

TOOL TESTS: SLIDE COMPOUND-MITER SAWS; ROBLOID X31; INCRA ULTRA-TS

WOODWORKER'S JOURNAL

Vol. 21, No. 3 May/June 1997

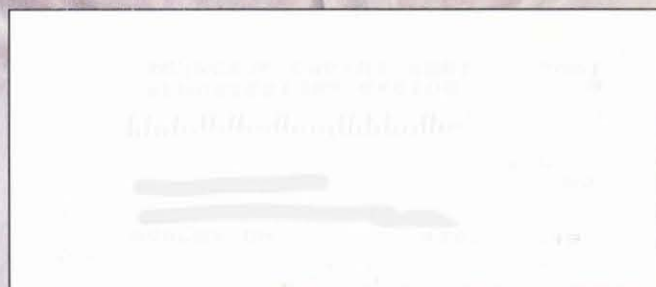
PEDESTALS

DECORATIVE
CLASSICS Page 46



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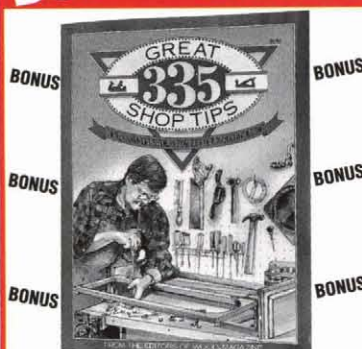
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8"x40T 3/32"	\$136	\$99	\$89	\$79
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Delta 9"x80Tx5/8"	\$204	\$119
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Fine Woodworking Magazine test Oct. 96 page 43

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

Rick Price

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WOODWORKER'S JOURNAL

Vol. 21, No. 3 May/June 1997



60



30



66

PROJECTS

30 Corner-Keyed Blanket Chest

Here's an attractive, easy-to-build plywood chest that's just right to set at the foot of your bed

46 Cover: A Gallery Of Pedestals

Five stately stands that harmonize with any home decor

56 Shadow Boxes

A dramatic way to display your precious collectibles

60 Shop-Built Trammel

A functional, heirloom-class tool



56

FEATURE

66 Greenwood Chairmaking

A rural West Virginia craftsman keeps a venerable tradition alive

TOOLS AND TECHNIQUES

16 Shop Test: Robland X31

After spending a year with this machine, we report our findings

22 In the Shop: The Bench Plane

Jim Tolpin tunes these instruments to make them sing sweetly

36 Woodworking Basics: Accuracy

Techniques and practices that can make you a better craftsman

41 In the Shop: High-Tech Hand Saws

If you haven't looked at hand saws lately, you're in for some surprises

76 Hands-On Report: Incra Ultra-TS

Daru Stevens explains why he uses this precision tablesaw fence

80 Tool Review: Sliding Compound-Miter Saws

We test 13 of the newest, most feature-laden machines available



80

DEPARTMENTS

4 Shoptalk

6 Reader Letters

10 Shop Tips

12 Woodworker's Club Spotlight

14 Product News

cover photograph: Kevin May
Art Objects: Courtesy of The Calla Lilly, Peoria, Ill.

**TOOL CHEST
DRAWING
WINNER!**

SHOP TALK



Notice the smiling woodworker in the photograph: John Kunte of Rome, Pennsylvania, had just unpacked the *Woodworker's Journal* tool chest he'd won by completing and returning our survey questionnaire last fall. When I last visited with John, he hadn't yet decided whether the attractive chest would stay in the family home for all to admire or quietly find its way into his woodshop.

In case you missed the plans and would like to build a Breakfront Tool Chest like John won, have a look at our July/August '96 issue, pages 26-34.

Several readers have told us about an outstanding exhibit of furniture and other fine woodworking at the Misugi Designs gallery in Berkeley, California. The collection, assembled by Kayoko Kuroiwa and Bruno Welz, includes pieces by James Krenov, several of his students, and other excellent cabinetmakers.

Former *Woodworker's Journal* assistant editor Craig Moro has several chip-carved boxes in the show also. Other items on display include lamps, accent pieces in both wood and ceramic, and unique handmade woodworking tools.

Unfortunately, I didn't learn of the exhibit until after I'd returned from a recent trip to San Francisco. If you'll be visiting the Bay area during the next few months, consider adding the gallery to your itinerary. It's located at 2233 5th Street in Berkeley (telephone 510/549-0805).

The reception you've given our Frank Lloyd Wright-inspired Prairie Lantern (Nov./Dec. '96) has us happily surprised. Quite a number of you have written or e-mailed us to report on your experiences building this unusual piece. One reader said he'd already made three and was starting his fourth! We enjoy developing unique designs like the lantern, so drop us a line if you have a special project you'd like to see us work up.

We're also delighted with your response to the magazine's newest departmental feature, *Woodworker's Club Spotlight*. In this issue you can read about the activities of the 500-member strong Northeastern Woodworker's Association centered in the Albany, New York area. Like the other clubs we've reported on, they carry on a wide variety of educational, social, and community-benevolent activities.

I feel strongly that participating in a woodworking club is a great way to further one's enjoyment of this great hobby. If you don't know if there's an active club in your area, check with your local tool or hardwood supplier. They'll gladly put you in contact with a local club.

Charles Sommers

WOODWORKER'S JOURNAL

<http://www.woodworkersjournal.com>

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2 News Plaza, P.O. Box 1790
Peoria, IL 61656
Customer Service 1-800-765-4119

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Woodworker's Journal (ISSN 0199-1892) is published bimonthly in Jan./Feb., Mar./Apr., May/Jun., Jul./Aug., Sept./Oct., and Nov./Dec. by PJS Publications, Inc., P.O. Box 1790, Peoria, IL 61656. Telephone (309) 682-6626. Periodicals postage paid at Peoria, IL and additional offices. Copyright 1997 by PJS Publications, Inc. No part of this publication may be reproduced by any method without permission from the publisher. Subscription Rates: In the United States and its possessions—One year (6 issues): \$21.98; Canada—One year: \$32.08 (U.S. funds), includes 7% GST.

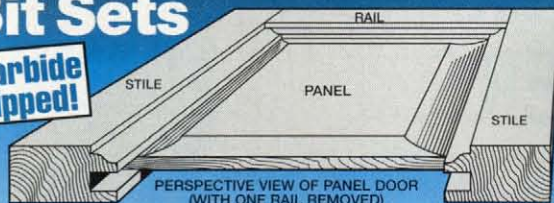
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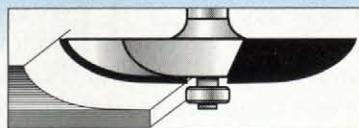
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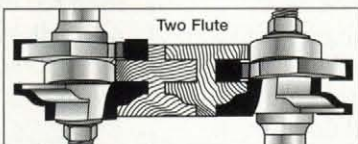
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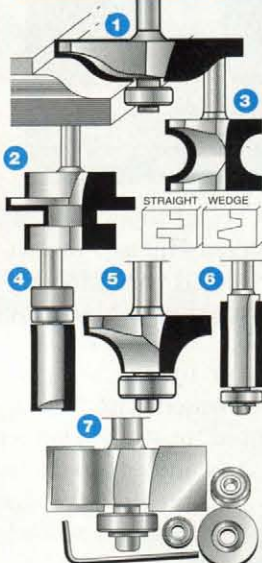
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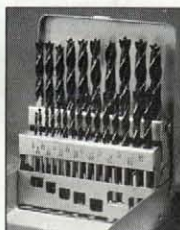
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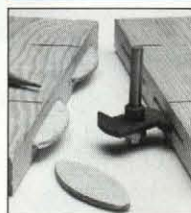
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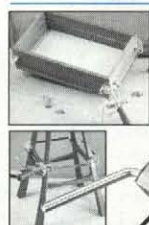
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**TOOL-PRIZE
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READER LETTERS



Enclosed is a photo of the Contemporary Hall Table, featured in the May/June '96 issue of *Woodworker's Journal*. I build my table out of red oak. As you can see, it fits very nicely in my hallway.

*George Sarault
Danielson, Conn.*



I used the Rosette router Jig from the Jan./Feb. '96 issue, as shown here, to decorate the pieces I made for a bedroom set. I enjoy your magazine very much.

*Dan Uncaphur
Littleton, W. V.*



*Walter Strauss
Boca Raton, Fla*



Here is my version of the lace-work mirror featured in the Jan./Feb. '96 issue of *Woodworker's Journal*. I enlarged the design to fit over my medicine cabinet door and used red oak and a natural finish to match the vanity. The lacework part opens out for easy cleaning of the mirror.

*Frank Mutnansky
Chicago, Ill.*



As the technical supervisor of our university theater department, I appreciated your Mobile Plywood Storage Rack (March/April '96). I developed a larger, two-sided version based on the figures and dimensions provided. The base is a regular castered theatrical platform framed with 2x4s and covered with $\frac{3}{4}$ " plywood. This project saves us a lot of lifting, carrying, and restacking. Thanks for the easy-to-follow building instructions.

*Keith Duster
Iowa State University Theater
Ames, Iowa*

Tool Prize Winner

For being selected as the winner of the tool-prize drawing, George Sarault will receive a Makita model 6233DWAE cordless drill. This 14.4-volt cordless drill features a 2.0 amp/hour battery for extended run time, two variable-speed settings, a keyless chuck, and externally accessible brushes. The names of readers whose project photos appear in Reader Letters are entered into a tool-prize drawing for each issue. To become eligible, send us a good photo and description of a project you've built from the pages of *Woodworker's Journal*. Send your submissions to: Reader Letters, *Woodworker's Journal*, P.O. Box 1790, Peoria, IL 61656.





The English Pub Table in the July/August '96 issue of your magazine caught my fancy, and after some study I concluded that it would be a challenge to reproduce this table in one-quarter scale. My version stands 7½" high, and the table measures 9x9" retracted or 14½" extended. The chair is my interpretation of the one pictured in the magazine. As the Brits would say, "Good show!"

Frederick Bowen
Kimberton, Pa.

I recently finished the gun cabinet from the September/October '91 issue for my son-in-law. I used walnut throughout, including a solid back where you specified plywood. Your projects still keep me busy, and I appreciate the different ideas.

Charles Groves
Woodlawn, Ill.



Continued on page 9

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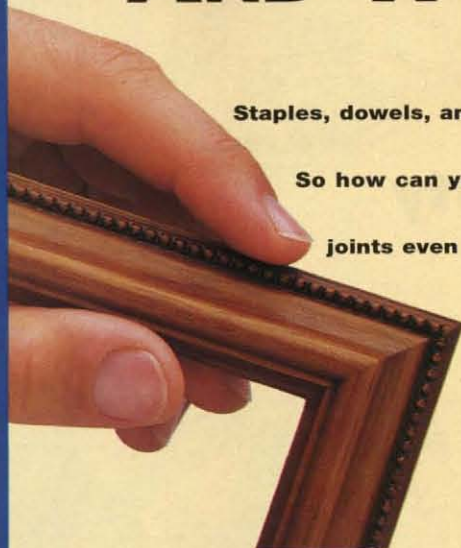
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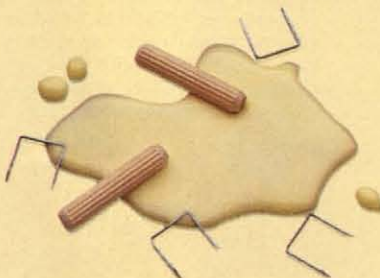
Detail Biscuit Joiner, that's how.



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READER LETTERS

Continued from page 7

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In the Nov./Dec. '96 issue of your magazine, we were a little disappointed in not being cited as a source for screws, fixtures, and the like. On pages 61-63 of our catalog, we list over 100 screws and kits. We sell millions of screws and hope you will look to us as a source in the future.

Steve Erbach
Vice President, Grizzly Imports, Inc.
Bellingham, Wash.

Editor's note: For a copy of Grizzly Import's 178-page catalog, call 800/523-4777 (east of the Mississippi), or 800/541-5537 (west of the Mississippi).



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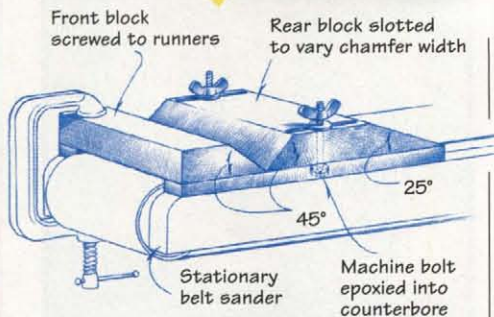
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Stationary Belt-Sander Fixture Provides Quick, Accurate Chamfers

Rather than cut chamfers with a saw blade, I built this adjustable fixture for my stationary belt sander. To use it, simply clamp the fixture to the side rails of the belt sander, turn on the machine, and lower the workpiece into the V-groove formed by the two blocks.

The front angle block attaches to the $\frac{1}{2} \times \frac{3}{4}$ " runners with screws and glue, but the rear block is secured with hex-head machine bolts and wing nuts. The machine bolt heads are recessed into the bottom of the runners and held in place with epoxy. The slots in the rear angle block allow it to be positioned at various distances from the front block, so you can increase or decrease the chamfer's width. An additional bevel angle can be machined on the other end of the rear block to increase the fixture's usefulness.

*Gale Ramerman
Bellingham, Wash.*

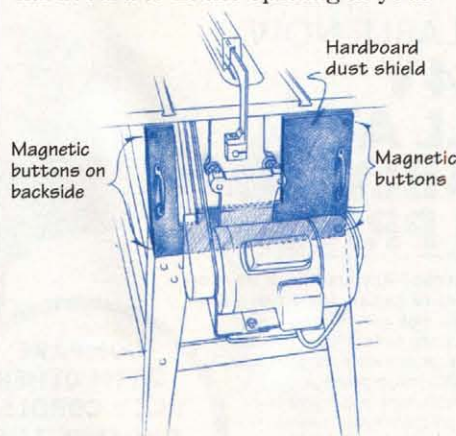
SHOP TIPS

Magnetic Catches Make Dust-Shield Removal Easier

The opening in the back of a contractor-style tablesaw provides clearance for the arbor and motor when making bevel cuts. Unfortunately, this big opening also makes efficient dust collection nearly impossible.

To solve this problem, I came up with this removable dust cover. When the blade is vertical, the shield covers most of the opening. Held in place with magnets, it can be removed quickly when you need to tilt the blade.

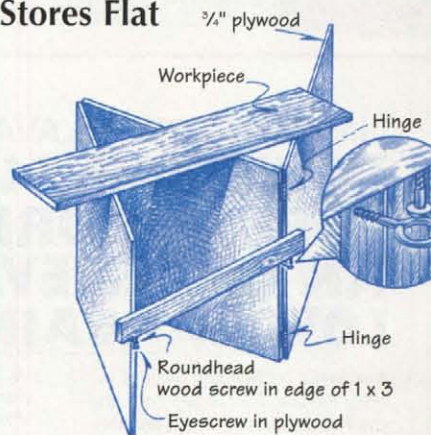
Cut the shield from $\frac{1}{4}$ " plywood or hardboard to fit the opening in your



saw's cabinet, and notch it so it doesn't interfere with the belt. Next, bore a shallow, flat-bottomed hole in each corner of the shield, and epoxy button magnets into these holes. Drill two $\frac{1}{8}$ " holes in the flanges on the edges of the cabinet, and epoxy two $\frac{1}{2}$ " lengths of $\frac{1}{8}$ " threaded rod into these holes. (The threaded rod acts as an indexing pin and prevents the shield from vibrating into the belt.) Then, attach a pair of cabinet handles to the sides of the shield, drill the holes to accept the indexing pins, and slide the shield in place.

*Glenn Sheils
Neuville, Quebec*

Fold-Out Sawhorse Stores Flat



I needed a handy work stand that could adapt to a number of different situations so I built this hinged plywood sawhorse. To make it, cut three pieces of plywood to equal size and connect them with hinges as shown. For better stability, first drive a screw eye into the vertical end of each panel. Next, drive a pair of roundhead wood screws into the edge of a 1x3, leaving about $\frac{1}{2}$ " of the screw shaft exposed. Then, drop the screw heads through the eyescrews to lock the panels in position.

*Howard Moody
Upper Jay, N.Y.*

Get Paid For Your Advice

For submitting the top shop tip in this issue, Gale Ramerman will receive a Bosch model 1614EVS electronic plunge router. Powered by a $1\frac{1}{4}$ hp/ 7.8 amp motor, the router features a six-position variable-speed switch with speeds from 12,000 to 23,000 rpm. Its electronic variable speed controls provide a soft start and maintain the selected speed under load.

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

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



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CLUB SPOTLIGHT

Northeastern Woodworkers Association

Albany-based club growing by leaps and bounds

Woodworking clubs generally start small and slowly pick up new members over the years. The Northeastern Woodworkers Association started much the same way, with a few people meeting in a living room. But since that 1991 meeting, the group has quickly grown to nearly 500 members and lists as one of its numerous activities an annual two-day Expo that draws 7,000 visitors. The secret of NWA's success is simple and certainly bears examining by other clubs looking to boost their membership rolls.

Many of the current members made first contact with the club through one of its public shows, says Herman Finkbeiner, Expo chairperson and one of the group's founders. Six months after that 1991 meeting, members organized their first "Expo," a weekend display of their work at Curtis Lumber, a local hardwood supplier. The club gained a dozen new members from that show and, when they repeated the event a year later, they attracted an additional 50. This second show packed so many people into the aisles of Curtis Lumber that the group had to move the following year's show to a nearby high school to accommodate the crowds.

For the third Expo, the NWA added commercial exhibits and beefed up publicity by submitting announcements to area newspapers and radio stations. Despite a surprise snowstorm, the show drew nearly 4,000 visitors. "I arrived early Saturday morning to unlock the doors and I couldn't even

find a parking space," Finkbeiner recalls. The club quickly ran out of programs and literature while signing up about 100 new members.

Acres of Woodworking

Encouraged by their success, members moved the '95 Expo to Saratoga Springs Convention Center. With room to spread out, the NWA Expo has burgeoned into a 25,000-square-foot display of furniture, fine woodworking, tools, lectures, and demonstrations.

Each year, the Expo incorporates a special event. For the 1995 show, the club exhibited projects made by top woodworkers such as Michael Dunbar, David Ellsworth, Sam Maloof, Rude Osolnik, and the late George Nakashima. The '96 Expo featured "Home Workshop Options," a display of tools and equipment alternatives that targeted woodworkers of all skill levels and budgets, and included a "Dream Workshop" that dazzled visitors.

The 1997 show, slated for the weekend of April 5-6, will showcase a gallery of rustic Adirondack-style furniture and an extensive display of jigs and fixtures, both commercial and shop-made. It will also showcase for the first time, work for sale built by professional woodworkers from around the region.

Educational opportunities make up a large part of each Expo. Past shows have spotlighted nationally known experts speaking on Windsor chair construction, hand plane techniques, wooden hat turning, veneering, finishing, and similar topics. This year visitors will see and hear Japanese tool expert Toshio Odate, Ian Kirby, and plane maker Tom Lie-Nielsen. Experienced NWA mem-

bers and local experts have also demonstrated the construction of dulcimers, oval Shaker boxes, bamboo fly rods, wooden flutes, and carousel horses. Specialized techniques such as bowl and spindle turning, marquetry, chip and figure carving, coopering, and tool sharpening have also been shown.

Tools For Sale and Tools For Free

The club leases 4,000 square feet of Expo floor space to tool and material vendors. In the past, such firms as Sears, Constantine, DeWalt, and Woodmizer have participated, as well as several antique tool dealers. The show also includes a sales shop where members can sell their work on consignment. Last year, sales grossed about \$8,000, mostly for items under \$50. At the Expo's Toy Factory, members make and give away toys to young attendees.

Despite the Expo's current size and complexity, the NWA relies on club volunteers to organize and run the entire show. According to Finkbeiner, about half of the members participate—staffing the committees, setting up booths, working the Toy Factory, and taking care of other chores.



The exhibition floor at Saratoga Springs Convention Center was crowded with great woodworking during NWA's 1996 Expo.



NWA member Brendan Murphy built this distinctive Windsor chair and displayed it at a recent Expo.

Getting the Word Out

The club attracts large crowds to these events through enthusiastic advertising and promotion, says Fran Finkbeiner, the NWA publicity chair. Fran uses mailing lists that include names of many interested or potential woodworkers. She also sends announcements to area newspapers and radio stations. This year the group was able to budget funds for several ads with local newspapers and television stations.

As part of its publicity effort, NWA also keeps the media apprised of potential feature stories. This occasionally garners some free exposure for the club. "Woodworkers make good stories," Fran says.

The Ideal Meeting Place

The club holds regular bimonthly meetings in what probably rates as one of the country's best sites for a woodworking group: a 150-year-old, timber-frame Shaker meeting house near Albany. According to Joe DeJulio, current NWA president, meetings start with a discussion of business followed by a presentation on a specific topic. Some of the recent offerings have included Adirondack guide-boat construction given by member Frank Gebhart, the life and works of George Nakashima given by his daughter Mira Nakashima-Yarnall, and tablesaw selection and care by Ian Kirby.

The annual calendar contains several regular events, says DeJulio. In April, the club tours members' shops. In May, members demonstrate their best shop tips and jig designs. At least one session a year features some kind of furniture workshop.

To counter the tendency of woodworking clubs to become closed societies, the club holds an annual family night in December. Spouses and chil-

dren are encouraged to attend, and refreshments are served. Last year, 56 members participated and showed approximately 190 pieces of woodworking including a wooden boat. During the summer, the club hosts families at an annual picnic. Last year's outing featured a log-sawing demonstration with member Ron DeWitt's Woodmizer sawmill turning logs into lumber.

Member-Written Newsletter

The NWA's newsletter reads like a four- to eight-page magazine. In addition to the usual business, it contains several member-written articles including: "Wood of the Month," "What Works and What Doesn't" (a column about members' personal experiences), and a feature on shop tips and jigs.

A specialty group has formed within the NWA that calls itself the "Wood Guild." These members take special interest in the science of wood identification and the technical properties of wood. The Guild meets in the off-months and conducts occasional tours of local sawmills and other tree- and wood-related enterprises. Recently, the Guild brought in a forestry expert from Virginia Polytechnic Institute for an intensive, two-day wood identification workshop.

Another group within the club volunteers at the Double-H Hole In The Woods camp for kids who have life-threatening diseases. Here volunteers have made cabin signs, built benches, and taught woodworking classes.

If you would like to join the NWA or get more information, contact the club at P.O. Box 94, Rexford, NY 12148. Or, call Herman or Fran Finkbeiner at 518/371-9145. 



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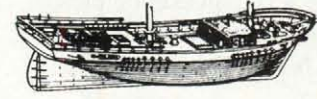
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PRODUCT NEWS



Porter-Cable belt sander model 360VS

Belt Sanders Quieted To A Whisper

Earlier this year, Porter-Cable announced a series of 3- and 4" belt sanders they say are the quietest and most powerful available. Firm officials claim the new Whisper™ series sanders run 18db quieter than other production sanders currently on the market. This difference they say, would require 63 of the new models to match the sound intensity produced by one previous model.

The new sander series includes three 3x24" models and three 4x24" models (360, 360VS, 361, 362, and 362VS, and the 363). All have a 12 amp motor, four sport dust-collection capability, and two incorporate variable-speeds (1000 to 1500 rpm). Each machine also has a quick-release belt-change lever, an ergonomically-designed handle, and an easy-to-adjust belt-tracking knob.

*Porter-Cable Corporation,
800/487-8665*

Cordless Spiral-Cutting Saw Gets Into Tight Spaces

Cutting any kind of access hole in an already enclosed cabinet or carcass can prove tricky and time-consuming, if not impossible. The SpiraCut cordless spiral saw, however, maneuvers easily in spaces

SpiraCut cordless spiral saw



where you can't usually get other motorized saws to go. With its small-diameter spiral-cutting bit, this tool makes its own pilot hole and cuts a cleaner kerf than most jigsaws or reciprocating saws. The unit comes with two 12-volt batteries, a one-hour charger, three cutting bits, and a carrying case. The manufacturer also offers optional specialized bits for cutting ceramic tile, solid-surface materials, plastic laminates, and other materials. About \$220.

RotoZip Tool Corp., 800/521-1817



Shelf-Pin Drilling Jig Eliminates Inaccuracy

With the JIG IT drilling template and self-centering bit, you can drill perfectly aligned shelf-pin holes quickly and easily. The predrilled template locates holes 1 1/4" apart at a distance of 37mm or 64mm from the edge of the workpiece. To extend the range of the 20"-long template, simply index it to a pair of previously drilled holes using shelf pins. The spring-tensioned drill bit rides inside a sleeve which

prevents the bit from wearing out the guide holes. You can order the kit with either a 1/4" or 5mm bit. The jig and bit cost about \$30.

*The Woodworkers' Store,
800/279-4441*



DeWalt model DW788 scrollsaw

New Variable-Speed Scrollsaw

Whether you're considering your first scrollsaw or looking to replace one, DeWalt's newly introduced unit warrants close scrutiny. The DW788 features a 20"-long throat capacity, variable speed, and a vibration- and noise-free double parallel link arm design. If you're a fretwork cutter, you'll especially appreciate the unit's simple, quick-release tool-free blade changing system. Flipping a front-mounted lever releases the tension; turning a thumbscrew at the top and bottom releases the blade clamps.

The designers thoughtfully placed all needed controls—including the blade-tension lever—up front. Blade strokes can be infinitely adjusted from 300 to 1750 SPM to better match sawing conditions. The generous-size cast-iron table tilts 45° in either direction. The saw comes with a dust blower; a stand, foot switch, light, and a full line of blades will be available. The new saw should be in stores and catalogs by the time you read this.

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*Mini-Flocker Kit, catalog no. 145;
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Stephen Hight-Woodturning Magazine, May 1995



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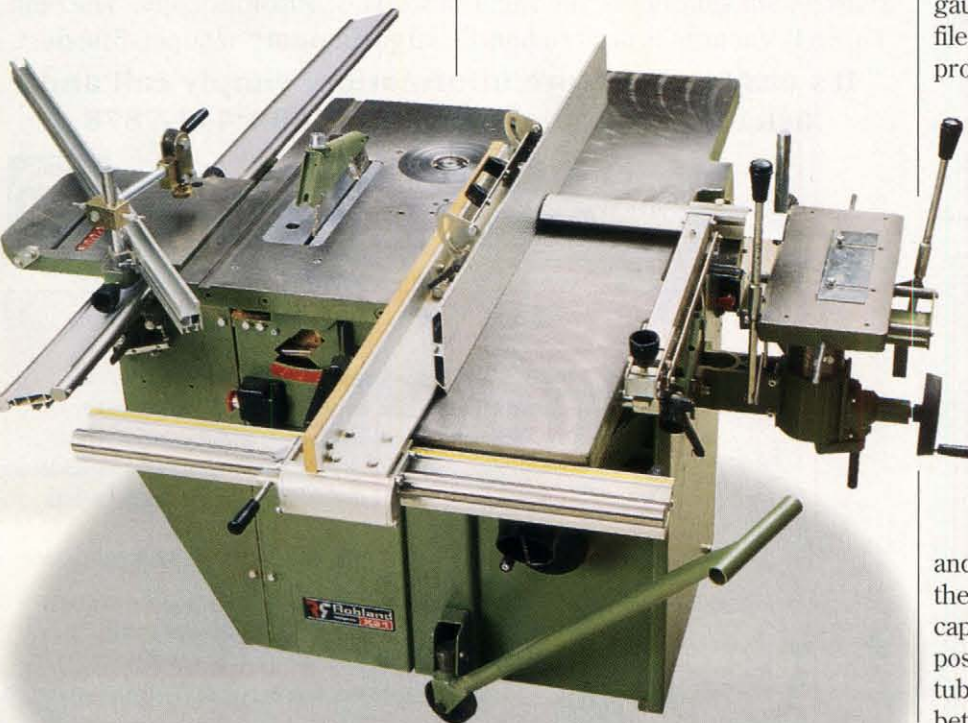
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Robland X31 Combination Machine

Five heavy-duty woodworking tools in one machine

Made in Belgium, the Robland X31 consists of five machines in one: a tablesaw, jointer, planer, shaper, and mortiser. (For specifications, see the chart on *page 20*.) Three German-made 3-hp motors (220-volt, single-phase) power the unit. The tablesaw and shaper run off their own individual motors; the planer, jointer, and mortiser all share one motor. All three motors switch on and off at one central location. To activate a particular machine, you first set a selector switch, then turn on the power switch. For safety, three "off" buttons have been



SHOP TEST

strategically positioned around the machine. To turn on the tablesaw, shaper, or thickness planer, you have to reach over to the central switch location on the machine's left side, then take a step or two back to the work area. Turning on the jointer also requires a couple of steps, however; you have to walk halfway around the machine to power up the mortiser.

Crosscutting With The Tablesaw

For most crosscutting, the Robland has a 14x14½" sliding table that rides on a pair of tubular steel rails mounted off the left edge of the main saw table. These rails can be unlocked and slid forward or backward. This lets you back up the sliding table for crosscutting wide stock or sheet goods. You can also shove the rails fully forward

and stand close to the machine. The sliding table incorporates a 47"-long miter extension with an integrated flip-over stop block and a cam-action hold-down clamp.

We found the sliding-table system a pleasure to use, but the design leaves only 7" of cast-iron tabletop to the left of the blade. This doesn't affect crosscuts, but if ripping wide panels, you may need to set a support to the left of the machine. You can order the machine with a larger sliding table that will provide additional support.

For crosscuts on small or short workpieces, the main tablesaw top incorporates a European-style miter-gauge groove. The mating dovetail profiles on the groove and miter-gauge bar provided smooth, positive sliding action. However, if you want to use any of your current tablesaw fixtures on this saw table, you'll have to machine new runners that fit the groove.

Repositioning the Rip Fence

The tablesaw rip fence rides along a tubular steel rail that mounts on the front end of the jointer outfeed table. Like the sliding table rails, this one can also be unlocked and slid back and forth. Fully extended to the right, the fence gives you 37¾" of ripping capacity to the right of the blade. When positioned fully to the left, however, the tubular fence rail creates a 14" gap between itself and the table, making it

Editor's Note

Combination machines are interesting feats of engineering, but their cost, complexity, and relative scarcity leave many people, our staff included, with a lot of questions. We set out to answer those questions by testing two of the most popular machines in the field. We're reporting on the Robland X31 here, and a review of the EuroShop C300 will follow.

difficult to balance large panels. A small ledge built into the left edge of the fence-locking mechanism provides a little extra support.

The heavy aluminum-angle fence, faced with unfinished MDF, extends just 3" past the rear of the blade. This European design reduces the chances of the workpiece pinching against the rear of the fence and kicking back.



Photo A: The arbor bolt with the large head enables you to use a dado set.

However, we found that the absence of an outfeed guide surface makes it tricky to control long boards near the end of a rip. Also, the MDF face only stands 2 3/8" high, a bit shorter than the fences we're used to on most American saws. You could correct both of these limitations, however, by bolting a facing of your own design to the fence.

Blade Changes, Guards, And the Elevating Mechanism

Saw blades mount on the Robland via a 5/8" bolt with an oversized head that you screw into the arbor shaft (photo A). You need both hands to do it, but the long bolt enables you to mount a standard dado set on the saw.

We especially like the arbor lock and blade guard. To lock the arbor for blade changes, you simply drop a steel rod through a hole in the tabletop and into a shallow hole in the arbor shaft (photo B).

The blade guard mounts on the splitter at a fixed height above the blade

and both ride up and down as you change blade elevation. The guard never touches the top of the table or bumps the edge of your workpiece. When you lower the blade below the tabletop, the guard and splitter follow, stowing neatly out of the way underneath the throat plate.

To elevate the Robland's blade, you push down on a lever rather than turn a hand wheel and worm gear. Although quick and functional, the lever action requires a bit of trial and error when you need to set blade height precisely. To tilt the blade you turn a traditional-style hand wheel.

Industrial-Size Jointer

The 12" jointer and 12" planer use the same three-knife cutterhead. On the jointer tables, we found a slight side-to-side crown (about .006"), however, this did not seem to affect performance. Turning a large knob raises and lowers the infeed table, but the lack of a depth scale forced us to eye-

Continued on page 18

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OGEE	P3820		
TRADITIONAL	P3818		
COVE & BEAD	P3817		
BEVEL	P3819		

STRAIGHTS*

A	B	SHANK	ITEM#	COMPARE AT	SALE
1/8"	3/4"	1/4"	P1211	\$16.00	\$4.95
5/16"	3/4"	1/4"	P1218	19.00	5.95
5/16"	1"	1/2"	P1219	20.00	5.95
3/8"	1"	1/4"	P1222	21.00	4.95
3/8"	1"	1/2"	P1223	20.00	4.95
3/8"	3/4"	1/4"	P1228	20.00	5.95
3/8"	3/4"	1/2"	P1231	21.00	5.95
1/2"	1"	1/4"	P1237	19.00	5.95
1/2"	1"	1/2"	P1238	21.00	5.95
1/2"	1-1/2"	1/2"	P1242	23.00	7.95
5/8"	3/4"	1/2"	P1253	19.00	6.95
5/8"	1"	1/2"	P1255	27.00	7.95
23/32"	3/4"	1/4"	P1265	23.00	7.95
23/32"	1"	1/2"	P1266	26.00	8.95
3/4"	3/4"	1/4"	P1270	21.00	7.95
3/4"	1"	1/2"	P1272	27.00	9.95
3/4"	1-1/2"	1/2"	P1274	30.00	10.95

ROUNDOVER

R	SHANK	ITEM#	COMPARE AT	SALE
1/16"	1/4"	P3101	\$32.00	\$8.95
1/8"	1/4"	P3102	34.00	8.95
1/8"	1/2"	P3103	36.00	9.95
3/16"	1/4"	P3104	34.00	9.95
3/16"	1/2"	P3105	36.00	9.95
1/4"	1/4"	P3106	33.00	9.95
1/4"	1/2"	P3107	35.00	10.95
5/16"	1/4"	P3108	36.00	10.95
5/16"	1/2"	P3110	36.00	10.95
3/8"	1/2"	P3111	37.00	12.95
1/2"	1/4"	P3114	38.00	12.95
1/2"	1/2"	P3115	40.00	13.95
5/8"	1/2"	P3116	66.00	15.95
3/4"	1/2"	P3117	62.00	18.95
1"	1/2"	P3119	120.00	29.95
1 1/4"	1/2"	P3121	157.00	35.95
1-1/2"	1/2"	P3123	36.00	51.95

DOVETAILS*

A	DEG.	SHANK	ITEM#	COMPARE AT	SALE
1/4"	7-1/2°	1/4"	P2201	\$23.00	\$4.95
1/4"	7-1/2°	1/2"	P2202	29.00	5.95
1/4"	8°	1/4"	P2203	23.00	6.95
5/16"	8°	1/4"	P2206	23.00	5.95
5/16"	8°	1/2"	P2204	23.00	7.95
5/16"	8°	1/2"	P2205	29.00	7.95
3/8"	8°	1/4"	P2207	23.00	7.95
3/8"	8°	1/2"	P2208	23.00	4.95
3/8"	8°	1/2"	P2209	26.00	5.95
3/8"	14°	1/4"	P2211	24.00	5.95
1/2"	8°	1/4"	P2215	26.00	7.95
1/2"	14°	1/4"	P2212	23.00	4.95
1/2"	14°	1/2"	P2213	26.00	4.95
5/8"	7°	1/4"	P2218	29.00	6.95
5/8"	7°	1/2"	P2219	32.00	6.95
11/16"	8°	1/2"	P2220	27.00	10.95
3/4"	7°	1/4"	P2223	30.00	8.95
3/4"	7°	1/2"	P2224	34.00	7.95
3/4"	14°	1/4"	P2221	27.00	6.95
3/4"	14°	1/2"	P2222	35.00	7.95

COVE

R	SHANK	ITEM#	COMPARE AT	SALE
1/8"	1/4"	P2901	\$35.00	\$9.95
3/16"	1/4"	P2902	36.00	10.95
1/4"	1/4"	P2904	35.00	10.95
1/4"	1/2"	P2905	36.00	11.95
3/8"	1/4"	P2908	35.00	12.95
3/8"	1/2"	P2909	36.00	13.95
1/2"	1/4"	P2910	38.00	13.95
1/2"	1/2"	P2911	40.00	13.95
5/8"	1/2"	P2912	63.00	19.95
3/4"	1/2"	P2913	70.00	20.95

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1/2" shank #P1023 1/2" shank #P1024

90° V-GROOVE

A	SHANK	ITEM#	COMPARE AT	SALE
1/4"	1/4"	P2102	\$17.00	\$7.95
3/8"	1/4"	P2103	22.00	6.95
1/2"	1/4"	P2110	28.00	7.95
5/8"	1/4"	P2112	30.00	11.95
3/4"	1/2"	P2114	42.00	11.95
1"	1/2"	P2116	70.00	14.95
1-1/2"	1/2"	P2117	85.00	22.95

PATTERN / FLUSH TRIM*

A	B	SHANK	ITEM#	COMPARE AT	SALE
1/2"	1"	1/4"	P1237B	31.60	8.95
5/8"	3/4"	1/4"	P1253B	30.60	11.95
3/4"	3/4"	1/4"	P1270B	33.40	11.95
3/4"	1"	1/2"	P1272B	47.60	14.95
3/4"	1-1/2"	1/2"	P1274B	57.00	22.95

ROMAN OGEE

R	SHANK	ITEM#	COMPARE AT	SALE
5/32"	1/4"	P3506	\$42.00	\$12.95
5/32"	1/2"	P3507	43.00	12.95
1/4"	1/4"	P3508	42.00	13.95
1/4"	1/2"	P3509	43.00	14.95

RABBETING

A	B	SHANK	ITEM#	COMPARE AT	SALE
1/8"	3/8"	1/4"	P2702	\$22.00	\$11.95
5/32"	1/2"	1/4"	P2703	23.00	11.95
1/4"	3/8"	1/4"	P2705	25.00	11.95
1/4"	3/8"	1/2"	P2706	26.00	11.95
3/8"	3/8"	1/4"	P2707	28.00	11.95
3/8"	3/8"	1/2"	P2708	31.00	11.95
1/2"	3/8"	1/4"	P2709	31.00	11.95
1/2"	3/8"	1/2"	P2710	35.00	12.95
1/2"	1/2"	1/4"	P2711	32.00	16.95
1/2"	1/2"	1/2"	P2712	36.00	16.95
3/4"	3/8"	1/2"	P2713	36.00	15.95

FLUSH TRIM*

A	B	SHANK	ITEM#	COMPARE AT	SALE
3/8"	1"	1/4"	P1804	\$21.00	\$6.95
1/2"	1/2"	1/4"	P1806	22.00	6.95
1/2"	1"	1/4"	P1809	22.00	6.95
1/2"	1"	1/2"	P1810	23.00	7.95
1/2"	1-1/2"	1/2"	P1813	29.00	8.95

SPIRAL UP-CUT*

A	B	SHANK	ITEM#	COMPARE AT	SALE
1/8"	1/2"	1/4"	P1501	\$22.00	\$9.95
3/16"	5/8"	1/4"	P1504	23.00	12.95
1/4"	3/4"	1/4"	P1508	24.00	11.95
1/4"	1"	1/4"	P1509	26.00	13.95
3/8"	1-1/4"	1/2"	P1514	56.00	26.95
1/2"	1-1/4"	1/2"	P1518	58.00	29.95
1/2"	1"	1/2"	P1520	52.00	29.95
1/2"	1-1/2"	1/2"	P1521	62.00	33.95

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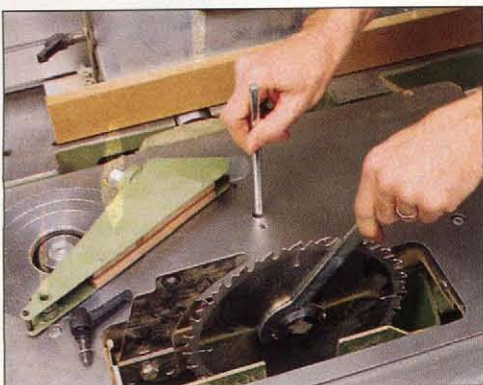


Photo B: The Robland's arbor lock holds the shaft, making tightening or loosening of the arbor bolt a snap.

ball the difference in table heights to gauge the cutting depth.

The jointer guard covers the entire length of the cutter head (*photo C*). This design makes you lift your hands over the guard, which prevents you from ever touching the wood directly over the cutter head. It takes a while to get used to this system, but it's undoubtedly safer than the pivoting guards on most U.S.-made jointers.

The jointer fence, which mounts on the back of the tablesaw fence, has positive stops at 90° and 45°. The 6" height gives good support for edge-jointing wide pieces, although we found a slight top-to-bottom bulge in the middle of the extruded-aluminum fence face.

Snipe-Free Planing

To gain access to the 12" planer, you flip the jointer tables up and to the side, turn over the dust-collector hood, and crank the planer bed to the desired height (*photo D*). The planer has anti-kickback dogs and steel

infeed and outfeed rollers. The structural rigidity of this system virtually eliminates snipe—we measured only .006" on the infeed end of our stock and .003" on the outfeed end—excellent by any standard.

The planer's layout, if you're working alone, requires you to walk around the flipped-up jointer tables (and the mortising table if it's attached) to retrieve long stock from the outfeed end. Then, you must circle back around to the infeed end—a few more steps than a conventional thickness planer requires. With shorter stock, you can reach over the machine.

The Robland's knife-setting jig straddles the jointer/planer cutter head. Springs hold the knives up against the underside of the jig at the correct height while you tighten the retaining bolts.

The Mortising Machine

Although the mortiser runs off the same motor that powers the jointer/planer, it reverses so you can use standard router bits with it (*photo E*). To reduce the shop space requirement, the manufacturer made the mortising table easy to remove—loosen two cap screws and lift the table off its mounting column.

Three positive stops limit the mortising table's dual-axis travel and are easy to set. During use, we found the tall guide handles that you use to push the table and workpiece into the bit bumped into angled and wide stock, occasionally limiting the table's travel. For cutting perpendicular mortises into

edge grain, the company provides a slotted steel backstop that bolts to the tabletop. However, the backstop doesn't align parallel to the bit for end-grain boring. You can use the cam clamp from the saw's sliding table to hold parts while mortising.

The table rides on a pair of cold-rolled steel bars. On our test unit, these bars had just enough play in them to allow the table to tilt ever so slightly under a lot of pressure. We didn't see any flex while mortising small stock, but we wouldn't clamp a heavy entry-door stile or wardrobe-sized workpiece to the table without some support at the other end.

Shaper Takes Three Types of Cutters

The 5"-tall shaper spindle on the X31 has two different diameters (*photo F*). This permits using cutters with 1¼" and ¾" bores and router bits with ¼" shanks (but, alas, not ½" shanks).

A massive, cast-iron cowling covers the shaper cutter and also holds the two independently adjustable fence halves as well as the work hold-down and hold-in. These two latter accessories were simple but effective, and we found it easy to adjust the fence halves accurately. The two fence faces measured slightly out of parallel, but we quickly corrected the problem with a shim.

Mobility and Storage

Robland's promotional literature claims that the machine passes easily

Continued on page 20



Photo C: On the jointer, the guard prevents you from getting your hands near the cutter head.

Photo D: Tilting back the jointer tables gives you access to the planer bed.



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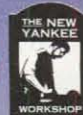
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through a 32"-wide door. We found this was possible—but not easy. To do it, we had to remove the side cover, which required a wiring disconnect. Then, we also had to remove the dust port, sliding table, and jointer tables.

To wheel this machine around your shop, you use a caster mount-

ed on a long handle. Pushing down on the handle tilts the machine back onto two casters mounted under the machine's base. To store, you can remove the sliding saw table and mortising table, which reduces the overall width of the machine to 44".

Robland X31 Specifications

Tablesaw

Blade diameter	10"
Blade RPM	3700
Max. depth of cut.....	3 ³ / ₁₆ "
Max. width of cut (with sliding table)	50"
Max. rip capacity (right of blade)	37 ³ / ₄ "

Jointer

Table width	12"
Table length (infeed plus outfeed)	55"
RPM.....	5500

Planer

Width	12 ³ / ₁₆ "
Max. height.....	9"
Max. depth of cut.....	1 ¹ / ₄ "
Stock feed rate	19 fpm
RPM.....	5500

Shaper

Spindle dia., top	3/4"
Spindle dia., bottom.....	1 ¹ / ₄ "
Vertical travel	5 ¹ / ₂ "
Max. cutter dia.	7"
RPM.....	6000

Mortiser

Table size	8x17"
Table travel, left to right.....	8"
Table travel, up and down.....	4"
Depth of cut	5"
Chuck capacity	5/8"
RPM.....	5500

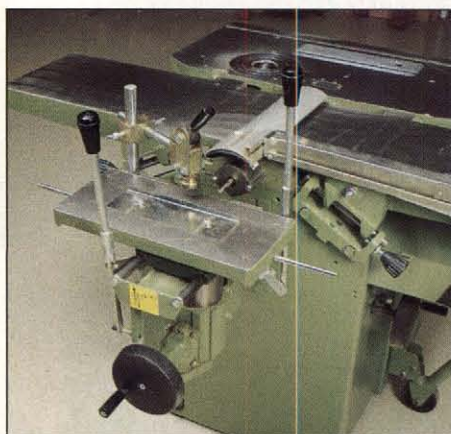


Photo E: Handles guide the dual-axis mortising table into a horizontal bit.

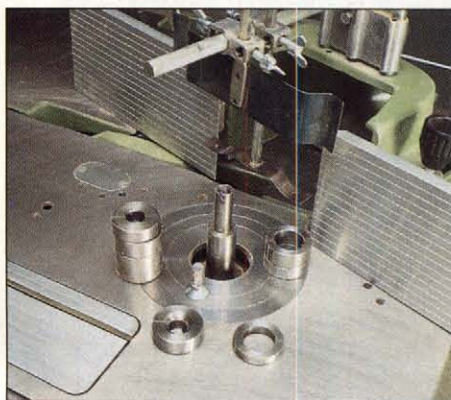


Photo F: The shaper spindle accepts two sizes of shaper cutters and 1/4"-shank router bits.

Our Conclusions

Other than the aforementioned characteristics of the mortising table and the need for extra support when balancing large pieces of plywood on the tablesaw top, we found the rest of the Robland's features either very good or excellent. All of the work clamps and locking handles tighten

with a snug, solid feel, and the elevation handwheels turn with very little effort. The formed steel used for the cabinet enclosures measures more than 1/8" thick, and all the cast parts show evidence of excellent workmanship with no burrs or rough edges. Compared to a collection of single-purpose machines with similar capacities, the Robland X31 (priced at around \$6,000) offers you a lot more machinery for the money.

If you've struggled in the past with the limitations of lightweight, consumer-grade machines, you'll love the power and beefiness of the Robland X31. Stepping up to features like a 12" jointer, a snipe-free planer, a dedicated mortiser, and a sliding crosscut table will propel your woodworking into a new dimension.

Furniture factories and high-volume shops may need the division of labor that only separate single-purpose machines offer. But many advanced amateur and small custom woodworking shops could realize a lot of value and benefit from a Robland X31. 

Product test: Dick Coers

Written by: Tom Jackson

Photographs: Kevin May

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The Bench Plane

How to make a fine instrument sing sweetly *by Jim Tolpin*

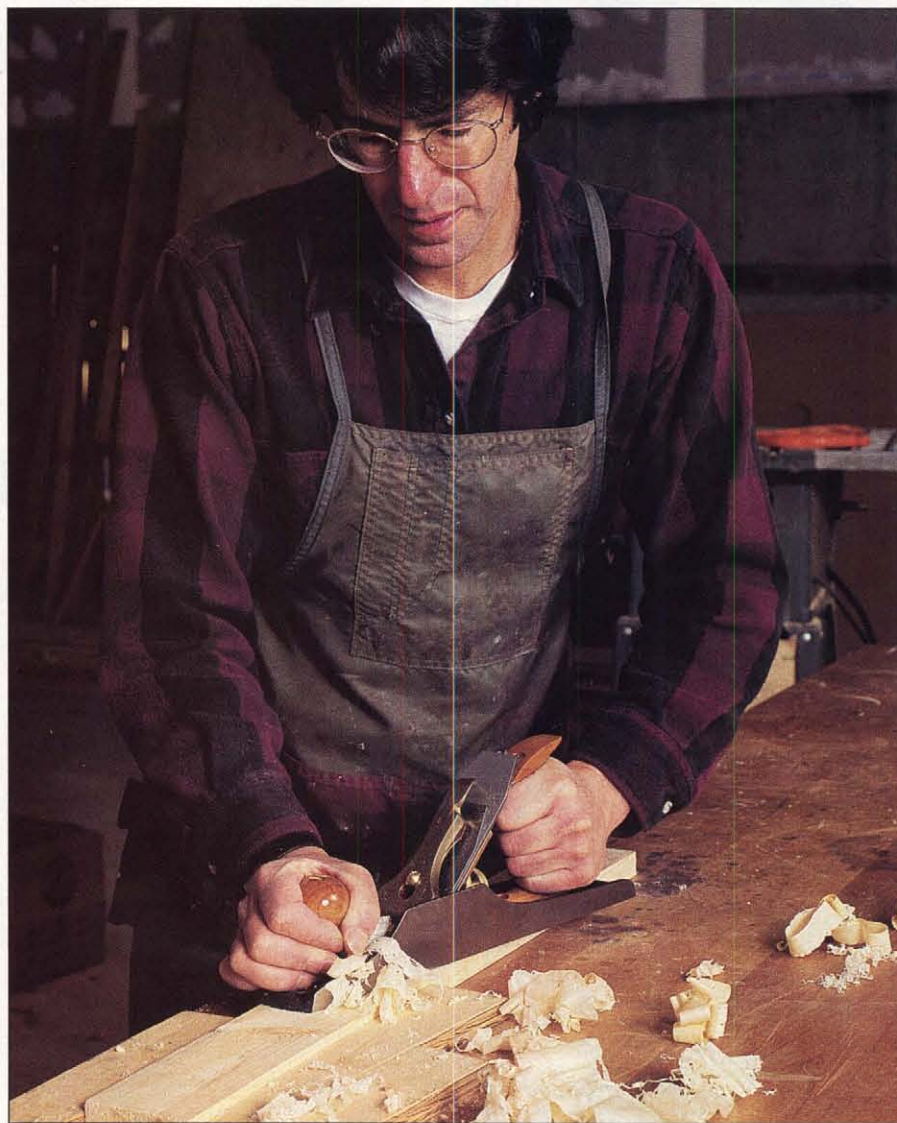
Hand planes are the violins in the woodworker's orchestra of tools—beautiful to behold, versatile in application, and almost unbearably sweet when placed in the hands of a virtuoso. Thankfully, one can master these woodworking instruments—with understanding and practice—in a fraction of the time required for a violin.

Starting here with the standard bench plane, I'll show you how hand planes work and how to tune and sharpen them for peak performance. But please—don't just sit there after reading these words and looking at the pictures. Instead, go into your shop and apply this "book-learning" to real steel and shavings. With a bit of dedication, you too can experience the joy of making a hand plane sing sweetly.

Why the Hand Plane?

In this increasingly high-tech age, one might argue that power tools can do everything a hand plane can do—if not better, then definitely faster. It's true that the hand plane's two basic functions, surfacing and shaping (squaring edges, making grooves, rabbets, bevels, hollows or rounds, and profiles), can be done quickly by a variety of powered planers, routers, and even sanders. However, this hardly makes a case against the venerable hand-powered plane.

As you may have found in your own shop, the hand plane can produce a surface far smoother than that produced by almost any type of power planing machine.* Even the best power planers still leave mill marks that must be removed to achieve a truly smooth finish. Nor can a wide-belt stationary sander fitted with the finest-grit belt match a hand-planed surface.



Few craftsmen ever know the joy of making a hand plane "sing," but the author's basic tuning and sharpening tips put this experience within reach of anyone.

Why not? Because a sanded surface, no matter how smooth, has fibers that have been crushed and abraded—not sliced cleanly as they are by a plane. Also, dust pushed into the wood's pores during the sanding process can cloud the finish, making the surface look dull and

shallow. Hand-planing, especially on smaller surfaces like drawer faces, usually takes far less time and is easier to control than power sanding. And, when it comes to final-fitting joints, the smaller models such as block and shoulder planes simply have no powered equivalent.

*Several years ago, Makita introduced a wood surfer that power-feeds a board against a fixed knife, producing a surface indistinguishable from a hand-planed one.



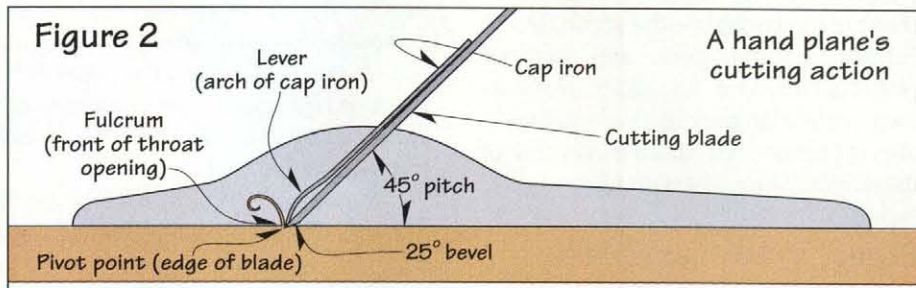
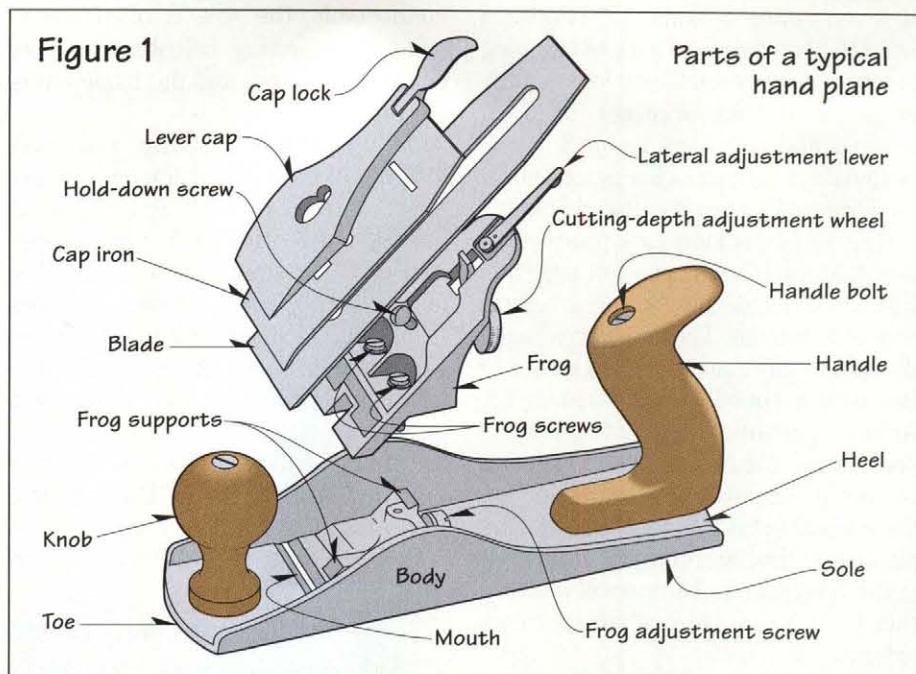
Photo A: Start with a quality instrument, then tune and sharpen it for peak performance. Shown here (front to back): Bailey #3 smooth; Stanley #10½ bench rabbet; Lie-Nielsen #4 smooth; Stanley #4½ wide smooth; Lie-Nielsen #5 jack; Stanley Bedrock #7 jointer.

How Hand Planes Work

The hand plane is essentially a holder for a chisel. (*Figure 1* illustrates the basic parts.) In fact, one of the earliest smoothing “planes” resembled a wide, teardrop-shaped chisel that was pushed flat face down along the surface of a board. However, woodworkers found these chisel/planes difficult to control. All too often, they would dive into the wood along grain lines, leaving gouges and tearout. Eventually, a toolmaker figured out that a wooden block with a wedged opening could hold the chisel at an incline (to reduce grain tearout) and control the depth of cut (to eliminate gouging).

By the mid-19th century, toolmaker Leonard Bailey had patented a plane body made of machined metal that proved durable and also incorporated adjustment mechanisms for precise blade-setting. His innovative cap iron—an arched piece of metal screwed to the cutting iron—added mass to the blade. This allowed the blade to be made thinner and hence easier to sharpen. Earlier planes without a cap iron required relatively thick blades ($\frac{1}{8}$ " or more as opposed to Bailey's $\frac{1}{16}$ ") to reduce vibration that often produced “chatter” marks, which were difficult to remove. The cap iron also increased the exit angle of the shaving, greatly reducing tearout.

Whether wood- or metal-bodied, hand planes cut by slicing a thin shav-



ing away from the underlying wood. The blade, set to a fixed depth, creates the shaving while the edge of the sole just ahead of the blade acts as a fulcrum for lifting the shaving. (See *figure 2*.) The rounded face of the cap iron acts as a lever for the sharp cutting edge, bending the shaving up and away from the wood at a sharp angle.

To smooth-cut dense hardwoods or wood with wild grain, you can narrow the opening ahead of the blade. This brings the fulcrum closer to the pivot point and reduces the lifting force. Setting the cap iron closer to the cutting edge increases the lever angle, forcing the shaving to exit at a steeper angle. I'll describe these adjustments for a typical metal-bodied hand plane in more detail.

Different Planes For Different Purposes

Typical bench planes range in size from the 8 to 9"-long “smooth” plane to the 14 to 15" “jack” plane. For more

specialized jobs, you can find smaller versions of the smooth plane and larger versions of the jack—from the 18" fore to the 24" jointer. (See *photo A*.)

If I could own only one plane, I would opt for the jack (*photo B*). With this jack-of-all-trades tool, I can smooth surfaces, joint edges, and plane end grain.



Photo B: If he could own only one plane, the author would choose a jack. This versatile 14-15" tool will smooth surfaces, joint edges, and plane end grain.

If given more options, I'd choose a smooth plane because it's less fatiguing to work on large surfacing jobs, a jointer plane for its accuracy on long boards, and a low-angle block plane because it cuts more cleanly and pushes more easily across end-grain fibers.

One English-made jack plane variation that often sees action in my shop has a wider side cheek and a removable side handle. These features make this plane more accurate and easier to use with a shooting board (*photo C*). Another variant of the jack that I sometimes use—Lie-Nielsen's reproduction of an old Stanley #62—features a $\frac{3}{16}$ "-thick blade set at a low 12° angle. This plane cuts cleanly and easily across end grain. A regular jack plane will work for this, but a low-angle jack requires considerably less effort.

You may run across a number of other plane variants—the scrub, block, rabbet, combination, and scraper plane, to name a few. Each plays its own particular part in the woodworking orchestra. I'll discuss several of these in a future installment.

Expect To Pay For Quality

If you're in the market for a hand plane, think twice before popping into the local building supply store and taking one off the rack. Most hand planes priced for the home DIYer (under \$50) lack the quality a dedicated woodworker needs. I've found that the handle on most garden-variety planes is rarely

comfortable, the sole is often out of true, blade-setting adjustments have considerable slop, and the blade tends to dull easily.

To my way of thinking, you can't afford *not* to buy quality in a hand plane. Instead of searching the local stores, check the mail-order supply houses for professional-quality Stanley and Record planes. Smaller specialty firms like Lie-Nielsen and St. James Bay also turn out exceptionally fine products. For quality used planes and antiques, try woodworker's swap meets and antique stores. (For more on this subject, see "Buying and Restoring Antique Planes" *below*.)

Before you part with your money,

retract the blade on the tool in question until it no longer projects, then check the sole with a straightedge. (See *figure 3*.) Cast steel sometimes contains stresses that tend to relieve over time by warping the metal slightly. Hold the plane up to a window or light, and check for clearance along the edge of your rule. You can easily detect gaps of .001" and less. (To see what .001" looks like, insert a .001"-thick feeler gauge leaf under one end of a straight ruler.)

I won't bring home a plane with a sole that's more than .002" out of flat. Correcting this much error takes considerable work with a lapping plate if you ever hope to get it to plane wood

Buying and Restoring Antique Planes

One way to obtain a quality metal-bodied plane at a reasonable price is to buy an "antique"—provided you find one that's still in decent condition. Most planes made before World War II were designed for professional use: a heavier, thicker body helps keep the plane firmly in contact with the wood, and a thicker blade of high-quality steel reduces chatter. The handles, which usually fit the hand more comfortably than their modern plastic counterparts, are made of walnut or sometimes rosewood.

If you're lucky enough to come across a Stanley "Bedrock," grab it. The machined frog bed, which contributes to the fine performance of these planes, makes them worth the premium prices most shopkeepers ask for them. (See the photos at *right*.)

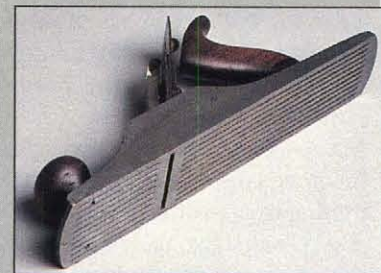
Before you buy an older plane, check the blade; it may be rust-pitted too deeply to ever again take a sharp edge. If it looks salvageable, consider taking the blade to a machine shop for resurfacing. At the same time, have the shop reharden the edge by heat-treating it to 60-62 Rockwell "C" or slightly higher. If you find the original beyond hope, replace it. Many of the mail-order suppliers that sell planes also stock replacement blades.

If you come across a rare antique, resist the temptation to strip off the old finish. Remove the original finish on the metal parts and wooden handles, and an old plane loses a good bit of its collector's value. Instead, simply disassemble the plane and clean off the grime by brushing on mineral spirits with a nylon brush. (An old toothbrush will also do.) Wipe away the residue with a cotton rag.

If you opt to refinish, apply stripper and lightly sand off the old finish. Then, apply an oil-varnish mixture to the wood and an enamel to the previously painted metal surfaces. Before reassembling, coat all the mechanisms with a spray-on, non-petroleum protective coating. (I avoid oil because it attracts and holds sawdust.) Rub hard wax onto the unpainted sole and side cheeks.



Pre-WWII Stanley Bedrock planes feature machined frog bed (shown here on a #5), which offers superior performance to more common cast beds.

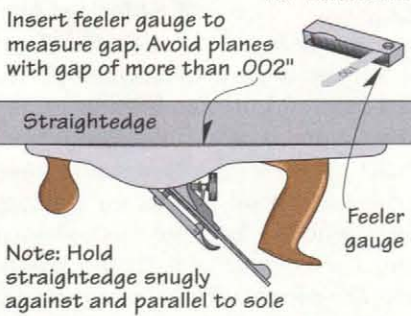


Corrugated sole on #5 Stanley Bedrock reduces drag, requires less effort on big surfacing jobs. Check the sole for flatness before buying an "antique" (or even a new plane). Stresses in cast steel can relieve over time, and warp the metal slightly.



Photo C: Two jack plane variants. Low-angle jack (right) has blade incline of only 12° for cleaner, easier end-grain planing. The "technical plane" (left) features wider side cheeks and removable side handle which makes it easier to use with a shooting board.

Figure 3 Checking plane sole for flatness



perfectly flat. However, if it's an otherwise excellent plane and you have the patience, it may prove worth your while. (For more on this topic, see "Making and Using a Lapping Plate" below.)

Making and Using a Lapping Plate

With this shopmade lapping plate, you can make the back face of a cutting blade (on a plane iron or chisel) perfectly flat to ensure the sharpest possible edge. You can also use this plate to flatten the sole of a metal- or wood-bodied plane.

If you can find (and afford!) a commercially made granite or tool-steel plate, buy it. Otherwise, a scrap of 1/4" or thicker plate glass (which you can obtain at a glass shop) makes a perfectly satisfactory substitute. Get a piece at least 8x26". To create a variety of abrasive surfaces, adhere strips of coarse, medium, and fine emery paper and a strip of 320-grit silicon carbide wet/dry paper. (See the drawing right.)

If you need to remove a lot of material because of warping or rust-pitting, start with the coarse emery paper. Otherwise, begin on the medium grit. As you rub the plane sole or cutting iron firmly along the full length of the strip, the high spots will quickly show up as bright surfaces. When the entire surface has brightened, you'll know it has become flat. To flatten a blade, I adhere it to a strip of hardwood stock with double-faced tape to help me apply firm, even pressure as shown in the photo at left.



A flat piece of wood enables author to apply firm, even pressure to the plane blade during the lapping process.

Once you've brought your new plane home, take it completely apart. To disassemble, lift the cam lock on the lever cap to free up the blade and cap-iron assembly. Check the action of the cam lock. If it binds, put a drop of oil on the pivot pin. If it still binds, remove the pin and file the sides of the lock. Next, unscrew the frog and remove it from the body. If there's a protective film on the side cheeks and sole, remove it with a non-toxic citrus-based stripper and 000 steel wool. If that doesn't do the job, try alcohol or acetone.

Remove the blade from the cap iron so you can sharpen it. (New blades are ground to the proper bevel by the manufacturer but are rarely honed ready to

use.) To avoid nicking the end of the blade when removing the cap iron, hold the assembly in your hand with the cap iron down. Now, remove the screw and carefully lift the blade off the cap. A word of caution: Resist the temptation to use the lever cap for a screwdriver, even though it fits. This part is usually made from weak pot metal and can easily chip.

Sharpen the Plane Blade

Achieving a razor-sharp edge is nowhere near as difficult or tedious as you might think. I can bring a cutting iron to hair-splitting sharpness in little more than a minute. The secret is starting with a blade that has been properly prepared—that means, having a flat, polished back and a bevel that's been finely ground to the proper angle. Of course, it's also essential to use correct techniques with good equipment.

Before addressing the sharpening process, however, I'll settle the question of microbevel versus monobevel. (See figure 4.) Some woodworkers swear by the former because it hastens sharpening and ensures a thicker and thus stronger cutting edge. Others swear at the microbevel because it doesn't afford as much clearance angle behind the cutting edge, a condition that can cause chattering when the wood fibers spring back up behind the blade (figure 5). On a low-angle block plane, a microbevel increases the effective pitch of the blade, defeating the purpose of the low blade angle, which is to reduce cutting resistance and prevent tearout of end-grain fiber.

Because I use equipment and techniques that enable me to hone an edge efficiently, I generally go with the monobevel, finding that it cuts most woods more smoothly than a

A shop-made lapping plate

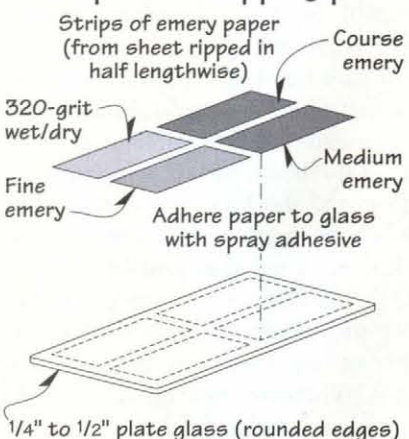


Figure 4

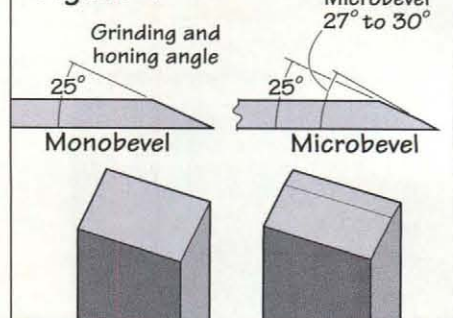
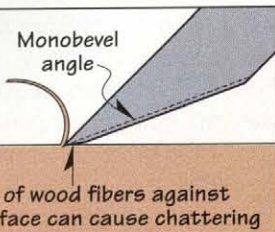


Figure 5

microbevel. When cutting particularly dense woods, however, I appreciate the stronger edge and slightly faster sharpening time of the microbevel.

There's also the question of whether to curve the edge of the blade or to leave it perfectly straight. (See *figure 6*.) A curved edge, which need be convex only as deeply as the thickness of a shaving (except on the specialized, coarse-cutting scrub plane), will not leave ridges along either side of the blade. However, I find a curved edge far more difficult to hone uniformly than a straight edge—you need to make and use a special jig to do it right. Instead, I lightly bevel the corners of the (straight) cutting edge by drawing them backwards along the medium-grit emery paper on my lapping plate. This configuration leaves relatively unnoticeable ridges in the wood that remove easily with a cabinet scraper.

The Sharpening Process

Unless you first polish the back of the blade smooth, no amount of work you do on the bevel will create a truly sharp edge. The reason: Milling striations in the metal form a minute sawtooth-like edge, not the necessary knife edge. But before you polish the back of the blade, using a series of flat stones, you must first make sure that the back is flat. To do this, I rub the back of the blade on a shopmade lapping plate, the same plate I use to flatten the sole of the plane body.



Photo D: If blade bevel is not ground to the time-tested 25° angle, regrind it using a slow-turning, large-diameter water-cooled wheel. The water keeps the blade cool, preserving its temper, and a large diameter reduces hollowing, which weakens the cutting edge.

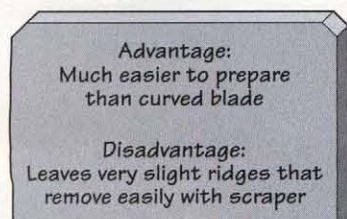
After flattening the back of the blade, I check the shape and angle of the bevel. If it doesn't measure 25° (the time-tested optimum angle for a sharp edge with maximum blade strength) or if the bevel is convex, then I regrind it. For this purpose, I use a slow-turning, 9"-diameter vertical water wheel (*photo D*). Water-cooling eliminates the possibility of overheating the blade and drawing out the temper, and the large wheel diameter reduces the depth of the edge-weakening hollow as much as possible.

As an alternative, you can grind the bevel on a powered horizontal water stone or by hand on regular flat stones. Whatever your choice of tool, always use a jig to hold the blade at the proper bevel angle. You must also make the edge as perpendicular to the sides of the iron as possible. Otherwise, the edge may end up so far out of square that you won't be able to square it to the sole using the plane's lateral adjustment lever.

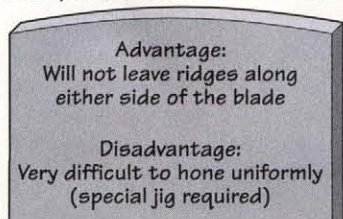
Figure 6

Straight and curved blade edges

Straightedge with beveled corners



Curved blade edge
(exaggerated for clarity: should be convex only as deeply as the thickness of a shaving)



I strongly advise against grinding the bevel on a typical high-speed 6" dry grinder. The heat generated by a fast-turning bench-grinder wheel can all too easily destroy the temper of the blade, and the small wheel radius creates an overly deep (and thus weak) hollow grind. Nor would I use carborundum oil stones for honing. They tend to become dish-shaped from use and do not flatten easily. Also, the messy oil lubricant can contaminate your workpieces, causing finishing problems.

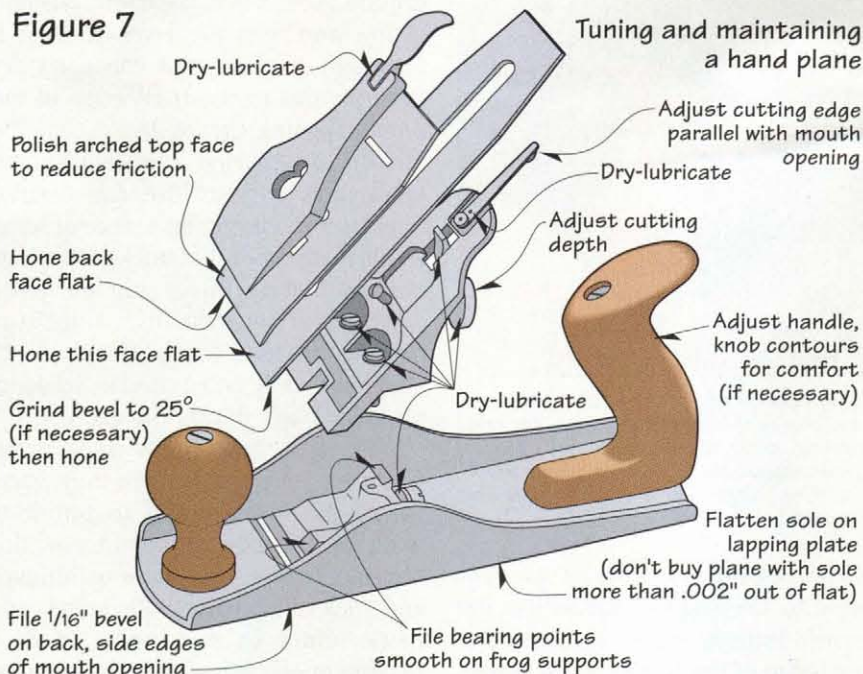
With the bevel ground properly, you then hone the bevel to razor sharpness. On my vertical water wheel, I refine the grit by holding a fine carborundum dressing stone against the wheel rim. Then, using the same jig setup, I hold the bevel against the wheel for about 10 seconds. The blade will then be ready for final buffing or "stropping" against a felt or leather wheel charged with rubbing compound. I hand-hold the bevel against the buffing wheel until it reaches a mirror polish. Then, I turn the blade over and touch its back briefly to the wheel to remove any burr. To avoid rounding the edge over toward the bevel, I hold the blade perfectly flat against the top of the wheel.

If I'm working with regular water stones, I set the iron in a holder, checking to make sure that the bevel sits flat on the stone's face (*photo E*). Assuming the bevel has been ground to the proper angle, I start with a 1000-grit stone, move on to a 1500, and then



Photo E: To hand-sharpen, use water stones and a blade holder that holds the 25° bevel flat on the stone. Author starts with 1000-grit stone, then proceeds to 1500-, and finishes on 6000-grit. He deburrs back of blade by rubbing firmly once or twice on 6000-grit stone.

Figure 7



finish up on a 6000. I deburr the back of the blade (only after polishing the bevel on this last stone) by rubbing it firmly once or twice on the same stone.

To check the blade's sharpness, I no longer try shaving off arm hairs. (I only have so many!) Instead, I hold the blade flat against my thumbnail and carefully push it forward a millimeter or two. A truly sharp edge will effortlessly raise a curl of nail material.

If you're tuning a new plane, however, you aren't quite ready to reinstall the blade. To really make this plane sing, spend a little more time with both the blade's cap iron and the plane itself.

Tune For Peak Performance

Now, follow the steps outlined here to make your bench plane perform as it was intended to—something, surprisingly, that few people get to experience. (See *figure 7*.)

Using a second-cut or mill-bastard file, form a $\frac{1}{16}$ "-wide bevel on the back and sides of the mouth opening (*photo F*). Caution: Don't bevel the edge just ahead of the blade. While you're at it, bevel the entire perimeter of the sole. This not only looks nice, but it helps prevent the edges from catching on the wood.

If your hands don't like the shape of your plane's handles, carve them to fit better or replace them. Before you alter a handle, look at older (pre-1922) Stanley planes, which have a flattened,

mushroom-shaped front handle. This shape feels far more comfortable in my hand than the pear-shaped handles on modern planes.

Check the fit of the cap iron on the back of the blade—there should be no gaps at the leading edge. Gaps here



Photo F: Using a second-cut or mill-bastard file, form a $\frac{1}{16}$ " bevel on the back and side edges of the mouth opening.

can jam with shavings and cause the cap iron to rock against the blade, allowing it to vibrate or chatter. To eliminate gaps, flatten the cap iron's bearing surface on the lapping plate or on a coarse honing stone (*photo G*).

Polish the arched front face of the cap iron on a buffing wheel. This finicky detail helps the cap deflect shavings with very little friction.

Before fitting the frog back into the plane body, file off paint and mill marks from the mating surfaces with a mill-



Photo G: Cap iron must sit flat on blade. To eliminate any gaps, flatten cap iron's bearing surface on lapping plate or coarse honing stone.

bastard or second-cut flat file. If the frog rocks on its supports, paint the bearing points on the supports with machinist's blue ink to see how they contact the frog. Remove high spots with the file (*photo H*). Note: If your plane is a "Bedrock," you can probably skip this step. The frog sits on a carefully machined flat bed, one of the reasons these planes perform so well.

Lubricate the moving parts of the plane: the threaded shaft on the depth adjustment knob, the pivot on the lateral adjustment lever, and the pivot on the lever cap hinge. I use an oil-less lubricant such as Dri-cote™.

Finally, coat the sole and cheeks with paste wax, then buff the wax to a sheen.

Reassemble and Fine-Tune the Instrument

You're now ready to put the plane back together and set it up to make beautiful shavings. Here's the sequence I follow.

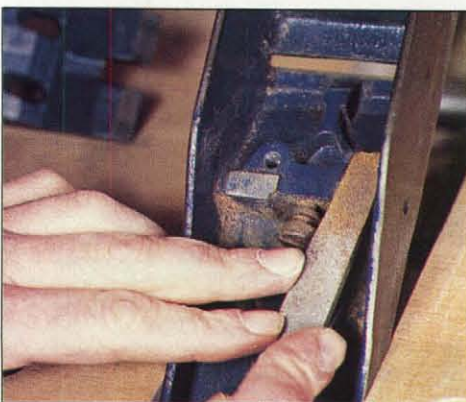


Photo H: If frog rocks on its supports, paint bearing points with machinist's ink to check contact, then remove high spots with a file.

Reinstall the cap iron on the blade. (See *figure 8*.) To do this, cradle the cap iron in one hand and just start the screw. Install the blade by laying it crosswise (bevel side up) on the cap iron, so the large hole slips over the screw. Slide the blade forward until the screw is at the bottom of the slot, then rotate the blade parallel to the cap iron. Next, slide the cap iron toward the blade edge, leaving a $\frac{1}{64}$ " backset for fine shavings or up to $\frac{1}{8}$ " for coarse work. Remember that the closer the setting, the smoother the cut, because the chance of tearout is reduced. Now, tighten down the screw snugly.

Place the cutter assembly into the plane body and clamp it down with the lever cap. Adjust the tightness of the cap by turning the lever cap screw in or out. The cam-action cap lock should snap down snugly with no play, but it should require only moderate thumb pressure to release it.

Set the position of the frog relative to the front of the throat opening: $\frac{1}{8}$ " for taking coarse shavings, $\frac{1}{16}$ " or less for fine, controlled shavings (*photo 1*). A



Photo 1: Adjust frog position relative to mouth opening to fit the job: $\frac{1}{8}$ " for coarse shavings, $\frac{1}{16}$ " or less for fine. Lie-Nielsen (shown) and Stanley Bedrock planes provide frog screws accessible at rear of frog, which allow removal of frog without having to remove the blade/cap iron assembly.

narrow opening also helps prevent tearout by keeping the pressure at the fulcrum (mouth edge) close to the pivot (edge of the blade). Most planes require removal of the cutter assembly before you can loosen the frog to make this adjustment. Others, such as the old Stanley Bedrocks and the Lie-Nielsen reproductions, provide release screws that are accessible from the rear of the frog.

Adjust Blade Laterally

Once you've tightened down the frog and have the cutter in place, sight down the length of the sole and extend the blade so you can see the cutting edge as a hairline against a white back-

ground. Now, adjust the lateral position of the iron with the lever, moving it from side to side until you align the edge parallel to the front edge of the mouth opening (*figure 9*).

Turn the knurled depth-adjustment knob until you achieve the desired thickness of shaving on a piece of scrap stock. Remember that thicker shavings require a larger throat gap and more cap-iron offset. Finally, snug the reverse-threaded knob clockwise to eliminate slack and possible backing-off of the blade during the cut.

With your hand plane now razor-sharp and tuned for peak performance, you're probably itching to put it to work. In the next installment of this series, I'll show you some techniques and tricks that I use with bench and block planes to work them to their maximum efficiency—which also maximizes the pleasure of working with well-tuned hand planes. *WJ*

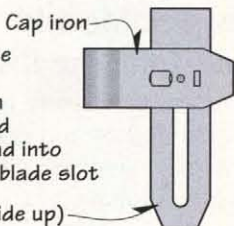
Photographs: Craig Wester

Figure 8

Installing and adjusting cap iron

Step 1

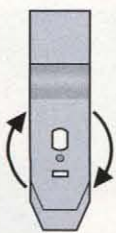
Install screw one turn in cap iron, then lay cap iron across blade and insert screw head into enlarged hole in blade slot



Blade (flat side up)

Step 2

Slide screw down slot, then turn cap iron parallel to blade



$\frac{1}{8}$ " to $\frac{1}{64}$ " backset

Step 3

Slide cap iron toward cutting edge of blade, leaving $\frac{1}{8}$ " backset for coarse work, $\frac{1}{64}$ " for fine. Tighten screw to lock down cap iron on blade

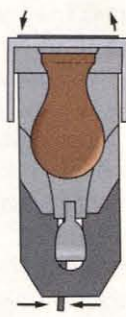


Figure 9

Adjusting blade laterally

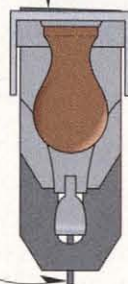
Blade not parallel with sole
1. Sight down sole of plane against white background

Lateral adjustment lever



Front views (plane inverted)

2. Move lever side to side to adjust cutting edge parallel with sole



SOURCES

For information about quality hand planes, contact:

Bob Kaune
(Bailey, antique Stanleys)
360/452-2292

Lie-Nielsen
800/327-2520

Record
800/267-8367

St. James Bay
800/574-2589

Stanley (Tool Traditions)
800/453-6736

For quality sharpening supplies and/or planes, contact:

Garrett Wade
800/221-2942

Highland Hardware
800/872-4466

The Woodworkers' Store
800/279-4441

Veritas Tools
613/596-1922

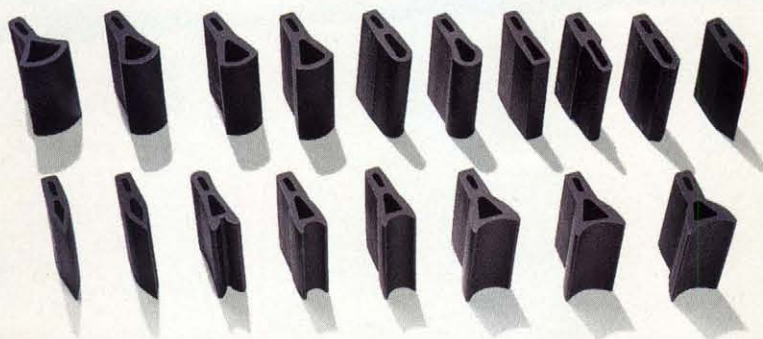
Woodcraft
800/225-1153

Woodworker's Supply
800/645-9292



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CORNER-KEYED

BLANKET CHEST

Plywood keeps it simple, walnut gives it panache

Last spring, designer/craftsman Dick Coers' wife Shirley put in a request for additional blanket storage. Dick had just trimmed some mitered jewelry boxes with corner keys, so he decided to try the same approach on a larger scale. Here's his solution. Plywood construction eliminates the complications of frame-and-panel joinery, and walnut accents finish the piece with a hint of Prairie styling.



Before You Start

Dick built his chest from maple plywood and trimmed it with walnut feet, edging, and corner keys. Instead of putting in a solid bottom, he laid aromatic cedar slats crosswise, splining them together without glue to allow seasonal movement and easy replacement.

To ensure good results with the mitered construction, start with perfectly flat plywood and take extra care with your tablesaw setups. The cuts must be square, and the beveled ends must be a true 45°. In fact, to be on the safe side, Dick suggests overcutting the bevels a bit (to 45½° or so) to ensure that no gap will show on the assembled corners.

You'll need duct tape and band clamps to assemble the case. Dick uses the same technique we've used in the past for assembling small, ornamental mitered boxes—hinging the corners with tape and folding the sides into a box. Because of this project's scale, we suggest you recruit a helper to assist with the glue-up. Also, apply band clamps carefully—it's easy to mar the fragile corners of the softwood-core plywood by overtightening.

Prepare and Edge-Band The Case Parts

Step 1. From a full sheet of ¾" cabinet-grade plywood, rip two 17¼x96" panels. Lay out the case parts on these panels where shown on the Cutting Diagram on page 35. (This will wrap the grain around the visible parts of the case.) From the second panel, crosscut the back to 40" rough length. Set aside the remaining piece; you'll cut the lid from it later.

Step 2. Crosscut the sides (A) and front and back (B) to finished length plus ½". Select the better face on each part, then mark the "inside" face and top edge on each.

Step 3. Rip and crosscut 20 linear feet of ½x1½" walnut for edge-banding. Note: Four of the trim pieces must be at least 39¼" long, and four must be 15½" long. Glue a trim strip to both edges (not the ends) of each part, making sure these overlap both plywood faces. Use full-length clamp pads to distribute clamping pressure evenly.

BILL OF MATERIALS

CHEST

PART	T	W	L	MTL.	QTY.
A Sides**	¾"	18"	15½"	P	2
B Front/Back**	¾"	18"	38¾"	P	2
C Cleats—short	13/16"	1"	11½"	S	2
D Cleats—long	13/16"	1"	37¼"	S	2
E Feet*	17/8"	3¾"	3¾"	W	4
F Corner keys*	3/16"	11/16"	17/16"	W	36
G Bottom slats*	13/16"	311/16"	139/16"	C	10
H Lid panel*	¾"	15½"	38¾"	P	1
I Lid edging—short*	¾"	15/16"	17"	W	2
J Lid edging—long*	¾"	15/16"	409/8"	W	2

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

**Finished width includes ½"-thick edge band on top and bottom edges.

MATERIALS LIST

P—plywood (maple or birch)
S—softwood (spruce, pine, or fir)
W—walnut
C—aromatic red cedar

SUPPLIES

#8x1½", 1½", 1¾" flathead wood screws; hardening oil finish. (For additional hardware, see Sources at end of article.)

Step 4. After the glue dries, remove the clamps. Then, using a flush-trim bit and handheld router, rout all edge bands flush with the plywood faces.

Miter the Case Parts, Then Assemble

Step 1. Edge-miter (bevel-cut) the sides, front, and back to finished length. These cuts must be precise—use a sliding table or cutoff jig with a stop block on the tablesaw. Cut test pieces first to verify that your blade tilt setting will form an accurate, 90° miter joint.

Note: As an alternative, you could crosscut the parts to final length, then bevel the edges using a table-mounted router fitted with a 45° chamfer bit. Note: If you elect to use this procedure, make a test-joint to check the bit—we tested several 45° bits and found they did not make accurate 90° joints.

Step 2. Place the panels face up on a flat, level surface in front-side-back-side order. Align the panel edges and butt the ends, then apply a duct-tape hinge to each joint. Next, flip the taped panels over. Note:

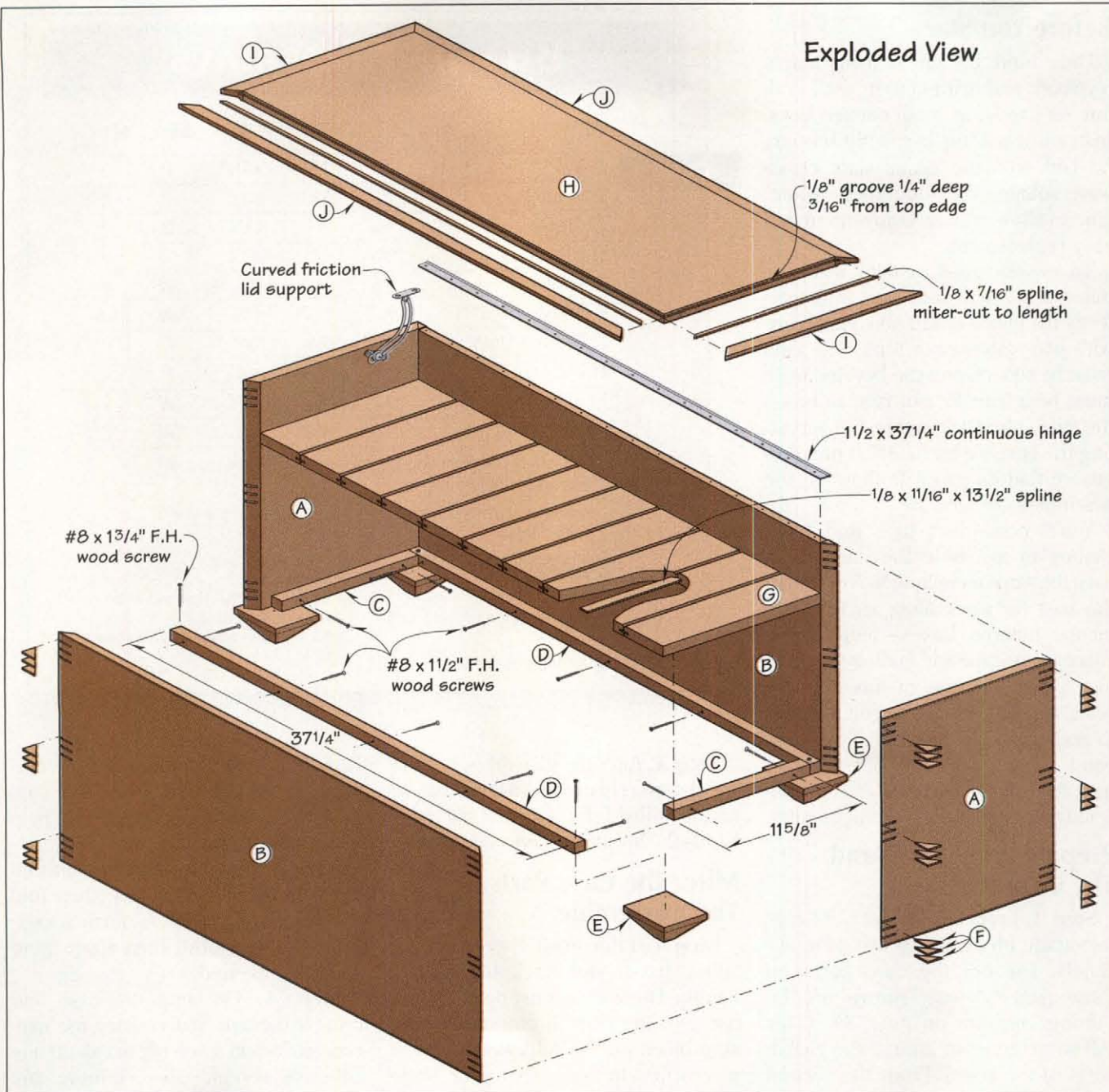
Handle the parts carefully—the corners are very fragile. Note: We suggest you recruit someone to help with this operation.

Step 3. Apply glue to the mitered ends of the taped panels, then fold the panels together to form a box. Tape the last joint, then apply band clamps if needed.

Step 4. Unclamp the case and remove the tape. If necessary, use mineral spirits and a soft rag to rub off any adhesive residue. Also, remove any glue squeeze-out from the case interior.

Step 5. To make cleats (C, D) for attaching the cedar-slat bottom, surface a 4x38" piece of pine or other softwood stock to 13/16" thick. Rip three 1"-wide strips from it. From these strips crosscut two 37¼" and two 11½" lengths.

Step 6. Glue and clamp the 13/16" edges of the cleats along the inside faces of the case, aligning them flush with the bottom edges. (For location, see the Exploded View.) Drill and counterbore evenly spaced holes for #8x1½" flathead wood screws (five in each long cleat, two in each short one). Drive the screws.



Machine the Walnut Feet

Step 1. To make the feet (E), cut a 4x20" piece of 8/4 walnut stock and surface it to the maximum thickness it will yield. (We started with 2"-thick roughsawn stock, then face-jointed and planned it to 1 $\frac{5}{8}$ ". If you're using surfaced stock, remove the minimum amount of material needed to flatten it.) Then, joint and rip the blank to 3 $\frac{3}{4}$ " wide.

Step 2. Elevate your tablesaw blade to full height and tilt it to 45°. Bevel-rip the feet blank to the sectional profile shown on the Front/Side

View drawing *opposite*. Then, cross-cut the four 3 $\frac{3}{4}$ "-square feet.

Step 3. Cut a 3 $\frac{3}{4}$ x12" piece of scrap $\frac{3}{4}$ " plywood to use as a carrier board. Compare it with the feet and make the widths identical. Next, mark a line across the width 3 $\frac{3}{4}$ " from one end to form a square, then draw diagonals to find its center. (See *figure 1*.) Drill and countersink two shank holes through the board for #8 wood screws—one at the center and one off center where shown in the figure. Note: If you don't have a miter saw, use $\frac{1}{2}$ "-thick plywood and 1" screws for the carrier board.

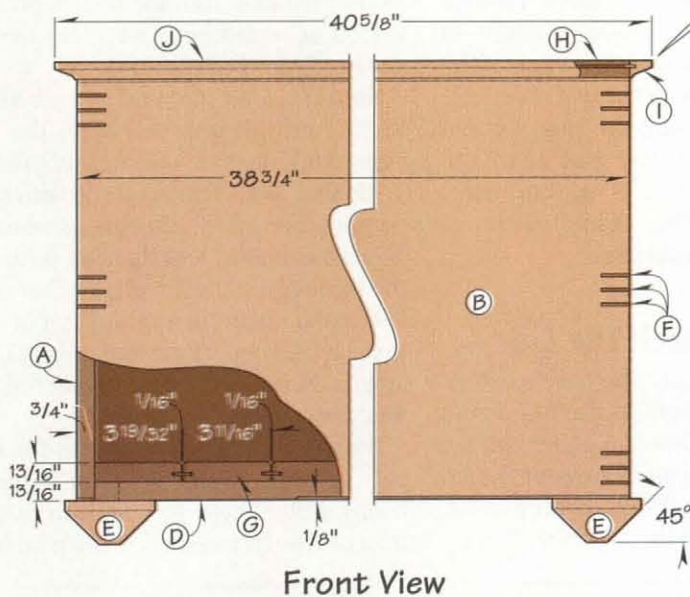
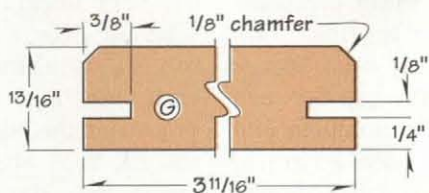
Lay the board flat on your tablesaw and cut the bevels using a miter-gauge extension with a stop block.

Step 4. Place the flat face of each foot in turn against the end of the carrier board, orienting the beveled edges parallel with the board's edges. Align the edges and ends, then clamp. Using the shank holes in the board as guides, drill pilot holes $\frac{1}{2}$ " deep into the foot. Now, attach the foot to the board using #8x1 $\frac{1}{4}$ " flat-head screws.

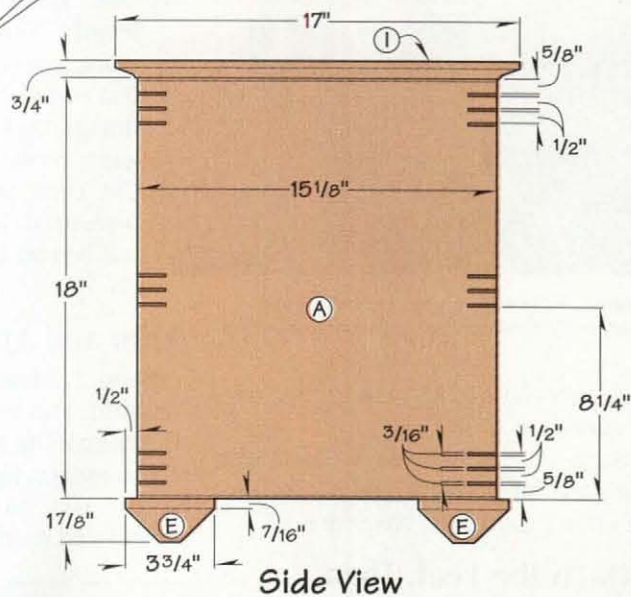
Step 5. Stand the carrier board and foot on edge against the fence of your

Note: On two end slats, cut outside edge to fit; do not chamfer or groove outside edges

Section view



Front View



Side View

miter saw. Set the saw to cut a 45° miter, then position and clamp the carrier board to the fence so the blade will cut a bevel identical to that you ripped earlier along the two opposite edges of the foot. Make the cut.

Step 6. Remove the off-center screw, then rotate the foot 180° on the carrier board. Pilot-drill the foot at this point, then secure it with the screw. Reclamp the board to the fence, then bevel-cut the opposite end of the foot. Repeat this procedure to bevel the remaining feet.

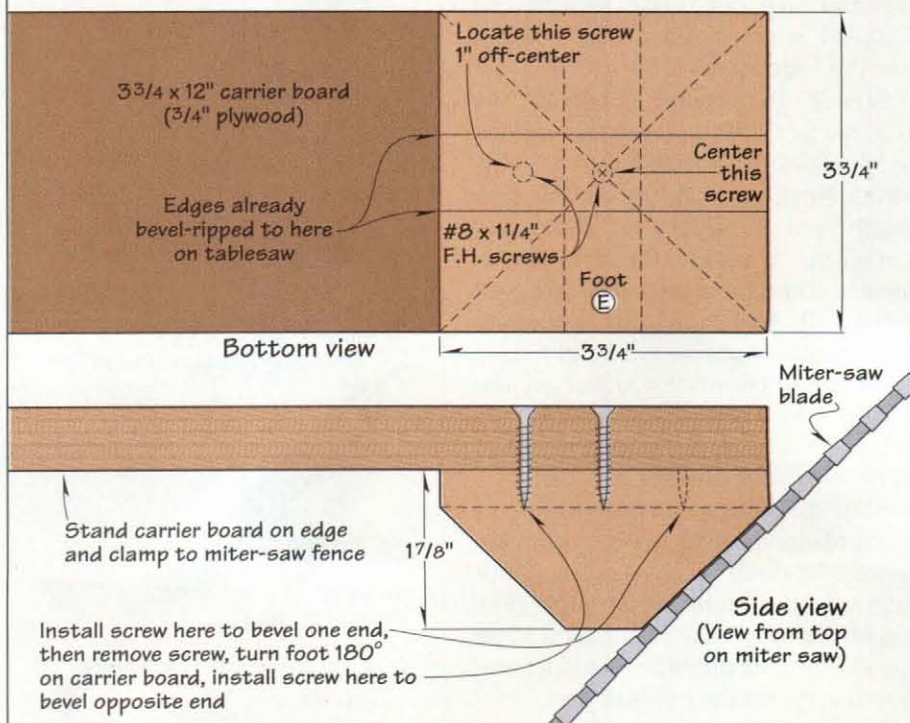
Step 7. Finish-sand all four feet to 220-grit.

that will fit snugly in the slots. (We cut three 3/16x1x24" strips.) From this material, bandsaw 36 slightly over-

sized keys (F). Tap the keys into the slots using a hardwood block. Then, apply several drops of low-viscosity

Figure 1

Bevel-cutting the feet using carrier board



Add the Corner Keys

Step 1. To cut slots for the corner keys, first build a router jig like the one shown in figure 2. Then, clamp the jig to the corners and rout the slots using a 3/8"-o.d. guide bushing and 3/16" spiral upcut bit. Note: The bit should have a cutting surface at least 1 1/16" long. (To mail-order such a bit, see Sources.)

Step 2. From 1"-thick walnut stock, rip key strips to a thickness



Photo A: With this jig you can rout the key slots on the chest corners easily and accurately.

cianoacrylate (CA) glue to the faces of each key.

Step 3. Sand the keys flush with the case faces. Note: Take care that you don't round the case corners.

Attach the Feet, Then Install the Bottom

Step 1. Position each foot beneath a corner of the case as dimensioned on the Side View drawing. Then, glue and clamp it to the case and cleats. Drill a countersunk hole through each end of the long cleats and into each foot, then drive a #8x1 3/4" flathead wood screw. (For location, see the Exploded View.)

Step 2. To make the 10 bottom slats (G), surface aromatic red cedar stock to 1 3/16" thick, then rip it into 3 1/16"-wide strips. Next, measure the interior case width and subtract 1/16" from that dimension. Crosscut the slats to this length. (Ours measured 13 3/16" long.)

Step 3. Rout a 1/8" chamfer along both edges of one face on eight slats. (See the section view detail on the Front/Side View.) Chamfer just one edge on the two remaining slats. (These will become the end slats.)

Step 4. Using your table saw, a 1/8"-thick blade, and rip fence, cut a centered, 3/8"-deep groove along both edges of the eight inside slats. (For dimensions, see the Front/Side View detail.) Groove only the inside (chamfered) edge on the two end slats.

Step 5. From 1/8"-thick hardboard, cut nine 1 1/16x13 1/2" splines. Starting with one of the end slats, spline the 10 slats together without glue, using a 1/16"-thick spacer to create a uniform gap between the slats. Add the remaining end slat, then measure the length of this assembly. Check this dimension against the case's interior length. Rip an equal amount of stock from the outside edge of the two end slats so the slat assembly fits tightly inside the case with no gaps between the end slats and the case sides. (Our end slats measured 3 19/32" wide.) Remove the bottom until later.

Trim and Attach The Lid

Step 1. Measure the case's exterior width and length at the top. From the remaining plywood panel you set aside earlier, rip and crosscut the lid panel (H) to these dimensions. Select and mark the top face.

Step 2. To make the lid edging (I, J), surface a 2 1/4x60" piece of 4/4 walnut to the same thickness as your plywood. Joint one edge, then rip the piece into two 1 3/16"-wide strips. Mark one face of each strip "top." Cut matching spline grooves in the edges of the trim stock and lid. Note: Make sure to index the groove from the top face of all parts. Don't attempt to rout the trim to profile yet. (For reference, see the detail shown on the Front View.)

Step 3. Miter one end of each strip to 45°. Fit the trim pieces to the lid edge, working your way around the lid. To do this, align a mitered end with one corner, then mark the opposite end. Miter this end to length, then position the piece along the lid edge. Miter one end of the offcut, fit it to the end of the first piece, then mark and miter it to length. Repeat until you've mitered all four trim pieces.

Step 4. To spline the trim to the lid, cut 7/16"-wide strips of 1/8"-thick hardboard. Miter these to length to fit the trim pieces. Dry-assemble the trim and

Figure 2

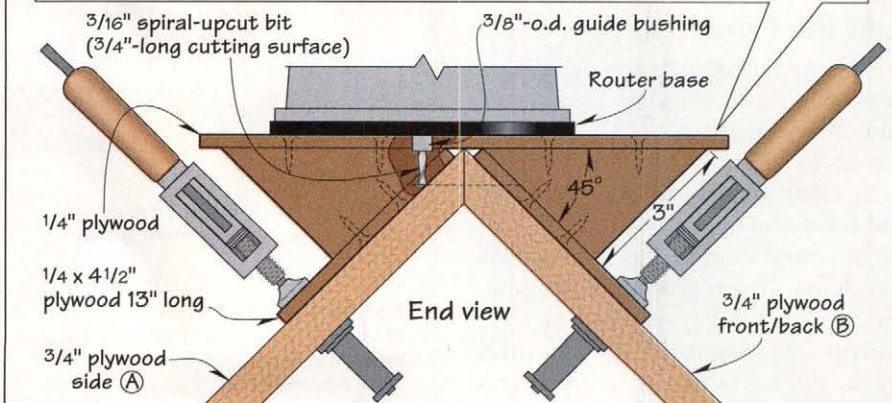
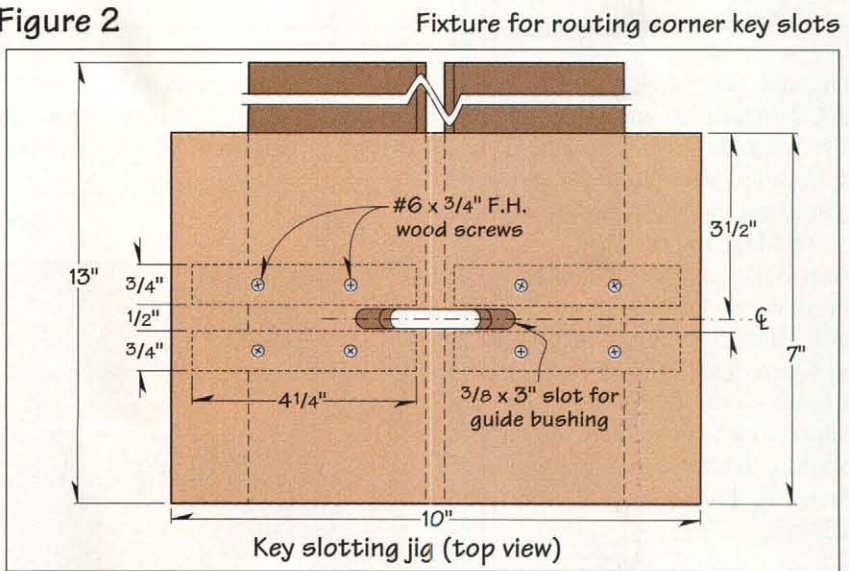
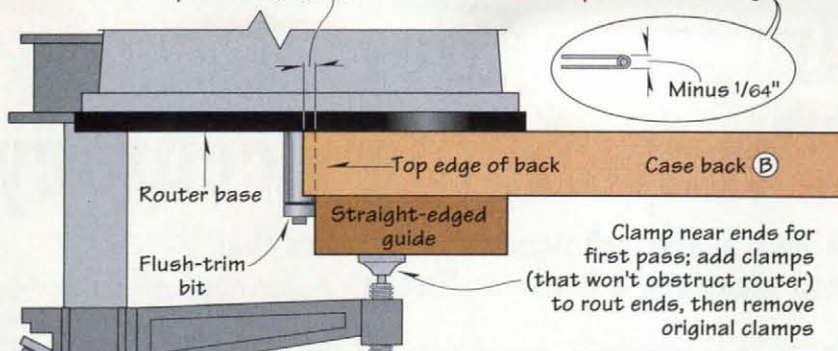
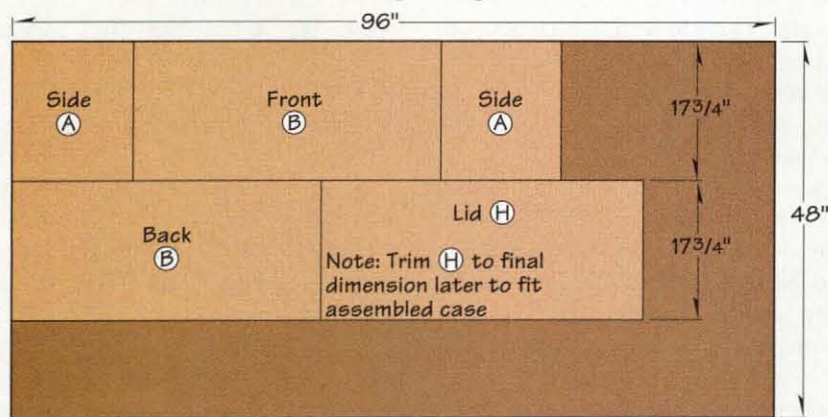


Figure 3**Routing gain for continuous hinge**

To determine depth of hinge gain, subtract $1/64"$ from depth of folded hinge

**Cutting Diagram**

Note: Initially cut parts (A) & (B) to finished length plus $1/2"$

splines to the lid to check for fit, making sure the top faces align. Now, glue, spline, and clamp the trim to the lid.

Step 5. Install a small, straight 25° raised-panel bit in your table-mounted router. Note: Make sure the profile will fit the dimensions of the trim. (See the detail shown on the Front View drawing. We used a Freud UC202 shaper cutter. (You can use any large panel-raising router bit that's designed to work on $3/8"$ thick stock.) With the lid lying top face up on the router table, rout the profile to full depth in three passes.

Step 6. Using a handheld router and flush-trim bit, rout a hinge gain along the top edge of the back panel to accept a $1\frac{1}{2}"$ -wide piano (continuous) hinge. (To mail-order, see Sources at right.) To set the gain depth, first fold your hinge so the leaves are parallel, and measure the total thickness. Next, clamp a straight-edged guide to the inside face of the case back, positioning the guide just a hair short ($1/64"$) of this depth from the top edge of the back. (See figure 3.)

Woodworker's Journal

Step 7. Lay out the ends of the gain on the top edge of the back. Transfer the end marks to the back's outside face where you'll be able to see them when routing later. Next, turn the case over onto its front face, rest the router base on the back's outside face, and rout as much of the gain as you can. Install additional clamps where they won't obstruct the router. Then, remove the original clamps and rout the rest of the gain. Square the gain ends.

Step 8. Cut the hinge to fit the gain, then position it along the back edge of the lid centering the barrel over the seam between the panel and trim. Lightly clamp the hinge in place, drill a hole every 6" or so using a Vix bit, and drive screws as you go. Unclamp, then drill the remaining holes.

Step 9. Position the lid on the chest with the hinge closed. Carefully lift the back of the lid and apply three large dots of hot-melt glue to the gain, quickly relocate the lid and hinge, and then press down until the glue sets. Carefully lift the lid and gently mark

three hinge holes in the back. Pop the lid off and drill pilot holes where marked. Replace the lid, drive these three screws, and test the lid's fit. If some adjustment is necessary, loosen the screws and reset the lid. Once you get a good fit, drive the remaining hinge screws.

Apply Finish, Then Complete The Final Assembly

Step 1. Mount a curved friction lid support to the lid and side where shown on the Exploded View. (See Sources for a mail-order supplier.) Remove the support, the lid, and the hinge.

Step 2. Finish-sand all parts to 220-grit. Then, apply a clear finish to the exterior surfaces of the case and lid but not to the inside surfaces or the cedar-slat bottom. (We applied two coats of a hardening Danish oil finish, and then waxed the case.) Allow the finish to cure thoroughly.

Step 3. Fit the splined bottom assembly (without glue) into the case so it rests on the cleats. Nail the slats at each end to the long cleats. Reattach the lid to the case. 

Photograph: StudioAlex

Project design: Dick Coers

Produced by: Doug Cantwell

SOURCES

Piano hinge. $1\frac{1}{2} \times 48"$ brass-plated steel. Catalog no. 19291. Price: \$8.29 plus s/h.

Curved friction lid support. Brass-finished steel, $5\frac{1}{2}"$ overall, screws included. Catalog no. 25619 (right hand) or no. 25627 (left hand). Price: \$3.99 plus s/h. Order either/both of the above from:

The Woodworkers' Store
800/279-4441

Spiral upcut bit. Solid carbide, $1/4"$ shank, $3/16"$ diameter, $3/4"$ cutting length. Catalog no. 880-005. Price: \$19.20 plus s/h. Order from:

CMT Tools
800/531-5559

Improve Your Woodworking Accuracy

A look at the techniques and practices that can make you a better craftsman *by Bob Colpetzer*

During my years as a shop instructor, I heard a common lament from prospective woodworkers: "I love to work with wood, but I'm just not very good at it. Nothing I do comes out right. I need better tools and equipment to do really good work."

These students didn't understand that the quality of their work depends not only on the tools they used but on their techniques. Too many assumed that if they bought expensive tools, their results would be perfect.

Better tools will often improve one's woodworking, but not automatically. The fact that one tablesaw costs three times the price of another doesn't guarantee that anybody who uses it will do more accurate work. The expensive saw won't prevent layout or setup errors any more effectively than its downscale counterpart.

I don't mean to imply that upgrading to better tools is a waste of money. Generally, you get the quality you pay for. There are substantial differences between professional- and handyman-grade tools, although they're not always obvious. Better tools usually will improve your work *provided* you employ sound techniques.

I advise you to buy the best tools and equipment that your budget will allow. At the same time, however, I encourage you to put serious time and effort into developing your techniques and learning accurate procedures.

Tune Up Your Tools

Whatever grade of tools you use, set up and adjust each piece for optimum performance. Study the owner's manual supplied with the tool and familiar-

ize yourself with all assembly and alignment procedures.

For starters, align everything. I've yet to buy a machine that was perfectly tuned and ready to use right out of the box. It may have been set accurately at the factory, but shippers seem to be wizards at undoing the manufacturer's efforts. Larger equipment, often shipped in several parts, requires some assembly. After you've assembled it, go back and double-check each step.

If you buy a tool already assembled, go over it thoroughly when you unpack it. I always assume pessimistically that the person who assembled it was either inadequately trained or not given enough time to do it thoroughly.

Also, make a habit of maintaining your tools regularly. This may seem to be a hassle at times, but I consider it a small price to pay for better tool performance. Rather than rely on memory, keep a simple maintenance chart within handy reach of each machine.

Some power tools—the tablesaw, radial-arm saw, jointer, planer, and bandsaw—require regular tuning. Without going into a lot of detail, I'll list some basic parts and functions to check on each. For complete tune-up procedures, consult your owner's manual.

Tablesaws: The miter gauge slot and rip fence must be parallel to the saw blade. Positive stops on the miter gauge should be set at precisely 45° and 90° (*photo A*). Likewise, the bevel stops should allow you to tilt the saw blade to a 45° angle and then return it to vertical 90°. The manual will show you how to make any needed adjustments.



Photo A: Author uses an accurate try square to set the 90° stop on miter gauge. Note: Blade guard has been removed to avoid interference.

Next, inspect the miter gauge closely. The head should fit securely to the bar. If there's play in the pivot, you won't get an accurate or smooth cut. Sometimes, simply tightening the pivot pin can correct the problem. Also, the miter-gauge bar should fit snugly in the slot.

Radial-arm saw: If you own one, you already know it requires frequent alignment. Level the table, straighten the fence, and set the blade at 90° to the table and the fence. In addition, check the heel of the blade relative to the arm. Set the angle and bevel stops at 45° and 90°.

Jointer: Set all knives to the same height to establish a uniform cutting circle. Make certain that the cutter head is parallel to the infeed and outfeed tables. Adjust the outfeed table to the same height as the cutting circle, and make sure that the two tables lie in the same plane. Set the fence stops at 45° and 90° (*photo B*).



Photo B: Checking the 90° setting on the jointer fence and table with a try square.

Thickness planer: Set all knives in the same cutting circle, and make sure the circle runs parallel to the planer bed. Adjust infeed and outfeed rollers parallel to the bed. If your machine is so equipped, adjust the height of the front chip breaker and the rear pressure bar to minimize planer snipe. Check the bed rollers to see that they're parallel to the bed, and set them to proper height.

Bandsaw: The wheels should align parallel and track in the same plane. Adjust the blade to proper tension. Adjust upper and lower blade guides and blade supports to the blade. Square the table to the blade, then set the table tilt stops and indicator.

Stay Sharp

Sharp cutters require less power (either muscle or motor) and produce a cleaner, more accurate surface than dull ones. Dull cutters also increase the hazards to you. I consistently find it more time efficient to take the time to resharpen or change a blade, especially if using a dull tool results in my remaking a part—or worse, having an accident.

Replace dull circular-saw blades. Remove bandsaw blades that drift or cut to one side or won't cut a straight line. On a tuned bandsaw, sidewise drift indicates that the teeth are dull on one side and that the blade should be replaced.

Learn proper sharpening techniques. Then, keep the cutting edges of chisels, gouges, and planer blades sharp. (See *photo C*.) For help with the techniques, see my article "Putting On A Good Edge" in the Jan./Feb. '96 *Woodworker's Journal*, pp. 70-77.

Measuring and Marking Lines

Measuring and marking stock is a critical part of woodworking. In fact, it establishes the tolerances that can make a project successful.

Obviously, not all projects require the accuracy that a slant-front desk or grandfather clock demands. However,

I recommend that you make it a habit to work as precisely as you can, regardless of the project.

Inaccuracies can creep in as you measure and lay out the work. Improper measuring, faulty layout procedures, poor line definition, and inaccurate tools all contribute their share of error.

At one time or another, we've all lost concentration long enough to misread a rule. To avoid this pitfall, stay alert and make a practice of double-checking critical measurements. The well-worn adage "measure twice, cut once" holds as true today as the moment it was first spoken.

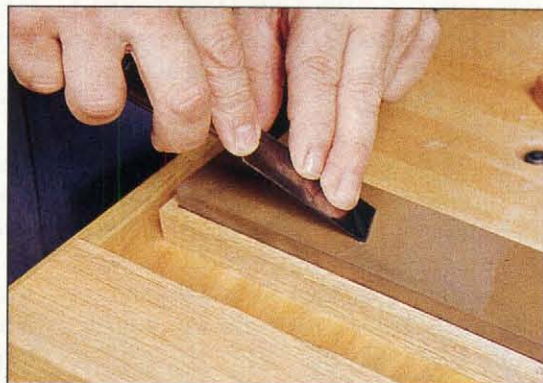


Photo C: Sharp cutting tools reward the user with more accurate results.

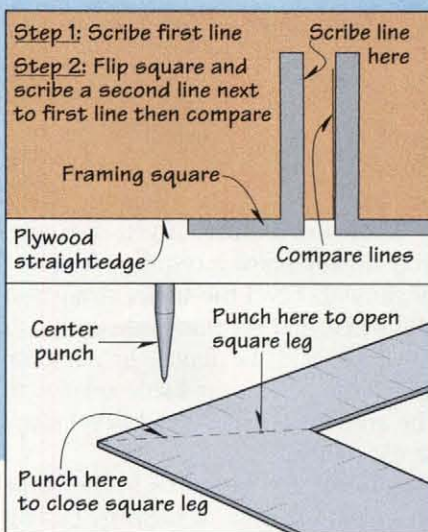
Error can also creep in whenever you pick up a low-quality or inappropriate measuring tool. Tape rules are convenient, but I find their 1/16" tolerance too crude for most fine woodworking. I use a tape only when I can get by with rough measurements.

For general woodworking, I use a quality 6' folding rule. For closer tolerances, I'll switch to a good 2' or 3' bench rule with 1/64" divisions on at least one edge. I also like having a good 6" rule in my shirt pocket to check setups. If I need to accurately measure stock thickness, tongues, mortises, or hole diameters, I grab my calipers (*photo D*).

Having said all of this about measuring devices, I often find that the most accurate measurements can be made using no rule at all. Once you've started construction, mark critical dimensions from a part you've already prepared directly onto its mating part (still to be cut). By eliminating the extra steps of taking a measurement and then transferring it to a piece of stock

To true a framing square, secure a piece of plywood with a cleanly sawn straight edge. Position one leg of the square against that plywood edge, then scribe a line along the other leg. Now, flip the square over as shown on the drawing *below*, repeat the procedure, and compare the two scribed lines.

If the lines don't match, true the square by center-punching the inside corner to *open* the legs slightly, or the outside corner to *close* them. (See the lower drawing.) Continue to test and adjust the square until the two lines align.



erances, I reach for a sharp, single-bevel layout knife. This tool makes a clean, thin line.

Use a marking gauge to lay out precise mortises, hinge gains, or handcut dovetails—or wherever you need dupli-

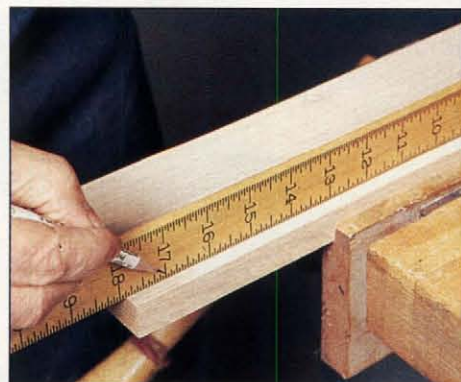


Photo E: To improve accuracy, the author turns his rule on edge for a better view when measuring or marking a dimension.

square using my benchmark try square. (For guidance on this procedure, see the Pro Tip, at *right*.)

Once you've acquired accurate layout and measuring devices, learn to use them correctly. It's not difficult to mark a dimension from a rule, but the way you do it can make the difference between an accurate and an inaccurate layout.

To measure or mark, I place the rule on edge and square to the surface (*photo E*). This gives me the most direct line of sight to the rule. Don't lay the rule flat and try to eyeball the measurement—any deviation will give a false reading. To scribe a measurement, I like to slide the point of my pencil or scribe down the rule's etched increment line to the stock and mark the point.

Remember to indicate the waste side of the line so you don't cut on the wrong side. I'll make a long-tailed V or X to positively identify the waste side of a cut line.

Limit the number of times you transfer a measurement, because each transfer can increase an error. If you need the measurement on the edge of a piece, lay it out on the edge rather than on the face. Transferring from the face to the edge can degrade the precision.

Whenever you rip stock to width on the tablesaw, measure from the rip fence to the inside edge of the saw teeth; measure from the miter-gauge stop to the teeth when crosscutting to length. Measuring and scribing a line on the board and then setting the saw to that line takes additional time and introduces another possible source of inaccuracy.

That brings me to line quality. Take extra care when scribing lines on a project. Don't expect precision if your pencil lead makes a $\frac{1}{16}$ "-wide line. A freshly sharpened #3 or #4H drafting pencil may be adequate for general use. Even a .5mm technical pencil line may be too wide for the tight tolerances of a seamless joint. (Note: The fragile .5mm lead doesn't fare very well in the shop environment.) When I need really close tol-

Photo D: Author considers high-quality layout and measuring tools essentials—not luxury items.

by measuring again, you reduce the chances of compounding error. To lay out parts directly, I place the piece next to or over the location where it will be installed, then mark it with a sharp pencil or knife.

Using a "story stick" also eliminates numbers you have to read and measurements you need to make, which translates into fewer opportunities to introduce error. You can make a story stick for any job, whether in the shop or on site, then take it to the saw to make the required cuts.

Buy Quality

I learned long ago not to fudge on quality when buying layout tools. You simply can't lay out a joint or set up a machine accurately with a tool that's less than 100 percent accurate. I suggest you buy the highest-quality try square, combination square (fitted with a centering head and protractor head), sliding T-bevel, marking gauge, framing or cabinet square, and straightedge you can find.

If you're worried that buying an entire set of quality measuring tools will break your bank, acquire them one by one as your budget allows. When I started working wood seriously, I bought a dead-accurate try square, then used it as a benchmark to gauge my older squares and set machines square. I used it only when I really needed fine tolerances and treated it with great respect. When finished with it, I'd return it to its holder to protect it from accidental damage.

For accuracy on larger-scale work, I bought a quality, name-brand framing square, then fine-tuned it to dead

cate marks. I've found that the models with a cutting disc marker produce a fine, accurate line.

Don't be afraid to write notes on the stock. To help my memory, I leave little reminders indicating the correct side to cut on, the miter angle, and other useful information. These simple notes eliminate a lot of confusion and error.

In my shop, I've always used good drafting tools as low-cost alternatives to layout equipment. I especially like preset 30, 45, 60, and 90° triangles for tasks like machine setup and checking. An adjustable triangle helps with those odd angles I occasionally encounter.

Plan Your Work

Success with any project has its roots in the idea stage. If you don't have detailed drawings, take the time to draft them and then write up a bill of materials.

At this stage, I also make up a plan of procedure. This plan outlines in order the steps I need to take to build a project from start to finish. Besides providing a roadmap of the construction steps, this exercise forces you to think through every facet of the project's construction.

It also helps you organize the work, so identical pieces can be milled at the same time using the same machine setup. Accuracy almost always suffers if setups have to be duplicated later in order to make identical parts.

If you draw up a procedural plan, I guarantee that it will shorten your construction time, reduce the likelihood of error, and make the project more enjoyable to build.

Even though you've written a bill of materials, avoid the temptation to cut all parts to size first. Measurements vary from one part to another, and no matter how carefully you work, even

slight errors can accumulate. To prevent this, I cut and assemble parts of a project as I work, letting the resulting assembly determine the dimensions of subsequent parts. For example, I'll assemble a cabinet's carcass, then cut the face-frame members and cabinet trim to fit the carcass.

Master the Basics

I've always felt that if successful craftsmanship could be traced to a single skill, it would be the ability to accurately mill and cut a board to a specified thickness, width, and length.

To qualify as accurately milled and cut, the finished board should be free of any warpage, and its two faces should be parallel for uniform thickness. Its edges should be straight, square to the faces, and parallel to each other, forming a uniform width along the entire length. The ends of the board must be cut square to the edges

Continued on page 40

HOW TO OBTAIN CONSISTENTLY ACCURATE RESULTS

Mastering these fundamentals can help ensure accurate woodworking:

1. Using oversized or rough dimensions from your bill of materials, lay out the parts on the stock. At the same time, check the stock for internal stresses, knots, nails, staples, and other potential problems. Cut the pieces to rough length using a hand jigsaw or hand circular saw, then rip to rough widths and into manageable pieces that will fit on your jointer. If the pieces seem badly warped or twisted, you may want to use a bandsaw to break them down.

2. Joint one face of each piece to make it flat and eliminate any warp. (See illustration at right.)

3. Thickness the piece by placing the jointed face on the planer bed and planing the opposite face parallel to it. After planing the second face parallel to the jointed face, take equal cuts from both faces until you've reached thickness.

4. Joint one edge so it is square to the previously jointed face.

5. Set the tablesaw rip fence $\frac{1}{16}$ " wider than the finished width. Place the jointed edge against the rip fence and the good face up, then rip the board to width. Note: If cutting several parts from the same piece, joint a new edge before ripping the next piece. Rule: Always pass a *jointed* edge against the rip fence.

6. To remove saw marks from the edge, size the piece to finished width, or make the cut edge square to the face, first set the jointer to cut $\frac{1}{32}$ ". Next, place the sawn edge of the piece on the jointer bed and, holding one face

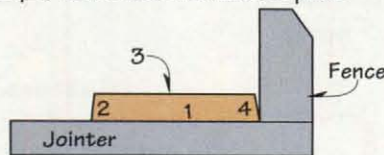
firmly against the fence, make a test by jointing 1" of the workpiece. Back the piece off the jointer head and measure the piece remaining at the cut (not the amount taken off). Continue adjusting and making trial cuts until you reach the desired width of the piece. Then, joint the entire length of the sawn edge. Joint all ripped pieces to this dimension.

7. To square one end, place the piece on the tablesaw with its good face up. Position a squared edge against the square miter gauge, and crosscut a small amount of stock from the end. Then, square the end of all the pieces.

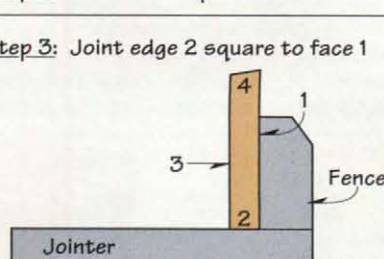
8. Set a stop on the miter-gauge extension at a distance from the saw blade equal to the finished length of the piece. Place the squared end against the miter-gauge stop (with the good face up). Then, crosscut the piece to finished length. Repeat this step for all pieces that need to be cut to the same length.

Squaring Stock

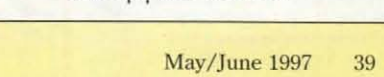
Step 1: Joint face 1 to flatten piece



Step 2: Plane face 3 parallel to face 1



Step 3: Joint edge 2 square to face 1



Step 4: Place edge 2 against rip fence and rip piece to width

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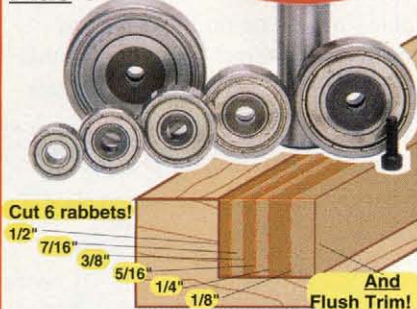
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Continued from page 39

and to the correct length. (Perhaps I would broaden this single skill to include the ability to produce as many identical parts as needed.)

Making a straight, square reference edge on a piece of stock is the most basic of woodworking procedures. Unless you've mastered it, you simply can't perform any hand or machine operation with accuracy. And yet, simple though this may seem, I still see many woodworkers struggle because they don't understand this fundamental.

Joinery

Take the time to set up machines accurately before starting any operation. Use an accurate rule or square to set up the tool, then test the setup on same-sized scrap. Adjust as needed.

I prefer to use jigs for repetitive operations and for those requiring a great deal of setup time. Many experienced woodworkers use cutoff

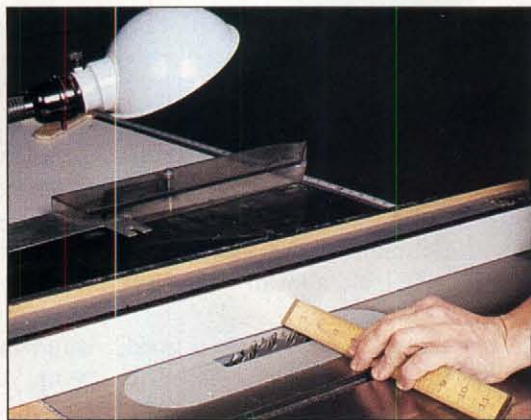


Photo F: Author has added point-of-use lights at key work stations for close-tolerance work. Note: Blade guard removed for dado setup.

tables and miter jigs on tablesaws and bandsaws to work around the limitations of a small or inadequate miter gauge. Realize, however, that the work you do on a jig will only be as accurate as the jig.

Your Shop and Working Conditions

Make sure your work area is well-lighted. Don't try to work to a 1/4" tolerance in a shop lit so dimly that you can't see the rule marks.

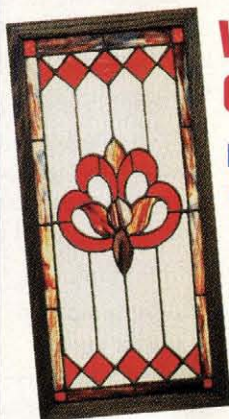
Although we may not like to admit it, our eyesight tends to deteriorate with age. For me, corrective lenses were necessary. But even with glasses, I find that I need more light than I used to for close-tolerance work. I simply turn on the extra light on when I need it for critical measurements and setups, then turn it off and swing it out of the way.

Work at a pace that lets you think through the procedure, and which allows you time to double-check your measurements, and that gives you a feeling of confidence. Avoid rushing a job or working when fatigued. Doing so will likely increase hazards, cause errors, and result in poor workmanship.

Finally, I believe you need to practice being accurate. As with playing golf or shooting trap, we need to practice regularly to maintain the skills we've developed. As you refine your woodworking techniques, your craftsmanship will evolve to an even higher level.

Photographs: by author

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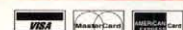
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HIGH-TECH HANDSAWS

**East meets West on
the cutting edge**

by Tom Jackson



Although it often takes a back seat to power tools, the humble hand saw has yet to disappear from any shop. For many less-than-critical cuts, hand saws work more quickly and more cleanly than their motorized counterparts. If you venture out to the store to buy a new hand saw today, however, what you'll find will likely surprise you.

Roughly three-fourths of the new hand saws sold today bear only a superficial resemblance to the traditional Western-style saw that many of us grew up with. The new saws may appear Western in shape, but look closely at the cutting edge. You'll see a hybrid: teeth with elements of both Western- and Japanese-style saws.

These new saws still cut on the push stroke, as Western saws always have, but they also cut on the pull stroke as well. Manufacturers combine different arrangements of set and unset teeth to improve tracking and keep the blade from binding in the kerf. Many of the saws come in shorter lengths—15"- or 16"- long blades. You'll also find teeth heat-treated for extra hardness, non-stick coatings to lessen friction and resist pitch buildup, and ergonomic handles for a better grip.

Lower Cost, Better Performance

Traditionalists may grumble about this departure from a technology that has worked well for years. At first glance, one might even dismiss these saws as low-cost tools designed for weekend hackers. None of them costs more than \$25—one-half to one-third the price of a quality traditional saw.

In my experience, however, the new saws perform better than traditional, file-sharpened saws. They don't hop or skip when you try to start a kerf. They track a straight line exceptionally well, leave a clean top edge on the kerf, and cut with surprising speed. I also find the shorter blades much more maneuverable when making small notch cuts and inside corner cuts that a circular saw can't reach. Granted they may be disposable, but under normal condi-

tions, any of these saws should last at least 10 years. This makes them an excellent value for the money.

If your old hand saws are about to give up the ghost, or you can't locate a decent sharpening service, you'll face the choice of purchasing a traditional-style hand saw or one of the new high-tech designs. Unless you have a lot of money, live in a city with a good sharpening service, and don't mind the wait while they're being resharpened, I suggest you consider one of the new saws.

Japanese-Inspired Tooth Designs

To understand this redesign of the Western hand saw, first look at the Japanese saws. Like Japanese hand planes, these tools cut on the pull stroke rather than the push stroke.

Figure 1 Traditional Western crosscut

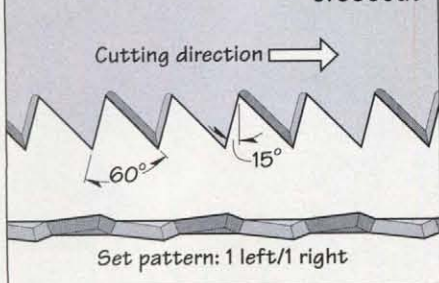


Figure 3 Stanley

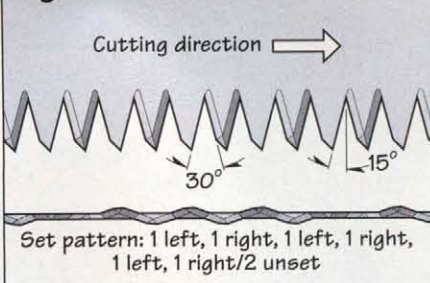


Figure 2 Typical Japanese crosscut

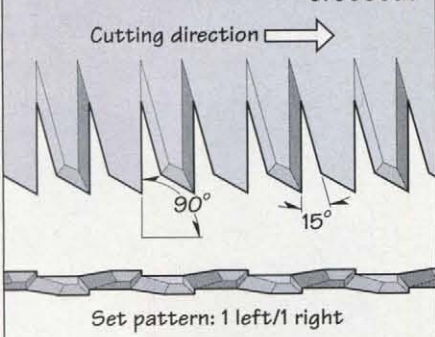
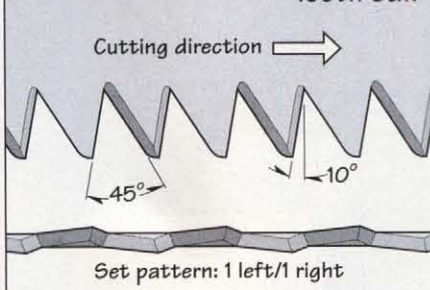


Figure 4 Jackplus Aggressive Tooth Saw



This keeps the blade straight and under tension during the cut, so they can get by with a thinner blade and narrower teeth. (See figures 1 and 2.)

A thin blade offers several advantages over the thicker blades of older Western push saws. Notice in the drawings how the cutting edge on a Japanese saw tooth attacks the wood straight up. This angle (or lack thereof) is called the *rake*. Note too the angle of the *gullet*, which spans the distance between the front edge of one tooth and the back edge of the next. Japanese saws typically have an aggressive 0° rake and a steep 15° gullet.

On conventional Western crosscut saws, the teeth lean backward at a less aggressive 15° rake and are separated by a wide 60° gullet. The thinner, more aggressive Japanese tooth cuts faster and yet creates less sawdust, eliminating the need for a wide gullet. A Japanese saw tooth also terminates in a secondary cutting surface that resembles a tiny skew chisel ground onto the tip.

Japanese saw teeth also have a lot less *set* than Western teeth. Set is the angle to which saw teeth are bent outward from the vertical axis of the blade. Without some set, the teeth would cut a kerf

only as wide as the blade and cause the blade to bind on every stroke. Japanese saw blades also taper in thickness (wider at the cutting edge, narrower toward the top), which further eases binding. Tapered blades were once common on Western saws, too, although you now find them only on expensive models.

All of the new, high-tech hand saws shown here incorporate some adaptation of the Japanese tooth design. The blades do not taper, nor are they as thin as their Japanese counterparts, but manufacturers use various combinations of set and unset teeth to virtually eliminate kerf-binding.

Stanley, Disston, and Jack

Stanley first broke the mold in the mid-'80s by introducing a line of saws with a 15° rake on both the front and back tooth edges (creating a 30° gullet angle) and an aggressively angled version of the Japanese chisel point. (See figure 3.) The Jackplus Aggressive tooth and Disston Tiger Force saws use a similar tooth profile. (See figure 4.) These designs have three cutting surfaces per tooth and a push-pull cutting action.

To minimize binding on its saws, Stanley sets six alternating left-right teeth followed by two unset rakers. The Disston teeth are set right-left followed by two unset teeth. The Jackplus uses a traditional set pattern.

Sandvik and Jack General Purpose

Sandvik's "XT" tooth ing uses two different teeth on the same blade as shown in figure 5. The grind on both types forms a 15° rake and a 45° gullet, but the longer teeth terminate in a sharp point and don't receive any set. The shorter, set teeth terminate in a chisel point. The tooth pattern consists of two long unset teeth followed by a shorter tooth, with the set



on the shorter teeth alternating left-right. The longer teeth do most of the cutting and track very straight due to their lack of set. The shorter, set teeth widen the kerf and eject sawdust to prevent binding.

The Jackplus General Purpose Saw uses the same rake and gullet angles as a conventional Western crosscut. However, the Jackplus alternates a pair of unset teeth with a pair of set teeth, the latter being set left-right. (See figure 6.)

Heat-Hardened Teeth

Stanley brought another innovation to market in the '80s—induction-hardened teeth. This tempering process increases hardness as measured on the Rockwell scale. Most other manufacturers have followed suit, some calling the process "impulse-hardening" and billing the result as "hard-point" teeth. Whatever you prefer to call it, heat-hardening darkens the teeth relative to the rest of the blade (photo A).

According to marketing claims, teeth hardened by this process will stay sharp three to eight times longer than non-hardened teeth. Such longevity has advantages and disadvantages. Hardened teeth better withstand the abrasive effects of particle-

board and plywood adhesives which quickly dull ordinary saw teeth. The drawback, however, is that these teeth, because of their hardness as well as their unusual profiles, are difficult to resharpen.

Purists may question the ethics of throw-away tools, but given the cost of resharpening and the scarcity of competent sharpeners, hardened teeth make good sense. Priced at \$12 to \$25, these new saws will save you money, both in the initial layout and in the resharpenings you won't have to pay for. Economy aside, the teeth are ground to profile by industrial machines that put a keener edge on them than you'll get with even

an expert hand-sharpening. (If you count yourself among those who were born to recycle tools, you can always grind the teeth off one of these blades—should you ever wear one out—and cut it up to make scrapers.)

Blade Sizes

In the past, when carpenters and woodworkers cut most of their stock by hand, they needed every inch of their 26"-long hand saws to maximize their stroke length and cutting efficiency. Today, power tools make short work of most stock dimensioning, leaving hand saws to take care of small detail work and quick, expedient cuts.

Manufacturers responded to this change by producing hand saws with 15"- and 16"-long blades, while still offering the conventional 20"-plus lengths. The smaller saws handle more easily, especially on delicate cuts, and fit neatly inside almost any tool box. Even when you have a long straight edge to cut, the aggressiveness of the new tooth designs compensates for the shorter stroke length.

Ergonomic Handles

More recently, saw designers have turned their attention to user comfort, developing handles that fit your hand more naturally (photo B). Stanley has added a rubber-

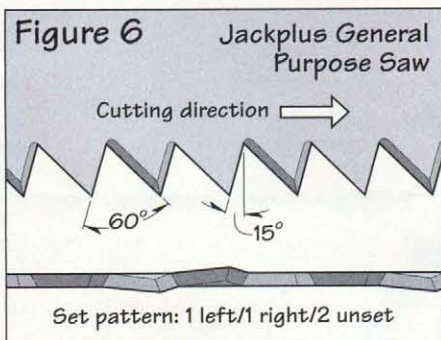
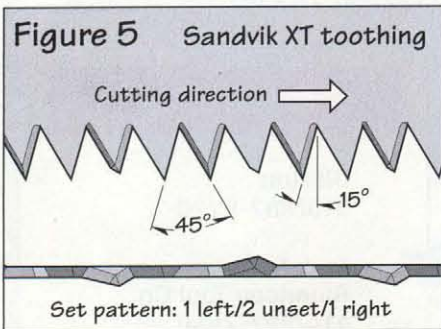
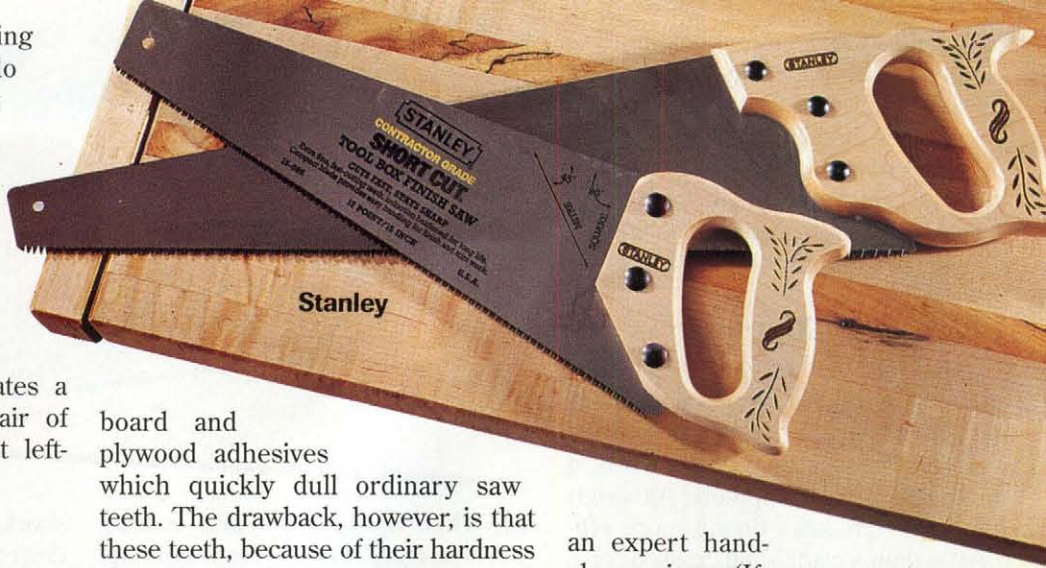


Photo A: The darkened teeth indicate that they have been heat-tempered, which keeps them sharper longer.



Photo B: Padded and ergonomically designed handles improve grip and reduce hand strain.

ized pad to the wooden portion of its handles. This non-slip grip has an oval cross section that requires less gripping effort than the traditional hard, square profile. Jack and Disston offer molded, texturized, plastic grips. Sandvik incorporates a cushioned, non-slip grip on most of its hand saws.

What About Ripping?

The firms that produce these new saws claim they'll rip as well as cross-cut. In my experience, however, they excel at crosscutting but do only a fair-to-good job on rip cuts. Although the high-tech saws do rip more efficiently than a traditional crosscut saw, I'd prefer an old-fashioned, aggressively toothed rip saw if faced with a long rip (and deprived of power tools). Still, in most cases this situation does not warrant the purchase of a traditional rip saw.

Other Features and Considerations

All of the saws discussed here come with some kind of protective cover. The Stanley and Disston Hardpoint saws have a cardboard sheath that covers the entire blade. The rest come with a snap-on or slide-on plastic guard that protects just the teeth. A word of caution: Keep these guards and use them—the new teeth can bite. They come razor-sharp from the factory, and the irregular set patterns make them very grabby to the touch.

Sandvik coats its blades with a low-friction material that you'll appreci-

ate. This black, Teflon-like coating prevents rust, reduces resin buildup, and helps the saw glide through the kerf more easily.

Choosing a Suitable Saw

For the home woodworking shop, I'd recommend two variations of the new high-tech saw. First, a toolbox-size model with 9 to 12 points (teeth per inch). It will give you fast, clean cuts for general work and handle easily in tight spaces. Second, a longer saw (20-22") with fewer teeth (7-8 points). It will quickly cut beams and big timbers down to manageable size.

These more aggressive 7- and 8-point saws leave considerable tearout on the stock's bottom face and may chip or tear plywood veneers even on the top face. That's why I recommend them in the long lengths for rough stock-dimensioning only. Frame carpenters and other tradespeople, however, may prefer the speed and convenience of a

short, aggressive saw for jobs that don't require a clean cut.

For more precise work, Sandvik and Jack make fine-tooth flooring saws with aggressive tooth designs. Sandvik also sells a backsaw that incorporates its XT toothing and comes with a coated blade.

Bear in mind that these new saws probably won't meet all of your handsaw needs. You still can't beat the traditional Japanese *dozuki* and *ryoba* saws for furniture-quality cuts and surgically clean paring cuts. For most other operations, however, the new high-tech hand saws give you the quiet convenience of traditional hand saws plus the added benefits of faster cutting, better control, and affordable prices. **WJ**

Photographs: Kevin May

SOURCES

Disston
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remaining 60° angles in sequence as shown in *figure 1*. Then, rout the chamfers and coves on the edges of each where shown on the Exploded View details on *page 48*. To minimize tearout, rout the edges that run across and diagonal to the grain (edge grain) first.

Bevel the column sides. Rip and crosscut the stock for the six column sides (C), but leave the edges square for now. Install a 30° chamfer bit in your table-mounted router, then rout the edges to form the bevel. (We used CMT Tools' 30° chamfer bit, no. 857-501.) Note: Make several passes on each edge, gradually elevating the bit to sneak up on the final cut without over-cutting. The bevel must come to a point, and all six pieces must measure exactly the same width.

An alternate technique: use a split fence on your router table with independently adjustable halves. This setup allows you remove stock as you would on a jointer (*photo A*). Routing a full 1/16" or so from the width reduces the chances of splintering and results in very accurate, tight joints. If you use this technique, you must rip the parts wider initially to compensate for the stock removed.

Assemble the column. Place the six beveled pieces outside face up, arrange them for best grain continuity,



and mark them. Flip the pieces over, then drill pocket holes for face frame screws where shown. Note: Make sure the pilot portion of each pocket hole breaks through the end of the workpiece. During assembly, you'll be driving these screws blind and won't be able to deepen the holes.

Rearrange the pieces in order, outside face up, with the edges butted

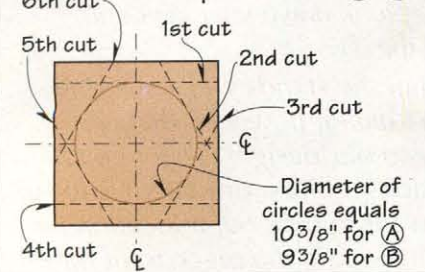


Photo A: Routing a profile with an offset fence reduces the risk of splintering.

Simple, stately, and unpretentious, oak looks good no matter where you put it, and this column will fit in almost any room in your house. To create the appearance of a solid, carved mass of wood, cut all parts from a single board if you can. This ensures that the wood's grain and color will wrap continuously around the column. If you can't get all the pieces from a single board, strive for a close match in color and grain. Even subtle variations can look somewhat abrupt on a six-sided column.

Make the hexagons. Edge-glue enough stock to form the top and base (A, B). Next, lay out hexagons on these four blanks by drawing a 10 3/8"-diameter circle on parts A and 9 3/8"-diameter circle on parts B. Rip one edge tangent to the circle, then use a power miter, radial arm, or tablesaw to cut the five

Figure 1 Cutting sequence for top and base (A) (B)



together and the ends aligned flush. Apply strips of packaging tape across the width of the assembly, spacing them about 8" apart. Now, carefully turn the taped boards over, apply glue to the beveled edges, and fold the assembly into a hexagon (*photo B*). Tape the remaining joint to close the column, and band-clamp it if necessary to apply additional pressure. Make sure the ends are still flush.

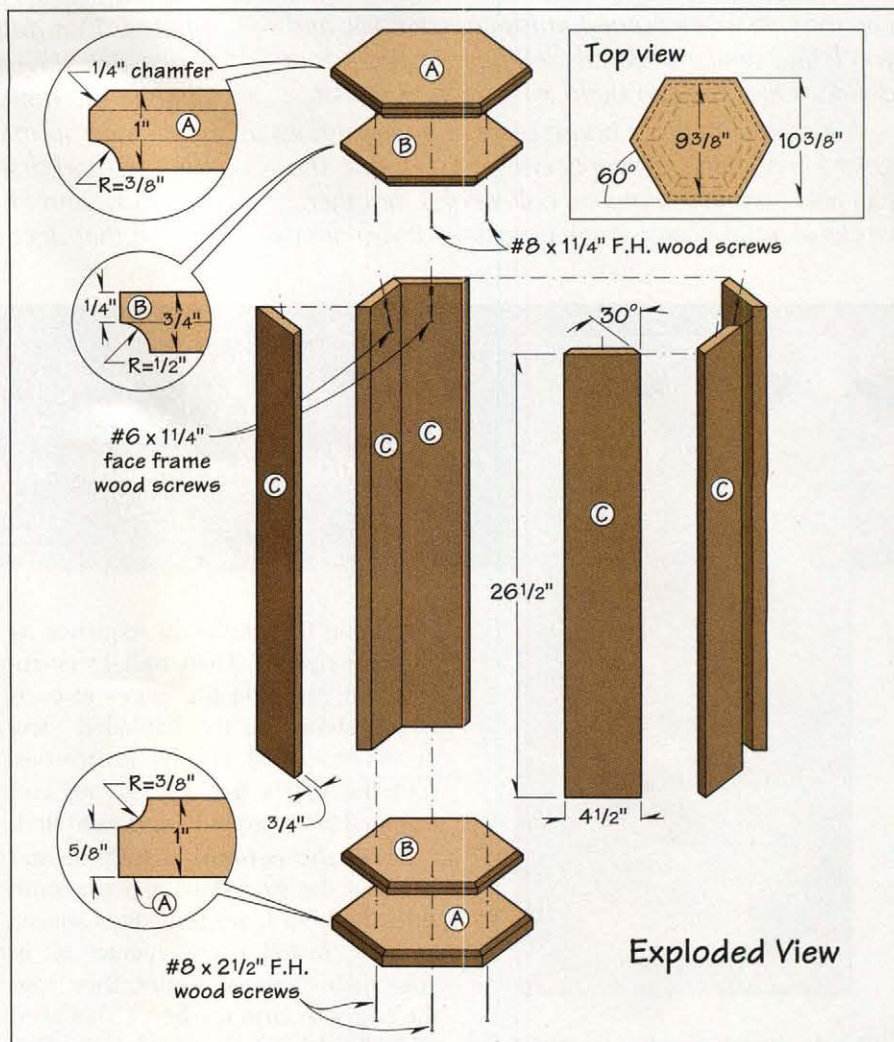
Sand and finish. Finish-sand the parts to 220-grit, then glue and clamp



Photo B: For effective, low-cost clamping of multi-sided projects, strap the pieces with brown packaging tape.

the top and base assemblies (A, B). After the glue has dried, attach the top and bottom to the column with screws where shown on the Exploded View, *below*. Next, apply your stain

and finish. We used Minwax Golden Oak stain to enhance and even the color. Three coats of polyurethane will protect your oak pedestal against water stains from potted plants.



A FLUTED FOUR-SQUARE

Add a touch of antiquity to your home

From their early origins in classical Greece, fluted columns and their crisply carved capitals have graced Western architecture for more than 3,000 years. We've recreated the basic form here using 3/4" medium-density fiberboard (MDF) and paint. The stark white lines of this column would set off a robust houseplant,

with its green leaves spilling over the sides, very attractively; or they can draw your eye forcefully to a single object d'art.

Build up the base and top. Start by cutting blanks for the top and base assemblies (A, B). Then rout the chamfers and coves on the edges of the blanks as shown on the

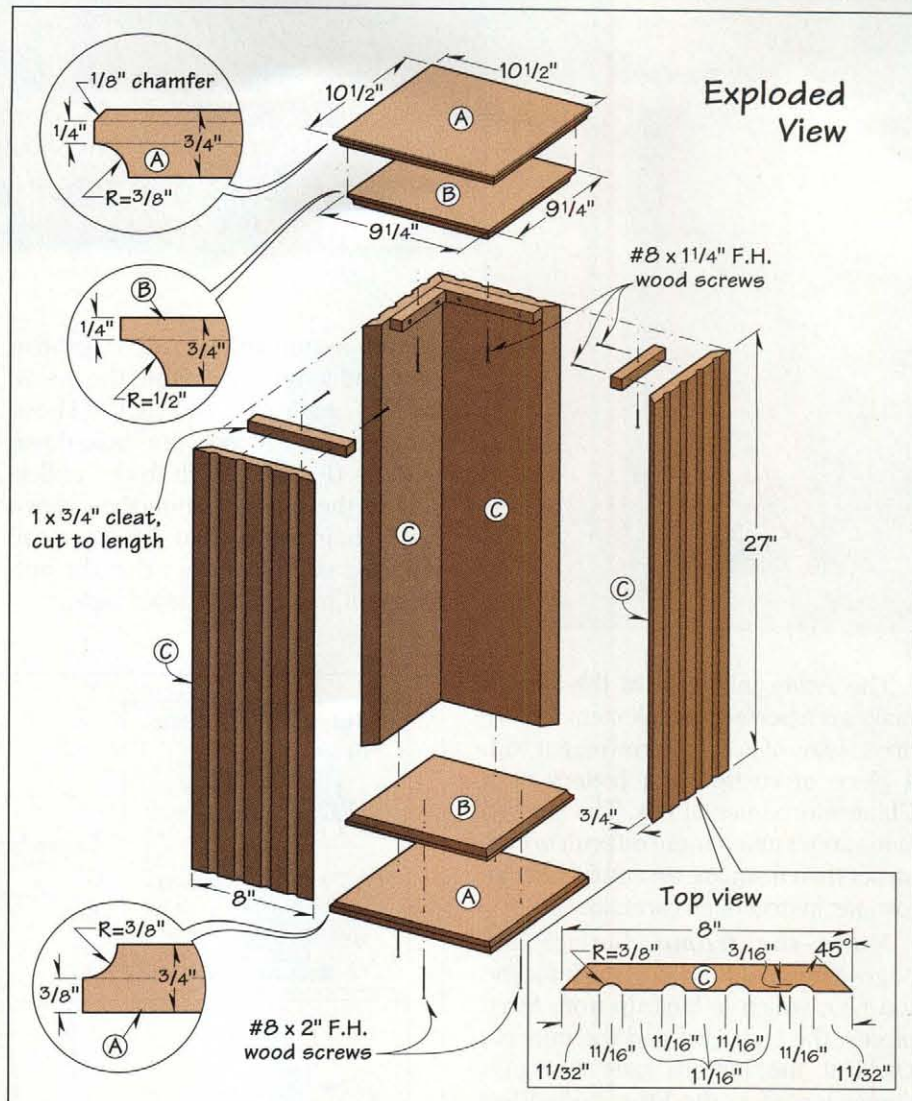


Exploded View drawing, *right*. You'll need to sand the routed grooves thoroughly to eliminate any fuzziness. Glue and clamp the A parts to the B parts.

Cut the column sides (C) to length and bevel-rip or chamfer the 45° edges. Lay out and mark the flute locations on the top end of each side. Next, measure and cut the cleats from solid stock. Then, lay out two shank holes on one face of each cleat, making sure the holes do not align with any of the flutes. Drill the two pilot holes, then drill a single pilot hole in the adjacent bottom edge for the screw that will attach the top to the cleat. (See the Exploded View.) Now, glue and screw the cleats to the top ends of the sides where shown.

Clamp with tape. Assemble and glue the four sides of the column using the same technique we suggested for gluing and taping together the hexagonal oak column. (See photo B, *opposite*.) After the glue dries, clean off any squeeze out on the outside faces of the column, and then rout the flutes using your table-mounted router and a 3/8"-radius core-box bit (*photo C*).

To simplify this procedure and accurately space your flutes, rout the flutes in pairs, rotating the column end for end on the second pass. Set the fence in the first location and rout the two outside flutes on all four sides. Then reposition the fence and rout all the inside flutes.



Prime and paint all the parts before attaching the top and base to the column. We brushed on two coats of primer on all edges and the routed profiles (the MDF soaked up lots of it in these areas), then sprayed the faces with two coats.

Follow the primer with two color coats, then apply a final clear coat of lacquer or polyurethane for durability and depth. When the finish has dried, center the top on the column and screw it to the cleats, then screw the base to the column.



Photo C: You need just two fence settings to rout the four flutes in the column sides. After routing the first flute at each setting, turn the piece end for end, then rout the second flute starting at the opposite end. Move fence to cut the second set of flutes into each side.

THE CRAFTSMAN STAND

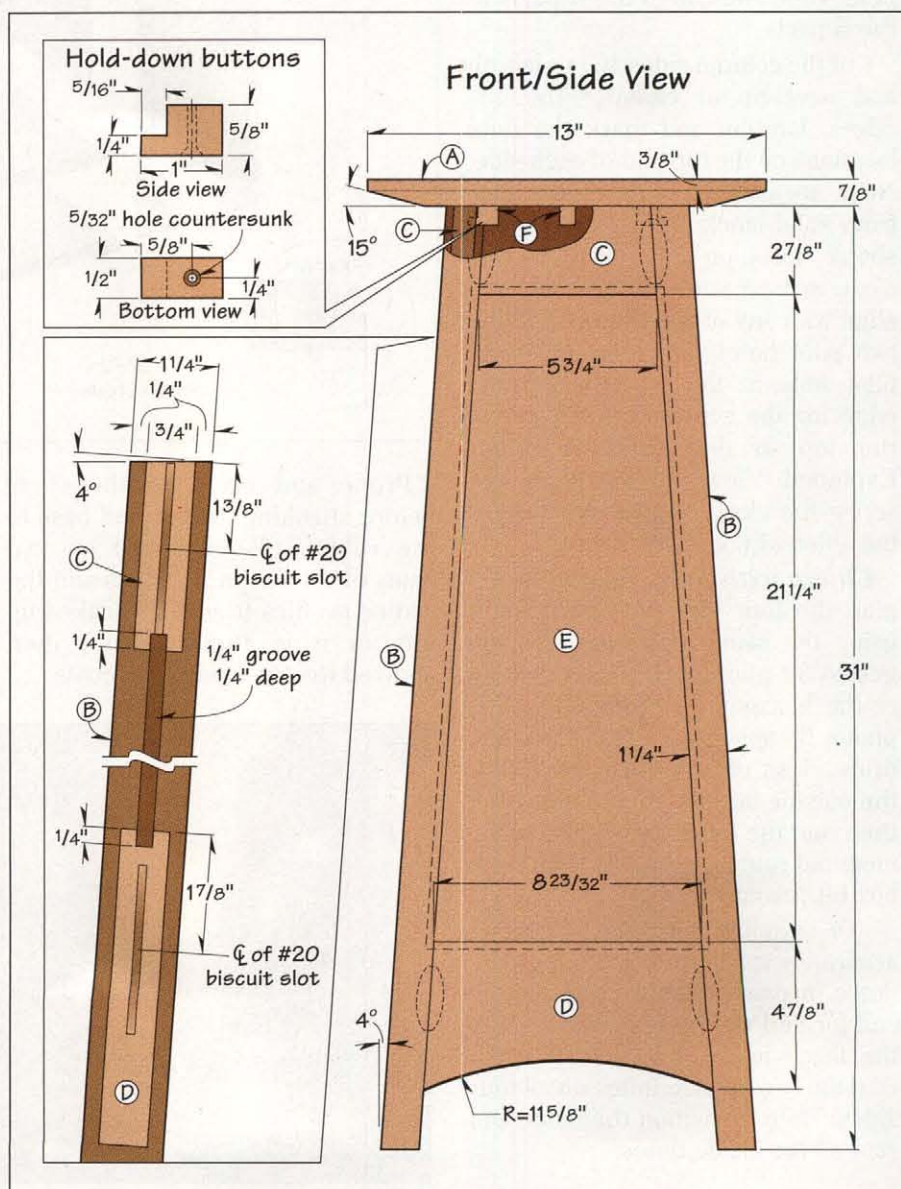
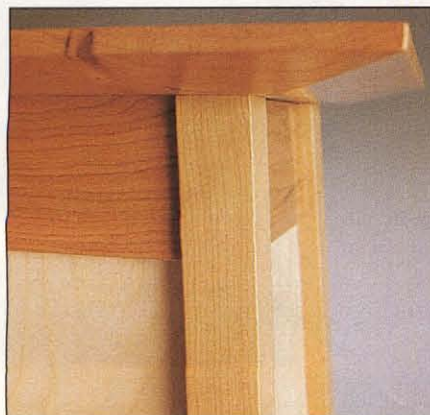
It'll fit right in with other Arts and Crafts furniture

Route a stopped $\frac{1}{4} \times \frac{1}{4} \times 1\frac{1}{2}$ " groove centered lengthwise along the inside face of each top rail (C). (These grooves will accept the hold-down buttons (F) that attach to the underside of the top.) Position the groove just a hair more than $\frac{3}{8}$ " from the rail's top edge to ensure that the buttons will pull the top down tight.

Cut the angled legs. To compound-miter the ends of the legs, tilt your miter saw 4° to the left of perpendicular and rotate the turntable 4° counterclockwise. (See *figure 2*.) Using this setup, cut one end of a leg. Next, mark the longest point on the cut end. Turn the leg end for end and rotate it so that the previously

The Asian influence in this design makes it a perfect complement for kindred styles of art. Try crowning it with a piece of rustic Raku pottery or a Chinese ornamental box. The tapered sides aren't much more difficult to construct than a square assembly. Just follow our instructions carefully.

Make the frame. Surface and edge-join enough cherry stock for the top (A), which is built up from three pieces, the legs (B), and the rails (C, D). Cut the bottom rails to rough dimension. (See the Front/Side View drawing at *right* for dimensions.) Tilt your tablesaw blade to 4° from perpendicular and bevel-rip the top edge of the top rails. (See the detail on the Front/Side View.) Next, rip all eight rails to final width, then miter-cut them (4°) to length. Now, lay out, bandsaw, and sand the 11 5/8" -radius on the bottom edge on each bottom rail.



marked long point faces up and contacts the fence as shown. Then, miter-cut the opposite end of the leg to length. Cut all four legs following this procedure.

Prepare the Joints. Cut biscuit slots in the legs and rails where shown on the Front/Side View detail. Next, rout grooves in the legs for the birch plywood panels (E). Note: Measure the thickness of your plywood before cutting these grooves in case it's less than $\frac{1}{4}$ " thick. Dry-assemble the frames, then measure

the distance between the grooves for the panels. Size the plywood $\frac{1}{16}$ " smaller in length and width than the actual groove-to-groove dimensions. Using a router, straight bit, and straight-edged guide, cut the tapered panels (photo D).

Cut the 15° bevel around the underside of the top using your tablesaw, a tall fence, and a tall feather board for safety. (For more information on this beveling technique, see the Craftsman-style lantern project, page 56, in the March/April '97 issue of *Woodworker's Journal*.)

Assemble the frame. Sand all parts to 220-grit and lightly break the edges. Then, glue, assemble, and clamp the rails and stiles around the panels, leaving the panels to float in the grooves without glue. Glue up the two sides first, then join these sides in a second glue-up using the remaining rails and panels.

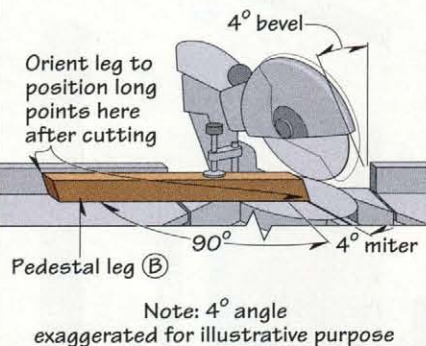
Make four hold-down buttons as dimensioned on the Front/Side View detail. Insert these in the grooves in the upper rails, then center the top on the assembled pedestal. Using the



Photo D: To cut the tapered plywood panels, rout to the line using a straightedge or jig to guide the router.

button shank holes as guides, lay out pilot-hole centerpoints on the underside of the top. Remove the top, drill the holes, then screw the buttons to the top. Now, apply your choice of finish. (We applied three coats of a wipe-on polyurethane.)

Figure 2 Cutting compound miter on legs (B)



If you admire the fine patina on time-worn antiques, this pedestal will fit right into your home decor. In spite of its apparent detail, our frame-and-panel construction doesn't require expensive cope-and-stick router bits. Instead, we built a post-and-rail frame, then infilled with plywood

FRAME-AND-PANEL PEDESTAL

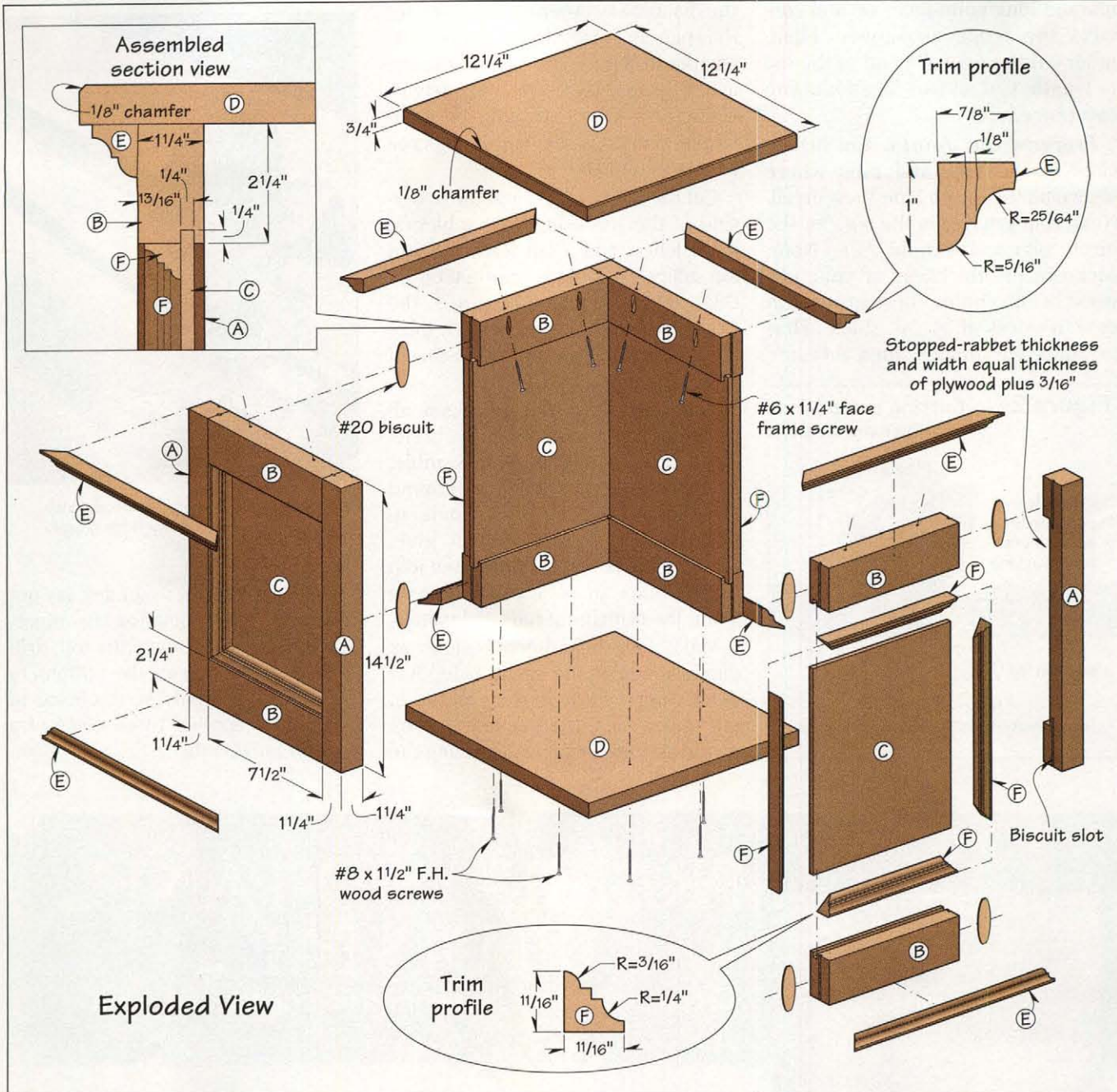
Create an instant heirloom using distressed paint

panels and concealed the seams with mitered moldings.

Make a poplar frame. Begin by surfacing enough poplar to make the four posts (A) and eight rails (B). Cut mating biscuit slots centered on the rail ends and post edges. (See the Exploded View on page 52.) Measure the actual thickness of your $\frac{1}{4}$ " panel plywood, then cut or rout same-size grooves in the rail edges and stopped rabbets on the post corners for the panels. Next, drill two pocket holes in each top rail where shown.

Dry-assemble the posts and rails, then measure between the grooves





and rabbets to determine the panel dimensions. Next, cut the four panels (C) from 1/4" plywood, undersizing them 1/16" in width and length. Glue, biscuit, assemble, and clamp two sets of posts, rails, and panels. After these have dried, join them using the remaining rails and panels. Note: Lightly glue the panels into their rabbets, then tack them in place using a couple of brads.

MDF for the top and bottom. Cut the top and bottom (D) from MDF, then chamfer the top edge of the top. Screw the top to the stand using the

pocket holes. Attach the base using screws where shown.

To create the moldings, we used two multi-profile router bits: a Freud 99-PK1 for the top and base trim (E) and a Freud 99-PK7 for the panel moldings (F). You can also cut these or similar profiles with a round-over and a cove-cutting bit.

To make this operation safer, rout the profiles on a wide piece of stock, then rip the square back edge of the molding to width (*photo E*). Miter-cut the moldings to length and glue them to the inside perimeter of the frames.

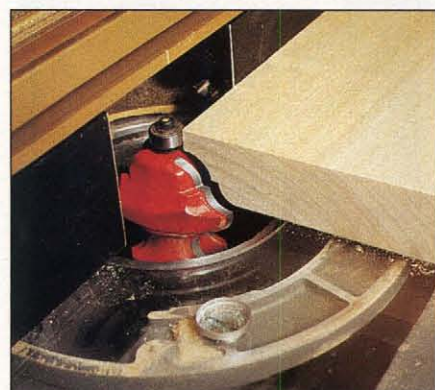


Photo E: Rout the moldings using a multi-profile bit. For safety, rout the profile on a wide piece of stock, then rip the edge opposite of the molding to finished width.

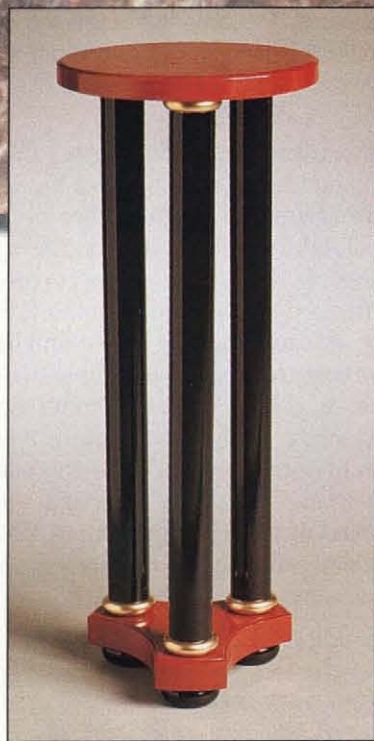
Drill pilot holes, then nail the moldings to the frame where shown using brads.

Paint and distress. With the project fully assembled, brush a coat of primer on all exposed MDF edges. Next, spray or brush the entire project with two coats of primer, sanding lightly between coats. After the primer has dried, spray or brush on a color base coat. (We applied a Wedgewood blue.)

Top that with an ivory- or buff-colored aerosol crackle paint. (See Sources at the end of the article for additional information.) Scrape through the crackle paint in a few areas to reveal some of the color coat, then lightly sand these "worn" areas to feather out the edges.

To age the pedestal, wipe on and then quickly wipe off a wood stain

around the corners of the panels and the edges of the moldings. Note: Work fast—otherwise, the stain will soak in quickly and darken the paint too much. (We used Minwax golden oak stain.) Finally, top-coat the entire project with a clear polyurethane—water-based if you want clear, crisp whites; oil-based if you'd prefer an amber patina.



ART DECO DISPLAY

An exciting jazz-era design



With its bold colors and neo-classical shapes, this piece will draw attention wherever you put it. Don't be put off by what appears to be complicated construction and unusual shapes. We made the columns out of PVC pipe and used a simple router-table technique to shape the round pads and bun feet.

Prepare the PVC columns. Start by cutting three columns (A) to length from 2"-diameter PVC pipe. Clean the pipe with a household cleaner such as Formula 409 to remove any oil or grime, then sand the surface with 220-grit sandpaper to remove any mill marks. Once you start sanding, you'll see very faint lengthwise facets. Sand until these disappear. (We smoothed our PVC with a quarter-sheet palm sander and rolled the pipe back and forth to avoid sanding flat spots.)

Clean the sanded columns thoroughly again, then prime and paint them. We applied three coats of H-2-Oil Primer, sanding between coats to get a super-smooth finish. (See Sources for additional information.) For the color coat, we used a water-based spray enamel. We found these water-based products take a bit longer to tack than most, especially if the room is a bit cool. To keep the paint from running, rotate the pipes on long dowels as you spray.

Glue up base and top. Edge-glue 8/4 and 6/4 poplar to form blanks for the base (B) and top (C). After the glue dries, surface the base blank to 1 3/4" thick, the top blank to 1 1/4". Make a cardboard template of the base layout and use it to align the hole centerpoints (in both pieces) for the threaded rod

and threaded inserts. Lay out the base and top as shown on the Top and Bottom View drawings on page 54, then drill the holes and counterbores.

Bandsaw the base freehand, and use a circle-cutting jig to help shape the top. (To build this jig, see the March/April '81 issue of *Woodworker's Journal*, or buy a commercially made jig such as the one listed in Sources.) Next, sand the sawn edges smooth and rout the cove profiles on the perimeters as shown.

Shape the pads and feet. To make the column pads (D) and the bun feet (E), cut 3 1/4" discs from stock of the required thicknesses. To obtain

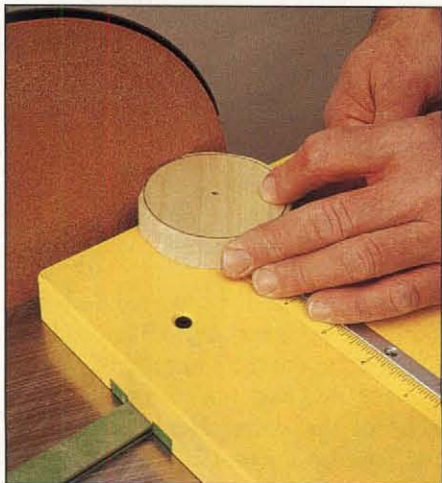
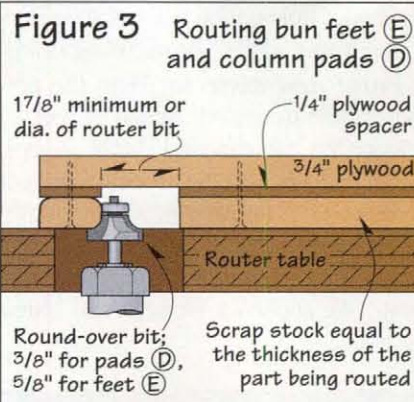
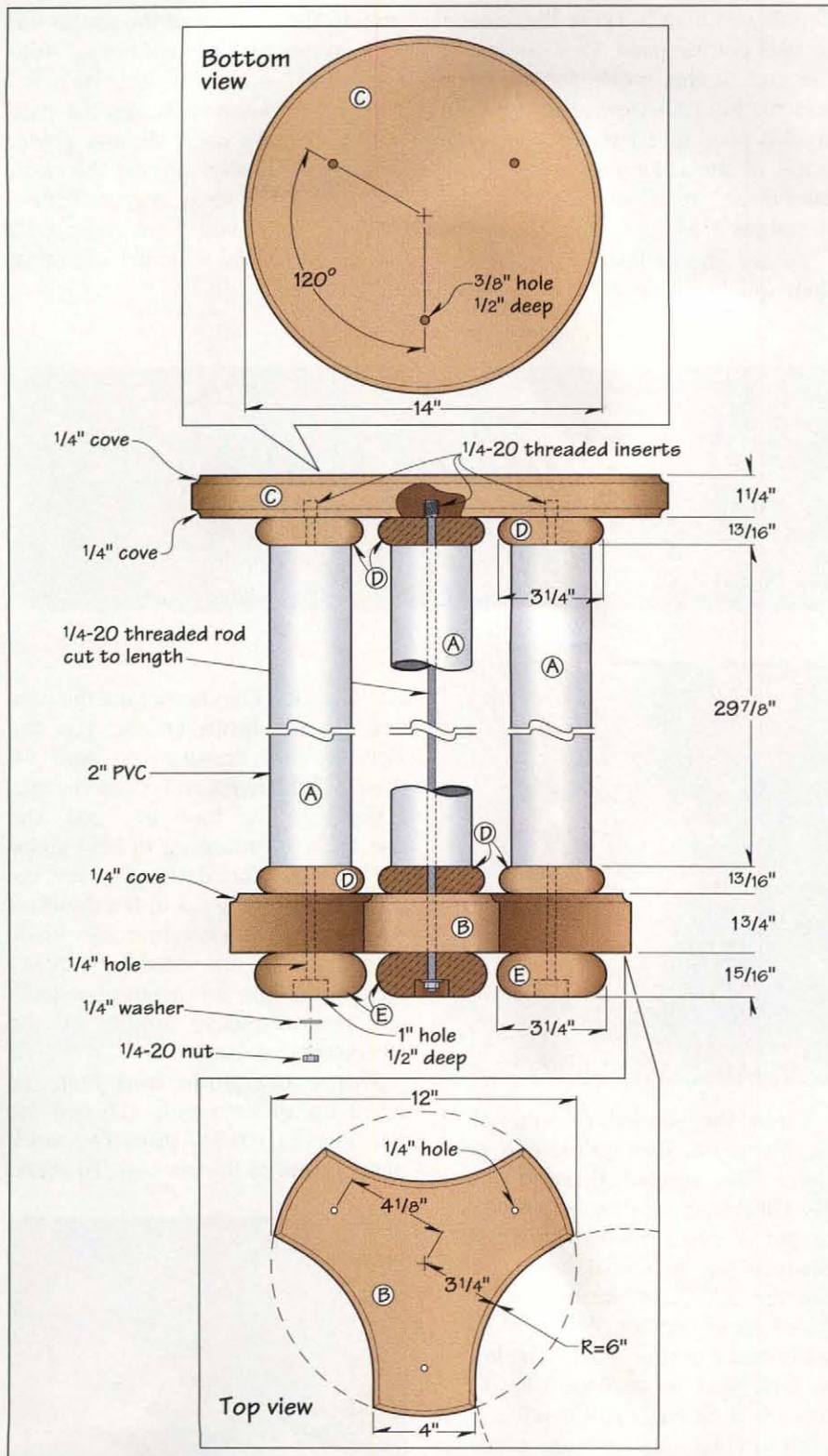


Photo F: A circle-cutting jig and stationary disc sander produce perfectly round pads and feet.



disc. Chuck the long end of the rod in a portable electric drill, then sand the discs by spinning them at low speed against a palm sander.

Finish-sand all wooden parts to 220-grit. Note: Make sure you get the end grain as smooth as the other areas. Install the threaded inserts in the top, then prime all pieces. Use short pieces of threaded rod to hold the top off the table during painting. (We applied three coats of primer, sanding between coats to create a glass-smooth surface.) Next, apply two or more color coats of spray enamel. After the paint has dried thoroughly, assemble the pedestal using three lengths of 1/4"-20 threaded rod with the appropriate nuts and washers. **W**

Project designs: Dick Coers

Photographs: Kevin May

Written by: Tom Jackson

Objects of art courtesy of: The Calla Lilly, 5901 North Prospect Road, Peoria, IL 61614

SOURCES

Colorbolt Crackle Spray.

Several colors available. For more information, contact:

**Colorbolt Division
Carnival
602/821-1812**

H-2-Oil Base Primer. For information, contact:

**William Zinsser & Co.
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uniform, round discs, we sanded ours using the jig listed in Sources (photo F). Next, make the router jig shown in figure 3, and use it to round over both faces of the discs. Note: Set the bit low enough so that it leaves a small flat band around the perimeter. This flat gives your router bearing a sur-

face to ride on and the flat can easily be sanded off later.

Drill and counterbore a hole centered in each disc for the threaded rod where shown. Working one disc at a time, insert a short length of rod through the hole, then tighten nuts and washers on each end of it to secure the

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Before You Start

In essence, you'll be creating an artistic display, so take your time and consider how to size the box, finish it, and arrange the object in it for best effect. For your first shadow boxes, I suggest you choose a wood, stain, and finish that complement the surroundings in which you'll be displaying them. I want the interior finish to direct focus toward the tool, so I'll often use flat black paint. Black paint adds drama, minimizes reflections from nearby lights, and also accents most woods handsomely.

However, you might prefer to leave the interior of your boxes natural, line them with felt or fabric, or even flock those surfaces.

How to dimension your box? This depends on the object to be displayed. As a rule of thumb, I'll add 2" of clearance around all sides, including 2" between the glass and the object's front surface (once I've determined its position in the box).

This brings up another important consideration—how to fasten the object in the shadow box. Some

items can be fastened directly to the back. Others look better "floating" away from the back or sides, so I try to make it look like they're suspended in space. To create this illusion, I conceal all wires, straps, screws, and other attaching devices. I may use nylon cable ties (you can get them in different colors), or even build a platform and attach the object from the backside so the screws don't show.

Some objects actually look best attached to the box top or bottom a short distance out from the back with

Photo A: Design the display structure in your box to accommodate the tool. Here, author has built a platform and hold-down to fit a Japanese hand plane.



a wooden platform and hold-down (*photo A*). The three boxes shown in the photo at *left* demonstrate these various methods.

I elected to build my boxes out of white ash. A heavy, strong, and durable material that works easily, this wood ranges from off-white to light tan and has straight grain, coarse texture, and medium density. Even without stain, I've found this wood complements most decors. However, you select the wood that will best complement your situation.

I use glass viewing panes rather than acrylic. I've found that acrylic tends to scratch easily and often has a slight bow, which makes it more reflective than glass. Single-strength ($\frac{1}{16}$ " glass will be adequate. Just cut a groove wide enough to allow easy removal—a thin kerf (.090") should be narrow enough to keep the glass from rattling. I always buy the panes from a glass dealer and ask them to seam the edges. This minimizes the chances of cutting my hands when handling the panes.

I also want access to the objects in my shadow boxes so I've designed the boxes so that the glass pane can be easily removed through a slot in the top. If you follow the slot-cutting sequence as described later in the Pro Tip, you shouldn't have any problems.

As with any woodworking project, use the proper tools and make sure your blades and bits are sharp. To build these boxes, I used a sliding compound-miter saw, a tablesaw, and a table-mounted router; as well as a jointer, thickness planer, and biscuit joiner. A 40-tooth combination blade on the tablesaw and a 60-tooth trim

blade on the miter saw (72-tooth if it's a 12" blade) will handle all cutting operations.

Prepare the Case Parts

Step 1. Face-joint, then plane your stock to uniform thickness—between $\frac{5}{8}$ " and $\frac{3}{4}$ " for this size and type of box. Rough-cut the case parts to width and length plus $\frac{1}{4}$ ". Mark an inside face and front edge on each piece, then joint the front edge and rip the back edge to finished width. Note: With projects like this, I'll start with longer stock than necessary and trim the snipe from the ends. Then, I'll cut the parts in a side, top, side, bottom sequence to wrap the grain around the case.

Step 2. Using a table-mounted router or tablesaw, cut a rabbet along the back edge to accept a $\frac{1}{2}$ " or $\frac{3}{4}$ " plywood back. Cut this rabbet $\frac{1}{16}$ " wider than the actual thickness of your back stock and $\frac{3}{8}$ " deep (or half the thickness of your case stock).

Step 3. On the tablesaw, cut the glass groove $\frac{1}{4}$ " deep and $1\frac{1}{8}$ " in from the front edge of the case parts. *Photo B* shows both the rabbet and the glass groove already cut.

Step 4. Without moving the rip fence, plunge-cut a centered, stopped slot in the case top to allow removal of the glass (*photo C*). (For help with this operation, see the Pro Tip on *page 58*.) Note: Although I don't (for clarity's sake) show



Photo B: Rabbet the back edge of the case parts to accept a $\frac{1}{2}$ "- or $\frac{3}{4}$ "-thick plywood back. Cut a thin groove near the front edge for the single-strength glass pane.

MATERIALS YOU'LL NEED

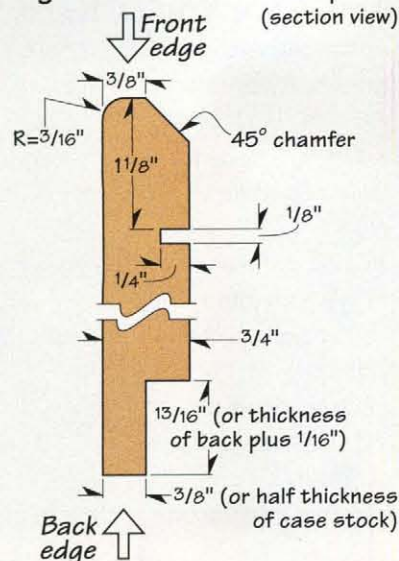
- 4/4 or 5/4 ash, oak, or other richly grained hardwood
- $\frac{1}{2}$ " or $\frac{3}{4}$ " birch plywood
- #0 or #10 biscuits
- Yellow or white woodworker's glue
- #6x1 $\frac{1}{2}$ " flathead wood screws
- Single-strength ($\frac{1}{16}$ " glass
- Primer and paint (or fabric) for interior
- Stain (optional)
- Polyurethane or hardening oil finish

them in the photo, always use hold-downs or feather boards to secure the workpiece during the plunge-cut.

Step 5. Chamfer the inside front edge of the case parts. To do this, fit your table-mounted router with a 45° chamfer bit, then adjust its cutting depth to leave a $\frac{3}{8}$ "-wide flat surface along the outside edge. (See *figure 1*.) Next, round over the outside edge using a $\frac{3}{16}$ " or $\frac{1}{4}$ " round-over bit.

Step 6. Set the blade on your sliding compound-miter saw or tablesaw to 45°, then miter both ends of each case part to finished length. Whichever tool you use, set a stop block to ensure uniform length on the identical parts.

Step 7. Lay out and cut biscuit slots in the mitered ends of the case parts. Depending on the depth of your box, the joints may require more than one biscuit apiece. Also, make certain that the biscuit slot does not break out into the glass groove or outside face. (See *photo B*. I use #0 and #10 biscuits for my boxes.)

Figure 1

Step 8. Dry-assemble and clamp the case (with biscuits) to make sure the miters meet and everything fits proper-

ly. Adjust as necessary. With the case still assembled, measure the rabbeted recess in the back edge, then cut the back to fit from 1/2" or 3/4" birch plywood.

Step 9. Using a keyhole slot cutter, a plunge router, and an edge guide, cut a pair of holes in the back face of the back to accept screws for wall-mounting. Center the holes an equal distance from the two edges and about 3" down from the top. Now, finish-sand the inside faces of all parts, including the chamfered edge. Note: Take care not to round the chamfer during sanding.

Assemble the Box, Then Apply Finish

Step 1. Glue, biscuit, and clamp the four case parts (not

the back) using web and/or frame clamps (*photo D*). Check the assembly for square, then allow the glue to dry.

Step 2. Using a hand saw, carefully finish sawing the ends of the glass slot. To do this, lay out the two slot ends at the correct distance from the case corners, then extend the two edges of the

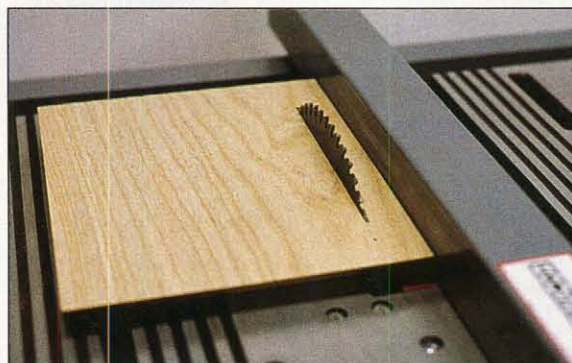


Photo C: Plunge-cut a centered, stopped slot in the case top to permit insertion and removal of a glass pane. Note: Tablesaw hold-downs and stopblocks have been removed for clarity.

PRO TIP

To cut the glass slot in the top, first transfer the glass-groove locations from the mitered ends to the front edge as shown in the drawing *below*.

Mount the blade that you used to cut the glass slots on your tablesaw. Next, place the case top part behind the saw blade, front edge against the blade, and lock the rip fence against the back edge of the top. (See the Side View on the drawing at *right*. Also, note the left/right positions on the drawing and use these directionals when following this set up.)

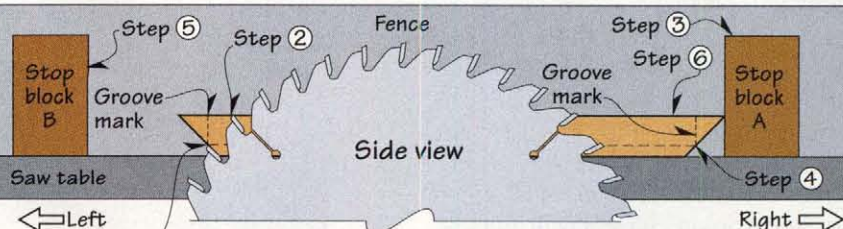
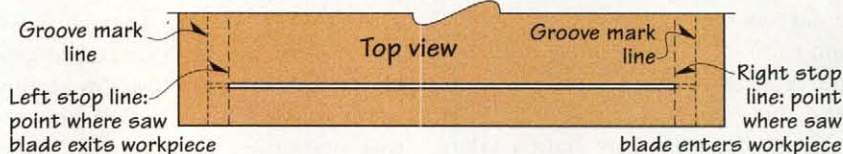
Elevate the saw blade. Caution: The higher you set the blade the less uncut stock you will have to remove by hand later. However, realize that a high blade setting increases the hazard so use stop blocks, a holddown, a push stick, and keep your hands well away from the blade at all times.

Slide the top to the *left* until a tooth tip aligns with the point where the groove line and miter intersect on the top's edge (*step 1*). Rotate the blade and determine where the teeth exit the top. Scribe a line (*left stop line*) across the top's face at that point (*step 2*). See Top View drawing *below*. Now, without

moving the top, clamp stop block A to the fence at the right end of the top (*step 3*).

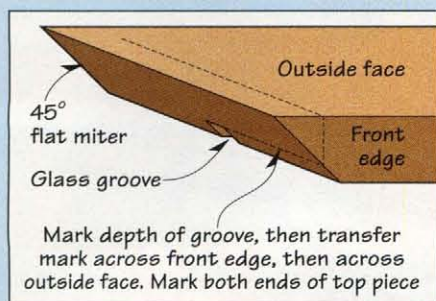
To position stop block B, slide the top to the left until a saw tooth aligns with the intersecting point of the groove line and mitered edge at the top's *right* end (*step 4*). Then, clamp stop B at the left

Setting Stops to Cut Glass Slot in Top Piece



- Step 1** Align workpiece so saw tooth intersects with groove mark
- Step 2** Mark edge where saw teeth exit workpiece and scribe stop line across face
- Step 3** Move rip fence against workpiece, then clamp stop block A to it

- Step 4** Move workpiece to left and position it so saw teeth intersect with groove mark on right end
- Step 5** Clamp stop block B at left end of workpiece
- Step 6** Scribe line across face where saw teeth enter workpiece



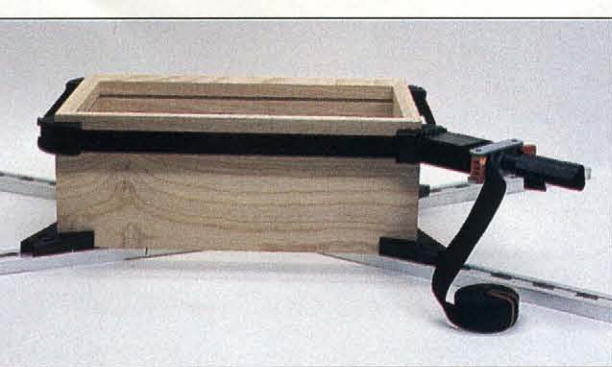


Photo D: Glue, biscuit, and assemble the case, then clamp using web and/or frame clamps.

Photo E: Finish the glass slot after assembling the box by carefully cutting along groove lines using a Japanese ryoba or other backless, thin-kerf saw.



plunge-cut kerf with a straightedge and pencil. Using a Japanese *ryoba* or other backless, thin-kerf saw, carefully cut along both lines (*photo E*). Then, square the ends with a sharp chisel (*photo F*), making sure that they align with the bottoms of the side grooves. Measure the width and length of the opening (including the grooves), then have a glass dealer cut and seam a single-strength pane to these dimensions. Insert the pane into its groove, check

the fit and ease of removal, then remove the pane.

Step 3. If you plan to build and attach a platform or other display structure to the back, do it at this time. Conceal all fasteners if possible.

Step 4. If painting the interior, prime and paint the case interior and the inside face of the back. To do this, first mask the glass groove with tape or strips of $\frac{1}{8}$ "-thick cardboard. Do not apply paint forward of the groove or to the rabbeted recess in the back of the case. If you intend to spray the interior, mask these forward surfaces as well. Allow the paint to dry thoroughly before applying a second coat.

Note: On open-grained woods, I'll often apply a second primer coat and sand between coats to keep the finish level. It's always a good idea to sand between coats of clear finish as well, using 320- or 400-grit paper.

Step 5. Finish-sand the exterior surfaces of the case to 220-grit. Next, remove all sanding dust, then apply your choice of stain to the exterior, to the rabbeted recess in the back, and to the front edge of the interior, including the groove and slot. (A thin artist's brush comes in handy here.)

Step 6. After the stain has dried, apply your choice of clear, interior-grade finish. To do this, first cut a piece of cardboard to the same dimensions as the glass, then insert it in the grooves to protect the previously painted box interior from the finish. (I usually apply two coats of satin polyurethane, sanding between coats with 400-grit sandpaper.) Later, I'll use a small brush to apply finish to the grooves.

Step 7. Attach the object to the mounting structure or the back. (See



Photo F: After sawing to the groove limits, square the ends of the glass slot using a small chisel. Make sure slot ends align with the glass grooves in the sides.

photo A). Then, secure the back to the box. (I used two #6x1 $\frac{1}{2}$ " flathead screws per side, angling them toward the outside and countersinking them.) Clean and install the glass, then hang your masterpiece. **Wj**

Photographs: By the author

end (*step 5*). Without moving the top, determine where the teeth will enter the top at the right stop line (*step 6*).

Lower the saw blade so it extends $\frac{3}{16}$ " or less above the table top. To properly position the rip fence, first place the top part on the blade so the teeth engage in the glass groove cut into its underside. Slide the rip fence against the back edge of the top and lock it in place. Make a safety hold-down by placing a scrap piece on top of the workpiece and clamping it to the fence. Note: Make the hold-down wide enough to cover at least half the top's width. Also check to make certain the saw blade won't hit the clamps when you raise it to cut the slot into the top piece.

Lower the blade about $\frac{1}{8}$ " and place the *right* end of the workpiece against stop A. Turn on the saw and slowly elevate the blade until it cuts to the left stop line you scribed across the top. To finish cutting the slot, push the workpiece *forward* using a push stick until it hits stop 2. Turn off the saw, then remove the hold-down and workpiece.

Note: You'll finish cutting and squaring the ends of the glass slot after assembling the box.

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A Shop-Built Trammel



Author's shop-built trammel with 12", 18", and 36" bars.

*A helpful tool
you'll be proud to
use in your shop*

by Bob Colpetzer

Editor's Note

A trammel may not be the workhorse of hand tools, but when you need to scribe oversized circles, arcs, or radii, having an accurate, easy-to-use one sure simplifies the job. A shop-made trammel also lends itself to customizing—you can be as fancy or as makeshift as you want. Bob Colpetzer came up with this design, which makes a nice weekend project and an heirloom-quality tool.

Begin With the Heads

Step 1. To make the two trammel heads (A), start with a 1½" turning square at least 12" long. (I made the bars and heads out of padauk as shown in the photo *above*, but any stable hardwood such as mahogany or maple would work nicely.) Bring the blank to 1¼" square by jointing two adjacent edges, then plane the opposite edges parallel to the squared edges.

Step 2. Trim both ends to make the blank 12" long, then draw diagonal lines to locate the centerpoint on each end. Set up your drill press as shown in *photo A*, then drill a 29/64" hole ½" deep centered in each end of the blank. In both of these holes, cen-

ter and drill a 5/16" hole 1¼" deep (including the ½" depth of the first hole). To hold the blank perpendicular to the table for drilling, make a tall support fence by joining two blocks at a 90° angle, then clamp the blank to it.

Step 3. Using the dimensions shown in *figure 1*, lay out the two through mortises on the blank. Next, make a carrier board as dimensioned in *figure 2* to use for mortising.

Step 4. Chuck a 3/8" mortising chisel into your drill press or mortising machine. Place the blank on the carrier board with one end against the stop, then insert a 3/8"-thick shim *under* one end of the carrier board, so

that the chisel will cut through the workpiece at an angle. (See *photo B*.) Next, position the (tilted) carrier board and workpiece to cut the inside angled end of one mortise where dimensioned in *figure 1*. Clamp the carrier board to the fence, then make one pass through the blank. Turn the blank end for end, then cut an identical angled mortise through that end of the blank.

Note: If you don't have a mortising chisel, see the Pro Tip on *page 62* for



BILL OF MATERIALS

TRAMMEL

PART	T	W	L	MTL.	QTY.
A Heads*	1 1/4"	1 1/4"	3 13/16"	P	2
B Bar**	3/8"	1 1/8"	36"	P	1
C Bar**	3/8"	1 1/8"	18"	P	1
D Bar**	3/8"	1 1/8"	12"	P	1
E Wedges*	3/8"	5/8"	3 1/4"	P	2

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

**Three bar lengths suggested for additional working range. Make longer bars as needed.

MATERIALS LIST

P—padauk

SUPPLIES

Two 5/16" brass compression unions (Ace hardware no. 41230); two nylon compression washers (Ace hardware no. 43055); 5/16" brass rod; 8d finish nail.

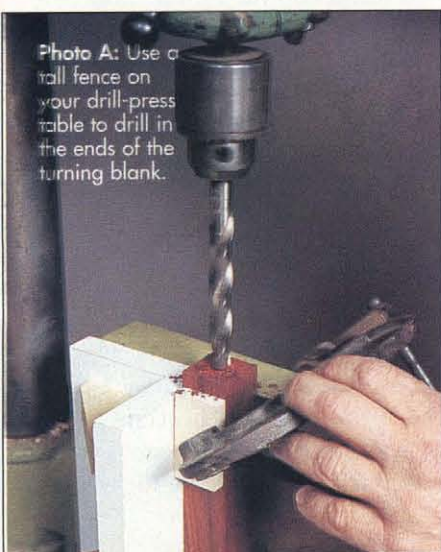
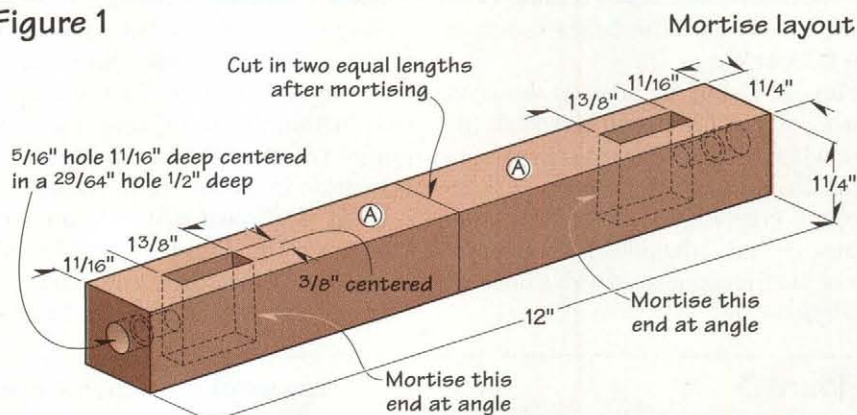


Photo A: Use a tall fence on your drill-press table to drill in the ends of the turning blank.

Figure 1



an alternative method of mortising the blank.

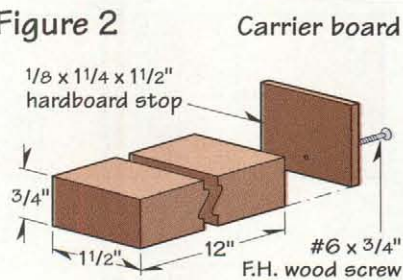
Step 5. Remove the 3/8" shim from under the carrier board. Reposition the carrier and blank, then finish cutting both mortises. Now, crosscut the blank into two equal lengths.

Step 6. Obtain two 5/16" brass compression unions and remove the compression washers and nuts from both ends. (You can buy these parts at a well-stocked hardware store.) Enlarge the center hole in each union to



Photo B: To cut the through mortises in the head blank, make a carrier board to support the workpiece. Place a 3/8"-thick shim under the end of the carrier to angle-cut the inside end of each mortise.

Figure 2



5/16" diameter. Next, using a 1/2"-20 tap, thread the 29/64" holes you drilled previously in the ends of the blank. Apply epoxy to the threads in each hole, then install a brass union (photo C). Allow the epoxy to cure before proceeding.

Next, Turn the Blanks

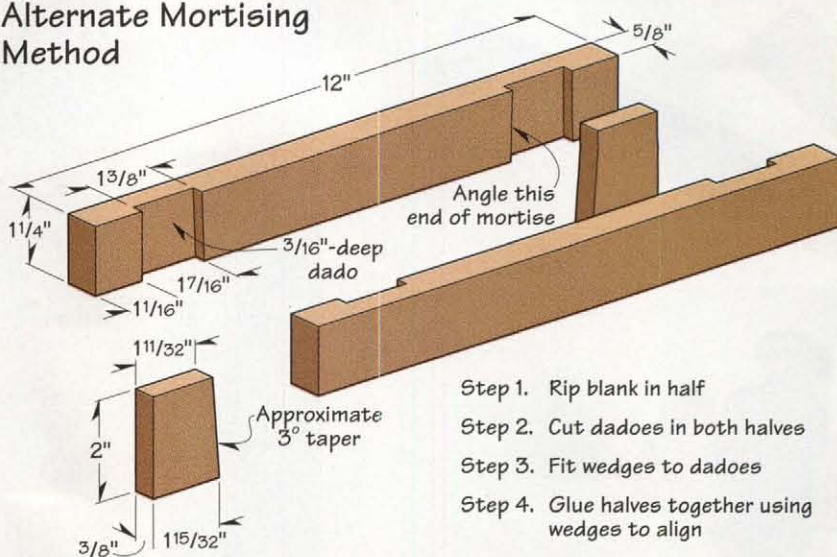
Step 1. Mount one of the trammel blanks between the centers of your lathe. (I used a standard spur center on

PRO TIP

If you don't have a mortiser, rip the blank in half. Lay out the mortise locations on both halves where dimensioned on the drawing at right. Then, using a dado head on your table-saw, cut matching $\frac{3}{16}$ "-deep dados in both halves of the blank. Note: Use stop blocks to ensure uniform dado placement. You'll need to angle the saw's miter gauge slightly to taper the inside end of both mortises.

Make two alignment wedges as dimensioned on the drawing. Next, glue the two blank halves back together in the same position to match the grain and minimize the glue line. Place the wedges in the dados to align the pieces, clamp them, and then remove the wedges and any glue squeeze-out from the mortises.

Alternate Mortising Method



- Step 1. Rip blank in half
- Step 2. Cut dados in both halves
- Step 3. Fit wedges to dados
- Step 4. Glue halves together using wedges to align

the headstock and a ball-bearing cone center to secure the brass union to the tailstock.)

Step 2. Using dimensions shown in figure 3, lay out the head and mark the area where the turning makes the transition from square to round. To help prevent chipping at these transition points, cut a $\frac{1}{8}$ "-deep kerf at each corner of the transition area with a dovetail saw (photo D).

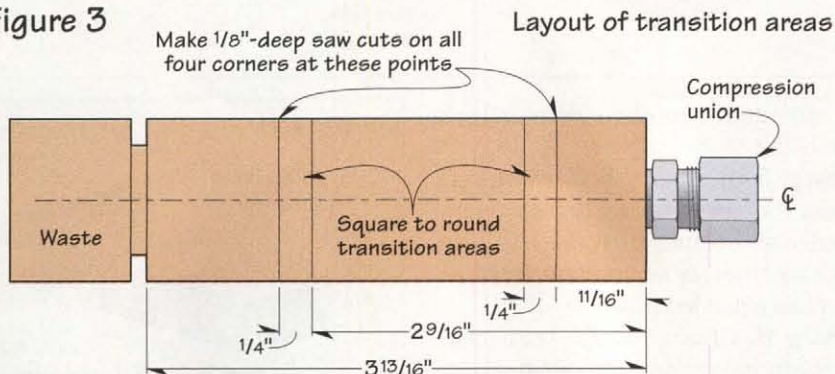
Step 3. Using a parting tool and calipers, part next to the saw cuts to establish the largest diameter of each turned section. Turn each section to this diameter, then use a $\frac{3}{8}$ " gouge to carefully cut and form the transition from square to round.

Step 4. Transfer the dimensions shown on the Trammel Head drawing to the blank, then turn each section to profile. (See photo E. I used a

high-speed steel skew to round the hex section of the brass union.) For a smooth finish, take light steady cuts using the heel of the skew (photo F).

Step 5. Finish-sand the turning. Next, mount the second trammel head blank and turn it the same way. Once you're satisfied that the two heads look identical, remove the waste stock from each head. Sand and blend the area where the waste was removed to complete the profile of the top bead in each head.

Figure 3



Now, Make the Bars and Wedges

Step 1. From $\frac{3}{4}$ "-thick stock, rip and crosscut two $1\frac{1}{2}$ "x38" pieces. Use one piece as the 36"-long trammel bar (B). From the second length, cut one 18"-long bar (C) and one 12"-long bar (D). Save the remaining bar stock for the wedges.



Photo C: After applying epoxy, thread the compression fittings into the holes, but don't over-tighten them.

Photo D: Before turning each head to profile, cut kerfs to help prevent chipping at the points where the blank makes transition from square to round.



Step 2. Cut $\frac{1}{16}$ " chamfers on both ends of each bar, then sand their faces and edges. Also, break the bar edges.

Note: The fit of the wedges to the mortise angle determines how easily and accurately the trammel can be set to the desired dimension. A perfect fit enables you to lock the head in position by applying only very slight pressure to the wedges. Because mortise and part dimensions on your trammel may vary slightly from those given on the drawing, I suggest you work with a test wedge.

Step 3. To make a test wedge, use the dimensions shown in figure 4 as a guide, but fit the piece to match the mortise angles. Then, use it as a pattern to lay out the two actual wedges on the leftover piece of bar stock.

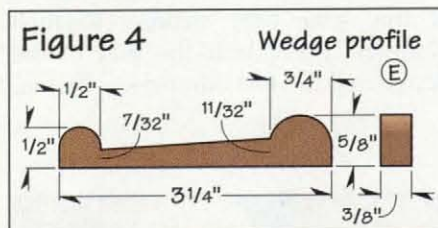
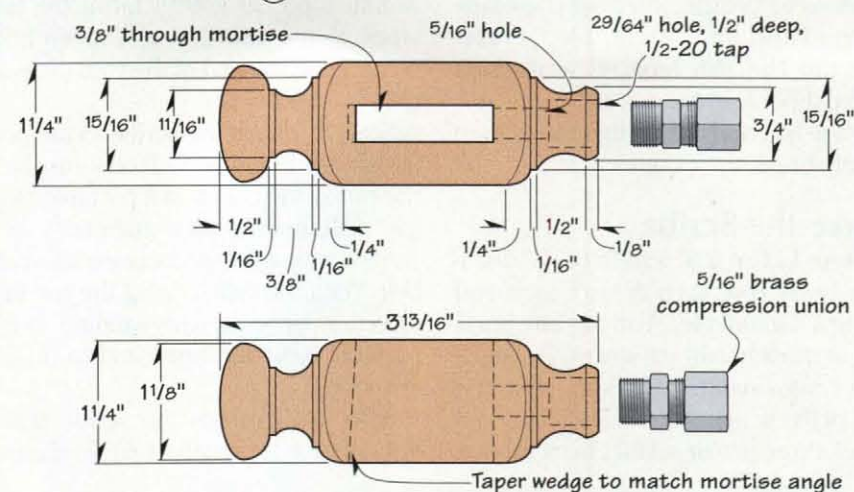


Photo E: Lay out each turning section, then turn and sand both blanks to identical finished profiles.



Photo F: Author uses the heel of a high-speed steel skew chisel to round the hex section of the brass compression union.

Trammel Head (A)



EQUIPMENT AND SETTINGS FOR TURNING TRAMMEL HEADS

Lathe accessories

Spur center
Ball-bearing
cone center
Tailstock
(three-jaw or scroll)

Lathe tools

$\frac{3}{4}$ " roughing-out gouge
 $\frac{3}{8}$ " spindle gouge
 $\frac{1}{4}$ " high-speed steel skew
 $\frac{1}{8}$ " parting tool
Outside calipers

Lathe speeds

Rough turning:
500 to 800 rpm
Finish turning:
1200 to 1500 rpm
Finish sanding:
800 rpm



Photo G: To center a $\frac{1}{8}$ "-deep hole in the end of the $\frac{3}{16}$ " brass rod, chuck a length of rod into the lathe, then install a no. 39 bit in the tailstock to drill the hole.



Photo H: Author shaped the brass rod to profile using a portable electric drill and belt sander.

Step 4. Using a scrollsaw, cut the wedges to profile, keeping the blade wide of the line. Then, file, scrape, or sand the two tapered wedges to make a perfect fit.

Step 5. Sand the wedge faces, then lightly break their edges.

Make the Scribe

Step 1. Cut a 5" length of $\frac{5}{16}$ "-diameter brass rod, then deburr each end using a flat mill file. (You can buy brass rod at most hardware stores. For mail-order information, see Sources at the end of the article.) Next, chuck the rod into a three-jaw or scroll chuck mount-

ed on the headstock of your lathe. Mount a no. 39 (.099") bit in the tailstock chuck and drill a $\frac{1}{2}$ "-deep hole centered in the end of the rod. (See *figure 5* and *photo G*.)

Step 2. Shape the scribe to the profile shown in figure 5. To do this, lock the rod in the chuck of a portable electric drill, and fit your stationary belt sander with a 100-grit aluminum-oxide belt. With the drill turning the rod in a direction opposite the sanding belt's rotation, sand the brass rod to profile (*photo H*).

Step 3. To form the scribe point, first cut the head off an 8d finish nail.

Lock the headless nail in the chuck of a portable drill, then grind the nail to the shape shown in figure 5 using a bench grinder. (See *photo I*. I set my drill to turn the nail in the direction opposite that of the grinding wheel and ground it on the wheel's face using a light but steady touch.)

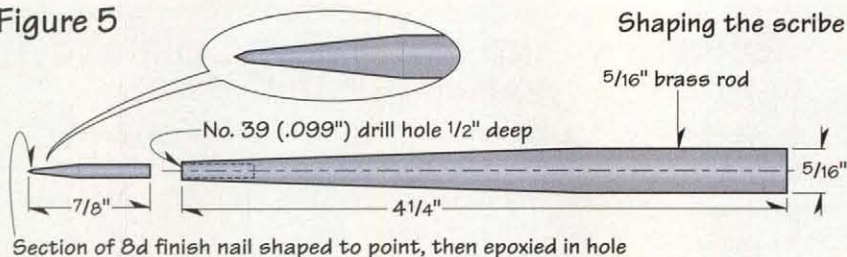
Step 4. Cut the pointed nail to $\frac{7}{8}$ " long, then epoxy it into the hole you drilled in the end of the brass rod. Allow the epoxy to cure.

Step 5. Using 180-grit aluminum-oxide or silicon-carbide abrasive, sand the brass scribe to remove any marks left by the belt sander. Next, buff the scribe to a high polish. (See *photo J*.) I used a buffing wheel loaded with jeweler's rouge and rotated the rod opposite the direction of the buffing wheel.

Step 6. Cut the rod to $4\frac{1}{4}$ " long. File the end to remove the saw marks, at the same time making a small chamfer. Then, buff the end of the scribe and the two compression nuts.

Figure 5

Shaping the scribe



Section of 8d finish nail shaped to point, then epoxied in hole

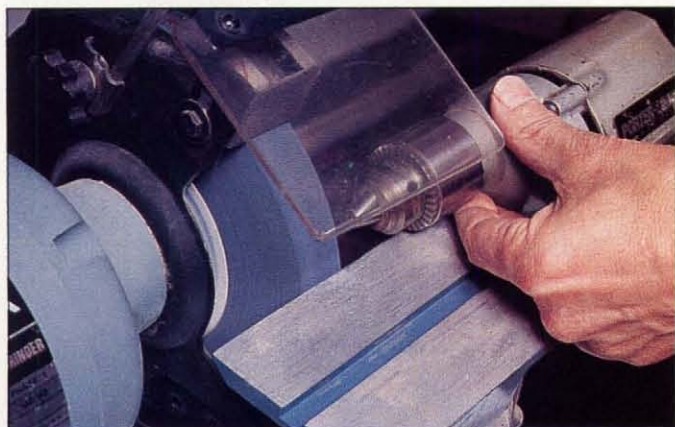


Photo I: Shaping the nail point on the bench grinder, again using a portable drill.

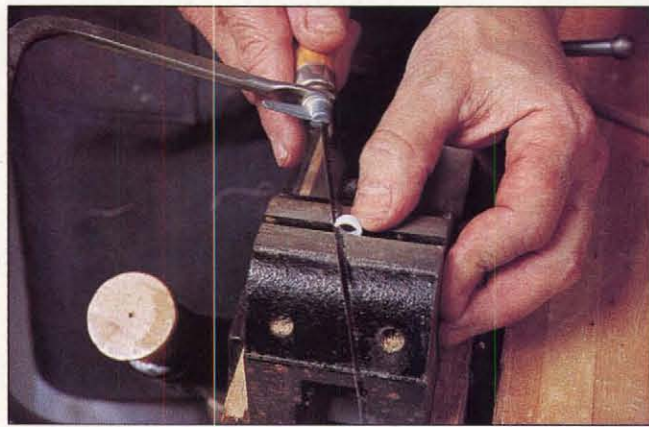


Photo K: Author uses a coping saw to cut a section from the nylon compression washers to form split collets.



Photo J: Buff and polish the brass scribe to a scratch-free high gloss.

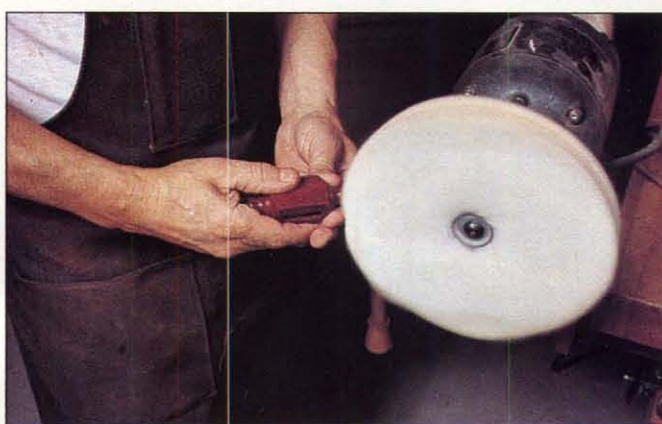
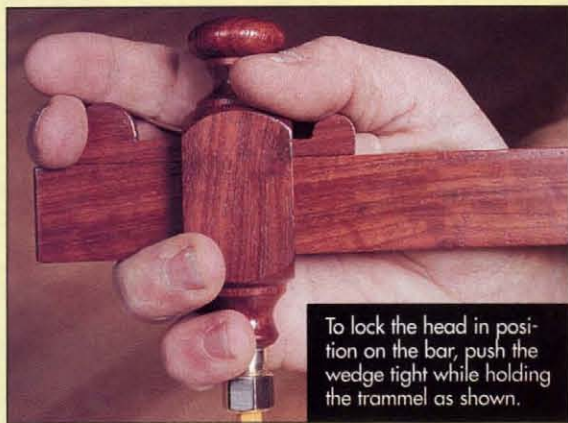


Photo L: After the Danish oil finish has cured, buff all trammel parts.

How To Use The TRAMMEL

If you've carefully matched the taper on the wedges to the angle of the mortises, then with a little practice you'll be able to adjust the radius of your trammel quickly and with amazing accuracy.

To set the trammel, I tighten the wedge just enough to provide a slight resistance to any movement of the head along the bar. As the head approaches the desired radius, I position my hand on it as shown in the photo at *right*. With my hand in this position, I can hold the head steady on the bar and still fine-tune the setting. Once I've reached the exact setting, I tighten my grip on the head and bar, at the same time pushing the wedge tight with my fingers to lock the head at that spot.



Step 7. Mount the scribe in one trammel head and a pencil in the other. To do this, replace the brass compression washers that came with the unions with nylon washers. Cut a small section from each of them to form a split collet (*photo K*). These can be easily compressed by finger-tightening the compression nut.

Finish the Job

Step 1. Apply the finish of your choice to the wooden parts and allow it to dry. (I used Danish oil.)

Step 2. Polish the wooden parts. (I

buffed them using Tripoli, then White Diamond, and finally a wheel loaded with hard wax. See *photo L*.)

Photographs: By the author

SOURCES

Turning Squares and Lumber.

Domestic and many exotic species available, including padauk (which I used). Order from:

Constantine
800/223-8087

Brass Rod. $\frac{5}{16}$ "-diameter. Catalog no. Q-ZRB-5-6 (6" length) or Q-ZRB-5-12 (12" length). Prices: \$1 and \$2 for the respective lengths. (Firm has \$15 minimum order requirement.) Order from:

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Greenwood Chairmaking

An Appalachian tradition worth preserving by Thomas Lynch

I live and work in rural West Virginia on a 56-acre homestead. My wife and I moved here in 1976 to flee the urban sprawl of metropolitan Washington and raise a family in these tranquil surroundings. My love of trees and mountains first drew me to this beautiful state. I knew at the time, however, that I wanted to work with wood, and the accessibility of fine Appalachian hardwoods made this area even more appealing.

In 1977, I started an informal apprenticeship at the Linger Chair Factory in Rock Cave, West Virginia. This business had been manufacturing cant hook handles since the early 1900s, with chairs as a sideline. When the cant hook business began to taper off in the 1930s, the chairs became more of a production item, mostly for local consumption.

When I started working there part-time, I was the only employee and we were open only on weekends. At times, the factory had employed up to 20 people, each of whom performed a separate task, so that no one ever really learned the whole process of chairmaking. When I started, however, the owner let me train at different stations from week to week until I learned all of the stages.

At the time, I wasn't told the reason for drying the rungs, or keeping the posts relatively green, or making the side mortises intersect and overlap those on the front. The reasons became clear when I later read John D. Alexander's book *Make A Chair From A Tree: An Introduction to Green*



After an informal apprenticeship at the Linger Chair Factory, the author went on his own, using traditional techniques to make sturdy Shaker-style chairs of austere beauty.

Woodworking, which explained the traditional chairmaking techniques I had learned as an apprentice.

For me, making a chair starts at the sawmill (*photo A*). The local mill here lets me select the logs I want and then saws them to my specifications: mostly 8/4 for the legs, 6/4 for the front rungs, and 4/4 for the side and back rungs. (See *figure 1*.) Although the figure and lead photo show a rocker, which is my signature piece, I was making more ordinary chairs the days we photographed the process, so I've focused on that type of chair.

Having whole logs sawn at the mill also allows me to maintain uniform color and grain in a set of chairs by using boards sawn from the same tree. I stack the lumber carefully in a breezy location under metal roofing. To minimize warp, I place dry stickers of uniform thickness between the layers, spacing them 12 to 20" apart and directly above those in the layer below.

After a year or so, I move the lumber into an open shed and stack it without stickers until I'm ready to use it. The wood's moisture content at this point is about 14 to 20%, the optimum for green woodworking. Since my turning stock is sawn instead of rived, I pick the straightest-grained logs I can find for strength. I've learned to identify figured wood in an unmilled log, so I keep an eye out for curly maple and quilted cherry.

I rip the air-dried 8/4 boards into 2x2" material for the front and back

legs. I joint one edge, then rip the 2"-square stock into strips to be cut to length later. Before turning the wood, I remove the corners on the square stock, which lets me keep the tool rest on the lathe in one position. Normally, you have to move the tool rest as the diameter changes, but starting with the octagonal shape eliminates this step.

To rough out the rungs, I use a dowel machine (circa 1920s) that I salvaged from a broom factory (*photo B*). I then sand the dowels on a stationary drum sander, using a fixture I devised from skateboard wheels. The wheels are mounted slightly above the drum sander; they hold the dowel in place as it rotates on the sander (*photo C*). I wear heavy gloves for this operation, as the dowel spins quite fast.

Turning the Legs

Turning is probably the most technical operation in chairmaking. I've found that by modifying a $\frac{3}{8}$ " gouge with the "Irish grind" that

Editor's Note

Up until 1950 or so, the bodgers of the British Isles had for centuries gone to the woods with their spring-pole lathes to turn chair legs and rungs on site from freshly cut saplings. They would then peddle their wares to chairmakers, who oriented the grain in the mating parts so that mortises would shrink around tenons as the green stock dried, ensuring joints that would remain tight indefinitely without glue.

Today, Tom Lynch continues this tradition but now has science on his side. Research done by John Alexander and R. Bruce Hoadley during the 1970s convinced him that the principles of greenwood chairmaking would work even more effectively if he first air-dries the "green" wood to 15-20 percent moisture content. To learn more about the details of Tom's enlightened technique, read on.



Photo A: At the Rosewood Lumber Co., mill operators let me select my own logs and then saw them to my specifications. I sticker the lumber in a breezy but covered location and allow it to air-dry for about a year.



Photo B: To rough-out the chair rungs, I use a 1920s-vintage dowel cutter that I salvaged from a broom factory.



Photo C: To smooth the rung blanks, I devised a fixture for the stationary drum sander that uses skateboard wheels.

Figure 1

Shaker-style rocker

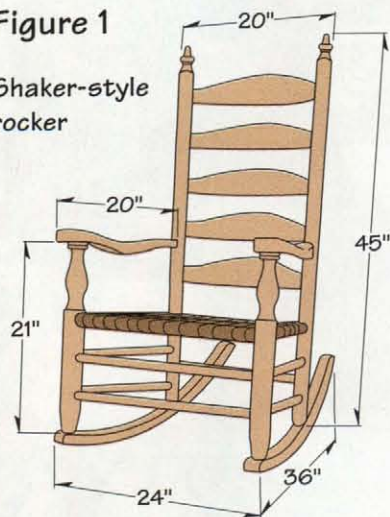




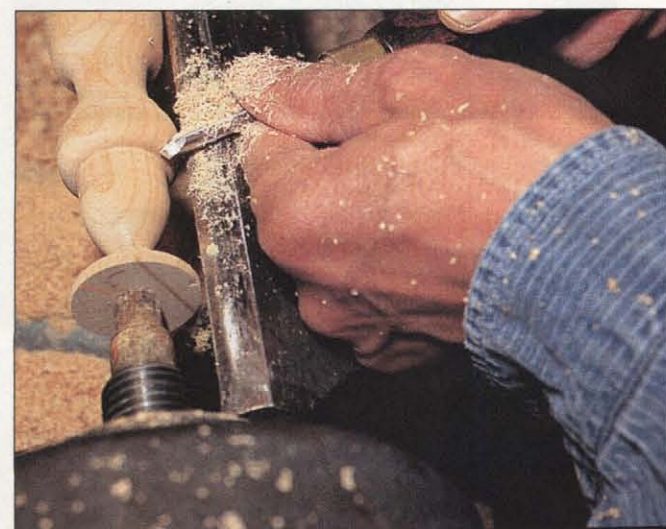
Photo D: I rip the square leg blanks to hexagonal shape, then do the roughing-out work with a $\frac{3}{8}$ " spindle gouge modified with an "Irish grind."

many bowl turners use, I can do all my roughing-out work with a single tool (*photo D*). After rounding the octagonal stock, I use a marked "story stick" as a pattern. With the lathe spinning, I mark the mortise locations on the leg blank and also the coves and beads for the finial. I then make scoring cuts with the parting tool and, if needed, the calipers, although I find by this time that eyeballing the cut saves time and is usually just as accurate as the calipers (*photo E*).

With a smaller $\frac{1}{4}$ " gouge and the skew chisel, I can do all my finish cuts. For the detail work on the finials, I make a clean cut to eliminate any need for heavy-grit abrasives (*photo F*). I often make the final cut with the skew. The shearing action of this tool leaves a smooth surface, eliminating much of the need for sanding. I avoid the skew, however, if the grain is at all figured because it tends to lift and tear out the fibers.



Photo E: After laying out the leg using a "story stick," and pencil, I use a parting tool to score the grooves that mark mortise locations, then size the coves and beads to their proper diameter.



◀ **Photo F:** To avoid excessive sanding, which softens the detail, I make as clean a final cut as possible, here using a $\frac{1}{4}$ " gouge.

Photo H: Pre-finishing ▶ legs on the lathe makes for easy buffing and a lot less finishing work after assembly. Since I cut all mortises and tenons after this initial oiling, I don't mask these areas.

I start sanding the turned parts with the finest grit possible, usually 180- and then 240-grit with the lathe turning. I then turn off the lathe for a final with-the-grain sanding using 240-grit. I try to preserve the turned detail, which is easy to lose during the sanding process. For parting off, which I postpone until after the final finish is applied, I make a clean final cut at the headstock end, then let the piece drop into my hand while the lathe is still spinning (*photo G*).

Although it's unorthodox, I've found pre-finishing the pieces on the lathe effective (*photo H*). I use a tung oil finish, giving each part at least two coats before assembling the chair. Pre-finishing makes for easy buffing, ensures a good buildup of finish, and leaves a lot less work to be done after assembly. I cut all mortises and tenons after this initial oiling, so I don't have to worry about getting oil on the gluing surfaces.

I've added a foot clutch to my lathe, which speeds up production time con-

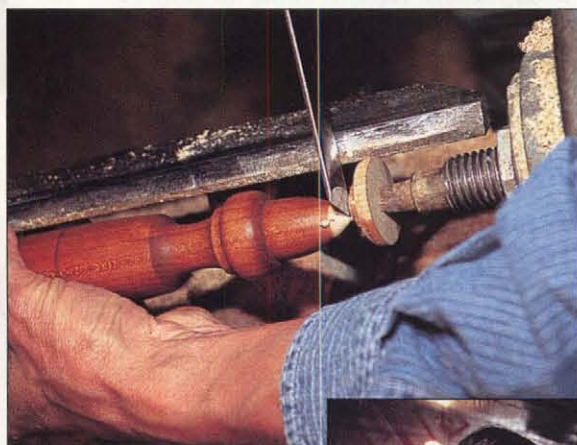


Photo G: After applying and buffing the final finish on the lathe, I part off the acorn finial, keeping a hand underneath to catch the leg as it falls.





Photo I: To bend the slat blanks, I boil them for 15 minutes in a stainless-steel kettle. Unlike cast iron, stainless steel doesn't react with the wood's tannic acid.

Photo J: After bending the slat blanks on a form, I dry them under tension on a rack for one to two weeks. The slats are ready to work when they've dried enough to slip out of the rack.



siderably. A pedal on the floor lifts the hinge-mounted motor by way of a rod, taking tension off the belt. With the belt loose, I can stop the lathe in an instant using an outboard handwheel without turning the motor off. This lets me examine a turning in progress or check the piece between sanding grits for defects and scratches. I power-sand as much as possible using a 3" foam-cushioned sanding pad and an air drill. The foam cushion eases the aggressiveness of the abrasive, which means fewer scratches and less work.

Bending the Slat

For this relatively simple operation, I use a stainless-steel kettle because it eliminates the reaction of tannic acids in the wood with the iron (*photo I*). I start with rough blanks that are approximately $\frac{3}{8} \times 4 \times 20$ ", totally submerging them in boiling water until they're flexible enough to bend easily—usually about 15 minutes. I do the initial bending on a form, then dry them under tension on a rack (*photo J*).

You can use kiln-dried, air-dried, or green wood for bending. I find kiln-dried stock tends to be brittle, but overnight pre-soaking in cold water seems to help. Green wood can be bent with less heat, but it tends to be unstable unless I let it dry completely in the racks. I prefer air-dried lumber for this purpose. It doesn't break or splinter as readily as kiln-dried wood, yet it dries more quickly than green wood—within a week or two, depending on the temperature and humidity. When the slats shrink enough that they no longer fit tightly in the rack, they're dry enough to be worked.

I match a set of slats for each chair by grain and color, then pilot-drill and nail them together, keeping the nails in the waste areas (*photo K*). Next, I straighten the bottom edge of the stacked set on the jointer (*photo L*). I crosscut both ends to length, which, because of the curvature and stacking, makes each slat slightly shorter than the next one down in the stack. Using a pattern, I trace the slat outline onto the top face, then band-saw the curved top edge of the stacked slats with a single saw cut.

Mortising the Legs And Cutting Tenons

The curved slats join the back legs at an angle, which makes positioning the rung mortises tricky. The wood tends to split during assembly if the rung mortises are drilled either perpendicular to or

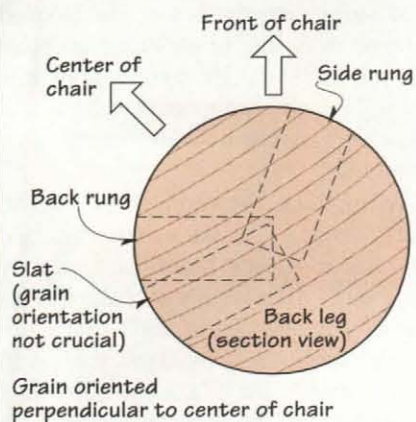


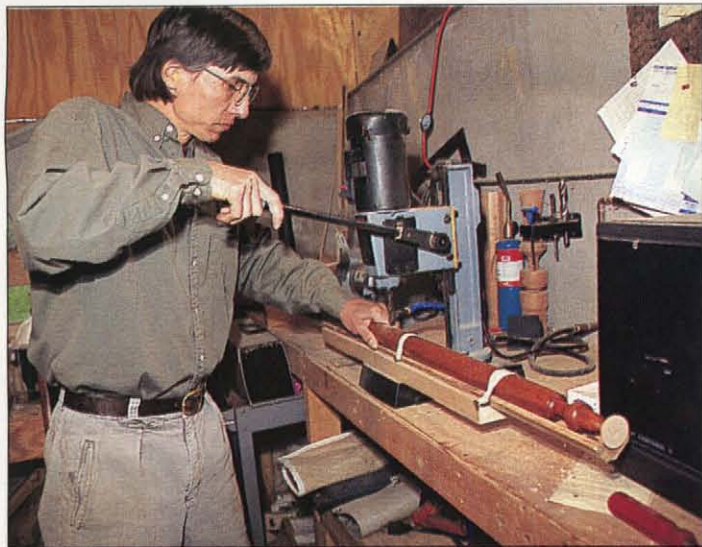
Photo K: I match a set of bent slat blanks for color and grain, then stack, pilot-drill, and nail them together in the waste areas.



Photo L: I straighten the bottom edge of the stacked slats on the jointer, then crosscut the ends. Because of the curvature, each slat is a bit shorter than the next one down in the stack.

Figure 2 Orienting leg grain for mortises





◀ **Photo M:** Before mortising the back legs for the slats, I orient the grain so the mortises enter at 45° (or diagonal to the face grain and edge grain). I lay out the mortises, then cut them using a hollow-chisel mortiser.



Photo N: After tracing the profile from a pattern, I bandsaw the top edge of the stacked slats with a single cut, then drum-sand them to final shape.



Photo O: I also use the drum sander to thickness the slats, checking the ends for fit in the back-leg mortises as I work. Note the yet-to-be-parted finials on the back legs.



Photo P: I use a sliding V-block jig to drill the back-rung mortises. To align them with the slat mortises, I dry-assemble a slat to the back leg, then sight down the length of the leg. I rotate the leg until the slat end intersects with the vertical plane of the drill bit.

directly in line with the grain, so I orient the mortises accordingly. To do this, I lay the pair of legs on the table and rotate each one until the face grain radiates at a 45° angle from the center of the chair. (See *figure 2*.)

With the back legs in this position, I mark the front of the chair and then mark the point where the legs touch in the middle. This creates a reference line for locating the rung mortises later and also establishes the inside edge of the slat mortises.

I cut the rectangular slat mortises in each back leg using a hollow-chisel mortiser and sliding V-block jig (*photo M*). Since the back legs taper slightly from bottom to top, I gradually decrease the depth of these mortises from 1½" for the bottom slat to less than 1" for the top slat. This compensates not only for the leg taper but also for the graduated length of the

slats, which I mentioned earlier.

Next, I sand the curved edge of the slats using a stationary drum sander (*photo N*). As I work, I also sand the slats to thickness, checking them for fit in the mortises (*photo O*). After rounding the edges, I give the slats a once-over with the palm sander using fine-grit paper, then apply a coat of oil. Because the slat ends will be pegged but not glued into the leg mortises, I oil the entire surface.

To mortise the back legs for the back rungs, I insert a slat to each leg, then secure the leg in the V-block jig (*photo P*). The sliding jig I use for mortising the legs (also shown in *photo M*) consists of a V-grooved "trough" that bolts to the drill-press or mortiser table and a second length of V-block that slides in the trough. I secure the leg to the sliding block with rubber bands, then clamp it

down tight with a vise-grip clamp to immobilize it for drilling or mortising.

I align the back-rung mortises with the slat mortise by sighting down the leg from the side of the drill press. Using the drill bit as a guide, I rotate the leg in the jig until the end of the slat intersects the vertical plane of the bit. I bore the mortise for the seat rung directly below the scored groove and the lower-rung mortise midway between the grooves. At this point, I assemble the slats, rungs, and back legs, using no glue on the slats (*photo Q*).

To mortise the front legs for the front rungs, I again orient the face grain at 45° (so it faces the center of the chair), then lay out a centerline on each leg. (See *figure 2*.) I mark the inside surface of the legs, then drill the mortises on the centerline just below the scored grooves.

The chairs are trapezoidal in shape (the fronts being wider than the backs) so the side rungs must be off-square with respect to the front and back rungs. To mortise for these, I first assemble the front legs and rungs (having assembled the back earlier). I secure one leg in the sliding jig, supporting the rest of the subassembly on a cradle beveled to the required outward angle (*photo R*).

Each front leg, in turn, receives an inward-angled mortise. I drill these side-rung mortises directly on the scored line, so that the front- and back-rung mortises, drilled directly below the lines, will overlap them. (See figure 1.) This overlapping allows the intersecting rung tenons to be glued to each other as well as to the leg, which reinforces the joints.

To allow for seasonal swelling and shrinking in the chair, I also orient the grain of the rungs. I turn the face grain toward the top and bottom, so the edge grain faces inside and outside. This ensures that cross-grain swelling and shrinking in the rungs and legs will coincide rather than conflict.

I cut tenons using a lathe-mounted tenon cutter (*photo S*). I used to hand-turn the tenons using a box wrench as a sizing tool, but I've found this specialized cutter to be much faster and more accurate. I cut the tenons approximately 1½" long, drilling the mortises slightly deeper to make room for any excess glue.

In greenwood chairmaking, the tenon-mortise fit is critical. It must be tighter than a slip fit but not so tight that it crushes the wood or splits the post. This is where the difference in moisture content comes into play. I dry the rungs in a microwave oven before cutting the tenons. The microwave dries wood from the center out, unlike conventional kiln-drying, which dries from the outside in, sometimes causing case-hardening or honeycombing of the wood.

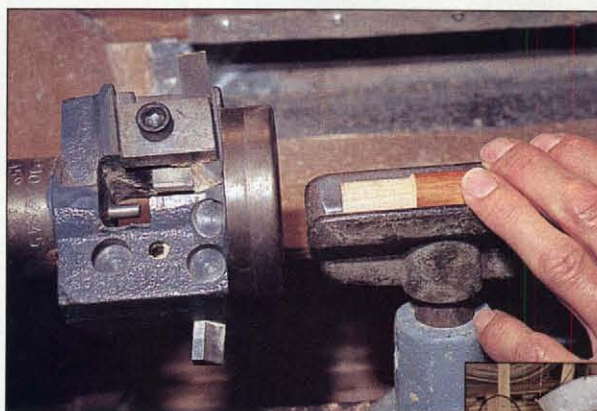
I've never measured the actual difference in diameter between mortise and tenon, although I've read that the tenon ought to be about .003" larger for greenwood joinery. Once I've driven the rung tenons home using a shot-filled mallet and block of



Photo Q: After drilling the back rung mortises, I assemble the back legs, slats, and back rungs. I use glue on the rungs but not on the slats, which I'll peg later. The woven seat will cover the unfinished seat rung.



Photo R: After gluing up the back and front as separate subassemblies, I drill angled mortises for the side rungs. To do this, I use a V-block jig with a beveled block that supports the unit at the correct angle.



◀ **Photo S:** Before cutting tenons using this lathe-mounted cutter, I dry the rungs in a microwave oven, which shrinks them without case-hardening the center. After assembly, they will gradually regain moisture, ensuring that joints will remain tight.

Photo T: I assemble the side rungs to the chair front and back using a shot-filled mallet and softwood block. I size the rung tenons slightly larger than the mortises (about .003") for a snug fit that won't crush wood fibers.

softwood, they're impossible to remove (*photo T*).

Traditionally, greenwood chairmakers do not use glue, but I find that it helps reinforce the rung joints and also slows seasonal wood movement. On the slats, rockers, and arms, I use pegs but no glue. After joining the front and back of the chair with the side rungs, I check the legs for flatness on a level surface and attempt to rack the chair flat if necessary.





◀ **Photo U:** This close-up of the underside of a woven seat shows the staggered weave and carefully knotted hickory bark strips.



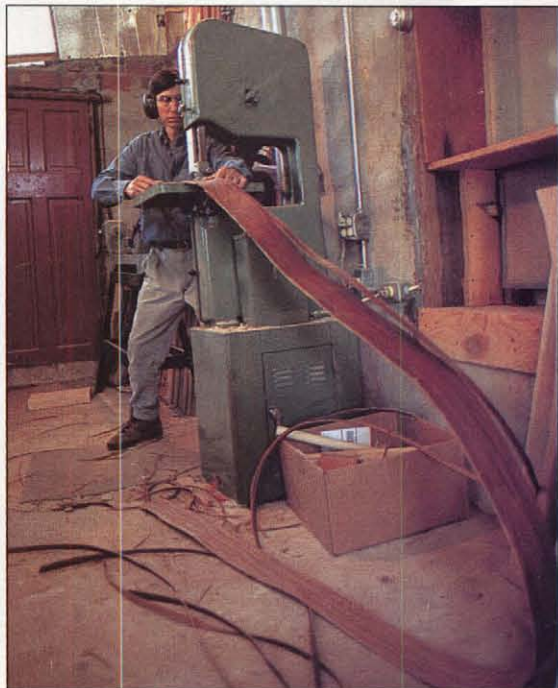
▲ **Photo W:** To prepare the bark strips for weaving, I soak them in hot water just long enough to make them pliable. If they absorb too much water, they'll tighten excessively as they dry.

Weaving the Seat

I use several different materials for the woven chair seat, including natural rush and Shaker tape, but hickory bark is by far the most popular (*photo U*). It makes a rugged, durable seat that should last for generations. When I first learned how to gather and weave hickory bark at the Linger factory, we did it the time-honored way, using a drawknife and pocket knife. In the spring, we would fell a straight tree of 6 to 16" diameter with no limb scars or low branches. We'd remove the outer bark with the drawknife, then cut one lengthwise strip of inner bark at a time.

These days, I check the local mills during the spring months for good bark logs. Mill owners willingly accommodate me because the fibrous

Photo V: After stripping the hickory bark at the mill, then planing off the rough outer bark, I bandsaw the inner bark into strips for seat-weaving.



◀ **Photo X:** Employee Lightning Riffle, does most of the seat-weaving.

hickory bark is a real nuisance at this time of year. It gets caught in the debarker, wrapping around the cutters and shutting the mill down. No other tree species causes such problems, so loader operators will gladly move hickory logs for me or set them aside for stripping.

Often the first reaction to my request is "You want what?" Once I explain the seat-weaving, however, I often hear "My granddad used to do that." With a chainsaw, I score the length of the tree, then strip the bark in 6"- to 10"-wide sections. I run these sheets through a planer to remove the rough outer bark. (I keep a set of beat-up blades specially for this pur-

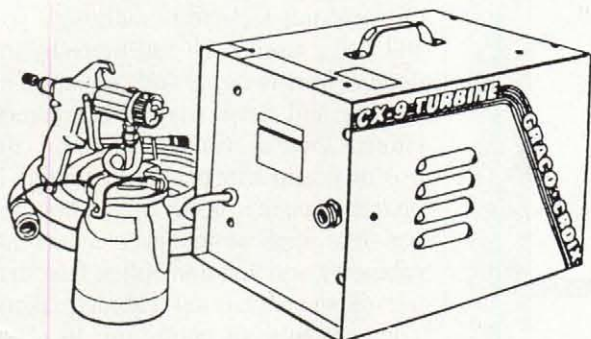
pose.) The bigger the tree, the thicker the inner bark. With a large hickory, I can usually split this inner layer and get two uniform strips.

Instead of cutting the strips with a pocket knife, I use my bandsaw and a meat-sawing blade (*photo V*). I then dry the bark and store it until I need it, either in sheets, strips, or ready-to-use splints. When I'm ready to weave a seat, I soak the strips in hot water until they're flexible enough to use (*photo W*). If soaked longer, they absorb too much water and then shrink excessively as the seat dries. These days, my employee, Lightning Riffle, now weaves most of my seats (*photo X*). Two summers ago, I received a grant from the Augusta Heritage Center in Elkins, West Virginia, to train an apprentice in traditional hickory bark seat-weaving.

Continued on page 74

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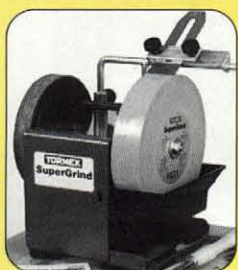
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Greenwood Chairmaking

Continued on page 72

A certain mystique surrounds chairmaking that causes most woodworkers to shy away from it. It also requires special tools and techniques, which is why shops that make chairs at all tend to specialize in it. Green woodworking, for example, is almost exclusively a chairmaking technique, although you still find it used here and there by traditional wheelwrights and coopers. The mortise and tenon may be a common enough joint in woodworking, but the use of round mortises and tenons is unique to chairmaking. Steam-bending has few applications in conventional cabinetry, and you don't often find turning expertise among cabinetmakers. These factors all contribute to chairmaking's exotic reputation, yet none of the techniques I use is beyond the grasp of the interested woodworker.

I find chairmaking a rewarding and fulfilling occupation. Other woodworkers often ask if I don't get bored doing the same thing every day, but making chairs of this style involves so many different operations that I never do the same thing two days in a row. In the course of developing a business, I've had to acquire skills in quite a range of fields in addition to chairmaking: forestry and entomology, machinery operation and repair, economics and market analysis, as well as sales and marketing.

Self-employment can have its drawbacks. Working until the job is finished sometimes requires long hours, and knowing that it won't get done unless you do it can be stressful. However, there are certain joys that come with being your own boss—when the job is done, you can declare an unscheduled holiday and go fishing. 

Photographs: Deana Steiner Smith

Illustrations: Don Pauli

About the Author

Tom Lynch makes chairs in Rock Cave, West Virginia, where he also lives with his wife, Grace, and their two children. During the summer, Tom teaches twig chairmaking at the Augusta Heritage Center, Elkins, West Virginia, phone 304/637-1209, and the Basketry School, Chloe, West Virginia, phone 304/655-7429. Visit Tom's home page on the internet at www.msys.net/tomlynch.

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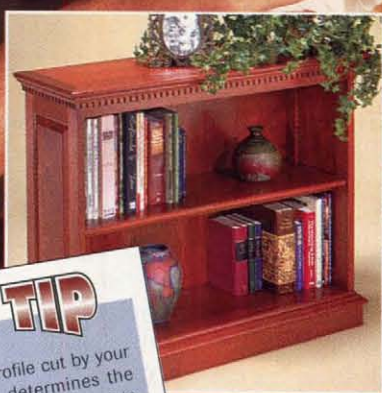
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PRO TIP

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, up the bit to route the profile. Make a test cut on scrap. Measure the width of the crown. To calculate the crown's length, measure the length of the panel (rail plus stiles), then the width of the bit's profile (to allow for a 1/8" reveal at each end). To calculate the crown's width, add the width of the bit's profile to the test cut, then add 1/8" for the reveal.

When working with narrow pieces, you start with a piece wider for safer handling in the routing operation. Then rip it to final width later.





The Incra Ultra-TS Micro-Precision Tablesaw Fence

by Daru Stevens

When first asked to test the new Incra tablesaw fence, I was skeptical. My shop is small and I wasn't sure I could accommodate the unit on my saw. The Ultra-TS was designed to be removed for crosscutting, but I figured I'd have to leave it on the saw because there simply isn't any room for stowing it. I'd also lose the capacity to rip stock wider than 26" and would not be able to use several of the jigs I'd made to work with my Vega fence.

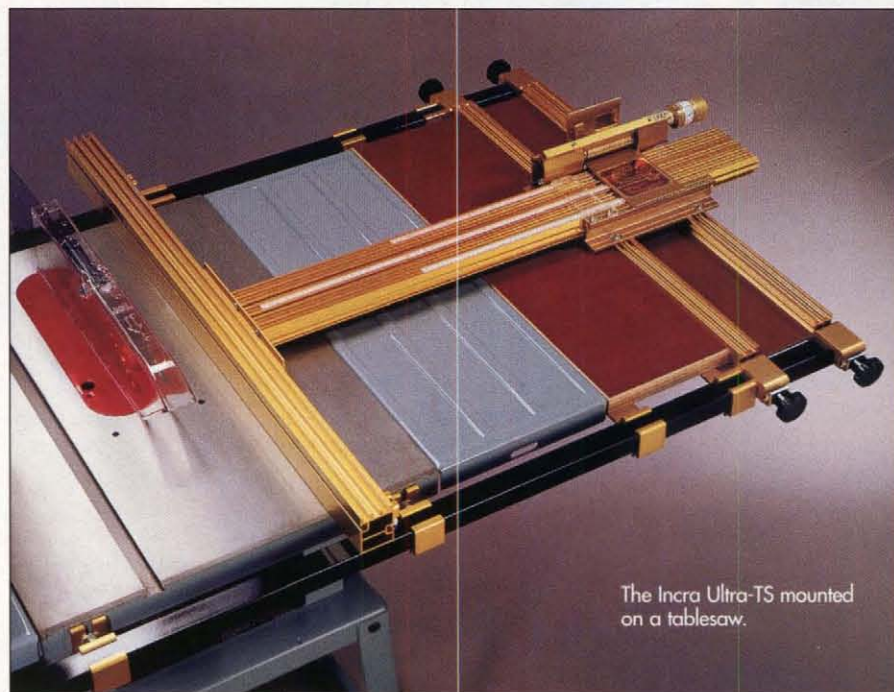
I've always gotten the accuracy I wanted using the micro-adjustment on the Vega fence. However, having used Incra jigs on my router table and drill press for several years, I was curious to see if the jig would improve my results on the tablesaw.

The heart of this tool is the Incra Jig, a unique fixture that provides accurate, incremental fence positioning with precise repeatability. Originally developed for the router table, the designers modified the Incra Ultra for the tablesaw. (For a report on the router-table version of the Ultra, see the Jan./Feb. '96 *Woodworker's Journal*.)

Installation and Tuning: Fast and Easy

The TS system arrived in two parcels: the Incra Jig Ultra in one, the TS package in the second. The latter includes the fence, steel rails, base support bars, fence glides, and the mounting brackets and hardware needed to mount the jig permanently on a tablesaw.

I had no trouble installing or tuning the TS system and no modification or drilling was required. The well-written



The Incra Ultra-TS mounted on a tablesaw.

and clearly illustrated instructions helped with the installation and its operation as well. I set the fence parallel to the miter-gauge slot (actually off-set .012" at the rear), zeroed the fence to the blade, made a test cut, and recalibrated using the micro-adjuster. The jig was making precise cuts in no time.

To test the TS, I decided to make cutting boards and boxes doing a stock lay up shown in Perry McDaniel's book, *Incra Jig Projects and Techniques*. I ripped the stock into pieces ranging from $\frac{1}{32}$ " to $\frac{17}{32}$ " in thickness. Without the Incra's automatic positioning, this task would challenge even the most surgically precise woodworkers.

I used to cut thin strips on the outside of the blade by placing my original Incra jig to the left of the blade to position the stock and snugging the Vega fence up against the stock on the oppo-

site side. Then I'd back off the jig $\frac{1}{32}$ ", make the cut, and go through the procedure again.

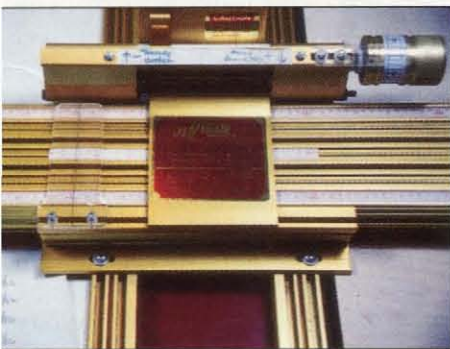
The built-in capabilities of the Ultra-TS made these maneuvers unnecessary. I simply faced the stock first by making a thin rip cut. Next, I installed a left/right scale on the Ultra. (See the photo *opposite*.) On this scale, the numbers increase as the fence moves closer to the blade so I can measure the stock thickness being cut on the outside of the blade.

I zeroed the left/right scale to the fence where the facing cut had been made. Next, I calculated the settings needed to cut the stock widths: $\frac{1}{8}$ " kerf + $\frac{1}{32}$ " = $\frac{5}{32}$ "; $\frac{5}{32}$ " + $\frac{1}{8}$ " + $\frac{2}{32}$ " = $\frac{11}{32}$ "; $\frac{11}{32}$ " + $\frac{1}{8}$ " + $\frac{3}{32}$ " = $\frac{9}{16}$ "; and so on through $\frac{17}{32}$ ". Using these settings, I got accurate cuts, easier and faster than by my previous method.

Resaw To Exact Thickness

I do a lot of resawing on the table-saw. In fact, to thickness any stock less than 6" wide, I'll resaw rather than plane it because this allows me to use shorter lengths, produces less waste (no snipe), and achieves greater accuracy.

With the Vega fence, I used a large, elaborate jig for resawing. With the TS, I made a tall auxiliary fence out of some 5/8"-thick melamine. I set the jig at 5/8" (fence thickness) + 1/2" (resaw thickness). This system gave me exact thicknesses in record time without any test cuts.



Author calculated settings for each piece thickness, then set jig for each cut using the center scale, reading left to right.

With the TS system, resawing angico, maple, and cherry for 3/8"-thick hinge stock was a breeze. I installed the tall auxiliary fence, set the TS at 5/8" + 3/8" (1"), and got a precise 3/8" thickness with no test cuts.

This capability allows me to resaw at my convenience; I don't have to cut all of the parts at the same time because the TS will give me exactly the same thickness every time with minimal setup.

No More Guesswork

The micro-adjuster on the Inca Jig has always struck me as the frosting on the cake. Hardly a week goes by in my shop that I'm not shaving .002" off something to get that perfect fit.

To micro-adjust my Vega fence, I used trial and error. I figured out that a quarter turn of the dial equals 1/64", but the Vega lacks a scale to indicate exactly how far I've moved the fence. I would deliberately cut my hinge gains just a bit smaller than my wooden

Continued on page 78

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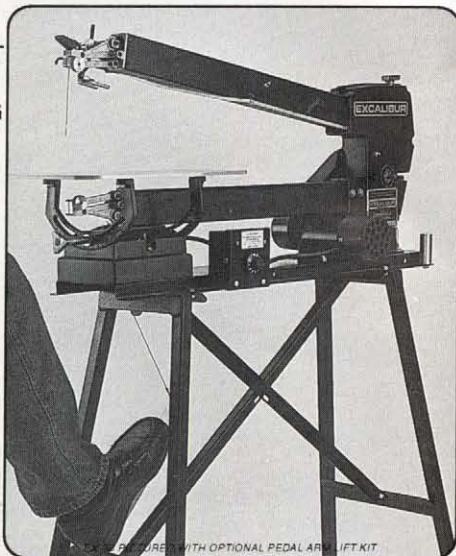
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Incra Ultra-TS

Continued from page 77

hinges. Then, I'd trim the hinges to fit by shaving off a few thousandths of an inch, using a caliper to check and estimate the Vega's micro-movement. With the built-in micro-adjuster on the Incra Ultra-TS, I dial in .007" or .010" or whatever I need and arrive at the perfect fit with just a shave or two.

Should You Own the Incra Ultra-TS?

There will be a few tradeoffs to consider if you already own a good rip fence. With the TS fence you can't make rips wider than 26". The Incra's 14-gauge, 1 1/4"-square steel rails are smaller than most conventional rails. But since the Incra doesn't lock to the rails, it doesn't need a lot of mass here to secure the fence against lateral pressure. Note: The Incra fence is anchored in the center where the gauge arm bolts to the fence. This arrangement provides plenty of rigidity along the length of the fence. If you need to crosscut long stock, the Incra Ultra-TS can be taken off the saw in under a minute, but it requires a bit more effort than lifting off a regular rip fence.

Although stock hold-downs can be attached using the T-slots on top, I wouldn't do so. I don't want to put vertical stress on a tool that I rely on to cut stock to within .002" precision.

On the other hand, if you make mostly small items, and require absolute accuracy, this tool can save you time and enhance the beauty of your work. Now that I've completed a set of projects, I'm hooked on the TS. In spite of the few tradeoffs, I've made the Incra Ultra-TS a permanent fixture on my tablesaw. **WJ**

Incra Ultra-TS, about \$340
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Daru Stevens is a retired English teacher and woodworker. His work has been featured in the Jessel Gallery in Napa, Calif.

Photographs: Taylor Design Group, Inc.; author

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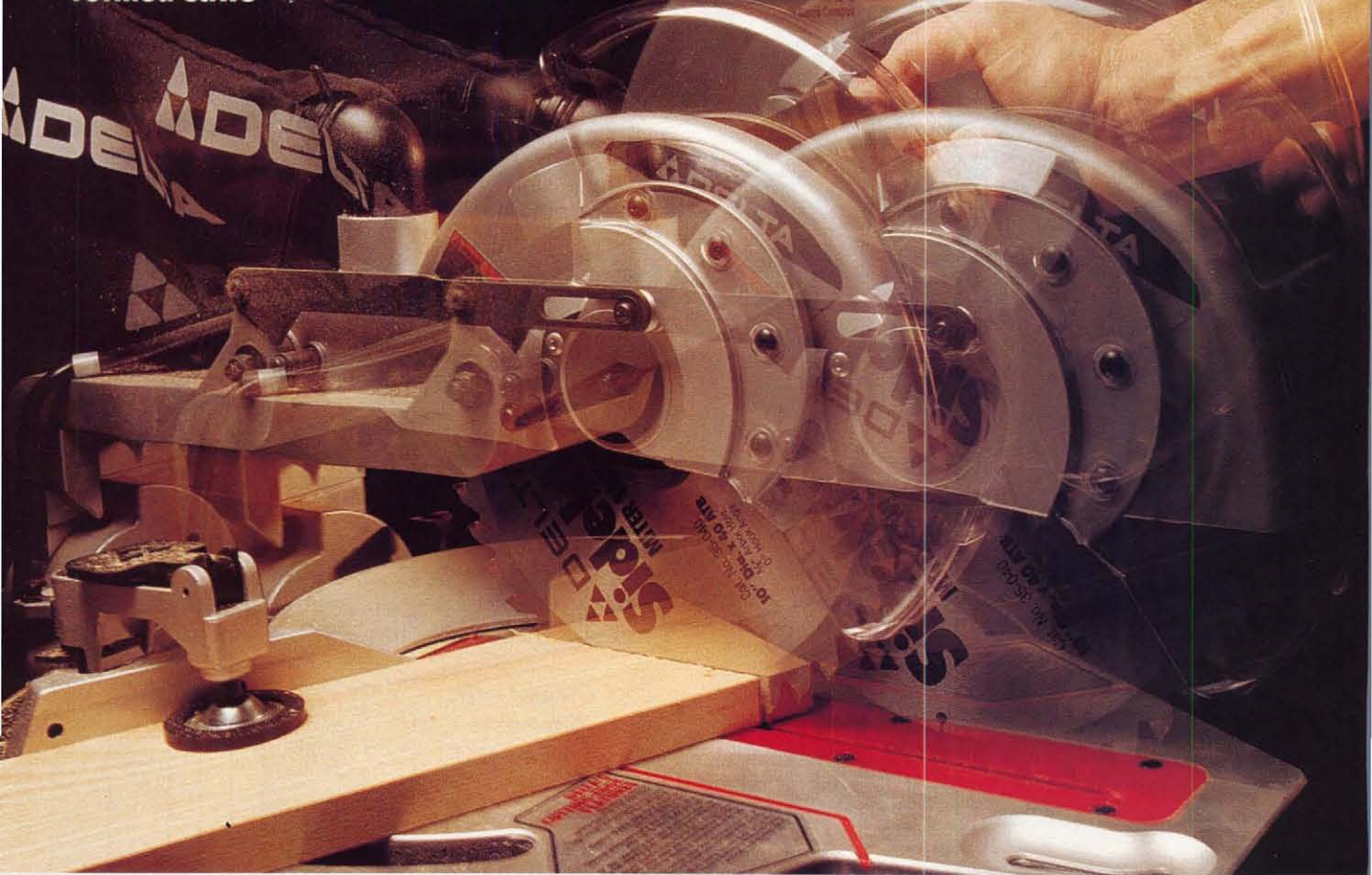
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SLIDING COMPOUND MITER SAWS

**For capacity, accuracy, and versatility,
nothing can touch these highly
refined saws** *by Leon A. Frechette*



Today's modern sliding compound-miter saws are the product of several decades of power-tool evolution that started back in the 1940s with the introduction of the radial-arm saw. Even though it represented a great leap forward, the radial-arm saw's weight made it difficult for carpenters to transport, and its wobbly blade tracking frustrated many a woodworker's desire for precision cuts.

The first solution appeared in 1967, when Rockwell International introduced the first power miter saw. This easily portable tool cut laser-straight kerfs, but it couldn't handle stock wider than a 2x6. To cut a bevel, you had to stand the workpiece on edge, which limited the width of stock the saw could handle.

Fifteen years later, Delta further refined the design and gave us the first compound-miter saw—a machine that cut both flat miters and bevels. Then, in 1988, Hitachi added yet another dimension to this unique tool when it introduced its sliding compound-miter saw, which could cut stock up to 12" wide. Other major portable power tool manufacturers started offering a "slider," and despite the near-breathtaking prices, these machines have quickly gained popularity and continue to sell briskly today.

So what's all the hullabaloo about sliding compound-miter saws? If all you need is a cutoff saw to trim 2x4s, 2x6s, or 4x4s, and if you never intend to cut crown or cove moldings taller than about 3½", then a simple power miter saw will



meet your needs. These units generally cost half of what you'll pay for a slider. But if you want to cut stock wider than a nominal 2x6 (5½"), then you need the additional capacity offered by one of the new sliding compound-miter saws. (See *photos A-D*.) As detailed in our chart on *page 86*, the smallest 90° crosscut capacity of any saw in our review still measures a whopping 11½", and one of them will even crosscut 16"-wide stock.

This capability makes the sliding compound-miter saw as versatile as the old radial-arm saw it evolved from and offers several additional advantages of its own. For one, these saws, when properly set up, are very accurate. The blade travels on an extremely stable rail (or set of rails), producing clean, straight cuts.

For another, sliders are considerably safer to operate. With a radial-arm saw, you *pull* the spinning blade *toward* you. With a slider, you pull the blade and motor assembly from the rear of the support mechanism, turn on the saw, and then lower and *push* the spinning blade *away* from you.

A slider also offers portability. Shop-bound woodworkers may not see the need for a portable saw, but if you ever intend to build a deck or gazebo, trim out a room, install cabinets, or build a fireplace mantel, this portability will save you countless trips to the garage shop or basement.

If you've never examined one of these highly evolved machines up close, you'll soon find there's a lot to learn about their function and performance. Here's what you need to know before setting out to make a purchase.

Sliding Mechanisms

All sliding compound-miter saws travel on some type of tube or rail system. The saws I tested used seven different types of sliding mechanisms.

Makita's LS1211 has a single, top-mounted rail that's covered with a boot to protect it from sawdust. The firm's LS1011 saw has a single rail (no boot) that operates from the unit's underside.

The Delta Sidekick design incorporates two parallel horizontal rails that also work from the underside. On the Delta Sawbuck, two vertically aligned support rails or tracking arms are top-mounted. The DeWalt uses two vertically positioned rails.

Both Ryobi and Tradesman use a triple-rail system that operates from the top: two parallel horizontal rails with a third centered on top to form a triangle. The mechanism has a cover to keep out dust.

The Bosch, Sears, Freud, and both Hitachi saws feature a pair of horizontal rails that operate from the top. Freud's rails incorporate a protective cover.

Milwaukee offers a unique design. Its stationary parallel rails are aligned one above the other and inclined at a slight angle. The lower rail is mounted to the bottom of the saw. The motor head, like that on Delta's Sawbuck, slides on the rails.

Miter and Bevel Scales

I never gave miter scales much thought until I examined these units in my shop. I suddenly discovered big differ-

Sliding compound-miter saws cut stock four different ways: a square crosscut (*photo A*); a flat miter (*photo B*); a bevel cut (*photo C*); and a compound miter or mitered bevel (*photo D*).

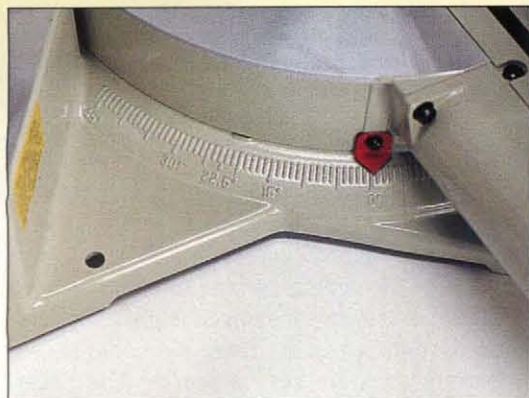


Photo E: The low-contrast miter scale on the Makita LS1011 made reading the numbers difficult, and the fat pointer didn't improve the situation.

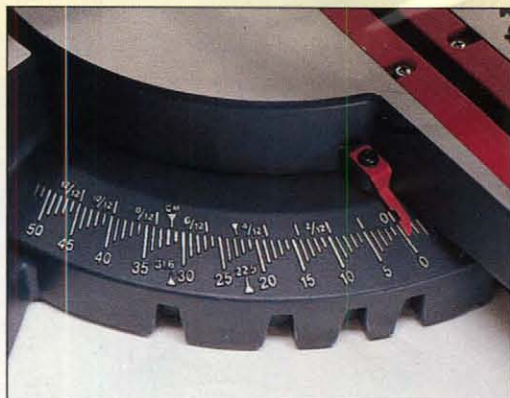


Photo F: The numbers and degree marks on the Bosch saw stand out in crisp contrast to their dark background, making the scale easy to read.

ences, especially in readability. In general, those scales that show numbers against a strongly contrasting background were easiest to read in any light conditions. (See *photos E and F*.)

Unless you cut a lot of crown moldings, you won't use the bevel scale much. I found this scale, located at the backs of the machines, both less accessible and harder to read than the miter scale. On some of the saws, you can read this scale fairly well, but because you are looking over the machine from the front, the numbers appear upside down.

Miter Mechanism

This mechanism includes the turntable, the miter detent lever, the knob or trigger that releases the turntable, and the turntable locking handle. The turntable should move freely and lock firmly in the detents (the spots along the miter scale where the turntable automatically stops as you rotate it). Typical detent locations include 0, 15, 22.5, 30, 31.6, 35.3, 45, and 60°. The stops may be activated by the locking handle engaging notches in the turntable, by a compressed spring and steel bearing engaging in small holes in the turntable, or by a combination of bearings and locking lever, as on the Delta Sidekick.

A detent system that relies on a spring-loaded bearing (*photo G*) doesn't feel as secure as a system of notches (*photo H*). Still, I prefer the bearing mechanism over the other two styles. I would rather grab the turntable handle and turn the knob or push down on a lever than have to grab

the handle and then pick up on the lever with my index finger to activate the turntable. (See *photos G and H*.) I suggest you try out a number of different detent systems and determine which you prefer before making a final decision.

Dust Bags

All of the units provide a dust-collection bag except for the Sears and the Delta Sawbuck (33-055). However, most of the saws equipped with a bag did a poor job of collecting dust anyway. On most units, most of the sawdust blows out the back behind the blade, and the problem is worse on saws with larger blades than on those with smaller ones. Connecting the port to a dust-collection system can remedy the situation somewhat. Freud added a second collection port in the back for this purpose and it makes good sense.

Extension Table Wings

Some saws come with table extensions. In my experience, the wings offer limited value, especially when it comes to working with longer material. In the interests of safety, I recommend you secure the saw firmly to a stand or bench and position a roller stand or other stabilizing device on either side. For extra-long pieces, consider placing two stands on one side, but in any case, locate at least one roller stand on the cutoff side to prevent the offcut from falling and binding the blade. You'll find a wide variety of aftermarket miter-saw stands available with extension wings that fold up and roll away for easy transport.

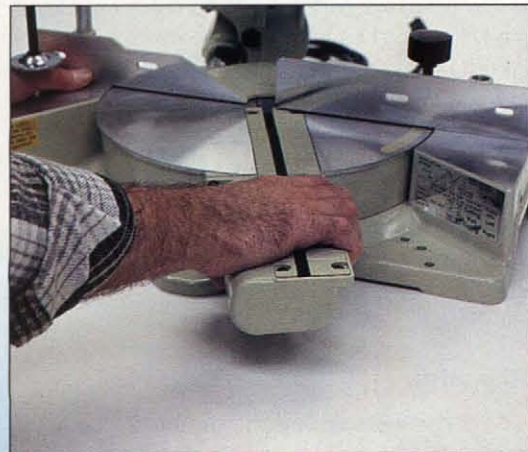


Photo G: The bearing-activated Makita LS1011 turntable glides smoothly from stop to stop but offers only the turntable arm for a handle, which makes it difficult to grasp.



Photo H: The Bosch turntable uses notches and a detent trigger. It also has a detent override clip that lets you swing the turntable freely to any position on the miter scale.

If installing one of these saws in a shop, I would attach the saw permanently to a benchtop and build supporting wings on both sides of it. Again, you can find plans for benches designed specifically for miter saws as well as commercially available fence/table units such as the Biesemeyer T-Square Miter Saw Stop System that's used in the magazine's woodshop. (See *Woodworker's Journal* Sept./Oct. '96.)

Fence

Some saws incorporate a one-piece fence, while others come with a two-piece fence. The blade gaps in the two-piece setups are generally too wide to provide proper support for short workpieces. For those jobs, use auxiliary fences, either shop-made wooden ones or aftermarket accessory units. Milwaukee's saw has an extra-tall flip-up fence on the left side to help guide both short and tall stock. Both Hitachi models come with sliding plastic fences for closing the blade gap. DeWalt also uses a tall sliding fence that's easily adjusted.

While it doesn't happen often, the fence on a new saw may need aligning. I found this task easier with a two-piece fence than with a one-piece. Some manufacturers supply a plastic square for adjusting the fence to 90°; others recommend using a framing square.

Motor Kick

When you start the motor, the power on most of the saws is delivered instantaneously. This often causes a disconcerting motor kick or recoil. The Hitachi C10FS, however, has a soft start as well as a belt-driven blade, both of which help minimize this problem. This saw also offers electronic speed control, another nice feature. If the motor comes under strain during operation, the control supplies more power to help maintain consistent blade speed.

Blade Guard

To shield the operator from flying wood chips and spinning saw teeth, most of the saws come with a two-part blade guard that includes a fixed upper guard and a clear plastic lower guard. The lower guard connects to the upper by way

of a link arm, enabling it to rotate up and out of the way as you lower the blade into the cut. If you get a chance to look over some saws before purchasing one, test the action of the guard and link arm to make sure these parts operate smoothly and unobtrusively.

Work Clamps

I consider on-board clamps a must on these tools to prevent the workpiece from creeping during a cut. A screw-type clamp mounted to a vertical post is the most common design (*photo I*). The Delta Sidekick and the Bosch saw both employ a lever-type clamp (*photo J*).

Safety

A removable lockout switch makes it possible to disarm a saw if you have children around the shop or work area. (The chart on *page 86* indicates the units that have this feature.) All of the saws have an electric brake to stop the blade within seconds of releasing the trigger. However, don't let the presence of a brake lull you into a false sense of security. Keep your hands away from the blade's line of cut at all times, and make sure you wear eye and ear protection when operating one of these machines. Also, learn the correct operating procedure for each type of cut.

Other Considerations

Not all of the saws come with a top-quality blade. Generally, I recommend that you not make this a major consideration when purchasing a sliding compound-miter saw. Buy the saw for its features and capabilities, then acquire the blades to handle your specific projects when the need arises. With some machines, however, the cost of having to upgrade the blade can make the price of a well-equipped saw more competitive.

Also, I noticed that all but one of the saws favor a right-handed operator. Hitachi's C10FS was the exception. The handle on this machine, which is built into the upper blade guard, is centered in front of the blade. Moving the lockout switch to the right side of the handle would make this saw even easier for a left-hander to operate.



Photo I: Makita's workpiece clamp simply screws down onto the workpiece.

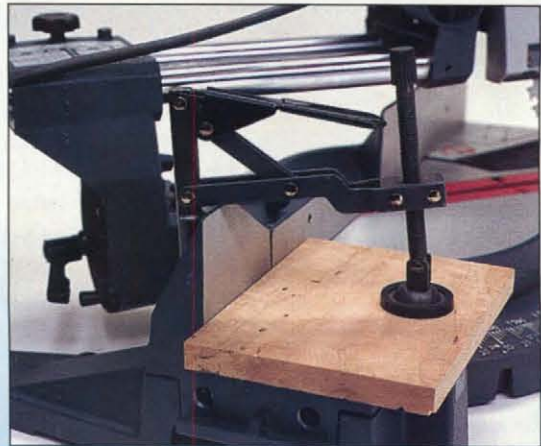


Photo J: The Bosch saw employs a cam/lever system to clamp the workpiece to the table.

HOW THE SAWS PERFORMED



BOSCH 3915

This tool features a high fence on the right-hand side and a blade-height adjustment. The 90° elbow for the sawdust port plugged frequently, probably because the upper blade guard is narrow in this area. The tiny 1 3/16" i.d. on the port didn't help the situation. In addition, I would prefer that the bevel-lock handle on this unit be a little longer. Overall, though, I found it to be a solid, functional, and well-designed machine.



DELTA SIDEKICK 36-250

On this saw, the legs offer two adjustment heights. The extension wings worked well, although when extended to the maximum, they flexed slightly under the weight of long or heavy stock. The bevel-lock handle operates easily, and I found the scale easy to read. The unit offers adjustable blade height but could use a longer adjustment bolt. I found the sliding action to be excellent all around.



DELTA SAWBUCK 33-055

Changing the blade on this machine requires removing the entire blade guard assembly and then raising the motor, which proved tedious. I'd prefer a better design both in the guard and in the adjustment-screw mechanism that raises the motor in the carriage. On the other hand, I like the fact that this saw accepts dado heads—others don't. It also has a spring-loaded miter-lock handle, and both the bevel and miter adjustment mechanisms worked smoothly. The handle felt comfortable in my hand. You can buy fence extensions for this saw, but not hold-down clamps. This unit weighs more than any of the others, but the wheels make it easy to transport.



DEWALT DW708

DeWalt introduced this brand new saw just as we were going to press so I wasn't able to test it as thoroughly as the others. However, I was able to run it through the paces and I think you'll find a lot to like in this new offering—both left and right beveling, an extra-tall and easy-to-adjust sliding fence, a 12" blade powered by a 13 amp. motor via a combined belt-and-gear system, and a lever-actuated miter-locking system.

The horizontal D-style handle has a 3-finger-wide trigger switch that I found both comfortable and convenient to operate. There's also an easy-to-set

lever for controlling blade-depth, easy-to-read stainless-steel bevel and miter scales that rival the Milwaukee's, and comfortable built-in handles for toting the tool. A work clamp and molding guide will be offered as options.



FREUD TR215

I found the built-in handles on this saw's base sharp-edged and uncomfortable to use. The weight of the motor, along with the force of the back spring, occasionally caused the entire unit to slide backwards. To operate the machine, you have to pull the motor all the way out (at a slight angle) and then lower the motor head. This took some getting used to, but after a few cuts, it flowed naturally. The bevel-lock handle tightened without trouble, and the scale was easy to read. The lower blade guard does not retract automatically.



HITACHI C8FB2

This saw's turntable includes positive stops for the bevel settings, but I'd have preferred a longer bevel-lock handle. The bevel scale reads easily, but the numbers would've been easier to read if they had been placed upside down. The unit incorporates blade-depth adjustment capability, and blade-changing was easy. The handle on the upper blade guard makes the machine easy to transport. Unlike those on the other saws, this dust bag actually collected most of the blow-by sawdust.



HITACHI C10FS

This machine runs smoothly. Blade-changing was effortless, and the blade adjustment has an extra-long bolt. A retractable handle built into the motor housing adds portability. I thought the bevel scale was hard to see, and the bevel-lock handle should have extended out farther so your hand wouldn't hit the blade guide. However, the mechanics work well. I found the bevel/miter settings a little disappointing. At a right 45° bevel, you can set the miter to only 30° left because the handle on the blade guard hits the backside of the fence. At right 57° miter, the bevel can be set to only 20° left because the blade-track housing hits the back of the fence.



MAKITA LS1011

The full-length trigger switch on this machine is comfortable to use, and the long bevel-lock lever operates smoothly. It took me a while to get used to the lower blade guard, which got in my way during blade changes. When I swung the turntable to the right, the motor was obstructed by the miter-lock handle between 20° and 58°. The unit offers no blade-height adjustment, and as with the Bosch unit, the sawdust port plugged frequently. The lack of a handle made the turntable awkward to use.

Woodworker's Journal



MAKITA LS1211

This saw has an easy-to-read bevel scale, an easy-to-operate bevel stop handle, and a blade-depth adjustment. I found the chain used to lock the motor down in the carrying position somewhat annoying. I liked the full-length trigger switch and the long handle for the turntable adjustment. The machine comes with a high-quality carbide-tipped blade. This unit performed quite well and ranked high for design and function.



MILWAUKEE 6497-6

Of all the saws, this one has the best bevel scale I've seen. The bevel-lock handle operates well and is easy to reach. A built-in handle on the motor housing makes for easy transporting when used with the base handles. An adjustment bolt lets you set cutting depth, although I'd prefer a longer bolt. The dust-collection bag collected most of the blow-by. The flip fence can be adjusted in one position for miter cut, another for bevel or compound cuts.

How To Operate A SLIDING COMPOUND-MITER SAW SAFELY

The sliding action of a miter saw provides new sawing capabilities but also adds new safety concerns. Besides observing the general rules of operating and handling power tools, thoroughly familiarize yourself with all of the movements and functions of your specific saw.

1. Cut workpieces using a chop or press cut (lowering blade into stock) whenever possible. Chop cuts are faster and easier to make than sliding cuts.
2. When making slide cuts, *push* the turning saw blade away from you. Never cut while pulling the saw toward you—this can cause the saw to kick upward and toward you.
3. To make a slide cut, grip the handle firmly, pull the saw head out and over the workpiece, start the motor, allow blade to reach full speed, and then lower the saw head straight down and push it through the stock. When you've completed the cut, release the trigger switch, wait for the blade to stop spinning, then raise the saw head to its full up position.
4. Support the workpiece firmly by aligning it against the fence and clamping it to the saw's fence or table to keep it from moving during the cut.
5. After resetting the saw or fence, make a test pass (motor not running) to verify that

the blade and guard will operate properly and clear all parts.

6. Support workpieces that extend beyond the ends of the saw table.
7. If cutting small workpieces, attach an auxiliary fence or face board to the fence.
8. Adjust kerf plates as recommended by the manufacturer to minimize blade clearance and reduce splintering. If you use blades of different cutting widths, dedicate a different kerf plate to each blade.
9. When bevel cutting, apply gentle forward pressure parallel to the blade so as not to distort the cut.
10. To cut kerfs or dadoes, set the depth stop so the saw head stops at the desired blade-cutting depth. Test the setting on scrap. When satisfied, cut the two outside kerfs, then remove the waste between the kerfs with a chisel. With wide dadoes, make several passes between the two kerfs, then chisel out the waste.
11. Set a stop to cut uniform repetitive lengths.
12. To cut round or other irregular-shaped stock, use a V-block or suitably support the material so it can be clamped firmly to the saw table.



RYOBI TSS200

The slide action on this saw felt solid but sounded rough. The right-hand fence includes a $\frac{1}{8}$ " scale. I had a hard time reading the miter scale due to light reflecting off of the surface. The handle had a good feel, but the switch operated stiffly. This machine includes a blade-depth adjustment, but the red line indicator is too thick to give an accurate reading. The head locks down with a chain, but I prefer a locking pin.



CRAFTSMAN 23492

The blade-depth adjustment on this unit requires a hex wrench to operate, which is not supplied. The dust bag picks up most of the blow-by, but the plastic elbow needs a different angle to keep the bag off the fence and/or the support. I liked the comfortable trigger handle, but the trigger and safety-lock switches operated stiffly. The unusually wide kerf opening in the base could cause tearout problems on some stock.



TRADESMAN 8336

This saw has an excellent bevel-lock handle and an easy-to-read scale. The blade-depth adjustment includes an easy-to-read depth scale and comes with a generously sized bolt. The trigger handle felt comfortable, but the switch operated stiffly. I found the sliding action smooth and solid, even though it sounded a bit rough. **W**

Photographs: the author; Kevin May; DeWalt

SOURCES

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SLIDING COMPOUND-MITER SAWS

MANUFACTURER MODEL NUMBER	BLADE DIAMETER INCHES	MITER ANGLE RANGE DEGREES (LEFT/RIGHT)	BEVEL ANGLE RANGE DEGREES (LEFT/RIGHT)*	90° CROSSCUT MAX HEIGHT/RESULTING WIDTH INCHES	45° BEVEL MAX HEIGHT/RESULTING WIDTH INCHES	45° MITER MAX HEIGHT/RESULTING WIDTH INCHES	COMPOUND MITER MAX HEIGHT/RESULT- ING WIDTH INCHES	MOTOR AMPS	BLADE RPM	WEIGHT (LBS)	REMOVABLE LOCK- OUT SWITCH	COUNTRY OF ASSEMBLY	STREET PRICE
DELTA (33-055) SAWBUCK	8	47/47	45	2 $\frac{1}{4}$ x16	1 $\frac{1}{4}$ x16	2 $\frac{1}{4}$ x12	1 $\frac{1}{4}$ x12	15	5500	93	NO	U.S.	659
CRAFTSMAN 23492	8 $\frac{1}{4}$	47/53	45	2 $\frac{1}{2}$ x12	1 $\frac{1}{4}$ x12	2 $\frac{1}{2}$ x8 $\frac{5}{8}$	1 $\frac{1}{4}$ x8 $\frac{5}{8}$	10	5000	43	NO	T	450
FREUD TR215	8 $\frac{1}{2}$	45/45	45	2 $\frac{1}{4}$ x11 $\frac{1}{2}$	2x11 $\frac{1}{4}$	2 $\frac{1}{4}$ x8 $\frac{1}{4}$	2x8 $\frac{1}{4}$	9.7	4300	33	NO	S	359
HITACHI C8FB2	8 $\frac{1}{2}$	45/57	47	2 $\frac{1}{16}$ x12	1 $\frac{1}{4}$ x8 $\frac{5}{8}$	2 $\frac{1}{16}$ x8 $\frac{5}{8}$	1 $\frac{1}{4}$ x8 $\frac{5}{8}$	9.5	4900	40	YES	U.S.	500
RYOBI TSS200	8 $\frac{1}{2}$	45/60	45	2 $\frac{1}{4}$ x12	1 $\frac{1}{4}$ x12	2 $\frac{1}{4}$ x8 $\frac{1}{2}$	1 $\frac{1}{4}$ x8 $\frac{1}{2}$	10	5000	43	NO	T	400
TRADESMAN 8336	8 $\frac{1}{2}$	45/60	45	2 $\frac{1}{4}$ x12	1 $\frac{1}{4}$ x12	2 $\frac{1}{4}$ x8 $\frac{1}{2}$	1 $\frac{1}{4}$ x8 $\frac{1}{2}$	10	5000	43	NO	T	349
BOSCH 3915	10	52/62	47/3	3 $\frac{1}{2}$ x12	2 $\frac{1}{4}$ x12	3 $\frac{1}{2}$ x8 $\frac{5}{8}$	2 $\frac{1}{2}$ x8 $\frac{5}{8}$	13	4700	50	NO	T	590
DELTA (36-250) SIDEKICK	10	47/57	45	3 $\frac{5}{8}$ x11 $\frac{1}{2}$	2x11 $\frac{1}{2}$	3 $\frac{5}{8}$ x8	2x8	13	5000	58	NO	T	500
HITACHI C10FS	10	45/57	31/46	3 $\frac{1}{16}$ x12 $\frac{1}{4}$	2 $\frac{1}{16}$ x11 $\frac{1}{16}$	3 $\frac{1}{16}$ x8 $\frac{5}{8}$	2 $\frac{1}{16}$ x8 $\frac{5}{8}$ **	10	3800	46	YES	U.S.	740
MAKITA LS1011	10	45/58	45	2 $\frac{1}{4}$ x12	1 $\frac{1}{16}$ x12	2 $\frac{1}{16}$ x8 $\frac{7}{16}$	1 $\frac{1}{16}$ x8 $\frac{7}{16}$	12	4600	39	YES	U.S.	420
MILWAUKEE 6497-6	10	51/59	48/3	3 $\frac{1}{8}$ x8 $\frac{1}{2}$	3 $\frac{1}{16}$ x12 $\frac{5}{8}$	3 $\frac{1}{8}$ x6	2 $\frac{1}{8}$ x7 $\frac{1}{16}$	15	4800	53	NO	T	650
DEWALT DW708	12	50/60	48/48	4 $\frac{1}{2}$ x12	3 $\frac{1}{16}$ (L)x12 1 $\frac{1}{16}$ (R)x12	4x8 $\frac{1}{2}$	3 $\frac{1}{16}$ x8 $\frac{1}{2}$	13	4000	57	NO	U.S.	650
MAKITA LS1211	12	60/60	45/45	3 $\frac{1}{16}$ x12 $\frac{1}{16}$	1 $\frac{1}{8}$ (L)x12 $\frac{1}{16}$ 1 $\frac{1}{4}$ (R)x12 $\frac{1}{16}$	3 $\frac{1}{16}$ x8 $\frac{5}{8}$	1 $\frac{1}{8}$ (L)x8 $\frac{5}{8}$ 1 $\frac{1}{4}$ (R)x8 $\frac{5}{8}$	15	4000	54	YES	U.S.	800

*Saw bevels only to the left on those units listed with just one number.

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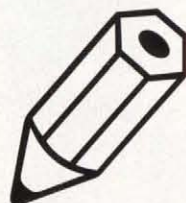
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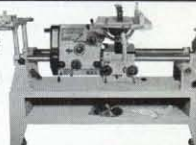
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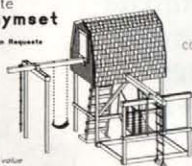
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LIST OF ADVERTISERS

Adjustable Clamp Co.	page 11
Arrow Fastener	page 7
Benny's Woodworks	page 59
Berea Hardwoods Co.	page 20
C. J. Spray	page 73
CMT Tools	page 40
Craft Supplies U.S.A.	page 9
Delphi Stained Glass	page 40
Delta International Machine Co.	pages 19, 21
Dremmel Tool	page 29
Econ Abrasives	page 55
Enviro-Safety Products	page 55
Fein Power Tools	page 15
Forrest Manufacturing Co.	page 2
G and W Tool Inc.	page 78
Great Tools Direct	page 87
Gudeman Enterprises	page 7
Jet Equipment & Tools Inc.	page 92
Klockit	page 77
Laguna Tools	pages 65, 77, 78
Leigh Industries Inc.	page 87
Makita	page 91
MLCS Ltd.	page 5
Model Expo	pages 13, 45
Oneida Air Systems Inc.	page 55
Osborne Wood	page 73
Performax	page 55
Price Cutter	page 17
Pro's Edge	page 9
Ryobi	page 8
Seyco Sales	page 78
Taylor Design Group (Inkra)	pages 9, 11, 13
Timberking Tools	page 9
Tormek	page 73
Total Shop	page 79
Van Dyke Supply	page 78
Vision Network Plans	page 65
Woodcraft Supply	page 15
Woodline Arizona Inc.	page 11
Woodmaster Power Tools	page 40
Woodworkers' Store	page 88
Woodworker's Supply Inc.	page 73
HARDWOOD SHOWCASE	page 74
MARKETPLACE	pages 88, 89, 90

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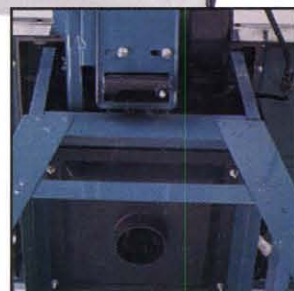
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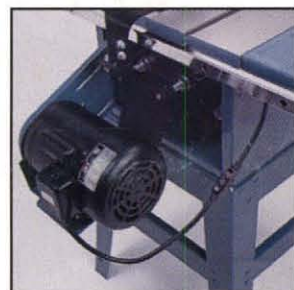
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