May/June 1989, No. 76, $4.50

Fine WoodWorking

Display Cabinet

Shoulder Planes

Building Garden Benches

Plate-Joiner Review

Ebonized Finishes

Building a Pencil-Post Bed

05
73361 64797

MAKE THE ARTISAN'S CHOICE

As "the" producer of top end industrial woodworking machines since 1921, Powermatic now focuses their engineering expertise and resources for the craftsman, contractor and home hobbyist.

Responding to **your** expressed needs, the **Artisan's Line** of woodworking machinery was developed. Leading the industry in quality, features, and exceptional value. Available now for little or no more than you'd pay for run-of-the-mill machinery.

- **10" Contractor's Saw** — setting the standard for accuracy, ruggedness and portability with industrial quality Vega fence, built-in dust shroud, T-slot miter gauge and more
- **15" Scroll Saw** — ideal for every shop, with clamp blade holder for ease of blade mount, and chip blower standard
- **14" Drill Press, Bench and Floor Models** — with front mounted switch with removable key; 12 spindle speeds; and a table that elevates by crank, tilts, and rotates
- **Shaper** — with ¾" solid and ½" interchangeable spindle cartridges, exclusive fence with integral dust shroud, and spindle reversing switch

Call your **Powermatic Artisan's Line** distributor today for assistance in selecting the right machines for you.

The Artisan's Choice

POWERMATIC

A Division of Stanwich Industries, Inc.
McMinnville, Tennessee 37110
800/248-0144 □ 615/473-5551
TELEX - 554455
FAX # 615/473-7819

Fine WoodWorking
May/June 1989

Plate-joiner machines, reviewed on p. 60, offer the small shop a fast, accurate and economical method of joinery. Cover: This pencil-post bed by Christian Becksvoort graces a room at the bed-and-breakfast Bagley House in Freeport, Me. (See article on p. 32.)

Fine Woodworking is a reader-written magazine. We welcome proposals, manuscripts, photographs and ideas from our readers, amateur or professional. We'll acknowledge all submissions and return those we can't publish. Send your contributions to *Fine Woodworking*, Box 355, Newtown, Conn. 06470.

Fine Woodworking (ISSN 0361-3453) is published bimonthly, January, March, May, July, September and November, by The Taunton Press, Inc., Newtown, CT 06470. Telephone (203) 426-8171. Second-class postage paid at Newtown, CT 06470, and additional mailing offices. **Subscription rates:** United States and possessions, $22 for one year, $40 for two years; Canada and other countries, $26 for one year, $48 for two years (in U.S. dollars, please). Single copy, $4.50. Single copies outside U.S. and possessions, $5.50. Send to Subscription Dept., The Taunton Press, PO Box 355, Newtown, CT 06470. Address all correspondence to the appropriate department (Subscription, Editorial, or Advertising), The Taunton Press, 63 South Main Street, PO Box 355, Newtown, CT 06470. U.S. newsstand distribution by Eastern News Distributors, Inc., 1130 Cleveland Road, Sandusky, OH 44870.

DEPARTMENTS

ARTICLES

Postmaster: Send address changes to The Taunton Press, Inc., PO Box 355, Newtown, CT 06470.

More articles on Shopsmith tools—I see you have excluded Shopsmith from one of your comparison articles again! Why? There are thousands of Shopsmith owners out there who read your magazine, and I can tell you for a fact that we are not happy with you.

Your recent article on scroll saws (*FWW* #74) did not include the excellent model Shopsmith makes. For the money, the Shopsmith brand is the best deal you can get: variable speed, 20-in. throat, 2-in. capacity, stand and motor, 60 blades, 15¾-in. by 20¾-in. table, parallel arms, 45° table tilt right and left, *plus* a foot that will tilt to remain parallel to the table, which I've never seen any other scroll saw do. All this for only $549. None of the saws you mentioned beat my machine.

—Matt Kottman, Derry, N.H.

Dado sizes with Delta radial arm—The article on radial-arm saws in *FWW* #73 states that the Delta Model 10 will not hold more than ½ in. worth of dado cutters. This is incorrect. Delta specifies that their saw will hold up to 13/16 in. of dado cutters. This is accomplished by using the thin arbor flange on the inside and the arbor nut on the outside without an arbor flange.

—Jeff Keating, Omaha, Neb.

To Our Subscribers

Recent issues of *Fine Woodworking* have been sent to you wrapped in a protective plastic bag. Unfortunately, many plastic products will retain their strength for hundreds of years after being discarded. Tests conducted with sophisticated carbon-14 tracing indicate that it may take 200 to 400 years to reach full disintegration. The interest in developing degradable plastics has grown over the past few years, and quite recently some manufacturers have begun to offer materials that meet the needs of the magazine publishers. The Taunton Press has been active in locating and testing these products, and we are pleased to commence using them for wrapping all of our publications.

What makes these plastics so degradable is the addition of several new ingredients. One is a starch granule derived from cornstarch, and there are also some oxidizing agents formulated from fats and fatty acids. The aim is to provide additional ingredients within the plastic that will promote molecular breakdown of the plastic once it is buried in the soil. The specific processes involve both chemical reactions and biological activity. The current technology relies on the presence of both moisture and micro-organisms, and is also affected by environment and temperature. With this in mind, it should be clear that the rate of degradation is variable, and not subject to clear standards. However, several tests have demonstrated that degradable plastic can decompose completely within three to six years. (In one test, plastic buried in a compost pile decomposed in 30 days). Yet the shelf life and strength of degradable plastic are comparable to conventional plastics. *—Philip VanKirk, Production Manager of Magazines, The Taunton Press*

Warnings on three-cutter molding heads—I'm concerned about the molding-head cutter described in the article on blanket chests in *FWW* #75. The picture on p. 49 shows John Dunham roughing out the curved sides of the chest with one of these molding heads, which is fitted with three cutters and designed to run on a tablesaw. In describing the operation, Dunham states that the molding-head cutter keeps the work pressed against a clamped fence, and he advises to "think safety." Well, I did, especially since I suffered a severe hand injury in 1988 while using such a molding head.

Despite 40 years of injury-free use on a 10-in. tablesaw and a keen awareness of the dangers of the molding head, I let my guard down for an instant and suddenly all hell broke loose. As I figure it, the 7-in.-dia. molding cutter, rotating at 3,450 RPM on my saw, has a cutting-tip speed of nearly 0.2 miles per second. Depending on the blade shape and sharpness, depth of cut and work-feed speed, this tool can generate high horizontal and vertical dynamic forces. This cutting tool is perhaps the most dangerous in the woodshop.

Dunham's fixture compensates for the workpiece's horizontal travel caused by the cutter blades. No fixture is provided to keep the work from moving upward, away from the table surface. All Dunham has to stop this movement are his hands and fingers, which might not be sufficient if the cutter blade strikes a knot or hard wood area. One or more dull blades on the cutter head will cause even greater and unpredictable dynamic forces. Because of the great danger of this and other operations, perhaps it would be extremely beneficial to readers if *FWW* established a specific section to address safety concerns associated with specific tools and woodworking operations. Readers need to be informed and instructed as to how, when, where and why to achieve safety—only then will they have an intelligent way to "think safety." *—Bill Hayman, Annapolis, Md.*

Pianos are wonderful but fragile machines—As a professional rebuilder of pianos and a longtime reader of *FWW*, I was excited to see the back cover of issue #74. I feel the need, however, to write a few words of caution, lest every other woodworker in the country rushes out to perform miracles of cabinetry on old pianos.

First, it should be noted that the Wendell Castle Steinway was built from scratch, and you can bet that the great technicians from Steinway had a lot to do with the whole project. Emmett Day's Steinway, on the other hand, was built in 1927; from the article, I am assuming that the piano's workings and structure were rebuilt by a qualified piano technician. Given that it was a quality instrument when it was new, and assuming that its "dilapidated condition" was not so far along that restoration was impossible, Day probably ended up with a fine piano, provided the work was done correctly.

I would strongly discourage woodworkers from starting such a project without the close help and support of a qualified piano technician. It is too easy to begin with a lousy piano and turn it into a piece of beautiful furniture, only to find that perhaps thousands of dollars of *piano* work is necessary to give the project any value at all. Such efforts are a huge waste of time and energy:

TAUNTON PUBLICATIONS
...by fellow enthusiasts

The Taunton Press: Paul Roman, *publisher*; Janice A. Roman, *associate publisher*; Roger Barnes, *design director*; Carol Gee, *executive secretary*. **Accounting:** Wayne Reynolds, *controller*; Patrick Lamontagne, *manager*; Jeffrey Sherman, *financial analyst*; Mary Sullivan, *accountant*; Carol Diehm, Lydia Krikorian, Rosemary McCulloch, Judith Smith, Rachel Yahwak, Elaine Yamin. **Books/Videos:** John Kelsey, *associate publisher*; Eileen Hanson, *administrative secretary*, Deborah Cannarella, *managing editor*; Paul Bertorelli, *senior editor*; Christine Timmons, *associate editor*; Maria Angione, *secretary*; Videos: Rick Mastelli, *producer/director*; James Hall, *assistant producer*; Art: Deborah Fillion, *manager*; Steven Hunter, *associate art director*; Cathy Cassidy, *art assistant*; Copy/Production: Ruth Dobsevage, *manager*; Pamela Purrone, *copy/production editor*; Marketing: Jon Miller, *manager*; Philip Allard, *senior copywriter*. **Corporate Marketing:** Dale Brown, *director*; Andrea Ondak, *manager*; Donna Pierpont, *public relations manager*; Barbara Buckalew, *marketing secretary*; Christine Cosacchi, *customer service coordinator*. **Data Processing:** Drew Salisbury, *manager*; Brendan Bowe, *senior programmer/analyst*; Susan Partis, *programmer trainee*; Ellen Wolf, *PC coordinator*. **Fulfillment & Operations:** Tom Luxeder, *director*; Jane Torrence, *secretary*; Circulation: Karen Cheh, *coordinator*; Barbara Hess, *fulfillment assistant*; Customer Service: Terryl Thomas, *manager*; Anette Hamerski, *coordinator*; Patricia Malouff, Nancy Schoch, Marylou Thompson, Claire Warner; Distribution: Danny D'Antonio, *manager*; Grace Aumuller, David Blasko, Timothy Harrington, Linnea Ingram, Mary Ann Costagliola, Fred Monnes, Alice Saxton, Robert Weinstein; Purchasing & Facilities: William Schappert, *manager*; Lois Beck, *office-services coordinator*; Donald Hammond, *mail-services clerk*; Chuck Hollis, *office maintenance*; Christopher Myers, *office-operations clerk*; Debra Brown, *chef/manager*; Subscription: Carole Ando, *manager*; Patricia Aziere, Connie Barczak, Donna Baxter, Gloria Carson, Dorothy Dreher, Peggy LeBlanc, Denise Pascal. **Manufacturing:** Kathleen Davis, *director*; Austin E. Starbird, *prepress manager*; Robert Marsala, *graphic arts supervisor*; Susan Kahn, *staff photographer*; Peggy Dutton, *production manager/books*; Philip VanKirk, *production manager/magazines*; Diane Flanagan, *print buyer*; Ellen Olmsted, *production coordinator*; Rosemary Pagel, *secretary*; Richard Booth, Monica Bulson, Priscilla Rollins, *production assistants*; Deborah Cooper, Mark Coleman, *scanner operators*; Laurene Jakab, *color proofing operator*; Dinah George, *composition systems manager*; Nancy Knapp, Margot Knorr, Lisa Carlson, *systems operators*. **Personnel:** Carol Marotti, *manager*; Linda Ballerini, *personnel assistant*; Chris Lincoln, *secretary*.

Many times I have been called to service a refinished piano, only to find that beneath a (sometimes) terrific cosmetic job rests a piano either beyond repair or in need of so much work that it's financially impractical, or simply not worth it.

Not all pianos were well made. Excesses in dryness and humidity, and the changes between the two, are a piano's worst enemies. The best pianos in the world, kept in optimal conditions, generally need major work after 30 or 40 years. It is best to bear that in mind.

How do you find a qualified technician? You can start by inquiring whether or not a tuner is a member of the Piano Technicians Guild (PTG). Write to the PTG, Inc., at 4510 Belleview, Ste. 100, Kansas City, Mo. 64111; or call them at (816) 753-7747. The PTG is the only organization in America that certifies its members for skill and integrity in the piano business. Through difficult exams and a code of ethics, registered tuner-technicians in the PTG have proven themselves. *—Tom Patten, Milton, Penn.*

Ban use of ivory—I'm appalled at the use of ivory in any form, so I'm disturbed to see products made from ivory in *FWW.* Using ivory is unconscionable when the African elephant faces extinction by the end of the next decade, largely due to poaching.

FWW is usually a very responsible publication in these matters, sensitive to environmental issues of importance to woodworkers. However, issue #74 was a great disappointment to me, because it showcased objects made with ivory in both the article "The International Turned Objects Show" and with the pianos on the back cover. (During the heyday of piano building, the use of ivory for the keys accounted for the vast majority of the 25,000 to 100,000 animals slaughtered each year between 1860 and 1930).

If you're going to promote the use of ivory, I think it would be fair if you devoted some space to the issue of its harvest, indeed to the fact that it comes from a living animal whose destruction is imminent unless we reduce our demand for its teeth and hide. It is an aesthetic gone haywire that prizes the beauty of an object made from ivory over the beauty of the source of the raw material—the elephant existing in the fullness of life for generations to come. *—George Dirolf, Loudonville, N.Y.*

Penn State criticizes scroll-saw review—We appreciated the opportunity to have our Super 15 scroll saw reviewed in *FWW* #74. We would like, however, to respond to several of the criticisms directed toward the Super 15.

In criticizing the "fit and finish" of our saw, the author, Greg Bover, states that "the Super 15 has a cheap plastic hold-down and minuscule pump bellows that are absolutely useless." Firstly, what Bover considers a hold-down is in fact a finger guard. As for the pump bellows (our dust blower), this item simply works as advertised; thousands have been sold and used effectively on our saws. If Bover had a problem with it, we never heard from him; we have an experienced customer-service department skilled at solving any such problems.

Bover mentioned that the saw banged because of a "bent" cover when he first turned it on. As with any machine, our saw must be properly set up before it runs properly, and it's not fair to criticize the product when it is used with an improper set-up. Because of packaging, the cover does have to be repositioned on occasion before using it so that it clears the top rocker arm; however, this is a simple adjustment and in no way should reflect on the overall performance of the saw.

As for the blade clamps being "badly machined and don't grip the blade well," we admit that earlier versions of the saw's

clamps were difficult to tighten, and Bover tried these earlier clamps. However, this problem has been solved with a redesign of the improved clamps. Again, with a call to our customer-service department, we would have replaced Bover's clamps under warranty. Customer service would have also solved the problems he had with vibration. *–Ed Levy, marketing manager, Penn State Industries, Philadelphia, Penn.*

Praise for RBI Hawk–I'd like to comment on the scroll-saw article in *FWW* #74. I cut 100 parts per week of various configurations for arts-and-crafts show items. I used to work with a bandsaw and belt sander, but this method is not satisfactory because of the time, edge finish and inability to cut sharp corners. A scroll saw seemed the answer, so I bought a Delta. My experience with it was exactly the opposite of that described by the author. Mine vibrated so badly that I had trouble following a cutting line and could not read the digital meter. Also, the blade breakage was excessive. After one week of experimenting with different blades at different speeds and tension, I returned the saw for a refund.

Another crafter suggested I try an RBI. Again, my luck was just the opposite of that described in the article. My Hawk 16 has little to no vibration. The legs are made of sheet metal, but I have not experienced any wobble. The saw is light compared to Delta's, but I consider this an advantage, because during good weather last summer I was able to move it outside and cut in the fresh air. I believe it is generally accepted that blade quality varies within a package. I have had some blades break within a few minutes and others run until they got so dull you wish they would break. I guess the old saying "different strokes for different folks" applies here, but I have had good luck with my Hawk. *–Bob Brown, Pecatonica, Ill.*

Lacework techniques clarified–I was pleased to read Michael Podmaniczky's article on the ITOS show (*FWW* #74). I would like to thank Albert LeCoff for all that he has done for turned-object makers. I was amused, however, by the assumption that I allow the top of my work to distort and create my lacework effect. If anyone knows of a process that would allow me to mold or distort the edges in a controlled fashion, please contact me. In the meantime, I will continue to cut and carve each delicate wave and loop. *–Frank E. Cummings III, Long Beach, Calif.*

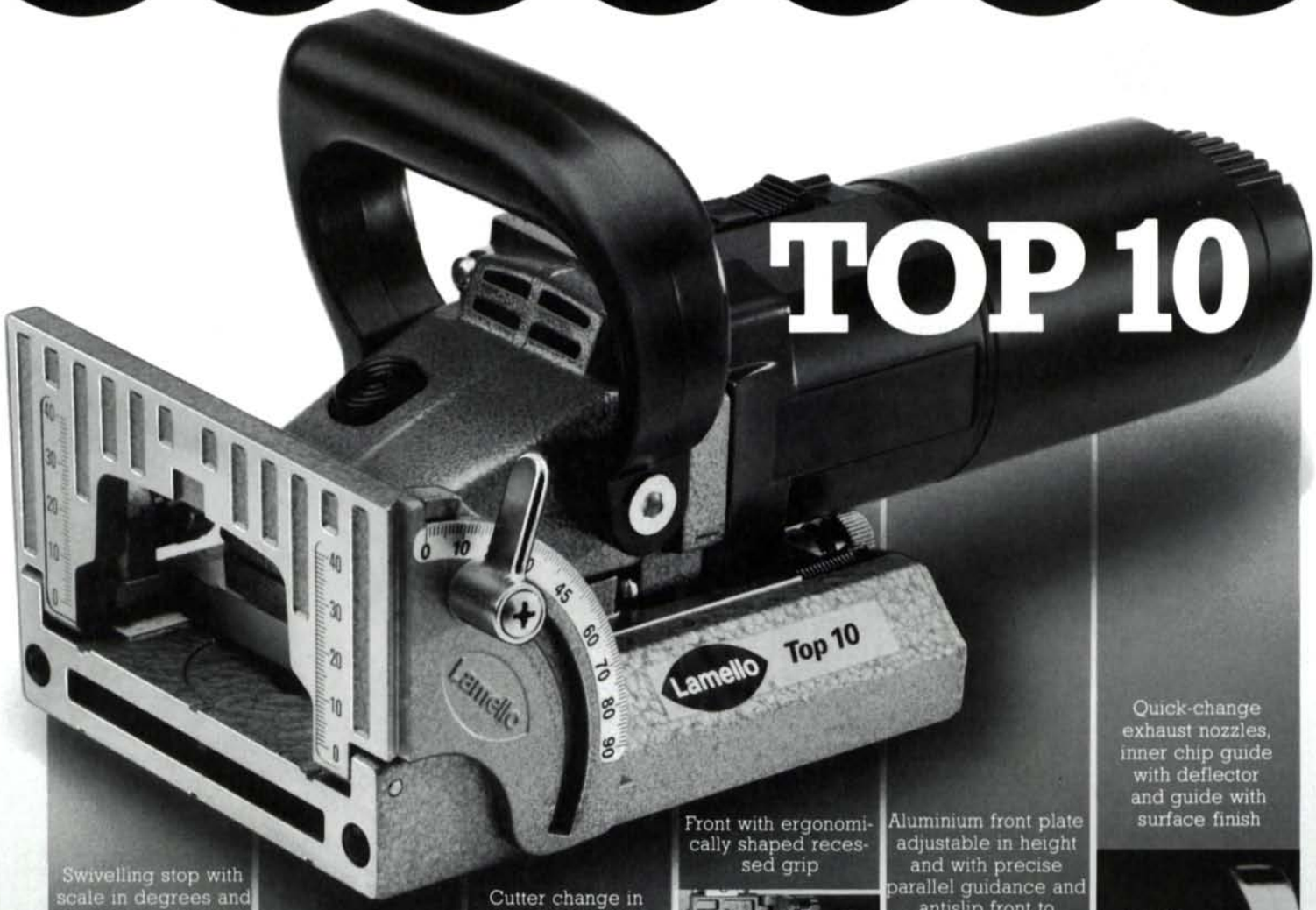
Alder too good for firewood–I was pleased to see red alder discussed in *FWW* #74 (p. 14). Too many people think of it primarily as firewood; I've used alder extensively in a friend's house and for all the kitchen cabinets and paneling in my own house. The paneling was made of ½-in.-thick alder, which I tongued and grooved, and fastened to the sheet rock with panel adhesive.

Alder is easy to work and finishes beautifully, if the finish is properly applied. It's essential that a washcoat of thinned shellac be applied before staining; otherwise, the stain gives a very uneven color. I tried a few other sealers but found they also produced a blotchy appearance. With white shellac thinned with about equal parts of alcohol applied first, the stain can be wiped off to a uniform color. I finished with three coats of satin polyurethane for a beautiful finish. *–M. Charles Keck, Anacortes, Wash.*

Tips on secret compartments–I enjoyed Christian Becksvoort's article on secret compartments (*FWW* #74). I do have one suggestion that would make the false-bottomed drawers more accessible without being visibly overt. Instead of running a screw through the bottom of the drawer to hold it in place, rout the drawer front for the false bottom a bare 1/32 in. higher than the

Lamello Lamello Lamello Lamello Lamello Lamello Lamello

TOP 10



The new generation of plate (or biscuit) joining machines, from Lamello, the originators of plate joinery.

The Lamello Top has been known for years as the "Top of the line" of the Lamello system. Now, however, there is the Lamello Top 10

brand new and even easier to operate

with 10 additional features for the highest standards in plate joining technology. The Top 10 is the product of our 30 years of experience, created for hard, everyday use. And just like every "Lamello", the new model is easy and reliable to operate. The Top 10 is impressive because of its precision and flexibility – there is no better.

Lamello Top 10 – one step ahead of progress.

Colonial Saw

Main Office: 100 Pembroke St. · P.O.Box A · Kingston · Mass. 02364/USA · Telephone (617) 585-4364 · Telex 289762 · Telefax (617) 585-9375
Western Office: 845 Milliken Avenue · Suite F · Ontario · Calif. 91761/USA · Telephone (714) 986-1168 · Telefax (714) 986-1059

side grooves. Also, bevel the front edge of the bottom so that when it's pushed home, it has to force itself up into the front groove. This puts it under tension, so it's not likely to pop out, but when pushed sharply with the hand, it will slide out easily. This makes for easy access while the compartment still remains hard to discover. *–Gary Rogowski, Portland, Ore.*

Skill, not gimmicks, make good turnings–Working 50 years plus as a woodturner has given me a few ideas I'd like to share. The concept of turning is thousands of years old. A lathe is basically two centers between which spins a piece of wood. The left, "live," spur center provides the power to the work. The right, "dead," center merely idles along and holds the work in place.

In catalogs, we see manufacturers touting all sorts of ball-bearing centers, electronic devices and other frills for lathes. I'm afraid people might forget the quality of a turning depends mostly upon the skill of the person holding the chisel.

I suggest manufacturers concentrate on quality: better finishes on their castings, better tool-post clamping devices, more accurate indexing, steel pulleys instead of pot metal and metal handwheels instead of plastic. And bowl turners, as myself, appreciate good, mobile tool rests to do the job.

–Nathan Roth, Monroe, Wisc.

Don't keep children out of the shop–Alan Sandler's letter in *FWW* #73 concerning child safety in the shop is a sobering reminder that the workplace is a dangerous realm for kids as well as adults. While I do agree that safety is a critical issue, relegating children to "the playroom where they belong" is off target.

My son is an "avid" woodworker. This may be hard to believe when you consider he is only four years old. He has been with me on construction projects and in the shop for a little over two years. While I know this involves some risks, I think this experience, handled properly, gives him lifelong benefits. Already his understanding of tools, working techniques and especially the dangers of the work are well ingrained. I believe this early exposure to a worthwhile skill and craft is of far more value than having him mesmerized by television.

–Bob Snidorf, Croton, N.Y.

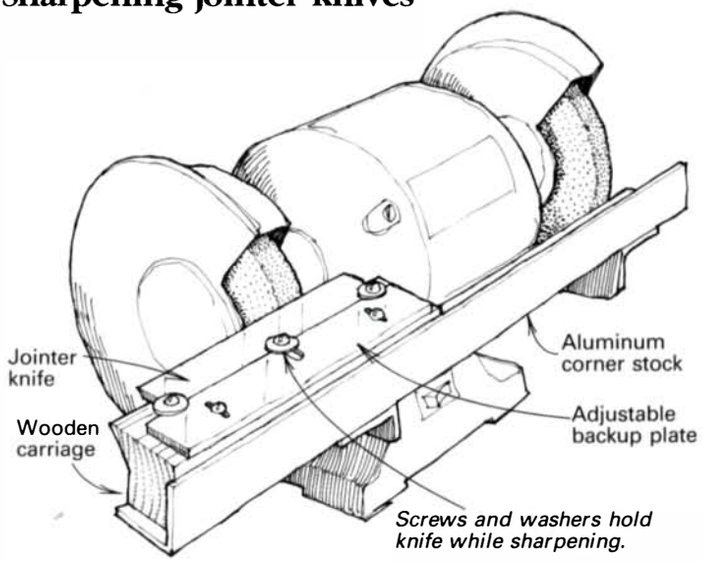
Update on Jim Cummins' video–Did you purchase a copy of the *FWW* video "Small Shop Tips and Techniques with Jim Cummins" at a retail store? If so, we want you to know that we have just reworked a portion of this tape to improve its presentation of tablesaw safety. We want to extend you the opportunity to exchange the tape you purchased for the new version–at no charge to you. We have already extended this offer to those who bought it directly from us; now we'd like to do the same for our retail customers. Just write to The Taunton Press, Attn: Customer Service Dept., 63 S. Main St., Newtown, Conn. 06470.

About your safety:
Working wood is inherently dangerous. Using hand or power tools improperly or neglecting standard safety practices can lead to permanent injury or death. So don't try to perform operations you learn about here (or elsewhere) *until you're certain that they are safe for you and your shop situation.* We want you to enjoy your craft and to find satisfaction in the doing, as well as in the finished work. So please keep safety foremost in your mind whenever you're in the shop.

–John Lively, associate publisher

edited and drawn by Jim Richey

Sharpening jointer knives

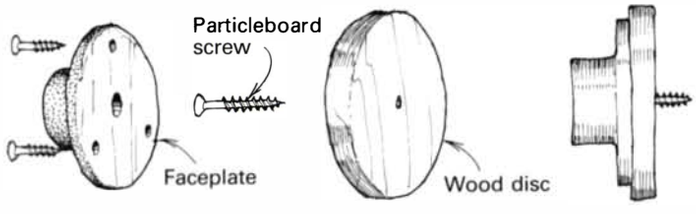


Although I tried several of the jointer-knife sharpening methods published in this column, none worked well for me. One day, while looking at my bench grinder, I was hit with the idea that if the two tool rests were connected, they would provide an ideal support for a sliding sharpening carriage, even if only one abrasive wheel was used for the actual sharpening. To implement my idea, I spanned both tool rests with a length of 1-in. by 2-in. aluminum corner stock, letting one end extend beyond one of the rests. I fastened the corner stock to the tool rests with flat-head machine screws and wing nuts. Then, I milled a sharpening carriage from hardwood to the profile shown in the sketch so it would fit around the wheel's arc. On top of the carriage there's an adjustable aluminum backup plate and three screws and washers to hold the knife to be sharpened. The carriage's dimensions are such that the blade bevel is ground at a 30° angle.

To use the carriage, install the first knife with the backup plate adjusted so the knife just touches the wheel. Slide the carriage past the wheel with constant light pressure directed downward and backward toward the aluminum guide. For the first few passes, the downward pressure should be minimal. For successive passes, I move the blade toward the wheel by shimming with one, then two and eventually three strips of writing paper between the vertical side of the aluminum guide and the back of the wooden carriage. You might say this is crude, but it works just fine. *—Henry R. Jaeckel, P.E., Nevada City, Calif.*

Quick tip: A local Mennonite woodworker taught me to quickly slicken a sticky saw table by rubbing it with a piece of waxed paper. *—Eric Haarer, Mason, Mich.*

Screw-drive centers

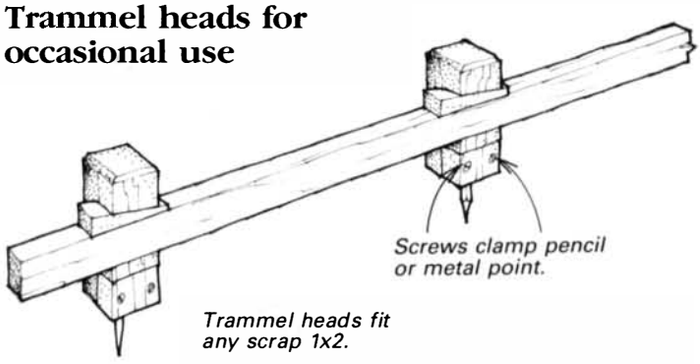


You can make all sorts of custom screw-drive centers for the lathe quickly and inexpensively by utilizing particleboard screws. These screws, which have only recently become commonly available, feature large, wide threads with tremendous holding power. If your local hardware store doesn't carry them, try the Woodworkers' Store, 21801 Industrial Blvd., Rogers, Minn. 55374-9514; (612) 428-2199.

To make a screw drive, mount a piece of wood to a small faceplate, turn a disc to the desired diameter and mark the center. Now remove the disc from the faceplate, drive the particleboard screw through the disc from the back and remount. The combination of the wide-thread screw and the wood-to-wood friction will give the drive good holding power. *—Ken Picou, Austin, Tex.*

Quick tip: Dowel pins need grooves for glue to escape. Instead of cutting grooves, I compress them by tightening the dowel in the ½-in. chuck on my drill press. Dowels so treated tend to swell up again when glue is applied, locking themselves tightly in place. *—D.R. Smith, Miami, Fla.*

Trammel heads for occasional use



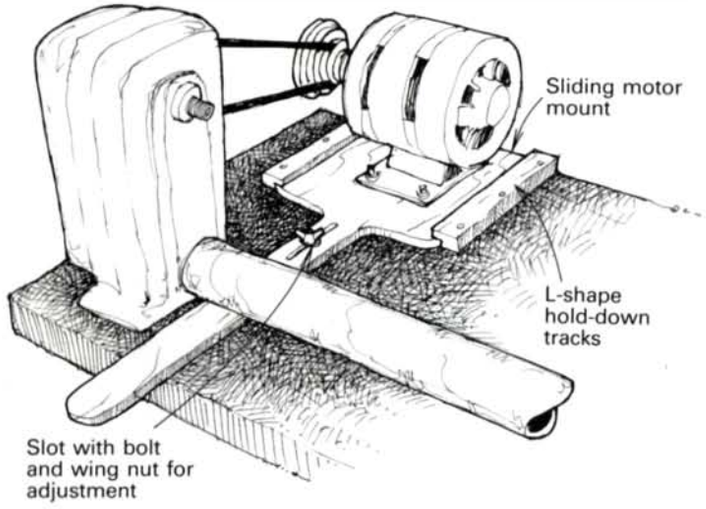
Faced with the occasional need to draw large-radius circles, I made a pair of wooden trammel heads that will fit on any available scrap 1x2.

Each head is 1¾ in. sq. in section, with a notch to accept the beam and a wedge for tightening. A clamping block at the bottom of each head will take a steel spike or a pencil. To make the clamping block, drill a 5/16-in. hole in the center of the bottom, then cut away a portion of the head halfway through the hole. Drill the block for two tightening screws.

—Percy W. Blandford, Stratford-upon-Avon, England

Quick tip: A small sheet of ⅛-in.-thick rubber carpet pad—the kind used to keep Oriental rugs from slipping—will both protect the top of your workbench and keep your work from sliding about. *—Chuck Lakin, Waterville, Maine*

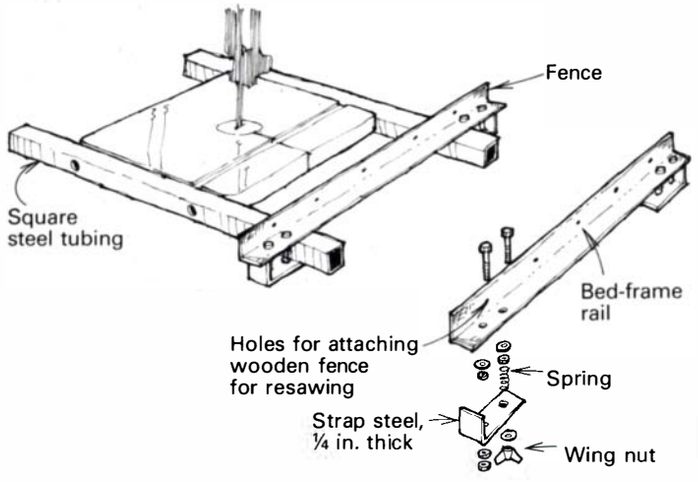
Sliding motor mount



This sliding motor mount for the lathe offers several advantages over the usual hinge-type mount. The device prevents the motor from jumping when a lathe tool gets hung up in the work, and it enables belt tension to be adjusted and remain constant when

set. The mount consists of a plywood paddle on which the motor is attached and a couple of L-shape hold-down tracks. A slot in the paddle arm allows the mount to be locked at any position with a wing nut or to be loosened by hand for moving the belt to a different pulley. *—Charles W. Whitney, Mount Vernon, Ohio*

Shop-built bandsaw fence



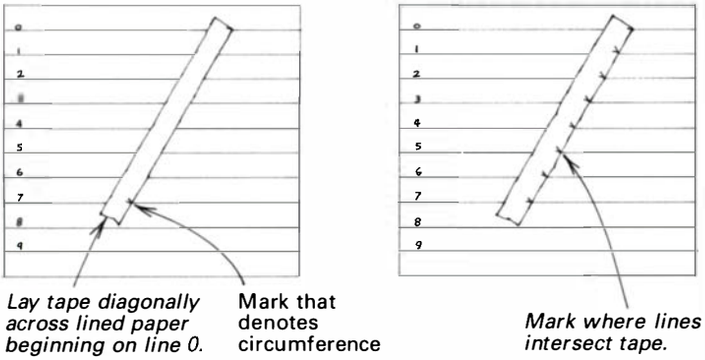
When I purchased my Delta 14-in. bandsaw, I decided not to buy the factory rip fence, because it clamps to the saw table only at one end. I do lots of hardwood resawing and believe that an accurate resaw requires a rigid fence clamped to the saw table at both the front and back.

Using standard hardware-store items, pieces from a tempered steel bed frame and lengths of 1½-in. cold-rolled square-steel tubing, I assembled an extremely sturdy, quickly adjustable fence for under $15. The fence's construction doesn't require any welding, so it can be built and installed in an evening or two. The design allows the fence to be used on either side of the blade and to be angled slightly, as needed, to match the blade's natural line of cut. I screw a taller wooden fence to the angle iron for resawing wide boards. Construction dimensions may be readily altered to suit the maker's saw.

—Donald G. Sterchi, Bowling Green, Ky.

Quick tip: The best cleaner I know of for clogged sharpening stones is Easy-Off oven cleaner. This opens the pores much better than kerosene. *—George Allen, Greenwich, Conn.*

Laying out equidistant intervals

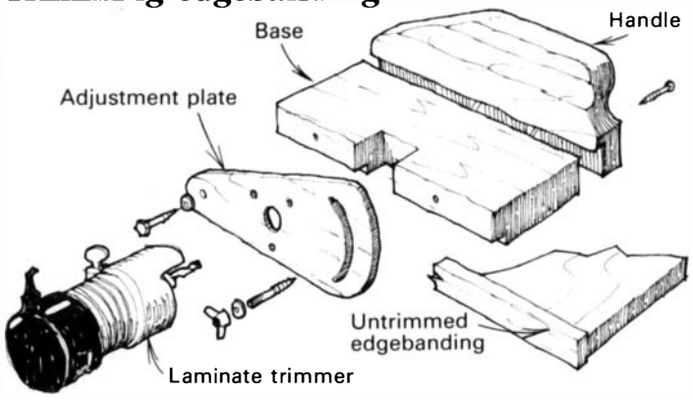


Here's an addendum to Randall Bishop's tip for using tape to divide the circumference of a circle into equally spaced intervals (*FWW* #65, p. 12). Bishop recommended wrapping tape around a disc to determine the circumference, then unwrapping the tape, laying out the intervals on the tape and rewrapping the tape to transfer the intervals to the disc. The question Bishop didn't answer is once you've got the tape off the disc, how do you divide it into the desired number of intervals? Well, here's how:

First draw a series of parallel equidistant lines across a large sheet of paper. The distance between the lines should be slightly less than the smallest interval you will normally use. Number the lines starting with line 0, 1, 2, 3 and so on. Now wrap the tape around the disc, mark where the ends overlap and remove the tape. Assuming the number of desired intervals is seven, for example, you would lay the tape diagonally across the sheet so that line 0 intersects one end of the tape and line 7 intersects the mark denoting the circumference. Now mark where each intermediate line intersects your tape for accurate equidistant intervals without measuring. *—Kathleen Wissinger, Elkton, Va.*

Quick tip: You don't have to steam an entire length of stock if you only want to bend part of it. Just wrap the section you want to bend in a damp cloth and apply a hot household iron to it. *—Chuck Lakin, Waterville, Me.*

Trimming edgebanding

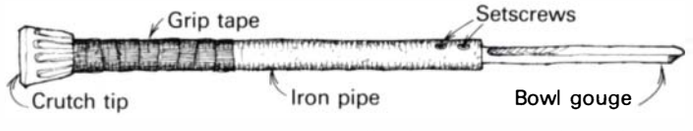


Trimming solid-wood edgebanding on plywood with a plane or belt sander can be a trying task, so I designed this simple trimmer fixture, which holds a horizontally mounted router. An adjustment mechanism allows the router's bit to be adjusted up or down so it cuts the banding flush with the plywood. Instead of a full-size router, I use a Porter-Cable laminate trimmer, which provides plenty of power for trimming the ¼-in.- to ⅜-in.-thick banding I use. I've found that an Onsrud ¼-in., two-flute spiral bit gives a smooth, splinter-free cut that's ready for finish-sanding.

—Warren W. Bender Jr., Medford, N.Y.

Quick tip: If your ¼-in. split-ring router collet sticks, making bit removal difficult, apply a thin film of paste wax to the outside surface. *—Steve Spoltman, Dayton, Ohio*

Pipe handles for bowl gouges



A steel pipe makes a nice handle for high-speed steel bowl gouges. It is not only heavier and more stable than a wooden handle, but it also allows the gouge to be adjusted in or out, depending on the application. Drill and tap two holes for setscrews near the end of the pipe for adjusting and securing the gouge. To improve the grip, wrap the last few inches with tennis-racquet grip tape and put a rubber crutch pad on the end of the pipe. *—Earl R. Rice, Augusta, Ga.*

Methods of Work buys readers' tips, jigs and tricks. Send details, sketches (we'll redraw them) and photos to Methods, Fine Woodworking, *Box 355, Newtown, Conn. 06470. We'll return only those contributions that include an SASE.*

FS TOOL CORPORATION

FS Tool Corporation
P.O. Box 510, 210 Eighth Street
Lewiston, NY 14092
1-800-387-9723

Contact us for more information and for the name of your local authorized FS Tool Dealer.

Over 3,000 Stock Items at Affordable Prices.

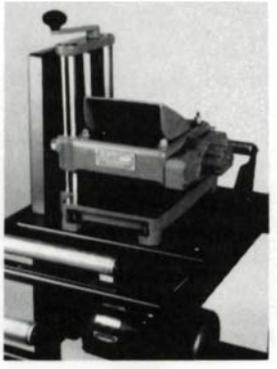
Unlike other manufacturers, two commitments have earned us a reputation as an industry leader and world-class manufacturer;

1. Our attitude: to use the finest materials available, develop and use the latest in advanced machinery, take pride in our work and care about the safety and productivity of our customers.

2. Our product offering: to build and stock the entire range of industrial woodworking cutting tools including saw blades, cutters, insert tooling, disposable knives, router bits, boring bits and diamond tools.

FS Tool . . . your complete industrial woodworking cutting tool manufacturer.

NEW YORK • TORONTO • ATLANTA • LOS ANGELES



ANYTIME ANYWHERE ANYWOOD

W&H Molder-Planer & Lathe

Professionals and hobbyists alike know the strengths of our products!
The W&H Molder-Planer converts from planing to molding in only two minutes, and duplicates moldings from ¾" deep to 7" wide.
Our 12" Lathe, with its cast iron headstock/tailstock and solid steel ways, has four-speed versatility and 46" between centers!
Superior made-in-USA construction, exceptional warranties, and free 30 day trials are your assurance of long life and total satisfaction.

Mail this ad or call us toll-free today.
1-800-258-1380 In NH 603-654-6828

Williams & Hussey
P.O. Box 1149, Dept. 139EM
Wilton, NH 03086
YES! Send your free information kit today!

Name _____
Address _____
City _____ State _____ Zip _____

TOOLAND, INC.

VISA — MASTER CARD
(415)-365-8665
1-800-822-2505

ALL ORDERS SHIPPED UPS/FREIGHT. PREPAID (CONTINENTAL USA) EXCEPT HITACHI F1000A. SALE PRICES LIMITED TIME ONLY AND SUBJECT TO CHANGE WITHOUT NOTICE. WE ACCEPT VISA, MASTER CARD, MONEY ORDERS, PERSONAL CHECKS. SORRY WE ARE UNABLE TO SHIP C.O.D.

PORTER+CABLE
PROFESSIONAL POWER TOOLS

314 4 ½" trim saw.....$127.99

7548 variable speed jig saw.....$149.99

362 4"x24" Belt Sander with Dust bag...$189. 99

#555 Plate-Jointer $154.99
With kit (1000 biscuits & steel case) $179.99

#100 ⅞ H.P. Router.....$99.99
#309 Trimmer $84.99

Delta

Wet/Dry Grinder 23-700 .....$144.99
40-150 15" Scroll Saw.....$139.99
31-460 Combination Belt Disc Sander .$134.99

Hitachi

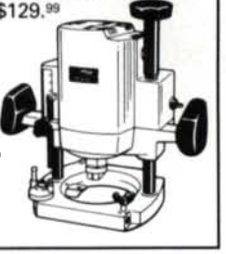
C15FB 15" miter saw
saw only $339.99
15" H.S. Blade.....$29.99
15" Carbide tip 100-tooth blade $99.99

F1000A 12" Planer/6" Jointer
Combination machine
F.O.B. Redwood City CA.....$1384.00

RYOBI.

L 12OUK 3 ⅝" planer kit.....$99.99

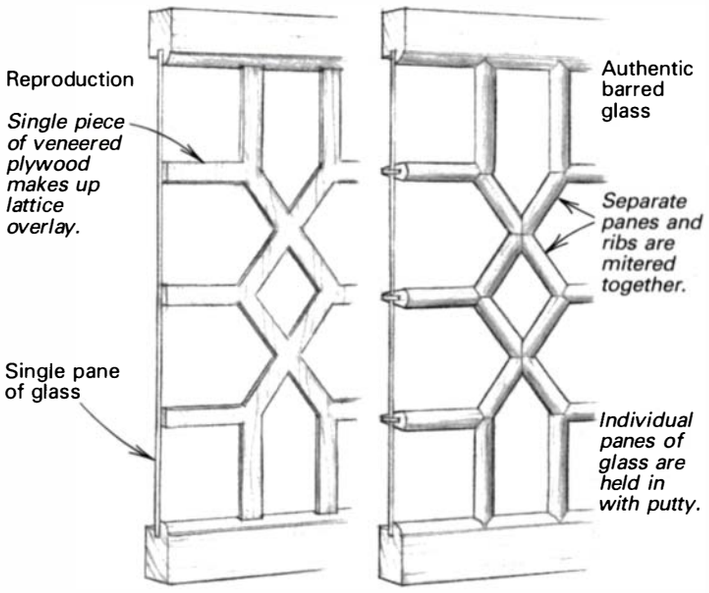
BE 321 3"x21" Electronic Belt Sander Variable Speed $129.99



R 500 2 ¼ H.P. Plunge Router....$164.99

Fixing barred-glass doors

I have an antique secretary desk with doors that have a latticework overlaying the glass. Some of the thin bars are broken and need replacing, but the latticework appears to be made out of a single piece of wood. How can a new latticework be made? ***—Linda Faulkner, Cutchogue, N.Y.***



Mac Campbell replies: Even if only some of the bars of the latticework are broken, you'll need to replace the entire lattice. The most commonly used technique is to cut the lattice from thin plywood, veneered and finished to match the frame, as shown in the sketch above (left). One drawback of this method is that if the glass breaks, it often breaks the plywood overlay as well. Also, this lattice looks just like what it is: a mass-produced imitation of a more-difficult-to-make, traditional latticework assembled from separate wooden bars supporting individual panes of glass. To better imitate this technique with a single-pane door, make the overlay from solid wood instead of plywood. The techniques for doing this are very similar to those I outlined for building barred-glass doors in *FWW* #72, p. 48. Make up a pattern, miter the pieces, then epoxy them together: Since this is still an imitation of a true barred-glass door, the lattice, when viewed from any angle other than straight on, still looks as if it's overlaid. You could make another overlay for the back side of the glass, but I think this would be more work than building a true barred-glass door and still would not look as nice. In a true barred-glass door, the latticework holds separate panes of glass that are held in place with putty, as shown in the sketch (right). Although they involve more work, the technique is more intimidating than difficult.

[Mac Campbell owns Custom Woodworking in Harvey Station, N.B., Canada.]

Removing wax finishes

In my refinishing business, I occasionally need to lacquer a piece of furniture that has a wax finish already on it. Is there any way of removing the wax without stripping and resanding the entire piece so a new coat of lacquer can be applied?

—Dave Hewlett, Bellingham, Wash.

Bob Flexner replies: You can remove wax from furniture by washing the surface thoroughly with a solvent, such as mineral spirits or naptha. If the wax was applied originally over a sealed surface, then it will come off easily, because it hasn't entered the wood's pores. If the wax was applied to raw wood, it will be more difficult to remove, but here is what to do:

Wearing rubber gloves, take a folded cloth soaked with one of the solvents and wet the surface thoroughly. Then begin drying it off, refolding the cloth continuously so that the dissolved wax is picked up on a clean part of the cloth and not just spread around. Repeat this procedure several times, using fresh cloths as needed. Then let the surface dry and examine it for traces of wax—a shininess in the pores or a waxy feel. If you think the surface is clean, wash it one more time to be safe. You can also apply regular paint and varnish remover, which is a more powerful solvent for wax. Rub it off with paper towels as described above, then wash the surface with mineral spirits or naptha.

Let the wood dry overnight, to give all the solvent time to evaporate. Because no water has been used to remove the wax, there should be no raising of the grain and therefore no need to resand the surface. If you intend to lacquer or varnish the piece, seal it first with a coat of shellac, which will act as a barrier between any minute quantities of remaining wax and the new finish. Treat the shellac just as you would a sanding sealer, scuffing it lightly with fine sandpaper to smooth it before finishing.

[Bob Flexner is a professional finisher and restorer in Norman, Okla. His videos, "Repairing Furniture" and "Refinishing Furniture," are available from The Taunton Press, Box 355, Newtown, Conn. 06470]

Basement wood storage

I'm going to store some kiln-dried solid cherry and several sheets of cabinet-grade plywood in my dry basement. Is it best to store the wood flat, stickering the lumber, or vertically?

—Edward Jonke, Glen Arm, Md.

John Wilson replies: I appreciate your concern over how to store your wood: It represents a considerable investment. I assume the lumber has been responsibly kiln-dried, which would mean that it is at about the same moisture level as the interior space of homes in your area and free from stresses caused by being dried too hastily. Because the drying process is reversible, and a dry board can regain moisture and expand in a matter of a month or two, you'd do well to protect the wood from direct contact with the concrete floor and any moisture that's present. Lay down a plastic tarp or keep your stack off the floor with blocks. There is no need to sticker the boards, just lay them flat. Storing lumber vertically is alright, but unless the boards are short, I doubt you'll have enough room in your basement. Such precautions as stickering and vertical separation would be needed only if the moisture content of the lumber was higher and circulation of dry air was needed to complete the drying.

Plywood storage is a bit different. Although plywood is dimensionally stable, you'll want to store the sheets flat, to protect the edges from moisture or damage. They can get a permanent bend over the length or width of the sheet from being stored without proper support. This happens most often if you lean the sheets vertically against one or two points; the weight of six sheets is considerable. If space is a problem and you must store the sheets vertically, give the stack plenty of support on the sides.

[John Wilson makes and sells Shaker oval boxes. He also teaches woodworking part-time at Lansing Community College in Lansing, Mich.]

Glue-joint clamping time

I have read all I can find on clamping glue joints, yet I'm still not sure how long a glued joint should be under full clamp pressure. Manufacturers' directions range from 10 minutes to overnight. What's the correct clamping time, and is it possible to leave something clamped too long?

—John Stevenson, St. Charles, Ill.

George Mustoe replies: Clamping time always depends on the cure rate of the particular adhesive you use, so it's no surprise that recommended times range from minutes to many hours. The most certain method is to leave the parts clamped

DUST COLLECTOR
UFO-90.....1HP Motor
UFO-101.....2HP Motor
UFO-102B....3HP Motor

DRUM SANDER
SK-15DS....$1545.00
15" sanding width, 3 HP
SK-20DS....$1875.00
20" sanding width, 3 HP
SK-25DS....$2355.00
25" sanding width, 5 HP
Two different grit precision contact drums.
Dust chute. 1/4 HP feeding motor.

STROKE BELT SANDER
SK-1500BS.....$1095.00
60"x21-1/4" sliding table
6" sanding belt width 2 HP
SK-2100BS.....$1599.00
80" x 21-1/4 sliding table
6" sanding belt width 3 HP

JOINTER
JT-0012.....$1595.00
12" planing width
13-3/4" x72" precision ground cast iron table
3 HP motor

TRUE VALUE &
TRUE QUALITY

LOBO POWER TOOLS
10922 Klingerman St #3, So.El Monte,
CA 91733, USA (818) 350-1096

Unit 3, 2375 Alpha Ave, Burnaby, B.C.
Canada V5C 5L2 (604) 299-0911
All F.O.B. So. El Monte, CA

Write or call now
FREE BROCHURE
One year free parts warranty
We specialize in customer satisfaction

12" PORTABLE PLANER
WP-3012.....$379.00
Stand (Optional)
WP-12ST.....$ 39.00
FREE SHIPPING

BAND SAW
SK-20BS...$1195.00
20" cutting width
2 HP motor
cast aluminum wheel

12" TILTING ARBOR TABLE SAW
HTS-0012A $825.00
With cast aluminum guide rail.
3 HP motor 2 Belt drive

10" TILTING ARBOR TABLE SAW
TS-1010.....$1155.00
With cast aluminim guide rail
3 HP 3 belt drive

POWER FEEDER
SK-303FD....$659.00
1 HP, 3 phrases
SK-301FD...$699.00
1 HP, 1 phrases
SK-321FD...$390.00
1/4 HP, 1 phrases

WIDE BELT SANDER
A-2548....$5535.00
24" working width
A-3760....$8685.00
36" working width
3 precision balanced contact drum. Rugged heavy duty metal construction. Full power motors drive sanding and auto infeed smoothly. Computer control adjust table.

SPINDLE SHAPER
SK-30SPA.....$799.00
1" and 3/4" Spindle
28" x 30" table
forward and reverse
Springhold down, 3 HP
SK-35ST.....$199.00
Sliding Table

until the adhesive is fully cured, but time-conscious woodworkers often want to pull off the clamps as soon as possible to speed the flow of work through their shops. With caution, this philosophy is okay, but it's necessary to understand the way in which an adhesive bond develops its strength.

Most adhesives, including polyvinyl acetate-base white and yellow glues, hide glue and epoxy, reach a solidified state rather quickly. However, much more time is required before the adhesives attain full strength. Shortly after application, glues become tacky, and even this initial bond may be sufficient to hold the mating surfaces together after the clamps are removed.

How long does this take? For glues that cure by evaporation of water or organic solvents, such as yellow and white glues, the rate varies greatly depending upon the amount of adhesive applied and the porosity of the adjacent material. Temperature and humidity also play a role, but it is usually less important. However, catalyzed adhesives, such as epoxy, resorcinol and urea-formaldehyde "plastic-resin" glue, cure at rates that depend almost entirely on temperature, and 5° or 10° will make a big difference in determining clamping time.

In light of these factors, there's no simple answer on "how long is long enough?" The best approach is to learn by experience. Keep in mind that it is usually safe to remove clamps prematurely only if the work is not under significant stress, such as from the force of gravity acting on heavy components or pressures generated by further woodworking operations performed before the curing is complete. Prolonged clamping is never harmful, assuming you have not used brute force to crush together badly formed surfaces. Although water-base adhesives do add a small amount of moisture to the wood, the glue itself shrinks in volume as it cures. These effects are usually insignificant, although the shrinkage phenomenon explains why clamps sometimes mysteriously loosen a little when you have used white or yellow glue.
[George Mustoe is a geochemistry research technician at Western Washington University in Bellingham, Wash.]

Quieting a squeaking bed

We have a massive, ornate black walnut Victorian bed. The problem is that the bed squeaks, rattles and rolls if you so much as scratch your nose while you're sleeping. How can we strengthen and stabilize this rumbling giant?

—Nina Angela McKissock, Carversville, Penn.

Ben Erickson replies: We also have a massive four-poster bed with canopy, so I am familiar with the problems associated with these antiques. Because I don't know the details of your case, I will address several possible remedies. The best procedure is to isolate what is causing each sound and fix each defect individually. First, the rigidity and quietness of most beds depends on the tightness of the joints that connect the rails to the bed posts. In many smaller beds, the headboard and footboard are permanently attached to the bed posts. If these joints are loose, the mortise and tenon between the end rails and the posts should be disassembled, cleaned and reglued. Epoxy glue works best for this, because of its ability to fill gaps in loosely fitting joints. Clamp the parts together with long pipe or bar clamps until the glue sets. If the headboard- or footboard-to-post fit is very loose, causing rattling, insert thin wedges or veneer shims in the interior side of the joint where they won't be seen. Don't shim the top and bottom of the joint, as space here may be needed for expansion and contraction of the joint. Tap the shims into place and break them off.

The side rails in smaller beds and all four rails on larger beds are often held to the posts by stub mortise-and-tenon joints anchored by one or two bed bolts screwed to a captured square nut. The most obvious culprit for squeaking in this case is bed bolts that have not been tightened securely. Torque the bolts down with a bed wrench or by forcing a socket wrench over the square nut. Bed bolts and wrenches are available from Ball & Ball, 463 W. Lincoln Highway, Exton, Penn. 19341; (215) 363-7330 or from Horton Brasses, Box 120F, Nook Hill Road, Cromwell, Conn. 06416; (203) 635-4400. Bed bolts are either exposed and tightened on the end of the posts (often covered with brass plates) or hidden inside the rails near the corners.

The condition and the method of attachment used to fit the mattress and box spring to the bed may also be a noisy culprit. Our bed is an odd size, so unless we have a box spring and mattress custom-made, we're stuck with the ancient ones that came with the bed. Our box spring was so worn out that we replaced it with a flat platform made from a framework of 1x6s covered with plywood. This platform eliminated the squeaking box spring, though I did have to get used to a firmer bed.
[Ben Erickson is woodworker in Eutaw, Ala.]

Bandsaw tracking problems

I have a 14-in. Delta bandsaw and an annoying problem: The blade will not track in the center of the wheels. While this in itself isn't a problem, the saw tracks erratically and even backing out of a cut causes the blade to shift its position on the wheels. What can I do to remedy this problem?

—Ed McDaniel, Fulton, Mo.

Mark Duginske replies: The problem of the blade not tracking in the center of the bandsaw wheels is common on older bandsaws, especially ones with flat wheels. The most plausible reason for your problems, however, is tire wear, which, fortunately, can be easily solved by either reshaping or replacing the tires on the wheels.

The reason for this problem requires some explanation: When a bandsaw has convex or "crowned" wheels, like the ones on your Delta, equalizing forces cause the blade to automatically center itself on the crown or middle of the wheel. The blade rides on a rubber tire that acts as a cushion between the blade and the wheels and as a buffer against vibration from wheels that aren't perfectly round. As the tires wear, the rubber tends to stretch or become thin in the middle, creating a concavity. The blade usually refuses to track in the concavity and will track on either side of it.

You can eliminate the concavity and restore the tires to their original crown by sanding the outside edges of the tires or by turning the edges down with a gouge. First, make sure the tire has not stretched so much that it will slip when you try to true it. With the blade removed, clamp a small piece of wood to the saw frame as a tool rest and turn the new crown with a small, very sharp gouge. If you're not an experienced turner, it's probably best to reshape the tire by sanding. After the lower, driven wheel is shaped, you can rotate the top, nondriven wheel by using an electric drill fitted with a small sanding drum as a friction drive (have a friend hold it against the wheel as you work). You should occasionally check the thickness of the tire by sticking a pin into it. Because the metal bandsaw wheel itself is crowned, the shape of the tire will be close to its original shape when the tire is the same thickness in the middle as on the edges.

If the tire becomes loose as you shape it, glue it in place with rubber cement or contact cement. Also, if as you shape it the reshaped tire ends up less than 3⁄32 in. thick, it should be replaced. Replacement tires are available from saw manufacturers or can be ordered from specialty supply houses. I order mine from G.C. Peterson Machinery Co., 3125 S. 108th St., West Allis, Wisc. 53227; (414) 543-5522.
[Mark Duginske is a woodworker, teacher and author. He lives in Wausau, Wisc.]

Stained spruce pine

I have several hundred board feet of air-dried spruce pine (yellow pine) that I just took out of the drying shed. The boards are full of dark blotches that extend through the entire

The Kaiser Plate Joiner

KAISER

See Us In Booth #1905 At The 1989 Anaheim Show!

The Kaiser Vario plate joiner will save you time and make joining wood for cases, cabinets, and raised panel doors a snap. It has the most powerful motor in the industry, the most versatile fence system, and it's the only plate joiner with a non-slip rubber faceplate instead of metal locating pins. This lets you work on both high and low pressure laminates like melamine and formica without slipping or scratching the surface. The Kaiser Vario is by far the most versatile plate joining system in the world today. Get your hands on the plate joiner that works as hard as you do...the Kaiser Vario.

Call 1-800-638-6405 For Your Nearest Kaiser Dealer

KNECHT HOME CENTER INC.

320 W. BLVD.
RAPID CITY, S.D. 57701

OUR 60th YEAR IN BUSINESS

Makita

6093DWK Var. spd/clutch Complete Kit **$129**

2012 12" planer,12 amp 52 lbs, $499

6071 DWK VSR., 7.2V	105
6092 DWK VSR.,9.6V	120
9005B 5" HD Grinder	85
BO4550 w/bag	45
1900 BW 3½ Planer	116
3601 B D handle router	129
3612B 3 hp router	195
3620 1¼ router	105
3700B Trim router	98
4300BV Jigsaw	135
4302G Orbital jigsaw	155
5007NB 7¼ saw	114
6013BR ½ drill	125
6510LVR HD 3/8 drill	82
9900B 3x21 sander	132
9924DB 3x24 sander	138
9401 4x24 sander	163
LS1020 10"miter box	229
7.2 Volt battery	26
9.6 Volt battery	32

ALL TOOLS SHIPPED PREPAID
(Continental U.S.)

CALL FOR PRICES ON:

- Bullet ™ Bits & Sets
- Full Line Makita
- Parts And Access.
- Piranha ™ all sizes
- Air Hose — all made in U.S.A. (We also custom make hoses)
- Sandpaper (3M and Belts Makita)
- Screws And Bits
- Many one of a kind specials — Call for List — Super Prices

RYOBI

TS251U 10"/Elec. brake **$188**

AP10 10" planer	349
RA200 8¼" radial arm	238
E3810 0-2500 drywall	72
E3800 0-4000 drywall	72
5500A 1/6 sht. sander	38

BOSCH

921VSRK Var. spd/clutch. Complete Kit **$138**

1651 7¼",13amp,C.T.Blade 92
1604 1¾ hp router 119
1611 220, 3hp router 249
Call for prices on Rotary Hammers
Complete line Router and Shaper Bits
4 bits any mix 30% off!

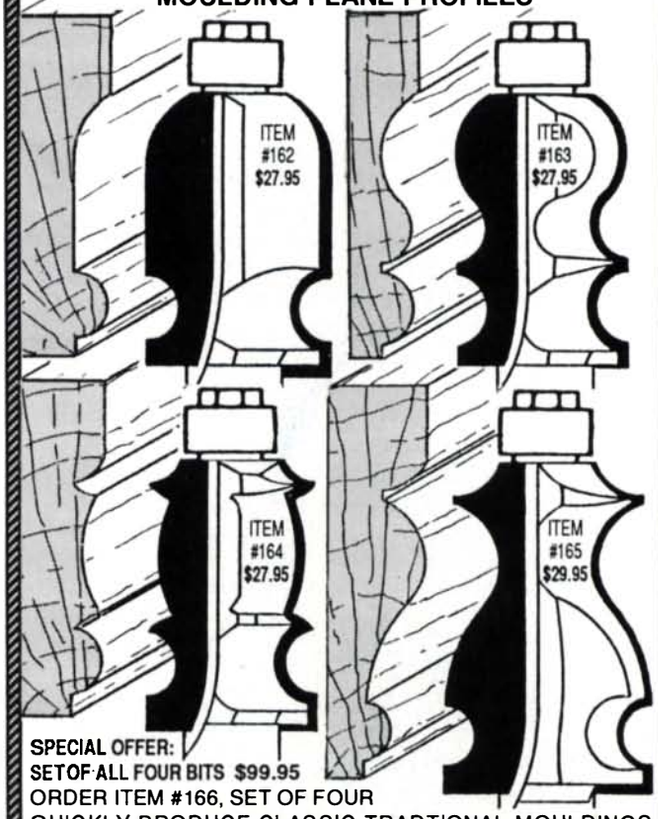
Stanley-Bostitch

N80C Coil Nailer **$399**

N60FN 1¼-2½ fin. nailer 339
T31-1 5/8-1 finish nailer 139
T31-2¼-7/8 uphol. stapler 139
N12B-1 Roofing nailer 399
Full Line Bostitch Guns And Compressors
Nails & Staples — in stock — priced right
(All fasteners FOB Rapid City)

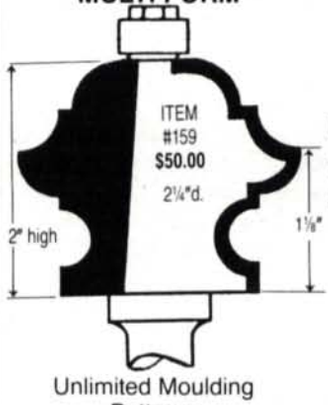
ORDER TOLL FREE — 800-426-8077 ASK FOR GARY
(In S.D. — 800-422-3136) VISA • MC • CHECK • COD 3.00
FAST SHIPPING — MOST ORDERS SAME DAY!
WE THANK YOU FOR YOUR BUSINESS

1/2" SHANK CARBIDE-TIPPED ROUTER BITS MOULDING PLANE PROFILES



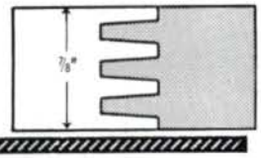
SPECIAL OFFER:
SETOF ALL FOUR BITS $99.95
ORDER ITEM #166, SET OF FOUR
QUICKLY PRODUCE CLASSIC TRADTIONAL MOULDINGS
BITS ARE SHOWN **FULL SIZE - 2 FLUTE CARBIDE TIPPED.**

MULTI FORM*

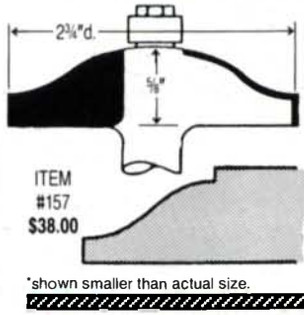


Unlimited Moulding Patterns

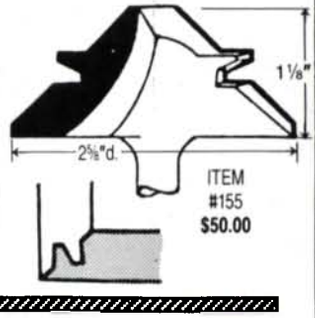
FINGER JOINT*



RAISED PANEL*



LOCK MITRE*



*shown smaller than actual size.

To order by Master Charge or Visa Toll Free
7 Day - 24 Hour Order Service, Call
1-800-533-9298 or send check to:
MLCS, Ltd., P.O. Box 4053FA, Rydal, PA 19046

thickness. It looks like water, moisture, mildew damage or some of each. Do you know of any way to get rid of this stain so I can use this lumber in unpainted furniture pieces?

—W.B. Badenoch, Jr., Ophelia, Va.

Jon Arno replies: Judging from the sample you've forwarded, your wood suffers from a typical case of "blue stain." This term is a bit misleading in that the color may vary from blue to a grayish shade. In any event, it is caused by fungi that invade the wood while it is moist. Blue stain can be prevented by spraying or dipping fresh-cut lumber in commercially available fungicides, but these chemicals are potentially dangerous and I would not recommend them for do-it-yourself application.

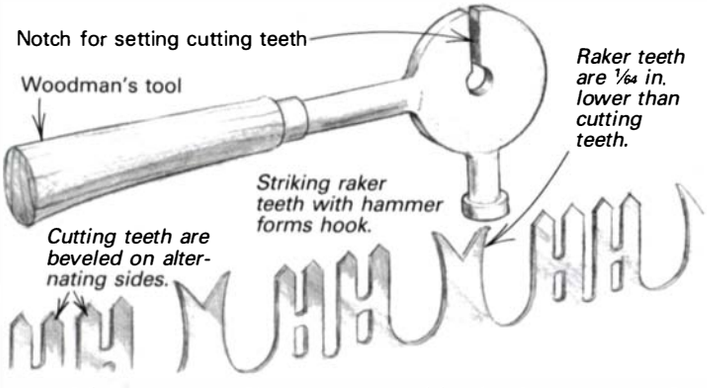
The probability of wood staining in the drying process is greatly reduced simply by getting the surface moisture content (MC) down to the fiber saturation point (25% MC to 30% MC, depending upon the species) as quickly as possible. This is best accomplished by keeping air flowing through the drying stack. If your drying shed lacks a fan, just a few calm, humid days can let the fungi get established. Temperature is also important, because the fungus is inhibited by temperatures above 95°F or below 40°F. In the North, for example, the odds of avoiding blue stain can be enhanced by harvesting in the late fall and beginning the drying process in the winter; even this is not a certain preventative. Adequate airflow early in the drying process is critical.

Unfortunately, once blue stain occurs, there is no practical remedy. The wood can be bleached, but this alters the natural wood color. The caustic bleach may also cause future problems with finishes. Despite the stains, the dried wood is structurally sound enough for most interior applications. The infected areas or "blotches" tend to be more porous and will stain slightly darker than the normal tissue, but under a dark, highly pigmented oil stain, the contrast between the two is much less noticeable. A natural finish is out of the question unless, of course, you like the appearance of blue stain.

[Jon Arno is a woodworker and amateur wood technologist in Schaumburg, Ill.]

Sharpening crosscut saws

I enjoyed Harold H. Payson's article "Sharpening HandSaws" in FWW #68. However, it didn't cover the sharpening of a crosscut saw or a bucksaw, which are used for cutting firewood or for log-sawing competitions. Are there any special sharpening methods? *—Lee Crouch, Vallejo, Calif.*



Harold Payson replies: I've enjoyed log-bucking contests for years, and I've always marvelled at the speed at which two men can melt their way through an impressive-looking log. Not long ago an oldtimer gave me a woodman's tool that he said was made especially for the crosscut saw, sketched above. The notch in the head of the tool is for setting the cutting teeth, while the small hammer is for putting a hook on the tips of the raker teeth, which are designed to clear the kerf. The hook ensures that the teeth don't just drag the sawdust out, but instead curl out a shaving. I'd never seen a tool like this before, but the oldtimer assured me that by knocking or turning over the points of the raker teeth, the saw would beat any bucksaw just filed in an ordinary way. Since then, I've discovered that Timeless Tools, 122 W. Spring St., Box 41, Marquette, Mich. 49855; (906) 226-3313 sells a saw-setting hammer like the one I was given. In lieu of a special tool though, you can hook the points of your raker teeth by tapping them with a very light hammer—about the weight of a modeler's hammer for a home-type bucksaw. Knock the tips of the raker teeth so they're about 1/64 in. lower than the cutting teeth. The best method I know for improving the efficiency of the cutting teeth is to make them peg-shaped and sharply beveled and set.

[Harold "Dynamite" Payson is a writer and boatbuilder in South Thomaston, Me.]

Getting the stain out of PEG

I've been soaking black walnut in polyethylene glycol (PEG-1000) to stabilize the green-wood turning blanks and prevent shrinking and cracking during the drying process. The PEG works fine, but the solution has been getting darker and darker from the walnut stain absorbed during each soaking. This causes the finished walnut to look much darker than it normally would and also prevents using this PEG solution on light-colored woods. Is there a method for removing the stain from the PEG solution to return its original clear color?

—Robert William Beharka, Los Banos, Calif.

Philip Moulthrop replies: It's also my experience that a PEG solution will indeed retain the stain deposited by soaking walnut. The color will stain lighter woods that are soaked in the same containers, but the stain usually does not penetrate extremely far; when the piece is turned on the lathe, the stained exterior can often be removed.

Fortunately, the stain can be removed from the PEG solution by adding swimming-pool chlorine, such as "HTH," which acts as a bleach. This will return the solution to a very light color, thereby allowing lighter woods to be treated in it without staining them.

To avoid the staining problem, I always designate one container of PEG solution for walnut and separate containers for lighter woods. Even so, I must periodically bleach the solutions for lighter woods to prevent color build-up.

[Philip Moulthrop is a part-time woodturner and lawyer. He lives in Marietta, Ga.]

Dyeing pearwood black

I am looking for a way to dye pearwood black, not just on the surface, but completely throughout its thickness (approximately .020 in. thick). So far, I have used alcohol-solvent dye (lightfast black). Even after soaking for four days, the wood is still not completely black.

—Edward Leibhardt, Woodstock, Ill.

Michael Dresdner replies: The Italians seem to have the dyeing market wrapped up, and they are both successful and secretive with their methods. Word has it that they accomplish "through" dyeing by introducing the dye either under pressure or in a vacuum, and these methods would be impractical in a home shop. I suspect that they are using water-soluble dyes. You can also buy black-dyed pearwood that's .025 in. thick from Certainly Wood, 11753 Big Tree Road, East Aurora, N.Y. 14052; (716) 655-0206. I have used black-dyed pearwood quite a lot, though, and to tell you the truth, the sample you sent was as good as any I ever bought.

[Michael Dresdner is an instrumentmaker and finishing specialist in Zionhill, Penn., and a contributing editor to *FWW.*]

Send queries, comments and sources of supply to Q&A, Fine Woodworking, *Box 355, Newtown, Conn. 06470. We attempt to answer all questions, but due to the great number of requests received, the process can take several months.*

S.F. BAY AREA'S LARGEST POWER TOOL DEALER! NOW AVAILABLE NATIONWIDE!

Call Toll-Free 800-845-2000 (outside California) 415-845-3000 (inside California)

WHOLE EARTH ACCESS

OPEN 7 DAYS 2990 Seventh Street, Berkeley, California 94710

ALWAYS THE LOWEST PRICES!

Free Freight on all portable tools in continental USA *FOB Berkeley

PORTER+CABLE

NEW! SAW BOSS 6" Circular Saw Model 345 **99.**

621	3/8" VSR Drill	90.
7511	3/8" VSR Drill	100.
7514	1/2" VSR drill	115.
666	3/8" T-Handle drill	119.
7556	2-Spd. rt. angle drill	185.
303	Pro 7" paint remover	149.
304	Pro 7" disc sander	125.
305	Pro 7" disc polisher	125.
320	Abrasive plane	95.
367	3¼" plane	135.
9118	Porta-plane kit	209.
9652	Versa-plane kit	265.
309	Laminate trimmer	89.
310	Laminate trimmer	120.
312	Offset base lam. trimmer	129.
319	Tilt base lam. trimmer	144.
399	Drywall cutout unit	69.
100	7/8 HP router	100.
518	3 HP microprocssr, 5spd.	335.
536	1½ HP speedmatic	195.
537	1½ HP spdmatic, d-handle	209.
630	1 HP router	109.
690	1½ HP router	115.

PORTER+CABLE

Speed-Bloc Finishing Sander Model 330 **54.**

691	1½ HP router, d-handle	134.
555	NEW! plate joining machine	165.
505	½ Sheet pad sander	105.
352	3"x21" dustless belt sander	125.
360	3"x24" dustless belt sander	195.
362	4"x24" dustless belt sander	205.
503	3"x24" wormdrive belt sander with bag	349.
314	4½" Trim saw	125.
315-1	7¼" Top handle saw	105.
548	Heavy duty bayonet saw	165.
7548	VS,var. orbit, d-handle jigsaw	134.
7648	VS, var. orbit jigsaw	134.
9627	2-Spd. Tiger saw w/case	130.
9629	Var, spd Tiger saw w/case	138.
7523	Pos. clutch screwdriver	139.
7542	TEKS Driver	119.
7545	VSR Drywall driver	109.

SKIL 12 V. VSR Cordless Drill Kit

Model 2735:04 **119.**

77	7¼" worm drive saw	135.
5825	6½" Worm drive saw	139.
5510	5½" Trim saw	83.
5790	10¼" Circular saw	225.
5865	8¼" Worm drive circular saw	149.

FREUD

90-100	15 pc. router bit set	159.
94-100	5 pc. router cabinet set	179.
CS112	12 pc. carving set	109.
DB-050	50 pc. comb. drill bit/brad pt. set	49.
DS-306	6" dado	92.
DS-308	8" dado	105.
EC-900	5 pc. door making shaper cutter set	319.
FB-100	16 pc. Forstner bit set	169.
LM72M008	8"x24T rip	32.
LM72M010	10"x24"T rip	36.
LU73M010	10"x60"T ATB	42.
LU78M008	8"x64T TCG gen. purpose	59.
LU82M010	10"x60"T TCG	42.
LU84M008	8"x40" 4&R Combination	42.
LU84M011	10"x50T 4&R combination	37.
LU85M008	8"x64T ATB fine cut-off	49.
LU85M010	10"x80T ATB fine cut-off	59.
LU85M014	14"x108T ATB fine cut-off	98.
LU85M015	15"x108T ATB fine cut-off	105.
PS203	7¼"x24T ATB gen. purpose	18.
PS303	7¼"x40T ATB gen purpose	23.
WC106	6 pc. chisel set	34.

Milwaukee 3/8" VSR Drill

Model 0222-1 **95.**

0239-1	1/2" drill, keyless chuck	115.
0224-1	3/8" Magnum holeshooter	105.
0234-1	1/2" Magnum holeshooter	105.
0375-1	3/8" close-quarter drill	135.
0379-1	1/2" close-quarter drill	159.
1676-1	Hole-hawg kit	225.
3002-1	Electricians rt. ang. drill kit	169.
3102-1	Plumbers rt. ang. drill kit	175.
5397-1	3/8" VS hammer drill kit	145.
8975	Heat gun	54.
5680	2 hp router	220.
5925	3"x24" dustless belt sander	219.
5935	4"x24" dustless belt snader	225.
6012	1/3 Sheet pad sander	99.
6014	1/2 Sheet pad sander	109.
6215	16" Electric chainsaw	179.
6226	2 speed bandsaw w/case	249.
6246	Single speed jigsaw	125.
6256	Variable speed jigsaw	140.

Milwaukee 2 Speed Sawzall

Model 6511 **119.**

6507	Var. sp. sawzall w/case	129.
6365	7¼" top handle circular saw	105.
6377	7¼" wormdrive saw	155.
6405	8¼" circular saw	120.
6539-1	Cordless screwdriver	59.
6543-1	VSR Screwshooter	145.
6750-1	VSR Drywall driver	89.
6754-1	VSR Magnaum drywall driver	115.
6798-1	Adj. clutch screwshooter	105.

HITACHI ½" Plunge Router

Model TR12 **169.**

F20A	3¼" Plane w/case	99.
TR6	Laminate trimmer	95.
TR8	¼" Plunge router	119.
CR10V	VS, Var. orbit recipro saw	119.
DRC10	3/8" Cordless drywall screwgun	85.
D10D	3/8" 9.6 v. cordless driver/drill	110.
W6V1	0-4000 drywall screwgun	69.

HITACHI NEW! 8½" Compound Miter Saw

Model C8FB **529.**
FREIGHT INCLUDED

C10FA	Deluxe 10" miter saw	289.
C15FB	Deluxe 15" miter saw	379.*
F1000A	12" Planer/6" jointer combo	1399.*
CB75A	Band saw	1549.*
R100Y	Dust collector	559.*
P100F	12" Planer	1059.*

RYOBI 10" Portable Planer

359.
Model AP10
FREIGHT INCLUDED

RA200	8" portable radial arm saw	249.
L120UK	3-5/8" Planer kit	99.
R500	2¼" HP plunge router	179.
R150K	1 HP plunge router kit	109.
TR30U	Laminate trimmer	79.
B7075K	3"x21" Belt sander kit	119.
S500A	Finishing sander, 1/6 sheet	36.
TS251U	10" Miter saw	185.
TS380	14" Miter saw	345.

SPECIAL PURCHASES PORTER+CABLE NEW

Tiger Cub All Purpose Saw Kit No. 9647 **119.**

12 V. Magnequench VSR Cordless Driver Drill Kit No.9850 NEW! **135.**

FOREDOM Crafts Kits

Model 2272 **165.**

BOSTITCH Finish Nailer

N60FN **339.**

Emglo 3/4 HP Twin Tank Hand-Carry Air Compressor

Model AM39-HC4 **275.**

David White Instruments Sight Level Package

LP6-20 Includes instruments & tripod **229.**

Makita VS Cordless Driver/Drill w/ Clutch Kit

Model 6093DW **129.**

DP4700	1/2" Drill	109.
6012HDW	2-Spd. cordless driver/drill kit	119.
6510LVR	3/8" Drill, heavy duty	75.
9207SPC	7" Electronic sander/polisher	139.
3612BR	1/2", 3HP Plunge router	187.

Makita 7¼" Framers Saw w/hypoid gears

Model 5077B **139.**

2708	8" Table saw/carbide blade	249.
9401	4"x24" Dustless belt sander	165.
9900B	3"x21" Dustless belt sander	135.
LS1020	10" Miter saw	229.

Elu BLACK & DECKER 1 HP Plunge Router

Model 3303 **159.**

3304	1hp electric plunge router	195.
4023	3x21 belt sander	195.

Call for Elu products not listed

BLACK&DECKER™ 7¼" Super Saw Cat

Model 3047-09 **165.**

2690	7¼" Builder's saw cat	112.
3051	7¼" Worm drive saw	139.
7790	12" DeWalt cont. radial arm saw	879.*
7770-10	10" DeWalt cont radial arm saw	689.*

AEG Drywall Screwdriver 0-4000 rpm

Model SCR2E-2 **95.**

HBSE75S	3x21 VS Belt Sander	155.
EZ502	Cordless screwdriver	59.
EZ506	3/8" Cordless drill screwdriver	120.
OFS50	1 HP plunge router	169.

NORTON Multi-Oilstone

Model 85960-9 **99.**

ADJUSTABLE CLAMP COMPANY

		EA.	BOX/12
#50	'PONY' clamp fixture	7.50	80.00
#52	'PONY' clamp fixture	6.00	65.00
		EA.	BOX/6
3/0	6" JORGENSEN h/screw	8.35	47.60
2/0	7" JORGENSEN h/screw	8.95	51.00
#0	8" JORGENSEN h/screw	9.95	56.70
#1	10" JORGENSEN h/screw	11.40	64.95
#2	12" JORGENSEN h/screw	13.00	74.00
3712	12" Steel bar clamp	5.95	32.50
3724	24" Steel Bar clamp	7.35	40.00

LEIGH

D1258-12	12" Dovetail jig, blind & through	259.
D1258-24	24" Dovetail jig, blind & through	309.

BOSCH Var. Speed Var. Orbit Jigsaw

129. Model 1581VS

1582VS	VS, Var orbit jigsaw	118.
3238VS	VS, Var. orbit std. duty jigsaw	95.
1654	7¼" Builders circular saw	99.
1500	16 guage shears	205.
1942	Heavy duty heat gun	69.
3268	Std. duty heat gun	59.
3258	3¼" Power plane	119.
1600	2½ HP, D-Handle router	245.
1604	1¾ HP Router	119.
1606	1¾ HP, D-Handle router	128.
90300	3¼ HP Production router	329.
1609K	Laminate trimmer installer's kit	169.
1609	Off set base laminate trimmer	119.
91064	3/8" Mighty Midget VSR drill	99.
1631K	2-spd Panther recipro saw	119.

BOSCH 3 HP Plunge Router

Model 1611 **198.**

1608T	Tilt base laminate trimmer	89.
1632VSK	VS, Var. orbit Panther recipro saw	129.
1530	14 gauge nibbler	269.
91066	1/2" Mighty Midget VSR drill	109.
1158VSR	3/8" VSR drill	59.
1196VSR	3/8" Hornet II hammer drill	109.
1198VSR	1/2" VSR hammer drill	125.
11203	1½" Rotary hammer	409.
11212VSR	5/8" VSR bulldog SDS rotary hammer	185.
11304	Brute breaker hammer	1299.*
11305	Demolition hammer	659.
1272D	3'x24" dustless belt sander	169.
1273D	4"x24" dustless belt sander	179.
1273DVS	4"x24" VS, dustless belt sander	209.
3270	3"x21" dustless belt sander	129.
1347	4½" mini grinder	85.

DELTA 10" Unisaw 1½ HP

34-761F **1185.***

34-782F	10" Unisaw, w/unifence	1550.*
34-783F	10" Unisaw, w/unifence 3HP	1550.*
43-375F	2 Spd wood shaper	1379.*
33-150	Sawbuck	509.
33-990	10" Radial arm saw	469.*
11-950	8" bench drill press	109.*
17-900	16.5" Drill press	259.*
28-283F	14" Wood band saw w/¾HP motor encl steel std	589.*

DELTA 10" Contractors Saw w/1½ HP motor

Model 34-410 **599.**

28-243S	14" Wood bandsaw w/std., ½hp motor	450.*
43-122	Shaper, light duty, 1hp, 1 ph	450.*
22-651	RC-33 13" Planer	950.*
37-150	6" long-bed jointer w/electricals	929.*
37-350	8" long-bed jointer w/electricals	1249.*
31-730	6" Belt, 12" disc w/electricals	839.*
34-985	Production stock feeder	575.*

CALL FOR QUOTES ON MACHINES NOT LISTED

LAMELLO

Junior	Std. hand joining machine	CALL
Top	Deluxe hand joining machine	CALL
Standard	NEW, hand joining machine	CALL
Plates	# 0,#10,#20, 1000/box	29.

Prices effective for mail & phone orders only.

Errors subject to correction.

by Dick Burrows

Polishing up finishing articles—Most woodworkers have problems with finishes at one time or another. In fact, we receive more requests for help with finishing problems than for any other single area of woodworking. I've always been a little curious why. Perhaps it's because most people so dislike working with chemicals, oily rags and other finishing paraphernalia that they never bothered to invest the time and energy needed to learn the correct procedures. Or, is finishing really a mystical science that can be mastered only by a select few, and must be endured by the majority of us who can't afford to hire someone to do our dirty work?

Because of all the finishing problems we hear about, we regularly run articles on lacquer, varnish and other finishing methods. In our last issue, we wrote about applying an oil finish, one of my personal favorites, and generated what I think is an interesting response, both in what it indicates about finishing and about what readers want to see in the magazine.

Frank Klausz, a top-notch craftsman in Pluckemin, N.J., was very upset with the article, because he thought comments on oil's low resistance to abrasion and to water and alcohol implied that oil finishes were inferior and weak.

Not so, says Klausz, who feels that a careless workman will produce a poor finish, regardless of whether the material is oil, varnish, shellac or lacquer. The number of coats and the care and skill with which they are applied are the important factors. A good oil finish can be tough and can offer ample protection for fine furniture, he says: In his shop, he may apply up to 12 coats of hand-rubbed medium-sheen Waterlox. He says he has a table in his house that is oiled and just gets more beautiful each year. You can even spill whiskey on it and it doesn't mark, as long as you don't leave it on there for an hour. (Klausz demonstrates his oil-finishing methods in the video "Wood Finishing," available from The Taunton Press, 63 S. Main St., Newtown, Conn. 06470.)

Terry Moore, a cabinetmaker in Newport, N.H., had some even harsher criticisms of the oil article and the magazine in general. He wants more profiles on craftsmen and their work, such as the piece on John Boomer's sculpture in *FWW* #73, and less space devoted to what he calls "a plethora of hobby, project articles." Commenting on the oil-finish article specifically, he points out that "the directions are on the can, you know."

In contrast, Tom Wisshack of Galesburg, Ill., said he enjoyed the article, although he feels it should have more strongly stressed the need to let the oil dry thoroughly between coats so the finish can mature "to form a relatively hard film of protection on the wood." He warns against assuming that the driers added to modern oil mixtures can reduce the drying time to a matter of hours.

"To my mind, the greasy, hurried look of many of the oil finishes I see is the result of applying too many coats of oil in a short period of time or not letting the object go through a case-hardening or maturing before being passed on to the customer or gallery. Some of us are purists and prefer to wait a bit longer so that the oils or resins can begin to cure and react to the wood to form the beginnings of a patina."

These somewhat divergent points of view are typical of the reader reaction generated by many of our articles. There are probably as many finishing theories and methods as there are finishers. At *Fine Woodworking*, we generally find that there is no universally accepted "right" or "wrong" with finishing methods, just as there is no one universally accepted way to cut a dovetail, or chop a mortise, or assemble a carcase. We've all come up with our own systems, based on our personal experiences, our teachers and numerous other factors. And we feel it is important for *Fine Woodworking* to be a forum for allowing woodworkers to share their different ideas and to learn from each other. That reader-written aspect has, in fact, been our trademark since the very first issue.

What does "reader written" mean?—The contents page of *Fine Woodworking* states that we are a reader-written magazine. That's a phrase that is taken for granted around here, but perhaps it's good to remind everyone that it is an invitation for all readers to share their skills. We seldom work with professional writers: Our authors are serious woodworkers, with sometimes decades of experience as amateurs, small-shop professionals or teachers. Through their work, we aim to stress all aspects of contemporary and traditional woodworking, from felling the tree to applying the final finish.

Reader involvement is necessary for our magazine to thrive and to present a comprehensive view of our craft. When we began publishing in the mid 1970s, most woodworkers operated in relative isolation. The traditional apprenticeships and training programs had been replaced by the rote of the assembly line. Woodworking was a job, barely a craft, and certainly not an art. *Fine Woodworking* gave those craftsmen and would-be craftsmen a voice and a teacher. This is still our goal.

Over the years, woodworkers have become more sophisticated and techniques have been refined, but we still like to talk about our craft, see new work and hear how other craftsmen design, build and finish their best pieces. If you can teach us a technique or help some other woodworker master the craft, we want to hear from you. If you built a piece you're especially proud of and want to share it with other woodworkers, send us some photos and information about the work. If you've come up with a neat jig, tell us. And if you have comments about the magazine, please send a letter to the editor. We'll publish as many as we can and will consider all comments as we prepare future issues.

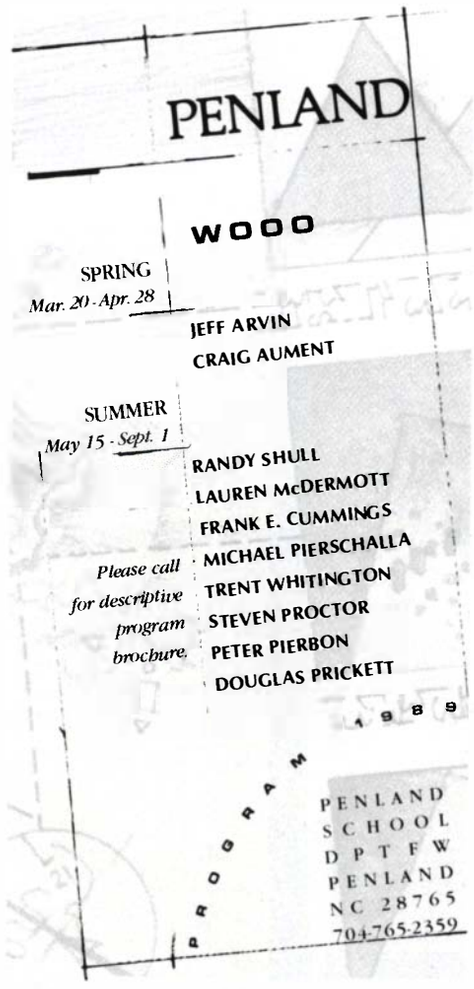
The business of woodworking—We often include production tips in our articles, even though we realize most of our readers are amateurs. We feel, however, that these tips, based on the experiences of workers who have to work efficiently to make a living, are valuable, because they help amateurs get the most out of the time they spend in the shop. Some readers may find this information distracting, as in this letter from F. William Hart of Indialantic, Fla.:

> I recently received my first issue of *FWW* (#73). I was delighted with it. Only one article was disappointing. Attracted to it by the illustration—a handsomely designed pepper mill and saltshaker—I soon found it was quite difficult to find the basic information I needed to duplicate them. This information was buried in myriad details of how to mass-produce the two items.
>
> While I realize some of your readers make money pursuing what most of us practice as an amateur hobby, I believe such articles should be constructed to tell how to make one copy of a piece, then, as sort of an addendum, provide the information of interest to those who wish to make multiple copies.

How do you other readers feel about production tips and other business topics in *FWW*? Please let me know by addressing your letters to Dick Burrows, Editor, Fine Woodworking, 63 S. Main St., Newtown, Conn. 06470.

Giving credit where credit's due—We inadvertently neglected to give proper credit to some of the people who helped us with our article "Woodworkers of Saskatchewan" in *FWW* #75. First of all, we didn't mention that photographer Grant Kernan's company is called A.K. Photos of Saskatoon. We would also like to credit The Craft Factor magazine, published by the Saskatchewan Craft Council, for allowing Kernan to take the photos for *FWW*. □

Dick Burrows is editor of FWW.



The Speed Varies So The Results Won't.

The new 3.25 H.P. Bosch electronic variable speed plunge router lets you make perfect plunge cuts time after time, no matter what the material or bit size. That's because it puts *you* in total control of speed, cutting depth, and the router itself, due to an excellent ergonomic design.

The Advantages Of Variable Speed.

Select any speed, from 12,000 to 18,000 RPM, to match your material and bit size—and get far better cutting results.

1611EVS electronics give you two more big advantages, too. "Soft start" when you press the trigger—no jarring "torque twist" means better control. And by monitoring RPM and feeding power as needed, it keeps you from bogging down, even in the toughest cuts.

Master Of Ergonomics.

From the first moment you get your hands on the variable speed model 1611EVS or the single speed model 1611, you'll know what separates it from other plunge routers. The handle grips feel like they were molded especially to fit your hands. The trigger switch, built into the right handle, and the plunge lock mechanism by your left thumb, let you reach these controls without taking your hands off the router.

Then press the trigger and take the plunge. Feel the housing glide down, and the ample power at your command as the bit slices effortlessly into your workpiece. Release the spring-loaded plunge lever and the housing locks firmly into position. And you can use the multiple-step depth-stop to make progressively deeper cuts with precision.

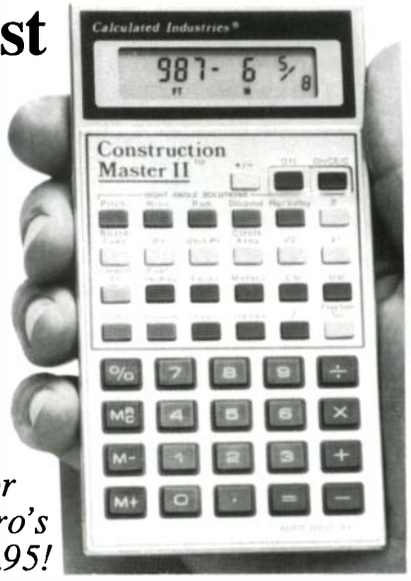
Both models accept the full array of ½", ⅜" or ¼" shank bits. And with their built-in, spring-loaded shaft lock, changing bits is fast and simple.

The Bosch models 1611EVS and 1611 are available in cooler running, higher horsepower 220V models, too. Ask about them and the complete line of fine Bosch power tools for woodworkers, at your nearest Bosch power tool distributor. He's listed in the Yellow Pages under "Tools—Electric."

BOSCH

"Quality You Can Hold On To."™

World's Best Feet-Inch Calculator Just Got a Whole Lot Better*!



Now with Many Time-Saving New Features for Woodworking Pro's — Still Just $79.95!

Now you can save time and avoid costly errors with the new and improved Construction Master II feet-inch calculator.

More Than Ever, It's The Perfect Tool for cabinetry, furniture making, design, framing, estimating, stairs, concrete, lineal footage, stringers, roof rafters, squaring-up rooms and much, much more.

Add, Subtract, Multiply and Divide right in feet, inches & any fraction —1/2's, 1/4's, 1/8's, 1/16's, 1/32's, up to 1/64's — or no fraction at all. You can even mix fractions in your problems.

Convert Between All Dimension Formats — directly to or from any of the following formats: Feet-Inch-Fractions, Decimal Feet (10ths, 100ths), Inches, Yards, Meters, Centimeters, Millimeters, Board Feet. Also converts in square and cubic.

Calculate Area and Volume by simply multiplying your dimensions together. Plus, find the area of a circle with just one button!

New Full Material & Board Feet Lumber Estimating lets you quickly and accurately do full material estimating (including with square and cubic dimensions) with its new "Unit Price" key. Also, improved board feet/lumber keys calculate board feet and total dollar costs for individual or multiple boards or an entire job.

Solves Angles Instantly — and directly in feet and inches. You simply enter the two known sides (or one known side and the Pitch), and press one button to solve for the third. Ideal for stairs, trusses, roof rafters and squaring-up rooms. Plus, new Hip/Valley key solves for adjacent hips/valleys — with just one button!

Works As a Math Calculator & Includes Time-Saving New Utility Functions Measures a mere 2-3/4 x 5-1/4 x 1/4" and works as a math calculator with 4-function (+,–,x,÷) Percent, Square Root, X^2, +/–, π, Memory and battery-saving Auto Shut-Off.

Comes Complete with easy-to-follow User's Guide, 1-Year Warranty, 2-Yr. batteries and vinyl carrying case — an optional leather case is also available.

New! 30-Day RISK-FREE Trial! Clip the coupon below, or call Toll Free today 1-800-854-8075. If you're not 100% delighted with the new Construction Master II, return it within 30 days for a full, no-questions-asked refund. Why not order yours today — Risk Free!

Clip & Mail Today!

Calculated Industries, Inc.
22720 Savi Ranch Parkway
Yorba Linda, CA 92686
714-921-1800

Toll Free 24 Hrs. 7 Days
1-800-854-8075

Please rush me the following order:

Qty		Price (ea.)	Shipping	Total
	Cons. Master II	$79.95	$3.95 for 1 calc./ *	$
	Leather Case	$10.00	□ Brown □ Burgundy	$
	Gold Initials	Your initials: ___	$1.50/init.	$

*For ea. additional unit ordered add $1.50 shpg.

CA add 6% tax $____
TOTAL $____

Name _____
Address _____
City/St/Zip _____

Qty. Disc. 5+$74.95

□ Check □ VISA □ MasterCard □ Am/Exp
Account No. _____ Exp Date ___/___
Sign Here _____ FWC-589

Personalized leather cases are, of course, not returnable.

JET+ FREE FREIGHT

On Jet Orders Over $ 2000

Nationwide service, $2,000,000 parts inventory and the most reliable warranty in the business. Jet is unquestionably the best value in woodworking Quantities limited at these prices. Merchandise shipped from Santa Rosa, CA, Smyrna, TN, Tacoma, WA.

CTAS-10 3hp, Sgl Ph + Biesemeyer #50	**1299**
CTAS-10 3hp, Sgl Ph +Excalibur	**1299**
CTAS-10 3hp, Sgl Ph + Vega	**1249**
JWS-18 Woodworking Shaper	**329**
JWS-34-1 Woodworking Shaper	**895**
WSS-3 Woodworking Shaper	**1289**
DC-610 Dust Collector	**249**
DC-1182 Dust Collector	**399**
JJ-4 4" Jointer	**215**
JJ-6 6" Jointer	**319**
JJ-8 8" Jointer	**849**
JBS-14MW 14" Bandsaw	**329**
JWP-12 12" Woodworking Planer	**395**
JWP-15H 15" Woodworking Planer	**895**

ROUSSEAU MiniSaw PortaMax P.M. 2700

FEATURES

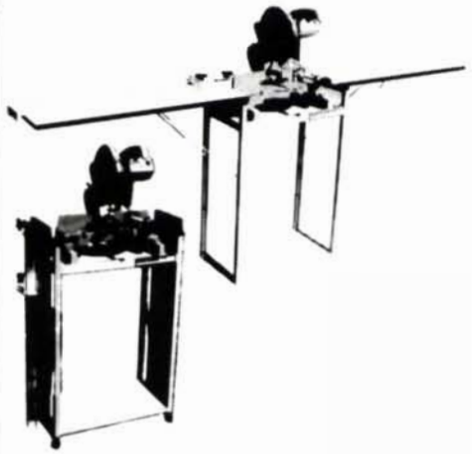
* For MAKITA #2708 &
* RYOBI #BT2500
* Basic unit can rip up to 27"
* With optional extension (P.M. 2710) can rip up to 49"
* Optional outfeed table (P.M.2720) for stock support
* Hairline indicator and tape measure
* Folds up for easy storage
* Portable

FREE FREIGHT

PM2700	PORTAMAX	**$ 199.95**
PM2710	EXTENSION	**69.00**
PM2720	OUTFEED	**83.00**

Bench top saw not included

ROUSSEAU MiterSaw SuperStand S.S. 2800



FEATURES

* Designed to fit most 10" & 14" miter saws
* Fast and accurate stop system
* Tape measure covers 12" - 84"
* Mobile with locking casters

FREE FREIGHT

SS2800 SUPERSTAND **$ 219.95**

Miter saw not included

SANTA ROSA TOOL & SUPPLY, INC.

Call for FREE catalog • Our 23rd Year • CA residents add sales tax

(800) 346-0387 (800) 345-8665 in Calif. 1651 Piner Road, Santa Rosa, CA 95403

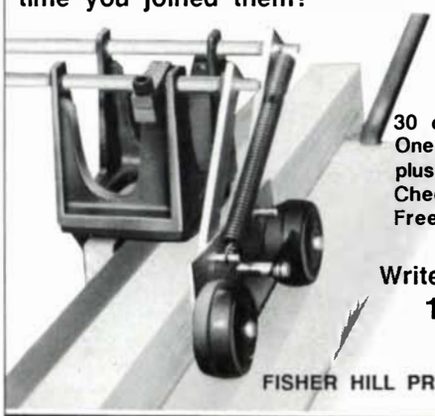
FAX **(707) 545-3705**

Ad Expires 06/30/89

LOOK! NO HANDS NEAR THE BLADE

STRAIGHTER CUTS
NO KICKBACKS
NO ADJUSTMENTS
KEEPS FINGERS SAFE!

The RIPSTRATE is now an indispensible tool in tens of thousands of amateur, professional, school, corporate, government and military shops. Isn't it time you joined them?



30 day money back trial. One year guarantee. $69 plus 3.50 for shipping. Check, M.O., Visa or M.C. Free brochure.

Write, or call toll free:
1-800 421 0256

FISHER HILL PRODUCTS 1 Fisher Hill
Fitzwilliam NH 03447

RIPSTRATE®

The Best Blade Is No Secret...It's A *WIZARD!*

A sharp departure from conventional blade design, the *WIZARD* is the smoothest cutting carbide blade ever manufactured!

ELIMINATES TEAROUT OR SPLINTERING: Large bevel angles (30°) produce lower cutting pressures — virtually eliminating tearout.

SANDED-LIKE SIDES: Shallow side clearance angles enable the *WIZARD* to cut with the entire side of the carbide tip (not just the top), creating a planing action which leaves the wood with a smooth, sanded-like finish.

100% CUSTOMER SATISFACTION GUARANTEE: If the *WIZARD* isn't the smoothest cutting blade you've ever used, return it for a full refund.

Available in heavy duty plate for stationary equipment and mitre-thin plate for mitre boxes.

Call or write for a free catalog, sample cuts and the name of your local dealer.

OLDHAM-
UNITED STATES SAW
P.O. Box 1, Burt, NY 14028
1-800-828-9000 (Nationwide)
1-716-778-8588 (New York State)
716-778-8625 (Fax)

Here's another "buy 1 tool get our 212 page tool free" offer.

Just a few of the unique woodworking tools of the 3,500 others available from our most versatile tool, the 1989 Garrett Wade Catalog.

The 212 page Catalog, regularly $4.00, is Free with any order from this ad. Or if you would just like the Catalog, send us $4.00 with your name and address.

A / New Multi-Angle Poly Gauge Speeds Set-Up

Do you find it hard to set up a machine for an accurate cut? Now there is an easy way to do it all – square, mitre, or even up to 12 sides.

This hardened Aluminum gauge is accurate to 5 arc minutes (1/12°) on every angle, and will help set up almost any machine quicker. Laid flat, it can be used to set mitre fences or for layout work. Used vertically, the large slotted Brass knob holds the Gauge erect, freeing both hands for machine adjustment. Ideal for precise machine set-ups for 4, 5, 6, 8 or 12 sided joints. Instructions included.

25N01.01 Poly Gauge $24.75

B / Deluxe Cabinet Scraper

With an extra-heavy main iron casting and Solid Brass thumb screws, this is clearly the best of the cabinet scrapers available. The Sole is a full ¼" thick, very flat, and polished. It has good heft and feels very satisfying to use. One of our most highly recommended tools.

19K06.05 Deluxe Cabinet Scraper $26.50

C / Super-Hard, Pre-Sharpened Scrapers Keep Their Edge Longer

Most scraper blades are sheared from steel hardened to Rc 38-42. This makes them fairly easy to file, stone and burnish. The hook, however, wears quickly in hard use.

These are sheared from spring steel hardened to a Rc 48-51. Both edges are then surface ground to a sharp, square 90°.

The prepared edge saves you filing and stoning initially and the extra hardness lets you use the scrapers longer between burnishings. Supplied with edge guards, which you should always replace after use.

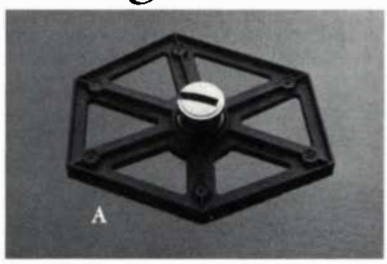
Comes in a set of 4: .015", .025", .035" and .042." thick.

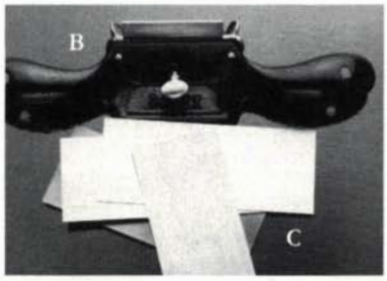
51K07.04 Set 4 Super-Hard $15.95
19K03.01 Triangular Burnisher $9.10

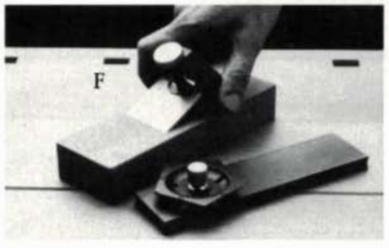
D / Woodworker's Logbook Does It All

This logbook not only includes a wealth of information on tools, hardware and supplies, but it provides a method of organizing for all information unique to your shop.

For example, it has an inventory record system, and an indexed project section for information specific to various pieces you build. Comes with ruled paper, graph paper and tracing paper.







The extensive tabular material gives standard furniture dimensions. It includes lumber and plywood standards, pre-drill sizes for screws, bit operating speeds, all of those hard-to-find reference tables that you frequently need.

All this comes in a 2½" thick, soil-proof cloth-covered 7 ring, D-ring binder. The design lets the book open flat, allowing easy reorganization or addition. An excellent shop tool for any woodworker.

14L01.01 Logbook $19.95

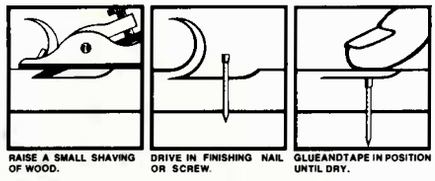
E / The "Blind Nailer" Used To Be A Staple In Every Tool Box

This unique tool functions like a positioning jig. Simply slip the Special Chisel in and tighten.

Then place the flat Sole on the wood. You will be able to operate it in a one-handed fashion, using no mallet, as the chisel, which has a "finger-nail" shaped cutting edge, is mushroom shaped to fit comfortably in your palm.

The chisel edge, controlled by the Blind Nailer, will lift a a perfect small chip. Hammer your nail in and then glue the chip back in place. Result: No nail head hole. You can work very quickly.

44K01.03 Nailer Plus Chisel $12.95



F / Advanced Precision Honing Guide Sets Micro Bevels With Great Accuracy

The first real advance in Honing Guide design. It will work chisels, plane blades, spokeshaves, skew chisels and all mortise chisels.

The secret of the Precision Honing Guide is a 3-stage, Spring Loaded Cam which shifts the Bronze Stone Roller and changes the honing angle in 1° to 1½° increments. Allows you to put precise micro bevels on any chisel or plane blades.

The Bevel Setter, mounted on an Aluminum plate, rotates on a knurled Brass bolt. It has 5 angles machined on it (15°, 20°, 25°, 30° and 35°). It gives you access to 25 precise angles. Most importantly, you can return to exactly the same angle each time to hone. This improves accuracy and reduces sharpening time. Comes with complete instructions.

80J01.01 Precision Honing Guide $19.95
80J03.01 Guide & Setter Combo. $28.90

Garrett Wade Co., Inc.
161 Avenue of the Americas
New York, NY 10013 Dept. 630
Call Toll Free 800-221-2942
(NY 212-807-1757 No Collect Calls Please)

Please send me these Garrett Wade tools and include a FREE 1989 Catalog with my order. *(Prices good until August 31, 1989)*

Name:_____
Address:_____
City:_____ State:_____ Zip:_____
☐ Check or Money Order Card Number
☐ Visa ☐ MasterCard
☐ American Express
Expiration Date_____

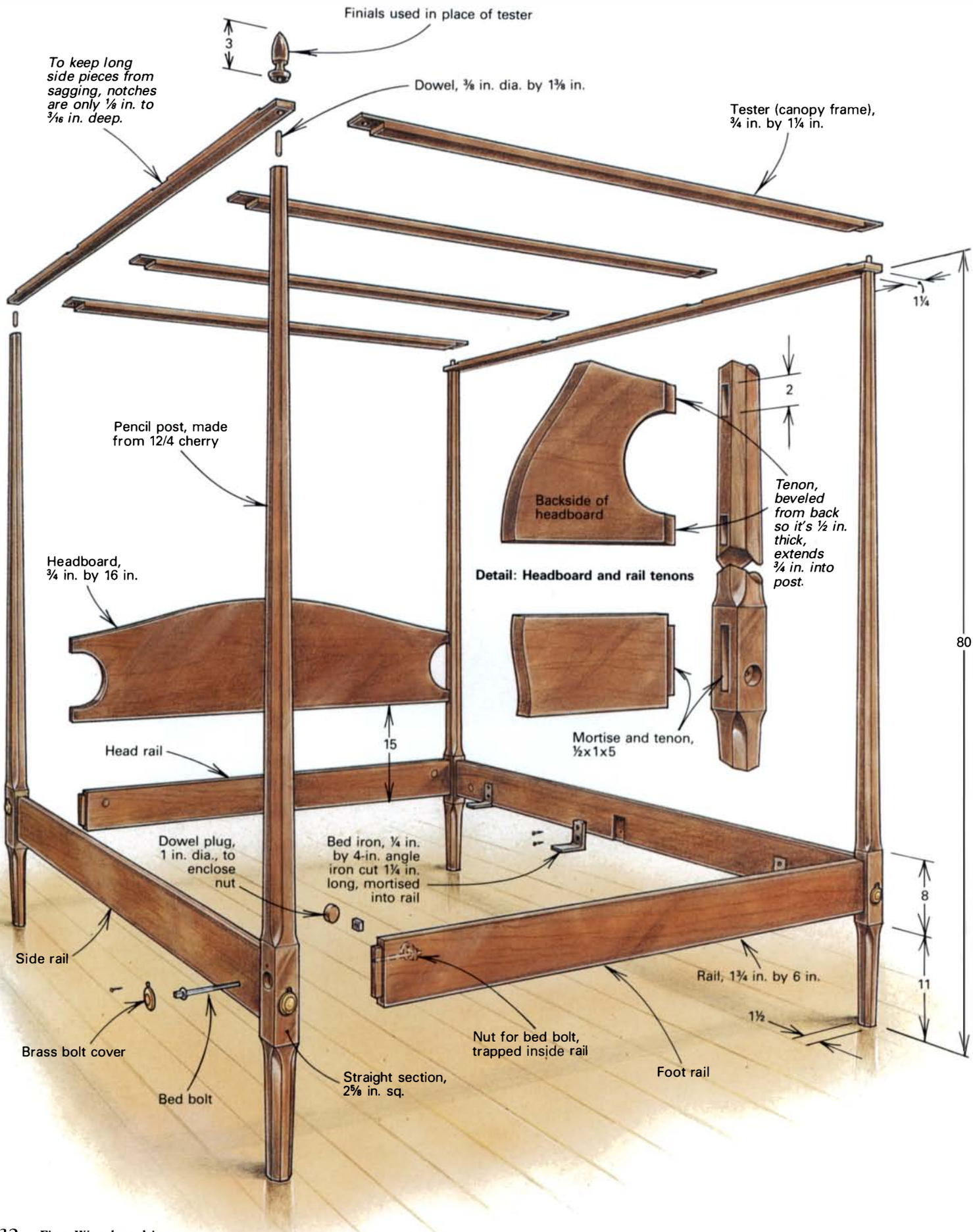
STOCK #	QTY.	DESCRIPTION	PRICE	TOTAL
GW	1	1989 Catalog (free with order)	$4 00	

Sub Total	
Sales Tax	
Shipping	$2.95
Grand Total	

If you call in your order, be sure to tell us you are ordering from this ad.

New York Residents add applicable Sales Tax

Fig. 1: Pencil-post bed



The Pencil-Post Bed

Jigs for machining tapered octagons

by Christian H. Becksvoort

The pencil-post bed is a classic form that has been in use for centuries. The high posts were originally designed to hold a canopy frame, or tester (pronounced teester), as shown in the photo at right. Before central heating, a canopy was standard equipment and was often accompanied by thick, quilted curtains on all four sides. Drawing the curtains at night created a room within a room designed to conserve warmth and provide privacy. In warm weather, the heavy curtains were replaced by fine lace netting, which offered protection against insects. Today, the testers are covered with either net or lace canopies or left bare, a decorative reminder of earlier times. I usually turn finials for the tops of the posts so the customer has the option of removing the tester entirely and capping the posts with the decorative turnings.

Traditionally, bedding was supported by a rope mattress woven between the bed rails. Early on, the rope also held the bed parts together, but around 1750, builders switched to bed bolts, which could hold the bedstead securely together even when the rope mattress started to sag. The 6-in.-long bed bolts I use extend through the posts and thread into nuts that are trapped within the side rails *and* the head and foot rails. On conventional, low-post beds, the headboard and footboard are usually glued up and knock-down hardware is used for assembling the side rails. However, it would be difficult, if not impossible, to move an assembled headboard with tall pencil posts upstairs, through doors and around tight corners. Therefore, a pencil-post bed must be made to knock down completely into individual members: four posts, two side rails, a head rail and foot rail, a headboard and a six-piece canopy frame and/or four finials. Besides the eight bed bolts that secure the rails, the bed is held together by the mortises and tenons where the rails and headboard join the posts, and the lap joints on the tester.

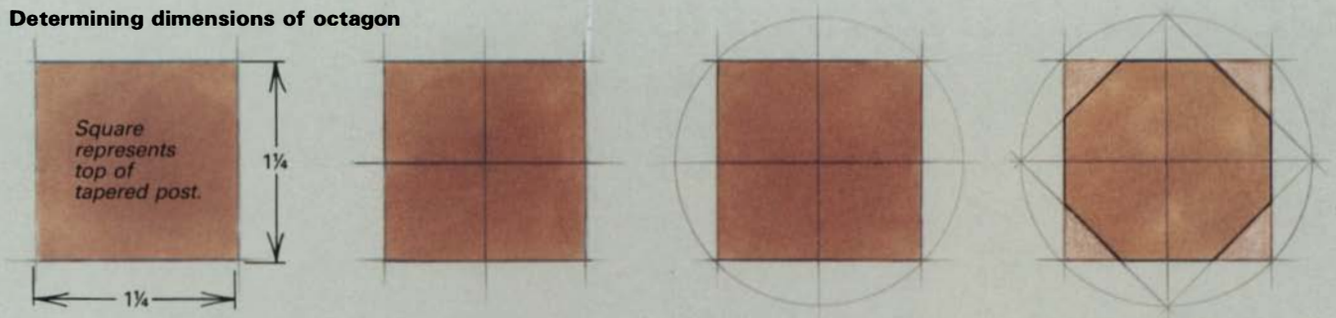
Before building this or any bed, check and recheck the actual box-spring dimensions, because they are anything but standard; few people today would want a bed that can accept only a woven rope mattress. I build pencil posts only in full- or queen-size, purely for reasons of proportion. The single-size seems too narrow and tall, while the king-size begins to resemble a cube.

Pencil posts—The evolution of tall bedposts has been from massive square posts to thinner and tapered posts, then to even more delicate, eight-sided tapers, the shape we now associate with pencil-post beds (though most pencils today are six-sided). In addition, I prefer to taper both the upper portion of the post and the shorter, lower portion below the rails. I used to bevel the corners of the tapers with a handplane or spokeshave to create an octagon. This was time-consuming and presented the risk of tearing out the grain as well as the problem of shaping a smooth transition from the bevels to the square portion where the rails join the posts. To simplify this, I devised the two simple jigs shown in figure 3 on the next page. I use the jigs in conjunction with a tablesaw molding head, but they can be used with a shaper or a table-mounted router and a 45° cutter (you'll need 1 ⅛ in. of cutting surface). The posts are first roughed out on the bandsaw, and the tapers are cleaned up on the jointer. Then, the corners of the tapered portions are beveled into octagons by running them over the molding head, using one jig for the upper portion and the other for the lower portion. Cutting the bevels by machine saves time and virtually eliminates tearout and, because of the cutter's arc, automatically leaves a smooth transition from the bevels to the square portion of the post. This results in a completely shaped post right off the ma-

A pencil-post bed with traditional tester or canopy frame is shown above. The eight-sided, tapered posts are mortised to receive the four bed rails, which are held in place with bed bolts concealed behind the brass bolt covers. There are no glued joints, so the entire bed can be disassembled for ease of transport.

Drawings: David Dann

Fig. 2: Determining dimensions of octagon



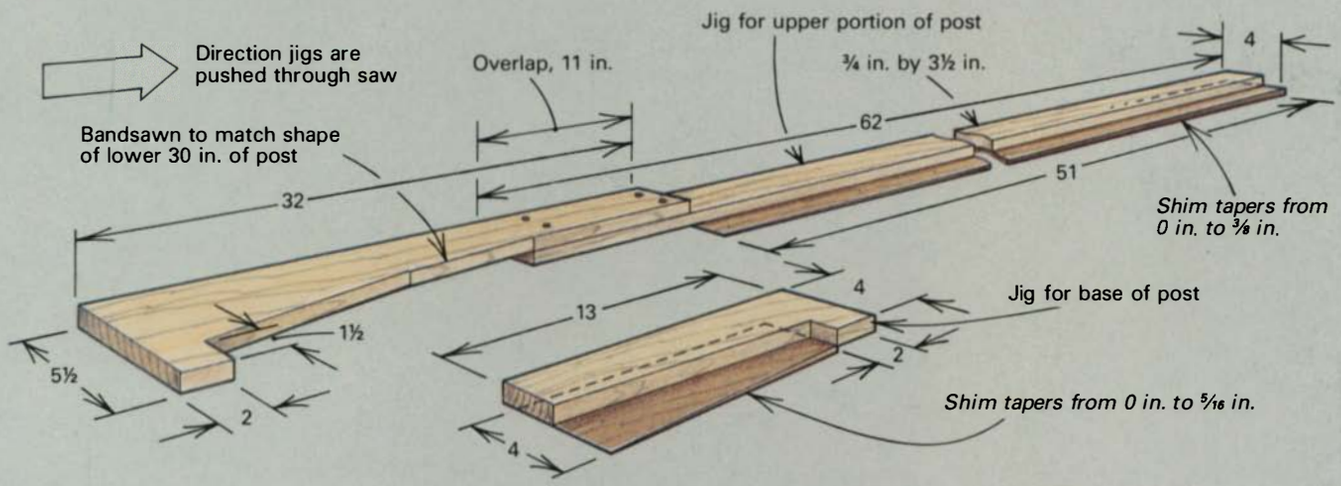
A. Draw square to the dimensions of the piece to be made into octagon.

B. Divide sides of square in half with 'crosshairs.'

C. Draw circle that circumscribes square.

D. Connect points where 'crosshairs' intersect circle. Octagon is inscribed within original square.

Fig. 3: Jigs for sawing tapered bevels



The photo at left shows the setup for beveling the upper portion of the post. An auxiliary fence and the height of the 45° cutter in the molding head are set to expose 1 1/16 in. of cutting edge. Above, the author bevels the base of the post with the smaller jig. The larger jig pushes the post past the cutter; the smaller jig is pushed with the post; both jigs help to safely hold the post against the fence. The lines on the fence and the post indicate where to stop the cut.

chine, with nothing left to do but sand out the machining marks.

To make the posts, I begin with 12/4 stock up to 12 in. wide by 7 ft. or 8 ft. long. Since I don't have a jointer wide enough to true up one face of these planks, I lay out the posts on the rough wood, using a pattern cut from ¼-in.-thick Masonite. My pattern is 80 in. tall, which, adding 3 in. for the finial, gives a total height of just under 7 ft. The untapered portion of my posts, the section that will contain the mortises for the rails, is 8 in. long by 2⅝ in. sq. and begins 11 in. from the bottom of the post. The post tapers from this 2⅝-in.-sq. section to 1¼ in. at the top and 1½ in. at the bottom (see figure 1, p. 32). Because of this taper, you can save a fair amount of wood by reversing the pattern as you lay out the posts side by side.

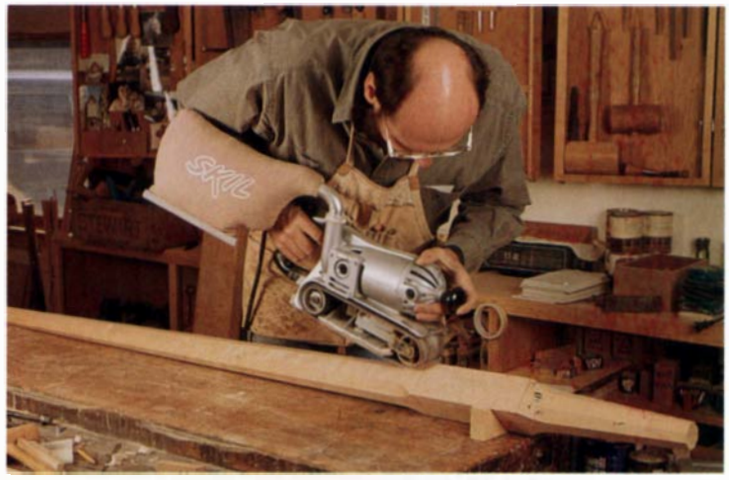
After all four posts are laid out, bandsaw them apart, leaving them slightly oversize. Then, square up two adjacent sides of the 2⅝-in.-sq. by 8-in.-long section on the jointer, working to the pattern line on the side that's laid out. You only need to true up the area around the square sections, because you'll be bandsawing tapers on the rest of the length of the post. Then, bandsaw the top and bottom tapers on the posts, leaving the pattern lines to work to when cleaning up the shape on the jointer later. Crosscut the posts to length on the pattern lines, then lay out the pattern on the adjacent side of the posts that was previously trued on the jointer. Bandsaw away the waste, then take the posts to the tablesaw and clean up the bandsawn sides of the 2⅝-in.-sq. sections by ripping them 2 1/16 in.

thick. Take the posts to the jointer and clean up the tapers to the pattern lines. One final pass on the jointer will plane off the saw-marks from the square sections and bring them to 2⅝ in.

To complete the shaping of the posts, you must bevel the corners of the tapers to make them eight-sided. The beveling jigs are designed to cut bevels that increase in width as the post increases in width, so that at any given point, all eight sides are equal in width, forming an equilateral octagon in cross section. Figure 2 on the facing page shows my method for determining the dimensions of the octagonal cross section at the top of the posts. On a piece of paper, draw squares to represent the dimensions of the post's top, bottom and square section, and use this method to determine the octagon's size at each of these points. You will have an octagon with 17/32-in. sides inscribed within the 1¼-in. square representing the tops of your posts and an octagon with ⅝-in. sides for the 1½-in.-wide bottoms of the posts. Draw these octagons on the top and bottom of one of the posts, to use as a reference when setting the fence of the tablesaw and the height of the cutter. The 2⅝-in.-sq. portion of the post will give you an octagon with 1 1/16-in. sides. This will be the maximum length of the cutting edge that should be exposed when the molding head's height is set.

The jig for beveling the long, upper portion of the posts, shown in figure 3 on the facing page, consists of a cradle glued to a tapered shim that gradually lifts the post's length off the machine table, thereby yielding a tapered bevel cut. The shim is about 4 in. wide and 51 in. long, and tapers up to ⅜ in. thick. It's glued under the 62-in.-long 1x4 portion of the cradle so about 2 in. of the shim's width overhangs the full length. This overhang will lift and support the post, although part of it will be ripped off with the first pass on the tablesaw. The lower portion of the cradle is bandsawn from a 32-in.-long 1x6, to conform to the shape of the lower 30 in. of the post and to wrap around the bottom end of the post, acting as a push stick. The two parts of the cradle are screwed together, with the shorter portion on top, which raises the push-stick part of the cradle enough to contact the bottom of the post completely. The smaller jig for beveling the bottom of the post is built on the same principle, except in this case, the post pushes the jig instead of the jig pushing the post. This variation makes it easier and safer to control the post for the short, lower portion of the post and vice versa for the longer, upper portion. The shim for the smaller jig is 4 in. by 11 in., tapering from 5/16 in. to zero. It's glued to a 13-in.-long 1x4, bandsawn to fit the post's taper and to wrap around the post's bottom.

The setup I use, with a tablesaw molding head fitted with shop-made 45° bevel cutters, is shown in the lower, left photo on the facing page. The same basic procedures would apply to a router table or shaper. Our earlier calculations told us that the sides of the octagon at the largest portion of the post are 1 1/16 in. wide. So, we now set the cutter and an auxiliary fence to expose 1 1/16 in. of the cutting edge so we can cut the tapered bevel in one pass. To double-check this, place the post, with the octagons drawn on its ends, on the larger jig so that the tapered, top portion of the post will run along the saw's fence, as shown in the photo. Raise the cutter so that at the peak of its arc it will bevel the corner right up to the side of the octagon. Slide the fence over to the side of the post and lock it in place, with the cutter centered on the octagon's side. With this setup, you can bevel all four upper corners on each post as well as all four lower corners. The jigs themselves compensate for the different tapers of the upper and lower portions of the post. After setting the fence and the cutter height, use a square and a felt pen to mark on the fence the location where the cutter goes into the table. This is the point where the cutter begins its cut. In addition, mark each post at 11 in. and 19 in. up from the bottom. This designates where to stop the cuts, preserving the square section.



With the shaped post supported by a simple V-block, Beckswoort beltsands the machining marks from the tapered bevels of the octagon. A smooth, continuous motion and a light touch with the nose of the belt sander are requirements for sanding the curving transition from bevel to square.

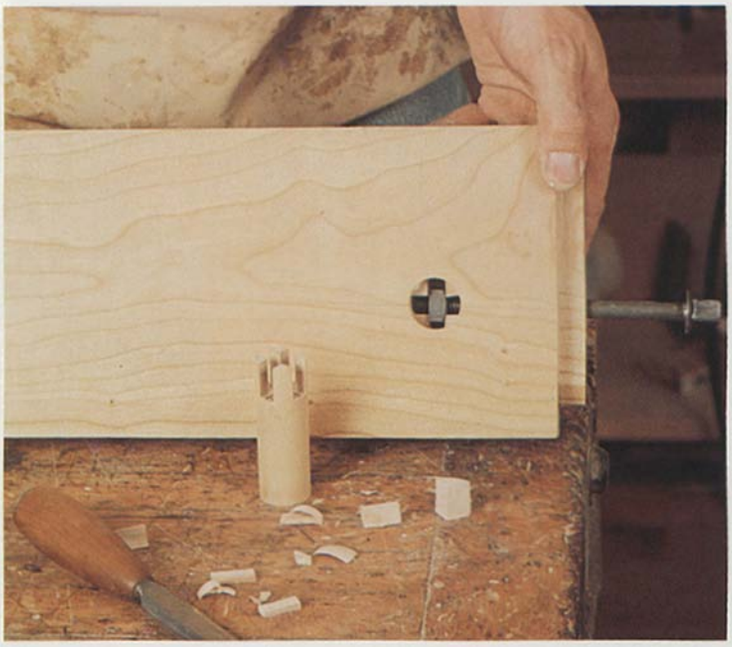
Push the jig and post, with its tapered side running along the fence as shown in the lower, left photo on the facing page, over the spinning molding head. When the line on the post indicating the top of the square section meets the line on the fence, pull the post and jig away from the fence. Repeat this procedure for the other three corners to form a tapered octagon on the top section of the post. Bevel the bottom of the post in the same way with the smaller jig, as shown in the lower, right photo on the facing page. Stop the cut when the line at the bottom of the square portion lines up with the line on the fence. Repeat the cuts until the four corners are beveled. Once all four posts are beveled top and bottom, you've completed the most difficult part of the bed.

I sand the machine marks from the bevels with a belt sander. With experience, a light touch and a confident hand, I've gotten so I can use the front wheel or "nose" of the belt sander to sand the curving transition without making it wavy (see the photo above). If you don't feel comfortable using a belt sander for this, a cabinet scraper and a hand-sanding block will do the trick.

Rails, mortises and bed bolts—Traditionally, the rails on pencil-post beds were nearly square (2⅝ in. by 3 in. was common), to resist the inward pull of the rope mattress and the downward weight of the bed's occupants. However, today's beds rely on a box spring that only bears *down* on the rails, so the more familiar, 1-in. or 2-in. by 6-in. board-on-edge serves nicely. I mill my rails from straight 8/4 stock to a finished size of 1¾ in. by 6 in. The 6-in. width hides all but 1 in. or so of a standard box spring.

The mortises for the rails are ½x1x5 in. and centered top to bottom and side to side on two adjacent faces of the square section of the posts. This ½-in. depth may seem shallow for bed-rail mortises, but cutting the mortises deeper would only weaken the posts. Besides, the bed bolts hold the tenons tightly in the mortises and help support the downward force on the rails, while the mortises and tenons provide alignment and prevent inward rotation of the rails. In the past, I've done my share of routing, drilling and chiseling mortises, but I now have the luxury of a horizontal mortising machine. However you cut your mortises, be sure they are all the same length and the same distance from the bottom of the posts. Use a square to lay out for the length of the mortises, transferring the lines around the corner of the adjacent faces of the post. Accuracy here will ensure a level mattress support.

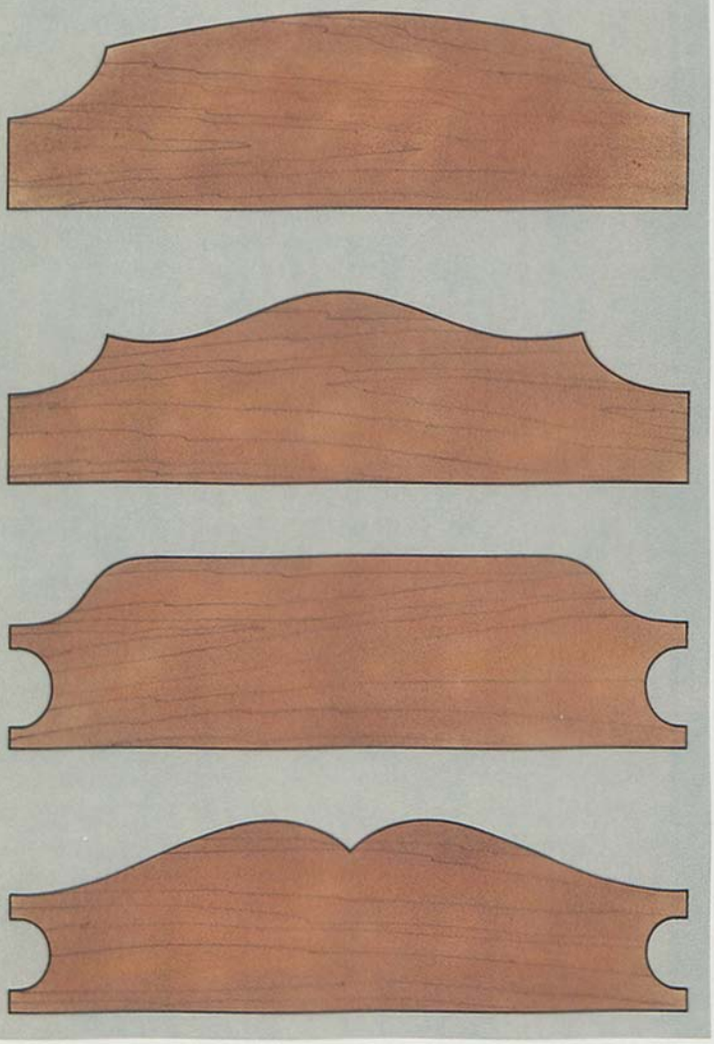
After the mortises in the posts are complete, the two side rails



The nuts for the bed bolts are dropped into a 1-in.-dia. hole that intersects the bolt hole. Pie-shape pieces are bandsawn from a 1-in. dowel, chiseled to fit around the nut and glued in place to keep the nut aligned with the bolt hole. The nut is then trapped in place with a glued-in dowel plug.

Fig. 4: Headboard profiles

The style and design of a pencil-post bed can be altered simply by varying the headboard shape.



and the head and foot rails are crosscut to length to suit the size bed you're building. Double-check the box-spring dimensions, and don't forget to add 1 in. for the ½-in. tenon on each end of the rails. Add an extra ¼ in. to ½ in. so the box spring is easier to install or remove, and take into account the 7/16 in. the rails are set back from the inside corner of the posts. The ½x1x5-in. tenons are cut on the ends of all four rails, using whatever method is comfortable for you: backsaw, tablesaw, router, or even bandsaw or radial-arm saw. Because these joints will be assembled and disassembled, the tenons should slide into the mortises easily but without excess play. To ease assembly, sand or file a 1/16-in. bevel on the tenon corners and around the perimeter of the mortises.

After fitting the tenons to the mortises, you're ready to drill for the bed bolts. To locate the holes in the posts, I made a rectangular plug that fits into the mortise. On this plug, I marked the vertical center of the mortise and then drilled two 7/64-in.-dia. holes through the plug: one ½ in. above center for the head and foot rails; the other ½ in. below center for the side rails. These holes accept a 6d finish nail, which is inserted through the appropriate hole and tapped into the mortise to locate the bolt holes. With the drill press, I drill a ⅛-in.-dia. hole from the mortise through the post to locate the hole on the outside of the post. Then, I turn the post over, and using a 1-in.-dia. Forstner bit, drill a ¾-in.-deep hole to countersink the bolt head. Finally, I change to a ⅜-in.-dia. twist bit and drill back through the ⅛-in.-dia. hole to the inside of the mortise. I repeat the procedure for the other seven bolt holes.

The bolts will extend through the holes in the post and into holes in the tenon ends of the rails. To align these holes, mount a rail horizontally in a bench vise, find the mating post and mortise for that particular rail end and slide the mortise onto the tenon. Hold the post in place with one hand while you drill a ⅜-in.-dia. hole through the post-bolt holes into the tenon ends. Unless you have an extra-long bit, you'll need to remove the post and extend the hole 4 in. deep into the rail to accommodate the 6-in.-long bed bolts. Repeat this procedure for the remaining tenons. The rails are now ready for nut holes.

To locate where the nut will be trapped in the rail, lay the rail on the bench, with its inside face up, and slide a bolt partially into the tenon hole. Align a straightedge with the centerline of the bolt shaft; with a pencil, mark this centerline on the rail. Measure in about 3 in. from the tenon shoulder, along the bolt's centerline, and use an awl to locate the hole you'll drill for the nut. This should fall about ⅜ in. from the end of the bolt. Traditionally, the nut was dropped into a ⅜x1x1¼-in. slot chiseled into the rail. A plug was then cut and glued into the hole to prevent the nut from falling out. These slots can be chopped by hand or cut with a ⅜-in.-wide hollow chisel or a plunge router and jig. I find it easier to drill a 1¼-in.-deep hole with a 1-in.-dia. Forstner bit. Then, I drop the nut into the hole and screw the bolt through. To hold the nut in place, I bandsaw a ⅜-in. by ⅜-in. cross out of the end of a 1-in. dowel, saw off the four remaining pie-shape pieces and pare them with a chisel until they fit snugly around the bolt and nut, as shown in the photo this page. I glue them into place around the nut, leaving the bolt threaded through the nut until the glue sets, to ensure proper alignment. Then, I plug the hole with a 1-in.-dia. dowel.

Next, I mortise the inside faces of the two side rails to receive the bed irons that support the box spring (see figure 1). You can have a local blacksmith or machinist cut 1¼-in.-long pieces from ¼-in.-thick 4-in. by 4-in. angle iron or bend ¼x1¼x8-in. stock to 90°. You can also purchase them from one of the sources listed at the end of this article. The irons should be drilled and countersunk for #12 flat-head screws. The mounting screws should be 1 in. to 1½ in. long. Each rail should have one iron 10 in. to 12 in. from

Toying with tradition

Photo: Kip Brundage

Just because the pencil post is a traditional form doesn't mean it has to look traditional. Here are two variations that toy with the pencil-post theme.

A few years ago, I made a "real" pencil-post bed for an architect. The photo (far right) is the model I made from actual pencils. To make a full-size bed, the pencil posts had to be 11 times the actual pencil size. I made four pencils 3⅛ in. by 82½ in. tall. I used cherry, because Port Orford cedar, the usual pencil wood, is a bit too weak and difficult to obtain in 16/4 stock. The posts were cut to six sides and sharpened with a block plane; the grooves and flutes for the eraser holder were carved in, as was the lettering. I painted the posts to match a pencil's colors. The headboard is a section of ruler, to scale.

A friend of mine, David Stenstrom of Portland, Me., built the pencil-post bed in the photo (right) from maple, then had it sprayed to a high-gloss, candy-apple red. The expected clash of style and color results instead in a stunning piece you can't take your eyes off. —*C.B.*

Don't write-off the diminutive pencil-post bed (right) as just a small pun: Beckswoort made it as a model for a full-scale version. Woodworker David Stenstrom grew tired of his traditional cherry pencil-post bed, so he built another (left) and lacquered it bright red. The form is so simple and the lines so clean that this contemporary treatment doesn't seem at odds with the design of the piece.

each end and one in the middle. I mortise them into the inside face of the rails so the angle is flush with the bottom of the rail.

Headboard and tester—The bedstead is not complete until you've made the headboard. You can choose from a variety of shapes, such as the profiles shown in figure 4 on the facing page, or you can design your own. I prefer a simple curved top with a semicircle cut out of each end. My headboards are 14 in. to 18 in. wide, depending on the bed's size. To determine the length and placement of the headboard, assemble the head rail and two posts. Measure up about 15 in. (the combined thickness of box spring and mattress) from the bottom of the rail, and mark this point on both posts. This is the bottom of the headboard. To determine the headboard's length, measure between the posts where the upper tenons will be and add 1½ in. for the two ¾-in.-long tenons that extend into the posts. I glue up ¾-in. stock to the desired width and bandsaw the headboard to shape. Make the four tenons that anchor the board to the posts about 2 in. wide and bevel them in back so the part of the tenon that extends into the posts is about ½ in. thick. Then, place the bottom of the headboard against the marks on the posts and locate the exact positions of the tenons (mortises-to-be) on the inside facets of the posts. Disassemble the head rail and drill, chisel or rout the mortises. The angle created by the posts' tapers is so minor over the 12-in. distance between tenons that it's easy to compensate for by slightly angling the top and bottom of the mortises with a chisel. The fit should be loose but not sloppy, as this is not a glued joint. Reassemble the entire head unit to check for fit.

Now the posts, rails and headboard can be finish-sanded. If they were shaped and planed with no major tearouts, I begin with 120 grit and sand through 400 or 600.

The tester is made from ¾-in.-thick stock, ripped to 1¼ in. wide to match the width of the post tops and joined with unglued lap joints. If it was glued together, you'd have a large, flimsy, unwieldy frame to contend with when it was removed for transport or storage. The tester's corners are anchored with dowels in the four post tops.

Determine the size of the tester frame pieces by assembling the bed and measuring from the top of the posts, outside to outside. Make the lap joints in the side frames shallow, ⅛ in. to 3/16 in. deep, to help prevent sagging. Cut four crosspieces, one for each end and two middle pieces; lap their ends to fit the laps in the side pieces.

I use a doweling jig to drill the ⅜-in.-dia. by ¾-in.-deep holes into the tops of the posts for the dowels that secure the tester frame. To aid in clamping the doweling jig to the tapered posts, I cut off a chunk from the thick ends of two of the strips bandsawn from the post tops and use them as spacers. I chamfer both ends of ⅜-in.-dia. by 1⅜-in.-long dowels and insert them in the post tops. Drill ⅜-in.-dia. holes through the corner laps of the tester frame to fit over the dowels in the tops of the posts.

As an alternative to the tester, I also turn finials for the posts. Traditional forms include the ball, acorn, urn, tall urn and flame. I've settled on a modified acorn pattern borrowed from a Shaker chair design. Drill a ⅜-in.-dia., ¾-in.-deep hole in the bottom of the finials to fit over the dowels in the post tops.

The bed featured here is made from cherry with an oil finish, but it looks just as nice in American mahogany, walnut or figured maple. After finishing, the bed irons are attached and decorative bolt covers (usually six) are screwed over the bolt holes. □

Christian H. Beckswoort builds custom furniture in New Gloucester, Me., and is a contributing editor to Fine Woodworking.

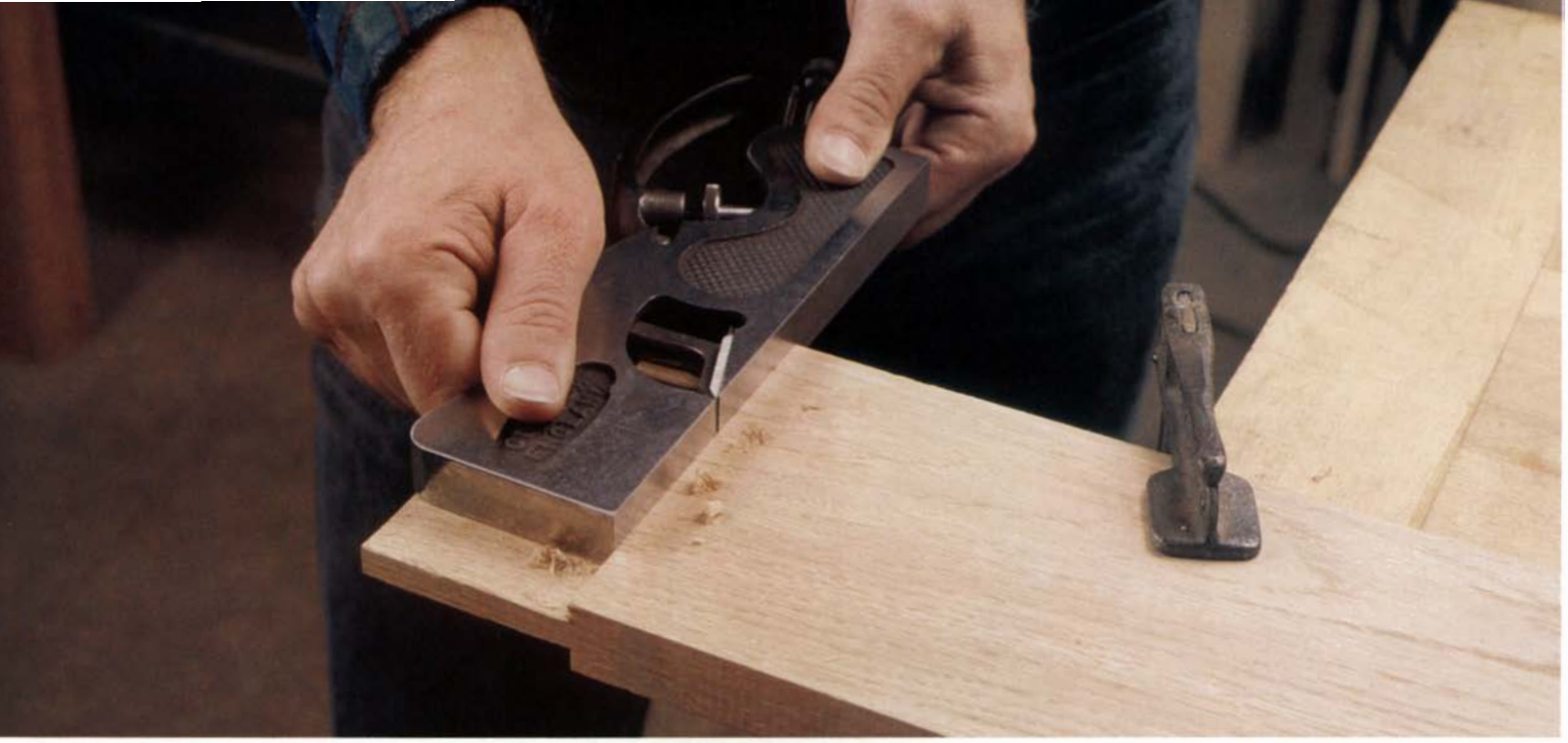
Sources of supply

Bed bolts and nuts, wrenches, angle irons and bolt covers (both pressed and cast):

Ball & Ball, 463 W. Lincoln Hwy., Exton, PA 19341; (215) 363-7330.

Horton Brasses, Box 120F, Cromwell, CT 06416; (203) 635-4400.

Period Furniture Hardware, Box 314, Charles Street Station, Boston, MA 02114; (617) 227-0758.



A shoulder plane's sides and sole are milled perfectly square so it can shoot along the face of a tenon to true up the shoulder. Its top edge is contoured to provide finger grips when used on large tenons. Made to refine rather than create joints, a shoulder plane is a precision tool.

Shoulder Plane

Unmatched for precise trimming in 90° corners

by Maurice Fraser

It's hard to imagine life without a trusty shoulder plane. When you need to trim a tenon's end-grain shoulder, fine-tune a rabbet joint or smooth flush up to an obstruction, you can rely on the control and finesse of a shoulder plane. While its cousin, the rabbet plane, efficiently cuts joints, the shoulder plane was born to refine or correct existing ones: The joint is its shooting board. If things always went perfectly, correctives wouldn't be needed. But erring, reportedly, is human, and that's when these tools can be "divine."

Shoulder planes probably didn't appear much before the mid-1800s. They are likely a product of the burgeoning of metal technology during the Industrial Revolution, when metal sheathing was applied to wooden objects, from handplanes to ships. Metal tools have several obvious advantages over wooden ones, including dimensional stability and the wear resistance of contact surfaces. A more subtle point is how metal elevated the plane body from a mere blade holder to a major contributor to the finesse of cut. The shoulder plane is a prime example—a classic wooden rabbet plane that was not simply ironclad but transformed into something quite new.

Before the Industrial Revolution, worn, wide-mouth wooden planes were a fact of life. Toolmakers could shrink mouth openings by flipping the blade, bevel upward, and thereby eliminate the gap between the mouth's rear lip and the blade's cutting edge. But this combined the blade's 30° bevel with the plane's 45° blade-seating angle, resulting in an unworkable 75° total cutting angle. A 15° blade-seating angle would compensate, but would result in a very thin sole behind the mouth. Such a thin sole, impossibly fragile in wood, *was* possible in metal. The new mouth, narrower by more than 300%, not only supports the cutting edge better, but makes the cutting action almost integral with the sole itself, as though a sharp rear lip of the mouth were cutting. These durable, hair-fine mouths (see the left photo on the facing page) promised a way to refine planing, parallel to that offered by the then new-fangled cap iron. Other finessing tools evolved this way as well: the miter plane, chariot, thumb and small miter block (today's block plane). But only the shoulder, from out of the rabbet plane's body, carried this genetic trait: It could work into corners.

Shoulder or rabbet?—Today, books and catalogs, as well as their readers, confuse shoulder planes with rabbet planes. That's understandable: Simple rabbet planes are near look-alikes of shoulder planes. Both are slim, unhandled and have blades, at full body width, coming through the plane's sides. Besides, manufacturers love to blur terminology to make the buyer think he is getting both in one.

The right photo on the facing page compares shoulder planes to rabbet and dado planes. Because they're designed to cut joints, "complete" rabbet planes have fences, depth gauges, cross-grain

scoring spurs and handles. Shoulder planes, meant for trimming, don't need these accessories. Rabbet planes, for good chip clearance, are big mouthed; shoulder planes conversely are soft-spoken. Both cut at the same 45°-50° angle, but shoulder planes do so with their bevel up and a low 15°-20° seating angle (see the drawing detail on the next page). Add to this that the tops of shoulder planes have curves, to provide a grip when shooting along a large tenon, and they are always metal bodied (some with wooden cores). Rabbet-plane bodies are either all wood (old style) or all metal.

There's a third species, I'll call a trim-rabbet plane, that might be an intermediate stage from wooden rabbet to shoulder plane. It has a steel body with a wooden core and its blade bevel is up, but it has a steep 58° cutting angle. In effect, it's a high-angle shoulder plane, good for highly figured long grain and cross-grain in rabbets, but cranky on endgrain.

Uses of the shoulder plane—One of the principal uses of the shoulder plane is correcting tenon shoulders that have been cut high, round or canted. When doing so, clamp the work horizontally and rest the plane's side on the tenon's face, as shown in the photo on the facing page. Begin by pressing the nose of the plane onto the work surface, to avoid tilting the plane during the first inch of the cut. In addition, tenon faces can be planed cross-grain if minor corrections are necessary.

There's also a subspecies of shoulder planes, bullnose planes, that add considerable versatility. They are easy to grip in one hand, and their bobbed nose lets them work almost smack up to a wall. Other than their small size and nose, they are identical in design and performance to shoulder planes.

Shoulder and bullnose planes excel at fine-tuning frame rabbets, where panels or glass can't be trimmed; softening tongue or groove corners; and paring (or thinning) tongues to ease insertion, especially with breadboarded tabletops. Correcting lap or halved joints, or dadoes, with "petite" models is a snap. They're indispensable for cleanup in tight areas, like lap dovetails behind lipped drawer fronts, tablesawn raised-panel bevels or tool-torn quirks on moldings and rule joints. And, no other handtool forms knuckle-joint "necks" or secret dovetail miters as precisely.

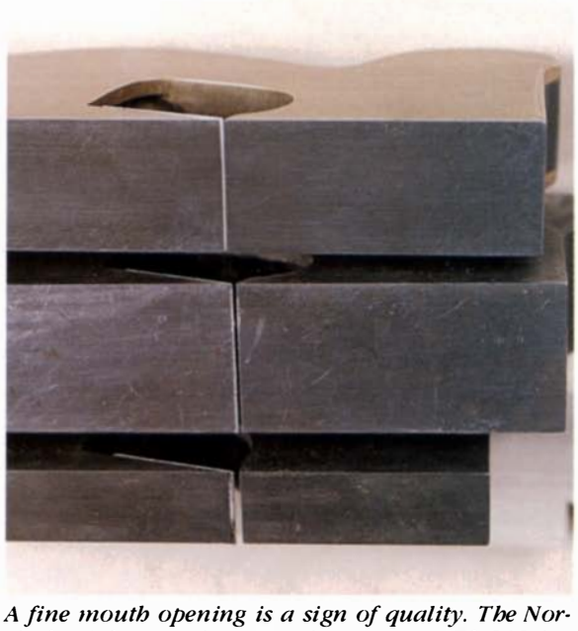
Grinding and setting the blade—The cutting edge of a shoulder-plane blade must be kept perfectly square with the blade (and plane) sides when it's sharpened. Other plane blades correct easily, with lateral adjustment, but any corrective tilting here will make it impossible to set the blade so it protrudes equally from each side of the plane body. You have to grind the cutting edge perfectly. Even the smallest discrepancy in blade-corner depth can spoil joints.

After grinding a 25° bevel on the cutting edge, insert the blade into the plane body so it protrudes equally from both sides. Inspect the barely emerging cutting edge. If it's not square, scribe a pencil line behind the blade's edge, bearing against the rear lip for reference. Then, regrind to this line. Persistent small errors can be honed off on a medium-grit stone, using greater hand pressure at the appropriate corner.

Next, remove the burr and hone in a 5° second bevel, either a traditional full one, with a medium stone, or a microbevel, with a hard Arkansas or its equivalent. (Both styles total 30°.) I prefer the latter, because the microbevel can easily be removed by honing to the 25° bevel and started anew, as opposed to retaining and enlarging it with each honing. With this method, you can rehone easily for a long time and postpone the need for the perfect regrinding of the primary bevel. Some prefer honing a single 30° bevel.

Insert the sharpened blade diagonally into the oblong entry opening with care, to avoid nicking it on the plane's interior. When the blade appears in the mouth, guide it to rest with the left hand. For endgrain or difficult figured grain, the front lip of an adjustable mouth should be set between 1/100 in. and a full 1/64 in. from the cutting edge. On most hardwoods, between 1/64 in. and 1/32 in. will probably allow sweet, clog-free shearing. The depth of cut should be just enough to produce a continuous shaving. Sawdust means too light a cut; an opaque chip, too heavy. On some planes, the final tightening of the hold-down lever or wedge gives a microadjustment toward a fuller cut. If so, learn to compensate.

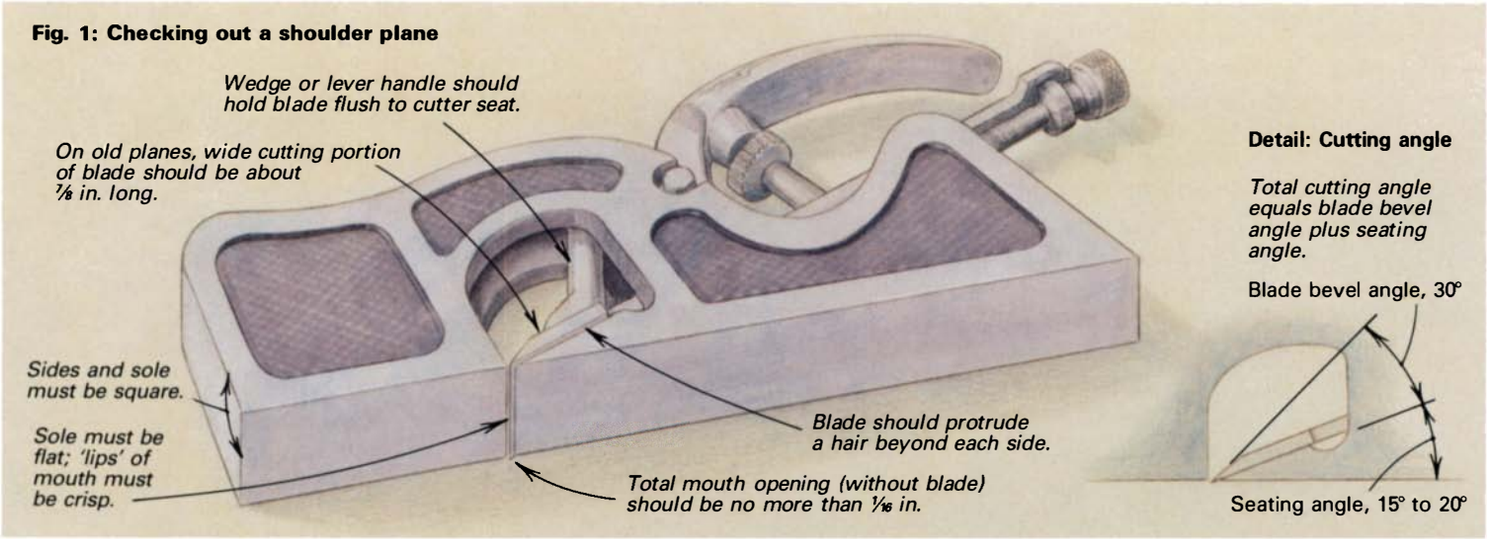
Choosing a shoulder plane—Let me share some hard-earned prejudices. First, large, heavy shoulder planes offer more delicate control and refinement of cut than the smaller versions—even on small work. Their length lends linear accuracy; their mass acts as a



A fine mouth opening is a sign of quality. The Norris (top) has a minute cutting aperture of .010 in.; the Mathieson (middle), an acceptable .025 in; and the Record #042 (bottom), a marginal .051 in.

The rabbet plane (right, top) and dado plane (right, bottom) have fences and depth gauges for cutting joints. Shoulder planes (left), for trimming joints, never do. They have fine mouths, with their blade bevel up. The trim-rabbet plane (right, center) has a steeper cutting angle than shoulder planes and a straight top.

Fig. 1: Checking out a shoulder plane



shock absorber for cut resistance; their weight seats you into the cut, adding momentum; and their high profile adds a welcome reference surface, especially when working the plane on its side. On narrow ledges, if most of a wide plane hangs over empty space, there's no harm, so long as your fingers feel in control.

Second, if the big tool perches on the workpiece like a horse on a high chair, then it's time to reach for the junior size. Although small planes sometimes chatter and deflect on hardwoods, they will compensate: They are pocketable, will follow slightly bowed surfaces, cut in confined places and work easily in one hand.

Third, two extreme sizes do more than one middling. In the mid-range are Stanley's #93 (6½ in. long) and Clifton's 3-in-1 plane (6 in. long). The latter has interchangeable noses to go from shoulder to bullnose plane, or it can drop its nose to become a chisel rabbet plane. These well-made planes work satisfactorily, but they lack the authority of larger planes and the maneuverability of smaller planes.

The chart on the facing page lists models currently being made and available through many large mail-order tool companies and local suppliers. Of these, the most versatile package consists of Record's massive but refined #073 (mouth and blade adjustment) partnered by the compact Stanley #92, plus Stanley's #90 bullnose for small or enclosed work (see photo below)—David and Goliath, plus a mascot, on the same team.

The chronology of shoulder and bullnose planes. Top to bottom: (19th- to mid-20th-century British), bronze and ebony Norrises; (20th-century British), Record #042, with depth adjustment, and Preston bullnose; and (20th-century American), Stanley #92, with adjustable blade and mouth, and Stanley #90 bullnose.

Shopping for a classic or a bargain—The tools mentioned earlier are currently made...and are good. But, a working antique *might* be better, especially cheaper. Antique tool dealers and auctions are worth a look, but you must be knowledgeable about the types and merits of the planes you'll find.

The photo below, left, shows three shoulder planes and their bullnose counterparts. Each represents one of three basic categories, based on when, where and how they were made. The best shoulder planes are the original British models: simple, solid and elegant. They were hand-assembled, from Victorian times until World War II, by firms like Slater, Spiers, Mathieson and Norris. The tool's dovetailed steel shell houses a rosewood core and wedge, which sandwich a stout Sheffield blade that is adjusted manually by sight and touch. It takes a little practice, but once set, requires little readjustment. These tools are still available, but you'll pay in the range of $150 for a workable tool to $600 for a fancy bronze and ebony model in mint condition. What you get in return is buttery planing—the legacy of a standard of workmanship now, sadly, historical.

A second category of shoulder plane, the all-metal, screw-adjusted, 20th-century British variant, was pioneered (circa 1900-1930s) by Preston. Originally semi-mass produced but hand-fitted, their hollow iron castings were heavy and well machined, though campy-ornate. In the 1930s, the line was continued by Record, who added an adjustable mouth to the large sizes. There was some post-war decline of quality, the only plus being the elimination of Preston's glitzy nickel plating, which wears badly. Record also deleted many models, a few of which have been reissued recently by the Clifton firm. These tools have proportions and profiles roughly similar to the historic type (Norris, et al.) and at best, can work...oh, nearly as well. And, with their blade-adjusting screw, they *are* user-friendlier. In price ($50 to $120), as in quality, they stand in the middle ground between the Norris type and the current U.S.-designed tools.

The third version of the shoulder plane, the 20th-century American all-metal one, is Stanley's. They've manufactured the #92 and #93 models since 1902, avoiding the term "shoulder plane" in their literature and calling them instead "cabinetmaker's rabbet planes." Lighter, shorter and lower slung than analogous English versions, they trade off some mellowness and alignability for compactness and versatility. They are wickedly adjustable—far exceeding Norris' and Preston's—by screw action. You can change mouth width or blade depth, or drop the nose for close-up (chisel-planing) cuts. The machining quality is as good as ever, despite their auto-bumper nickel plating.

Regardless of class, shoulder planes are finicky. Roughly made (new) or roughly used (old) planes are rarely fine-tunable and

Drawing: Bob La Pointe

Models currently made					
Tool model and type	**Dimensions W x L**	**Mouth adjustment**	**Convert to chisel plane**	**Approx. price**	**Comments**
Shoulder plane:					
Record #073	1¼ by 8⅛	Yes	No	$94 - $99	*The last large classic shoulder plane still made.*
Clifton #420	¾ by 8	No	No	$100	*As above, but less massive. Specialized for shooting narrow ledges. Medium mouth. Remake of Record #042.*
Clifton #410	⅝* by 5⅜ * some are 11/16 in. wide	No	No	$98 - $100	*The smallest shoulder plane now made. Handy. Good partner to large plane. Proper mouth. Remake of a classic.*
Stanley #93	1 by 6½	Yes	Yes	$57 - $60	*Middle member of Stanley's original trio: #92, #93, #94. Useful. Well made and designed. Curious size.*
Stanley #92	¾ by 5½	Yes	Yes	$49 - $52	*Smaller version of #93. Size close to Clifton #410 with added versatility if needed. Good partner to a large plane.*
Bullnose plane:					
Record #077	1⅛ by 4	Shims to 4 widths	Yes	$52 - $55	*Fine appearance. Good Weight. Nose section a bit thick.*
Stanley #90	1 by 4	Yes	Yes	$46 - $49	*Despite glitzy look, a good tool. Better mouth adjustment than #077. Thin nose section cuts closer to obstructions.*
Stanley #75	1 3/32 by 4	Yes	Yes	$25	*Remake of Stanley's 1879 "el cheapo." Poorly machined; still no bargain.*
Clifton #400	⅜ by 3¼	No	No	$70	*Remake of Preston. Wedged blade. Narrowest bullnose available.*
Combination plane:					
Clifton "3 in 1"	Shoulder: 1⅛ by 6 Bullnose: 1⅛ by 4⅞	Shims to 4 widths	Yes	$110 - $115	*Ingenious idea, but clumsy in hand. Pricier and less useful than set of Stanley #92 and #90, but more compact.*

should be avoided. Features to watch for are shown in figure 1 on the facing page and listed below:

1. Fine mouth openings are essential for precise work. On fixed-mouth planes, total mouth width should be no more than 1/16 in. (1/64 in. or less is ideal) and equal all across. Any filing of "lips" to straightness will widen the mouth—a cure worse than the disease. Test adjustable mouths to see if they close parallel and all the way to the blade's edge (zero opening). A skewed front lip can be filed straight. A skewed rear lip, filed back, loses its thin support at/under the cutting edge and is worse off. Better leave it alone.

2. The sole must be machined flat in length and width and not reflect a wavery shine when turned slowly under a light. The mouth must be a crisp slot and not round inwards like lips sucked in. If the sole is slightly out of flat, rub it on wetted 150-, then 220-grit wet-or-dry abrasive paper supported by a thick glass plate. If flaws are great, don't buy it. Skilled machining is expensive, with the risk of mouth-widening or distortion.

3. Sides and sole must be perpendicular to each other. Check this with a good square. Some unscrupulous old-tool dealers grind out pitting and patina...and alignment! Never be suckered into buying these shiny but functionally dead tools.

4. The blade should protrude just a hair beyond each side. It must never be narrower than the body. A blade flush with or narrower than the sides will leave a series of steps with each pass, instead of a single, clean corner. Nowadays, shoulder-plane blades often come too wide for their bodies: Remove the blade and file its edges until they protrude between 1/100 in. to a scant 1/64 in. on each side. If you find a shiny old tool with an over-width blade, beware: Likely the plane body got narrowed (and distorted) by ruinous "cleaning." Original owners rarely left blades too "full."

5. On old tools, the wide, cutting portion of blades should be at least ⅞ in. long (after nick removal on edges and corners). On wedged models, the blade stem should protrude back beyond the wedge for easy malleting. Avoid pitted blade backs: Flattening is tedious and unremoved pits eventually become gaps in the edge. If a lightly pitted blade back is the worse flaw on an otherwise desirable tool, you might level it on a coarse-grit, polka-dot diamond stone. Out-of-true water stones are fatal here.

6. Blades should be held flush to the cutter seat by the clamp, lever handle or wedge. Be wary of replaced wedges. Fine, continuous wedge fit is essential for a solid blade hold-down. Realistically, a cobweb-thin glimmer of light under the blade, though undesirable, is less of a problem with thick-bladed, wedged, old models (with a generous contact area around a rigid blade) than with newer models with thin blades and scanty hold-down levers. So, look a gift shoulder plane in the mouth—a sound one is a boon to craftsman and woodbutcher alike. □

Maurice Fraser teaches woodworking at the Craft Students' League in the Y.W.C.A. at 53rd and Lexington Ave., New York City, N.Y.

Building a Display Cabinet

Production-shop speed with small-shop tools

by Jeffrey Greef

I work in a custom architectural millwork shop, and when I wanted to make a wall-hung display cabinet, I decided to scale down our production methods to suit a small piece of casework. This seemed logical, because our methods for producing large quantities of millwork at the Davenport Mill are accurate and economical. Further, the operations we use for making full-size doors and windows—cutting mortise-and-tenon joinery and cope-and-stick work—are essentially the same for making the parts for a cabinet frame. But cutting small parts on a shaper normally used for thicker stock seemed much too risky for the parts and my fingers. Also, I didn't have the right shaper cutters to allow the cabinet frames to accept glass panels, nor were standard cabinet-door router-bit sets compatible with my design. Not wanting to compromise the joinery or the look of my cabinet, I developed some router techniques for cope-and-stick work and for other shaping on the cabinet. I used stock bits and employed plywood jigs and templates to set up repetitive operations that allow me to build several cabinets in a single production run, if I desire.

The author's handsome walnut display case is built with a combination of production joinery techniques adapted for a router and stock bits. Although the cabinet is designed to hold adjustable glass shelves, here it is shown without them, displaying two Sundanese rod puppets made in West Java by Aming.

My display cabinet, shown below, left, consists of a carcase constructed from front and back frames with shaped stiles and curved top rails, joined together with mortises and tenons. These frames are plate-joined to the side frames. The side frames, as well as the cabinet's hinged door, are cope-and-stick cut and rabbeted to hold glass. The cabinet's arched top is steam-bent and laminated, and it fits into grooves dadoed in the top rails of the frame. The back is a panel covered with fabric. Pins in shelf holes support adjustable glass shelves inside the case.

While most of the work requires only basic cabinetmaking skills, an understanding of sash-making is necessary. In a cope-and-stick sash frame, the inside edges of both stiles and rails are molded; this is the "sticking." For the sticking to mate in the corners, the rail ends are shaped or "coped" to fit the sticking. For more on this, see *FWW Techniques 6*, p. 86.

Building the case—The first job is to size and cut the parts from ¾-in.-stock for the front, back and side frames and the door. It's crucial that all your stock is accurately planed to exactly the same thickness; otherwise, you'll have problems later with the alignment and fit of both the joinery and the molding profiles of the cope and stick. Following the dimensions in figure 1 (facing page), rip all the straight frame members to width, adding ¼ in. extra to those that will receive sticking. The stiles for the front and back cabinet frames are ripped straight, and the curved pattern on the outside edges is cut later. Note that the stiles for the back frame are ¼ in. wider than the front ones, to provide extra width for the sticking. Next, cut all frame members to exact length, leaving an extra 1¾ in. on the rails for ⅞-in.-long tenons on the ends.

To avoid the weakness of cross-grain, each of the cabinet's three curved top rails (two for the cabinet frames, one for the door) are glued up from three separate pieces joined together, as shown in figure 2. This rail assembly may not look as good as one cut from a single, wide board, but it will be stronger and less subject to distortion from expansion/contraction. To keep the pieces from shifting out of alignment due to clamping pressure during glue-up, tack on a small scrap strip at the joint before clamping. Don't drive the nails in too far; otherwise, the holes will show in the finished rail. After tightening the clamps, check for flatness by laying a ruler on the stock perpendicular across each joint.

I template-rout the rails to ensure that the outside curve of the door will match the inside curve of the front rail. Two templates need to be made: one for the carcase rails and one for the door rail. I make the templates from ¼-in. Baltic birch, each the same

Drawings: Joel Katzowitz

Fig. 1: Display cabinet

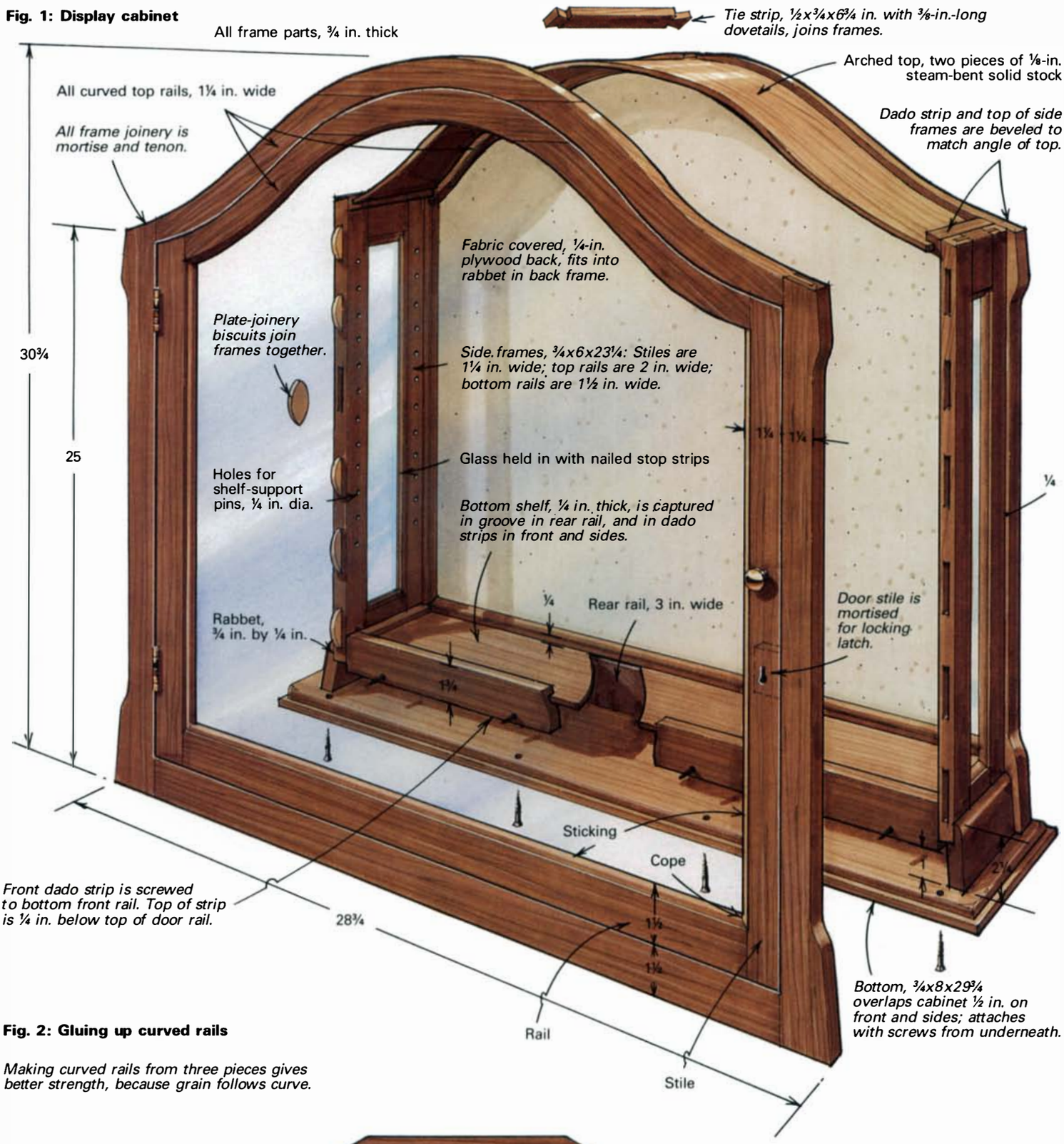
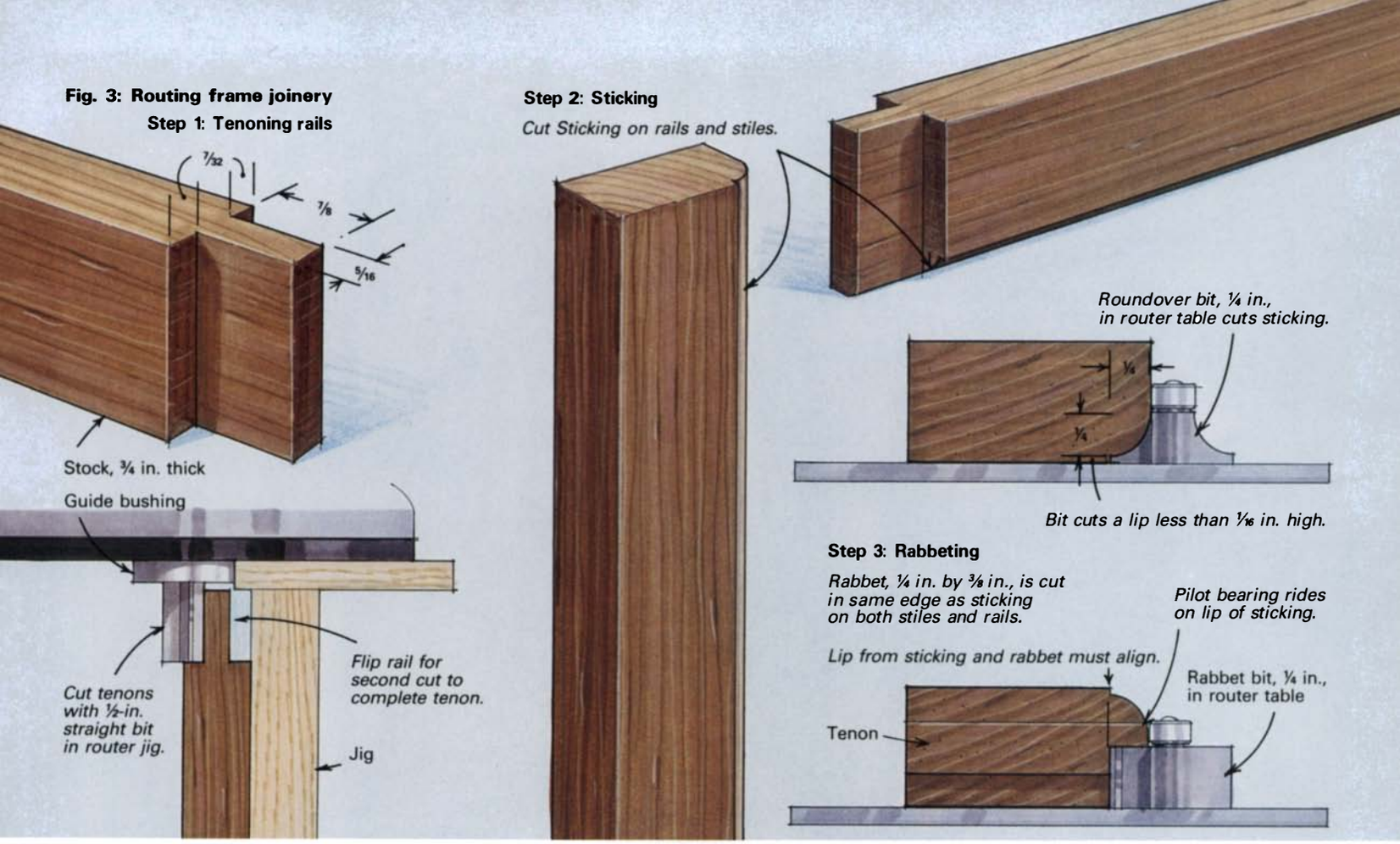
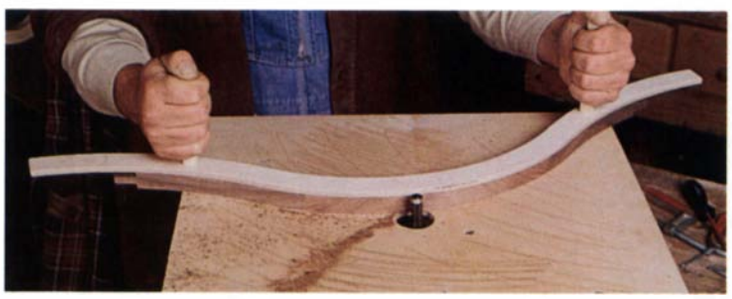


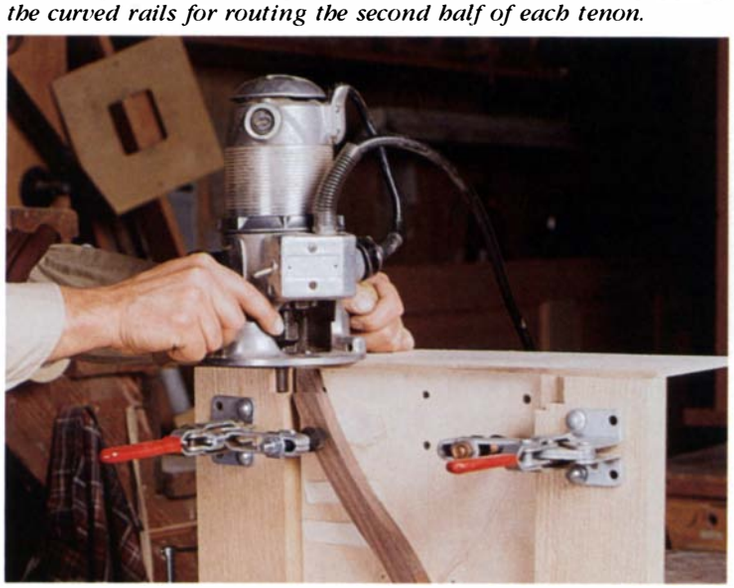
Fig. 2: Gluing up curved rails

Making curved rails from three pieces gives better strength, because grain follows curve.





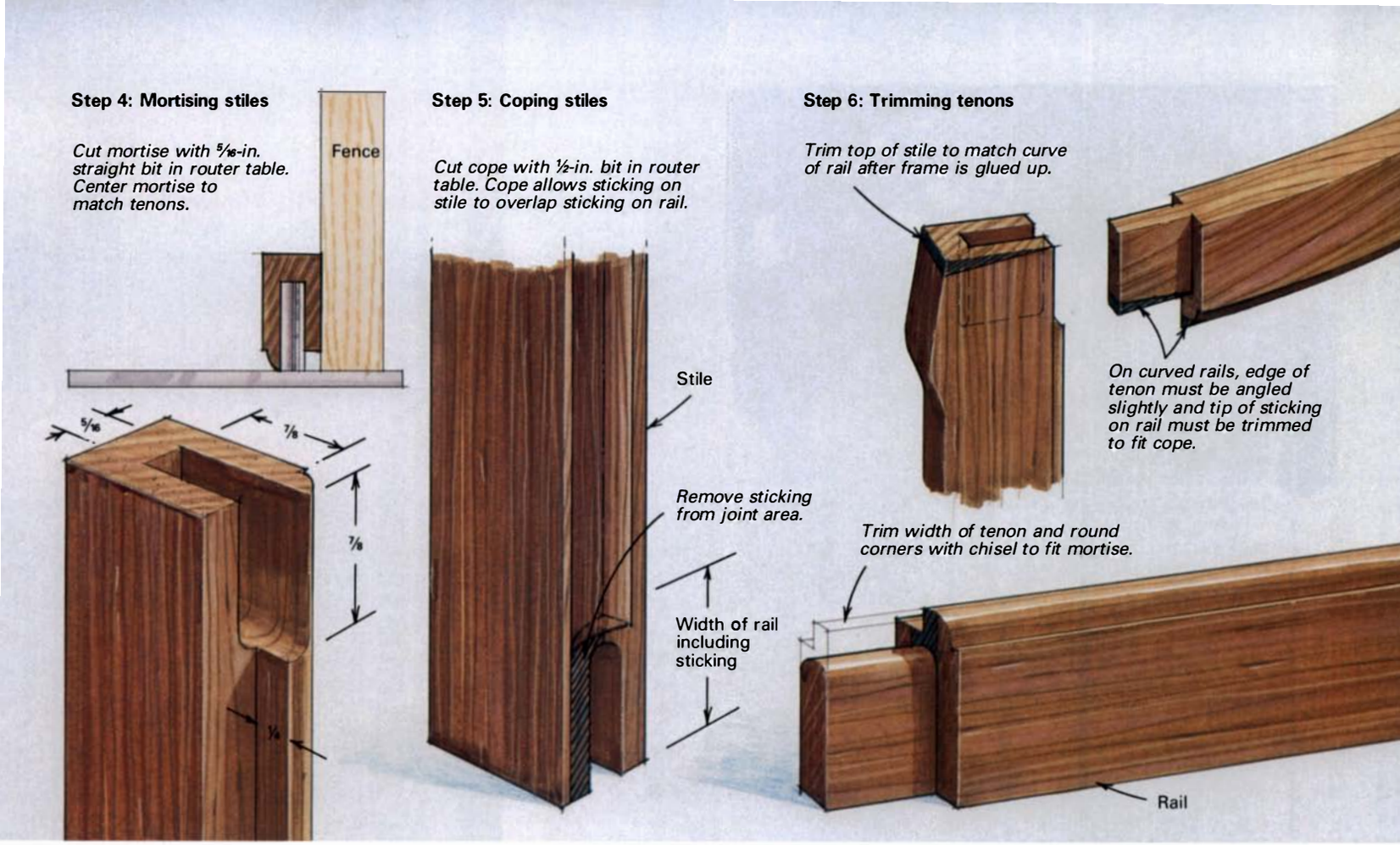
Above: Using a flush trimmer in the router table, the author does the final shaping on a curved rail for the cabinet frame. The template, temporarily screwed to the back of the rail, guides the cut and has two dowel handles for convenience and safety. Below: The tenoning jig allows router-made tenons to be cut in two passes. The jig has two fences and clamping stations, to accommodate flipping the curved rails for routing the second half of each tenon.



width as the final rail, with the curve carried past where the tenons will be cut on the ends. Mark a centerline on each template. To shape the 1¼-in. curved top rails, first bandsaw out the rough curves to lines scribed from the template, leaving about 1/16 in. on the edges for trimming and enough stock on the ends for the tenons. I screw two ¾-in.-thick, 6-in.-long dowels to the templates, to act as handles. Countersink the screw heads and temporarily screw the template to what will be the back side of the rail. Trim each piece to final shape by running the template against the pilot bearing of a flush trimmer in the router table, as shown in the top photo at left. The handles let you move the workpiece past the bit smoothly, and they keep your hands well away from the cutter. To avoid tearout as you trim parts of the curve against the grain, climb-cut these sections by feeding the work into the cutter in the direction of the cut, instead of against it as usual. Take the cut slowly, as a climb-cutting router can kick back the workpiece unexpectedly if it's fed too quickly into the cutter.

Before removing each rail from the jig, transfer the centerline mark from the template, to help you align the rail for trimming the ends. I do this by clamping each curved rail to a piece of plywood with three blocks glued to it. The ends are then cut on the radial saw, with the front edge of the plywood against the fence. By setting the cut according to the centerline on the jig, the two halves of the curved rail will be symmetrical, essential for a good fit between the door and the cabinet frame.

Frame joinery and shaping—Because I make most of the joints and shaped edges of the frame members with a carbide router bit guided by a pilot bearing, the order of operations is important, both to avoid tearout and to always give the pilot a surface to ride on. The order of operations, as shown in figure 3, above, is tenoning, sticking, rabbeting, mortising, coping and tenon trimming. You tenon before mortising, instead of the other way around, so that the pilot bearing



of the rabbeting bit doesn't plunge into the mortise at the ends.

In step 1, the ⅞-in.-long tenons on the ends of both the straight and curved rails are cut using a jig that holds the pieces vertically, while a ½-in. straight bit in the router cuts both tenon shoulder and cheek in one pass. A template guide bushing on the router's base bears against the jig's fence and guides the cut. The rail is clamped to the jig, as shown in the lower photo on the facing page. Each tenon is cut on one side first, then flipped and cut on the other side. This automatically centers the tenons. The curved rails are aligned in the jig by resting both ends against the fence. After cutting half of the tenon on each end, the rail is flipped front to back and clamped on the jig's other side, where the tenon is completed.

Next, the sticking and rabbet are cut on the outside faces of the side and door frames and on the inside face of the back frame members, as shown in steps 2 and 3. Both operations are done on the router table, with a piloted ¼-in. roundover bit for the stick and a ¼-in. piloted rabbeting bit for the rabbet to hold the glass and back. Adjust the roundover bit's height for the sticking cut so the bit forms a lip that's less than 1/16 in. high. It's very important that the radius-cutting portion of the roundover bit be exactly ¼ in. high (viewing the bit's profile). This is so the bit will not remove stock where the pilot of the rabbet cutter must bear. Also, when setting up the ¼-in. by ¼-in. rabbet cut, make sure the lip on the sticking and the rabbet align with each other (see step 3). These considerations are important if the tenon shoulders on the rails are to mate squarely with the stiles when the frame is assembled later.

It's best to cut the sticking and the rabbet in several passes, rather than in a single heavy cut. During the last light pass, make certain the work is flat on the table as it passes by the bit, as any variance will change the height of the cut. Take some care when doing the rabbeting, as the pilot bearing rides on the relatively delicate edge of the sticking cut in the previous step.

The mortises are cut in the stiles in step 4, with a straight bit,

A ½-in. straight bit in the router table cuts the cope in the ends of the stiles and removes the sticking where the rail and stile will mate. Here the stop block is set for cutting one end of each stile; the other ends are cut with the block left of the bit.

also on the router table. The mortise is open on the end of the stile so the stile can be slid along the fence and fed into the bit. I use a 5/16-in. bit to match the tenon's thickness and raise it 1⅛ in. above the router table, the depth of the mortise plus the width of the sticking. The bit chatters nastily if you try to chop the mortise in one pass, so I cut it in stages, taking only 3/16 in. of depth in a single pass until I reach the full depth of cut.

The next step is coping the ends of the sticking on the stiles so that the quarter-round sticking will mate at the corners of the frames. I use a ½-in.-dia. straight bit, because its radius matches the ¼-in. radius of the sticking. With the bit elevated ¼ in. (the width of the sticking) in the router table, the fence and end stop are set so that the bit will remove the sticking and create the cope precisely where the rail will mate with the stile (see step 5 and the photo above). With the rabbeted side against the fence, cope one end of each stile, then move the stop to the other side of the bit to do the other ends. There may be some tearout problems when

A bending form, screwed together from scraps of ½-in. plywood, lends shape to the two ⅛-in.-thick walnut pieces that will form the cabinet's arched top. The radii of the jig are slightly tighter than the final shape of the top, to allow for springback when the steam-bent pieces cool.

making the right-hand cuts, because the bit cuts against the direction of the grain. If tearout occurs, gently lower the stile into the cutter from above, keeping the stile firmly against the fence.

Before final fitting the frame joints, the rail tenons must be trimmed in width and rounded to match the mortises. On the straight rails, I cut the excess tenon off with a scroll saw, then use a chisel to pare it flush with the tenon shoulder. I also use the chisel to round the tenons' corners so they'll approximately match the rounded mortises (precision isn't crucial here, as that part of the joint is hidden). On the curved top rails, one corner of tenon must be trimmed at an angle to fit the mortise and a small corner of the sticking must be chiseled down where it meets the cope. This final bit of trimming, again, isn't crucial, because the cope will cover it.

Arched top—The cabinet's ¼-in.-thick arched top consists of two separate ⅛-in.-thick steam-bent laminations. Bending it from two thinner slices instead of from one thick piece makes it easier to control springback after bending. The steamed pieces are clamped to the bending form, as shown in the photo above, right out of the steambox, and then left to cool. I don't glue them together, as they're easier to fit into the dado as more-flexible, separate layers.

The top rides in a groove dadoed into the curved top rails with a ¼-in. straight bit. A plywood template guides the router-base guide bushing to keep the bit centered and a uniform distance from the edge all the way along the curve. Cut the dado with the rail and template assembly clamped to the bench; make sure to align the rail's centerline to the template and dado only the inside surface. The ends of the top fit into two ½x¾x6-in. dado strips, made slightly diamond shape to match the angle of the top. Plow ¼-in.-deep, ¼-in.-wide dadoes in the strips and glue them to the side frames where the ends of the top will slide in.

I add a small dovetailed tie strip to keep the curved rails that support the floating top together in the center. I make the female dovetails on the rails with a ⅜-in. dovetail bit in a router guided by a scrap-strip fence I clamp to the rail. Set the fence to guide the router's base perpendicular to the center of the rail. The male dovetails on the ends of the tie strip are cut with the dovetail bit in the router table: Hold the piece vertically, with its edge against the fence, and run it past the bit for half the tail. Then, flip the piece and run the other edge against the fence to complete the tail. Bit height determines the length of the dovetail, and bit-to-fence distance will determine the final width of the tail.

A few more machining operations need to be done before the cabinet is assembled: Plate joints must be cut to attach the frames together to form the carcase. Lay the stiles flat on the workbench, and with a square, draw lines across to locate the biscuits in the same place on each stile. Transfer these marks on the edges of the side-frame stiles, and cut all the slots for #20 biscuits. For the cabinet's adjustable glass shelves, ¼-in. holes must be drilled in the frame stiles for pin-style shelf supports. Lay out these holes the same on all stiles so the shelves will be level. To hold the cabinet's bottom shelf at the rear, cut a dado in the 3-in.-wide bottom rail on the back frame. On the sides and front, the shelf is held in dadoed strips, like the ends of the arched top. Because the back bottom rail is wider than the front bottom rail, the strips bring the height of the bottom shelf up to where it's just ¼ in. below the door's bottom rail. This is to keep whatever is displayed in the cabinet in clear sight with the door closed. Two 2¼-in.-wide base moldings on the sides of the cabinet mate with the bottoms of the side frames, raising them to the same level as the bottom of the door frame. As shown in figure 1 on p. 43, the moldings angle slightly, to match the angle on the lower front and back frames. Make the molding's rabbet match this angle and round over the top edge. Mortise the door for inlaying the locking latch, unless you plan to use a bullet catch or other type of latch. Cut out a ¾-in.-thick piece for the cabinet bottom and rout its edges with a ¼-in. roundover bit, to match the sticking. Finally, sand all the parts to at least 280 grit.

Assembly and finishing—The first stage of assembly is to glue up the individual frames. To prevent distortion of the curved rails, run an extra clamp from the middle of the arch to the opposite rail and don't apply any more clamping pressure than necessary. Check for square and frame flatness, and allow the frames to sit overnight. After the clamps are off, flush-trim the stiles to conform with the curve of the top rails, and check the fit of the door into its frame. If it doesn't go into the opening, or if the fit is uneven, adjust with a handplane or spokeshave.

Before gluing the frames together to form the carcase, bandsaw the outside edges of the front and back stiles, and clean up the edges by flush-trimming them with the router, following a template temporarily screwed to the inside surface of the frame. Glue and nail the dado strips and base moldings on the side frames, and screw the front dado strip to the back of the front frame. As you glue the carcase up, slide the bottom shelf into its groove, and make sure the stiles align at the bottom evenly.

After cleaning up the glue drips and doing any touch-up sanding, screw on the bottom of the cabinet and plug the holes; now you're ready to apply the finish. For the back of the cabinet, I nail on a piece of ¼-in. plywood covered with fabric. Take care to drive the nails at an angle, to avoid nailing through the sticking. If you prefer a mirrored back, hold it in place with thin stop strips screwed into the back of the frame. To hold in the glass on the door and side frames, I use small stop strips that are held in with brads. I made the curved stop for the door by bandsawing a strip from an extra rail I template-routed earlier. To mount the cabinet to the wall, I screw two 3-in. "L" brackets (vertical leg of the L pointing up) to studs in the wall, to support the cabinet at the bottom. The top is secured by a hook bent from a piece of ¾-in. flat iron, attached to the wall with drywall butterflies. The hook will hold a flat-iron strip screwed to the top rail on the back of the cabinet. To attach, slide the cabinet down so the top strip engages the hook, and screw the brackets in the bottom. All that's left is to fill the cabinet with whatever treasures are to be displayed. □

Jeff Greef is a woodworker at the Davenport Mill in Davenport, Calif.

Ebonized finishes created with chemical stains can blacken mahogany and other woods without obliterating the natural grain patterns. Here the author stains a piece of wood with a mixture of iron (from steel wool) and vinegar, then protects the finish with lacquer.

Ebonizing Wood

Home brew lets the grain glow through

by John McAlevey

I first started using ebonized or black finishes several years ago when I needed a dramatic touch for a special piece of furniture I was designing. Inspired after seeing the exhibit "The Art That Is Life: The Arts-and-Crafts Movement in America 1875-1920" at the Museum of Fine Arts in Boston, Mass., I returned to my studio eager to sit down and draw the multitude of lines, shapes and forms racing through my mind. I wanted to build something very special, something I would one day look back at and call a personal milestone in the way I approach my work.

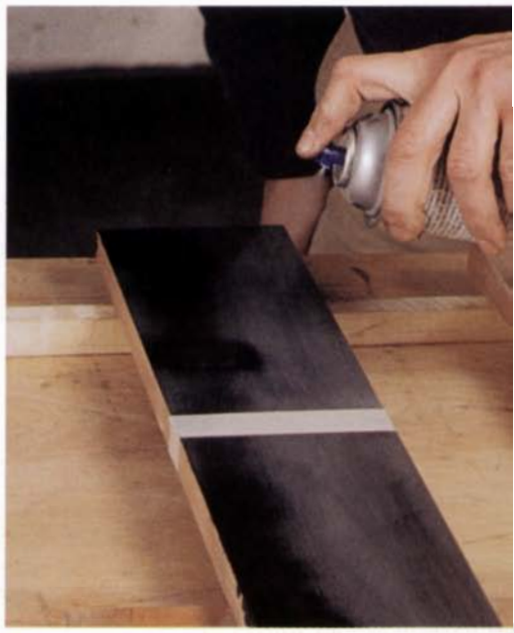
The design I came up with was for a mahogany settee. I continued to refine the details of the piece in my mind as I worked on other furniture pieces that were already commissioned. Even after I began working on the settee—cutting joints, carving and modeling the top rail to flow into the side pieces and deciding on the spacing of the back slats—I continued to mull over ways to refine my design, especially how I would finish it. The settee was turning out to have a dramatic presence; the finish should be equally special.

While scraping and sanding away, my thoughts wandered back to a recent meeting of the League of New Hampshire Craftsmen's wood jury: I'm one of the jurors who screens prospective members. Ruth Burt, director of standards at the League, had mentioned an ebonizing process where a precipitate, formed by mixing iron and vinegar, turned wood black. Since ebonized finishes were in vogue during the Arts-and-Crafts period, I though a black finish might be appropriate for my settee.

Taking a break from sanding, I hurried out to a nearby convenience store and purchased a bottle of cider vinegar. Since I didn't have any rusted iron nails around, I found some rusted pieces of steel behind the shop and put them into a container with the vinegar. After an hour or so, expecting instant gratification, I dipped some mahogany scraps into the solution. Nothing happened. The following morning again nothing happened. Impatient, I tore up a piece of steel wool and threw it into the vinegar. I then left the solution to "cook" all day. Before leaving the shop that evening, I again dipped a scrap of mahogany in the solution. It quickly turned black. I next tried dipping a piece of red oak in the solution, and it also turned black.

The following morning, I sanded another piece of mahogany

A strip of mahogany, above, illustrates how each coat of stain darkens the wood. The left side is plain; the center has one coat of the steel wool/vinegar mixture; and the right, three coats. Each coat is sanded with fine paper before the next coat is applied. Applying a coat of aniline dye on top of the stain darkens the wood even further (see p. 50 for more on aniline dyes).



Deft spray lacquer makes a good finish. Just make gentle overlapping passes with the spray, as shown, then sand lightly between coats.

and then brushed on my mix of steel wool and vinegar. As I applied the solution, the mahogany blackened. After the panel dried, the grain had raised, so I sanded the panel before reapplying the solution. I later experimented with white and red oak, walnut and cherry, and each of the woods darkened. The mixture didn't do much to improve poplar, but that's understandable. From my research and what others have told me, I've concluded that the mixture is most effective on woods containing tannin or other acids that react with the steel wool/vinegar mixture.

I've ebonized quite a few pieces since my first experiments, but my method remains pretty simple. I cut off the top of a ½-gal. milk container to create a plastic bucket. I rip up a pad of steel wool and add it to the container, to which I add 1 in. or so of ordinary vinegar, available from any supermarket. Then I let the mess sit for four or five days. You could use other kinds of iron, such as nails, but steel wool seems to work the fastest, and it just about dissolves in the vinegar, so you don't have much residue to worry about.

The stain will be strong enough after sitting overnight to turn most woods black, but the extra aging time just richens the color. I usually apply at least three coats, but after that additional coats are kind of overkill, giving the color a reddish cast. The greatest advantage of my mixture is that in addition to producing an even coat of color, the three coats don't obliterate the natural wood grain the way some commercial products do.

You can strain the mixture through a paper coffee filter, but I don't usually bother. The small amount of steel-wool residue that might end up on the wood is easily blown off with compressed air once the wood dries. I apply the stain with inexpensive throwaway foam brushes, available at any hardware store. Brush strokes aren't a problem here: The coats blend together very nicely and everything evens out. This even blending makes the mixture ideal for large pieces, such as a tabletop, as well as for smaller pieces, where you want to use color to accent the lines of the piece, such as the coffee table shown on the facing page.

I leave each coat on for 30 minutes, during which time it will soak in pretty well, depending on the heat and humidity. I then wipe off the excess and allow the wood to dry completely before sanding. Because vinegar is largely water, the stain will raise the grain of most woods, especially on the first coat. I usually sand the wood with 220-grit silicon-carbide paper. For subsequent coats, 400 grit is ample. You might be worried about the strong vinegar odor on the wood, but leave the piece overnight and the odor will dissipate.

One problem with chemical stains like this is that they don't penetrate very deeply. You can sand through the stain, especially near edges. To avoid any major problems, always do all your shaping and other edge treatments before applying the stain. In cases where I've sanded through, I touch-up with a black felt-tip pen.

If I want a black that's darker than the color produced by three coats of stain, I'll apply a coat of Solar-Lux nongrain-raising stain (Jet Black B503-1A46), available from H. Behlen & Bros. Inc., Route 30 N., Amsterdam, N.Y. 12010; (518) 843-1380. It's also available by mail from Woodcraft Supply, Dept. FW98, 41 Atlantic Ave., Box 4000, Woburn, Mass. 01888; (800) 225-1153 or (617) 935-5860 in Massachusetts, or from Garrett Wade Co. Inc., 161 Ave. of the Americas, New York, N.Y. 10013; (800) 221-2942 or (212) 807-1757 in New York. This stain also doesn't seem to obliterate the grain. I don't like using the stain by itself, though, because it doesn't produce the same sense of richness and depth I get with the three coats of the steel wool/vinegar mixture.

Lacquer finishes work well over the stains; I generally use an Apollo low-pressure spray system (Apollo Sprayers International Inc., 11577 Slater Ave., Unit H, Fountain Valley, Calif. 92708; 714-546-3100). You can also get good results from an ordinary can of Deft Semigloss Clear Wood finish, available at most hardware and department stores. The key here is to relax. If you get uptight, you'll make a mess, just as you would if you panicked during a glue-up. Just make gentle overlapping passes, as shown in the photo above, right. Sand between coats with 400-grit paper, then spray again. You can spray up to three coats with no problems, and the finish will be pretty durable.

To rub out the lacquer, I use 0000 steel wool, lubricated with water and ordinary grocery-store yellow soap. Always work with the grain; once the suds get going, the soap will work like rubbing compound. Rinse off the piece, dry it and then finish with a coat of paste wax, such as Minwax. □

John McAlevey designs and builds furniture in Warner, N.H.

Black finishes for dramatic accents

Small tables can be attractive and functional accents in any home. And for the small-shop woodworker, they can provide a satisfying and profitable introduction to production runs on a modest scale. The table shown here is a fairly simple design, but it is striking, especially with the strong lines created by the ebonized components.

Mahogany is used throughout. I plane all the stock and cut it to the dimensions shown in the drawings at right; the legs are the only tricky part. I rough-cut them on the tablesaw, then refine their outer edges to the curve, as shown in figure 1A, with a block plane, spokeshave, scraper and pad sander. Before shaping these 1⅞-in.-thick pieces, I cut all the joints.

I do all the mortises with a plunge router and a simple box jig (see *FWW on Joinery*, p. 45, for more on this box jig). The jig looks like a miter box but with end stops to set the length of the mortise and a reference surface for the router's fence. You can clamp the workpiece to the box and rout the mortises easily and accurately. You can also chop the mortises by hand.

For the legs, I first cut the mortise for the lower cross brace while the stock is still rectangular, to make it easier to clamp the piece to the mortising jig. The next step entails ripping the corners of the outside edge of the leg, as shown in figure 1A. This eliminates much of the waste, making the final shaping much quicker. Finally, I rip both inside corners at a 45° angle to mate with the tenoned rails that will support the top frame. One advantage of this miter box is that you can use shaped blocks to hold irregularly shaped pieces at any angle while they are being mortised.

After shaping the legs as described above, I cut the tenons on the apron pieces and cross braces, and the lap joints on the braces. Again, use your favorite technique: router, tablesaw or handsaw and chisel. The corners of the top frame are simple butt joints reinforced with a plate joiner and small biscuits. Screws that run up through the apron, as shown in figure 1, secure the legs. Before assembling the frame, rabbet its inner edge with a straight router bit or dado blade to accept the ¼-in.-thick tempered glass top.

After all the pieces are glued up, I let the joints dry overnight and then finish-sand the table with a pad sander. Finally, I ebonize the wood as described in the main article. *—J.M.*

Black ebonized finishes create a dramatic accent and highlight the lines of small pieces like the table above. The distinctive curved legs are first roughed out on a tablesaw, then refined with a block plane, spokeshave, scraper and pad sander.

Fig. 1: Building a small table

Table measures 32 in. square.

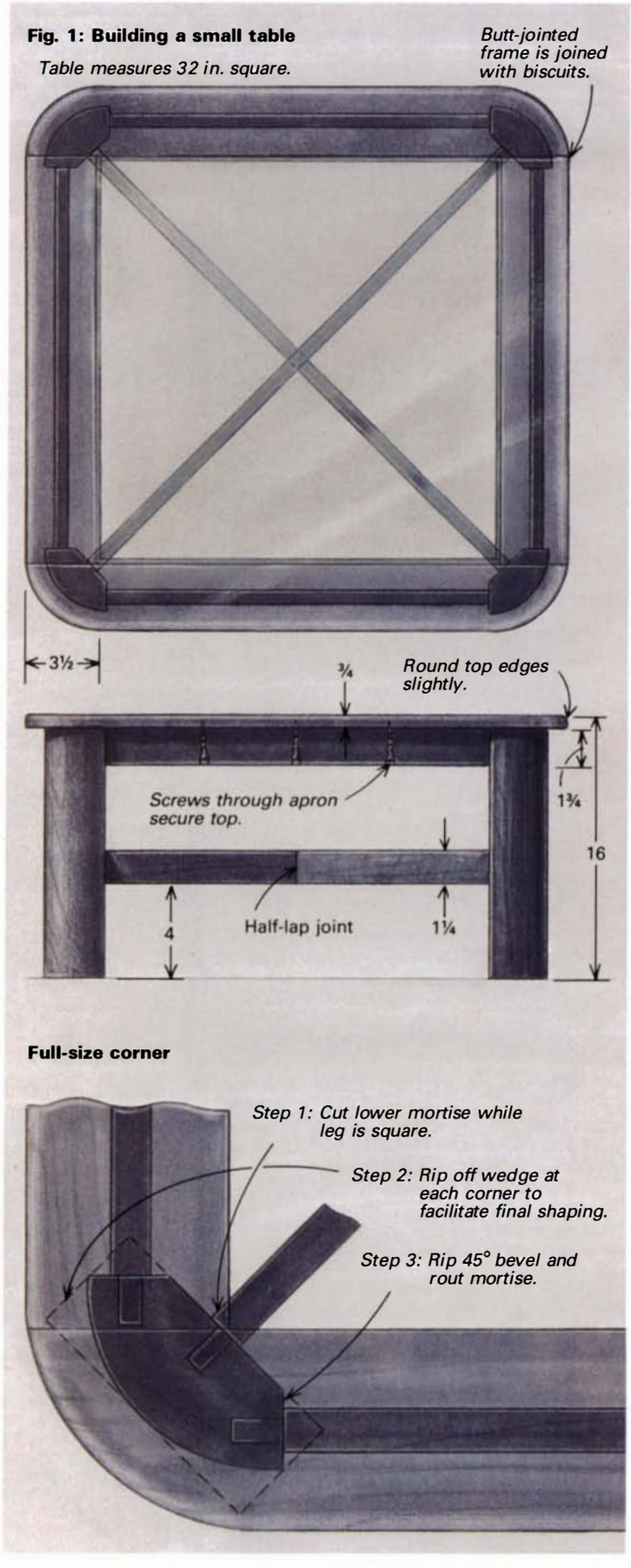


Photo this page: Timothy Savard, Photoworks; drawing: Bob La Pointe

Aniline Dyes

Coloring wood with modern chemicals

by Michael Dresdner

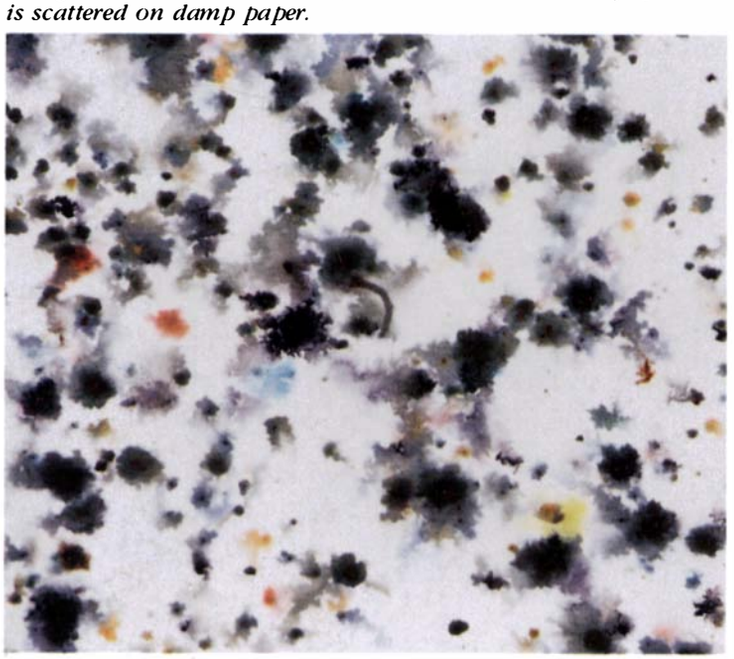
Although natural dyes can be very appealing, the vast majority of contemporary finishers prefer to use modern dyes and stains. These materials are generally much more dependable than the natural dyes. In addition, the chemical mordants and organic materials needed to make natural dyes, which produce color by reacting with the wood itself, can be messy, unpredictable, dangerous and hard to obtain.

Aniline dyes, or dye stains, which are very similar to many modern fabric dyes, are usually sold in powdered form. Formulated for one of three common solvents, they will dissolve in either water, alcohol or oil. The dye works by saturating the wood with color as the solvent soaks in. Pigmented stains, which are basically pigments or tiny opaque particles of color that are suspended in a medium, color wood by depositing the particles in the pores and crannies of the wood's surface. Unlike the transparent dyes, which will remain in solution indefinitely, the pigment in stain will settle to the bottom of the container over time.

When any wood is stained or dyed, the resultant color is a combination of the original wood color plus the dye. Hence, if a blue stain is put on a yellowish wood, the end result is not the original blue color of the dye but rather a greenish hue. Most woods have some color to them, and most ebony dyes are actually dark blue or green, although better-quality black anilines have orange added to make the dye "blacker." As a result, simply staining a piece of maple with black dye will cause the wood to appear blue-gray under a finish; on oak it will come out greenish-gray. To get the true black referred to as ebonizing, it is easiest to use several layers of dye or stain, a process that also gives you more control of the color.

Because water penetrates wood so well, water-soluble anilines are the best choice for the first coloring operation. Sponge the wood with water to raise the grain; after it is dry, sand lightly with 220-grit paper to defur it. This will prevent the water in the dye from significantly raising the grain again when the color material is actually applied. Dissolve the aniline in moderately hot water and soak the wood with a rag or sponge. The amount of dye dissolved in the water and not the amount of solution applied will control the intensity of the color. Try to get the whole piece or section wet at one time, and then wipe off any excess liquid. If it is not dark enough, add more dye to the water and restain the piece after it dries, but remember, there is a limit to how much stain a piece of wood will take. After a certain point, excess stain will merely accumulate on the surface and form a layer of colored dust when it dries.

Black aniline dye is not actually black, but rather a mixture of oranges, blues and other colors, as shown below when dye powder is scattered on damp paper.



Nongrain-raising (NGR) stains (water-type anilines predissolved in an anhydrous solution) will also work, but because they are premixed, you have less control of the color intensity. Both alcohol- and oil-soluble anilines, which actually work with naptha and lacquer thinner as well as oil, are generally less lightfast, and depending on the solvent, may flash off faster than dyes mixed with water, making them harder to control. All types of dyes vary greatly in their lightfastness, but nonfading anilines are now available in a variety of colors and solvencies.

On very porous woods, such as oak and mahogany, the pores will not absorb water-soluble aniline very well, so the pores may remain lighter than the surrounding wood. If the pores are to be filled with semipaste filler before the final finish coats are applied, this will not be a problem: Simply use black filler; otherwise, you might want to color the pores by wiping on a black pigment stain that is compatible with whatever finish is to follow.

After the first coat of finish has been applied, if the surface is still not dark enough for your liking, you can shade it up by adding an aniline dye to the next coat of finish. There are transparent dyes available that can be added to virtually any finish—oil, lacquer, shellac, varnish, water-base lacquer and even catalyzed finishes. Proceed cautiously, though, as too much dye added at this stage will make the finish look painted.

Because ebony is rarely all black, you might want to ebonize to a different color by using a combination of stains. This layered method will allow you to achieve any look you desire. □

Michael Dresdner is an instrumentmaker and woodfinishing specialist in Zionhill, Penn., and a contributing editor at FWW.

Sources of Supply

Highland Hardware, 1045 N. Highland Ave., Dept. F, Atlanta, GA 30306; (800) 241-6748 or (404) 872-4466 in Georgia.

The Woodworkers' Store, 21801 Industrial Blvd., Dept. 1212, Rogers, MN 55374-9514; (612) 428-2199.

Woodcraft Supply Corp., 41 Atlantic Ave., Box 4000, Dept. FW39, Woburn, MA 01888; (800) 225-1153 or (617) 935-5860 in Massachusetts.

Wood Finishing Supply Co., 100 Throop St., Palmyra, N.Y. 14522; (315) 597-3743.

This 18th-century Boston Bombé chest by Tom Lee, a graduate of the North Bennet Street School, Boston, Mass., illustrates the excellent color and grain patterns of true mahogany.

Mahogany

Classic-furniture timbers are getting harder to find

by Jon Arno

To build with mahogany is to share a woodworking experience with the skilled 18th- and 19th-century cabinetmakers who created some of the world's most cherished furniture. Unfortunately, fewer woodworkers are able to savor that experience today, because the true mahoganies, what the old cabinetmakers called Cuban and Honduras mahoganies, are in short supply. The trees, often growing more than 100 ft. high and as much as 40 ft. around, are found in ever smaller and more remote groves. Most of the original stands have disappeared; those that remain have been heavily logged. Usually only a few mahogany trees, two or three per acre, constitute a "stand," which makes logging inefficient and expensive. Harvesting is haphazard and often badly managed, with little thought given to ensuring adequate supplies for the future. Attempts to cultivate mahogany haven't been very successful: The tree is slow growing, requiring 60 years to reach economically viable size, and many immature trees are destroyed by larvae of the widespread pyralid moth and ambrosia beetle. Also, the best of the highly figured lumber is often marked for use as veneer in production furniture shops or for interior decorative work, further depleting the supply. So mahogany, if you can find it, is expensive. For the real thing, cost can range between $5 and $10 per bd. ft. for clear, but plain-figured stock.

The true mahoganies come from several species in the genus *Swietenia*, but two species predominate: *Swietenia mahagoni*, the West Indies or island species, often called Cuban mahogany; and *Swietenia macrophylla*, the mainland species, found from east central Mexico to Bolivia, commonly called Honduras mahogany. With less true mahogany available, you're likely to find lumberyards stocked with substitutes, such as African mahogany (khaya) or even totally unrelated timbers, such as lauan, the so-called "Philippine

Photo: Lance Patterson

mahogany" or Australian "Red" mahogany, which is actually a *Eucalyptus*. Some of the substitutes, such as khaya, sapele and andiroba, are members of the mahogany family, which includes about 50 genera and nearly 1,000 species, and are fine cabinetwoods in their own right.

The differences between the substitutes and the real stuff aren't always obvious, even to a practiced eye. It isn't until you begin working with the woods that the real differences become apparant. True mahogany is easily worked and shaped. Its exquisitely figured grain, hidden beneath the surface of roughsawn lumber, seems to come alive with a soft luster when planed. And stability, a virtue of true mahogany unmatched by any of its alternatives, may not be evident until months or even years after a project has been completed.

A historical perspective—The Spaniards must have begun harvesting mahogany almost as soon as they arrived in the New World. It was used in the construction of a cathedral in Santo Domingo begun in 1514. And the Spanish colonists quickly discovered the advantages of mahogany for shipbuilding: Strong, but lighter and more buoyant than oak, mahogany is an ideal ship timber. It also became important for its excellent bending properties, ability to be carved and high resistance to dry rot. Although it is not as impervious to decay and attack by borers as is teak (*Tectona grandis*), the heartwood of true mahogany is a popular choice for ship construction. It is so durable, in fact, that logs cut and left to rot in Santo Domingo in the late 1700s were salvaged more than 50 years later, with the heartwood still sound. The common seamen preferred mahogany, because unlike oak, it was slow to burn and didn't splinter as badly when hit by cannonballs.

Although the English were actively logging the coast of Central America as early as 1638, it wasn't until more than half a century later that mahogany—the English at this time called it "cedar wood"—reached England in quantity. But by 1725, mahogany was the preferred wood, along with walnut and oak, for the finest English furniture. Thomas Chippendale (1718-1779) used mahogany extensively, and his furniture became the leading edge of style. By the late 1700s, mahogany was also flourishing in America: Chippendale's designs were popular with British-trained American cabinetmakers. For the colonials, this style, with its imported look, had status.

Chippendale used high-quality mahogany, but he relied on the design of his furniture—its shell motif and claw-and-ball carvings—rather than on highly figured wood to achieve the furniture's rich appearance. With the introduction of the Federal style and its emphasis on simpler designs and straight lines, cabinetmakers began embellishing their furniture less and focusing more on the wood itself. Thus, the Federal style favored the more flamboyant and marble-like grain patterns that we now associate with the work of Thomas Sheraton (1751-1806).

Mahogany continued to be the premier cabinetwood in England and America through most of the 1800s. Its highly figured grain remained popular and contributed to the distinctive charm of the work of masters, such as Duncan Phyfe (1768-1854) in New York.

Thus, true mahogany is indispensable for the reproduction of period furniture, and although increasingly scarce, it continues to be the wood of choice for many woodworkers—a small wonder when you consider its characteristics. Few woods have as much going for them as true mahogany: Its durability, stability, structural uniformity and beauty provide a hard-to-beat combination. Because of this appeal, the woods of perhaps 100 or more species belonging to more than a dozen different genera and at least five unrelated botanical families have at one time or another been sold as "mahogany" (see the table at right). Some of them are fine cabinetwoods, similar to true mahogany in color, figure and density, and can sometimes pass as the real thing. But when it comes to true mahogany, pretty close isn't good enough.

Mahogany's characteristics—Among the true mahoganies, not even the closely related Cuban and Honduras species produce woods that are totally interchangeable. Both species vary considerably as a result of growing conditions, and some of the mahogany now coming out of South America differs substantially from that of the same species logged in Central America. The slower-growing island variety is usually a denser, heavier wood with tighter, more finely textured grain structure. But when less than ideal conditions produce slower growth, mainland mahogany, like the island variety, is also dense and finely textured.

Although the density may vary considerably from tree to tree, with specific gravity ranging from as low as 0.40 to more than 0.60 (oven-dry weight to green volume), the wood in a given board will have remarkably uniform density. As a rule, the mainland species density averages about 0.45. This makes it almost 12% lighter than black walnut (0.51) and a little too soft for applications that expose it to heavy wear, but it is surprisingly strong for its weight.

Few commercially important woods are as stable as mahogany: Tests conducted by the U.S. Department of Agriculture's Forest Products Laboratory indicate an average volumetric shrinkage of only 7.8% (green to oven-dry)—only about half the value for most popular domestic hardwoods. Sugar maple, for example, is 14.7%; black walnut, 12.9%; and white oak, 16.3%. Even black cherry, noted for its stability, measures 11.5%. Because shrinkage is small, mahogany dries with less tendency than most woods to check and warp.

Of at least equal importance to a wood's in-use stability is the amount it shrinks tangentially versus radially. When a wood's tangential shrinkage (shrinkage across the flatsawn board, i.e. perpendicular to the radius) is substantially more than its radial shrinkage, warp-producing stresses are magnified. Typically, most woods shrink about twice as much tangentially as they do radially. For example, black cherry has a tangential shrinkage of 7.1% and a radial shrinkage of 3.7%, producing a tangential/radial (T/R) shrinkage ratio of about 1.92. Black walnut is much better in this respect: With a tangential shrinkage of 7.8% and a radial shrinkage of 5.5%, its T/R ratio is only 1.42. But mahogany is even better:

The More Common Mahoganies

	Common name	Genus
The mahogany family *(Meliaceae)*	American mahogany	Swietenia
	African mahogany	Khaya
	Sapele	Entandrophragma
	Andiroba (crabwood)	Carapa
	Rose mahogany	Dysoxylum
	Tigerwood	Lovoa
	Spanish cedar	Cedrela
The Lauan family *(Dipterocarpaceae)*	Philippine mahogany (Lauan Meranti)	Shorea, Parashorea Pentacme

Mahogany look-alikes

Family name	Common name	Genus
Myrtaceae	Australian red mahogany	Eucalyptus
Guttiferae	Santa Maria	Calophyllum
Burseraceae	White mahogany	Canarium
Burseraceae	Gaboon (okoume)	Aucoumea

With a tangential shrinkage of 4.1% and a radial shrinkage of 3.0%, its T/R ratio is a low 1.36.

Working with the wood—This tolerance to swelling and shrinkage is of great practical benefit, but from the woodworker's point of view, the real joy of true mahogany is found in its working characteristics. These characteristics are largely attributable to its structure. Mahogany is a diffuse-porous wood and has a very uniform structure. Unlike other diffuse-porous woods, such as maple and birch, however, mahogany's pores are larger. In fact, they are similar in size to those of walnut, but are more evenly distributed, making mahogany more uniformly textured than walnut. Also, unlike walnut, mahogany is still available in long, wide, warp-free boards. Cabinetmakers like this, because they spend less time dressing the lumber and jointing boards to width, making mahogany an ideal choice for large casework. And because of its high stability, mahogany can be worked to close tolerances with little fear of joints working loose over time. Straight-grain mahogany planes smoothly and easily. There is some tendency for the more highly figured woods to tear out, but its not nearly as pronounced as with, for example, quartersawn cherry. There are harder cabinetwoods that can be easily worked with high-speed power tools, but few are as pleasant to work using handtools as mahogany, yielding fluidly to sharp cutting edges without excessive and tiring effort.

It's difficult to point to any specific characteristic to explain mahogany's special charm, but color is part of it. When freshly sawn, mahogany varies in color from yellow to pinkish red. It rapidly darkens to a warm, brown shade with highlights that vary from rich purple-red, most common in the island species, to amber-gold tints, occasionally seen in some of the lighter-color stock from the mainland. However, even the mainland species sometimes produce wood approaching the color of black walnut.

The island and mainland species produce mostly straight-grain woods, but interlocked, "ribbon" grain is not uncommon. Flamboyantly figured grain, such as fiddleback, blister, swirl, mottle and curly patterns, are available, but rare. Island mahogany generally is more figured, probably resulting from its slower growth. Unlike many woods that owe their unique figure primarily to some single, anatomical attribute, such as the large size of their earlywood pores or the dominance of their rays, the figure of true mahogany is like a composition, a "symphony" of subtle elements, each contributing to the wood's character without drowning out the others. On the tangential surface, the rays appear as short, dark, vertical lines approximately ⅛ in. long, forming horizontal, wavy bands across the board at ¼-in. to ½-in. intervals.

The vessels provide another striking component of the wood's figure. These tube-like structures are clogged with deposits that may vary in color from white to black in any given sample. When cut lengthwise, they pepper the tangential surface with vertical lines from about ¼ in. to 1½ in. long, depending upon how true to the grain the board has been cut. White vessel markings tend to be more common in the island species, but here again, either species will produce deposits that range from chalk white to carbon black.

Also contributing to the figure in a very subtle way are fine, pencil-thin, white lines that meander across the tangential surface. These are caused by concentric rings of parenchyma cells that form periodically as the tree grows, much like annual rings. This also is an important feature to look for in identifying mahogany, but these rings are not always easy to see once the wood has been finished.

Mahogany stains evenly and is complemented by shellac, varnish, oil or lacquer finishes, but because of the wide variation in color and figure, it's advisable to match woods for a piece carefully. The finish can alter or emphasize color differences between boards, so try the finish on a sample when selecting woods. Although mahogany will darken over time with exposure to sunlight, the deep hues, often associated with old furniture, result more from the darkening of the finish than from the wood itself. The appearance of true mahogany is enhanced by a certain almost-indescribable surface luster lacking in many of the mahogany pretenders, especially in the so-called Philippine mahoganies or lauans. Because this luster is more pronounced with dense mahogany, it is produced mostly in the island species, but both the island and mainland species finish beautifully. □

Jon Arno is an amateur woodworker and wood technologist in Schaumburg, Ill.

Mahogany look-alikes

The two most common substitutes for true mahogany are African mahogany and the Southeast Asian lauans, which are popularly called Philippine mahogany.

The English began to exploit African mahogany in the mid-1800s when American sources of true mahogany began to dwindle. African mahogany, or more accurately khaya, closely resembles the true mahoganies in most important respects. Khaya is cut from more than one species, but the most important is *K. ivorensis*. The wood comes mainly from West Africa, although subtly different species of khaya are widespread from Portuguese Guinea to Angola and from the Sudan to Mozambique. The colors of these woods span the full mahogany range, from light pinkish tan to reddish brown, but they seldom exhibit the amber-gold highlights found in some of the mainland American timbers. The grain is often interlocked and somewhat more coarsely texured, yielding a striped figure on quartersawn boards. Generally, khaya enjoys the same complex symphony of elements in its figure as the true mahoganies.

Although it is true mahogany's closest substitute, it is not identical. Though highly stable, khaya's average volumetric shrinkage of 8.8% is a full percentage point higher than true mahogany. Its tangential/radial (T/R) shrinkage ratio of 1.41 is also slightly higher, and on average, khaya is a little lighter and softer than true mahogany.

Philippine mahogany, or more accurately lauan, may have been introduced into Europe and America from Southeast Asia at least as early as 1800, but it had little impact on cabinetmaking until the 20th century. Since World War II, its use has skyrocketed, and lauan is now our most important tropical timber. This plentiful mahogany substitute is cut from numerous Southeast Asian species, but they are not at all closely related to the mahogany family, *Meliaceae*.

There are at least 70 subtly different species of lauan, and they produce woods ranging in color from ash gray to deep reddish brown. Many of them have interlocked grain, which gives radially cut (quartersawn) boards a beautiful mahogany-like, ribbon-striped appearance; on flatsawn surfaces, however, they are seldom as figured as true mahogany. The lauans are generally more coarsely textured, far less stable and usually softer than true mahogany. Specific gravity ranges from about 0.30 to as high as 0.70, so lauan can be almost as light and soft as basswood (.28) or heavier and denser than white oak (.60).

The softer woods from the so-called "white lauan" group make good secondary stock for interior components, while the darker "red meranti" (from Malaya) make attractive primary woods. There are a few lauan species that should be avoided: Mayapis (*Shorea squamata*), for example, has a high gum content that clogs sandpaper and prevents finishes from drying. Also, some species in the Balau group are extremely hard and cause cutting edges to dull quickly. For projects where authenticity or historical accuracy is not important, lauan has a lot going for it: It is inexpensive; comes in a variety of colors, densities and grain patterns; and is available in wide, clear boards. Lauan is one of the world's most important timbers, producing more plywood veneer than any other hardwood.

The table at the bottom of the facing page should help in sorting out some of the woods you might come across while in quest of "the real thing." —*J.A.*

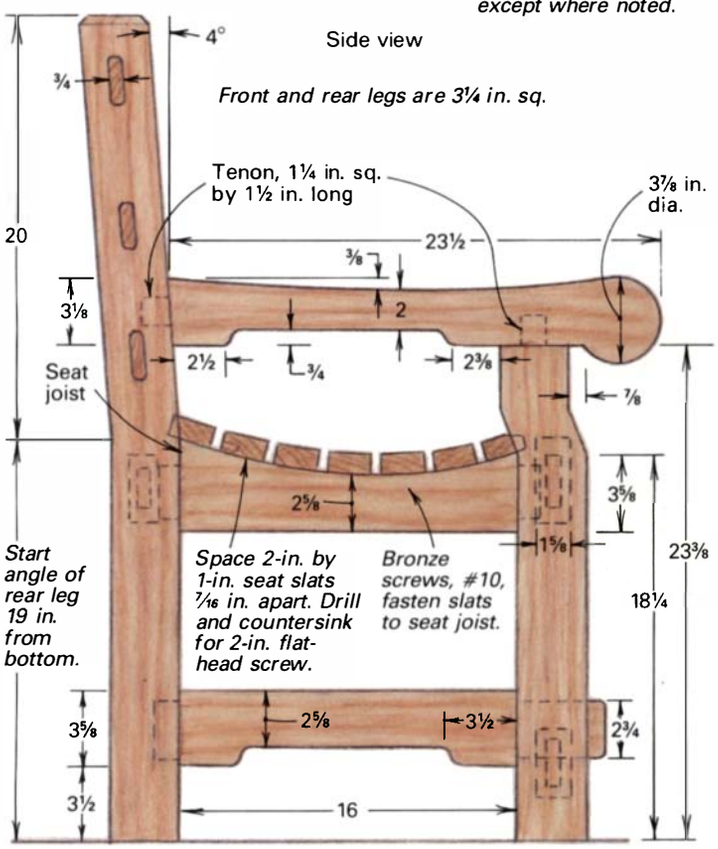
Three Benches

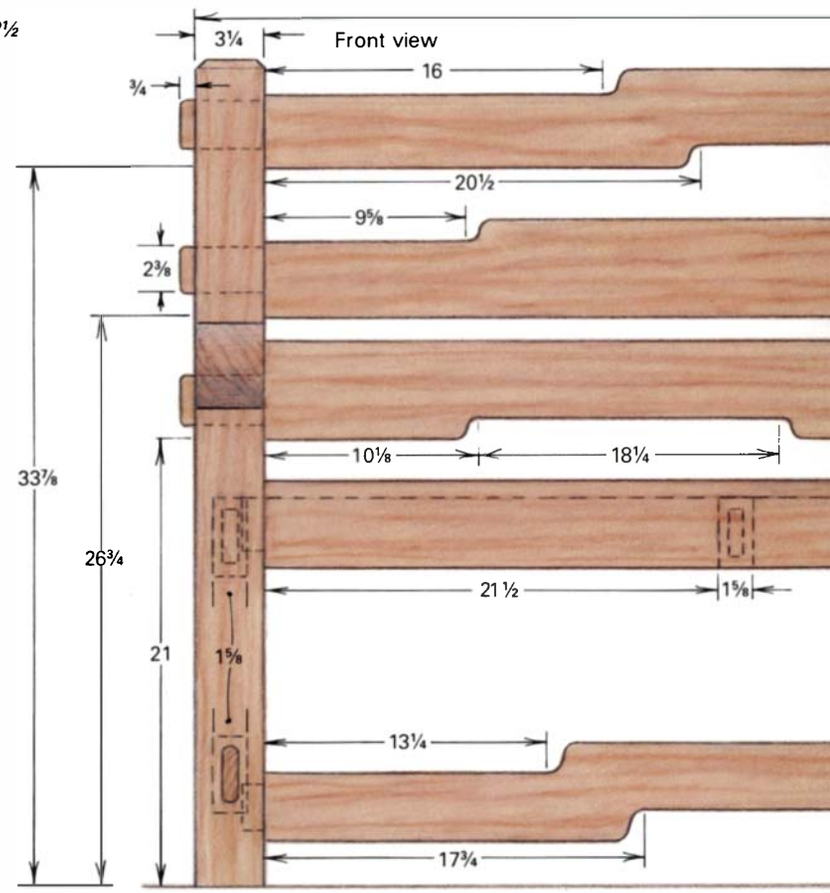
Park seating with a Japanese flair

by John Goertzel

Fig. 1: Garden-bench plan

All blind tenons are ¾x1x2½ except where noted.





Benches are a delightful addition to any yard or garden. They add a decorative touch and provide a pleasant spot for quiet conversation, contemplation or for simply enjoying the outdoors. But the bench I built has a special purpose: It serves as a memorial to H.G. "Jerry" Sanders, a conservationist who was the leader of a successful grass-roots effort to preserve one of the last-remaining stands of old-growth forest on south Whidbey Island, about 30 miles north of Seattle, Wash., in Puget Sound.

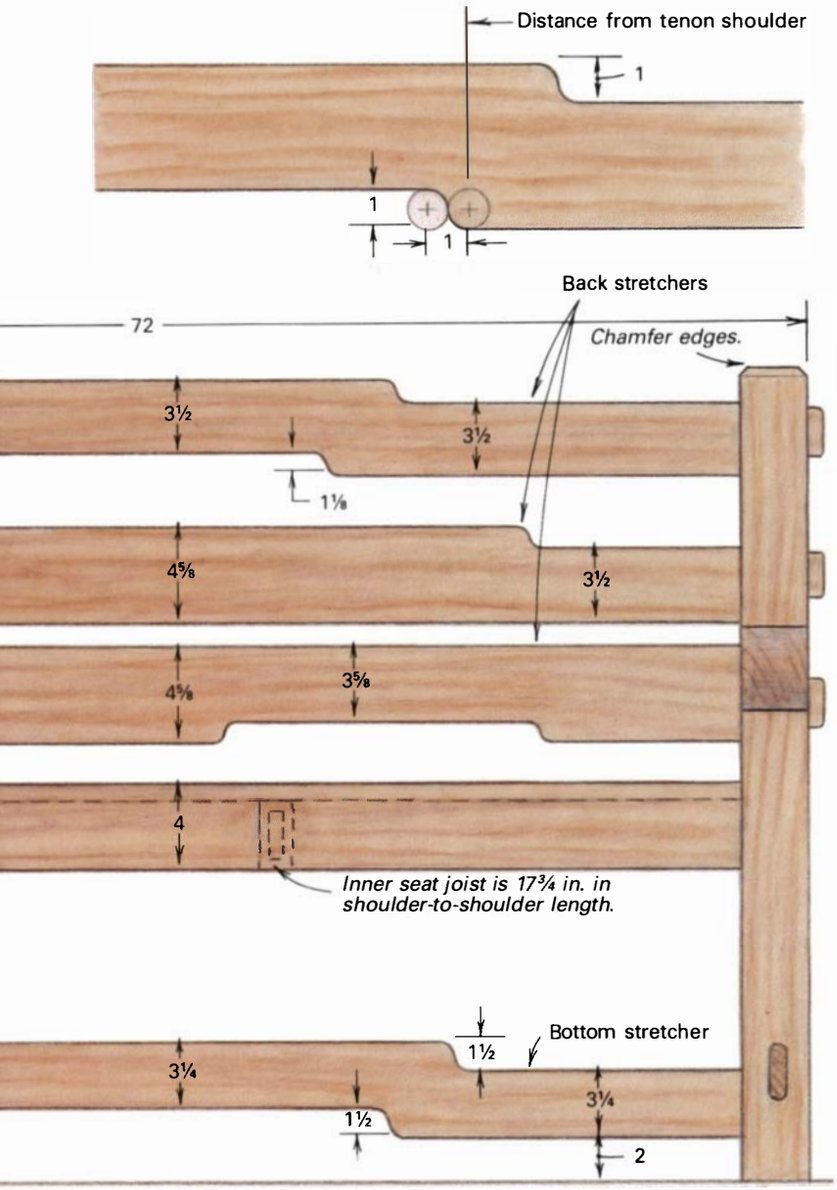
The 6-ft.-long bench shown in the photo on the facing page is large enough to seat three or four people. It has the look of a traditional English-garden or park bench, but with an Oriental twist suggested by the back stretchers, which are stepped much like the roof line of a Japanese temple. And, as is common with Japanese furniture, the joinery itself is also a strong visual element. Mortise-and-tenon construction is used with waterproof epoxy resin to connect the bench members. The only hardware are the bronze, square-drive screws fastening the slats to the seat joists. The bench is permanently installed with bolts that extend from the bottom of the bench's legs and are set in concrete.

Wood selection and bench design—Intended for public use, the bench had to be ruggedly constructed to withstand the wear and tear of the anticipated traffic and the rigors of the Pacific Northwest climate. I didn't want the bench to be dwarfed by the background of giant Western red cedars, so I went with a hefty construction, which seems appropriate for the size of the bench and in scale with the neighboring trees.

Selecting the right wood for your climate can eliminate much of the maintenance and periodic refinishing that might otherwise be necessary. I wanted my bench to weather naturally and blend with its environment. Little light filters through the old-growth forest, so the area remains damp for long periods of time; thus, I was limited to durable, moisture-resistant varieties, such as teak, cedar or redwood. I chose Alaskan yellow cedar, because it is durable, more dense and structurally stronger than Western red cedar or redwood. It is also very aromatic and cheaper than teak. I selected the most-attractive pieces, those with straight, tight grain and those containing a minimum of knots and sapwood, which would eventually rot. And, much of the air-dried and check-free wood I purchased was full-dimensional, rough-surfaced 4x4s and 5x5s, enabling me to build the bench without laminating any of its parts.

If you can't get West Coast species, woods such as white oak, which

Fig. 1A: Stretcher transition detail



had been influenced by ideas from Asia. Some of their designs were based on strong horizontal line patterns, such as the cloud-lift patterns found in the tiered, roof-beam construction of traditional Chinese and Japanese buildings. In developing my final design, I modified the traditional English park bench, like the ones you find in quality mail-order gardening catalogs, to incorporate this same kind of strong but delicate-looking tiered construction.

The dimensions of the finished bench are 72 in. long, 38 in. high and 24 in. deep (see figure 1 at left). The back of the bench is composed of three horizontal supports, each of different width with offset curving transitions. The shape of the back, created by all its pieces joined together, is important, because the back is visually dominant and therefore strongly suggests the bench's theme. I've continued the Japanese flavor into the elegant, flowing shape of the arms, front legs and leg spreaders. The through mortises with protruding tenons connecting the back members to the leg posts focus ones attention on the joinery, further emphasizing that Asian touch.

I was determined to make the bench pleasant to sit on, so I decided on a gently sloped back and a slatted, concave seat, both of which are comfortable and attractive. This design also makes it possible for rain water to run off the bench easily. The back of the bench is straight, but the whole assembly angles back at about 4°. The three horizontal members of the backrest are hefty and positioned to provide plenty of support.

Building the bench—I start by rough-cutting all pieces to length and by truing up the stock. Most of the pieces must be shaped, but I cut all mortises and tenons first, while the pieces are still rectangular (or square). I rough-cut the mortises with a ¾-in. Forstner bit in a drill press. For the through mortises, a lumber scrap placed under the workpiece prevents the bit from tearing out the wood. I pare the walls carefully with a chisel, but leave the corners rounded. I find it easier and faster to round the tenons to fit rather than square the mortises.

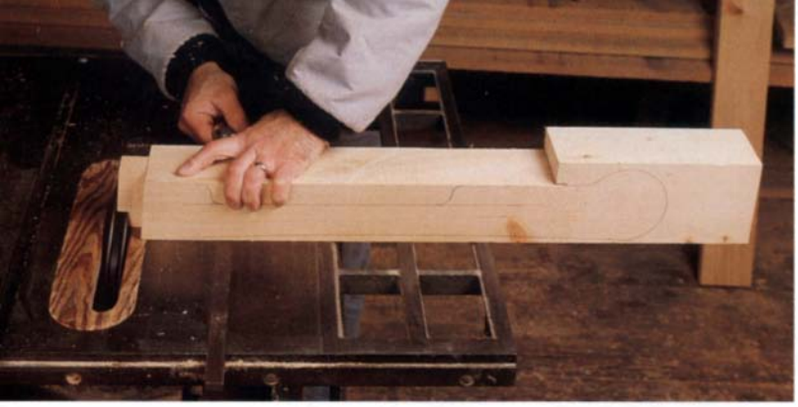
The tenons are cut with a dado blade, as shown in the photo at the top of the next page. Because many of the parts are large and awkward to handle, I built a crosscutting jig like the one described by Tage Frid (see *Tage Frid Teaches Woodworking, Book 1: Joinery*, p. 43; available from The Taunton Press, 63 S. Main St., Box 355, Newtown, Conn. 06470). My jig has two parallel hardwood strips

woods used for roof shingles and outdoor decks are also options. Softwoods are generally more dimensionally stable over a wider range of humidity than hardwoods and may be easier to work, but if you expect your bench to receive hard use, stick with the hardwoods.

Because Sanders had lived for years in Japan, I wanted this bench to reflect his great appreciation of the Japanese aesthetic. I first intended to base the design on traditional Japanese park benches, but was surprised to discover that such benches are not part of the country's culture. Public parks as we know them did not exist in Japan until about 150 years ago. The compounds of shrines and temples, which are not parks per say, are laid out with narrow, meandering walkways, and visitors can admire the landscaping as they stroll through the grounds. Occasionally, backless stone stools, designed to be a part of the landscape, are found in private gardens. The benches found in newer Japanese parks are mostly due to modern Western influences, and as such are reminiscent of benches sporting bright commercial advertising at bus stops in this country.

In looking for new inspiration, I remembered that several architects from the American Arts-and-Crafts tradition of the early 1900s had been influenced by ideas from Asia. Some of their designs

The author's bench is in a forest on Whidbey Island, Wash., amid a stand of Western hemlock, Douglas fir, sitka spruce and grand fir. Nearby is a 400-year-old Western red cedar, 31 ft. in circumference.



Above, Goertzel cuts the angled dado on one of the bench arms while the stock is still square. Afterwards, he'll use a bandsaw to rough out the shape of the arm to the marked outline.

glued to the bottom of a large sheet of ½-in. plywood. The strips fit the saw's miter grooves. The workpiece rests against a fence on the jig, which slides easily and provides good control when making crosscuts. The jig is simple and effective. After cutting the tenons, I round the corners with a rasp to fit them to the mortises.

At this point, I'm ready to shape the parts. I use the tablesaw and bandsaw to cut all the pieces within 1/16 in. of their final size. Handplanes, power- and hand-sanding with 80 grit and 120 grit quickly shape and smooth the pieces to their final form. Yellow cedar has a pungent odor and is an irritant to some people when it is being sanded or cut, so it's important to wear a respirator when working with this wood.

After dry-clamping the bench to check for fit and squareness, and to work out the assembly sequence, I'm ready to glue it up. I use epoxy resin, because it is strong, waterproof and a good gap filler. The epoxy "Cold Cure," available from The Wooden Boat Shop, 1007 N.E. Boat St., Seattle, Wash. 98105; (206) 634-3600, is especially formulated for cold temperatures and is often used by boatbuilders in the cool maritime climate of Puget Sound. Alternative glues, such as resorcinol or those with a urea-formaldehyde base, would also be suitable. I glue up the two end sections first and then lay them aside while I glue the seat joists to the front and rear seat stringers. Lastly, I glue these three sections together, along with the three back spreaders and the lower spreader that connects the front legs. Having an assistant available can help the assembly and glue-up go smoothly and quickly in a single stage. I use a rag soaked with acetone to clean away any excess glue before it has a chance to set up. Finally, I fasten the seat slats to the joists with countersunk, 2-in., square-drive #10 bronze screws.

I sand the bench once more, this time with 150 grit, to remove any remaining defects and to clean the surface in preparation for applying the finish. Two coats of 1:1 mix of Daly's Sea Fin Teak Oil (Daly's Inc., 3525 Stone Way N., Seattle, Wash. 98103; 206-633-4200) and Flecto Exterior Varathane (The Flecto Co., Flecto International Ltd., Box 12955, Oakland, Calif. 94604; 415-655-2470) varnish are applied. The mixture seals more quickly and more thoroughly than oil by itself. The finish doesn't prevent the bench from weathering to a natural gray color, but it does help prevent checking and warpage as the bench adjusts to its outdoor environment.

To install the bench in its permanent location, drill ½-in. holes 5 in. deep in the center of the bottom of the legs. Drive in ½-in.-dia. by 10-in.-long galvanized hex-head bolts and set them into wet concrete pads. The bench is elevated approximately 1 in. above the concrete, to keep the legs as dry as possible and to prevent moisture absorption by the endgrain of the legs. □

John Goertzel is a woodworker and builder. He lives on Whidbey Island, Wash. His company, Threshold Construction, specializes in passive solar structures. Sue Ellen White-Hansen is a freelance journalist and coauthor of this article. She also lives on Whidbey Island.

Walnut settee by the sea

by Thomas Hughes

I designed this walnut bench to provide a comfortable seat large enough for three people to enjoy a magnificent vista of the Pacific Ocean from the living room of an Arch Cape, Oreg., beach house. Almost 7 ft. long, the bench, shown at the top of the facing page, provides ample space to place drinking glasses or snack dishes. It also complements a framed, glass-top coffee table I built for the owners of the house.

The bench's apparent simplicity is deceptive. Contoured front and back rails reinforced with concealed metal brackets support a suspended seat made from contoured, laminated slats. The legs cant inward at the bottom, giving a visual lift to the bench, but this requires joining the legs to the aprons at an angle. These joints are not difficult to cut, though, if you lay them out carefully.

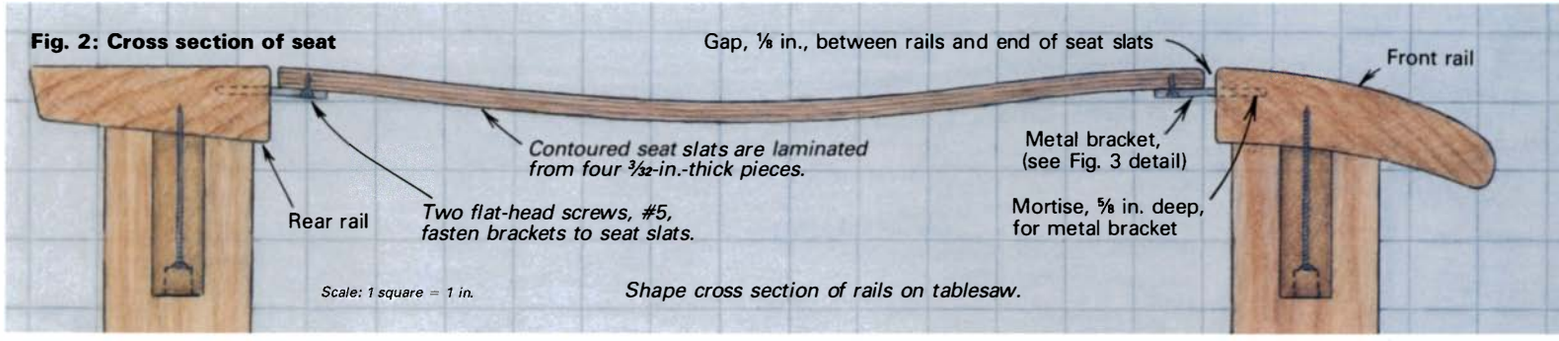
Bench design—I always make sketches to help sort out my ideas. Once I have a good sense of the piece, I usually make dimensioned scale drawings, along with full-size renderings of complex joints and other details. These drawings are needed to make this bench, but more importantly, they give me a better feel at this stage of whether or not my idea will "work." Finally, I build full-scale models from wood, cardboard and other scrap materials so I can study the design from a variety of angles and refine my ideas.

Three-dimensional models also give me a way to test the bench for comfort and to resolve construction details. I knew from my sketches that a framed, slatted seat would work well visually, but I needed to determine the most comfortable shape. To do this, I bandsawed different profiles from ¾-in. particleboard and set them on improvised pedestals so I could sit on them. Then, I kept modifying the shapes until one felt good. Next, I made a full-size end-view drawing of the bench seat to help determine how the front and rear rails should be shaped so they blend smoothly with the contoured slats (see figure 2 on the facing page).

I wanted the slats to be as thin as possible so the bench would appear light and the seat would give a little when a person sat down. I decided ⅜-in.-thick slats would be best, but this creates a structural problem in attaching the slats to the rails. Dovetails work, but appear too busy for my taste. I decided to use metal brackets: one end fitting into a mortised slot in the rails; the other end screwed to the bottom side of the slat. This solution enhances the feeling of lightness, because there's a ⅛-in. gap between the slats and the rails. The seat appears to be free-floating. This arrangement also increases the "springy" feel and adds to the bench's comfort.

I use 4-in.-wide stiles at both ends of the seat frame and an off-center middle stile, as shown in figure 3 on p. 58. The middle stile, the focal point of the bench, is made from a highly figured piece of walnut bordered with sapwood. By cutting the walnut into two pieces separated by a curved, tapering gap with the sapwood oriented toward the outer edges of the stile, interest was added. I left each outside edge irregularly shaped, as I had found it after removing the bark. Aside from design considerations, this two-piece

The author's 7-ft.-long walnut viewing bench will accommodate three people. Hughes designed the bench for a beachfront home overlooking the Pacific Ocean in Arch Cape, Oreg. The bench's slatted, contoured surface makes for comfortable seating.



stile is useful as a convenient, built-in table surface.

The front and back aprons are tenoned into the leg tops. Screws counterbored up through the aprons fasten to the underside of the bench seat. The I-shape leg-stretcher assembly is also tenoned into the legs. While experimenting with my full-scale model, I discovered that I liked the appearance of the legs canted slightly inward from each side at the bottom, as shown in figure 3 on the next page and in the photo above. These odd angles complicate layout and cutting, so I make full-size patterns for the canted parts.

Construction—I start by building the lower frame, then do the seat. I pay particular attention to setting up my power tools and building special fixtures for odd-angle cuts. The old adage "measure twice, cut once" is good advice here.

I rough-cut stock for the legs to length and then square it up. The top and bottom of the legs are cut at a 6° angle, to allow for the leg cant. In addition, the tops need to be trimmed to match the contoured shape of the underside of the seat frame's front and back rails. I transfer the angles for these onto the ends of the legs directly from my full-scale drawing before cutting them on my tablesaw. I also mark the orientation of each leg, to avoid confusion.

I use the full-scale drawing again to mark the location of the mortises on the legs where the aprons and leg stretchers will be joined. To account for the leg cant, I tilt the drill-press table 6° before roughing out the mortises with a ⅜-in. brad-point drill bit. The leg stretchers are joined to the legs at 90°, but are skewed 6° from the leg vertical, so I return the drill-press table to its horizontal position before roughing out these mortises. I pare the mortise walls and square the ends with a chisel.

Next, I cut stock for the aprons and stretchers to length and square it up. The tenons are easily laid out directly from the full-scale drawing. I cut the shoulders on the tablesaw and then switch to a dado blade to remove the waste from the tenon cheeks, cutting shy of the intended depth. I use my router with a ½-in. dado clean-out bit (Carbide Saw & Tool Co. Inc., 2337 E. Burnside, Portland, Oreg. 97214; 800-777-7798) to bring the tenon cheeks to their final size. I also rough out the apron tenons on the tablesaw, but because the shoulders here are angled, I cut them by hand using a Japanese Kaisoku Noko saw (Grizzly Imports Inc., Box 2069, Bellingham, Wash. 98227; 206-647-0801 or 2406 Reach Road, Williamsport, Penn. 17701; 717-326-3806). I then clean up the apron tenons and shoulders with a chisel. I prefer the Japanese saw over a backsaw, because the Japanese saw cuts on the pull stroke, which I find more accurate and easier to control.

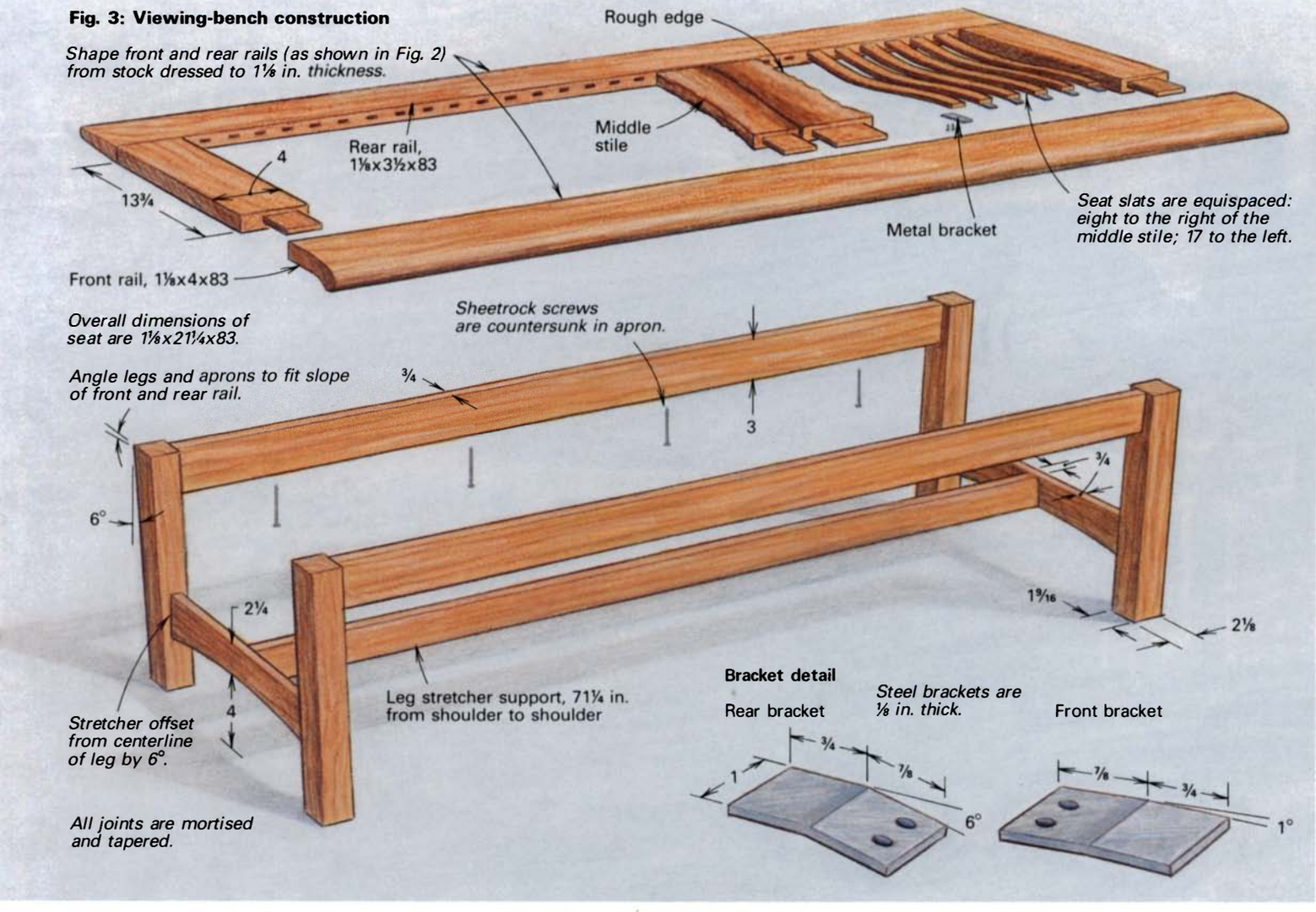
After drilling and counterboring holes in the aprons for screws that I'll use later to fasten the frame to the bench seat, I dry-clamp everything together to check the fit of the frame members. I make any necessary final adjustments and then reassemble and glue with Titebond. Now I'm ready to work on the bench seat.

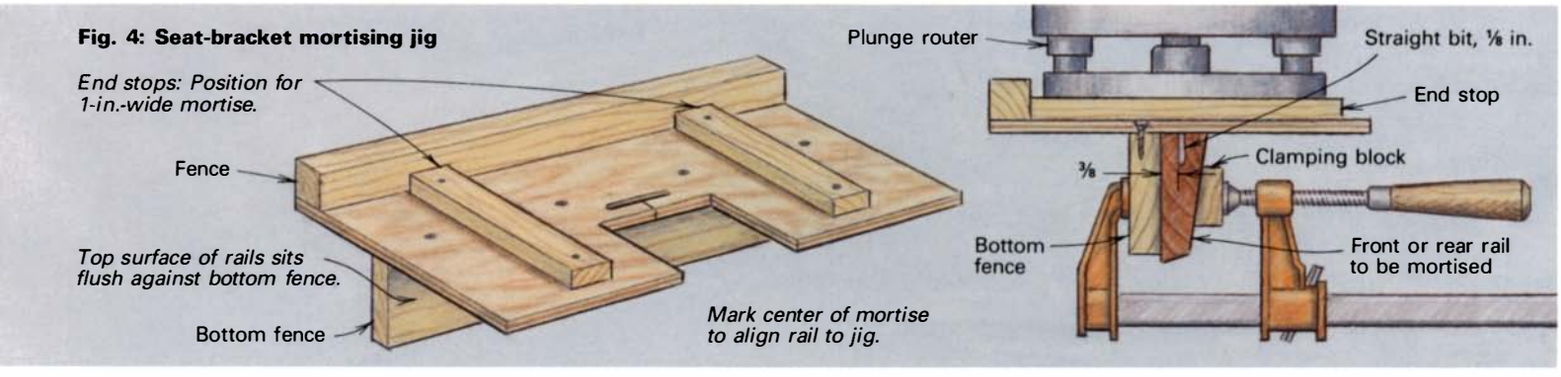
I make the frame for the seat first. The mortises and tenons are cut in the rails and stiles as described above. To cut the tenons in the irregularly shaped middle stile pieces, however, I screw both stile sections to a squared-up piece of ¾-in. particleboard. The screws run up through the particleboard and into the underside of the stiles. (Even though these screw holes don't show, I still fill and sand them later.) After aligning stiles on the particleboard to replicate the way they will fit in the frame, I use the square particleboard edges as reference surfaces for cutting the tenons.

I'll later make and install metal brackets to support the floating seat slats. These brackets will fit into mortised slots in the front and rear rails. I rout these slots next, while the stock for the rails is still square. The mortise locations are taken directly from the full-size drawing; the top, inside edge of each rail is used as a reference, because this edge will not be affected later, when the rails are shaped. The mortises are cut with a plunge router with a ⅛-in. straight bit (available from Wisconsin Knife Works, 2710 Prairie Ave., Beloit, Wisc. 53511; 800-225-5959 or 608-365-9581 in Wisconsin; catalog #60006), using the shopmade mortising jig as shown in figure 4 on the next page.

To contour the length of the front and rear rails, I transfer the profile of the rails from the drawing to the ends of the rail stock. The back rail requires only two angled rip cuts on the tablesaw:

Drawings: Lee Hov





The first cut shapes the bottom of the rail; the second shapes its rear edge. A jointer plane can do the job just as well. The front rail is a bit more involved. With my tablesaw blade set at 16° (from vertical), I make a rip cut to remove most of the waste from the top surface of the rail. Then, using a ⅜-in.-wide dado blade, I rip along the underside of the rail to rough out its shape. The first pass is the deepest cut, extending just shy of what will be the rail's inside, bottom edge. The next pass, adjacent to the first, is made a bit shallower, but again, shy of the profile line drawn on the end of the rail stock. I continue in this way until I've completely carved out, in rough form, the concave shape on the stile's bottom surface. I use an old wooden jack plane (the sole and blade made convex to a 5-in. radius), a belt sander and hand-sanding to refine the shape and smooth the surface to its final form. I use Titebond glue when assembling the stiles and rails to form the seat frame.

Both the seat-frame and lower-frame assembly are sanded and lacquered next. I use 80 through 320 grit on the contoured surfaces and 120 through 320 grit on the flat surfaces. I apply two coats of lacquer sanding sealer (available from Imperial Paint Co., 2526 N.W. Yeon St., Portland, Oreg. 97210-1895; 503-228-0207), rubbing with 00 steel wool after each application. Finally, I apply two coats of semigloss lacquer. Each of these coats is rubbed down with 0000 steel wool.

The brackets connecting the slats to the rails are made from 1x1x1⅝-in. mild bar steel. I buy mine cut, drilled, bent and filed smooth at a machine shop for about $150. Each bracket has two ⁵⁄₃₂-in. holes drilled and countersunk for #5 ⅜-in. flat-head screws. After masking the ends of the brackets, which will later be inserted in the mortises, I prime them with Rustoleum spray primer and finish them with a coat of flat-black Rustoleum spray paint (available at local hardware stores). When the brackets are dry, I

cement the brackets in the mortised rails with epoxy resin. Be sure to use only a moderate amount of epoxy, because squeeze-out can ruin the lacquer finish. If I do get some squeeze-out, I clean it up immediately with flat toothpicks.

At this point, I'm ready to make the contoured slats for the seat. These can be steam-bent from solid stock, but I decided to make mine by laminating four 3/32-in.-thick strips. I start by rip-cutting 3/16-in.-thick slats on the tablesaw from 1 5/8-in.-wide stock. I plane the slats to their final 3/32-in. thickness. I use a shopmade form to glue four slats together, again using Titebond glue. After jointing one edge, I rip the slats to width on the tablesaw. The slats are then placed back into the form, which I use as a kind of sled to cut the slats to length on the tablesaw. To complete the slats, I hand-sand them with 80 through 320 grit, gently rounding their edges, and finally apply three coats of Watco Natural Oil. I rub the slats down with 0000 steel wool after each coat. The last step entails fastening the slats to the metal brackets with screws and assembling the seat to the frame with screws that go up through the front and rear aprons and into the underside of the seat rails. □

Tom Hughes lives in Arch Cape, Oreg., and specializes in designing and building custom furniture.

Art-nouveau garden bench

by Bim Burton

Art nouveau, with its flamboyant, free-flowing curves, was the rage at the turn of the century. The briefly popular style leaned heavily on nature for much of its inspiration, so it was natural that the Chelsea Flower Show, England's most prestigious horticultural event, would celebrate its 75th anniversary by trying to re-create a spirit of the era. I was invited to design and build a garden bench for the show that would echo this theme. My oak bench, shown below, is large enough to seat two people. Its slatted construction makes for an open, airy appearance, and the effect is accentuated by the interplay of light with the line and structure of the bench.

Although the bench is ruggedly constructed, I avoided complex joinery in building it. I used butt joints and countersunk screws throughout to secure all the bench's parts. Screws make the bench quick to assemble and add a decorative touch. The shape of the slatted back is the result of a freehand sketch. Each slat is wedged between the two rear seat planks and screwed to the bottom rail. I drilled a hole near the top of each slat and threaded yacht rope through. The rope is knotted between each slat to fix the spacing and provide stability, but it also allows for a little "give" to the backrest, adding to the bench's comfort. The bench has armrests, but they are not structurally necessary, so can be added on or not according to one's personal taste. After sanding, I finish the bench with several coats of exterior varnish. □

Bim Burton designs and makes furniture at Workshop 119 in London, England.

Photo: Courtesy Kim Ivrey and 'Practical Woodworking'

This distinctive bench was especially built for display at the 1988 Chelsea Flower Show in London, England. The bench's lines, reminiscent of styles popular at the turn of the century, would make the bench a bright spot in any garden or yard.

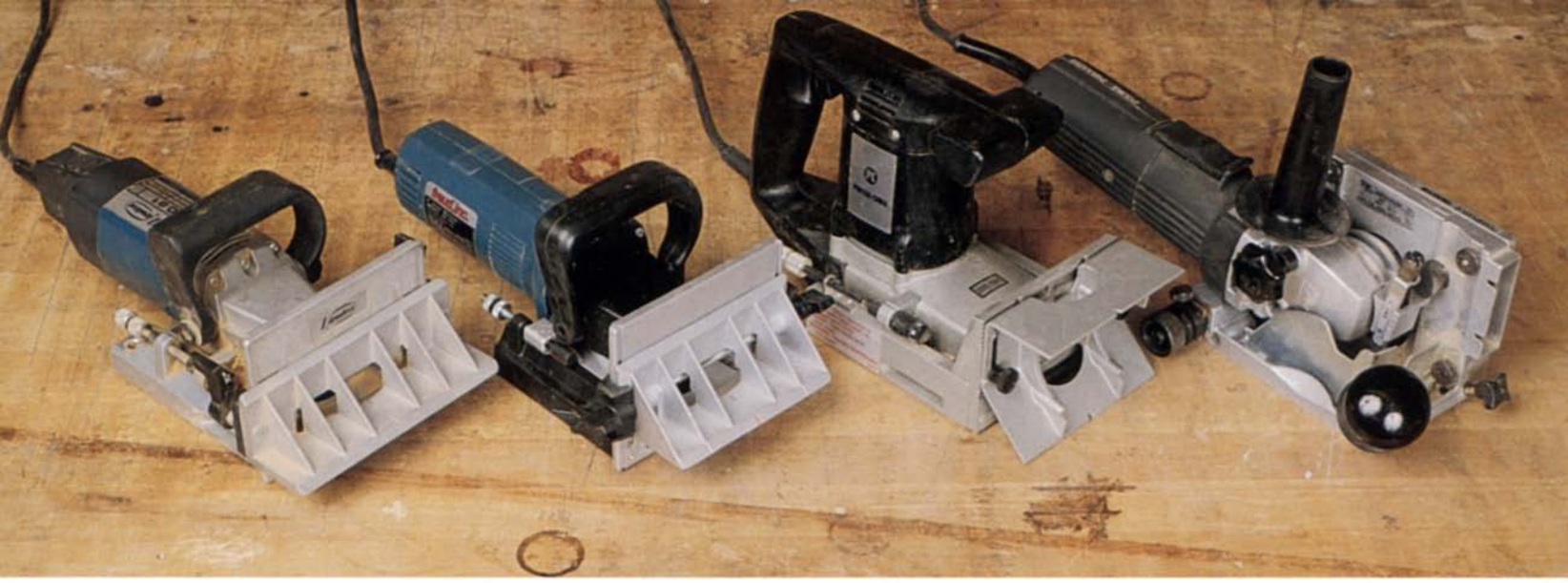


Plate-joinery machines offer furnituremakers and cabinetmakers a fast and accurate way of joining wood together. The plate joiners above, from left to right, are the Virutex 0-81, Freud JS 100, Porter-Cable Model 555 and Elu Jointer/Spliner 3380.

Plate Joiners

Comparing eight portable slot-cutting machines

by Allan Smith

A newcomer to the field of woodworking techniques, plate joinery has won wide acceptance among American cabinetmakers. It is especially useful in small cabinet shops that lack sophisticated joinery equipment, like multispindle horizontal boring machines or computer-controlled mortisers. A plate joint is a species of spline or "floating tenon" joint: Slots are cut in both pieces to be joined, and precut plates or "biscuits" of compressed wood are glued into the slots. Plate joints let you bypass much of the layout work and cutting operations associated with traditional joints, such as dovetails, dowels and rabbets/grooves. They are fast, accurate and safe to produce, and they are suitable for all types of wood and wood-base materials, such as plywood and particleboard. As in the case of dowel joints, parts can be cut to final size prior to joining, but the slots for plates are easier to locate and more forgiving than dowel holes. Three different sizes of biscuits are available for use in stock of different widths and thicknesses.

The speed and convenience of plate joinery is due to a special machine called a plate joiner. The machine is basically a plunge-cutting circular saw with a guide for referencing the blade to the stock and with built-in stops, which set the cut to the correct depth for biscuits. Although all plate joiners cut slots in a similar fashion, there are differences between various makes and models worth considering before buying. To date, there are eight different machines on the market, shown above and at the top of the facing page, manufactured by six different manufacturers: Virutex, Freud, Porter-Cable, Elu, Kaiser, Lamello. I tried these machines for six months in my shop in New Jersey, where I build custom cabinets and furniture. While all the machines cut slots well, I found that some of the machines are easier to use than others. Also, there are special features that can make one machine more useful than another for particular applications, including operations other than plate joinery. Before I discuss my observations about the individual machines, let's look more closely at how plate joints are made, how a plate joiner is constructed and the features that distinguish various models. A chart summarizing the eight models is on p. 64.

How plate joinery works—The first step to creating a plate joint is to accurately cut mating slots in the two pieces of wood to be joined. Butt the two pieces together and strike a short pencil line on the face of the pieces across the joint to mark the location of each slot. Generally, a biscuit will be inserted every couple of inches along the joint. Next, the depth adjustment is set to locate the slot, generally in the middle of the edge. The pieces to be joined are separated and the center mark on the plate joiner is aligned with a pencil line. The machine is turned on and pushed into the wood to cut a slot. The operation is repeated until slots are cut at each pencil line. Glue is put into the slots, and a biscuit is inserted into one side of each mating pair. The biscuits are die-cut from compressed wood and should fit snugly into the slots (provided they are kept dry). When the joint is clamped, moisture from the water-base white or yellow glue causes the compressed fibers of the biscuit to expand, resulting in a joint that's remarkably strong. Although a plate joint registers the pieces to be joined parallel to the biscuit surfaces, the slots are slightly longer than the biscuits and allow the joint to be shifted a bit along its length—about 1/16 in. in either direction.

Plate joiners are plunge-cutting circular saws that create slots for football-shape biscuits, glued into the slots like splines. The machines above, from left to right, are the Kaiser Mini 3-D and the Lamello Junior, Standard and Top 10.

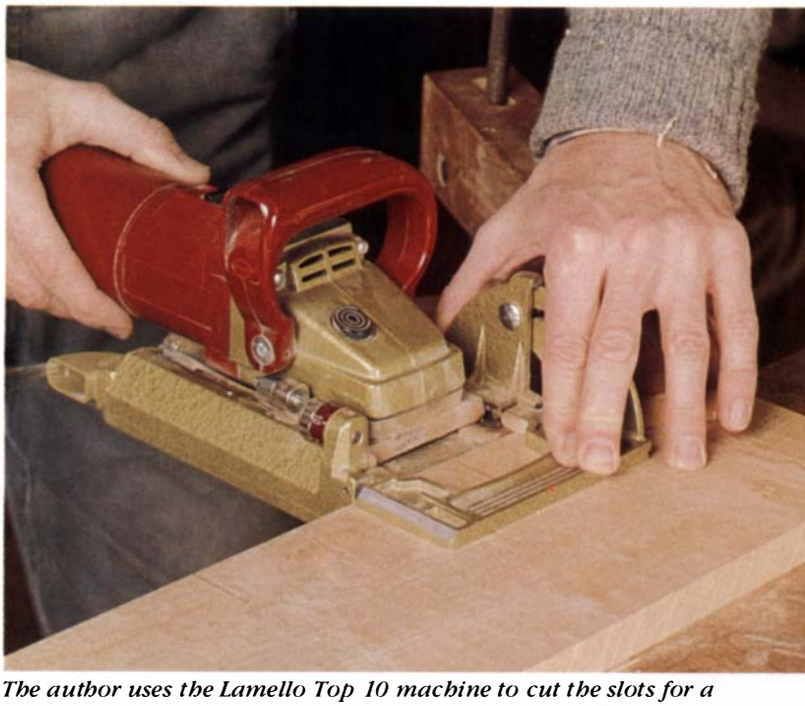
While case construction is perhaps its primary use, a plate joiner is very versatile and can be used in making panels and frames, or for cutting grooves. You can use biscuits to join boards along their edges, say for a tabletop, as shown in the photo below, right, or you can join a leg and apron or rail and stile with biscuit-reinforced butt joints or miters. Partitions or shelves can be joined to cases by cutting slots for biscuits in the face of one panel and on the edge of another. In each case, the slots should be spaced evenly along the joint; use as many as needed for strength and alignment of the joint. Sometimes two plates are used side by side, to give more strength when joining heavy stock, say 8/4 or thicker. For other plate-joinery applications, check your machine's manual and use your imagination.

Like all other joining methods, plate joinery has its limitations: It cannot be used effectively on very small or very large parts, and it has no decorative value. Because slots allow some side-to-side shifting, a plate joint won't align parts perfectly along the joint the way dovetails or dowels will.

A plate joiner is probably one of the safest power tools in the shop. But, its whirling blade still deserves respect, and you should observe a few rules for safe plate joining: Never attempt to cut a slot in a small piece that's hand-held or can't be firmly clamped down, to prevent the plunging blade from grabbing and hurling it. Manufacturers recommend you always keep your hands behind the blade area when plunging, but many craftsmen prefer to press down on the fence, to stabilize the machine—a practice I've found safe because your hand is still away from the cutting edge. When plunge-cutting, a plate joiner can send a cloud of particles through its dust chute with considerable force, so keep your face away from the chute area and always wear safety goggles. Also, if you work for a long period of time, you should wear a dust mask or fit the machine with a vacuum hose. Most plate joiners are very loud—an unpleasant reminder to wear earplugs or earmuffs.

Plate-joiner construction—On most plate joiners, the blade, arbor and motor are mounted on a moving carriage that rides in the machine's baseplate. Pushing on the plate joiner's body and/or handle plunges the blade through the faceplate, which is part of the base, and into the workpiece. After the slot is cut, a spring retracts the blade behind the faceplate, out of harm's way. To plunge smoothly and accurately, the fit between carriage and baseplate must be precise: If the fit is too loose, the blade may make a sloppy cut, resulting in too large a slot; if the fit is too tight, plunging will be difficult or jerky. The return springs, too, should provide just the right amount of pull, so the blade is retracted quickly but you don't have to fight the spring during plunging.

Fences and guides—Most plate joiners have adjustable, removable fences that attach to the machine's faceplate. With the fence held down on the face of the stock, both the angle of the machine and the placement of the slot on the stock's edge are determined. Adjusting the fence's height, relative to the blade, allows the slot to be centered on an edge, or placed as desired. Most machines have tracks or guides to keep the fence parallel to the blade while its height is adjusted, so that slots will also be parallel. The Lamello Top 10 and Kaiser Mini 3-D were the only machines I tried that had tracks machined accurately enough to allow setting the fence



The author uses the Lamello Top 10 machine to cut the slots for a simple edge-to-edge joint, such as would be used to join the boards for a wide tabletop. The adjustable-angle fence on the Top 10 is locked down so the face of the machine contacts the edge of the board squarely. Pencil lines on the board, which mark where the slots will be cut, are aligned to a centerline on the plate joiner's fence.

The adjustable fence on the Porter-Cable Model 555 flips over and positions the machine for cutting slots on a mitered panel's edge. Its 'D' handle design distinguishes it from other plate joiners, which must be grasped by the motor housing for plunge-cutting slots.

The stepped depth-stop on the Lamello Standard quickly sets to three positions that adjust the machine's depth of cut to make slots for different-size plate-joinery biscuits. Similar depth stops are found on most other models.

squarely without having to use a try square or painstakingly measure fence-to-blade distance. Most machines have hand screws or levers for locking the fences and for keeping the fence from moving during slot-cutting. The Lamello Standard, however, relies on two Phillips head screws for securing its fence, which is somewhat inconvenient.

In lieu of a fence, plate joiners can also be used by laying both the machine and stock flat on the bench, for plunging. The Elu, which lacks a front fence, must be used this way for edge-cutting slots. Most fences are reversible, the flip side allowing slotting on 45° edges, for mitered frames or panels. To locate the plate on a mitered edge, the fences on most machines reference to the inside edge of the miter. In contrast, the fences on the Elu and Porter-Cable reference to the miter's outside edge, so even if the pieces are of slightly different thicknesses, the tips of the finished miter will align. The Lamello Top 10 and Junior allow the miter to be referenced from either side of a mitered edge. In addition to 45° fences, the Lamello Top 10 and Standard and the Kaiser machines have fences that set at any angle from 0° to 90°, for plate joining odd-angle pieces. On machines without this feature, you must make an angled wedge to shim the standard fence to the angle you need. Besides the standard fence, the Elu and the Kaiser come with edge guides for aligning slot cuts or grooves on a surface parallel to the edge—very handy for panel work.

Most plate joiners use some kind of device to keep the machine from shifting out of position due to the force of the blade entering the workpiece. Among the machines I tried, most have a pair of spring-loaded steel points that retract into the faceplate when it's pressed against the work. Some plate joiners allow points to be removed if the machine is used to cut continuous grooves. The Lamello Top 10 has a pair of rubber bumpers in lieu of points, but these aren't removable and I didn't find them any more effective than steel points. I found the best anti-slip feature on the Kaiser's faceplate, which has a ribbed-rubber covering that's very effective in preventing slipping, though it can't be removed for grooving operations. The Elu model I tried had no anti-slip feature, but I did not find this to be a problem during slot-cutting. Elu's newest models feature removable steel points.

Motor and blade—The universal motors used in plate joiners range in rated amperage from 4.6 amps to 6.7 amps (manufacturers don't rate them for horsepower output). Generally, the more-expensive machines come with more-powerful motors, but all the machines are adequately powered. Cuts in hard maple caused all the machines to slow, but the Kaiser and Lamello Top 10 slowed the least. The Porter-Cable and the Lamello Junior slowed down the most, but not enough to cause any problems.

Most plate joiners have the motor mounted horizontally and transfer the power to the blade via beveled gears. While this may be mechanically efficient, it seems to make the machines very noisy. Surprisingly, the least-expensive machine in the review, the Porter-Cable, was by far the quietest, probably because its vertically mounted motor drives the blade with a belt instead of gears.

Most of the blades on the machines are 6-tooth carbide blades approximately 4 in. in diameter, except the Elu, which sports a 12-tooth blade. Although blade designs varied, all cut smoothly. For grooving or trim work in veneers or plywoods, Elu offers an optional 30-tooth blade. Blade change requires partial disassembly of the carriage and baseplate on all plate joiners, and most use a pair of wrenches to loosen the bolt that locks the blade. In contrast, the Lamello Top 10 and Kaiser machines both incorporate blade locks, to make blade changes, however infrequent, easier.

Depth adjustment—The depth a plate joiner's blade plunges can be set anywhere from 0 in. to about ¾ in., and most machines have built-in stops for the three standard biscuit sizes: #0, #10 and #20. Depth of cut is set by turning a threaded stop rod conveniently located on most machines on the base aside the motor. Most of the machines have three stops, making it easy to change over from one biscuit size to another without fine-tuning the depth of cut. The exceptions are the Elu and the Lamello Junior. When setting the Lamello Junior, the adjustment rod must be screwed in or out and the depth of blade plunge measured. This makes changing from one biscuit size to another a matter of careful measurement or trial and error—a real hassle. The Elu's depth adjuster is slightly better, because it has a depth-of-cut scale calibrated in millimeters, but it has no markings to indicate plate sizes. The machines with stepped stops allow the depth of cut to be fine-tuned with a locking collar on the stop rod.

Handles and switches—Most plate joiners are designed to be held by the "barrel," or motor housing, and a handle on top during use. But two of the machines, the Porter-Cable and the Elu, are

designed to be held differently: The Porter-Cable has a "D" handle with a trigger switch; the Elu works on an altogether-different principle from the other plate joiners—pivoting the blade into the work rather than plunging—and hence has a different grip.

Switches may be found on the top, side or rear of the motor housing, depending on the machine. I found it easy to get used to switching any of the machines on or off. The Virutex features a rubber switch cover, to keep dust from fouling the switch's electrical contacts. Most of the machines have locking switches, so you don't have to keep your finger on the switch during the cut. The exceptions to this are the switches on the Porter-Cable and the Elu, both requiring constant pressure. This can get tedious, but can add to the machine's safety: The motor switches off when the operator lets go.

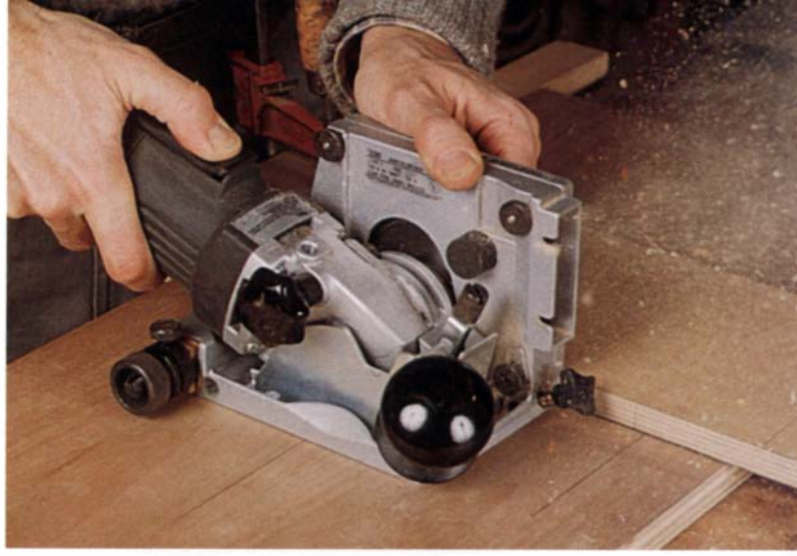
Accessories—Standard accessories for plate joiners usually include wrenches for changing the blade, lubricating oil to keep the carriage sliding smoothly and an assortment of biscuits. All the models come with carrying cases (the Lamello Junior's is cardboard), which can be very handy if you do on-site work. Vacuum hoses are available for all the models (except the Freud and Porter-Cable). These attachments are especially great for left-handers, who stand on the dust-chute side of the machine while running it.

An accessory I consider indispensable is Lamello's glue applicator: It's a glue bottle with a tip that fits into plate slots and applies glue to both sides at once. It works well in positions that would be awkward to reach with an ordinary glue bottle. Several companies, most notably Lamello, manufacture a variety of tools for installing special hinges and knock-down fittings, which fit into the slots cut by all plate joiners.

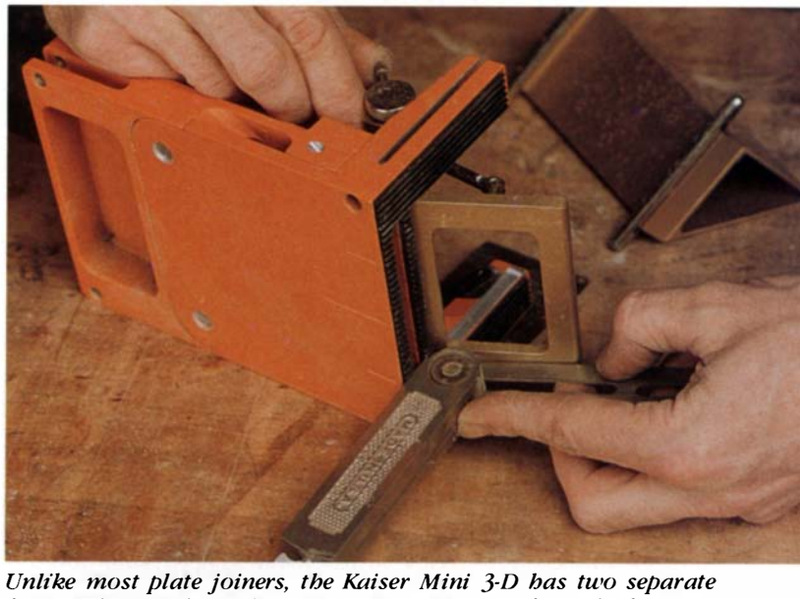
Lamello Top 10, Standard and Junior—The Swiss-made Lamello was the first plate joiner introduced into the United States, and in some ways, Lamello has set the standards for the field. Their Top 10 recently replaced the "Top" as Lamello's best and highest-price model. It is an extremely well-made machine. The Top 10's powerful motor and blade unit slide on precisely machined runners with absolutely no play, and the firm-yet-not-too-strong spring tension makes plunging it a pleasure. The machine's adjustable-angle fence is calibrated from 0° to 90°, which makes cutting odd miters a breeze. The fence has a quick-set position that automatically centers slots in ¾-in. stock, and a clip-on plastic fence plate, which is provided, will center slots in ½-in. stock. The detachable, standard fence adjusts for height on an accurately machined track, and my only complaint is that the height scale on the fence is marked in ⅛-in. increments—too coarse for precise positioning. Optional accessories for the Top 10 include special defect-patching attachments, designed to cut out surface defects and replace them with football-shape patches, available in a selection of woods. Also, there's a stand for turning your portable machine into a stationary tool.

Lamello's Standard and Junior models exhibit the same high-quality construction as the Top 10, but lack some of its features. The Standard has an adjustable-angle fence, but it's uncalibrated except for a 45° mark, and its adjustable-height fence lacks the guides found on the Top 10. The Junior has no adjustable-angle fence, and I found the tracks that the fence rides on didn't keep the fence parallel to the blade when I adjusted its height. The Junior's greatest shortcoming is that its depth adjuster makes no provision for easy shifting from one size plate to another, as discussed earlier.

Elu Jointer/Spliner 3380—Distributed in the United States by Black & Decker, the German-made Elu is a high-quality machine that is so distinct in design that comparing it to other plate joiners is a bit like comparing apples to oranges. The machine's pivoting



The unusual design and pivoting-blade action of the Elu 3380 allows it to do more than just cut slots for biscuits: It plows grooves and does panel cutting, trim and cut-off work as well. Above, the author uses the Elu with a scrapwood fence to cut biscuit slots across a plywood panel so it can be joined to a partition.



Unlike most plate joiners, the Kaiser Mini 3-D has two separate fences: The one shown being adjusted pivots out from the face and adjusts to any angle for odd-angle miter joinery. The other fence, on the bench behind the machine, does only regular 45° and 90° joints. It slides up and down, for adjustment, in two vertical holes just behind the Kaiser's ribbed-rubber anti-slip face.

carriage is designed to allow the unit not only to cut slots, but to plow continuous grooves and to work as a small panel saw, with a maximum depth of cut of about ¾ in.

Standard equipment with the Elu includes an edge guide and a 45° fence with rods that slide into the faceplate. As mentioned earlier, having to screw and unscrew the depth adjuster to change between plates sizes is inconvenient.

The Elu doesn't have a front fence for doing regular slot cutting in square-edge stock; the machine's base and the stock must be laid on a flat surface for edge slotting. Instead, the Elu features a fine-adjustment screw that allows the blade to be raised or lowered relative to the base. By setting the blade height, the slot can be centered on the edge of ½-in.- to 1¼-in.-thick stock. Overall, I found the Elu somewhat less convenient than the other machines for general-purpose plate joinery. However, for the purpose of making grooves or panel sawing and cut-off work, no other machine is so versatile.

Kaiser Mini 3-D—This machine is based on a disc grinder manufactured by AEG in Germany, to which a moving carriage base and

Plate-joiners								
Manufacturer Model number	**Distributor**	**List * price**	**Motor amps**	**Fence settings**	**Weight (lbs)**	**Accessories Standard, *Optional***	**Switch-lock/ blade lock**	**Anti-slip feature**
Elu Jointer/Spliner 3380	Black & Decker 10 N. Park Drive Hunt Valley, MD 21030	$485	5.0	90°/45°	7.9	Metal case, edge guide, tools *vacuum adapter and hose, 30-tooth veneer blade*	No/No	Steel points, detachable
Freud JS 100	Freud 218 Feld Ave. Highpoint, NC 27264	$285	5.0	90°/45°	6.2	Plastic carrying case and tools	Yes/No	Steel points
Kaiser Mini 3-D	W.S. Jenks and Son 1933 Montana Ave. N.E. Washington, D.C. 20002	$559	5.7	0° to 90° Adjustable	6.4	Metal case, edge guide, tools, *vacuum adapter and hose*	Yes/Yes	Ribbed rubber
Lamello Top 10	Colonial Saw 100 Pembroke St. Box A Kingston, MA 02364	$639	6.4	0° to 90° Adjustable	6.8	Wood case, *edge trimmer, defect-patching attachment, stationary stand, vacuum hose, glue bottle*	Yes/Yes	Rubber bumpers
Lamello Standard	Colonial Saw	$489	4.6	0° to 90° Adjustable	6.6	Same as Top 10, except plastic case	Yes/No	Steel points
Lamello Junior	Colonial Saw	$369	4.6	90°/45°	6.1	Same as Top 10, except cardboard case	Yes/No	Steel points
Porter-Cable Model 555	Porter-Cable Box 2468 Jackson, TN 38302	$270	5.0	90°/45°	6.1	Metal case and tools	No/No	Steel points
Virutex 0-81	Holz Machinery 45 Halladay St. Jersey City, NJ 07304	$305	5.0	90°/45°	6.5	Plastic case and tools, *vacuum hose*	Yes/No	Steel points

* Street prices are typically 20% to 45% lower

slot-cutting blade have been added. The AEG motor is of high quality, and the sliding action of the carriage is equivalent to that of the Lamello machines. Blade change is particularly convenient on the Kaiser. The machine comes with a standard fence, reversible for 45° miter work, and an edge guide for making slots on a panel up to 10 in. from the edge. Both the anodized-aluminum fence and edge guide mount on posts that slide in holes running through the machine's face. The posts keep the fence parallel to the blade and thumbscrews lock it positively. The face of the Kaiser has a separate adjustable-angle fence, shown in the lower photo on the previous page, that pivots out for odd-angle miter work. This pivot system works well, but there's a small amount of play in the locking mechanism, and the small fence itself felt a bit delicate. My only other complaint about the Kaiser is that fine adjustment of the depth of cut is extremely inconvenient, as it requires partial disassembly of the machine. When I spoke to the manufacturer's representative about this, he assured me that the depth of cut is supposed to be correctly set at the factory and that fine-tuning should be rarely necessary.

Virutex 0-81—The Spanish-made Virutex is a medium-price machine that's very similar in construction and features to the Freud and Lamello Junior. The fence on the Virutex is cast metal and has a 45° wedge on one side for guiding slot cuts on miters. The Virutex's fence locks with levers, which are easier to lock than many of the plastic knobs found on other machines. The sliding action of the carriage is not as smooth as on the Lamello machines—there is a small amount of play—but it is adequate for accurate slotting. The Virutex's main shortcoming is the inadequacy of the tracks for keeping the fence parallel to the blade, which makes setting the fence somewhat tedious. The Virutex is a decent-quality machine, considering its price is in the low half of the field.

Freud JS 100—The Freud plate joiner is made in Spain and comes similarly equipped to the Virutex, but sells for less money. It has a smaller base and fence than any of the other machines, but this is not a significant disadvantage. The Freud's fence is practically identical to the Virutex, except it uses opposing thumbscrews to lock the fence height. There's more play in the Freud carriage than on any other machines I reviewed, and the blade had enough runout on the first machine I tried that the slots it produced were $\frac{1}{128}$ in. oversize. This blade wobble also seemed to make the blade more apt to grab the workpiece during plunging. Fortunately, a second machine I tried didn't have this problem. Overall, the Freud performed adequately, and it's one of the lowest-price plate joiners on the market.

Porter-Cable Model 555—Except for the Elu, the American-made Porter-Cable is the only plate joiner that departs from the standard horizontal-motor design pioneered by Lamello and adopted by all the other companies. The Porter-Cable's motor is mounted vertically, and the different type of drive mechanism associated with this arrangement no doubt accounts for the quietness of the machine. Those who have used tools with "D" handles, such as those found on most hand-held circular saws, will probably find this machine more comfortable to hold than any of the other machines. The handle was, however, awkward to grip when the machine was used vertically, say for cutting slots in the face of a panel resting on the benchtop.

The Porter-Cable I tried included a reversible fence for 90° and 45° work, but it lacked tracks for fence alignment, and the two small plastic knobs used to lock the fence were nearly impossible to tighten by hand. Since I conducted this review, Porter-Cable has remedied both of these shortcomings by adding tracks and larger knobs to the fence. I feel the carriage's return springs are too strong; I like the plunging action of the machine better with one of the two springs detached. Despite these few peeves, I think the Porter-Cable is a good value, especially considering it's the lowest-price plate joiner on the market. □

Allan Smith builds custom furniture in Hopewell, N.J.

Laying Out Compound Joints

Getting an angle on splayed sides

by Graham Blackburn

Projects involving angled joinery are not difficult: The main challenge is determining the compound-angle cuts needed to join splayed sides. The true shapes and complex angles of even the simplest projects aren't easy to visualize and can't be measured directly from the usual plan drawings showing top, front and side views. You can always look up angles in a reference book, but learning how to work them out will give you the confidence to attack sophisticated projects you never thought possible.

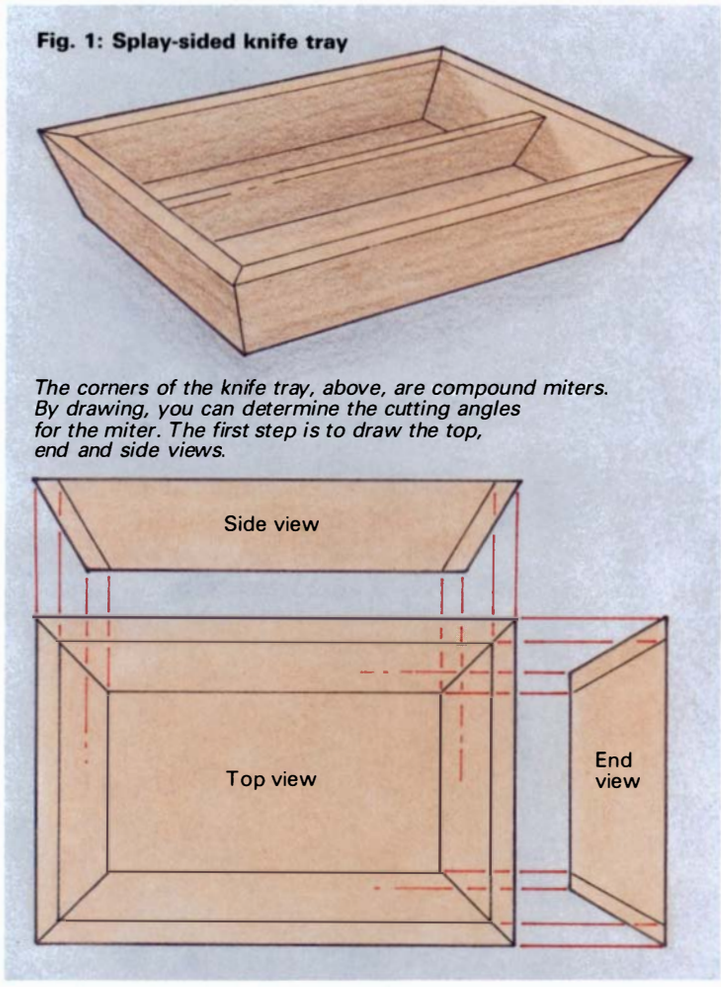
There are many occasions when splayed joinery is desirable and some cases where it's unavoidable. Thin crown molding for cornices, for example, is designed to fasten at an angle and requires splayed joinery in corners or wherever the molding changes direction. Elegant "poche-vides," the unenclosed drawers hung beneath small worktables, are invariably made with splayed sides. And the design of knife trays, hoppers, troughs, flower boxes, planters and innumerable other articles can be enhanced with sloped sides.

Here I'll explain the graphical procedure I use to lay out simple or housed butt joints and splayed (or compound) miter joints. The method works equally well for splayed dovetail joints. It applies to special cases where, for example, different thickness wood is used for the sides and ends, or where the splay angle of the sides and ends are different—cases where references are annoyingly incomplete or not applicable. You will need to refresh your skills in representing three-dimensional objects in two dimensions, but no special tools, apart from a compass, protractor and straightedges, are required. An electronic calculator with the geometric functions might be helpful in some cases, but it's not essential.

One word of caution: It's important to make your drawings accurate, because the accumulation of small measurement errors will lead to sloppy joints. This is particularly true for angle measurements, where errors are magnified: A small error in the 45° miter joint between two ¼-in.-wide pieces of wood may be negligible, but the same error in joining two 1-in.-wide pieces can be a disaster. To minimize the errors, I recommend making all your drawings full-scale, and even larger when practical.

Splayed butt or miter joints—I'll use the simple knife box shown in figure 1 at right to explain the layout procedure developed in figure 2 on the next page. All of the tray's sides are splayed at the same angle and made from the same thickness wood. Also, no actual dimensions or angles are given. I haven't provided this information, because the method works equally well for any set of measurements or angles, and the simplification helps make the method easier to understand. The method is exactly the same for butt and miter joints, so I'll describe the procedure for the butt joint (see figure 2A), but I'll also show the result for mitered construction with equally and unequally splayed sides (see figures 2B and 2C).

Fig. 1: Splay-sided knife tray



The corners of the knife tray, above, are compound miters. By drawing, you can determine the cutting angles for the miter. The first step is to draw the top, end and side views.

For projects requiring only right-angle joinery, the top, front and side views give you all the information you need. This is not so when angled joints are used. For example, none of the three views shown in figure 1, taken individually or as a set, provides either a direct measurement of the angle between the tray's sides and ends or their true shapes. This is because the two-dimensional representation distorts the true shape of the sides: What you see is only a projection of the true shape on the plane of the drawing paper. You need to imagine the ends and sides as if they were laid flat, so when looked at from above, the true shape may be seen and measured.

Begin with the ends—The angle of the top and bottom bevels of the ends can be measured directly, because the side view (see the bevel angle S in figures 2A through 2C) gives the true cross-section

Drawings: Roland Wolf

Fig. 2: Determining cutting angles for splayed joints

Instructions apply to these three examples and all other cases.

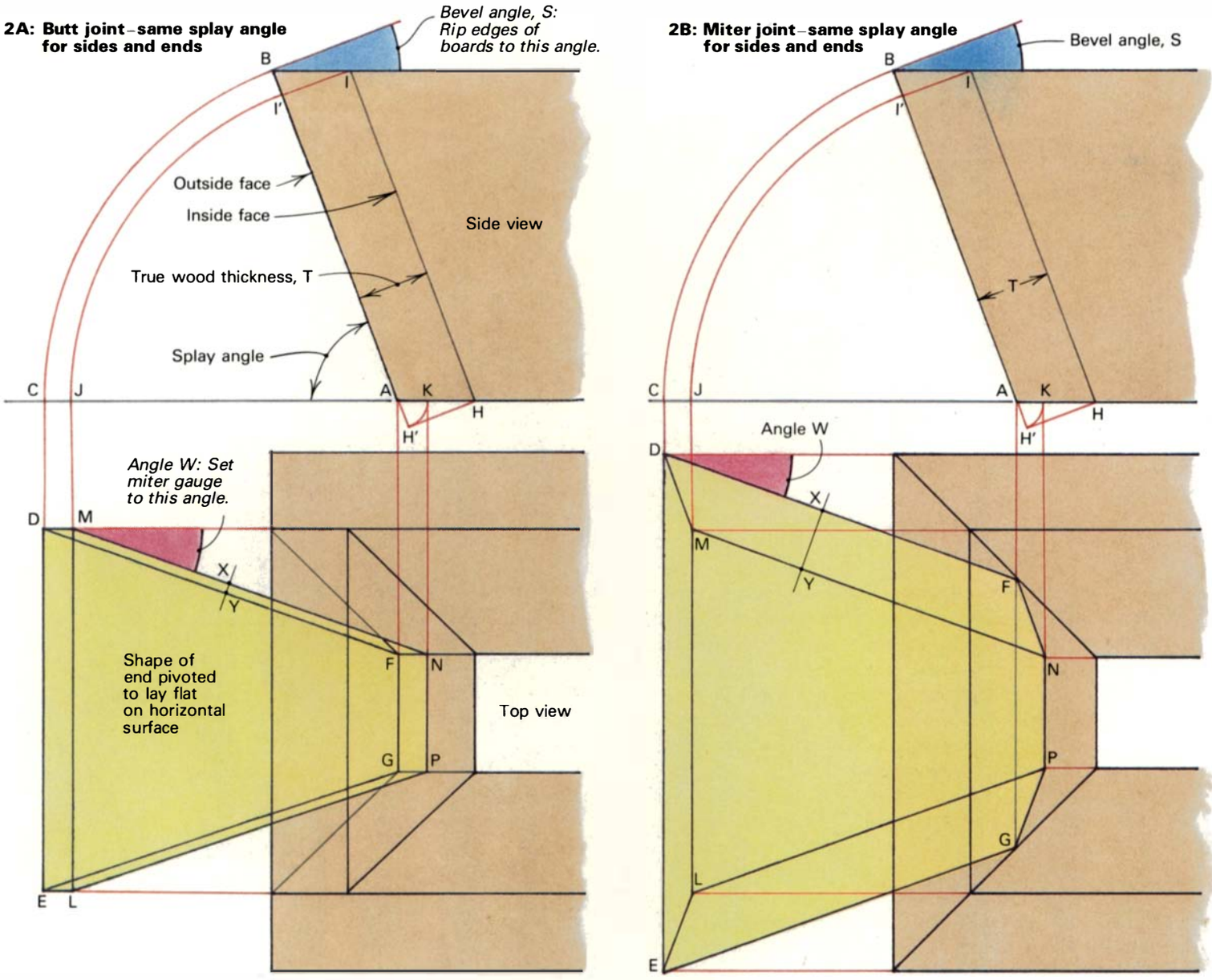
I: To determine true shape of outside face of end:

1. *With A as center, rotate true height of end; line A-B to intersect bottom extension at C.*
2. *Drop vertical lines from A and C to intersect extension lines from corners of outside face (D, E, F, G) in top view.*
3. *Connect D, E, F, G to get true shape of outside face.*

II: To determine true shape of inside face of end:

1. *Project I and H (true length of inside face) onto line A-B.*
2. *With A as center, rotate projected length of inside face, I'H', to intersect extension at J and K.*
3. *Drop vertical lines from J and K to intersect extension lines from corners of inside face (L, M, N, P).*
4. *Connect L, M, N, P to get shape of inside face.*

III: Set miter gauge on tablesaw (or rotate arm on radial-arm saw) to angle W. Measure with protractor.

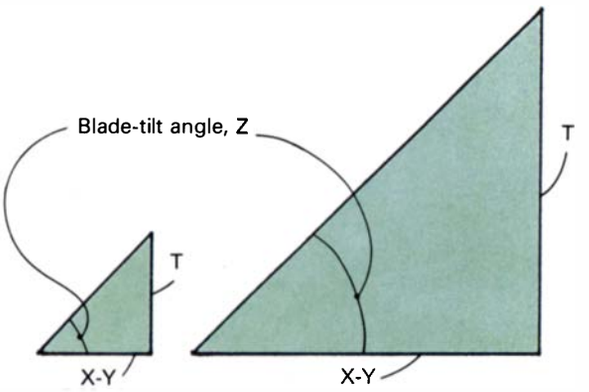


shape of the end. Use this angle, measured from the vertical, to set the blade tilt when making these bevel cuts; otherwise, the end's shape is distorted. But if you imagine its outside, bottom edge (F-G) to be hinged, the end can be rotated (around point A) to lay flat in the plane of the paper, to reveal its true shape. It follows an arc centered on the bottom, outside corner (A), with a radius equal to A-B. The arc intersects the extended bottom line of the tray at C. Line A-C is the end's true height. Now, drop perpendiculars from C and A. These intersect with line continuations in the top view at D, E, F and G. When these points are connected as shown, the end's true shape, as if laid flat, is defined. More precisely, it is the true shape of the *outside* face of the end. To get the true shape of the *inside* face, follow the same procedure, with one small wrinkle: The inner face must also be rotated about the same point (A) as the outside face, to ensure that the faces register properly in the true end view you're developing. To accomplish this, project H and I onto line A-B before doing the rotation. When the points are connected as shown, the end's true shape is fully developed.

The miter setting on your tablesaw (or the arm swing, if you have a radial-arm saw) to cut the sloped sides of the ends is measured directly from the true top view, as shown in figures 2A through 2C. Both faces are the same size, but because they are offset, the angle formed along the edge is not 90°. This angle determines the blade tilt necessary to make the compound-angle cut.

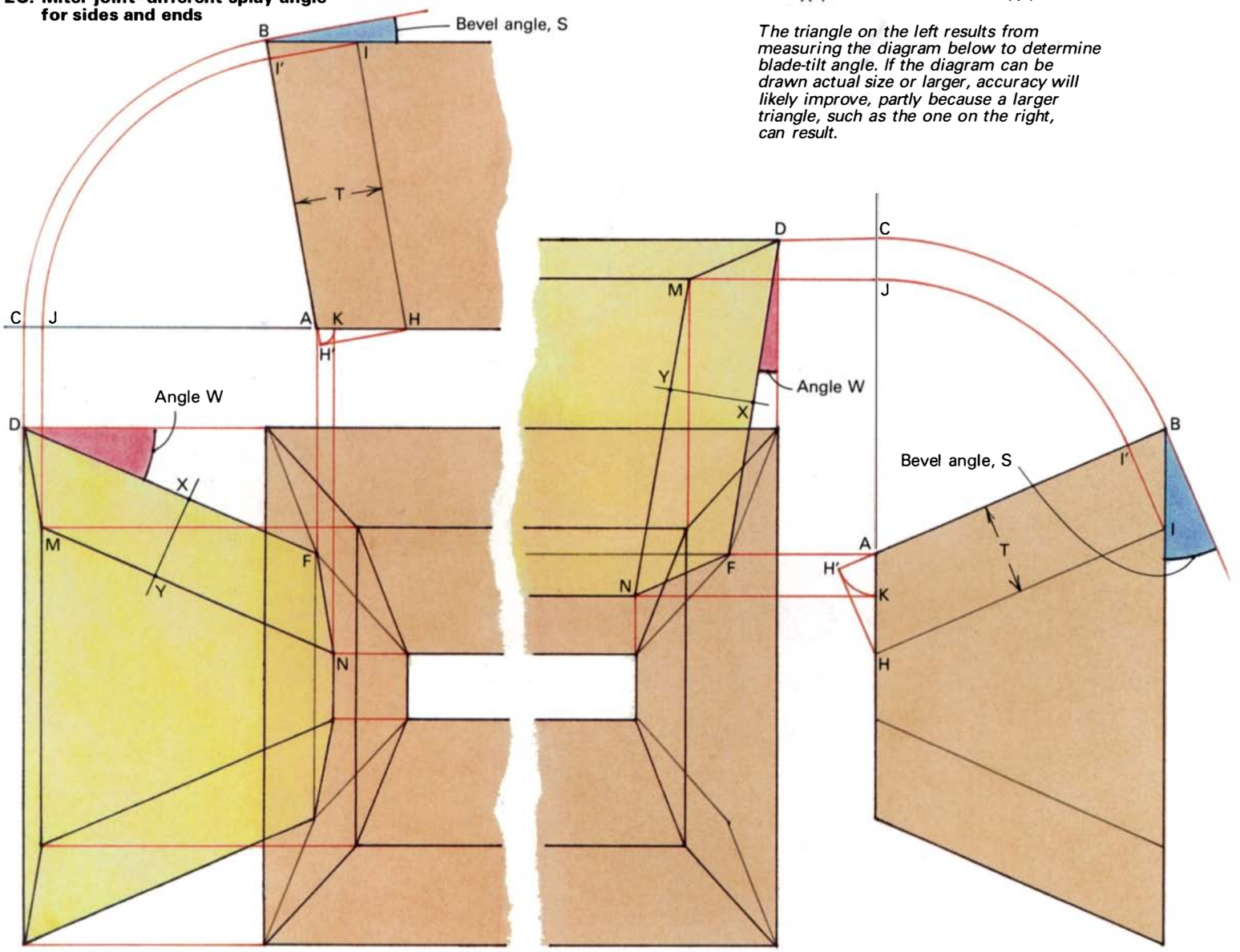
IV: To determine blade tilt:

1. *Draw perpendicular line, X-Y, to side M-N.*
2. *Measure X-Y and divide by true thickness of wood, T.*
3. *Calculate blade tilt angle, Z=arctan X-Y/T, or:*
4. *Construct right triangle with perpendicular sides equal to X-Y and T.*
5. *Measure blade-tilt angle Z with protractor.*



The triangle on the left results from measuring the diagram below to determine blade-tilt angle. If the diagram can be drawn actual size or larger, accuracy will likely improve, partly because a larger triangle, such as the one on the right, can result.

2C: Miter joint–different splay angle for sides and ends



There are two ways to determine this angle: Measure the distance X-Y and divide it by the true thickness of the wood. Then use the arctangent (tan-1) function on your calculator (or use tables) to compute the angle. If you don't have the calculator or tables, carefully construct a right triangle with one perpendicular side equal to X-Y and the other equal to the thickness of the wood. Then use a protractor to measure the angle directly as shown in the drawing. As mentioned earlier, the accuracy of your measurement will be improved if you scale up your drawing as much as possible.

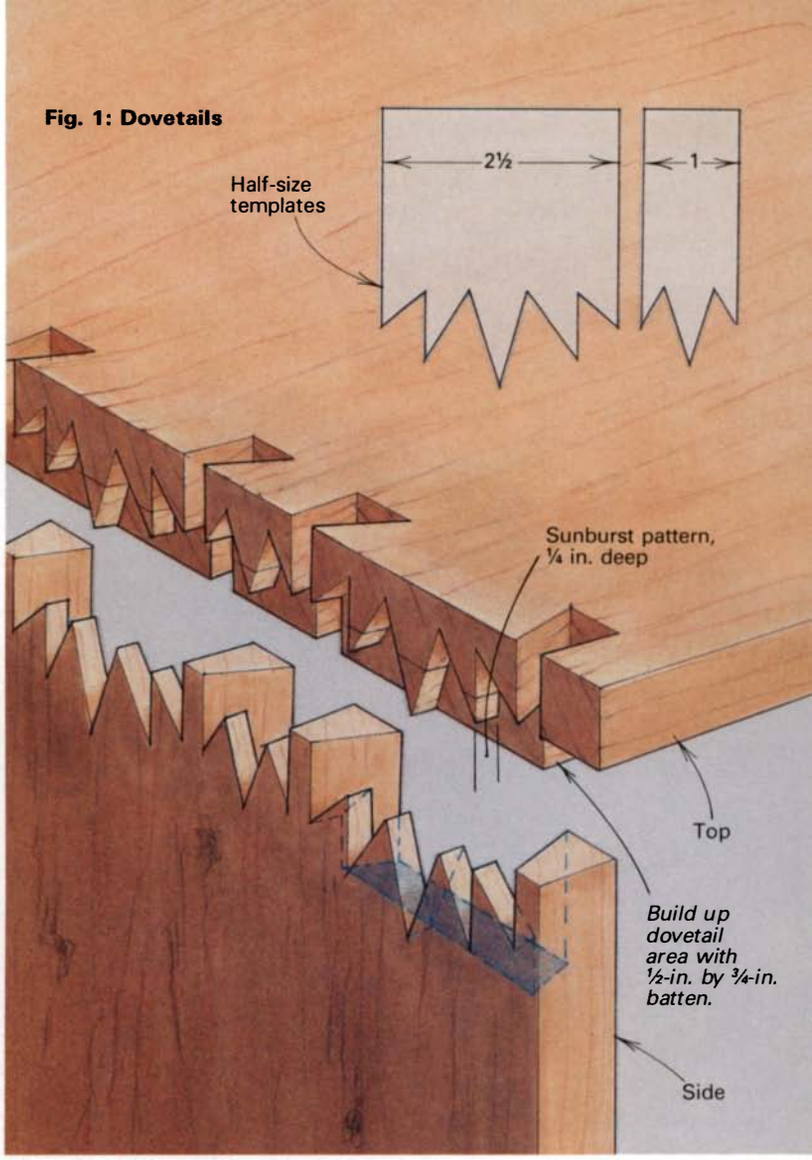
If, as in this example, the sides and ends are splayed equally, no further layout work is required: All of the dimensional information necessary to construct the tray is available from the top and side views and from the true shape of the end you have just developed. But if the ends and sides are splayed differently, as in figure 2C above, or if you are using different thickness wood for the sides and ends, you have to repeat the process, this time using the end view in place of the side to determine the cutting angles for the sides.

Housed butt joints or splayed dovetails are handled in the same way. Once you have a true view of the ends, layout becomes a simple matter of adding the necessary construction lines. □

Graham Blackburn, author of numerous books on woodworking, is a furniture designer and maker in Soquel, Calif. He is also a contributing editor to Fine Woodworking.

The author designed his own decorative dovetails for this Wellington campaign chest. Designed to accompany an officer on a military campaign, the chest includes a drop-front secretaire and a hinged rail that locks over the drawer fronts to secure them for transport.

Fig. 1: Dovetails



Campaign Chest

Locking drawers and a drop-front secretaire

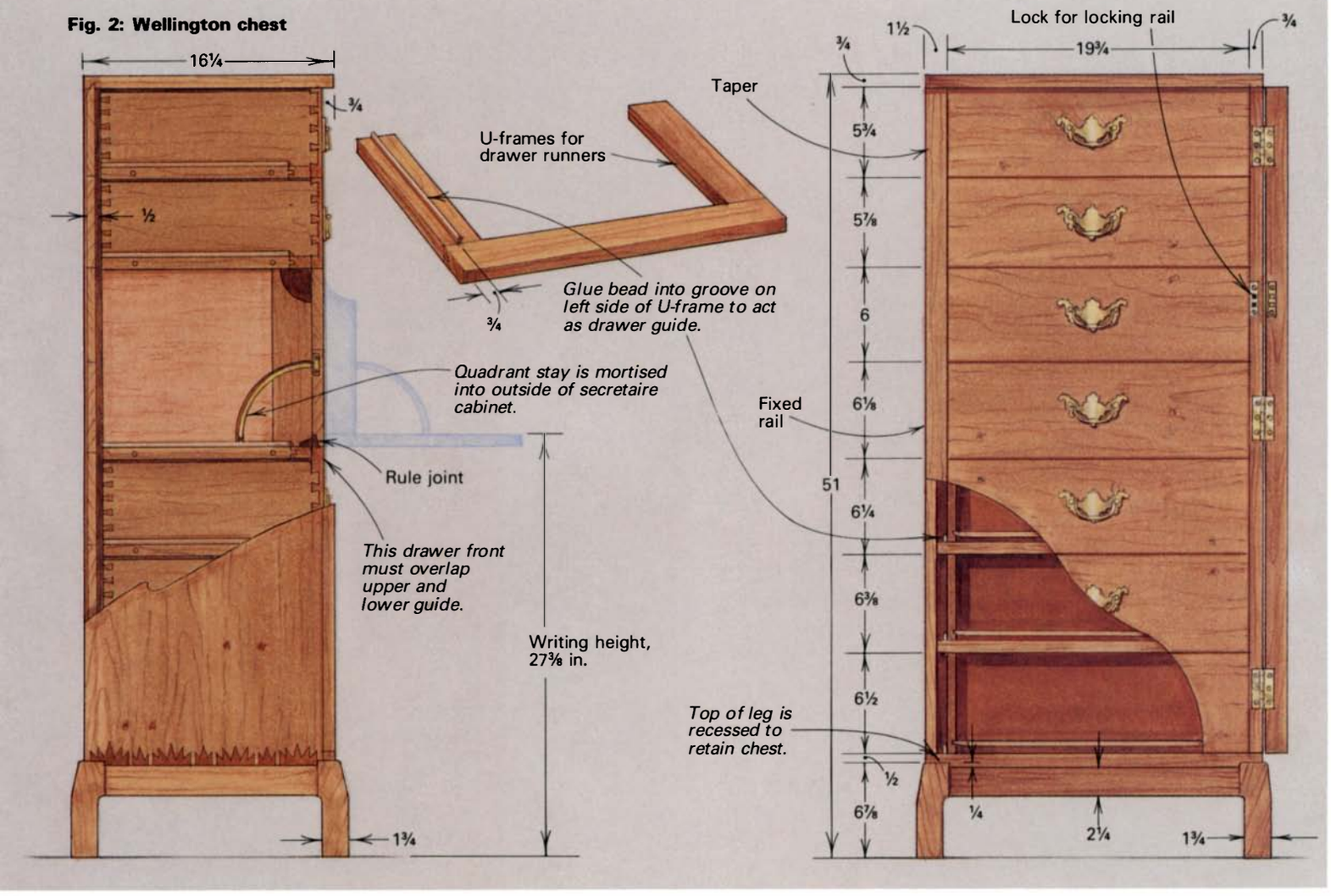
by Vernon Harper

For more than 300 years, cabinetmakers on the island of Bermuda have been designing personal decorative dovetail patterns to join the carcases of their chests-on-frames. Because I was living in Bermuda when I built the Wellington campaign chest shown in the photo above, I followed this tradition and designed my own "sunburst" variation for the carcase dovetails. Named after the first Duke of Wellington, Arthur Wellesley (known for accepting Napoleon's surrender at Waterloo), Wellington chests are made to be removed from their base frame so they can accompany an officer on a military campaign. A hinged locking rail (on the right side of my chest) overlaps the drawer fronts, holding the drawers closed when the chest is being transported. To maintain symmetry, an identical dummy rail is glued to the edge of the carcase's other side. In addition to serving as a mobile chest of drawers for an officer's personal possessions, these chests provide a portable office. The secretaire component, concealed behind the false double drawer-front, is the highlight of the piece for me. When the false front is pulled out, it brings with it a separate cabinet, which slides out about 2 in. on one of the U-frame drawer guides. With the secretaire cabinet pulled out, you can reach through scalloped cutouts on the sides of its face frame, unlatch the false drawer front and pull it down to create a writing surface.

My chest is constructed of native Bermuda cedar. Actually a juniper (*Juniperus Bermudiana*), Bermuda cedar is one of the few trees

Photo: Ann Spurling; drawings: Kathleen Creston

Fig. 2: Wellington chest



able to withstand pounding salt spray and the hurricane gales that frequently batter the island. However, the extensive use of cedar by shipwrights, carpenters and furnituremakers, coupled with several destructive cedar blights, has virtually decimated the island's once-abundant cedar stands. Consequently, the availability of cedar is extremely limited, and milled cedar is very costly—approximately $20 per board foot at present. Cedar is also a difficult wood to work, due to its irregular grain around the knots and its difference in hardness between the earlywood and latewood. As a result, the creation of a large piece of furniture in Bermuda cedar is a true labor of love.

Designing the chest—My principal design consideration was arriving at a comfortable height for the secretaire's writing surface while preserving visually pleasing proportions for the heights of the seven drawer fronts. I decided on 27⅜ in., slightly less than the standard table height of 30 in. I arrived at this height by making the top drawer front 5¾ in. high and increasing the height of each front by ⅛ in., resulting in a 6½-in.-high bottom drawer. The drawers of most chests increase in height from top to bottom, and even this ⅛-in. increase provides a pleasant visual effect.

Once I was satisfied with the design, I made a quarter-scale drawing to establish dimensions. Then, I glued up the chest's individual components: sides, top, bottom and back. Because I acquired the wood myself, I was able to keep the boards together in the same order they were sawn from the log. This made it possible to book-match the grain on the chest's sides and top by edge-gluing consecutively sawn boards. Grain isn't a major concern on the bottom, because only its edges are visible. The solid back panel is glued up from ½-in.-thick boards with their grain running side to side. After cutting the back panel to size, all four edges are beveled on the tablesaw to create a fielded panel that fits into dadoes cut in the carcase.

Dovetailing the carcase—To show off the Bermuda dovetails to maximum advantage, I laid them out with the sunburst on the sides of the chest, as shown in the photo. This meant cutting the tails on the chest's top and bottom and the pins on its sides. To accommodate the size of the dovetails' decorative pattern, I glued a ½-in.-thick, ¾-in.-wide, short-grain batten along the ends of the top and bottom to increase their thickness from ¾ in. to 1¼ in.

To add variety to the overall pattern of the carcase dovetails, I made two templates from plastic laminate in my sunburst design: one with five "rays"; the other with three (see figure 1 on the facing page). I also made a third, smaller three-ray template for use on the four small secretaire drawers. To make the templates, draw the pattern on pieces of laminate, saw them out with a hacksaw and clean up and refine them with a file. Then, glue and pin each template to a small woodblock to act as a reference block when laying out the patterns. The largest sunburst can't extend beyond 1¼ in., because that's the thickness of the built-up ends of the top and bottom. With regular dovetails, you can make adjustments to the depth of the pins by paring the flat shoulders to true or square them up. If this leaves the ends of the pins proud of the surface after assembly, you can just sand the pins flush—not so with Bermuda dovetails. Here, one must preserve the integrity of the original marking-out lines or lose all reference to the fit of the rays. Be-

cause of this need for precision, I use a sharp knife instead of a pencil line when marking from the template. Then, I saw close to the line and carefully trim to the line with a chisel.

Figure 1 on p. 68 shows how the sunburst patterns are incorporated into the cutting of the half-blind pins and tails. I mark out for the sunbursts and the pins on the chest's sides, alternating the five- and three-ray templates to determine spacing. With a marking gauge, I mark the ¼-in. depth of the decorative pattern on the endgrain of both sides and on the interior surfaces of the top and bottom. I then reset the gauge to the 1¼-in. thickness of the top and bottom and mark for the shoulder of the pins on the interior surface of each side. I saw the pins out down to the peaks of the rays and chisel out the waste from behind the ¼-in.-thick patterned area, down to the shoulder's gauge line. I use a small fine-tooth dovetail saw to cut out the sunburst and then chisel into the acute, angled corners with a 3/16-in. chisel that I ground and sharpened on the skew specifically for this purpose. I work to the layout lines and use the templates to double-check my accuracy.

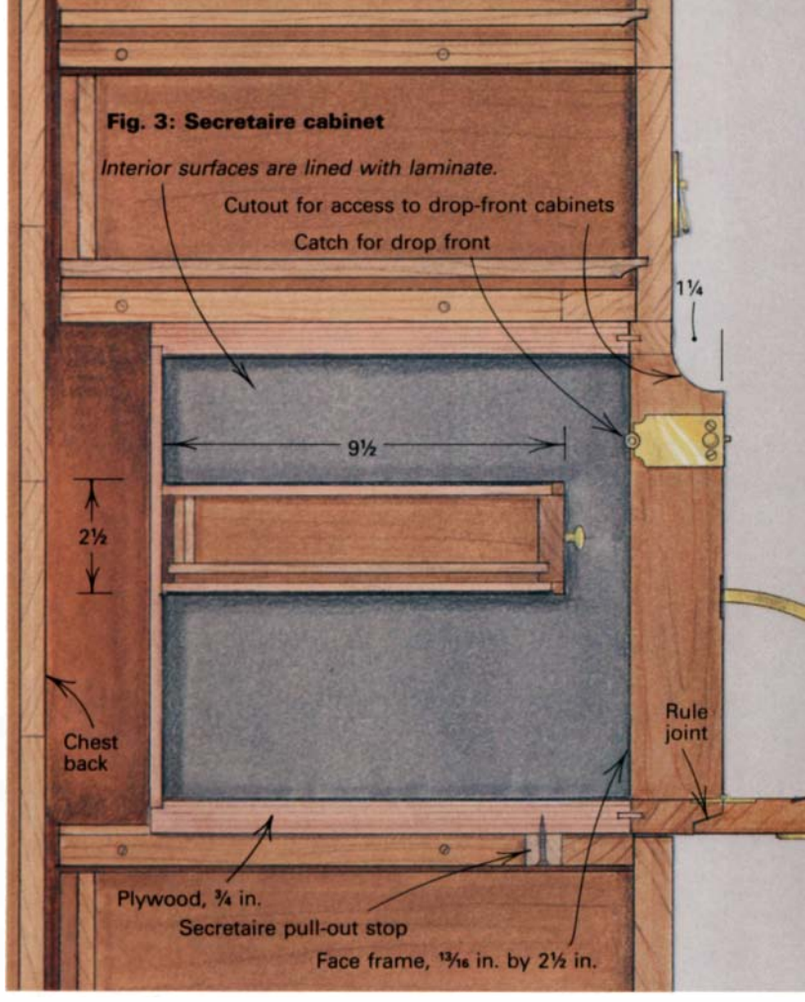
When I'm satisfied with the pins, I hold them up to the mating top and bottom ends and carefully mark for the tails on the inside surfaces. I use the templates to lay out the sunbursts on the endgrain of the top and bottom. The tails are sawed out like normal dovetails, and the sunburst patterns are chiseled ¼ in. deep into the endgrain. Make sure all surfaces are crisp and square before assembling the parts, because you can't fit them together and take them apart without a great risk of breaking off the points of the ray patterns. You should assemble the corners only once—during glue-up.

After the carcase is assembled, I install U-shape frames to support, guide and stop the drawers (see figure 2 on the previous page). Because the dummy rail on the left is fixed and does not swing out of the way, the drawers need to be offset to the right so they can slide past this fixed rail. A bead is glued into a groove on the left side of each U-frame, in line with the edge of the rail, to act as a side guide for the drawers. The U-frames are then fastened to the cabinet sides with brass screws in slightly oversize holes, to allow for expansion or contraction of the carcase sides.

The seven drawer fronts are arranged so the grains are bookmatched on adjacent drawers. The third and fourth drawer fronts from the top are actually the drop-front desktop of the secretaire. They're edge-glued together and grooved to give the impression of two separate drawers. I made all the drawer parts, sides, backs and bottoms from solid cedar, but would not do so if building the chest again. The wood-to-wood contact between the drawer sides and case seemed to increase the cedar's tendency to weep its sticky resin. Because of this and the softness of the wood, I lined the bottom edge of the drawer sides and the bearing surfaces of the U-frames with strips of plastic laminate. The drawers are joined with dovetails all around: through dovetails in the back and half-blind ones on the fronts of the large drawers. The four small secretaire drawer fronts are Bermuda dovetailed together so the sunburst motif is reiterated on their fronts (see figure 3 above). The drawer bottoms are 5/16-in.-thick, solid, fielded panels slid into grooves in the drawer sides and front, and pinned in the bottom edge of the back.

Assembling the secretaire—The secretaire cabinet shown in figure 3 is ¾-in. mahogany plywood joined at the corners with splined miter joints. Before cutting the miters, I covered all four interior surfaces with black plastic laminate. The black laminate contributes a pleasing aesthetic to the interior of the secretaire as well as provides a practical finish. The ¼-in. plywood back panel is also covered with laminate and fitted into a rabbet in the back edges of the cabinet sides, top and bottom.

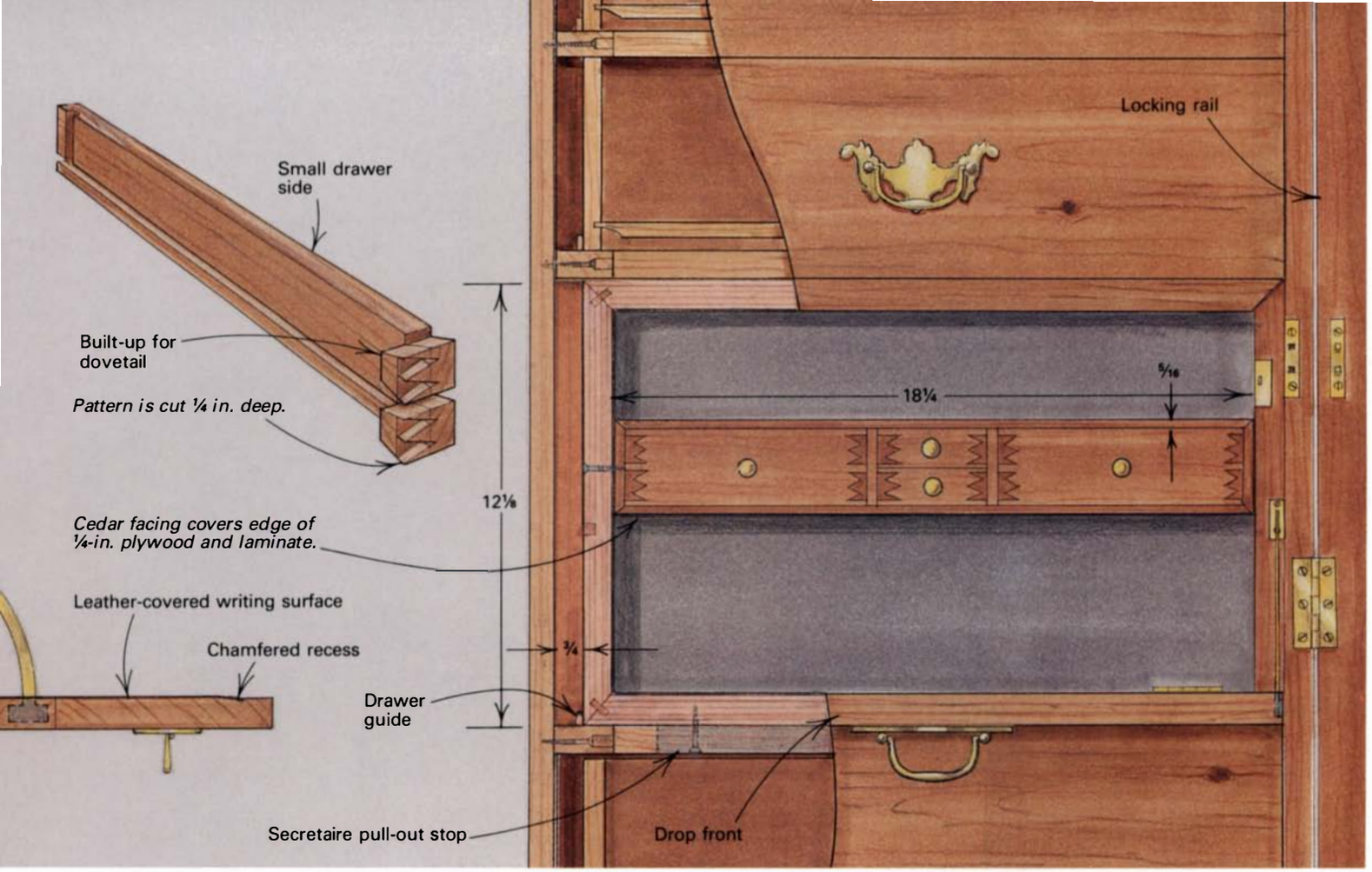
The mitered cedar face frame that covers the plywood front



edge of the secretaire is 2½ in. wide by 13/16 in. thick. Before the frame is glued up, the scalloped cutouts, for access to the drop-front catches, are bandsawn in the side pieces, and the top piece is ripped to the proper width to match the cutouts. The cedar frame is then edge-glued with splines to the secretaire cabinet. After gluing up the frame, I reinforce the miters by handsawing angled kerfs in the outside corners and gluing in pieces of veneer the same thickness as the sawkerfs. I call this "key-veneering," and in spite of the thinness of the veneer, this strengthens the miter joint considerably. A narrow case containing the small interior drawers completes the secretaire cabinet. It's made from ¼-in. plywood; the top and bottom are covered with black laminate; and the front is edge-trimmed with cedar. The case is slipped into the secretaire cabinet and held in place with countersunk screws from the outside of the secretaire into the drawer case. Make sure the screws don't come through and interfere with the drawers.

My design calls for black leather on the writing surface of the drop-front desk. To inset the leather, I chisel a 1-in.-wide chamfered recess in a rectangle approximately 1½ in. from the edge of the drop-front panel. The deepest part of the recess is the same depth as the leather's thickness. The leather is glued in place after the finish is applied to the chest. An angular rule joint is tablesawn on the bottom edge of the drop-front panel and on the bottom edge of the secretaire cabinet. The joint's profile is designed so the bottom edge of the secretaire cabinet is concealed when the drop front is closed.

The drop front is attached to the cedar face frame with flush-mortised table hinges and supported by brass quadrant stays. I rout arcs into each side of the secretaire cabinet for the brass quadrant stays by running the router base against a curved template. Finally, I mortise the latches that secure the drop front into the sides of the face frame and the mating catches into the wood around the leather writing surface.



The assembled secretaire cabinet is now slid into its space in the chest. To provide a stop for the sliding cabinet, I remove the drawer below, reach in and screw a strip of wood to the bottom of the cabinet that will bump the front rail of the U-frame when the top, front edge of the cabinet is even with the drawer front above it (see figure 3 above).

Locking rail and base—The 1½-in.-wide hinged rail, which closes and locks over the drawers to keep them from falling out when the chest is transported, is mounted with three brass butt hinges mortised into the rail and carcase. A chest lock and escutcheon plate are mortised into the right side of the carcase, and the keeper is let into the back side of the rail. The fixed rail is glued to the edge of the carcase's left side to maintain symmetry. Before mounting the rails, they are contoured as shown in figure 2 on p. 69.

The base frame consists of four rails and legs mortised and tenoned together. The rails meet the legs ¼ in. down from the top of the legs. I chisel out a ¼-in. recess from the back side of the legs so the carcase can rest in this recess on the legs and on the top edge of the rails. The chest is retained by the portion of the legs that extends up around its corners.

Owing to the irregular grain, especially around the knots, I found the best preparation for finishing to be a hand scraper followed by hand-sanding with a cork block and 120-grit paper. Sanding with coarser grits or with power sanders simply raises the grain. Finishing knotty cedar can be a real challenge: The knots harbor the tree's resin, and for many years the resin tends to bleed through any finish, forming a gummy residue that gradually picks up household dust and other airborne particles. The only remedies I've found are to refinish the piece after, say, five years, or to accept the residue as a natural phenomenon. I doubt if even shellac, which is known for its sealing ability, could hold back this resin. Naturally, the older the piece of furniture, the less bleeding will occur.

I finished my Wellington chest with five coats of interior-grade polyurethane, rubbing the chest down with 0000 steel wool between coats. However, I've also used tung oil with equal, if not better, success. The same preparation is required, and the final finish appears a little softer than the polyurethane finish. The advantage of the oil finish is that when bleeding occurs, you can recondition the surface by scraping the resin from the offending areas and applying another coat of oil. With polyurethanes, you need to completely strip the finish and refinish from scratch.

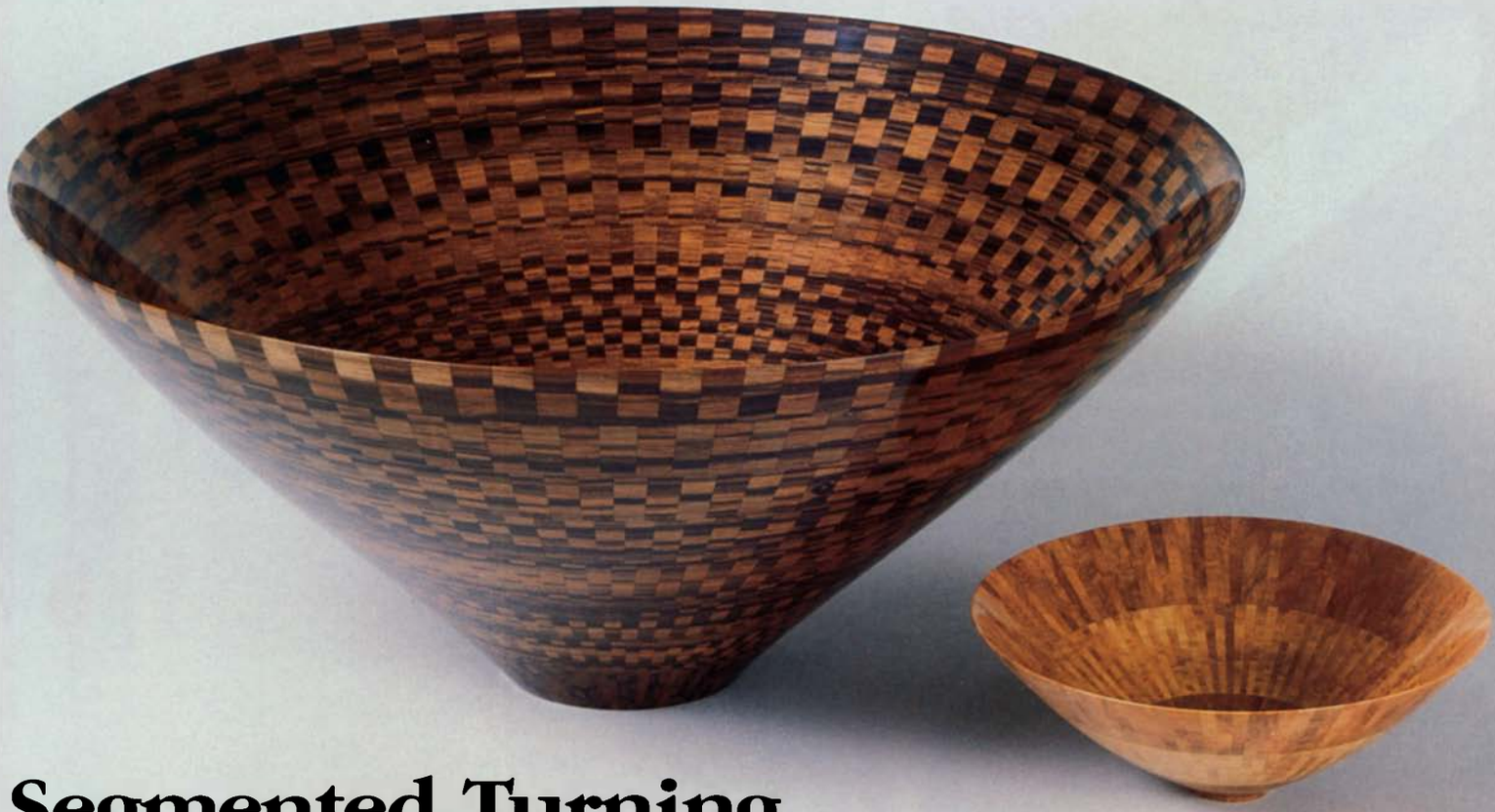
After finishing, glue the leather into the chamfered recess on the inside of the drop front. I used Weldwood Plastic Resin glue, which is available at most hardware stores. I find that leather stretches some while gluing, so I advise you to run a test first to see if your leather is going to stretch; if necessary, cut the leather a little small to start with so you won't have to trim it after it's covered with glue. I made beveled strips that fit into the chamfered recess to help clamp the leather in place while the glue dries overnight. □

Vernon Harper, a graduate of the School of Furniture, Birmingham, England, was the lecturer in Commercial Carpentry at Bermuda College from 1980 to 1986. He now lives in Ontario, Canada.

Sources of supply

Brass hardware for the Wellington chest is available from Ball and Ball, 463 W. Lincoln Highway, Exton, PA 19341; (215) 363-7330. Hardware is listed by part name and 1987 catalog number:

Chippendale pulls, C51
Knobs for small drawers, G17-136
Quadrant stays, J38
Drop-front catches, J39
Chest lock for rail, TJB-056
Hinges for rail, H35-313
Table hinges for drop front, H36-343



Segmented Turning

Swirling patterns by cutting and reassembling a single board

by Michael Shuler

I've always been fascinated with turned forms, even before I knew what a lathe was. When I was 14 years old, I made miniatures on a makeshift lathe from birch dowels. A pocketknife was my only tool, but I was turning wood, and that was all that mattered. Later, in high school, I turned candlesticks, then chair legs, lamps and other creations, searching for a way to make the lathe a tool for artistic expression. Then one winter, sick in bed with a cold, I read some back issues of a woodworking magazine a friend had given me and discovered the work of turning greats like Frank Knox and Ed Moulthrop, as well as the wealth of different things the lathe could do, including segmented turning.

Segmented work and the design possibilities it offered met my needs for artistic expression, but most segmented vessels tended toward strong contrasts, with some makers using half a dozen or more different woods in a single piece to achieve a colorful effect. I wanted to see what could be done by segmenting a single kind of wood in a bowl. After experimenting with different geometric patterns and methods of gluing up segments, I discovered a way to create a striking look in a turned vessel that didn't require the use of several colored woods to achieve pattern and contrast.

I start with a single board, take it apart, reorganize the figure and put it back together in the form of a bowl. The pattern that's formed by the grain of the reassembled board flows almost continuously through the bowl from top to bottom. The segments grow proportionally smaller, all the way from the rim down to the base. Inside the bowl, the wedge-shape segments meet at their points, forming a radial geometric pattern. The combination of the decreasing size of segments and the grain of the wood makes looking into some of these bowls feel like you're someplace in the sky looking down at a hurricane or looking into the iris of an eye. Before going through the specific steps involved in making bowls like the ones pictured above, I'll generally discuss how this segmentation method works and how the designs develop.

Segmentation strategy—When finished, one of the large bowls looks as if it's been tediously glued up from hundreds of separate pieces, but these pieces aren't cut and glued up individually. The process revolves around the cutting of thinly tapered wedges that are glued up into discs: a large one for the body of the bowl and a smaller one for the base. For the larger disc, wedges are first glued up into two half discs, which are bandsawn apart into concentric half rings. Then the matching pairs of half rings are glued together; these rings are stacked atop the base disc and glued into a cone-shape bowl blank. The vessel is then turned to final form and finished.

Photo this page: Michele Russell Slavinsky; all other photos: Susan Helgeson

Wedges are the bowl's basic building blocks and provide an economical way to glue up the large number of pieces needed for a complex segmented pattern. Although any number of wedges may be used for the body and base discs, I've settled on 104, because it results in segments that are about ⅜ in. wide on the outer rim of a 12-in. bowl, an arrangement pleasing to my eyes. Also, 104 is evenly divisible by many other numbers: 52, 26, 13, 8. Divisibility isn't important for your first bowl, but it allows me to divide the rings into sections and play with the order of wedges in these sections to get special grain effects and contrasts. I typically use figured woods or exotics, but even plain-grained woods become attractive when segmented by this method.

Cutting the wedges—The first step is to cut a board into the two kinds of wedges needed for each bowl. The wedges that make up the large disc for the body are crosscut, so the figure of the side grain shows on the bowl's sides. The wedges for the base disc are ripcut, because these must taper to a pinpoint and converge at the center of the bowl. It's practically impossible to cut these fine points across the grain.

If you start with a board that's ¾x5⅜x60 in., you can produce a large and a small bowl at the same time. The disc glued up from the crosscut wedges yields the body of a 12-in.-dia. bowl and part of a 4½-in.-dia. bowl. Two base discs must be made from ripcut wedges—one for each bowl. Mark a line on one side of the board, to help later in orienting the wedges in the large disc. Crosscut the 5-ft. length to get two 18-in. lengths for the body, four 2½-in.-long crosscut strips for the base of the larger bowl and two 1½-in.-long strips for the base of the smaller bowl.

To cut the wedges, I built a special sliding taper jig that rides in the tablesaw's miter-gauge slots. The jig has two stations: one for crosscut wedges and the other for ripcut wedges. An adjustable fence and two stops reference the stock for the acute-angle cuts. Two DeStaCo quick-action clamps (one for each wedge-cutting station) clamp the board directly over the blade to ensure that the board is perfectly flat and doesn't budge during the cut (see the photo at the top of this page). These clamps are available from Woodcraft Supply, 41 Atlantic Ave., Box 4000, Woburn, Mass. 01888; (800) 225-1153. An 80-tooth, triple-chip-grind (TCG) carbide blade leaves a smooth surface on each wedge that's ready for gluing. The sawblade passes through a block fastened to each clamp, which helps keep splintering on top of the cut to a minimum.

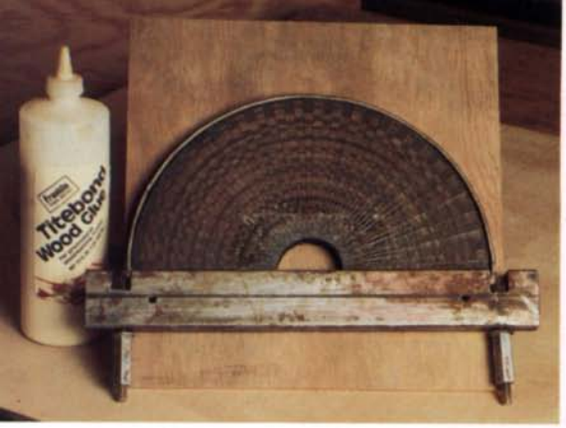
Before cutting begins, carefully adjust the position of the stops and fence so the crosscut station will yield 5⅜-in.-long crosscut wedges that have a .062-in. taper. This means that for the large bowl, the body wedges taper from .37 in. on the fat end to .037 on the skinny end. Because the ripcut station uses the same fence, the wedges for the base have the same taper as the body wedges. However, a spacer screwed to the fence makes it possible for the blade to take thinner cuts: The 2½-in.-long ripcut wedges are .15 in. on the fat end, tapering to a sharp point at the other end. Check the wedges with a micrometer to verify the measurements and tweak the fence's final position accordingly. Also, make sure the sawblade is dead square to the jig. These steps are necessary if wedges are to glue up into a disc without gaps in any of its 104 seams.

Cut the crosscut wedges first, placing the end of the board against the fence and clamping it down. After cutting off a wedge, slide the jig back, well away from the blade, before unclamping and removing the wedge. Flip the board edge for edge before each successive cut, and arrange the wedges on a separate table in a circle, with the same side up as they came off the saw. I usually count the number cut and mark the halfway point of the disc with a strip of paper. When all 104 wedges are cut, set the dry-assembled disc aside.

Above: A sliding jig on the tablesaw makes both crosscut and ripcut wedges—the basic building blocks for the author's segmented bowls. Two quick-action clamps hold the stock securely during cutting to help maintain the high accuracy required for flawless glue-ups. Below: The wedges for the small disc, which makes the base of the bowl, are glued up using a band clamp, like the ones used in plumbing. While the base wedges are assembled in random order, the body wedges are left dry-assembled in the order they came off the board (seen here in the background) before glue-up.

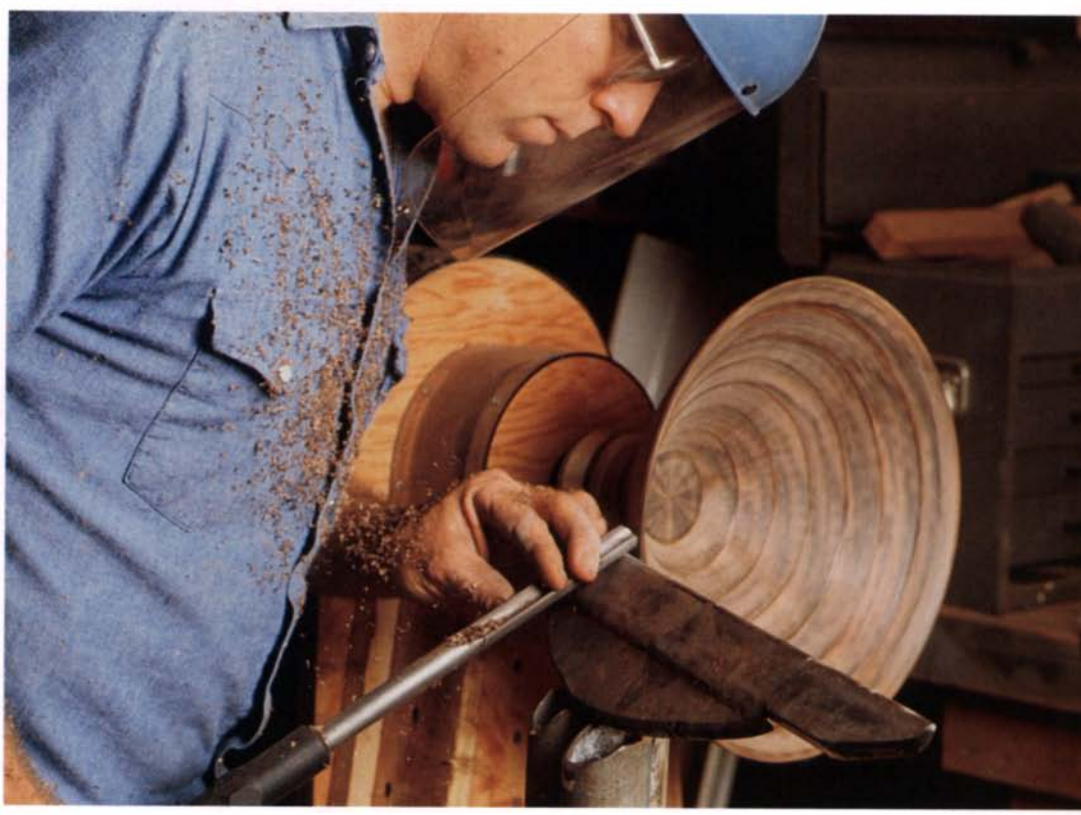
Cut the ripcut wedges for the base the same way as described above, only using the second station on the sliding jig. These wedges don't have to be as carefully ordered and oriented as the ones for the body, so I just cut them off and collect the 104 I need in a coffee can. The base for the small bowl only needs 20 wedges, because it's much smaller; these are cut as described earlier, only using another sliding taper jig made specifically for this operation set to cut at 18°.

Gluing up the discs—Instead of trying to glue up all the wedges for a bowl in one step, glue up a small disc for the base, then glue up two half discs for the body. The disc for the base is glued up in a band clamp, like the hose clamps sold in hardware stores for plumbing or exhaust systems (see the photo above). Buttering one side of each ripcut wedge liberally with yellow glue, assemble them in the clamp in a random order, aligning the points in the center as you go. The points pretty much align themselves, but you'll have to squish the wedges around occasionally to get the points to meet perfectly in the center. When all 104 wedges are in place, tighten the clamp with a box wrench until the joints are snug. Be warned that this glue-up is hectic: You only have five or 10 minutes before the glue sets, and you won't know how the disc



Above: The wedges for the body of the bowl are glued into half discs in a special clamping jig made by the author. The steel clamping strap is tightened with a wrench to close the joints between all the wedges. Right: With the table set to 45°, half rings are bandsawn from the half discs following concentric lines scribed on earlier with a large pair of dividers. Below: After matching pairs of half rings are glued together, the seven largest rings are stacked to form the bowl body. The pattern of segmentation is changed by rotating the rings in relation to each other.

Above: The ring layers of the bowl are glued up, two at a time, in a press welded up from rectangular steel tubing. Here, the author tightens the press screw, which bears on a waste block glued to the bowl's base disc. Right: With the lathe rotating at 1,200 RPM, the author turns the outside of his segmented bowl to final shape. When the walls approach ⅛ in. to 1/16 in. thickness, he supports the rim of the bowl with three fingers, to keep the cut from chattering.



will come out until after the glue-up. Any small error in wedge angle is multiplied 104 times, so the wedges need to be extremely accurate to form a perfect disc. But don't be discouraged if your discs don't come out perfectly: Keep an extra length of bowl stock on hand, in case you need to make another base.

I glue the half discs using a clamping jig I made from a ⅛-in. by 1-in. steel strap with a short section of threaded rod welded to each end. The rods are slipped through holes in a 1x2x15-in. rectangular steel tube that's slotted to allow clearance for the ends of the strap (see the top, left photo on the facing page). The gluing operation is simple, but it must be done quickly before the glue sets up. One side of each wedge is buttered as before and placed in the clamping jig in the same order and orientation as it was dry-assembled. When all 52 wedges are in the jig, the strap is tightened by torquing nuts on the threaded rods with a box wrench. Two small steel plates are bolted to either side of the half disc through the hole in the middle, to keep the center area flat during tightening. Snug up the strap a little, bolt on the plate and then finish tightening the strap. Considerable force will be needed to get the joints between all the wedges tight. Again, this is a hectic process, but it shouldn't take more than five minutes from start to finish.

Wait a couple of days for the glue to cure, and carefully break the discs out of their steel clamps by tapping the edges of the straps with a hammer. Waxing the steel ahead of time helps keep the glue from sticking. Face off the base discs on a three-jaw chuck on the lathe, making both sides flat and true. Flatten both sides of the two half discs using a ¾-in. straight bit in a router-rail jig, similar to the one described by Giles Gilson in *FWW Techniques 4*, p. 52. The jig supports the router a fixed distance above a table that holds the half disc in place. It takes many passes with the router to surface the half disc, sliding the router both sideways and front to back on the rails, but the jig brings the thickness of the two halves to within .003 in. of each other. Flatten one side of each disc, then the other, removing about 1/16 in. of material per side to wind up with a final thickness of about ⅝ in. An overarm router or abrasive planer can also do the surfacing, provided both half discs are made uniform in thickness.

Next, lay the two half discs on a scrap of plywood so they form a circle, and match up the grain so the wedges are in the same continous order as they came off the saw. Tape the outer edges to the plywood so the discs can't shift, and drive a finish nail into the plywood at the middle of the disc so the end of the nail sticks up about ½ in. Now place the point of a divider in the dimple in the nail's head and scribe a series of concentric circles on the discs that are ⅝ in. apart (the same distance apart as the thickness of the disc). Starting with the largest circle just at the outer rim, you should be able to scribe nine or 10 circles. Remove the half discs from the plywood and take them to the bandsaw. With the bandsaw table set to 45°, saw each half disc into a series of half rings, following the scribed lines. Next, true up the ends of each half ring on the disc sander—just a touch—until they are clean of glue and square.

Glue the two halves of each ring together by taping them down to a flat surface and using the tape to keep the mating edges pressed together. A slab of Corian works well as a gluing surface, but any really flat surface that glue doesn't stick to will suffice. Once the rings have dried, do a little touch-up sanding to remove any glue squeeze-out and to ensure ring flatness. For this, I use another slab of Corian on which I mount four sheets of 60-grit, closed-coat, silicone-carbide paper. With a light touch, I move each disc back and forth on the sandpaper, occasionally rotating it.

Gluing up the rings—All the rings from the large disc, except the smallest one, are stacked on top of the 5-in. base disc to form the body of the large bowl. But before the base disc is ready, it needs to have a ring cut off its outer edge for the smaller bowl. Take the faced-off disc, and with a pair of dividers, score about a 3½-in.-dia. mark on one side. Remount the disc on the three-jaw chuck, and with a narrow parting tool held at 45° to the face of the disc, make a plunge cut at the line and pop out the base of the large bowl. The ring that's left over, combined with the smallest ring from the large disc and the extra, small base disc make up the small bowl.

Back to the large bowl: As you stack the rings into a cone, you'll notice the seam on each ring where the grain in the first wedge meets the grain in the 104th wedge. By rotating each ring slightly and staggering the seam a half a segment between layers, like rows of bricks in a wall, the segments become more visually individual and the bowl's grain pattern is accentuated. To de-emphasize the seam and to get a bowl with an even grain pattern all the way around, start with a board that has grain that's similar at both ends.

To glue up the large bowl, I glue the layers of rings two at a time, using a special press frame I made by mounting a square-threaded screw in a frame welded from the same rectangular steel tubing used for the half-disc clamping jig. First, glue the base disc to a thick waste block, clamping the assembly in the press as shown in the lower, left photo on the facing page. Glue on the layers of rings two at a time, truing the face of the outermost ring after each glue-up. Do this by mounting the waste block on a screw center chucked in the lathe, taking a very light cut. Truing overcomes cumulative errors in the flatness of the rings and keeps the glue joints between layers perfect. The small bowl is glued up one layer at a time, truing faces for flatness between layers.

Turning the bowl—All that remains is to turn the bowl to final shape on the lathe. Remount the assembled bowl to the screw center and rough-turn the outside profile first. Then turn the inside to final shape and return to the outside for the final turning. I like my bowls to be featherlight, so I typically turn the walls down to ⅛ in. to 1/16 in. thick. When the walls start to get really thin, I turn with my left hand's thumb (I'm right-handed), guiding the tool while three fingers ride on the outside of the rotating bowl, steadying the rim. Cloth tape on my fingers protects them from friction burns. About 1,200 RPM is a good speed for doing the final turning.

Because there are so many gluelines in these segmented bowls, turning them tends to dull the edges of most lathe tools quickly. I used to turn with a gouge designed by Jerry Glaser made from A-11 steel, but now I find his micro-grain, carbide-tipped gouge tools to be superior (available from Glaser Engineering Co. Inc., 1661 E. 28th St., Signal Hill, Calif. 90806; 213-426-1722). To prevent turner's elbow (a turner's version of tennis elbow), Glaser recommends weighting the hollow handle of lathe turning tools with about 10 oz. of #9 lead bird shot, which helps absorb arm-fatiguing vibrations.

Sand the outside and inside of each bowl down to 320-grit paper, with the bowl on the lathe. Then, French polish the bowl by applying thin coats of shellac while the bowl's still on the lathe (not spinning). When the finish dries, reverse the bowl on the lathe to turn the foot. I mount the bowl on a special chuck consisting of a rounded cone that bears against the inside while a collar presses against the bowl's outside. The collar has three bolts around it that screw into a faceplate that mounts on the lathe. The bowl can be adjusted in this collar, to be accurately recentered within .005 in., something I verify with a dial indicator. To complete the bowl, part the waste block from the bottom and turn and finish the foot. □

Mike Shuler is a woodturner in Santa Cruz, Calif.

Lift Cabinets

Remote-control devices open the possibilities

by Scott Peck

People have always been fascinated with electronic gadgets that at the push of a button make things happen. At my shop, Masters Furniture and Design, we capitalize on this fascination by creating remote-control, electric-power lift cabinets that raise their tops to reveal what's inside. Lift cabinets offer a challenge for the woodworker and a dramatic presentation for televisions, video and projection equipment, stereos and small bars, and for displaying collectibles, like the guns in the cabinet we built, which is shown on the facing page.

The principle of a lift cabinet is simple: A remote-control device, like the one used to open your garage door, sends a signal to a receiver that activates an electric motor. The motor drives the lift mechanism mounted in the cabinet, which raises an inner case and whatever's inside it. Concealing precious items within such a controlled-access cabinet has a variety of advantages: It offers excellent security for valuables and protection from children, as well as protection from the adverse effects of light and dust. In its closed position, a lift cabinet can function as a hall table, chest or credenza. Lamps, photos or small sculptures can be left on the top continuously, provided you have ceiling clearance when the lift opens. Because of the many possible variations of lift cabinets, I won't describe how to build a particular cabinet in this article, but rather will describe the basics of lift mechanisms, cabinet design and wiring considerations, to help you design your own remote-control lift cabinet.

Remote-control lift mechanisms, like the one shown here by Hettich, are compact, yet powerful enough to lift heavy cabinets for pop-up televisions, display cabinets and home-entertainment centers.

Lift mechanisms—There are lots of different ways to raise and lower a cabinet vertically, using scissor lifts, electrically driven screws, or air or hydraulic cylinders. After searching the catalogs to see what's commercially available, we discovered several units that are specifically designed for lift cabinets. These electric lift units are light and compact, and run on regular 110v household power. Depending on which brand and model you buy, lifts can raise cabinets weighing from 175 lbs. to 2,000 lbs. from 8 in. to 21 in. high. Most models are available with or without a remote control. The biggest drawback of lift mechanisms is their expense, which ranges from about $300 to more than $5,000, depending on the weight capacity and maximum height of lift.

We buy most of our lift mechanisms from two West Germany cabinet hardware companies: Hafele America Co. (Box 4000, 3901 Cheyenne Drive, Archdale, N.C. 27263; 800-334-1873 or 800-672-4853 in North Carolina) and Hettich (Box 7664, Charlotte, N.C. 28217; 800-438-5939 or 704-588-6666 in North Carolina). Their lifts operate on a scissor-action principle, lifting a cabinet much as a scissor jack lifts an automobile for tire changes, but using an electric motor instead of muscle power. The Hafele unit is built with angle iron and is somewhat lighter and less expensive than the Hettich lift. The Hettich unit features strong, rectangular steel tubing, and its added weight and rigidity give it a great deal of stability in the raised position. This led us to choose a Hettich unit for the gun cabinet and other large-scale lift cabinets we've built.

Case construction—A lift cabinet requires two separate cases: an exterior shell, which is the visible exterior of the cabinet; and an interior case that can be raised and lowered by the lift mechanism. The basic components of a lift cabinet can be seen in the drawing, on p. 78. The design of the inner case depends on its function. For example, it may house a television, stereo system, bar or display cabinet. It may also have shelves, drawers or storage spaces, as needed. This case may be any size, as long as its weight, plus the material it's designed to hold, doesn't exceed the lifting capacity of the mechanism. Also, the case must be laid out to distribute weight evenly over the lift mechanism, to avoid stability problems and vibration when the lift operates. This means that heavy items should be centered over the lift, and the lift should be centered inside the exterior shell. The inner case shouldn't be shorter than the maximum distance the lift mechanism will rise; otherwise, the mechanism will show when the case is raised all the way up.

The exterior shell should be proportioned to allow at least ¼-in. clearance all the way around the inner case. The height of the exterior shell must be great enough to house the inner case as well as the closed lift, which is about 5 in. high. The goal is for the top of the inner case and the exterior shell to be level on the assem-

Disappearing gun display

The cabinet pictured above and right was designed to hold a matched set of shotguns. Its exterior shell is Honduras rosewood solids and panels veneered in Brazilian rosewood; the inner case is honeycomb panels veneered in Macassar ebony. Doors on the ends of the inner case allow access to the leather gun cases stored inside, and there are two flip-down shelves below the guns on the sides.

The cabinet holds four Holland-and-Holland double-barrel shotguns, two displayed on each side of the freestanding case. The guns, magnetically suspended from the mirrors, are engraved by Ken Hunt, with scenes depicting highlights of the Napoleonic era. The set includes more than 80 lbs. of leather, gold and ivory accessories, and is valued at $500,000. The cabinet was designed by myself and built by shopmate Jeff Reed at a cost of $16,000. —*S.P.*

The author's custom gun cabinet is based on a remote-control lift mechanism, shown fully open above. When the cabinet is closed, above left, it hides and protects the expensive guns it was designed to house and display.

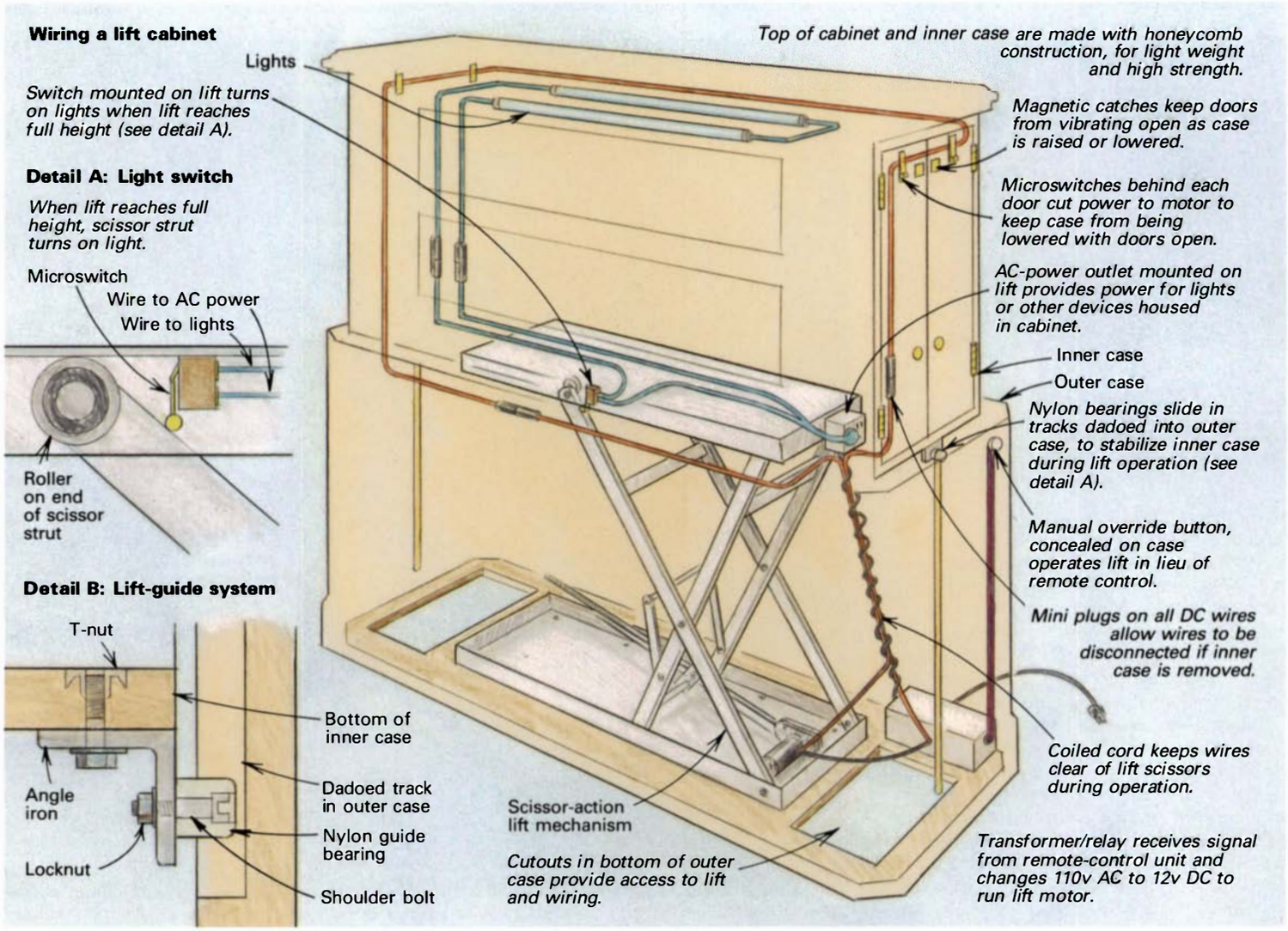
bled cabinet. The cabinet top attaches only to the inner case and raises along with it. By making the top overhang the shell by 1 in. or 2 in. on all show sides, slight misalignment between the top and shell won't be apparent when the top is shut.

Weight is probably the most important consideration when building a lift cabinet. A lift mechanism will raise the maximum load it's rated for, but the greater the load, the slower the lift. On smaller cabinets, we avoid heavy hardwoods and rely on strong frame-and-panel construction, reducing the thickness of case parts wherever possible. However, a larger case built this way is more subject to racking and lift-stability problems. We've found the best solution is to build the inner case and top with the veneered, honeycomb panels described in the sidebar on p. 79. These panels, which are similar to torsion boxes (see *FWW Techniques 6*, p. 92) or hollow-core doors, help the case retain its strength and stability while reducing its weight. You may use any materials or building methods you wish for the outer case, but on large cases, I've found it advantageous to use honeycomb-panel construction here as well. This weight reduction won't help the lift perform better, but it will save your back when the cabinet is moved.

Lift guides—Most commercial lift mechanisms tend to lack stability in the raised position. The extended scissor supports have very little lateral strength or resistance to wobble. The mechanisms may also vibrate while lifting or lowering. To prevent these problems, especially in a large cabinet, you should build a guide system to stabilize the inner case. The system we came up with, shown in detail A on the next page, uses two nylon bearings that ride in tracks in the exterior shell. It works well and is not difficult to make or install. The guide bearing is a short section of ¾-in. nylon rod with one end chamfered and its center drilled with a stepped hole. You could instead substitute a short hardwood dowel lubricated with wax. A shoulder bolt secures this bearing to an angle-iron section screwed to the underside of the inner case. The bearing rides in grooves dadoed on the inside of the shell. The dadoes are about .010 in. to .015 in. wider than the diameter of the bearing and are stopped so they won't show when the inner case is raised. We leave two of the mounting holes on the angle-iron bracket slightly oversize, to allow for lateral adjustment. Also, be sure the bearing bolt is fastened with a locknut: Lift vibration has amazing screw-loosening capabilities. To allow access for installing the guides on the inner case, cut out openings or trapdoors on the bottom or back of the shell. The openings also allow a malfunctioning lift to be serviced without removing the inner case (and its heavy contents).

After I began writing this article, the Auton Co. (Box 1129, Sun Valley, Calif. 91353-1129; 213-659-1718) sent me literature on a lift mechanism with geared tracks on each corner of the platform. I haven't tried the mechanism yet, but the manufacturer claims it eliminates the stability problems of scissor lifts and will support uneven loads of up to 600 lbs. (or more if custom-ordered).

Photos this page: Brian Mark



Wiring—The wiring for lift mechanisms isn't particularly complicated, but should be carefully planned before you start building. Following the drawing above, you'll see that there are really two kinds of wiring in a lift cabinet: 110v AC wiring and 12v DC wiring (drawn in orange). The lift motor runs on DC power delivered via a transformer/relay box, which receives AC power through a power cord plugged into a regular receptacle. Mounted next to the lift inside the shell (close to the openings, for replacing blown fuses), the box relays the signal to raise or lower the cabinet from either a remote-control unit or from a DC-wired, manual override button or key switch mounted in a discreet location on the exterior shell. An AC-power receptacle is attached to the lift itself, to supply power to appliances or lights in the inner case. This receptacle is connected to the power source by a heavy coiled cable designed to take up slack as the unit is retracted. The power cord from the relay box can be led out the back of most cabinets, but if the cabinet is free-standing, you'll have to consider how you're going to supply power to the cabinet. Two of our clients have ordered cabinets to go in the middle of a room, which required the electrical supply to be brought up from under the floor.

Interior lights can be installed inside the cabinet, provided you allow ventilation for bulb heat and follow safe practices for installing lights inside a wood enclosure (refer to building codes regarding enclosed fixtures). You can install regular on/off light switches inside the inner case, but our favorite trick is to use a hidden switch to turn the cabinet lights on and off automatically; the effect is very dramatic. Mount a microswitch, available from electrical-supply houses, inside the lift as shown in the drawing, so the strut of the lift engages the switch only when it's fully open. Wire the switch so that when it's on it completes the power circuit to the lights.

Safety—A lift that's powerful enough to raise a big load is also powerful enough to cause potential harm, so there are a few precautions you should build into any lift cabinet. First, never bolt the inner case directly to the top of the lift. Instead, bolt a subbase to the lift with holes bored in it to receive short dowels on the bottom of the inner case, which keep the case in position. Next, if the inner case has doors or drawers, mount microswitches at each and wire them so that when they're open they break the circuit and cut power to the motor. These precautions are needed, because the force of an accidentally lowered lift is capable of crushing either a hand or a door that's left ajar. Also, anything that opens, such as a drawer, should have a magnetic or bullet catch to keep it closed, because vibration can cause things to open as the lift is rising.

The wires from the door and drawer switches all need to be run to the base. We've found tying these together and running them down the center of the coiled cable works well. Another trick is to have these switch wires connected with miniature plugs, available from electronic-supply houses, so you can still remove the case or power supply without having to remove both. □

Scott Peck is a furnituremaker and owner of Master's Furniture and Design in Denver, Colo.

Drawing: Roland Wolf

Honeycomb-panel construction

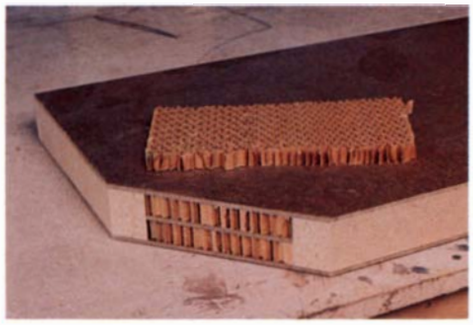
Honeycomb panels are incredibly strong, despite their light weight. We make ours by fitting a paper honeycomb into a frame, then gluing on a particleboard, fibercore or smooth hardboard skin. The panel is then veneered and edgebanded. The honeycomb core held in tension by the skin increases the panel strength tremendously, without significantly increasing its mass or weight. Honeycomb panels are not only ideal for lift cabinets, but for any big furniture, such as executive desks and conference tables, where weight, strength and a perfectly flat surface are a concern.

Industry has long used honeycomb construction as a weight-reduction technique for a variety of products, from hollow-core doors to featherweight aircraft parts. And, the technique isn't outside the reach of most craftsmen with access to some sort of press. Here I'll briefly outline the materials and procedures involved in making a honeycomb panel and point out some ways a small shop can produce high-quality panels.

Materials: Honeycomb cores are available in many materials, including paper, plastics, foams and metals. I've found corrugated-paper honeycomb to be economical and more than adequate for cabinet and furniture-making purposes. Paper honeycomb is available from The Norfield Corp., 36 Kenosia Ave., Danbury, Conn. 06810; (203) 792-5110, and from Verticel Inc., 4607 S. Windermere, Englewood, Colo. 80110; (303) 789-1844. The material comes in large sheets of plain or resin-coated paper in a variety of specifications. We've found that the higher the cell density, the stiffer the panel. The resin-treated paper yields the strongest, premium panel, but the less-expensive, untreated paper is fine for most applications.

For skin material, we prefer to use medium-density fiberboard (MDF). Although we occasionally use smooth hardboard, we typically use ¾-in.-thick honeycomb and face both sides with ¼-in. to ½-in. MDF, depending on the final desired panel thickness. For thicker panels, you can double or triple the honeycomb as long as the layers are separated by another skin layer. Skin materials thinner than ¼ in. are not recommended, because the honeycomb core will tend to telegraph through. Veneers glued to both sides of the panel provide the final surface and can be of whatever type of wood suits the project.

Because honeycomb panels receive edgebanding, you can use particleboard



Surrounding a corrugated-paper honeycomb material with a particleboard frame and sandwiching it between layers of MDF, smooth hardboard or particleboard creates a strong, rigid and lightweight panel.

or any kind of wood for the panel's frame, as long as you make sure the stock is dry and dimensionally stabilized to your climatic conditions.

Construction: The first step in making a honeycomb panel is to build a frame that will surround the core material. The thickness of the frame members equals the honeycomb skin thickness. Frame width should be proportional to panel size and thickness: For a panel 2 ft. by 4 ft., we typically make a 2-in.- or 3-in.-wide frame. We prefer plate-joining the frame together, but you can use any joinery you like. Make the frame slightly oversize, so you can trim the panel to final size after it's been glued up. Besides an outer frame, you must add crossmembers to your frame that span the hollow parts wherever joinery will attach the panel to other panels or frame members. Also, add crossmembers in large panels every few feet, for additional strength and stiffness.

Because the strength of honeycomb construction depends on the edge of the paper bonding perfectly to both interior faces of the skin, close tolerances in frame thickness are crucial for a successful glue-up. If the outer framework is even slightly thicker than the honeycomb, you'll have little glue bond between the skin and the honeycomb near the frame, seriously weakening the panel. If the frame is thinner, the fragile edges of the paper honeycomb will bend when the skin is pressed on, again weakening the panel.

After the wooden framework is ready, the honeycomb is pieced into the frame to a friction fit. We usually cut the pieces we need from sheets we keep in stock, and if larger or irregular-size pieces are needed, we just fit in additional pieces. Edge-gluing the pieces together or into the frame is unnecessary, because the panel gains rigidity through the honeycomb's vertical corrugations, not its horizontal stiffness.

Glue-up: The filled framework is now ready to be sandwiched between the outer skins, which have been trimmed to the same size as the frame. Coat the inside surfaces of both skins with a film of aliphatic-resin (yellow) glue applied with a short-napped roller. The sandwich is then assembled and placed in a veneer press until the glue dries overnight. If you are using a hydraulic or air-powered press, the pressure should be set a lot lower than if you were laminating a solid panel of the same size. This is because the actual surface area of the paper corrugations being bonded to the skin is relatively small.

Before applying the face veneers to the panel, you need to true up the skin to remove any surface distortion resulting from thickness variation in the different layers. We do this with a large thicknessing panel sander equipped with an 80-grit belt. If you don't have or can't rent time on such a sander, a high-speed orbital sander, such as the Porter-Cable 505, is capable of sanding a near-perfect, true surface...if you replace its sole. To do this, remove the felt pad and replace it with a square of ¼-in.-thick double-tempered hardboard cut to the same size. Scribble all over the surface of your panel with the side of a pencil. Then, lightly sand the surface with 100 or 120 grit, and you'll quickly see if you have any low spots. If you do, sand until true. This trick also works well for the first stage of final-sanding any veneered panel.

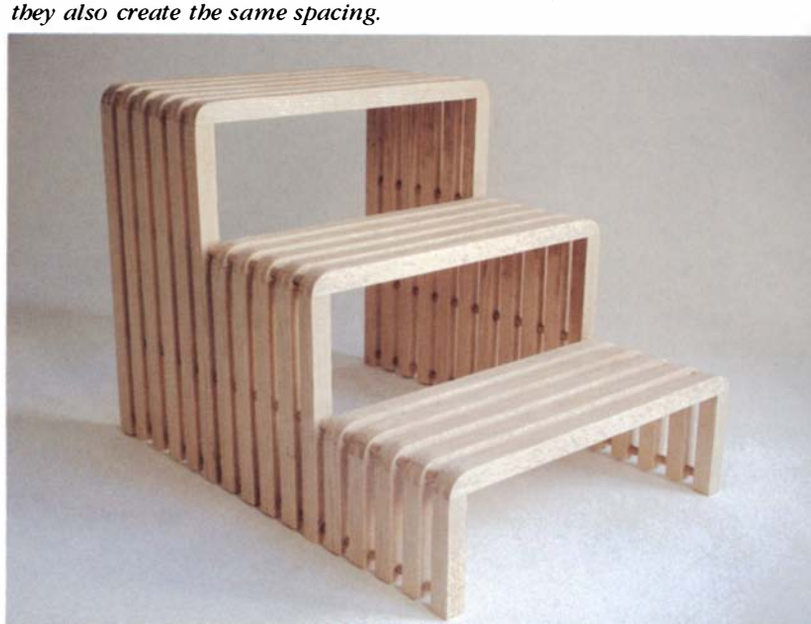
Veneering: The trued panel is now ready for veneering, which can be done anyway you choose, though our shop uses a large veneer press. After the veneering, the panel is trimmed to final size with a jointer, router or tablesaw. The edgebanding is then glued on and shaped as needed. All that remains is to cut the slots or mortises, or to bore the holes for the joints that attach the panel to the cabinet. It's best to keep a drawing or some record of where the crossmembers are, in case you need to cut joinery or mount hardware somewhere in the center of the panel. Finally, make sure to finish the honeycomb panel as you would any veneered panel—the same way on both sides. You'll enjoy working with the reduced weight of honeycomb panels, and they'll add a more high-tech element to spice up your work. —*S.P.*

Design/Build

Architects in the shop

by Scott Smith

Mohamed Adzlee Harun combined cherry and walnut in his library steps, above. The walnut handles are rabbeted and doweled into the extended legs. The bracing legs fold flat and are held closed by a wood friction catch. Kristina Kirmse used 70 linear ft. of 1⅛-in.-sq. oak and 90 segments of ½-in.-dia. doweling to build her step stool, below. She arranged the ¾-in. spacing between the slats by drilling through the mortised ends of the treads but not through the tenons on the side pieces. When the seats were glued up to make the steps, the 1½-in.-long dowels were driven into the holes until they hit the tenons, automatically creating the proper spacing. The holes for the dowels near the bottom and on the sides of the upper two steps are drilled exactly ⅜ in. deep, so they also create the same spacing.



The relationship between craftsmen/builders and designers/architects is sometimes strained. Builders complain that designers don't pay enough attention to the practical aspects of the materials or to the processes required to execute their designs. One classic example is when the designer specifies a cabinet with 25-in.-wide plywood panels, forcing the builder to buy a separate 4x8 sheet for each side.

A special "Introduction to Architecture" program at Carnegie-Mellon University in Pittsburgh, Penn., however, is attempting to bridge the gap between designers and builders by teaching woodworking to architecture students. As director of the "Design and Build" part of the program, I supervise the students' hands-on work in the architecture department shop. The high caliber of craftsmanship and wide variety of solutions to assigned furniture problems are, I think, evident in the library step stools shown here; all were built in one semester by first-year architecture students.

Because the Design and Build program is 15 years old, it has a strong sense of tradition. Current students are shown slides of projects built by previous classes, as a way to motivate and challenge them. In addition, they study slides of sculpture and all kinds of furniture and woodwork, ranging from Louis XIV through Victorian, Shaker, New England Pine, Stickley and Arts-and-Crafts Movement to contemporary architect-designed and one-of-a-kind custom furniture.

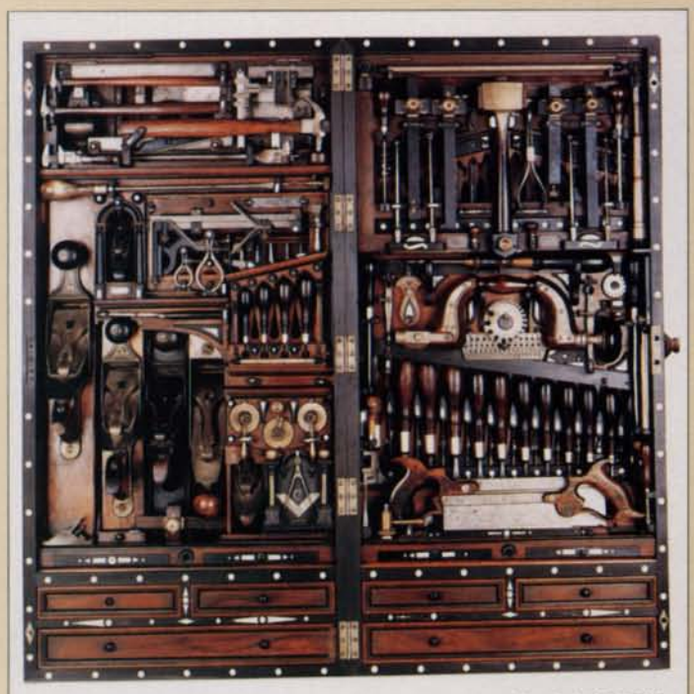
The students are required to submit developmental drawings and scaled working drawings as they design their projects. But the final proof of their understanding of the materials and tools is in the actual construction of the project. The experience helps future architects understand the common-sense logic of shop procedures and develop a design approach that will be in harmony with the material qualities of wood and the limitations and possibilities of the tools used to manipulate it. □

Scott Smith is director of the architecture woodshop at Carnegie-Mellon University in Pittsburgh, Penn. All photos are by the author.

The structural nature of the maple and cherry piece by Brian Press, above, creates a distinctly architectural look, with 'girders' supporting 'horizontal slabs' and passing through 'walls.' The through tenons on the maple crosspieces first step down about ¼ in. at the treads' edges, which are held back from the sidewall, then step down again where they go through the wall. The tall sidewall is a useful hand hold, both for climbing and for leaning on when reaching for a book on an upper shelf.

A sliding dovetail joins the oak steps to the walnut uprights on Vern Lei's design, above. To ensure that the joint would fit and stay tight, Lei angled the bottom of the dovetail mortise so it's not parallel with the top edge. Then, he drove a long maple wedge, with the dovetail angle ripped along its bottom edge, into the mortise below the tread. The combination of wedged dovetail treads and the braced uprights creates a very sturdy ladder. John Kim devised an ingenious all-wood folding mechanism for his library steps, below and below, right. Kim made the moving parts large enough to convince any climber that the steps are sturdy. The pattern created by the contrast of the 1-in.-dia. walnut doweling and oak legs is echoed in the walnut and oak laminated treads. Each side of Lynn Truskie's cherry steps, right, is made up of two S-shape pieces lapped together. After milling the lap joint close to the layout lines, she chiseled out the waste until the curves fit together. Finger joints attach the treads to the side supports. The design suggests two separate ribbons and gives the illusion that each step is independent of the other.

From Back Cover to Poster



TOOL CHEST LEGACY

If the workmanship in a tool chest is any indication of the maker's talent, then the craftsmanship of master carpenter and stonemason H.O. Studley must have been awe-inspiring. In an oak clamshell box adorned with rosewood, ebony, pearl and ivory, Studley kept both tools he made and a collection of the finest hand tools made prior to 1900, including a complete set of woodworking tools as well as machinist and stonemasonry tools. To pack the 300-plus tools into a case only 19½ in. wide, 39 in. long and 9½ in. deep, Studley devised a jigsaw-puzzle arrangement of flip-up trays, fold-out layers and hidden compartments. Maine native Pete Hardwick now owns the chest, which has been in his family since it was bequeathed to his grandfather by Studley. Hardwick acquired the chest from his brother by trading a 1934 Ford sedan for it. A good trade? It would seem so; just one tool—the Stanley #1 plane housed in the ebony archway in the upper-left part of the chest—was appraised at $700. Hardwick, a nonwoodworker, plans to sell the chest.

Now available from *Fine Woodworking* magazine

The response to *Fine Woodworking*'s July/August back cover was overwhelming. So many of you called or wrote asking for a poster reproduction of the exquisite tool chest by H.O. Studley, that we decided to go ahead and print one up.

We rephotographed the chest and enlarged the photo to fill the 18" x 26" poster shown above. Seen at this size, Studley's ingenuity and workmanship is even more apparent.

The poster is printed in full color on the same book-quality stock as the *Fine Woodworking* covers. And we'll mail it to you carefully rolled to keep it suitable for framing.

It makes a great gift for you or a friend.
To order, use the coupon below or call 1-800-888-TAUNTON.

☐ **Please send me** ____ copies of The Tool Chest poster at $9.95 each, plus $2.50 postage and handling (#180).

Name _____

Address _____

City _____ State _____ Zip _____

☐ Payment enclosed ☐ MasterCard ☐ VISA ☐ Am. Ex.

Charge card # _____

Exp. Date _____ Signature _____

TAUNTON MAGAZINES
...by fellow enthusiasts

The Taunton Press
63 South Main Street
Box 355PWAM
Newtown, CT 06470

Bosch Variable Speed Belt Sander: As Good At Fine Finishing As It Is At Finishing Fast.

One Finger Control Lets You Dial-In The Speed You Need.

Now you can rely on more than just the grit of your sandpaper—and the muscles of your arms—to control the quality of your sanding. Believing is getting your hands on the versatile Model 1273DVS variable speed belt sander by Bosch.

With six different speed ranges to choose from, the 1273DVS lets you take advantage of the power of a belt sander on jobs you might not have thought possible. Choose a lower speed with a fine grit for finishing sanding—or with a coarse grit to reduce heat build-up and clogging. Combine the higher speeds with a coarser grit for faster stock removal, no matter what the material. The speed selector dial is conveniently located just under the trigger. And the on-board sanding guide helps you select the right speed for your job.

SOLID WOOD	4-6
VENEER	3-5
CHIP BOARD	5-6
PLASTICS	3-5
STEEL	3-6
PAINT REMOVAL	3-6

The powerful 10.5 amp motor gives you power—even for heavy-duty production sanding. And this sander's fine balance lets you control that power with minimal effort.

Use the 1273DVS with its own dust collection bag—or connect it to the Bosch Air Sweep™ Dust Extraction system. Change belts with the snap of a lever. And the unique belt tensioning system makes sure belts stay centered through all kinds of work.

So check out what a world class variable speed belt sander can do for the quality of your sanding. See your Bosch Distributor today—he's listed in the Yellow Pages "Tools—Electric." Let him show you how this belt sander gives you more control with one finger than others do with two hands.

BOSCH

"Quality You Can Hold On To."

CLASSIFIED

The CLASSIFIED rate is $5.75 per word, minimum ad 15 words. All payments must accompany orders; all are noncommissionable. The WOOD & TOOL EXCHANGE and SITUATIONS WANTED are for private use by individuals only; the rate is $8.00 per line. Minimum 3 lines, maximum 6 lines, limit 2 insertions per year. DISPLAY CLASSIFIED rates on request. Send to: *Fine Woodworking*, Advertising Dept., Box 355, Newtown, CT 06470. Deadline for the *July/August* issue is April 25.

Business Opportunities

STUDIO/SHOP SPACE FOR LEASE. GENOA now leasing space to professional furniture designer/makers, craftspersons, artists. Each studio resident enjoys full access to GENOA's comprehensive machine rooms, spray painting facilities and promotion through on-site gallery. To receive a copy of our catalog and more information, please contact: GENOA, Box 250, Academy St., Genoa, NY 13071. (315) 497-3000 or 889-7291.

WOOD LOVER'S DREAM: SPECIALTY LUMBER/WOODWORKING BUSINESS. Home occupation. Real estate, inventory, equipment. Well established one man operation. Nationwide clientele. Woodworking, Box 243, Mansfield Center., CT 06250.

DEALER INQUIRIES INVITED

We are a direct importer stocking all quality hand tools needed for a woodworking tool store or specialty department. Resale only—no enduser sales.

Robert Larson Company, Inc.
33 Dorman Avenue
San Francisco, CA 94124 (415) 821-1021

Help Wanted

CUSTOM CABINET SHOP doing extremely high-end work looking for experienced cabinetmaker. Park Slope, NY. (718) 237-2592.

WOODWORKER/RESTORER - Premier Washington studio. (703) 548-4604. 1101 Duke, Alexandria, VA 22314.

EXPERIENCED CABINETMAKER custom furniture, salary negotiable, located Mt. Kisco, NY. Designs For Leisure, Ltd., 41 Kensico Dr, Mt. Kisco, NY 10549. (914) 241-4500.

APPRENTICE VIOLIN MAKERS and restorers: Positions available with finest rare violin shop in the country. Good salary and benefits, excellent training program. Professional woodworking experience required. Must be willing and able to learn. Bein & Fushi Inc., 410 S. Michigan Ave., Chicago, IL 60605.

SMALL, ESTABLISHED, CABINET SHOP IN YONKERS, NY seeks skilled cabinetmaker for involvement in planning, fabricating and installing high-end custom work. Also, assistant position available for individual seriously motivated to learn trade. (914) 963-9292

WOODWORKING INSTRUCTOR to teach and live-in at summer camp for teenagers in New Milford, CT. July - August 1989. Buck's Rock, 140 Riverside Dr. NY 10024. (212) 362-2702.

BOOK EDITOR: Highly respected publisher of how-to books seeks experienced, top-notch editor to acquire, develop and edit books on a variety of woodworking and how-to subjects. Position demands creative ability, excellent organizational and editing skills, good head for details and lots of energy. Knowledge of woodworking essential. Editing is done on computer. Excellent benefits including fitness center and no-smoking policy. Pleasant location within 1 hour from Philadelphia and 2 hours from New York City. Please send resume and salary requirments to: Personnel Dept. (BE-FW), RODALE PRESS, INC., 33 East Minor St., Emmaus, PA 18098. E.O.E.

CABINETMAKER, requires familiarity with hand and power tools. Shop specializes in fine wooden furniture and architectural woodworks. Kramer and Eiland Woodworking, PO Box 221, Washington, VA 22747. (703) 675-3882

CABINETMAKER/FURNITUREMAKER. Excellent opportunity for experienced woodworker in well-equipped shop located in central New Jersey. Must be able to produce extremely high-end work. Salary commensurate with abilities. Call (201) 442-4023.

SKILLED CRAFTSMAN TO JOIN GROWING WOODWORKING SHOP near Harpers Ferry, WV. 18th-century furniture re-creations. Phone (304) 876-6325.

Situations Wanted

English craftsman experienced in releathering desk tops, etc., and gold tooling work seeks employment in the U.S.A., own tools. Please write, G. Curd, 43 Talbot Rd., Sudbury, Suffolk, UK.

Journeyman, 38, quiet, architectural and yacht joiner work background, seeks learning, growing postion in small furniture shop in central New England area. Michael Smith, Box 2206, St. Augustine, FL 32085. (904) 824-6224 evenings.

Highly motivated 29-year-old seeks intense, multi-discipline apprenticeship with master craftsman in low production, high end furniture/woodworking shop. Rural location a plus. (804) 853-3168.

Instruction

CHICAGO SCHOOL OF VIOLIN MAKING. Full-time, comprehensive program under direction of master violin maker. Traditional methods of violin construction and repair taught; applications now being accepted for 1989-90. Write C.S.V.M., 3446 North Albany, Chicago, IL 60618. (312) 478-0505.

LEARN WOODEN BOAT BUILDING AND DESIGN. Two full-time residential programs that offer intensive training in a creative but disciplined environment. V.A. approved. Accredited member, NATTS. Financial aid available. Equal opportunity enrollment. The Landing School, Box 1490F, Kennebunkport, ME 04046. (207) 985-7976.

EVER WANTED TO BUILD A WOODEN BOAT? Come to Maine, take our six-week course. Summer workshops. Rockport Apprenticeshop, Box 539F, Rockport, ME 04856. (207) 236-6071.

VILLA MARIA WOOD WORKSHOPS, Aug. 13-19, 1989; carving classes in caricature, songbird, waterfowl, relief, fish, stylized, marquetry. PO Box 37051, Minneapolis, MN 55431.

APPRENTICESHIP IN PROFESSIONAL FINE FURNITURE MAKING with the prominent Jeffrey Greene Design Studio--realistic preparation for an uncompromisingly vital career as an independent artisan designing, making, marketing the very finest furniture in solid walnut/rosewoods. Tuition. New Hope, PA. (215) 862-5530. Call don't write. Monday thru Friday, 9:30-4:00.

LEARN TO TURN. Two-day concentrated course in all aspects of lathe. Workshop located in converted 18th-century spring house. Individualized instruction. Reading and Lancaster nearby. Send for free brochure. James L. Cox Woodworking School, R.D. 2, Box 126, Honey Brook, PA 19344. (215) 273-3840

PRESERVATION CARPENTRY- Nine-month course. Preserve and restore pre-20th-century buildings. CABINET & FURNITURE MAKING - two years, custom furniture construction. Traditional styles; hand joinery and embellishment. PIANO TECHNOLOGY - two years. Tuning, action repairs, and rebuilding. VIOLIN MAKING & RESTORATION - three years for making; optional fourth year for repair/restoration. Financial aid available to qualified students. Accredited member NATTS. NORTH BENNET STREET SCHOOL, 39 North Bennet St., Box A, Boston, MA 02113. (617) 227-0155.

WOODTURNING WORKSHOPS. Two-, three- & five-day classes include functional and artistic turnings. Gallery B, 11324 Arcade Dr., Little Rock, AR 72212. (501) 221-0266. Visa/MC/AmEx.

INDIVIDUAL INSTRUCTION learning milling, solar kilning, designing and making custom furniture. Student product development. Geoffrey Noden, Trenton, NJ. (609) 890-8152 or (609) 895-0511, graduate Parnham House, Dorset, England.

THE HYMILLER SCHOOL OF FINE FINISHING/REPAIR AND HAND JOINERY. One two-week intensive in-shop training will give you all the necessary knowledge to start your own business. Send $5 for complete info package. 3rd generation master craftsman. 912 Lakeshire Dr., Fairfield Glade, TN 38555. (615) 484-9309

RUSS ZIMMERMAN'S HOUSE OF WOODTURNING
Turner's Workshops and Supplies. Call or write for free brochure.
RFD 3, BOX 242
PUTNEY, VERMONT 05346
802-387-4337

For a catalogue describing our two year educational program in the fine art of furniture making, contact:
GENOA
Box 250,
Academy Street
Genoa, NY 13071
Furniture Making Education, Studios and Gallery
315.497.3000
315.889.7291
GENOA does not discriminate with regard to race, religion, color, creed, national origin, sex, sexual orientation, marital status, age or handicap

GENOA

peters valley crafts center
Layton, N.J. 07851
(201) 948-5200
Write or call for FREE brochure
Study Woodworking
June/July/August Summer Workshops
One to Nine Day Workshops

INSTRUCTION IN WOODWORKING THROUGH PARTIALLY PAYING APPRENTICESHIP PROGRAM. Training encompasses designing, producing, and marketing of fine furniture/cabinetry. Maxwell & Kelly Furniture, Philadelphia, PA. (215) 988-9065.

GILDING WORKSHOPS. Intensive courses in applying gold leaf embellishment to carving, frames, furniture, glass, and interior and exterior ornament. Individualized instruction in traditional methods by leading British gilder, **Frances Binnington**. Courses held in both the U.S. and London, England. For details write Kim Steele, 496A Hudson St., Box G5, New York, NY 10014. Tel. (212) 727-2765, or 'P & F Binnington', 65 St. John's Hill, London SW11 ISX, England. Tel. (011.44.1) 223-9192

WOODWORKING & LUTHIERY SCHOOL. One year intensive woodworking program. Four-month guitar-building course. Financial aid. Accredited member NATTS. Free brochure. Roberto-Venn School of Luthiery, 4011 S. 16th St., Phoenix, AZ 85040. (602) 243-1179.

APPRENTICESHIP AVAILABLE: All aspects of custom woodworking. Prestigious gallery in exclusive area. Tuition flexible, Tony Bilello, Gallery B, 11324 Arcade Dr., Little Rock, AR 72212. (501) 221-0266. Visa/MC/AmEx.

Glues/Adhesives

HIDE GLUE—ALL GRADES, 5# AND UP. Bjorn Industries, Inc., Box 1280, Matthews, NC 28106. (704) 845-2288.

BUILDING? RESTORING? REPAIRING? USE CHEM-TECH T-88 - the epoxy glue professionals use! Strength and reliability proven in boats and aircraft over 15 years. Introductory offer - ½ pt. of T-88 only $9.95 ppd. USA. Orders shipped within 48 hrs. Technical staff on call to answer your questions. Call/write CHEM-TECH, 4469-F Lander Rd., Chagrin Falls, OH 44022. (216) 248-0770.

Finishes

POLYESTER WOOD FINISH. A complete line of professional products for producing the ultimate piano/high-tech finish. Clears, custom colors. Catalog $2. Donald M. Steinert, Dept. FW, 800 Messinger Rd., Grants Pass, OR 97527. (503) 846-6835

PURE 100% TUNG OIL, Tung/Varnish & Exterior Tung Oil, dealer prices. Hope Co. Dept. FW, PO Box 749, Bridgeton, MO 63044. (314) 739-7254.

COMPLETE LINE OF FINISHING SUPPLIES including natural dyes, sandarac, gamboge, etc. Full-stocking Behlen dealer. Hand tools, books, seminars. Catalog $1, refundable. Olde Mill Cabinet Shop, 1660 Camp Betty Washington Rd., York, PA 17402. (717)755-8884.

SPRAY-ON-SUEDE LINING. Finish any project with a soft touch. Free brochure (sample enclosed). Donjer Products, Ilene Court - Bldg. 8F, Belle Mead, NJ 08502. (800) 336-6537.

BEHLEN WOOD FINISHING PRODUCTS. Best prices nationwide. Call or write for catalog. Western Antique Restoration Supply, PO Box 9409, Santa Fe, NM 87504-9409. (505) 983-5535

POLYMERIZED TUNG OIL at various percentages. Also available, 100% tung oil wiping varnish, polymerized and urethane base. For professional use. Volume orders at wholesale prices. Frank Welles (800) 322-1245.

"DAY-VAR" SATIN CATALYZED VARNISH suitable for table or bar tops. Send SASE. Mannhardt's, 139 Public Square, Knoxville, IL 61448. (309) 289-6469.

BEHLEN WOOD FINISHING PRODUCTS, WATCO, DEFT, WATERLOX, KWIK, MINWAX. Orange shellac flakes bulk $6.99 per lb (best quality). Harper Hardware—since 1898, 1712 E. Broad St., Richmond, VA 23223. (804) 643-9007.

ZWEIHORN ANTIQUE RESTORATION PRODUCTS, finest French polish available. Imported from Germany. Please contact; Remembrance of Things Past, Antique Restorations. (516) 261-9457.

Swedish Wood Dyes *Beautiful, brilliant colors. Imported and unique. Inexpensive, non-toxic. Professionally used. $3 for sample and brochure.*
Thore Henningson, P.O. Box 6004, Dept. FW, Rockford, IL 61125

THE FINE GOLD LEAF PEOPLE ™
Genuine, Imitation and Variegated Sheets & Rolls
Brushes, Supplies & Technical Books
IN USA: Three Cross Street
Suffern, NY 10901-4601
1-800-772-1212
(NY-AK 914-368-1100)
IN CANADA: 508 Douglas Avenue
Toronto, Ontario, M5M 1H5
416-787-7331
"WORK WITH THE BEST IN THE BUSINESS"

Musical Supplies

18-NOTE REUGE MUSICAL MOVEMENTS and accessories. Send SASE for information. Woodsmiths, 128 Henry Rd., Enola, PA 17025.

LUTHIERS' SUPPLIES: Imported tonewood, tools, varnishes, books, plans, parts, accessories, strings, cases, for violins, violas, cellos, basses and guitars. Assemble-yourself violin and guitar kits. Catalog, $.50, includes 10% discount certificate. International Violin Company, Ltd., Dept. WX, 4026 W. Belvedere Ave., Baltimore, MD 21215.

VIOLIN, GUITAR, banjo, mandolin-making materials, accessories, books. Catalog, $1. International Luthiers Supply, Box 580397, Tulsa, OK 74158.

HAMMERED DULCIMER PLANS! By noted builder Charlie Alm. Best book on subject. $19.95. Woodworks, Box 428, Brookston, IN 47923. (317) 563-3504.

GUITAR SUPPLIES, KITS & REPAIR TOOLS. Hot Stuff™ super glues, finishing supplies, Free 96-page catalog. Stewart-MacDonald, Box 900F, Athens, OH 45701. (800) 848-2273.

Plans & Kits

BOOKCASES, ENTERTAINMENT CENTERS, WATERBEDS, Bedroom and Children's furniture, etc. Catalog $3.75 (refundable). Over 70 professionally-designed plans! Kraemer Furniture Designs, 1350 Main St., Plain, WI 53577.

LEATHERCRAFT CATALOG. 100+ pages. Largest selection available of genuine leathers, tools, kits, books, supplies. Tooling, utility leathers, garment leathers, suedes, exotics. Belt, wallet, moccasin kits and more. Send $2 pstg. hdlg. to: Tandy Leather Company, Dept FW589C, PO Box 2934, Fort Worth, TX 76113.

Publications

Accessories

ROUTER BITS/CUTTERS. Standard and custom. TRUE CUT TOOL CORP. 1074 Hwy 93 South, Victor, MT 59875 (800) 262-2487.

ROUTER BITS MADE IN THE U.S.A.! New 1989 EAGLE AMERICA mail-order catalog. Over 700 items avail. High quality bits at factory-direct prices. Send $3 (and get $5 off first purchase) to EAGLE AMERICA, PO Box 1099, Dept. FW, Chardon, OH 44024. "Come back to American made quality...Come back to Eagle."

FILTER BAGS FOR DUST COLLECTORS: replacement sets, custom bags. Fabric $10/yd ppd. Free system plans. Barter Enterprises, Box 102B, Prospect Harbor, ME 04669.

EASILY SAW 1/2 - 80° ANGLES. Keep saw at 90°. New EZE-ANGLEGUIDE® brochure FREE. Steussy Creations, 334 Atherton, Novato, CA 94945.

Hand Tools

SPECIALS ON EUROPEAN MACHINERY AND FINE HAND TOOLS. You'll be talking with a master craftsman. Catalogs and postage, $5. Mail order only. John Hymiller, Woodworker, 912 Lakeshire Dr., Fairfield Glade, TN 38555. (615) 484-9309. MC/Visa.

TOOLS — ANTIQUE & USED — STANLEY. Quality selection of many hard-to-find handtools. Satisfaction guaranteed. Prompt, postpaid service. VISA/MC. Current illustrated list $1.50. Subscription - $6/year, 5 lists. Bob Kaune, 511 W 11th, Port Angeles, WA 98362. (206) 452-2292

THE BOWSCRAPER. Removes wood quickly, smoothly. Won't dig in like spokeshave. SASE Richard Baugh, 490 Gary Ct, Palo Alto, CA 94306.

JAPANESE TOOLS SINCE 1888. Free catalog. Tashiro's, 1435 S. Jackson, Seattle, WA 98144. (206) 322-2671.

Power Tools

NEW ENGLAND AREA. Call us about your industrial machinery needs. New, used, rebuilt. Woodshop Machines, Inc. 78 Regional Dr. Concord, NH 03301. (603) 228-2066.

RESTORED MACHINERY - Finest woodworking machines ever made. Oliver, Yates, Northfield. Bandsaws, table saws, wood lathes, etc. Puget Sound Machinery. (206) 857-5088

WIDE-BELT THICKNESS SANDER KIT, 24-in. CAPACITY, quick change belts, conveyor feed, accurate, rugged. Finished machines available. The affordable alternative. Free information. Miller Woodworking Machines, 1110 E. Quilcene Rd., Quilcene, WA 98376. (206) 765-3806

LEASE ANY MAJOR BRAND OF EQUIPMENT for your shop. Helping others for years. For information: (704) 252-8735.

DELTA SPECIAL 16-in. jointer $4,200; 1-in. shaper spindle cartridge, $175 ppd. New Rockwell 6-in. jointers. Other new & used machinery. Plaza Machinery Co., R#2 Box 921, Bethel, VT 05032. (802) 234-9673.

Services

COMPUTERIZED (IBM), KEY-WORD SEARCH, INDEX OF FWW. Issues 1-76 $31.95. Bit-Stream Products, 5302 Burnett Dr., Madison, WI 53705.

CUSTOM TURNING-Have turnings made to your exact specifications. Any quantity. For free brochure call (716) 593-3495.

Shows

2nd ANNUAL DESIGNS IN WOOD - OCTOBER 26 - 28. A juried show for fine artists. For applications write Somerset Mall, 2801 W. Big Beaver Rd., Troy, MI 48084-3201 or call (313)643-6360. Deadline June 1.

Toy Plans/Kits

MAKE WOODEN TOYS, whirligigs, classic autos, swing sets, doll houses, crafts, furniture with our plans, parts, kits, supplies. Color catalog subscription $1. (614) 484-4363. Cherry Tree Toys, Belmont, OH 43718-0369.

Wood

EXOTIC HARDWOODS: Mac ebony KD, as low as $12.50/bf. Cocobolo $4.50/bf. Bocote $4.25. Many fine furniture and cabinet woods. Best selection of turning squares and blocks, including outrageous spalts. Write or phone for FREE COLOR CATALOG: (213) 542-3576. Eisenbrand, 4100 Spencer Suite. C, Torrance, CA 90503.

EAST MOUNTAIN HARDWOODS, Rte. 7, Box 31H, Sheffield, MA 01257. Select oak, cherry, maple, ash, butternut, walnut, mahogany, tulip, pine, plank flooring, butcher block, hardwood plywood, custom milling. Toll free: MASS., 1-800-551-5028; Northeast 1-800-521-2019.

SAWMILL DIRECT. SNAKEWOOD, MARBLEWOOD, cocobolo, maple burl, redwood lace burl, ebony, bocote, verawood, boxwood, pernambuco, lignum vitae, zericote, Mexican kingwood and more. Lumber, logs, crotches, bowl stock, guitar setssquares, large inventory, wholesale retail. SASE for list. Tropical Exotic Hardwoods of Latin America, PO Box 1806, Carlsbad, CA 92008. (619) 434-3030

ARROYO HARDWOODS- Mac. ebony 4/4 KD $1750 per 100 bd ft. Pernambuco 4/4, 8/4 KD $900 per 100 bd ft. English brown oak 4/4 $795 per 100 bd. ft. 100 bd. ft. mins. Boxwood logs $2.50/lb. Palo Santo rounds (verawood) $2.50/lb. 50 lb. mins. Arroyo Hardwoods, PO Box 70781, Pasadena, CA 91107. (818) 304-0021.

HIGHLAND HARDWOODS Hardwood Distribution Center, Route 125, Brentwood, NH. Kiln-dried red oak, cherry, maple, ash, butternut, walnut, poplar, birch, pine and hardwood plank flooring. Mail: P.O. Box 426, Kingston, NH 03848. (603) 679-1230.

GUARANTEED CLEAR cocobolo, squares, lumber, cants, bocote, ebony, koa, lignum, cirocote. Custom kiln-drying available. Tropical Timber Corporation: (503) 654-5349.

SELECT AND BETTER: WALNUT $2.97/bf, cherry $1.90/bf, hard maple $1.27/bf. Additional species - Catalog $1. Master Card-Visa. BADGER HARDWOODS, Rt. 1 Box 262, Walworth, WI 53184.

REDWOOD LACE BURL, OTHER WESTERN SPECIES, squares, slabs, whole. Western lumber, figured lumber, rare woods, sample kits. SASE list. Eureka Hardwood Supply, 3346 D St., Eureka, CA 95501. (707) 445-3371.

HOMESTEAD HARDWOODS, 2111 Messick Rd., N. Bloomfield, OH 44450. (216) 889-3770. Kiln-dried ash, basswood, butternut, cherry, chestnut, curly maple, oak, poplar, sassafras, walnut.

WALNUT, CHERRY AND MANY OTHER FINE CABINET WOODS. Widths up to 32 in. NO MINIMUM. Days, nights, weekends, G&H Lumber, 109 Creek Rd., Landenberg, PA 19350. (215) 274-8810 or (717) 548-3834.

CHESTNUT SPECIALISTS: paneling, flooring, woodworking stock from antique barn lumber. (203) 589-5765 or 283-4209.

HONDURAS ROSEWOOD lumber squares, mill ends. Pine Creek Wood Co., PO Box 588, West Linn, OR 97608. (503) 636-6430.

THIN HARDWOOD DOMESTIC AND EXOTIC RWRL dimensioned stock available. Tennessee Hardwood and Tool Supply, 1106 Elm Hill Pike, Ste. 135, Nashville, TN 37210. (615) 242-9663.

CALIFORNIA WOOD: ACACIA, LIVE OAK, LOCUST, MADRONE, panoak, walnut, others. Figured, burl, lumber, slabs, KD, air-dried. SASE: Plane and Square, Box 760, Marshall, CA 94940. (415) 663-1665.

AIR-DRIED WALNUT & CHERRY LUMBER. Any thickness or size. Near exit 23 PA Turnpike. Frank, (215) 942-4332. We ship.

QUARTERSAWN WHITE OAK AND FIGURED LUMBER
Curly, Bird's-eye, Quilted, Crotch
Personalized Service — (215)775-0400
RD3, Box 3268, Mohnton, PA 19540-9339
TALARICO HARDWOODS

Flooring
Oak 21/4 strip No. 2 $.75 BF
Heart Pine, Cherry, Walnut, Maple, Hickory, Pine
Harmony Exchange
Rt.2 Box 843-W Boone NC28607 704-264-2314
Timbers Logs Stress-Skin Panels
Paneling Decking Siding

GILMER WOOD CO.
503-274-1271
Rare & Exotic Woods
- in logs, planks & squares
- over 50 species in stock
- also cutlery, turning & musical instrument woods

2211 NW St. Helens Rd., Portland, OR 97210

California Woodworkers-Restorers
Your source for: exotic veneers, hardwoods, inlays, tools, hardware, moldings, craft books, finishes, cane, etc. Exclusive supplier of Constantines of New York, quality products.
Constantines Wood Products, Inc.
5318 W. 144th St., Lawndale, CA. 90260
(L.A. area) 213-643-9484

WESTERN PENNSYLVANIA WOODWORKERS
50 Domestic & Imported Woods
Veneers • Finishes • Mouldings • Hardware
Carving Stock • Inlays & Bandings
Plans • Books • Magazines • Quality Tools
Call or Visit Our Store
WOODCRAFTERS' SUPPLY
7703 PerryHwy. (Rt. 19)
Pittsburgh, Pa. 15237 (412) 367-4330

FREE CATALOG
Lowest prices on a full-line of wood working supplies. Craft, hobby & toy parts. Superb quality, smooth—ready to finish. Custom imprinting designs available.
The WOOD SHOP
4619 Vanessa Lane Dept. B Erie, PA 16506

Sandy Pond Hardwoods
Your
TIGER and BIRDSEYE
Maple Specialist
and other Native
Figured Hardwoods
CHRIS S. POND
921-A Lancaster Pike, Quarryville, PA 17566
(717) 284-5030

CURLY, BIRD'S-EYE AND QUILTED MAPLE. 4/4 - 12/4. Also myrtle and cherry. Bill Largent, San Luis Obispo, CA. (805) 544-9663.

AFRICAN EBONY SUPER PRICE direct from importer. Wholesale/retail. SASE for information. R. S. Newman, 89 Canal St., Rochester, NY 14608. (716) 328-1577.

EXOTIC, HIGHLY-FIGURED FLAME BURLS from logger/sawmill. Any size, thickness, dryness, quantity. Bruce Remington, (707) 442-1319.

ATTENTION:
FLORIDA WOODWORKERS
We have Florida's largest selection of exotic and native hard and soft woods, table slabs, veneers, etc. for the professional and novice. Send $1.00 for list.
HENEGAN'S WOOD SHED
7760 Southern Blvd.(FW), West Palm Beach, Fl 33411
Call (407) 793-1557

Wood Parts

WOOD PARTS
TOY, FURNITURE, CRAFT & GAME
Wheels • Spindles
• Balls • Knobs
• Shaker pegs • And more!
Since 1927! Send $1.00 for Catalog.
BROWN WOOD PRODUCTS CO.
P.O. Box 8246FW, Northfield, IL 60093•(312)446-5200

Videos

FINE WOODWORKING "VIDEOLOG"—Send for your 50-minute sampling of the world's most in-depth woodworking videos. Includes tips on finishing turning, furniture repair, workshop techniques and other related subjects. Available VHS or Beta. $5 fee is good toward your first order. *Write: The Taunton Press, Attn; Video Dept., 63 South Main St., Box 355F, Newtown, CT 06470. Or call toll-free 1-800-888-8286.*

WOOD & TOOL EXCHANGE

Limited to use by individuals only

For Sale

New Hapfo copying lathe, model AHDK-125 with TS3 copier. Workpiece is completed in one pass. 59 in. between centers, copies 51 in. Same lathe as advertised in *FWW* for years. Today's price $8900; will sell for $5000 plus accessories.(409) 727-0239.

Mesquite Lumber. 4/4 and 8/4, 500bf. $5/bf plus shipping. All or part. H. Nordmeyer, PO Box 68, Knippa, TX 78870. (512) 934-2616 (answering machine).

Liquidating below cost, over 15,000 Redwood burl slabs of all sizes, shapes and thickness. Clocks-$1/up, coffee tables-$15/up. Call Bruce Remington, (707) 442-1319, 12-5 pm, California.

Sassafras lumber 6,000 ft. stack dried 4/4, $1/ft. Wm. Gray, 1145 Brookwood Ln., Nashville, TN 37220. (615) 373-1329.

Hegner HDB 175 wood lathe with LQ 400 duplicator, other accessories, $1375. Cape Cod, (508) 477-0198, evenings.

FELDER 12-in. sliding table saw, 3 spd tilt 1¼-in. shaper, 12-in. joint/planer, horizontal borer 3-3HP, 3PH motors. Mint condition $14k new plus $2300 accessories. (303) 841-9596.

Bird's-eye redwood lumber, approximately 4,000 board feet, $1.80 per board foot. (707) 445-3371.

36-in. DoAll bandsaw, excellent condition, purchased 1984, $8200; willing to sell for $1900, or best offer. Handcrafted Hardwoods, PO Box 182, Verdi, NE 89439. (702) 345-0160.

Wanted to Buy

Will pay top dollar for your Cuban mahogany. Please contact Jim Mirto, (516) 261-9457.

FWW #1 to #45 or later, complete and in good condition, competitive price. J.T. Goodwin, (507) 289-6649, Minnesota.

Seek copies of *Fine Woodworking*, nos. 19, 24, 25, 26. Ask for Danny at 1-800-882-3112.

Popular, Pocket-size
MINI-LIGNO
$110
Only

Incl. Case, Batteries and Pins for 3/16" and 7/8" Measuring Depth.
Also available as: Mini-E: Range 6-36% Mini-C with external probe.

Everybody Knows
that the moisture content of wood is crucial. Moisture related defects such as surface checks, warpage, cracks, loose joints, foggy finishes, etc., can ruin the best piece ever built.

Everybody Knows
moisture defects are irreversible. Therefore don't waste money and time on wet wood. Use a moisture meter to be sure you work only with dry wood.

Ask for *free brochure* on moisture meters (range 4-30%, 4-60%) and accessories to monitor air or kiln drying.

Wood Moisture Meter
from Lignomat USA
P.O. Box 30145
Portland, OR 97230
Tel: 800-227-2105 503-257-8957

SUNHILL

SEATTLE
1000 Andover Park East
Seattle, Washington 98188
(206) 575-4131

ATLANTA
3184 Marjan Drive
Chamblee, Georgia 30340
(404)455-8109

RELY ON 25 YEARS SHENG SHING EXPERIENCE
to give you the PERFECT FINISHING TOUCH!

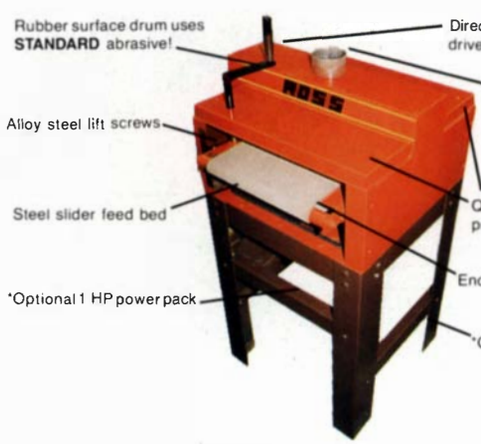
The Sheng Shing SDM-Series 25" & 37" cabinet shop wide belt sanders offer highest VALUE for your dollar!

$$\text{Value} = \frac{\text{Quality x Service}}{\text{Price}}$$

SATISFACTION GUARANTEED!
Please contact Sunhill for more information
-or-
Call our toll free number 1-800-544-1361

ROSS SUPER SANDER

THE ONLY DRUM SANDER MADE WITH **ALL** THESE FEATURES!



ALL THIS FOR LESS THAN $1,000.00*
*Does not include optional items

For futher information contact your local dealer or...

ROSS INDUSTRIES INC.
P.O. BOX 637 • PINEVILLE, MO 64856
(417) 223-4031

Listings of gallery shows, major craft fairs, lectures, workshops and exhibitions are free, but restricted to happenings of direct interest to woodworkers. We'll list events (including entry deadlines for future juried shows) that are current with the months printed on the cover of the magazine, with a little overlap when space permits. We go to press two months before the issue date of the magazine and must be notified well in advance. For example, the deadline for events to be held in March or April is January 1; for July and August, it's May 1, and so on.

CALIFORNIA: **Workshops**–Traditional Japanese woodworking Shoji screen Tansu chest, joinery and hand sharpening by Jay Van Arsdale (author of book "Shoji"). Contact Hida Tool Co., 1333 San Pablo Ave., Berkeley, 94702. (415) 524-3700.
Show–8th annual College of the Redwoods furniture show, May 13–29. Highlight Gallery, 54052 Main, Mendocino, 95460. (707) 937-3132.
Class–Saturday morning tool clinic w/ Simon Watts, July 15. Students bring their own woodworking tools and learn how to sharpen, adjust and use them. For more info., contact Crissy Field, National Maritime Museum Assoc. Bldg. 275, San Francisco, 94109. (415) 929-0202.
Show–LBMA Artists' Market, June 3–4. Long Beach Museum of Art, 2300 E. Ocean Blvd., Long Beach. 10 A.M. to 5 P.M.; $3 adults, children 12 and under are free. For information, call (213) 439-2119.
Classes–Basic woodcarving, June 4–16; tools & techniques, June 26–July 14; projects, July 17–Aug. 11. College of the Redwoods Woodworking Program, 440 Alger St., Ft. Bragg, 95437. (707) 964-7056.
Show–7th Los Angeles based Contemporary Crafts Market, an invitational exhibit featuring over 200 leading crafts designers, June 9–11. Santa Monica Civic Center, corner of Pico & Main St., Santa Monica. For more info., call (213) 829-2724.
Classes–Numerous home-improvement, wood-carving, busines, and furniture & cabinetmaking classes. For schedule, contact Ganahl Lumber Co., 1220 E. Ball Road, Box 31, Anaheim, 92805-5993. (714) 772-5444.

COLORADO: **Workshops**–15 summer workshops in craft & art furniture, and product design, June thru Aug. For a free catalog, contact Anderson Ranch Arts Center, Box 5598, Snowmass Village, 81615. (303) 923-3181.

CONNECTICUT: **Juried show**–21st Annual Celebration of American Crafts, Nov. 13–Dec. 23. All media; slide deadline June 15. Send SASE and resume for information to The Celebration, Creative Arts Workshop, 80 Audubon St., New Haven, 06510. (203) 562-4927.
Exhibit–"Tri-And-A-Half Crafts," an exhibit of Guilford crafts past and present, May 13–June 3. Guilford Handcrafts Center, 411 Church St., Box 589, Guilford, 06437. (203) 453-5947.
Workshops–Make your own shoji screen, April 29–30; turning plates, bowls & platter, May 6–7; elements of design in woodturning, June 3; advanced European cabinetmaking, June 3–4; lamination techniques, June 10–11, evening woodworking in Brookfield, June 15–Aug. 3; evening woodworking in Sono, June 14–Aug. 2. Brookfield Craft Center, Box 122, Route 25, Brookfield, 06804. (203) 775-4526.
Exhibit–"A New Elegance: Furniture for the '90s," May 10–July 16. The Elements, Gallery of Fine Contemporary Design, 14 Liberty Way, Greenwich, 06830. (203) 661-0014.
Show–Woodworking Show, April 21–23. Hartford Civic Center, 1 Civic Center Plaza, Hartford, 06103. For more info., contact The Woodworking Shows, 1516 S. Pontius Ave., Los Angeles, CA 90025. (213) 477-8521.

FLORIDA: **Juried show**–"Spotlight '89," a juried exhibit featuring artists from the 11 states of the Southeast Region of the American Craft Council, June 18–July 23. Univ. of Fla. Gallery, 102 F.A.B., Univ. of Fla., Gainesville, Fla. 32611.

HAWAII: **Classes**–Bowl turning with Richard Raffan, May 18. Contact Mark at Olsen Tool & Supply Co., 1931 S. Beretania St., Honolulu, 96826. (808) 946-5912.
Show–Arts & Antiques Market, an invitational show including 200 artists in all arts media, May 5–7. Blaisdell Exhibit Hall, 777 Ward Ave., Honolulu. For more info., contact Roy Helms & Associates, 777 Kapiolani Blvd., Ste. 2820, Honolulu, 96813. (808) 836-7611.

ILLINOIS: **Show**–Woodworking Show, April 28–30. Odeum, 1033 N. Villa Ave., Villa Park, 60181. For more info., contact The Woodworking Shows, 1516 S. Pontius Ave., Los Angeles, CA 90025. (213) 477-8521.
Show–Chicago Art Buyers Caravan Show, May 6–8. Expocenter, Chicago. Open to buyers from the trade only. Contact Paul Karel, ABC, 408 Olive St., St. Louis, MO 63102. (314) 421-5445.
Classes–Numerous conservation and preservation training classes, April thru Aug. Campbell Center For Historic Preservation Studies, Box 66, Mount Carroll, 61053. (815) 244-1173.
Juried show–10th annual Fountain Square Arts Festival, June 24–25. Evanston. FSF, c/o Evanston Chamber of Commerce, 807 Davis St., Evanston, 60201. (312) 328-1500.

Photo: Eric Smith

Above: A 'Norfolk Island Pine' bowl by Ronald Kent, one of the featured woodturners at the Janis Wetsman 20th-Century Decorative Art Show in Farmington, Mich.

INDIANA: **Show**–Madison Heritage Days festival, June 2–4. Around the Lanier State Historic Site, Madison. For more info., write 1119 W. Main St., Madison, 47250. (812) 265-5080.

IOWA: **Classes**–Numerous one-day woodworking classes, June thru Sept. Contact Vesterheim, Norwegian-American Museum, 502 W. Water St., Decorah, 52101. (319) 382-9681.
Exhibit–American Wildfowl Decoys, April 16–June 10. Shorebird and duck decoys carved between 1870–1960. Muscatine Art Center, Muscatin. Contact Susan Flamm, 444 Park Ave. S., New York, NY 10016. (212) 481-3080.
Juried show–19th annual "Art in the Park," May 20–21. Four Square Park, Main Ave., Clinton. Clinton Art Assoc. Box 132, Clinton, 52732. (319) 259-8308 (Carol Glahn).

KANSAS: **Juried show**–"Dimensions '89," Lenexa's 5th annual national 3-dimensional art show, May 19–21. Sar-Ko-Par Park, 87th St. Parkway at Lackman Rd., Lenexa. Free admission; 5 P.M. to 7:30 P.M. Friday, 10 A.M. to 7:30 P.M. Saturday, 10 A.M. to 5 P.M. Sunday. For more info., contact William H. Nicks or Jennifer Seveland-Box, 13420 Oak, Lenexa, 66215. (913) 541-8592 or 492-8800.

KENTUCKY: **Symposia**–Woodturning/sharpening, May 26–28; joinery/finishing, June 9–11. Instructors: Jim Hall, Sanford Hill & Ersal Kindel. Contact Adventure in Woods, 415 Center St., Berea, 40403. (606) 986-8083.

LOUISIANA: **Juried show**–Lafayette Art Assoc. Annual Juried Competition of Fine Art & Original Crafts, Oct. 9–Nov. 10. Slides due July 1. For prospectus, write Sara Parker, Lafayette Art Gallery, 700 Lee Ave., Lafayette, 70501.

MAINE: **Classes**–2- and 3-week homebuilding classes, June 12–23, May 8–26, July 10–28. Shelter Institute, 38 Centre St., Bath, 04530. (207) 442-7938.

MASSACHUSETTS: **Juried show**–10th annual Fair of Traditional Crafts, Dec. 2–3. Open to craftspersons who create products typical of 19th-century New England; deadline June 1. Contact Frank G. White, Curatorial Dept., Old Sturbridge Village, 1 Old Sturbridge Village Rd., Sturbridge, 01566. (508) 347-3362, ext. 236.
Show–The Boston Woodworking World Show, April 28–30. The Bayside Expo Center, Boston. For more info., contact CDI Productions, Box 796, Plymouth, NH 03264. (603) 536-3768.
Exhibits–Turned wood by Dan Kvitka, April 29–May 27; floor coverings & lamps, June 3–July 15. For more info., contact The Society of Arts & Crafts, 175 Newbury St., Boston, 02116. (617) 266-1810.
Show–ACC Craft Fair's Original Rhinebeck Craft Fair, June 20–22 (trade), 23–25 (public). Eastern States Expo., 1305 Memorial Ave., W. Springfield. For more info., contact ACC Craft Fair, Box 10, 256 Main St., New Paltz, NY 12561. (914) 255-0039.
Juried exhibit–"Surface and Substance: Exploration of Texture in Craft," June 16–Aug. 6. The Berkshire Museum, 39 South St., Pittsfield, 01201. (413) 443-7171.
Workshops–Finish carpentry, May 8–12, June 12–16; timber framing, June 19–23; housebuilding, May 22–June 9, June 26–July 14. For a brochure, contact The Heartwood School, Johnson Rd., Washington, 01235. (413) 623-6677.
Events–Various events, workshops, lecture series, etc., April thru June. Society for the Preservation of New England Antiquities, Harrison Gray Otis House, 141 Cambridge St., Boston, 02114. (617) 227-3956.
Show–Featuring artists involved in a provactive explosion of turned wood, thru April 30. Monday–Saturday 10 A.M. to 6 P.M.; Thursday 10 A.M. to 9 P.M.; Sunday 1 P.M. to 5 P.M. Ten Arrow Gallery, 10 Arrow St., Cambridge, 02138. (617) 876-1117.

MICHIGAN: **Class**–Lofting and building the Herreschoff pram w/ Simon Watts, May 6–13. Charlotte. For more info., contact John Wilson, 500 E. Broadway Hwy., Charlotte, 48813. (517) 543-5325.
Class–Building the sailing pram, Sea Lion, w/ Simon Watts, May 20–27. Sutton's Bay. For more info., contact Lois Bahle, Bahle's Store, Main St., Sutton's Bay, 49682. (616) 271-3640.
Meeting–Annual meeting of Early American Industries Assoc., May 18–21. Ford Museum & Greenfield Village, Dearborn. Contact EAIA, Box 2128, Empire State Plaza Station, Albany, NY 12220-0128.
Show–Metro Carvers of Michigan 9th annual Woodcarving Show, April 22–23. United Food Workers Hall, 876 Horace Brown Dr., Madison Heights. Whittled pieces, human figures, wildlife, carving tools & supplies. Contact Metro Carvers, 25400 W. 14 Mile, Franklin, 48025, or Judy Petrous, show chairman, at (313) 752-4304.
Show–Woodturning show, April 28–May 20. Janis Wetsman 20th Century Decorative Art at Artpack Services, Inc. & A.I.R., 31505 Grand River, Door #10, Farmington, 48024. Call (313) 645-6212.

MINNESOTA: **Juried show**–7th annual Upper Midwest Woodcarving Exhibit, July 23–28. Blue Earth. For more info., contact Harley Schmitgen, 311 E. 14th St., Blue Earth, 56013. (507) 526-2777.

MISSOURI: **Classes**–Classes cover a broad range of folk and fine arts, June, July & Sept. For catalog, write or call Bethel Colony School of the Arts, Box 127, Bethel, 63434. (816) 284-6493.
Show–2nd annual Laumeier Contemporary Art & Craft Fair, May 12–14. Laumeier Sculpture Park, St. Louis. Laumeier CACF, 12580 Rott Road, St. Louis, 63127. (314) 821-1209 or 391-8201.

NEW HAMPSHIRE: **Conference**–5th Annual National Conference by Timber Framers Guild of N. America, May 19–21. Millersville Univ., Millersville. Contact the Timber Framers Guild at (603) 357-1706 or write TFGNA, Box 1046, Keene, 03431.
Sale–Antique & Craftsmans Tool Auctions: listed sales, May 13 & June 24; unlisted sale, June 10. Dansforths 4 Corners, Hillsboro. For more info., contact Your Country Auctioneer Inc., R.F.D. #2, Box 339, Hillsboro, 03244. (603) 478-5723.
Workshops–16th Annual Violin Institute workshops in-

DYANITE™ BREAKS THE PERFORMANCE BARRIER.

New Golden Eagle™ saw blades with Dyanite™ outperform ordinary carbide-tipped blades.

This is the revolutionary new Golden Eagle saw blade. It performs like no other blade you have ever seen.

The secret is cutting teeth made of Dyanite premium carbide, a breakthrough compound far tougher than any grade of carbide ever developed. Dyanite means incredible performance and durability.

In numerous field tests under identical cutting conditions, Dyanite premium carbide blades outperformed standard C-4 carbide-tipped blades in cutting a variety of materials…hardwood, particleboard, green lumber, plastic laminates, and more.

Dyanite carbide can be given a sharper edge than standard carbide, yet requires no special tooling to be resharpened. It's more corrosion-resistant than other grades of carbide and more resistant to high temperatures generated during cutting.

The Golden Eagle line of saw blades featuring Dyanite premium carbide teeth totals 37 blades in sizes ranging from 8″ to 16″ in diameter, in 24 to 100-tooth configurations.

Golden Eagle saw blades from DML. They're available only where quality industrial tools are sold. Call for the name of your nearest distributor.

800-233-7297 (SAWS)
800-626-1802

Dyanite has patents pending.

DML
Cutting everything but corners.

Louisville, KY 502-587-5562
Muscle Shoals, AL • Hot Springs, AR • Lenoir, NC • Wilkesboro, NC

tended for violin builders, bowmakers, musicians, stringed-instrument craftspeople and music educators, June thru Aug. For a brochure, contact Univ. of NH, Div. of Continuing Ed., Violin Institute, 6 Garrison Ave., Durham, 03824. (603) 862-1088.
Show–Pratt Institute's "Summer Creative Arts Therapy Institute," June 19–July 15. Lincoln. For details, contact Leslie Abrams, Creative Arts Therapy Dept., at (718) 636-3428.

NEW JERSEY: **Juried show**–10th annual woodcarving show, June 3–4. Wheaton Village Glass Museum, Millville; 10 A.M. to 5 P.M. Sponsored by South Jersey Wood Carvers. For info., contact Jack or Connie Raleigh, 716 Wood Lane, Cinnaminson, 08077. (609) 829-8731.
Workshops–Numerous woodworking workshops, June thru Aug. For more info., contact Peters Valley Craftsmen, Route 615, Layton, 07851. (201) 948-5200.
Exhibit–Spring Showcase, contemporary art, American crafts & jewelry, April 14–May 13. Will feature woodturned vessels by Michael Foster. Sheila Nussbaum Gallery, 358 Millburn Ave., Millburn, 07041. (201) 467-1720.

NEW YORK: **Show**–11th annual Great Neck Celebrates Crafts, May 14. Middle Neck Road, Old Village, Great Neck. Contact Creative Faires Ltd., Box 1688, Westhampton Beach, 11978. (516) 288-2004.
Juried show–"Artitudes, New York–1989," a multi-media international art & craft competition, including wood. Winners will exhibit at Art 54 Gallery, Soho, NYC. Slide submission deadline June 23. For application, Artitudes, Dept. RW, Box 380, Hartsdale, 10530. (914) 633-5333.
Show–12th Annual New York Renaissance Festival, July 29–Sept. 17. Sterling Forest, Tuxedo. Weekends only plus Labor Day Monday. Contact Creative Faires Ltd., Box 1688, Westhampton Beach, 11978. (516) 288-2004.
Workshop–Hand tool workshops by Robert Meadow, May 20–21 and June 24–25. Learn to use Japanese tools, sharpening techniques, joinery, furnituremaking, instrumentmaking. Hands on; individualized instruction; all levels. The Luthierie, 2449 W. Saugerties Rd., Saugerties, 12477. (914) 246-5207.
Show–4th annual Lilac Art Show, May 13–14. Highland Park, Rochester. For more info., contact Arts for Greater Rochester, 335 E. Main St., Ste. 200, Rochester, 14604. (716) 546-5602.
Exhibit–12th Annual Wood Carvers Show by the Southtowns Wood Carvers, May 6–7. Creative Arts Bldg., Erie County Fairgrounds, Hamburg. Free admission. For info., contact Eva Kirsch, show chairman, at (716) 652-4593.

Classes–Woodworking classes at all levels, all beginning week of June 5. 10 4-hour sessions with Maurice Fraser, $192; 8 3-hour sessions in faux marble and in furniture finishing with Susan Perry, $120 each; router workshop with Bill Gundling, $75; free demo (hand dovetails & bowl turning), May 30. Craft Students' League, YWCA Bldg., 610 Lexington Ave. (corner of 53rd), New York, 10022. (212) 735-9730.
Juried show–3rd annual American Craft At The Armory exhibit and sale, May 4–7. 7th Regiment Armory, NYC. American Craft Enterprises, Box 10, New Paltz, 12561. (914) 255-0039.
Exhibit–"The New Work: First Generation Furniture and Objects From The Studios," on display at GENOA, Box 250, Academy St., Genoa, 13071. (315) 497-3000 or 889-7291.
Juried show–Chautauqua Crafts Festival '89, June 30–July 2 & Aug. 11–13. Application and slide deadline April 20. Bestor Plaza, Chautauqua Institution. For application, send SASE to Gale Svenson, Chautauqua Crafts Festival '89, Box 89, Mayville, 14757.
Exhibit–"George Nakashima: America's Living Treasure Series," May 7–July 9. American Craft Museum, 40 W. 53rd St., New York, 10019. (212) 956-3535.
Show–New Paltz Art & Craft Fair, May 27–29. Ulster County Fairgrounds, New Paltz. For more info., contact Scott & Neil Rubinstein, Qual Hollow Events, Box 825, Woodstock, 12498. (914) 679-8087 or 246-3414.
Revival–Clearwater's 1989 Great Hudson River Revival, June 17–18. Westchester Community College, Valhalla. Contact Clearwater's great Hudson River Revival Crafts Committee, c/o Joan Silberberg, RFD #2, Pudding St., Carmel, 10512. (914) 454-7951.
Juried show–13th annual American Crafts Festival, July 1–2, 8–9, 15–16. Lincoln Center, Fordham Univ. Plaza, NYC. Contact Brenda Brigham, American Concern for Artistry & Craftsmanship, Box 650, Montclair, NJ 07042. (201) 746-0091.

NORTH CAROLINA: **Seminar**–Weekend seminar by Rude Osolnik & Dale Nish discussing design concepts, techniques, materials, tools and equipment, June 9–11. Campbell Folk School, Brasstown, 28902. (800) 562-2440 or (704) 837-2775 or 7329.
Workshop–Woodcarving with John Hillyer, June 6–7. Numerous other workshops, exhibit, etc. Folk Art Center, Milepost 382, Blue Ridge Parkway, Asheville. For info., contact Cornelia W. Graves, Southern Highland Handicraft Guild, Box 9545, Asheville, 28815. (704) 298-7928.

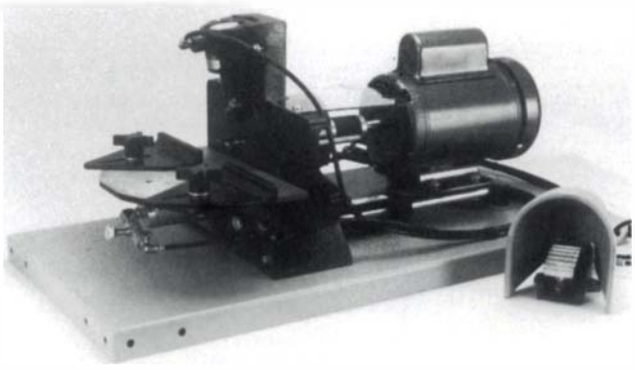
Workshops–Week-long summer workshops, July thru Oct. Contact Country Workshops, 90 Mill Creek Rd., Marshall, 28753. (704) 656-2280.
Juried shows–2nd annual North Carolina Showcase of Fine Art & Crafts, May 19–21. Raleigh Civic Center. 14th annual Highland Heritage Art & Craft Show, June 15–18. Asheville Mall. For more info., contact Gail Gomez, High Country Crafters, 46 Haywood St., Asheville, 28801. (704) 254-7547 or 253-6893.

OHIO: **Workshops**–One-week intensive, hands-on instruction on a number of subjects, June thru July. For information, contact Conover Woodcraft Specialists, Inc., Conover Workshops, 18125 Madison Road, Parkman, 44080. (216) 548-3481.
Show–Woodworking Show, May 5–7. Cleveland Convention Center, 1220 E. 6th St., Cleveland, 44114. For more info., contact The Woodworking Shows, 1516 S. Pontius Ave., Los Angeles, CA 90025. (213) 477-8521.
Workshop–Spray finishing technology, by Bowling Green State Univ. and the DeVilbiss Co., May 8–12. Technical Training Center, DeVilbiss Co., World Headquarters, Toledo. For additional info., contact Judy Jennings at (419) 372-2439.
Juried exhibit–"American Contemporary Works in Wood '89," a biennial, national juried competition of contemporary woodworking, Sept. 16–Oct. 15. Slide entry deadline May 19. For entry forms, contact the Dairy Barn Southeastern Cultural Arts Center, Box 747, Athens, 45701. (614) 592-4981.

OKLAHOMA: **Show**–13th annual National Woodcarving Show, sponsored by Eastern OK Woodcarvers Assoc., July 7–9. Kensington Galleria Shopping Mall, 71st & S. Lewis, Tulsa. For more info., contact Dale Hill, Rt. 1, Box 75, Broken Arrow, 74011. (918) 455-8683.

OREGON: **Workshops**–Various workshops in woodworking for summer quarter, June 13–Aug. 22. Oregon School of Arts & Crafts, 8245 S.W. Barnes Rd., Portland, 97225. Call (503) 297-5544 for a summer schedule.
Exhibits–"Furniture Invitational," functional and nonfunctional forms by Northwest furnituremakers May 14–June 17; "From Inside Out," garden pieces of multi-discipline appropriate for the Northwest environment, June 25–July 29. Contemporary Crafts Gallery, 3934 S.W. Corbett Ave., Portland, 97201. (503) 228-2308.

PENNSYLVANIA: **Exposition**–Symposium '89: A Na-



DOWEL IT!

For tough joints that are perfectly aligned, The Dowel Mate is the answer. A single step on the foot pedal first clamps the wood and then shoots in two dowel holes.

- Air clamp and air feed.
- Double spindles on 1" centers.
- 3/4 hp 115/220 V with switch & cord.
- Shipped ready for production.
- USA High quality at Low price.

See your woodworking machinery dealer or call toll free for an informative brochure.

PORTA-NAILS, INC • PO BOX 1257 • WILMINGTON, NC 28402
PHONE (919) 762-6334, OUT OF NC 1-800-634-9281

• Porta-Nailer • Router Mate • Panel Template • Ring Master

WOOD PARTS FROM MIDWEST DOWEL WORKS

Compare Our Low Prices!

		Qty.	Cost
3-1/2" Poplar Shaker Peg	$15/100		
1-3/4" Mini Shaker Peg	$7/100		
3-1/2" Country Wall/ Mug Peg	$15/100		
2-1/2" Country Shorty Peg	$12/100		
Large Bean Pot Candle Cup	$17/100		
Brass Inserts	$9/100		
1/2" Mini Candle Cup	$10/100		
1-1/2" Toy Wheel	$10/100		
2" Toy Wheel	$17/100		
Axel Pegs	$4/100		

SMOOTH SANDED HEARTS

3/4"x1/8" Hearts	$2.75/100		
3/4"x1/2" Hearts	$4.50/100		
1"x3/16" Hearts	$6/100		
1"x3/8" Hearts	$7/100		
1-3/8"x1/8" Hearts	$7/100		
1-3/8"x1/4" Hearts	$8/100		
1-3/8"x1/2" Hearts	$10/100		
2"x1/2" Hearts	$18/100		

Great Buys!

		Qty.	Cost
3/8"x36" Standard Dowels	$21/100		
3/4"x36" Oak Dowels	$15/10		
3/8" Maple Buttons	$2.15/100		
1/2" Maple Buttons	$2.25/100		
1-1/2" Maple Spindles	$9/100		
2-1/8" Maple Spindles	$18/100		

ORDER NOW

☐ MC/Visa ☐ Check Enclosed

Total Cost _____
Handling $3.00
Ohio residents add 5½% sales tax _____
Final Cost _____

MC/Visa Number _____
Expires _____ Phone _____
Name _____
Address _____
City/State/Zip _____

FREE 16-PAGE CATALOGUE

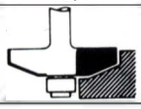
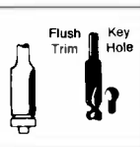
Circle this section for FREE Dowels — mixed pack, Maple, Oak, Walnut Cherry, from 1/4" up to 1" Approximately 10 LFT. 14" long. $5.00 value with any order.

MIDWEST DOWEL WORKS
4631 Hutchinson Road
Cincinnati, Ohio 45248
(513) 574-8488
Same Day Service/Order before Noon
Factory Direct/Satisfaction Guaranteed

CARBIDE TIPPED ROUTER BITS

PROFESSIONAL PRODUCTION QUALITY

1000's SOLD TO READERS OF FINE WOODWORKING

BEST CUT BEST PRICE	ITEM NO.	DESCRIPTION	RADIUS	LARGE DIAM.	CUTTING LENGTH	PRICE
		COVE				
	#01	1/4" R	1/4"	1"	1/2"	$13.00
	#02	3/8" R	3/8"	1-1/4"	9/16"	14.00
	#03	1/2" R	1/2"	1-1/2"	5/8"	15.00
		ROUND OVER				
	#04	1/4" R	1/4"	1"	1/2"	$15.00
	#05	3/8" R	3/8"	1-1/4"	5/8"	16.00
	#06	1/2" R	1/2"	1-1/2"	3/4"	19.00
		ROMAN OGEE				
	#07	5/32" R	5/32"	1-1/4"	15/32"	$18.00
	#08	1/4" R	1/4"	1-1/2"	3/4"	20.00
	#11	3/8" RABBETING	Deep 3/8"	1-1/4"	1/2"	$14.00
	#09	1/8" (KERF) SLOT CUTTER		1-1/4"	1/8"	14.00
	#10	1/4" (KERF) SLOT CUTTER		1-1/4"	1/4"	14.00
	#12	45° Chamfer	45° Angle	1-1/2"	5/8"	$15.00
	#15	Raised Panel	20° Angle	1-5/8"	1/2"	$25.00
	#35	1/4" V Groove 90°		1/4"	1/4"	$ 8.00
	#36	3/8" V Groove 90°		3/8"	3/8"	9.00
	#37	1/2" V Groove 90°		1/2"	1/2"	11.00
	#16	3/8" Dovetail 9°		3/8"	3/8"	$ 7.50
	#80	1/2" Dovetail 8° (For Leigh Jigs)		1/2"	13/16"	12.00
	#17	1/2" Dovetail 14°		1/2"	1/2"	8.50
	#18	3/4" Dovetail 14°		3/4"	7/8"	10.50
		CORE BOX (ROUND NOSE)				
	#19	3/8" Core Box	3/16"	3/8"	3/8"	$11.00
	#20	1/2" Core Box	1/4"	1/2"	11/32"	14.00
	#21	3/4" Core Box	3/8"	3/4"	5/8"	18.00
	#056	Tongue & Groove (FOR WOOD THICKNESS FROM 1/2" to 1")		1-5/8"	1"	$30.00
	#24	1/4" Straight Bit		1/4"	3/4"	$ 7.00
	#25	5/16" Straight Bit		5/16"	1"	7.00
	#26	3/8" Straight Bit		3/8"	1"	7.00
	#27	1/2" Straight Bit		1/2"	1"	7.00
	#28	3/4" Straight Bit		3/4"	1"	10.50
	#13	1/2" FLUSH TRIM		1/2"	1"	$ 8.50
	#14	3/8" KEY HOLE (This Bit Only HSS)	CUTS 3/8" KEY HOLE FOR FLUSH MOUNTING PICTURE FRAMES, ETC.			$ 8.50

WHEN ORDERING ANY THREE OR MORE DEDUCT $1.00 EACH
ALL PRICES POSTAGE PAID

Professional Production Quality • 1/2" Ball Bearing Pilot • 1/4" Diameter Shanks x 1-1/4" Long • One Piece Construction • Two Flute Thick High Quality Tungsten Carbide Tips

To order by MasterCard or Visa Toll Free
7 Day—24 Hour Order Service Call
1-800-533-9298
or send check to:

MLCS, Ltd., P.O. Box 4053F1, Rydal, PA 19046

tional Exposition of Stringed Musical Instrument Making and Repair, June 22–25. Lafayette College, Easton. For info. and applications, contact (SASE) Symposium '89, 14 S. Broad St., Nazareth, 18064. (215) 759-7100 (evenings).
Show–6th Annual Woodworking Show and Sale, May 20–21. Sponsored by William Rush Chapter of National Wood Carvers Assoc. Athletic Center, PA State Univ. Delaware County Campus, 25 Yearsley Mill Road, Lima. 9 A.M. to 5 P.M.; $2 per person over 12. For more info., contact Bob Young at (215) 446-8945.
Workshops–Shaker band box w/ John Wilson, May 19–20; planes and making planes w/John Wilson, May 20–21; woodfinishing w/ George Frank, June 10–11; Japanese joinery & techniques w/ Toshio Odate, June 23–25. Olde Mill Cabinet Shoppe, 1660 Camp Betty Road, York, 17402. (717) 755-8884.
Show–Spring PA Crafts Day, April 30. Members of PA Craft Guild selling their crafts in the museum courtyard; 9:30 A.M. to 4:30 P.M. For more information, contact John Sheppard, Brandywine River Museum, Brandywine Conservancy, Box 141, Chadds Ford, 19317. (215) 388-7601 or 459-1900.
Juried exhibit–"Studio Days/Design '89," Oct. 13–15. 6th annual invitational and juried exhibit of contemporary crafts in all media; deadline June 15; $10 fee. Send SASE to Chester Springs Studio, Box 329, Chester Springs, 19425. (215) 827-9111.
Juried show–The Pocono State Craft Festival, June 24–25. On the grounds of the Shawnee Inn Resort; 10 A.M. to 6 P.M.; $3 adults, children 12 and under are free. For more info., contact PA Designer-Craftsmen, Box 718, Richboro, 18954. (215) 860-0731.
Workshop–Japanese woodworking w/ Robert Meadows, April 29–30. PGC Craft Center, Tyler State Park, Richboro. Contact PA Guild of Craftsmen, Box 820, Richboro, 18954. (215) 860-0731.

SOUTH DAKOTA: **Class**–Building the Petaluma with Simon Watts, June 9–17. For more info., contact Dan Packard, Art Dept., Univ. of S. Dakota, 414E Clark St., Vermillion, 57069. (605) 677-5636.

TENNESSEE: **Classes**–Numerous one-week summer classes available, June thru August. Also workshops, conferences and exhibits. For information, contact Arrowmont School of Arts and Crafts, Box 567, Gatlinburg, 37738. (615) 436-5860.
Classes–Numerous guitar construction and repair programs. For more information or a free brochure, contact The Apprentice Shop, Box 267, Spring Hill, 37174. (615) 486-2615.
Juried exhibit–"Animal Imagery: New Forms, New Functions," thru May 20. Gallery hours Mon. thru Sat. 8:30 A.M. to 4:30 P.M.; free admission. Arrowmont School, Box 567, Gatlinburg, 37738. (615) 436-5860.
Symposium–The Tennessee Assoc. of Woodturners 2nd Annual Symposium, June 10–11. Appalachian Center for Crafts, Smithville. For more info., contact TAW, 5428 San Marcos Drive, Nashville, 37220.

UTAH: **Workshops**–Richard Raffan, May 8–12; Dale Nish, June 19–23, 26–30, July 17–21, 24–28. For more info., contact Craft Supplies USA, 1287 E. 1120 S., Provo, 84601. (801) 373-0917.

VERMONT: **Workshop**–One-week cabinetry courses, July 9–15 for beginners; July 16–22 for advanced. Contact Diane Lisevick at Yestermorrow Design/Build School, Box 344, Warren, 05674. (802) 496-5545.

VIRGINIA: **Show**–14th Annual Richmond Craft & Design Show, Nov. 17–19. Slides are due June 1. For application, contact the Hand Workshop, 1812 W. Main St., Richmond, 23220. (804) 353-0094.
Juried exhibit–"Sound Arts," a juried and invitational exhibit at Vista Fine Crafts, Aug. 19–Sept. 9. Slides/photos & resume deadline June 1. Eligible: all craft artists with work in musical instruments (traditional & experimental), bells & chimes, anything that makes music or sound. For application or more information, send an SASE to Sherrie Posternak, Vista Fine Crafts, Box 2034, Middleburg, 22117. (703) 687-3317.
Symposium–Upholstery Conservation Symposium, Feb. 2–4, 1990. Colonial Williamsburg, Williamsburg. Call for papers: submissions of proposals for papers that are appropriate as slide presentations are encouraged, with length parameters of 15–45 minutes. Send a 200-word abstract, indicating length of presentation and current vitae by May 15 to Marc A. Williams, American Conservation Consortium, Ltd., 87 Depot Rd., E. Kingston, NH 03827. (603) 642-5307.

WASHINGTON: **Workshops**–Painting & varnishing techniques, May 6; caulking, May 20; spar making, June 10; galvanized deck & rigging hardware, June 24. Northwest School of Wooden Boatbuilding, 251 Otto St., Port Townsend, 98368. (206) 385-4948.
Demonstrations–Chainsaw carving by Rocky McArthur, May 6; carving by Mary Stapp, June 17; works by Alan Rose, June 24 thru July. Artwood, 1000 Harris Ave., Bellingham, 98225. (206) 647-1628.
Show–"Usable Surfaces," a show of tables by Northwest furnituremakers, May 4–28. Northwest Gallery, 202 First Ave. S., Seattle, 98104. (206) 625-0542.
Seminar–"Maximizing Quality and Profit for Your Woodworking," April 29. Sponsored by the Washington Woodworkers' Guild. To register, contact Jack McClintock, 9901 Burke Lake Road, Burke, VA 22015. (703) 250-7122.

WEST VIRGINIA: **Workshop**–Progressive Windsor chairmaking, with Randall Fields, April 24–29. Tuition $100. For more info., contact the Crafts Center, Cedar Lakes Conference Center, Ripley, 25271.

WISCONSIN: **Show/workshops**–7th Annual Festival of Crafts, June 16–25. Univ. of Wisc.-Stout, Menomonie. Workshops include boatbuilding, woodturning, basketry, woodcarving. For more info., contact Nancy Blake or Jim Bjornerud, Center for Craftsmanship, 111A Tech Wing, Jarvis Hall, Univ. of Wisc.-Stout, Menomonie, 54751. (715) 232-2213; 232-1102; or 962-3062.
Exhibit–American Wildfowl Decoys, July 9–Sept. 2. Leigh Yawkey Woodson Art Museum, Wausau. Shorebird and duck decoys carved between 1870–1960. Contact Susan Flamm, 444 Park Ave. S., New York, NY 10016. (212) 481-3080.

CANADA: **Show**–The Quinte Wood Show, April 28–30. Ben Bleecker Auditorium, Fairgrounds, Belleville, Ontario. Featuring seminars, commercial exhibits, the Eastern Ontario juried woodworking competition. For more info., contact The Quinte Wood Show, Box 973, Belleville, Ont. K8N 5B6. (613) 966-5564.
Conference–Contemporary Furniture Design & Techniques 2, Aug. 5–7. Kelsey Campus, Saskatoon, Saskatchewan. A conference examining current trends in furniture design; participating instructors include Gary Bennett, Wendel Castle, Judy Kensly McKie, Wendy Muruyama and Alan Peters. For more information, contact Michael Hosaluk, R.R. #2, Saskatoon, Saskatchewan. S7K 3J5. (306) 382-2380.

CHINA: **Study tour**–Visits to famous woodworking factories, Imperial Palace Museum, Shanghai Furniture Factory, Xian Raw Lacquer Research Institute, June 3–19. $3,505 includes air fare. Contact Eva Frank, 3504 Beneva Rd., Sarasota, FL 34232. (813) 923-3377.

ORDER TOLL FREE 1-800-328-0457 – MAIL ORDER HOURS 7:00-5:30 C.S.T. MONDAY-FRIDAY

DELTA BENCH TOP TOOLS

Model		List	Sale
23-700	Wet/dry grinder	201	139
23-680	6" bench grinder ¼ H.P.	81	62
23-880	8" bench grinder ½ H.P.	136	99
23-980	10" bench grinder 1 H.P.	246	215
11-950	8" drill press	164	125
14-040	14" drill press	313	259
40-150	15" hobby scroll saw	178	125
28-160	10" hobby band saw	189	135
31-050	1" belt sander 2.0 amp.	93	69
31-460	4" belt/6" disc sander	178	125
31-340	"NEW" 1" belt/8" disc sander	226	159

DELTA STATIONARY

34-761	10" unisaw 1½ H.P.	1579	1199
34-740	Super 10" motorized lable saw	690	399
34-429	10" tilting arbor bench saw 1½ H.P.	1479	999
28-243F	14" band saw w/stand, no motor	621	419
33-990	10" radial arm saw	727	555
11-072	32" radial drill press	487	375
37-280	6" motorized jointer	440	335
50-179	¾ H.P. 2 stage dust collector	435	339
50-180	1 H.P. dust collector	535	425
50-181	2 H.P. dust collector	760	615
37-154	Deluxe DJ-15 6" jointer w/¾ H.P. motor	1288	979
33-050	"NEW" 8¼" Sawbuck	742	559
34-330	"NEW" 8¼" Table Saw 13A	321	245
34-670	10" motorized table saw	437	325
34-985	½ H.P. stock feeder	698	545
28-560	16" 3 wheel band saw	546	355

MILWAUKEE TOOLS

0395-1	"NEW" 9.6V cdlss. drill comp. w/case	264	159
0224-1	⅜" drill 4.5A magnum	179	110
0234-1	½" drill 4.5A mag0-850 rpm	189	105
0244-1	½" drill 4.5A mag 0-600 rpm	189	105
0222-1	⅜" drill 3.5A 0-1000 rpm	169	95
0228-1	⅜" drill 3.5A 0-1000 rpm	154	90
0375-1	⅜" close quarter drill	208	119
0379-1	½" close quarter drill	243	139
0212-1	⅜" cordless drill v/spd.	263	149
6539-1	Cordless screwdriver 190 rpm	108	64
6540-1	Cdlss. screwdriverw/bits & cse	137	89
6546-1	Cdlss. screwdriver 200 & 400 rpm	120	72
3102-1	Plmbrs rt angle drill kit	295	175
3002-1	Electricians rt angle drill	290	175
5399	½" D-hdle ham drill kit	299	179
1676-1	H.D. Hole Hawg w/cs	395	229
6511	2 sp SawZall w/cs	209	119
6405	8¼" circle saw	209	120
6750-1	Drywall gun 0-4000 4.5A	149	89
6798-1	Tek screwdriver	173	105
6507	TSC SawZall w/case	219	129
6170	14" chop saw	430	275
6012	Orbital sander 3⅝"x73⅛"	179	105
6014	Orbital sander 4½"x9¼"	189	110
6305	6¼" cordless circle saw	284	165
6753-1	Drywall gun 0-4000 3.5A	129	83
8977	Var. temp heat gun	109	70
0214-1	⅜" v. spd. cordless drill	220	125
5397-1	⅜" v. spd. hammer drill kit	227	135
5371-1	½" v. spd. hammer drill kit	313	179
3107-1	½" v. spd. rt angle drill kit	305	179
6754-1	Drywall gun 0-4000 4.5A	179	110
6747-1	Drywall driver-0-2500	149	87
0230-1	⅜" drilt 0-1700 rpm	169	99
3300-1	½" v. spd. magnum rt angle kit	289	179
5620	Router 1 H.P.—8 amp	289	169
5660	Router 1½ H.P.—10 amp	299	179
5680	Router 2 H.P.—12 amp	350	205
5455	⅞" polisher 1750 rpm	199	125
5535	7" polisher 2800 rmp	209	129
6215	16" chain saw	280	189
8975	Heat gun	85	55
6366	7¼" circular saw	198	112
6368	7¼" circular saw w/cse	226	129
0216-1	2 spd cordless drill Hi-torque	222	145
0235-1	½" drill keyless chuck mag	199	115
6016	¼ sheet pad sander	75	44
6145	4½" grinder 10,000 rpm	149	95
8 950	8 gal wet/dry vac	205	145
8955	10 gal wet/dry vac	279	189
0239-1	½" drill keyless chuck	189	114
6749-1	Drywall gun 0-2500 4.5A	189	115
6377	7¼" worm drive saw	275	155

FREUD SAW BLADES

⅝" Bore—Industrial Grade

CARBIDE TIPPED SAW BLADES

Item No.	Description	Diam.	Teeth	List	Sale
LU72M010	Gen. Purp. A.T.B	10"	40	77.49	34
LU81M010	Gen. Purp. TrCh.	10"	40	79.32	39
LU82M010	Cut-off	10"	60	98.89	42
LU84M011	Combination	10"	50	85.25	35
LU85M010	Super Cut-off	10"	80	126.90	50
LM72M010	Ripping	10"	24	74.22	30
LU73M010	Cut off	10"	60	91.16	37
LU87M010	Thin kerf	10"	24	56.90	36
LU88M010	Thin kerf	10"	60	69.90	43
PS203	Gen'l Purp.	7¼"	24	31.42	16
PS303	Plywood	7¼"	40	37.74	22
DS306	6" Dado - Carbide			168.13	95
DS308	8" Dado - Carbide			205.89	108
F0	1¾" x⅝" Biscuits 1000-Qty.				25
F10	2⅛" x¾" Biscuits 1000-Qty.				25
F20	2⅛" x1" Biscuits 1000-Qty.				25
FA	Assorts Biscuits 1000-Qty.				29
WC104	4 pce. chisel set w/cse ¼"-1"			39	29
WC106	6 pce. chisel set w/cse ¼"-1"			52	38
WC110	10 pce. chisel set w/cse ¼"-1½"			88	59
F8100	16 pce forstner bit set ¼"-2⅛"			262	149
94-100	5 pce router bit door system			260	159
JS100	Biscuit Jointer w/case			285	154
EB100	"NEW" edge banding machine			350	299

MAKITA CORDLESS

Model		List	Sale
6070DW	⅜" var. spd. rev. 7.2v	123	69
6071OWK	⅜" var. spd. rev. w/removable batt. 7.2v	190	105
5090DW	3⅜" saw kit, 9.6v	243	125
5600DW	6¼" circular saw, 10.8v	317	167
6010DWK	⅜" cordless drill kit, 7.2v	155	89
6010SDW	⅜" cordless drill, 7.2v	103	59
DA3000DW	⅜" angle drill, 7.2v	238	130
4390DW	9.6 volt cdls. recip saw kit	218	124
6010DL	⅜" drill w/flashlight, 7.2v	198	113
6012HDW	2 spd. driver drill w/clutch & case*, 9.6v	224	110
6710DW	Cordless screwdvr kit, 7.2v	186	103
6092DW	V/spd. drill, kit complete	237	115
6093DW	V/spd. drill w/clutch--complete	248	119
6891DW	Drywall gun 0-1400, 9.6v	225	119
6320D7-4	9.6 volt battery	49	29
632002-4	7.2 volt battery	42	27
2012	BRAND NEW 12" portable planer	885.50	519
5007NBA	7¼" saw w/elec. brake	228	119
5008NBA	8¼" saw w/elec. brake	276	139
804510	¼ sheet pad sander	80	46
9900B	3"x21" belt sander w/bag	254	139
9924DB	3"x24" belt sander w/bag	268	139
9035	⅓ sheet finish sander	106	60
9045B	½ sheet finish sander	216	115
9045N	½ sht fin. sand. w/bag	219	116
4200N	4⅜" circ. saw 7.5 amp	213	114
5201NA	10¼" circ. saw 12 amp	560	285
4301BV	Orb. v/sp jig saw 3.5 amp	274	145
JR3000WL	2 sp recip saw w/cse	220	122
JR3000V	Vs. recip saw w/case	224	125
LS1020	New 10" mitre saw	440	229
9820-2	Blade sharpener	354	205
410	Dust collection unit	480	269
3705	Offset trimmer	255	129
1900BW	3¼" planer w/case	198	115
1100	3¼" planer w/case	381	225
9207SPC	7" sander-polisher	262	145
3601B	1¾ H.P. router	242	125
3700B	½ H.P. trimmer	180	92
9501B	4" grinder, 3.5 amp	137	65
B04530	6" round sander	95	57
B04550	¼" sheet pad sander w/bag	85	46
DA3000R	⅜" angle drill	256	138
OP4700	½" v/sp w/rev. 4.8 amp	198	109
6300LR	½" angle drill w/rev	325	169
2708W	8¼" table saw	474	239
2711	10" table saw w/brake	800	460
GV5000	Disc sander 5"	109	65
6800DB	2500 rpm 3.5 amp	140	85
6800DBV	0-2500 rpm 3.5 amp	154	89
6801DB	4000 rpm 3.5 amp	140	85
6801DBV	0-4000 rpm 3.5 amp	154	89
2030N	12" planer/jointer	2970	1599
2040	15⅝" planer	2470	1375
1805B	6⅛" planer kit w/case	646	345
JV1600	var. speed jig saw	220	119
JV2000	var. speed orb. jig saw	242	127
5005BA	5½" circular saw	211	115
9503BH	4½" sander-grinder	153	79
6404	⅜" drill 0-2100 rpm, 2 amp.	102	60
6510LVR	⅜" drill rev. 0-1050 rpm	137	72
6013BR	½" drill rev. 6 amp	240	125
5402A	16" circular saw - 12 amp	605	325
3612BR	3 H.P. plunge router	376	185
9401	4"x24" belt sander w/bag	302	168
3620	1¼ H.P. plunge router w/cse	182	97
4302C	V/spd. orb. jig saw	287	145
5077B	7¼" Hypoid saw	248	139
LS1440	14" Mitre saw	624	409
2414	14" cut-off saw AC/DC	350	195
5007NB	7¼" circ saw 13 amp	209	110
3612B	3 HP plunge router sq/b	376	185

SKIL SIZZLERS

Model		List	Sale
5510	(551) 5½" circ saw	112	92
5625	(552) 6½" circ saw	175	115
5656	(553) 7¼" circ saw	132	105
5665	(554) 8¼" circ saw	204	125
5750	(807) 7¼" circ - drop foot	198	122
5765	(808) 8¼" circ - drop foot	216	135
5790	(810) 10¼" circ - drop fool	400	245
5825	(367) 6½" worm saw	229	139
5865	(825) 8¼" worm saw	250	149
4580	Vari - orbit jig saw w/cse.	144	98
3810	10" Mitre saw	263	195
595	3"x21" sander w/bag 5.5A	197	125
7565	¼" palm sander	52	34
7313	3x18 belt sander 4.5A	72	58
77	7¼" worm drive	230	137
5350	2½ HP circ. saw	80.99	69
5250	2¼ HP circ. saw	68.99	55

XTRA SPECIAL BY SKIL

2735-04	12v V.Spd. Cordless Drill comp. w/cse & 2 Batt.	210	128

LEIGH DOVETAIL JIGS

D1258-12—List 314.00—Sale 255.00

D1258-24—List 375.00—Sale 299.00

HITACHI TOOLS

Model		List	Sale
TR6	Trimmer	177	95
TR8	Plunge router, 1½ H.P.	219	119
TR12	Plunge router, 3 H.P.	354	169
C10FA	10" dlxe. mitre saw	490	265
C8FB	8½" slide compound saw	859	475
C15FB	15" mitre saw	745	389
FREUD	LU85M015 - 15" Carb. Bld. 108 Tooth	181	115

1989 TOOL CATALOG AVAILABLE

Call Toll-Free 1-800-328-0457 — In Minnesota Call (612) 224-4859

CHECK • MONEY ORDER • VISA • MASTERCARD • DISCOVER

SEVEN CORNERS ACE HDW. Inc.

216 West 7th St. • St. Paul, MN 55102 • Est. 1933

DELTA TOOLS

34-444 Table Saw Complete w/1½ H.P. motor & stand **589.00**

33-150 8¼ "Saw Buck **499.00**

33-890 12" Radial Arm Saw 1½ H.P. complete w/legs **1139.00**

28-283F 14" Band Saw w/enclosed stand & ¾ H.P. motor **599.00**

22-661 NEW 13" Planer **1095.00**

17-900 16½" Floor Drill Press **315.00**

40-601 18" Scroll Saw w/stand and blades **679.00**

DELTA #34-080 10" MITRE BOX XTRA SPECIAL 189.00 List 289.00

TOOLS ON SALE™

AMERICA'S LOWEST PRICED TOOLS

FREE FREIGHT TO THE 48 CONTINENTAL STATES ON EVERY ITEM.

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

PIRANHA By Black & Decker

CARBIDE TOOTH SAW BLADE

Model#	Diameter	#Teeth	List	Sale
73-716	6-1/2	18	13.10	7.10
73-756	6-1/2	36	28.96	16.30
73-717	7-1/4	18	13.14	7.10
73-737	7-1/4	24	16.36	9.00
73-757	7-1/4	40	29.72	16.35
73-758	8	40	42.04	24.15
73-759	8-1/4	40	42.86	24.60
73-719	8-1/4	22	18.96	10.60
73-739	9	30	31.48	17.85
73-769	9	60	66.58	38.95
73-740	10	32	32.98	18.95
73-770	10	60	67.02	36.90
73-715	5-1/2	16	13.00	7.30

STYLE 32 PONY SPRING CLAMPS

with coated tips and handles

Model	Size	List	Sale Ea.	Lots of 25
3201-HT	1"	1.89	1.10	24.75
3202-HT	2"	2.78	1.65	37.15
3203-HT	3"	5.22	3.00	67.50
3204-HT	4"	9.48	5.15	115.85

ADJUSTABLE HANDSCREWS BY JORGENSEN

Item No.	Jaw Length	Open Cap	List	Sale	Box of 6
#5/0	4"	2"	12.88	7.25	40.50
#4/0	5"	2½"	13.83	7.95	45.30
#3/0	6"	3"	14.83	8.35	47.60
#2/0	7"	3½"	15.94	8.95	51.00
#0	8"	4½"	17.74	9.95	56.70
#1	10"	6"	20.29	11.40	64.95
#2	12"	8½"	23.29	13.00	74.00
#3	14"	10"	29.53	17.50	99.95
#4	16"	12"	38.38	23.00	139.95

STYLE 37 2½" Throat ¼"x¾" JORGENSEN

Item No.	Jaw Length	List	Sale	Box of 6
3706	6"	8.86	5.75	32.50
3712	12"	9.81	6.25	35.00
3718	18"	10.83	6.85	37.50
3724	24"	11.83	7.35	40.00
3730	30"	13.19	8.25	45.00
3736	36"	14.43	8.95	49.00

PONY CLAMP FIXTURES

Model		List	Sale	Lots of 12
50	¾" black pipe clamps	12.48	7.50	80
52	½" black pipe clamps	10.41	6.00	65

STYLE J. ADJUSTABLE HANDSCREW KITS

Model	Length Jaws	List	Sale
J04	4	7.10	4.99
J06	6	8.13	5.29
J08	8	9.12	5.69
J10	10	10.66	6.39
J12	12	13.21	7.69

BOSCH

Model		List	Sale
1581VS	Top hdle. jig saw	235	129
1582VS	Barrell grip jig saw	220	119
Bosch metal case for above jig saws		34	26
Bosch blade assortment for jig saws 30 of Bosch's best selling blades		23.99	
1942	Heat gun 650°-900°	99	69
1272D	3"x24" B.S. w/bag	299	168
1273D	4"x24" B.S. w/bag	315	178
11-212	Bulldog ¾" SDS rotary	339	189
1196VSRK	⅜" vs hammer drill	215	110
1198VSR	½" vs hammer drill	229	125
1608	5.6 amp lam trimmer	140	80
1608L	Same as above w/trimguide	145	84
1608T	5.6 amp tilt base trim	159	91
1609	5.6 amp offset base trim	205	122
1609K	Lam installers kit w/1609 — Offset base, trimmer tilt base, trimguide, ¼" collet, collet nut, wrenches, hex keys and case	295	165
1601	1 H.P. Router 25,500 rpm	165	99
1602	1½ H.P. Router 25,000 rpm	199	110
1603	1½ H.P. D Handle Router	223	125

The famous Bosch 1604 1¾ h.p. Router List $219 Super Spec. $117

1606	1¾ H.P. D hdle. Router	243	135
3258	3¼" planer w/blade guard	210	135
3258K	3258 planer w/cse.	235	149
3270D	3"x21" belt sander w/bag 5A	225	135
1273DVS	Var spd. 4"x24" 6 speed range sander 10.5 amp	339	185
1611	3 H.P. plunge router	349	198
1611EVS	"NEW" 3 H.P. elec. v/spd. plunge router	410	255
1651	7¼ circ. saw drop foot	179	99
1654	7¼ circ. saw pivot base	179	99
1922K	Cdlss. jig saw w/cse.	239	165
921VSRK	⅜" cdlss. drill v/spd. w/clutch and case	235	135
1632VSRK	Recip. saw 8.4A orb. v/spd.	225	129
11-304	"The Brule" breaker hammer	1950	1185

BOSTITCH AIR NAILERS

Model		List	Sale
N80C-1	Utility coil nailer	730	399
N80S-1	Stick nailer	760	409
T36-50	Shealhing & decking stapler	550	305
N12B-1	Coil roofing nailer	725	399
N60FN-2	Finishing nailer	595	335
T31	Brad nailer	245	145

SENCO AIR NAILERS

Model		List	Sale
SFN1	Finishing nailer 1" - 1¾"	377	288
SFN2	Finishing nailer 1½" - 2½"	571	435
SN2	General purpose 1⅞" - 2¾"	621	485
M2	General purpose 1⅜" - 2"	475	359
SN4	General purpose 2" - 3"	685	515
LS2	Pinner ⅝" - 1"	351	269
SKS	Stapler	351	269
LS5	Pinner, 1"-1½"	399	305
PW-RFR	Roofer, ½"-1¼"	351	269

WORKMATES By Black & Decker

Model		List	Sale
79-029	#85, 18#	63.00	39.00
79-032	#200, 23#	103.00	65.00
79-033	#300, 28#	117.00	70.00
79-034	#400, 35#	152.00	98.00

BLACK & DECKER DEALS

1707	8½" crosscut mitre saw	813	469
1166	⅜" drill, 4A, 0-2500 rpm	96	55
2037	0-4000 5 amp drywall gun	160	92
1703	10" mitre saw w/73-770 blade	313	169
2660	0-4000 4.5 amp drywall gun	138	87
4015	½ sheet sander 3 amp	190	109
2600	⅜" 0-1200 4.5 amp drill	125	76
4018	½ sheet sander 2.3 amp	122	76
3047-09	7¼" super saw cat w/brake	282	164
3048-09	8¼" super saw cat w/brake	297	174
3157	Orb v/spd. jig saw	202	125
3153	V/spd. jig saw	195	121

RYOBI SPECIALS

Model		List	Sale
JP155	"NEW" portable 6" jointer/planer	545	329
R500	2¼ H.P. plunge router	326	159
TS251IU	10" mitre saw	392	169
TS251IUS	10" mitre w/acc. kit & 60 tooth carbide blade	435	199
AP10	10" surface planer 13 amp.	820	358
RA200	8¼" radial arm saw	515	235
RE600	3 H.P. plunge router	398	199
R150K	1 H.P. plunge router w/cse.	206	95
BE321	3"x21" v/spd. belt sdr.	259	119

PORTER CABLE

Model		List	Sale
630	1 H.P. router 6.8 amp	170	110
690	1½ H.P. router 8 amp	215	119
691	1½ H.P. router D hdle	235	133
536	1½ H.P. speedmatic router	310	195
518	3 H.P. 5 speed router	560	339
520	3 H.P. 15 amp router	510	315
309	3.8 amp lam trimmer	135	85
310	3.8 amp H.D. lam trimmer	190	114
312	Offset base lam trimmer	215	120
319	Tilt base lam trimmer	221	129
695	1½ H.P. router/shaper	299	190
696	H.D. shaper table	165	110
351	3"x21" belt sander w/o bag	215	125
352	3"x21" belt sander w/bag	225	125
360	3"x24" belt sander w/bag	310	175
361	3"x24" belt sander w/o bag	290	170
362	4"x24" belt sander w/bag	325	185
363	4"x24" belt sander w/o bag	310	179
7556	½" right angle drill	295	175
315-1	7¼" top hdle 13 amp circ saw	195	110
9315-1	315-1 comp. w/cse. & carb. bld.	225	125
617	7¼" pushhandle 13 amp	195	110
9617	617 comp. w/cse. & carb. bld.	225	125
368-1	8¼" top handle 13 amp.	205	129
314	4½" trim saw 4.5 amp	205	125
548	X HD bayonet saw	255	165
9548	X HD bayonet saw w/case	275	175
9629	Recip saw v/sp 8 amp	230	133
9627	Recip saw 2 speed 8 amp	220	125
666	⅜" H.D. vsp drill - Hdl	185	122
621	⅜" H.D. v spd. 0-1000 rpm	155	96
320	Abrasive plane 3 amp	150	99
126	Porta plane 7 amp	290	164
9118	Porta plane 7 amp kit	325	185
9652	Versa plane 10 amp kit	430	275
7545	0-2500 drywall gun 5.2 A	169	100
7540	0-4000 5.2 amp gun	165	99
505	½ sheet pad sander	195	105
7511	⅜" v spd. drill 5.2 amp	185	105
7514	½" v spd. drill 0-750	195	114
303	Paint remover	230	149
304	7" disc sander 4000 rpm	195	125
305	7" disc polisher 2000 rpm	195	125
367	3¼" planer 6.5 amp	225	148
537	1½ H.P. D hdle router	325	205
7548	Top hdl jig saw 4.8 amp	215	119
7648	Barrel grip jig saw 4.8 amp	210	119
330	Speed block sander ¼ sht	97	55
555	Plate biscuit jointer 5A w/cse.	280	165
345	6" saw boss 9 amp	160	99
5060	"Stair Ease" stair templet	194	125
5061	"Stair Ease" hard wood stair templet	204	135
659	0-4000 drywall gun 4 amp	130	79
100	⅞ H.P. router.	160	94
59381	Door hanging kit	229	152
399	Drywall cutout unit	110	69
43218	Drywall cutout unit bit	6.75	5.50
5008	Dovetail template kit	99.50	75
5009	Mortise & Tenon jig.	54.95	40
5002	"NEW" stub-rite plastic pipe cutter	99.95	75
308	"NEW" laminate slitter	189	135
5116	"NEW" omni-jig	395	269

—BRAND NEW—By Porter Cable

Model		List	Sale
9647	TIGER CUB recipro saw	185	119
9850	12 volt cordless driver/drill comp w/charger-batt-case	210	129
8500	Extra 12v battery	48	33

FREE FREIGHT TO THE 48 CONTINENTAL STATES ON EVERY ITEM.

Making The Attikamek Snowshoe by Henri Vaillancourt. *The Trust For Native American Cultures & Crafts, Box 142, Greenville, N.H. 03048; 1987. $27, paperback; 176 pp.*

Long before North American native people helped the first white man out of a snowdrift, they were navigating skillfully over deep snow on lightweight wooden frames laced with rawhide. As a practical and versatile means of wintertime conveyance, the traditional native snowshow is unequalled. It can be built in the forest, using only a few hand tools and a variety of locally available materials. And it's adaptable to suit the size of the user, as well as unusual conditions.

The snowshoe survived industrialization and was eventually adopted by whites as a tool for recreation. The modern snowshoe remains essentially the same as its venerable ancestor—at least in its design and function, if not in the materials and methods of its construction. In danger of extinction, however, are the traditional skills required to make snowshoes the old way. And that's what this book is about.

In *Making The Attikamek Snowshoe,* Vaillancourt reports on the continuing practice of traditional snowshoemaking among a handful of Attikamek Indians on the Manouane Reserve in central Quebec, Canada. The Attikamek build a snowshoe that's as unlike its modern, manufactured counterpart as a birchbark canoe is unlike an aluminum or fiberglass one. They select a yellow birch tree, and using an ax, a crooked knife and a few other basic hand tools, they proceed to fell, split, shave and bend the wood into a traditional, square-toed frame. This frame is tightly woven with raw moose-hide lacing, but there's nothing rustic about the result. Attikamek shoes reveal an intricacy and precision not associated with most handmade snowshoes, much less the finest commercial products.

What's also notable about the craftsmen is their age. Moise and Elizabeth Flamand and Judith Quitich, 75, 73 and 69 years old, respectively, are among the last of an endangered species. Younger generations of Attikamek, more accustomed to roads, cars and snowmobiles than to bush trails and snowshoes, no longer rely upon the crafts of their elders for their living and are not likely to pass them along to their children. That's why Vaillancourt has pursued the Attikamek and why his book is so important.

The book begins with a brief overview of snowshoemaking styles and history and concludes with a discussion of traditional footgear and the smoke-tanned, moose-hide snowshoe harness. Vaillancourt is at his best in his step-by-step description of the process of building the frame, preparing the hide and lacing the snowshoe. Readers unfamiliar with native bending techniques can't help but be impressed by the dramatic sequence of photos that depict the shaping and bending of the frame. Likewise, the section on preparing skins is the most comprehensive treatment of the subject I've seen anywhere.

The book is published by The Trust For Native American Cultures & Crafts, a nonprofit organization of which Vaillancourt is a founding member. This connection is at once the book's strength and weakness. Unencumbered by the demands of a commercial publisher, Vaillancourt has been able to pursue in great detail the intricacies of a relatively obscure craft. Unfortunately, however, the book would have benefited by an experienced editorial eye. Vaillancourt is so intimate with his subject that he sometimes neglects to provide the details necessary for a thorough understanding of the topic. His description of the weaving process, for example, is much leaner than his treatment of the frame construction, leaving the reader to puzzle out the complex lacing patterns.

What's more, because text, photos and drawings often occur in three different places, I found it confusing flipping back and forth between them. The text is clearly written and informed by Vaillancourt's considerable experience, but for the best of the construction tips and the author's own insights, you have to wade through the rather lengthy footnotes.

It should be noted that while the Attikamek snowshoe—with its 17-in.-wide (or wider) frame and intricate lacing pattern—is not a likely first project for a would-be snowshoemaker, Vaillancourt has made one important concession to the reader. He thankfully sacrifices ethnographic accuracy for clarity by illustrating a much more open weave than that employed by the Attikamek people he observes. As a result, the 20 pages of simplified weaving diagrams are clear and easy to decipher. They would provide an excellent starting point for a novice builder of almost any style of traditional snowshoe.

My editorial criticisms notwithstanding, this book makes an important contribution to the study and preservation of native crafts. Anyone who enjoyed his earlier article, "Making Snowshoes" (*FWW* #49, p. 77), will appreciate the additional material in this book.

I think it's tragic, but you're more likely to learn about snowshoes in a library or museum than from the residents of most northern villages. Still, that's better than having no record at all. And as long as such a dedicated and qualified researcher as Vaillancourt is at work, we can be assured that a significant body of material will not be lost entirely. *—Scott Landis*

Modern Practical Joinery by George Ellis. *Linden Publishing Co., 3845 N. Blackstone, Fresno, Calif. 93726; 1987. $15.95, paperback; 486 pp.*

It would be wonderful to learn the day-to-day practices of the topflight woodworkers of the past without having to duplicate their often miserable lives or ply the trade 60 hours a week. Those laborers/artisans had to work rapidly and probably competitively in the absence of machine tools, yet with routine excellence. A stern sort of craftsmanship was the norm and there was a rich clientele accustomed to quality. Many of the skills the craftsmen acquired over their lifetimes usually died with them, and trying to re-create their methods by examining their work, or their tools, is usually more tantalizing than informative. Old books on the subject all too often lack detail—and are sometimes dead wrong. But they're all we have.

From before the machine age of woodworking, our best informants have included Joseph Moxon (*Mechanick Exercises; 1677*); D. Diderot (*Encyclopédie ou dictionnaire raisonné des sciences, des arts, et des métiers; 1751-1772*); and Charles Holtzapffel (*Turning and Mechanical Manipulation; 1846-1847*). Most of these books have been reissued in modern times. Also, from the twilight of the hand-tool era, there was George Ellis, whose *Modern Practical Joinery*, unavailable since its last edition of 1908, is now reprinted for the first time in 80 years.

This compelling book was a "cram" book for the professional advancement of apprentices and practitioners, and it contained material usually required by "examining bodies in London" for joinery. It served also, no doubt, as a trade-school text of the practical skills needed in the best Victorian London joiners' shops. As a 25-year practitioner of the craft and a lecturer on carpentry and joinery at the London Council School of Building, Ellis is the best sort of pipeline to past mastery. He was a doer, unlike Moxon, who is suspect of plagiarisim, and Diderot, a clean-fingered gentleman who was sometimes duped by the wary French craftsmen whose trade secrets he solicited. Ellis' text became a part of the English woodworking tradition echoed today in fine books by Charles Hayward and Ernest Joyce.

Woodworking, traditionally, was divided into three parts: carpentry—the constructive woodworking of a building; joinery—the built-in exterior and interior fittings of a building; and cabinetmaking—movable wooden furnishings. Ellis' book does not deal specifically with fine furnituremaking; it does treat joinery, how-

ADVERTISEMENT
ITASCA, ILLINOIS
RYOBI AMERICA CORP.

Ryobi announced that it is voluntarily retrofitting the portable radial arm saw, model number RA-200. These units have been distributed since December, 1986. No other Ryobi products are involved. Ryobi America Corporation said that the carriage center, which is the component of the unit that affixes the motor assembly to the overarm, may break under certain circumstances, which presents a possible safety hazard. Ryobi will refit all returned RA-200 units with modified carriage centers at no cost to the owner.

Customers who bought product before December 1st, 1988 should discontinue using the RA-200 immediately. Owners should verify if the product has already been refitted. Ryobi America Corporation said the refitted product has a round green "PASSED" sticker affixed to the bottom portion of the switch. Or a "REM Quality Checked" sticker is affixed to the outside of the carton.

Call Ryobi America Corporation toll-free on weekdays between 8:30 AM and 5:00 PM, Central Standard Time, at 1-800-323-4615 for further information.

ever, at a time when joinery was practiced with a finesse to be envied by any modern cabinetmaker.

The elements of joinery relevant to general woodworking occupy about two-thirds of Ellis' book, but even the more architectural portions are ripe in interesting nuggets for the furnituremaker. For instance, hospital doors in 1908 excluded moldings in order to avoid dust with germs; or, a big clamping/wedging jig for assembling stairs, that would work fine for large bookcases; or, look up ancient light...but don't get me started.

Applicable general topics include (in no particular order) the workshop, benches, vises, clamps, tools (their use, care and sharpening); joints (their applications, their variants, measuring, marking out, workshop gear and jigs, dressing wood, gluing, pinning, nails and screws); multiple aspects of moldings, scrapers, drawers, frame and panel, curved work (bent, steamed, coopered); and many other topics.

For the serious builder, the serious renovator, scholarly restorer or teacher, there are in-depth chapters on making and putting in doors, shutters, windows, stairs and hand railings, as well as chapters on your everyday bank, library, museum or church installations. Although some techniques will seem dauntingly labor intensive, and the Victorian designs dated enough to inspire some kind of daffy neo-revivalism, the overall scope and thoroughness of the book makes it a solid resource on the fabric of a building, as it was and (with adaptations) can be. The text, though dense with fact, is clear...even graceful. The book also includes a comprehensive index of the contents (30 pages of it) and an A-to-Z glossary of terms in joinery that's a mini-reference work in itself. Despite its strong points, the book is too advanced and too idiosyncratically organized to be practical for a beginner—though it might make a flattering gift for one. This is not a book you read through. You nibble and savor—or else, you're looking something up.

Although it's rare, Ellis' savvy sometimes falters: He "explains" some imported U.S. tools as though by hearsay; he believes the old tale of rough surfaces grabbing glue best; and he departs from conventional wisdom by advocating low-angled planes for difficult face grain. But these are molehills beside his mountain of verities.

Modern Practical Joinery was also a harbinger of what woodworking would become. Its 1902 first edition contained little on power tools. But by the 1908 third edition, Ellis had to update with three chapters on the new machines that he feared would be exploited "for their supposed advantage in displacing skilled labour." A craftsman, Ellis trusts only the craftsman's eye, reminding us that "a machine, however well constructed, cannot think." Sound familiar?

With mechanization in its infancy, mass production and safety precautions were rudimentary or nonexistant. For Ellis, machines represented challenge and promise. He was not for turning back the clock. He grappled earnestly with logical "modern-shop" organization, but envisioned a mating of the virtuoso craftsman with the timesaving machine. A union that, in the main, has not been fully consumated. ***—Maurice Fraser***

A former book editor at The Taunton Press and sometime snowshoe builder, Scott Landis is author of "The Workbench Book" (The Taunton Press, 63 S. Main St., Newtown, Conn. 06470; 1987) and "Secrets of the Snowshoe People" (Harrowsmith magazine, Dec./Jan. 1983). Maurice Fraser teaches woodworking at the Craft Students' League in the Y.W.C.A. at 53rd and Lexington Ave., New York City, N.Y.

"The Language of Wood" highlights woodworking in Finland

Photos: Courtesy of Museum of Finnish Architecture

'The Language of Wood' included such diverse examples of Finnish woodworking as Risto Kamunen's dog-drawn racing sleigh (top), made from ash with birch and fiberglass runners; Tapio Wirkkala's salad servers (above, left), laminated from ebony, makore and jacaranda; and a birch and beech chair (above, right) by Kari Asikainen.

Anyone even slightly familiar with Scandinavian design would not be surprised by the grace and simplicity of the work shown in "The Language of Wood," a major exhibition of woodworking from Finland. The exhibition, which occupied all three floors of the American Craft Museum in New York City, presented 200 objects—most never seen outside Finland—and numerous photographs encompassing architecture, sculpture, furniture and utilitarian objects. The display spanned woodworking from farming implements to fishing lures. It also spanned centuries, from the 14th-century carvings of saints, by the unknown Master of Leito, to Risto Kamunen's sleek racing sleigh (see the top photo this page). Kamunen's sleigh, made in 1982, consists of ash and birch joined with flexible thongs

The scope of the show was so broad and all-encompassing that for the first time, I was able to walk away with an understanding of how the simplicity of Scandinavian design evolved. It's the close attention to natural forms that binds the work together—that, and a stubborn refusal to discard the heritage of a culture that has grown in the shadows of the forests, which cover nearly three-fourths of the country.

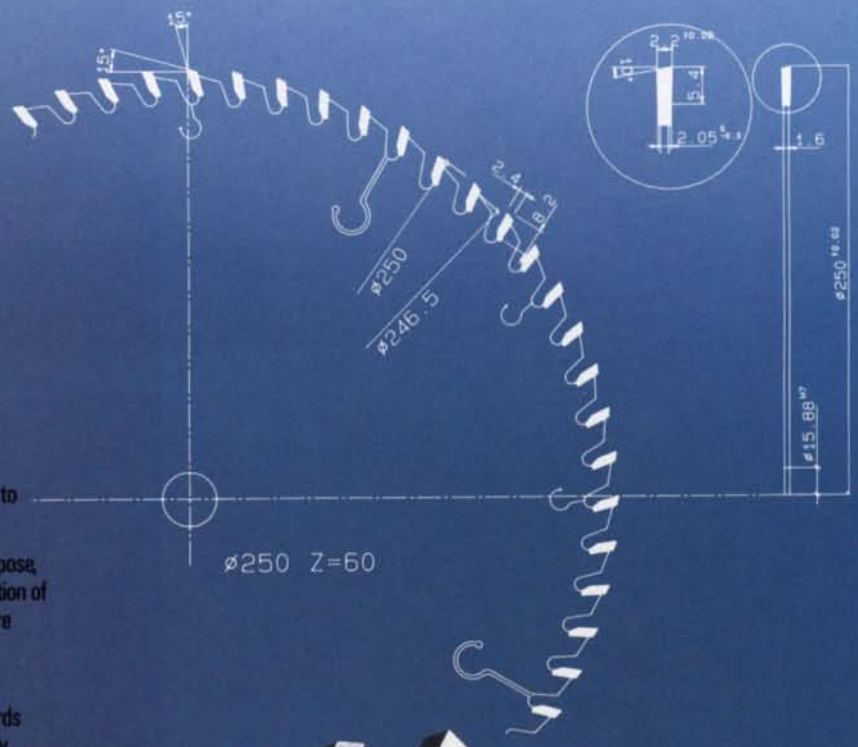
The use of natural forms is evident in many of the works, such as an ancient fisherman's anchor, which is made by tenoning a forked branch to a curved board so they capture a suitably shaped stone; and a 19th-century alder box, made to hold a seal hunter's provisions, and shaped with simple, flowing curves, obviously inspired by the graceful form of the hunter's prey. This attention to natural forms was somehow not lost in the Industrial Age, when Finnish designers, such as Alvar Aalto, turned to the new technology of laminated veneers to give us the "modern" look we all associate with Scandinavian design. The chair in the lower, right photo this page, built by Kari Asikainen in 1981, is a continuation of the simple style pioneered by Aalto and his bentwood furniture, manufactured from the late 1920s through the 1960s. Although constructed with form-pressed birch legs and a continuous beech plywood seat and back, the lines of Asikainen's chair are not so far removed from the 19th-century peasant chairs in the show, with front legs, seat and back all carved from a single piece of wood.

It's not surprising that plywood and bent laminations are an important element in Finnish design, because birch from their forests provides the raw material for the highest-quality plywood veneers. But the designs of Tapio Wirkkala exploit the possibilities of using laminations for surface decoration in quite novel ways. His salad server prototypes from 1956, pictured above, illustrate this use of laminations for surface treatment. And, his sculptural experiments with aircraft plywood are all the more remarkable for their harmony of surface and form, achieved with what many consider a fairly mundane material.

In contrast to the smooth surfaces and gentle curves of most woodwork produced during the Industrial Age, much of the earlier work and especially the architecture shown in photographs in the exhibit preserve the textures created by hand and tool. For instance, the hatchet marks left on the hewn timbers of many of the buildings serve as the inspiration for the tactile relief carvings done by Kain Tapper in the 1960s. And the imagery and rustic spirit embodied in the figure carvings of Finnish folk art are re-created in the planks and nails used by Vijo Mäkinen in his dynamic animal sculptures from the 1960s. These works also reflect the association with nature and historical woodcraft, which is the glue that holds this show together.

Quoting Pekka Suhonen's introductory essay, "Wood and Everyday Aesthetics," in the catalog documenting the exhibition: "There's a Finnish word, *yöpuu* (literally night wood), whose meaning many no longer know...a simple yet skillfully made slow-burning fire the hunter or some other forest camper builds against the night, to sleep alongside.... The fire burns quietly, steadily,

Thin Kerf. Advanced Design.



The Freud Difference

Superior Carbide. Some of the physical properties of carbide, elasticity, hardness and resistance to chemicals, can be changed to meet cutting requirements.

To ensure the blade you buy has the best carbide qualities for its purpose, Freud produces special blends at its own factory. Through a combination of robotic and computer monitoring, each batch is checked to assure purity and quality.

Advanced CAD System. The Computer-Aided Design System simulates actual cutting conditions in three dimensions and records the blade performance. This allows Freud engineers to electronically vary the material being cut and the blade's physical characteristics to develop saw blades that provide optimum cutting performance.

Laser Technology. A computer-controlled, 500-watt laser is used in the production of Freud cutting tools. The concentrated beam of light creates a perfectly round blade, produces shoulders identical in shape and size and precisely centers the arbor hole. In addition, expansion slots are strategically placed to allow for heat dissipation during brazing and blade body expansion during actual use.

Thin kerf blade compared to standard kerf blade

Freud thin kerf blades
Rip (left), Crosscut (right)

Freud Perfects the Thin Kerf Blade.

Using advanced technology, Freud's international team of European and North American engineers have perfected the thin kerf saw blade. They have eliminated misaligned teeth, poor blade body tensioning, carbide chipping and a variety of other problems common with some thin kerf blades.

The kerf on the Freud 10-inch crosscut blade, 28% thinner than the standard .126 inch kerf blade, reduces material loss when working with rare or expensive wood.

Freud's thin kerf blade also requires less energy to feed the material into the saw blade, eases the strain on your power tool and makes your work easier and safer.

Turn your under-powered saw into a real board cutting champion with Freud's thin kerf blade. Each thin tooth takes out less wood than the standard carbide blade, thus requiring less horsepower to produce equally good results. Also, the radial arm saw's aggressive self-feeding characteristics are virtually eliminated.

For the best value in advanced thin kerf blade technology, demand Freud.

Stock Number	Thin Kerf Rip	Kerf	Suggested Retail
LU87M008	8" x 22 x 5/8"	.086 inch	$49.00
LU87M009	9" x 22 x 5/8"	.094 inch	$54.00
LU87M010	10" x 24 x 5/8"	.094 inch	$56.90
Stock Number	**Thin Kerf Crosscut**	**Kerf**	**Suggested Retail**
LU88M008	8" x 48 x 5/8"	.082 inch	$59.90
LU88M009	9" x 54 x 5/8"	.090 inch	$63.90
LU88M010	10" x 60 x 5/8"	.090 inch	$69.90

Call for the name of your local distributor:

freud®

Freud Inc.
218 Feld Ave.
High Point, NC 27264
(919) 434-3171

independently of the surrounding forest from which it draws its fuel. The sleeper alongside his slowburner illustrates in all primitive simplicity the trustful and natural relation to forest and wood Finns still achieve wandering in the forest and fashioning wood for work or art."

For me, the show succeeded in its expressed intention: It illustrated how, historically and symbolically, the forest culture of Finland has permeated the lives of the people. The continuity of Finnish design, in all facets of their woodworking, comes through...not loud and clear, but more like *yöpuu*—quietly and warmly.

"The Language of Wood" was organized by the Museum of Finnish Architecture, Helsinki, Finland, in recognition of the 70th anniversary of Finnish Independence. It was curated by internationally recognized architect Juhani Pallasmaa. The exhibit made its American debut February 11 through April 23 at the American Craft Museum in New York City, and will be traveling to some, as yet, unannounced cities in the United States and Canada throughout the year. A 228-page full-color catalog is available for $41.50 (ppd) for American Craft Council members and $46.50 for non-members by writing to ACC Publications, 40 W. 53rd St., New York, N.Y. 10019.

From May 7 through July 9, the American Craft Museum will feature the first retrospective exhibition of George Nakashima's furniture. The show will include 55 of Nakashima's most important works. A book to accompany the retrospective will be available in April. For more information, contact the ACC at the above address. *—Jim Boesel*

Photos: Dean Powell

Design challenge

Exciting results can be expected anytime imaginative furnituremakers are given free reign to express their creative ideas. A group of craftsmen took advantage of such an opportunity and designed special pieces for the Clark Gallery's "Specific Spaces: Unique Furniture Exhibition" last January in Lincoln, Mass.

Peter Dean often uses marquetry and inlays of various types of wood to produce intricate, rich surface patterns. His 50-in.-wide chest (above) includes quartersawn white oak, ash and maple. The chest's strong lines reflect Dean's professional architectural background. Parker McComas' small, sculptured table (right) uses rosewood, ebony, cherry and pearwood in combination with etched glass, paint and gold leaf to achieve its futuristic look. Glass artist Ellen Sheppa helped with the finishing touches.

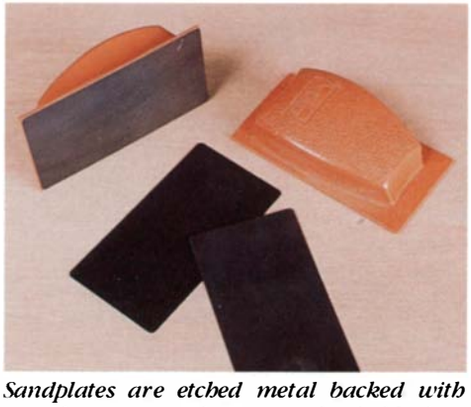
Product reviews

Sandplate Sanding System, *Sandvik Saws and Tool Co., Box 1220, Scranton, Penn. 18501.*

Sanding always transforms the appearance of my shop. The floor and bench rapidly become littered with worn-out, half-used and torn scraps of sandpaper. I'm usually neat and reasonably well organized in attacking a project, but my system runs amok when it comes to sanding. So, in yet another effort to make sanding simpler and a little less chaotic, I recently tried the Sandplate Sanding System.

This system is a unique approach to sanding. The "abrasive" is a hardened steel plate that has been masked and acid-etched to form sharp-edged, mesa-like structures—"points"—uniformly distributed across its surface. In theory, these points, because they are on the same level, should produce a more evenly abraded surface than the irregular grains of sandpaper.

Sandplate is presently available in two



Sandplates are etched metal backed with tape for easy attachment to plastic blocks.

"grit" sizes: 50 points per square inch, equivalent to about 80- to 100-grit sandpaper; and 160 points per square inch, or 150 to 200 grit. According to Mark Weigel, marketing services manager, Sandvik plans to introduce a 300-points-per-square-inch Sandplate sometime this year.

Each Sandplate comes with an adhesive backing that makes attaching and changing plates a breeze. A handy plastic block is available for each size of Sandplate, but you could use a piece of scrapwood as well. Because they're flexible, the plates can be attached to curved surfaces or specially shaped blocks to suit the application. Weigel hinted that additional formats might be added to the product line at some future date.

Using the plates isn't much different than conventional sanding. All the usual "rules," such as sanding with the grain, need to be followed. I didn't see any drawbacks in using the plates on either pine or cherry; the plates have about the same feel working on softwoods and hardwoods as conventional sandpaper. Sandvik claims the plates work five times faster than sandpaper, but I didn't see a significant difference. The plates have an annoying tendency to rapidly clog with sanding residue (on both pine and cherry), and this residue hampered my efforts to get surfaces uniformly sanded. By frequently tapping the plates with my fingers between strokes, however, I found the residue was removed easily, and this improved the sanding uniformity.

Because the plates are small (two sizes are

INDEX TO ADVERTISERS

available: 2⅜ in. by 4⅞6 in. and 2⅜ in. by 8⅞ in.), I don't think they'll replace power sanders for large, flat surfaces, but I found the plates especially convenient and effective for edge-sanding and corner-rounding. I didn't try the plates for sanding between finish coats: The plates currently available are too coarse. But, the soon-to-be-marketed, 300-points-per-square-inch plate may work nicely for this purpose.

At $3.19 each, the plates are not inexpensive. If they last 100 times longer than sandpaper, however, as Sandvik claims, they are a real bargain.

Angle Ease, *J.K. Jenner, 2294 Stringer Gap Road, Grants Pass, Ore. 97527.*

Graham Blackburn's article on p. 65 shows you how to determine sawblade tilt and miter-gauge settings for splayed joints using a graphic technique. But for those who find representing three-dimensional objects in two-dimensions depressingly difficult, Angle Ease may be more helpful. Even if you are comfortable with the graphic method, you'll find Angle Ease convenient and quick, especially if you do much angled joinery.

Angle Ease is designed to work like a circular slide rule. One side of the scale provides blade tilts and miter settings for sides splayed from 5° to 55° (from the vertical). It works for butt-jointed projects (four sides) and mitered projects (four, six and eight sides). The proper settings appear in windows directly across from the work angle that you select.

The other side of the scale provides blade tilt or miter settings for vertical-sided polygons having three to 20 sides. Here, you set the scale for the number of sides and read either the required blade-tilt angle or miter-gauge setting in the window directly opposite. The miter-gauge setting is appropriate for "flat" projects, such as a hexagonal picture frame; the blade-tilt angle is selected when building "vertical" projects, such as an octagonal planter.

Determining the proper saw settings is only half the job: You will still need to know how wide to cut each segment in your polygon. Angle Ease provides the information to enable you to easily calculate the outside (or inside) width of each segment. For example, an "outer-circle factor" appears in a window opposite the setting for the number of sides in the project. Multiplying the radius of the circle that circumscribes your project by this factor gives the outside width of each segment.

Angle Ease comes with clear, easy-to-read directions; is equally applicable for tablesaws and radial-arm saws; and sells for an affordable $6.95. To use Angle Ease most effectively, you'll probably find it necessary to recalibrate the scales on your saw.

—Alan Platt

Photo: Ken Altman

An old puzzle block solved one woodworker's problem of making a living in a small shop. By direct-marketing his sliding dovetail boxes, Ken Altman established a thriving business.

Production boxmaking

I stumbled across the idea for my dovetail boxes, pictured above, back in 1983. A friend showed me a puzzle of sorts that a machinist had made. It consisted of two square metal blocks seemingly locked together by four dovetails, one on each side of the square. It reminded me of a similar wooden puzzle block I'd seen many years before. The trick was that the four dovetails were really the ends of two sliding dovetails that ran diagonally to the sides of the square blocks. I played around with the idea and realized that if I hollowed out one of the blocks, I'd have a clever little sliding-lid box. Six years and thousands of boxes later, I'm still making them. In fact, they now account for about 85% of the business I do in my small-scale (one-man) woodworking enterprise.

Before I came up with these boxes, I was struggling along, like many aspiring artisans, trying to make a living doing custom work. While I was fortunate enough to sell a few pieces on speculation and land some large commissions from time to time, I was hardly prospering. By doing production work, I've been able to earn a good living and still have some time to pursue other, more-creative projects, such as making the more-exotic, hardwood boxes pictured on the back cover.

One key to my success with these boxes has been a wholesale mail-order program, carefully targeted at shops and galleries across the country that show this kind of work. I knew that if I was going to be successful with a direct-mail approach, I would have to get people's attention. Because the photography, typesetting and layout for a brochure was a considerable expense, with no guarantee of a response, I decided instead to send a free sample box to prospective buyers. I reasoned that my boxes would be appreciated much more if they could be held and played with rather than just seen in a photograph. Plus, while a brochure might get tossed, the box would stick around as a reminder, and could even be set out on display to see if customers were interested.

I got orders from about one-third of the 25 shops I contacted on my first mailing. This is an excellent response compared to the less than 5% response usually expected from a direct-mail campaign involving a flyer or brochure. It has proven to be a cost-effective way to market my work. I now also work with a sales representative who sells at wholesale gift/trade shows, so my boxes are getting new exposure and I don't have the travel expenses. Another valuable resource for finding new markets has been the "Crafts Wanted" page of The Crafts Report, which bills itself as "a news monthly of marketing, management and money for crafts professionals." The address and phone number are 700 Orange St., Box 1922, Wilmington, Del. 19899; (302) 656-2209.

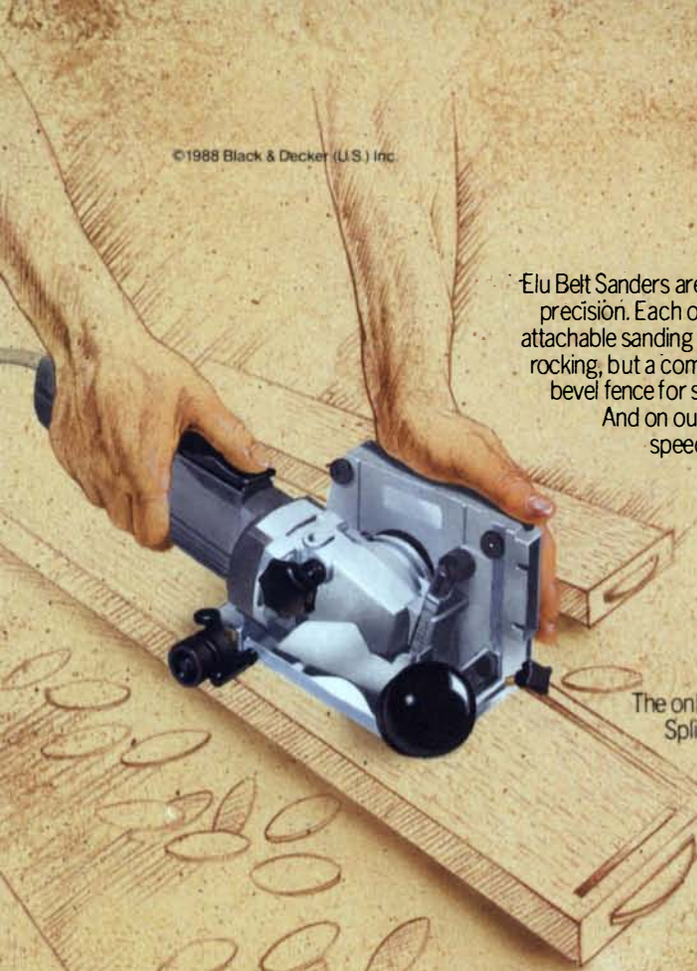
The computer I bought shortly after the orders started to come in has proved to be an invaluable asset. Not only for mailing lists, invoicing and other record keeping, but especially for communicating with my customers: verifying orders and letting them know I'm alive and well and that they are important to me. Even though I wholesaled to more that 40 shops last year, the memory of the first order arriving in my mailbox is still vivid and exciting. And some of those first shops that I contacted continue to be regular customers.

—Ken Altman, Silverton, Ore.

Notes and Comment

Do you know something we don't about the woodworking scene in your area? Please take a moment to fill us in. Notes and Comment pays for stories, tidbits, commentary and reports on exhibits and events. Send manuscripts and color slides (or, black-and-white photos—preferably with negatives) to Notes and Comment, Fine Woodworking, ***Box 355, Newtown, Conn. 06470.***

Elu Belt Sanders are designed to provide maximum precision. Each one is available with not only an attachable sanding frame to prevent gouging and rocking, but a compatible inversion stand or bevel fence for sanding from any position. And on our electronic model, variable speed selection gives you an even greater degree of control.



The only one of its kind in the U.S., the Elu Jointer/Spliner has a motor that swivels, so plate cutting from any position is easy. What's more, it makes grooves for flat dowels and splines, and is even a precision trim saw. Making it by far the most flexible tool you can own.

Solid and powerful, all Elu Plunge Routers provide perfect 90 degree entry and exit from the workpiece. Plus, on two models, electronic controlled variable speed is perfect for matching cutters to all different materials to assure the finest finish. And each Router is available with a variety of attachments to give you total versatility and control.

Our Universal Planer has the power and durability needed for a wide variety of materials. Its cast aluminum shoes are precision machined after assembly so they're parallel to the planing surface and rabbeting edge. And it gives you a satin-like finish every time.

The Elu System. A tradition of painstaking craftsmanship and modern technology combined to create the benchmark for woodworking accuracy.

Every tool we build has ball and roller bearing motors, heavy-duty housings and the latest power transmission systems. Plus innovative accessories that allow you to meet even the most grueling shop standards. With flawless performance every time. Raising woodworking to a whole new level of perfection. Elu.™ From Black & Decker.®

Elu™
WOODWORKING TOOLS BY BLACK & DECKER

ANYTHING LESS WON'T CUT IT.

JEWELS

Ken Altman of Silverton, Ore., specializes in making small, finely crafted wooden boxes. He spares no expense in time or materials as he shapes and details the exotic woods, gold and ivory that make these boxes equal partners with the precious objects they're meant to contain. The boxes, shown slightly smaller than actual size, are part of a series to which Altman adds a new box about every six months. Each of the designs will be reproduced no more than 50 times, then the jigs used for routing and shaping them will be destroyed. These "high-end" boxes are a creative outlet for Altman, who single-handedly produces about 2,500 simpler sliding-dovetail boxes each year, which he wholesales to shops and galleries all across the United States. (For more on Altman's boxes, see p. 110.)