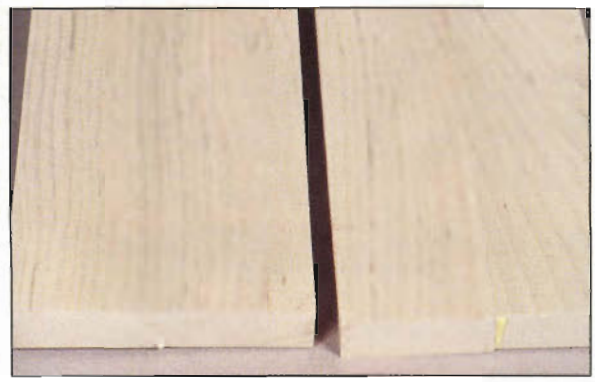
The new polyurethane products proved every bit as effective as Excel and Gorilla Glue at producing strong, waterproof, and non-creeping joints. All five glues were much easier to use than two-part epoxies or resorcinol products.

One word of caution: If you've never worked with these adhesives, take some time to learn just how much glue to apply to each joint. I often hear polyurethanes criticized because they foam out of the joint excessively. Often, these complaints come from users who simply apply too much of the product.

With polyurethanes, apply one-fourth the amount of glue that you normally use, and apply it only to one joint surface. Also, work smart when applying the glue. Think through what will happen when you join the parts. When gluing and assembling through dovetail joints, for example, I spread a thin coat of polyurethane on the tail surfaces only. That way, when you slide the pins into position, any excess glue will spread to the outside of the joint where you can easily clean it up after it cures. As a result, I get very little foaming on the inside of the joint (where it's difficult to remove).

As mentioned earlier, I found differences in viscosity, open time, clamping time, and cure rate among the five brands. This makes it tough to pick one product over another unless you base your choice on a specific gluing job. Excel Express and Titebond polyurethanes, for example, have a thicker consistency, which makes them less apt to run on vertical surfaces. On the other hand, this makes them harder to spread into a thin film on a joint where you want minimal squeeze-out. Probond, Wood Wizard, and PL have a thinner consistency and brush easily into a thin film. Of the three, Probond has a slight edge in this category.

Photo B: Once squeeze-out was scraped away, glue lines of all products were undetectable on both light and dark woods.



While all polyurethanes expand and foam from the joint as they cure, the PL brand appeared to foam slightly less than the others. However, foaming should not be a major problem with any of the brands if you apply the correct amount.

Four of the five glues have an open time of 15 to 30 minutes and a clamping time of one to four hours. This generous open time

makes these adhesives ideal for those complicated assemblies that take time to assemble, reposition, and clamp before the glue starts to set. These times will vary slightly with the moisture content of the materials, atmospheric humidity, and temperature.

Excel Xpress, as its name implies, was the one exception. It offered a five- to eight-minute open time and a clamp time of 40 minutes. I wouldn't recommend it for complicated assemblies, but it may prove the best choice for simple edge-joining and for assemblies that require a waterproof joint with a minimum of clamp time. All polyurethanes reach full cure and strength after 24 hours.

As mentioned, you buy Excel Xpress in a caulking tube that fits standard caulking guns. When I first saw this, I had reservations. We've all had experiences with caulking tubes: once you open it, you either have to use it up in a short period of time or you end up throwing the leftover away.

My reservations about Xpress, however, proved to be unwarranted. After applying small quantities from the tube off and on for over a month, no hardened glue formed in the nozzle. The screw-on cap seals the tube effectively, and the glue flows as smoothly now as it did the day I opened it.

Wood Wizard uses a standard plastic bottle like the others but has a unique twist cap that stays on the bottle. A quarter-turn opens the nozzle. Twisting it back closes, seals, and cleans the nozzle, so you never have to remove hardened glue. Nor will you ever lose the cap.

At first glance, these glues seem a bit pricey. But keep in mind that, compared to PVA or aliphatic resin products, you'll use about one-fourth to one-third the quantity of glue per joint. If you also factor in the waterproof, non-creeping bond you get with polyurethanes, they begin to look more cost-effective. I do, however, try to buy these adhesives in quantities that fit my gluing needs. Large containers reduce the per-ounce cost, but you won't save money if you end up throwing away half of the glue.

I recommend all of these glues. All five performed well and passed the use test. Select one with characteristics that best match your needs, and you'll be pleased with the results. WJ

Tips For Using Polyurethane Glues

1 Prepare clean, dust-free, tight-fitting joints.

2 Wear disposable vinyl or rubber gloves and use these glues in a shop with adequate ventilation. Polyurethanes are activated by moisture, so avoid contact with skin. Always read the warning labels.

3 Apply a thin, uniform layer of glue to one of the surfaces to be joined using a brush, roller, squeege, or spatula.

4 Clamp the work in the usual manner and for the time recommended on the product label. Clamp time may vary with temperature, ambient humidity, and wood moisture content.

5 Remove uncured squeeze-out with lacquer thinner, denatured alcohol, or acetone. Scrape or sand off cured adhesive.

6 These products work best on wood that has eight to twenty percent moisture content. To bond woods with less than eight percent, or to accelerate curing, dampen the non-glue surface.

7 Clean up uncured glue, tools, and brushes with lacquer thinner, mineral spirits, acetone, or other suitable solvents. Dispose of the cleaning materials as recommended by the manufacturer.

Five New Polyurethanes: Glue Selection Guide

Brand	Viscosity	Open Time	Clamp Time	Full Strength	Cost*
Wood Wizard	Standard	20 min.	1-4 hrs.	24 hrs.	4 oz.–$3.99 8 oz.–$6.99 16 oz.–$10.99
Probond	Standard	15 min.	1-4 hrs.	24 hrs.	8 oz.–$7.95 16 oz.–$12.95
Excel Xpress	Gel (no-run)	5-8 min.	40 min.	24 hrs.	10.4 oz.–$15.99
Titebond	No-run	30 min. formula	1-4 hrs.	24 hrs.	8 oz.–$6.99 16 oz.–$11.99
PL	Standard	30 min.	2-4 hrs.	24 hrs.	4 oz.–$4.49 8 oz.–$6.99 16 oz.–$9.99 32 oz.–$15.99

* Prices may vary depending on supplier

Sources

Wood Wizard
For nearest retail outlet, call 800-Loctite

Probond
Grizzly Imports
East: 800/523-4777
West: 800/541-5537

Excel Xpress
Woodworker's Supply
800/645-9292

Eagle America
800/872-2511

Titebond
Woodcraft
800/225-1153

The Woodworkers' Store
800/279-4441

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Most major hardware chains

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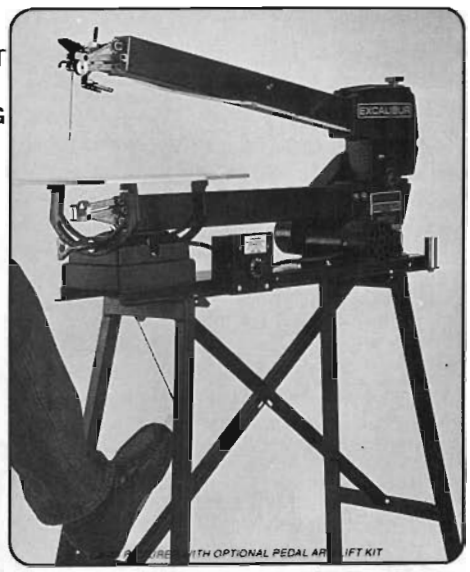

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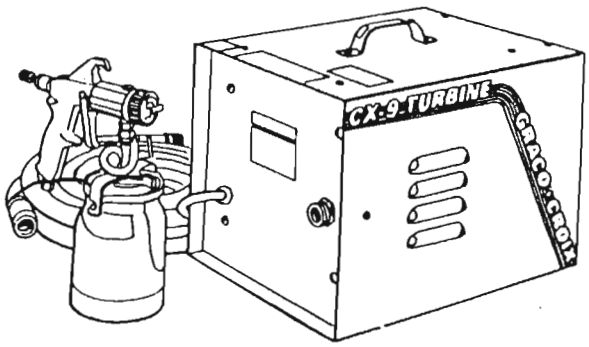

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At the Northwest School, students build and restore wooden vessels using traditional techniques. Shown here (front to back): a Mason 31, a sloop-rigged daysailer; the Gary Thomas, a 26' cruising sloop; and the St. Catharine, a 50' power cruiser built in 1927.

If You Can Build A Wooden Boat ...You Can Build Anything

Sign on for six months of "total immersion" at the Northwest School of Wooden Boatbuilding

by Doug Cantwell

Patrick Molzahn came here from Wisconsin after taking a degree in architecture because "architects never get to lay hands on the actual building materials." Amy Sandidge, an Austin, Texas native, had spent three years on salmon trawlers in Alaska, then found that she liked the boats better than the fishing.

Don Rust came from a woodworking background, but took a leave from his Santa Cruz, California cabinetry practice in pursuit of a fresh start. "I want to find a small boat design that everybody likes and then go into production with it," he says.

Restless people of many backgrounds seek out this school, secluded among tall firs near Port Townsend, Washington. Many hope to find jobs in boatyards or restoration shops. Others seek the skills needed to build a boat of their own.

The majority, like Rust, are male, in their 20s or 30s, drawn from one U.S. coast or the other. But their diversity defies norms. Of the 19 who started last January, five are women. Students often enroll fresh out of high school, and more than a few take the course during their 70s. Within the last couple of years, enrollees have come from France, the Netherlands, Australia, Thailand, even the Marshall Islands in the South Pacific.

The Northwest School promises them total immersion in traditional techniques of wooden boatbuilding. A boat presents challenges that transcend conventional carpentry and cabinetmaking. You work with parts that have angles, bevels, and twists, sometimes a combination of all three. Virtually nothing is square, yet everything must fit snugly. "It doesn't get any more complicated than wooden boatbuilding," says Rust.

A Six-Month Course

The school offers an intensive, six-month regimen of 40-hour weeks that will qualify even a raw beginner for entry-level employment in the boatbuilding industry. How many such green novices put the school to this test? "We usually have at least a couple in every class, sometimes more," says Lisa Chandler, who runs the front office and handles registration. "There's always a wide spread of experience and natural ability. That's why the first three weeks of the course are self-paced."

This three-week introduction, Beginning Projects, acquaints both newcomers and seasoned cabinetmakers with the eccentricities of boat joinery. Students take on a series of gradually more difficult bench projects that teach them how to adapt standard joints to complex shapes. "You can't predict, based on prior experience, how fast they'll progress," Chandler adds. "If they have the talent and enthusiasm, beginners will often outpace the 20-year veterans."

The *faering*, a Nordic Lapstrake design often built as a project vessel.

Drawing: Michael Kowalski

These first projects also give students practice with traditional hand tools, especially those that are unique to boatbuilding. Eventually, they make some of the tools they'll use in the project work ahead. Chandler notes that experienced cabinetmakers often enroll who have rarely picked up a hand tool. "It's kind of like starting from scratch for them, too," she says.

Lofting Makes the Critical Difference

The second section introduces students to the science of lofting. It lasts only a week, but students fear this 40 hours as a rite of passage. According to lead instructor Jeff Hammond, lofting establishes the crucial link between the two-dimensional lines laid down by the designer and the three-dimensional forms liberated from the paper by the boatbuilder.

Taking a set of plans, students sit at a drafting table and project the scaled-down lines of a particular hull design. This is where they begin to grasp the complexities of the third dimension. Sandidge, now only a month away from graduation, recalls that lofting stymied her at first. Eventually came the lightbulb click of comprehension, and she suddenly understood its full implications. "Every line you plot you can check with another line. Lofting gives you all the info you need to cut through any section of the hull, roll it over, and then replot it on a different plane."

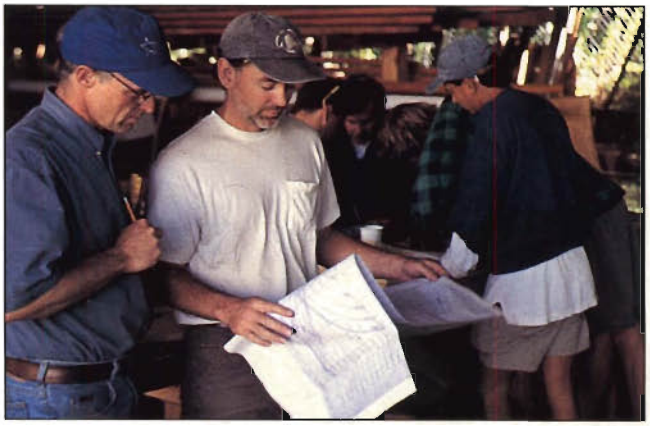
Once they've projected the lines in small scale, students return to the bench and produce a half-model—what you'd get if you sliced the hull in two along its keel. Then begins the real construction of the boat. During the four weeks of Section III, students go to the 20x40' loft in the shop's mezzanine and plot the lines of the hull in full scale on a gridded plywood floor. Using the cross-checking techniques they learned in the classroom, they fair the lines to very close tolerances, then transfer them to each component.

Why the need to go to full scale with the drawings? "The thickness of a pencil line on a small-scale plan can amplify into a ½" error in full scale," explains Hammond. If you loft the components to full size, you can then fabricate them up front with complete confidence that they'll fit. This eliminates the need to trial-fit parts as you assemble them, so the hull goes together quickly and

The school curriculum emphasizes traditional hand skills. Here, Lucy Deakins uses the spokeshave on a bench project.

▲ Mark Reuten eases the fit of frame to transom on the Mason 31.

Scott Whitesides (left) and Scott Chichura plot hull lines on the school's lofting floor.



Don Rust (right) consults lead instructor Jeff Hammond about a lofting problem.

efficiently. They say that for every hour you spend lofting the boat, you'll save 10 in construction time.

While it's possible to build a boat without first lofting the design, you should prepare yourself for a vessel that may not look much like the original plans. Not only that, but it will probably sail much better on one tack than on the other. The starboard contours of the hull, in other words, may not match those on the port side.

Class starts at 8:00 a.m., and during the first half of the course, students spend most of their morning in the classroom. Instructor Hammond believes fanatically in sound lofting principles, which he explains on the blackboard with enviable patience. "Jeff is intense in the classroom," says Molzahn. "I took 120 pages of notes during those first three months." On graduation day, Molzahn gratefully presented the lead instructor with a bound copy.

Hammond emphasizes thorough planning not for the sake of academic rigor but because mistakes waste time and cost money. Wooden construction may have the aesthetic edge over manmade fabrications, but it usually carries a heftier price tag as well. If traditional boatbuilders acquire good lofting skills, says Hammond, they can cut construction costs and price their work competitively.

600 Hours Of Hands-On

After two months of preparation, students go to the shop floor, where three or four vessels stand scaffolded, each at a different stage of completion. During this final, packed 15 weeks, they'll construct a 10 to 15' lapstrake skiff of classic design; loft and begin constuction of a larger 20–30' vessel; complete construction of another vessel of similar size; and, during their spare time, apply the techniques they've learned to building and restoring other large craft.

At any given time, the school has several project boats under construction and restoration. To ensure a steady supply of project work, the school accepts commissions and also builds vessels on speculation for later sale. Because the staff have developed a reputation for assuring superior materials and workmanship, virtually every boat has a buyer before it's completed.

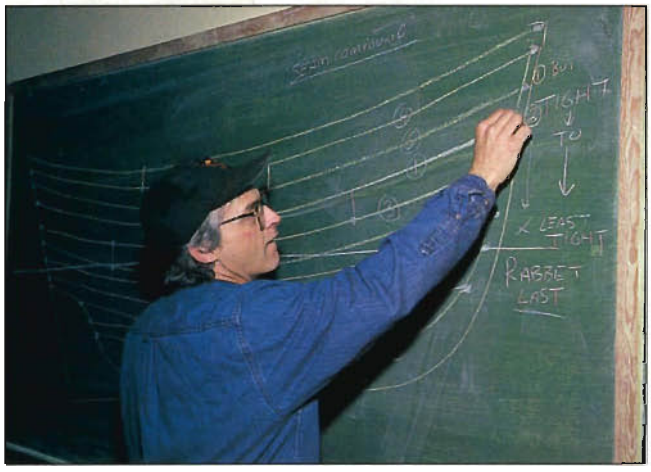
For their skiff project, Sandidge and her classmates are building a 15' *faering*, a double-ended lapstrake design evolved from the Viking ship's boat. With guidance from Ray Speck, another of the school's master instructors, students will construct the boat using only traditional materials: yellow cedar for the strakes, white oak for the frame, copper rivets and roves, and galvanized spikes.

Members of this class have put many of their 600 hours into restoring the *St. Catharine*, a 50' power cruiser built in 1927. Under Speck's supervision, they've replaced much of the frame and replanked most of the hull. "It's definitely been one of the high points for me," Sandidge reports. "This week, we're caulking the hull and deck with cotton."

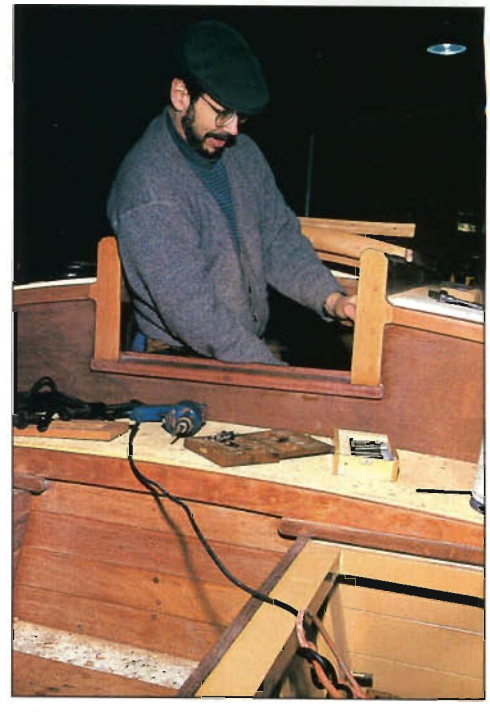
A Master Shipwright's Legacy

Having built wooden vessels in the Puget Sound area for 50 years, Bob Prothero had learned a lot about the trade that wasn't explained in textbooks. He wanted to help keep his craft alive by passing this lore along to a younger generation of boatbuilders.

Prothero set his sights on Port Townsend, a community of 8,000 that had grown up on a point that forms the corner



Instructor Hammond explains the technique of caulking a planked hull during a morning classroom session.



▲ Mark Miller installs trim on the companionway of the *Gary Thomas* as part of his larger-vessel training.

Amy Sandidge fits a bilge panel in a 15' *faering* with help from instructor Ray Speck.

▲ Martin Mills (left) and Sean Selfe fit a rub rail on the stern of a Tremelino, a 28-foot auxiliary sloop.

between Puget Sound and the Strait of Juan de Fuca. During the last century, ships put into port here before starting the arduous beat down the sound to Seattle and Tacoma.

The village prospered as the first U. S. Customs port in the region, and optimists believed it would burgeon into a major shipping port and rail connection. Sea captains and timber barons put up stately Victorian homes in what is still known today as "uptown." Downtown was another story. In waterfront taverns and brothels, sailors scuffled with the loggers and prospectors who sought their living in the Olympic Mountains that rise to the west.

Port Townsend's hopes for a major seaport fizzled, but the town did develop into a boatbuilding hub, especially for classic wooden construction, rigging, and sailmaking. During the 1970s, local tradespeople and enthusiasts formed the Wooden Boat Foundation, a non-profit group that promotes wooden boatbuilding and seeks to preserve the maritime skills through education. The Foundation organized the first Wooden Boat Festival in September, 1976. This three-day gathering has since grown into a world-class event that draws participants and spectators from all over North America.

Prothero moved from Seattle, set up shop, and opened the Northwest School in January, 1981. It struggled for survival for several years, but a trickle of students kept showing up each term to learn the traditional methods, and the doors stayed open. Prothero, then in his 80s, had come to Port Townsend with failing health. His scramble to keep the school afloat didn't improve it.

When Hammond came from Wisconsin to take the course in 1985, the ailing shipwright recognized his extraordinary talents and took him on as assistant instructor. The apprentice learned quickly, which was a fortunate thing; Prothero passed away suddenly in October, 1986. "Bob worked at the school literally up until the day he died," Hammond recalls.

Although he pushed students who lacked motivation, the founder had never tried to sell the school to prospectives. "Bob didn't encourage anybody to take the course," says Hammond. "He wanted the decision to be wholly yours." As lead instructor, Hammond holds with this policy. He also cautions new students, many of whom arrive with impossibly high expectations. "Be realistic in terms of your skill level," he tells them. "Don't expect to master the craft during the six-month course. Law school doth not a lawyer make."

Under current director Bill Curry, staff members have built on Prothero's rigorous approach to the basics.

A Year-Round Slate Of Workshops

If you don't have time to sign on for six months, the Northwest School also offers a full schedule of short seminars. Staff instructors teach some of the workshops, but for the most part the school draws on the talents of Port Townsend's lively community of maritime craftspeople.

John Archambeau, a 72-year-old semi-retired physician, and Sharon O'Hara, in her 50s, are here for a nine-day working vacation. With instruction from Jay Smith, they and five others will build a *faering*, a four-oared craft of Nordic origin that has been in use on the fjords for centuries. Smith, whose mother is Norwegian, served apprenticeships in traditional lapstrake construction in Norway and the Faroe Islands. Although he makes most of his living from restoring wooden yachts, Smith puts a lot of energy into teaching and promoting Nordic boatbuilding techniques.

There's also Kit Africa, who runs one of three Port Townsend rigging lofts and has rigged everything from daysailers to multi-masted schooners. He teaches a five-day workshop on designing and fabricating traditional sailboat rigs. Drawing on his experience as a delivery captain, which has taken him to ports around the world in all kinds of craft, he offers another seminar on selecting and buying an ocean-cruising vessel that fits your needs. During the fall, he leads several one-day workshops on celestial navigation.

Africa has the most fun teaching "Diesels and Diodes: Marine Engineering For the Mechanically Timid." In this five-day course, students learn how to keep a marine diesel from becoming an "infernal" combustion engine, how to troubleshoot and repair shipboard "electrickery," and how to keep the refrigerator, pump, and ship's head in working order.

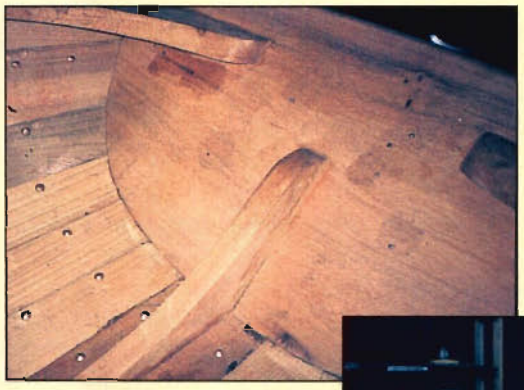
Julia Maynard, who moved her boat refinishing business here from San Francisco, teaches "Professional Finishing," which takes you from the bare wood right through to the finish coat. Originally apprenticed at the Mystic Seaport Museum in Connecticut, Maynard has spent the last several years building a 34' gaff-rigged cutter with carver/boatbuilder husband George. (They finally launched the craft last year; it's featured in the Mar./Apr. '96 issue of *Wooden Boat* magazine.) Maynard also teaches "Woodworking for Women," a five-day summer course.

You can learn nautical blacksmithing, sailmaking, blockmaking, seachest-building, and marlingspike knot work from Port Townsend's able-bodied residents—even casting bronze ship's hardware. But the school's workshop roster still focuses on making boats from wood. Instructors Speck and Joe Crecca teach a couple of six-day courses in lapstrake construction, during which students build a 10-foot dinghy. Speck also teaches a one-day introduction to lapstrake techniques and another workshop on making watertight decking. Instructor Hammond offers an intensive, six-day seminar on lofting as well as shorter courses on spar-making and steam-bending.

Corey Freedman, who has carefully researched the seagoing craft of Northwest coastal tribes, teaches two nine-day courses each summer on designing and building traditional Aleut kayaks. Under Freedman's guidance, students custom-fit the design to their body build and skill level. During a two-day follow-up course, they carve a double-bladed paddle for their craft from a single length of Alaska yellow cedar.

You probably won't find a greater concentration of skilled maritime artisans anywhere in the world. If it has to do with traditional boatbuilding, chances are that somebody teaches it at the Northwest School.

▲ Staff instructor Joe Crecca explains centerboard construction on a 10-foot lapstrake sailing dinghy built by students during a six-day workshop, one of the school's short courses.



◀ Detail of 10-foot lapstrake dinghy built by students during six-day workshop. Because of superior quality workmanship, almost every boat built at the school has a buyer before it's completed.

▶ Sharon O'Hara and John Archambeau plane yellow cedar strakes for a *faering* they'll build during guest instructor Jay Smith's nine-day workshop.

Hammond has developed a more comprehensive unit on lofting, and Speck has added breadth to the curriculum with his expertise in lapstrake construction, decking, and caulking. Those who have watched the school grow note that today's graduates have an even stronger command of the basic skills and a broader competence in the various disciplines of the trade. To further enrich the program, the school will begin offering an intensified, nine-month course next year.

Of all that Hammond absorbed from watching Prothero teach, one kernel of wisdom stands out. "You'd be doing students a disservice not to let them make a mistake," he says. "Maybe you cringe a little when somebody wastes a $125 piece of teak. But what they learn from their mistake is usually worth a lot more than the expensive piece of wood." WJ

Photographs: *Craig Wester (pg. 76-79), Doug Cantwell (pg. 80), The Wooden Boat Foundation (pg. 81)*

The Wooden Boat Foundation And Its Festival

The Wooden Boat Foundation, which works in alliance with the Northwest School, teaches the traditional maritime skills and otherwise promotes the appreciation of wooden seafaring. Between April and October, the Foundation offers a dozen community-based programs of educational adventures. Best known is the three-session Summer Youth Sea Camp, during which teens learn basic seamanship and marine ecology aboard several historic vessels, including the 101-foot schooner *Adventuress.*

For Jefferson County's Maritime Bicentennial in 1992, the Foundation commissioned the Northwest School to build a replica of Captain George Vancouver's gig *Townshend.* This 26', eight-oared longboat was used by the crew of *HMS Discovery* when they charted these waters 200 years before.

Since its launch, the *Townshend* has become a mainstay of Foundation activities, especially its community rowing program. On most Tuesdays and Thursdays during the warmer months, local residents can "reserve an oar" for an evening excursion aboard the three-masted gig. The rowing lacks coordination at first, but one of the program's goals is to teach a crew of eight first-time acquaintances to work together. The reward comes when the captain instructs them to stow their oars and hoist sails for a relaxing cruise back to Point Hudson.

In spite of its popularity as a tourist's spectacle, the annual Wooden Boat Festival remains predominantly an educational event, thanks to the efforts of the Foundation. Along the waterfront, you'll see demonstrations of ropecraft, carving, steam-bending, rigging, surveying, joinery, and wooden boat maintenance. You can tour boat shops, foundries, and sailmaker's lofts and watch the town's artisans practice their trades.

The Foundation presents films on seafaring history and slide shows by local residents who have done long-range ocean cruising in their own vessels. To promote enthusiasm among future generations, the Foundation offers toy boatbuilding, sea stories, and fish printing for 12-and-under spectators. Several Pacific Northwest bands perform traditional nautical ballads and sea chanties.

Out on the bay, you'll see scores of wooden rowing craft, sailing vessels, working boats, and tall ships. Some skippers keep their boats at anchor or in port, inviting spectators aboard for tours. Races are held among various classes of sailing dinghies and oar-powered boats, and judges award the Pacific Northwest Schooner Cup to the finest schooner in attendance. On the last day, over 100 wooden vessels participate in the festival regatta, which makes for a spectacular close to the three-day event.

More than 100 wooden vessels and 15,000 spectators attend Port Townsend's annual September Wooden Boat Festival, hosted by The Wooden Boat Foundation.

This replica of a ship's gig used by Capt. George Vancouver, who first mapped the Port Townsend area, was commissioned by the Wooden Boat Foundation and built at the Northwest School.

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SHOP TEST

Open-End Drum Sanders
Comparing the Performax and Ryobi

by Charles Self

Up until a few years ago, the price-to-capacity ratio for drum sanders put these machines out of the reach of most of us. Even today, the least expensive 24" drum sander on the market costs more than $1,000. Price tags on the larger and more complex machines skyrocket through the ozone hole.

Then, in 1994, Performax Products introduced the Performax 16-32. This new sander, with its cantilevered, open-end 16"-long drum, will sand stock up to 32"-wide in two passes. The firm's original 16-32 sold for about $800, but its latest release, the 16-32 Plus, runs about $900. In 1996, Ryobi unveiled a similar machine, the WDS1600. It currently sells for around $600. Recently, I had a chance to work with both machines side by side, and here's what I found.

The Basic Design

Both the Performax and Ryobi have a 16"-long sanding drum that is open on one end and attached at the other end to a tall cast shroud. The motor mounts in line with the drum on the outboard side of the shroud. To adjust sanding drum height, you crank a handle raising or lowering the motor/drum assembly in the casting.

A long, 3"-wide cloth-backed strip of abrasive winds around the drum in spiral fashion and attaches to the drum ends with spring-loaded clips. Below the sanding drum, a 16"-wide conveyer belt turns around a platen to feed the work into the drum. The feed belt is powered by a variable-speed DC motor that operates independent of the main motor at speeds of 0 to 10 feet per minute.

Both manufacturers classify their machines as benchtop tools although their weights—95 pounds for the Performax, 104 for the Ryobi—stretch the limits of that category. You can buy an after-market stand for either unit or simply bolt them to a wooden bench.

I found the Performax's square-tube steel base more rugged than Ryobi's cast-aluminum feet, and the steel tubing should better withstand the knocks that beset most shop equipment. If I had a Ryobi and didn't mount it on a stand or benchtop, I'd bolt the feet to a pair of 2x2s or 2x4s to protect them.

Keeping the Drum Parallel

On both machines, the sanding drum must be aligned parallel with the feed-belt platten to ensure uniform thicknessing. I found that this adjustment was easier to do on the Performax than on the Ryobi.

I also discovered that to maintain alignment on an open-end design like these, you need to guard against any unnecessary pressure on the outboard end of the drum. Simply draping an arm or hand on the end can skew the drum out of parallel with the bed and cause a workpiece to emerge thicker at one edge than at the other.

continued on page 84

The Benefits of Abrasive Planing

Flattening wide panels and stock with a hand plane or belt sander is a rite of passage for any woodworker. Even for experienced craftsmen, the task requires a fair bit of "by hope and by golly," not to mention some vigorous exercise. The open-end drum sander not only takes the sweat and uncertainty out of this job but also shortens the work of other tedious tasks.

For starters, these sanders will surface material to smaller thicknesses than any planer can manage. Most planers balk if you try to feed stock thinner than ¼", and even the best machines simply refuse material thinner than ⅛" unless you rig them with an auxiliary bed and carrier. Open-end drum sanders, however, will surface pieces as thin as 1/64". They also accept lengths as short as 2¼", whereas planers typically require at least 10", with 12" the recommended length. However, keep in mind that neither sander accepts stock thicker than 3", whereas most planers can handle thicknesses of 6" or more.

This capacity for handling both wafer-thin stock and short lengths means good news for a variety of different specialties. Scrollsawyers, for example, can remove the pattern paper and adhesive residue from sawn pieces simply by passing them through the machine once or twice. The steady, controlled action of the drum will neither break nor tear out fragile points and edges.

The thicknessing accuracy of these machines offers a welcome advantage for musical instrument makers and others who regularly work with exacting tolerances. According to Donna Green, vice-president of Performax, many of the firm's customers use the 16-32 sander along with a micrometer or dial caliper to sand off just a few thousandths of an inch with each pass. If you've ever struggled with inlays, spline stock, or other parts that require a snug but still sliding fit, you'll appreciate this degree of precision.

You can also use a drum sander to produce veneers from resawn stock. Drum sanders handle the rough faces of bandsawn kerfs without catching or kicking back, and they surface highly figured woods without tearing out irregular grain.

Don't expect these machines to hog off a lot of material in one pass. Patience is mandatory: Neither sander will remove more than 1/32" in one pass, and 1/64" or less is more typical. You'll want to spend some trial-and-error time finding the best stock-removal settings for each type of material you run. The trick is to carefully match the feed rate and depth of cut to the stock hardness.

Continued from page 82

Dust Collection a Must

Both machines incorporate a 2½" dust-collection port in the top of the sanding drum cover. The Ryobi accepts either a straight-in hose or an elbow; the Performax accepts only a straight connection. My Sears shop vacuum provided sufficient suction to keep either unit adequately clear of dust.

Don't operate either unit without a dust-collecting system. Otherwise, sawdust will quickly build up and lodge between the sanding drum and workpiece and cause it to slip.

Changing Abrasives

Both firms offer cloth-backed abrasive strips in grits ranging from 36 to 220; Performax also offers a 24-grit strip. The strips sell for $8 to $9. Changing the strips at first seemed like an all-thumbs ordeal, but it's still easier than changing and setting planer knives.

To mount a strip, you first secure one end of the cloth-backed abrasive roll in a spring-loaded clip at the outboard edge, then wind it onto the drum in spiral fashion *(photo A)*.

Up to that point, it's an easy enough task. But then you have to reach into a blind spot to open the inboard clip as you thread the end of the cloth through the drum slot and into the clip. At the same time, you have to maintain tension on the strip and keep it aligned.

With practice, the procedure becomes less cumbersome. I found Ryobi's system a bit easier to work with, although Performax recently came up with a bent steel rod it calls the "TufTool" that helps you gain some leverage on the spring *(photo B)*.

Motors and Switches

Performax powers its machine with a 12-amp U.S.-made Leeson motor. The firm recently upgraded this motor from intermittent- to continuous-duty, and this is the main difference between earlier models and the new 16-32 Plus. Ryobi equips its unit with a 10-amp Taiwanese motor.

My testing didn't really provide an opportunity to uncover major performance differences between the two motors that might surface over the long term. The Ryobi motor seemed a cut above other Taiwanese motors I've worked with in the past, but if I were betting on longevity, I'd go with the Leeson.

As mentioned earlier, both sanders drive the feed belt with a separate motor. The Performax feed drive has its own switch, but the Ryobi uses a single switch to activate both the sanding drum and feed belt. With the Performax's independent switches, you can run the feed belt without turning on the sanding drum, which makes it easier to determine when the sanding drum will engage the workpiece.

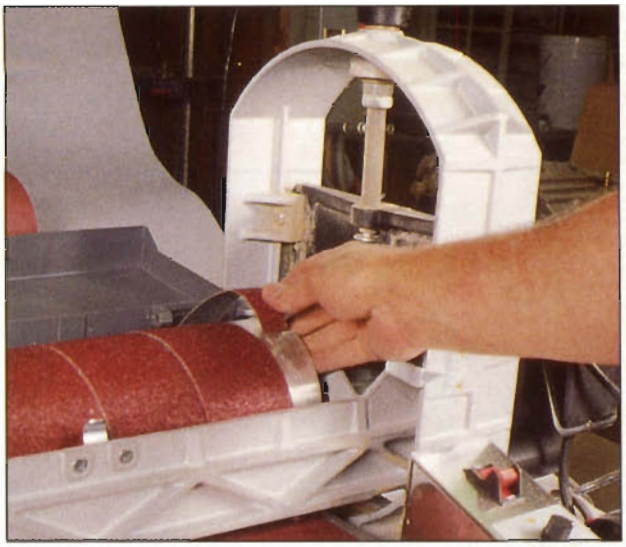

Photo A: Author wraping the cloth-backed abrasive strip around Ryobi's sanding drum.

Photo B: Performax's "TufTool" takes some of the strain out of securing the adhesive strip.

Comparing the Manuals

Performax provides a very good manual with good tips and information about abrasive planing. Ryobi's offering, on the other hand, was very disappointing. With a major tool purchase such as this, I expect a lot more. (I recently saw the manual that Leigh supplies with its dovetail jig—proof that manufacturers can and still do provide quality manuals.)

My Conclusions

When it came to sanding, I found that both machines performed about equal. None of the small differences I noticed in ease of setup, tune-up, or abrasive-changing compels me to speak out in favor of one sander or the other.

However, based on its motor quality and overall ruggedness of construction, I expect that the Performax will outlast the Ryobi, and probably justify the $300 price differential over the long haul. If you're in the market for a drum sander today, I suggest you base your choice on how much you want to pay for longevity. Either tool will make life easier and advance woodworking into a new dimension. WJ

Sources

Performax Products, Inc.
800/334-4910

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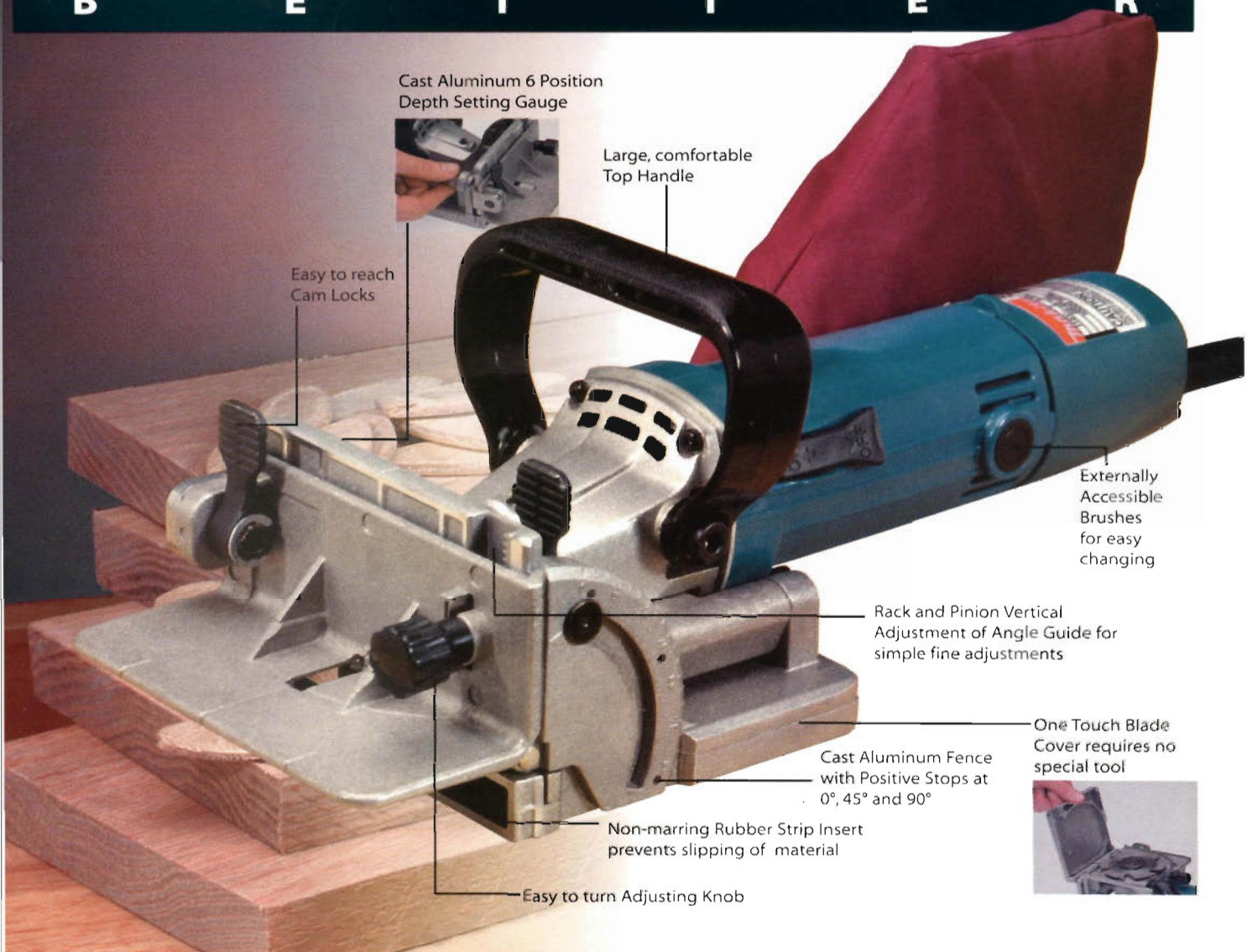

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