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June 2005
No. 177

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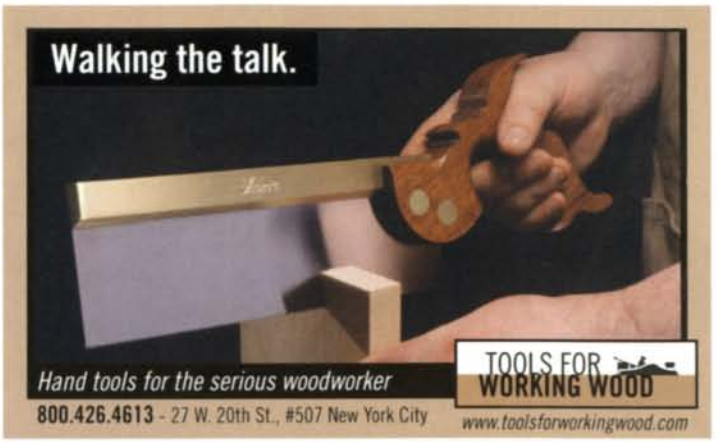

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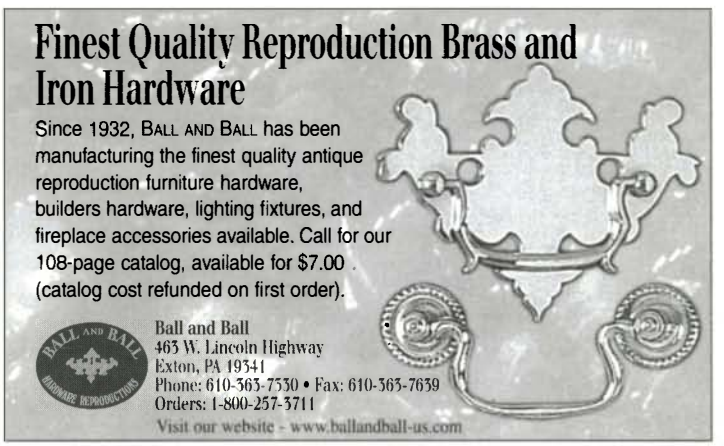

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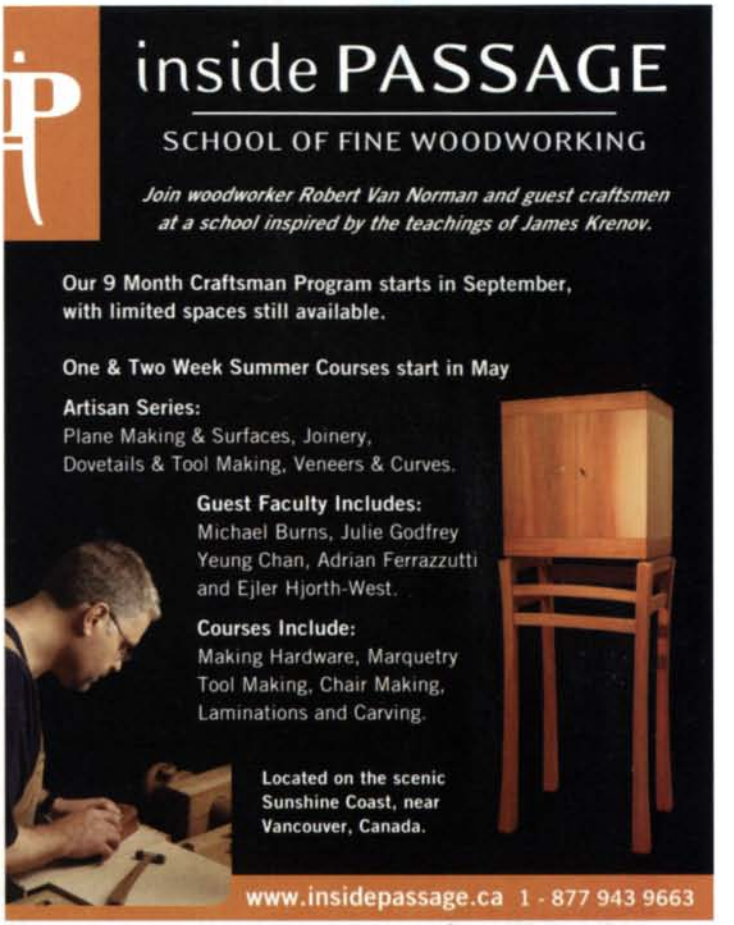

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contributors

Yeung Chan *("Five Smart Router Jigs")* began working wood as a child in China, making toys, model planes, and boats. He worked for 12 years as a product engineer and a research and development manager at Metropolitan Furniture Corp. before studying under James Krenov at the College of the Redwoods. Chan now divides his time between designing and building custom furniture, as well as making hand tools based on his own ideas. He spends much of the summer teaching at various woodworking schools. At home, he enjoys cooking, gardening, and drawing. Chan is the author of *Classic Joints with Power Tools* (Sterling Publishing Co. Inc., 2002).

Paul Snyder *("Three Steps to a Flawless Painted Finish")* is a professional finisher in Fredericksburg, Va. His work ranges from restoring antique furniture to finishing new furniture, cabinetry, and architectural woodwork. Snyder is a technical adviser on the professional finishing forum at Woodweb and a contributor to the Knots forum at www.finewoodworking.com. He also has developed his own Web site: www.furniturefinishwizard.com.

Scott Grove *(Master Class)* owns and operates a woodworking studio in Rochester, N.Y. He produces custom furniture for private collectors as well as corporate clients. He exhibits nationally and is a member of The Furniture Society. For more examples of his work, visit www.scottgrove.com.

Jonathan Binzen *(Back Cover)* is a former senior editor at *Fine Woodworking*. In the 1980s he taught woodworking at a school for refugees in Philadelphia and later spent several years in Malaysia writing, working in a refugee camp, and making furniture in a Malay shop. These days he lives in New Milford, Conn. Between loads of laundry and trips to the elementary school with his daughters, he writes about furniture and interiors.

Ernie Conover *("Shaker Rocker")* is a long-time contributor to *Fine Woodworking*. He and his wife, Susan, run Conover Workshops (www.conoverworkshops.com) in Parkman, Ohio, where he teaches woodworking and wood-turning courses, including one on the Shaker rocker. He enjoys sitting in the chair almost as much as he enjoys making one, he says. Conover has written several books for The Taunton Press, including *Turn a Bowl with Ernie Conover* (2000) and *The Lathe Book* (2001).

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Fine Woodworking
The Taunton Press, 63 S. Main St., PO Box 5506,
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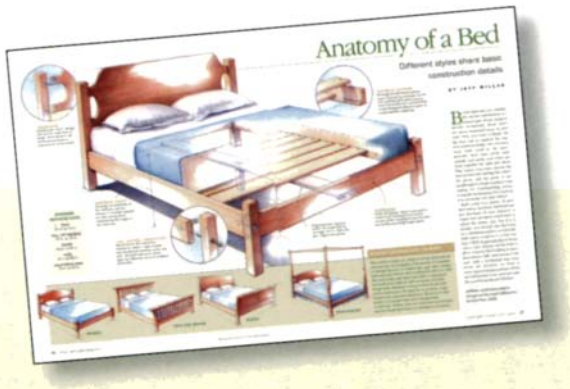
letters

Spotlight



ISSUE #175
January / February 2005
Page 36

NEW BOX SPRINGS NEED CENTER SUPPORT

I work in the mattress industry and want to clarify a point about bed design ("Anatomy of a Bed," *FWW* #175, pp. 36-41). Most major mattress manufacturers in North America require queen- and double-bed frames to have a center support: a slat or metal bar that connects from one side of the bed to the other, or from the head to the foot of the bed, with a support in the middle that extends to the floor. Box springs used to be made of hardwood, negating the need for center support in the bed frame. But nowadays box springs generally are made of softwoods. A double or queen sleep set that is on a frame without a center support will sag and bow badly within a short time. To make matters worse, the warranties for queen and double beds are considered void by most manufacturers if the customer has a frame without a center support.

—DAMON STOELTING, Vancouver, B.C., Canada

Fire safety article update

As a firefighter, I want to thank you for the article "Fire Safety in the Shop" (*FWW* #174, pp. 55-59). I would like to add the importance of grounded electrical outlets and the other big one, cleanliness. I have seen many dust-ignition fires that could have been prevented. Another point that I would like to make is the use of PVC for sprinkler supply. A sprinkler is designed to operate at a specific temperature. When that temperature is reached, part of the sprinkler head melts and allows water to flow. PVC has a high melting point but is not suitable for this use because a fire in a spot not near the sprinkler head could melt the pipe and prevent the sprinkler from working properly. The risk is twofold, fire and flood.

—TOBY BROWN, Olga, Wash.

Bruce Ryden replies: Yes, there is a specific type of plastic pipe designed for this application, but it is very expensive and difficult to install. I would much rather have a flood than a fire. Not too many do-it-yourself shop owners would go to the trouble of using that material.

Uncanny timing

In the middle of making a set of picture frames in walnut, issue #176 arrived. I had to laugh when I saw an article on finishing walnut as well as one on building picture frames. What timing! This was not the first time you guys have done this. A couple years ago, while reading some books by James Krenov, I received *FWW* #162, which had the interview with Mr. Krenov in it. It is this special attention to the needs of your readers, to almost a personal level, that makes receiving your magazine such a pleasure.

—MIKE DEMBROGE, Alameda, Calif.

Corrections

The article on dado blades (*FWW* #176, pp. 54-59) should have listed Forrest Manufacturing's URL as www.stores.yahoo.com/forrestman, and a phone number of 800-733-7111.

An e-mail address in a story about Weyerhaeuser's new line of colored MDF (Tools & Materials, *FWW* #175, p. 32) was incorrect. The correct address is: bill.andersen@weyerhaeuser.com

A drawing in the article "A Benchtop Bench" (*FWW* #176, p. 40) mislabeled a fastener. The bolts used to hold the base of the bench together are 3/8 in. dia.

A drawing in a recent Rules of Thumb (*FWW* #174, p. 114) gave an incorrect dimension for the stop block. The block should be cut 1 5/8 in. high. Recessed into a 1/4-in. deep dado, the block will stand 1 3/8 in. proud of the platform surface.

In the Q&A "What is a helical cutterhead?" (*FWW* #174, p. 96), the cutterhead described to fit commonly available planers and jointers is manufactured by Byrd Tool Corp.

DO YOU MAKE YOUR OWN TOOLS?

For the next *Tools & Shops* issue, we are seeking photos of tools that you have built: handplanes, marking tools, machine tools, benches. Please send images (print, transparency, or high-resolution digital file) to *Fine Woodworking*, Readers Gallery Department, 63 S. Main St., Newtown, CT 06470, or email tbegnal@taunton.com.

About your safety

Working wood is inherently dangerous. Using hand or power tools improperly or ignoring standard safety practices can lead to permanent injury or even death. Don't try to perform operations you learn about here (or elsewhere) until you're certain they are safe for you. If something about an operation doesn't feel right, don't do it. Look for another way. We want you to enjoy the craft, so please keep safety foremost in your mind whenever you're in the shop.

—Anatole Burkin, editor

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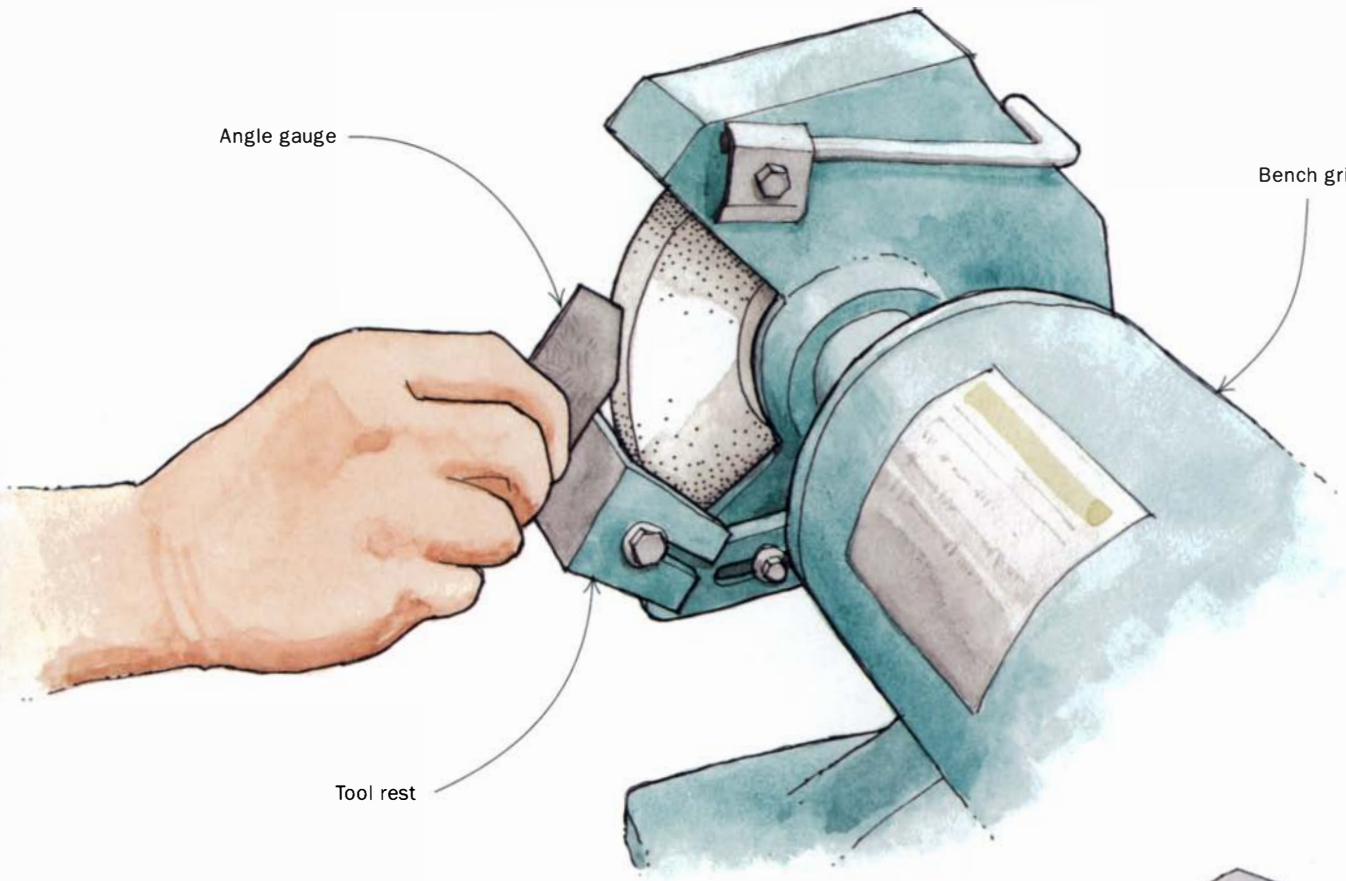


Best Tip

Angle gauges for bench grinders

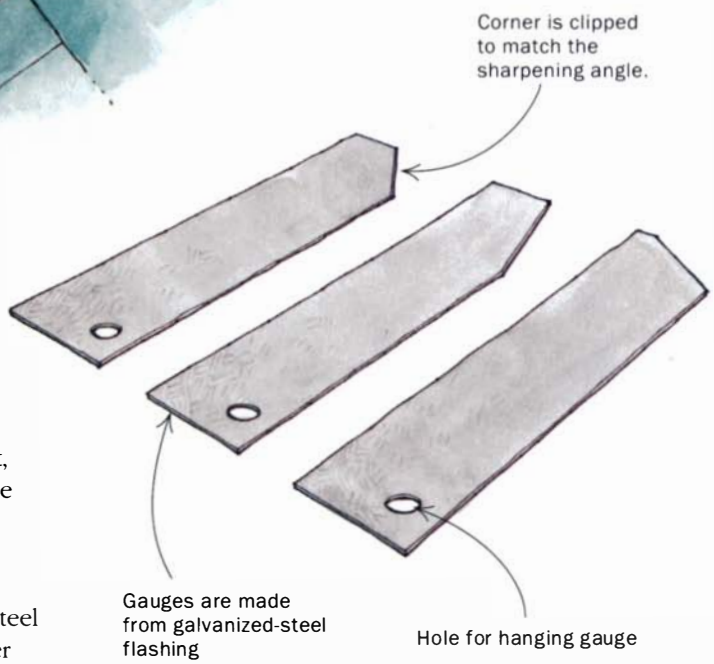
A retired mechanical engineer from Los Alamos National Laboratory, Philip Thullen began turning wood in 1980. He typically spends two or three days a week turning decorative bowls.

I GET EXCELLENT RESULTS SHARPENING MY various turning tools using nothing more than the standard tool rest on my bench grinder. The secret, I've learned, is to set the tool rest to the exact same angle each time I regrind a tool. To do that, I use a shopmade angle gauge for each of the common grinding angles.

The gauges are nothing more than galvanized-steel flashing cut into 1-in.-wide rectangles. One corner of the rectangle is clipped to the desired sharpening angle for a given tool.

To use the gauge, place one edge on the tool rest. Then adjust the angle of the tool rest until the clipped corner of the gauge is tangent to the grinding wheel. The clipped corner is properly positioned when the wheel touches it near the bottom of its length, about where a tool's edge would hit the wheel. Once the tool rest is locked in place, you're ready to start sharpening.

—PHILIP THULLEN, Los Alamos, N.M.



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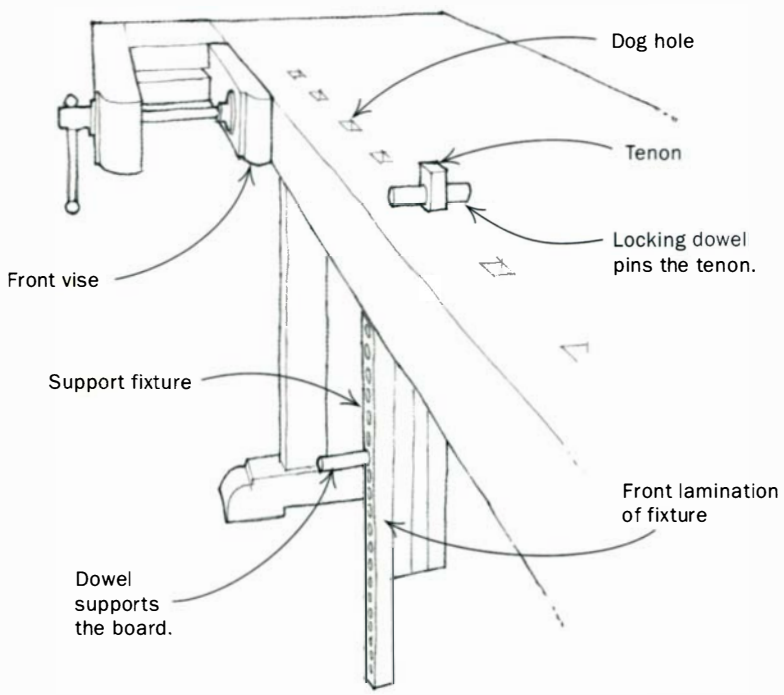
Workbench support fixture for edge-planing long boards

When I'm edge-planing a long board on my workbench, the front vise usually won't fully support the entire board. I wanted to add some form of extra support on the far end of the board but didn't want another "helper" that would always be in the way as I worked at the bench.

I came up with a removable support fixture. When I need to plane a long board, I insert the top tenon up into any dog hole and pin the tenon with a locking dowel. To ensure that the front of the fixture would be flush with the front of the bench, I made the support by laminating several pieces. To accommodate various widths of lumber, a series of holes are bored in the front lamination. The holes, with centerpoints spaced 1-in. apart, accept a dowel that supports the board. When not in use, the fixture hangs on the wall.

—RICHARD J. GOTZ, Plymouth, Minn.



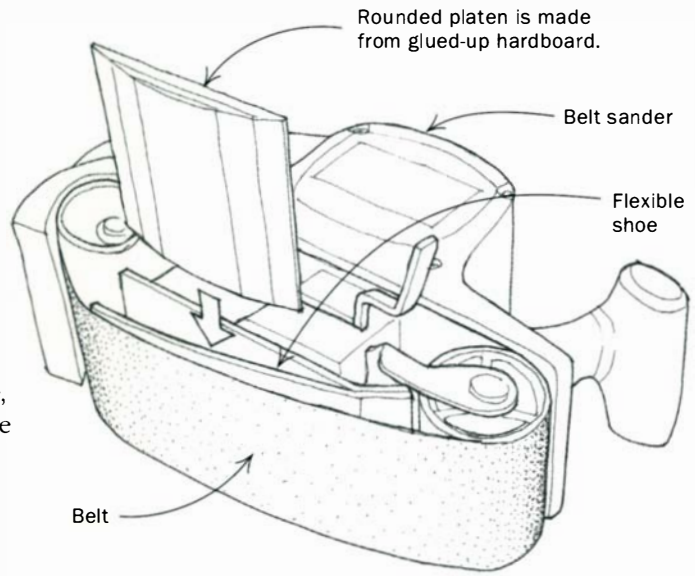
Sand smooth curves with a belt sander

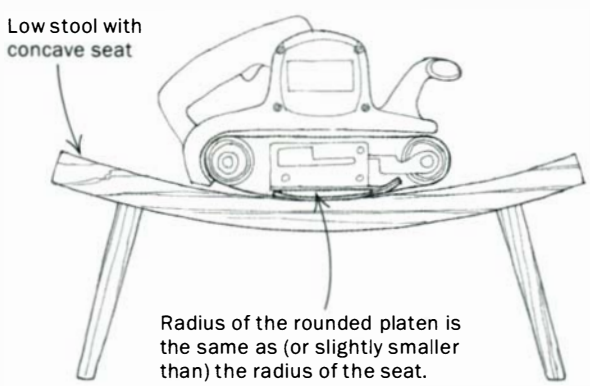
I make low stools as gifts, each one with a gently shaped concave seat. It was time-consuming to smooth the concave surface, but things got easier when I slipped a rounded piece under the spring-steel shoe of my belt sander.

The rounded piece, or platen, is made by face-gluing three pieces of ⅛-in.-thick hardboard. Use a rasp or file, along with some sandpaper, to shape the platen to the radius of the seat.

To sand the concave side of the seat, simply insert the rounded platen under the flexible shoe from the side of the sander. There's no need to use anything special to hold the platen in place; the tension of the sanding belt does that. The thin spring-steel shoe bends to the same radius as the seat, enabling me to sand the entire concave surface. Indeed, by working up through the various grades of abrasive belts, I can finish a seat in no time at all. When the rounded platen is removed, the shoe springs back to its original flat shape.

—NICK ROWE, Greenlane, Auckland, New Zealand

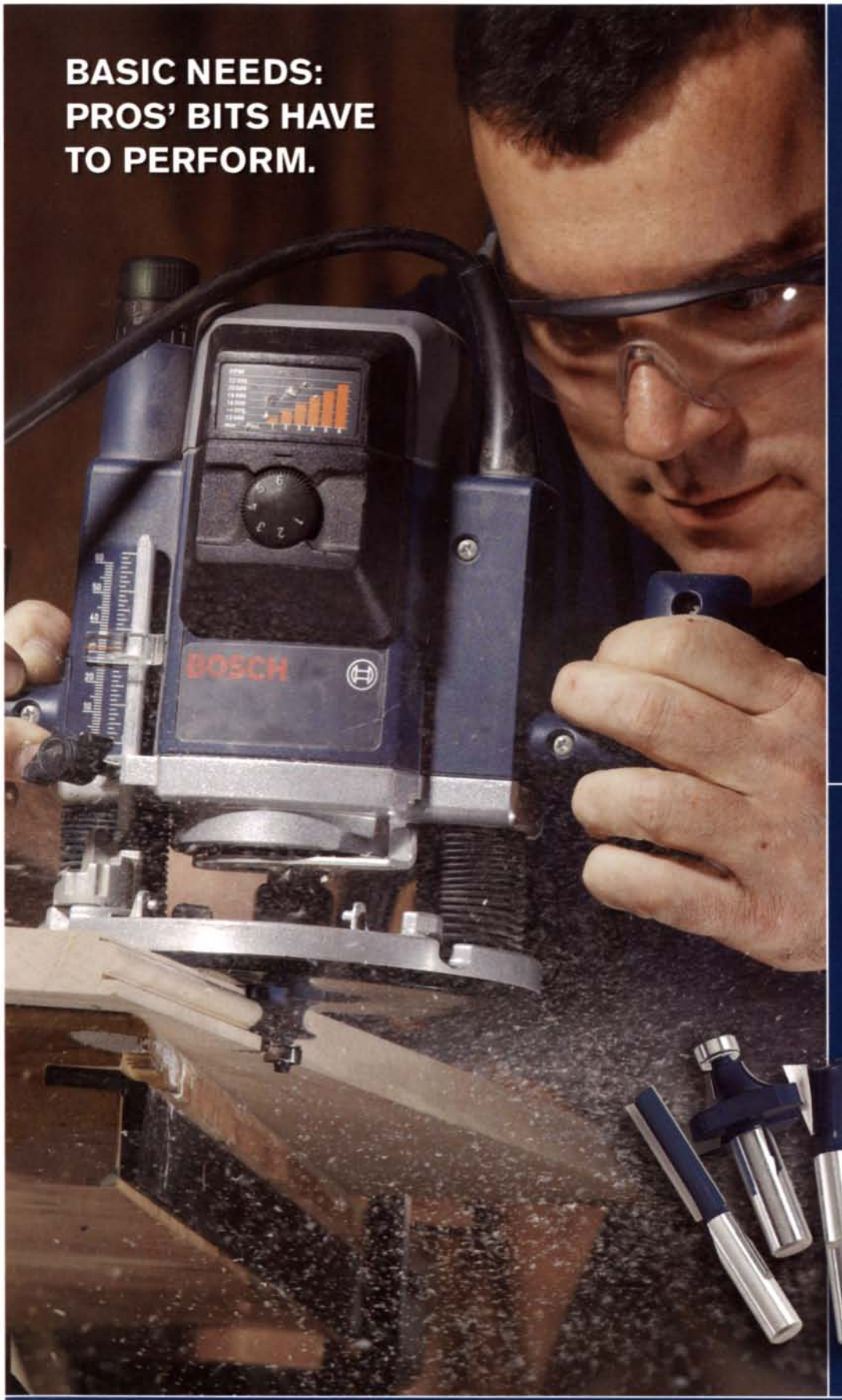




Quick Tip

To apply clamp pressure evenly when gluing veneer to a small project, I use foam-insulation board as a clamp pad. Cut the foam the same size or a little larger than the project and use a piece of plywood on top to protect the foam from being damaged by the clamp jaws. The softer and thicker the foam, the better it conforms to the shape.

—CHARLIE JAMES, Williston Park, N.Y.



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Pipe dividers organize sheet goods

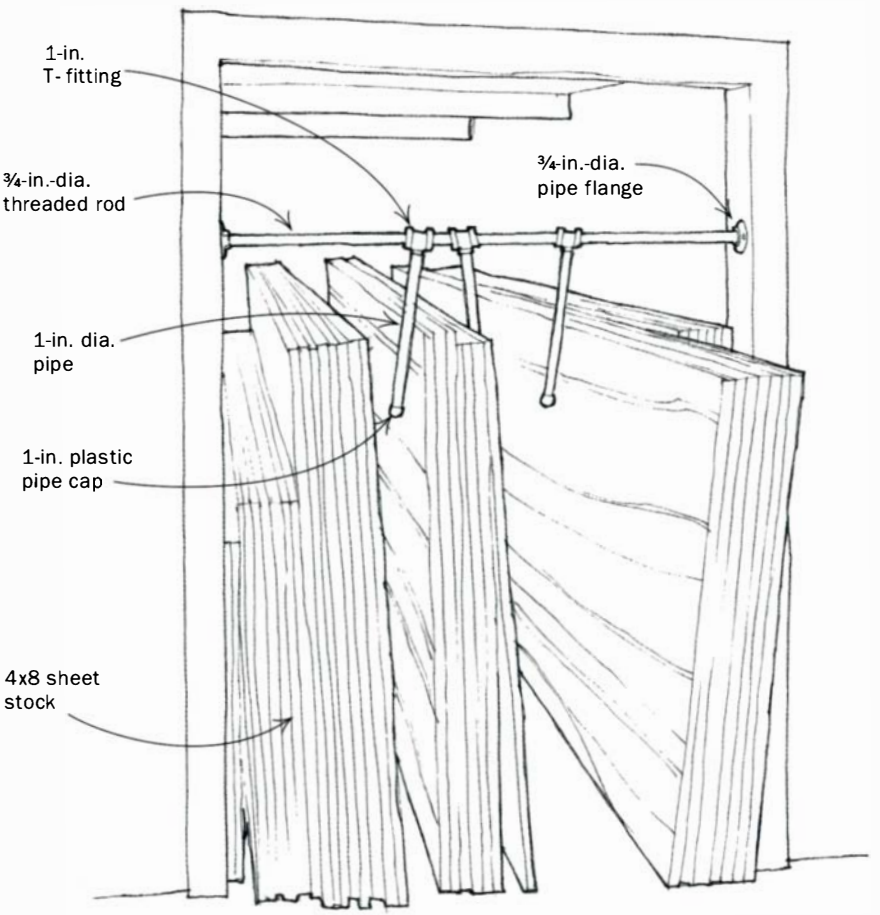
We've always had difficulty sorting and organizing the various sheet goods that move though our shop. Because our inventory is always changing to suit our different projects, we were constantly reshuffling the sheets to keep them accessible. Of course, the sheet we needed was always behind a 10-sheet stack of ¾-in.-thick medium-density fiberboard (MDF). Tipping that much weight back and forth was difficult, sometimes bordering on dangerous.

We came up with an inexpensive divider system that easily adjusts to our regular changes in inventory. Also, it secures the sheets so they stand more vertically in the rack.

The system uses ¾-in.-dia. threaded rod (also called all-thread), and short sections of 1-in.-dia. pipe, threaded on each end. Make each divider by threading a length of pipe into a T-fitting. On the other end of the pipe, add tape or a plastic cap to the exposed thread to help protect the sheet stock from scratches. Now slide the dividers onto the threaded rod, then install the rod across the storage area above the sheet stock.

In use, the larger-diameter pipe-fittings allow the dividers to be adjusted laterally across the threaded rod. But when the weight of the sheets tips the Ts slightly, the fittings lock in place and won't slide.

—ROD KAZENSKE, Denver, Colo.



Quick Tip

When turning a piece of greenwood on the lathe, you must keep the wood from drying too quickly, which causes checking. Plastic food wrap is a perfect solution to this problem. Just leave the wood on the lathe and wrap it up. The wrap will seal the workpiece and faceplate tight enough to keep the workpiece from drying out too quickly—even if your turning schedule is interrupted for a week or two.

—TERRY CHAPMAN, Fairburn, Ga.

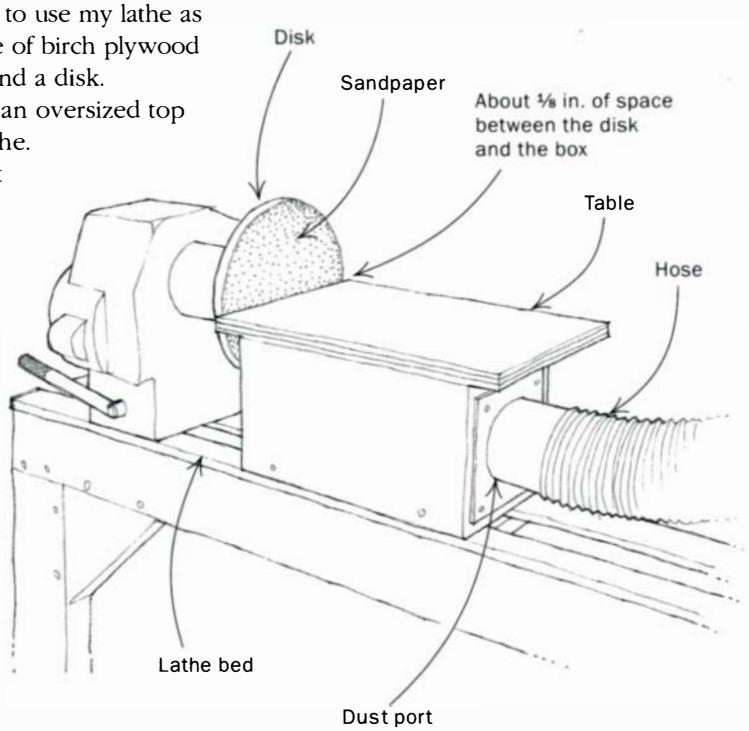
Turn your lathe into a disk sander

This shopmade fixture allows me to use my lathe as a disk sander. The fixture is made of birch plywood and has two main parts: a table and a disk.

The table is simply a box with an oversized top that mounts to the bed of the lathe. To help control some of the dust generated by the disk, one end of the box has a port that connects a hose from my dust collector. The other end of the box is open, to accept the dust.

The disk is 8½-in. dia. and is fastened to a faceplate. The disk diameter makes effective use of a full sheet of sandpaper. I attach the sandpaper with a friction-activated glue stick, but contact cement or rubber cement works as well.

—STEVE BOWEN, Lewisburg, Pa.



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West meets East in Japanese artisan's work

Asian cabinet stands on Western tradition. *The legs mimic those of a Windsor chair, and the door plays with the design of a Windsor chair back. The piece is made of Japanese red pine.*

JAPAN'S WOODWORKING traditions of tansu and temple building have influenced many aspects of Western furniture making, from joinery to design to hand tools. But the East-West connection goes both ways, as shown in the work of Kazafumi Yamamoto, an instructor at Okayama University, southwest of Tokyo.

Yamamoto, 42, creates furniture rooted in Japanese heritage that also evokes Western influences such as Danish-modern furniture maker Hans Wegner, the Windsor style, and the Arts and Crafts movement. He uses native Japanese timbers such as red pine, hemlock, and cryptomeria, finishing each piece with urushi lacquer.

Yamamoto said he wants to help Japan appreciate hand-crafted furniture despite a culture driven by modern technology and manufacturing.

"From the ancient times, Japanese people have respected trees and the skills to manufacture (furniture from) them," he e-mailed. "But after a period of high economic growth, the … spirit has become thin and weak as if it was plastic imitation wood."

—Matt Berger, new products editor

Pacific materials, Atlantic style. *With cabriole-style legs and a dovetailed carcase, this cabinet is made of Japanese red pine and hemlock and finished with syouen (the soot of burnt pine) and urushi lacquer.*

Small details leave a big impression. *This keepsake box of bubinga and hemlock is finished with urushi lacquer.*

A place to seek inspiration. *A tour of Sam Maloof's home and studio is a highlight of the 2005 Furniture Society conference.*

Furniture Society's 2005 conference: California dreamin'

FURNITURE SOCIETY OFFICIALS ARE PREPARING for what should be the group's largest national conference yet, set for June 9-11 in San Diego.

The agenda for the ninth annual event promises a rich variety of panel discussions, demonstrations, and workshops. The theme of the conference is alternative materials, techniques, and forms.

Exhibits will include a retrospective of chairs by designer Roy McMakin and a juried show of student work.

Also among the highlights are a preconference bus tour of Sam Maloof's home and studio in Alta Loma, Calif., and a tour of two Greene-and-Greene bungalows in Pasadena.

The Furniture Society, a nonprofit organization, works to advance the art of furniture making. Its members are primarily furniture designers and builders. For conference details, go to www.furnituresociety.org.

Photos, this page: Courtesy of Kazafumi Yamamoto (top four); Asa Christiana (bottom left)

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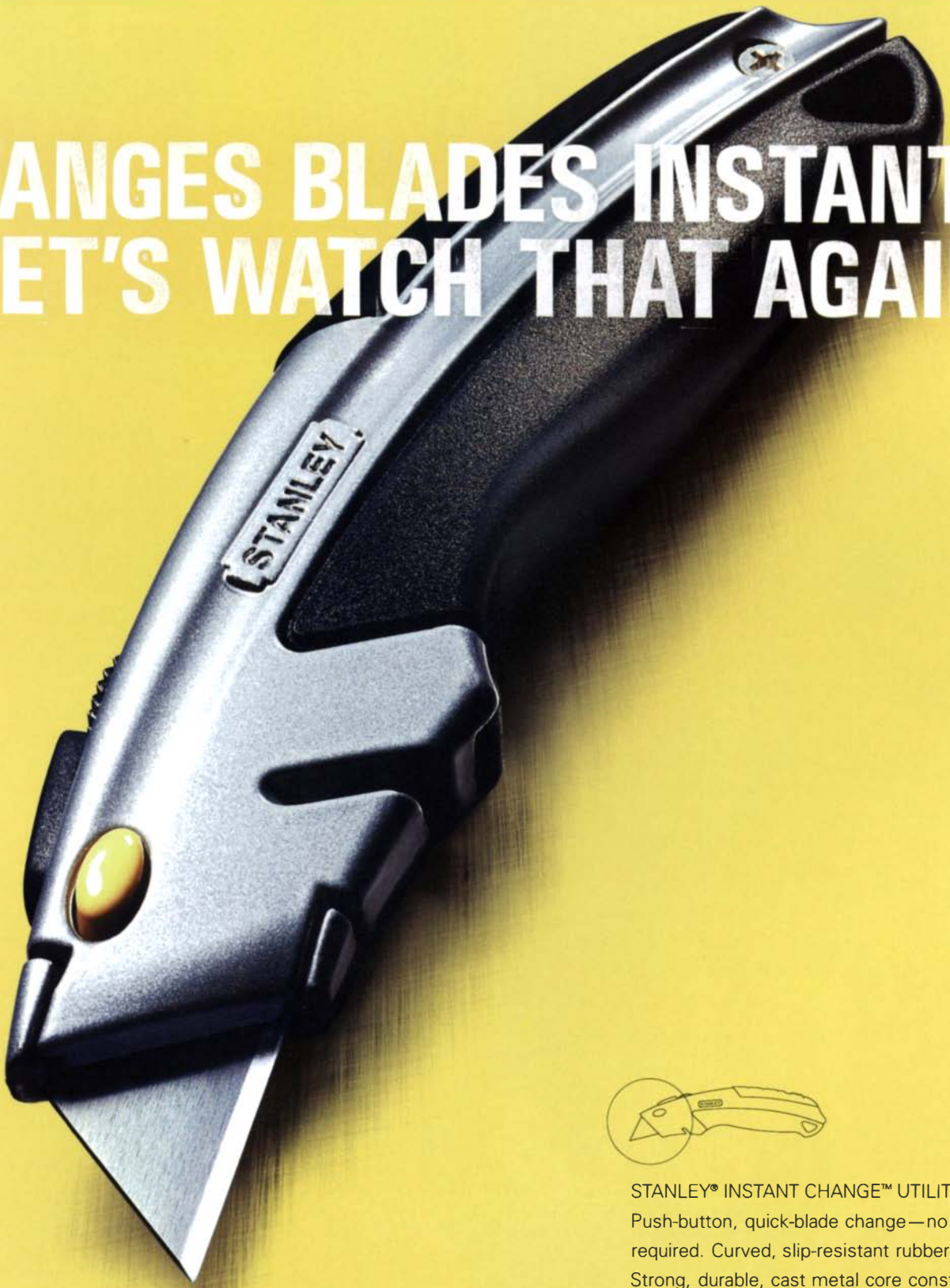

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READER SERVICE NO. 180

Intricate boxes hold key to acclaim for Oregon builder

KAGEN SCHAEFER, A WOODWORKER IN Portland, Ore., is gaining international recognition for his mechanical puzzle boxes.

Schaefer's Dodecahedron Box took the grand prize for design at the 2004 International Puzzle Party, an annual competition that draws hundreds of puzzle makers and collectors from Europe, Asia, and the United States.

The prize-winning box, made of bubinga, wenge, and maple, consists of 12 pentagon-shaped sides, each of which rotates. The lid opens only when the sides are spun into proper alignment, a task that can take up to 38 correct moves in a row.

Prize winner. *The interlocking movements of Dodecahedron Box require careful grain orientation to prevent binding caused by expansion.*

Assembling the side panels from small individual pieces of wood is like building up strips of decorative inlay, Schaefer said.

Schaefer set aside graduate studies in math to build wooden puzzles professionally four years ago, making him a bit of a rarity in the field. "Most people do it as a hobby," said Jerry Slocum, the Puzzle Party's founder and organizer.

Schaefer produces his puzzles in limited runs of 30 or 40 and sells them primarily over the Internet (www.kagenschaefer.com). The Dodecahedron box sells for $450.

—S.S.

A puzzling mosaic. *Schaefer's latest work, Disc Box, requires up to 150 moves to open. Each of the 19 discs must be rotated to form an overall triangular checker pattern. The box is made of wenge, maple, and bubinga.*

Spectacular setting. *Anderson Ranch, nestled in the Colorado mountains, offers woodworking education with a fine-art flavor.*

Rockies ranch is haven for artists, woodworkers

SOME EXPERIENCES ARE priceless. For me, a retreat at Anderson Ranch Arts Center is one of them.

Anderson Ranch, just outside Aspen, Colo., is unique in placing woodworking education within a fine-art context. In addition to woodworking, the center offers summer workshops in ceramics, painting and drawing, printmaking, photography, and art history. Students benefit from the cross-cultural mix of woodworkers pursuing traditional hand skills and studio artists testing the boundaries of traditional materials and forms.

More than two dozen woodworking workshops, priced from $550 to $795, are geared for every skill level. Susan Working, the program director for furniture and woodworking, balances the one- and two-week course offerings between traditional techniques and workshops in contemporary design. The Ranch has one of the best setups for woodworking on the summer-school circuit. It comprises a large machine room, two bench rooms, a loft studio, and a separate wood-turning area with nine state-of-the-art lathes and its own deck. Each participant has his or her own bench.

Meantime, there is much else to be inspired by: the spectacular setting with hiking trails and local fauna (bear warnings are posted); comfortable private or shared accommodation; and exhibits and lectures by guest artists. In the café or on its patio, lively conversation hovers over fluffy pancakes or spicy chili. The dialogue crosses generations and disciplines; e-mail addresses frequently are exchanged.

For professionals whose woodworking career could use a boost, the intensive residency program runs from October to April. Two-, three-, and six-month residencies with studio space and accommodation are offered.

For more information, visit www.andersonranch.org, or call Working at 970-923-3181.

—D Wood, a design instructor and freelance writer in Tucson, Ariz.

Photos, this page: Courtesy of Anderson Ranch (top right); courtesy of Kagen Schaefer (left three)

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READER SERVICE NO. 48

Pros and cons of oil finishes

BY CHRIS A. MINICK

In a recent poll on the *Fine Woodworking* Web site, more than half of readers chose either pure oil or an oil/varnish mix as their favorite finish. This is not surprising, given that oil finishes are easy to use, easy to renew, and above all, hard to mess up.

But there still is a lot of confusion about oil finishes: What are the merits of different types of oil? What can oil finishes do and not do? What are the differences between pure-oil finishes and oil/varnish mixtures?

Not all oils are suitable for finishing

Vegetable oils form the largest family of natural resins used for finishing wood. These oils are divided somewhat arbitrarily into three classes: drying oils, semidrying oils, and nondrying oils.

Only the drying oils, primarily linseed oil and tung oil, can form a cohesive, hard film when used as a wood finish. Linseed oil is derived from flaxseed, while tung oil, also known as China wood oil, is obtained from the nuts of the tung tree. Semidrying oils like soybean, safflower, or sunflower are used in the manufacture of oil-based varnish. Nondrying oils such as corn, cottonseed, coconut, and olive are better used as salad dressing than as wood finish.

Your doctor may have advised you to switch from saturated to polyunsaturated fats, and as it turns out, what is good for your health is good for your finishing, too. Polyunsaturated oils have a greater number of double bonds in each fatty-acid segment, making them more chemically reactive. Not only can your body digest them more easily, but when applied to wood, they have better drying characteristics. For instance, raw linseed oil dries when applied to wood, but soybean oil does not. That's because more than half (52%) of the fatty-acid segments in linseed oil contain three double bonds, whereas only 9% of the segments in soybean oil have

The right oil for the job

When applied in their pure state, three types of oil are suitable for finishing wood. Linseed, tung, and walnut oils have characteristics that make them suitable for different woods and projects.

BOILED LINSEED OIL

This the cheapest and most widely available of the pure-oil finishes. It will darken the wood as it ages, so if you want an antique look or if you find the appearance of freshly sawn cherry too pale, linseed oil is the right choice.

TUNG OIL

Pure tung oil is harder to find than linseed oil. It produces a slightly more durable finish and doesn't darken the wood as much. This makes tung oil a good choice to use on woods that you wish to remain pale, such as curly maple (left), or on woods already sufficiently dark, such as walnut (right).

WALNUT OIL

This oil is expensive and dries slowly, but it has exceptional nonyellowing properties and in its pure form is completely nontoxic. To make sure it contains no metallic driers or other harmful chemicals, buy it in the salad-dressing aisle at the supermarket. Apply three coats to cutting boards, wooden utensils, and bowls. Wait two days between applications to let each coat cure.

Photos: Mark Schofield

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Why oily rags can combust

Heating up fast. *In seven minutes, the internal temperature of this wadded-up cloth soaked in linseed oil rose from less than 100°F to 350°F and started to smoke (above). Less than five minutes later, the temperature rose from 350°F to almost 500°F, and the cloth caught fire (right).*

Uncontrolled combustion, spontaneous or otherwise, is not a good thing in any shop. I'm aware of two fires near where I live that have been attributed to the spontaneous combustion of oily rags.

Wadded-up, oil-soaked rags contain the three ingredients needed for spontaneous combustion: an ignition source, fuel, and oxygen.

The same process that causes an oil finish to dry can cause an oily rag to ignite. To begin with, the liquid oil absorbs oxygen from the atmosphere, a phase that continues for several hours. Once sufficient oxygen has been absorbed, a chemical reaction starts, producing heat as a by-product.

When trapped inside a wadded-up oily rag, the heat feeds on itself. A fundamental rule in chemistry states that the higher the temperature of a chemical reaction, the faster the chemical reaction proceeds. The heat trapped inside the rag causes the reaction rate to increase, producing more heat, which increases the reaction rate, which produces more heat, and so on. Within 15 minutes, the heat can ignite the rag.

Avoiding disaster is easy if you dispose of rags correctly. Spread them on your shop floor to dry, or hang them over a rack outside. Once dry, the rags can be tossed into the trash safely.

Hung out to dry. *To prevent the chance of spontaneous combustion, oil-soaked cloths should be spread out and allowed to dry before being discarded.*

three double bonds. Tung oil dries even faster because 80% of its molecules contain three double bonds.

How oil finishes dry

Tung oil and linseed oil dry to a usable finish in a two-step process: Oxygen is absorbed into the wet oil around a molecule's double bonds to form peroxide. This oxygen absorption takes a surprisingly long time, ranging from eight hours for boiled linseed oil to about five days for raw linseed oil. Next, the peroxide decomposes to produce very reactive free radicals, which attack the unsaturated fatty-acid segments of another oil molecule. This forms a stable chemical bond between the two molecules, at the same time producing another free radical to carry on the reaction. Eventually, all of the oil molecules are linked by a network of stable chemical bonds known as a polymer—the dry finish we see on our masterpieces.

The main reason that boiled linseed oil dries so much faster than raw linseed oil is the addition of metallic driers. The driers in boiled linseed oil catalyze the uptake of oxygen, decreasing the wet time and initiating a rapid decomposition of the peroxides to speed up the polymerization process. More important, metallic driers produce a greater concentration of free radicals in the oil, which leads to a tightly bonded finish. Thus, not only does boiled linseed oil dry faster than raw linseed oil, but it also produces a longer-lasting, more protective finish.

Tips for using oil finishes

Oil finishes may be easy to apply, but they are not foolproof. Good surface preparation and thin coats

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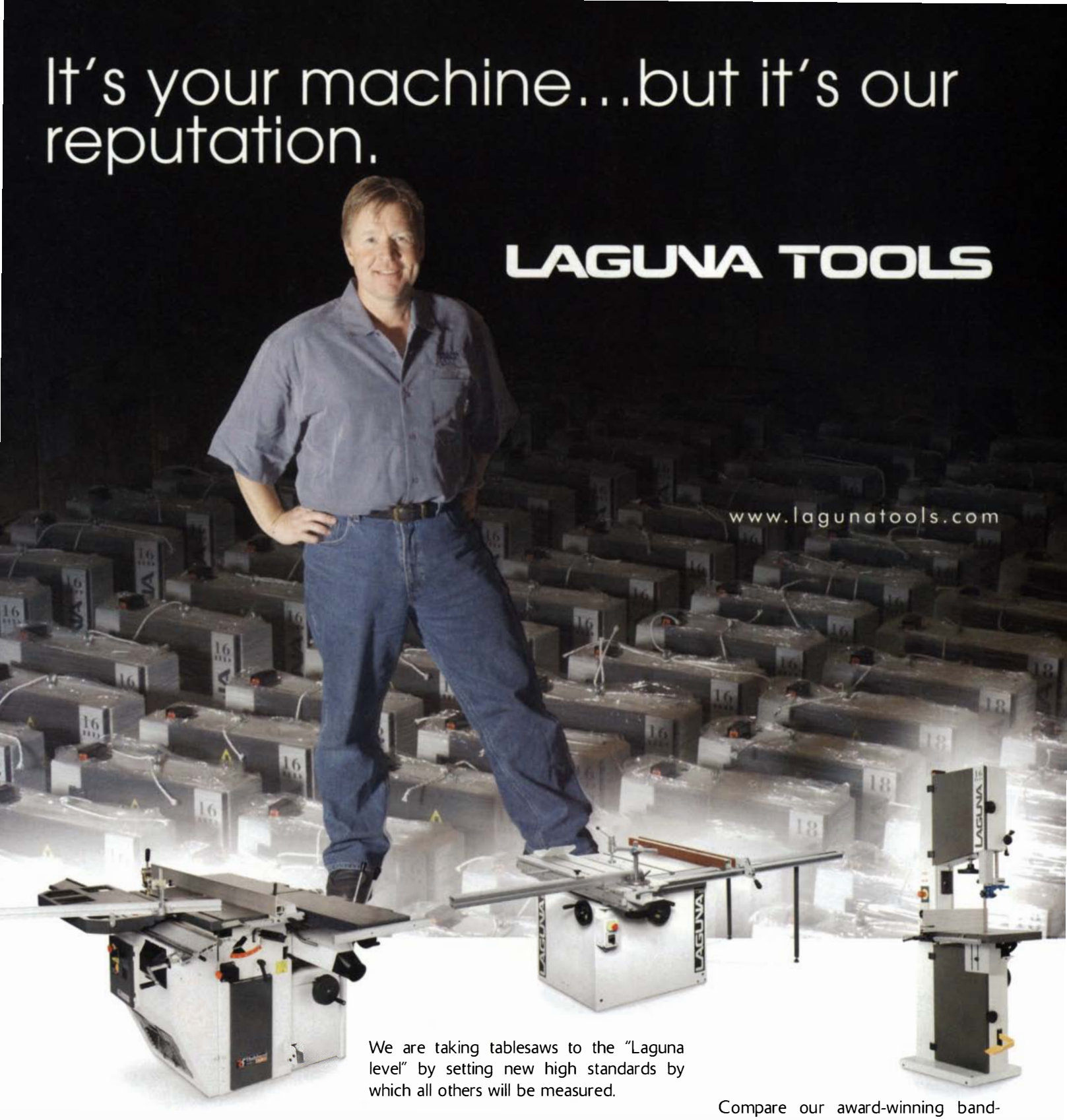

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are the keys to success. When preparing the surface of the workpiece, don't skimp on the sanding. Oil finishes don't cover stray sanding scratches or other defects very well because applications are much thinner than most brushed-on finishes.

I power-sand most wood species to P180 grit with aluminum-oxide sanding disks and then hand-sand with 180- and 220-grit (CAMI) garnet paper. Hand-sanding eliminates machine-made swirl marks and generally improves the appearance of the wood. Garnet sandpaper leaves a softer, less noticeable scratch pattern than other sandpapers. This sanding sequence is not written in stone; if you have a cherry board that appears likely to blotch, you may want to sand up to 400 or even 600 grit (CAMI) to burnish the wood and make the oil absorption more even.

Allow the wood to absorb as much oil as it can. Flood the surface by applying the oil with a brush, or simply pour it on and wipe it around with a cotton cloth. Reapply oil to the dry spots as they show up, keeping the wood thoroughly wet. After 30 minutes or so, wipe away any excess oil and allow the wood to dry overnight. Buff the dry surface with a fine, gray nonwoven abrasive pad, then repeat the procedure until you have applied at least four coats.

Wet-sanding (with the oil, not water) the second and third coats with 400- or 600-grit (CAMI) wet-or-dry sandpaper creates a slurry of oil and sanding dust that fills the wood's pores to produce a smooth surface. It's not a good idea to wet-sand a project if it contains contrasting woods because the slurry from the dark wood will discolor the lighter wood.

When finishing open-pore woods such as oak, ash, and walnut, oil may bleed back, or ooze, out of the pores. If this ooze dries on the surface, shiny patches of polymerized oil will result. To avoid this problem, apply the oil early in the day and recheck the piece every 30 minutes to wipe away any ooze. The oozing should stop after four or five hours.

The good and bad about oil finishes

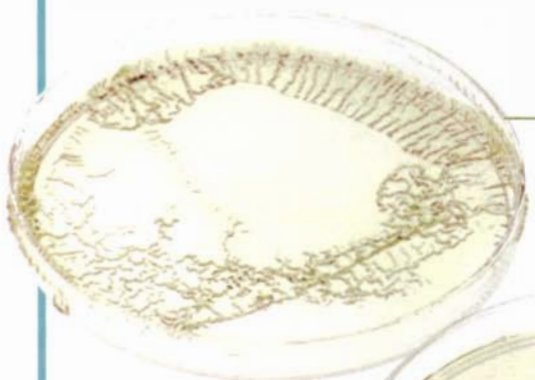
Oil finishes excel at bringing out the figure in a piece of wood, increasing the depth and natural beauty of the piece. But they offer minimal protection from food or water stains. Nor can you expect to get even a semigloss appearance. If you want a shiny, waterproof tabletop, use a different finish.

Easy repairability is the biggest advantage of an oil finish. If the piece is scratched sometime in the future, just sand out the ding and reapply another coat of oil. A periodic reapplication of the same oil keeps the piece looking new. □

Not all oil finishes are pure oil

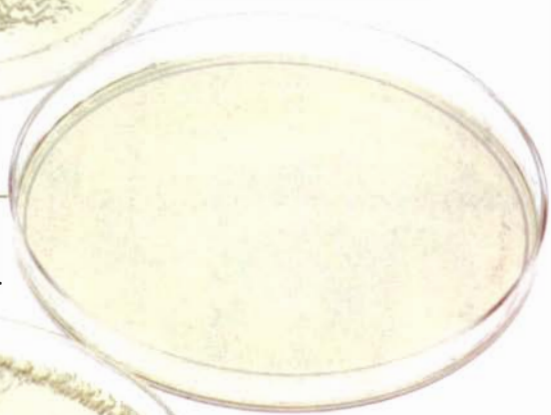
Danish oils and other wipe-on oil varnishes often are lumped in with pure-oil finishes like tung oil and linseed oil because the application technique is the same and the appearance of the finished wood is similar. However, Danish oil is chemically quite different from pure oil: An additional processing step is taken by manufacturers to convert part of the raw oil to an alkyd varnish. Thus, wipe-on oils such as Minwax Antique Oil and Waterlox share the convenient application method of traditional oil finishes and have the added protection of varnish.

There are two ways to tell if a finish is pure oil or an oil/varnish mix. Check the can's label to see whether the contents include resins, mineral spirits, or hydrocarbons, none of which should be part of a pure-oil finish. Or, pour a little finish onto a nonporous surface such as glass or laminate. Because oil absorbs oxygen and expands as it dries, a pure-oil finish will dry severely wrinkled. Varnish will dry very smooth, while Danish oil, being a combination of the two, will be somewhat wrinkled when it dries.



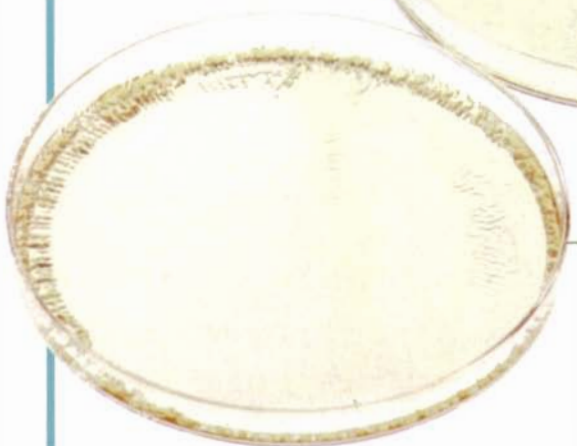
PURE OIL WRINKLES

Pure-oil finishes will wrinkle on an impermeable surface because they absorb oxygen and expand as they dry.



OIL/VARNISH MIX DRIES SMOOTH

An oil-based varnish does not expand as it dries and therefore does not wrinkle.



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POWER TOOLS

Affordable cabinet saw from Craftsman

IF YOU'RE INTERESTED IN A SMOOTH-running tablesaw that comes with a good fence and a reasonable price tag, check out the Craftsman Professional saw. It's a cabinet-style machine for the price of a contractor-style saw. (The saw is also available in two other, less expensive versions.)

The cabinet-style model that I tested (model OR35504) comes with a pair of 12-in. cast-iron table extensions, a Biesemeyer-brand fence, and a laminate-covered table insert that gives the fence a 30-in. ripping capacity to the right of the blade (18 in. to the left of the blade). The cast-iron tabletop, though nicely machined, was not perfectly flat (0.003 in. out). The position of the paddle switch is adjustable, and it was easy to turn it off with my hip.

The saw was not ready to run when I got it uncrated. Fitting a blade on the arbor revealed that the tabletop wasn't aligned correctly on the cabinet, preventing me from raising the blade through the throat-plate opening. Removing four hex-head screws freed the top from the cabinet, and enabled me to enlarge the mounting holes so that the top could be adjusted to the correct position. The saw comes with a flip-up outfeed table, useful for cutting long stock.

Street price	$950
Motor	1¾ hp/15 amps at 120v
Blade tilt	Left
Maximum rip capacity	30 in.
Runout	0.000 in.
Blade alignment	Required large adjustment
Dust collection	Angled chute to 4-in.-dia. outlet

Although it was a hassle, removing the top gave me a close look at the trunnion assembly, easily the most impressive part of this saw. Beefy and precisely machined, the cast-iron mechanism functioned flawlessly and without any detectable slop. Equally impressive was the flat poly drive belt, which helps the saw run quietly and makes the motor seem a lot more powerful than its 1¾-hp rating.

The runout on the arbor, measured at the rim of a 10-in. disk, was insignificant. The arbor will accept a full 8-in. dado set for a 13/16-in.-wide cut.

—Tim Snyder is executive editor of Fine Homebuilding.

HAND TOOLS

GET A GRIP ON FILES AND RASPS

Gripping a file with both hands provides greater safety, power, and control. But until recently, you could purchase a handle only for the tang end. Veritas now offers an auxiliary handle that clamps onto the opposite end. It features a large wooden knob and a rubber shoe on the clamping pad that prevents damage to the file's teeth.

I prefer half-round files and rasps because the combination of flat and convex faces enables me to invert the tool and keep shaping and smoothing a workpiece regardless of its surface contour. Working that way, I found it necessary to invert the Veritas handle. But it wasn't a problem to adjust my grip. Overall, I found the Veritas file handle to be a very useful accessory. It sells for $14.50 from Lee Valley (www.leevalley.com; 800-871-8158).

—LONNIE BIRD runs a woodworking school in Dandridge, Tenn. (www.lonniebird.com).

The large knob is easy to grip. *And a pad protects the file's teeth.*

Photos: Rodney Diaz

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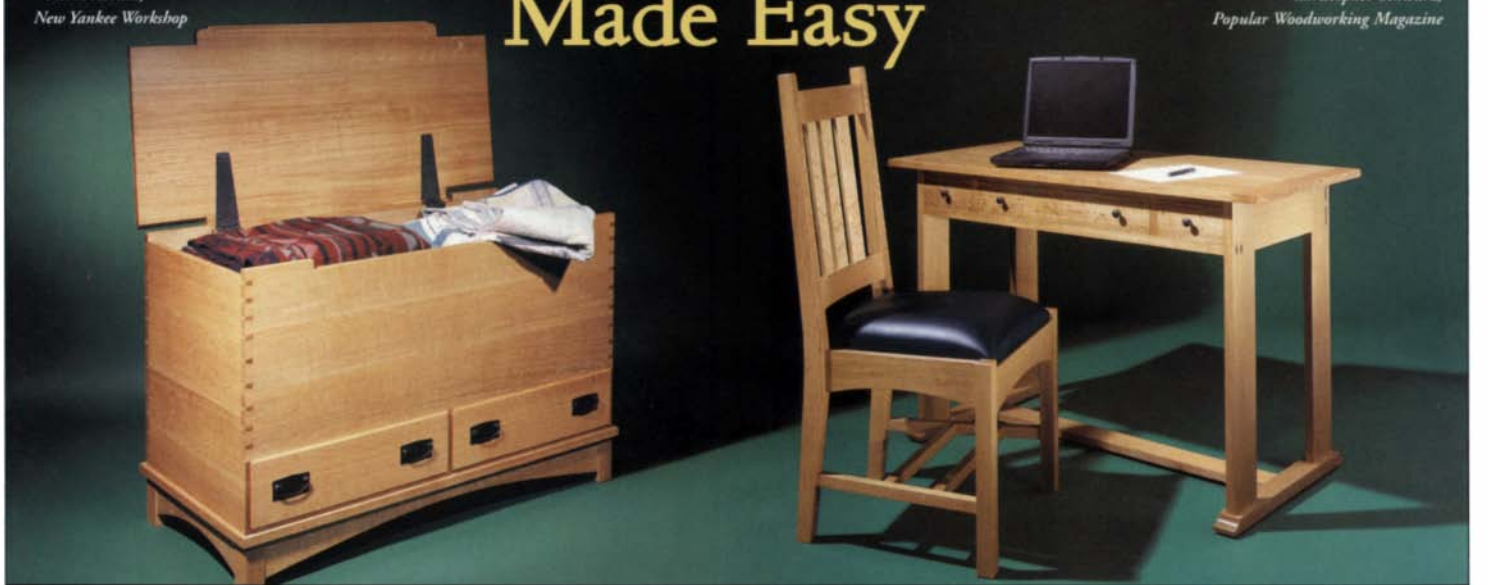

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BEST NEW TOOL 2004 WORKBENCH TOP 10 TOOLS

Head to Head

Rust removers do their job

Condensation from damp weather and basement-shop environments often leads to problems with rust on tools and machinery. Left unattended, extensive rust can ruin a tool or produce a pitted tabletop. Here are a couple of products for woodworkers who must deal with rusted surfaces.

EVAPO-RUST

I first got wind of this product by reading a post about it on the Knots discussion board (www.finewoodworking.com), so I tried a sample. I soaked part of a severely rusted engineer's square in a beaker of the solution for 20 minutes, and then wiped away all of the surface rust with a rag. As long as you saturate the rusted surface and give Evapo-Rust time, the stuff works. I'm not a chemist, so I can't tell you how; you can read the manufacturer's description at www.evapo-rust.com. By the gallon, Evapo-Rust sells for about $22. Check the Web site for distributors, or call 888-329-9877.

Let it soak. *For Evapo-Rust to do its job, rusted metal must be immersed in the solution for 20 minutes or more.*

TOPSAVER

TopSaver may be familiar if you've been to a woodworking supply show. I tested the product on a rusted shaper tabletop. It took a couple of applications, and I had to scour the surface vigorously with the abrasive pads supplied, but I was able to remove most of the surface rust. A kit with scouring pads, towels, and an 8-oz. bottle of TopSaver sells for around $20, and you can also buy it by the gallon for $130. TopSaver is available at woodworking supply stores and directly from the manufacturer. For more information, visit www.empiremfg.com or call 866-700-5823.

– William Duckworth is a contributing editor.

TopSaver requires some elbow grease. *Spray the solution on the surface and scour it vigorously with synthetic steel wool. More than one application may be necessary.*

HAND TOOLS

A BETTER SCREWDRIVER

Last year Sears decided to redesign some of its hand tools. The new Craftsman Professional screwdrivers have a greatly improved grip: The rubberized plastic handle fits comfortably in hand. Another improvement are the hardened tips, which should last a lifetime. On the larger sizes, hex heads at the base of the shaft allow you to use a wrench for added torque. A 10-piece set sells for $60 (800-377-7414).

–W.D.

Ergonomically pleasing. *The tapered handle and rubberized grip allow for greater torque.*

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HAND TOOLS

TRADITIONAL TENON SAW IS SHARP AND ACCURATE

Thomas Flinn Sawmakers looked to 18th-century Sheffield, England, for design inspiration for the new PAX 1776 line of saws.

The PAX brass-backed tenon saw I tried sets a high standard of quality, performance, and design. Its thin 10-in. blade, made from alloy steel, had been precision ground and polished. The 15-tpi blade had been filed for a crosscut and given a minimal set that produces a narrow kerf of roughly 0.026 in. The blade is held in tension by a hefty back made of folded brass. I found the PAX saw surprisingly rigid for having such a thin blade.

The blade and back in the PAX tenon saw are secured to the handle with two brass screws. The handle is made of English elm, a strong and attractive wood. The comfortable handle, the angle at which the handle is secured to the blade, and the weight of the brass back all give the saw a nice balance.

With this saw, it was extremely easy to start the cut, and the saw tracked a line smoothly throughout the cut. The PAX tenon saw is well suited for dovetailing and cutting small tenons, but its 10-in. blade would be challenged by larger tenon work.

The blade can be purchased with either 15 tpi or 20 tpi and filed both rip and crosscut. The saw is available from www.thebestthings.com and www.toolsforworkingwood.com.

—CHRIS GOCHNOUR teaches woodworking and builds furniture in Salt Lake City, Utah.

Made the old-fashioned way. *The thin steel blade is made rigid by a folded brass back on these tenon saws, which also excel at dovetails.*

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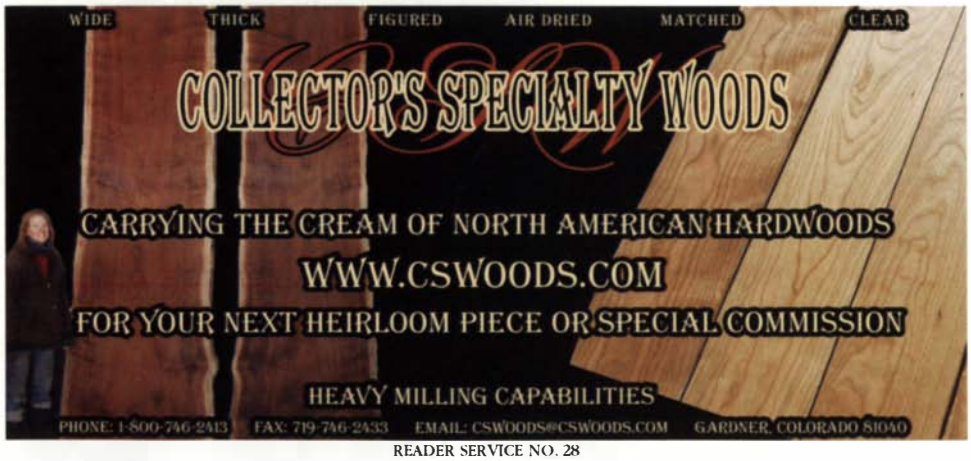

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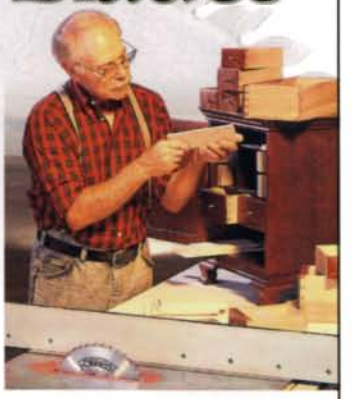

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Surviving Glue-Ups

A guide to stress-free gluing and clamping

BY GARY ROGOWSKI

No movie chase scene could provide as many heart-pounding thrills as gluing up a project in the woodshop. After weeks of effort and preparation, all of your careful work comes down to 15 minutes of heart-palpitating frenzy. Few other things in life can compare to this, except perhaps getting to the airport late for your flight.

Just as there are strategies for milling lumber and cutting joinery, there are strategies for gluing that increase your chances of success. Organizing your tools beforehand, planning for contingencies, gluing up in stages, applying glue intelligently, and practicing assembly techniques will help you to avoid most of the stress of glue-ups. Notice that I did not say all

GLUE

Which type of adhesive to use depends on several factors: strength, open time, clamp time, and appearance. For 90% of my projects, yellow glue has proven to be great. However, it has a short open time so you must be prepared to work quickly once you wipe it on.

Photos: Asa Christiana, except where noted

Essential clamps and supplies

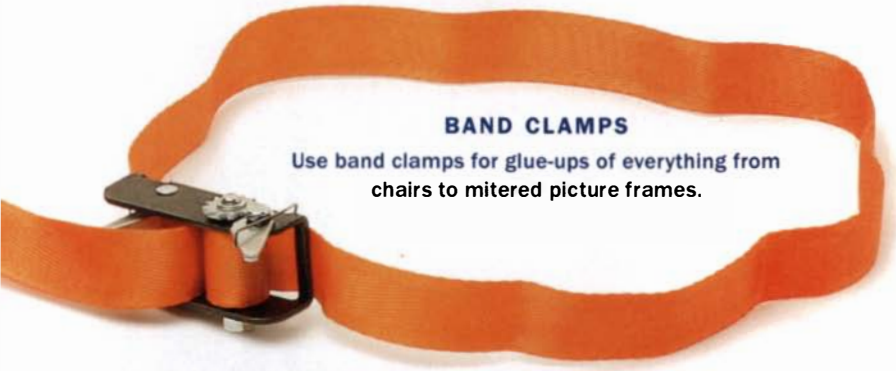
Like everything else in woodworking, successful assembly depends a lot on having the right gear. This includes the right type and number of clamps, the right clamp pads and cauls, the right mallet, and the right gluing accessories.

LIGHT-DUTY CLAMPS

For simple assemblies, spring clamps will suffice. For slightly larger glue joints, small, sliding-arm bar clamps will work. Have an array of these from 6 in. to 18 in. in length.

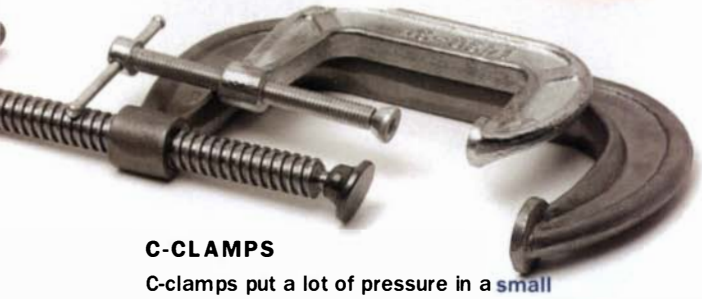
HEAVY-DUTY CLAMPS

For bigger jobs like pulling together frames, carcases, or panels, you'll need heavy-duty bar or pipe clamps of sufficient size and length. Use a threaded pipe coupler and pipe that is threaded at both ends to make two shorter bar clamps into a long one.



BAND CLAMPS

Use band clamps for glue-ups of everything from chairs to mitered picture frames.



C-CLAMPS

C-clamps put a lot of pressure in a small area, and work for both light- and heavy-duty clamping. Be sure to use clamping pads, as C-clamps can mar the work surface.

HAND SCREWS

Wooden hand screws won't mar the workpiece, but practice closing them before the glue-up. They can provide light to moderate pressure over a wide area.

DEADBLOW MALLET

Persuasion comes in many forms. Rather than using a framing hammer and a block of wood to protect the work surface, use a deadblow mallet. They pack a wallop without leaving marks.

GLUE BOAT AND STICKS

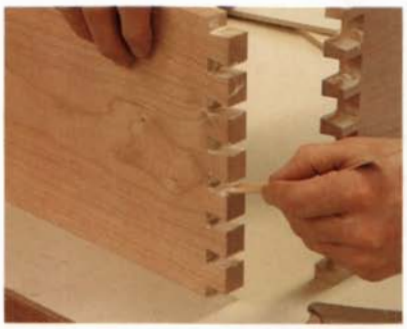
To make the glue accessible, use a glue boat of some sort—a plastic lid, a folded-up piece of cardboard. To avoid getting glue on your fingers, spread it with wood sticks.

CAULS

Clamps often need help to do their jobs properly. Clamping cauls vary from thin, protective pads to curved and angled pieces that redirect or distribute clamping pressure. Use cauls made of melamine or cover the cauls with tape so glue won't stick to them. Thin, flat strips of wood will protect your project, while thicker cauls will spread clamp pressure. Save your bandsawn offcuts to act as shaped cauls.

Photos this page: Kelly J. Dunton

DOVETAILED CASES: APPLY GLUE SPARINGLY



Avoid squeeze-out inside the case. *Apply glue to the cheeks of the pins and tails, but put only a dab on the outside edges of the end grain. Drive the joint home with a deadblow mallet, which won't mar the workpieces. Wipe away the squeeze-out before clamping.*

of it. Most of these important factors come under the heading "preparation."

Preparation is the key to success

The assembly of your project may be the most important job you face during its construction. Before you squeeze out any glue, check that your assembly tools are at the ready. This will save you precious time during glue-up. It also may send you to the store to get the right tools for the job.

A lamentable truth is that you will never have enough clamps. Get over it; it's true. Choose clamps appropriate for each job, and buy as many heavy-duty ones as you can afford. Before using clamps, unscrew them as much as possible so you have plenty of adjustment available, and arrange them so that the head and tail stops are at the proper distance.

Different clamps have different jaw depths. Put clamps on your project to check that you'll get pressure where you need it. Make sure any caul or clamp pad you use is free of dried-up glue. Nothing dents wood as well as that hard old stuff.

This may seem simple, but number the parts clearly so there is no confusion when you are under the gun. There is no worse feeling than finishing your clamping only to discover that tenon A is in mortise C. Use big, bold letters or numbers. You won't have time in the midst of your gluing frenzy to look for neat little script.

In every case, do a dry run to make sure everything is in order beforehand. Check the parts to see that they are not twisted or bowed by the clamping pressure. Adjust the pressure to keep frames flat while still pulling them tight at the joints. This may mean changing the position of the clamp heads.

Just enough glue, just where you need it

The age-old question asked by most new woodworkers is: How much glue should I use? The age-old answer is: Just enough. Unfortunately, experience is the best teacher. I used enough glue on my first large bookcase to glue three of them together. More glue is not usually better, and the cleanup can be time-consuming and difficult, especially if you are following with a finish (such as oil) that highlights glue residue.

A little bit of squeeze-out is what you're shooting for in most situations. Let the glue dry until it's reached a plastic state. Then it can be lifted from the surface of the wood with a sharp chisel or scraper. Do not wet a rag and smear the glue around unless you're painting the piece or you have no other choice. If the glue does dry completely, you'll have to get it off. Dried glue is hard, so in this case use your second-best chisel, one that you don't mind resharpening often.

The best glue joint is long grain to long grain, so don't worry about gluing

Use melamine cauls and check the diagonals. *On dovetails, Rogowski keeps the long grain proud, which allows him to use flat cauls. Later, he planes the sides flush with the pins and tails. If the diagonals don't match, use a long clamp to draw the assembly square.*

end-grain surfaces unless that's all you've got to work with.

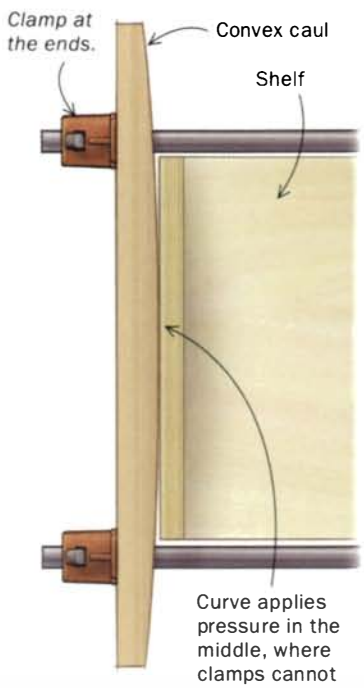
There are a variety of gluing situations, but I've drawn up a few of the more common scenarios that you'll run into. Advice on these specific glue-ups can be applied to many variations.

Dovetailed cases: Keep glue on the outside

Carcase dovetails usually need some clamping help to come together. I like to leave the long grain of the case just slightly proud of the end grain so I can put a flat caul right over the joint. If you leave the pins and tails proud, you'll have to use notched cauls for clamping. I also find it easier to plane the long grain flush than to work on the end grain of protruding pins and tails.

Dovetails can be a messy glue-up. Use melamine cauls or cover the cauls with tape so they won't become glued to the

PLYWOOD CASES: CURVED CAULS REACH ACROSS LONG SHELVES



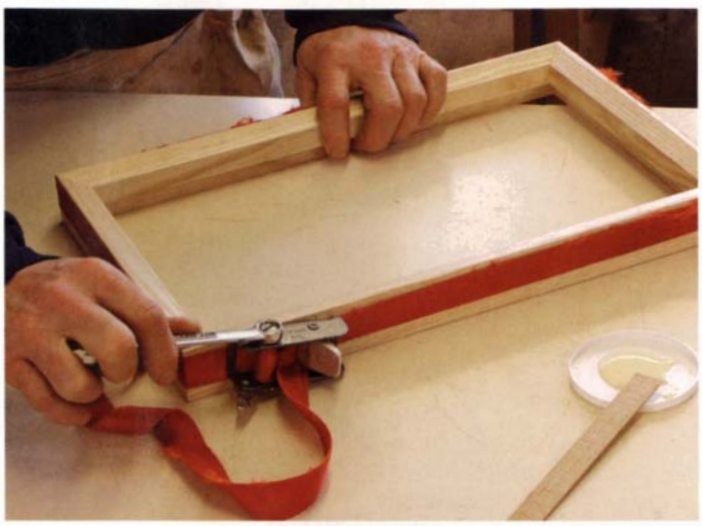
Glue large cases in stages. *Here the case is upside down, and the top panel is only dry-fit in its rabbet, while the other panels are glued. To apply pressure along the entire edge of the middle shelf, Rogowski uses a convex caul.*

Drawings: Chuck Lockhart

Miter joints

BAND CLAMPS HANDLE MOST PICTURE FRAMES

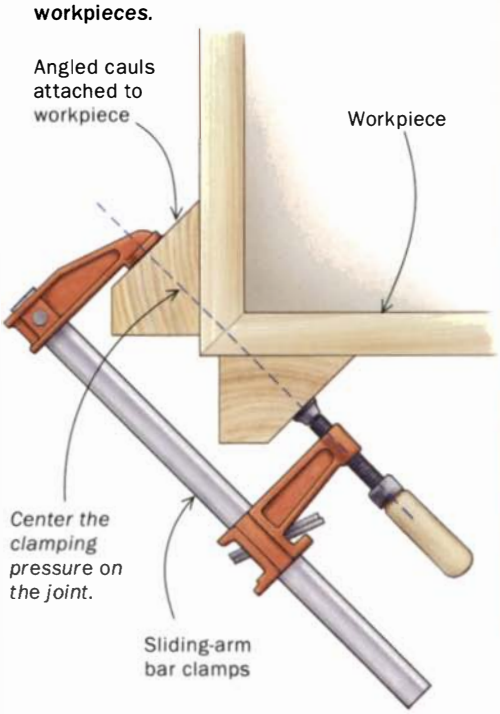
Size miters to avoid starved joints. *Size is a preliminary coat of glue that seals the end grain. Scrape away any excess and wait a few minutes before applying glue again.*

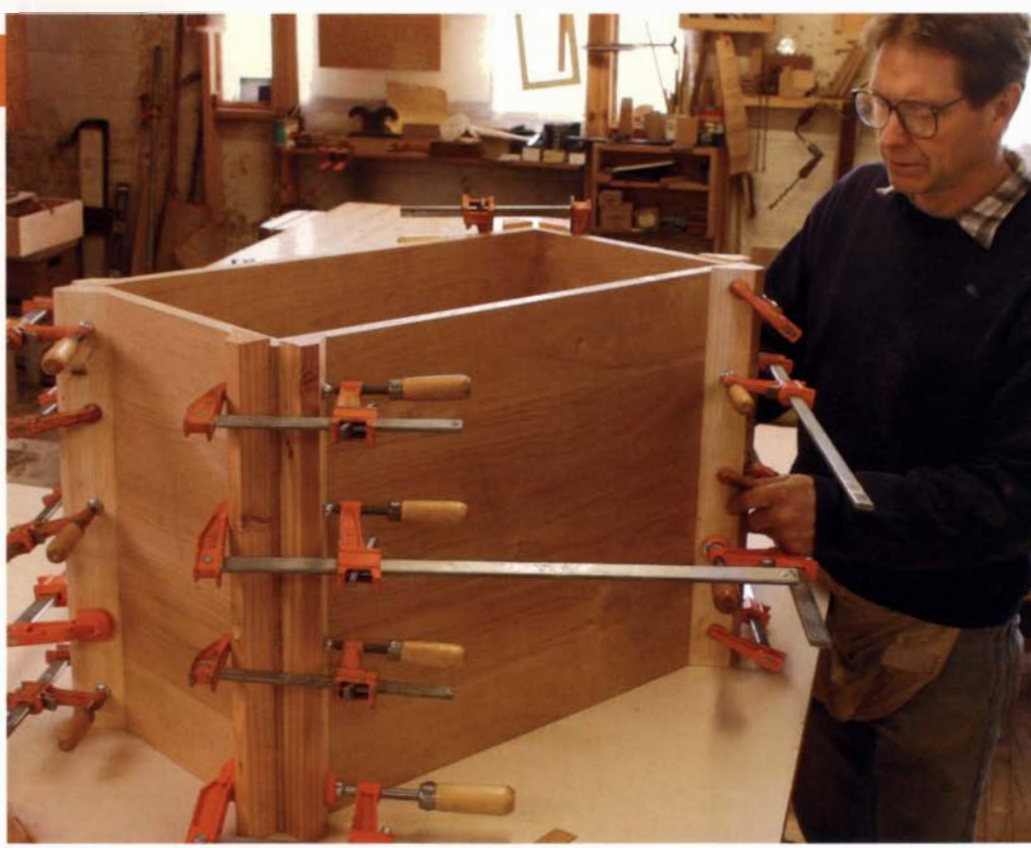


A band clamp makes tight miters. *This one, from Jorgensen, is ratcheted tight with a small wrench.*

BAR CLAMPS ARE A BETTER CHOICE FOR MITERED CASES

Use these with angled cauls to ensure that miters close completely and accurately. Cauls can be glued, taped, or clamped to workpieces.





Attach cauls onto large mitered cases. *Angled cauls direct clamping pressure through the joints. If you glue on the cauls, make them out of a softer wood so they are easy to remove.*

case. Put glue on all of the long-grain surfaces but only lightly touch the outer half of the end-grain surfaces with glue. Gluing the end grain doesn't help and causes a lot of squeeze-out inside the case.

Plywood cases: Curved cauls spread pressure

Everyone builds plywood boxes eventually. In some cases, you can use simple butt joints and biscuits to join the pieces. If the cabinet is going to be painted or if the sides won't be exposed, you can use screws or nails to hold the biscuited assembly together while the glue dries.

However, for maximum strength and clean looks, you probably will opt for rabbet and dado joints, and you'll need clamps for the glue-up. In that case, you'll have to plan the assembly more carefully.

For deep cases, use convex curved cauls, which will extend pressure to the center of interior panels. Curved cauls also can distribute pressure along a long edge, bailing you out if you don't have enough bar clamps. You can curve a caul with a few passes of your handplane or belt sander.

Put glue in the rabbet and dado joints, with just a touch along the end grain of the

BLIND TENONS ARE STRAIGHTFORWARD

The mortises get the glue. *Handle the pieces carefully so the glue doesn't drip out. To minimize squeeze-out, the tenon cheeks get just a touch of glue, and the shoulders get none.*

Glue up table bases in stages. *This allows you to check and adjust the flatness and squareness of subassemblies before the final assembly.*

horizontals. Excess glue will squeeze out into tight corners, causing problems later. After clamping, check the diagonals and make any necessary adjustments.

Use glue size to avoid starved miters

Large, mitered solid-wood carcases will test your band-clamp supply. If you don't have enough, glue angled cauls directly onto the case and use small clamps to put pressure exactly where you need it. Attach the cauls with hot-melt glue, double-stick tape, or even a thin bead of yellow glue. If you use yellow glue, make sure the caul is a wood that's softer than your project stock. After the glue has cured, you can take a chisel and knock off the bulk of the cauls. Clean up any wood sticking to the carcase with a handplane or belt sander.

Miters soak up a lot of glue, so apply a preliminary coat of glue---called size—to close up all of the porous end grain.

I use band clamps to close up mitered picture-frame-type joints, but there are other good methods. One strategy I've used is to make thick cauls with V-cut notches in them at each end. Clamp these cauls to the two mating pieces, with the notches

THROUGH-TENONS SQUEEZE GLUE WHERE YOU DON'T WANT IT

Seal the end grain of through-tenons with shellac. *The ends always wind up with glue on them, which soaks quickly into the grain, where it can interfere with the final finish. Use clamps to pull the tenon evenly and safely through the mortise. Wipe away the squeeze-out as soon as possible.*

Sliding dovetails

A QUICK AND EASY METHOD FOR DRAWERS

To begin assembly, clamp the drawer face to the bench. *Apply a good amount of glue to the female part of the joint but just a touch of glue to the male part.*

Use pipe clamps to drive the dovetail home. *Have another one ready to finish where the first clamp leaves off. With steady, focused pressure, the joint won't bind. The small dovetailed strip taped to the drawer side protects it as it is driven fully home.*

positioned over the glue joint. Then clamp across the notches.

Blind mortise-and-tenons: Put more glue in the mortise

Different mortise-and-tenons require different gluing strategies. The two basic types involve through-tenons, which we'll deal with shortly, and blind tenons. A blind tenon ends inside the mortised piece. A good example is a standard table base.

Put glue in the mortises all the way to the bottom, with a little bit extra near the mouth. Then just kiss the tenon cheeks with glue right before pushing the joint together. Do not put any glue on the end-grain tenon shoulders or mortise ends because those surfaces won't do much holding, and you're just asking for more squeeze-out.

Make sure the rail, when assembled, is a bit higher than the ends of the legs. This way, the joinery will be easy to clean up using a handplane. Otherwise, you'll have to remove end-grain wood from the tops of the legs. Check that the legs don't twist when you apply clamping pressure.

Through-mortises and -tenons: Seal the end grain

Through-tenons squeeze their way through a glued mortise like a car through a car wash. They come out completely wet with glue. Almost inevitably, your carefully crafted tenon end will develop blotches

The drawer back also is dovetailed. *Use two clamps to push the workpiece evenly downward. Note the small slip of wood used to align the slots for the drawer bottom.*

Edge joints

STRAIGHT PIPE CLAMPS MAKE FOR FLAT PANELS

Run a bead of glue and spread it. *Rogowski props the middle board against the bench to apply glue to both edges. Rubbing the edges together creates a good glue bond.*

Be sure the boards are seated on the pipes. *Use C-clamps and pads to align any wayward edges. Cover black pipe at the glue joints with tape or clamp pads, so that it doesn't stain the wood.*

where the glue soaked in and prevented the finish from penetrating.

Plan ahead by prefinishing the tenon end and any other part of the tenon that will show. Apply several coats of thinned shellac to seal it completely, being careful to keep the finish off the gluing surfaces. Later, you can follow with any other finish. Wet down the entire tenon with glue, but put less in the mortise.

Sliding dovetails: Use steady clamping pressure

This joint makes for quick drawers (among many other uses), often with metal drawer slides placed in the extra space along the sides. But sliding dovetails can be a challenge to glue. I'm lying—they're much worse than that. If they fit properly, there's no way to get them home without applying steady, perfectly centered pressure. A clamp is better for this than a mallet, which can force the parts in crookedly, causing them to bind.

Pipe clamps offer a long screw length, which is important for keeping the joint moving steadily over a longer distance. Have two pipe clamps ready to go.

Spread glue into the female part of the joint, with just a touch on the male part, and start driving the joint home with a pipe clamp. Do not take any time to scratch your nose; the joint will swell up and be tough to get moving again. When one clamp runs out of thread, grab another and keep that drawer side moving until it's in place. Breathe.

Panels: Check for flatness

Edge laminations should come out flat. But they will not if your assembly table is not flat, if your clamps are not straight, or if your wood isn't true. Check those things first. Have pipe clamps ready to go. To avoid staining the lumber, put tape on black pipe clamps where they contact the glue joints or use galvanized pipe.

Make sure all of the boards are numbered or the joints marked so you know how the pile of lumber goes back together.

Keep a deadblow mallet close by as you apply pressure to persuade the faces to line up. If they won't, a C-clamp on the ends will pull the faces into line. The right amount of clamp pressure for panel glue-ups is the maximum force you can apply comfortably with your off hand (I'm right-handed, so everything is left-hand tight). Make sure the boards are sitting flat on the clamps. Bang them down if they're not.

Let glue stiffen before removing it. *Wait 15 or 20 minutes, and the gelled glue will peel off easily with a sharp paint scraper.*

If you are helping a friend glue up a project, you will marvel at how calm you remain while he or she is going nuts. And the reverse is also always true. So, to keep your blood pressure low, plan ahead. □

Gary Rogowski operates The Northwest Woodworking Studio, a school in Portland, Ore.

User's Guide to Plywood

For furniture makers, sheet goods offer strength, stability, and good looks

BY ROLAND JOHNSON

BALTIC BIRCH

Numerous layers of birch, alder, or both yield exceptional stability, strength, and density. Baltic birch is especially suited for building drawers. Check sheet sizes before ordering; several manufacturers produce only 5x5 sheets. Similar products are known as ApplePly, Europly, Russian, or Polish birch.

As much as I enjoy building furniture out of solid wood, there are times when it is not the best choice of material. When I make built-in cabinets or large tabletops, I turn to plywood. Its sandwich structure of thin veneer layers, with the grain oriented at right angles, makes plywood flat and stable. When faced with a high-grade hardwood veneer, plywood looks good and saves time and money.

Plywood also is structurally stronger than natural wood and has excellent screw-holding capabilities. It is also ideal for door panels, frame panels, drawer bottoms, and cabinet backs. As a shop resource, plywood makes strong and stable jigs and fixtures that are inexpensive to build and easy to modify.

How plywood is graded

The best way to buy plywood is to select sheets individually from a dealer with a good inventory. If that is not possible, it helps to know what to ask for.

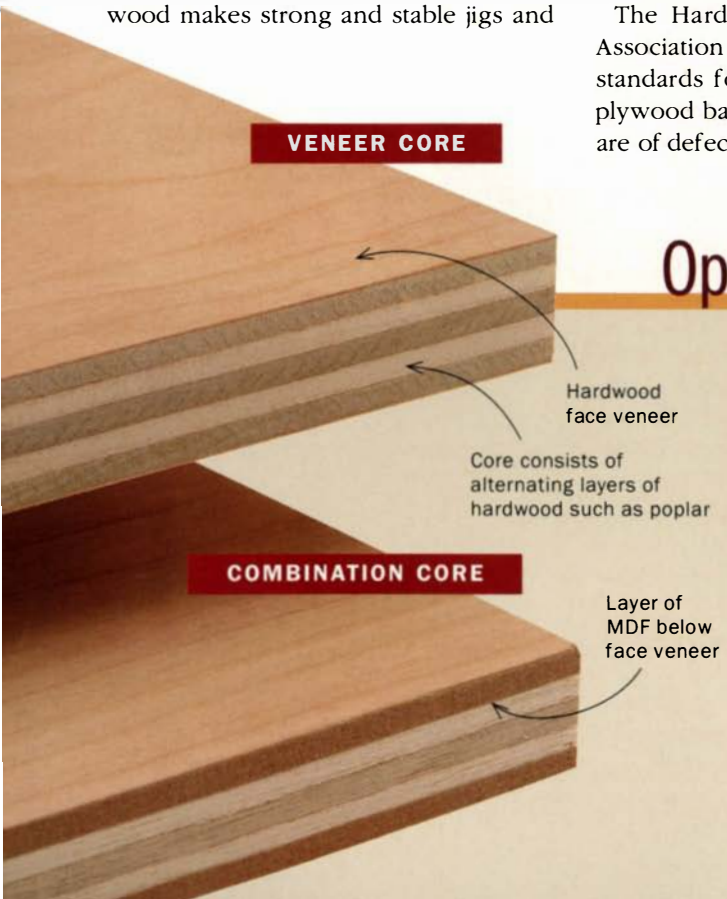
If you're ordering plywood sight unseen from a distributor, you'll want to specify several things, including the quality of the veneer on the sheet's face and back (the face is generally better looking) and the composition and quality of the plywood's inner core.

The Hardwood Plywood and Veneer Association (HPVA; www.hpva.org) sets standards for grading hardwood-veneer plywood based on how free the surfaces are of defects such as knots, patches, and color variations. Grades for face veneer begin with AA for the best quality and run down to grade E, which can include unlimited color variations and patches. The back veneer is number graded, with grade 1 being the best and grade 4 allowing knotholes, splits, and other defects.

You also should select plywood with a core that's as uniform and free of voids as possible. In the HPVA grading system, J signifies the best core material with no voids in the plies. Cores step down in quality to grade M.

This system occasionally changes, and other types of plywoods, such as Baltic birch, or ApplePly, use their own grading systems. When in doubt, ask your distributor how the product is graded.

When I order plywood, I prefer to let the lumber dealer determine the correct grade



Options for hardwood-veneer plywood

Furniture makers are most likely to use plywood made with a hardwood face veneer. Domestic hardwoods are the most readily available as face veneers, although exotic species may be special ordered.

VENEER-CORE PLYWOOD stays flat, holds a screw well, and is reasonably lightweight. This material is ideal for building cabinet cases. Panels, partitions, and cabinet floors can be cut to size quickly and assembled into strong, light boxes. Veneer-core plywood also can be used to make cabinet tops and tabletops, but they'll need solid-wood edging and a durable finish to protect the thin face layer.

COMBINATION-CORE PLYWOOD has an MDF layer between the inner plies and the hardwood face veneer, which eliminates voids and ensures that grain from underneath won't cause imperfections in the top layer. Combination core can be used anywhere veneer core is used. It's not much heavier than veneer core, with similar screw-holding ability and less tearout when sawing.

Photos, except where noted: Steve Scott; this page, facing page: Michael Pekovich

MEDIUM-DENSITY OVERLAY (MDO)

MDO combines a veneer core with a top layer of kraft paper impregnated with waterproof glue. This provides a flat, smooth surface favored by outdoor sign makers; it is absolutely waterproof. MDO is great for furniture panels that will be painted or that don't require the look of wood grain. It is ideal for painted outdoor furniture.

BENDING PLYWOOD

Bending plywood can conform to a tight radius without splitting because the grain in all of the veneer layers runs in the same direction. This material is indispensable for making curved doors and panels. Once laminated or veneered (a vacuum bag is best), it will hold the intended shape. Thicknesses range from ⅛ in. to ⅜ in., and species include poplar, birch, okume, and lauan. It comes in 4x8 sheets with grain running either the length or width of the sheet.

for my application. I tell him what I need, such as cherry veneer-core plywood with plain-sliced veneer, both sides good. Most likely the product will be A1, VC (veneer core) Cherry PS (plainsawn), but that may be simply how my sheet-goods distributor has it set up in the inventory system.

Tips on cutting big sheets safely and without tearout

Plywood sheets are awkward and heavy. It's always a good idea to work with a helper while making your first cuts in a full sheet. If help is not available, set up sawhorses with height extensions, movable workbenches, or whatever it takes to support the sheet both before and after the cut.

The worst kickback I have experienced occurred when I tried to rip an edge off a half sheet of plywood without adequate support. The tablesaw sent the half sheet and me flying to the shop floor with damage to both me and the plywood. The floor survived intact.

For ripping or crosscutting plywood cleanly, use a triple-chip blade with a high tooth count (80 teeth on a 10-in. blade is not uncommon). Be aware of the rotation of the blade and the good veneer face of the plywood. When cutting on a tablesaw, the good veneer should face up; with a circular saw, the good veneer should face down.

For especially delicate face veneers that are prone to tearout when crosscutting, I sometimes scribe the face veneer with a sharp utility knife before cutting. This procedure is very fussy, and absolute accuracy is a must, but it does work.

A handheld circular saw will quickly reduce full sheets of plywood into more manageable sizes. If possible, cut the pieces about ⅛ in. to ¼ in. oversize and

Elegance in sheet goods. *The back and door panels of this cherry cabinet were made from ¾-in.-thick veneer-core plywood with a book-matched face.*

Veneer can be taken off the log in several different ways, and each method yields its own distinctive look. The most common types of face veneer are rotary cut; plain, or flat sliced; and rift cut. There are also several methods for matching the veneer on a panel face: book matching, slip matching, and random matching.

CHOOSE FACE VENEERS BY CUT AND MATCH

BOOK MATCHING is accomplished by turning over every other sheet of veneer for a face that resembles the opened pages of a book, with opposite patterns identical.

SLIP MATCHING uses progressive veneer sheets joined side by side, with the same sides facing up. Book matching accentuates the grain, while slip matching tends to appear uniform, more like solid wood.

RANDOM MATCHING is as it sounds. Sheets are randomly assembled, with the chance of veneer from several logs on one face. This method can lend a very real laminated look, but it also can lead to multiple color and grain patterns in one face.

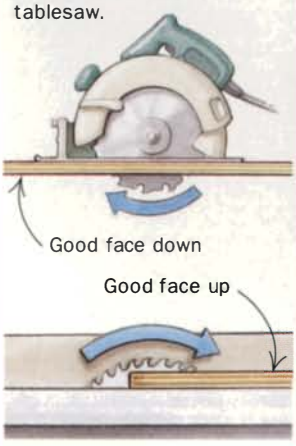
CUTTING IT DOWN TO SIZE

Ripping. *Large sheets can be ripped safely on the tablesaw, but make sure you have plenty of room on the outfeed table.*

Crosscutting. *For longer pieces, use a circular saw with an edge guide clamped to the stock (right). Shorter stock can be cut on the tablesaw with a crosscut sled (below right).*

WHICH SIDE UP?

To minimize tearout, orient the show face down when cutting with a circular saw and up when cutting with a tablesaw.



make the finish cuts on a tablesaw. I use a straightedge clamp (Tru-Grip) as a guide for the saw.

On the tablesaw, a zero-clearance throat plate will help control tearout, at least when the plate is new and the clearance is still close. If you have a large production run that justifies the expense, you might consider a scoring-blade attachment (a small-diameter blade that rotates opposite the main blade and precedes it during the cut) that helps minimize crosscut tearout. Modulus makes an attachment that fits most cabinet and contractor-style saws (Modulus SS-100, available from Woodworker's Supply for around $450).

Best joints for plywood

Because plywood does not have continuous grain orientation throughout its thickness, it does not lend itself to all of the same construction techniques as solid wood. Plywood faces can be glued together with good results, but edge-to-edge or edge-to-face joinery must be mechanically or structurally secured.

For joining two edges or an edge to a face, biscuits provide moderate strength. However, because the joint is shallow, it can be pried apart by leverage (heavy books in the midspan of a biscuited shelf, for instance).

Dadoes add great strength in edge-to-face joints, so they are especially effective for use in shelving or cabinet partitions.

Butted corners and edge-to-face joinery without a dado or biscuits need to be mechanically fastened with screws or nails to provide a secure joint.

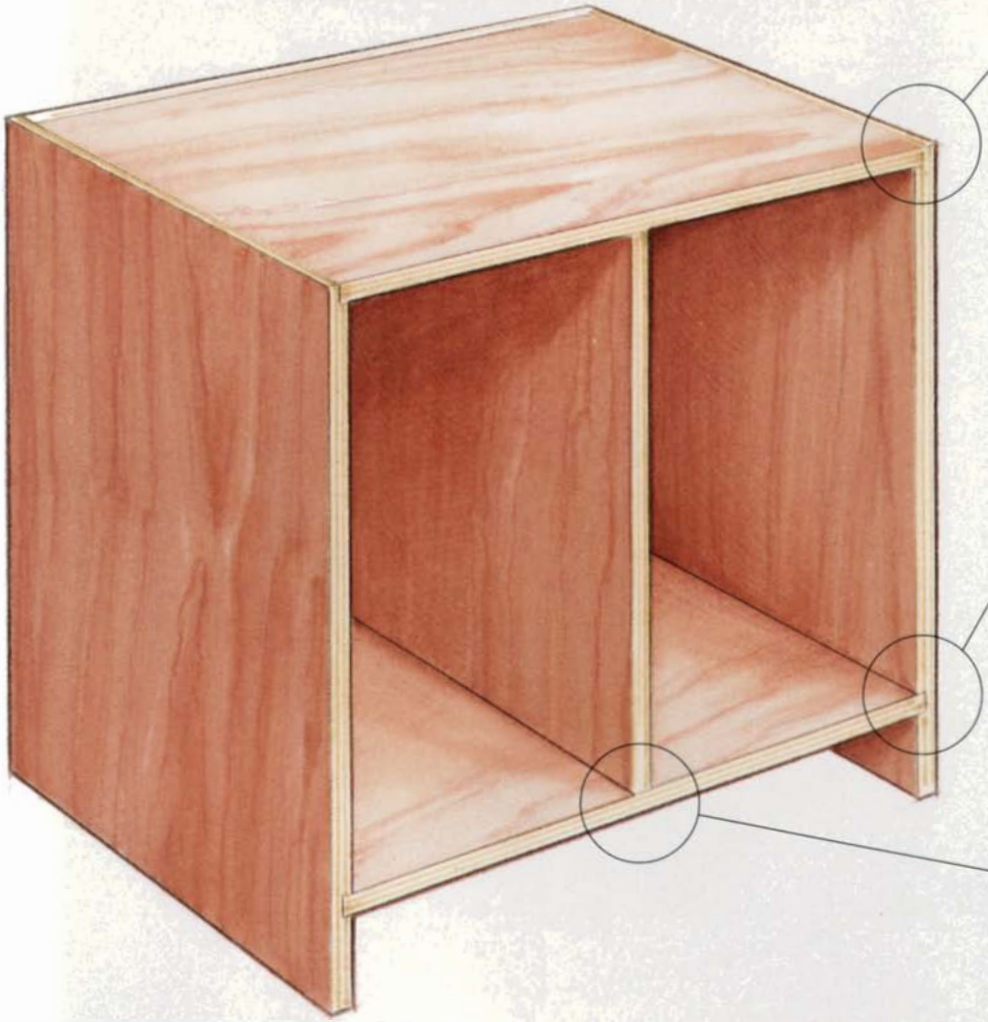
Half-lap or rabbet joints work reasonably well as long as there is not great twisting pressure applied to the joint, which could cause splits to develop in one or more of the cut veneer layers. This joint has good shear strength, meaning it won't tend to fail when loaded heavily at the point where the two pieces meet.

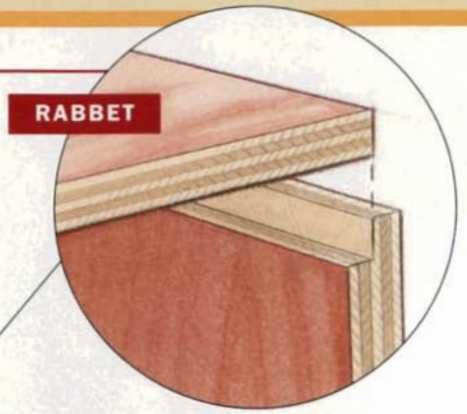
Edging hides the ugly layer lines

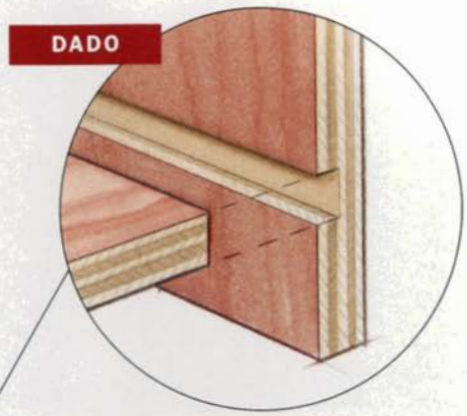
Because of the layered core, the edge of a sheet of plywood is not particularly attractive. Fortunately, there are several ways to conceal it. Cabinets typically are

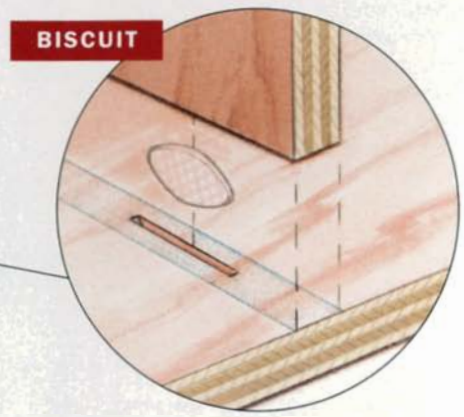
JOINERY FOR PLYWOOD

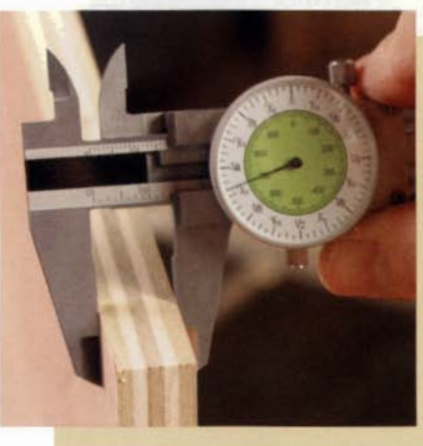
Plywood cases can be assembled using a variety of joinery techniques, including rabbets, dadoes, and biscuits. A rabbet joint's structure makes a stronger corner than a simple butt joint. Dadoes provide great strength in edge-to-face joinery. Biscuits work well for edge-to-edge or edge-to-face joints. They aren't as strong as dadoes or rabbets, but they're useful for keeping adjoining surfaces properly aligned.











Cutting accurate dadoes

Plywood rarely measures up to its stated thickness, so standard dado-head widths can yield sloppy joints. For a snug dado, start by gauging the thickness of the shelf or partition. Then install enough chippers to get close to this mark, and use shims to fine-tune the width of the dado. Another option is to cut dadoes with a router, using a straight bit sized specifically for plywood. A number of manufacturers offer undersize bits to accommodate common plywood widths.

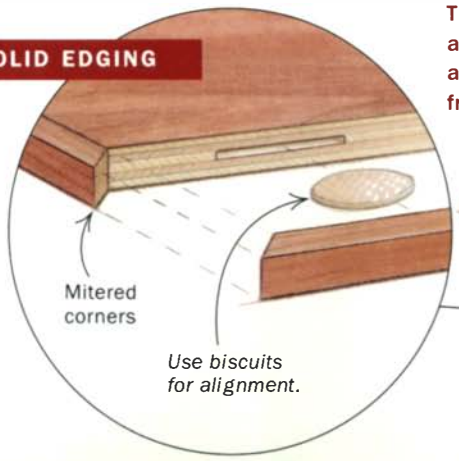
Shim for a perfect fit. *Because plywood is often narrower than its stated size, shims are needed to create a dado of the correct width.*

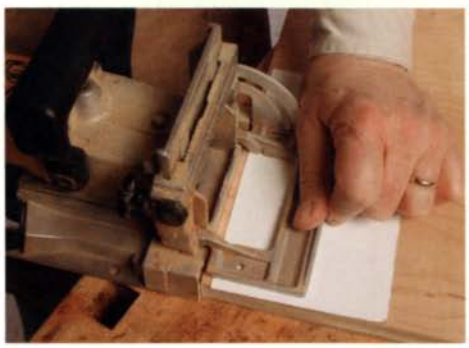
Drawings: Bob La Pointe

Hiding unattractive edges

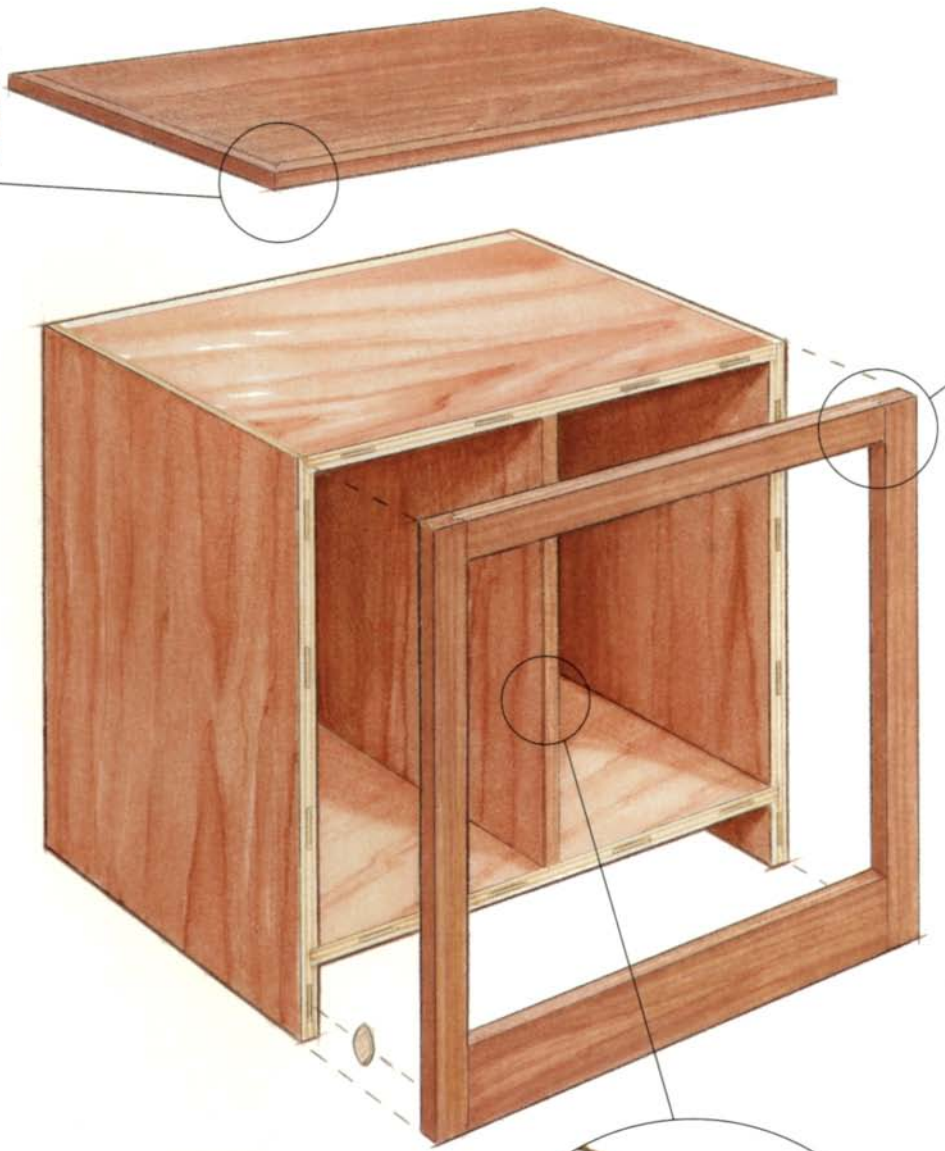
There are a few ways to hide the wood-sandwich edges of plywood. Solid-wood edging is appropriate for high-wear edges, such as on tabletops, and can be profiled with a router after installation. Iron-on veneer tape is adequate for shelving or case partitions. A face frame will give a more refined look.

SOLID EDGING



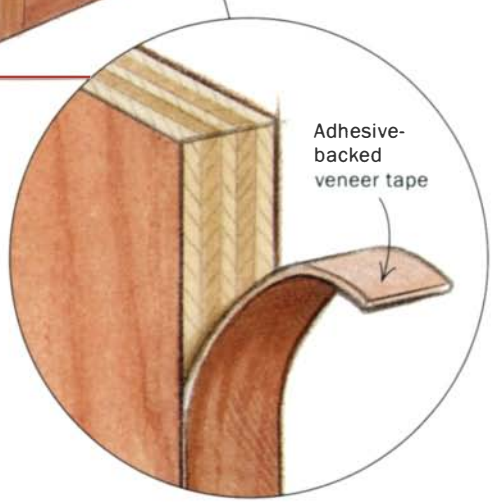


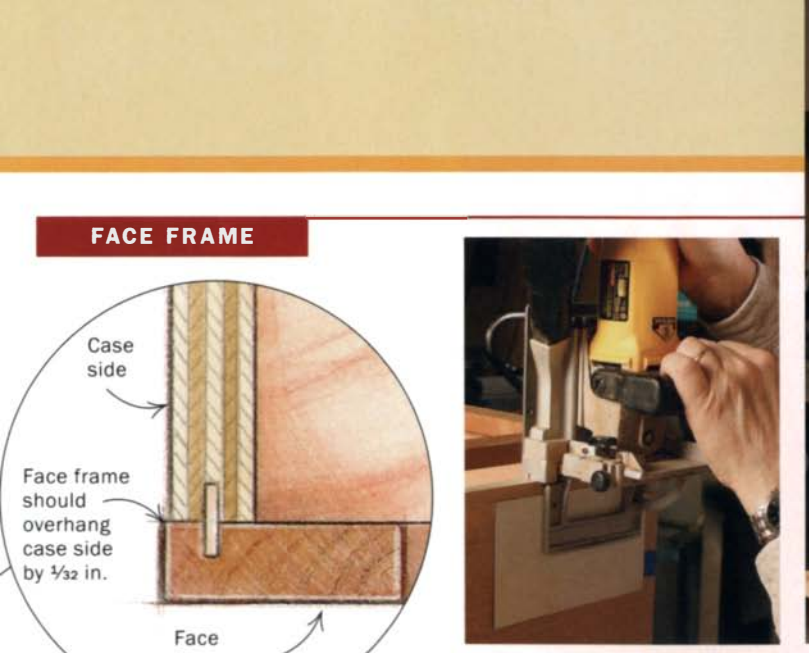
Biscuits align solid edging. *Use card stock as a shim when slotting the plywood (above), but not on the edging. Milled slightly thicker, the edging will stand proud of the top. Plane each edge flush before gluing (right).*



IRON-ON VENEER

Iron-on veneer edge-banding. *The material may be bonded with the use of a household iron. Trim the edges flush with a handplane or specialty trimmer.*





Build the face frame oversize. *To create an even overhang on each side, use a card-stock shim when biscuiting the case (above left). Glue and clamp the face frame to the case (above right). Use a block plane to bring the face frame flush with the case side (left).*

covered with face frames. Solid or veneer edge-banding usually is applied to shelves or tabletops.

Edge-banding with a heat-sensitive glue back can be purchased in most domestic and some exotic woods. Shopmade solid edge-banding usually is attached to plywood with yellow glue (aliphatic resin). When using thick edge-banding, apply glue to both the banding and the plywood because the end grain readily absorbs glue.

Edge-banding typically is wider than the plywood is thick, so it must be trimmed flush to the plywood's edge. Sounds easy enough, but the process is always a nail-biting experience because of the fear of damaging the plywood. Most often, I trim the edge-banding flush with a well-tuned block plane, working from the sheet out across the banding. With a little practice, it's relatively easy to trim the edge perfectly flush without gouging the face veneer. A router with a flush-trimming bit will work fine, but it's often not as handy to use as a block plane.

A clean surface is an important starting point if the cut edge will be banded. The edge of a sheet of plywood is often damaged or dirty. Try to cut away these damaged edges as you're cutting the plywood to size. Start by ripping a little wider than needed, and then trim the edges for a final cut.

I used to use a belt sander to level edge-banding with the plywood, a risky procedure because it's easy to ruin the plywood face with this aggressive machine. My technique was simple. I scribbled on the plywood with a graphite pencil, making lines that came up to the back edge of the banding and extended 5 in. or 6 in. into the plywood. These reference lines let me know whether the belt sander was staying flat or tipping into the plywood, and saved me lots of veneer sand-through.

Sand with care

Generally speaking, I'd stay away from sanding plywood with a belt sander. If you're not careful, you could sand through the face before you know it. On the edges, the sander can tip over easily and erase the thin veneer there. I use a random-orbit sander instead.

Always follow the grits in order, and don't skip any. Start with P120 grit to clean up marks and small dings, work quickly up to P150, and finish with P180.

Sand with relatively slow, even strokes. Swirl marks are hard to remove from the thin veneer without doing damage. □

Roland Johnson is a contributing editor.

Shaker Rocker

Jigs and story sticks ensure accurate joinery

BY ERNIE CONOVER

The Shaker rocker is one of the most recognized rocking-chair designs, and rightfully so. It has simple and attractive lines, it is economical to build, and, if designed properly, it can be very comfortable.

This chair also is a wonderful project in my woodworking classes because it introduces students to spindle turning, steam-bending, and a few important hand-tool techniques. The plans I use in class are an amalgamation of an early brethren's rocker, which is detailed in John Kassay's *The Book of Shaker Furniture*, and the rocking chairs made later at the famous Shaker production shop at Mount Lebanon in New York state.

I made a number of modifications to improve the strength of the chair, taking into account modern-day physiques. The original 1⅜-in.-thick back posts are beefed up to 1 9/16 in. thick, and all of the seat rails and stretchers are about ⅛ in. larger in diameter than those on classic examples of the chair.

I also took some historical liberties with its design, incorporating features from various chairs produced by different Shaker communities. The arms and rockers are ½ in. thick and book-matched from the same figured maple board. The front arm posts have a ginger-jar profile and attach to the arms with a through-tenon and a mushroom cap. Finally, the back is woven with one curved back splat above.

Turn all of the spindles

Turning the various chair parts is fairly straightforward, but there are a few tips and tricks that will make it go easier. To begin, mill all of the stock for the rails, stretchers, and posts to length but just oversize in

TURNING TIPS

All of the parts for this chair, except for the arms, rockers, and the curved back slat, are turned on the lathe. The back posts require a steady rest and a lathe that accommodates a 43-in.-long turning.

Use a steady rest to turn the long back posts. *Conover used a bed extension on his Nova DVR 3000 lathe to accommodate the 43-in.-long posts. At this length, a steady rest is required to prevent the turning from chattering when working the center region.*

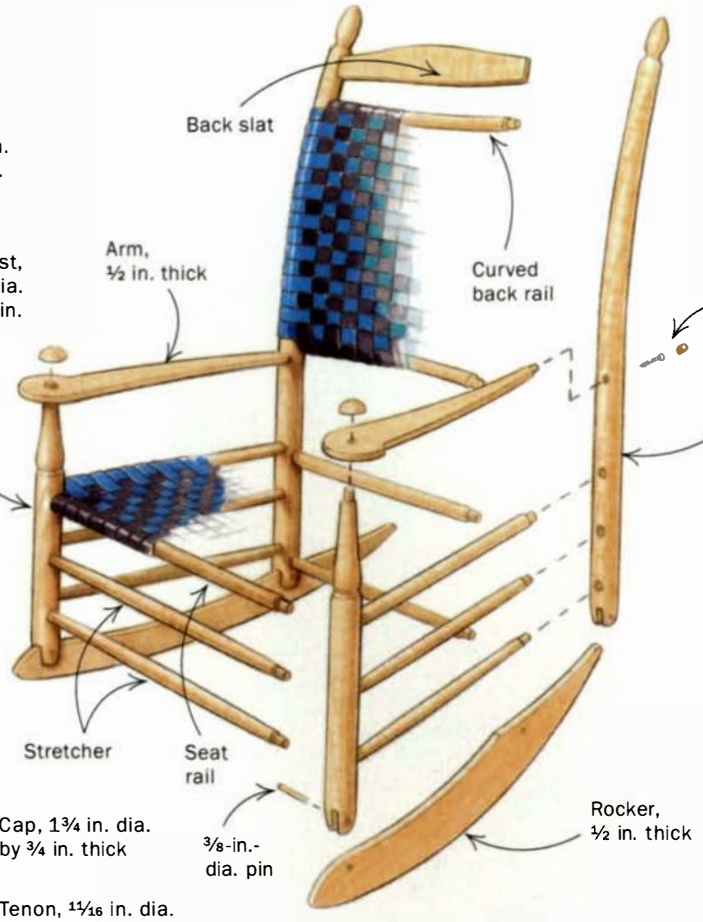
Size the rail tenons precisely with a wrench. *Turn the tenons with a wide parting tool until the open-ended wrench slides over the tenon.*

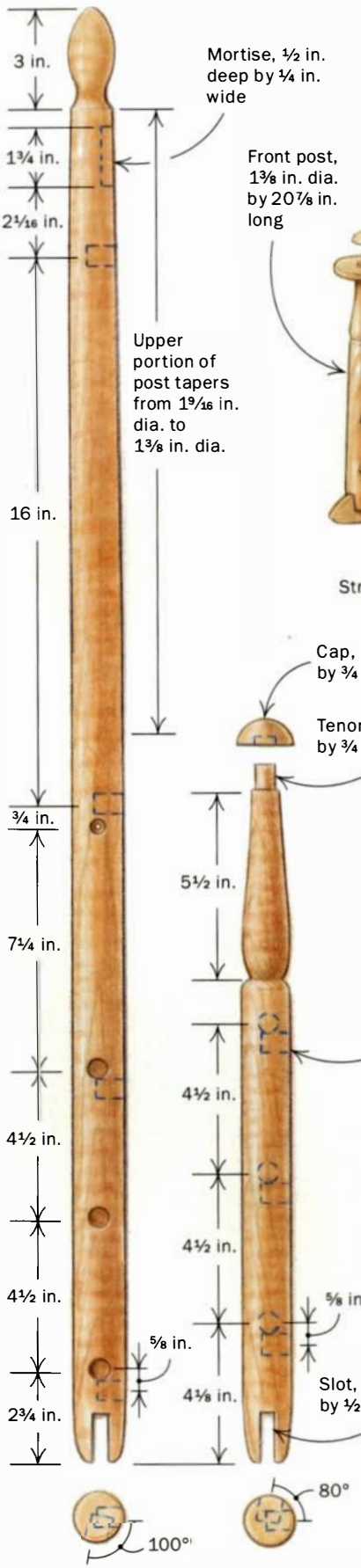
A simple method to hold the mushroom caps for turning. *Turn a tenon on scrap stock, then jam the cap blank over the tenon.*

Photos: Matt Berger

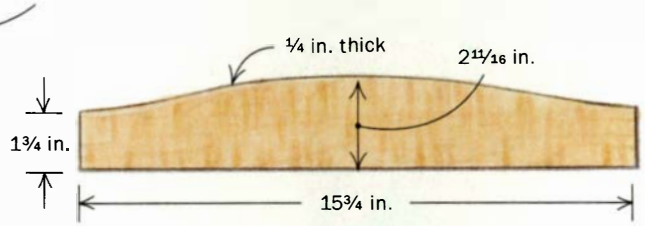
SHAKER ROCKER

The chair is made from roughly 8 bd. ft. of hard maple. Conover used curly or figured wood as much as possible, except for the seat rails and stretchers, where straight-grain stock is necessary for strength. All of the finished dimensions include tenons.

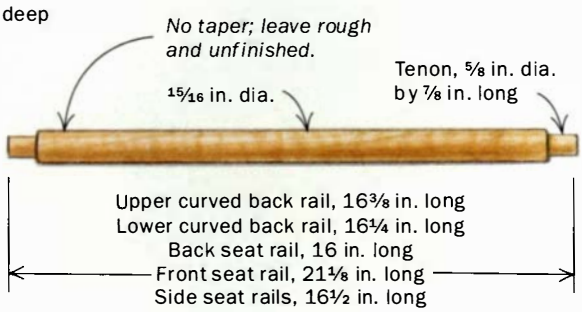




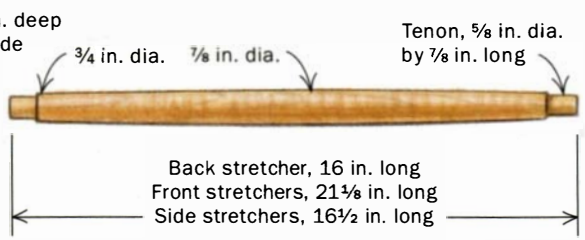
FRONT AND TOP VIEWS OF BACK AND FRONT POSTS



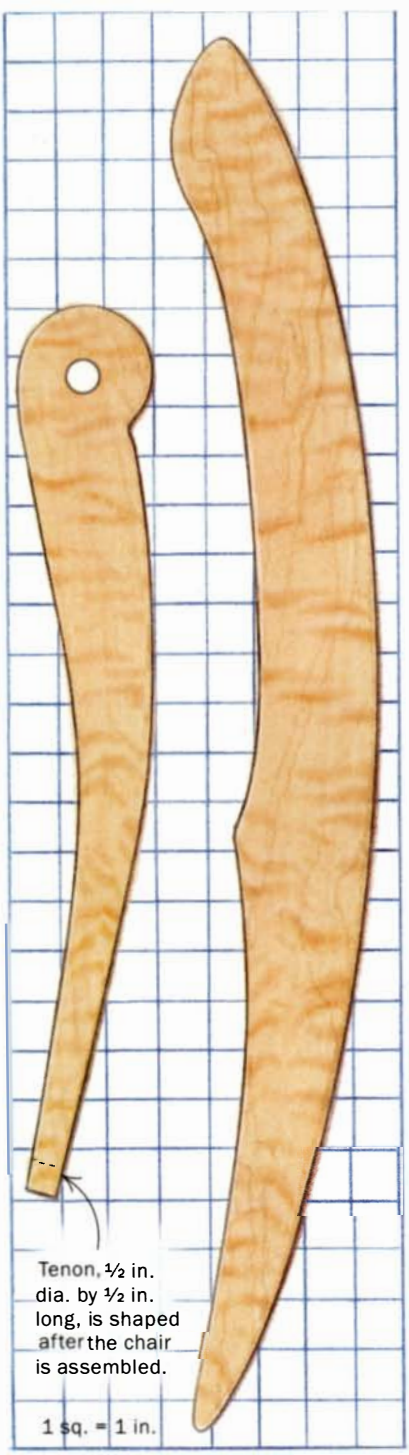
BACK SLAT



BACK AND SEAT RAILS



STRETCHERS



ARM AND ROCKER

Drawings: Bob La Pointe

thickness so that you have some room for error when turning the delicate stretchers and rails to their final diameters.

This project requires you to be diligent and organized in the way that you mill and dimension the turning billets. Because there are so many parts that are nearly identical, varying only slightly in length and diameter, it's wise to mark each piece as it's made.

Steady rest prevents chatter—The long back posts require a lathe with 43 in. between centers. To accommodate that distance, I attached a bed extension to my Nova DVR 3000 lathe. A turning of this length also requires the use of a steady rest, which supports the post at the center to keep it from chattering. Steady rests are available commercially or can be made in the shop (see *FWW* #161, p. 34 and *FWW* #143, p. 14, respectively).

Size tenons with a wrench—Another turning trick helps produce consistent and perfectly sized round tenons, which will ensure a good glue bond when they are joined to the round mortises. First, mark the length of the tenon with a set of dividers, measuring from the end of the turning. Then, as you approach the final diameter of the tenon, fit an open-ended wrench of the finished diameter over the area. It will slide over the tenon when it's turned to the correct diameter. Ease into the fit, because if you turn the tenons undersize, you increase the chance of the joinery failing.

Finish parts on the lathe—You can sand and finish nearly all of the round parts on the lathe (see *FWW* #165, pp. 62-65). The exceptions are the back posts, the seat rails, and the curved back rails. The back posts are steam-bent before finishing, and the seat rails and curved back rails are left unfinished to provide traction so the Shaker-tape weave doesn't slide around.

The Shakers generally finished their chairs with varnish. I favor either Minwax or Olympic Antique Oil.

Jigs align parts for accurate joinery

After steam-bending the back posts, you can begin drilling the round mortises for the rail and stretcher joinery. This requires two jigs to hold the posts steady at the drill press. I also make four story sticks to locate the center points of the seat rail

Steam-bending made simple

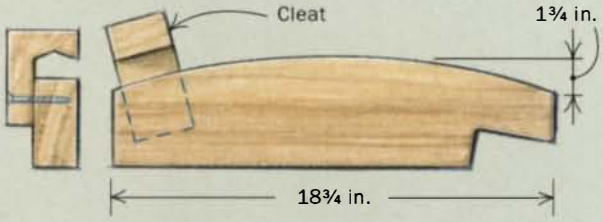
The bending of the back posts, the back slat, and the back rails is done by heating the parts in a steambox and then clamping them to a form.

To do the job, I use a shopmade steambox composed of a propane outdoor stove that boils water in a 5-gal. gas tank and then sends steam through a radiator hose into a 4-in.-dia. Schedule-80 drainpipe. The back posts should steam in the box for about an hour at a temperature around 200°F to become flexible enough to bend. The back slat and rails need to steam for only about 15 to 20 minutes. Once a part is removed from the steambox, you have about 30 to 60 seconds to clamp it to a form.

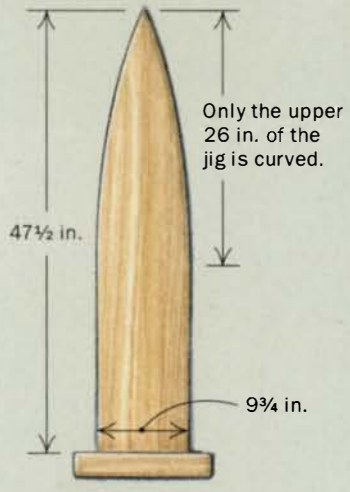
Just like a teapot, the steambox must leak steam to prevent it from exploding under pressure. Also, it must be positioned on a slope so that condensation inside the box can drain into the water tank. Always wear heavy gloves and eye protection when operating the steambox and shuttling parts to the bending jigs. An extra pair of hands is a big help.

For more on steam-bending, see *FWW* #149, pp. 78-83.

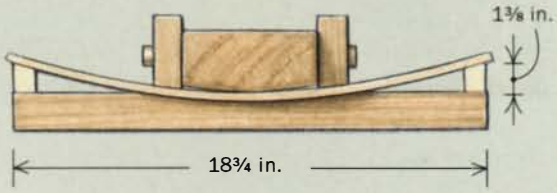
BACK-RAIL BENDING JIG



BACK-POST BENDING JIG



BACK-SLAT BENDING JIG



USE A JIG TO DRILL THE RAIL AND STRETCHER MORTISES

The adjacent mortises on each post must be drilled at precise angles. Begin with the mortises for the front and back rails and stretchers. Then use a tenoned stick to set the angle for the side rail and stretcher mortises.

Position the back posts in a drilling jig. *V-blocks attached to a plywood base help to hold the posts in place for drilling. Use a center punch and a story stick to locate and align the drill bit. Then drill the mortises 1 in. deep.*

and stretcher mortises. The measurements for the seat-back mortises aren't included on the story sticks and instead are located with a tape measure, measuring from the bottom of each back post.

It doesn't matter in what order you cut the mortises, but I begin with the front posts. Using the story stick, lay out and mark the center point on the mortises for the two front stretchers and the front seat rail. With the post clamped in the jig, drill ⅝-in.-dia. mortises, 1 in. deep, using a drill press. Then insert a spare spindle into the mortise and rotate the front post 80°, using the guide block for alignment. Clamp the front post in the jig in its new orientation and mark the mortises for the side stretchers and seat rail. Drill those mortises with the same setup. The process is the same for the back posts, but the mortises are 100° apart.

The most important detail to keep in mind is to drill adjacent mortises on the correct side of each post. I mark the inside edges of the front and back posts to keep things straight. Once all of the mortises have been drilled, you will notice that some adjacent holes intersect (you can see daylight when you look into the mortises). This is intentional: The intersecting holes will help strengthen the glue joints when all of the parts are brought together.

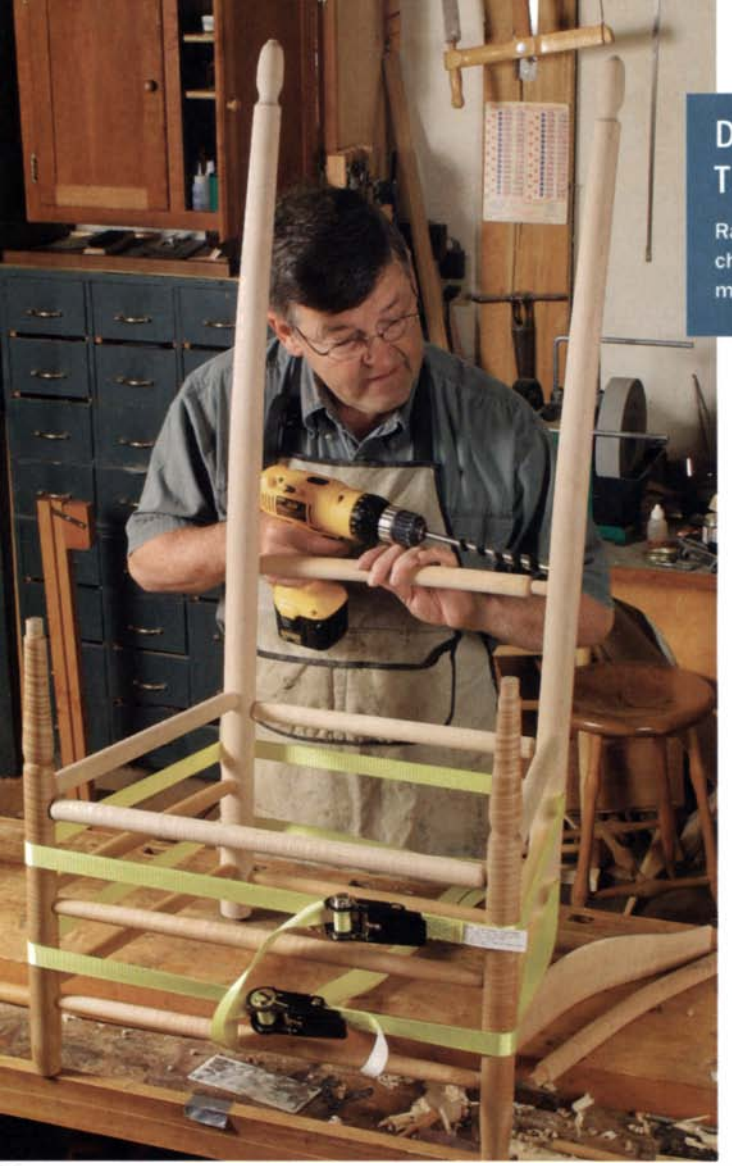
Drill and chisel mortises by hand— Mortising the back posts for the curved back slat is best done by hand. Use a handheld drill to bore the round mortises for the curved back rails. First, dry-fit the chair with two band clamps. Measure from the bottom of each back post to mark the location of the back slat and rails, then use the bent parts to eyeball the approximate

Set the angle for the side mortises. *Make a shorter jig to allow clearance for the bend in the back posts. Insert a tenoned stick into the mortise and use a guide block angled at 10° to align the post in the jig (left). Then transfer the mortise locations from the story stick to the post (center).*

Drill holes for the side rails and stretchers. *The adjacent holes should intersect with the front and back rail and stretcher mortises.*

DRY-FIT THE CHAIR, AND ALIGN THE OTHER MORTISES BY EYE

Rather than calculate the angles of the mortises, Conover dry-assembles the chair using band clamps and holds the curved part in place to determine the mortising angle.



Drill for the curved back rails. *With the chair temporarily assembled, Conover uses the curved back rail to align the drill at the correct angle.*

Determine the angle of the mortise. *Conover uses a mortising chisel to chop the mortises for the curved back slat. He rests the slat in place to set the proper angle for chopping (center). A piece of tape on the chisel marks the desired depth of the mortise (right) so that it can engage ⅜ in. of the tenon.*

angle of each mortise. Hold the chisel to this angle during mortising, and do the same thing with a handheld drill to bore the round mortises for the rails.

Long open time aids assembly

I use 90-minute clear epoxy to assemble the chair, taking advantage of the glue's long open time and its ability to prevent squeaky joints. Apply well-mixed epoxy to the mortises and tenons with a solder brush. Be sure to wear disposable gloves; epoxy is difficult to get off your skin.

Assemble the back posts first, then add the side stretchers and finish up with the front-post assembly. Two band clamps generally are adequate to hold the chair together while the glue sets. However, during assembly a bar clamp can be helpful to drive some of the tenons home. Once the chair is clamped, set it on a flat floor and muscle it into proper alignment by stepping on the front rail to hold it steady;

ASSEMBLE THE CHAIR

All of the parts of the chair, except for the arms and rockers, go together in one glue-up. Conover prefers to use 90-minute epoxy for its long open time. Join the back parts first, then insert the side stretchers, and wrap up with the front-post assembly, clamping it with two band clamps. Once all of the parts are assembled and clamped, rest the chair on the floor to check for alignment.

CUT BRIDLE JOINTS FOR THE ROCKERS

Both rockers are cut from a single piece of 5/4 curly maple. First bandsaw and smooth the profile, then resaw it into two pieces for perfectly matched rockers.

Mark the location of the rockers. *With the chair clamped upside down in a vise, the rockers are positioned where they will join the front and back posts. Scribe a line down both sides of the post to the correct depth.*

then shake the back posts side to side and front to back.

Attach rockers after glue-up

I choose highly figured material for the arms and rockers. The arms are book-matched and the rockers mirror-matched, so only one of each needs to be shaped. Trace the patterns onto planed 5/4 material, bandsaw to the lines, and handplane or sand away all saw and planer marks. Resaw the shaped pieces, then plane them to ½ in. thick. Finally, round over the top and bottom edges of the arms with a ¼-in. roundover bit.

Each rocker is attached with a pinned bridle joint, a process best done by hand. Scribe the rockers to the bottom of the posts, then lay out the bridle joint 1¾ in. deep. Backsaw the shoulders of the joint and remove the waste with a chisel. Undercut the joint with the chisel from both directions to prevent tearout, much like cutting a through-mortise. Then test-fit the rocker and refine any tight spots with a chisel and rasp.

After a slide fit has been achieved, trace the outline of the bridle joint on the rocker to facilitate positioning it in the same place on subsequent trials. The fit is refined on the front by flattening the edge of the rocker between the pencil marks. You also will have to chisel the back edge of the bridle joint on the back post so that the rocker sets fully in the joint. Glue the rocker into place once you're satisfied with its fit, then drill a through-hole and pin the rocker to both posts with a maple dowel.

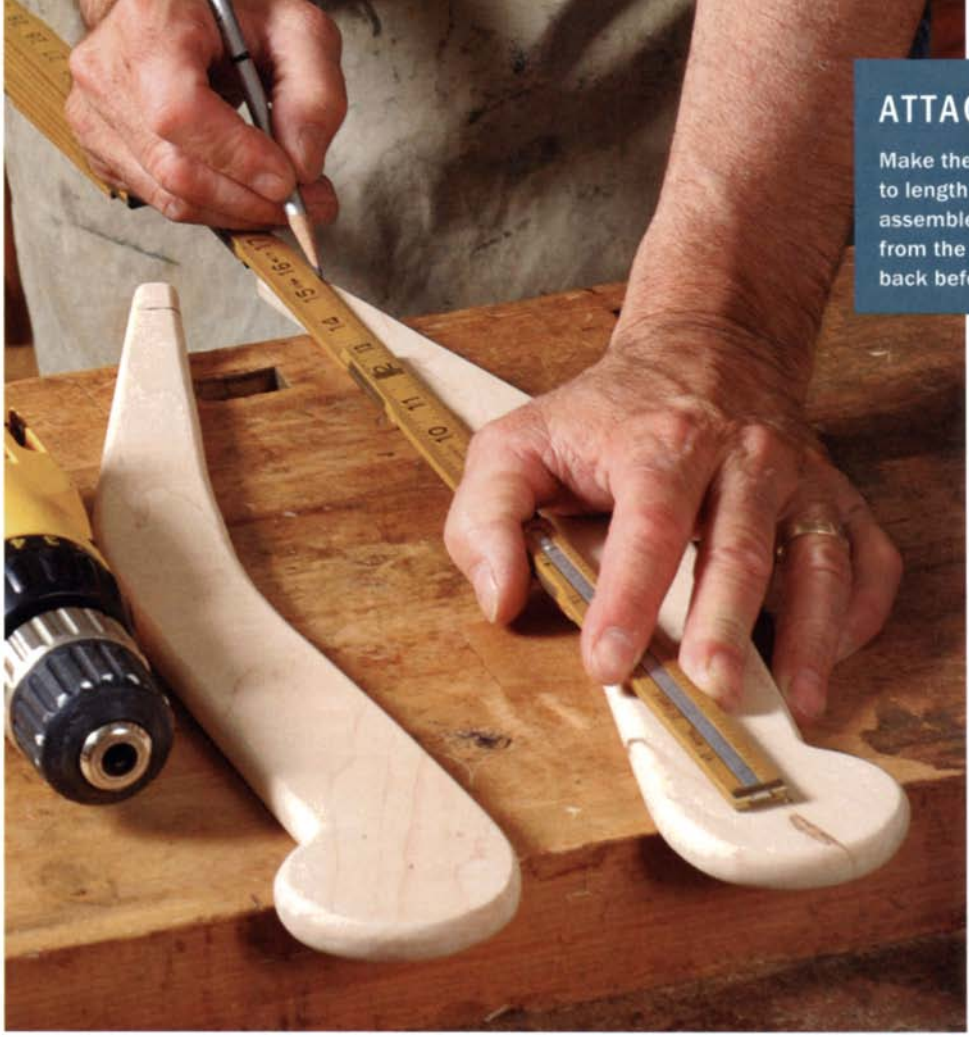
Arms go on last

The arms are attached after the woven seat and back are completed. First, measure the

Cut the bridle joints by hand. *Use a backsaw to cut along the scribe lines. Then clean out the waste with a chisel.*

Measure the gap. *The rocker initially won't sit flat in the groove. Use dividers to measure the gap on one side when the other is set.*

Chisel the mortise until the rocker is fully set. *Then the rockers can be glued and pinned to the front and back posts.*



ATTACH THE ARMS

Make the arms longer than necessary, then cut them to length and tenon the ends after the chair has been assembled. The joint is reinforced with a screw inserted from the rear of the back post. Weave the seat and back before attaching the arms.

Measure for the arm joinery. *Determine the distance from the back post to the center of the front-post tenon on the assembled chair. Add 1/16 in. to determine the distance from the tenon shoulder to the mortise center to ensure the joint stays under tension after assembly.*

Locate the arm mortise. *Hold the arm in place to determine the mortise angle. Drill through the post using a 1/16-in.-dia. drill bit, then drill a 1/2-in.-deep mortise using a 1/2-in.-dia. bit.*

Countersink the back of the post. *After weaving the seat and back, glue the arm in place and secure it with a screw. Cover the screw hole with a maple plug.*

distance from the back post to the center of the front-post tenon. That measurement, plus 1/16 in., is the distance from the arm's tenon shoulder to the center of the round mortise at the front of the arm. The extra 1/16 in. puts the joint under tension.

Next, raise a 1/2-in. tenon on the end of the arm to go into a stepped hole drilled into the back post. Although I use an antique tenon maker, modern versions can be used in an electric drill. Alternatively, the job could be done by careful carving.

Mark the location of the mortise on the back post at the same distance above the seat as on the front post. Drill through the back post with a 1/16-in. bit to locate the center point of the mortise. Now, drill a 1/2-in.-dia. by 1/2-in.-deep mortise to accept the arm tenon. Finally, from the opposite side, countersink the 1/16-in. through-hole for a #8 by 2-in. flat-head wood screw. I drill deep enough to bury the screw under a plug, but not too deep that it breaks into the 1/2-in. mortise on the opposite side.

The arms are glued and secured with a faceplate-turned mushroom cap on each front post and a wood screw covered by a plug from the rear. □

Ernie Conover is a regular contributor to Fine Woodworking *who teaches woodworking at his workshop in Parkman, Ohio.*

Shaker weave

My wife, Susan, who is a fiber artist, weaves the Shaker-tape seats and backs on my chairs. However, most of my students find that weaving is part of the fun of making a Shaker rocking chair. You'll need about 80 yd. of 1-in.-wide tape to complete this chair. For instruction on weaving with Shaker tape, see *FWW* #121, pp. 78-81. Instructions are also available from Shaker Workshops.

SHAKER-TAPE SOURCES

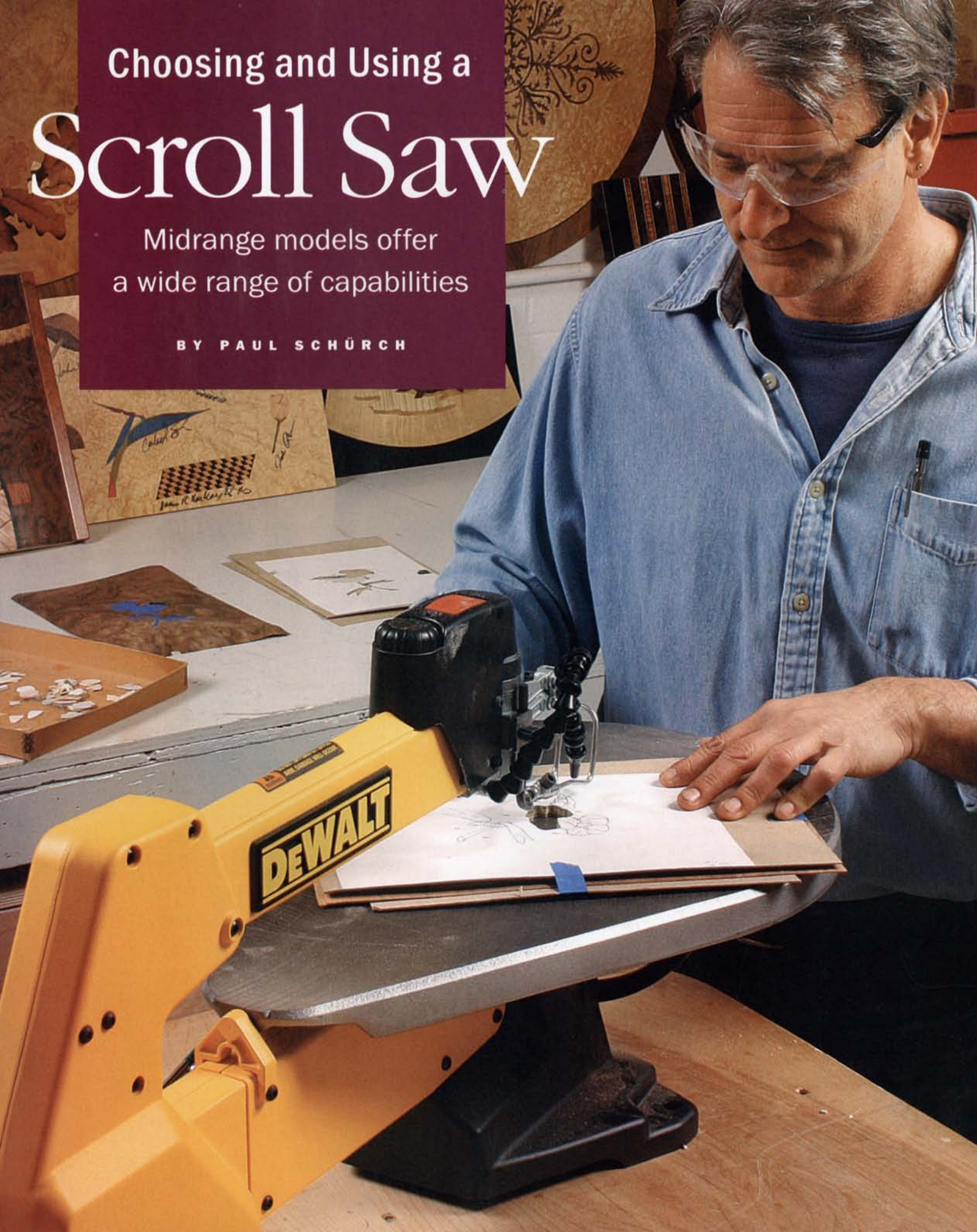
Shaker Workshops
800-840-9121; www.shakerworkshops.com

Royal Wood Ltd.
800-526-1630
www.royalwoodltd.com

Choosing and Using a Scroll Saw

Midrange models offer a wide range of capabilities

BY PAUL SCHÜRCH



The scroll saw holds extremely fine blades under tension, allowing it to do jobs that no other motorized saw can do. Unfortunately, many woodworkers think that a scroll saw is only for hobbyists who make fretwork, bookends, whirligigs, and knickknacks. As a professional furniture maker, I've found the machine much more useful than that, and I believe it makes a valuable addition to any woodworking shop.

I use a scroll saw to rough out dovetails, to cut mortise-and-tenon templates, to make small mock-ups of furniture I am designing, and to make cuts particular to marquetry, such as cutting "packets" of multiple layers of veneer. I've also cut material such as shell, bone, sheet brass, pewter, and copper for decorative hardware and inlay. It is even possible to cut ⅛-in.-thick glass for a curvy door panel using a barbed diamond-wire blade, or to perform detail sanding and polishing using small belts attached to the scroll saw like a blade.

It is true that most scroll-saw users don't focus on furniture making. But decorative fretwork and intarsia (a picture made of various woods, of various thicknesses) certainly qualify as woodworking. Some professionals also make a living gluing pictures onto seven-ply, ¼-in. aircraft-grade plywood and scrolling beautiful puzzle patterns. If these areas interest you, there are clubs devoted to scroll-sawing, and scores of books and magazines that contain useful information, project ideas, and patterns.

Inlay, marquetry, and beyond

For inlay and marquetry, a scroll saw is indispensable. These machines give you an easy and accurate means of cutting highly detailed inlay pieces to add to your furniture. Whether it's a bellflower on a period table leg, or a mother-of-pearl square to be used as a decorative element, the process is straightforward. Draw the design onto the inlay material—usually between 1/16 in. and ¼ in. thick—and cut it out on a scroll saw with the table set at a slight 2° to 4° angle, beveling each edge of the material inward a bit. This is called a conical cut. Then place the inlay onto the background, scribe around the outline with a knife, and hollow out the recess with a small router and a small chisel. Clamp and glue the inlay firmly into place, and then level it with the background after the glue has set. The bevel-cut edges will ensure a tight fit with the surrounding wood.

TOOL TEST

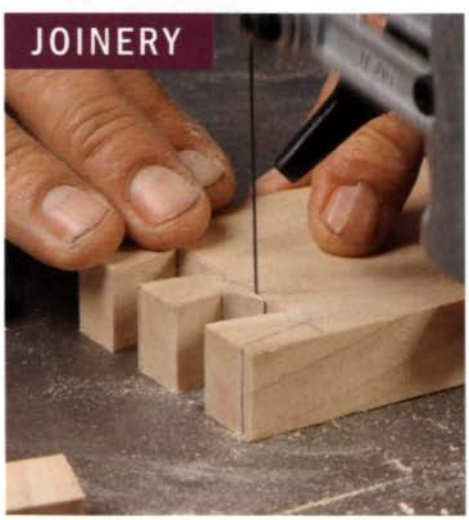
Turn to p. 60 for a review of five midpriced scroll saws, all suited to a wide range of tasks.

With a decent scroll saw, you can step past inlay into the world of marquetry, which involves making detailed pictures by joining multiple pieces of veneer. Panels of marquetry can elevate the look of your furniture and case work. Except for one machine, which takes only pin-style blades, all of the midrange saws tested on pp. 60-61 will perform the basic marquetry cuts well, including the packet, contour, conical, window, piece-by-piece, and boulle methods.

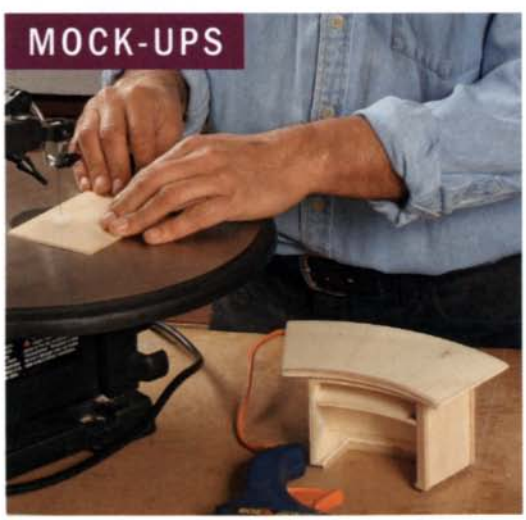
For packet cutting, my preferred marquetry method, a good scroll saw and a very thin blade make the job as easy as stacking and pinning together all of the veneers to be featured in the final picture, spray-gluing a drawing onto the stack, cutting out all of the pieces in one shot, and then pulling the pieces apart

Scroll-saw uses in the shop

Indispensable for marquetry. *A scroll saw can cut through a thick packet of veneers (facing page) with a very thin blade, cutting out all of the pieces for a picture in one shot.*



Perfect for dovetails. *After the initial cheek cuts are made, the tiny scroll-saw blade makes it easy to cut across the bottom of a dovetail socket and quickly remove the waste.*



An easy way to test designs. *With a scroll saw, small, intricate pieces are easy to cut quickly and assemble using hot-melt glue. This 1/10-scale model is a reading podium.*

Photos: Asa Christiana

Endless options for pierced work. *Schürch made this jewelry-box tray by cutting out small openings in solid wood and laying that fretwork onto a felt-covered plywood bottom. He detailed the carved leaf after the main vertical cuts were done.*

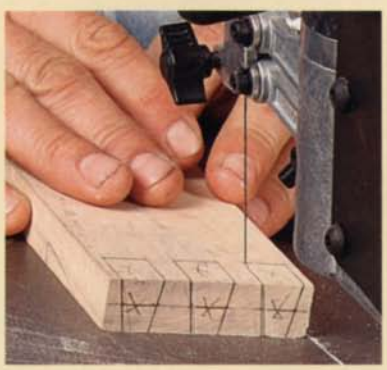
and taping them into place. A #2/0 blade leaves only a 0.010-in.-wide kerf, which tends to close up in the final pattern. For more information on marquetry techniques, go to my Web site (www.schurchwoodwork.com).

Scaled mock-ups of furniture are very helpful in the design process, allowing a 3-D preview prior to drawing and building the actual piece. Models also are great for selling a design idea to a client. A scroll saw is ideal for the detail work involved in building a model out of thin materials. The pieces can be put together very quickly using hot-melt glue.

I sometimes use a scroll saw for cutting dovetails, roughing out the pins and tails before trimming them to the line with a sharp chisel, if need be. Other times I make the initial sawcuts with a dovetail saw and then use a scroll saw to cut squarely across the bottom of each socket, removing the waste. If the blade is tensioned properly, the cuts will be accurate and need very little cleanup. I've seen other woodworkers (*FWW* #152, pp. 56-61) make the initial cuts on a tablesaw, then use a scroll saw to remove the waste.

Once you have a scroll saw, you'll find that lots of odd cuts become easier to make. I've used one to create matching templates in ½-in. plywood for routing odd-shaped mortises and tenons where large furniture components join (see *FWW* #94, p. 54). The matching inside and outside templates are attached temporarily to the mating workpieces, where they can guide a flush-cutting router bit. I use this technique often when joining solid wood legs

Scroll-sawing tips



ADJUST FOR DRIFT TO CUT A STRAIGHT LINE

I have found that the toughest techniques to master are cutting straight lines and going around sharp corners. Many blades are milled in a way that can leave the blade slightly sharper on one side, so it tracks like a dull bandsaw blade. To cancel out blade drift when following a straight line, adjust the angle of the workpiece when pushing it into the blade. For best results, work in a series of short pushes, making small corrections as you go. As the blade dulls, the drift gets worse; keep blades well tensioned and change them often.

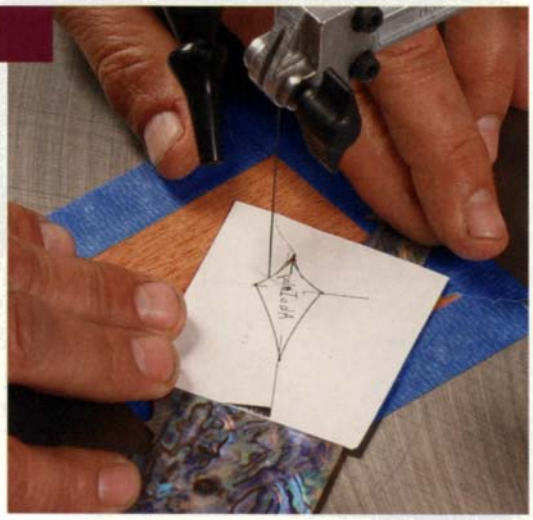
finewoodworking.com

Visit our Web site to see the author demonstrate straight-line cutting and turning sharp corners.

HOW TO TURN A SHARP CORNER

When cutting marquetry or finely detailed fretwork, negotiating sharp points and corners can pose a challenge. Essentially, you need to pivot the workpiece around the blade while the saw is running, reorienting it toward the new direction. This is accomplished by cutting up to the corner, then slightly pressing the workpiece against the side of the blade. This method stabilizes the workpiece without any unwanted cutting. Now maintain that pressure as you pivot the workpiece into the desired position, shifting the pressure onto the back of the blade as you go .

INLAY



Inlay becomes straightforward. *Tape the design to thin material and cut out the inlay. Then scribe around the inlay piece to lay out the recess. When cutting fragile materials like this abalone, make a zero-clearance plate from a piece of veneer.*

directly to a top piece. On period furniture, I've used a scroll saw to cut out carving blanks for applied decorative elements.

Setting up your saw

It's important for first-time users to realize that scroll-saw blades break regularly, especially thin ones. A #2/0 blade, for example, will break in five or 10 minutes when cutting ½-in.-thick material. A broken blade can make a startlingly loud noise, but it doesn't necessarily mean you are doing anything wrong.

For best results, the blade should be tensioned to roughly an octave above middle C on the piano, or until a clear musical plucking sound is reached. If the blade is too loose, it will make a "thunk" sound when plucked and will tend to deflect in use, distorting the cut, fatiguing the blade, and causing it to break early. With too much tension, the blade will snap more often or slip out of the blade clamps.

A few modifications—I recommend making changes and adding accessories to any scroll saw. A wider auxiliary table placed over the top of the standard table will support wider work. To turn the saw on and off, a foot-pedal switch (the electrical type that stays on only when the pedal is depressed) takes the panic out of scrolling detail work and stops the noise when the blade breaks. Also, I tape zero-clearance plates of thin cardboard, plastic, or veneer on the saw table to support fragile material and keep small pieces from dropping through the throat.

I don't like the blade guards on a scroll saw—they only get in the way—so I remove them. In the classes I teach, with students ranging in age from 8 to 85, I've never seen more than a minor cut on any scroll saw with the blade guards removed.

Paul Schürch, a furniture maker and teacher in Santa Barbara, Calif., specializes in marquetry.

Blade Sources

SCROLL-SAW BLADES

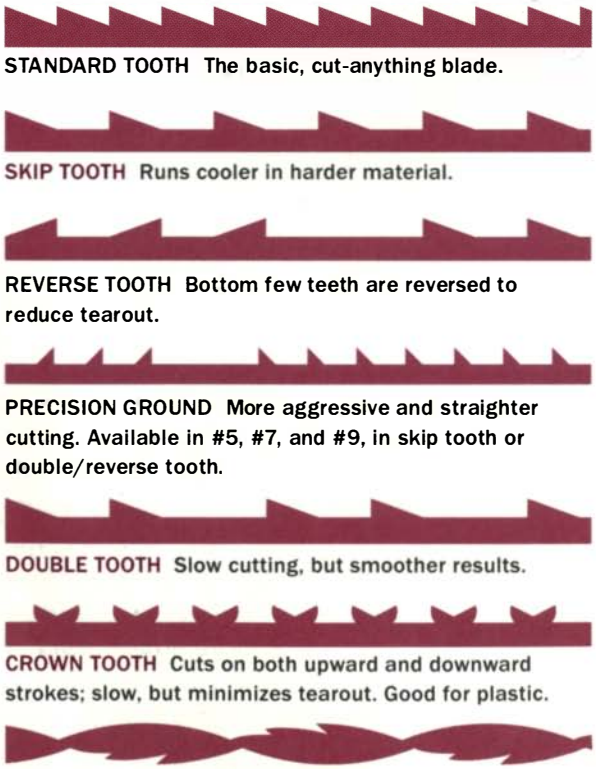
Wildwood Designs
www.wildwooddesigns.com
800-470-9090

Woodcraft Supply
www.woodcraft.com
800-225-1153

BARBED DIAMOND WIRE
for cutting glass and other very hard materials

Alpha Supply,
No. J0510B
www.alpha-supply.com
800-257-4211

Tooth patterns



STANDARD TOOTH The basic, cut-anything blade.

SKIP TOOTH Runs cooler in harder material.

REVERSE TOOTH Bottom few teeth are reversed to reduce tearout.

PRECISION GROUND More aggressive and straighter cutting. Available in #5, #7, and #9, in skip tooth or double/reverse tooth.

DOUBLE TOOTH Slow cutting, but smoother results.

CROWN TOOTH Cuts on both upward and downward strokes; slow, but minimizes tearout. Good for plastic.

SPIRAL Cuts in any direction but leaves rougher, wider kerfs.

MATCH THE BLADE TO THE TASK

Scroll-saw blade sizes range from the smallest #8/0 (pronounced eight-aught) to the largest #12 (sometimes called #0/12), with the most common for woodworking between #3/0 and #8. Thinner blades have more teeth per inch. The orientation of the teeth also is important (see chart at right). For more blade information, check out the excellent chart at www.olsonsaw.com/scroll_chart_1.html.

AN ESSENTIAL BLADE KIT

These are the six blades Schürch uses most often, with Olson item numbers in parentheses.

#12 skip tooth (453): Heavy-duty blade for cutting straight lines in thicker material such as plywood.

#5 precision ground, reverse tooth (495RG): Used for straighter-line fretwork.

#5 skip tooth (446): Thinner depth than the precision-ground #5; turns tighter corners. Good for more detailed fretwork, as well as dovetails.

#2/0 skip tooth (440): The one I use for marquetry and other very finely detailed work. Kerf is only 0.010 in.

#1 metal-cutting (479): For metal, shell, and bone.

Tool test Midrange scroll saws

With the average woodworker in mind, I tested five midrange scroll saws with throat depths between 18 in. and 22 in. Each saw has enough throat capacity, power, and accuracy to handle all of the tasks described in this article, and each costs less than $600. (Unfortunately, Craftsman was not able to supply its latest 18-in. model in time for testing.)

I put the machines through a variety of tasks, and all made acceptable cuts. For each of these saws, it is important to find an ideal midrange speed for any given task, a "sweet spot" that is the balance between speed and smoothness. If you don't push a saw past that point, you will minimize vibration and produce the best cuts.

One of the most important factors for efficient and enjoyable scroll sawing is the ease of tensioning and changing the blade, especially if you plan to try fretwork or other pierced cutting where the blade must be untensioned, removed, threaded through the workpiece, and reattached often. All of these saws come with quick-release blade clamps, which are important, but not all have access to their tensioning system at the front.

Schürch used each saw to make a variety of cuts in a variety of common materials. *He graded the smoothness of cut by feel and by looking at the cuts under magnification.*

Also important is the ability to change speeds quickly. Some saws have easy-to-reach adjustment knobs at the front, offering an infinite range of speeds, but two have pulley systems that take more time and effort to adjust and offer a limited range of speeds. I also prefer saws with a larger stroke, which uses more of the blade's teeth and prolongs blade life.

I evaluated the stability of each saw's upper arm and table, looking at how wobbly they were and how easily they could be knocked out of adjustment. If either happens while cutting through a packet of veneers, for example, the crooked cut will leave big gaps in the finished marquetry. I can't recommend scroll saws that accept only pin blades. These perform well for rougher work but have limited abilities for finer detail.

My choice for the best overall scroll saw is the DeWalt, a quiet, smooth-running, well-designed machine at a reasonable price. It is very solidly built. The trunnions supporting the table are strong and allow full tilt in both directions. The upper arm lifts up, making it easier to thread work onto the blade from above, which is helpful for pierced cutting.

My choice for best value goes to the Dremel. It also is a smooth performer, with important adjustments at the front of the saw. While it tends to bog down just a bit more often than the DeWalt, the Dremel is a great value at its price and includes some helpful attachments, such as a small disk sander on the side, a work light, the ability to take either pin-end or plain-end blades, and the option of attaching a rotary, flex-shaft tool onto the motor.

DELTA 40-680

800-223-7278
www.deltawoodworking.com

The Delta is a solid performer, but the belt system forces you to turn off the saw and reach under it to change speeds. (The PS Wood also has a belt system.)

Model	Average price	Throat depth
Delta 40-680	$480	20 in.
DeWalt DW788	$390	20 in.
Dremel 1800 Scroll Station	$240	18 in.
Grizzly G0537	$130	22 in.
PS Wood Machines 21-in. Scroll Saw	$600/ direct	21 in.

DeWALT DW788

800-433-9258
www.dewalt.com

The DeWalt, like the Delta and Dremel, has its tensioning lever up front (jutting out at top), making it easy to release the blade.

DREMEL 1800 SCROLL STATION

800-437-3635 www.dremel.com

Like the Grizzly and DeWalt machines, the Dremel's speed-control knob is up front, allowing you to improve the cutting action while under way.

GRIZZLY G0537

800-523-4777 www.grizzly.com

The Grizzly machine takes only pin-style blades, which require a bigger pilot hole than plain-end blades, making then unsuitable for the finest pierced work.

PS WOOD MACHINES 21-IN. SCROLL SAW

800-939-4414 www.pswood.com

The removable blade clamps add two minutes to the blade-changing process, requiring a special jig built into the side of the machine.

Blade types	Table angle	Stand	Strokes per minute	Stroke length	Ease of blade changes	Ease of changing speed	On/off access	Stability of table and arm	Smoothness of cut
Plain end	Left 45° right 15°	Included and necessary	400-2000, 6 speed	7/8 in.	Very good	Fair	Very good	Excellent	Excellent
Plain end	Left 45° right 45°	Optional	400-1750, Variable	13/16 in.	Very good	Very good	Excellent	Very good	Excellent
Plain end and pin end	Left 45° right 7°	Optional	500-1700, Variable	13/16 in.	Good (plain end) Excellent (pin end)	Excellent	Very good	Very good	Very good
Pin end	Left 30° right 2°	None	425-1300, Variable	5/8 in.	Fair	Good	Poor	Fair	Fair
Plain end	Left 40° right 30°	Included and necessary	170-1370, 5 speed	15/16 in.	Fair	Poor	Fair	Fair	Good

Table Design

A well-proportioned table balances ergonomics with style

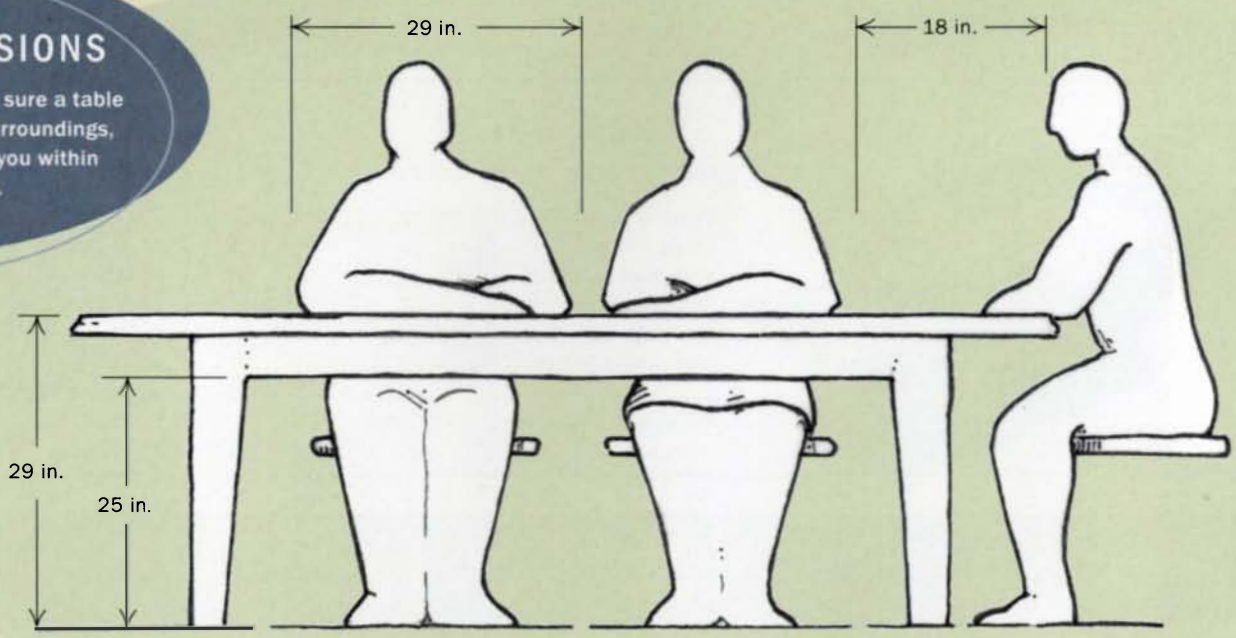
BY GRAHAM BLACKBURN

Tables must above all function on a practical level. So far as function goes, ergonomic decisions, the choice of material, construction method, joinery details, and finish are of greatest importance. But — and this is a very big 'but' — for a table to be completely successful, aesthetic considerations are also extremely important.

For dining tables, the design begins with seating capacity. Unless you are planning to use extension leaves, you have to decide how many people you want the table to accommodate and live with that. Although it may be tempting to build a large table to account for any eventuality, you should consider how the table functions on a daily basis for the immediate family. If you need flex-

DINING DIMENSIONS

While it's important to make sure a table is sized to fit its intended surroundings, these dimensions will get you within striking distance.



COMFORT A CRITICAL FACTOR

Overall table height, legroom below the apron, overhang on the table ends and the space allotted for each diner should all be considered when designing a dining table.

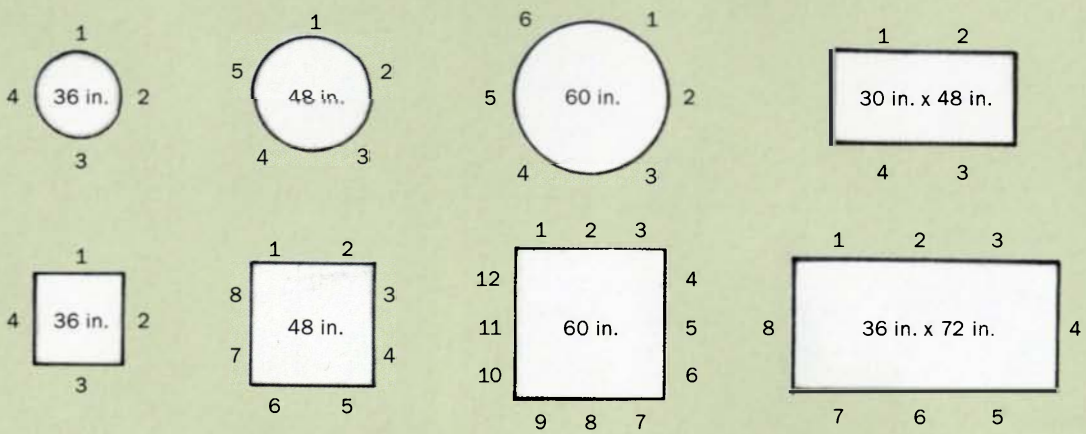


TABLE SIZE AND SEATING CAPACITY

While 29 in. elbow room per person is ideal, it's not an unbreakable rule. Less space can be allotted at the corners, and more space is rarely a problem.

Drawings: Graham Blackburn

ibility, extension tables are the best option but will require more effort to engineer the leaf supports.

With work tables, height might be the most important consideration. For example, a writing table will be too high for use as a computer table unless accommodation is made for a keyboard tray. Occasional tables have their own requirements, but height and width decisions are less critical. Still, consider how they will relate to existing furniture in the home. Sofas and arm chairs, for example, do not come with standard arm heights.

Regardless of your woodworking experience, the design of your particular table will benefit if you spend time identifying its precise function, giving careful consideration to the material and the construction, and following some form of aesthetic rationale throughout the piece.

Function: Tables need to work as intended

The original and quintessential function of a table is to provide a flat surface for writing, playing games, eating or working. The form of any given table may be as varied as these uses. So it is of the utmost importance to be clear at the outset about the requirements of the table you intend to design. These include not only structural requirements—so that the table can do its intended job-—but also ergonomic requirements. The most exquisite dining table will be a complete failure if it proves too small to sit at.

Attention to function is absolutely the designer's first responsibility. Familiarize yourself with tables designed for similar functions, and note features designed for specific purposes, such as sturdy legs for heavy loads, drop or draw-leaves for tables that must expand, lipped tables designed to prevent objects from falling off, and added drawers or shelves for storage. A reference such as Architectural Graphic Standards (by Ramsey and Sleeper) is a useful place to explore table types by function, and a basic reference for so-called "standard" or average dimensions.

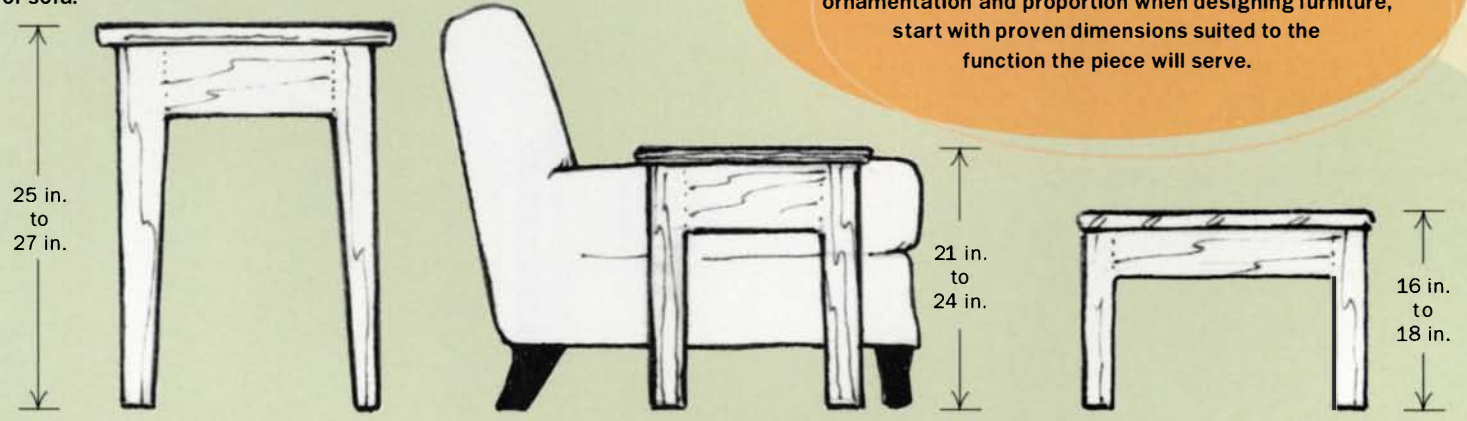
Beware of "standard" dimensions. Few people are exactly "standard." Unless you are building many examples of a particular table, your client will be better served if the dimensions are uniquely suited to him. Nevertheless, certain aspects of many

TABLE HEIGHT GUIDELINES

Although there are endless possibilities regarding style, shape, ornamentation and proportion when designing furniture, start with proven dimensions suited to the function the piece will serve.

OCCASIONAL TABLES

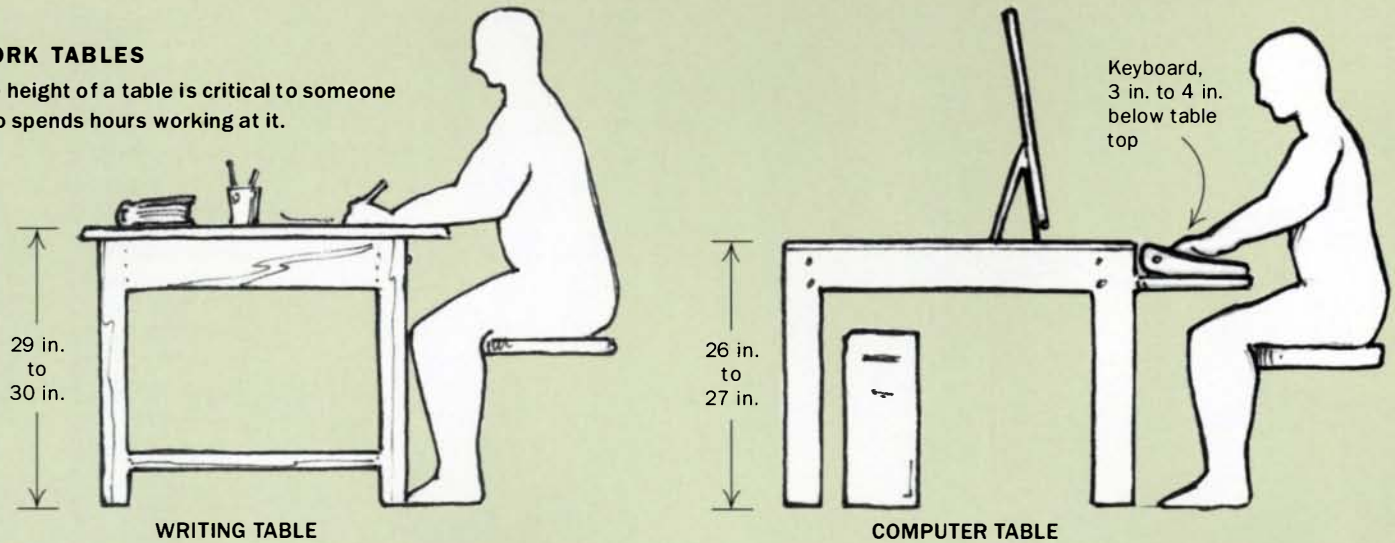
A coffee table should afford views across a room, while an end table should be convenient to someone seated in an armchair or sofa.



SOFA TABLE | END TABLE | COFFEE TABLE

WORK TABLES

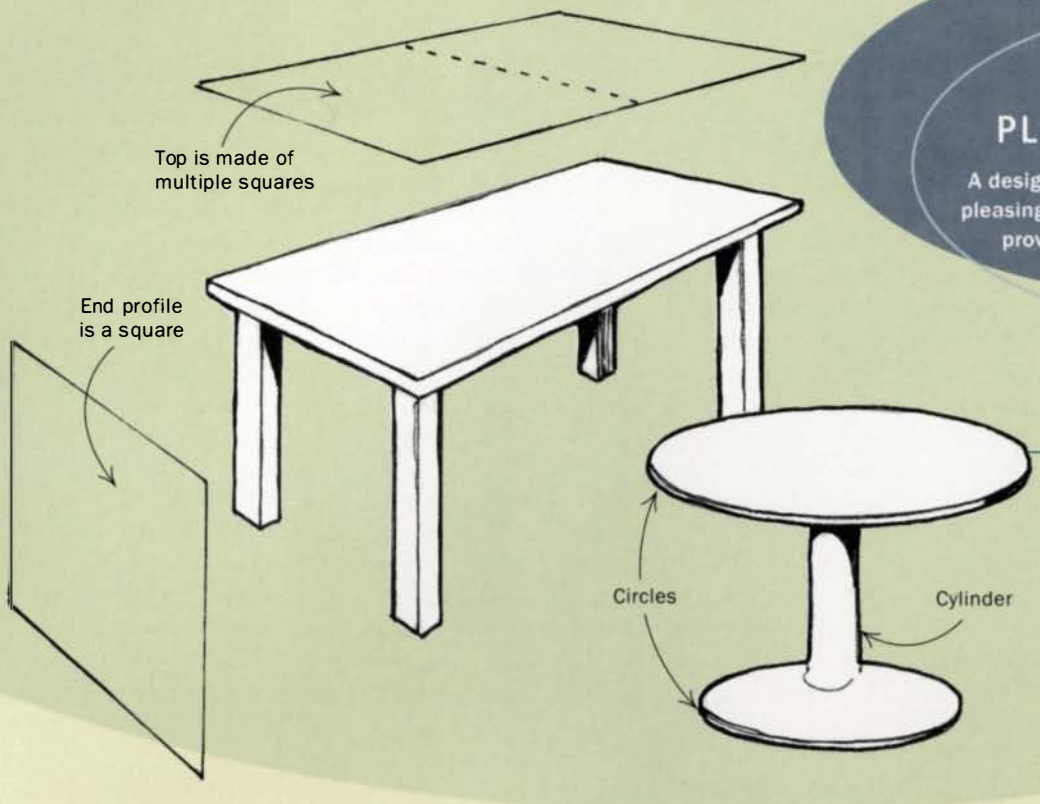
The height of a table is critical to someone who spends hours working at it.



WRITING TABLE | COMPUTER TABLE

THREE PATHS TO PLEASING PROPORTIONS

A design rationale is crucial to building tables with pleasing proportions. The three described below are proven approaches, but others are possible.

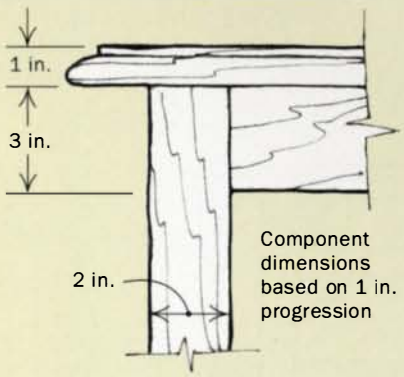


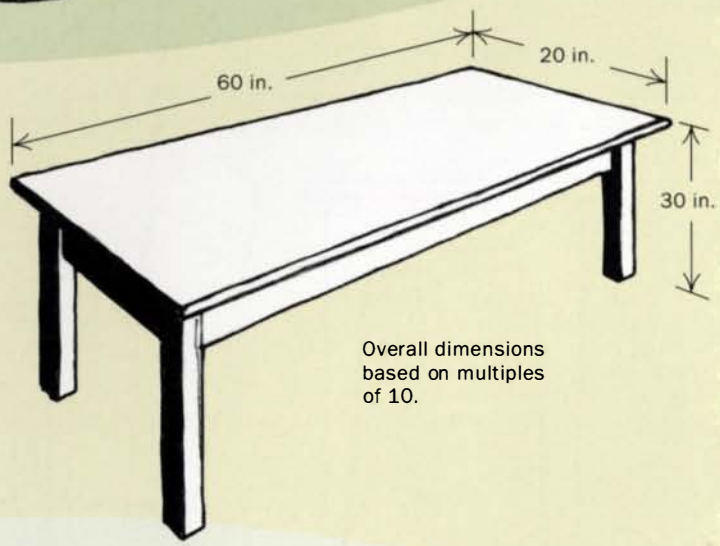
REPEATING GEOMETRIC SHAPES PROVIDE ORDER

Basic geometric shapes, such as squares, cubes, circles, ovals or ellipses, can be used to define both the overall shape and the details of a table, thereby providing it with a repeated pattern that unifies the whole structure.

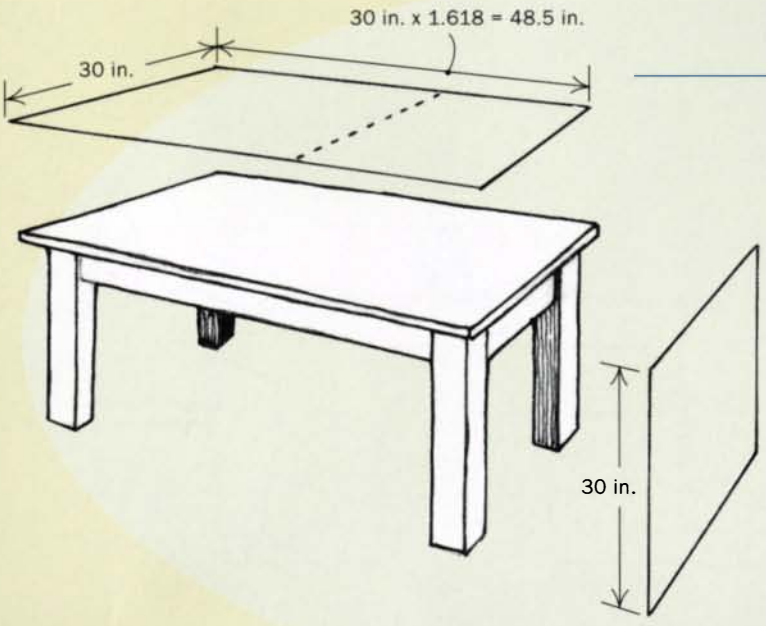
A NUMBER PROGRESSION IS A SUBTLE DESIGN DEVICE

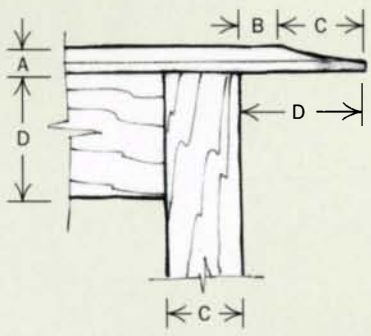
Starting with a 1-in. thick tabletop, for example, you might construct legs that measure 2 in. square and an apron that is 3 in. deep. Relating all dimensions to a common unit, either in multiples or regular increments, provides the table with an implied pattern that may not be immediately apparent but which lends it a fundamental unity.





CLASSICAL PROPORTION SYSTEM PLEASES THE EYE





A = tabletop thickness
B = A x ϕ
C = B x ϕ
D = C x ϕ

The Golden Mean is the ratio of 1 to 1.618, represented by the Greek letter phi (ϕ). A table top might be designed so that its long side was 1.618 times longer than its short side. The ratio might also be used to determine the dimensions of the various parts of a table. The apron might be ϕ times the width of a leg, the leg ϕ times the thickness of the table top.

tables really shouldn't be changed, such as the amount of leg room required beneath a skirt or the area a diner needs for greatest convenience.

More to a table than function and style

A table may also be defined by various structural features. The construction should, of course, be consistent with the intended use: a knock-down trestle table for portability; a draw-leaf table for occasional enlargement.

Frequently, there are trade-offs to be considered. A gate-leg table, for example, has leaves that enlarge it when needed. The leaves are supported by hinged legs that swing out. When folded, the leaves can interfere with seating, and when opened, there sometimes seems an inordinate number of legs that get in the way of diners' legs. A group of four nesting tables stores in the space of one, great for occasional use. However, they are sequential in height and either the tallest or the shortest is apt to be at a less-than-optimal level.

While your own experience and available tools will dictate to a large extent how any given table is constructed, resist the impulse to build only what you are comfortable with. It is worth the effort to research a new technique or a new joint for the sake of better function or more pleasing shape.

At the same time, do not get carried away by the urge for novelty. Successful construction entails the use of appropriate species, relevant construction methods, the right joint for the job — dovetail, mortise-and-tenon, dowels, biscuits, etc.—and a finish consistent with the intended use.

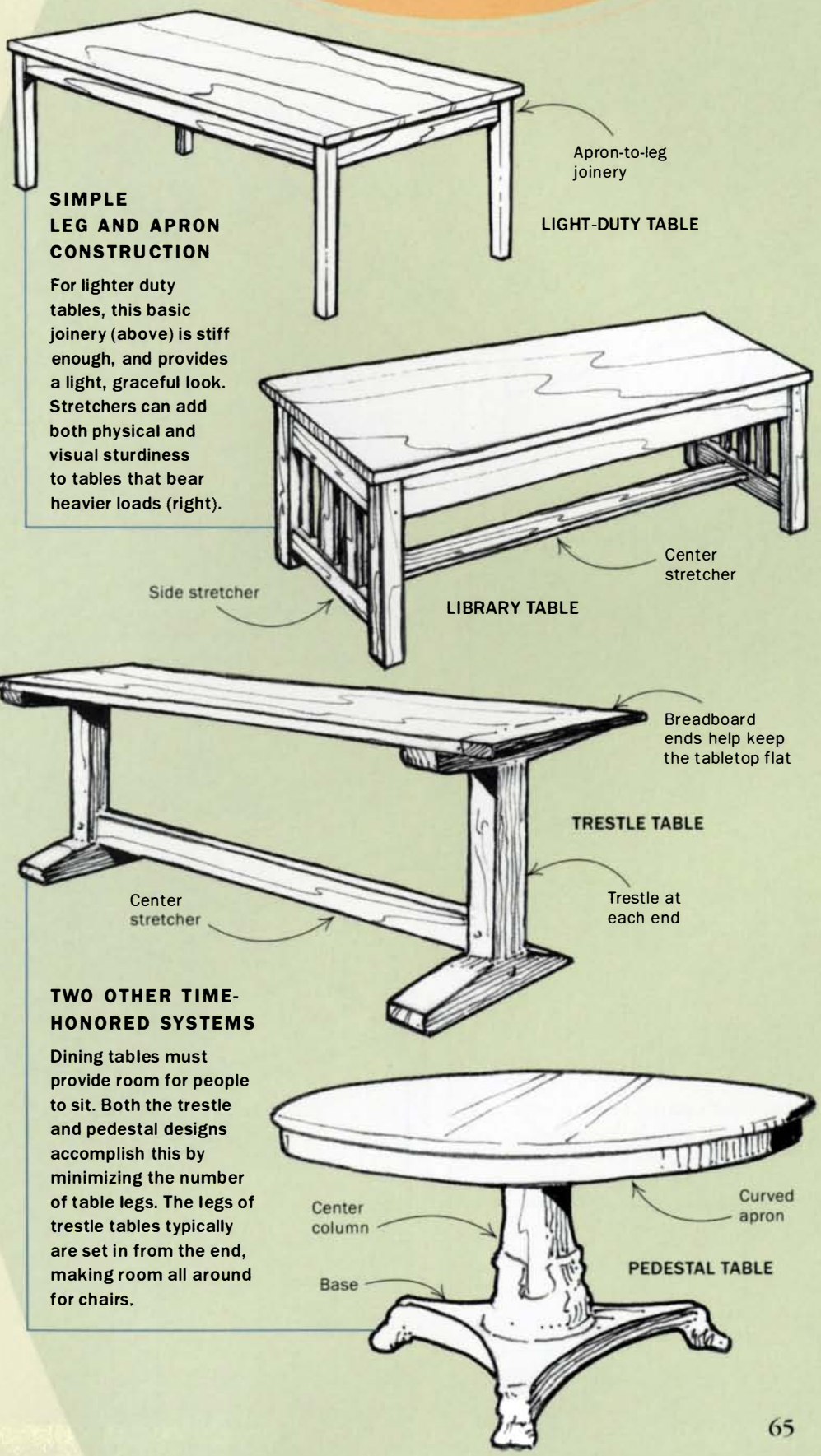
Legs set the style

To a great extent, all table tops are the same. They're flat, and intended to support something. While the wood species, edge treatment and apron certainly can make stylistic statements, it is the legs that most clearly establish a table's style and visual effect. As important as well-designed legs are, they will only be successful if they are considered as part of the overall design.

When viewing a table in a room that has enough light to make out forms but not details or wood species, it is still possible to discern the function of the table by looking at the legs. Four heavy legs joined by a horizontal stretcher tell us that this is a library table intended to support a load

TABLE BASE OPTIONS

Not only must legs be appropriately sized to support the table top, they're usually the element that makes the strongest design statement.



SIMPLE LEG AND APRON CONSTRUCTION

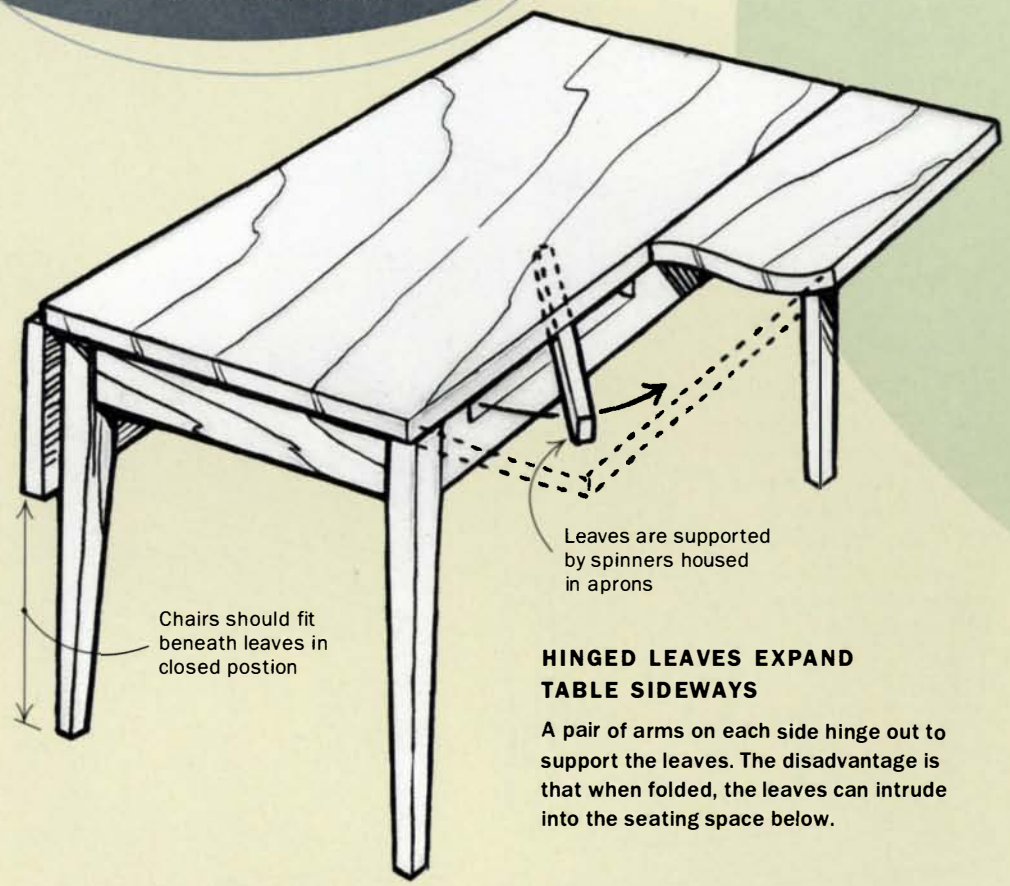
For lighter duty tables, this basic joinery (above) is stiff enough, and provides a light, graceful look. Stretchers can add both physical and visual sturdiness to tables that bear heavier loads (right).

TWO OTHER TIME-HONORED SYSTEMS

Dining tables must provide room for people to sit. Both the trestle and pedestal designs accomplish this by minimizing the number of table legs. The legs of trestle tables typically are set in from the end, making room all around for chairs.

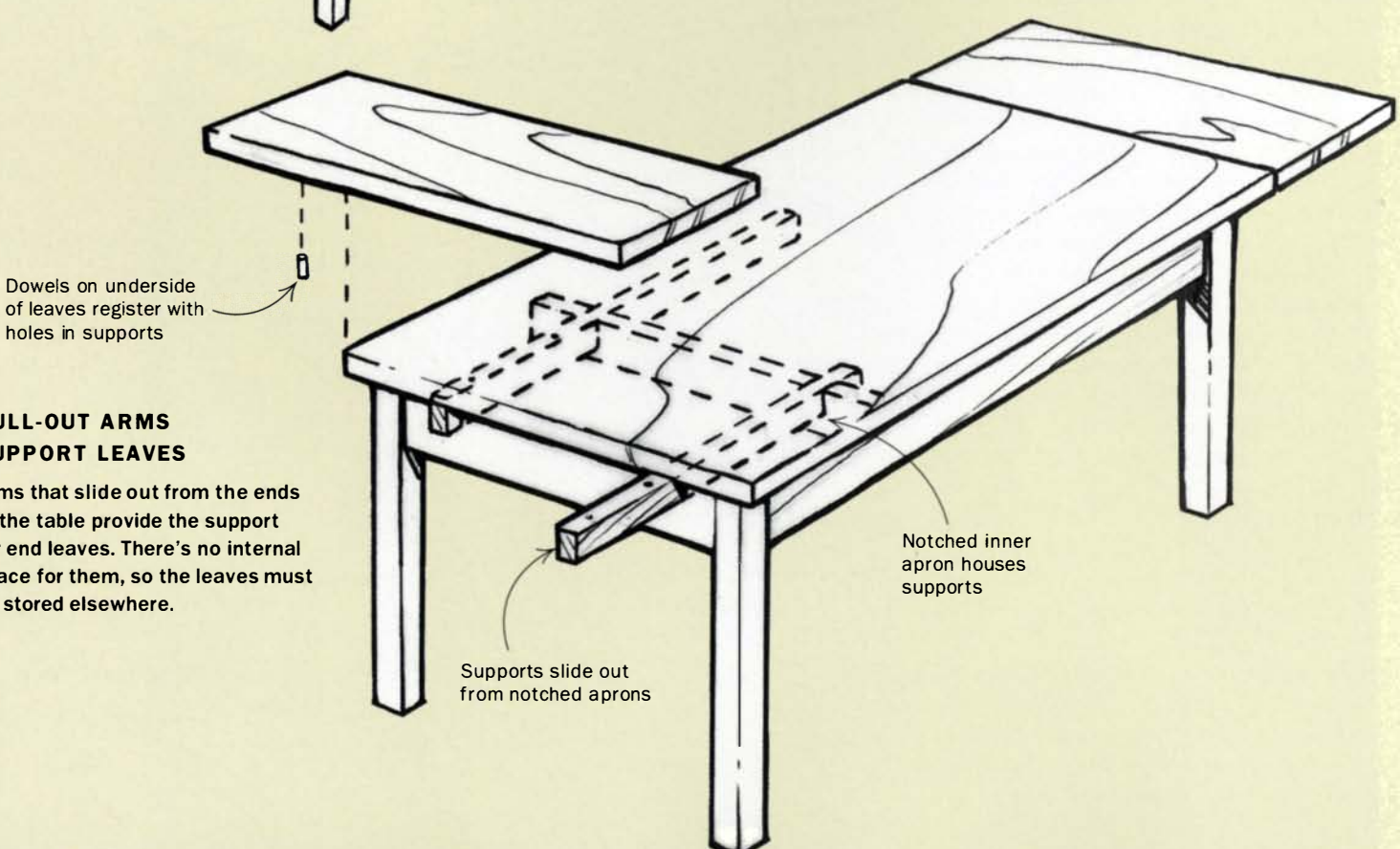
EXPANDING TABLES

The ability to expand can greatly enhance a table's utility, but this versatility comes with challenges. Sturdiness and leaf storage are two prime considerations.



HINGED LEAVES EXPAND TABLE SIDEWAYS

A pair of arms on each side hinge out to support the leaves. The disadvantage is that when folded, the leaves can intrude into the seating space below.



PULL-OUT ARMS SUPPORT LEAVES

Arms that slide out from the ends of the table provide the support for end leaves. There's no internal space for them, so the leaves must be stored elsewhere.

of books. Light and gracefully tapered legs that focus attention on the table top, as if it were floating, suggest that this may be a hall table for the display of some precious ornament.

Legs are frequently the key determinant of the table's style. For example, a Queen Anne table's top and apron are typified by restrained ornamentation. It is the cabriole legs that allow us to recognize the style. The same is true of the Shaker style, whose simple and efficient legs carry their load with no ornamentation or excess weight. And the Art Deco tables designed in the 1920s by Émile-Jacques Ruhlmann cast away traditionalism in favor of legs whose sensuous curves resembled nothing that had gone before. (See the back cover for a modern interpretation of Ruhlmann.)

Develop a plan that ties together all the elements

The final ingredient for successful table design requires that every detail be con-

sidered from the point of view of how the table will look.

Given that the functional requirements have been satisfied, and that the construction is sufficiently workmanlike, the most striking feature of any table is how well it fits in with its surroundings. This can mean designing in an established style such as Queen Anne or Arts and Crafts, or designing so that the general proportions, shapes, and colors are compatible with neighboring pieces. Compatibility can result from similarity or contrast. A severely modern design might fit very well with the relatively simple lines of a room full of Shaker furniture, but might look uncomfortably out of place in a room furnished in a ponderous Gothic or an ornate 18th-century style.

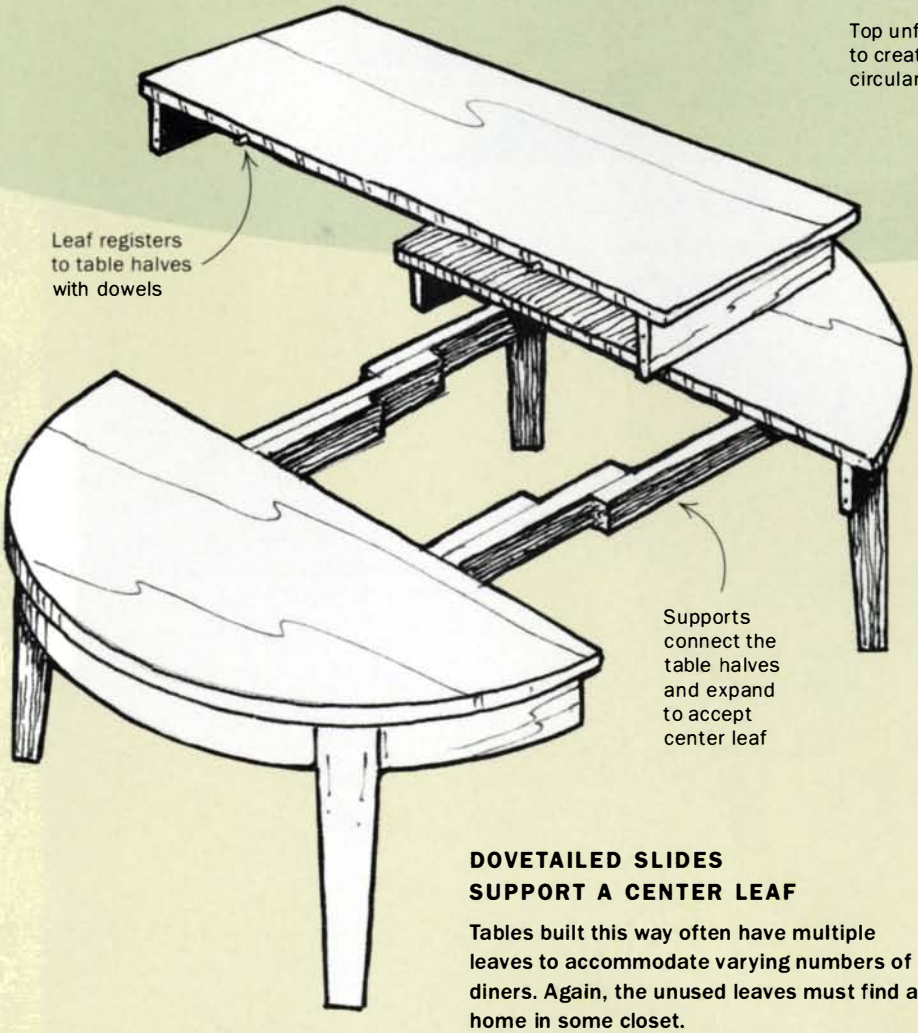
Designing in a particular period style can be difficult without understanding the underlying design sensibility of the period. It is not enough to employ superficial features of a period to achieve the right feeling. Slapping some mis-proportioned cabriole legs onto a table does not guarantee that it will look "Chippendale." Incorrect details can produce ludicrous and unhappy results, similar to applying a distinctive Rolls-Royce hood to a Volkswagen Beetle.

Arts and Crafts furniture is not as uncompromisingly rectilinear as it may initially appear. And Shaker furniture, for all its apparent simplicity and lack of ornament, is often surprisingly sophisticated in its proportions. Before attempting to design a table in a period style, make sure that you understand the typical construction techniques, the common materials, and the forms that governed the proportions.

This last point— forms that govern proportions — is more important than almost anything else. The term simply means that, functional and structural requirements aside, some method has been employed to decide on all the dimensional details of your table. Making decisions about the exact width of a leg or the depth of a skirt or apron based on structural requirements alone may guarantee solid joinery, but unless you are the rare designer possessed of an inherently perfect "eye" it is unlikely that your table will look as balanced and graceful as it could if designed according to some plan.

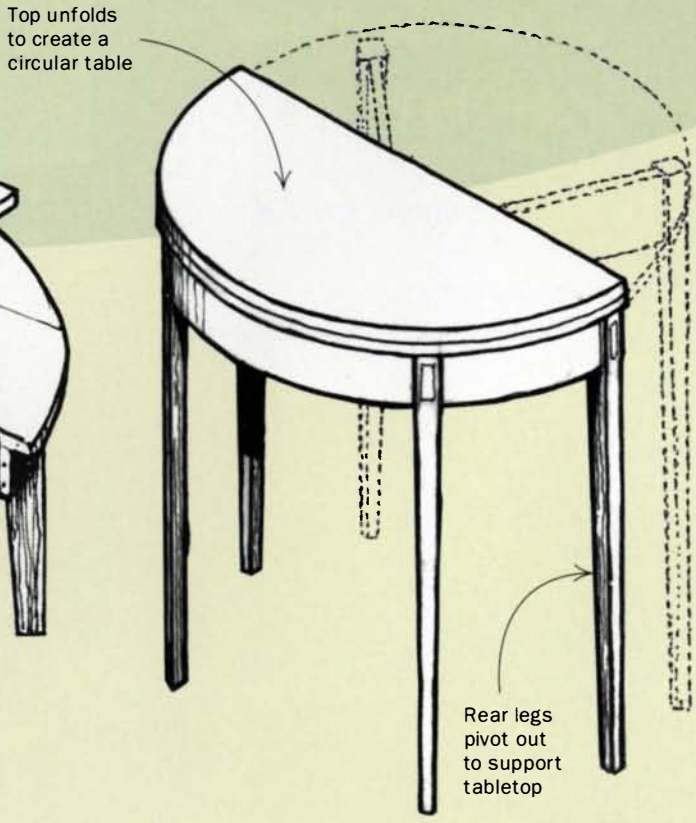
There are, in fact, numerous design paradigms commonly used by designers, some exceedingly simple, others more sophisticated. You may, indeed, invent your own paradigm or plan — the point is that using virtually any plan is better than making decisions about exact dimensions based on nothing more than what material is conveniently to hand, or what size router bits are available. □

Graham Blackburn is a furniture maker who teaches a design course at the Marc Adams School of Woodworking, and is the publisher of Blackburn Books (www.blackburnbooks.com) in Bearsville, NY.



DOVETAILED SLIDES SUPPORT A CENTER LEAF

Tables built this way often have multiple leaves to accommodate varying numbers of diners. Again, the unused leaves must find a home in some closet.



FOLDING TOP RESTS ON GATE LEG

With the top folded, this Federal demi-lune table tucks neatly against wall. When needed, gate legs swing out from the back, and the top folds open.

Five Smart Router Jigs

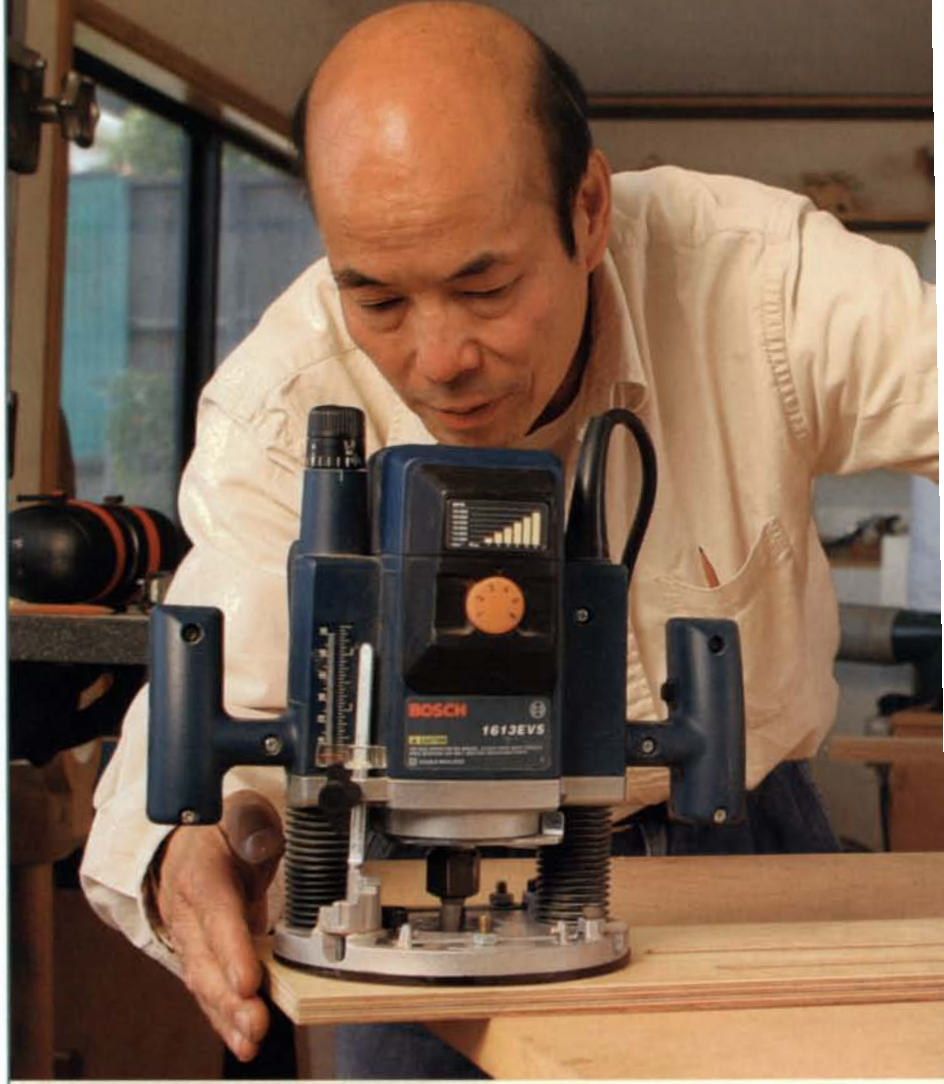
Get more from your router with this set of easy-to-make accessories

BY YEUNG CHAN

Few woodworkers enjoy the luxury of a spacious shop, and I'm no exception. Lacking the space for many large machines, I rely on my router when building furniture. However, used on its own, the router is limited in its abilities. More often than not, I use it in conjunction with various shopmade jigs that increase its ability to quickly and accurately cut circles, make edge profiles, cut dadoes, trim edge-banding, and even substitute for a lathe.

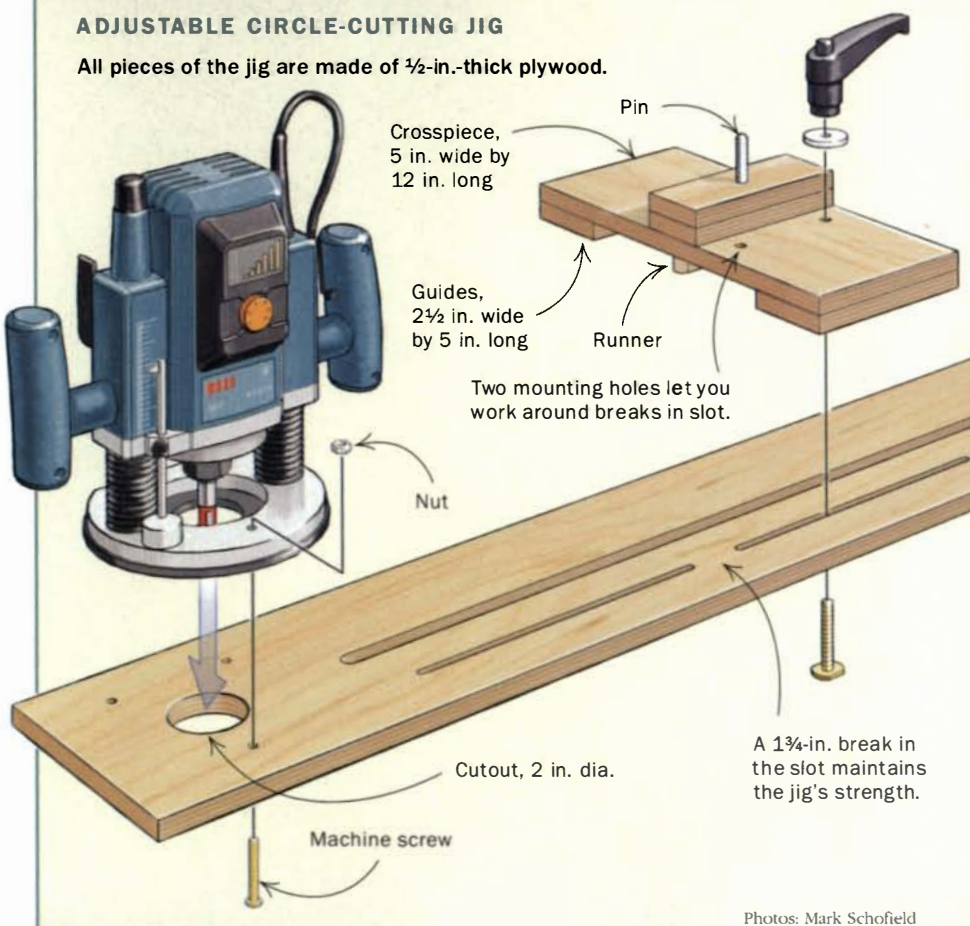
The five jigs illustrated here are all made from cheap and stable plywood or medium-density fiberboard (MDF) and require only a few pieces of hardware, available through Lee Valley (www.leevalley.com; 800-871-8158) or Rockler (www.rockler.com; 800-279-4441). These router jigs are as easy to use as they are to make.

Yeung Chan builds custom furniture in Millbrae, Calif.



ADJUSTABLE CIRCLE-CUTTING JIG

All pieces of the jig are made of ½-in.-thick plywood.



Photos: Mark Schofield

Cut perfect circles

This jig can be used to rout a circle with a maximum diameter of 72 in., but the design can be modified for other diameters. First, drill a ¼-in.-dia. hole, ¼ in. deep, in the middle of the workpiece. If you don't want the hole to show, work on the underside. Next, mark a point on the desired edge of the circle, place the sled over the base, and fit the jig's pin in the center hole. Move the base in or out until the bit is on the mark, then lock the sled.

Turn on the router and plunge down to start the initial cut, which should be less than ⅛ in. deep, just enough to define the circle. Use a jigsaw to cut away the outside pieces, leaving about ⅛ in. outside the final size of the circle. This method enables you to support the corners as they are cut off so that they won't damage the finished workpiece. Once the bulk of the waste has been removed, the router has to make only a light final cut. If you're working with solid wood, pay attention to the grain's orientation and the bit's rotation. Climb-cut when necessary to avoid tearout.

finewoodworking.com

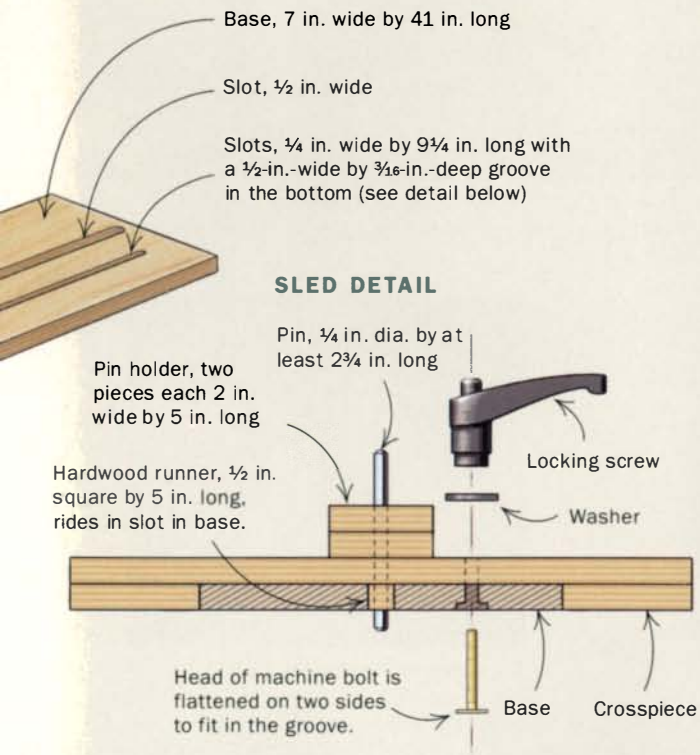
Visit our Web site to see the author demonstrate his circle-cutting jig.

Set the size of the circle. *With the pin registered in the center of the workpiece, move the jig's base until the inside edge of the router bit is aligned with the desired outside edge of the circle.*

Make a shallow cut to define the circle. *The initial cut made with the router should be only about ⅛ in. deep.*

Remove the waste. *Following the track left by the router, saw away the waste.*

The final cut. *The router now has to remove only a small amount of material, creating less dust and leaving a clean cut.*



Drawings: John Hartman

Trim or cut large panels

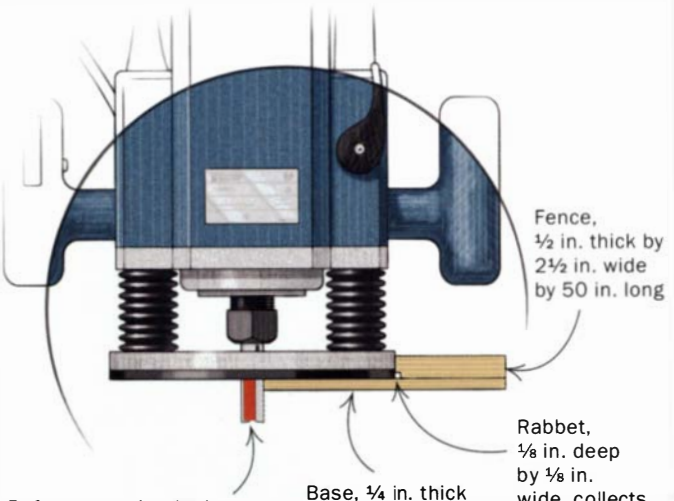
It is a difficult job to cut a large panel on a tablesaw that's not equipped with a sliding table. So I made a simple jig that can be used to cut out a section from a full sheet of plywood or medium-density fiberboard (MDF) or to clean up a rough cut made by a jigsaw or a circular saw.

Once you've assembled the jig, run the router along the straight edge of the fence to create a matching straight edge on the base. To use the jig, clamp it at both ends of the workpiece with the edge of the jig aligned with the desired cut. As the router rides along the jig, it leaves a perfectly straight, clean cut.

Straighten edges. *Rough-cut the panel, then clean up the cut with this straight-edge jig.*

STRAIGHT-EDGE JIG

Always use the same-diameter router bit with this jig. A smaller bit will cut wide of the jig's edge, while a larger bit will eat into the jig.



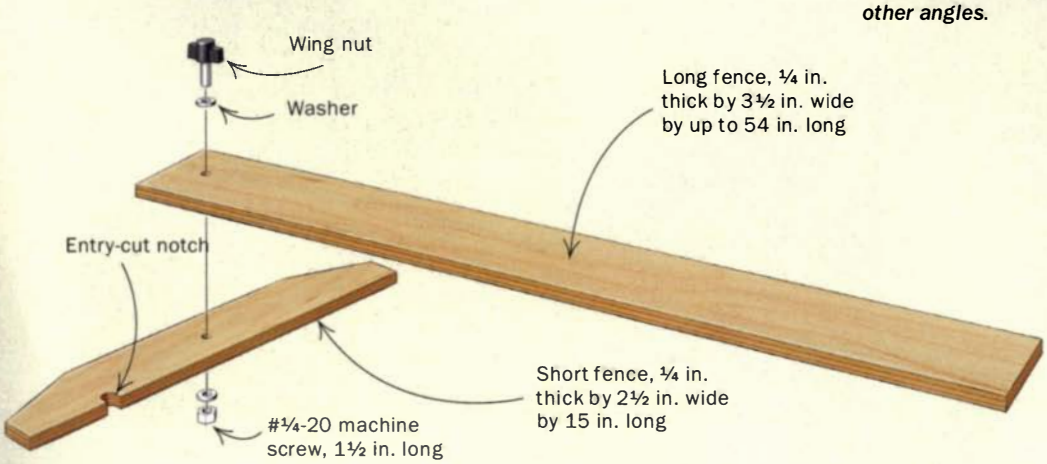
Cut dadoes at any angle

I reach for this jig when I have to cut multiple parallel dadoes on a panel. Most of the time these grooves are perpendicular to the short fence of the jig, but they can be cut at different angles. Like the straight-edge jig (above), this one needs to be clamped at both ends during use. As long as you use the same size bit each time, and the same angle, the entry cut on the jig's short fence will show the location of the dado. Use an up-cut spiral bit, which will prevent chips from jamming in the dado. For deep dadoes, make several passes.

Variable-angle jig. *Although dadoes usually are perpendicular to the long edges of a panel, this jig can make cuts at other angles.*

DADO-CUTTING JIG

Align the notch cut by the router in the short fence with the desired dado location.



Cut clean and accurate dadoes. *Clamp the dado jig at both ends and make the cut in two or three passes.*

Trim edge-banding quickly and cleanly

One of the hardest parts of using solid wood to edge plywood or laminate panels is trimming the edge-banding flush with the plywood. If you use a plane, you risk cutting through the thin plywood veneer, and sanding can leave cross-grain scratches on the plywood. This router jig enables you to trim the banding flush, quickly and flawlessly.

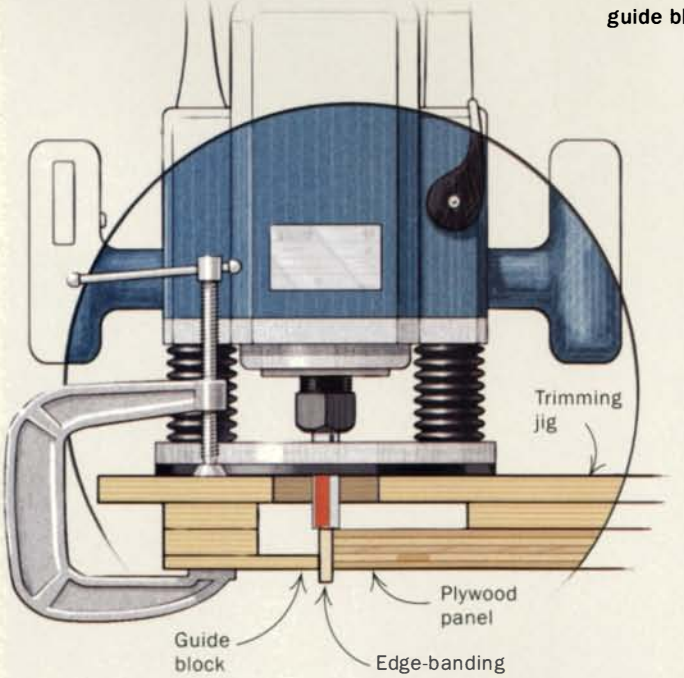
Mount the router on the jig, and set the depth of the bit so that it just clears the plywood surface. A router with micro-adjustment comes in handy. Adjust the guide block to align the bit so that the carbide tips extend just a hair over the plywood. Clamp the guide block tight, and you're ready to go.

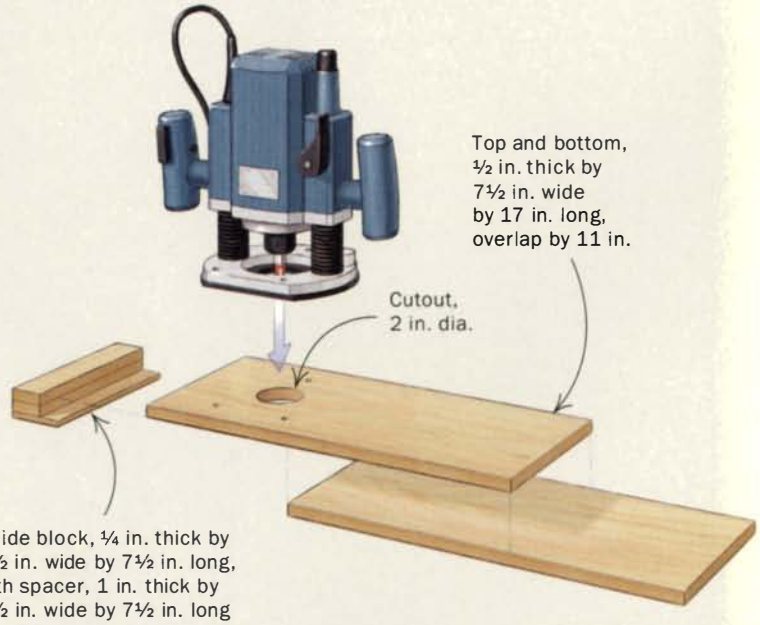
Pay attention to the router bit's rotation and the direction you move the router. To avoid tearout, you want the leading edge of the bit to enter the wood first. Known as climb cutting, this method can be dangerous if the bit pulls the router forward uncontrollably. Because the amount of wood being removed is so small, you should be able to control the router easily.

Flush-cut edge-banding. *This jig allows you to cleanly cut solid-wood edge-banding flush with the plywood panel.*

EDGE-BAND TRIMMING JIG

The router bit should be positioned a hair above the plywood surface. The spacer/guide block is clamped to the jig to steer the router along the edging.





Make turnings with a router

This jig allows you to "turn" round columns and posts using a router. To use the jig, first drill a 5/16-in.-dia. hole, 1½ in. deep, in each end of the workpiece, then insert a steel rod to hold the workpiece inside the jig. Lock a drill stop on each end of the rod where it enters the jig to prevent the workpiece from shifting during the turning. Clamp two wood guide pieces to the edges of the router subbase to restrict the router's side-to-side movement.

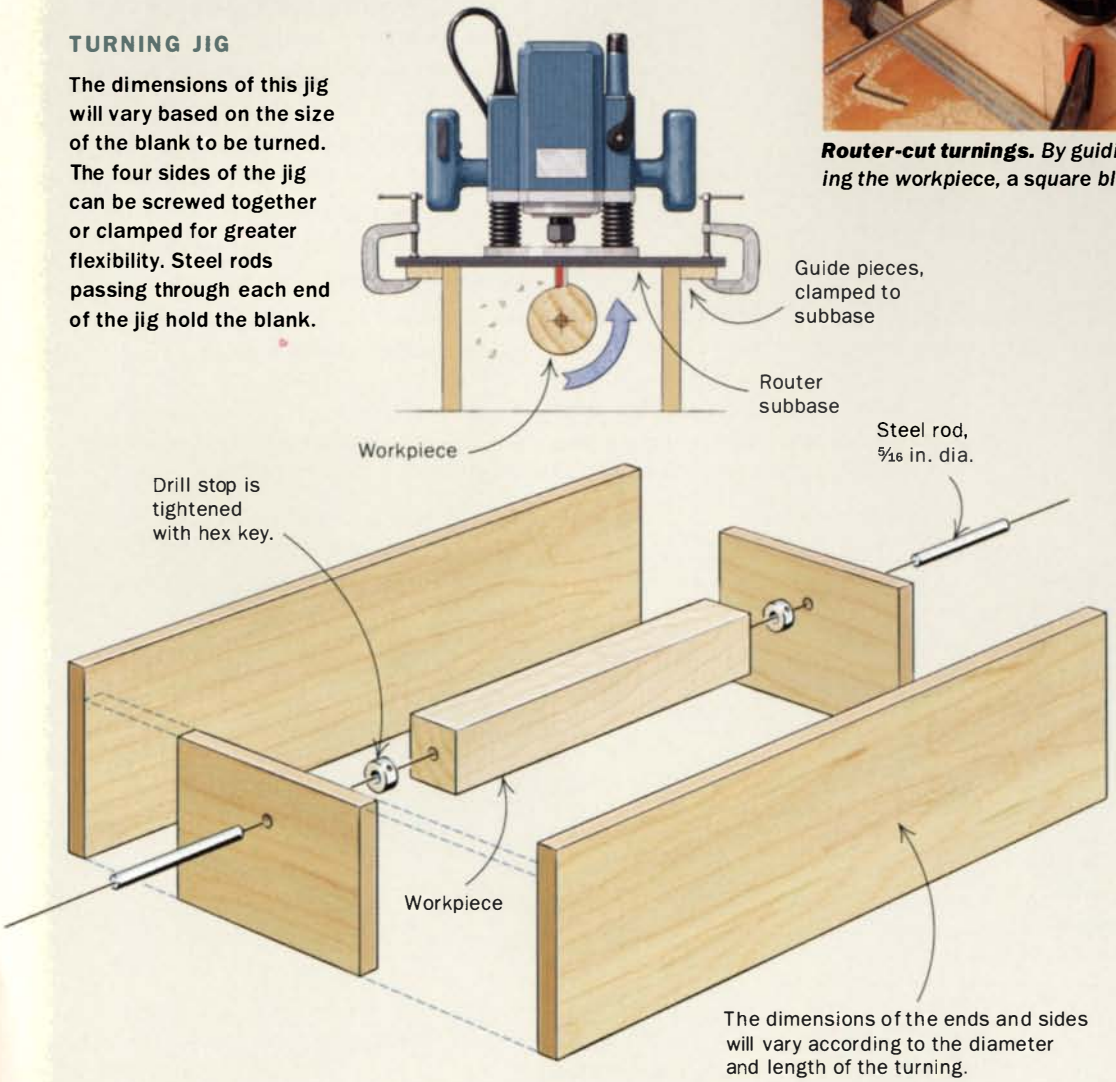
Turn on the router, slowly plunge down, and move the router halfway up and down the jig as you slowly rotate the workpiece. As you increase the depth of cut, you'll create a cylinder. Then repeat the process on the other half of the workpiece. Throughout the process, make small cuts for a better finish and a safer operation.

You can adapt this jig to create different turnings. Offset the hole at one end of the jig to make tapered turnings, or clamp blocks to the long sides of the jig to produce stopped turnings. If you design the jig with gently curving sides, the workpiece will become football shaped as it is turned.

Router-cut turnings. *By guiding the router back and forth while turning the workpiece, a square blank gradually becomes a cylinder.*

TURNING JIG

The dimensions of this jig will vary based on the size of the blank to be turned. The four sides of the jig can be screwed together or clamped for greater flexibility. Steel rods passing through each end of the jig hold the blank.



Tapered turnings. *Lower the hole at one end of the jig to taper the turned workpiece.*

Stopped turnings. *Clamp blocks to the side of the jig to leave a square section on the turning.*

Metal Smoothing Planes

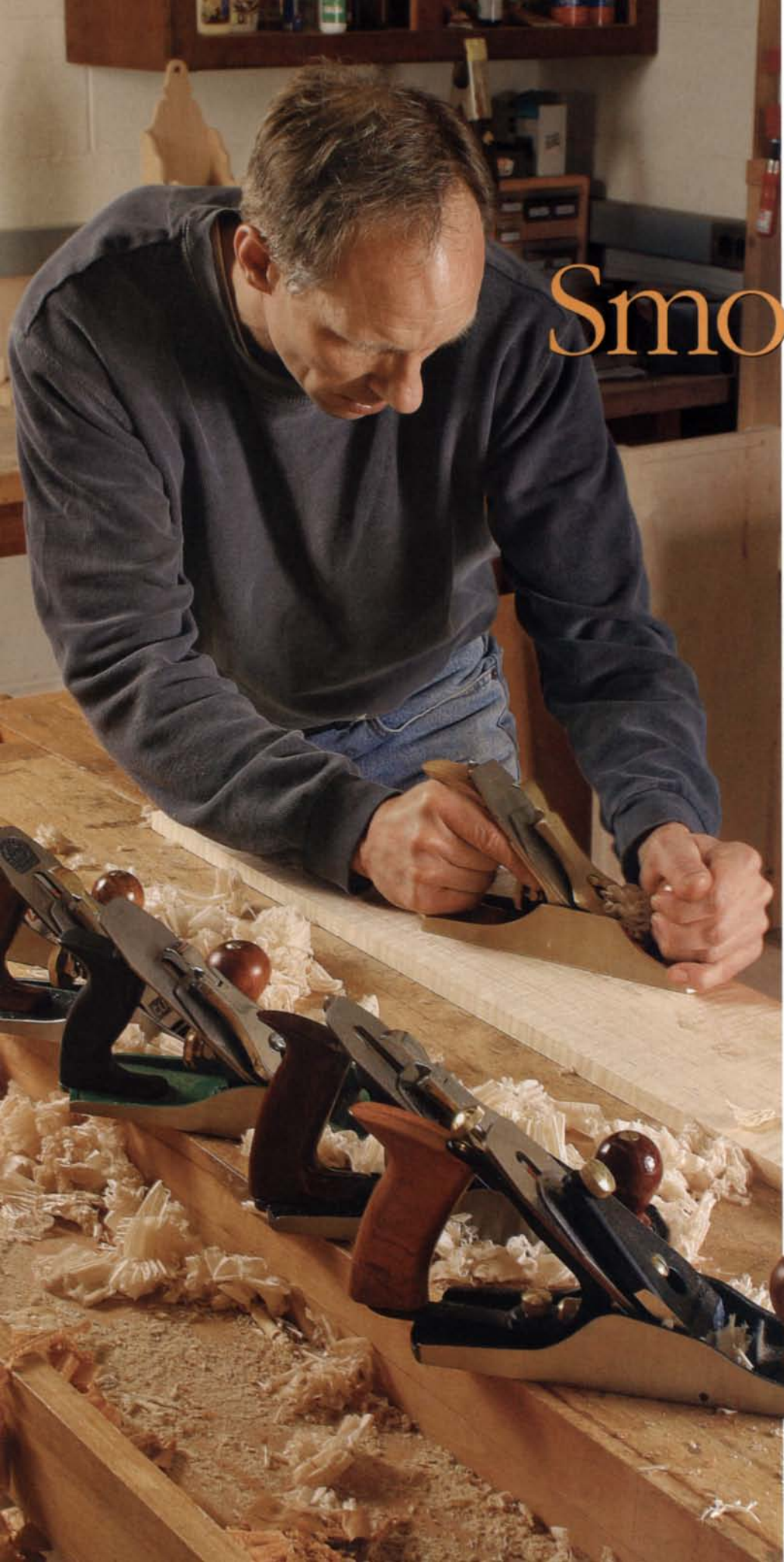
There are several great choices between $30 and $300

BY CHRIS GOCHNOUR

When I first set up shop building custom furniture, I relied completely on portable belt sanders and orbit sanders for all surface preparation. However, I soon grew weary of the sanding woes—too much dust and noise, time and tedium working through the progressive grits. It never failed that when the finish finally went on, I became painfully aware of some sanding flaw I'd overlooked or planer snipe I'd neglected to remove.

With so much time spent on surface preparation, I needed a more effective method of accomplishing the task. I knew little about smoothing planes, but I was aware of their value to artisans throughout the ages, so I decided to give them a fair shake.

At first, the results were mixed. I



Unmatched at surface preparation. *A good-quality, well-tuned handplane will create a dead-flat, cleanly sliced surface in minutes.*

struggled with getting the planes sharpened and tuned just right (for more on tuning, see the story on p. 79). I also strived to comprehend the importance of reading and understanding wood grain. In spite of the learning curve, I thoroughly enjoyed the journey. In time, the tuning process became routine, and understanding wood grain became second nature. Now I use smoothing planes as my primary means of surface preparation, and I get cleaner, crisper results in less time than I ever did by sanding.

Ten planes, four different designs

For this article, I looked at eight metal Bailey- and Bedrock-style planes in the most common No. 4 size—as well as two low-angle models. Within this wide selection and price range (from $30 to $300), everybody from hobbyist woodworkers to professional furniture makers can find a tool that suits their needs.

The Bailey-style planes can trace their roots back 125 years to an original designed by Leonard Bailey and made by the Stanley Rule and Level Co. The Bailey plane worked so well that little has been done over the years to improve upon its basic design. The Anant, Footprint, Groz, Kunz, and Stanley planes (right) are based on the Bailey pattern.

Around the turn of the 20th century, Stanley refined the basic Bailey design and created the Bedrock plane, declaring it the best plane made. The Clifton and Lie-Nielsen planes (see pp. 76-77) are based on the Bedrock pattern.

The Veritas bench plane (see p. 77) is a uniquely 21st-century tool. It is not based on any one historic design; instead, it draws on successful elements from a variety of makers and incorporates some truly original concepts.

Low-angle smoothing planes are becoming more popular and are appealing in their simplicity. So I decided to try two low-angle smoothers made by Lie-Nielsen and Veritas (for more on the low-angle planes, see p. 78).

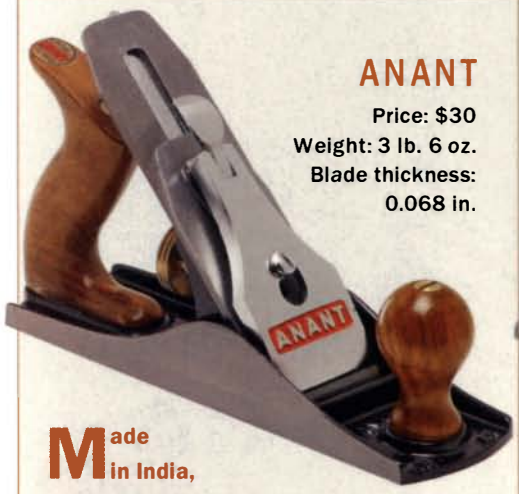
What to look for in a handplane

I find there are three critical criteria in selecting a handplane, as well as a handful of other characteristics that make a plane more effective. First is a good-quality blade that can be sharpened to a keen edge and then hold that edge for a substantial

Bailey-style planes

The original No. 4 Bailey design featured a cast-iron body, wooden tote and knob, an adjustable frog milled at 45°, and a blade held with the bevel down. Though variations exist among the Anant, Footprint, Groz, Kunz, and Stanley, they all are Bailey-style planes, with prices ranging from $30 to $80. Some of the planes required a good deal of tuning before being put to wood, but each performed reasonably well. For the price, they make good general-purpose planes, suitable for miter, end-grain, and long-grain work.

Classic Bailey-style design. *The adjustable frog on the Anant plane allows for easy vertical and lateral adjustments.*



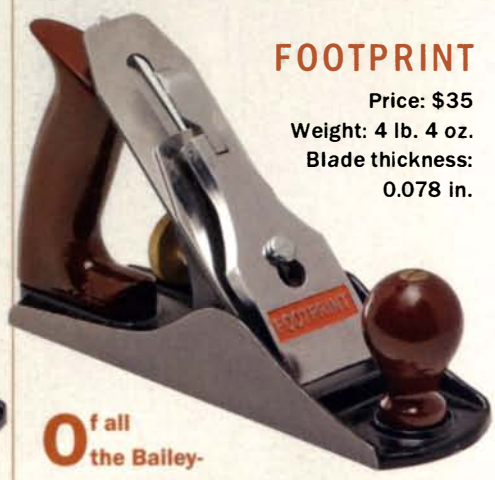
ANANT

Price: $30
Weight: 3 lb. 6 oz.
Blade thickness: 0.068 in.

Made in India, the Anant appears to be a reproduction of an original Bailey, but it lacks refinement in its fit and finish. That said, I didn't have to spend much time tuning it. The handles are made from a tropical hardwood resembling mahogany. The finish on the handles was a bit rough but still comfortable. I honed the blade and tuned the chipbreaker, and the plane gave satisfactory results.

There was a lot of backlash in the blade-adjustment knob—nearly four rotations—and it was difficult to get it set for a light cut. Once set, it held well. The blade is only 0.068 in. thick and chattered slightly when planing challenging hardwoods.

If tuned meticulously and fitted with a thicker aftermarket blade, the Anant could be a dependable smoother.



FOOTPRINT

Price: $35
Weight: 4 lb. 4 oz.
Blade thickness: 0.078 in.

Of all the Bailey-style planes reviewed, the Footprint, made in Sheffield, England, comes the closest to matching the original made by Stanley. The casting and machining were clean. Like the Baileys of old, the Footprint has a three-piece lateral adjuster, solid-brass blade-adjusting screw, and a frog-adjustment screw. It even has wooden handles, although they're painted.

I had trouble aligning the frog with the body while adjusting the mouth opening. I discovered that the blade's factory grind was slightly out of square, which required me to adjust the frog laterally to get it aligned. The sole of the Footprint was out of true by nearly 0.003 in.—enough that it required lapping. Once sharpened and tuned, however, this plane had a feel similar to vintage Bailey planes.

Trust your eye. *To align the blade parallel with the sole on a Bailey-style plane, you simply sight down the sole and adjust the lever.*

Thick blade is better. *The spring tension in a blade and chipbreaker assembly can cause a thin blade to bow, which will cause chatter. Install a thicker aftermarket blade to boost performance.*

GROZ SP-4

Price: $37
Weight: 3 lb. 12 oz.
Blade thickness: 0.085 in.

The Groz is a new plane made in India by a company that also makes precision machine tools. The plane looked good with its black japanning, nickel-plated lever cap, tropical hardwood tote and knob, and brass fittings. But my optimism dimmed after closer inspection.

The frog bed was concave from side to side by 0.003 in. and, coupled with a thin blade, caused the plane to jump and chatter on white oak and maple. The chipbreaker needed tuning to help shavings pass without jamming. Even fitting the plane with a 3/32-in.-thick Hock blade and a Clifton Stay-Set cap didn't help. Also, although the sole was flat, it was so coarsely milled that it required lapping with an abrasive. To work satisfactorily, the Groz plane also would require lapping the frog bed flat, a difficult task because the lateral adjuster and the yoke are in the way.

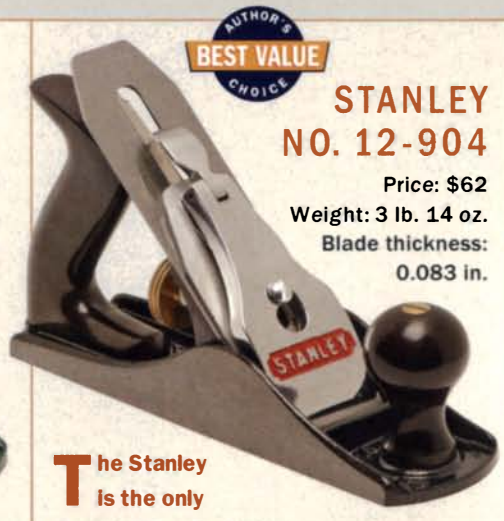
KUNZ NO. 581-1204

Price: $80
Weight: 2 lb. 15 oz.
Blade thickness: 0.095 in.

The Kunz plane is made in Germany. Though lacking in aesthetic appeal, the plane was comfortable to use. Compromises of the original Bailey design, such as a pressed-steel lateral adjuster, a pressed-steel yoke, and no frog-adjusting screw, in no way restricted the plane's adjustment capabilities. Note that unlike all of the other planes, the blade-adjustment knob on the Kunz advances the blade with a counterclockwise rotation, which took me a minute to get used to.

The thick blade had been nicely lapped at the factory, which made sharpening a breeze. The chipbreaker had a little burr, but once removed, it fit the blade just right.

In spite of an adjustable frog, the narrowest I was able to close the mouth was about 1/8 in.—a bit wide for optimum smoothing. This plane required little time to set up and performed reasonably well.



STANLEY NO. 12-904

Price: $62
Weight: 3 lb. 14 oz.
Blade thickness: 0.083 in.

The Stanley is the only Bailey-style plane that rightfully can trace its lineage directly to its inventor, Leonard Bailey. But sadly, the once familiar rosewood handles have been replaced with molded plastic and the trademark three-piece lateral adjuster is now one piece of pressed steel. On the plane I looked at, the frog-to-body contact was quite rough, and the sole was dished 0.002 in., toe to heel.

Once tuned up, this tool felt similar to the vintage Baileys I've used for years. After I replaced the stock blade with a 1/8-in.-thick Lie-Nielsen blade and chipbreaker, this plane produced a consistently thin shaving in dense hardwood.

Even though Stanley's current offering isn't quite at the level of quality it once was, as a general-purpose plane it's still a good product, and it's my choice for best value among the planes reviewed.

Photos: Rodney Diaz

amount of working time. The blade thickness matters, too: Thin blades are more likely to chatter and vibrate.

Second, for those planes that incorporate a chipbreaker, a well-made one is essential. Chipbreakers serve two purposes: They hold the thin cutting edge of the blade steady during the cut, and they aggressively deflect the shaving upward, keeping tearout to a minimum. If the chipbreaker is not made or tuned properly, it becomes more of a liability than an asset, creating undue friction and requiring more force to propel the plane. Worse yet, it can snag the shaving, causing it to back up and quickly choke the mouth. The best smoothing planes have well-designed chipbreakers that need little tuning.

Third, you need a plane with a flat sole. A smooth, consistent cut is not possible if the sole is far out of true. To do its best in finishing a surface, a smoothing plane need only take a gossamer-thin shaving of 0.001 in. to 0.002 in. thick. If the sole of the plane is concave from toe to heel by, say, 0.003 in., then the blade needs to be advanced before it even contacts the surface. It's not possible to maintain a consistent, light cut if the sole of the plane is not flat. Again, the best models need little tuning.

Other important factors:

Ease of adjustment—Can the blade be set quickly and does it hold its setting? The blade must seat flat and be held securely to the frog. Are the adjusters where they should be for easy access?

Narrow mouth—For optimum smoothing of figured wood, a narrow mouth should be possible. A narrow mouth closely supports the fiber being cut by the blade, further reducing the potential for torn grain.

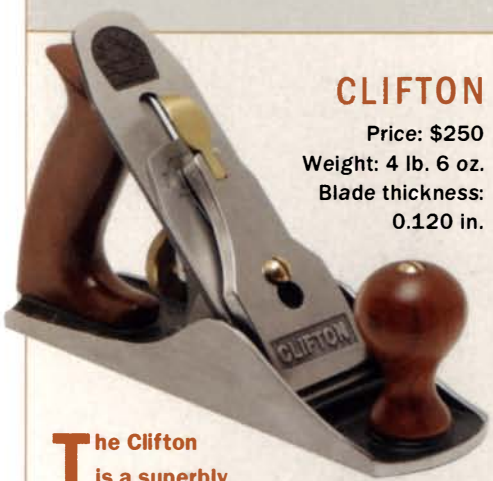
Heft, or weight—Within reason, a heavy tool can dampen vibration, making the plane less fettered by changing figure, grain, and knots.

Ergonomics and aesthetics—Is the plane comfortable to use for extended periods of time? Are you content with a functional tool lacking in aesthetic appeal, or do you prefer to outfit your shop with tools steeped in form as well as function?

Chris Gochnour builds furniture and teaches woodworking near Salt Lake City, Utah.

Bedrock-style planes

The original No. 4 Bedrock-style planes were refined versions of the basic Bailey design (see p. 74). The frog moves forward and backward on a track, which eliminates slop and allows you to adjust the mouth opening without removing the blade assembly. Two pointed draw pins, accessible from the rear of the frog, engage slightly offset conical depressions, allowing the frog to be loosened and tightened from behind. The Clifton and Lie-Nielsen planes both are based on the Bedrock pattern. The Veritas bench plane (far right) is a different animal, drawing on successful elements from diverse makers, as well as some wholly original concepts, such as a frog and handle that are one unit.

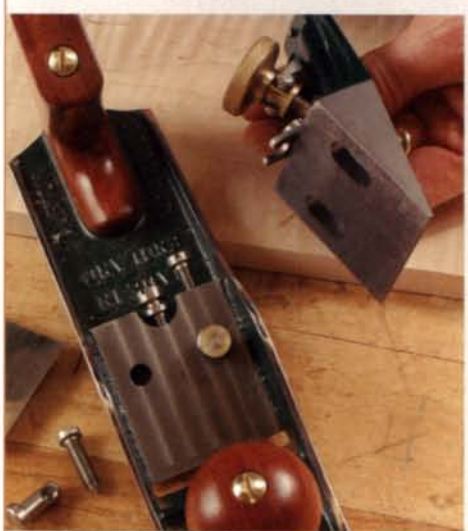


CLIFTON

Price: $250
Weight: 4 lb. 6 oz.
Blade thickness: 0.120 in.

Two-piece chipbreaker. *The Stay-Set design on the Clifton allows for quick honing of the blade and more support near the cutting edge.*

The Clifton is a superbly detailed plane, with polished edges, bubinga handles, and fittings that are machined from solid brass or stainless steel. Clifton has patterned this plane after the Bedrock design, so the frog is rock solid and easy to adjust. The blade is 0.12 in. thick and made from hand-forged high-carbon steel. The back of the blade was slightly distorted, and it took me about 20 minutes to lap it flat.



Frog provides plenty of support. *The blade and chipbreaker are mounted on a solidly milled frog, which gives better support and adds stability in use.*

The two-piece, Stay-Set chipbreaker required no tuning. This unique design has a couple of advantages. First of all, it makes touch-up honing of the blade quick because the front piece lifts right off, exposing the cutting edge and the back of the blade. Also, the chipbreaker adds excellent support and dampening qualities to the blade, especially near the cutting edge where it's most needed.

One disappointment with the Clifton was the sole, which was dished 0.003 in. from toe to heel. In use, the concave sole made for erratic performance, especially in harder woods. Fortunately, this was remedied easily in about 30 minutes by lapping the sole with abrasives on a flat surface. With its sole flattened, I was able to take full advantage of this good-quality tool.

LIE-NIELSEN NO. 4

Price: $300
Weight: 4 lb. 10 oz.
Blade thickness: 0.125 in.

Lie-Nielsen's bronze smoothing plane, based on the Bedrock design, was impressive right out of the box. The sole was dead flat, and the blade had been ground accurately and lapped flat at the factory. The chipbreaker required no tuning. After less than five minutes of honing the edge, the plane was in service and cutting perfectly.

Bronze castings dampen vibration and give the plane an unwavering feel, but you also can buy a version made from ductile cast iron for about $50 less. The cherry tote and knob fit the hand just right. The blade is a full ⅛ in. thick, made from A2 steel that has been cryogenically tempered. It held a keen edge well.

Lie-Nielsen has designed a new chipbreaker that makes things even better. Made from ⅛-in.-thick steel, it has a 25° bevel with a 0.015-in. lip on its underside. I was able to move the chipbreaker right up close to the cutting edge, maximizing its utility without increasing any drag on the plane caused by friction. You can buy this plane with a frog milled at 50°. The increased cutting angle can help control torn fibers in highly figured woods.

The bronze Lie-Nielsen smoothing plane is the best overall tool of the bench planes reviewed.

Beefier frog and blade. *The frog on the Lie-Nielsen plane benefits from the added weight of bronze, which helps dampen vibration. The ⅛-in.-thick blade was lapped flat at the factory and held an edge well.*

VERITAS NO. 4

Price: $175
Weight: 4 lb. 9 oz.
Blade thickness: 0.127 in.

I really like this plane for two reasons: Its design is unique and original, and it works well. The Veritas plane is cast from ductile iron and trimmed with hardwood handles and knurled brass knobs. Its blade is a full ⅛ in. thick and made from A2 steel.

Two setscrews center the blade in the mouth opening. Hence, all lateral movement occurs in back. The Norris-style adjuster serves double duty, controlling both depth and lateral adjustments. Though not quite at your fingertips, as in the Bedrock design, the adjuster is precise and had very little backlash.

The frog and handle become one assembly. *This new design adds strength and stability to the handle and frog.*

The frog assembly is unique. The handle and frog are one unit, which adds strength and rigidity to both. The blade bed on the frog is sizable and precisely milled, and it extends through a cutout in the body of the plane, allowing the frog to reach all the way to the sole. This provides maximum support of the blade all the way to its beveled cutting edge. Like the traditional Bedrock design, the frog on the Veritas can be moved forward and back to adjust the mouth opening without having to remove the blade.

All of these design features, fine workmanship and a reasonable price make this a first-rate plane, capable of planing even the most highly figured hardwoods. It ties for best overall with the Lie Nielsen.

Low-angle planes

Low-angle smoothing planes orient the blade with the bevel up. They do not have a frog and chipbreaker; instead, the blade is supported by a large bed and held in place with a lever cap. Because the bevel faces up, the angle at which you sharpen the blade alters the cutting angle. The standard 25° sharpening angle, plus the 12° bed, produces a 37° cutting angle, ideal for end-grain and cross-grain work. A blade sharpened at 38° produces a 50° cutting angle, perfect for tackling highly figured woods prone to tearout.

Low-angle planes excel at slicing end grain. *Dampening the stock with paint thinner will help reduce tearout.*

LIE-NIELSEN NO. 164 LOW ANGLE

Price: $235
Weight: 3 lb. 9 oz.
Blade thickness: 0.173 in.

Lie-Nielsen's low-angle smoother is patterned after Stanley's No. 164, which was produced for a relatively short period, and consequently, originals are rare. Hats off to Lie-Nielsen for taking a great design and making it even better.

The plane is the same size as a No. 4 bench plane. It's cast from ductile iron and fitted with familiar cherry handles. The stout 3⁄16-in.-thick A2-steel blade is mounted bevel up on a large, precisely milled bed. The mouth can be adjusted easily by loosening the front knob and shifting the cam lever left or right.

The plane's compact size doesn't allow for a depth adjuster behind the blade. As a result, a very unconventional design was adopted where the adjuster sits atop the lever cap. This works well enough, and it puts the knob right at your fingertips, though it does make blade removal slightly more cumbersome. Lateral adjustments are made by manually shifting the blade back and forth.

Out of the box, this plane was up to the stringent standards Lie-Nielsen has established. Everything was in perfect order and ready to go after a couple of minutes of honing the blade.

With its blade sharpened at 25°, the Lie-Nielsen excelled at end-grain and cross-grain tasks. With a blade sharpened at 38°, it became a high-angle smoother capable of handling the most challenging woods.

Simple to adjust. *The knurled knob on the Lie-Nielsen No. 164 plane serves as the depth-of-cut adjuster.*

VERITAS LOW ANGLE

Price: $160; Weight: 3 lb. 5 oz.
Blade thickness: 0.129 in.

The Veritas low-angle smoother is basically a large-handled block plane cast from durable ductile iron, outfitted with bubinga handles and nicely detailed. The A2-steel blade rests firmly, bevel up, on a precisely milled bed.

The adjustable mouth accommodates coarse or fine cuts. The blade is centered in the mouth by two setscrews, so all lateral movement occurs at the back. It's regulated by a Norris-style adjuster that handles both vertical and lateral adjustment. With its stock blade ground to 25°, the plane excels at end-grain tasks, such as making dovetails flush. By replacing the standard blade with an optional high-angle blade (35°), the plane becomes an outstanding smoother. Its clever design also makes it perfect for use with a shooting board. Overall, the Veritas low-angle smoother is a well-designed, versatile plane at a very reasonable price.

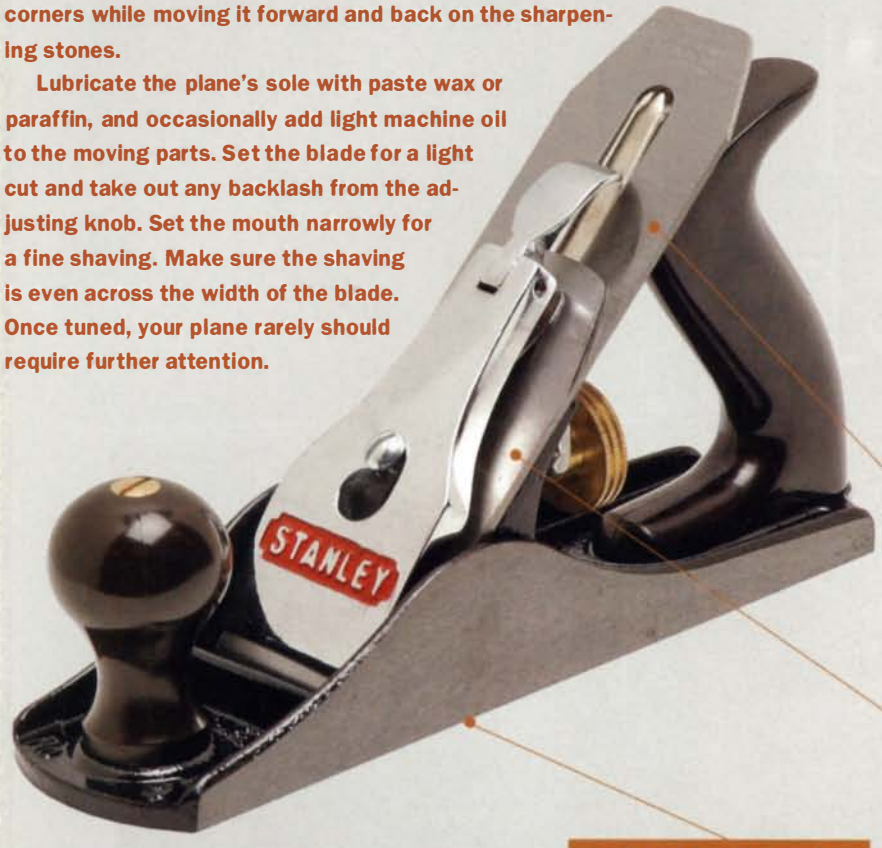
Well-designed for use with a shooting board. *Dimples in the square body make the Veritas easy to hold while on its side.*

Tuning up a bench plane

Take the time to fine-tune your plane if it needs it. Flatten the sole by lapping it with sandpaper on a truly flat surface and tune the chipbreaker.

Sharpening the blade should be the only maintenance the plane requires on a regular basis. I like to put the slightest crown on the edge of the blade. This allows the shaving to feather to nothing at its edges, and prevents hard blade lines in its wake. I crown the blade while honing it by exerting a little extra pressure on the left and right corners while moving it forward and back on the sharpening stones.

Lubricate the plane's sole with paste wax or paraffin, and occasionally add light machine oil to the moving parts. Set the blade for a light cut and take out any backlash from the adjusting knob. Set the mouth narrowly for a fine shaving. Make sure the shaving is even across the width of the blade. Once tuned, your plane rarely should require further attention.



HONE A SLIGHT CROWN ON THE BLADE

By exerting a little extra pressure on each corner, you can eliminate blade marks on the workpiece.

TUNE THE CHIPBREAKER

Smoothing the outside edge of the chipbreaker (above) will help eject shavings effortlessly. Flattening its inside edge (below) will maintain tight, even contact between the chipbreaker and the blade.

FLATTEN THE SOLE

Sanding the metal sole is like sanding wood: Work from coarse to fine abrasives on a reliably flat surface to flatten the sole and get rid of burrs.

Sources of supply

These planes are available from a variety of sources, but here are some good places to start:

Anant, Groz
www.highlandhardware.com

Lie-Nielsen
www.lie-nielsen.com

Veritas
www.leevalley.com

Footprint
www.sears.com

Clifton
www.toolsforwoodworking.com

Kunz
www.traditionalwoodworker.com

Stanley
www.woodcraft.com

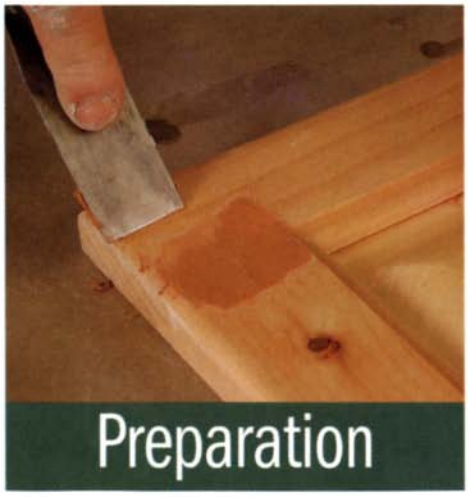
Three Steps to a Flawless Painted Finish

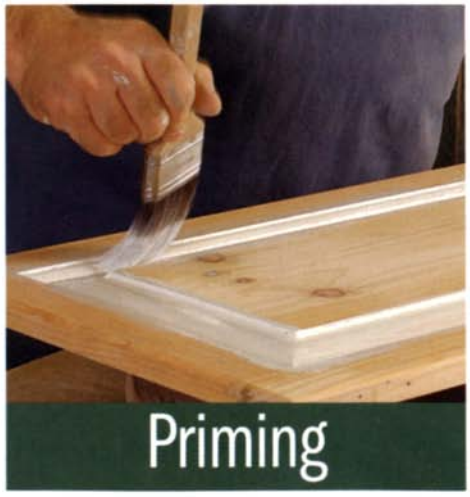
BY PAUL SNYDER

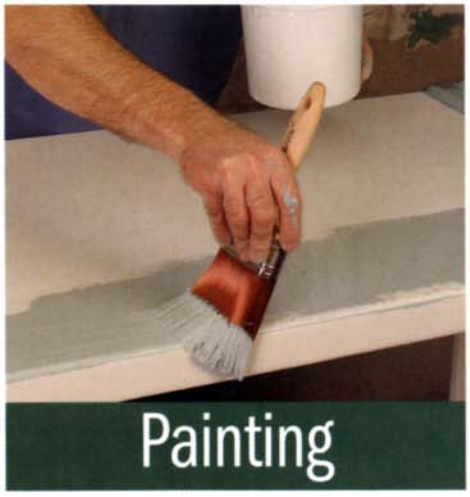
If you associate the word "paint" with images of a pail of house paint, a roller, and a brush, you may have difficulty linking it to fine furniture. However, painted built-in cabinets, bookcases, wall units, and furniture are as popular today as they have ever been, and a great paint job stands comparison with the best clear finish.

There is more to achieving a quality painted finish than meets the eye, and the process is different than obtaining a clear finish. Much of the effort centers on the need for a perfectly flat, smooth base for the paint. To get this base, I work through a series of preparation and priming steps that get the surface of the piece progressively smoother.

Because the wood will be hidden under paint, it doesn't make sense to use expensive furniture-grade hardwoods, such as oak, ash, walnut, and mahogany. Poplar, medium-density fiberboard (MDF), birch plywood, pine, and paint-grade alder and maple are more suitable for painting. Paint grade just means the wood







Photos: Mark Schofield

Preparation A filler for every blemish

Fillers under a painted finish don't need to blend into the wood, but they shouldn't shrink as they dry, leaving a low spot that must be refilled. Use fillers that are easy to sand. I also prefer fillers that dry fast.

Some of the best painted finishes are on cars, and auto-supply shops sell fillers that will help you achieve such quality. For fine cracks, flat end grain, and flat MDF edges, automotive spot and glazing putty works well.

Spackle is a good choice on flat or routed end grain and MDF profiles. However, spackle shouldn't be used to fill a deep hole; sanding it can leave a depression in the surface of the piece. Spackle also dries a lot more slowly than other fillers, so use it sparingly.

A smooth surface. *Large holes are best filled with an auto-body filler that must be mixed with a hardener (far left). Fast-drying wood filler is ideal for medium-size holes (near left).*

has grain or color variations that make it unsuitable for a clear or stained finish.

Surface preparation is critical

Getting the wood ready for painting is even more important than preparing it for a clear finish, despite the fact that any repairs will be hidden under the paint. The first step is to inspect all of the surfaces and fill any holes, cracks, and gaps, and remove any glue runs or drips.

Once the filler is dry (for more on the different types of fillers, see the story above), sand the wood with P150-grit paper. This grade of paper levels the surface and makes it uniform, but leaves it relatively rough so that the primer still has some "tooth" to latch onto. As you sand each surface, start with any areas that were filled; excess filler will create a high spot that will show up later in the finish. However, filler used in large holes might shrink, leaving a recess that will need to be filled and sanded again.

Pay attention to end grain, edges, and profiles—End grain will soak up a lot of primer if you don't pretreat it. Either seal end grain with glue size, shellac, glazing putty, or spackle and

Tips for MDF

When MDF is cut or routed, a rough, porous surface is exposed. The best way to fill and smooth it is to cover the area with spackle, and then use a small, dampened brush with the bristles cut short to work the excess spackle out of the corners and curves before it has a chance to harden. Once the spackle dries, smooth it with a sanding sponge that can be shaped to fit into the profile.

Avoid using a water-based primer on MDF, which can cause the fibers to swell and leave the surface bumpy. Instead, choose an oil-based primer or alcohol-based shellac.

Priming Select a compatible primer

Primer should be compatible with the topcoats and adhere well to both the wood and the topcoats. The primer also should fill the grain, leaving the surface flat, as well as dry quickly and sand easily. If you'll be using a water-based topcoat, choose a 100% acrylic primer.

There are situations when another type of primer is preferred. On areas prone to staining—wood knots, sap streaks, tannins, and pitch—shellac is the best choice. To simply seal the wood, use clear shellac, but to seal and prime the wood, use pigmented shellac such as Zinnser's BIN.

If the paint you're using contrasts a lot with white primer, tint the primer to a color close to the paint. The paint will obscure the tinted primer with fewer coats, and if the finish is scratched or otherwise damaged, the primer will be less visible.

then sand it smooth; or sand the edges with P220- or higher-grit sandpaper to burnish the surface, which will prevent the primer from soaking in too deeply.

On routed profiles, the aim is to achieve a smooth surface but still retain the crispness of the profile. Automotive glazing putty dries too fast, and glue size is relatively difficult to sand; like shellac, glue size doesn't fill the many small voids that cause a rough texture. I've found that the best filler for profiles is spackle (for more on using spackle, see "Tips for MDF" on p. 81) because it is easy to use and easy to shape when dry. Spackle is especially well suited for filling mitered corners in crown molding, where the detail and location call for a filler that can be spread easily and then sanded.

Break the corners for a better surface—The final preparation is to lightly sand the sharp corners, rounding them over slightly. Known as breaking the corners, this step helps paint flow from a flat surface onto a corner, avoiding paint buildup. It also reduces the chances of sanding through the primer on the corners.

Primer readies a smooth surface for the topcoats

With the obvious defects filled, everything sanded, and the corners broken, it's time to prime. Don't think of primer as being optional; it's indispensable for the flat, smooth base necessary for a painted finish. Primer performs a variety of functions that either the paint itself doesn't do or the primer does better.

The first coat of primer may be absorbed unevenly—Apply an even coat of primer using the brushing techniques described in *FWW* #156 ("Choosing and Using Brushes," pp. 38-43). With MDF and maple, one coat of primer often is all that's needed because the substrate is dense and free of pores. Other woods usually take two coats and sometimes three.

Despite the extra preparation on end grain and profiles, these areas still may absorb an excess of primer. The natural instinct is to apply it more heavily to get continuous, even coverage. But applying primer thickly leads to sags and runs and

Seal before priming

I use a clear sealer when I'm painting a piece that's made of wood suitable for a stained or clear-coat finish (e.g., pine). Applying the sealer makes it easier to strip paint from the piece if someone ever wants to change the look; it's hard to remove every last trace of the pigments when primer or paint is applied to bare wood. An alternative to alcohol-based shellac is a water-based shellac such as Ultra-Seal from Target Coatings. It can be sprayed safely and cleans up with warm, soapy water.

Apply the first coat of primer. *Brush on an even coat. On areas that will absorb the primer, let this coat dry and then apply a second coat.*

Fill small blemishes. *The first coat of primer reveals surface imperfections that may have been missed during the initial preparation.*

also slows the drying time. A better option is to apply primer in several thin coats until you get uniform coverage.

Once the primer dries, it's time to find and fix all of the surface flaws that this first coat has revealed. Each little hole, crack, and other imperfection that you didn't see during the surface preparation stands out clearly after the first coat of primer.

Filling, sanding, and applying the next coat of primer—If you need to make minor repairs, and you are working with MDF or a tight-grained wood such as maple, sand the whole surface carefully after the filler dries; use P220 grit on a sanding block or a random-orbit sander. If the primer has soaked in a lot, or if there's a strong grain pattern, the entire surface will need a vigorous sanding, which means you may end up removing most of the primer. If the grain is visible, use P150 grit, sanding until either the wood begins to show through the primer or all the shiny dimples (low spots) on the surface disappear. Use a random-orbit sander on large, flat areas, but on narrow boards, molding, or inside corners, use a sanding sponge. To avoid cutting through the edges and corners on narrow pieces, fold the sponge to fit the width.

With everything sanded, remove the dust and feel the surface with your fingers. Sand any rough areas again as needed. If there are bare spots, prime and sand them again. Then apply a second coat of primer over the entire surface. Sand this additional coat

Sand the primer. *Depending on how rough the surface is, sand the first coat of primer using P150- or P220-grit paper on a random-orbit sander. A sanding sponge is a good choice for smoothing moldings.*

Painting Pay top dollar for the topcoat

Paint for interior cabinetry and furniture should be formulated to resist sags and runs, and it should dry fast to avoid excessive dust collection. It also should provide a completely opaque finish after two coats and be durable enough for the intended use of the piece. Don't be tempted to economize with a $15 can of paint from a home center; quality is indicated by price, so be prepared to pay upwards of $30 per gallon for paint used by the pros.

There are a number of quality 100% acrylic and acrylic-enamel house paints. Generally speaking, manufacturers use the term enamel to describe any paint that has a smooth, hard surface. Add a few ounces of Floetrol, a latex paint additive that improves flow-out and leveling, to each gallon you use.

A good paint deserves a good brush. Pay extra for a quality nylon brush with flagged ends (the bristle ends are split). Nylon is softer than polyester or polyester/nylon blends and will help the paint lay down more smoothly with fewer brush-stroke ridges. The flagged ends will leave a finer, smoother pattern.

Try to paint horizontally. *It is easier to get a good finish with no sags or runs if you paint surfaces when they are horizontal.*

with P220-grit paper and a fine sanding sponge, working carefully to avoid cutting through the primer. When you're finished, remove the dust and inspect the surface to make sure all of the problem areas have been addressed. The surface should look as defect-free as you want the final painted finish to look. If you sanded through to bare wood, prime and sand only those areas again.

Two tinted topcoats are protected by a clear coat

Now that all of the hard work is done, it's time to paint. If more than a day has passed since you last sanded the primed surfaces, go over them quickly and lightly with P220-grit sandpaper. Like other finishes, primer continues to cure for a number of days, so the sanding scratches tend to shrink and close, reducing the bond between primer and paint.

If the paint is tinted and you have more than one can, mix them all together in an empty paint bucket to ensure the same color throughout the job. Then pour the paint into a smaller container with a large opening until it's half full. Dip the brush into the paint no more than halfway up the bristles, and gently tap them on the inside wall of the container to remove excess paint.

Brush with the grain in long strokes, holding the paintbrush at about a 45° angle to the surface. Overlap strokes slightly to maintain a wet edge and apply light pressure to keep all of the bristles in contact with the surface. Pull up as you reach the end of a stroke to avoid leaving a ridge. On long surfaces where you need to apply the paint in sections, start a new section just beyond the last strip and brush back into the wet section. Starting in the wet section causes pooling.

Plan to use two coats of paint. Trying to obtain 100% coverage with one coat encourages applying the paint too thickly. Scuff-sand between coats to promote good adhesion, and allow the paint to dry for at least two weeks to reach optimal durability before putting the piece to use.

Clear coat the paint—After letting the second coat of paint dry for 24 hours, you can apply a coat of clear finish for improved durability, added depth, and optional sheen adjustment.

The texture of the painted surface and the final sheen determine how much sanding is needed

Paints designed for spraying

Spraying is the quickest and easiest way to get a smooth, high-quality finish. I use high-volume, low-pressure (HVLP) spray equipment and select a paint designed for spray application. A couple of good brands are Target Coatings and M.L. Campbell.

FOR PERFECT RESULTS

Choose the right brush. *Use a 2-in. or 2½-in. angled brush to get into small or confined areas (above). Switch to a 3-in. brush for large panels (left), and apply the paint in long, flowing strokes.*

Sand between coats. *Use a fine sanding sponge to smooth the first topcoat. Don't worry about sanding through to the primer in some spots; it is more important to get a smooth surface.*

before the clear coat. If the surface is flat and you're planning on a satin or semigloss clear coat, then a light scuff-sanding is fine. If there are substantial brush ridges, or if you want a high gloss, the paint should be sanded until it is level.

For hand-sanding, use sanding sponges. Their padding helps to avoid cutting through the paint. For larger flat surfaces, Mirka's Abralon abrasive pads can be attached to a random-orbit sander to make the job faster.

To minimize changes in color, the clear coat should be completely clear, nonyellowing, and compatible with the paint. A water-based polyurethane is a good choice. You will be rewarded with a painted finish every bit as attractive as the finest clear finish. □

Paul Snyder is a professional finisher near Fredericksburg, Va.

A clear coat is optional

Applying a clear coat protects the paint and gives a look of greater depth. To minimize changes in color, the clear coat should be completely clear, nonyellowing, and compatible with the paint.

readers gallery

MARK DUTTON
Dike, Iowa

Dutton's design for this armoire was inspired by his visit to the Stickley furniture plant in Manlius, N.Y., and driven by his need for a cabinet to store both clothing and a television in his bedroom. The walnut used for the carcase and drawer fronts came from a tree that was cut down to make room for a public library expansion. The drawer sides are hard maple. Two additional drawers are hidden behind the cabinet doors. The piece (24 in. deep by 44 in. wide by 68 in. tall) is finished with four coats of orange shellac and features Mackintosh hardware from Horton Brasses Inc. PHOTO BY BOB GLAWE

BILL GULLBERG
Kirkwood, Ill.

Designed to be used at a 46-in.-high countertop, this Windsor-style chair (24 in. deep by 21 in. wide by 55 in. tall) has a poplar seat, sugar-maple legs and stretchers, and a hickory bow and spindles. The lowest spindle serves as a kind of ladder rung, providing a helpful boost into the seat. Gullberg finished the chair with satin lacquer over milk paint.

GARRETT HACK
Thetford Center, Vt.

Hack made this small table (he calls it a demi demilune) for the annual auction of the New Hampshire Furniture Masters Association. Measuring 13 in. deep by 33 in. wide by 30 in. tall, the table features cherry legs with holly string inlay and birch-plume panels outlined with holly and ebony in a dot/dash inlay pattern. The oval front-panel is bird's-eye maple. On top, a small box mimics the elliptical shape of the tabletop. Hack signed the box lid in Morse code using a fine dot/dash inlay on a field of crotch cherry and bird's-eye maple. The finish is oil and varnish, followed by shellac.

LANCE McAFEE
Dauphin, Pa.

After several requests from his wife for a cheval mirror, and many discarded sketches later, McAfee finally was satisfied with this design. He built the mirror (30 in. deep by 34 in. wide by 84 in. tall) from mahogany and finished it with aniline dye followed by six coats of Waterlox Original Wood Finish. McAfee used a brass finial from Ball & Ball as a finishing touch, completing the mirror just in time to surprise his wife on Christmas Eve.

RANDALL SHOPE
Hollidaysburg, Pa.

This hutch (21 in. deep by 60 in. wide by 85 in. tall) is constructed of cherry and secondary woods of pine and poplar. Inspired by the clean lines of the Shaker style and early Pennsylvania antiques, Shope adhered to the idea that form follows function when building the piece. The hutch has a Danish-oil and wipe-on polyurethane finish.

Submissions

Readers Gallery provides design inspiration by showcasing the work of our readers. For an entry form, visit www.finewoodworking.com. Send photos and entry form to Readers Gallery, *Fine Woodworking*, 63 S. Main St., Newtown, CT 06470.

NIALL CAHILL
Dunboyne, County Meath, Ireland

Straying from his traditionally smooth, functional pieces, Cahill turned this bowl (6 in. dia. by 2 in. tall) from ash. "This was a deliberate move on my part to progress from what would be termed 'craft' towards the development of my artistic talents," Cahill noted. To create the burst of color on the top, he used a Sorby texturing tool, scorched the surface, and colored it with Chestnut Spirit Stain, a non-grain-raising dye. Feeling that the piece still lacked a point of captivation, he gilded the central pot with 24-karat gold leaf. The base of the bowl is finished with Danish oil.

BRYAN KELLY
North Olmsted, Ohio

Asked by a client to make an armoire with Oriental accents, Kelly combined several ideas he had seen in magazine articles. The armoire (24 in. deep by 48 in. wide by 78 in. tall) is constructed of walnut, cherry, and red oak and features ebonized oak handles. The piece is finished with TransTint dyes, garnet shellac, and acrylic lacquer.

DONALD M. RANSOM
Wilmington, Del.

Ransom took the design inspiration for this Queen Anne drop-leaf table (42 in. dia. by 28 in. tall) from several pieces on display at the nearby Winterthur Museum and from examples in numerous books. He built the table for his mother, making it from walnut with a secondary wood of red oak. The finish is rubbed-out varnish.

DON BOLANOS
Friday Harbor, Wash.

Bolanos's love of the Arts and Crafts style, combined with a Gustav Stickley drawing, inspired his design of this wall cabinet for media storage. Constructed with sliding dovetails, the piece is made of quartersawn white oak, which Bolanos fumed and then finished with five coats of a linseed oil and beeswax mixture. The cabinet (11 in. deep by 42½ in. wide by 12¾ in. tall) holds 40 CDs and 24 DVDs. The windows are leaded glass, and a battery-powered light illuminates the interior.

DONALD MONTEMURRO
London, Ont., Canada

After reading an article about Charles Rennie Mackintosh, Montemurro wanted to reproduce a dining chair Mackintosh originally had designed for the Ingram Street Tea Rooms in Glasgow, Scotland. On a visit to England, Montemurro was able to view and measure the chair firsthand at London's Design Museum. His reproduction (15½ in. deep by 16¾ in. wide by 59½ in. tall) is made of red oak, ebonized with black dye, and finished with five coats of Deft Danish oil followed by two coats of black shoe polish. The seat fabric was chosen from a historical collection produced in Austria. Montemurro donated the chair to a charity auction that raises funds for disadvantaged children. PHOTO BY BILL MILLS

ANDREW J. RITCHIE
Toronto, Ont., Canada

This piece has roots on both sides of the Atlantic Ocean. "I had taken an excellent veneering course with Phil Lowe," Ritchie said. "Later, while on vacation in England, I saw an exhibit on the work of Thomas Chippendale, which inspired me to put my newly acquired veneering knowledge to work." The result is this reproduction of an early 18th-century English bachelor chest. The 16 in. deep by 30 in. wide by 37 in. tall case is made of amboyna and pine, and the veneer is quartersawn amboyna and amboyna burl. The finish is hand-rubbed oil varnish.

Use winding sticks to ensure flat stock

BY DOUG PETERMAN

Winding sticks are simplicity itself: a matched pair of sticks carefully made to be straight and parallel on all surfaces. Placed across each end of a board, they make it easy to see if there is any twist or wind. Although they've been around a long time, winding sticks have not outlived their usefulness, even in a machine-based shop.

They make twist visible

It doesn't take much twist to make your project go awry. In a 12-in.-wide frame-and-panel door, a twist of just 1° in the stiles can cause one corner of the finished door to stick out 3⁄16 in. One degree of twist is fairly obvious in a wide board but can't be seen in a narrow one. Winding sticks placed across the ends of a narrow board make the board appear wider so that the twist is easy to see.

Using the sticks is straightforward. With the board on a surface at about waist height, place a winding stick across each end. The sticks should be at right angles to the length of the board and parallel to one another. From several feet away, crouch down to sight along the length of the board and examine how the top edges of the sticks line up. Aligned edges indicate that the ends of the board are in the same plane; any variation shows the direction and degree of twist. It helps if the edges of the sticks being viewed are contrasting woods.

A variety of uses

The key to dealing with twist is finding it, whether in the project stock or in finished assemblies like doors and drawers. If you flatten slabs or glued-up panels by hand—or

Where to use them

Winding sticks are great for checking for a consistent angle while handplaning the edge of a board (above). Use them to test boards for movement during milling (right) and to find the high spots in a board or a glued-up panel that's too wide for the jointer (below).

Photos: Steve Scott

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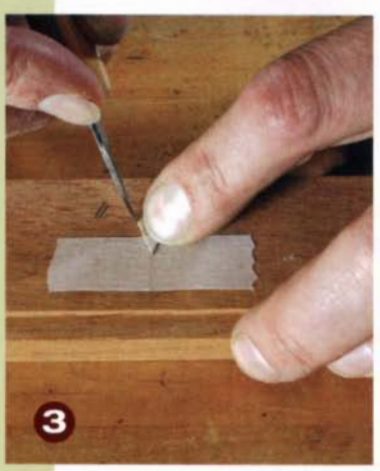

Make a stable, stylish set

1. *Cut a shallow rabbet in each stick and inlay a contrasting strip of wood.*

2. *When the glue dries, sand or plane the strip flush with the stick.*

3. *Inlay a diamond to indicate the center point. Begin by taping down the inlay and scribing around it with a knife.*

4. *After cutting the mortise, fill it with glue and set the inlay in place. Level the inlay after the glue dries.*

if you need to handplane a flat reference face on a board that's too wide for your jointer—winding sticks will show the high spots. If you use a handplane to dress or joint the edge of a board, frequent checking with the sticks will help you keep the proper angle along the length of the edge.

Winding sticks are also valuable insurance for anyone using modern milling machines. Jointers produce flat surfaces initially, but the exposed wood will exchange moisture with the air and may pull out of flat almost immediately. The best way to ensure flat boards is to rough-mill the stock slightly oversize, let it settle for a few days, and then mill it to final dimensions. After an initial milling, I randomly check several boards with winding sticks to see if the stock is twisting.

A few critical components like door stiles and drawer parts require even more checking. These assemblies move freely within a finished piece and won't be pulled into true and held there as part of the whole. Drawers and doors have to be square and true on their own to work properly.

How to make winding sticks

A few years ago I made a good set of sticks with two helpful variations. A contrasting edge strip improves visibility, and a centered diamond inlay allows easier balancing on narrow boards. The sticks are mahogany with a maple edge strip. They're about ½ in. thick by 1⅝ in. wide by 18 in. long.

Use stable stock with straight, regular grain. About a week after making the sticks, you should check that they're still straight. Lay the edges on a flat surface like the top of a tablesaw, or check the sticks against each other by mating the top and bottom surfaces in a number of different combinations (bottom to bottom, top to bottom, top to bottom with one stick flipped end-for-end, etc.). If the surfaces mate closely in every orientation, the sticks are straight.

I don't recommend applying a finish; it might make the winding sticks look nicer, but it's no guarantee against wood movement. If you find that the sticks need remilling later (you should check periodically), an unfinished stick can be machined and returned to service immediately. □

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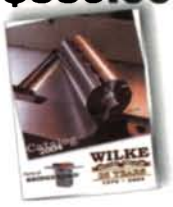

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Q&A

Resawing to an even thickness

Q: When resawing a 6-in.-wide board on a bandsaw, how much thickness deviation is acceptable?

CLARK MCCLOSKEY, Yukon, Okla.

Proper setup gives good results. *With a sharp blade and a tall fence for support, you can resaw to a consistent thickness.*

A: ON A WELL-TUNED BANDSAW with a good sharp resaw blade (3 tpi) and a tall fence, the thickness of the resawn piece should be consistent, ideally varying only by a few thousandths of an inch between the thickest and the thinnest areas. If you are having trouble getting a consistent thickness, more than likely the fence is not parallel to the blade. It's best to use a tall auxiliary fence with a support brace; a screw on the bottom makes the brace adjustable. To check whether the fence is parallel to the blade top to bottom, bring the fence right up to the blade. Adjust the screw on the bottom of the brace until the fence is set parallel. The outfeed end of the fence must be locked to the table to prevent it from lifting and shifting sideways.

To prevent tension in the wood from causing the offcut to twist and push the stock away from the fence, use a fence that is short in length. A shorter fence allows the offcut to move without affecting the blade and the stock. (For more on bandsaw fences, see *FWW* #159, pp. 44-51.)

In addition, the face of the stock going against the fence should be flat. Joint the face of the resawn stock before starting each cut.

–John White, author of Care and Repair of Shop Machines *(The Taunton Press, 2002)*

Use a tall fence that's parallel to the blade. *A brace on the back prevents the fence from tilting. An adjustment screw on the bottom of the brace (above) helps set the fence parallel to the blade (right).*

Lock the fence into place. *First, clamp down the fence at the outfeed end. Then clamp a block at the outfeed end to stop the fence from shifting sideways. Note that the auxiliary fence stops just past the blade, to allow offcuts to twist away freely.*

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How to repair worn mouths on wooden planes

Q: The common method to remedy an enlarged mouth on a wooden plane is to inlay a piece of wood ahead of the mouth. Why not replace the entire sole instead?
PETE FLEMING,
Sydney, New South Wales, Australia

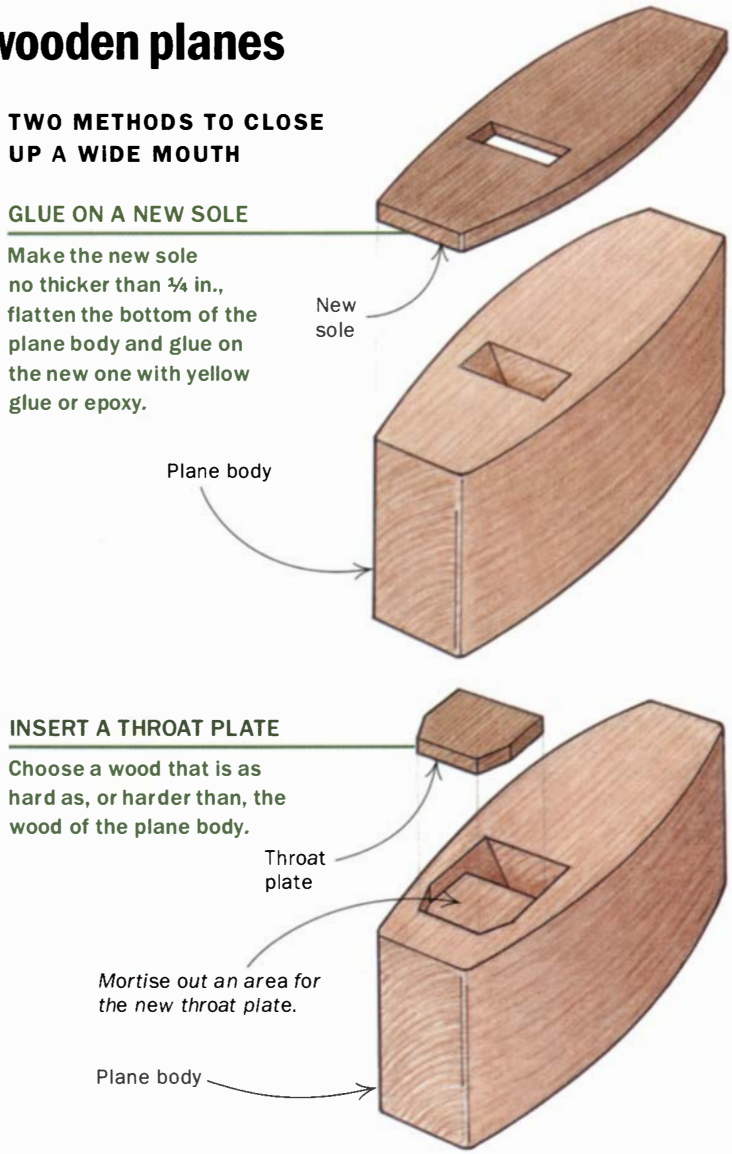
Worn wooden plane. *An enlarged mouth will create coarse shavings and result in tearout. A narrower mouth will put pressure near the cutting action, minimizing tearout.*

A: GLUING ON AN ENTIRE NEW SOLE is a fine way to repair a worn mouth on a wooden-bodied plane. Made out of a hardwood such as rosewood or ebony, the new sole will glide smoothly when waxed and be long-wearing. Flat soles are easiest to repair—although reshaping a molding plane can be done—the only tricky part is opening the mouth just enough but not too much. To avoid problems with setting the iron deep enough, keep the new sole less than ¼ in. thick.

Inlaying a throat plate is an effective alternative that's not only faster to execute but also preserves the integrity of the original plane body. Size the throat plate carefully for the right size mouth.

For more information on inlaying a throat plate, see *FWW* #142, pp. 106-110.

—Garrett Hack, contributing editor

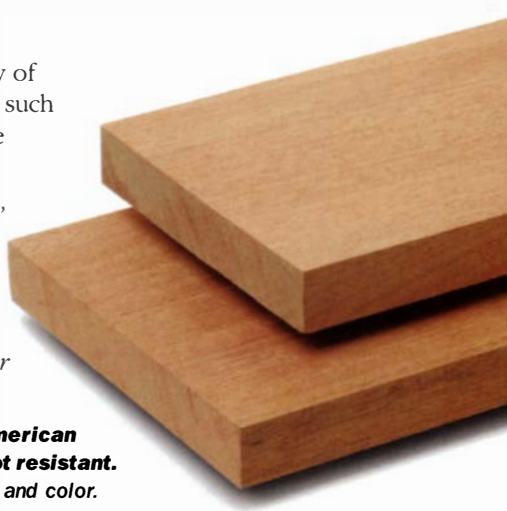


South American vs. African mahogany

Q: How rot resistant is African mahogany compared with South American mahogany?
JEFF COOK,
Gaylordsville, Conn.

A: SOUTH AMERICAN MAHOGANY, *Swietenia macrophylla*, ranks as one of the most decay-resistant species in the world. African mahogany, which is cut from several species in the genus *Khaya*, has moderately good decay resistance. Both of these woods are "true" mahoganies in that they belong to the mahogany family, Meliaceae. While the South American variety has superior decay resistance, both are respectable choices for exterior projects and certainly better than many of the mahogany substitutes such as lauan (AKA "Philippine mahogany") or banak.

—Jon Arno, a long-standing and frequent contributor to Fine Woodworking, *passed away last December*



African (top) and South American (lower) mahoganies are rot resistant. *Both can be similar in grain and color.*

Photos, except where noted: Marcia Ryan; drawings: Vince Babak; lower right: Kelly J. Dunton

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Coloring figured wood

Q: I'm reproducing a slant-lid desk in tiger myrtle. The original was made of tiger maple and finished in J.E. Moser's maple aniline dye stain. Myrtle is pinker than maple. What stain would you use?
BILL BILLINGSLEY, Belfast, Northern Ireland

A: AS A RULE, dye stains such as the J.E. Moser's product and others are the way to go to enhance the pattern in figured woods, such as tiger maple or tiger myrtle.

When working with figured hardwoods, I typically choose a water-soluble dye stain over oil-soluble or alcohol-soluble types. The former are easy to use, penetrate deeper, and are more lightfast. However, they raise the grain of the wood. The solution is to raise the grain with clear water beforehand, allow the wood to dry, then sand it; the grain won't raise again.

When selecting a color, start with a manufacturer's color chart. For charts, visit www.woodworker.com and www.homesteadfinishing.com. Also arm yourself with plenty of scraps from the wood you are using to test the color before applying it to your furniture.

—Jeff Jewitt is the owner of Homestead Finishing Products.

Test the color on samples. *Mix the powdered dye in hot water, let it cool down, and apply it to your surface to bring out the figure.*

Don't shape curved panels with vertical bits

Q: I have been using a vertical panel-raising bit for safety for many years, and now I'd like to make a panel with the top curved. Could you tell me how to make a jig that would work for this?
ROBERT REDINGER, Shorewood, Ill.

A: ROUTING A CURVED PANEL WITH A VERTICAL PANEL-RAISING BIT isn't practical or safe. The fixture for this application is so complicated and risky that it does not justify itself. The work has to be rotated past the cutter while on its edge against the fence. It's unsafe at any speed because there's poor workpiece control.

However, curved panels can be raised with a router using a horizontal cutter. It requires bearing-guided panel-raising bits of 3 in. dia. or more. With these large cutters, making deep cuts in one pass is hazardous. So cut in stages by moving the bit up in increments. Note: Large-diameter bits must be run at much slower speeds.

—Pat Warner, author of The Router Book *(The Taunton Press, 2001)*

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SHAPE CURVED PANELS WITH HORIZONTAL BITS.

The curve of the panel rides against the bearing on the router bit as the bit is gradually raised for successive cuts. The pin in the table allows the workpiece to be pivoted into the cutter to begin the cut.

Photos, this page (panel and bits): Kelly J. Dunton

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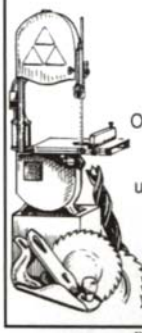

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Tips for hollowing end grain

BY ALAN LACER

End grain is the bane of many woodworkers. Furniture makers go to great lengths to hide it, and finishing end grain poses a number of problems. End grain can be just as ornery in wood turning.

Hollowing into end grain requires a different approach than hollowing into face grain. With a face-grain turning, a gouge is used in a cutting action that travels from the rim to the center (see *FWW* #147, p. 52). In this orientation, the bevel of the gouge rubs against the inside wall while cutting the wood fibers in the direction of the grain. However, a gouge does just the opposite when hollowing into end grain. Rather than laying down the fibers, it tears them.

To our benefit, wood turners have relied on a solution that dates back many centuries: the hook tool and its modern counterpart, the ring tool (see the photo on p. 102). In essence, these two tools work like a bowl gouge with the flute bent to 90°. Unlike a gouge, the hook or ring tool is used in a cutting action from center to rim. The cutting area and bevel are at right angles to the shaft of the tool, thus making it possible to rub the bevel against the wood as it cuts. A hollow center on the ring or hook tool provides a place for the wood chips to exit the cut.

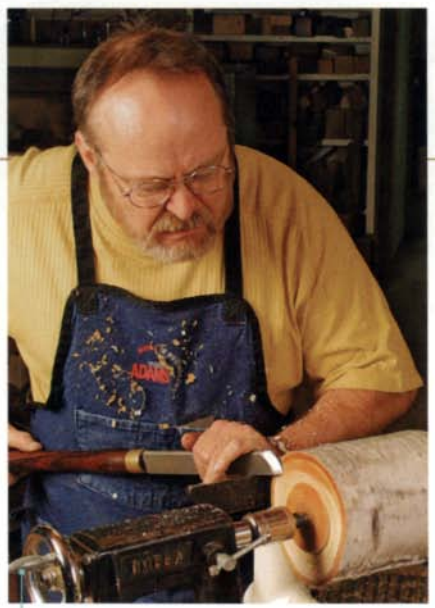
Practice on a green-wood bowl

Hook and ring tools have a bad reputation because they are very aggressive and can catch easily. I find the

Start with a log or cut limb

A section of a small log or large tree limb is ideal for turning end-grain bowls with a natural edge. Mount the log on the lathe between centers to rough it round.

1 Find the center. *Lacer uses a clear plastic template with various diameters traced on it to help locate the center of the log.*



2 Face off the top with a skew chisel. *A shoulder cut with a skew chisel will make a cleaner cut in the bark than a parting tool.*

3 Turn a tenon on the base. *Make a peeling cut with a skew chisel to cut the tenon.*

4 Rough-turn the outside. *Preserve a strip of bark for the rim and peel off the remaining bark before roughing.*

Photos: Matt Berger

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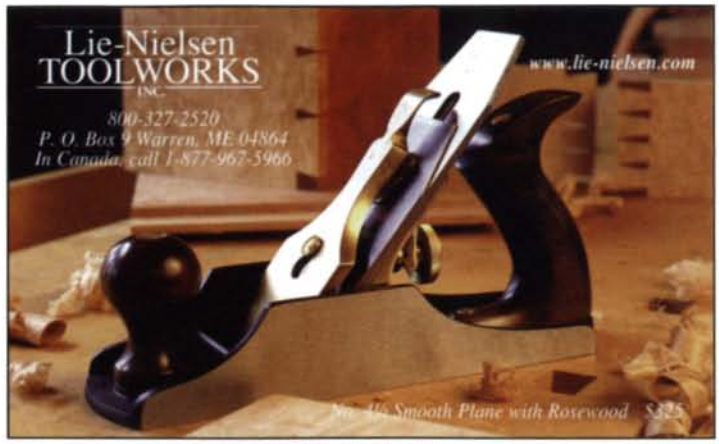

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best way to teach people how to hollow into end grain with these tools is to turn a shallow green-wood bowl. Green wood cuts much easier and cleaner than kiln-dried lumber, and bowls made with it can incorporate a natural edge that often will distort as it dries, adding an element of surprise to a design.

Another benefit of green-wood turning is that material is easy to find. I like to use freshly cut logs or tree limbs measuring anywhere from 3 in. to 12 in. dia.

Identify the center and mount the log

Most logs are not truly round. As a matter of fact, they come in about every shape other than square. So to incorporate a natural-edge rim successfully, you need to take some care when locating the center point. I use a shopmade template of Plexiglas inscribed with different-diameter circles. I line up a circle with the perimeter of the log and then mark the center with an awl.

When first mounted between centers, the log will be off balance, so make sure it's on the lathe securely and that your lathe is set to a slow speed. Pound a four-spur center into the base end of the log and use a live-cup center to hold the rim end at the tailstock.

The first step is to face off the rim with a skew chisel. Unlike a parting tool, which tends to leave a jagged edge and tear the delicate bark, a shoulder cut with the toe of the skew will cut the bark cleanly.

Next, cut a round tenon on the base so you can remount the turning in a scrolling chuck. Use a skew chisel for this operation as well, making a series of peeling cuts by holding the flat of the skew against the tool rest and bearing down on the turning with the bevel of the tool. The tenon should be straight, and the shoulder above should be slightly concave to rest on top of the chuck jaws. Also, be sure the tenon isn't longer than the depth of your chuck. Next, rough-turn the exterior of the vessel, leaving a small patch of bark around the rim. Once you've completed the initial work between centers, take the turning off the lathe and remount it in the chuck.

TWO TOOLS FOR HOLLOWING INTO END GRAIN

The ring tool (top) is a modern version of the hook tool (bottom), which dates back centuries. Although they have some similarities to a bowl gouge, they cut from the center to the rim and have a cutting edge 90° to the handle.

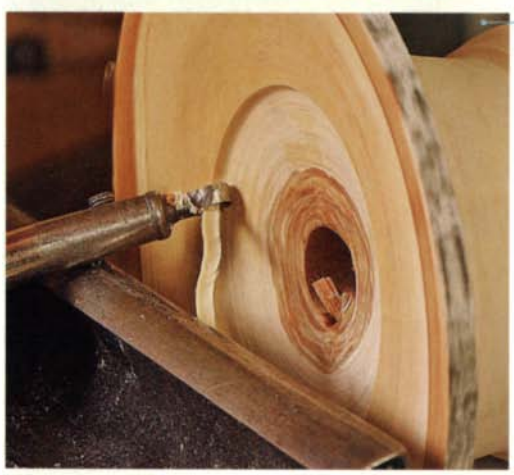
Rough out most of the exterior

Several shapes will emphasize the natural edge. One is a flared rim—often described as a bell shape or a

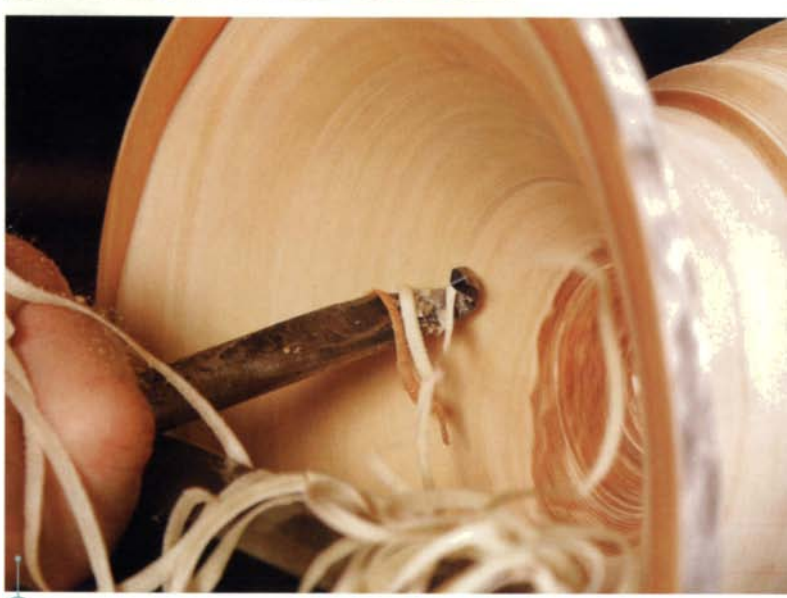
Hollow out the inside

For the rest of the process, mount the tenon in a four-jaw chuck. Begin hollowing the center while using the tailstock center for extra support. Then remove the tailstock so you can cut deeper, alternating between the inside and outside of the turning.

1 ***Rough out the inside rim with a bowl gouge.*** *This may cause tearout, but it is effective at removing waste quickly.*



2 ***Switch to a ring tool or hook tool.*** *Smooth the surface left by the gouge with either the ring tool (left) or hook tool (below). Cut from the center to the rim to produce a smooth surface. Hold the tool so that the flute is pointing between 9 and 10 o'clock.*



3 ***Continue the roughing and smoothing process.*** *Use a bowl gouge to remove material quickly, then a ring or hook tool to smooth out the final surfaces.*

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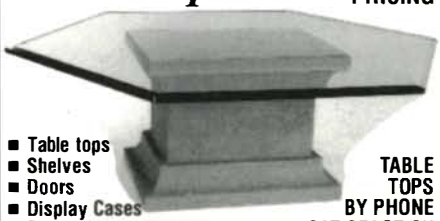

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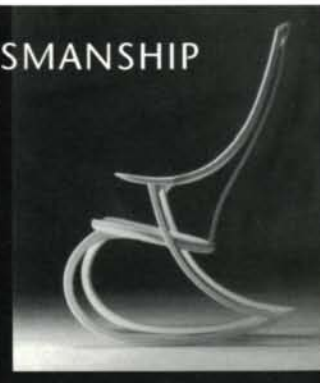

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flower petal. Begin roughing out the exterior shape with a gouge. I use a heavy detailing gouge (½ in. across) or regular ⅜-in. or ½-in. bowl gouges. For this initial work, I still use the live-cup center on the tailstock end to keep it steady.

Cut most (two-thirds or so) of the outside shape before shifting attention to the interior. Also, turn the area around the delicate rim to a near finish, because it will be difficult to get a clean cut in this region once you've removed the supporting fibers on the interior.

Follow a strategy for hollowing

Begin hollowing by establishing a clean upper natural-edge rim, making light, shallow, slow cuts with a very sharp gouge from the rim toward the center. The tool may tear the fibers, but it is effective at removing waste rapidly, and the surface will be refined with the hook or ring tool. When you are satisfied with the rim, remove the tailstock center and drill a hole (½ in. or ¾ in. dia.) to establish the depth. This hole also removes the "stationary" center region and provides a start for the hook or ring tool. Then work the interior just below the rim with the hook or ring tool, cutting from the center to the rim.

When the rim area is complete, continue hollowing the turning, first with the bowl gouge, working from outside to inside, and then with the hook or ring tool, making clean cuts from the center to the rim.

As you cut deeper with the hook or ring tool, hold the tool so that the flute is pointing between 9 o'clock and 10 o'clock, and take light to moderate passes. As you make the turn from the bottom up the wall of the turning, move the handle of the tool down and away from your body so that the bevel is always rubbing on the wood. If the bevel lifts, you run the risk of a catch. A catch also can occur if the angle of the flute approaches 12 o'clock.

When only the lower fourth of the bowl needs hollowing, shift your sights back to the exterior and turn it to its final shape. Then complete the inside with the hook or ring tool until the walls are uniformly about ¼ in. thick.

Scrape and sand to achieve a finished surface

To reduce sanding time dramatically, make the final passes on the interior of the bowl using a round-nose scraper oriented to make a shear cut. Hold the scraper tilted to about 45° off the tool rest, pivoting on the left corner of the tool and cutting from the center to the rim. You'll know that you're holding the tool correctly

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1 ***Establish the outside shape.*** *Use a detailing or bowl gouge to form the profile of the turning, always cutting in a downhill direction and with the grain.*

2 ***Measure the wall thickness.*** *Aim for consistently thick walls to prevent the wood from cracking as it dries.*

3 ***Scrape a finished surface.*** *A rounded scraper tilted to 45° generates a shear cut, which reduces sanding time.*

4 ***Wet-sand on the lathe.*** *Small turnings can be sanded on the lathe, using water and wet-or-dry abrasives ranging from 120 grit to 320 grit.*

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if the cut produces long, thin shavings, as opposed to dust. Experiment with the cutting angle until it works.

Wet the entire bowl with a paper towel, and sand with 120- through 320-grit abrasives. Then part the turning at the base with a skew chisel and cut it off with a thin-kerf saw with the lathe turned off. The base, which contains the pith of the tree, should be as thick as, or thinner than, the walls to prevent it from cracking as the wood dries.

Dry slowly and finish

To avoid cracks, slow the drying time by placing the bowl inside two heavy paper bags, or wrap it in newspaper and store it in plastic bags. Most of the drying—depending on humidity conditions—will take place in the first 48 to 72 hours using either method. For good measure, check the piece every day and change bags or newspaper regularly. If cracks start to develop, soak them with medium-viscosity cyanoacrylate glue. Give the piece at least 10 days of the paper treatment. After that, it should be ready for a final sanding and finish. I spray on a water-based, shellac-based, or lacquer finish for light woods and a wipe-on oil-based finish for dark woods. □

PART THE BOWL AT ITS BASE

Cut off the turning with a thin-kerf saw (left). The remaining nub can be removed with a chisel or carving gouge. After the bowl has been dried, give it a final sanding (below) and then apply a finish.

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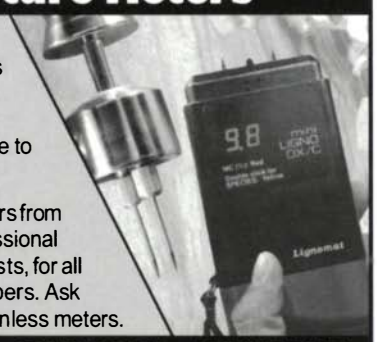

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Working with burl veneer

BY SCOTT GROVE

Disappearing seam. *Grove's counter-bevel technique makes seams hard to detect, as is the case with his contemporary coffee table.*

I have always been intrigued by the swirling patterns in burl-wood veneer. Each is a one-of-a-kind mural by Mother Nature herself. If burl wood is selected, processed, seamed, and finished properly, no other wood will generate such striking figure. However, burl veneer can be difficult to work with and often requires special handling.

Burl-wood veneer is created by slicing an abnormal growth mass in a tree into paper-thin sheets. Man-made burls are available, but they are reconstituted and dyed from cheaper woods.

Selecting the best material is a critical step. I buy most of my veneer through mail order and always purchase an extra leaf to use as backup or for patching. The veneer should arrive in sequence. As you flip through the stack, the figure on each piece should be similar but gradually change. Label each leaf in sequence to keep from getting mixed up during layout. Also, inspect each leaf for flatness, brittleness, checks, surface compression, and other inclusions. Cull the imperfect sheets from the stack and tape the edges of brittle sheets for easier handling.

Flatten and patch veneer first

Veneer first must be flat to be used. Some veneers are inherently wrinkled, such as olive ash or oak burl, and will require flattening and softening. However, most that come from a supplier should be no more than ½ in. out of flat.

There are several methods for flattening veneer, and many involve soaking the sheets in a solution (see *FWW* #167, p. 120). I prefer to buy a premixed product called GF-20, made by Borden. It doesn't cause the leaves to stick together as some home-brewed concoctions do. For minor, isolated instances of flattening, use a household iron set at about 150°F to 212°F dry or with a steam setting. Apply gentle pressure and iron both sides of the veneer.

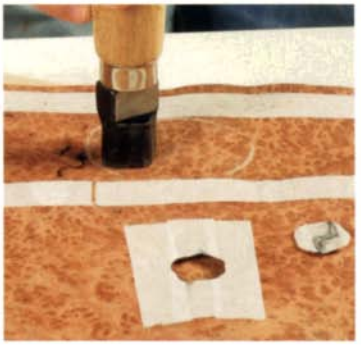
Patch medium-size imperfections with a punch

Major imperfections should be repaired before cutting and gluing the veneer. Medium-size holes,

Make small repairs with a punch

Tape over the void to prevent it from checking. *Work the sheet with the face side up and never leave tape on the underside.*

A cloud-shaped punch is best for burl. *This type of punch is commercially available or can be made by hand from steel pipe.*



Make the patch from a spare veneer leaf. *Cut the patch from an area with matching color and figure to conceal the repair.*

Flip over the leaf to inspect your work. *A good patch will blend into the surrounding material.*

Photos: Matt Berger

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Patch large areas with a template

Trace the area to be patched. *Draw the perimeter with a wavy line, and then make a Masonite template of that shape.*

Template guides the cut. *To prevent checking, tape the veneer around the area to be cut, then make several passes with your cutter.*

Cut a patch from the spare leaf. *Look for an area on the extra leaf that is a match in grain and color, and take the patch from there.*

Flip the leaf to inspect your work. *Paying attention to grain and color makes patches easier to conceal.*

roughly the size of a quarter, can be repaired with a patch from matching material. You will need a veneer punch, which is available in a variety of sizes and shapes (Veneer Systems Inc.; www.veneersystems.com; 800-825-0840). The cloud-shaped punch is best for burls.

A veneer punch is used like a cookie cutter, but some preparation is required. First, stick veneer tape over the imperfection to prevent the edges from checking. I like to trace the area to be removed with a pencil so I can position the punch accurately. Then simply punch out the void. On brittle material, I heat up the area with an iron to ensure a clean cut. Next, with the veneer punch, cut a patch from the extra leaf that matches in color and figure. Use veneer tape to hold the patch in place for pressing.

Large patches require a hand-made template

It's not unusual for burl to have large missing sections or holes greater than the size of a punch. To make patches, I use a cloud-shaped Masonite template larger than the area to be repaired. Keep the template's edges smooth and square.

Tape around the perimeter of the damaged area to prevent the edges from checking. Lay the template over the damaged area and hold it firmly in place. (A piece of sandpaper on the bottom of the template will prevent it from slipping.) Gently cut around the template with a utility knife. Start with a light pass and gradually increase pressure; typically it will take three or four passes to break through. Be sure to keep the blade square with the template edge. Repeat this process with the patching material to create an exact plug for the damaged leaf. Then tape the patch in place with veneer tape.

Use wavy lines for joints, too

Traditionally, veneer sheets are joined with a straight seam, which I find unappealing. My alternative technique is called a contour bevel seam. By cutting a wavy seam through the burl figure on a bevel, I can make the seam almost invisible.

The contour bevel seam employs the same cutting technique as marquetry inlay. Two pieces of veneer are overlapped and cut at the same time on a 14° bevel. When the two are joined, the beveled edges overlap perfectly, hiding the sawkerf.

To start, identify precisely the seam location on each leaf and make a mark on the veneer sheets at the top and bottom edges. Most of the time you want to align the two sheets so that they are book-matched. You can use a mirror to help visualize this pattern. If the seam will not have a book-match, join the two pieces at areas of similar tone and grain

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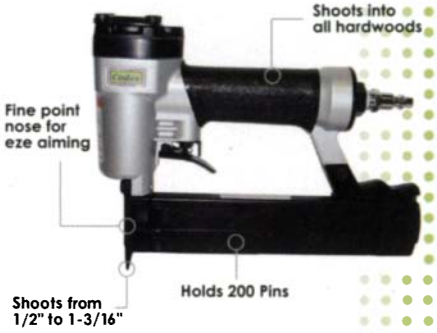

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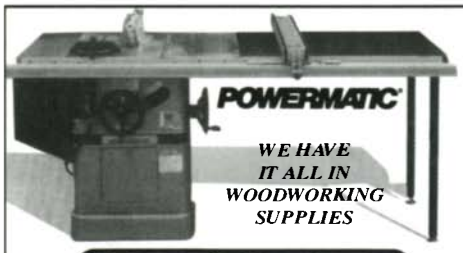

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Use a wavy seam to join leaves

Cut the wavy seam on a scroll saw. *Align the two leaves and tape them together from both sides. Tilt the scroll-saw table to 14° and cut in a wavy line.*

Tape the leaves together. *Temporarily join the leaves with blue masking tape, then apply veneer tape (left), over the seam. Tear away the masking tape, and use more veneer tape to fill the gaps. Iron the veneer tape immediately to release the moisture (right).*

Flip the leaves to inspect the seam. *The irregular seam blends with the burl and will be hard to locate after finish has been applied.*

pattern. Overlap the leaves, lining up the edges with the pencil marks. Then shift them up and down until the grain pattern matches across the seam. Tape the two sheets together with masking tape, and lay masking tape on both sides of the veneer in the path of the seam to help prevent chipout when cutting.

To make the contour bevel cut, I use a scroll saw with a 2/0 blade and tilt the table to 14°. I always cut the veneer face side up and keep the blade cutting in a wavy pattern. After the cut, carefully remove the masking tape from both sides of the veneer. If you don't have a scroll saw, this cut can be done by hand with a long, wavy Masonite template and a utility knife, similar to the patching method described earlier. This technique works not only for joining leaves but also for making large repairs on a single leaf.

Tape the seam for pressing

Dry-fit the seam and temporarily tape together the entire piece, face up, with masking tape. The wavy seam will align itself. Once the pieces are aligned perfectly, secure the seam with veneer tape, removing the masking tape as the veneer tape is applied. Lightly iron the freshly taped seam to set it and drive out any adhesive moisture. As the tape dries, it will shrink and help pull the seam together. If it's not ironed, the seam may swell and appear tight, only to dry out later and open up.

Once the veneer has been adhered to a core with white PVA glue (for more on veneering, see *FWW* #164, pp. 74-79) and pressed in a vacuum bag or with clamps and a platen, there are a few final steps. After at least two hours, moisten the veneer tape with a wet sponge and peel it off. Also, check for glue that may have squeezed through during pressing and remove it with a touch of warm water and a hand scraper. Then inspect for air bubbles by rubbing your fingers over the surface and listening for a hollow, light sound. To repair, cut the bubbles open, inject glue, and iron or clamp the area flat.

Sand and finish

I generally sand with 120-grit, 150-grit, and 220-grit abrasives, being careful around the edges. After the last grit, wiping the surface with mineral spirits allows for a final inspection of glue or scratches.

I like to enhance the grain with a gel varnish and then spray a topcoat of catalyzed satin conversion varnish, sanding between coats and dealing with touch-ups after the first coat. My final rub is a wet-sanding series, up to 4,000 grit. This will leave a slightly open pore surface with a very durable, silky-smooth feel. □

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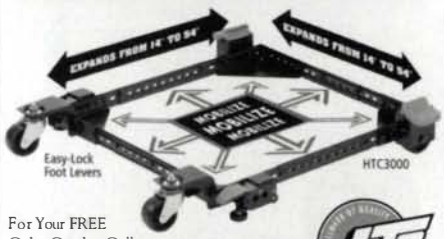

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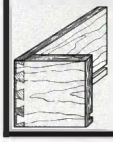

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Make your own grain fillers

TWO WAYS TO PREPARE WOOD FOR A SMOOTH FINISH

BY JEFF JEWITT

A smooth or textured surface. *On open-pore woods, use a grain filler if you desire a smooth finish. On this piece of mahogany (above), the open pores on the right side were filled with a grain filler before a clear finish was applied.*

When it comes to finishing, some woodworkers prefer to emphasize a wood's grain structure by using penetrating finishes. Others prefer uniformly smooth surfaces, with a satin luster or a glass-smooth, high-gloss "piano" finish. Such a finish requires the grain to be filled. You can fill close-grained woods such as cherry or maple with a couple of coats of finish. Open-grained woods such as oak, walnut, or mahogany, however, may require the use of a filler.

Grain fillers (also called pore fillers or paste wood fillers) are divided into two categories: oil based or water based. Both types are sold commercially but generally must be ordered from specialty woodworking stores.

I prefer to make my own grain filler, borrowing techniques used by finishers of the past. The ingredients are inexpensive and, unlike commercial fillers, are easy to find at any hardware store.

Linseed oil/pumice filler matches color beautifully

The combination of boiled linseed oil and pumice has been used for centuries as a grain filler. The advantages are twofold: First, once the light gray pumice (which actually is powdered volcanic rock) is mixed with the oil, it becomes translucent. Second, the slightly abrasive pumice works up a bit of sawdust, so the color of the filler matches the wood perfectly.

Because of this abrasion, you should be careful about staining the wood prior to filling the grain. Surface stains, such as pigmented wiping stains, are

Linseed oil and pumice: three easy steps

1 ***Sprinkle the pumice.*** *After wiping on a coat of boiled linseed oil, sprinkle some fine, 4F-grade pumice onto the wood.*

2 ***Pack the pores.*** *Work the pumice and linseed oil mixture into the wood using a cloth in a circular motion. The linseed oil causes the pumice to become translucent.*

3 ***Remove excess filler.*** *Wipe lightly across the grain with a clean, dry cloth to remove any filler that remains on the surface.*

Plaster of Paris: low-tech and quick-drying

Mix the plaster of Paris. *Add water a little at a time until you have formed a paste the consistency of drywall compound (left).*

Work fast with this filler. *Pack the pores quickly, working in one small section at a time (top). When the surface feels dry, remove the excess with a damp cloth (above).*

Smooth the surface. *After the board has dried overnight, sand the surface with P220-grit paper (above). As soon as the boiled linseed oil is applied (right), it turns the white grain filler translucent.*

worn away easily by the pumice. It's better to use a penetrating water- or alcohol-based dye beforehand, or apply a stain after filling the grain.

To begin, pour boiled linseed oil onto the wood and rub it in with a cloth. Sprinkle pumice (use the finest grade, 4F) over the surface and work it into the grain with a cotton cloth, using a circular motion. Use roughly a teaspoon of pumice for every square foot of surface. Add more oil if the mixture appears chalky. The oil filler has a generous open time, so you really can pack it into the grain. Examine the surface against a low-angle light, a technique known as backlighting, to make sure all of the grain is filled.

Last, with a clean, dry cloth, lightly wipe across the grain to remove the excess filler. This step is complete when the surface feels smooth. Let the filler dry overnight, and then examine the surface against backlighting a second time. Some open-grained woods, such as oak, may need a second application.

The filler should dry for at least 72 hours before applying a clear coat. Most finishes are compatible with this type of filler, including water-based finishes. But to be on the safe side, a 2-lb. cut of dewaxed shellac will seal the filler and allow the application of any finish.

Plaster of Paris filler dries quickly

If you have trouble finding pumice, plaster of Paris is an easy-to-use alternative. Mix the plaster with water until the filler has a fairly stiff consistency similar to drywall compound. The wetter the mixture, the more it will shrink after it has been applied to the wood.

Using a cloth, work the filler into the wood in a circular motion. Unlike the linseed oil/pumice filler, this water-based filler dries very quickly, so you will have to work in one small area at a time. After you're done, let the wood sit until the surface feels dry. Wipe off some of the excess with a damp cloth. Let the board dry overnight, and then sand it with P220-grit paper.

To turn the filler translucent, apply a coat of boiled linseed oil. If you wish to dye both the grain filler and the wood, color the linseed oil with artist's oil or Japan colors, or you can apply just about any oil-based wiping stain. To emphasize the grain pattern, dye the plaster of Paris when you mix it by adding water-soluble dyes, water-based pigment concentrates, or artist's acrylic colors. Instructions for applying clear coats on the plaster of Paris are the same as for the linseed oil/pumice filler. □

Photos: Mark Schofield

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Ruhlmann Retooled

Connecticut woodworker James Schriber takes historical furniture forms and thoroughly rethinks them, making furniture that pays homage to the past but crackles with its own vitality. Schriber's bubinga dining table blends two disparate sources—the supremely luxurious furniture of French Art Deco designer Émile-Jacques Ruhlmann and 17th-century Spanish Baroque furniture. In this piece, the torpedo-shaped legs that Ruhlmann might have used on a cabinet are gracefully reimagined to suit a table. To link the legs, Schriber devised a sinuous iron stretcher system, reflecting his affection for old Spanish tables with similar effects. The serpentine end stretchers bring to mind the swooping silver pedal support on a Ruhlmann piano.

— Jonathan Binzen

In a typically elegant touch, Schriber laid up the bubinga veneers on the tabletop in a pattern that echoes the shape of the stretchers below.

Photos: John Kane