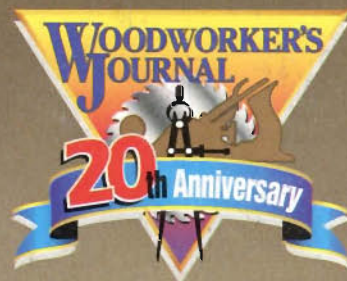


WOODWORKER'S JOURNAL

Vol. 20, No. 2 March/April 1996



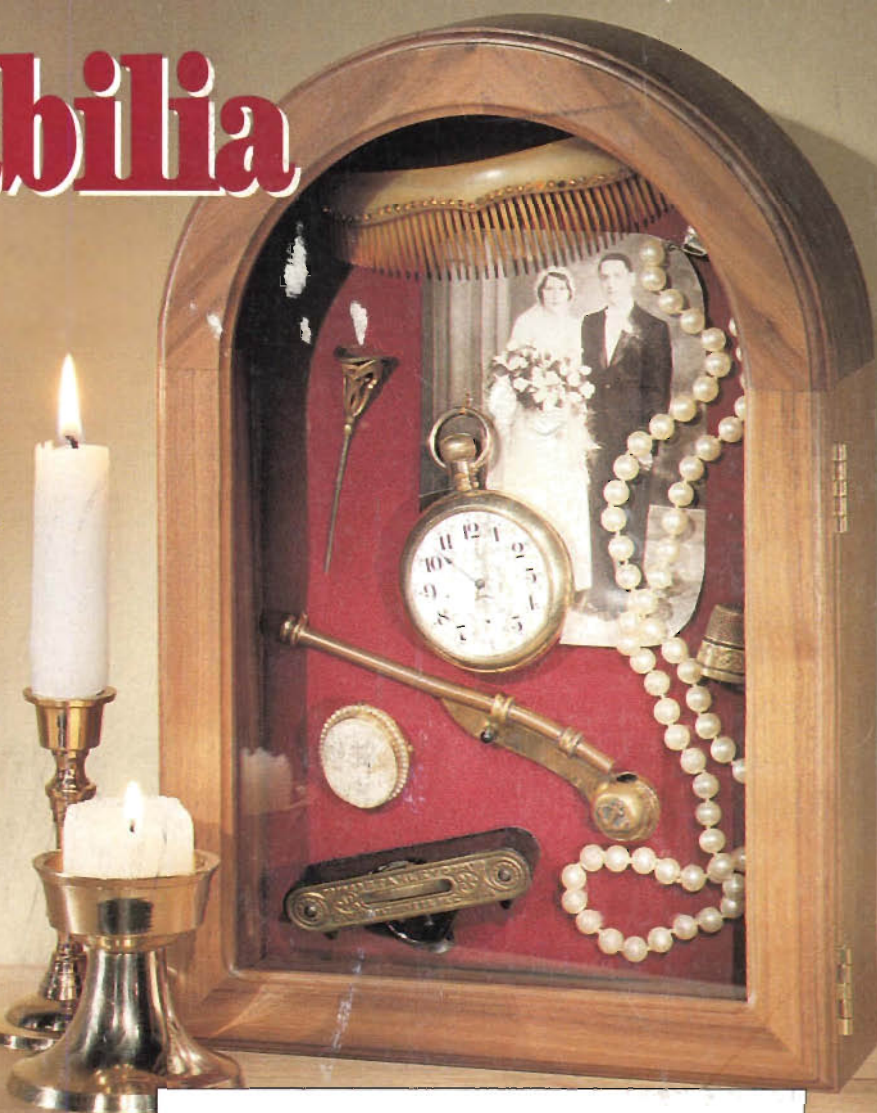
CRAFT AN HEIRLOOM **Memorabilia Case**

Page 46

COMPLETE TABLESAW TUNE-UP

CHALLENGING PROJECTS:

- **Jewelry Box**
- **Raised Panel Umbrella Stand**
- **Redwood Bat House**
- **Mobile Plywood Storage Rack**



10% to 20% OFF SPRING COMBO SALE

Sale prices good thru 4/30/96.

FREE \$45 IN SHARPENING COUPONS

GOOD ON ALL FORREST OR OTHER MAKES OF CARBIDE BLADES OR DADO SETS. Coupons expire 12/31/97.

Must mention **WOODWORKER'S JOURNAL** to receive coupons & bonus with purchase.

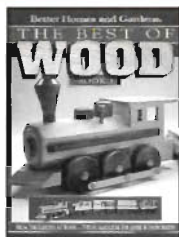
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The Best of Wood Book 1 is yours FREE with any saw blade or dado purchase from this ad.

This 160 page hardcover book features 35 of the best projects from WOOD Magazine. You must mention you saw this offer in WOOD Magazine, when ordering.

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WOODWORKER II	LIST	SALE	10%	20%
12"X40TX1"	\$183	\$129	\$116	\$103
10"X40TX1/8" or 3/32"	\$156	\$119	\$107	\$95
8-1/4"X40TX 3/32"	\$136	\$99	\$89	\$79
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Outperformed 36 other premium blades,
both foreign and domestic!

WOOD Magazine test, Sept. '93, pg. 45

WOODWORKER I - CROSSCUT For TABLE and RADIAL SAW

	LIST	SALE
12"x60Tx1" or 5/8" 1/8"K	\$198	\$139
10"x60Tx5/8" 3/32"K	\$162	\$129
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\$62 or \$50
NET COST TO YOU AFTER
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New specs, 5° Neg. Pts. & flat, runs
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smooth, splinter-free miter joints.

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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.



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5/8" HOLES. Boring up to 1-1/4" \$7.50 extra.
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Stops splintering on OAK/
BIRCH PLY VENEERS &
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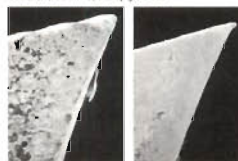
SIZES AVAILABLE	LIST	SALE
7-1/4"x60Tx3/32" K	\$149	\$129
8"x80Tx1/8" & 3/32" K	\$202	\$169
9"x80Tx1/8" & 3/32" K	\$207	\$179
10"x80Tx1/8" & 3/32" K	\$207	\$159
12"x80Tx1-1/8"K	\$212	\$181



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EXTRA 10%-20%
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Above 1" bore standard.
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.



STILL SHARP
AFTER 3,500 FEET
OF CUTTING!

The Proof Is In the Cutting

Both Woodworker II blades
performed very well, whether cutting
through butter-soft 3/4"-thick pine or
iron-hard 1 1/2"-thick ash. The 20°
positive hook angle and 15° alternate
top bevels give the blades an
aggressive attack; we maintained a
brisk, uniform feed rate while
ripping a variety of woods on the
powerful Unisaw and experienced no
discernible resistance or slowing. On
the smaller saws, switching to the
thin-kerf blade allowed very similar
feed rates, again with barely notice-
able resistance.

Although we've used blades that cut
faster, their cut quality couldn't touch
what we got with the Forrest blades.
On solid stock, ripped edges came off
our saws jointer-finished, smooth
and slick with no visible teeth
marks—good enough to edge-glue
without additional machining.

Crosscuts came out crisp and clean
with no fuzzing or tiny splintering.
The Bottom Line

Performance of the Woodworker II
is impressive enough that you could
bolt this versatile, general-purpose
blade on your saw and use it for
virtually all of your cutting opera-
tions.

SHOP TEST, Woodworker's Journal
Nov./Dec. '95 pg.78

NEW DELUXE DADO-KING! AS LOW AS \$184 NET AFTER USING SHARPENING COUPONS



C-4 Carbide Tips — 4 on each chipper with
special negative face hooks.

	LIST	SALE	10%	15%
6" D. 5/8" Bore NEW	\$299	\$269	\$242	\$229
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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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Cope-and-stick joinery creates a versatile project you can adapt to any number of uses

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Bat Conservation International (BCI) based this design on field-tested principles to ensure that you attract a houseful

46 Cover Story: Memorabilia Case

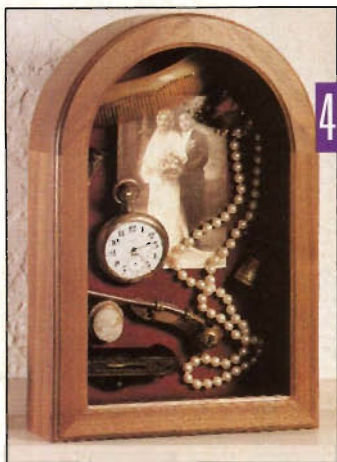
A stately arched cabinet for displaying small objects that hold big memories

54 Jewelry Box

David Peters combines mother-of-pearl inlay with a trio of American hardwoods in this generously proportioned box

32 Mobile Plywood Storage Rack

A sturdily constructed shop helper that we consider indispensable



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*Cover photograph:
Lynxwiler Photography*

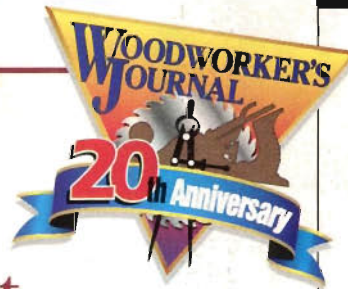
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SHOP TALK



Craig Moro

New Faces At Woodworker's Journal

This issue, I have the privilege of introducing three new *Woodworker's Journal* staffers. You'll be seeing a lot of their work in the future.

First, meet editorial assistant Craig Moro. A woodworker and world traveler, Craig has lived, studied, and taught English as a second language in India and Thailand. He is a graduate of the University of Chicago and Starr King School for the Ministry in Berkeley.

According to Craig, his woodworking hobby became a vocation somewhat by accident. He had bought a Japanese handplane but couldn't get it to work. So, he enrolled in a planing and sharpening class taught by Jay van Arsdale, a well-known Japanese-style woodworker and author in the Bay Area. That contact led eventually to an apprenticeship in hand joinery with van Arsdale that lasted, on and off, for several years.

Craig also serves as our resident chip carver. Essentially self-taught, he's designed and executed a number of commissioned pieces. He also produced the carving shown on *page 38*.

Keith Griepentrog comes to our staff as associate art director. An alumnus of Illinois State University, he has contributed his artistic talents to four other magazines on his way to *Woodworker's Journal*.

You'll likely find Keith during his off-hours building a toy or applying the finishing touches to his new 24x24' woodshop. Toys take up most of his shop time, particularly rocking horses and scooters. Before the holidays, Keith put in considerable overtime as one of Santa's busiest elves, constructing several versions of his well-received Lego table on commission for fellow employees.



Keith Griepentrog

Next, meet our most recent staff addition and new art director, Dan Scharfenberg. You may recognize Dan; we recruited him to put the finishing touches on the Early American wall clock for our Jan./Feb. '95 cover. A graduate of Bradley University in graphic design and communications, he has recently served as associate art director of two other magazines here at PJS.

A seasoned traveler himself, Dan also takes part in a slew of outdoor activities that include scuba diving and camping. He's currently acquiring new woodworking skills as he restores an old house.



Dan Scharfenberg

Charles Sommers

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The Adventures of Dusty Pyles



HEY B.E., HOW'D YOU WIN THE CLEAN SHOP AWARD? I SWEEP BUT I CAN'T SEEM TO KEEP MY SHOP CLEAN.



DUSTY, IT'S EASY WITH THE CLEANAIR SYSTEM. LET ME SHOW YOU...

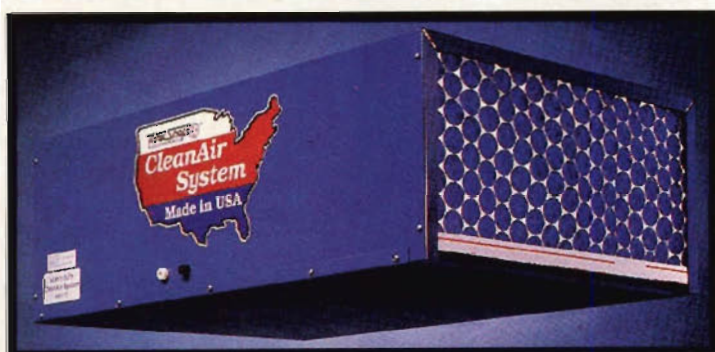


BY USING A UNIQUE 3-STAGE FILTRATION SYSTEM, THE CLEANAIR EFFECTIVELY CAPTURES 97% OF THE DUST PARTICLES IN THE AIR!... IT'S COMPACT AND VERY QUIET... AFTER 8 MONTHS I'VE NEVER HAD TO CHANGE FILTERS... AND IT MOUNTS ON THE CEILING SO IT'S NEVER IN THE WAY OF MY WORK! JUST LOOK HOW GREAT THIS PLACE LOOKS... AND I'VE BEEN WORKING IN MY SHOP ALL DAY!



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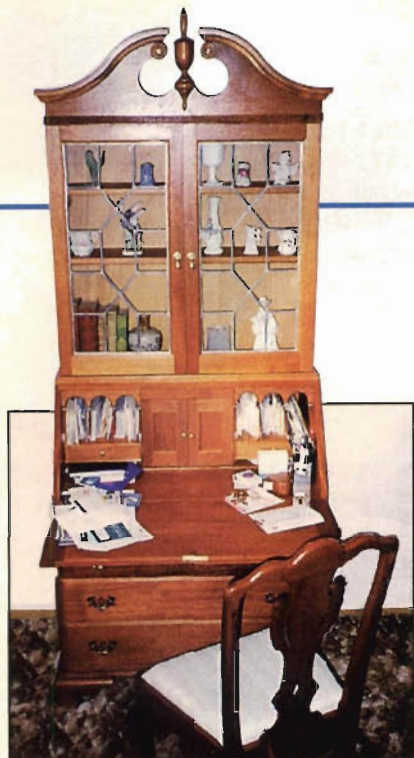
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I followed your plans to build this Governor Winthrop desk (Mar./Apr. '92) and top cabinet (Nov./Dec. '95), using mahogany instead of cherry because it's easier to work with. The plans were easy to follow even for an amateur like me, so I decided to make a chair to match. As you can see, it turned out alright. More plans like these, please!

Bill Schill
Cincinnati, Ohio

Your craft patterns are the greatest! As you can see, I have made many, many intarsia eagles (Sept./Oct. '93) and trout



(Sept./Oct. '94). I have also made the intarsia 8-point buck (Jan./Feb. '95) and raccoons (May/June '92). Keep up the good work.

Alvin Bergmark
Red Wing, Minn.

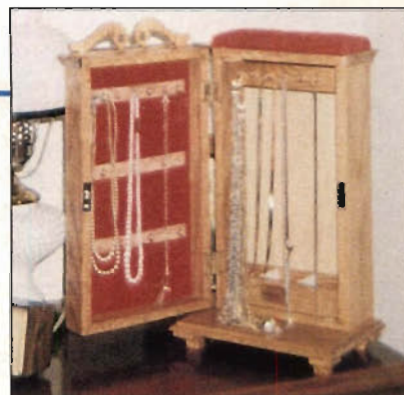
READER LETTERS

Last year I built the riding biplane (Jan./Feb. '94) for my grandson Zechariah. As you can see, I made a few modifications. A favorite relative was a Navy flight instructor,



so I added a radial engine to make it resemble the N3N he flew, and copied the markings from his plane. I assembled it with screws and decorative washers so it can be stored when Zechariah outgrows it. I really enjoyed making it, and was especially proud when it won "Best Toy" in the City of Phoenix Employees' Toy Show.

Frederick J. Osgood
Mesa, Ariz.



Here's my version of the Jewelry Mini-Armoire (Nov./Dec. '94). I added a few modifications—like the scroll and the pin cushion on top—to give it my personal touch. I made the case of oak from recycled (free!) crates, the front door from a red cedar log on our farm. I really enjoyed building this project, and my friend loved it as a gift.

Alexander Tryba
Benton, Ill.

If your readers are having any trouble finding old U.S. Post Office Box doors for the Mail Truck Bank (Nov./Dec. '95) or similar projects, I stock a variety of these doors at reasonable prices. (I also make a line of banks using the doors.)

Oscar Hubbert
Fletcher, N.C.

[Send SASE with inquiries to Hubbert Woodcrafts, PO Box 1415, Fletcher, NC 28372.]

Tool Award

For sending a photograph of his project, Bill Schill will receive a free Bosch 5" variable-speed random-orbit sander. This new Bosch sander features a powerful 3.3 amp motor with an operating speed range from 4,500 to 12,000 orbits per minute. Electronic feedback circuitry maintains selected rpm even under load, and the dual-bearing pad mount system eliminates wobble. Bosch adds a soft-grip top to make this tool a pleasure to use.



Woodworker's Journal will award a free tool each issue to a reader whose letter and woodworking project appear on this page. To become eligible for future tool drawings, send us a good photo and description of a Woodworker's Journal project that you have made. If your letter and photo appear in the magazine, your name will automatically be entered into that issue's drawing.

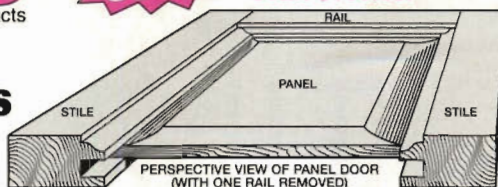
Please address correspondence to: Letters Dept., Woodworker's Journal, 2 News Plaza, P.O. Box 1790, Peoria, IL 61656. Please include your full name, address, and telephone number.

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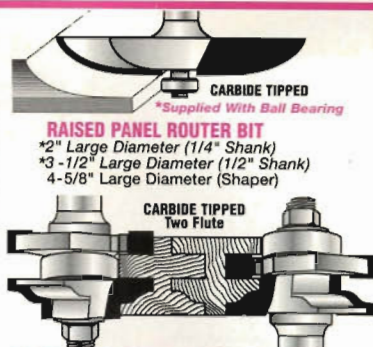
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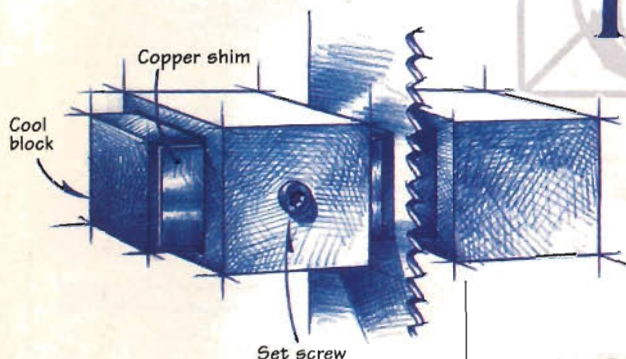
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SHOP TIPS



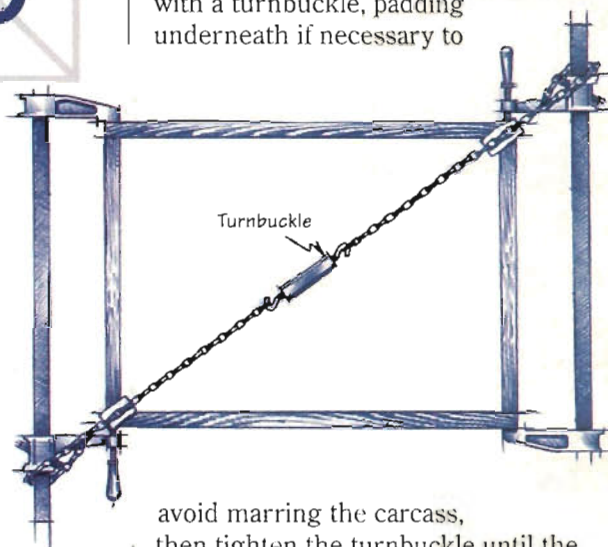
How to Foil Creeping Guide Blocks

It can be a real pain adjusting bandsaw blade guides, including "cool blocks." The guides tend to creep back toward the previous adjustment because of the set screw indentations in the blocks. Sanding or filing the blocks only solves the problem until the next blade change. A better solution is to cut small strips of copper or brass foil (available at hobby shops) and insert one between each guide block and set screw. Now the set screw will bear on the foil, not the block, and you will be able to micro-adjust the block many times.

Paul L. Stotler
Leonardtown, Md.

Turnbuckle Squares Carcasses

Squaring large carcasses can be a problem, especially if you don't have a clamp long enough to span the diagonal corners. Some lightweight jack chain and a small turnbuckle will do the job. After gluing and clamping, measure the diagonals to determine which two corners need to be pulled closer, then hook a length of chain to the clamps at



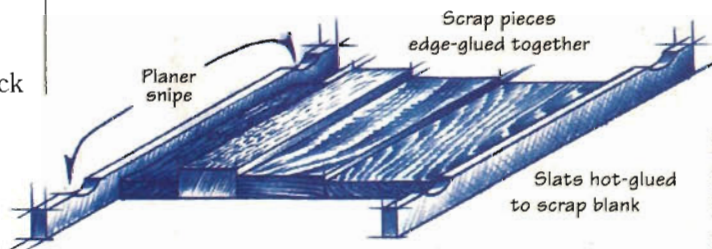
those corners. Join the two chains with a turnbuckle, padding underneath if necessary to

avoid marring the carcass, then tighten the turnbuckle until the carcass is square. Leave the chain on until the glue has dried.

Kristian Eshelman
Highland Park, N.J.

Salvaging Exotic Scraps

I've found a way to salvage irregular hardwood scraps, including short exotic pieces, that are difficult to machine safely but too good to burn. Start by jointing and edge-gluing the scraps together into a blank, keeping the bottoms and one



end even. (Length and thickness don't matter. The blank's maximum width is determined by the width of your planer.) After the glue has dried, find two scrap slats one foot longer than the longest piece in the blank and at least as thick as the thickest piece. Attach these slats to the sides of the blank using hotmelt glue. Now you can plane the blank to a consistent thickness. Any planer snipe will be limited to the long slats, which can easily be removed.

John Keller
Jamestown, Ohio

Best Tip Tool Winner

For submitting his shop tip, Paul L. Stotler of Leonardtown, Maryland, will receive the DeWalt 5" random-orbit palm sander (model DW423) shown at right. This new sander incorporates the firm's unique variable-speed feature and patented Controlled Finishing System, designed to give more control over the sanding process. The unit uses a hook-and-loop pad, and its integrated dust collector will channel up to 80 percent of the sanding dust into the canister.



To be eligible for a free tool or cash awards, send your original shop tip ideas (and sketches if necessary) to: Shop Tips Editor, Woodworker's Journal, 2 News Plaza, P.O. Box 1790, Peoria, IL 61656. We redraw all sketches, so they need only be clear and complete. If you want the material returned, please include a self-addressed stamped envelope.



The First Real Advance in Table Saw Fence Design Since the Invention of the Table Saw Itself.

The NEW INCRA ULTRA-TS Micro Precision Table Saw Fence™ uses patented sawtooth positioning racks with **Automatic Positioning Control™** to locate each and every cut with true machine shop precision and perfect repeatability ... *Instantly! ... Automatically! ... EXACTLY!* Overall accuracy is 0.004" (about the thickness of this page) with ZERO repeatability error. It's the only table saw fence that doesn't depend on a tape measure and your eyesight to position your work. And because of its structural design, centrally placed carriage, and optimized side mounted clamping system, the entire unit virtually welds itself together into one solid block of steel and aluminum when locked in place. The result is exceptional strength, rigidity, and stability.

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Four mounting brackets are included for user supplied table board

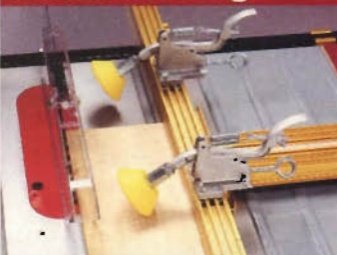
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Universal T-Slots for hold downs or other fixtures on the front face and top of the fence

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A Wrench, a Screwdriver, and About an Hour

Other after-market fences make you modify your table saw to fit their design. Not so with the ULTRA-TS. INCRA's innovative universal mounting brackets virtually guarantee compatibility with any 10" table saw built in the last 50 years. And because all positioning control, alignment, and tracking functions are built right into the ULTRA-TS at the factory, there are no special requirements or critical adjustments needed to put it on your saw. That means no drilling, no tapping, and no modifications. All you need for a typical installation is a wrench, a screwdriver, and about an hour.

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Positioning range is $25 \frac{1}{2}$ " to the right and 16" to the left of the blade. Accuracy is 0.004". Repeatability error is ZERO.

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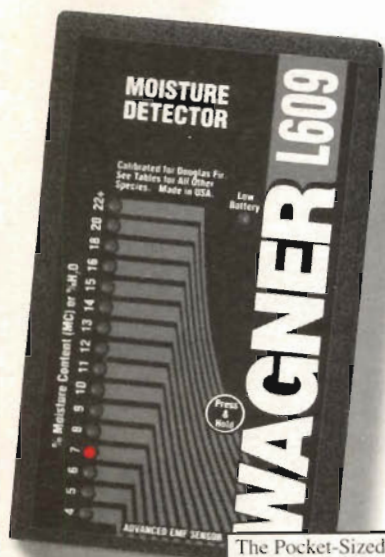
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READERS' INFORMATION EXCHANGE

I am in the process of remodeling and am amazed at the price of plantation shutters. Does anyone know where I can get plans for them?

Bob Albers
207 Oakwood Drive
Georgetown, TX 78754

I've been looking for a brass carpenter's square for two years to no avail. Does anyone have a square they want to part with?

Timothy A. Timm
7355 W. Oakmeadow Dr.
La Porte, IN 46350

I've recently acquired a Rockwell 14" bandsaw, model no. 28-240, and need a manual and parts list. I also have manuals and parts lists for the following pre-WWII Delta lathes and accessories: no. 930—11" cast-iron bed lathe (2 pages), no. 1460—12" lathe (2 pages), no. 347 sanding table (1 page), "Metal Turning with the Delta Slide Rest" (2 pages), "Metal Turning with the Delta 960-a Slide Rest" (2 pages), "Installing the Delta Universal Chuck on a Lathe" (1 page). I'd be happy to provide copies. Send SASE with one stamp per four pages.

Carl Bostrom
12508 Meadowwood Drive
Silver Spring, MD 20904

I need a manual for my 2-hp, 12-gal- lon Craftsman air compressor, model no. 919.176821. I'll pay for copying and postage.

Don Howard
Box 796
Brazzaville, MI 49617

I have written a computer program that is available free of charge. Woodpro is a database and wood selection expert system that runs on

any IBM PC or compatible. It answers queries about physical properties of woods and lists by order of price. Anyone can download from either of these sites: ftp.rahul.net/pub/geary/woodpro http://www.woodworking.com

Ken Young
1259 Park Ave. #23
San Jose, CA 96126

I have a Stanley router no. 91258, model 31, with a plane attachment. I need a complete base unit for the tool. Any clues where I might find one?

Ralph Summers
2301 Spielhagan Rd.
Troy, MO 63379
314/528-4747

I need the owner's manual for a Craftsman radial-arm saw, model no. 113.29410, and the Sears thickness planer, model no. 306.4748. I'll pay for postage and copying.

Gary Buchta
46 Green Pond Road
Sherman, CT 06784
203/775-4501 (day)
203/350-5975 (evening)

I need an owner's manual for the Power King shaper, model no. 411. Thanks!

Michael R. Shafer
130 Fayette Street
Palmyra, NY 14622

I need the gear housing for a Craftsman radial saw, model no. 103.29300. Does anyone know where I can find a new one or a used one in good condition?

Eugene Genibovs
60 Yale St.
Gardner, MA 01440

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PRODUCT NEWS

Engineers Design Miter Saw Around the Blade

Freud engineers selected their best industrial-quality blade, then developed their new 8½" sliding compound miter saw around it. This, they say, provides a saw with features, precision, cut capability, portability, and price unmatched by other miter saws on the market.



Freud TR215 Sliding Compound Miter Saw

Some of those advantages include an extra-wide cast-aluminum base with a 14½x19½" footprint, which gives an effective worktable area twice as wide as other saws; a miter turret that rolls on bearings for smooth table rotation; positive stops at the key angle positions; a special design feature that allows you to disengage the positive stop with the twist of a lever for settings close to but not on positive stops.

A 9.7-amp universal motor powers the blade at 4,300 rpm. An electric brake brings the blade to a quick stop after release of the trigger. The motor head glides on two solid steel rods, and four precision linear bearings hold the motor in line, eliminating side play.

At zero miter and bevel, maximum cutting width of the TR215 is 11¾",

maximum cutting thickness, 2¾". At 45° miter and 45° bevel, the maximum width is 8¾" with a maximum thickness of 2".

TR215 8½" Sliding Compound Miter Saw, \$688.90. Freud, 910/434-3171

Tiny Clamp Looks and Works Like Its Big Brothers

At first glance, you'll probably think this new QUICK-GRIP Micro bar clamp/spreader is some salesman's miniaturized promotional sample. Actually, the tiny but fully operational clamp offers the same one-handed clamping and spreading advantages you get with the full-sized QUICK-GRIP models. Made of high-strength,

lightweight resin, the Micro version comes in 10", 20", and 33" jaw-spread sizes. It has soft, pliable jaw pads to protect workpiece surfaces. Model and miniature builders will find its petite size especially useful.

QUICK-GRIP Micro Bar Clamp, \$13.00. American Tool Companies, 414/947-2400

QUICK-GRIP Micro Bar Clamp



DeWalt DW996K
Cordless Drill/Driver/
Hammerdrill

Hammer-drill Adds Punch To Cordless Drilling

You don't need to drill holes in concrete to utilize the advantages of a hammerdrill. Drive a bunch of wood screws into oak or similar hardwoods, and you'll quickly appreciate the percussion hammering action as you drive them home quickly and cleanly. In fact, DeWalt's 14.4-volt cordless drill/driver/hammerdrill would make a very handy "combination tool" addition to just about any shop.

The DW996K boasts a ½" keyless chuck, a fan-cooled motor with replaceable brushes, and an adjustable-torque clutch. It uses the same XR battery packs as the firm's cordless drills, saws, and screwdrivers. The selectable gear settings provide variable-speed ranges of 0 to 600 and 0 to 1750 rpm in the drill mode and 0 to 6,600 and 0

to 19,500 bpm (blows per minute) in the hammer mode. The packaged kit includes the drill, one battery, a one-hour battery charger, and a steel carrying case. A lighter 12-volt, ⅜" keyless version of this tool (DW976K) is available for those who don't require the heavy-duty version.

DeWalt DW996K 14.4-Volt Drill/Driver/Hammerdrill, \$396.00. DeWalt Industrial Tools, 410/716-7459

Continued on page 14

Z-SERIES

We are proud to offer this "Top of the Line" version of our standard G1022 10" Table Saw, with all the extras of saws costing a lot more. An exceptional value, the G1022Z comes complete with motor, fence, two cast iron extension wings, sturdy stand, blade guard, two blade inserts (one for the regular blade and one for the dado set), and miter gauge.

- Belt driven from the rear mounted motor to the arbor
- All ball bearing mechanism
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- Sturdy, precision-ground cast iron table and extensions
- Self-tensioning belt drive
- Heavy-duty rip fence with micro-adjustment knob
- Extra long, 1 1/2" diameter tubes can take on extremely large jobs
- Extra cast iron extension wings can be added with above tubes
- 1 1/2 H.P. Single Phase, 110/220V motor (prewired to 110V)
- Shipping weight: approx. 270 lbs.

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Product News

Continued from page 12

Dremel's Moto-Tool Goes Cordless

If you frequently reach for the Dremel, you'll really appreciate the freedom provided by the firm's new MultiPro 7700 Cordless. This 7.2-volt rechargeable version operates at both 7,500 and 15,000 rpm. To select the speed, you move a slide switch on the tool. Recharging the three-hour battery pack is easy, too—simply remove it from the tool and place it in the charger.

Dremel offers the 7700 in a storage case stocked with 25 accessory bits and a knurled collet nut that accepts 1/8" shanks. Additional 1/32", 1/16", and 3/32" collets may also be purchased. The unit is made of heavy-duty, shatter-resistant, glass-filled nylon.

Dremel 7700 MultiPro Cordless Kit, \$49.95 to \$59.95. Dremel, 414/554-1390

Radius Edge Guide Ensures Perfectly Rounded Corners

With your router, a flush-trim bit, and Vermont American's new Radius Edge Guide, you can rout perfectly rounded corners of 1", 1 1/2", 2", and 2 1/2" radii.

The preshaped router guide, part of the Wood Crafters Series of accessories, can be bought at home centers, hardware stores, and mail-order suppliers that carry the firm's products.

Radius Edge Guide (no. 23474), \$34.00. Vermont American Tool Co., 704/736-8020



Dremel MultiPro 7700 Cordless

Original Plate Joiner First To Go Cordless

Lamello, the inventor of plate joinery, recently unveiled

the Dynamic Cordless 10, the first battery-powered version of this increasingly popular tool.

Powered by a 12-volt, 1.7-amp nickel-cadmium battery, the tool can mill pockets for about 200 biscuit joints on one charge. The standard battery charger recharges the battery in one hour; a rapid-charge version can do it in 10 minutes. The battery pack carries a 1,000 recharge cycles rating with the standard recharger and a 3,000 cycles rating with the rapid-charging unit.

The Swiss-made Dynamic features the same head, fence, and operating features as the firm's corded model. It also offers two options for dust and chip control: a vacuum adapter and a disposable dust bag. The standard unit comes with one battery pack, the one-hour charger, and 10 dust bag filters. The rapid charger and additional batteries may be purchased.

Lamello Dynamic Cordless 10, \$675 to \$725. Colonial Saw Co., 800/252-6355



Vermont American's Radius Edge Guide

New Router Comes Loaded With the Most Sought-After Features

The spec sheet on Makita's 3612C router reads like a most-wanted features list. For starters, this plunge unit incorporates variable-speed (9,000 to 23,000 rpm) capability, a powerful 15-amp double-insulated motor rated at 3 1/4 hp, electronic constant-speed control,

a soft start, and an electric brake for fast stopping.

Maximum plunge depth for the 3612C measures 2 3/4". There's a rotating stage for pre-setting three plunge depths. The shaft has all ball bearings, accepts 1/4" and

1/2" shank bits, and incorporates a shaft lock to aid bit-changing.

Available accessories include template guides, template guide adapters, additional collet sleeves and cones, additional wrenches, straight and trimmer guides, and a guide holder.

Makita Variable-Speed Plunge Router, Model 3612C, \$270.00. Makita Tool Corporation, 714/522-8088



Makita Plunge Router Model 3612C

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Do you toss and turn at night? Can't seem to find a comfortable position? Does your back ache when you awake? These are signs that your metal coil mattress or waterbed may not be supporting you properly or be right for your body. Select Comfort can help you sleep better with a revolutionary mattress that's so comfortable and supportive, it's recommended by the many doctors who use our product.

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Select Comfort contours to your body.



With Select Comfort, you each get exactly the firmness you need.



Select Comfort provides proper back support and contours to your body. Weight is more evenly distributed and pressure points are reduced.



Metal coil mattresses can create pressure points and provide uneven support.

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Customize the firmness of each side of the mattress.

fact, the firmness adjusts independently on each side of the bed so you and your partner can get custom support without compromising comfort or quality of sleep.

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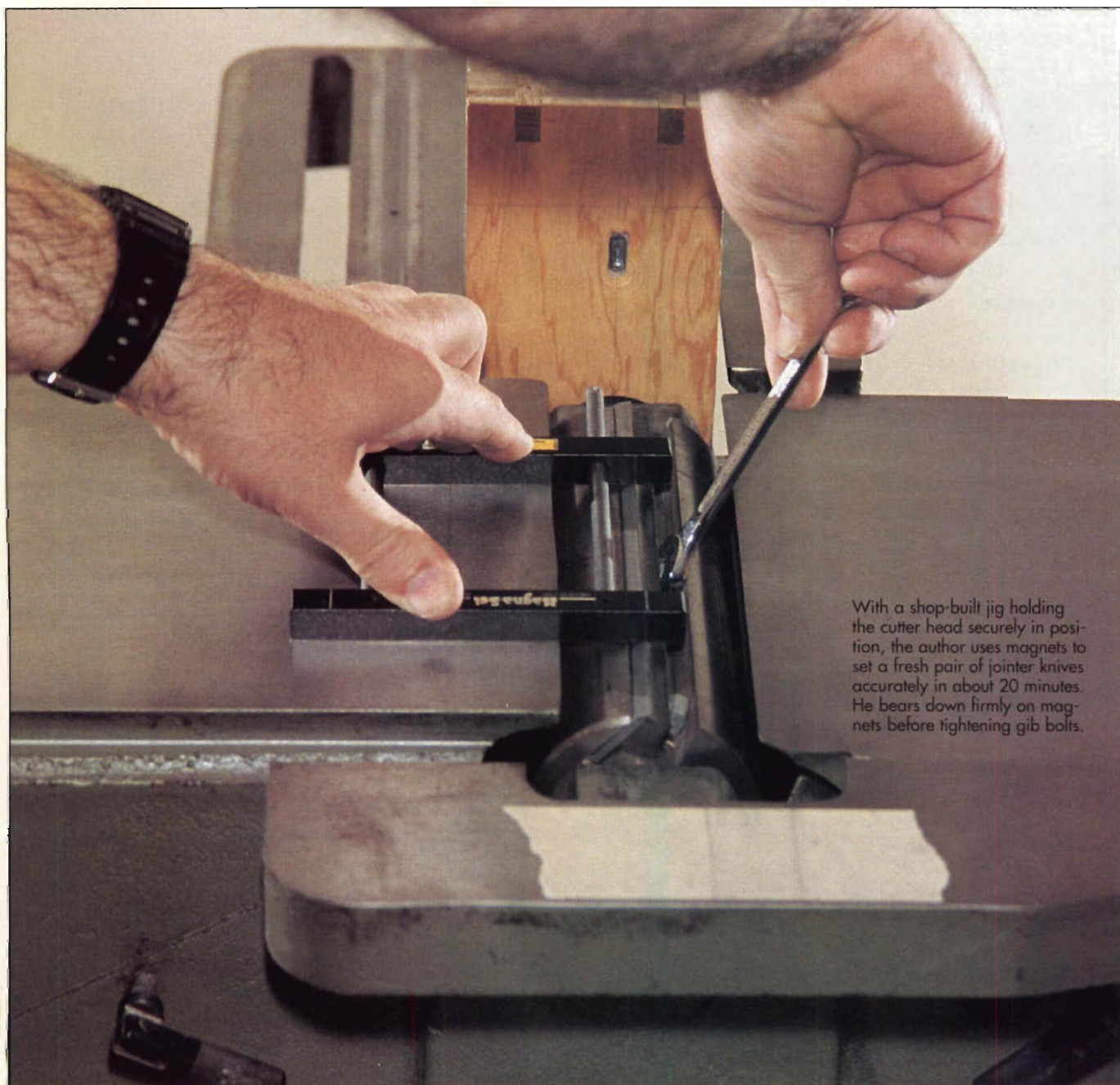
A Simple Jig Saves Time and Ensures Accuracy

Setting Jointer Knives

by David C. Volker

Every jointer owner fantasizes about magical knives that never grow dull or get nicked. Reality soon sets in, however, and out comes the owner's manual—

which never seems to explain how to set a fresh pair of knives quickly and accurately. The solution I found was to jig the cutter head.



With a shop-built jig holding the cutter head securely in position, the author uses magnets to set a fresh pair of jointer knives accurately in about 20 minutes. He bears down firmly on magnets before tightening gib bolts.

I know one woodworker who didn't change his knives for five years because of the time he'd spent and problems he'd encountered the first time he tried. One recent article on jointer maintenance even advises you to grab a stool so you can settle in and get comfortable for the task.

Two factors can make the process long and involved. For one, the cutter head moves when you start tightening the gib bolts, throwing everything off. The other challenge is setting each knife precisely to the height of the outfeed table—also due in part to the cutter head's tendency to roll. Setting jointer knives, however, need not be an all-day ordeal or a hit-or-miss proposition. In this article, I'll explain my method, which allows me to change knives in less than a half-hour.

Build a Jig To Fit Your Jointer

As the Exploded View on *page 18* shows, my jig consists of an inverted T-brace with a clamping head that grips the pulley on the cutter head, holding it fast. The T-brace is secured to a base that bolts to the jointer stand (*photo A*). You may need to adjust the jig's dimensions as shown here to fit your jointer; keep in mind that the principle is simply to clamp the pulley firmly (*photo B*).

Note: Before working around the jointer's cutter head—unplug the jointer. Fitting and using the jig requires that the guard and fence be removed, exposing an unforgiving set of knives to the careless. Even dull knives can slice fingers.

Start your jig by making the base, which provides a stable platform for the inverted T-brace. I made my base from $\frac{3}{4}$ "-thick oak and attached it to the jointer's metal stand using three counterbored #8x1" panhead sheet metal screws (*photo C*). Note: If your jointer stand is made from material thicker than $\frac{1}{8}$ ", you may want to use self-tapping screws. However, avoid using bolts—the nuts could come loose and fall into the jointer's moving parts. Do not install the T-nuts in the base at this time; wait until you've fitted the T-brace so you can position them accurately.

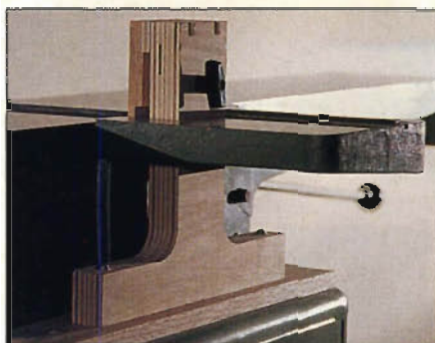


Photo A: Shown here installed on the jointer, the jig consists of a hardwood base, a laminated plywood T-brace, and a plywood clamping head with draw bolt and T-knob.

Before you make the inverted T-brace, adjust the T's dimensions to fit your machine, keeping in mind the following: (1) the T should extend about 4" above the cutter head pulley; (2) its base should be wide enough to accept the mounting bolts; and (3) it should be sturdy enough to provide a rigid post for the clamping head.

I laminated two pieces of $\frac{3}{4}$ "-thick plywood for the T-brace and band-sawed the lamination as shown. Once you've made the T, place it in position so that it touches the cutter head pulley. Then, locate the mounting holes on the base by inserting a scratch awl through the T-brace holes. With the base clamped in position, drill $\frac{5}{16}$ " holes through the base and jointer stand housing to create clearance holes for the machine screws.

Remove the base, then counterbore the $\frac{5}{16}$ " holes on its underside for T-nuts. Install the T-nuts, then reattach the base to the jointer. Attach the T-brace to the base using $\frac{3}{4}$ "-20x3" machine screws. (You could also use 3" eye bolts, which could be hand-tightened sufficiently without use of a driver.)

The clamping head is the only complex part of this otherwise simple jig. (See the Clamping Head Side View at *right*.) I made the clamp pad from $\frac{3}{8}$ "-thick plywood because this thickness is slightly less than the width of the hub on the cutter head's pulley. The semicircular cutout at the bottom allows the clamp to fit over the cutter head and bear against the upper half of the pulley's rim.

I made the pivot block from $\frac{3}{8}$ "-thick stock—about the same width as the pulley. The extra $\frac{3}{8}$ "-thick plywood filler simply beefs up the clamp-

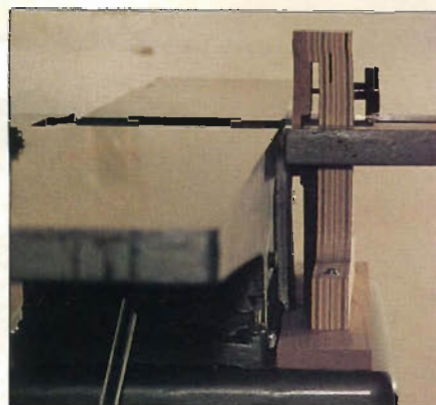


Photo B: Shown here in profile, the jig's clamping head fits over the pulley on the cutter head, locking it in position.

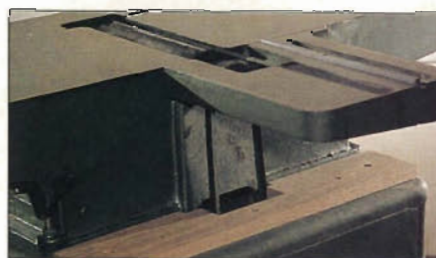
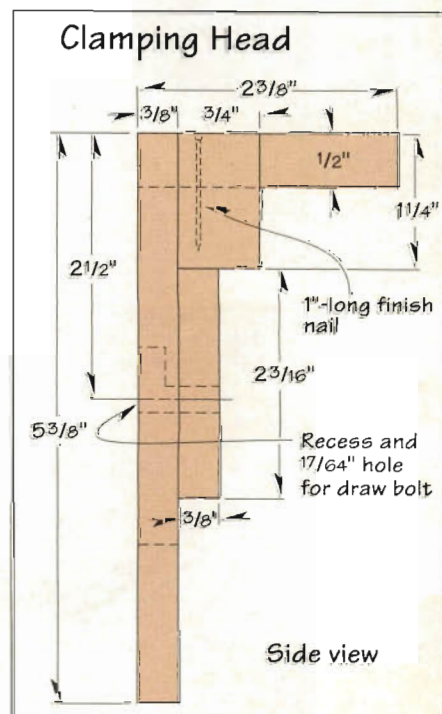
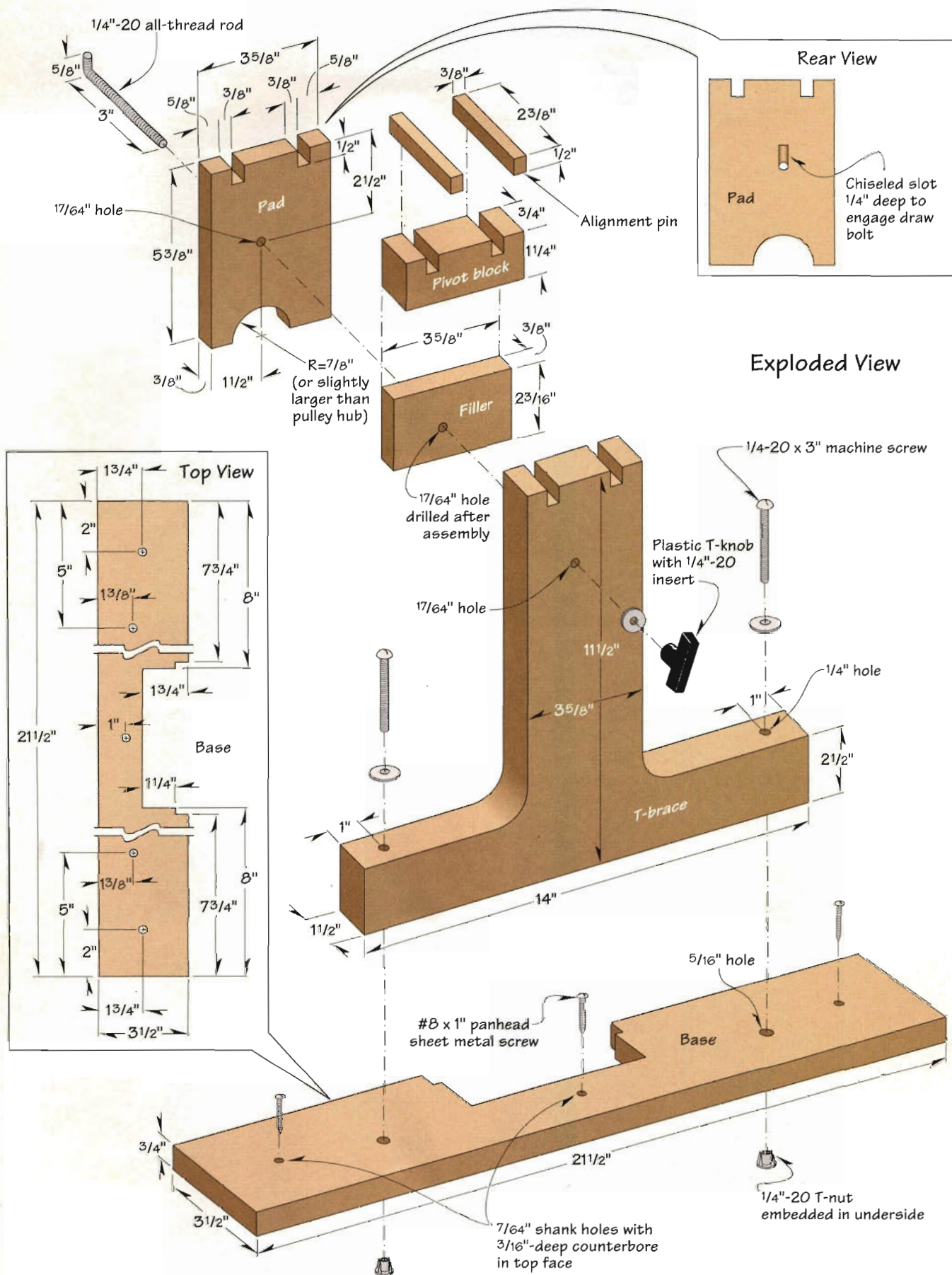


Photo C: Make the jig base from $\frac{3}{4}$ "-thick hardwood, adjusting the cutout dimensions to fit your jointer. Secure the base to the jointer stand with three sheet metal screws.

ing pad's thickness so that the L-shaped draw bolt won't break through the pad when pressure is applied.

Cut the pad to dimension, then trace the outline of the pulley onto the T-brace. Remove the T, and use it to lay out the semicircular cutout on the pad.





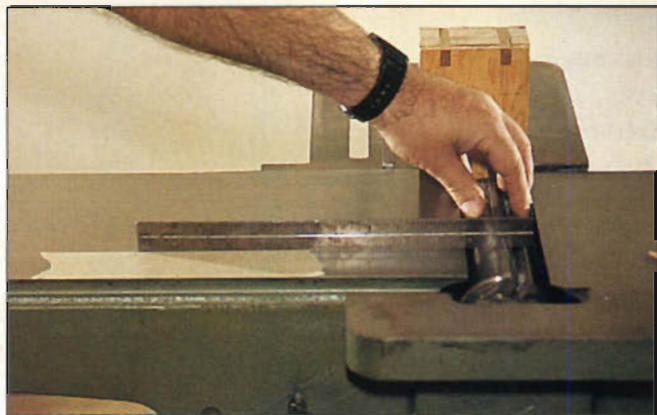


Photo D: Locate the top of the cutting arc using a combination-square blade on the outfeed table as shown. The midpoint of the distance traveled by the blade (as carried by the jointer knife) is the top of the arc.

(Remember, the cutout should be slightly larger than the pulley's hub or shaft but smaller than the pulley itself.) Make the cutout using a bandsaw or Forstner bit. (I used a 1 $\frac{3}{4}$ " Forstner for mine.)

Glue and clamp the pivot block and filler piece to the pad, aligning the top edges of the pad and pivot block. After the glue has dried, remount the T-brace, then dry-fit the assembled clamping head to its top end. Now, trim the head so that it aligns with the top end and edges of the T.

When everything fits, clamp the head to the T, and drill the draw bolt hole where shown and dimensioned. Align the hole with the center of the pulley and locate it midway between the pivot block and pulley. Next, remove the T-brace and head, and temporarily bolt them together. Using a $\frac{3}{8}$ " dado head elevated $\frac{1}{2}$ ", cut two slots in the top ends of the assembled parts for the alignment pins.

From hardwood, cut the pins as dimensioned on the Exploded View. Dry-assemble them into the slots in the clamping head, check for fit, then glue and clamp them in place where shown on the Clamping Head Assembled View at right. Drill $\frac{1}{16}$ " holes through the pins and into the head, then drive finish nails to reinforce the joints. Disassemble the T from the clamping head. Widen the slots in the T slightly ($\frac{1}{16}$ ") to allow easy but not sloppy insertion of the pins.

For the draw bolt, cut a 6" length of $\frac{1}{4}$ "-20 all-thread rod. Bend a 90° angle in it, then cut it to the dimensions shown. Insert the bolt through the clamping head, mark the position of the L on the clamp pad, then chisel out a recess to prevent the bolt from spinning when you tighten it.

To tighten the clamp, attach a T-knob and flat washer to the draw bolt on the T-brace side of the jig. Note that the knob should be attached on the outside face so it won't get in the way when you're setting knives. The jig is now ready to use. (See the Source listed at the end of the article to mail-order a T-knob.)

Use the Jig To Change and Set the Knives

Remove the jointer's guard and fence, install the jig base, and bolt the inverted T-brace to it. Slip the clamping head down over the cutter head pulley, engaging the slots in the T-brace with the alignment pins. Insert the draw bolt through the clamping head and T, then screw on the knob and washer, but don't tighten the knob yet.

To determine the top of the cutting arc on the first knife, place a straightedge on the outfeed table overhanging the cutter head (*photo D*). Then, slowly rotate the cutter head by hand; as the knife reaches the top of its cutting arc, it should contact the straightedge and drag it forward a short distance.

As the knife moves beyond the top of the arc, it will stop moving the straightedge. The point at which the straightedge has traveled half this distance is the top of the cutting arc. Now, tighten the clamping head on the jig to lock the cutter head in position.

If the knife is not exactly at the top of the cutting arc, the second and third knives will be off by the same amount as the first. You can correct any error by adjusting the outfeed table after all knives have been installed. Note: If your outfeed table



Photo E: Clamp the cutter head at top of cutting arc, then apply masking tape where shown. Use combination square to mark the forward edge of knife slot on tape.

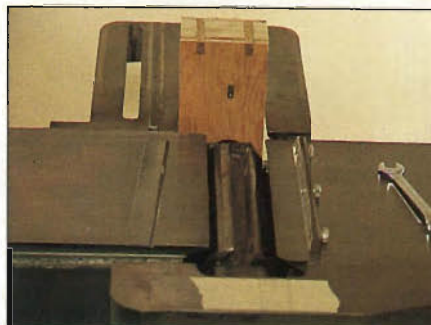
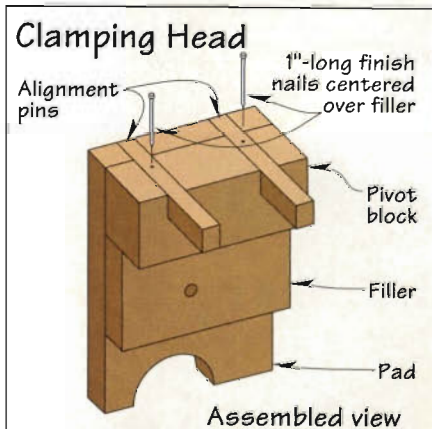


Photo F: Loosen gib bolts, remove knife and gib, then thoroughly clean slot before installing fresh knife.



doesn't adjust, use greater care in determining the top of the cutting arc.

Using a square, locate the position of the knife relative to the infeed table (*photo E*). Next, adhere a piece of masking tape to the guard base on the infeed table where shown. Align the blade of the square with the forward edge of the gib slot. Then, using a sharp pencil, mark the tape along both edges of the square's blade. By marking on both sides, you'll make repositioning the square for the second and third knives easier and more accurate.

Remove the knife and gib, and clean the gib groove (*photo F*). Then,

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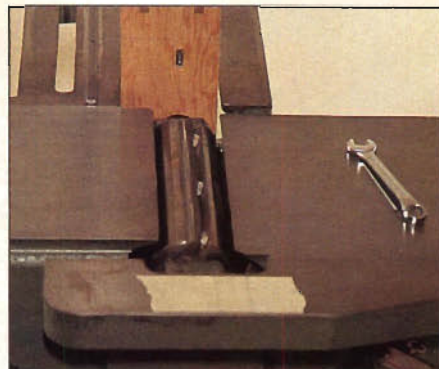


Photo G: Install new knife and gib, leaving gib bolts loose for knife-setting.

insert the new knife and replace the gib (*photo G*). Use a magnetic blade setter or a pair of strong magnets to hold the knife flush with the surface of the outfeed table. (See the lead photo on *page 16*. To mail-order a magnetic blade setter, see Sources.) As you tighten the gib bolts, press firmly on the magnets to prevent the knife from rising up.

Unclamp the cutter head, rotate it to the next knife, and align the slot with the square, using the lines on the tape you marked earlier. Repeat the procedure described above to set the remaining knives.

Note: Before using the jointer, remove the jig, double-check that all gib bolts are tight, then replace the guard and fence. Using this method, I set my jointer knives in about 20 minutes, dead on, the first try. *Wj*

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SHOP TEST

New Miter Saw Earns Permanent Spot In Our Woodshop

by Charles Sommers

"Awesome!" was craftsman Dick Coers' first comment after running preliminary tests on Makita's new model LS1211 slide compound miter saw. Dick is no stranger to the capabilities of this type of saw—he'd owned and used a smaller version in his cabinet shop for more than five years. But the perfect paper-thin slices of 8/4 cherry he passed around to show off indicated how impressed he was with this tool's performance.

Take More Than a Passing Glance

Look closely at the LS1211, and the same adjective Dick used will probably come to mind. For one thing, it's big—almost 41" from front to back—and its 12" blade looms imposingly. The saw also has an unorthodox look about it, especially in some of its working positions. As for power, the 15-amp motor didn't find the

8/4 cherry stock even slightly challenging. Overall, the saw offers big performance: crosscuts up to 12 $\frac{3}{4}$ " wide, miters to 60°, and bevels to 45° left and right.

As if these advantages weren't enough, the LS1211 will cut right bevels—a feature you won't find on any of its competitors. To offer this capability, Makita engineers figured out a way to mount the motor at an angle so it would clear the fence and table. This allows you to bevel in either direction without having to flip

the stock or cut it on the wrong face, which means you'll have an easier time making more accurate cuts.

You Don't Need an Engineering Degree

We found the saw, as delivered in its carton, nearly shop-ready. Attach the rear holder, check a couple of alignments, slip on the dust bag, get acquainted with the controls, plug in the cord, and you're ready to saw. Note: We recommend, however, that you read the operator's manual and thoroughly familiarize yourself with any new tool before operating it.

The well-illustrated instruction manual made setup easy. Our unit required only slight adjustment to bring the blade to perpendicular. (Makita thoughtfully provides a plastic triangle for checking all angle settings.) Fine-tuning was a snap because the engineers located the adjusting bolts up top within easy reach. A quick check of the saw's components showed the machine to be well designed, superbly machined, and carefully assembled. Unlike a few new tools we've encountered, this one revealed no missing bolts, ill-fitted parts, or sloppy machining. The saw's finish looked impeccable. Moving parts worked smoothly without slop or play, the rotating base locked precisely in the preset indents, and the carriage came back from bevel settings with a nice, crisp thump—dead on zero.

continued on page 24

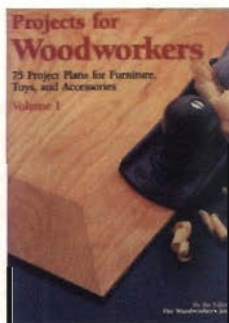


Makita Slide Dual Compound Miter Saw model LS1211

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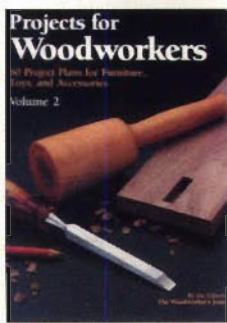
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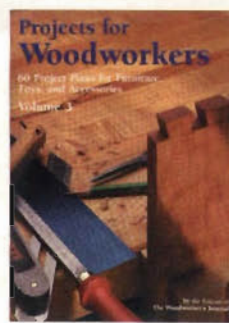
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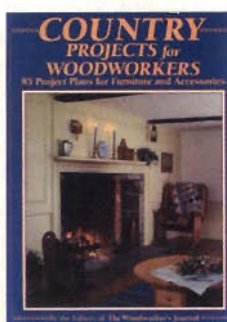
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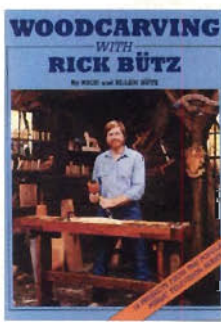
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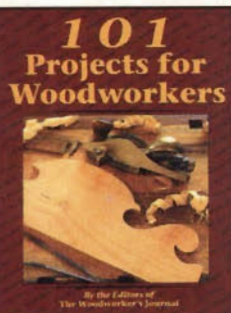
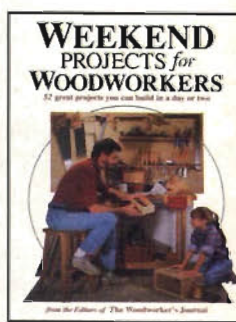
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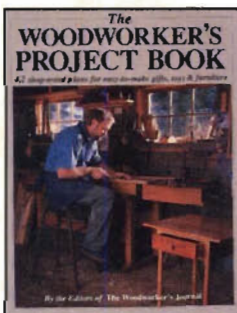
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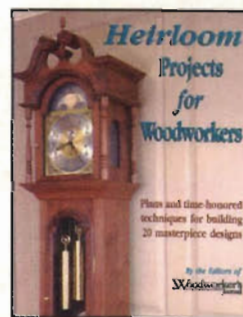
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SHOP TEST

continued from page 22

As we worked with the saw, we noticed other signs of thoughtful engineering. For example, both position-indicator scales are large and the pointers have been set close for easy readability. Compression bellows cover the slide tube fore and aft of the support arm, keeping the parts free of sawdust and grime.

We found that the stock 12" 96-tooth carbide-tip blade supplied with the saw compares in quality with our favorite miter-saw blade, the Forrest Chop Master. One socket wrench, which stores at the rear of the slide tube, conveniently handles all adjustments and blade changes.

The list of refinements doesn't stop there. The saw's retracting blade guard works as it's supposed to, and you can lift it out of the way if you need to align the blade with a line on the workpiece. The dust bag collects efficiently and empties easily, although you'd probably be happier with a vacuum attached. In case you need a quick review of the settings for cutting crown molding, you'll appreciate the chart attached to the side of the blade housing.

Makita has also made it easy to move the kerf boards, so you can keep blade clearance minimal for whatever cuts you intend to make. The adjustable depth stop, handy for controlling cutting depth and making dadoes, swings out of the way when not needed. You'll find the hand-grip on/off switch more comfortable and less fatiguing to operate than the one-finger triggers found on many saws.

The Nuts and Bolts of Operating This Saw

We'll say it again—this saw is big, and you'll eventually cut big, heavy stock on it. Pulling the carriage forward or throwing it left or right for bevel-cutting alters the saw's center of gravity dramatically—not a safe situa-



Photo A: The LS1211 is the only 12" sliding saw out there that can cut 60° left and right miters, 45° left and right bevels.

tion if it hasn't been secured to a bench or stand. Our caution: Bolt the saw down. If you need to have it mobile, bolt it to a plywood base, then clamp the base down. Don't even think about using it otherwise.

Another word of caution: Always secure the workpiece to the saw's table. Makita provides a movable vertical vise for this, and you can add an optional quick-release horizontal vise for additional holding assistance. We recommend using both so you never have to place your hands on the workpiece while the saw's running.

Know every move the saw can make. Compound miter saws are a different breed, and sliders even more so. Learn the correct, safe way to make press cuts, slide cuts, miters, bevels, and compound cuts—and you'll love this saw.

Hard To Find Any Flaws

After six months of shop use, we've yet to identify any serious deficiency in the LS1211. Even minor annoyances are few, although we'd prefer soft-start circuitry in the big motor to reduce the strong torque kick that startles us every time we fire it up. We also found that, because the fence is low and has such a wide opening, we had to attach an auxiliary fence to it when cutting small pieces.

When we first started using the saw, the blade guard blocked our view of the blade as it came in contact with the workpiece. This forced us to crouch down a bit to see what was happening or manually lift the guard for a better view. We've since resolved

this problem by simply raising the working level of the saw. We also miss the feeling of precise, solid detents when setting the arm for beveling.

We understand the reasoning behind the lock-off button/trigger switch combination, but we found it a bit awkward to operate with either the left or right hand. It takes conscious thought to work the button and trigger in order, which does at any rate serve the purpose of minimizing the chances of a mishap. As for other minor annoyances, the cheap link chain provided for securing the carriage during transportation seems incongruous with an otherwise refined machine.

How We Scored It

Many woodworkers are replacing their radial-arm saws with compound miter saws, and it's easy to understand why. Miter saws operate more easily and more accurately, requiring less maintenance. They also just plain do a better job of mitering—which is what they were designed for. So the answer to the question "Should I switch?" is an easy one, but "Which saw?" requires more deliberation.

The Makita LS1211, with all of its features and refinements, represents

continued on page 26

Saw Specifications

Model	Makita LS1211
Type	Slide Dual-Compound Miter
Motor	15-amp, replaceable brush
Blade diameter	12"
Arbor diameter	1"
Blade speed (no load)	4,000 rpm
Crosscut at 0°	3 1/8" x 12 3/16"
Bevel	45° left, right
Miter	60° left, right
Dimensions (LxWxH)	40 5/8" x 23 3/8" x 24 7/16"
Weight	51.2 lbs.

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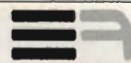
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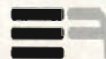
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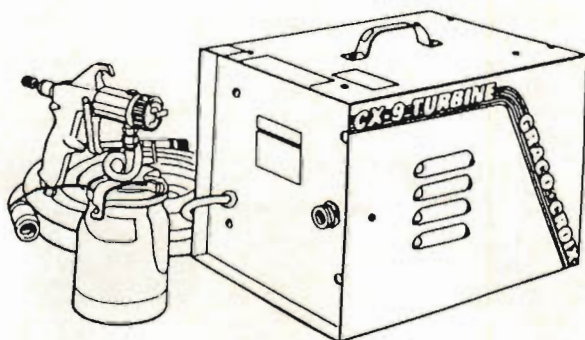
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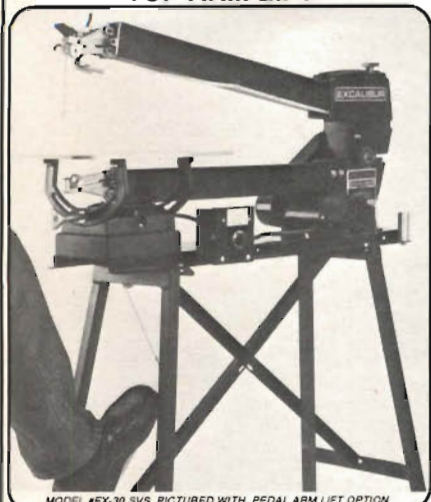
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SHOP TEST *continued from page 24*

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Photographs: Studio Alex

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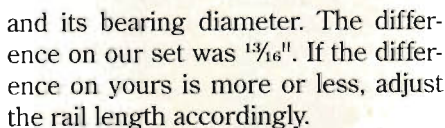
Raised Panel Umbrella Stand

If you're looking for an occasion to practice your cope-and-stick joinery and panel-raising technique, this adaptable mitered box answers the call. Use it to keep umbrellas and walking sticks handy by the door, size it to accept a flower pot, or put it to any number of other good uses. Just change the width and height of the stand to fit your needs.

With a basic paneled box like this one, your options are numerous. If you already have a classic milk can for umbrellas and stands for your plants, this project would make a handsome pedestal for a vase or sculpture. Just build the top frame around a contrasting wood panel or marble tile. To add drama, mount a light bulb inside and top the box with a translucent acrylic square. Or, insert a plywood panel with a circular cutout to hold a globe-style terrarium.

Step 1. Joint and plane 4/4 red oak stock to $\frac{13}{16}$ " thick, then joint one edge.

Step 2. From this $\frac{1}{16}$ "-thick stock, rip and crosscut eight stiles (A) and eight rails (B) to the dimensions listed in the Bill of Materials. Note: We used a matched, two-piece stile and rail bit set (Freud #99-260 or MLCS #843) to rout the cope and stick. You may need to adjust rail length if your stile and rail bits cut a different profile from ours. To determine this, measure the difference between the cope cutter diameter



Step 3. Check the setup of your stile and rail bits. (See *figure 1* for our cutter setup.) If you know that the joint they cut will fit, then proceed. If the set is new or if you're not sure that

STAND

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

MATERIALS LIST

O-Red oak

SUPPLIES

#0 biscuits; stain; urethane
spar varnish

the bits cut profiles that match, see the Pro Tip on *page 31*.

Step 4. Cut the cope on both ends of each rail. For assistance, see “How To Cut the Cope and Stick” on *page 31*. Then, cut the stick on the front inside edge of each rail and stile. (We suggest driving these bits with at least a 2-hp router, but follow the bit manufacturer’s recommendations for horsepower and router speed.)

Step 1. Dry-assemble one of the side frames. To determine panel size, measure the inside frame opening and add twice the groove depth. Note: If you're building these panels during the winter or in a dry environment, subtract 1/8" from the panel width to allow for seasonal expansion. If you're building during the summer, a 1/16" clearance should be adequate.

Step 2. Plane $\frac{3}{4}$ "-thick stock to $\frac{5}{8}$ " final thickness. Then, cut four panels (C) to the dimensions you determined in the previous step.

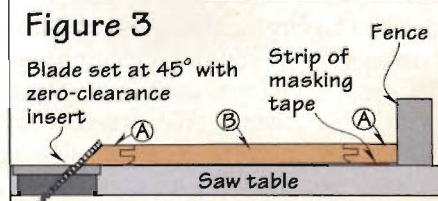
Step 3. Using a panel-raising bit in your table-mounted router or shaper, cut the panel bevels. (See the profile we made in *figure 2*. We used MLCS's vertical raised panel bit, no. 8681.) To eliminate splintering, start routing along one end (end grain) and work counterclockwise around

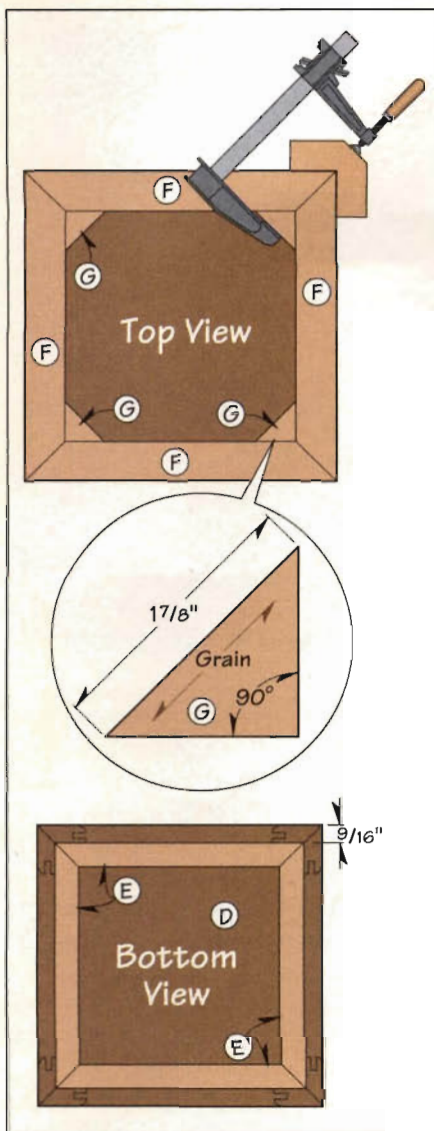
the panel, finishing with edge grain. (We routed to 1/4" depth in four passes.) Next, cut a 1/2" rabbet 1/8" deep around the back edge of the panel. This creates a 1/4"-thick tongue to fit into the frame groove.

Step 4. Finish-sand the panels to 220-grit, then apply stain using the same product and technique you'll use on the rest of the stand. This will prevent unstained tongue from showing after the panels shrink.

Step 5. Using 120-grit sandpaper wrapped around a short length of $\frac{3}{8}$ " dowel, break the sharp groove edges and remove any router chipout.

Step 6. Dry-assemble the frames and panels and check them for fit. If

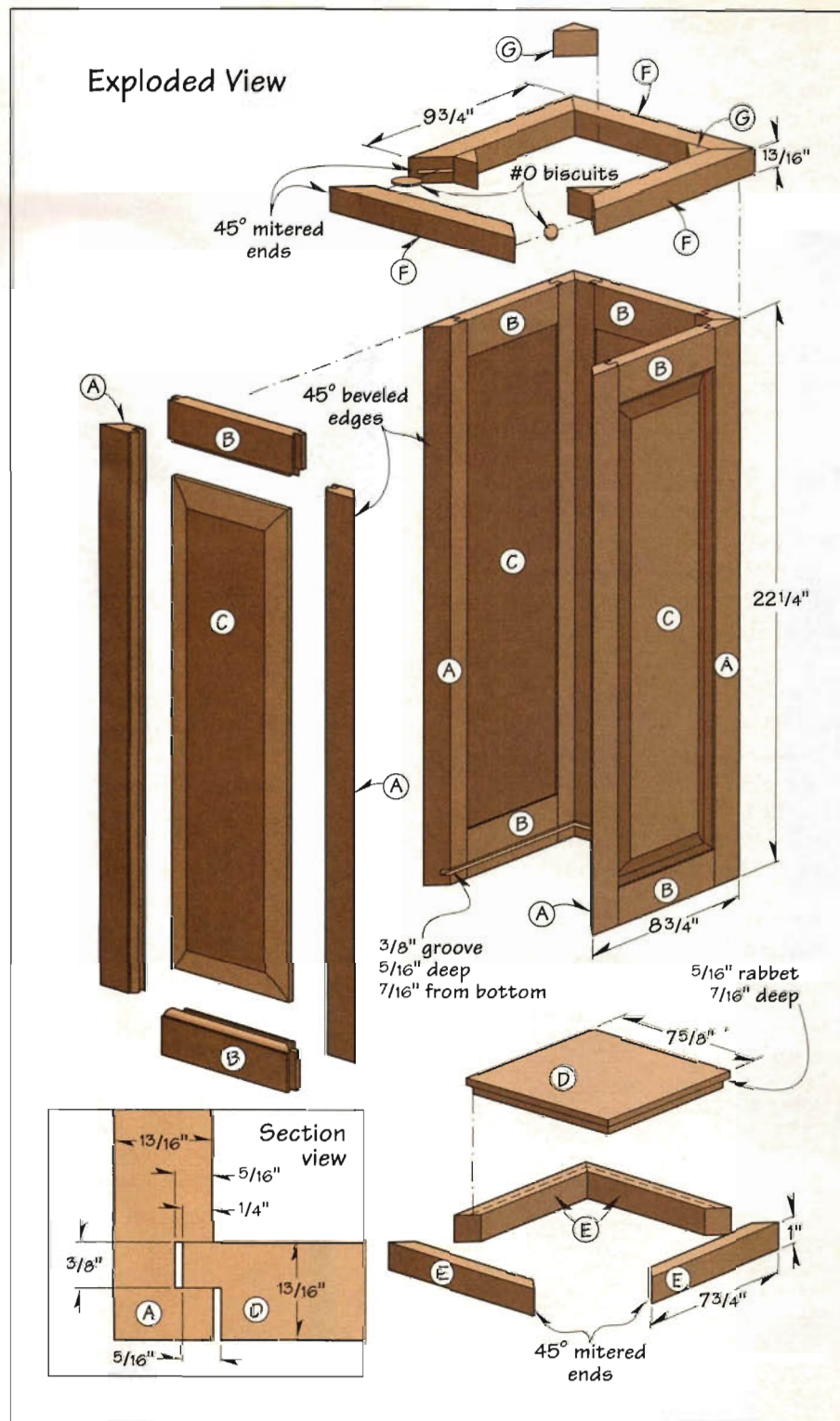




all joints fit well and the panels don't bind, disassemble, apply glue, and clamp. Note: Apply glue sparingly to the joints, even omitting it for the last 1/2" of the inside edges so it doesn't lock the panels into the grooves. Check each frame for squareness and flatness, then allow the glue to dry.

Bevel the Frames and Add the Bottom

Step 1. Bevel-rip one edge of each frame (without changing the frame's width any more than necessary), then reset the fence to cut the opposite bevels. Note: On most tablesaws, you will be cutting the bevels with the outside face of your workpiece down. To reduce tearout, use a zero-clearance table insert. (We overcut our bevels just slightly—less than 1°—to ensure a tight joint on the outside



corner. To do this, we put a strip of masking tape on the saw table next to the fence, as shown in figure 3.)

Step 2. To size the bottom (D), measure the width of one side between the insides of the miters, then add 1/2". (This extra stock allows for a tongue all around.) Rip and crosscut a square of 13 1/16"-thick stock to this dimension.

Step 3. Install a 3/8" dado head on the tablesaw, and cut a 5/16"-deep groove for the bottom on the inside face of each panel where shown on the Exploded View drawing above.

Step 4. Attach a wooden auxiliary fence to the rip fence. With the saw running, elevate the dado to cut 7/16" deep, "burying" it partially in the auxiliary fence to leave 3/16" of cutting width

exposed. Cut a $\frac{3}{16}$ " rabbet $\frac{7}{16}$ " deep around the bottom edge of the bottom panel to form a $\frac{3}{16}$ "-thick tongue.

Step 5. Lay the four panels faceup on your workbench. Align the ends carefully against a straightedge. Then, tape the adjacent edges with 2" duct tape, making sure that the joints are tight.

Step 6. Gently flip the assembly over. Fit the bottom into one panel, then roll all four panels together, forming a box. If everything fits well, unroll the panels and apply glue to the bevels, keeping the glue away from the bottom and its grooves. Roll the assembly together again and tape the fourth joint, then add band clamps. If necessary, add lightweight bar clamps all around, tightening them just enough to close the joints. Check for square, then allow the glue to dry.

Step 7. Remove the tape. (You can use mineral spirits to dissolve any tape adhesive.) Block-sand enough to break the sharp corners. Then, finish-sand the frames, keeping the sander away from the panels. (Mask the panels if necessary.)

Make the Base and Top

Step 1. From $\frac{1}{16}$ "-thick stock, rip and crosscut four 1x8" base frame parts (E). Stand the parts on edge, and miter-cut both ends of each part to an outside length of 7 $\frac{1}{4}$ ". Test the fit of the miters, apply glue, and band-clamp the base. Allow the glue to dry.

Step 2. Glue the base frame to the bottom ends of the sides, keeping glue away from the bottom panel. Center the base on the four sides as shown on the Bottom View drawing *opposite*, then clamp.

Step 3. If you're making an umbrella stand, cut a 1 $\frac{1}{16}$ x40" piece of $\frac{1}{16}$ " stock for the top frame parts (F). If you're making a plant stand, size the stock to support the pot, allowing its flange to overlap the sides by $\frac{1}{2}$ ".

Step 4. Crosscut four 10"-long pieces, then miter both ends of each top frame part to an outside length of 9 $\frac{1}{4}$ ". Dry-assemble the frame to check for fit, then glue and bandclamp. (We joined our top frame with #0 biscuits, centering the slots $\frac{1}{16}$ " in from the outside points of the mitered ends and allowing the slots to break out on the inside edge. The corner blocks hid the trimmed ends of the biscuits.)

Step 5. From $\frac{1}{16}$ x1" stock, miter-cut four 1 $\frac{1}{8}$ "-long corner blocks (G). (If you intend to recess an object into the base, size and shape your blocks to provide support.) Glue and clamp them in place inside the top frame corners using protective clamping cauls as shown on the Top View drawing *opposite*.

Step 6. After the glue has dried, sand the top frame flat. Apply glue to the top edges of the stand sides, center the frame over the opening, and clamp. Allow the glue to dry, then finish-sand the frame, breaking any sharp corners.

PRO TIP

We prefer to use a set of separate stile and rail bits (rather than a single, reversible bit) because you can, by using shims, match the two bits perfectly. Once they're set up, you never have to touch them again. (The set we used came with a shim pack installed at the factory and included extra shims under the lock nut for adjusting the profile.)

If you have to match the bits, move the wing cutter either closer to or farther away from the profile bit on the cope-cutting bit by adding or removing shims. This changes the tongue thickness.

Add Finishing Touches

Step 1. Apply stain inside and out. (We used a golden oak oil stain.) When the stain has dried, brush on a first coat of varnish. (We chose urethane spar to resist water damage.)

Step 2. Set up a small fan to circulate air inside the stand. (The solvents in spar varnish are heavier than air and may settle in the bottom, preventing the finish from curing.) Sand the first coat with 320-grit sandpaper, remove the dust with a tack cloth, then apply a second coat. 

Photograph: Studio Alex
Illustrations: Cad Art

How To Cut the Cope and Stick

With a matched, two-cutter set, one bit cuts the cope and one cuts the stick. For clarity, think of the stick profile as a rip cut you make with the grain along the workpiece edges. The cope, which is the profile you cut across the end grain of the workpiece, resembles a crosscut.

First, secure the coping bit in your table-mounted router, then notch an auxiliary wooden fence to fit over the bit. Using one of the rails as a gauge, place it against the bit and elevate it to cut the desired profile. With a straightedge, align the front face of the fence with the front of the bit's bearing, then clamp the fence in place.

Set the router at the speed recommended for the cutter. Place the rail facedown on the table with one end squarely against the fence. From scrap, cut a

square backing block, and use it to hold the rail perpendicular to the fence while moving it across the cutter. Note: If you make the cross-grain coping cuts first, the sticking cuts will then clean up any splinters. Cope both ends of each rail.

Unplug the router, then switch to the sticking bit. To set cutting height, place one of the coped rails facedown on the router table with the edge against the fence. Elevate the cutter to match it to the coped profile, testing it by just nicking the corner of the stub tenon on the rail end. Adjust the router up or down until the bit cuts squarely on the tenon. Now, plug in the router, and cut the sticking along the inside front edge of each rail and stile. Note: Before routing each piece, check the grain direction. Where possible, rout in the direction least likely to produce splintering.

Mobile Plywood Storage Rack

All of us at Woodworker's Journal like to handle solid wood, but we've never met anyone who actually enjoys handling sheet materials like plywood or fiberboard. It can be a daunting task to maneuver a 4x8' object of any thickness from place to place. Our mobile storage rack is designed to make workshop

handling and storage of such materials much more convenient. Built from standard lumber-yard materials, it's sized to pass through a 30"-wide doorway, so you can easily wheel it between rooms when you need to. Dadoes, screws, and glue bring the project together quickly and make it stable.



Start With the Supports

Step 1. Rip and crosscut a full sheet of $\frac{3}{4}$ "-thick plywood into four 24x48" pieces. (We used B-C exterior grade. You'll be cutting two nested supports from each piece as shown in *figure 1*.) Next, lay out one support (A) as dimensioned on the Exploded View on *page 34*.

Step 2. Using a portable jigsaw, cut out the support, keeping your blade $\frac{1}{16}$ " outside the diagonal layout lines. Then, clamp on a wooden straight-edge, and carefully flush-trim to the layout lines with your handheld router.

Step 3. Use this first support as a pattern to lay out the seven remaining supports. Jigsaw each piece, keeping the blade outside the layout lines as before. Clamp or screw the support pattern to a jigsawn blank, then flush-trim to the pattern. Repeat this procedure until you have eight matched supports.

Make the Front, Back, and Bottom

Step 1. Edge-clamp a straight $\frac{3}{4} \times 5\frac{1}{2} \times 96''$ piece of softwood for the front (B) to a full $4 \times 8'$ sheet of ply-

wood as shown in *figure 2*. (We used an 8' length of nominal 1x6 pine for our front.) Note: Check the ends of your stock for squareness before you buy. If the ends are not square, you may need to start with a longer piece to yield a full 96". Lay out the $\frac{3}{4}$ " dados and rabbets across the plywood and front piece where dimensioned in *figure 2*.

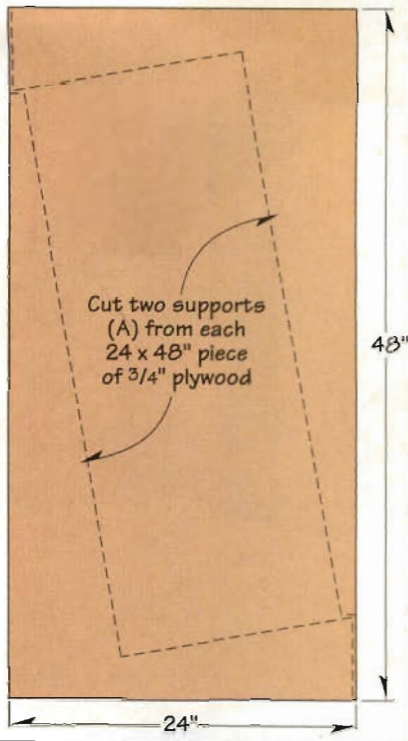
Step 2. Using a 54" straightedge and a 3/4" straight bit in your handheld router, cut the two end rabbets and six dados 3/16" deep where marked, slotting the plywood and front (B) simultaneously.

Step 3. From the dadoed plywood, rip the two backs (C) and bottom (D) to the dimensions listed in the Bill of Materials. Mark one end of all pieces so they stay aligned.

Make the Base, Then Attach the Supports and Front

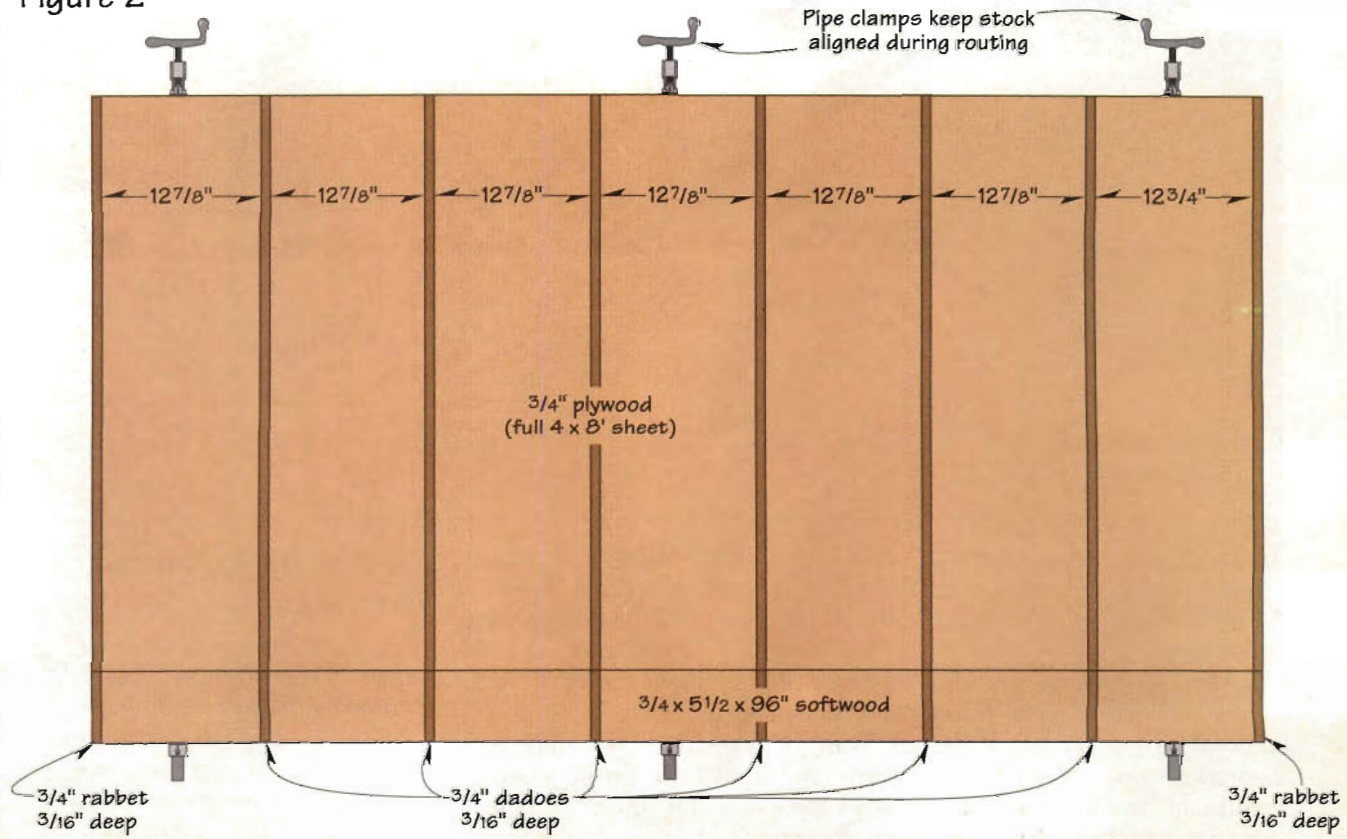
Step 1. Using a square, transfer the rabbet and dado locations from the front (B) onto a piece of base stock (E). (We used standard 2x4s for our base, selecting the driest and straightest ones we could find.)

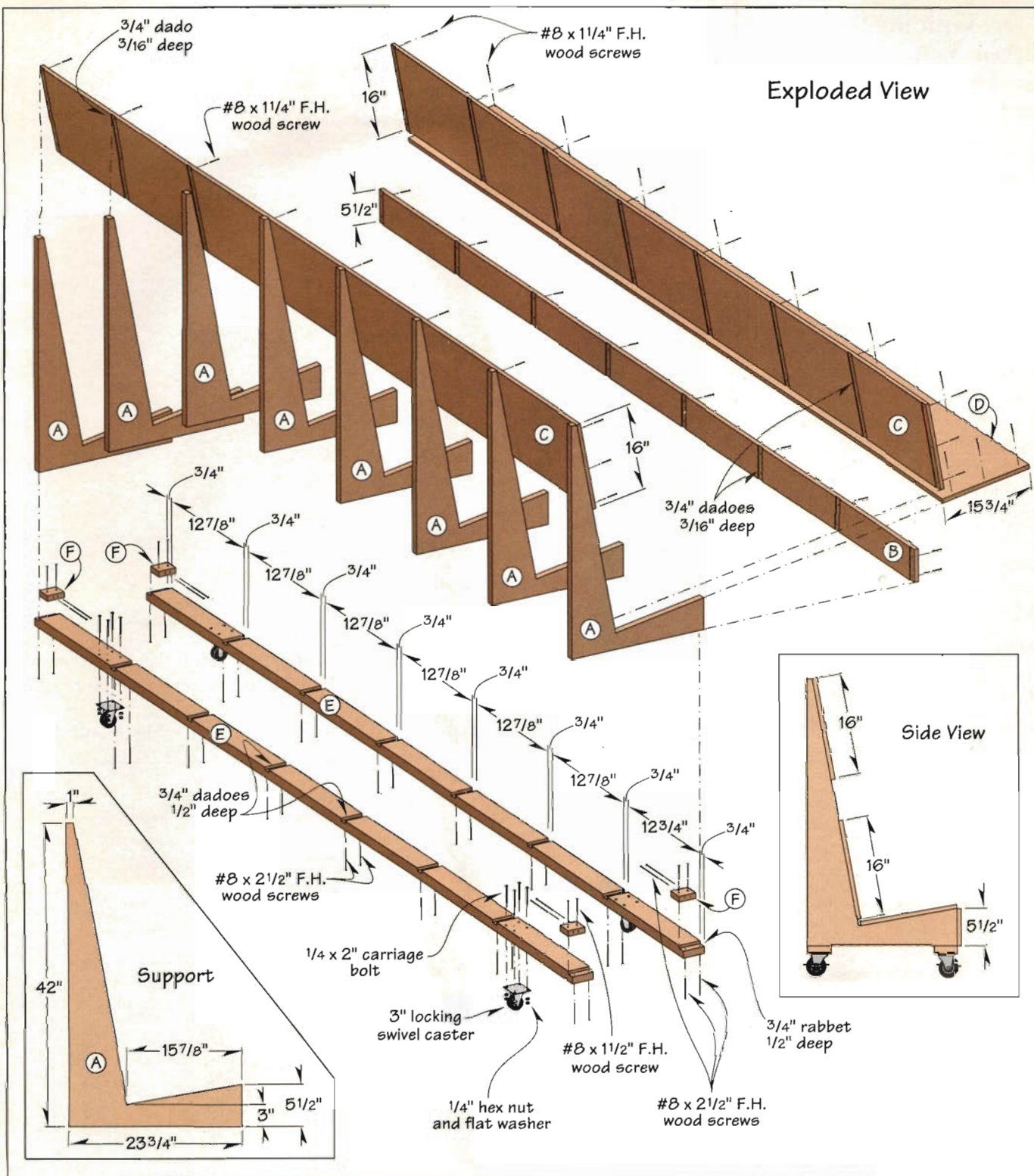
Figure 1



Step 2. Edge-clamp the marked base to the second base piece. Reset your $\frac{3}{4}$ " straight router bit to cut $\frac{1}{2}$ " deep, then rout rabbets and dados

Figure 2





across the base pieces where marked, using a short straightedge as a guide. Mark the pieces for orientation, then unclamp the parts.

Step 3. Align the base pieces with the L-shaped supports as detailed on the Exploded View. Pre-drill the parts, then apply glue and drive two #8x2½" flathead wood screws per joint. Cut four softwood cleats (F),

drill lateral shank holes, then attach them to the rabbeted base ends as shown. Apply glue to the joints, then drive #8x2½" flathead wood screws through the edges of the cleats into the end supports.

Step 4. Pre-drill, then glue and screw the front to the front ends of the supports using #8x1¼" flathead wood screws.

Add the Back, Bottom, and Casters

Note: For the next steps, recruit a helper to assist you with assembling the dadoed backs and bottom.

Step 1. Lay the base/support assembly flat on your work table (or a level floor) so it rests on the backs of

continued on page 36

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PRO TIP

The width of profile cut by your panel-raising bit determines the final size of the crown. To calculate the crown's width and length, measure the width of the bit, then make a test cut on scrap. Measure the width of the crown.

To calculate the crown's length, measure the length of the bit (rail plus stiles), then subtract the width of the bit's ends (to allow for a 1/4" reveal). To calculate the width, add the width of the bit, then add 1/4" for the reveal.

When working with narrow and wide pieces, you start with a piece wider for safer hand routing operation, then rip it to final width later.





Photo A: Secure casters to base using $\frac{1}{4} \times 2$ " carriage bolts. Locking casters make loading/unloading rack much easier.

the supports. Apply glue along the upper front edge (first 16") of each support, then place the upper back on the supports, aligning the top edges and seating the supports in the dadoes and end rabbets. Clamp to hold the back in place, then drill shank holes and drive three #8x1 $\frac{1}{4}$ " flathead wood screws through the back and into the support.

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PART	T	W	L	MTL.	QTY.
A Support*	$\frac{3}{4}$ "	23 $\frac{3}{4}$ "	42"	PW	8
B Front	$\frac{3}{4}$ "	5 $\frac{1}{2}$ "	96"	SW	1
C Back	$\frac{3}{4}$ "	16"	96"	PW	2
D Bottom	$\frac{3}{4}$ "	15 $\frac{3}{4}$ "	96"	PW	1
E Base	1 $\frac{1}{2}$ "	3 $\frac{1}{2}$ "	96"	SW	2
F Cleat	$\frac{3}{4}$ "	1 $\frac{7}{8}$ "	3"	SW	4

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

MATERIALS LIST

PW—plywood
SW—softwood

SUPPLIES

#8x1 $\frac{1}{4}$ ", #8x1 $\frac{1}{2}$ ", #8x2 $\frac{1}{2}$ " flathead wood screws; 3" locking swivel casters; $\frac{1}{4} \times 2$ " carriage bolts; $\frac{1}{4}$ " hex nuts and flat washers

Step 2. Follow the same procedure to attach the lower back (C) and bottom (D), locating these pieces on the supports where detailed on the Side View. If necessary, use a mallet to "persuade" the pieces together.

Step 3. Mount the four 3" swivel casters using $\frac{1}{4} \times 2$ " carriage bolts, flat washers, and hex nuts. (See photo A. We used locking casters, which make the job of sliding heavy material onto or off the rack much easier.) 

Photographs: Studio Alex

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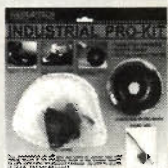
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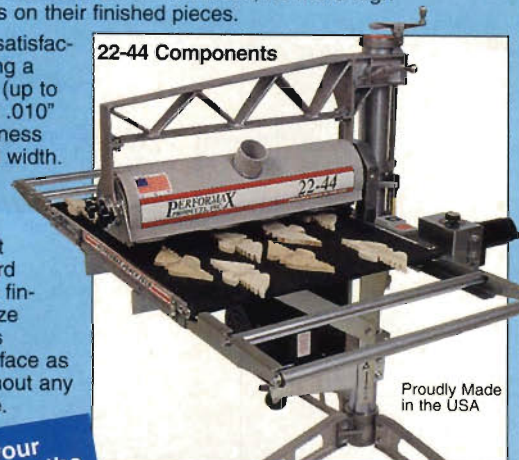
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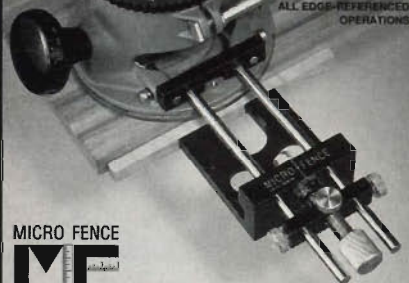
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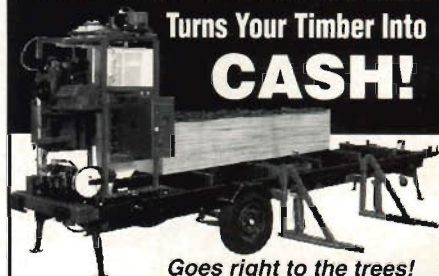
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Build a Better Bat House

Reader Harold Livesay of Woodburn, Oregon, wrote to Woodworker's Journal asking for bat house plans. His inquiry led us first to bat expert Dr. Tom Griffiths at Illinois Wesleyan University. Tom wanted to make sure that our house would attract bats and actually be good for their health, so he directed us to Bat Conservation International (BCI) in Austin, Texas. BCI here offers one of its most successful designs, the Large Nursery House, which we've modified slightly to allow for seasonal wood movement. (The organization has smaller versions as well.) Editorial assistant Craig Moro contributed a chip-carved medallion of BCI's distinctive logo to further decorate the house. (To learn more about bats and BCI, see "Bat Facts" and "Save the Bats" on page 43.)



This large nursery house will accommodate up to 300 mother bats and their young. We chose to construct it of redwood because of its weathering ability.

Before You Begin

We made our bat house (which we'll be donating to a local nature center for use in their bat education program) from clear quartersawn redwood. You can use any decay-resistant wood (red cedar or pine, for example) or even exterior-grade plywood. Avoid pressure-treated materials because they contain and release chemicals that may harm the animals.

We oriented the parts so the grain would run vertically on the house. This makes strong parallel glue joints that require no nails or screws, and minimizes seasonal wood movement problems. However, if you use quartersawn stock as we did, note that this also makes the lower front (B) rather delicate. Don't hang the house where baseballs or other flying objects may damage it (or the bats inside).

Start By Making the Front and Back

Step 1. Using a water-resistant glue (we used Titebond II), joint and edge-glue $\frac{3}{4}$ "-thick redwood stock to make one 27x39" panel and one 25x36". (We bought five nominal 1x6s, which yielded 27 $\frac{1}{2}$ "-wide panels initially.) Sand both panels flat, taking care to avoid gouging the soft wood.

Step 2. Rip the larger panel to 26" wide. Square both ends, then crosscut a 12" length for the roof (A) and set it aside. Next, rip 1" from each edge of this panel to get a 24"-wide panel for the upper and lower front (B, C).

Step 3. For the upper and lower back (D, E), rip the remaining panel to 24" wide and square both ends. Note: Don't crosscut either panel into upper and lower parts until later.

Step 4. Mount a $\frac{1}{2}$ " dado head on the tablesaw, and attach a wooden auxiliary fence to the rip fence. With the saw running, elevate the dado to cut $\frac{3}{8}$ " deep, "burying" it partially in the auxiliary fence and leaving $\frac{25}{32}$ " of cutting width exposed. (This will form a $\frac{3}{4}$ " rabbet plus a $\frac{1}{32}$ " overhang that will be sanded away after assembly.) Now, cut a rabbet along each edge of the front and back panels where shown on the Exploded View on *page 40*.

Step 5. If desired, prepare the bat medallion at this time as described on

BILL OF MATERIALS

BAT HOUSE

PART	T	W	L	MTL.	QTY.
A Roof*	$\frac{3}{4}$ "	26"	11 $\frac{1}{4}$ "	R	1
B Front-upper*	$\frac{3}{4}$ "	24"	19 $\frac{1}{2}$ "	R	1
C Front-lower*	$\frac{3}{4}$ "	24"	5 $\frac{1}{2}$ "	R	1
D Back-upper*	$\frac{3}{4}$ "	24"	23"	R	1
E Back-lower*	$\frac{3}{4}$ "	24"	10 $\frac{5}{8}$ "	R	1
F Sides**	$\frac{3}{4}$ "	5 $\frac{5}{8}$ "	33 $\frac{3}{4}$ "	R	2
G Cleats	$\frac{3}{4}$ "	$\frac{7}{8}$ "	23"	R	6
H Cleats	$\frac{3}{4}$ "	$\frac{3}{4}$ "	23"	R	2
I Ceiling**	$\frac{3}{4}$ "	4 $\frac{13}{16}$ "	22 $\frac{3}{8}$ "	R	1
J Partitions	$\frac{1}{4}$ "	22 $\frac{3}{8}$ "	23 $\frac{3}{8}$ "	PW	3

* Parts cut from edge-glued panels

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

MATERIALS LIST

R—Redwood

PW—Exterior-grade plywood

SUPPLIES

Fiberglass window screening (three 21x47" pieces); #8x1", #8x1 $\frac{1}{4}$ ", and #8x1 $\frac{1}{2}$ " stainless steel flathead wood screws; linseed oil.

page 41. Lay out the location of the medallion on the front panel where shown on the Front View drawing on *page 42*. Next, drill shank holes through the front panel and countersink them on the inside face. Mount the medallion using #8x1" flathead stainless steel wood screws.

Step 6. Switch to a combination blade, tilt it to 45°, and bevel-cut the bottoms of the front and back panels as shown. Next, tilt the blade to 60° and bevel-cut the top ends. Now, reset the blade to perpendicular, and crosscut both the front and back into two pieces where dimensioned on the Side View drawing on *page 42*.

Make the Sides, Then Assemble the Carcass

Step 1. To make the sides (F), rip two 5 $\frac{5}{8}$ x36" pieces of $\frac{3}{4}$ "-thick stock. Miter-cut the bottom ends at 45°, then miter the top ends at 60° to 33 $\frac{3}{4}$ " finished length. (See the Side View.)

Step 2. Mount a $\frac{1}{2}$ " straight bit in your table-mounted router, and using a fence and stopblocks, rout a 6"-long ventilation slot in each side where dimensioned on the Side View. (You

could also use a plunge router fitted with an edge guide.)

Step 3. From $\frac{3}{4}$ "-thick stock, rip and crosscut eight cleats (G, H) as dimensioned in the Bill of Materials. Lay out their locations on the inside faces of the sides where shown on the detail that accompanies the Side View. Then, glue and clamp the cleats in position.

Step 4. Test-assemble the two front parts, the sides, and the two back parts to check for fit. Apply water-resistant glue to the joints, then assemble and clamp the carcass. Check the assembly for square, and allow the glue to dry. Later, plane or sand the overlapping ends flush with the sides. (If you're using harder stock, rout the sides flush using a handheld router fitted with a flush-trim bit.) Break all sharp edges with sandpaper.

Add the Ceiling and House Partitions

Step 1. Measure the inside dimensions of the carcass. From $\frac{3}{4}$ "-thick stock, rip and crosscut the ceiling (I) to fit, subtracting $\frac{1}{4}$ " from the length (side-to-side measurement) and $\frac{1}{8}$ "

from the width (back-to-front) to allow for wood movement.

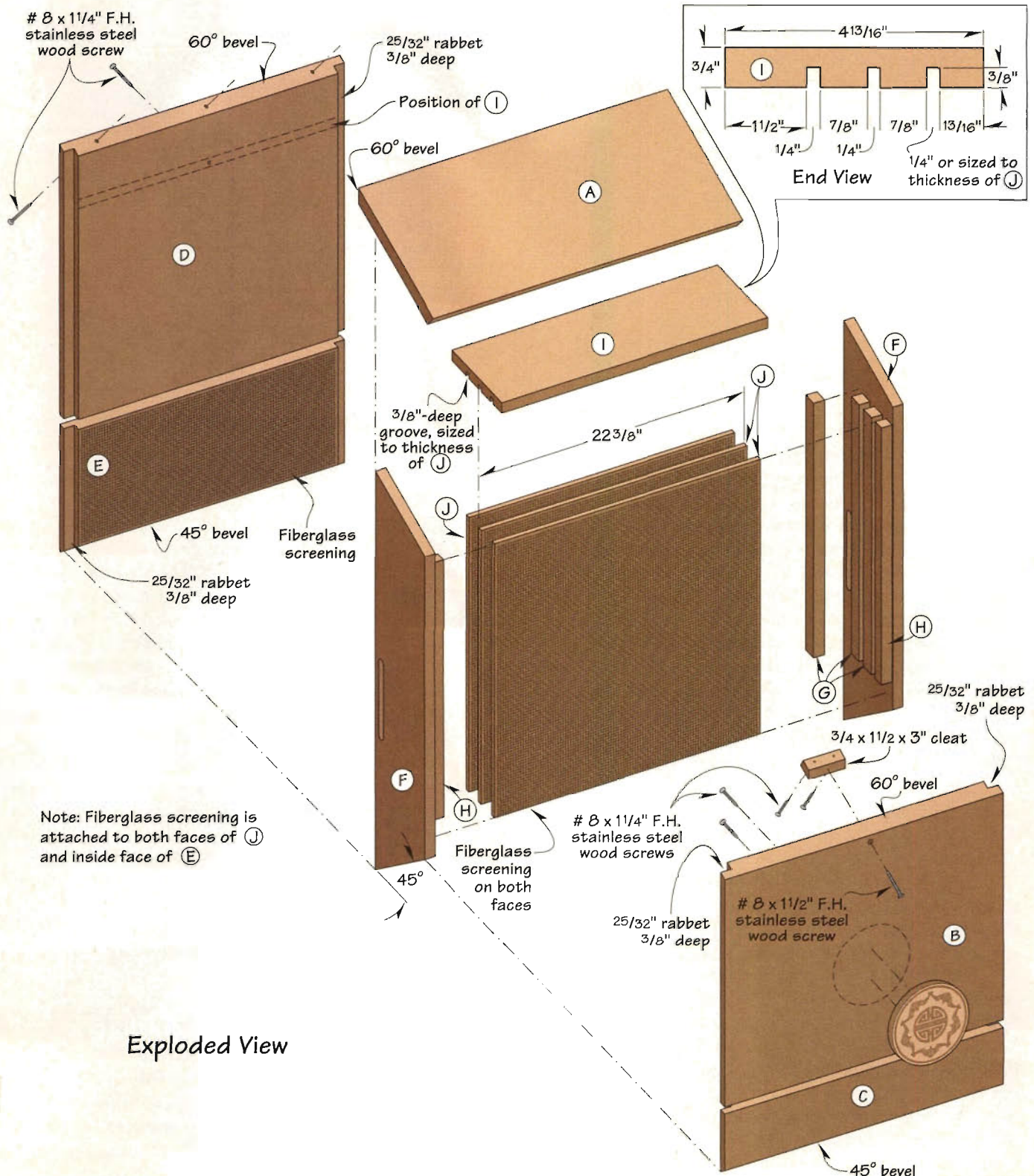
Step 2. Using dimensions shown on the End View detail associated with the Exploded View, lay out and then cut grooves in the bottom face of the ceiling. Make multiple passes on

the tablesaw, cutting the grooves just wide enough to accept the plywood you will be using for the partitions.

Step 3. Cut three panels of $\frac{1}{4}$ "-thick plywood to size for the partitions (J).

Step 4. Cut three 21x47" pieces of fiberglass window screen. (Don't use

metal screen.) Starting $\frac{1}{2}$ " from the top end, center the screen side to side on the width of the plywood, and staple it at the top. Pull the screen tight, wrap it around the bottom, then staple at the top end on the back side. Staple along the edges of the screen to



Carving the Bat Medallion

Most of us associate bats with vampires and Halloween. For the Chinese, however, bats signify good luck and happiness, and red is their color for joy. In BCI's logo, you'll find the Chinese character for longevity surrounded by five red bats, each representing one of the Five Blessings: health, long life, prosperity, love of virtue, and a natural death.

The logo lends itself handsomely to chip-carving techniques. We used basswood for our medallion, although white pine offers similar carving qualities as well as decay-resistance.

Scribe horizontal and vertical center-lines on both faces of a 7¼" square of ½"-thick stock. Now, cut a 7" circular blank from it using your favorite method, and then sand the edges smooth. Transfer the full-sized logo pattern shown on *page 44* directly to the blank using water-soluble paper glue, and carve right through the paper; or, use a hot dry iron to transfer the photocopy to the wood.



Photo A: To keep the chip-carving knife oriented at the proper 65° angle, wrap fingers around the back of the knife handle, using thumb to brace knife against workpiece.

Wrap your fingers around the back of the knife handle, keeping the tip of your thumb braced against the workpiece, roughly even with the tip of the blade. Hold the knife against the workpiece as shown, maintaining a constant cutting angle of about 65° toward the center of the chip you want to remove (*photo A*).

Why keep your thumb on the workpiece? You hardly move your knife hand at all for most cuts, using it instead to brace the knife at a constant angle while you turn or feed the workpiece in the desired direction with your other hand. The tip of your thumb and the bent knuckle of your forefinger help maintain the cutting angle.

Start with the left bat wing, beginning the cuts where shown in *figure 1* and removing the chips in the order

numbered. Start with a shallow cut, gradually going deeper as you approach the center, then going shallow again at the end. Turn the piece and repeat.

As you reach the rounded tips of the bat wings, raise your wrist to keep just the tip of the knife engaged in the cut. Try to remove each chip in as few passes as possible. If you keep your angle constant, each chip will have a neat central ridge or point. Note: When carving two adjacent chips, start removing the second chip by carving away from the previous one.

Chip 3, which forms the bat's elbows and knees, can be tricky. For best results, overcut the layout lines just a bit where indicated by the dashed lines.

Next, carve the Chinese character in the center, starting where shown and then rotating the piece to follow the lines (*figure 2*). Follow the arrows along the dotted lines across chips 3 and 4, completing the large chips 1 and 2 before removing the small sections.

To carve the circular border, start by cutting the inside line as indicated by the arrows. (See *figure 1*.) Finish with the outside line. (When carving a precise curve like this, keep your eye on the layout line immediately ahead of the blade.)

The finish and paint you apply must be compatible. (We used exterior urethane varnish, applying two coats to seal the wood thoroughly before painting with urethane-based paints.) After the paint has dried, apply another coat of finish over the paint for added protection.

—Craig Moro

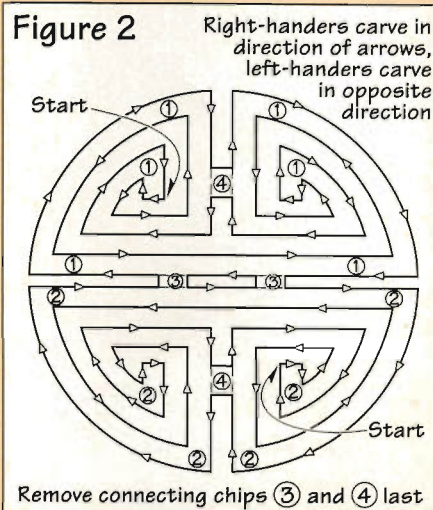
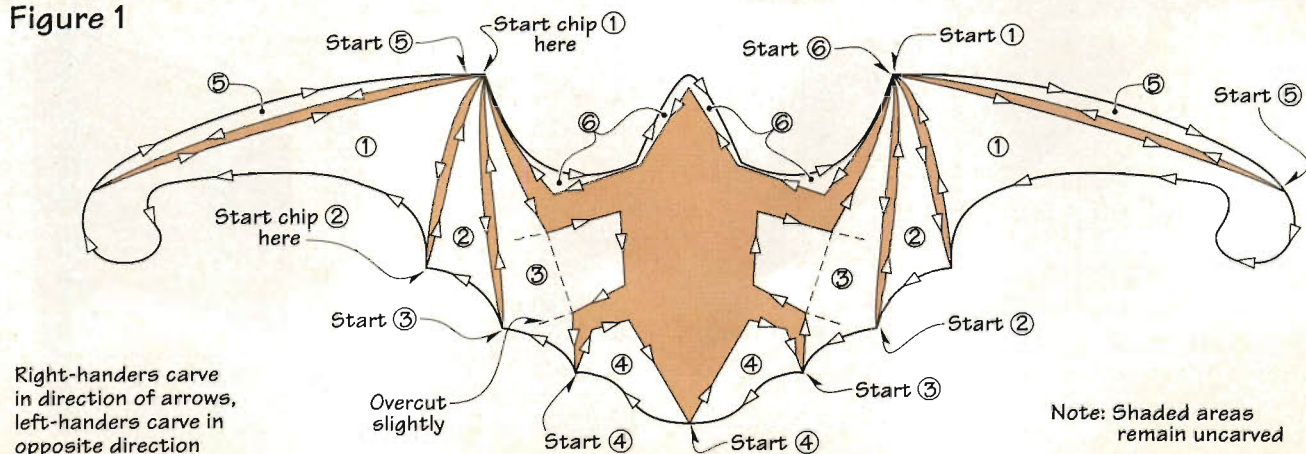
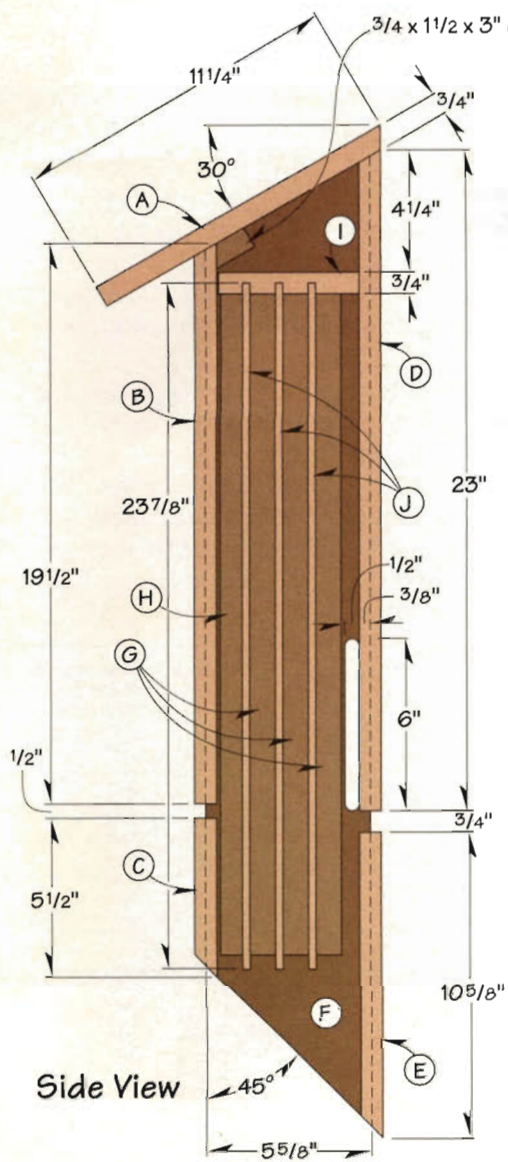


Figure 1





Front View

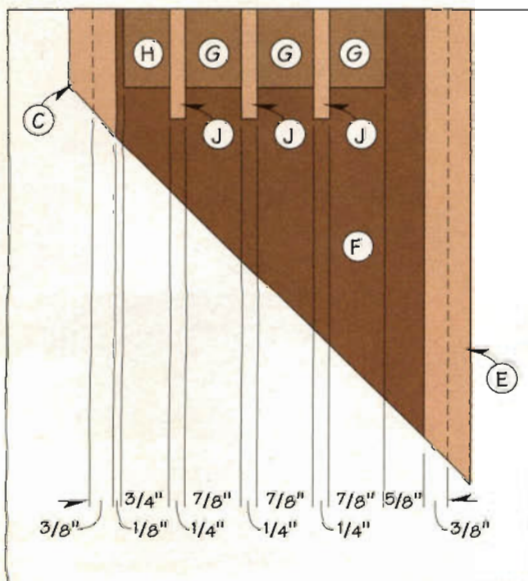
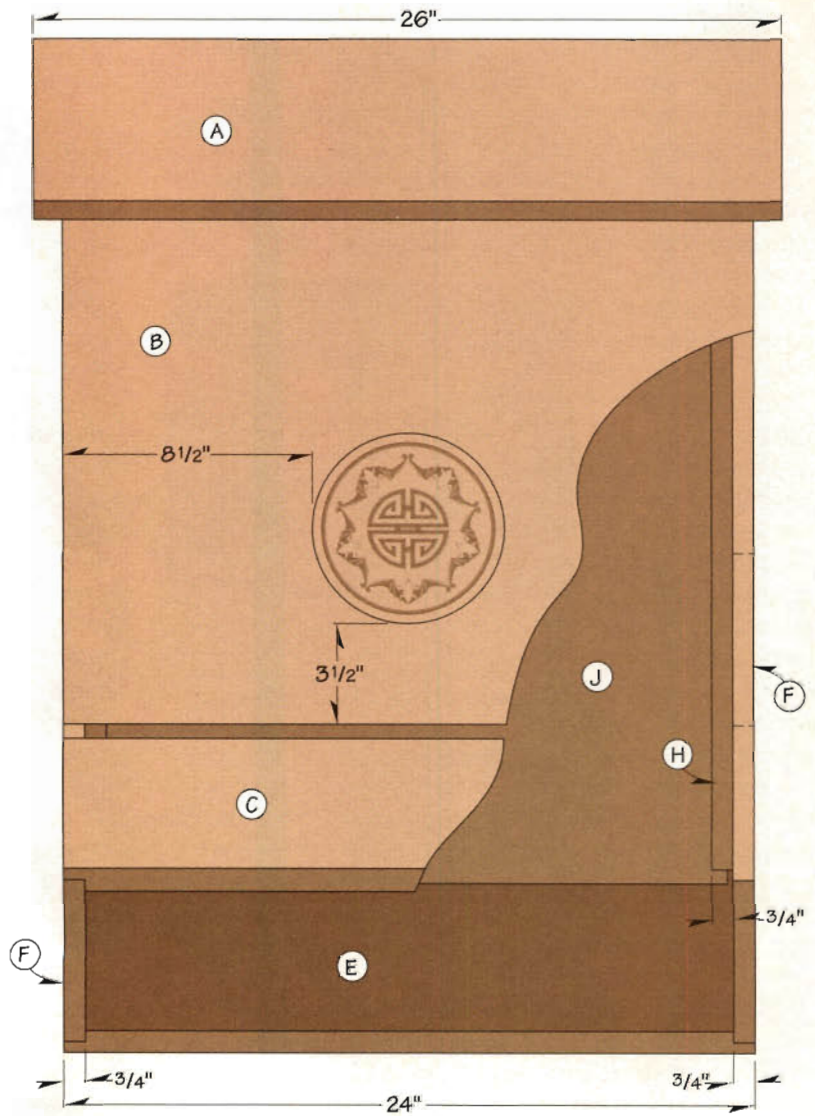
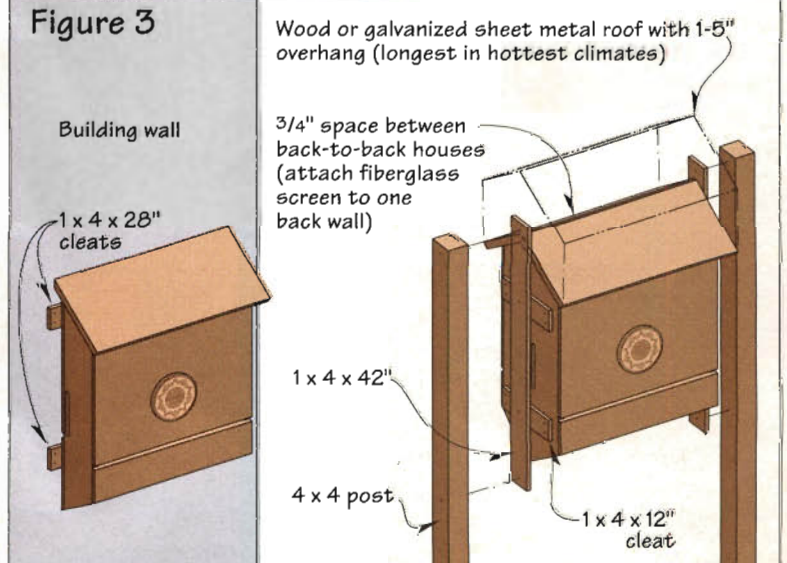


Figure 3



secure it in place. Cut a piece of screen to fit the inside face of the lower back (E) and staple it in place. (This screen provides a secure grip for the bats as they land.)



Photo C: The ceiling/partition subassembly slides into position between the side-mounted cleats (viewed from bottom). Simply remove the roof if partition repair is required.

Step 5. Apply beads of glue in the ceiling grooves, then insert the ends of the partitions into the grooves. Clamp only if necessary. (To keep the plywood spaced evenly while the glue dried, we slid the partitions partway into the carcass between the cleats. Don't insert them all the way, or the glue will bind the parts.) After the glue has dried thoroughly, push the ceiling/partition subassembly into position.

Attach the Roof, Then Apply Finish

Step 1. From $\frac{3}{4}$ "-thick scrap, cut a 2x12" strip. Bevel-rip one edge at 30°, then crosscut a 3"-long roof cleat from the strip. Position the roof on the house and measure the distance from the back edge to where it contacts the inside edge of the front. (See the Side View for cleat position.) Using this measurement, mark the location for the cleat (centered from side to side) on the underside of the roof. Tack the cleat temporarily in place with hot-melt glue, and test-fit the roof on the house. The cleat should fit snugly against the inside face of the front. When satisfied with the cleat's position, screw it permanently in place.

Step 2. Center and drill a shank hole through the upper front $\frac{1}{8}$ " down from the top edge and at a 30° up angle. Next, using a Kreig Jig, drill three pocket-screw holes spaced equally along the upper back to attach the roof.

Some Bat Facts From BCI

▶ A single little brown bat can catch 600 mosquitoes per hour. With a lifespan that sometimes exceeds 32 years, this bat outlives all other mammals of its size.

▶ The 20 million Mexican free-tails that inhabit Bracken Cave, Texas, eat 250 tons of insects nightly. Bats hunt for food using a kind of sonar called echolocation, which enables them to detect objects as fine as a human hair in total darkness.

▶ An anticoagulant from vampire bat saliva may soon be used to treat human heart patients.

▶ Contrary to popular lore, bats are not blind, do not become entangled in human hair, and seldom transmit disease to other animals or humans. The bat is more closely related to *Homo sapiens* than to the mouse.

▶ Bats are exceptionally vulnerable to extinction, in part because they reproduce more slowly than any other creature of their size. Most bear only one pup per year.

▶ Bats are the primary pollinators of many rain forest and desert plants (photo B). Reduction of bat populations increases demand for chemical pesticides, jeopardizes whole ecosystems of other animal and plant species, and can have a detrimental effect on human economies.



Photo B: Bats not only consume massive quantities of crop-destroying insects, they also pollinate many rain forest and desert plants—in this case, a giant saguaro.

Photo: Merlin D. Tuttle, Bat Conservation International

Save the Bats

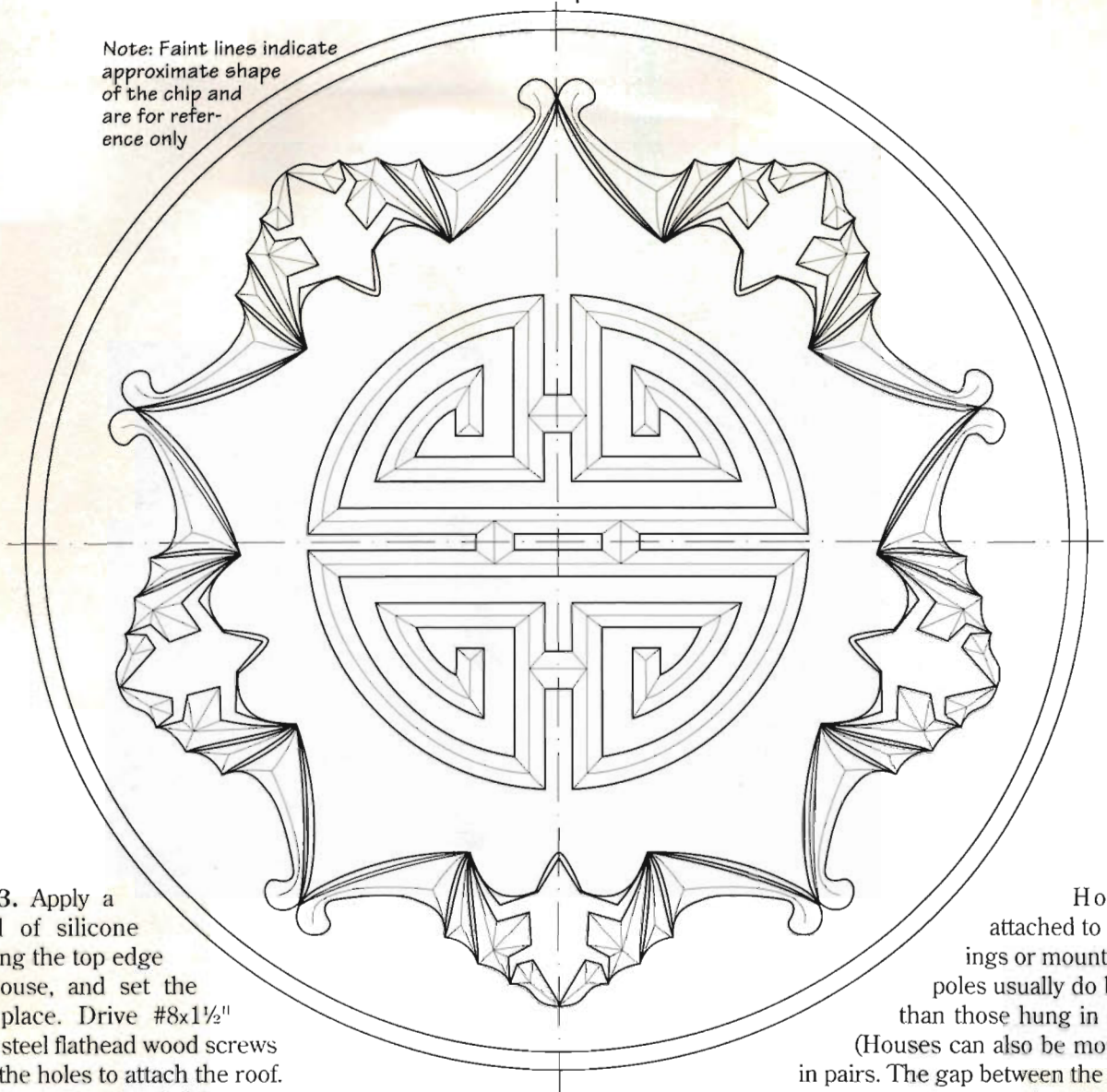
As natural bat habitats are destroyed, you as a woodworker can help to maintain bat populations by building structures in which bats can take shelter and raise their young. BCI encourages the building of bat houses and has developed several designs based on bat-friendly criteria: Will bats actually occupy such a house? Where should the house be located? What can be done to make the house a good environment for nursing mothers and their young? What changes need to be made to accommodate various bat species in different climates?

BCI was founded in 1982 by Dr. Merlin Tuttle, a scientist who had become alarmed about severe declines in bat populations. The nearly one thousand species of bats, which constitute almost a quarter of all mammals, have tremendous economic and ecological impact, notably in the reduction of mosquitoes and crop-destroying insects. BCI works worldwide to educate the public about the importance of bats and to spur initiatives for their preservation.

For more information, contact Bat Conservation International, P.O. Box 162603, Austin, TX 78716. (On-line address: <http://www.bat-con.org>) Telephone: 512/327-9721. A tax-deductible \$30.00 donation will bring you the quarterly *Bats*, a catalog of educational materials, and opportunities to participate in member field trips and workshops.

Full-sized pattern

Note: Faint lines indicate approximate shape of the chip and are for reference only



Step 3. Apply a 1/4" bead of silicone caulk along the top edge of the house, and set the roof in place. Drive #8x1 1/2" stainless steel flathead wood screws through the holes to attach the roof.

Step 4. Apply the finish of your choice. (We wiped two coats of linseed oil on the house exterior.) Do not apply any finish to the house's interior parts.

How To Make Bats Feel At Home

We used well-seasoned redwood for our bat house and applied linseed oil to protect it. This made it a medium red-brown color, ideal for our chosen site in central Illinois and many other locations in the United States.

With the help of active bat house builders and enthusiasts, BCI has researched the influence of color, height, and hours of sun exposure on bat house use. They've found, for example, that exterior color affects the interior temperature of the house, which is

critical for survival of the bats. In most climates, medium to dark brown seems to work best for houses receiving more than nine hours of full sun.

Black-colored house exteriors may be preferred very far north (or in locations where the house receives less than eight hours of direct sunlight), while white may be preferred in very hot or full-sun conditions. You can change colors at any time if you suspect the house is too warm or too cool.

Mounting height also makes a difference. Houses located less than 10 feet above the ground average about a 40 percent occupancy rate, while those elevated 21 to 30 feet average 70 percent occupancy. (Check local regulations before installing any poles this tall.)

Houses attached to buildings or mounted on poles usually do better than those hung in trees.

(Houses can also be mounted in pairs. The gap between the houses provides another roosting chamber with the addition of another piece of screen. See the mounting suggestions shown in *figure 3*.) BCI suggests building several houses of different colors, mounting them at various heights, and then observing the results. Don't worry if bats don't move in right away; many houses still vacant after one season will attract occupants during the second.

Bat houses built by informed builders have the best occupancy rates. We recommend that you contact BCI for information about the bats in your area and their preferences. 

Photographs: Studio Alex

Bat photograph: Merlin D. Tuttle,

Bat Conservation International

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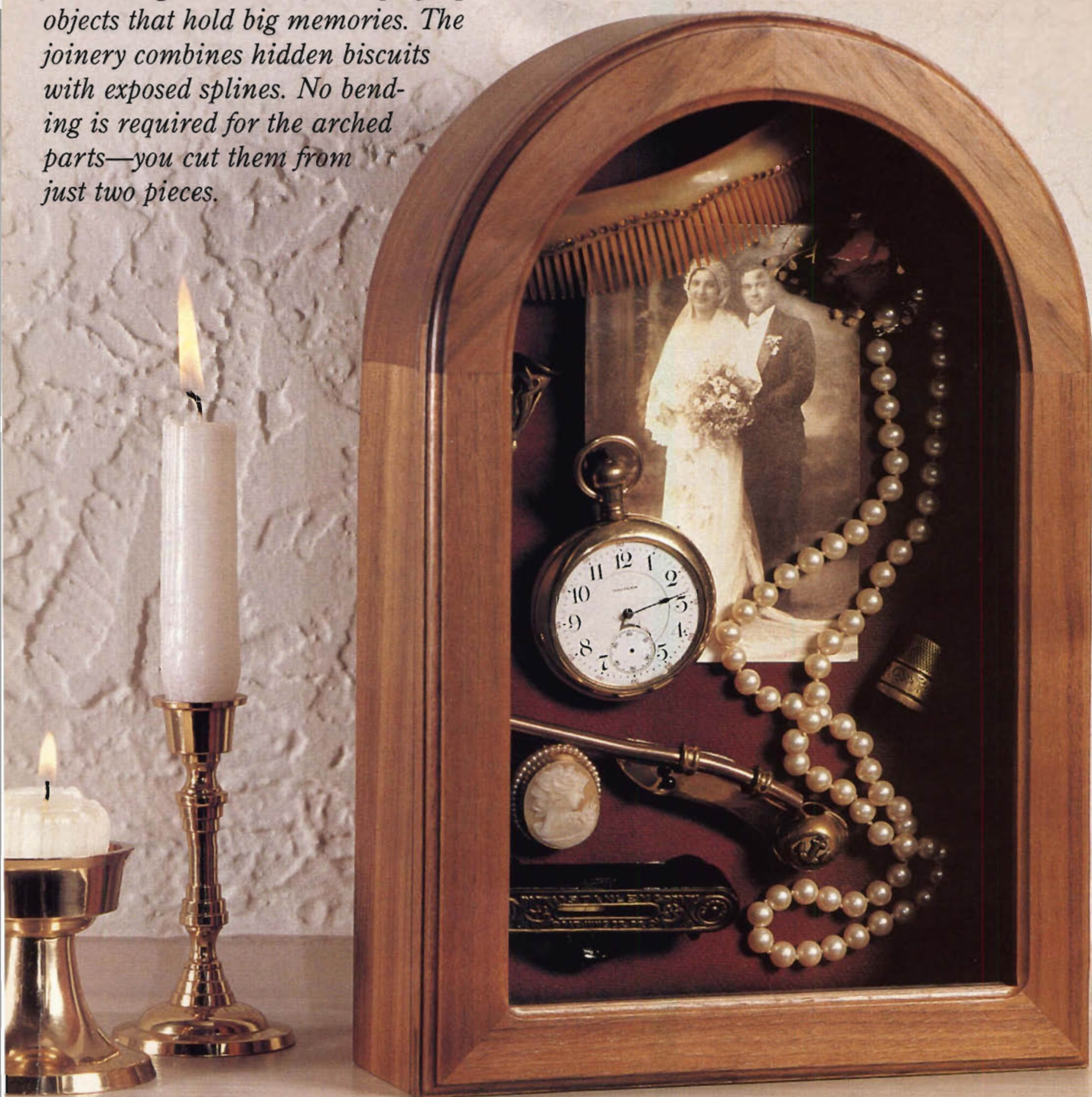
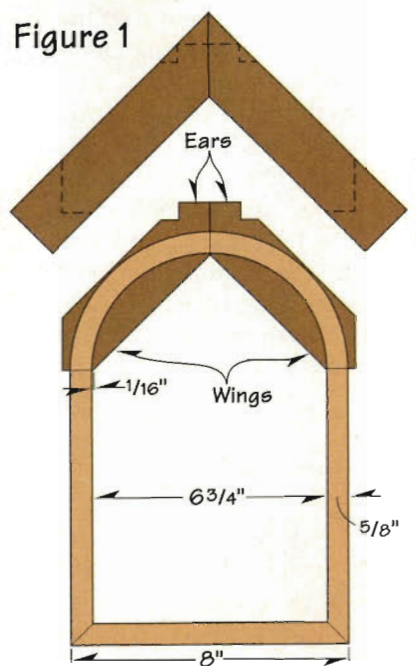


Figure 1



BILL OF MATERIALS

Box

PART	T	W	L	MTL.	QTY.
A Arch segments*	5/8"	2 1/4"	5 1/2"	W	2
B Sides*	5/8"	2 1/4"	8"	W	2
C Bottom*	5/8"	2 1/4"	8"	W	1
D Door—arch sections*	1/2"	1"	5 1/2"	W	2
E Door stiles*	1/2"	1"	8"	W	2
F Door—bottom rail*	1/2"	1"	8"	W	1
G Back*	1/4"	7 3/8"	11 5/8"	BP	1

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

MATERIALS LIST

W—walnut
BP—birch plywood

SUPPLIES

#20 biscuits; fabric for covering back; single-strength glass; #4x1/2", #6x1/2", #6x3/8" flathead wood screws; brown latex caulk. (For other supplies, see Sources at the end of the article.)

Start With the Arch

Step 1. Joint and plane a 2 1/2x20" piece of 8/4 stock to 1 1/16" thickness. (We used walnut.) From this piece, rip and crosscut two 2 1/4x8" blanks with continuous grain for the arch segments (A). Mark the pieces to keep color and grain oriented when you reassemble them after mitering. Note: We sized the blanks to give you ample stock for cutting the arch, miters, and clamping "ears" as shown in *figure 1*.

Step 2. Lay out the blanks using the dimensions shown in *figure 2*. Next, cut the 45° angles where marked. (We used our compound miter saw for cuts 1 through 4, then made cuts 5 and 6 on the bandsaw.) Note: The inside faces of both pieces must be exactly the same length. Use stopblocks on the saw to keep these lengths consistent.

Step 3. Lay out and cut mating slots for a #20 biscuit in the top (mating) ends of the two blanks. Center each slot 1 1/16" from the front edge, and adjust the fence of your plate joiner to cut the slot 1/4" from the inside face of the segments as shown in *figure 2*. (The biscuit slot will break out at the back edge.)

Step 4. Dry-fit the pieces with biscuits and clamp as shown in *figure 3*, making sure that the entire miter stays closed. Note the inside measurement across the "wings" for later reference, then mark and cut off the protruding end of the biscuit so the assembly will lie flat when clamped.

Step 5. Glue and clamp the ears of the blank. Lay the assembly flat, then clamp across the bottom wings, applying only enough pressure to close the bottom of the miter and squeeze out a

bit of glue. Verify the measurement across the wings and check for flatness. Allow the glue to dry.

Step 6. Glue up two scrap blocks and position them against the assembly's wings, as shown in *figure 4*.

Builder's Note

Small projects like this one pose special challenges for us woodworkers. One look reveals all the strengths and weaknesses of your work. There's no hiding joinery gaps or a poorly fitting door. This small size also means you'll be working very close to the machine cutters. Take your time and use fixtures when shaping small parts. One last tip: Family and friends will be clamoring for these cabinets, so plan from the start to make several of them.

—Dick Coers

Figure 2

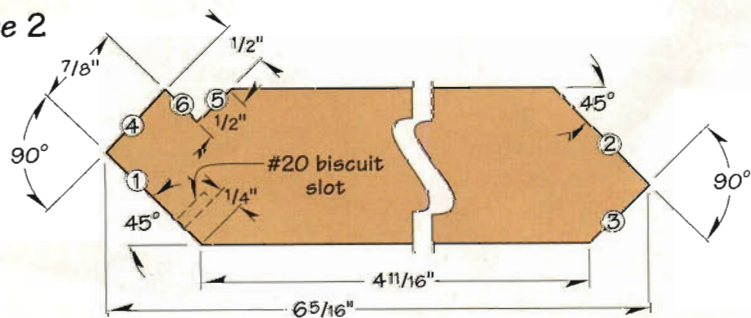
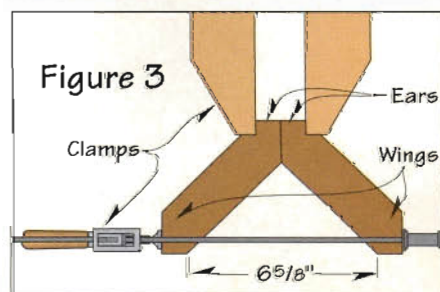


Figure 3



the workpiece through the holes on the carrier board. Then, secure the assembly with #6x $\frac{1}{2}$ " flathead screws.

Step 10. Fit your bandsaw with a $\frac{1}{4}$ " blade, double-checking the blade guides, tension, and 90° alignment to the table. Set a bandsaw circle cutter to cut $\frac{1}{16}$ " outside the 4"-radius line on the carrier board and blank (*photo A*). (For mail-order information, see Sources at the end of the article.) Slip the arch blank and carrier's pivot hole over the circle cutter's pivot pin. Cut the outer radius, then reset the circle cutter and cut $\frac{1}{16}$ " outside the inner radius. Work slowly, making sure the saw blade tracks properly.

Step 11. Remove the workpiece from the carrier board. Save the curved outer waste piece from the carrier board to use as a clamping caul later.

Make the Sides and Bottom, Then Assemble the Case

Step 1. Joint and plane a 3x35" piece of $\frac{3}{4}$ "-thick walnut stock to $\frac{5}{8}$ " final thickness. Joint one edge, then rip the piece to 2 $\frac{1}{4}$ " wide. Prepare a length of $\frac{5}{8}$ x2 $\frac{1}{4}$ " scrap at the same time to use for machine setups.

Step 2. Crosscut three 9" lengths in sequence, side-bottom-side, to "wrap" the grain around the case. Mark the sides (B) and bottom (C) to keep them in order. Finish-sand the inside faces.

Step 3. Using the plate joiner, cut slots in the top ends of the sides to

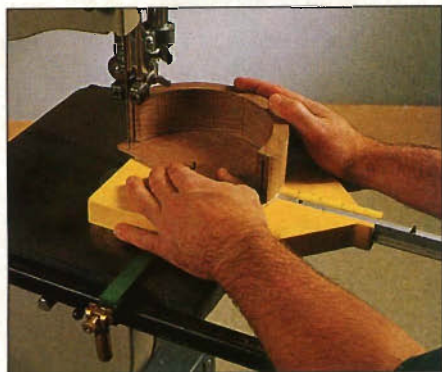
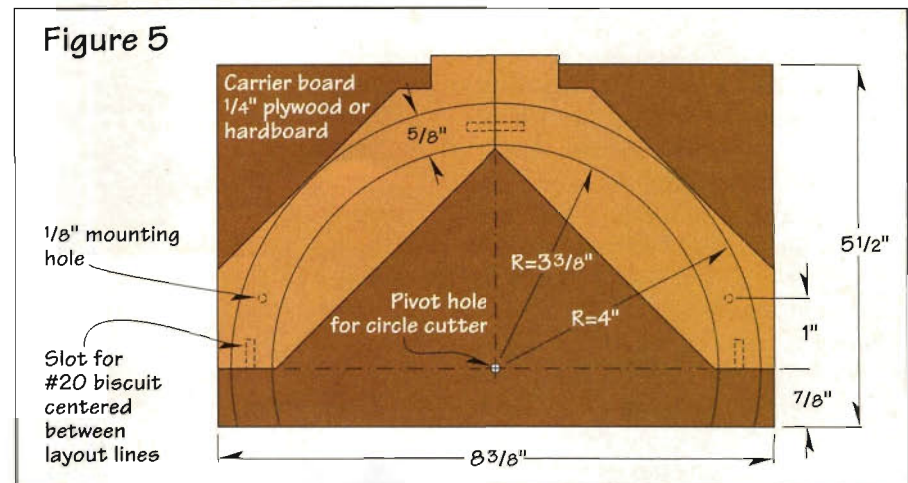
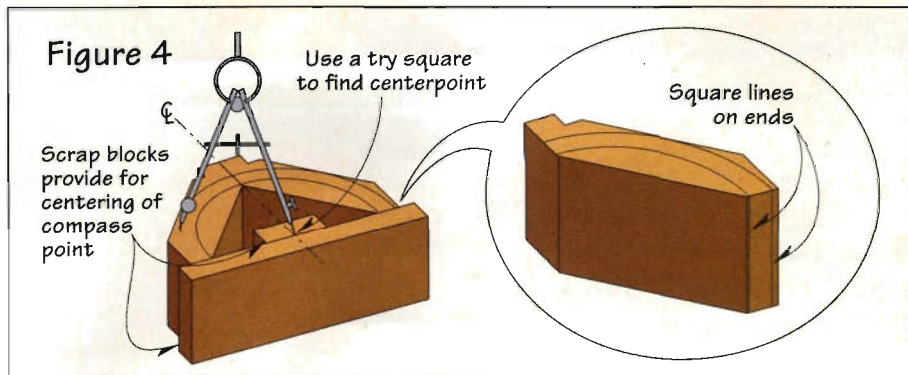


Photo A: To cut the case arch accurately, use a bandsaw circle cutter.

match the slots in the bottom ends of the arch. See the slot detail on the Front/Side View on *page 50*. (We test-cut a piece of scrap to check both biscuit slot locations so the side pieces would align centered on the arch

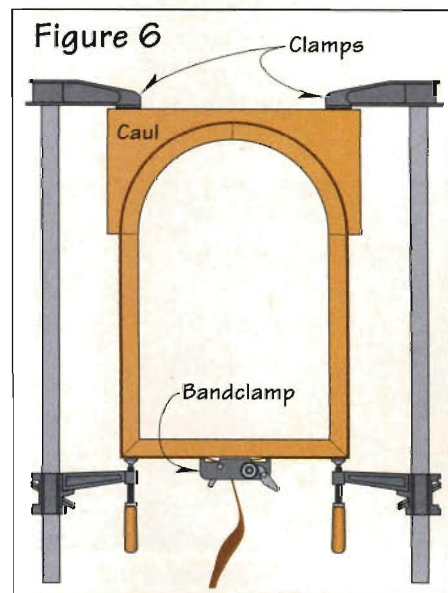


stock. Your bandsaw cuts might not have been perfectly true, so this is an opportunity to make adjustments.)

Step 4. Miter-cut the bottom end of each side to length, then dry-fit the sides to the arch. Miter one end of the bottom piece, then mark its length against the opposite side, and miter it where marked.

Step 5. Cut #20 biscuit slots in all mitered ends, positioning each slot $\frac{3}{32}$ " from the inside face of the part and centering it $1\frac{1}{16}$ " from the front edge. Note: Again, check your setup on scrap pieces to make sure the slot does not break out at the front edge or outside face.

Step 6. Insert biscuits in the slots and dry-assemble the arch, sides, and bottom. Use bandclamps to apply moderate pressure. Mark and cut off the protruding ends of the biscuits. If the pieces draw together tightly, apply glue and reclamp. If more pressure is needed to close the gaps, fit the outside cutoff from the arch carrier board you saved earlier over the band clamps as a clamping caul, then apply two bar clamps (*figure 6*). Check for square, and allow the glue to dry.



Step 7. Sand the case top to final shape, working close to the layout lines on the stationary disc sander. Remove the disc marks with a random-orbit sander and 120-grit paper. Sand the inside radius with an oscillating spindle sander, using a very light touch where the arch joins the sides. (It's easy to form a divot here, so touch the straight sides only on the final finish pass.)

Step 8. Install a rabbeting bit in your table-mounted router and, using the appropriate pilot bearing, cut a $\frac{3}{8}$ " rabbet $\frac{5}{16}$ " deep around the inside back of the case. Square the rabbet corners with a chisel.

Now, Cut the Door Parts

Step 1. Plane a 4x32" piece of $\frac{3}{4}$ "-thick walnut stock to $\frac{1}{2}$ " thick. Joint one edge, then rip a $2\frac{1}{4}$ "-wide piece and a 1"-wide piece from this stock.

Step 2. Using a rip blade in your tablesaw, cut a $\frac{1}{8}$ " kerf in a piece of scrap. Cut and plane a 12" length of your $2\frac{1}{4}$ "-wide walnut stock for splines, testing it in the saw kerf as you plane until it fits snugly. From this stock, rip and crosscut three $2\frac{1}{4}$ x1" and two $1\frac{1}{4}$ x1" splines. Note: For strength, and to avoid exposed end grain, run the grain widthwise across the splines.

Step 3. From $2\frac{1}{4}$ "-wide stock, crosscut and miter two blanks for the door arch sections (D), cutting the pieces consecutively as you did for the case arch. Dimension the pieces and locate the miters as shown in *figure 7*.

Step 4. Using your tablesaw and rip blade, cut a $\frac{1}{2}$ "-deep spline slot $\frac{1}{4}$ " from the outside face on both ends of both door arch sections. (We stood the

pieces securely, then applying light pressure on the wings if necessary to close the inside of the miter. (We used Quick-Grip clamps with soft rubber pads.)

Step 6. Using $\frac{1}{2}$ "-thick scrap blocks to provide a footing for your compass (as you did for the case arch), scribe a 4"- and a 3"-radius

semicircle on the door arch assembly from a single centerpoint. Cut these radii freehand on the bandsaw, staying $\frac{1}{16}$ " outside the layout lines.

Step 7. From your 1"-wide stock, crosscut three 9"-long blanks for the stiles (E) and bottom rail (F). Cut the blanks consecutively, side-bottom-

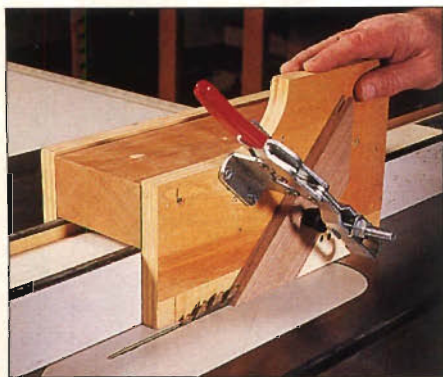
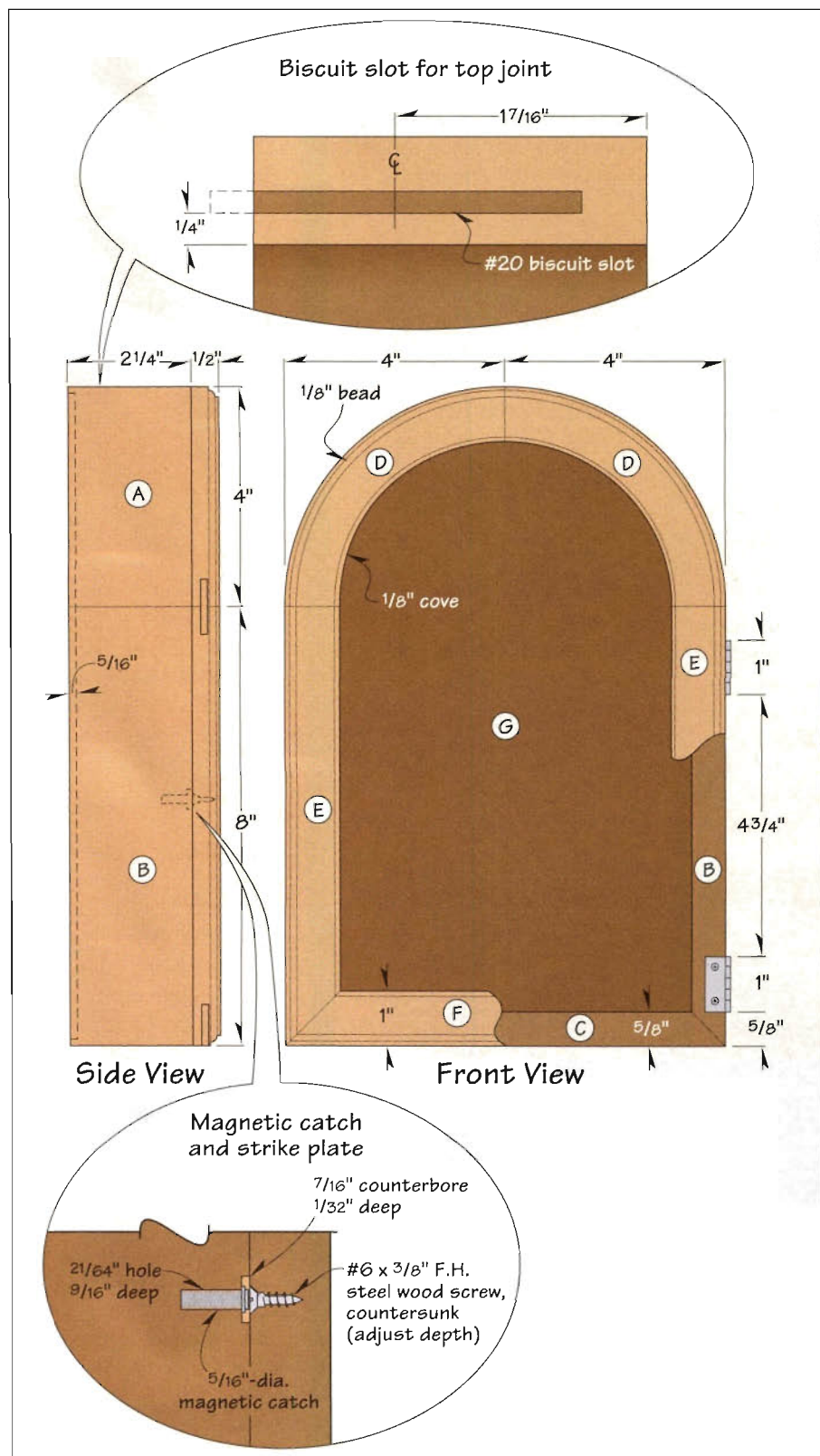


Photo B: Using a shop-built spline-slotting jig, cut 45° spline slots on the tablesaw.

parts on their mitered ends and secured them to a spline jig as shown in *photo B*. For more information on this useful tablesaw aid, see "Make a Spline-Slotting Jig" *opposite*.) Note: Be sure to keep the outside face of each piece *against* the fence as you cut the spline slots. Leave the saw fence and blade at this setting for now.

Step 5. Glue up and spline the door arch sections, first clamping the ears

Figure 7

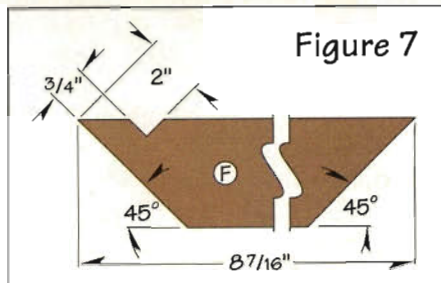
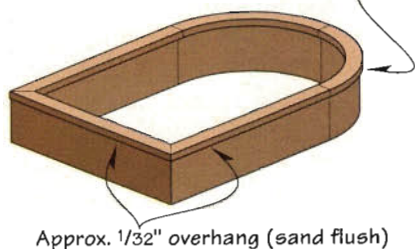


Figure 8

Approx. 1/16" overhang
(trim flush with router)



side, to achieve grain "wrap," then mark the pieces to keep them in order.

Step 8. Reset the spline-slotting jig fence so it holds the stile perpendicular to the table. (See *photo C*.) Slot the square top ends of the stiles on the tablesaw. (Remember to place the outside face of each piece against the fence to maintain part alignment.

Assemble the Door and Size It To the Case

Step 1. Dry-assemble the door arch, splines, and door stiles. Set this assembly on the case and position the top of the door so it overhangs the top of the case by 1/16". (See *figure 8*.) Align the arch/side joints with those on the case as shown on the Side/Front View *opposite*. Position the door stiles so they overlap the case sides very slightly (just enough to catch your fingernail), then mark the door arch where it meets the inside edge of each stile. Mark the lengths of the door stiles along the bottom of the case.

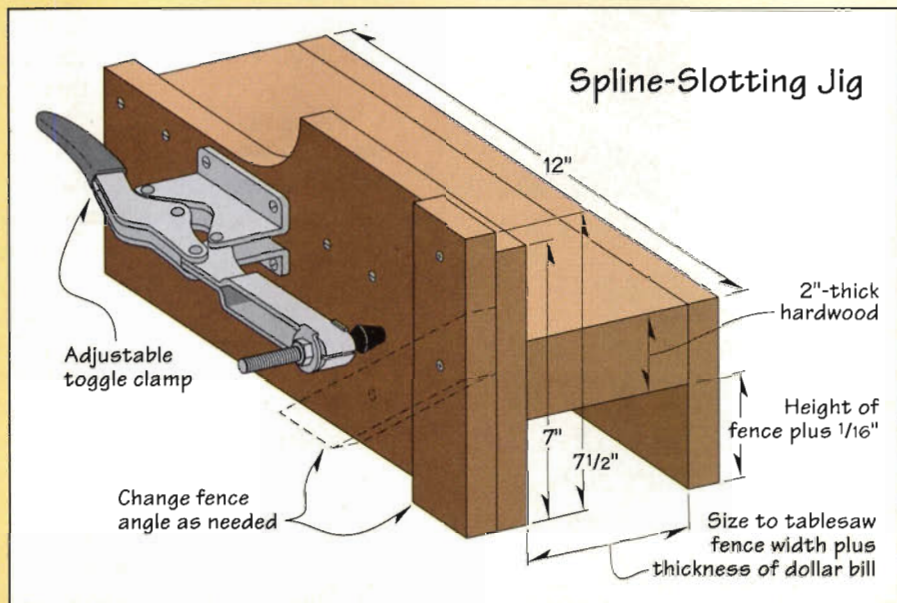
Step 2. Remove this assembly from the case. Next, mark the length of the door bottom rail (F) to match the outside dimension of the case at the point where the case arch and sides meet. Miter the ends of the stiles and bottom rail where marked. Reposition the jig fence at 45° to the table, then slot these mitered ends using the tablesaw and jig as shown in *photo B*.

Make a Spline-Slotting Jig

You don't need an elaborate jig to cut spline slots for the case door. We sized our jig to fit over our tablesaw's rip fence, which is a more secure method than sliding it against the fence.

We made the sides from 12" lengths of 3/4"-thick cabinet-grade plywood. Our jig's sides are 4 1/2" tall on the right side and 7" tall on the left (blade) side to provide extra support for taller pieces. (We initially bandsawed the front of the blade side level with the spacer to allow for a short bar clamp to hold workpieces to the jig, which works fine. For convenience, we later added a screw-mounted toggle clamp. Adjust the clamping system to suit your needs, locating all hardware out of the range of your tablesaw's blade.)

We used a piece of 2"-thick cherry to space the sides, which adds mass and stability to our jig. (To size the spacer to your fence, clamp the plywood sides



to the fence, adding a dollar bill's thickness where shown. Use this measurement to rip your spacer to width.) Attach the sides to the spacer using glue and countersunk #8x1 1/4" flathead wood screws. Add a movable 3/4"-thick poplar fence to complete the assembly.

To use the jig, set its fence carefully at the desired angle, securing it with two countersunk #8x1 1/4" flathead woodscrews. Clamp the workpiece to the jig, and adjust the spline slot location by moving the tablesaw's rip fence. (A square-ground rip blade works best for cutting spline slots.)

Step 3. Dry-assemble the door using a band clamp. If necessary, add bar clamps, using the outside plywood scrap from the case arch carrier board as a clamping caul (as you did when clamping the case). Double-check the door size on the case and check all joints for tightness. Mark the miter splines where they break out into the frame. Unclamp, then remove the V-shaped waste from the miter spline with a backsaw. Now, apply glue and reclamp.

Step 4. When the glue has dried, block-sand any protruding splines flush. Clamp the door assembly to the case, aligning the arch/side joints of both assemblies. (The top rail of the door should overlap the top edge of the case by about 1/16" and the outer door stiles should overlap the case sides by 1/32".) Using a flush-trim bit in your handheld router, trim the door arch flush with the top of the case, repositioning the clamps as necessary. Sand the door stiles and bottom

rail flush with the case, then remove the door from the case.

Step 5. Check the width of the door arch between the routed line and the inside layout line. If it measures the same width as the door stiles all around, sand to the layout line. If it's wider than the stiles, set your compass to the width

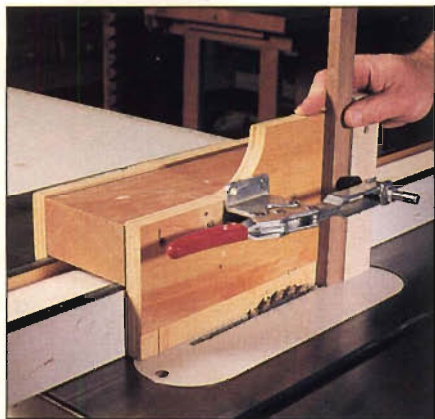


Photo C: Reset the jig to cut 90° spline slots.

of the stiles and use it to scribe a new layout line. Unclamp, then sand to the new line with your oscillating spindle sander, blending the arch and sides.

Rout the Details, Then Add the Hinges and Catch

Step 1. Install a $\frac{1}{8}$ " cove bit in your table-mounted router, and rout a cove along the front inside edge of the door frame. Change to a $\frac{1}{8}$ " edge-beading bit, and rout around the front outside edge.

Step 2. Using a rabbeting bit and the appropriate guide bearing, rout a $\frac{1}{4} \times \frac{1}{4}$ " rabbet along the back inside edge of the door to accept the glass panel. Square the rabbet corners with a chisel.

Step 3. From an 8" square of $\frac{3}{4}$ " plywood, make a template for routing

the hinge mortises. (A template of this width allows for easy clamping and alignment on the workpieces.) Using your tablesaw and miter gauge, cut a $\frac{3}{8} \times 1$ " notch in one edge $\frac{3}{8}$ " from each end. Mark one end of the template as the bottom for orientation.

Step 4. Align the notched edge of the template flush with the right outside edge and bottom of the case, then clamp. Install a piloted hinge-mortising bit in your handheld router, adjust the cutting depth to match the thickness of the hinge leaves, then rout the case mortises.

Step 5. Align and clamp the template flush with the right back edge and bottom of the door frame. Rout the mortises, then square their corners with a chisel.

Step 6. Carefully drill $\frac{1}{16}$ " pilot holes and install hinges. (To mail-order hinges and a magnetic catch, see Sources.) Note: Size the pilot holes for an easy fit, or the tiny brass screwheads might twist off. As an alternative, you could drive and remove steel screws first. Make sure the door aligns flush with the case. Block-sand if necessary to bring the edges flush.

Step 7. Break all sharp edges with sandpaper. Finish-sand the door and case, then apply finish. (We sprayed on two coats of semi-gloss lacquer, then sanded with 320-grit sandpaper before the final coat.)

Step 8. To locate the hole for the round magnetic catch, measure 4" from the bottom along the left edge of the case. Counterbore and drill holes for the catch as dimensioned in the detail on the Side/Front View drawing. Next, drill and countersink a $\frac{1}{8}$ " hole $\frac{3}{8}$ " deep in the back face of the door frame, aligning it with the magnetic catch hole. (We aligned the holes using a $\frac{3}{8}$ " dowel center in the catch hole.)

Step 9. Press the magnetic catch into the hole on the case. Drive a #6 $\times \frac{3}{8}$ " flathead steel wood screw into the door frame hole, adjusting the screw to barely touch the magnet. (Using a screw instead of a strike plate allows you to adjust the contact.)

Add the Glass and the Back

Step 1. Using thin cardboard, make a pattern for the glass. Trim it as need-

ed to fit freely inside the door rabbet. Have a glass dealer cut a piece of single-strength glass to match this pattern.

Step 2. Install the glass using brown caulk. (We used Dap acrylic latex caulk, which cleans up with water and can be smoothed with a damp fingertip.) Start in one lower corner, pulling a $\frac{1}{8}$ " bead evenly around the top of the frame to the other corner. Lift your caulking gun quickly, then connect the two corners. Dry any wet spots on the walnut immediately after dressing to prevent spotting. Later, trim excess caulk from the corners.

Step 3. Using a paper pattern, transfer the outline of the rabbeted back to a piece of $\frac{1}{4}$ "-thick birch plywood. Bandsaw to the inside of your layout lines, leaving enough clearance so you can wrap fabric around the back.

Step 4. Cover the back with fabric and adhere it with hotmelt glue on the backside. Drill $\frac{3}{32}$ " pilot holes through the back, centered in the case rabbet. Then, attach the back using five #4 $\times \frac{1}{2}$ " flathead wood screws where shown on the Exploded View. Install a sawtooth hanger for wall-mounting, centering it on the back 2" below the top of the cabinet.

Step 5. Use Velcro strips, thread, or monofilament fishline to attach objects to the fabric inside the case.

Project design: Dick Coers

Photographs: Studio Alex

SOURCES

Bandsaw Radius Cutter.

Fits $\frac{3}{4}$ "-wide $\times \frac{3}{8}$ "-deep or deeper miter slots; adjusts from 1" to 48" diameter. Catalog no. 878-582. Price: \$49.95 plus s/h.

Order from:

Woodworker's Supply
800/645-9292

Hardware. Round magnetic catch, $\frac{5}{16}$ "-dia., requires a $\frac{5}{16}$ "-deep hole (catalog no. 29272); one pair brass butt hinges, $1 \times \frac{3}{4}$ " (no. 25700).

Order from:

The Woodworkers' Store
800/279-4441

OK, Hold It.



Now Spread 'Em.



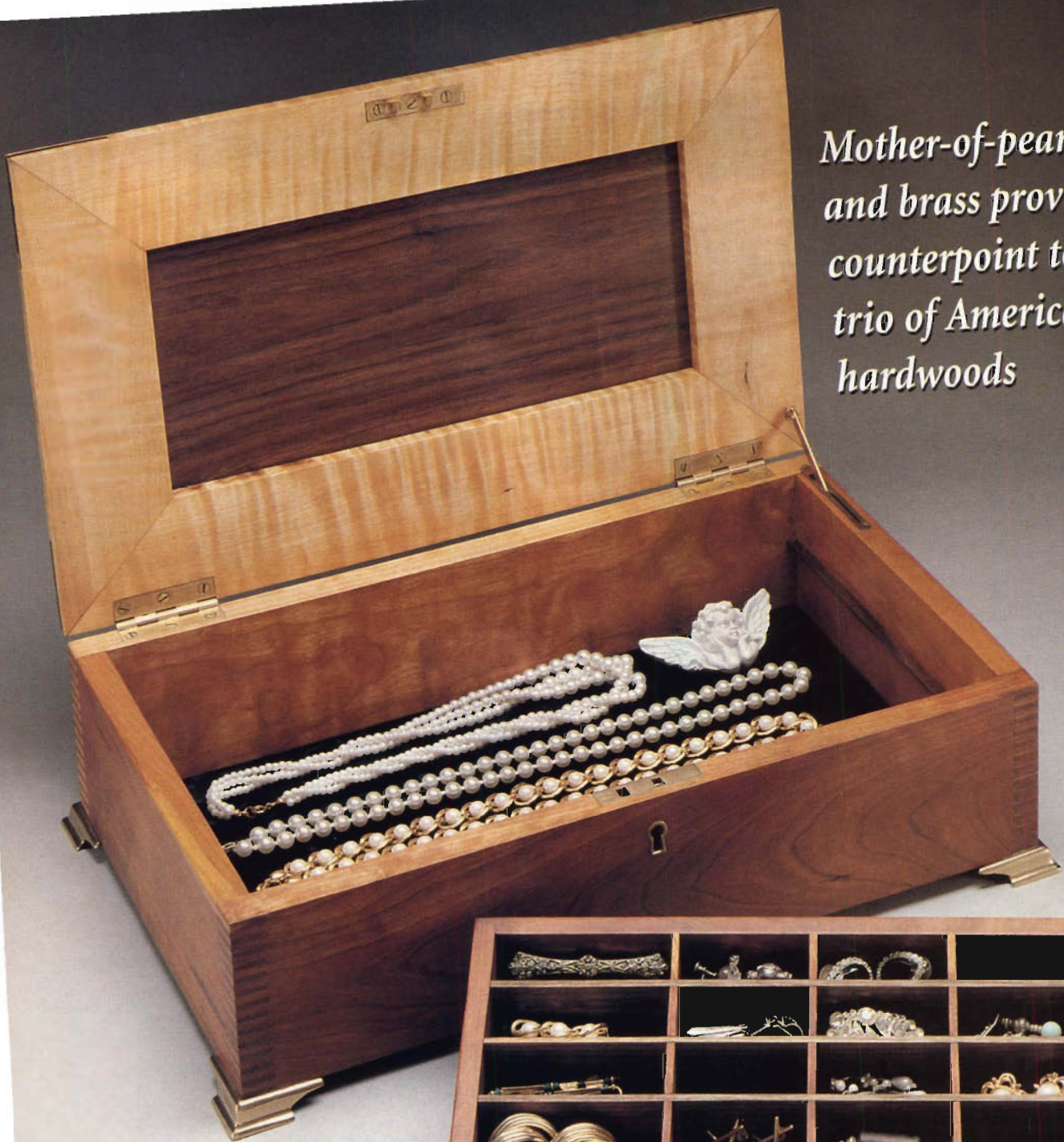
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FROM THE MAKERS OF QUICK-GRIP® BAR CLAMPS

*Mother-of-pearl
and brass provide
counterpoint to a
trio of American
hardwoods*



Visit any crafts fair, and you'll find a slew of jewelry boxes, few of which will house even an average array of rings, bracelets, brooches, and necklaces. This box, designed and built by David Peters, provides a handsome home for a large collection. Strong design elements include solid-brass pedestal feet, an escutcheon-style lock, and a raised panel lid with mother-of-pearl inlay.

Jewelry Box

Woodworker's Journal

Before You Start

Dave built his box from cherry, made the lid from curly maple and walnut, and added walnut corner splines. Because he used some hard-to-find parts and materials, we've listed mail-order suppliers in the Sources box at the end of the article.

Machine the Sides and Ends

Step 1. Plane a 4x56" piece of cherry stock to $\frac{5}{8}$ " thick. Rip it to $3\frac{3}{4}$ " wide, then crosscut a front and back (A) and two sides (B) to the lengths listed in the Bill Of Materials. Note: To "wrap" the grain around the box, cut the parts in front-side-back-side sequence. Select and mark a front face and top edge on each.

Step 2. Mount a $\frac{1}{8}$ "-thick rip blade with square-ground teeth on your tablesaw (such as Freud's LM 72M), and set it to cut $2\frac{1}{32}$ " deep. (This allows $\frac{3}{8}$ " for the final thickness plus $\frac{1}{32}$ " for flush-sanding the joints after assembly.) Using a box-joint jig, cut joints on the ends of the front, back, and sides. (See "Make and Use a Box-Joint Jig" on page 57.)

Step 3. Using a $\frac{1}{8}$ " straight bit in your table-mounted router, cut a $\frac{1}{4}$ "-deep groove along the inside face of each side (B) to accept the bottom. (For location, see the Front View drawing on page 58.)

Step 4. Using the same setup and a pair of stopblocks, rout a stopped groove for the bottom in the front and back.

Step 5. Reset the fence and stopblocks, and rout stopped grooves in the sides (A) for the tray supports. (See the Exploded View for location.)

Make a Bottom Panel, Then Install the Lock Parts

Step 1. From $\frac{1}{4}$ " cherry plywood, rip and crosscut the bottom panel (C) to finished size.

Step 2. Measure the actual thickness of your $\frac{1}{4}$ " plywood. Mount a $\frac{3}{8}$ " dado head on your table-saw, and set it to cut a rabbet that will leave a $\frac{1}{8}$ "-thick tongue on your ply-

wood. Now, cut a $\frac{1}{16}$ " rabbet $\frac{1}{8}$ " deep around the bottom edge of the bottom panel.

Step 3. From $\frac{1}{8}$ "-thick walnut stock, rip and crosscut a pair of tray supports (D). Next, test-assemble the front, back, and sides around the bottom, then test-fit the tray supports in their grooves. Trim the bottom slightly if necessary.

Step 4. Center the half-mortise lock on the inside face of the box front. Carefully scribe the mortise outlines. Using a router and edge guide, remove most of the waste, then chisel the mortise square. Test-fit the lock as you work so you don't remove too much stock.

Step 5. To cut the mortise for the escutcheon, drill two contiguous $\frac{3}{16}$ " holes centered on the lock mortise, locating the first hole exactly $\frac{3}{8}$ " from the top edge. Test-fit the lock, and then sight through the hole. The lock pin should center in it.

Step 6. Place the escutcheon on the box front so that the round hole is centered on the pin. With an X-acto knife, scribe the escutcheon outline. Using a drill press, rough out the waste inside the scribed lines, then use small files to finish the mortise. Test-fit the escutcheon as you work; it should press-fit into place.

BILL OF MATERIALS

PART	T	W	L	MTL.	QTY.
Box	A Front/back	$\frac{5}{8}$ "	$3\frac{3}{4}$ "	$15\frac{3}{4}$ "	C 2
	B Sides	$\frac{5}{8}$ "	$3\frac{3}{4}$ "	$9\frac{3}{4}$ "	C 2
	C Bottom	$\frac{1}{4}$ "	9"	15"	CP 1
	D Tray Supports	$\frac{1}{8}$ "	$\frac{1}{2}$ "	$8\frac{1}{2}$ "	W 2
Lid	E Sides	$\frac{3}{4}$ "	$2\frac{1}{4}$ "	$9\frac{3}{4}$ "	CM 2
	F Front/Back	$\frac{3}{4}$ "	$2\frac{1}{4}$ "	$15\frac{3}{4}$ "	CM 2
	G Panel	$\frac{1}{2}$ "	6"	12"	W 1
	H Splines*	$\frac{1}{8}$ "	$1\frac{3}{8}$ "	$2\frac{3}{4}$ "	W 4
TRAY	I Sides	$\frac{3}{8}$ "	$1\frac{1}{2}$ "	7"	C 2
	J Front/back*	$\frac{3}{8}$ "	$1\frac{1}{2}$ "	$14\frac{1}{2}$ "	C 2
	K Bottom*	$\frac{1}{4}$ "	$6\frac{7}{8}$ "	$14\frac{1}{8}$ "	CP 1
	L Short Divider*	$\frac{1}{8}$ "	$\frac{3}{8}$ "	$6\frac{1}{2}$ "	C 5
	M Long Divider*	$\frac{1}{8}$ "	$\frac{3}{8}$ "	$13\frac{3}{4}$ "	W 4

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

MATERIALS LIST

C—Cherry CM—Curly maple
W—Walnut CP—Cherry plywood

SUPPLIES

Velvet fabric ($\frac{1}{4}$ yard); $\frac{1}{16}$ " plywood;
#2x $\frac{1}{2}$ " roundhead brass wood screws;
 $\frac{1}{4}$ "-dia. brass rod. (For other supplies,
see Sources at end of article.)



Step 7. Mount the lock using four flathead brass screws. Spread a little quick-set epoxy inside the mortise, then fit the escutcheon into place.

Assemble the Box, Then Make the Lid

Step 1. Using a small brush, coat the box joints sparingly with white glue. Apply a drop of glue every inch or so in the grooves to secure the bottom panel, then assemble the front, back, and sides around the bottom. Clamp and square the assembly using pressure blocks set close to the joints.

Step 2. After the glue dries, remove the squeeze-out, then sand the joints flush with the sides. Glue and clamp the tray supports in their grooves.

Step 3. Select a piece of $\frac{3}{4}$ "-thick curly maple at least 56" long for the lid frame parts (E, F). Rip the stock to $2\frac{1}{4}$ " wide, then select and mark a top face and inside edge. Using a $\frac{1}{4}$ " dado head in the tablesaw, cut a $\frac{3}{8}$ "-deep groove along the inside edge of your lid stock to accept the panel tongues.

Step 4. Stand the lid stock on edge, then bevel it using a square-toothed rip blade tilted to 8° from perpendicular and elevated to $1\frac{1}{8}$ " (measured vertically). Next, reset the rip blade to perpendicular. Lay the lid stock flat on its top face, then rip it to remove the waste you bevel-ripped. (See the finished profile as detailed on the Front View drawing.)

Step 5. Miter-cut parts E and F to finished length. Note: To avoid splintered ends, make two passes.

Step 6. For the lid panel (G), select and plane walnut stock to $\frac{1}{2}$ " thick, then rip and crosscut it to final size. Next, cut a $\frac{1}{2}$ " rabbet $\frac{1}{4}$ " deep around the top edge.

Step 7. If you plan to add the mother-of-pearl and brass inlay to the lid panel, do it now. (See "How To Make the Inlay" on page 59.)

Assemble the Lid

Step 1. Apply glue to the mitered lid parts, then assemble them around the panel. Allow the panel to float in its groove without glue, and make sure it's centered with a $\frac{1}{8}$ " reveal on all sides. Clamp the lid using a frame or belt clamp, then check for square.

Step 2. Use a sanding block to square up the shoulder remaining at the top of the bevel and to even any irregularities where the miters meet. Then, sand a slight round-over on the top edge of the walnut panel.

Step 3. Install a $\frac{1}{8}$ "-thick rip blade in the tablesaw and elevate it to cut $1\frac{1}{8}$ " deep. Using a corner-grooving jig, cut a spline groove in the edge of the lid at each corner $\frac{1}{8}$ " from the bottom.

Step 4. Make four $\frac{1}{8}$ "-thick splines (H). Bandsaw them slightly oversized ($1\frac{1}{2} \times 3$ ") with the grain running parallel

to the long edge. Insert the splines into the lid grooves, then wick low-viscosity cyanoacrylate glue into the joints.

Step 5. Trim and sand the splines flush with the lid edges. Then, finish-sand the lid.

Step 6. Check to make sure the panel is centered, then drill a $\frac{1}{16}$ " hole in each end of the frame where shown on the Exploded View. Secure the panel with #2 $\times\frac{1}{2}$ " roundhead brass wood screws. Note: Dave chose to pin the panel from the top. If you'd prefer to conceal the screws, drill the holes in the underside.

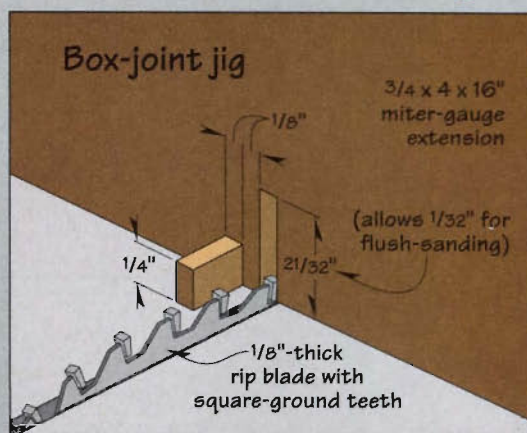
Make and Use a Box-Joint Jig

To make a tablesaw jig to cut $\frac{1}{8}$ " box joints, first cut a 4 $\times$ 16" miter-gauge extension from $\frac{3}{4}$ "-thick cabinet-grade plywood. Stand it on edge, and temporarily clamp it to your miter gauge. Set a $\frac{1}{8}$ "-thick rip blade with square-ground teeth to cut $\frac{1}{4}$ " deep, and cut a kerf through the edge of the extension 6" from the right end.

Cut a $\frac{1}{8} \times \frac{1}{4} \times 1\frac{1}{8}$ " hardwood key, and glue it into the kerf you just cut. Using a spacer, position the key exactly $\frac{1}{8}$ " from the tablesaw blade. Clamp the extension to the miter gauge, then secure it using #6 roundhead screws and flat washers. Raise the blade to $\frac{21}{32}$ " and cut a second kerf. This jig will cut $\frac{1}{8}$ " box joints in stock that is $\frac{1}{4}$ " or thicker.

Test your setup by cutting the ends of scrap pieces of the same width as your workpieces. To cut joints in your box parts, start with the front or back (A). Stand the piece on end, and butt the top edge firmly against the key. Clamp it to the extension, then cut the first slot.

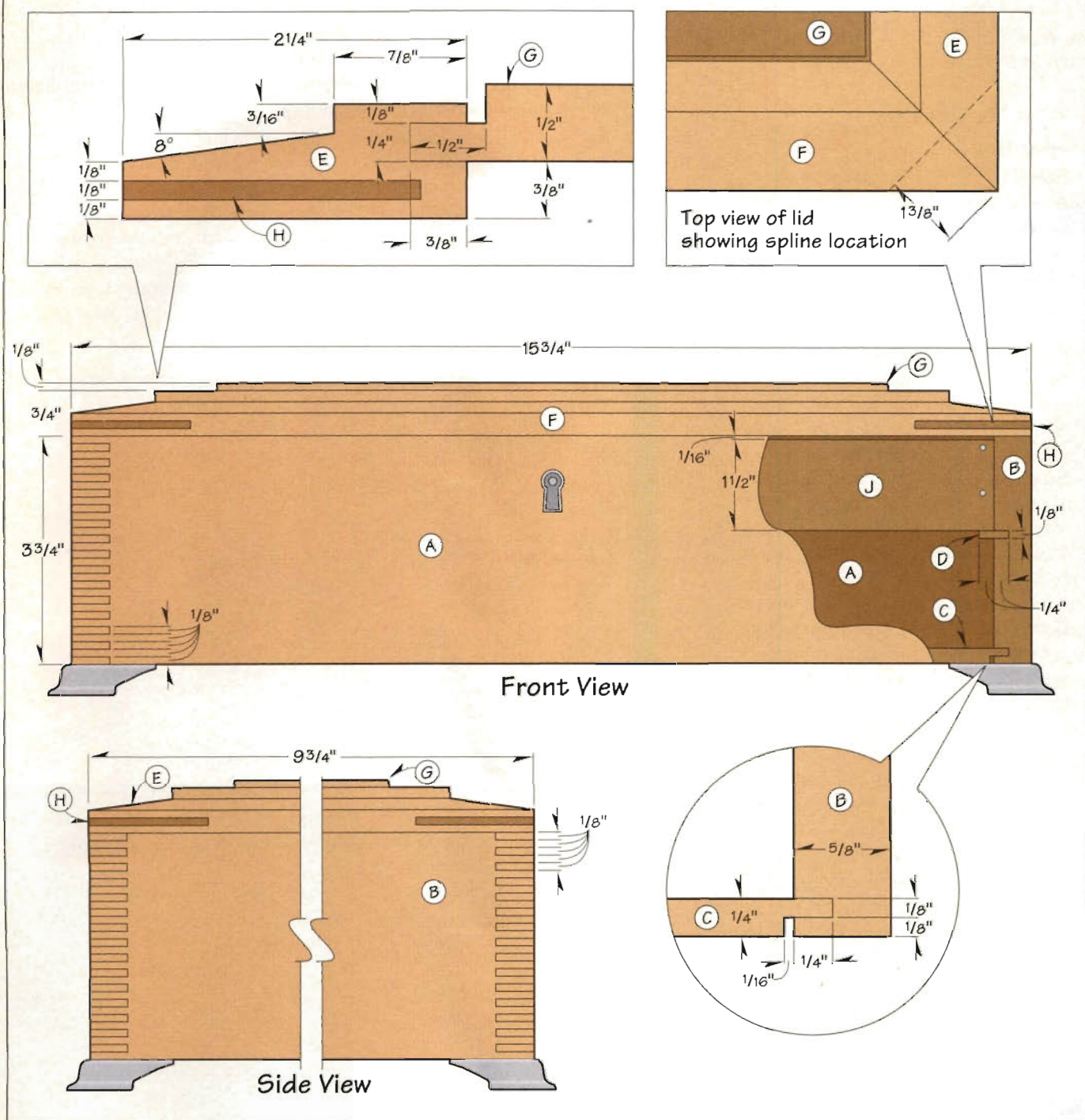
Reposition the workpiece so the slot you just cut is over the key, and cut the next slot. Repeat this sequence until you've slotted the entire end of the part, then flip the part end over end (not edge for edge) to repeat the process on the



uncut end. Slot the other part A, again starting with the top edge against the key. Note: When making your test cuts, make sure that the joint fits together with hand pressure. If the joint is too tight, loosen the screws holding the jig to the miter gauge and slide the jig a tiny bit to the right. If it's too loose, slide the jig left.

To properly index the mating joints in the box sides (B), first position the front or back (A) on the jig with its top slot over the key and its top edge flush with the blade. Butt the top edge of the mating side (B) against the top edge of the front/back, and cut the initial slot in the side. (This will notch its top corner.)

Remove the front/back, reposition the side so its initial slot (notch) is over the key, and cut the next slot. Slot the entire edge, then flip the side end over end and repeat the process.



Make the Tray

Step 1. Measure the interior of your box. Adjust the length of the tray front/back if necessary. (We made our tray $\frac{3}{32}"$ shorter than the interior box length.) Then, cut the sides (I) and front/back (J) to size from $\frac{3}{8}"$ -thick cherry.

Step 2. Using a $\frac{1}{8}"$ -thick rip blade, cut a $\frac{3}{16}"$ -deep groove for the bottom in the inside face of each tray part $\frac{1}{4}"$ from the bottom edge.

Step 3. Using a $\frac{3}{8}"$ dado head, a miter-gauge extension, and a stop-block, cut a $\frac{3}{8}"$ rabbet $\frac{1}{4}"$ deep on both ends (inside face) of the tray front and back.

Step 4. Dry-assemble, clamp, and square the tray parts. Measure the interior dimensions, add $\frac{3}{8}"$ to both, and cut the tray bottom (K) to this size from $\frac{1}{4}"$ -thick cherry plywood. Cut a $\frac{1}{4}"$ rabbet around the bottom edge of the bottom deep enough to form a $\frac{1}{8}"$ -

thick tongue. Note: Adjust the rabbet depth as needed.

Step 5. Test-assemble the tray front, back, and sides around the bottom. Apply glue to the rabbet joints and bottom groove, then assemble and clamp the parts. After the glue dries, secure each rabbet joint with a pair of #2x $\frac{1}{2}"$ roundhead brass screws. Then, sand the screw heads flush with the tray sides. Now, finish-sand the tray.

How To Make the Inlay

The inlay in Dave's box lid started as a fanciful sketch representing clouds, mountains, water, and moon. Make the same inlay using the full-sized pattern, or create your own. Note: Be sure to wear a respirator or dust mask when sawing mother-of-pearl to avoid inhaling the dust.

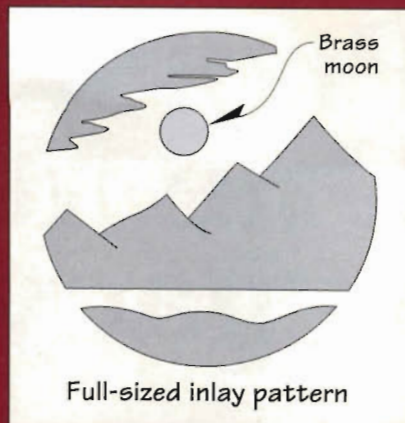
Trace or photocopy the full-sized pattern and adhere it to your mother-of-pearl with rubber cement or spray adhesive. Carefully cut out the pieces using either a scrollsaw or jeweler's saw fitted with a 1/0 blade mounted to cut on the pull stroke.

With a compass, lay out a centered 1 1/16" circle on the panel. Position the mother-of-pearl pieces within the scribed circle and trace their outlines on the panel. Using a Dremel or similar tool fitted with a straight bit, rough out the recesses for the inlay. Set the cutting depth so the inlay parts will sit slightly proud when glued in place. Cut to the lines with a sharp knife, test-fitting the inlays

as you work. Drill a 1/4" hole 1/4" deep for the brass moon.

Then, cut a 3/32" length of 1/4" brass rod. (Purchase this at any hobby store.) Spread a generous amount of quick-set epoxy in the recesses, then press the inlays into place,

allowing the excess epoxy to squeeze out. After the epoxy has cured, fill any gaps with a mixture of epoxy and walnut dust. Sand the inlay flush, starting with 300-grit wet-or-dry paper and then moving up to finer grits.



Step 6. Rip enough 1/8"-thick cherry and walnut stock to 7/8" wide for the short and long tray dividers (L, M). Trim the dividers to fit snugly inside the tray.

Step 7. Determine how you want to divide the tray space. Then, using a 1/8"-thick square-ground rip blade, cut half-lap joints in the tray dividers. Assemble the dividers without glue to permit future adjustment.

Mount the Hardware

Step 1. Using a sharp knife, score the hinge locations on the lid, then carefully cut the mortises with a chisel. Drill pilot holes for the screws and mount the hinges on the lid. Note: To avoid damaging the tiny brass hinge screws, use steel screws after drilling to cut the initial pilot-hole threads. Position the lid on the box, then repeat the above procedure to mortise and mount the hinges on the box.

Step 2. Position the lock catch on the underside of the lid so that it engages the lock smoothly. Temporarily secure it in place using double-faced tape or hotmelt glue. Score its location with a knife, then remove the lid from the box. Rough out the 3/16"-deep mortise with a chisel, then test-fit the catch as you trim the corners.

Step 3. Cut the mortise for the lid support in the top edge of the box where shown on the Exploded View. Reattach the lid temporarily, then dry-

assemble the lid support in its mortise to establish the location for the lid attachment. Drill a single 1/4" hole at this point for the support insert.

Step 4. Using one of the brass feet as a template, lay out and drill pilot holes at each corner of the box bottom. Temporarily screw the feet in place. Then, remove all hardware (except the lock) before finishing.

Add The Finishing Touches

Step 1. Apply finish to the box, lid, tray, and dividers. (Dave brushed on three coats of a hardening oil finish, wiping off the excess with a clean cotton cloth. He rubbed the finish with 0000 synthetic wool after each coat.) Note: Oil takes a long time to cure in an enclosed space. You can simply wax the box interior and tray to avoid a lingering odor.

Step 2. After the finish has cured thoroughly, apply a coat of beeswax polish, rubbing it into the wood until it tacks. Let the wax dry for 15 minutes, then buff to a soft luster. Now, remount the hinges and other hardware.

Step 3. Cut 1/16"-thick liners to fit the box and tray bottoms, allowing 1/16" all around for the thickness of the fabric you plan to use. (Dave lined the box and tray with black velvet, wrapping it around 1/16" plywood.)

Step 4. Cut the velvet about 2" larger (width and length) than the liners. Wrap the fabric tightly and

secure it to the bottom of the liner with hotmelt glue or fabric cement. After the finish has cured thoroughly, adhere the liners to the box and tray bottoms using double-faced tape. 

*Project designer/builder: David F. Peters
Photographs: Studio Alex*

SOURCES

Hardware Kit. One pair—2x1 1/4" drawn brass hinges; one solid brass mortised lid support; one half-mortise box lock and solid brass escutcheon. Ask for kit no. 123737. Price: \$29.95 plus s/h. Order from:

Woodcraft
800/225-1153

Brass Pedestal Feet. Solid cast-brass feet, 1 3/4" square with lip that registers on box corner. Catalog no. 00F10.03, \$19.50/set of four plus s/h. Order from:

Lee Valley Tools Ltd.
800/267-8767

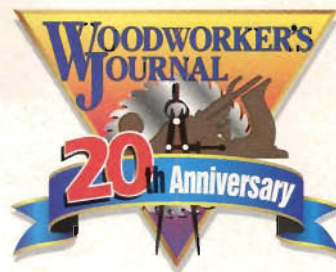
Mother-Of-Pearl Blanks. Call for current prices and ordering information.

The Luthier's Mercantile
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Twenty Years Of Woodworking with *Woodworker's Journal*

Projects: One Magazine's Legacy

*A Glance At a Few Of the
Noteworthy Projects Featured Over the Years*



by Charles Sommers

Grandfather clocks, Governor Winthrop slant-front desk, Chippendale chest, Connecticut River Valley highboy, Provincial four-poster bed, stepped back hutch, Federal-style washstand, Shaker blanket chests, country corner cabinet, Early American dry sink, contemporary cocktail table—all memorable, challenging projects that have appeared in the pages of *Woodworker's Journal* during the past 19 years.

There have also been decorative planters, wall shelves, end tables, dining tables, folding tables, candle boxes, pull toys, rocking toys, flying toys, floating toys, and rolling toys; benches, stools, wine racks, spice cabinets, and medicine cabinets; more clocks, more chests, more tables, more desks, more beds, jewelry boxes, pie safes, magazine racks, turned bowls, and candlesticks; carved Santas, whales, and decoys; mirrors, lamps,

whirligigs, harps, and dulcimers; Adirondack chairs and cutting boards. The list goes on, and all have been presented on these pages to keep woodworkers like you busy, whatever your interest or woodworking skill.

Too Many To Count

They number in the thousands—how many we're not sure; no one has taken the time to count them. But, it's



**18th-Century Pencil
Post Bed and
Nightstand,
Sept./Oct. '87,
pages 47-53**

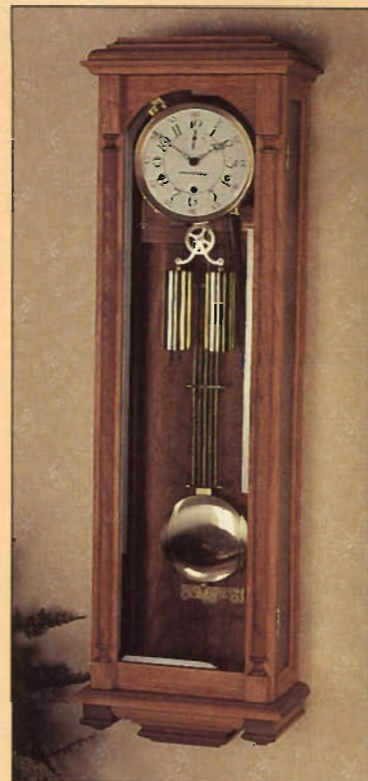
This pair of companion pieces makes an impressive statement in any bedroom, whether it be colonial, country, or even contemporary. Although such bedsteads were usually constructed of maple with wide pine stock for the headboard, we built this one from cherry for its strength, workability, and rich warmth. We stuck with traditional techniques of craftsmanship throughout.



Flemish Folk Harp,
Mar./Apr. '88,
pages 24-28

Our folk harp's origins date back to the instruments crafted by Flemish artisans during the 14th, 15th, and 16th centuries. Its 2½-octave diatonic range and nylon strings give it a tonal quality nearly identical to that of early catgut-strung instruments.

I've already built a grandfather clock similar to the Chippendale design published in Sept./Oct. 1984. My favorite, though, happens to be the Vienna Regulator, which first appeared in May/June 1987. This clock's case, derived from the styles perfected in 19th-century Austria and Germany, has smooth, pleasing lines. Its glass front and sides nicely expose the handsome brass clock movement, weights, and pendulum. It's perfectly sized to fit into today's homes and apartments, and I've made it number one on my must-build list of projects. Already, I can envision how great a walnut version of it will look on the wall in my living room or den.



Vienna Regulator Clock,
May/June '87, pages 48-52

The Vienna Regulator clock was and still is considered to be one of the classic European clock designs. This particular model, representative of traditional Vienna regulators dating from the mid-1850s, features a beveled glass door and sides.

always fun to look back through the older issues. Every time I do, I discover great projects that I didn't know the magazine had published before. Often these searches are instigated by readers calling and asking for a copy of a project they remember but just can't find in their files.

Personally, I like wooden clocks. The *Journal* has presented many memorable classics over the years.

Heirlooms All

Having a legacy of great projects makes it nice for you woodworkers but tough for us when we try to come up with new projects. Topping great designs like the Shaker desk (May/June '85), the 18th-century tilt-top table (March/April '89), and the English garden set (May/June '90) is no easy task. Mention an idea, and more than



Pennsylvania Small Chest,
May/June '91,
pages 48-50

Paula Garbarino's design shows off the fine detailing skills that woodworkers in the Pennsylvania area had achieved by the early 1700s. Its inlays, molded edges, and bun feet show a strong William and Mary influence. Every home has at least one nook for a handsome repository like this one.

likely it's already been done at least once before. We won't repeat projects unless they're changed significantly. One exception: the enduring Shaker blanket chest. It's appeared in the *Journal* with different looks no less than four times.

Until recently, finding an unknown or forgotten project that had appeared in the *Journal* was a challenge, because the indexing system was incomplete and difficult to use. We've solved that problem now. Hot off the presses, the new *Woodworker's Journal Cumulative Index* lists every project (and article) that has been published since the first issue appeared in January 1977. You can now purchase your own copy of this inexpensive project treasury. (Look for the advertisement elsewhere in this issue.) 

Many woodworkers figure they'll just put up with poor performance until they have enough money to buy a better saw. Yet, untuned, that "better" tool might just rumble louder and make even more smoke. By spending a couple of hours and less than \$100, you can make your saw run better than an untuned one costing twice as much.

Three key factors make a saw cut smoothly. The power train lines up and delivers energy straight from the motor to the arbor. Then, a round arbor rotates concentrically on good bearings, turning a flat, balanced blade. Finally, the long axis of the blade and the tilting axis of the arbor must line up perfectly with the miter gauge slots and the top surface of the saw.

Note: For this article, I'll be tuning a Delta Contractor's Saw, to which I've added a Delta Unifence. I've removed the blade guard assembly for the sake of clearer photos. Most of my suggestions apply to all similar saws of the contractor's type, i.e., those with an exterior-mounted motor, a belt-driven arbor, and trunnions that bolt directly to the underside of the table. To adapt the following recommendations to your saw, consult your owner's manual.

Align the Power Train

To begin a tune-up, unplug the saw, remove the blade and drive belt, then measure the pulleys. If they're not the same diameter, you should buy a new motor pulley of the same size as the arbor pulley. Find a replacement that's been machined, not just cast, as shown in *photo A*. (For mail-order information, see the Sources listed at the end of the article.)

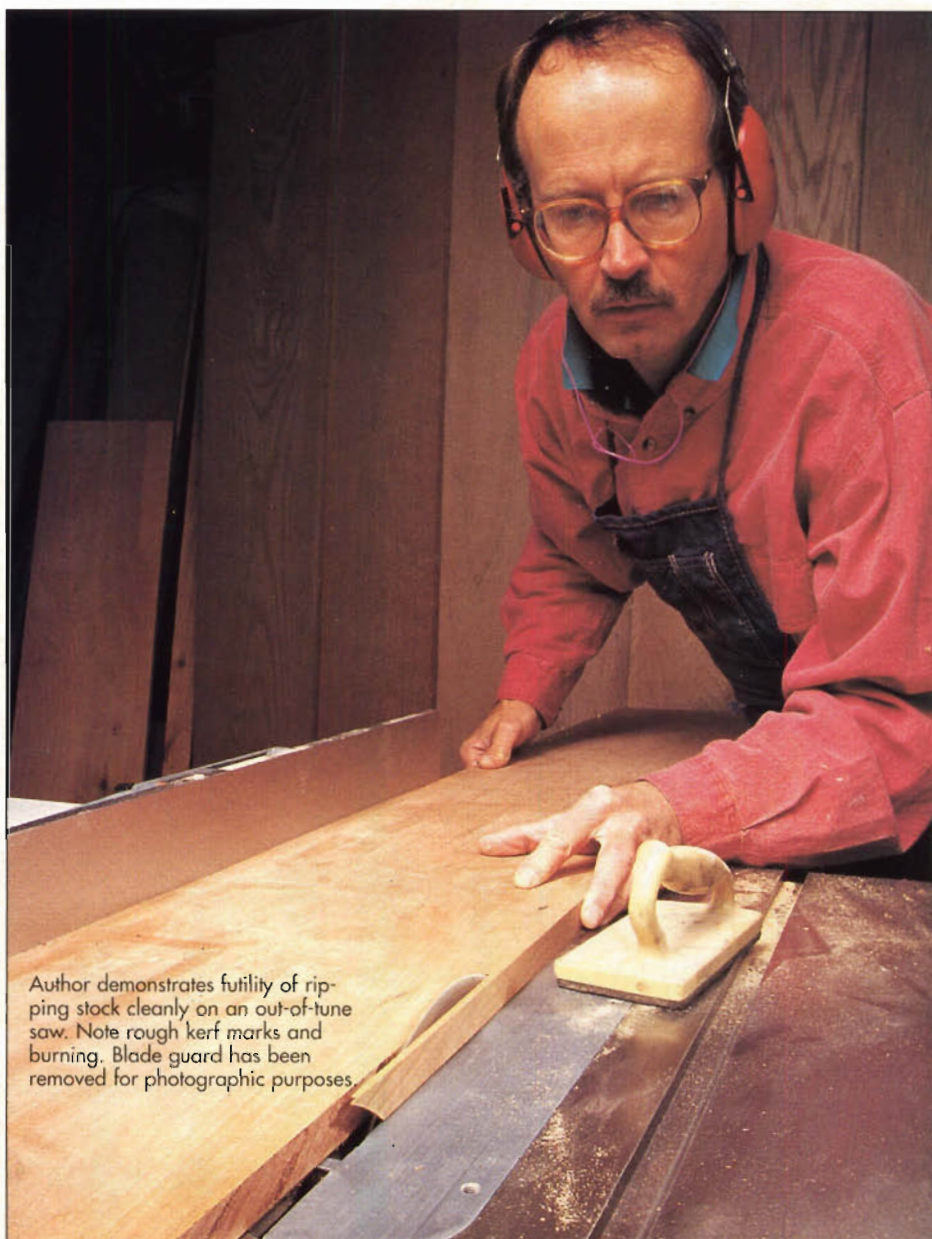
Many saws come equipped with a motor pulley that measures $\frac{1}{2}$ " larger in diameter than the arbor pulley. This makes the blade turn about 20 percent faster than the motor, which seems to increase vibration and also reduces torque.

Fine-Tuning Your Tablesaw

Serious Craftsmanship Begins Here

Does your tablesaw rumble and lurch like Godzilla, exhaling smoke and burning every timber in its path? If so, you're in good company, because half the saws in America run like that.

by Sven Hanson



Author demonstrates futility of ripping stock cleanly on an out-of-tune saw. Note rough kerf marks and burning. Blade guard has been removed for photographic purposes.

In some cases, simply changing to a smaller pulley effects a miracle cure.

Robert Archer, technical specialist at Delta's Memphis plant, reports that the Contractor's Saw will now come standard with a 2¼" motor pulley in place of the old 3"-diameter unit. "This drops the blade speed from 4,000 to 3,000 rpm, boosting the saw's torque proportionately," Robert adds. "It reduces vibration and allows you to run the saw for longer periods without overheating the motor."

While you're at it, check the pulleys, old or new, for "concentricity" (roundness). To do this, spin the shafts of the blade arbor and the motor while watching for wobble inside the pulley shoulders. If you're not sure whether they're wavering from side to side or up and down, put a machinist's dial indicator on them to check for runout. A reading of .010" or more, or anything you can "eyeball," calls for replacement.

Check the Drive Belt

Lay the belt on a level surface. A good belt will lie very flat with a minimum of twisting. Ordinary fan belts from discount auto parts stores often fail the test.

I've had good results with Kaman Industrial's plain V-belts and machined pulleys, shown in photo A. Some woodworkers prefer the multi-link adjustable belts, including the PowerTwist V-Belt, also shown in the photo. (See Sources listed at the end of the article.) The links interlock and offer the advantage of adjustability to the nearest inch—a great help when a new motor or pulleys leave you uncertain as to the final belt length you need.

The multiple links also eliminate the problem of "set" that you get with conventional belts when they sit wrapped around the pulleys all week waiting for Saturday duty. You'll notice this effect the most with wider belts—a ¾" belt with "set" will tend to vibrate worse than a ½" belt with the same affliction.

If you select new belts or pulleys, match the belt's width to the nominal width of the pulley, i.e., ½" to ½". I switched from the stock ¾"-wide equipment that came with my saw to two new ½"-wide pulleys and matching belt. These pulleys have a propor-

tionately smaller outside diameter (⅜" less than the ¾"). Since the shoulder of the arbor pulley limits the available cutting height, I'm able to raise my blade that much higher.

Check the Pulley Alignment

When the pulleys sit at odd angles, the force pulls the belt unequally against their shoulders. The belt tries to climb, then falls back toward center, then climbs and so on, creating a harmonic motion that vibrates the whole saw.

To make the pulleys sit coplanar, first loosen their set screws and also the motor mount bolts. Set them just enough to let you wiggle things around. Reach inside the saw and hold a straightedge against the outer flange of the arbor pulley (photo B). Adjust the arbor pulley until the straightedge points back at the outer side of the motor pulley. Always start by adjusting the arbor pulley.

Next, put the straightedge onto the motor pulley and wiggle the motor and pulley around until the two pulleys line up. Double-check the position of the arbor pulley, and then tighten the set screws and mounting bolts.

If you own a "motorized" saw (also called "direct-drive" because the blade attaches directly to the motor shaft), you don't need to follow the alignment procedures described above. In case you're feeling left out, follow these steps to align the motor pulley with the drive pulley on your bandsaw. Every tool runs more efficiently when you harness the power directly to the load.

Check the Arbor and Blade

Unplug the saw, take off the V-belt, and install your best blade. We're not cutting anything, so you could use the outer cutter from your dado set or a sanding disc if it's the flattest, roundest "blade" you own. (Freud and several other firms sell a machined disc especially for this purpose.)

Raise the blade to full height, then position your dial indicator with its tip zeroed near the outer edge (photo C). Now, rotate the arbor pulley by hand, being careful not to flex the blade. If the first blade you install seems to wobble a lot, try your second best blade.

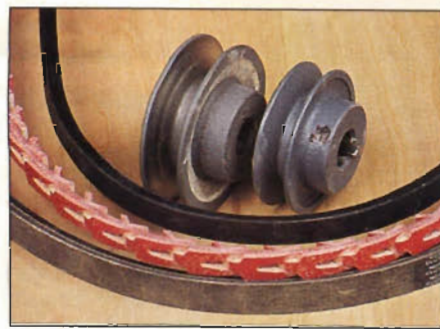


Photo A: Machined pulley (left) produces less vibration than cast pulley (right). Conventional ½"-wide V-belt (top) causes less vibration than ¾"-wide belt (bottom). Adjustable multi-link belt (middle) also reduces vibration.



Photo B: Using a straightedge, align arbor and motor pulleys to make them coplanar.

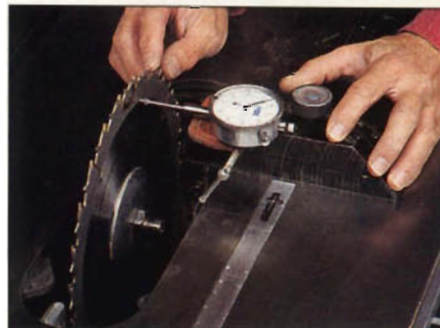


Photo C: To check for arbor runout, use a dial indicator clamped to the miter gauge. Test with several blades to make sure any wobble is due to the arbor, not the blades.

If the indicator shows runout within the common standard for woodworking tools of $\pm .005"$, you can break for coffee while the rest of us sweat the next step. (If you measure less than $\pm .003"$ runout, have a Danish to celebrate your good fortune.)

Anatomy of a Blade

Potato chips masquerading as saw blades cause half of all tablesaw problems. Some blades are born bad. Even manufacturers of respectable brands occasionally produce curved blanks, out-of-round or off-center arbor holes, or misground teeth. Some blades turn bad because of life in a nasty environment. Misaligned cuts, for example, can overheat and warp the blade, creating a condition that repair shops can't cheaply correct (*photo D*).

Two important differences distinguish expensive blades from cheap blades. Makers of good blades spend far more on creating consistent quality. They make each blade almost exactly the same in quality and performance. They also build the blade to last longer and survive several sharpenings. Better heat treatment of the plate and higher-quality carbide and brazing material create a blade with at least three lives.

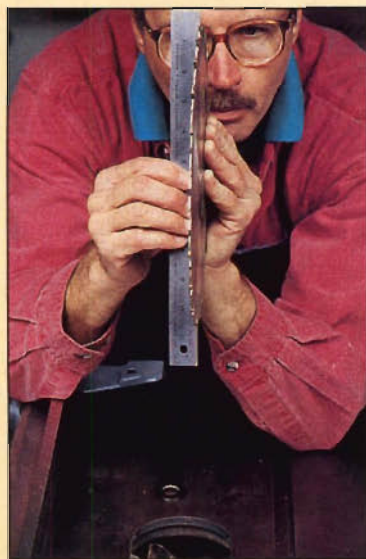


Photo D: Check a blade for flatness by holding a straightedge against the blade in two places at 90° intervals.

A cheap blade from the home center can cut very smoothly. The next blade behind it on the rack could cut much better or much worse. That explains why you'll hear two woodworkers arguing that an economical brand of blade is either a tremendous value or useless junk. They're probably both right.

I prefer to use a clean, sharp 24-tooth rip blade for almost all of my cutting. I've had good success with Freud's thin-kerf 24-tooth rip blade, no. TK-206. (See Sources.) Melamine and

Formica-type panels, Corian, and thin stock do, however, cut more cleanly with a 60- or 80-tooth blade.

The number of cuts per inch makes the biggest difference in the smoothness of the cut. If you feed a 24-tooth rip blade half as fast as you feed a 40-tooth combination blade, the rip blade will make 20 percent more cuts per inch. If you're sawing an 8/4 maple plank and the motor is bogging down, the advantage tilts further to the rip blade.

If you cut with a low-powered saw at the end of a long extension cord, as I did for years, you probably don't have the horsepower to properly run a blade with more than 40 or 50 teeth. You can't feed the material fast enough to keep all those teeth cutting full-sized chips. You'll bog down, overheat the motor and blade, and trip a circuit breaker.

For thin material—say, 3/8" or less—you can and should use an 80-tooth blade. The many teeth decrease the risk of kickback by preventing any single tooth from taking too big a bite. In an optimum situation, which includes a very clean blade perfectly aligned with the direction of feed, burning won't happen. If you're cutting a few thin pieces of

easily machined woods, you can feed an 80-tooth blade as slowly as you want.

Even for tiny trim cuts, I still use a sharp rip blade. The beveled, crosscut-style tooth you get on an 80-tooth trim blade tends to pull itself into the work (or the work into it) when you cut with only a portion of the whole blade width. Sometimes, this causes a misplaced or rough cut.

Thin-kerf blades (usually 3/32" [.100"] or about 20 percent narrower than the standard 1/8" [.125"] thickness) require less energy to cut, make less sawdust, and every now and then yield one more piece off some overpriced board. When mounted on a sturdy, well-tuned saw, they cut as smoothly as any other blade.

A Clean Blade In a Tuned Saw

A dirty, warped, or misaligned blade will quickly heat up, damaging itself and your work while filling the shop with acrid smoke. While the smoke might improve a salmon fillet, you'll find it a minor irritant at the least.

Smoke from exotic woods and manmade sheet goods, on the other hand, can poison you. The worst exotics inflict immediate harm—something like having the inside of your lungs stung by bees. Smoke from sheet goods exposes you to such carcinogens as formaldehyde gas.

You may not think it possible that a bit of resin built up on the trailing edge of a blade can cause overheating. Resin is soft compared to carbide teeth and wood, but by filling in behind the cutting edge of each tooth, it alters the tooth's shape. The resulting drag causes a snowballing effect as the increase of heat accelerates the resin accumulation. The friction in turn produces noticeably worse tearout.

Most oven-cleaning products dissolve resins and are easy to use for blade cleaning. Woodworking supply catalogs list a number of products such as Oxysolve that clean blades more effectively but cost more.

To clean a blade, I lay it on a piece of cardboard and thoroughly wet the perimeter with the product. Then I'll wait about 10 minutes—but not longer. Finally, I'll scrub the teeth with (you guessed it) a toothbrush (*photo E*). Rinse off the residue with cold water, dry the blade, and give it a light coating of machine oil to prevent rusting if it isn't liable to go back to work for a while. (Don't forget to wipe off the oil thoroughly before using the blade.)



Photo E: Pitch-covered blades cause almost as much trouble as a misaligned saw. To remove, apply a blade-cleaning product or oven-cleaner, then scrub with a toothbrush.



◀ **Photo F:** Check the condition of arbor bearings by wiggling and rotating the arbor. Listen and feel for rumble or stiff or sloppy action.



Photo G:▶ If bearings need to be replaced, tilt arbor to 45°, release allen screw that holds the blade height pivot shaft in place, then remove arbor assembly.

If the indicator moves excessively, try a different blade. If that one wobbles an equal amount in a similar progression, you probably have arbor problems. If, on the other hand, you now measure acceptable runout, mark the first blade "wobbles." (Blades are another topic, which I discuss in more detail in "Anatomy of a Blade" *opposite*.)

Examine the Arbor For Eccentricity

Four conditions cause the blade to wobble in and out more than an acceptable .010" (slightly more than the thickness of two sheets of notebook paper). Bad bearings allow the entire shaft to flop around. A bent arbor throws the blade up and down, in and out. An off-axis shoulder flange on the arbor pushes the blade out and in with each revolution. Or, you may simply have bought a bad blade or warped it by overheating.

To divine the condition of the bearings, first remove the belt and blade. Then, raise the arbor to full height and tilt it to 45°. As you wiggle and rotate the arbor, listen and feel for rumbling (*photo F*). If the bearings run stiffly or sloppily, replace them. To do this, take out the arbor assembly by removing the blade, tilting the arbor to 45°, and releasing the set screw that holds the height pivot shaft in place (*photo G*).

The assembly will then fall loose into your hands (or into the sawdust at the bottom of the cabinet, which you've been meaning to clean out). From there, an experienced mechanic pulls and replaces the bearings. Most of us, however, should take the assembly to a quality repair shop and spend the \$50 to \$100 for a professional repack.

To check the arbor shaft itself, sight across the threaded width and give it a spin by hand. See if it rises and falls as it rotates. Rough handling or sloppy machining can make a bad shaft. If the arbor rotates out of round, you'll need a new arbor.

Finally, check the arbor's shoulder flange. Raise the blade to full height, position the indicator flush with its outside face, and turn it by hand. Runout at the flange will be much less obvious than what you'd measure near the circumference of a blade, but if it's noticeable, mark the flange and change blades. Repeat the test, and if you find yourself making a second mark close to the first, you may need to have the flange machined or buy and install a new arbor.

Even if you can't immediately fix problems with the arbor, you should continue tuning up. You can still make great improvements by following the steps described below.

Align the Blade With the Miter-Gauge Slot

When blade and miter-gauge slots don't line up, the miter gauge (or mitering jig or cutoff sled) pushes the work into or away from the blade while guiding it forward. The convergence or divergence of work and blade causes burning and off-square cuts even if the miter gauge tests square with the blade (*photo H*).

A blade cutting out-of-parallel to the miter-gauge slots and/or rip fence cuts unequally. If this is the case, downward tooth marks will prevail on one of the sawn edges, whereas you'll see mostly upward-arcing strokes on the opposite edge (*photo I*).



Photo H: If the blade does not align with miter-gauge slots, miter gauge will push workpiece into or away from the blade while moving it forward.



Photo I: A good cut (shown here) has half its tooth marks arcing upward and half arcing down. If downward marks predominate, the leading edge of the blade is set too far in. If most marks arc upward, the tail edge of the blade is doing too much of the work.

Where downward strokes predominate, indicating that the leading edge of the blade is doing most of the work, you'll simply get a rough cut. If the tail edge of the blade does most of the cutting, it will spit dust in your face. The upward thrust will also tend to lift the workpiece off the table, adding hazard to the annoyance.

If you hope to diagnose any alignment problems accurately, first take the slop out of your miter-gauge bar. To do this, centerpunch the bar at several points along both edges. This will bulge the steel outward, creating a snug fit (*photo J*).

I start the adjustment by scratching a fine straight line $\frac{1}{2}$ " long on the center of the miter-gauge bar. Next, I raise the blade to full height, square it to the table, and *mark one tooth*. Then, I measure from the scribed mark to the outermost corner of this tooth (*photo K*).

Because the thin steel scale lies flat on the table, it will indicate the point at which the tooth sits even with the tabletop. Rotate the tooth to rest against the end of a $\frac{1}{64}$ " ruler. Good lighting and a magnifying glass will give you a better shot at a precise reading of the $\frac{1}{64}$ " hashmarks.

Next, I'll rotate the same tooth to the back side of the throat opening and slide the scribed line on the miter gauge even with the back of the blade. I then repeat the measuring procedure. Comparing the two measurements tells us which way we want to move the arbor or the tabletop. Always use the same tooth to compare the front and back blade positions. If you don't, you might be measuring variations in the blade rather than the arbor.

The blade holds its position relative to the miter-gauge slot in one of two ways. On many saws, the motor/arbor assembly attaches to the base, i.e., the square box that holds up the table. To adjust the blade to parallel, loosen the corner mounting bolts that secure the table to the base, then tap the top with a mallet until the miter-gauge slot lies parallel to the blade.

On the Contractor's Saw, the arbor attaches to the underside of the table with a pair of semicircular trunnions. You have to reach underneath to loosen the rear trunnion mounting bolts. Then, you pull the arbor/blade parallel to the slot using a bar clamp secured to the side of the tablesaw and the far side of the arbor mounts (*photo L*). I retest the blade alignment, then tighten the bolts if it passes.

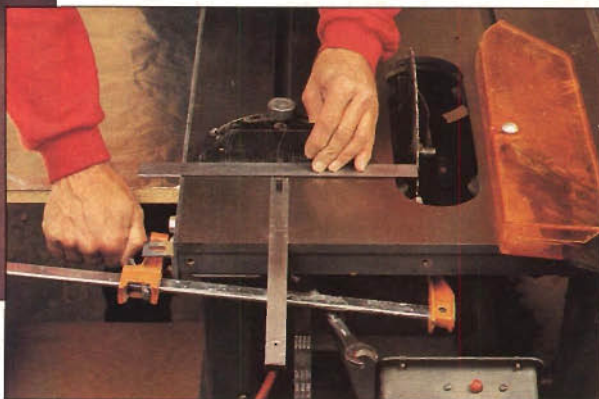
Sometimes the back trunnion won't move far enough to allow the proper adjustment. If that's the case, move the



▲ **Photo J:** Take the "slop" out of the miter-gauge bar by centerpunching the bar at several points along both edges to bulge steel outward.



▲ **Photo K:** To check alignment of blade with miter-gauge slot, measure distance between tooth and miter-gauge centerline with tooth positioned "up front." Measure again at rear edge of blade using the same tooth. A magnifying glass makes precise readings easier.



▲ **Photo L:** To align blade with miter-gauge slot, loosen rear trunnion mounting bolts, then pull arbor into position with a bar clamp. Clamp engages side of saw base and far side of arbor mounts.

front trunnion bolts in the opposite direction. If the arbor still falls short of parallel with the miter-gauge slot, you'll have to ream the trunnion mounting holes to create more adjustment.

Set the Trunnion Axis Parallel To the Table

Once you've aligned the arbor to the miter-gauge slot, cutoff jigs such as this picture frame mitring sled should make clean, straight cuts (*photo M*). However, the arbor may still go out of alignment when you tilt the blade to make bevel cuts.

As we saw earlier, the arbor tilts on two trunnions mounted at the front and back of the underside of the table. Their semicircular tracks guide quarter-circle trunnions as the arbor tilts from 90° down to 45° .

These are complicated parts doing a high-stress job. Even if they were designed and built by aerospace engineers, you could expect some problems. In fact, due to variations in manufacture and/or wear, the tilting axis rarely lies parallel to the table.



Photo M: With arbor aligned with slots, jigs and cutoff sleds will make clean cuts with blade at 90° , but axis of tilt still needs to be aligned with table.

To visualize the problem, tilt the blade to 45° , then lift just the back end of the throat plate. By raising it the smallest amount, you'll find that the inside edge of the opening begins to snub up against the blade. This cre-

Continued on page 68

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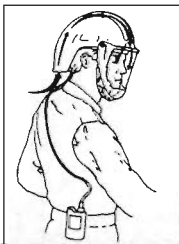
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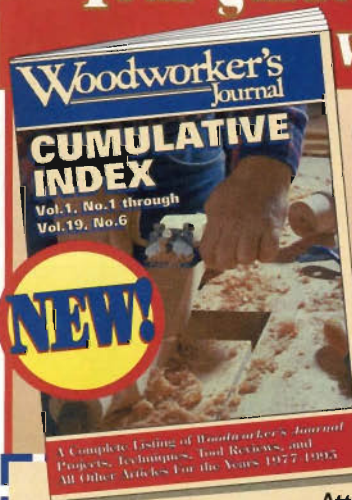
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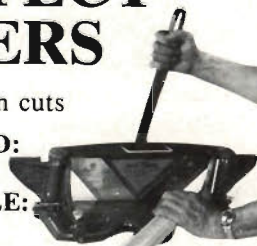
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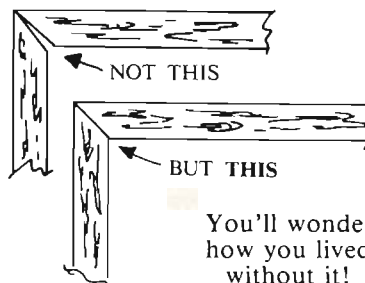
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Table Saw Tune-up

Continued from page 66

ates the same effect as having the back trunnion sit too low. When the axis of tilt isn't parallel to the table, tilting the arbor moves the front half of the blade a different distance than it moves the back half.

Adjust the Trunnion Height

To test whether the tilt axis is out of parallel to the tabletop, I tilt the blade and repeat the measuring process to see if it still sits parallel to the miter-gauge slot (*photo N*). A greater distance at the back of the blade indicates that the back trunnion should be lowered; a smaller back measurement calls for dropping the front trunnion.

There is a formula for figuring how much to lower the trunnions, but it involves complex trigonometry. For my alternative approach, I ease one of the mounting bolts slightly and loosen the other. I then push the loose side down with a wedge or reversed clamp until the front and back tooth measurements become equal, as shown in *photo N*.

With the gap between trunnion and tabletop fully opened, it's time to bring out the most useful tool ever overlooked by woodworkers—the automotive feeler gauge. This device, if you're not familiar it, consists of a set of flat metal strips about ½" wide and 3" long that are used to determine or set spaces as small as .001". You slip the strips into the gap one by one until you find the size that won't fit.

From brass shim stock (available at hardware stores or hobby shops), cut out washers totaling that thickness (or the next smaller thickness). Pull out the loose bolt and install the washers. Then, snug the bolts and remeasure. With a good blade and proper feed rate, your saw should now make glass-smooth cuts.

Lubricate the Works

While I'm under there, I knock out the sawdust and then spray all of the moving parts with WD40. This practice, if repeated every two weeks, will provide plenty of lubrication for a saw that sees an hour of daily use in a reasonably dry climate.

If you subject your saw to heavy-duty service, you can reduce wear by using lithium grease on the helical adjusters, oil on the rotating parts, and paste wax on the trunnions. Regular lubrication, especially if your saw resides in a damp environment, will help it live a long and productive life.

Once a month or so, I apply a paste wax (one without any abrasive ingredients) to the tabletop and fence. This not only helps protect these surfaces from moisture and abrasion, it also makes the saw safer and easier to operate. When the workpiece grabs and sticks, the sudden motion required to nudge it forward moves the workpiece out of the straightest path. This causes a rough cut and increases the risk of kickback.

Adjust the Fence Parallel To the Blade

Once you've adjusted the arbor position, the fence will no longer line up with the blade. To reset the fence, raise the blade to full height and place a smooth straightedge between the blade and fence. Then, fine-tune the blade height until the straightedge contacts a tooth at both the front and back edges of the blade (*photo O*). (Use a rip blade with square-ground teeth for accurate adjustment.)

If I need sharp, straight cuts in stable material, I set the fence perfectly parallel to the blade. Before running irregularly grained stock through the saw, I set the fence to "open up" about .005" at the back edge of the blade. This allows some clearance for the compressed wood to spring open as it's cut.

To adjust the original-equipment fence on the Contractor's Saw and similar models, loosen the two top bolts near the locking lever, push the fence into alignment, and then retighten the bolts. Sometimes this proce-

Continued on page 70

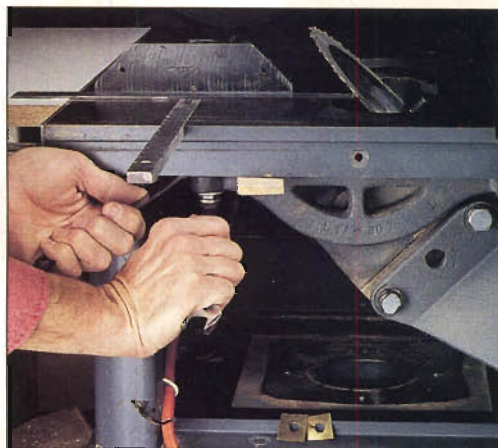


Photo N: After measuring alignment of tilted blade, loosen trunnion mounting bolt, push loose side down with wedge, then install shopmade washers to adjust trunnion height.



Photo O: To align rip fence with blade, raise blade to full height, place straightedge between the fence and blade, then adjust height until straightedge contacts a tooth at front and back edges of blade.

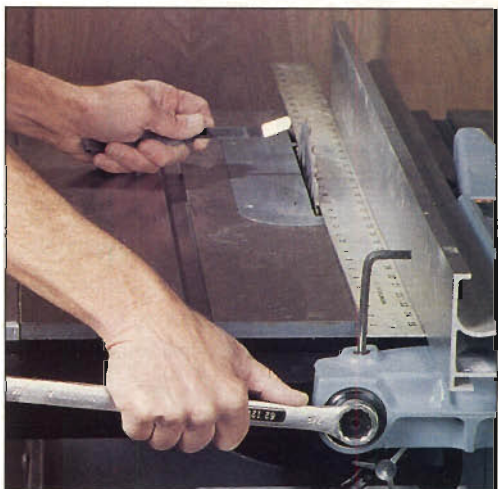


Photo P: To align Biesemeyer or Unifence (shown here) with blade, adjust allen screws controlling sliders that ride against the guide bar.

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Reset the Tilt Stops

After all the adjusting we've done, you'll also need to reset the 45° and 90° blade tilt settings. On the Contractor's Saw, the two stop bolts determine the front trunnion's end positions. Crank the blade to the stop positions, and test each setting against your square or angle gauge. If it needs adjustment, back off a little, move the stop in or out, and try again. Two or three tries should yield settings "close enough for wood-working." For precise bevels or miters, you'll want to use a gauge rather than relying on the stops.

On my current saw, the stops adjust by means of allen screws recessed into the table in front of the blade (*photo Q*). My old saw had bolt heads in exactly the same position that were accessible only from inside the cabinet.

If you do a wide variety of cut-and-fit work as I do, consider leaving the stops backed off a bit. That way, you can go to 1° or 2° past vertical to match a tilted fence or jig. At the other end, this allows you to tilt to 44° or 43° to complement an odd miter.

Build a Better Throat Plate

You can also improve performance (and enhance safety) by making custom throat plates. Most stock plates allow too much space around the blade, leaving the stock unsupported close to the cut, which increases tearout. In addition, small workpieces or waste can fall into this gap, ruining material and creating moments of high anxiety.

I build custom plates by laminating scrap countertop material to ½"-thick plywood or particleboard (*photo R*). I glue up an oversized piece, pencil the shape of the stock plate onto it, then bandsaw and sand the new plate to fit. On the underside, I drive four #8x½" flathead screws into ⅜"-deep holes to serve as levelers. I make the initial saw kerf with a smaller blade after trapping the new plate in place with the rip fence and a wedge. A word of caution: Don't saw the fence!

If the Saw Still Won't Cut

In some respects, a tablesaw resembles a car. Mechanics align car wheels

with 2° of "toe-in" so that at highway speed, when friction pushes the stance of the car open, the wheels end up pointing straight down the road. If, after a thorough tune-up, you still don't get good results, it's likely that your saw may be "opening up" too much.

You may simply have a blade problem, which is easy to diagnose and correct. A dull blade, or a blade with too many teeth and too little aggressiveness, can put up serious resistance. (Again, see "Anatomy of a Blade" on *page 64*.)

It's also possible that the arbor and tilting parts may have so much slop that the blade will never align—a problem we might call "radial-arm saw syndrome." Trying to correct this problem, however, could cost you a lot of money and even more grief. A new saw may be the better solution—provided you tune it as part of the initial setup. *Wj*

Photographs: The author

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Photo Q: On the Contractor's Saw, blade-tilt stops adjust by means of allen screws recessed into table in front of the blade.



Photo R: Make custom throat plates by laminating countertop material to plywood or particleboard. Install #8x½" flathead screws in the underside to serve as levelers.

Tablesaw Tune-up

Continued from page 68

dure takes two tries because the fence tends to slide out of alignment in the process of tightening.

Aftermarket rip fences like Delta's Unifence (*photo P*) and the Biesemeyer rely on a pair of adjustment bolts that control sliders riding against the guide bar. Pushing down the lock lever pulls the "tee" toward the guide bar, snugging it up against the sliders. Turning the left bolt clockwise, for example, moves the slider inward, which pushes that side of the head away from the bar. This adjustment moves the outfeed end of the fence closer to the blade.

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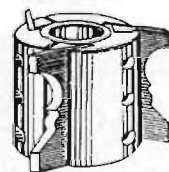
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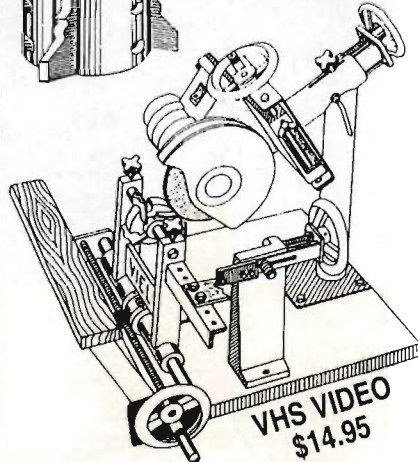
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by Jim Barrett

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We've all worked with routers, and a few of us have logged some time on stationary wood shapers as well. So what the heck is a router/shaper? Originally, this term was used to describe a conventional router mounted upside down in a shop-built or factory-made table—what we presently call a router table. With such a setup, you can perform shaping operations using router bits. (This essentially describes the Porter-Cable machine I've included in this review. See photo on page 76.)

However, three companies—Black & Decker, Delta, and Sears—now offer dedicated benchtop machines. Instead of a router mounted upside down in a table, these compact, fully

self-contained units more closely resemble a full-sized, cabinet shaper. They incorporate an integral, hard-wired motor and switch set into a cabinet-style base and include built-in spindle-height and lock controls. But, unlike their larger cousins, these router/shapers operate efficiently with 1/4"- and 1/2"-shank router bits, and also accept a 1/2" shaper spindle for use with 1/2"-bore, three-lip shaper cutters.

Of course, floor-model shapers, with their more powerful motors and larger-capacity spindles (5/8" to 1" shanks), enable you to make larger, more complex profiles in a single pass, especially if you're stacking two or more cutters on the spindle. On the other hand, a benchtop unit, though it

doesn't offer the capacity of a full-size shaper, doesn't require the sizeable cash layout that you'd have to make for a large, stationary machine replete with expensive cutters and a selection of spindles. If you already own a good assortment of 1/4"- and 1/2"-shank router bits, you're almost set; add a few 1/2"-bore shaper cutters, and you'll have a tool that offers more than enough versatility for most home woodworking projects.

How the Features Compared

While all of the units I tested for this article do essentially the same thing, you'll find certain differences worth noting. I'll mention a few major points

Delta router/shaper with matched molding cutters (separated by collar) shaping both top and bottom edges of 1 1/2"-thick stock in one pass.

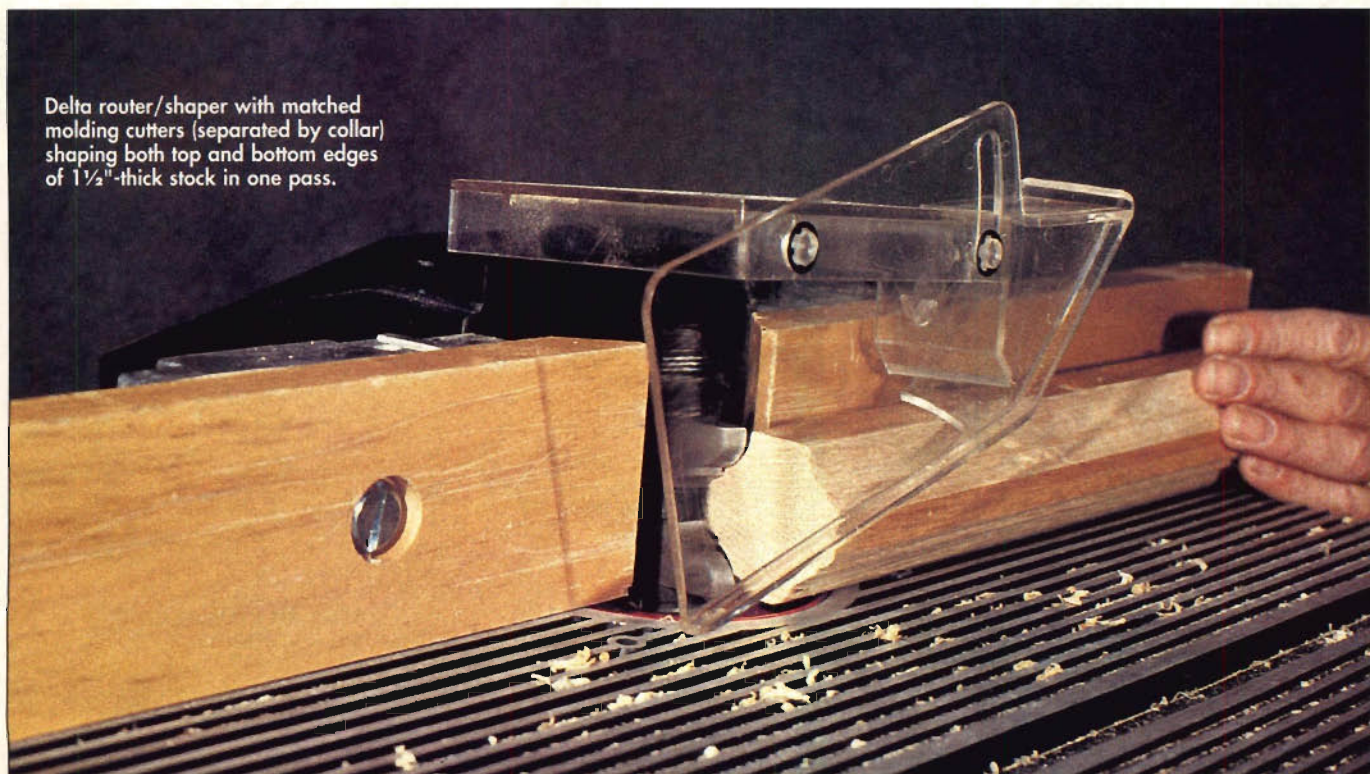




Photo A: The Black & Decker features an easily accessible "twist to lock" handle for adjusting spindle height. Other handy features include a separate forward-reverse switch and onboard storage for wrenches and miter gauge.

to consider before you buy a router/shaper, then discuss specific features of each machine in the individual descriptions starting on *page 75*.

Motors. As noted, the router/shapers from Black & Decker, Delta, and Sears have permanently wired motors, while the Porter-Cable features a detachable router body. The Black & Decker and Sears tools both use 9-amp universal motors (quite similar to each other in appearance) that run at approximately 2,400 rpm. On the Black & Decker, a set of reduction gears connects the motor to the spindle to produce a spindle speed of 10,000 rpm. Sears uses a belt-and-pulley drive to reduce spindle speed to 9,000 rpm.

The Delta carries a 9-amp brushless induction motor (like those used on stationary woodworking machines) and a belt to drive the spindle at 12,500 rpm.

On the Porter-Cable, the motor (or router body, if you prefer) has a no-load speed of 23,000 rpm. As with conventional routers, the bit rotates at the same speed as the motor shaft.

Engineers designed lower spindle speeds on the other machines for two reasons: first, lowering the speed increases torque, which helps prevent the motor from bogging down when making heavy cuts; second, to be safe, large-profile cutters must be run at lower rpm. (A note of caution: Never operate any shaper cutter or router bit at higher than its recommended speed.) The high-speed P-C, because it accepts only router bits, produces smoother cuts with smaller-diameter bits, but tends to bog down with large-

profile bits. (See comments under "How the Machines Performed" on *page 75*.)

Spindle Adjustment.

On all of these machines, you can adjust the spindle height, which raises or lowers the bit/cutter in relation to the table surface. Spindle travel ranges from $\frac{7}{8}$ " on the Black & Decker to $2\frac{3}{8}$ " on the Delta.

I particularly liked the adjustment mechanism on the Black & Decker (*photo*

A). It consists of a single large, accessible handle on the front of the machine that controls both the height setting and locking mechanism. Moving the handle left or right raises or lowers the spindle assembly in an inclined slot. Then, a twist of the same handle locks the spindle in position.

The Sears has a similar arrangement, but you'll find the adjustment knob on the back side of the machine in a less convenient location. The Delta has separate height-adjustment and locking knobs. Although these are not quite as handy as the "twist and turn" type on the B&D and Sears machines, the Delta provides a height-indicator scale for making fine adjustments, which the others don't.

To adjust the height on the Porter-Cable, you loosen a clamp on the router body (under the table) and twist the body itself to raise or lower the motor shaft, just as you would if you were using the router "right side up." However, the motor attaches to the table with the locking clamp on the back side. This makes it hard to access when you want to adjust the bit height from the operator's position.

If you're running a spindle with shaper cutters, you can also adjust cutter height by using collars or spacers as shown on *page 74*. With router bits, you can make height adjustments by raising or lowering the bit in the collet,

but you'll want to keep the base of the bit as close to the collet as possible ($\frac{1}{16}$ " to $\frac{1}{4}$ " clearance) to reduce chatter or runout. On all machines, a reversible plastic or metal table insert allows the bottom edge of larger bits or cutters to recess below the table surface when necessary.

Cutting Capacity. It's not so much the spindle height that determines the maximum thickness of stock you can shape; it's more the amount of clearance allowed by the clear plastic guard, under which the workpiece must pass. Likewise, the maximum diameter of cutter/bit profile that can be used depends on the guard dimensions, the table insert opening, and the maximum safe spindle speed. (I've included these specs for each machine on *pages 75 to 77*.)

Fences and Guards. All of these tools have a two-piece fence with individually adjustable infeed and outfeed halves. For operations that remove only a portion of the stock edge, you first line up the faces of the infeed and outfeed fences, then move both sections as a whole to align the fence with the cutter.

If you're removing the entire edge of a board (as, for example, in jointing

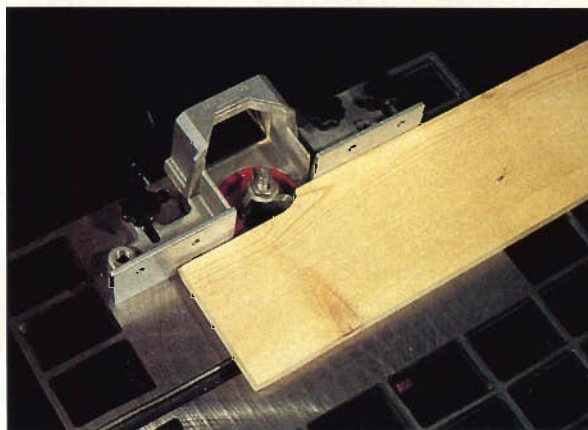


Photo B: On all machines tested (Sears shown), the infeed and outfeed fences adjust separately, so you can support the work on the outfeed side when shaping (or jointing) entire edge of a board.

or making a full bead), you can move the infeed (right-hand) fence separately, so that the outfeed fence supports the workpiece (*photo B*). While the machines are designed primarily for edge-shaping or routing, the Delta and Porter-Cable come with fences that can be set behind the centerline of the spindle, enabling you to rout straight

To introduce you to the advantages of owning a router/shaper, I'll summarize the basic operations described in the owner's manuals for these tools. To learn more advanced techniques, have a look at *Getting the Most Out Of Your Shaper*, available from Delta. Sears' *Craftsman Table Saw Handbook* includes a section on shapers that shows several jigs and fixtures you can make for the Craftsman machine.

Routing With the Fence. Most routing and shaping procedures require a fence. Even if you're using a piloted router bit or collars with the shaper cutters, you should use the fence to provide stability during straight cuts. When removing only a portion of the edge, set the infeed and outfeed fences on the same plane (figure 1).

Figure 1

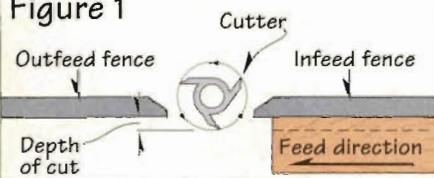


Figure 2

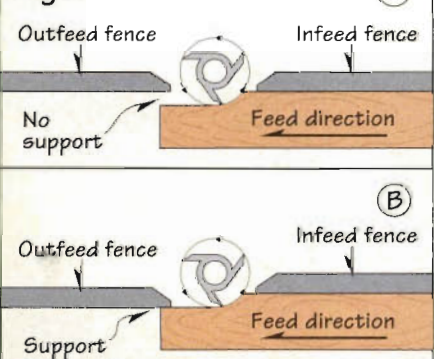
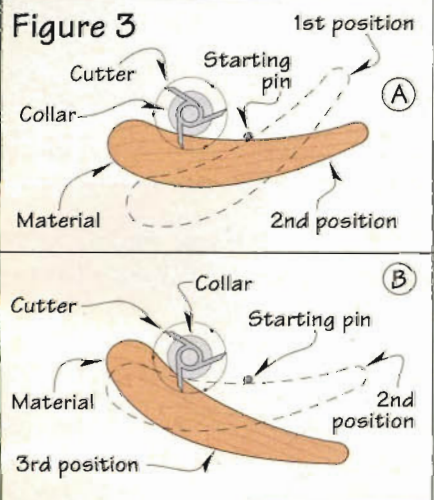


Figure 3



What You Can Do With a Router/Shaper

If the cutters or bits have collars or pilot bearings, set the fence to just clear these. If you're setting the bit to remove the entire edge of a piece, as when making a full bead, adjust the infeed fence so the shaped portion of the work will be supported by the outfeed fence (figures 2A and 2B).

Freehand Routing and Shaping.

On all of these router/shapers, the fence can be removed to rout or shape curved workpieces. Each tool comes with a starting pin (also called a radius pin) that inserts into the table to start the cut. (See photo C opposite.)

Freehand routing or shaping operations require a piloted router bit or shaper cutters fitted with a collar to support the part of the workpiece not being shaped. To start the cut, first place the work against the starting pin, then swing it into the cutter until the edge of the board contacts the collar or pilot bearing (figure 3A).

After starting the cut, press the workpiece against the collar or pilot and swing it away from the starting pin (figure 3B). The collar or pilot then serves as the guide. Feed the workpiece against the rotation of the cutter until finished.

Positioning Collars. Collars or spacers position the shaper cutters higher or lower on the spindle, both for freehand and fence-guided shaping. By mounting the collar under the cutter, you can watch the progress of the cut at all times (figure 4). With this setup, however, it's easy to lift the workpiece into the cutter, which will gouge and ruin it.

With the collar positioned above the cutter, you won't be able to watch the action (figure 5). However, any accidental lifting of the work will not gouge

it, nor will the cut be affected by any slight variation in stock thickness.

Figure 6 shows two cutters being used with a collar inserted between them as a spacer. You can also buy cutters in matched sets for shaping both edges of the work at once, as shown in the lead photo on page 00. If using a collar to guide or support the workpiece, make sure it provides sufficient bearing surface for the edge being shaped (figure 7).

All of the machines come with plastic ring guards for freehand shaping. The P-C and Sears tools use the ring guard for shaping or routing with the fence as well. Black & Decker and Delta provide a separate plastic guard for fence operations. (The Delta guard is shown in the lead photo on page 72.)

Figure 4

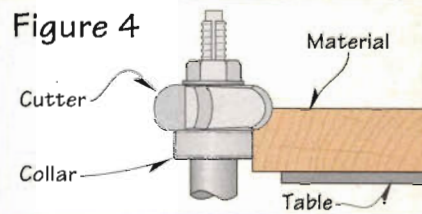


Figure 5

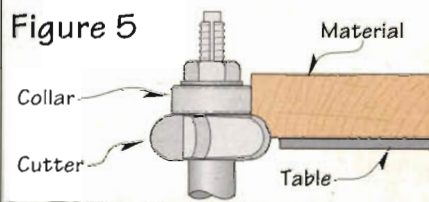


Figure 6

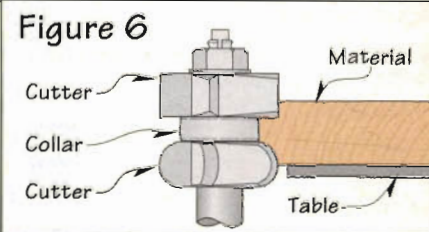


Figure 7

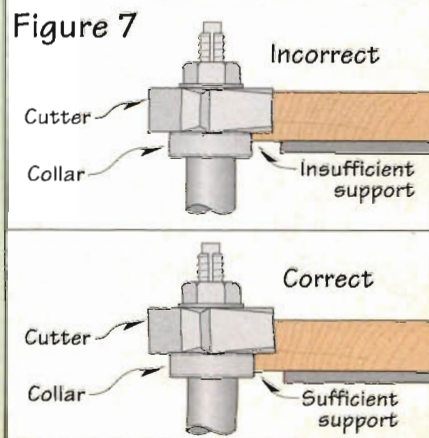




Photo C: To do freehand or curved shaping, remove the fence and insert a starting pin in the table. After you start a cut, the shaper collar or pilot bearing supports the work. All machines come with plastic ring guards for this operation (B&D shown).

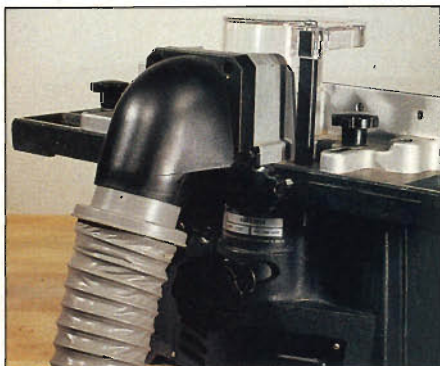


Photo D: The machines I tested incorporate dust chutes that accept 2 1/2" shop vacuum hoses. If not hooked up to a vac, the chutes tended to clog with chips unless they were detached from the table.



Photo E: A few operations call for a miter gauge, such as shaping the end of a board (Delta shown). This nice, sturdy gauge from Delta fits the P-C as well and accepts an optional hold-down clamp.



Photo F: Delta's optional table extension comes in handy when shaping long boards or large panels.

grooves, slots, or beads along the bottom face of the work. (On the Delta, the cut can be centered about 1" in from the board edge; the P-C allows you to center it about 2" in from the edge.)

In addition, all of these machines can be adapted for freehand (curved) shaping with shaper cutters and collars by removing the fence and inserting a starting pin in one of two locations on the table. The pin supports the workpiece at the beginning of the cut. After you start the cut, the shaper collar or bearing then provides the necessary support (*photo C*). (For more about shaper operations, see "What You Can Do With a Router/Shaper" *opposite*).

Dust Collection. Benchtop units produce mounds of chips and shavings in short order. All of the machines except for the Porter-Cable come equipped with a dust chute that fits 2 1/2" shop vacuum hoses. (Sears also includes a 2 1/2" to 1 1/4" adapter.) The chute attaches to the fence bracket behind the spindle (*photo D*), although it fortunately can be removed. During my tests, the dust ports quickly became clogged with chips and shavings if not hooked up to a vacuum.

Miter Gauges. All of the tables on these machines have a miter-gauge slot, which can also be used for other homemade jigs and fixtures. Black & Decker includes a miter gauge as part of the standard package; the other manufacturers list it as an optional accessory. (The Delta gauge also fits the Porter-Cable.)

The only use I can think of for a miter gauge is shaping or routing the ends of a board (*photo E*). Even with a gauge, this operation invites trouble. I'd add a hold-down clamp or use a backup board to help keep the stock square against the fence.

How the Machines Performed: An Overview

Black & Decker SR650. Although this unit costs the least, it offers some nice features that make it one of my favorites. In addition to the easily accessible spindle-height adjustment, it also has a forward/reverse switch. This feature comes standard on many floor-model shapers, but you won't find it on any of the other benchtop models I tested.

The switch has a flip-up plastic safety cover to prevent accidental motor reversal during operation. By reversing the spindle rotation, you can flip the shaper cutter upside down on the spindle, then feed the stock from left to right to achieve an inverted profile. This feature enables one cutter to do the work of two, such as cutting matched profiles on the top and bottom edge of a workpiece.

The B&D doesn't have quite the power of the Delta, although it matches the Sears pretty equally. (As mentioned, the two motors look virtually identical.) However, it has ample power to match the machine's size and capacity. (Keep in mind that these

Black & Decker model SR650

Motor: 9-amp, universal
Spindle speed: 10,000 rpm
Spindle travel (vertical): 3/8"
Cutting capacity (thickness): 3 1/2"
Maximum cutter diameter (recommended): 2 1/2"
Fence size (each segment): 2 3/4 x 7 7/8"
Fence material: medium-density fiberboard
Table size, material: 15 1/4 x 18 3/4", aluminum
Net weight: 28 lbs.
Average street price: \$200



Delta model 43-505

Motor: 9-amp, induction
Spindle speed: 12,500 rpm
Spindle travel (vertical): 2 $\frac{1}{4}$ "
Cutting capacity (thickness): 3 $\frac{3}{8}$ "
Maximum cutter diameter (recommended): 3 $\frac{1}{2}$ "
Fence size (each segment): 2 $\frac{3}{4}$ x11 $\frac{1}{2}$ "
Fence material: hardwood
Table size, material: 18x20", aluminum
Net weight: 53 lbs.
Average street price: \$285



units were designed for the home shop rather than for heavy production use.)

While this unit's lightweight plastic base doesn't feel as durable as the metal bases on the other units, it does reduce the weight of the machine significantly, making it easy to lift it on and off the bench. However, I definitely would bolt this one down to reduce machine vibration and "walking." The engineers thoughtfully designed in onboard storage for wrenches, miter gauge, bits, cutters, and other accessories. The stock miter gauge seems a bit wimpy to me for the size of the machine.

Standard B&D accessories include wrenches, two plastic guards (a cup-type guard for use with the fence and a ring guard for freehand shaping), a dust chute, $\frac{1}{4}$ " and $\frac{1}{2}$ " collets, a table insert, and a $\frac{1}{2}$ " shaper spindle. Unfortunately, B&D comes up short in the optional accessories. Other than router bits, there were none available at the time of this writing. I'd like to see, at the least, a good selection of table inserts, a leg set, and a table extension. You'll also need to buy the shaper cutters and collars from another company.

Delta 43-505. This machine provided power to spare. With its 9-amp induction motor, the Delta was hard to stop. I took full cuts in fir 2x4s using the larger shaper cutters and experienced very little bogdown. (As standard practice, however, I still suggest

making deep cuts gradually in several passes to extend motor life and produce a cleaner cut.)

Delta features a sturdy, easily adjustable hardwood fence; a large, well-machined ribbed aluminum table; and a heavy-gauge stamped-steel base. At 53 pounds, this machine outweighed the other three; the extra weight, however, works both for and against the tool. Although it's a job to lift the Delta on and off the bench, the machine will support smaller work without being bolted or clamped to the bench. (I was able to run 48" 2x4s through it without any walking. Even so, I'd bolt the unit to a piece of plywood, then clamp it to the bench.)

The basic machine comes with a clear plastic lift-type cutter guard for

use with the fence (like those on table-saws) as well as a plastic ring guard and starting pin for freehand shaping. Also included are $\frac{1}{4}$ " and $\frac{1}{2}$ " collets, a dust chute, a table insert, and wrenches. Surprisingly, the tool doesn't come with a $\frac{1}{2}$ " shaper spindle; it must be ordered as an optional accessory.

To shape long stock, I'd recommend the optional table extension (*photo F*). You can also buy an optional leg set to make it a stationary machine. Other accessories include a solid, heavy miter gauge, a hold-down clamp attachment for same, a plastic table insert you can trim to fit shaper cutters of $\frac{1}{2}$ " to 2 $\frac{3}{4}$ " diameter, a special table insert for use with template guides, and a large selection of spacing collars.

Porter-Cable 695. Competitors may argue that the P-C is not a "true" router/shaper as defined in this review, but I include it here for several reasons. As mentioned earlier, it uses a router motor inverted under the factory-made table. The table offers most of the features found on the dedicated machines: fully adjustable infeed and outfeed fences; an overhead cutter guard; a separate, stand-mounted on/off switch; a dust-collection port; and a miter-gauge slot (which accepts Delta's miter gauge).

Adjusting the cutter height requires loosening the retaining clamp screw and rotating the router body—not as convenient as on the dedicated machines, but not that much of a

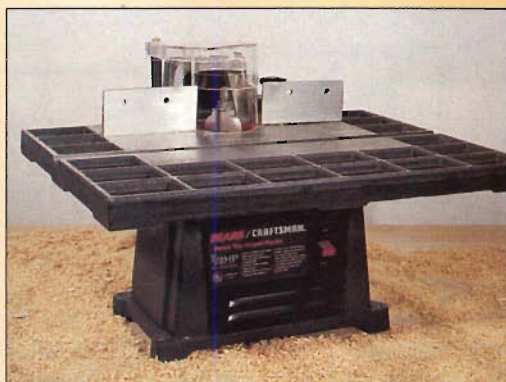
Porter-Cable model 695

Motor: 10-amp, universal
Spindle speed: 23,000 rpm
Spindle travel (vertical): 2 $\frac{1}{4}$ "
Cutting capacity (stock thickness): N/A
Maximum cutter diameter (recommended): 2 $\frac{1}{2}$ "
Fence size (each segment): 2 $\frac{3}{4}$ x11"
Fence material: hardwood
Table size, material: 16x18", aluminum
Net weight: 38.8 lbs
Average street price: \$250



Sears Craftsman model 23910

Motor: 9-amp, universal
Spindle speed: 9,000 rpm
Spindle travel (vertical): $\frac{3}{4}$ "
Cutting capacity
(stock thickness): $1\frac{1}{2}$ "
Maximum cutter diameter
(recommended): $2\frac{1}{2}$ "
Fence size (each
segment): $2 \times 4\frac{1}{4}$ "
Fence material: aluminum
Table size, material:
 $13\frac{3}{4} \times 17\frac{1}{4}$ ", cast iron
Net weight: 48 lbs.
Catalog Price: \$210 plus s/h



hassle, either. The unit comes with separate $\frac{1}{4}$ " and $\frac{1}{2}$ " collets and retaining rings, rather than a $\frac{1}{4}$ " insert for a $\frac{1}{2}$ " collet as on the other machines—a nice touch. And, if you happen to have a few old $\frac{3}{8}$ "-shank bits lying around the shop, you can buy a $\frac{3}{8}$ " collet for this tool and use them.

While the Porter-Cable can't be modified to accept shaper cutters, it does offer other advantages. You can buy the stand and motor as a single unit (sold as a "router/shaper"), or, if you already have a P-C router, you can purchase the stand separately. The table has mounting holes that will fit most P-C and Rockwell routers without detachment of the router's subbase. (Check the P-C catalog for compatible models.)

Conversely, if you buy the entire unit, you can easily detach the motor (held in place by three mounting screws). Then, fit it with one of several available base and handle configurations and use it as a conventional router or plunge router. P-C also offers a leg set for converting it into a stationary machine.

While the high-speed, direct-drive motor provides less torque than the other machines, it does produce nice, clean cuts with most router bits if you feed the stock slowly. If you expect to use large, $\frac{1}{2}$ "-shank panel-raising bits or other large-profile bits with this tool, I'd suggest buying the table separately and fitting it with one of P-C's gutsier variable-speed routers. With some larger routers, you'll need to place riser blocks under the table legs to accommodate the longer motors.

While the P-C has a plastic ring guard (shaped somewhat like a derby hat), the guard doesn't drop down low enough to completely cover the cutter when used with the fence. It's possible for your fingers to contact the cutter during operations if a portion of the bit extends above the top edge of the board. In fact, none of the guards on any of these machines will protect you if you accidentally slip your hand underneath it when finishing the cut—a strong case for using push blocks or a push stick, just as you would on a tablesaw or jointer.

Sears Craftsman 23910. This new release features a much larger table than the one on Sears' previous model, providing up to 50% more work space. The sturdy cast-iron table and base make the unit nearly as heavy as the Delta, although it is much more compact. The extra weight reduces vibration considerably, although the oversized table (in relation to the small base) makes this tool a bit top-heavy. As with the other machines, you'll want to secure it to a bench or stand to prevent tipping and walking.

Unlike the other units, the Craftsman doesn't come with wood or MDF fence extensions, the idea being that you can make your own from scrap to suit the type of work you do. I'd recommend drilling counterbored slotted holes in the extensions like those provided on the Porter-Cable. This would allow you to adjust the fence laterally to provide maximum support for the

stock, depending on the size of cutter or bit you're using.

Accessories include a spring-type hold-down that helps keep the board flat on the table and tight against the fence. This feature comes in especially handy when you're shaping short or narrow workpieces. A set of five shaper collars and a miter gauge round out the optional parts list.

The Final Analysis

All four machines performed well and were easy to set up and adjust. The Delta proved to be the sturdiest and most powerful of the lot, but it also carries the highest price tag. If you plan to use the tool frequently or handle much large stock, this is the unit I'd go with.

For a "home shop" machine, I'd definitely favor the Black & Decker because of its numerous useful features as well as its attractive price. If you want maximum versatility, go with the P-C (or at least buy the table). You can convert the detachable motor into a separate router by mating it with any of the router base and handle configurations offered by the firm. *WJ*

Photographs: The author

SOURCES

Black & Decker
Consumer Services
P.O. Box 618
Hampstead, MD 21074
800/762-6672

Delta International
Machinery Corp.
246 Alpha Drive
Pittsburgh, PA 15238
800/438-2486

Porter-Cable
Young's Crossing at Hwy. 45
P.O. Box 2468
Jackson, TN 38302-2468
800/321-9443

Sears Craftsman
Catalog Orders: 800/377-7414
Or contact nearest Sears store

SHOP TEST

The Exact Cuts alignment kit is marketed by Exact Cuts Tool Co., Inc. of Florence, Oregon. With it, the firm claims, you can align a tablesaw's blade parallel to the miter-gauge slot quickly and accurately, or, on a radial-arm saw, set the heel of the blade parallel to the arm. You can also set miters and bevels from 90° to 45° on either saw using the "A"-Justable Square.

The alignment kit (shown at right) includes the "A"-Justable Square and a heel and arbor bar machined from high-grade aluminum plate. The square, fabricated from nylon and reinforced with fiber-glass, has solid-brass connecting hardware. Degree markings from 45° to 90° in ½° increments are imprinted on both sides. The kit also provides instructions, a compound-angle chart, and paper templates on which to record special or often-used setups.

Testing the Kit On My Saws

To test the kit, I performed several basic tablesaw adjustments: aligning the heel, setting the 90° and 45° bevel stops, and setting the 90° and 45° miter-gauge stops.

First, the heel alignment: As you know, the blade on a tablesaw must align parallel with the miter-gauge slots. I've observed that heel mis-

alignment accounts for more poor saw performance than any other single problem. How to diagnose this condition? If you find it impossible to make a perfectly square cut, if the work binds at all points of a miter-gauge crosscut, if the workpiece burns on the end, or if the workpiece tends to creep as you make the cut, you have an alignment problem.

To align the heel, I first unplugged my saw's electrical cord, then removed the saw blade. Next, I installed the arbor bar from the kit on the arbor and connected the heel bar to it using the fasteners provided with the kit. I then adjusted the height of the arbor so the heel bar rested flat on the saw table.

To measure, you position the head of a try square in the miter-gauge slot and adjust its blade to touch the heel bar (*photo A*). The heel bar then swivels 180°, and you read the measurement at the rear of the saw. With information from my saw's manual, I was able to bring the table into perfect alignment with the blade in less than 10 minutes.

With the two bars still installed, I used the adjustable square to set the 90° and 45° stops on the miter gauge (*photo B*). Double-checking these set stops with a large 45/90° drafting triangle that I know to be dead accurate, I found

that the stops were off slightly.

In double-checking my procedure, I concluded that two problems caused the error. For one, it was difficult under my normal shop lighting to discern whether the edge of the adjustable square was flush with the heel bar. Against the dark background of my saw table, the square's black color made it tough to detect any void between it and the shiny heel bar. Adding more direct light helped.

The second problem I encountered was getting consistent accuracy with the adjustable square. It apparently was designed to read exactly 90° when fully opened and exactly 45° when closed. This proved true of the 45° setting, but I had trouble setting

A New Tool To Help Align Your Tablesaw Exact Cuts Alignment Kit

by Bob Colpetzer



Exact Cuts alignment kit includes machined aluminum arbor and heel bars, fasteners, and "A"-Justable square.



Photo A: Using the arbor and heel bars and a combination square to align the saw table with the saw arbor.

90° accurately without using a square. I had more consistent results using my drafting triangle to align the miter gauge to the heel bar.

During this test, I found that the degree markings on the square did not match from one side to the other. The deviation amounted only to the thickness of a line, but it was enough to cause a setup error.

To set the 90° and 45° bevel stops, I removed the heel bar but left the arbor bar attached (*photo C*). I checked the adjustable square to make sure it was set at 90°, then placed it against the arbor bar. I had no trouble performing this setup. Even the slightest void allowed light to show through. In this case, the black color of the square proved helpful by emphasizing any misalignment.

With the arbor bar adjusted to 90° to the saw table, I set the bevel stop so the blade could be returned to 90° without repeating the entire procedure. (You'll need to refer to your owner's manual for information on setting these stops.) I set the 45° stop the same way after aligning the arbor to the 45° angle of the adjustable square.

I also used the kit to set miter and bevel angles of other than 45° and 90° as well as some compound angles. I got the most accurate settings when I checked the adjustable square setting against the protractor head on my combination square. I found too that when setting bevels approaching 45°, it became harder to remove the arbor bar and install the

saw blade once I'd set the bevel. This was possible on my saw but may not be on other models. Check to see if you can remove/install the saw blade with the arbor tilted to 45°. If you can, you'll be able to use the kit.

Setting Up My Radial-Arm Saw

Aligning my radial-arm saw has always been tedious. Part of the problem is the limited blade-to-fence contact area available for making accurate measurements.

With the arbor and heel bars and an accurate cabinetmaker's square, however, I found it easy to align the heel with the table, square the blade to the table, and square the blade to the fence. I was pleasantly surprised because my radial saw, like most others, needs to be finetuned frequently. The ease and quickness that the kit provide will definitely encourage me to keep the saw tuned.

Using the kit to set miter and bevel stops on the radial saw also proved to be easy and accurate, especially when I double-checked the "A"-Justable Square as I did when making my tablesaw adjustments.

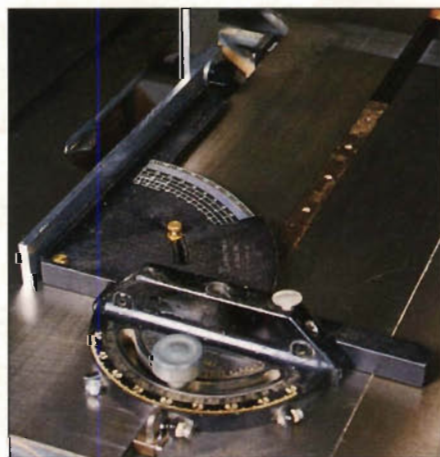


Photo B: Using the arbor and heel bars with the "A"-Justable Square to set the miter-gauge stop to 90°.

My Conclusions

During the testing, an Exact Cuts rep told me that the firm was working to improve the accuracy of the degree markings on the "A"-Justable Square. The first square I received had curved legs, so I sent it back. The firm replaced the defective part, no questions asked. Although I also have some difficulty with the "A"-



Photo C: Setting the bevel angle using the arbor bar and "A"-Justable Square.

Justable Square, I was able to work around the slight inaccuracies of the markings.

I especially liked the way the square stands on the saw table without falling over. This is very helpful when setting the bevel angle. The heel and arbor bars also proved to be a help in making quick and accurate adjustments and setups on what have previously been tricky and time-consuming jobs.

At \$59.95, the kit isn't cheap. Improving the accuracy of the degree markings would help make it more than worth the cost.

Exact Cuts Alignment Kit. Exact Cuts Tool Co., Inc., P. O. Box 268, 5306 Boy Scout Rd., Florence, OR 97439. Telephone 800/643-7411. 

Photographs: The author

SHOP TEST

Forrest 8" Dado Set

by Charles Sommers

We expect a lot from our dado sets these days. We want clean, perfectly flat-bottomed grooves, splinter-free edges in all kinds of stock, and the flexibility to match the exact thickness of the many undersized plywoods we encounter. The Forrest carbide dado came as close to acing all of these expectations as any we've seen.

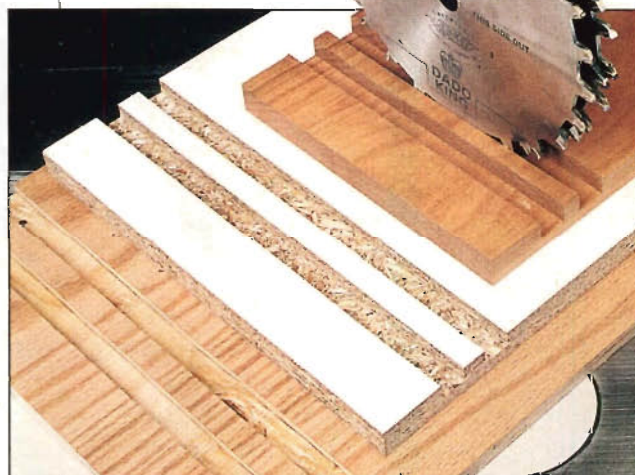
The 8" set we tested comes with two $\frac{1}{8}$ "x24-tooth carbide-tipped blades (top-beveled alternated with flat raker), a set of six four-tooth chippers (four $\frac{1}{8}$ ", one $\frac{1}{16}$ ", and one $\frac{3}{32}$ "), and five Mylar shims. Using different combinations of these 13 parts, you can cut grooves from $\frac{1}{8}$ " to $\frac{29}{32}$ " wide in $\frac{1}{32}$ " increments. Part finish was consistent with what we've observed on other Forrest saw blades.

Points of Difference

The blades and chippers attack the work at a negative hook angle. This means that you'll need to apply a bit more feed pressure than with a positive hook angle, but you'll end up with less tearout and splintering at the edges of the cut. The four-tooth chippers undoubtedly cost more to produce than two-tooth chippers, and should theoretically operate more smoothly and produce better results.

We ran the dado set through a series of tests on our three test saws (Delta Unisaw, Delta Contractor's Saw II, and Craftsman Contractor) using solid hardwoods, veneer plywoods, and melamine. The dado performed exceptionally well on all three

saws. Groove bottoms came out admirably flat and square in all tests. We observed no edge-chipping on the hardwoods or veneer plywoods. Crosscut dados in the melamine showed very slight edge-chipping, but they still fell within our range of acceptable standards.



A Couple of Surprises

In one instance, while we were cutting $\frac{3}{4}$ "x $\frac{3}{4}$ " grooves in solid cherry on the Craftsman saw, the sidewalls scorched. This did not happen when we tested the same setup on the other two saws using the same stock. Although we had fine-tuned the three saws beforehand, we suspected an alignment problem with the Craftsman miter gauge. Additional checks confirmed a very slight misalignment that was enough to cause a problem with the scorch-prone cherry.

In another run on our aging Unisaw, we observed an unevenly cut bottom; one of the $\frac{1}{8}$ " chippers had cut slightly

deeper than the others. Disassembling and then reassembling the head solved the problem. We were not able to reproduce this situation in subsequent tests on any of the saws or with any combination of chippers. Nor did a check of chipper circumferences reveal any offending part.

After additional checking, we concluded that on that particular setup, one of the chippers must have been positioned over a slightly worn spot on the arbor or at a point where the thread tapers into the shaft.

This "play" apparently off-centered the chipper just enough to cause the uneven cut.

Although we observed no blade or chipper failure, we did encounter trouble with one of the $\frac{1}{8}$ " chippers—part of a carbide tooth broke off during a test. This failure occurred within the carbide tip itself; the brazing was sound. We returned it to Forrest to be repaired, and the chipper now works fine. If it hadn't been marked, we wouldn't be able to identify it.

Our Verdict

Our Forrest dado produced exceptionally level groove bottoms and smooth side cuts in all of our test materials with virtually no nicking or splintering. The cutting rate was fast, and we were able to combine cutters and shims to match the exact groove width we wanted.

The dado set carries a premium price tag, but if your woodworking requires this quality of cut, you certainly should consider the Forrest.

Tested: Forrest 8" Carbide Dado Set, $\frac{5}{8}$ " bore, includes six 4-point chippers, five Mylar shims. List: \$299; sale: \$245. W

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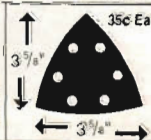
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