

TAUNTON'S

# Fine Woodworking

NEW FEATURE

A Closer Look: Why glue sticks

December 2003

No. 166

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**Choosing and using shellac**

**Quick and sturdy drawers**

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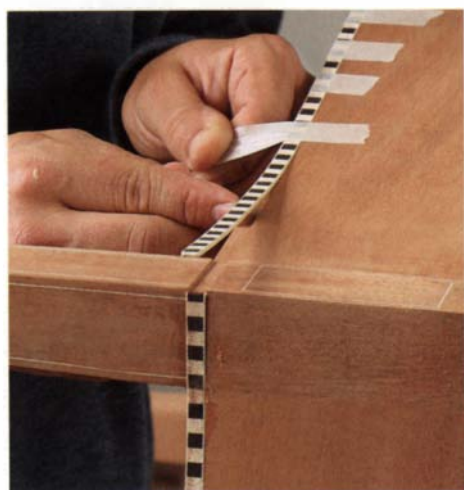
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# Contributors

**Dan Faia** ("Stringing and Banding Made Easy" and Master Class) has been a professional furniture maker and educator for 10 years. He is a graduate of North Bennet Street School in Boston, where he still teaches occasionally. He credits much of his success to three frequent *FWW* contributors: Will Neptune, Philip C. Lowe, and Mike Dunbar. While at North Bennet, said Faia, Neptune "mentored me and got me started in teaching." After graduating, Faia spent a few years working for Lowe, where he learned the practicality of production work. For the past five years, Faia has been a fixture on the staff of The Windsor Institute in Hampton, N.H., run by Dunbar. Faia's broad training in woodworking has taught him to be open-minded, to realize that there are many different ways to attack a project.



**Peter Gedrys** ("Versatile Shellac") runs Architectural Finishes in East Haddam, Conn. A self-taught artisan and restorer, Gedrys discovered his artistic side while working part time for an antique dealer. With the backing of his wife, he changed careers and turned to furniture restoration, working on 18th- and 19th-century pieces of American and Continental origin. Always seeking new challenges, he now includes graining and gilding of interior projects in his repertoire. Passing on his passion for finishing, Gedrys teaches classes on a wide range of subjects, from glazing to gilding. Any spare time finds him gardening in the summer, and as the seasons change, he relaxes by stopping pucks as a goaltender in a senior hockey league in New Haven, Conn. "I'm very fortunate to love what I do," said Gedrys. "How lucky can I be?"



**Philip C. Lowe** ("An Illustrated Guide to Crown Moldings") has been a contributor to *Fine Woodworking* almost since its inception. His current article on period crown moldings once again demonstrates his extensive knowledge of fine furniture making. For the past four years, Lowe has been running his own school, The Furniture Institute of Massachusetts, from his shop in Beverly, Mass. For more information on the program, workshop offerings, and schedules, check out his Web site: [www.furnituremakingclasses.com](http://www.furnituremakingclasses.com).



**Gary Rogowski** ("Gluing up Tabletops") started woodworking in 1974 in Portland, Ore., with a radial-arm saw and his dad's old handplanes. He now is a contributing editor to *Fine Woodworking* and has produced numerous articles and videos for The Taunton Press. His latest book from Taunton is *The Complete Illustrated Guide to Joinery* (2001). In 1997 Rogowski opened The Northwest Woodworking Studio in Portland. Holding year-round classes for novice- to mastery-level students, the studio offers a hands-on approach that emphasizes the value of time spent in the shop as much as the work produced. Come summer, the school offers weeklong classes that bring in instructors and students from around the country to enjoy both the craft of woodworking and the mild Oregon weather. You can find the studio on the Web at [www.northwestwoodworking.com](http://www.northwestwoodworking.com)

Books have been a recurring theme in the career of **Tony O'Malley** ("Built-In Basics"). It was the need for cheap bookcases during his freshman year in college that launched his interest in woodworking. After graduating, he spent 10 years working in a variety of commercial shops in the Philadelphia area, gaining broad exposure to the woodworking trade. The book theme continued when O'Malley took a job at Rodale, writing and editing on woodworking and home-improvement topics. For the past five years he has combined freelance writing and book editing with building a small business as a cabinetmaker specializing in custom built-ins, many of which hold (you guessed it) books.



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# Letters



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## **FWW unveils new department**

In an effort to continually bring you useful, interesting information, we are introducing a new department called A Closer Look ("How yellow glue works," p. 94), which in this issue covers the curious phenomenon of how glue sticks. A Closer Look will be published periodically and cover specific issues on tools and materials unique to furniture making. If you have any topics that you would like investigated, we would like to hear from you (see "Writing an article" on p. 10).

—Anatole Burkin, *editor*

## **A key missing finish**

Mark Schofield's Finish Line, "A starting kit for finishing" (*FWW* #163, pp. 117-118), was informative on the uses and trade-offs of various traditional clear-finish treatments. However, Schofield omitted any mention of that very common choice, lacquer.

As a former custom-home builder, I usually had the painter shoot all stained wood trim with lacquer; and as a woodworker, I have made extensive use of it as well. My usual choice for ease of application, durability, and appearance is Deft semigloss and a good bristle brush. With attention to the occasional sag or drip with 0000 steel wool and a following brush-up, it gives great results.

The major problem is the stink, so it's pretty hard to apply lacquer on work in place. But even then if you open all the windows, you're good to go.

—Bob Day, *Denver, Colo.*

**EDITOR REPLIES:** You're right. The stuff does have a strong odor. Traditional lacquer also is highly flammable, so we think it's not the best choice for woodworkers who work at home.

## **Assimilated by the machine?**

Improvements in power-tool technology have advanced at a staggering rate in the past years. But will machines take the place of hand tools? I have concluded that the answer is no. But I am curious about what more experienced craftsmen think about this matter.

A perfect example of power vs. hand

tool is the router-cut dovetail. This classic joint is the signature of craftsmanship because of its durability and complexity. But today, anyone who can afford the setup can produce flawless, identical dovetails in a matter of minutes.

Don't get the impression, however, that I'm questioning the morality of power tools performing the most basic of operations. Indeed, the rise of power tools has opened doors to woodcraft for many men and women who don't have the time or training to do everything the old-fashioned way.

Besides making this enjoyable craft more available, the obvious benefit of machines is that they cut production costs. The old adage "Time is money" is especially true in woodworking.

—Mark Ryden, *Seattle, Wash.*

## **No-nonsense tool reviews**

Congrats to you and Tim Albers for an honest review of miter gauges, "Replacement Miter Gauges" (*FWW* #165, pp. 74-79).

I just ordered my third JDS Accu-Miter because, in my opinion, it's the best overall gauge on the market. (I sold my first Accu-Miter when I parted with a tablesaw; the second one was damaged when it fell out of my truck at 65 mph during a move.)

During the interim, I tried two other gauges and found the same faults the author did.

I subscribe to several woodworking magazines in addition to *FWW*, and I have complained to them about their lip-service tool reviews. They seem to be more concerned with keeping their advertisers than they are with giving their subscribers accurate, honest reviews.

I have a small commercial shop, and my tools are used daily. A small glitch in a tool may not bother the hobbyist, but it will be a major annoyance to me that can lead to mistakes. Please continue your honest reviews. The manufacturers may not appreciate them, but a lot of your readers do.

—Jack Hinkel, *Apex, N.C.*

## **Do the math**

I just figured out that at the three-year subscription rate, *FWW* is about \$4 per copy. Each issue takes me about two



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# Letters (continued)

evenings to read all I want to read. That is very inexpensive entertainment.

—John Brugo, Los Gatos, Calif.

## 320 grit not necessary

I'd like to make a comment on Teri Masaschi's nicely done article, "Four Finishes for Turning" (*FWW* #165, pp. 62-65). I disagree with her on sanding in excess of 320 grit. It's a stylistic opinion, granted; but the one time I took a lamp base that I had turned in apple down beyond 320 grit, I was quite disappointed with the texture.

I finished it with about six thin coats of oil—a mixture of raw linseed, tung, turpentine, and Japan drier—and the resulting piece had such a smooth surface it may as well have been made of plastic. The texture and feel of wood were gone.

Since then, I sand to 220 grit, coat with a

couple of light coats of 2-lb. cut shellac, lightly sand to 320 grit, stain or not, and finish with oil. I may or may not wax the piece; but if I do, I use beeswax dissolved in turpentine. The resulting surface is much more pleasing to the hand, in my opinion.

—Leon Jester, Roanoke, Va.

## Squaring things away

In his letter, "Screwy info" (*FWW* #164, p. 14), John R. Guy offered some information that I believe is misleading. The Robertson patent for a square-drive configuration does call for a taper or draft of 3° per side. The reason for this was to allow the recess in the screw to be headed. If there was no draft in the recess, the metal would not flow around the header punch. The across-the-flat dimension of a given size recess was held to a very close tolerance, as was the comparable dimension of the mating driver. In this manner, there was very little wobble between driver and screw.

The patent for the Robertson design was actually licensed in the United States. The company I worked for, Cornwall & Patterson, had a license to produce the Robertson drivers. The patent expired in the late 1950s, allowing anyone to produce drivers and screws in any form that the market would support. We always made the drivers to the original Robertson specifications, while some drivers that were produced offshore had no taper and would fail prematurely.

No matter what, the Robertson configuration was and still is a superior design that is matched today only by the Torx system.

—Bob Naramore, Montrose, Pa.

## Getting it wrong

I have reread the review of the GRR-Ripper push block, "Grr-andiose push block" (*FWW* #163, p. 31), and also Henry

## Writing an article

*Fine Woodworking* is a reader-written magazine. We welcome proposals, manuscripts, photographs, and ideas from our readers, amateur or professional. We'll acknowledge all submissions and return those we can't publish. Send your contributions to *Fine Woodworking*, PO Box 5506, Newtown, CT 06470-5506.

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Two identical sessions will be held, Jan. 18-21 and Jan. 22-25. To register, contact Colonial Williamsburg at 800-603-0948, or go to [www.colonialwilliamsburg.org](http://www.colonialwilliamsburg.org).



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# Letters (continued)

Wang's letter, "More than a push block" (*FWW* #164, p. 10). I believe that the GRR-Ripper is the first real innovation in push-block design that I have seen in all my time in woodworking. The GRR-Ripper is its own blade guard and splitter and is a welcome addition for those of us who use the tablesaw without a blade guard anyway. Also, with the

## 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

GRR-Ripper push block, I find that I can control the workpiece much better, more easily ensure that it stays parallel to the blade and tight against the fence, and I haven't noticed that it takes any more force.

When it comes to cutting narrow strips, the GRR-Ripper has no competition. Both the stock and the narrow strip are held tightly with complete safety until they are well clear of the sawblade. Fingers are safe, and there is no danger of kickback.

—Roy Noyes, Chester, N.H.

## A true believer

Most likely everyone knows about the advantages of using a scraper except me.

Recently, I decided to refinish an outdoor bench constructed out of a series of wooden slats with iron supports at each end. The slats had gotten to a very dirty, dark, weather-beaten look, which cried out for refinishing.

I took the bench apart and started sanding each slat. Even with a power sander and 60-grit sandpaper, it was

taking forever to complete one of the many slats.

Then I decided to try out a scraper. To my amazement, the scraper removed the weathered condition in about one-tenth of the time it would take to sand it off.

I found that the teardrop-shaped scraper worked much better than the triangular version of the tool, which not only didn't clean the surface as well but also made a severely loud noise.

I would guess that scraping removed about  $\frac{1}{4}$  in. of the wood. And yes, the scraper required frequent honing.

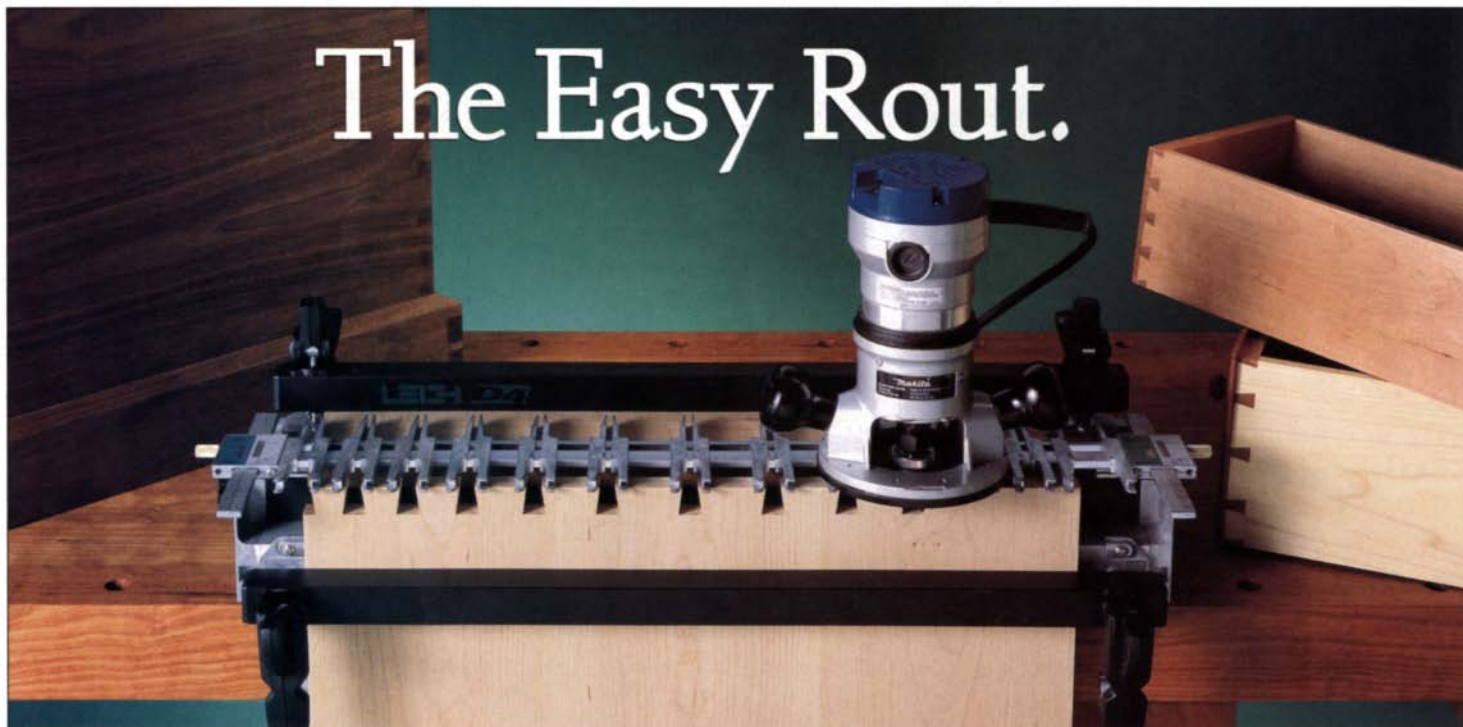
The use of a scraper saved the day for me. When similar projects come along in the future, I will utilize my scraper.

—Jack Vernon, Portland, Ore.

## Correction

Due to an editing error in "Step-Back Cupboard" (*FWW* #165, pp. 54-61), the radius of the roundover on the shelf edge was labeled incorrectly. The correct radius is  $\frac{1}{4}$  in.

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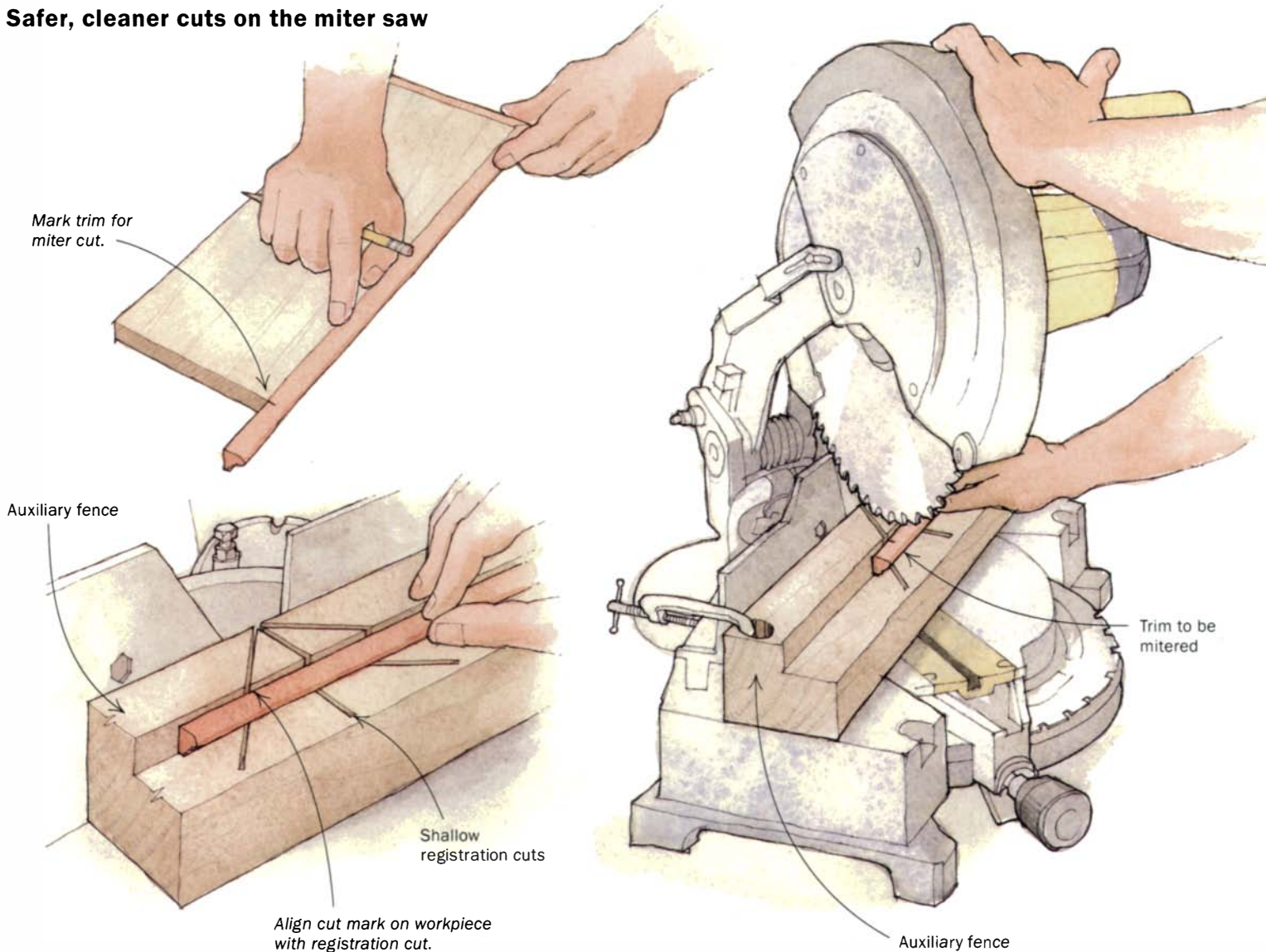
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# Methods of Work

EDITED AND DRAWN BY JIM RICHEY

## Safer, cleaner cuts on the miter saw



It is difficult to cut small pieces of mitered trim on a power miter saw. The short sections often get eaten up between the blade and the fence or the blade and the guard. Or, if the piece survives, you have to mount a search mission underneath the saw to find it. Also, you can get tearout, which will destroy a small molding, leaving scarcely any smooth, flat surface for a good glue joint.

To solve all of these problems, support small pieces of molding while mitering them by adding an auxiliary wooden fence to your miter-saw table. I've made many fences of different sizes to fit

whatever molding I need to miter. First, cut a rabbet in the front edge of the auxiliary fence to accommodate the size of the molding. Then make three registration cuts in the fence—one at each 45° angle and one at 90°. To keep from cutting the auxiliary fence in two, make the registration cuts only as deep as necessary to crosscut the molding.

Because the auxiliary fence supports the molding on both sides, you get cleaner cuts. You'll find the auxiliary fence especially useful on really short pieces, and the sawkerfs in the fence serve as



### A reward for the best tip

Steve Latta teaches woodworking to young people, so he's always thinking of safer and more efficient ways to accomplish tasks around the shop. His auxiliary wood fence for the power miter saw is a great idea because it increases accuracy while enhancing the level of safety when using the tool. For this winning tip, Latta will receive a set of hand-forged cabinetmaker's chisels made by Barr Specialty Tools ([www.barrtools.com](http://www.barrtools.com)) in McCall, Idaho. Send us your best tip, along with any photos or sketches (we'll redraw them), to *Methods of Work*, Fine Woodworking, PO Box 5506, Newtown, CT 06470-5506.





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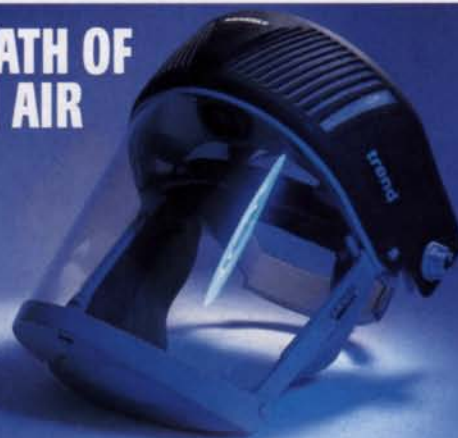
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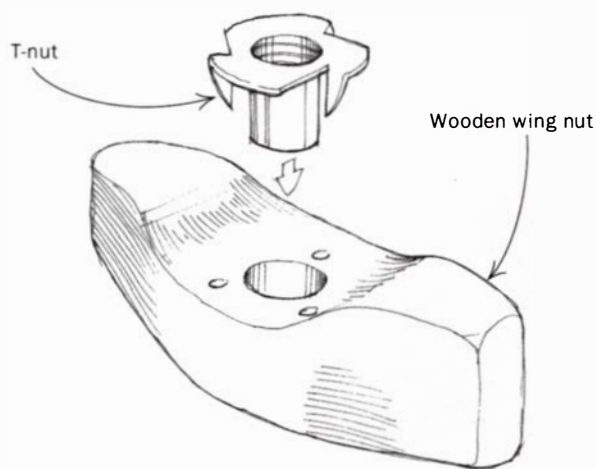


# Methods of Work (continued)

reference points for your cuts. Mark the cut, slide the line to the edge of the kerf, and cut away. All of the guesswork is eliminated.

—Steve Latta, Gap, Pa.

## Ergonomic wing nut

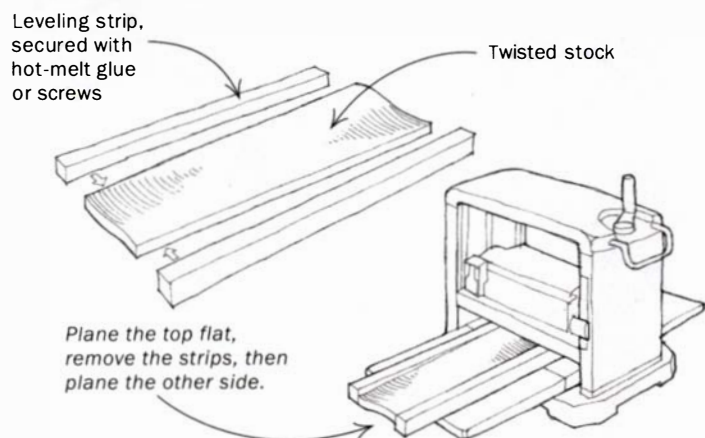


When I needed some wing nuts for a fixture, I rejected the hardware-store variety because the smaller sizes have fussy little wings that are hard to grasp, and the larger wing nuts require too large a stud. So I simply cut a wing nut out of a piece of hardwood, drilled a hole in the center, and pressed in a T-nut. The result is an ergonomic wing nut that you can make fit whatever stud size you choose. And it has large, easy-to-grasp wings.

To prevent splitting, drill pilot holes for the prongs and secure the nut with epoxy. Of course, the wooden part can be any shape you choose; three- or four-sided or round. If you want to be elegant, you can recess the T-nut and cover it with a wooden plug.

—Leon G. Wilde, Andover, Mass.

## Planing twisted boards



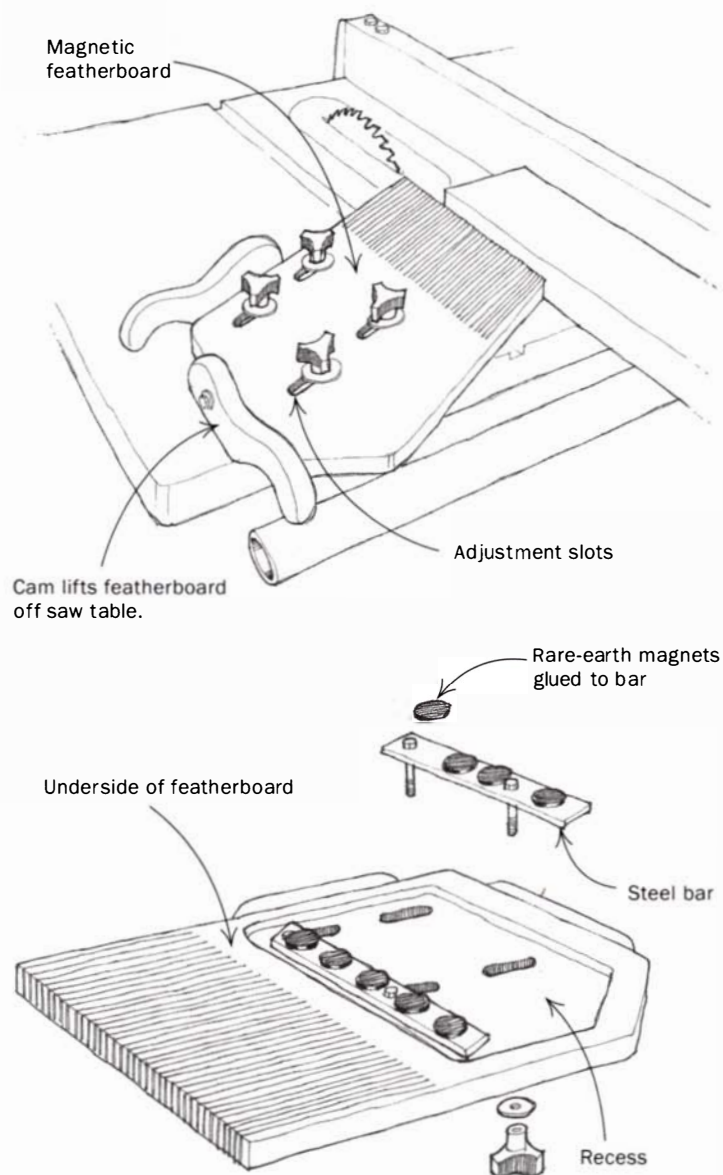
I needed to recover a short, wide piece of walnut that was twisted. My small jointer is very narrow, so I couldn't use it to flatten one face. Finally, the thought came to me to add a couple of leveling strips, one on each side of the board, and then put the board through my thickness planer. I cut the leveling strips as long as and a bit thicker than the twisted board. I then screwed one leveling strip to each side, adjusting the twist in the board equally between

them. Using hot-melt glue to attach the strips to the workpiece also would work and would reduce the possibility of nicking your planer knives with a screw.

I ran the resulting assembly through my planer until the board was flat on one side. Then I removed the strips and surfaced the other side. Finally, I squared up the board on the tablesaw. The whole process worked great.

—Wayne Johnson, Grand Ledge, Mich.

## Magnetic featherboard



When I couldn't find a commercial-tablesaw featherboard that was sufficiently strong and adaptable, I made this version in my shop. It utilizes a number of large rare-earth magnets (Lee Valley Tools; 800-871-8158) that grip the top of the tablesaw with tremendous force. To increase the strength of the magnets, I attached them to a length of steel bar. The grip of the magnets was so strong that I was unable to remove the featherboard from the tablesaw, so I added two cams to lift the featherboard off the saw table. I added



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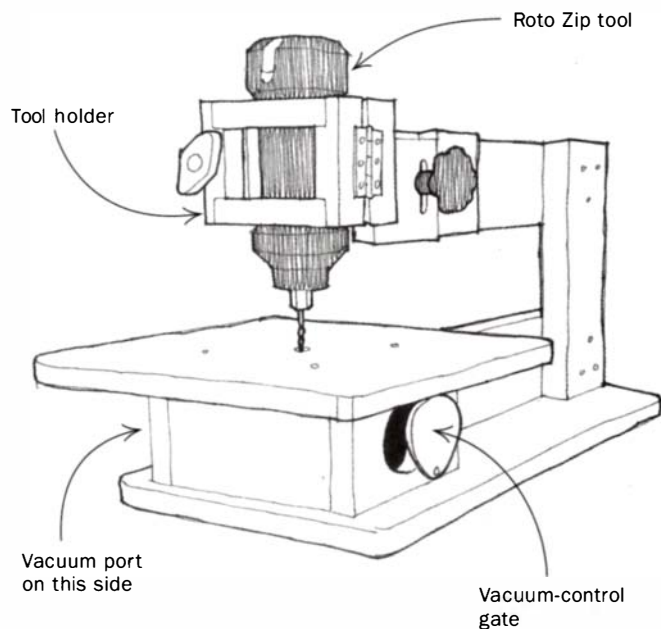


# Methods of Work (continued)

slots in the featherboard so that I don't have to remove the board when I need to make slight adjustments.

—Ed Gottlieb, Asheville, N.C.

## Roto Zip scrollsaw



Think of this fixture as a different kind of scrollsaw that uses the spiral-cutting action of a Roto Zip tool. It's easier to control the cut with the Roto Zip tool suspended above the workpiece, which is free to move under the tool. The spiral bit can cut a wide range of materials, even ceramics. Most of the dust is directed downward, and with a shop vacuum attached to the vacuum port, very little dust escapes into the air. I added a vacuum-control gate to manage the force of the vacuum, if necessary.

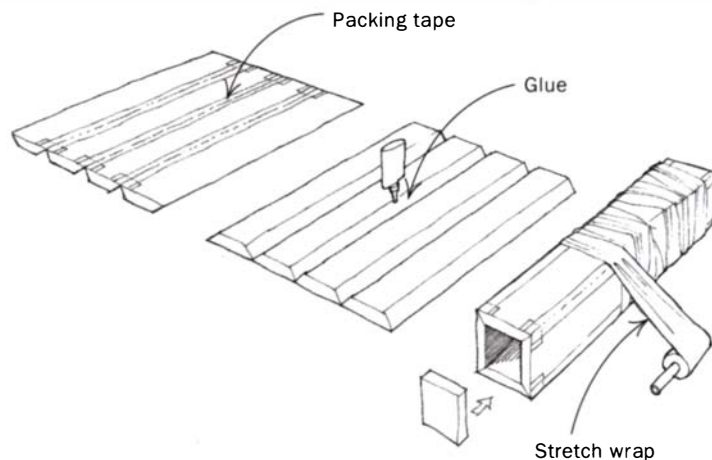
The fixture can be built from shop scraps and commonly available hardware. I recommend making the tool holder from maple or a similar strong hardwood.

To make the semicircular cuts in the tool holder, carefully scribe the diameter of the Roto Zip tool on the workpiece with a compass. Then rough-cut the piece, leaving the line, and sand to the line with a sanding drum in a drill press.

—Jacques Paquette, Somerset, Mass.

## Clamping with packing tape and stretch wrap

Recently, I needed to build some wooden columns by gluing up four mitered sides. To make a difficult process easy, I used a method that utilizes clear packing tape and stretch wrap. Start by laying the mitered workpieces flat next to each other. Connect the workpieces with small strips of tape to hold them initially, and then run the packing tape full length down the outside of each miter (see the drawing above right). This will provide a hinge to keep the pieces in registration. Once the edges have been taped, carefully flip over the assembly and spread glue to the inside of the miters. Fold the four pieces together, tape the last joint, and wrap with stretch wrap. This material (commonly used for wrapping bundles of trim at the lumberyard) comes in 5-in.-wide,

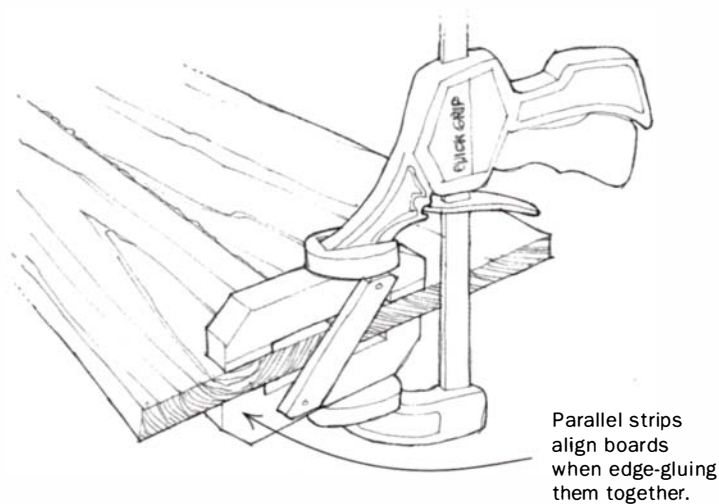
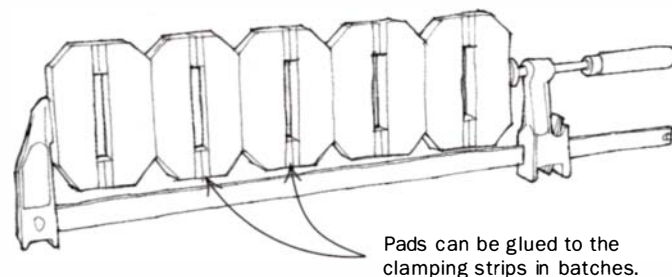


1,000-ft.-long spools from any packing-supply store or Woodworker's Hardware (800-383-0130). Be careful not to wrap the stretch wrap too tight, because it can apply tremendous pressure. Once the glue has cured, unwrap the stretch wrap and slowly remove the packing tape to avoid pulling off any splinters of grain.

Using stretch wrap as a clamping tool works in many other gluing situations and may provide a replacement for nylon band clamps or rubber inner-tube rings in many odd clamping applications.

—Nick Covelli, Kansasville, Wis.

## Align edge joints with parallel clamping pads



When edge-gluing a tabletop, I use a simple trick I learned from airplane-model making. First I make several 3/4-in.-thick clamping strips with pads on each end (see the drawing above). These strips



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# Methods of Work (continued)

can be gang-assembled in large numbers. Then I nail a batten diagonally across a pair of the strips. During glue-up, I clamp one of the parallel strips at each edge joint to make sure the boards are aligned. The clamping pads elevate the strips off the surface and keep them from getting gunked up with glue.

—Mladen Vranjican, Jacksonville, Fla.

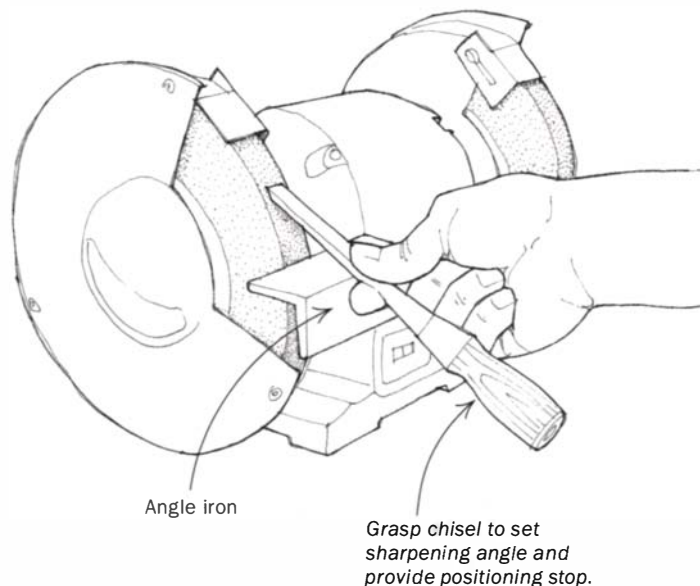
**Quick tip:** When hanging cabinet doors, I attach the hinges to the door, apply hot-melt glue to the hinge, and then press and hold the door in place for a half-minute. I then can swing the door open and mark the exact screw locations. The little time spent removing glue residue is a small price to pay for a perfect fit on the first try.

—David Baker, Halfway, Ore.

## Use your finger as a positioning stop for sharpening chisels

The method I use to sharpen chisels and planes is quick, accurate, and easy. No fancy fixtures are required—just a bench grinder with its standard tool rest.

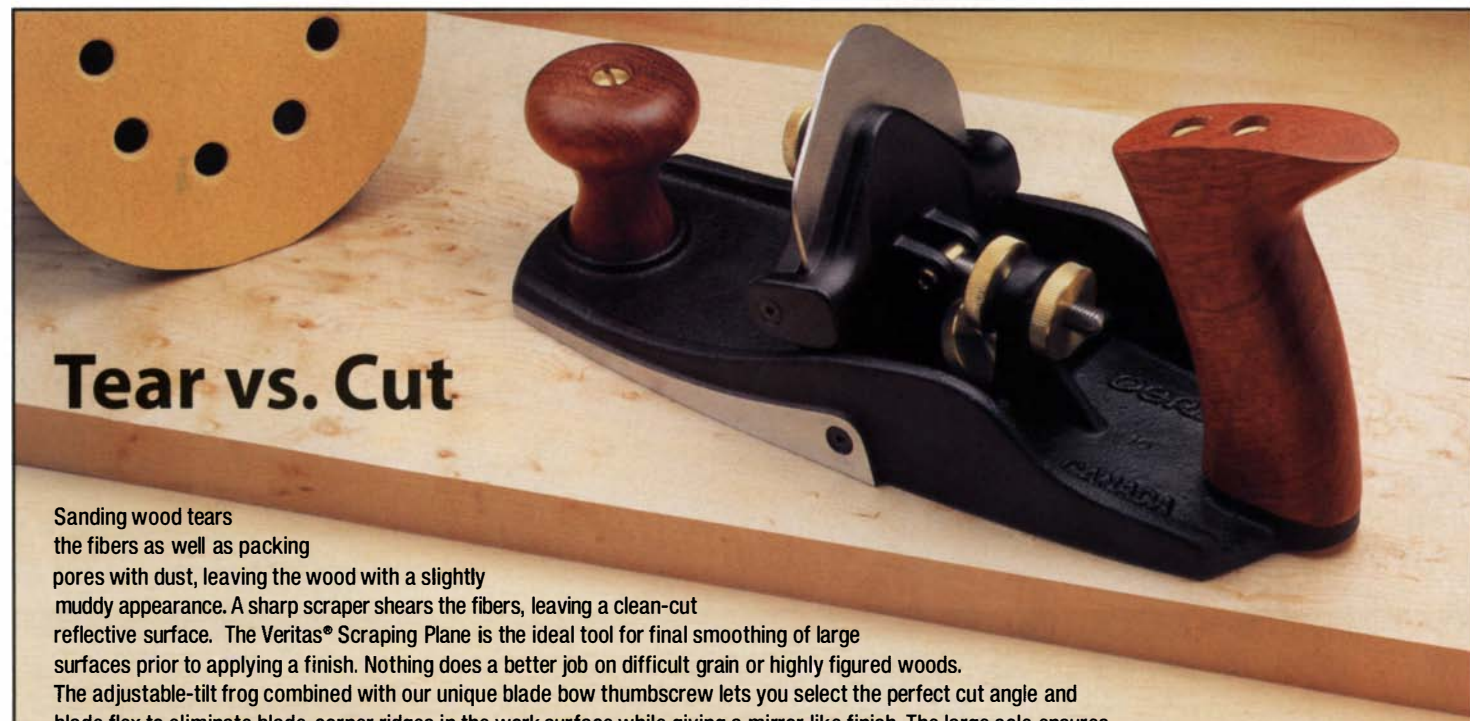
Before turning on the grinder, grasp the chisel to be sharpened with one hand, thumb on the top (flat side) and forefinger on the bottom. Position the tool on the wheel and tool rest to give the correct grinding angle. Now shift your forefinger to bear against the tool rest and grip the tool between your finger and thumb. Your finger will act as a positioning stop against the tool rest. You can move the tool away from the rest at any time to cool it in water and



return it to the same position, providing that you don't move your thumb and forefinger. During grinding, move the tool side to side quickly to avoid heat buildup.

For wider chisels and plane irons, you may wish to add a short length of angle iron to the outboard side of the existing tool rest to give you greater control of the side-to-side motion.

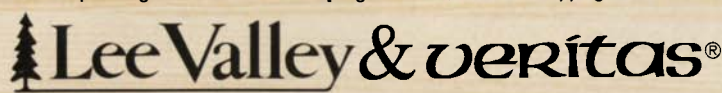
—David MacNeil, Bridgewater, N.S., Canada



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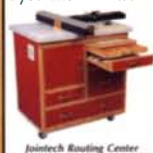
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# Notes & Comment

## Canadian school produces professional woodworkers

Michael Craigdallie works at his corner bench in the Selkirk College woodshop, finishing off a final project that is close to his heart. It's not the most complex work he's ever done, just a bookcase, but this one is for his mother's birthday. "She'll appreciate the work I put into it," he said with a smile.

Craigdallie wears a leather apron with pencils and pens tucked in the front. He is unfailingly polite—the kind of guy who calls re-

porters "sir" and makes gifts for his mother. He's also a talented young woodworker who's picked up international awards while still at his corner bench in college.

"Selkirk has one of the best woodworking programs in western Canada," Craigdallie said. "It's suited to the hobbyist or student who wants to make a career of fine furniture making."

Part of the allure of the Selkirk program is going to school in Nelson, a city in British Columbia surrounded by mountains, rivers, and towering stands of cedar and spruce. There also is the instruction. Head woodworking instructor Michael Grace was one of Canada's most sought-after studio furniture makers before he took up teaching, and he is a big part of the reason there is a two-year waiting list to get into the woodworking program at Selkirk. "What I am trying to do is split that line between giving people the opportunity to explore the designer world but also making sure they have enough technical knowledge to go out and get a job," Grace said.

In the first nine months of the course, students learn to transform raw logs into art or furniture, moving from designing, drafting, and calculating costs to woodworking techniques to marketing the finished product.

Craigdallie excelled enough in his first year to be invited back for a second. Usually, four students are chosen for a second, self-directed year during which they work on their designs at their own pace. Craigdallie said his plan is to apprentice in an established studio before striking out on his own. And he also has that birthday gift for his mother to finish.

Tuition for the fine-woodworking program at Selkirk College is roughly \$3,000 per year, plus \$1,000 for books and materials. For more information, go to [www.selkirk.bc.ca](http://www.selkirk.bc.ca), or call 250-352-6601.

—Bob Keating



**Learn from the best.** Michael Grace, left, works with second-year student Michael Craigdallie in the fine-woodworking program at Selkirk College in Nelson, B.C., Canada.

## Fruitwood rescued from the fireplace



**Fruit trees are his inspiration.** Tony Zizzi lives in Pennsylvania, surrounded by thousands of acres of peach, nectarine, pear, apricot, plum, and apple trees, which he both photographs and turns into treenware.

One afternoon Tony Zizzi had thought he perfected his recipe for spaghetti sauce, but something still wasn't quite right.

"It was the spoon," he said.

Zizzi is a photographer who lives in Cumberland County, Pa., which means he is surrounded by thousands of acres of fruit orchards—some actually planted by Johnny Appleseed. Zizzi made a rough sketch of the perfect utensil for stirring sauce, found a scrap of fruit cherry, and fashioned his first piece of treenware. Over the years he has refined his ergonomic yet artistic designs, but he still uses local scrapwood and simple tools—drawknife, spokeshave, gouges, and "lots of sandpaper."

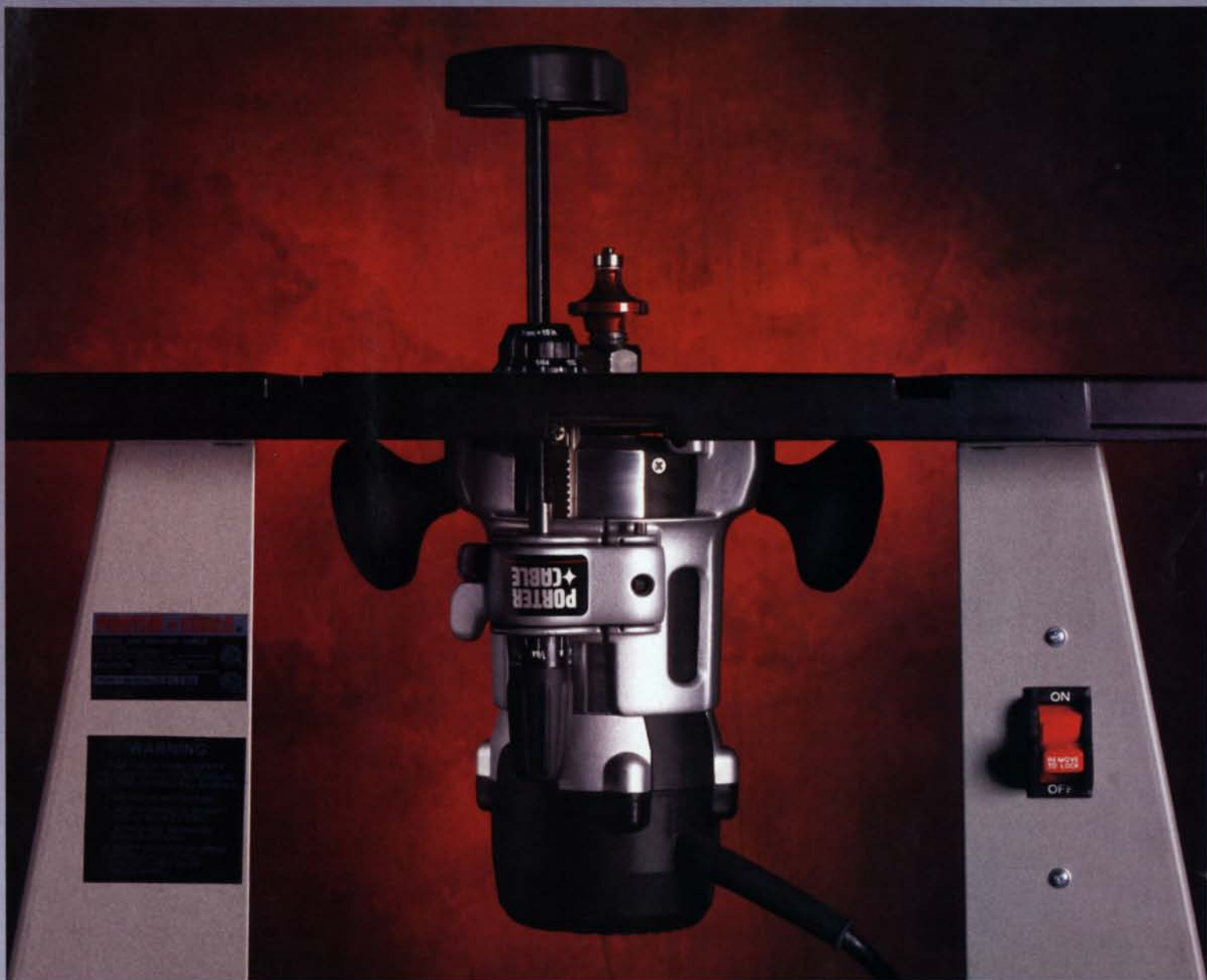
"I have rescued many a fine stick of Pennsylvania fruitwood that was otherwise destined for a woodstove or a burn pile," he said.



—Asa Christiana, senior editor



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## Furniture Society conference celebrates, sustains the art of woodworking

The Furniture Society is now 7 years old, with five annual conferences under its belt. After attending the most recent one in Philadelphia in June, I think it is safe to declare the society a great success. The group's mission is to "advance the art of furniture making," and I can't envision a conference hitting that mark any more squarely.

To be truthful, this was my first Furniture Society conference, so I can't compare the Philadelphia event to past gatherings. Some of the magic could be attributed to the setting: a city brimming with artistic and cultural history, with museum exhibits and gallery openings timed to coincide with the conference. And maybe the quality of this year's presenters and panelists—Michael Fortune, Michael Puryear, and Hank Gilpin, among many other standouts—was the luck of this year's draw.

But there is no mistaking the earmarks of a vibrant, effective organization. I have read about past conferences and sifted through press coverage describing some of the society's herky-jerky steps toward maturity. There are true challenges in joining curators and art professors to a bunch of furniture makers with sawdust in their hair. I was pleasantly surprised to find the conference to be as inclusive and harmonious as it was, with the various attendees exploring more what they have in common—a love of beautiful furniture—than what sets them apart.

"This conference was a watershed event for us," said Andrew Glasgow, executive director of The Furniture Society, in terms of "having such a good outcome from such a disparate group." The Philadelphia conference drew 560 attendees, a large jump from last year's 430 in Madison, Wis.

The first thing that struck me was the wide range of makers welcome and active at the conference. In lively panel discussions with inflammatory titles such as "Why Make Old Stuff?" there were more traditionally influenced makers such as Hank Gilpin, Timothy Philbrick, and John Dunnigan alongside art-based makers



**Down-to-earth demos.** The exchange of ideas at the conference included many technical presentations. Here, Jean-Francois Escoulen demonstrates efficient spindle turning using a bedan.

such as Garry Knox Bennett and Gord Peteran. The weakest parts of the event, for me, were the more academic discussions, too removed from the practical, earthly world of an actual furniture designer and woodworker. But there was an overflowing schedule of other options, including technical demonstrations on subjects from concrete to rural-American inlay.

I would highly recommend that any aspiring studio furniture maker join this group and attend its yearly conference. I left inspired and reinvigorated with a headful of valuable ideas.

For more information, go to [www.furnitureociety.org](http://www.furnitureociety.org).

—A.C.

## Woodcraft celebrates 75 years

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Seventy-five years later, Woodcraft has been celebrating its anniversary in a number of ways, including running a sweepstakes for a pick-up truck loaded with tools. The company also has been offering a series of limited-edition tools, a different set each month. And Woodcraft points to the year's slate of 9,000 woodworking classes, seminars, and demos as part of its celebration of woodworking.

Today, Woodcraft boasts more than 60 retail franchises as well as a catalog mailing list of more than 3 million people. In 1997 Woodcraft acquired The Woodworker's Club, where it rents space to woodworkers, and its latest venture is an online auction site. For more information about Woodcraft, The Woodworker's Club, or the online auction, visit [www.woodcraft.com](http://www.woodcraft.com), or call 800-535-4482.

—Sara Daniels



**A meeting of the minds.** The Members' Gallery was a popular gathering place at the 2003 Furniture Society conference. More than 50 members displayed work there.



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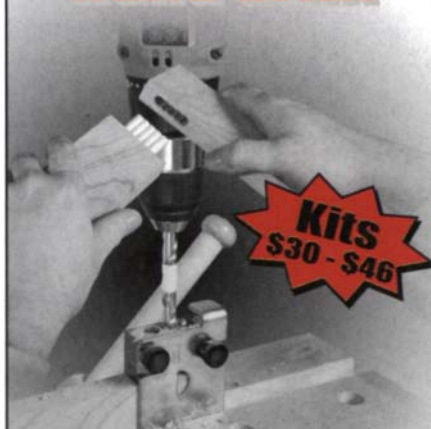
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accuracy without the table. Now, some of you are probably thinking this is nothing more than a toy. You'd be well-advised to think again. It boasts a 14-amp, 2 1/3 horsepower motor that turns



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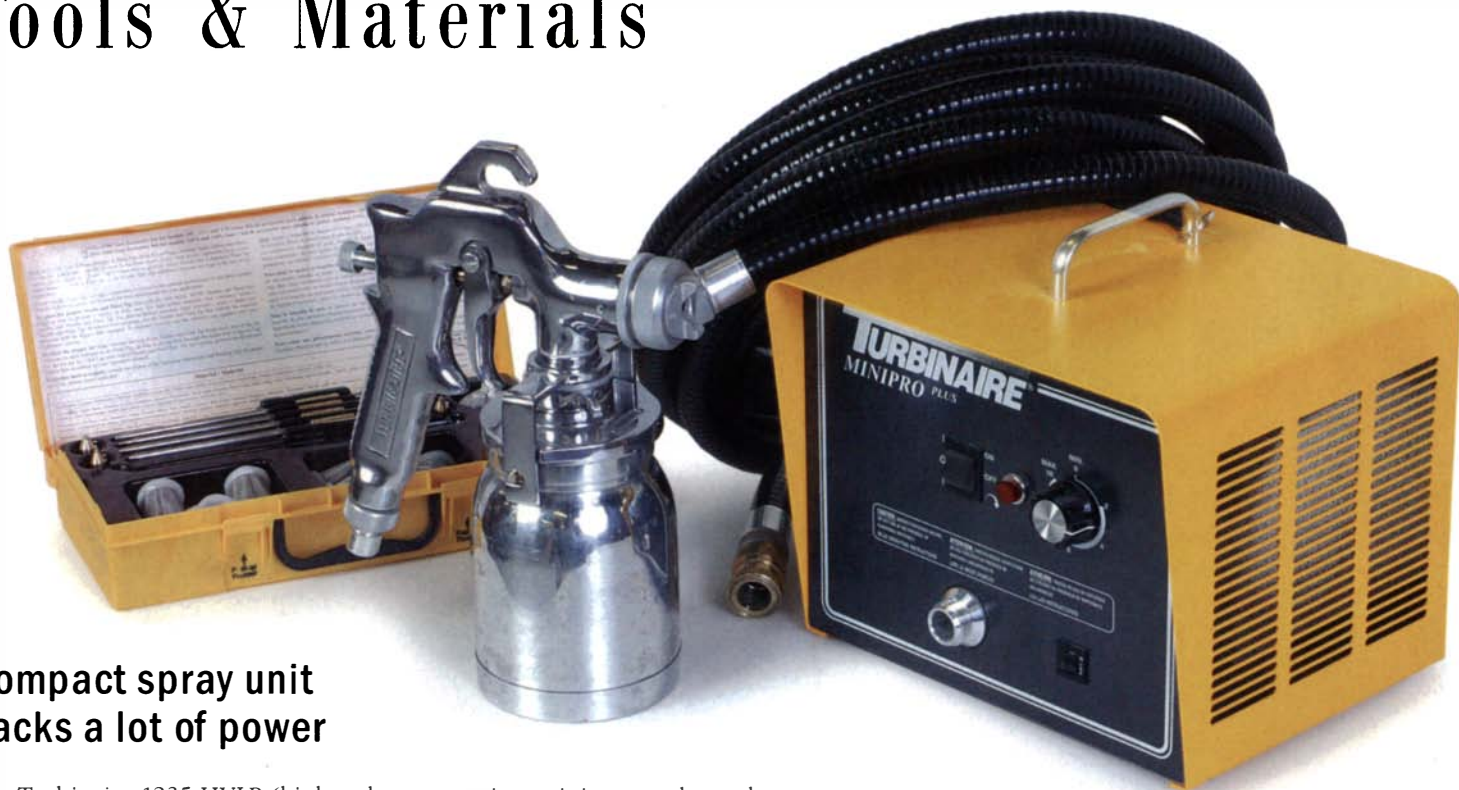
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# Tools & Materials



## Compact spray unit packs a lot of power

The Turbinaire 1235 HVL (high-volume low-pressure) sprayer is about a third smaller than most home-shop turbines. But small size doesn't necessarily equate to low performance. This well-built three-stage turbine had more than enough muscle to spray everything from water-thin stain to unthinned brushing varnish.

The manufacturer claims an air-volume output of 110 cu. ft. per minute (cfm). But atomization pressure really is what dictates spray-gun performance. I measured an atomization air pressure of slightly less than 6 psi at the turbine and almost 5 psi at the spray-gun nozzle. While 5 psi might sound

wimpy, it is more than adequate to spray most properly thinned finishes.

Unique to the Turbinaire 1235 unit is a variable-speed feature that allows infinite control of the atomization pressure and air volume. I was able to dial in the ideal atomization pressure, which considerably reduced overspray.

The spray gun was comfortable to use, well balanced, and easy to disassemble. A pair of optional accessory kits is available: one that works best with finishes and stains and one that, in addition, handles thicker products like paint.

The Turbinaire unit I tested had a bleed-

**What you get.** The Turbinaire sprayer comes with the turbine, a spray gun, and a hose. Accessory kits can be purchased separately.

er-type spray gun, not a favorite of mine because it blows full-pressure air from the air cap, whether you are spraying finish or not. It's a nuisance and stirs up a lot of dust. However, Turbinaire offers a non-bleeder-type gun as an option. There's also a bleeder-type gun with a check valve.

The internal fluid passages on the gun I tested were made from brass rather than stainless steel. Water-based finishes tend to



## Throat plate can be outfitted with multiple zero-clearance inserts

The throat plate that comes with most tablesaws is fine for many operations, but for certain tasks, the opening for the blade is too wide and provides little support when ripping narrow stock. Plus, with no support for the wood fibers around the cut, the wood is more likely to splinter.

To solve the problem, many woodwork-

**Combination throat plate.** This new table-saw throat plate combines the best features of metal and plastic.



corrode brass fittings, so the gun must be disassembled and thoroughly cleaned after spraying a water-based finish. Turbinaire's non-bleeder-type gun, however, is all stainless steel.

The unit I tested included the turbine, the bleeder-type spray gun, 25 ft. of hose, and a viscosity cup and sells for about \$700. With a non-bleeder-type gun, the price is about \$825. The woodworker's version of the accessory kit sells for about \$150.

Although, I think the system is pricey, it performed very well. Contact Turbinaire at 800-866-4857 ([www.turbinaire.com](http://www.turbinaire.com)).

—Chris A. Minick is a regular contributor to Fine Woodworking.



**Turbine power.** The HVLP sprayer from Turbinaire has plenty of power to spray any finish a woodworker is likely to use.

ers replace the original throat plate with a zero-clearance insert. Indeed, it's not uncommon to have several, each with a different opening to accept, say, a thin-kerf blade, a dado blade, or a molding-head cutter. With a zero-clearance insert, the space between the blade or cutter and the insert is as close to zero as one can get.

That's why I was intrigued by a new product called Tru-Cut, a unique replacement tablesaw throat plate. The Tru-Cut has two parts; an outside frame machined from aluminum and a smaller, rectangular-shaped insert made from phenolic plastic that fits into a recess in the frame.

The aluminum frame is rigid and should

## Lie-Nielsen unveils a new spokeshave



Lie-Nielsen Toolworks has introduced a new spokeshave, the SBS-F. Modeled after a vintage Preston design, this small (6¾ in. long) flat-sole bronze shave boasts a hefty ¼-in.-thick blade. The cap and thumbscrew secure the blade neatly and firmly when finger-tightened, which helps make blade adjustments easy.

With its narrow throat opening, this spokeshave is intended for fine finishing strokes, and it will take feathery, full-width shavings from the edges of rails or tabletops without chattering, even in figured hardwoods. If you enlarge the opening with a file, you can take thicker shavings and give this delicate-looking tool a vigorous workout.

On the downside, whether you push or pull the tool, the loop-style handles don't provide a good place to tuck your thumbs and forefingers, resulting in a somewhat awkward grip. That said, though, I'd say this is the best flat-sole metal spokeshave on the market.

The SBS-F sells for about \$75. Contact Lie-Nielsen at 800-327-2520, or visit [www.lie-nielsen.com](http://www.lie-nielsen.com).

—William Tandy Young builds furniture in Stow, Mass.

## Bargain-price benchdogs

Rockler's set of plastic benchdogs won't make your wallet bark too loud. Each dog has a 1½-in.-long post that fits into a ¾-in.-dia. hole. The dog extends above the surface by ⅞ in., so when planing or sanding stock that's ½ in. thick or more, you don't need to worry about hitting the dog. And if your plane blade should somehow meet the dog, the relatively soft plastic won't do damage. A set of four dogs sells for \$3.99. For more information, contact Rockler at 800-279-4441 ([www.rockler.com](http://www.rockler.com)).

—Tom Begnal is an associate editor.



**Inexpensive but effective.** Made from molded plastic, these dogs work just fine for stock that's ½ in. or thicker.

remain flat, something that plastic and plywood are less likely to do over time. And because it accepts the smaller plastic inserts, you don't need to keep an assortment of full-size inserts. The smaller inserts cost less than full-size commercial inserts.

Using setscrews, both the frame and the insert can be adjusted level to the saw table. Once level, the plastic insert secures to the frame with six screws. Each insert includes a slight cutout on the bottom to provide clearance for the sawblade, a useful feature when making the initial kerf cut through the insert. To hold the frame firmly in place, there are two

spring-loaded, ball detents recessed into the right side that bear against the throat-plate opening.

In operation, the Tru-Cut worked well. Like all plastic throat plates on the market, it's a bit noisy at first, but after a short amount of use, any slight runout in your sawblade will enlarge the kerf and eliminate the noise. It takes less than two minutes to add a new insert.

The Tru-Cut is available in several sizes to fit most tablesaws. It sells for about \$80 from Art Betterley Enterprises (800-871-7516).

—Tim Albers is a woodworker in Ventura, Calif.



## A router-bit system for edging sheet goods

For appearance's sake, the exposed edges of hard-wood plywood are rarely left uncovered. And more often than not, the covering of choice is either veneer tape or solid-wood edging.

Both work fine, but they have drawbacks. Veneer tape is thin, which means you cannot chamfer or round over a corner. That's not a problem with an applied solid-wood edging, if it's thick enough, but it always ends up looking just like, well, like it's applied.

Michael Burgess has developed a set of



router bits that goes a long way toward eliminating these problems. The Burgess Edge System, designed to be used with any 3/4-in.-thick plywood, consists of two router bits with 1/2-in.-dia. shanks. One bit creates a cove on the edge of the plywood; the other bit cuts a shape in a solid-wood strip that's a mirror-image of the cove. The two parts fit snugly to create

a nearly invisible gluejoint.

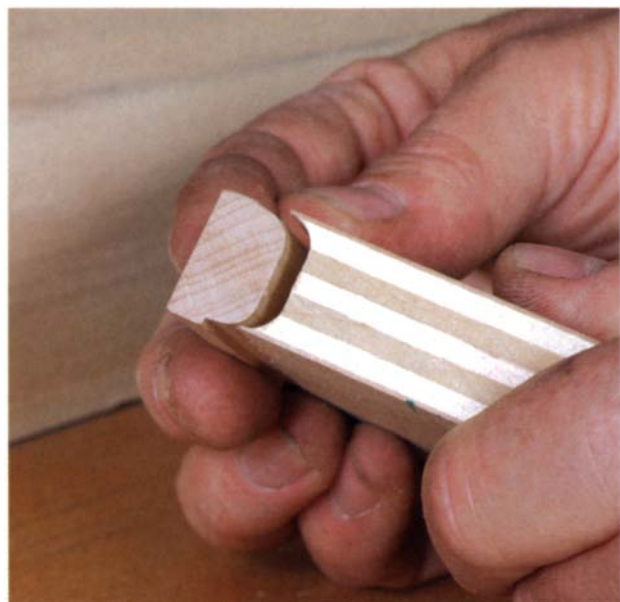
There are several benefits of such a system. Among them, the wood strip can be matched to the face of the plywood panel. For example, if the face of the plywood is plain sliced, or flatsawn, you can apply an edge with a quarter- or riftsawn grain pattern to produce the look of a solid board. Also, if the wood strip is left proud of the plywood edge, a slight chamfer or roundover can be added while still maintaining the solid-wood look.

Then, too, thanks to the rounded edges of the mating surfaces, the parts are self-aligning when clamped. In addition, the added surface area of the rounded edges creates a stronger glue joint.

It takes a bit of fussing to set up the bits to cut the proper width and then to get them set to the proper depth to leave the thin veneers intact. It would be an advantage to use two routers here, especially if the process is going to be repeated.

In short, the bits produced good results, although the set-up and trimming cuts were a bit fussy. You get both bits for about \$125. For more information, call 802-233-1489, or visit [www.burgessedge.com](http://www.burgessedge.com).

—Roland Johnson works wood in Sauk Rapids, Minn.



**Getting an edge.** The Burgess Edge System makes it easy to edge-band 3/4-in.-thick plywood. Used freehand or in a router table, the two-bit system creates a nearly imperceptible joint.

## Tool recall

### Black & Decker 18v cordless drill-drivers

Black & Decker has recalled about 265,000 18v cordless drill-drivers sold nationwide from September 1997 through February 2002. The drill-drivers either were sold separately or as part of various tool kits.

The switch on the drill can malfunction and overheat, posing a possible fire hazard.

The recall applies to the following:

| MODEL NO. | DATE CODES        | COLOR  |
|-----------|-------------------|--------|
| CD1800    | 20011952-20020652 | Orange |
| PS3700    | 973652-983052     | Jade   |
| PS3725    | 20003852-20013652 | Jade   |
| PS3750    | 20002454-20005252 | Jade   |

The model number is on the nameplate; remove the battery to find the date code. Owners of these drill-drivers should stop using them and remove the battery. Contact Black & Decker toll-free at 866-821-5444 to receive a free repair. —T.B.

## Upscale leather hardware

Wood and leather often complement each other, and Turnstyle Designs, a company in Devon, England, has introduced a line of fine-quality leather hardware. However, it's not cheap. For example, in the photo below, the bow handle sells for \$65, the cup handle for \$70, and the hand-stitched knob for \$100. However, if you want leather hardware, and only the best will do, I don't think you'll be disappointed. More information is available toll-free at 877-288-4642 ([www.turnstyle-designs.com](http://www.turnstyle-designs.com)).

—T.B.



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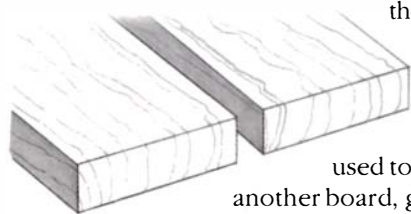


## Choose the right joint for the job

For a beginner, one of the most daunting aspects of building a piece of furniture is deciding what joints to use. Choosing the wrong joint can complicate construction, conflict with the design, undermine its integrity, and maybe even cause premature failure of a piece. A good place to begin when faced with the task of choosing a joint for a certain application is to identify and study the most widely used joints; there literally are hundreds of them in various configurations. Then consider the joints traditionally used in a particular type of furniture and evaluate your ability to execute them. Traditional joints all have withstood the test of time—we know they work. In this article I highlight some of the most standard joints and their common applications. They all can be executed by hand or by machine.

### Butt joint

A butt joint simply is where the long-grain edges of two pieces meet to form a seam. It is used to increase the overall width of a panel. The strength of this joint relies on the straightness of the edges (not necessarily the squareness). With modern adhesives, this joint can work very well and be as strong as the wood itself. When a butt joint is used to join the end of a board to the face of another board, glue alone isn't sufficient; biscuits or dowels are necessary to add strength. One advantage of the butt joint is speed.



### Rabbet joint

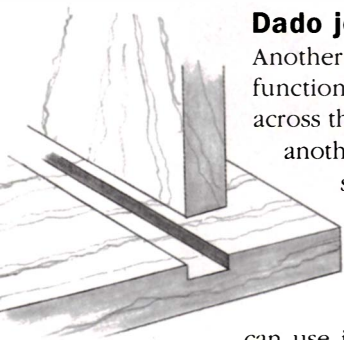
Another simple joint is the rabbet, in which boards are joined by removing a portion of one board's thickness to accommodate another board. A rabbet joint often is employed to set back boards onto the rear of a case piece. The back boards sit flush with the back of the case in the rabbet. Sometimes on simple cabinets the drawer sides are joined to a drawer face with a rabbet joint and nails.



### Dado joint

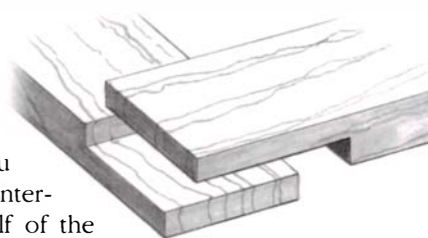
Another joint that is easy to make, attractive, and functional is the dado. Put simply, a dado is cut across the grain of one board to receive the end of another board. It's great for locating partitions inside cabinets or for supporting shelves on bookcase units. It can be cut across the full width or stopped.

A plow is similar to a dado, except it runs in the same direction as the grain. You can use it in the construction of frame-and-panel doors and for setting in drawer bottoms.



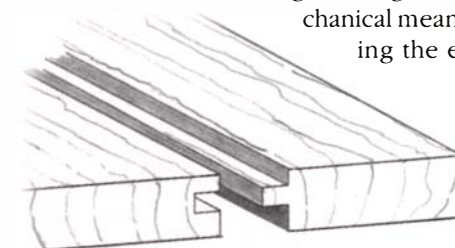
### Half-lap joint

If you were building a cabinet or sideboard with a face frame that intersects at various points, you might use a half-lap joint. On this joint you remove the full width of each intersecting member but only half of the thickness. Several half-lap joints on a cabinet face frame will ensure that it is rigid and long-lasting.



### Tongue-and-groove joint

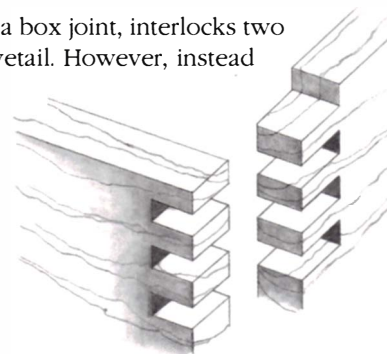
Tongue-and-groove joints provide a mechanical means of registering and joining the edges of narrow boards when forming a wider panel. Along one edge of a board a tongue is cut, usually centered on the thickness of the material.



On the other board, a corresponding groove is cut. One advantage is that the edges are registered, requiring little planing or cleaning up. This is particularly helpful when gluing up long boards without the aid of cauls to keep them flat. Another advantage is the increased glue surface. Disadvantages are that the joint is visible from the end of the panel and the joint requires precise milling to ensure that all parts fit correctly.

### Finger joint

The finger joint, sometimes called a box joint, interlocks two boards at a corner similar to a dovetail. However, instead of angled tails and pins like on the dovetail, the fingers are straight. This joint has a clean, utilitarian look that makes it perfect for kitchen, office, or shop containers. In my shop, I have several small toolboxes put together with finger joints.





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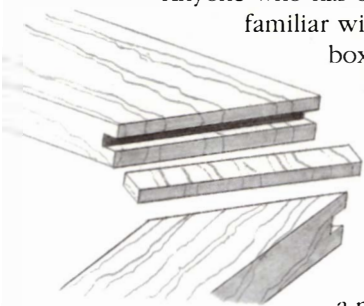
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# Rules of Thumb (continued)

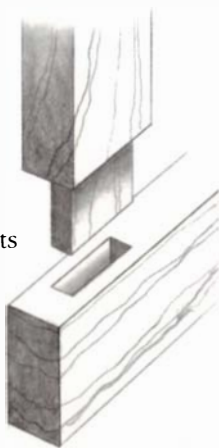
## Miter joint

Anyone who has ogled a painting or stared into a mirror is familiar with the miter. This joint is used on small boxes and decorative frames of all kinds. The first hurdle is to cut each half of the joint to 45°; then you have to figure out a way to glue them together without one half slipping past the other. The neatest way to align a miter is with a spline set into a slot cut on each side of the miter. The spline, in some cases, also provides a nice accent.



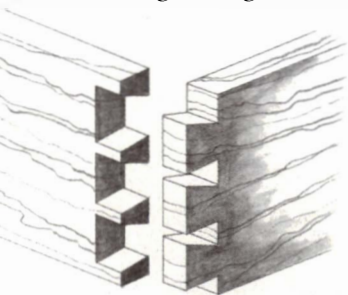
## Mortise-and-tenon joint

One of the most basic and widely used joints in furniture making is the mortise-and-tenon. This joint can be used to join the rails and stiles on frame-and-panel doors, the aprons to the legs of tables, and the rails to the posts or legs of chairs. Because of the deep penetration of the tenon into the mortise, wood parts can be supported securely, even without the benefit of glue. There are many variations to the mortise-and-tenon. The tenon can be stopped or continue through a board, and it can be reinforced with pins or wedges.



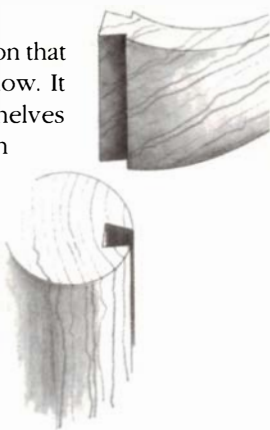
## Dovetail joint

Considered one of the strongest and certainly the most beautiful of joints, the dovetail exacts a stiff price in terms of skill for the strength and good looks it provides. This is probably the strongest method for joining two pieces with the grain going in the same direction. There are basically two types: through and half-blind. Through-dovetails are used to join carcasses, blanket chests, and small boxes. Half-blind dovetails are most commonly used to join drawer sides to drawer fronts, but occasionally you'll find the joint employed in the construction of carcasses. Today, there are jigs that enable a woodworker to cut dovetails by machine, but the end result looks mass-produced. The best-looking dovetails always have been cut by hand.



## Sliding dovetail joint

This joint consists of a dovetail-shaped tenon that slides into a corresponding groove or plow. It can be used like a dado for supporting shelves on a bookcase while offering extra strength to keep the sides of the bookcase from bowing outward. If you were building a Shaker candle stand, the sliding dovetail would be the strongest way to attach the legs to the column. In this instance, the dovetail-shaped joint keeps the legs tightly attached to the column. □



## Joinery checklist

### ✓ KEEP IT SIMPLE

Sometimes the simplest joint can do the job. There's no need to complicate things, and sometimes overdoing it can be detrimental. For instance, you don't have to pin every mortise-and-tenon joint; glue usually is sufficient to ensure a strong bond.

### ✓ STICK WITH WHAT HAS WORKED HISTORICALLY

In woodworking, there's often a good reason why things have been done a particular way for hundreds of years. Woodworkers sometimes struggle to reinvent a joint by exaggerating a part of it. For instance, when cutting dovetails, more is not necessarily better. Crowding the joint with pins can leave too little material on the tail board to support the joint. Study well-regarded pieces to follow as examples. The surest way to build successful furniture is to copy what has worked.

### ✓ MAKE SURE IT FITS PROPERLY

If you've bothered to make it, then make sure it fits well. Sloppy joints will come apart prematurely when the glue fails. Take your time, test-fit your pieces, and replace anything that's loose or cracked.

### ✓ MAKE SURE THE WORK IS CLEAN

I have one paramount rule regarding anything I build: Every piece should represent the best I was capable of building at the time. You shouldn't look at your work and think you could have done better. Sloppy work and short-cuts will haunt and trouble you forever.

### ✓ SHOW OFF THE JOINT IF IT'S APPROPRIATE

Nothing looks better than eye-popping dovetails or a tight, pinned mortise-and-tenon. When the joint fits the style of the piece, show it off.

### FOUR CRITERIA FOR CHOOSING A JOINT

1. The joint should contribute to the strength and integrity of the piece.
2. The joint should allow the wood to move as ambient conditions change.
3. The joint must allow for additional operations, such as grooving, rabbeting, moldings, or screws.
4. The joint should contribute to and not interfere with the appearance of the piece.





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angle reference guide. It has a brand-new fence with magnified cursor, micro adjustment and 4 T-slots for jigs. And it's heavier than the competition, with a fully enclosed cabinet, larger dust port, and wider stance that makes it far more stable. The SuperSaw is also the only saw on the planet that includes an on/off switch that can

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So to review, the JET 10" SuperSaw has better specs, more features, and a warranty that's twice as long. Oh, and did we mention it costs less? Visit your JET distributor for more details.



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BY PETER GEDRYS

**W**e are always searching for that perfect one-stop wood finish: It should be easy to apply, dry quickly, and color the wood at the same time. Modern combination stains and finishes have grown in popularity because they meet these needs. But to my eye they tend to impart too much color, and those that are pigment based can leave a cloudy appearance. Instead, I rely on a tried-and-tested combination finish.

Shellac's ability to impart color is unmatched by any other finish: It can add fire or glow to the wood naturally. In my classes, after padding out a piece of mahogany, I've heard students remark, "I didn't realize you could do that." They were reacting to the rich color and depth obtained using only shellac.

I'll talk about the different types of shellac available and the best methods of applying them, and give you tips on which colors go best with different types of wood.

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Buying dry shellac flakes and dissolving them in denatured alcohol has several ad-

vantages over buying and using premixed shellac. First, the dry flakes can be stored almost indefinitely without spoiling (once dissolved, shellac should be used in as little as six months). Also, compared with premixed versions, dry flakes offer a wider choice of grades and colors, and they're less expensive.

The ratio of dry shellac to denatured alcohol is known as the cut. Three pounds of shellac flakes in 1 gal. of alcohol is known as a 3-lb. cut, 2 lb. of flakes equals a 2-lb. cut, and so on.

One of the most frequently asked questions I get is, "What cut should I use?" Af-

ter using shellac for many years, I don't worry about exact measurements, relying instead on viscosity. I liken the viscosity to various dairy products: My initial mixture will be that of heavy cream; from that it can be thinned to light cream and then to skim milk. If you're a novice, this takes the exactness out of the equation and makes it easier to understand. After all, how often do you pour milk or cream?

However, for those who prefer exact numbers, I usually start with 5 oz. of flakes in 8 fluid oz. of alcohol, which is the equivalent of a 5-lb. cut. I cut this by 50% to form







### ALLSHELLAC STARTS OUT AS STICKLAC

a 2½-lb. cut for the initial application, then cut this again by 60% for a roughly 1-lb. cut for brushing on the last coat or two or when padding.

To speed up the dissolving rate, I use a small dedicated coffee grinder to reduce the flakes to a powder. I then add this to denatured alcohol. To further speed up the process, I set the container of solution in a warm spot or in a warm-water bath, being careful to avoid getting water in the shellac. Stir or agitate occasionally, and the shellac should be fully dissolved in a few hours.

There will be various amounts of residue, depending on the grade of shellac. Filter

the solution through a paint strainer, and you're ready to go.

### Premixed shellac is convenient

Buying premixed shellac saves you the trouble of dissolving flakes and filtering any residue. Premixed shellacs commonly available at the local paint or hardware store are produced by the Zinsser Co. These include 3-lb. cuts of amber and clear shellac, and a 2-lb. cut of super blond under the name SealCoat. However, a wider selection is available under the Liberon brand and at various online outlets (see Sources of Supply on p. 44).

### Waxed shellac gives an aged appearance

Shellac in its natural state contains a small percentage of wax. Grades that always contain wax are seedlac and buttonlac, while garnet and orange shellac are available with or without wax. The dissolved appearance of waxy shellac will be turbid or

somewhat cloudy compared with the dewaxed types. However, waxed versions are indispensable when imitating a mellow or aged appearance. Waxy shellacs may cause adhesion problems if they are used directly underneath another type of finish such as varnish, but layers of waxed and dewaxed shellac can be intermixed without problems.

If desired, you can dewax

All types of shellac start life as a brown, crusty substance, called sticklac, that appears around twigs of some trees in India and Thailand. Sticklac is a secretion made by the lac bug and is used by the bug to wrap its larvae. Sticklac is harvested and processed to form nearly a dozen different grades ranging from light-colored blond shellac to dark garnet shellac.





the shellac by letting it sit for a period of time in a warm or sunny place. After the solid wax particles have settled to the bottom of the container, carefully decant the clear liquid at the top.

### Dewaxed shellac highlights color

Dewaxed shellac enhances the natural color of wood without visually impairing the grain; it is for all intents and purposes transparent. Dewaxed shellac has one drawback. Because most of the natural lubricants or plasticizers have been removed, it is harder to sand. To make sanding easier, you can add a plasticizer called sandarac, available from Kremer Pigments Inc. (see Sources on p. 44). Like shellac, sandarac is alcohol soluble and in solution is a pale, transparent yellow. It can be added in small amounts, say 10% or less by volume, to liquid shellac and can be used with other finishes without adhesion problems.

### Adding color with shellac

One of the benefits of shellac is that you can use it to color wood, and the variations are endless. Applying garnet shellac to a workpiece deepens the color; buttonlac softens and mellows the appearance; orange or ruby shellac makes the piece shimmer with an inner light; seedlac imparts a deep, old brown.

You can use different-color shellacs on the same piece. On the one hand, you may want to give a uniform color to a piece made from boards with contrasting color; on the other hand, you may wish to differentiate parts of the workpiece just as you might use contrasting species of woods such as walnut and cherry.

There are two other benefits to using shellac as a colorant: Because there are no stains or pigments to fade, the color will stay true for a long time. However, if you don't like the color, you can adjust it with another coat of shellac or simply remove it with alcohol.

The color effects you can achieve with shellac vary based on the wood species. The color guide at right gives a few suggestions on what shellac to apply to some popular wood species used in furniture.

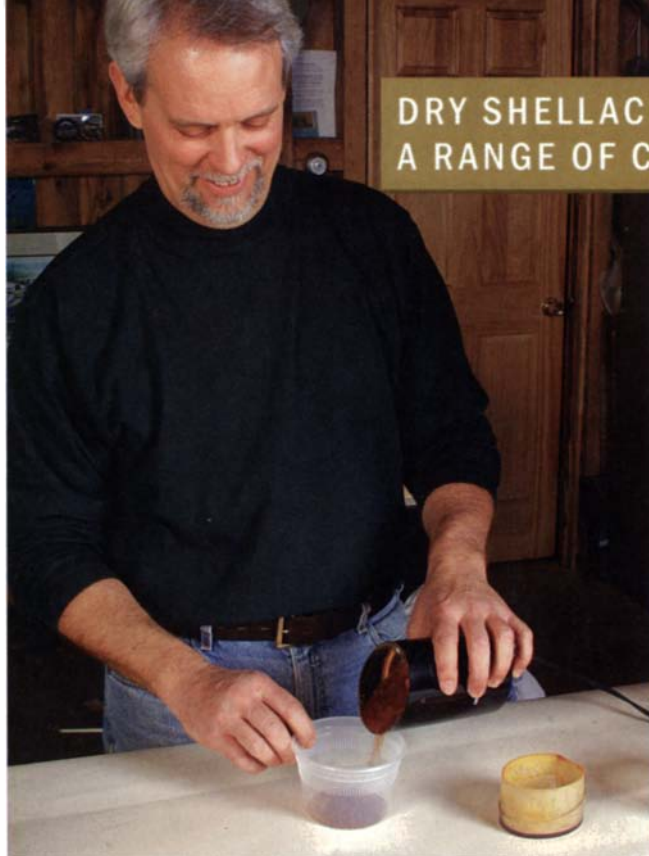
Remember, this is not an exact science, and some experimenting is necessary to please your eye. Just take notes on the proportions; after a while it will become intuitive. Because shellac dries quickly, it is not overly time consuming to get a good

## DRY SHELLAC COMES IN A RANGE OF COLORS

Before dry shellac can be used, it must be dissolved in denatured alcohol.

Gedrys first mixes a 5-lb. cut and dilutes it prior to application (see p. 44).

**1 Freshly ground.** A dedicated coffee grinder reduces the shellac flakes to a coarse powder that will dissolve quickly when mixed with denatured alcohol.



## A color guide to shellac



### MAPLE

Finish maple and other light woods with seedlac to give an old, brown appearance or buttonlac for a softer, warmer brown.



### MAHOGANY

To lighten mahogany, use dewaxed ruby or orange. For an antique appearance, use a coat or two of buttonlac.



### CHERRY

To soften the red of cherry, use the greenish hue of some garnets. Enhance figured cherry with blond or ruby.



### WALNUT

To neutralize the purple, use seedlac or garnet. To liven up a dull brown wood, use a ruby and garnet mix.







**2 Make the cut.** Weigh out 5 oz. of ground shellac flakes.



**3 Dissolve the shellac.** Stir the dry shellac into 8 liquid oz. of alcohol.



**4 Strain the finish.** After the shellac has dissolved, pour the fluid through a paint strainer to remove any impurities.



**BUTTONLAC**



**SEEDLAC**



**RUBY**



**GARNET**





## APPLY SHELLAC WITH EITHER A PAD OR A BRUSH

The viscosity or pound cut of shellac must be adjusted by adding denatured alcohol to match the method of application and the step in the finishing process. When building the finish with a brush, Gedrys uses a 2-lb. or 2½-lb. cut. When brushing or padding on the final coat, he uses a 1-lb. cut.

### CUT THE SHELLAC WITH ALCOHOL



*Gedrys' initial mixture (seen here) is a heavy 5-lb. cut he compares to the viscosity of double cream. This can be reduced with alcohol to the desired cut, depending on what's needed.*



**A pad for rubbing.** The two parts of a pad consist of an outer piece of cotton cloth that surrounds a folded section of cheesecloth.

finish. I could have finished a moderately sized table in the time it took me to write this article.

### Two methods of application

Shellac can be applied to a piece by brushing, padding, or spraying. But for this article I will concentrate on brushing and padding techniques.

### Shellac is easy to apply with a brush—

Because shellac is a thin, flowing finish, you don't need a brush with stiff bristles. White china bristles work well for the initial coat, but I usually reach for a softer, flat wash brush or a mop, both of which can be loaded with shellac to cover a large area before recharging. For the final coat or two, a brush with really fine bristles, such as manmade Taklon, will lay down a thin 1-lb. cut of shellac and leave almost no brush marks. Whatever brush you use, dedicate it to shellac so that there is no need to clean it thoroughly after each use. Let residual shellac harden in the brush, then soak it for a few minutes in alcohol before you use it the next time.

The first two sealer coats are brushed using a 2-lb. to 2½-lb. cut. One rule I follow

on a large surface is to start with pale shellac like blond or lemon. If you begin with dark shellac, there is the distinct possibility that you could wind up with a streaked surface where one brush stroke overlapped another. Remember, you're going to add color as you move along. As always, there is an exception to every rule. When doing a smaller component of a project, such as a leg, you can start with a deeper color.

### SOURCES OF SUPPLY

These companies sell both premixed and dry shellac:

#### HOMESTEAD FINISHING PRODUCTS

216-631-5309;

[www.homesteadfinishing.com](http://www.homesteadfinishing.com)

#### WOODFINISHINGSUPPLIES.COM

866-548-1677;

[www.woodfinishingsupplies.com](http://www.woodfinishingsupplies.com)

#### WOOD FINISH SUPPLY

800-245-5611;

[www.liberonsupply.com](http://www.liberonsupply.com)

Source for sandarac:

#### KREMER PIGMENTS INC.

800-995-5501;

[www.kremerpigments.com](http://www.kremerpigments.com)

If any sanding is required at this point, it should be minimal and done very lightly. Because there is only a thin coating, you want to be sure you don't cut through to the bare wood; be especially careful near the edges. If your initial application is reasonably flawless, you can skip the sanding and start to build the coating.

To build the finish, use an approximately 2-lb. cut. Depending on the wood being used and the desired color, different grades of shellac may be used at this point. When one application is dry to the touch, simply brush on another. If you miss a spot, don't try to brush over it while it is wet because you will pull or burn the surrounding area. To avoid unsightly runs, brush off an edge rather than onto it. Depending on your touch, at least four coats can be applied in fairly rapid succession. Then set aside the piece to cure overnight. If you want to build the coating of shellac further, sand with 320-grit paper before proceeding. Be careful when you add the next layer after sanding because it will want to "grab" the surface very quickly.

### Use a pad to build up layers quickly—

With a pad, or rubber, I can quickly lay thin





**Padding prevents sags and runs.** Gedrys applies shellac with a pad but uses a small brush to get finish into crevices and corners.

coatings that require very little sanding. As with any type of finish, a thin coat dries and cures faster than a thick one. To cut the shellac to thinner viscosity, pour some alcohol into a container and then add the shellac. You easily can judge the thickness this way. Start with shellac that is the consistency of whole milk.

I like using a pad because it offers more control and a better feel for the surface. The one universal rule is to make the pad damp, not wet. The core of the pad can be made out of cheesecloth or cotton wadding and acts as a reservoir for the shellac. I like to make the core in the shape of an ellipse or an egg before wrapping it with a fine-textured cloth. Don't use thick cloth because it will clog quickly. Old bed-sheets that have been washed many times work well.

When you wrap the outer cloth around the core, make sure there are no wrinkles on the face of the pad, as these will streak your work. The mistake I often see novices make when forming a pad the first couple of times is to make it very round and quite hard. To gauge how firm the pad should be, stretch out your hand and push the index finger of your other hand into the mus-



**Brushing it on.** Larger areas are easiest to finish with a brush. The larger capacity of a brush allows you to build up the thickness of a finish more quickly than using a pad.

cle at the base of your thumb: You should feel a slight deflection.

When you begin with a freshly charged pad, use a very light touch. As the pad discharges you can add more pressure. Always maintain contact with the surface of the work, but be sure not to stop the pad in one spot because this will mar the surface.

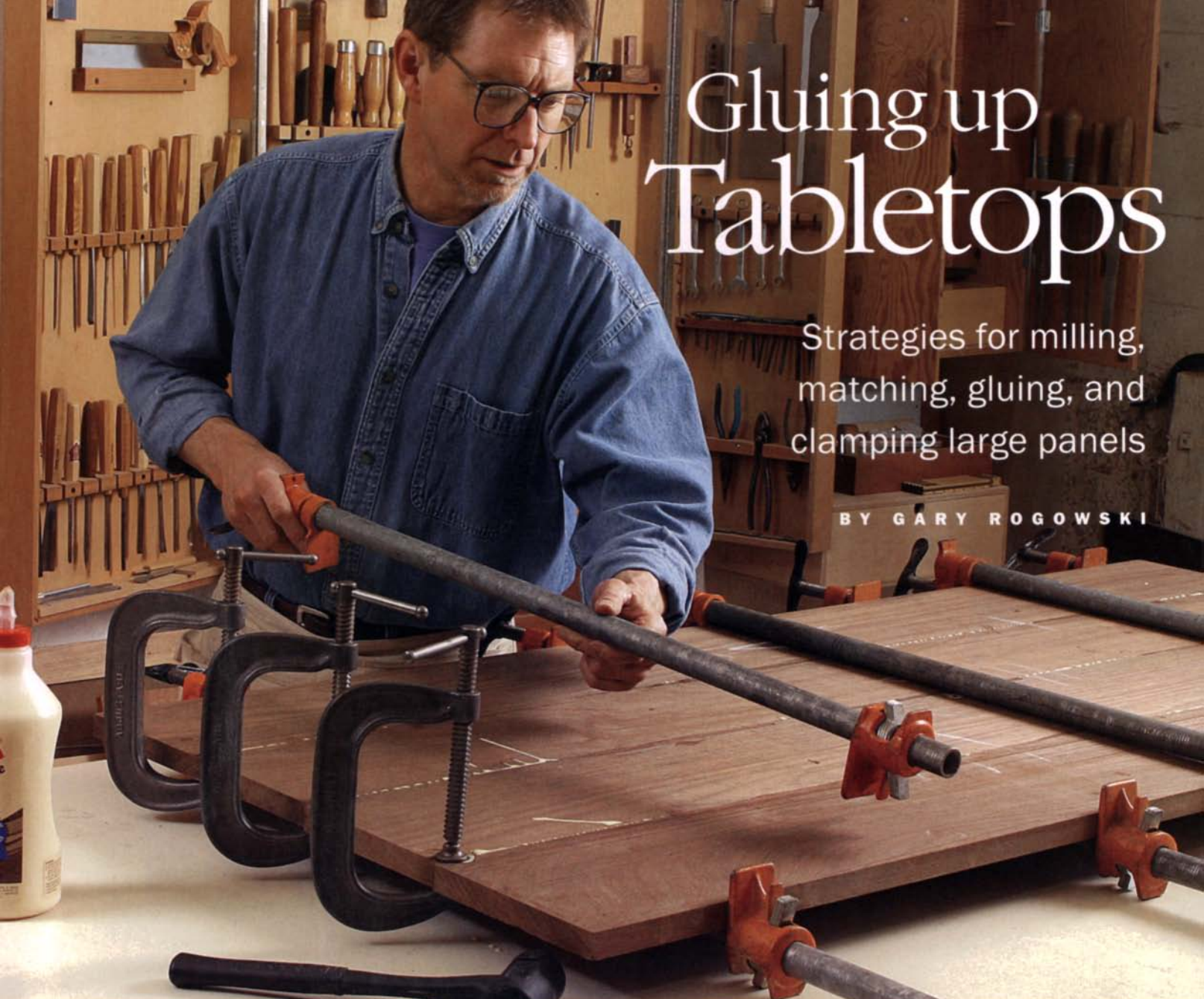
At this point you are tweaking the overall color of the piece as well as adding further body to the surface.

After allowing the finish to cure over-

night, you can buff the surface with steel wool for a softer look. For a high-gloss appearance, rub it out with oil and pumice followed by oil and rottenstone. As with any rubbing operation, be careful and mindful of the heat you are generating as you work. Last, apply some wax and buff it with a clean rag to give the workpiece a wonderful glow. □

*Peter Gedrys is a professional finisher and gilder in East Haddam, Conn.*



A man with glasses and a blue denim shirt is working in a workshop. He is using several large black C-clamps and orange bar clamps to secure a large, flat wooden tabletop. The workshop background is filled with various tools hanging on the wall and shelves. The title 'Gluing up Tabletops' is overlaid in the top right corner in a large, white, serif font.

# Gluing up Tabletops

Strategies for milling, matching, gluing, and clamping large panels

BY GARY ROGOWSKI

**F**or many woodworkers, the thought of making a large tabletop can be intimidating. After all, a tabletop is big and heavy—two good reasons for an elevated fear factor. Plus, it's nearly impossible to find individual boards wide enough to make such a big part. To create a wide surface, several narrow boards must be butted edge to edge and glued together. And that big, heavy surface needs to be flat, straight, smooth, and strong. So it's easy to understand why many shy away from making big tabletops.

But, as I have discovered during my 29 years as a woodworker, the procedure isn't that scary. A well-made top is mostly the result of following tried-and-true steps. These techniques can be used to make any surface, large or small, whether solid-wood desktops, carcase sides and backs, or panels in frame-and-panel construction.

## Mill the lumber, then let it stabilize before glue-up

Before reaching for the glue and clamps, it's worth spending time getting the boards ready. For starters, you want boards that are a

little thicker, wider, and longer than needed. To minimize any tendency toward warping, they should be given time to acclimate to shop temperature and humidity. As soon as the boards are brought inside, they should be stored flat with stickers in between each one so that air can circulate. Letting the boards rest in the shop for a few weeks is ideal, but as little as a day or two can prove helpful.

Once the boards have acclimated to the shop environment, flatten one face of each one on the jointer before using the thickness planer to flatten the opposite faces. Continue planing the boards until they're within  $\frac{1}{32}$  in. to  $\frac{1}{16}$  in. of the final thickness. Later you'll either handplane or sand the faces to final thickness. Then, after jointing one long edge on each board, use the tablesaw to rip the opposite edge parallel to the first.

## Arrange the boards for a pleasing pattern

Once the boards are flat and straight, you're ready to lay them out. Generally, though, to create a tabletop that looks good, you



## ARRANGE THE BOARDS AND JOINT THE EDGES

When arranging boards for glue-up, hitting the trifecta—achieving the best orientation of the heartwood sides of the boards, an ideal grain direction for handplaning, and a beautiful grain pattern—is pretty rare. You may need to make compromises based on how the panel is going to be used.

### 1. ORIENT THE HEARTWOOD

The heartwood side of a board is the one that faces toward the center of the tree. Boards tend to cup away from the heartwood side when they dry. And because a tabletop is made up of several boards, such cupping can affect the flatness of a panel.



#### ALL BOARDS WITH HEARTWOOD-SIDE UP (curves exaggerated)

If all of the boards have been edge-glued with the heartwood side facing in the same direction, the panel typically ends up looking like one big cupped board. For a tabletop that's screwed to heavy, flat cleats, I find it's often a good way to ensure that the top stays flat.



#### ALTERNATING HEARTWOOD SIDES (curves exaggerated)

Sometime it's best to alternate the boards in the panel—heartwood-side down followed by heartwood-side up. That way, the panel stays relatively flat across the entire width. However, it can result in a washboard effect.

### 2. DETERMINE THE GRAIN DIRECTION

To make handplaning easier later, examine each board to determine the general direction of the grain at the face surfaces, then use chalk to mark the direction with an arrow.

### 3. MARK THE MATING EDGE JOINTS

Mark the first edge joint with a single line across the mating boards. Continue by marking the second joint with two lines, the third joint with three lines, and so on.

### 4. MARK THE IN AND OUT FACES

When using a jointer, it helps to alternate the faces that run against the fence (see p. 49). Mark one side of the joint line with an I (for "inside"), and the other side with an O (for "outside").

### 5. JOINT THE EDGES BY HAND OR MACHINE



**No jointer? No problem when you plane in pairs.** The joints can be handplaned with the mating edges of the boards held flush in a vise.



**Jointing the edges.** When using the jointer, pay attention to the face-orientation marks.



## GLUE AND CLAMP THE BOARDS



**A flat worksurface is important.** A twisted worksurface can result in a twisted panel. Before starting the gluing process, check the surface of your worktable with a pair of winding sticks. Slipping a shim under one or more worktable legs generally provides a quick cure for twist.



**Add the glue.** A generous bead of glue is applied to the full length of each mating edge. To help keep your fingers glue-free, use a thin wood stick to spread the glue evenly along the edges of the boards.

**Deadblow hammer encourages flatness.** A deadblow hammer helps any boards that resist lying fully against the pipes.

need to consider a few things before finally deciding on the layout (see the story on p. 47).

### Two ways to edge-joint the boards

Before any of the boards can be glued, both edges need to be planed true and flat, either on the jointer or with a handplane. The jointer usually is the best way to go. But for those of you who don't have a jointer, a handplane gets the job done just as effectively with a little more effort.

**Handplaned edges**—When handplaning long boards, use the longest handplane you can find. I use a No. 7 jointer plane that is 22 in. long.

One key to obtaining a quality handplaned edge joint is to fold the adjacent boards, much like a book gets folded closed. Then mount the boards in a vise with the folded edges flush and ready for planing. When the edges are folded, it is not critical for them to be planed perfectly square to the face surfaces of the boards because both edges get planed at the same angle. So when the boards are unfolded and the edges are again butted together, the two angles supplement each other to create a perfectly flush and flat joint.

When handplaning, you need a sharp blade. Also, as much as possible, plane in the direction of the grain. When you can't avoid





planing against the grain, take extralight cuts to minimize tearout, and angle the plane for more of a shearing cut.

**Jointer-cut edges**—Before using your jointer, give it a quick check to make sure it's cutting properly. Any signs of snipe or taper should prompt an adjustment of the outfeed table. Also, you want sharp jointer blades; dull ones can burnish the wood, preventing glue absorption and compromising the strength of the joint.

Ideally, the fence should be set perfectly square to the outfeed table, but don't worry if it's not. The geometric principle that applies to handplaning also works here, although the technique is different. Once again, you're working with adjacent boards, and to get the geometry to work, simply alternate the faces that meet the jointer fence. Chalk helps keep track of the face directions. First, butt two adjacent boards together. On one side of the joint line, mark the board surface with an I, which means the face of that board must run inside, against the fence. Mark the opposite side of the joint line with an O, meaning it has to face outside, away from the fence.

Once all of the adjacent boards have been marked with Is and Os, it's just a matter of running the boards through the jointer, all the while making sure the correct faces of the boards meet the fence. After jointing, when all of the adjacent boards are butted, the supplementary angle principle ensures that the surfaces are flush and flat. I find this approach more reliable than running a pair of boards folded together through the jointer.

### Clamp the tabletop

With all of the boards flat, straight, marked, and arranged for the best possible appearance, you are ready to start thinking about the gluing process. But a little more prep work remains.

The first step to a flat tabletop is to make sure the clamps have a flat and

true work surface to rest on during glue-up. An uneven or twisted worksurface means that the pipes (or bars) of the clamps won't be in the same plane, and that ultimately can lead to an uneven tabletop.

By placing a straightedge across both the length and width of the worksurface, you quickly can tell if it's flat in both directions. Then use a pair of winding sticks to check the surface for twist. Most benches can be trued simply by adding shims under one or two legs.

Now you can begin laying out the clamps. You can use either pipe or bar clamps, but just be sure they're straight. It's also a good idea to span across all of the clamps with a straightedge. If the straightedge rocks or if a big gap appears between the straightedge and the pipe, replace the offending clamps.

**Do a practice run**—Glue waits for no man. Aliphatic resin (yellow) glue usually sets in about five minutes at 70°, less time if it's warmer. So, before any glue meets wood, it's important to practice the gluing sequence while the glue is still in the bottle.

All of the clamps you are going to need should be at the ready and properly adjusted. To provide adequate pressure along the full length of the joint, each clamp should be spaced no more than about 18 in. apart. Also, have a deadblow hammer nearby, or a block of wood and a hammer. When a board needs some encouragement to sit flat on the pipe, these persuaders prove very handy.

Keep in mind you need to alternate the clamps—one on top of the tabletop followed by one on the bottom—to balance the forces applied by them. At this point, have within reach a thin wood stick to use as a glue spreader. Place the bottom clamps on the worksurface where you want them, then lay out your boards on top. Add the top clamps and tighten them lightly.

Check both sides of the tabletop for gaps in the joints. A gap often shows up as a dark line in a joint. But a dark line isn't necessarily a gap; it also can indicate that the edges of the joint aren't perfectly flush and the misaligned surfaces are producing a thin



**C-clamps keep joints flush.** With the pads of a C-clamp temporarily spanning the joint lines at each end of the boards, the faces of the boards won't slide out of alignment.



**Add the top clamps.** Placing clamps on top helps balance the clamping forces applied by the bottom clamps. If all of the clamps were mounted on only one side, the panel likely would buckle when the clamps were tightened.



## CLEAN UP AND FLATTEN THE PANEL



**Clean up the glue before it dries completely.** Once the squeezed-out glue turns rubbery, usually after about 15 minutes, it's relatively easy to lift off most of it with a putty knife.

**Knock off the high spots.** A straight-edge placed across the panel at several points makes it easy to see high spots. Mark the high ground with chalk, then use a handplane to get everything flat.



shadow. So, if you see a dark line, put your hand in front of it to eliminate any shadow and confusion it can cause.

If you find a gap, don't try to close it up simply by adding more clamp pressure. That puts the entire tabletop under added stress, making it less likely to be flat when the clamps get removed. Instead, remove the board and rejoin the edge.

**Glue the boards**—When you're finally ready to start gluing, shut off the phone, put out the Do Not Disturb sign, and practice a few moments of deep breathing. If it's the end of a long, tiring day, I'd suggest postponing the glue-up until morning when you're fresh.

Generally, I use only glue to hold the boards together. Adding biscuits, dowels, or splines makes the entire procedure longer and fussier. An exception would be a chair seat, where the edge joints are subjected regularly to high stress. Some woodworkers use biscuits to align the faces of the edge-glued boards. Although biscuits consistently produce faces that nearly align, they rarely align as close to perfect as I like. Therefore, I use biscuits only when the tabletop is especially wide, say 48 in. or more, which means I'm faced with putting together a lot of boards in a hurry.

Apply a bead of yellow glue along the entire edge. Then use the stick to spread the glue. Next, put the two glued edges together and slide the boards side to side a little to make sure the glue is fully spread. Keep moving efficiently from one board to the next, making sure with each joint that the boards are going together as planned.

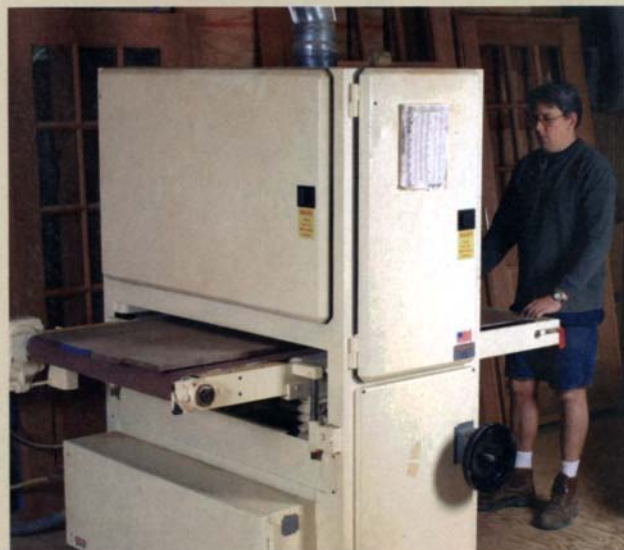
When all of the edges have been as-



**Finish with the scraper.** After planing, Rogowski uses a scraper to remove any areas of tearout and clean up any glue that might remain.

## Machine option

**If you have a drum sander wide enough to accept the tabletop, or if you have a commercial shop in your neighborhood that will sand the top for a fee, it's an option you might want to consider. Overall, it's likely to save you time. Handplanes and scrapers still are needed to flatten one side of the top before the machine can be used effectively.**





sembled, snug up the lower clamps and tighten them only enough to apply light but firm pressure. Check the underside of the tabletop to make sure it's sitting flat on the clamps. If it isn't, a few judicious raps from the deadblow hammer should solve the problem.

Starting at the middle of the tabletop and working toward the ends, begin applying additional pressure to the lower clamps. If the ends of any boards are misaligned, I temporarily mount C-clamps at both ends of the tabletop, with the pads of the clamps spanning each joint. Because the stay is short, the steel pads won't stain the wood. Once all the faces of the boards align, apply additional pressure to the end pipe clamps, then remove the C-clamps.

The top clamps are next. Once all of the top clamps are in position, it's just a matter of snugging them up tight. Check again to make sure the tabletop is flat on the pipes and that all of the clamps are tightened—but don't overtighten.

Invariably, the pressure from the clamps is going to squeeze some glue from the joints. Once that glue hardens, it's a chore to remove. To make life easier, I allow enough time, usually about 15 minutes, for the glue to turn rubbery. Then, using a putty knife, the glue will scrape off with relative ease.

### Let the glue cure before cleanup

To make sure the glue has fully bonded, I generally allow the tabletop to sit overnight before removing the clamps. But there's still work to do even after the clamps are removed.

**Scraping and flattening by hand**—Secure the tabletop to your workbench, then check the tabletop for flatness with a straight-

edge. Mark any high spots with a pencil or chalk. Then use a jack plane to level the high spots. Start by working diagonally across the tabletop from both corners, cutting with the grain to minimize tearout. Once you've removed the marks, check the tabletop again with a straightedge and mark again as needed. Finish by planing in the same direction as the grain. Then use a scraper to remove any tearout or errant spots of glue you may have missed.

### Techniques for trimming large panels

With both faces of the tabletop now flat and true, you can go ahead and joint all four of the edges, starting with one of the long edges. You can true these edges by hand if you prefer, but a long, straight board works nicely as a fence for the router. With a straight bit in the router, clamp the fence to the tabletop, positioning it so that the bit removes only  $\frac{1}{16}$  in. to  $\frac{1}{8}$  in. of the edge. Only one edge of the tabletop needs to be straightened with the router; the other edge is ripped parallel on the tablesaw.

For large tabletops, I use a straightedge along with a jigsaw or circular saw to trim the ends square to the sides. Then I use the router and straightedge to further smooth the surfaces left rough from the saw. But because this is an end-grain cut, it's important to remove no more than about  $\frac{1}{2}$  in. of material and to move the bit quickly to avoid burning. With all four edges now trued, they have to be smoothed. A little work with a scraper or some hand-sanding will take care of that in short order. □

Gary Rogowski lives in Portland, Ore., where he runs *The Northwest Woodworking Studio* ([www.northwestwoodworking.com](http://www.northwestwoodworking.com)).



## TRIM THE ENDS

**Rough-trim the ends of the top.** A jigsaw (shown) or a circular saw, guided by a straightedge, trims the uneven board ends on the tabletop to make them flush.



**Smooth the tabletop ends.** Use the router with a straight bit and an edge guide to further trim and smooth the jigsaw cuts on the ends of the top.



# Stringing and Banding Made Easy

Low-tech tools deliver  
high-style results

BY DAN FAIA

## STRINGING

Thin inlay highlights  
the lines of a piece.

## BANDING

Thicker, multiple-element  
inlay makes a stronger  
visual impact.

## Three ways to make stringing

The most basic method for making stringing is to use a straightedge and a marking knife or veneer saw. A veneer saw works better, as long as the saw is sharpened correctly. To avoid splintering the veneer, make a very light first pass.

But the fastest way to make stringing is to use a pasta machine. One pass through this handy kitchen aid yields a bowlful of ready-to-use stringing. Wet the veneer first with warm water to make it pliable.



MARKING KNIFE



VENEER SAW



## STRINGING SIZE THE SCRATCH CUTTER TO THE STRINGING

Use tin snips or a bench grinder to chop off pieces from an old bandsaw blade. These cutters are fragile, so tape them in a stack to make multiple identical cutters to serve as backups.



**Shape the tiny tip on the bench grinder.** Tape together a stack of cutters to ensure that each is identical.



**Finish the job with a file.** Compare the cutter against the thickness of the veneer (note that the veneer pieces go sideways into the groove in the workpiece). Use a dial caliper to check that every cutter in the stack is accurate.



As woodworkers, we often look for ways to embellish. An easy way to accomplish this is the use of stringing and banding. Stringing can accent a tapered leg or highlight a tabletop. Banding can add colors and patterns for a rich look. These decorative details add an extra touch that makes a simple piece a striking one. In fact, they are most of what separates Federal furniture from Shaker-style pieces.

The table featured here (built by John Louchheim) has stringing and banding on the legs and aprons. As is the custom with Federal furniture, the apron banding continues across the legs, and stringing rectangles in the upper legs reflect the lines of both the legs and the aprons. This ornamentation is placed only on the most visible surfaces; for example, the banding at the bottom of each leg does not continue around the back, and the stringing rectangles are placed only on the front faces of the front legs.

The beauty of stringing and banding is that installation is less difficult than it appears. There are some simple tricks for making stringing, assembling the banding (see Master Class on p. 116), and installing both types of inlay, and masking tape is the only clamp you will need.

I inlay the stringing first and then cut cleanly across it to install the banding. At this point the table has only been dry-fitted. To inlay stringing and banding on an assembled table would be difficult.

### Cut the stringing first

Stringing material is cut from a sheet of veneer. The fastest way to handle this job is to use a pasta machine, which will yield enough stringing from one sheet of veneer to last for years. These machines sell for \$30 to \$40 at department stores and



**Set the depth of the cutter.** Place a cutter in the scratch stock, and set its protrusion about  $\frac{1}{16}$  in. less than the width of the stringing. Then make a test cut on a scrap piece.

kitchen specialty stores (or order one from Atlas Manual Pasta Machine—800-232-4070; [www.kitchenetc.com](http://www.kitchenetc.com)) and basically draw a thin sheet of pasta between two rollers, one of which has blades that separate the sheet into strips. Feed wood veneer into the machine, turn the crank, and perfectly sized stringing comes out the other side.

There are a few keys to success. The veneer must be cut to width to fit into the pasta machine. The veneer also has to be moist, so dampen both sides with warm water using a damp rag or a mist bottle. Also, the veneer should be inserted so that it will be cut with the grain to avoid splinter-





## STRINGING INSTALL THE STRINGING

Stringing on the front faces of the legs, running between the apron and cuff bandings, highlights the long leg taper.



**Work slowly down to finished depth.** Start at the cuff location and move the scratch stock up the leg to the apron-banding location. Rotate the tool downward with each successive pass to increase the depth of cut.

ing. As the stringing exits the machine, guide the pieces to prevent any hang-ups. More than likely there will be a few casualties, but the stringing will be plentiful.

### Make a scratch stock to cut grooves

Every woodworker owns a bandsaw, and most hold onto old blades. These can be chopped up with tin snips or separated into pieces with a bench grinder to make scratch stocks to cut grooves for the stringing and banding. A small router or laminate trimmer can cut thin grooves for stringing, but these also can trash a piece instantly if the edge guide wanders from the workpiece and the bit goes off track. A scratch stock makes a more gradual and easily controlled cut.

Grind and file a stack of bandsaw blanks to the exact thickness of your stringing. I cut stringing from veneer, so that determines the thickness. This dimension is critical, which is why it is good to work on a stack at one time: If one cutter breaks during the project, an identical one is ready to

go. Create a simple scratch stock like the one pictured on p. 53 (covered more thoroughly in *FWW* #163, p. 63). Set the cutter in the scratch stock to the appropriate depth of cut and distance from its fence. I usually cut stringing about  $\frac{1}{8}$  in. wide, which fits into a heavy  $\frac{1}{16}$ -in.-deep groove, leaving a light  $\frac{1}{16}$  in. to be trimmed.

First, pencil in the locations of the apron and cuff bandings. Then scratch the grooves in the legs from the cuff locations to just past the apron edge. Start with light cuts, then rotate the scratch stock a little bit for each successive cut until full depth is reached. Check the depth with a piece of stringing. Make sure the grooves are clean and the depth is consistent. Spread glue in the grooves, just a bit at a time, and carefully press the stringing into place. No clamps are needed. Once the glue has dried, the stringing can be chiseled and scraped flush.

**Lay out the stringing rectangles**—The rectangles at the tops of the legs continue



**Glue in the stringing bit by bit.** Spread glue a few inches at a time and press in the stringing. If you spread glue along the entire groove, it will swell and close slightly before you can get stringing into it.



**When the glue is dry, pare away most of the excess.** Pare with the grain direction to avoid splintering the stringing.

the ornamentation on the table base. Lay out these rectangles with a combination square and a pencil. Use the same scratch stock to run the two vertical stringing grooves with the grain but stop short of the horizontal layout lines.

Cut a piece of medium-density fiberboard (MDF) to match the height of the rectangle. Clamp the piece to the leg and scribe the rectangle's top and bottom with a marking knife. To cut the outside edges of these grooves, place a scrap of stringing veneer against the MDF and use it to scribe the rectangle's top and bottom again.





**Last, scrape the surface flush.** Scrape just enough to clean the surface but not enough to cut beneath the shallow stringing.

Lightly chisel out the waste, working from the middle of the groove toward the knife cuts on each side—a technique called ramp-cutting.

Then take the cutter out of the scratch stock and use it to carefully scrape the horizontal stringing grooves to the same depth as the vertical ones. Be sure to work the cutter into all four corners to clean and square them.

Miter one end of a piece of stringing with a chisel, angling this tiny cut by eye. Then hold the stringing against its groove to mark its length. Miter it to finished length with

the chisel, and glue the stringing into place. Repeat the installation around the rectangle.

### Install the banding

Apron bandings usually carry around the legs. When laying out and cutting the rabbets and dados for the bandings, it's easiest to start on the table aprons and then transfer those locations to the legs.

First, set a marking or cutting gauge to the width of the banding pieces and score the aprons to prevent any tearout at the edge of the rabbet. Then cut a shallow rabbet for the banding, leaving the band-

## Stringing a rectangle



**Scribe the rectangle.** After penciling in the layout, use the scratch stock to cut the vertical grooves. Then use a block as shown (left) to scribe one side of the top and bottom grooves. Next, use a piece of the stringing veneer as a guide (right) to scribe the other side of each groove.



**Cut the waste.** Use a chisel to work from the center of the groove toward the scribed edges to remove most of the waste, a technique called ramp-cutting.

ing a bit proud. On a straight apron, this rabbet can be cut in a variety of ways. But because this apron is serpentine, the matter is more complicated. However, either a large scratch stock or a laminate trimmer (see the photo on p. 56) will follow the curve and cut a consistent rabbet.

Dry-assemble the table and use a wide chisel to transfer the banding locations from the aprons to the legs. The leg bandings should overlap the ends of the stringing.

Next, with a sharp knife and a combination square, scribe marks across the legs. You can use a piece of banding as a shim



## BANDING THE APRON BANDING IS CONTINUOUS

The legs are flush with the aprons, so the banding wraps unimpeded around the table. The rabbets for the banding are cut first in the aprons; then dados are cut into the legs.



**Cut the rabbets in the aprons.** First, scribe the bottom edges of the rabbets to prevent router tearout. Then use a small router (above) with a single-bearing edge guide to follow the curve. Make test cuts in scrap to ensure that the banding will end up just proud of the surface.



**Transfer the banding locations from aprons to legs.** Dry-fit the table, then use a wide chisel to carry over the layout marks.

to scribe the other edge of the dado. With a sharp chisel, remove the waste material down to the appropriate depth. To go deeper, scribe the edges again and pare away more of the bottom. Wait to install this continuous banding until the legs and aprons have been glued up.

**Install the cuffs now**—The banding at the bottom of each leg, at the point where the stringing ends, is called a cuff. To simplify handling, the cuff bandings are attached while the legs still are separate. Determine the height of the cuffs off the floor, and then mark them with a knife. Scribe the height around three sides of the front legs and two sides of the back legs.

### Installing the cuff banding

Attach the cuffs while the legs are separate. Measure up from the bottom, then cut the dados the same way you did at the top of the legs.



**Install opposite sides of this banding.** Then trim them flush with the dado to prepare for the last piece.



**Glue in the last piece.** Use masking tape or a small clamp to hold the banding in place. No banding is necessary on the back face.



**Level the cuff banding.** Pare away most of the waste with a chisel, then scrape and sand the surfaces flush.





**Scribe the edges of the dado.** Carry across the upper line from the apron. Then use a piece of banding to locate the lower edge.



**Chisel away the waste.** Start with ramp cuts with a wide chisel (left). Then switch to a narrow chisel to clean the bottom of the dado (right).



To scribe the other edge of these dadoes, lay the banding in place against the combination square—the same technique used before. Again, use a chisel to clean out the waste between the scribe marks.

Glue in the bandings, two opposite sides at a time. This will enable you to fit these two pieces tightly, then trim them flush with the dado for the final piece of banding. Make the corner joints ebony to ebony, which will hide the glueline. When the glue has dried, scrape the cuffs flush.

**Glue up the table and install the apron banding**—Once the glue has set, glue the apron banding in place using masking tape as a clamp. When the glue has dried, scrape the banding close to flush, then sand it flush. Be careful when paring or scraping banding, as it is prone to splintering.

These simple techniques will add the look of high-end craftsmanship to your woodworking projects. Never be afraid to try something new. The result may not be what you expected, but the lessons learned will expand your knowledge and skills. □

*Dan Faia teaches chair making at The Windsor Institute in Hampton, N.H., and furniture making at Boston's North Bennet Street School.*

**Glue up the table and install the apron banding.** Always dry-fit banding first to see where it should end to create a continuous pattern around each corner.







Lacking an outfeed table for my table-saw, I carefully coached my wife where to stand and how to hold the wood being ripped for the large bookcase I was building. The cut was almost completed when my wife brought the two cut sections back together again, trapping the blade. Voice communication was impossible over the screaming blade and earmuffs, and both my hands were full, which ruled out hand signals. Desperate head movements finally got the message across, and the cut was completed without too much damage. I realized, however, that avoiding strain on my marriage as well as on the table-saw depended on finding another method for supporting long boards.

The range of work-support stands is bewildering. Some stands fold away when not in use, height ranges vary, and prices run from under \$30 to nearly \$100. Surfaces that contact the wood include single or multiple rollers, medium or large ball bearings, and pivoting or stable skid tops. I bought a selection of stands, tested each one, and discovered that none are perfect, but all have virtues. If you choose to make your own, John White, *Fine Woodworking's* shop manager, has built a stand that combines the best features of the commercial ones (see p. 61).

### Support for table-saw ripping and crosscutting

It often is impractical to have permanent extension and outfeed tables around a table-saw. But cutting long pieces requires some means of safely supporting the stock. When ripping a long piece, it helps to have

# Support Stands

When working with large or heavy stock, these shop helpers increase safety and accuracy

BY MARK SCHOFIELD



**Moving around.** Ball-bearing supports allow the workpiece to be moved in any direction, as when cutting curves on the bandsaw.



**Rolling crosscut.** Multiroller stands with their wide surfaces offer the best support when crosscutting on the table-saw.



### HTC HRT-18 ROLLER STAND

**Height range** 26 in. to 40 in.

**Rating** Fair

**Price** \$99.99

The HRT-18 is an industrial-strength stand with a 500-lb. capacity that felt solid enough to jump on. The tapered post and angled screw handle made height adjustment a breeze. It's too short for most bandsaws, but otherwise it's a great stand. Too bad the price is so high.



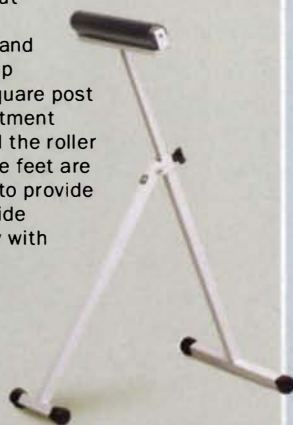
### HTC HPR-18 ROLLER STAND

**Height range** 25¼ in. to 43¾ in.

**Rating** Poor

**Price** \$29.99

The best thing about this lightweight, 150-lb.-capacity stand is the totally nonslip rubber feet. The square post made height adjustment relatively easy, and the roller seemed robust. The feet are too close together to provide adequate side-to-side stability, especially with the stand raised.



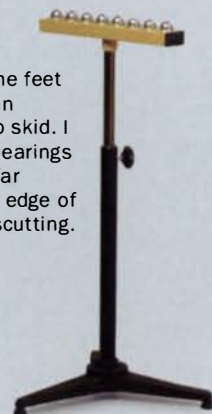
### LEE VALLEY ROLLER-BALL STAND

**Height range** 27 in. to 46 in.

**Rating** Poor

**Price** \$34.95

A sturdy enough stand, but the round post made height adjustment tricky. The feet cannot be adjusted in height and tended to skid. I found that the ball bearings in the head are too far apart to support the edge of a board during crosscutting.



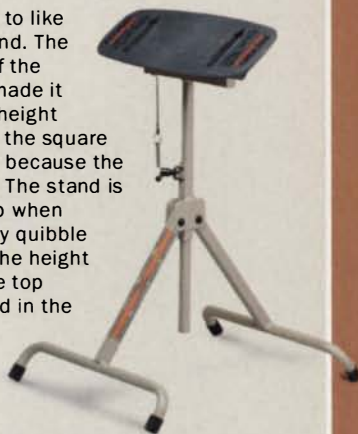
### RIDGID FLIP-TOP STAND

**Height range** 27 in. to 44½ in.

**Rating** Good

**Price** \$30

There is much to like about this stand. The wide stance of the nonskid feet made it secure, while height adjustment of the square post was easy because the top is so light. The stand is only 3 in. deep when folded. My only quibble is that to set the height accurately, the top must be locked in the horizontal position, then unlocked for use.



### WHAT TO LOOK FOR IN A SUPPORT STAND

Before selecting a support stand, decide what machines you will use it with and how great a weight you expect it to bear. If you plan to use it mostly with the bandsaw, make sure the support has enough height and is stable when fully raised.

To test stands for stability, I slid an 8/4 board onto them off a flat surface. Stands that were unable to lift the board ½ in. and instead skidded across the floor or were pushed over got a poor rating.

Success at ½ in. rated fair, and success at 1 in. rated good.

### ROCKLER FLIP-TOP STAND

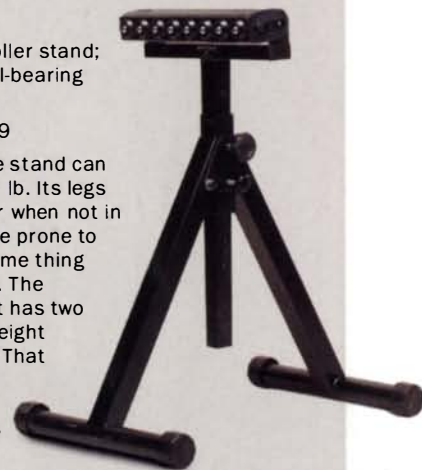
**Height range** 29 in. to 47½ in. as a roller stand; 30 in. to 48½ in. as a ball-bearing stand

**Rating**

Good as a roller stand; Fair as a ball-bearing stand

**Price** \$69.99

This massive stand can support 440 lb. Its legs fold together when not in use, but were prone to doing the same thing when in use. The tapered post has two screws for height adjustment. That seems like overkill, yet adjustments were easy.



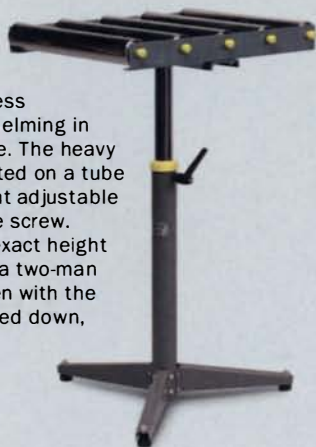
### SHOP FOX 5 ROLLER STAND

**Height range** 27½ in. to 44 in.

**Rating** Fair

**Price** \$59.95

This large stand was less than overwhelming in performance. The heavy top is mounted on a tube that is height adjustable with a single screw. Getting an exact height was almost a two-man job, and even with the screw cranked down, the top still pivoted.



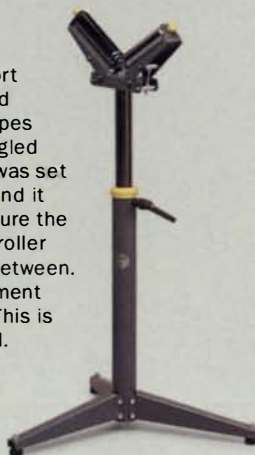
### SHOP FOX TILTING ROLLER STAND

**Height range** 27 in. to 43½ in.

**Rating** Poor

**Price** \$39.95

This stand is designed to support both flat and round objects such as pipes (rollers may be angled upward). When it was set for flat stock, I found it difficult to make sure the workpiece hit the roller and didn't fall in between. The height-adjustment screw felt flimsy. This is one stand to avoid.



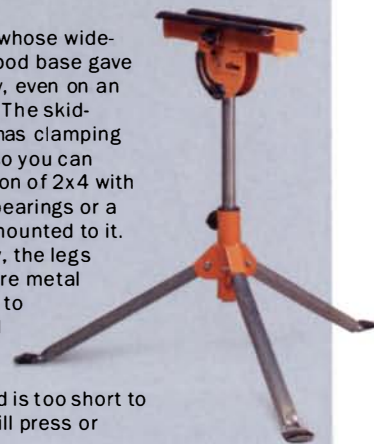
### TRITON MULTISTAND

**Height range** 25½ in. to 37½ in.

**Rating** Poor

**Price** \$59.35

A nice stand whose wide-spreading tripod base gave great stability, even on an uneven floor. The skid-plated head has clamping jaws inside, so you can insert a section of 2x4 with either roller bearings or a roller stand mounted to it. Unfortunately, the legs come with bare metal feet, so I had to wrap antiskid material around them, and the stand is too short to use with a drill press or bandsaw.





support both on the infeed and outfeed sides of the saw. To test height and placement of the two stands, make a dry run. The actual height doesn't have to be smack on. The supports should be placed so that the weight of the board is borne by the tablesaw and a support stand both before and after the cut.

If you use a roller support on the outfeed side when ripping, angle it 2° or 3° toward the fence to help keep the workpiece tight against the fence. Angling the stand has no beneficial effects on board travel when using stands with skid tops or ball bearings.

However, skid- and bearing-style stands are ideal for supporting stock when cross-cutting because the stand may be turned 90° to use the long axis of the top. With

their wide surfaces, multiroller stands work best during crosscutting. Be sure to set the height of a side support even to or slightly lower than the tablesaw to prevent the workpiece from binding on the blade.

### When jointing long lumber, stands provide stability

Long, heavy boards are difficult to pass over a jointer without tipping. Infeed and outfeed supports should be at the same height as the corresponding beds of the jointer. If they are too high or too low, an uneven cut can result. The only exception would be if you are milling a long, thin board prone to sagging. In this case, if the outfeed support is far away, the sagging board may be too low to be picked up by

the roller. Test the height and location with a dry run.

### Support stands help reduce snipe when thickness planing

As benchtop planers come down in price and improve in quality, more woodworkers are planing rough-cut lumber to thickness. One problem is that the planers' small infeed and outfeed tables can't handle very long boards, and the result is snipe at the beginning and end of the board. Setting the supports even with (or  $\frac{1}{16}$  in. above) the planer bed will alleviate this problem.

### Other uses around the workshop

After acquiring one or more support stands, you will wonder how you ever managed without them. For instance, it often is easier to crosscut a board on a miter or chopsaw than on a tablesaw. The key to doing this is to support the board safely on one or both ends. Be sure to have the supports even with the saw table, or you will bind the wood on the blade when making the cut.

Most bandsaws are equipped with tiny tables, so cutting even moderate-size wood requires external support. The challenge is to find a feed support that can match the height of the saw table and remain steady. When resawing a board, it is best not to use a bearing support because the edge of the board could drop down between the bearings. However, if you are working with the flat side of the board down, and the cut involves moving the workpiece a lot, then bearing rollers are the way to go. □

Mark Schofield is an associate editor.

## Features at a glance

**Expose the roller.** The Rockler stand comes with both a ball-bearing surface and a roller. Switching between the two requires readjusting the stand's height.



### Watch it on the Web

For video tips on using support stands, go to [www.finewoodworking.com](http://www.finewoodworking.com).



**Made for uneven floors.** The top of the Triton stand can be moved through 90°. This is useful for those workshops with uneven or sloping floors.



**Height adjustment.** The feet on the Rockler combination stand can be rotated to raise or lower the leg by up to  $\frac{3}{8}$  in. for slightly uneven floors.



**Hit the top and flip it up.** As the board hits the Ridgid flip top, it pushes the top flat, then rides across the surface. A board can ride up at least an inch if the stand is set too high.





## Make your own stand

BY JOHN WHITE

After studying the roller stands tested, Mark Schofield and I agreed that it should be possible to create one that is quick and easy to build, economical, and combines the best features of various commercial stands. My design appears unorthodox; however, it is stable, fine-tuning the height is a breeze, and I can use a variety of support surfaces.

You will need 12 ft. of 2x6 Douglas fir. After the boards have been flattened and squared, the final working dimensions will be around 1 $\frac{3}{4}$  in. thick and 5 in. wide.

The stand is assembled with simple butt joints held by drywall screws. For added strength, the front leg is set into a  $\frac{3}{8}$ -in.-deep mortise in the crosspiece.

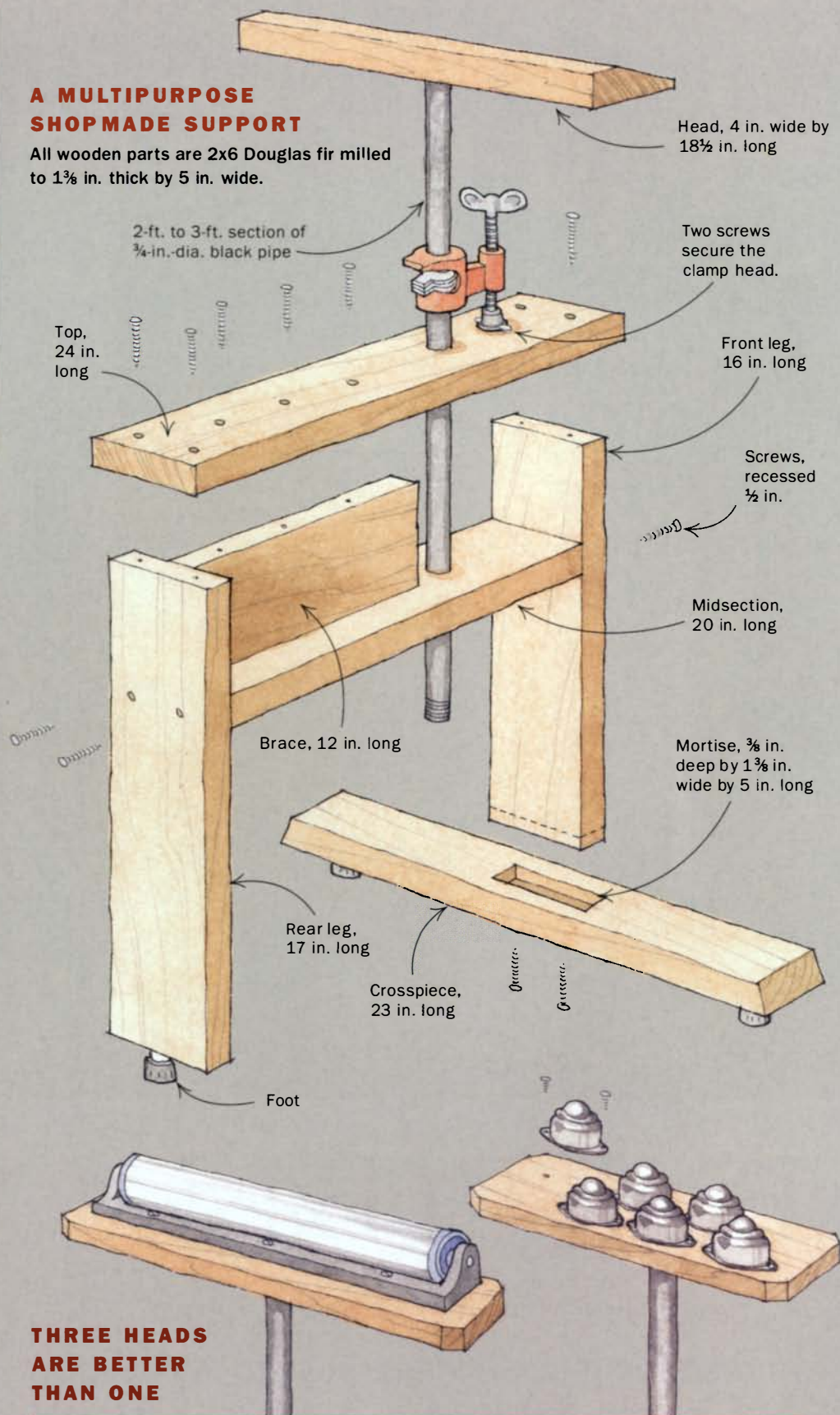
The stand uses a #56 Pony brand pipe clamp sold in hardware stores. A 2-ft. length of  $\frac{3}{4}$ -in.-dia. black pipe may be sufficient, but for tools with higher tables, such as bandsaws and drill presses, you may need a 3-ft. length of pipe. If the bed height of your tools ranges from 33 in. to 45 in., a single 30-in. section of pipe will cover all of your needs.

The base sits on three rubber crutch tips to prevent it from sliding. The tips are slipped over 1 $\frac{1}{4}$ -in. O.D. plastic plumbing pipe caps, which are screwed to the bottom of the stand.

*John White is Fine Woodworking's shop manager.*

## A MULTIPURPOSE SHOPMADE SUPPORT

All wooden parts are 2x6 Douglas fir milled to 1 $\frac{3}{4}$  in. thick by 5 in. wide.



## THREE HEADS ARE BETTER THAN ONE

The beauty of this shopmade stand is its interchangeable head design. All three heads illustrated here mount to the threaded pipe via pipe flanges screwed to the bottom of each head. Use your own head to determine which one is best for the task at hand.





# Built-In Basics

Level bases, modular construction,  
and scribing to walls are keys to success

BY TONY O'MALLEY

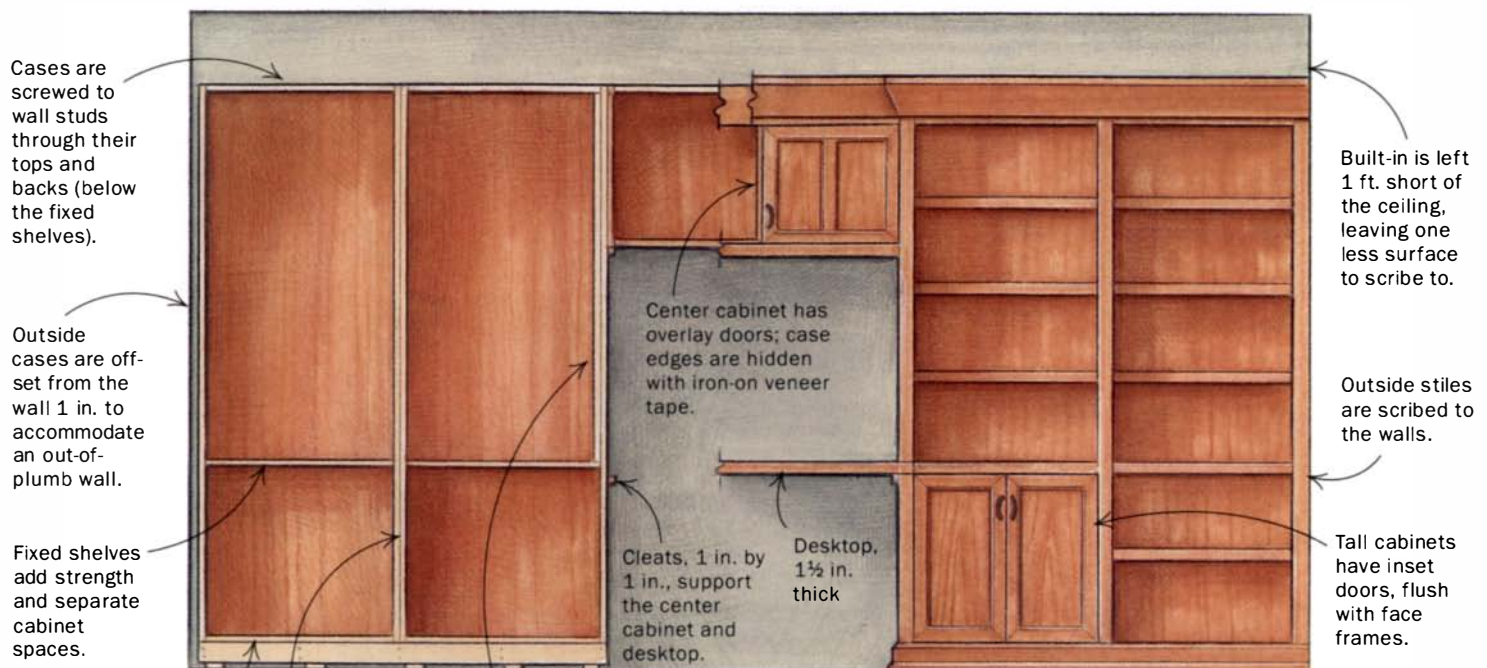
When designing and building the more utilitarian pieces for your home—entertainment centers, bookcases, corner hutches—you'll inevitably consider the question: Should I make it freestanding or built-in? The answer involves both aesthetics (which will look better?) and economics (do you want to spend all of that time and effort on a project you'll have to leave behind if you move?). Sooner or later, you're likely to tackle a built-in.

Over the last few years I've earned an increasing portion of my income from wood-



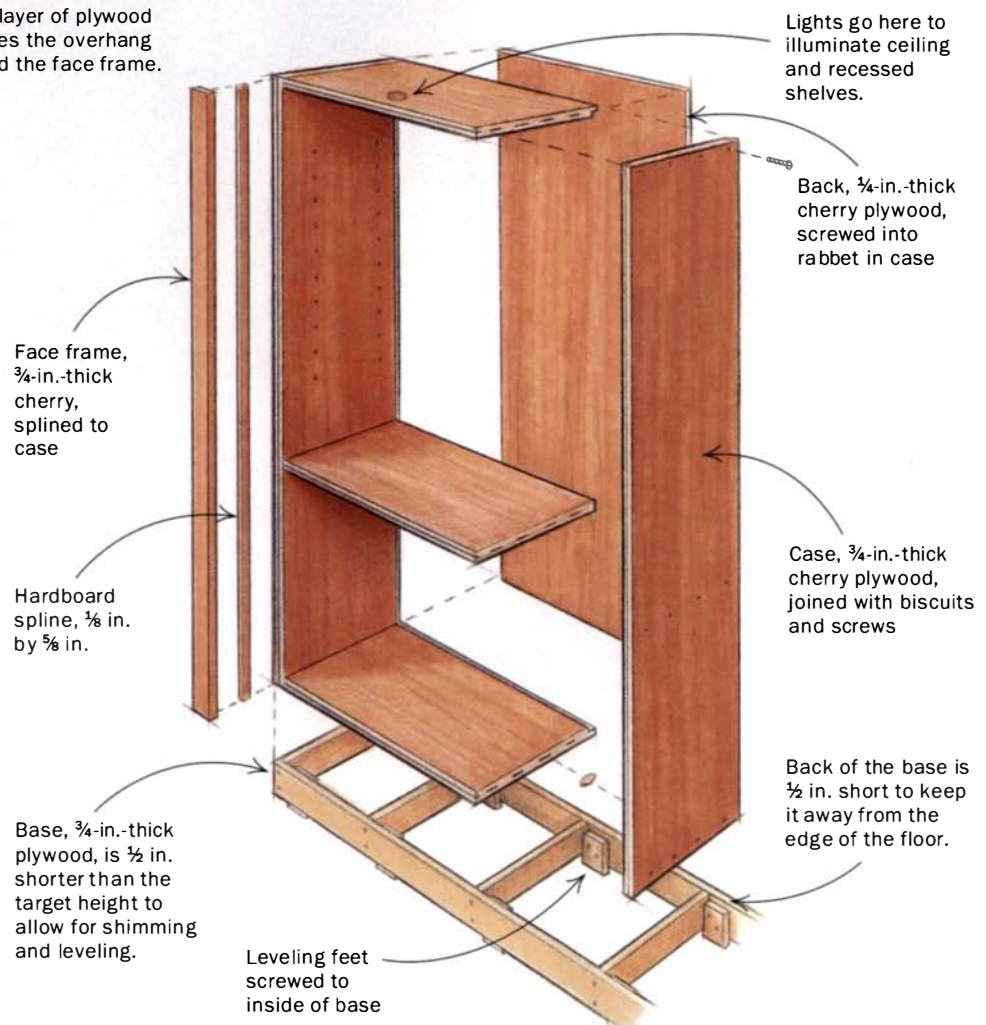
## ANATOMY OF A TYPICAL BUILT-IN

For this home office, separate cabinets, made of hardwood plywood, were screwed together on a level base. Then solid face-frame pieces were nailed to the cases with the two outside stiles scribed to fit the walls. Crest and base moldings went on next. Shelves (on adjustable pins) and doors (on cup hinges) were installed, and last, the thick desktop slab was slid into place.



working, and the majority of it has been from built-in projects. Built-ins are popular with homeowners for two important reasons: First, they add value, becoming a permanent, hand-crafted part of a home. Second, you can buy a piece of furniture at a store, but you can't buy a built-in.

Built-ins are a unique form of woodworking, sharing elements of furniture, cabinetry, and finish carpentry. Because the built-in is permanently attached to one or more of the walls, the floor, or the ceiling of a room, the design goal must be to make the built-in appear as an integral part of the room. That means matching and integrating the room's features, especially moldings, into the design. But a built-in also can stand out as a bold counterpoint to the design features of a room. Either way, a successful built-in requires careful planning for its installation. Ideally, all of the finishing is done prior to installation. That, in turn, leads to a number of construction techniques specific to built-ins, including modular cases, scribed edges, and reveals or V-grooves to conceal seams and joints where the cases or face frames come together.





## BASES AND CASES

### START WITH LEVEL BASES



**Shim one base level.** Check it along its length and width. While leveling it, raise it to the target base height.



**Use small squares of plywood as leveling feet.** Screw these to the base, which will remain level even when shifted slightly during later stages.



**Raise and level the second base.** Use a level and a tight mason's cord to bring the second base up to the same level as the first one.

This article follows the making of a built-in wall unit for a home office and includes many of the typical challenges that built-ins present, especially those that involve bookcases and cabinets.

### Start with the room

No two rooms are exactly alike, so no two built-ins are alike either. It's rare to find room surfaces that are dead straight, let alone level and plumb. Yet a built-in must stand level and plumb if it's to look right



**Place two cases on each level base.** These cases should be sanded and finished before installation.

and if the doors and drawers on the unit are to work properly.

Every built-in starts with a careful assessment of the room conditions, in addition to the obvious measuring of the space it will be built into. The key to success is to scribe parts accurately where they meet the walls, floor, or ceiling, which requires cutting those parts oversize.

### Then work out the design

Built-ins run the stylistic gamut from traditional to modern. A painted built-in generally is less expensive than a natural or stained-wood version. In my painted built-ins, I use birch plywood for most case construction and solid poplar for the trim.

Painted built-ins are more forgiving because the joints can be caulked and painted over.

The built-in here was planned for in the home's original design and construction. It fills the entire length of a 14-ft. wall but stops a foot short of the 8-ft. ceiling. It also calls for lights on top of the cabinets behind the crown molding and inside the top of each bookcase.

The design is contemporary and straightforward but with some subtle refinements worth mentioning. The wood is cherry, straight-grained in the face and door frames. For contrast, the door panels are plainsawn with custom walnut pulls. The four tall cabinets are in the same plane at 16 in. deep, with the upper shelves set back





**2**  
**Screw the cases together.** Drive the screws just below where an adjustable shelf might go.



**3**  
**Screw the cases to the base.** Make sure the cases are flush with the front and inside edges of the base so that the face frame and base molding go on straight. Note that the base ends up  $\frac{1}{2}$  in. short of the wall, avoiding inconsistencies at the edge of the floor.

a few inches to allow the interior lighting to reach them. The open shelves are deep enough for oversize books and magazines, while the closed cabinets are deep enough for storage. The desktop extends to 25 in., and its flared shoulders lie neatly over the vertical face frame, visually connecting the desktop to the fixed shelves in the bookcases. The center cabinet above the desktop is recessed from the main cabinets, creating a visual counterpoint and making the crown molding more eye-catching.

### Build the cases

The cases were built from  $\frac{3}{4}$ -in.-thick cherry plywood, and the backs from  $\frac{1}{4}$ -in.-thick cherry plywood. Hardwood plywood usu-



**4**  
**Connect the sides.** Set the center cabinet on its cleats to set the distance between the tall cases. Clamp in the desktop slab to plumb the cabinets, and screw through the cabinet backs to attach them to the wall studs. Shim where there are gaps.

ally has an "A" side and a mediocre side, so orient it for best appearance.

I use biscuit joinery for almost all case construction (see my article in *FWW* #165, pp.66-71) because it's versatile, simple, and reliable. On this project, most of the joints could have been screwed together as well because the rows of screws are concealed by moldings, the desktop, or adjacent case sides. Screwing together the cases strengthens the joinery and makes assembly easier because it eliminates clamping.

Before assembling the cases, I ran a  $\frac{1}{8}$ -in.-wide groove in the front edge of all



the case parts. These grooves will receive splines to position the face-frame parts. I also cut rabbets into the case parts for the back panels.

Before installation, I finished all of the parts with Waterlox, which is a tung-oil-based finish that can be wiped, brushed, or sprayed on, and builds like a varnish. I applied three coats, sanding in between with 320-grit paper.

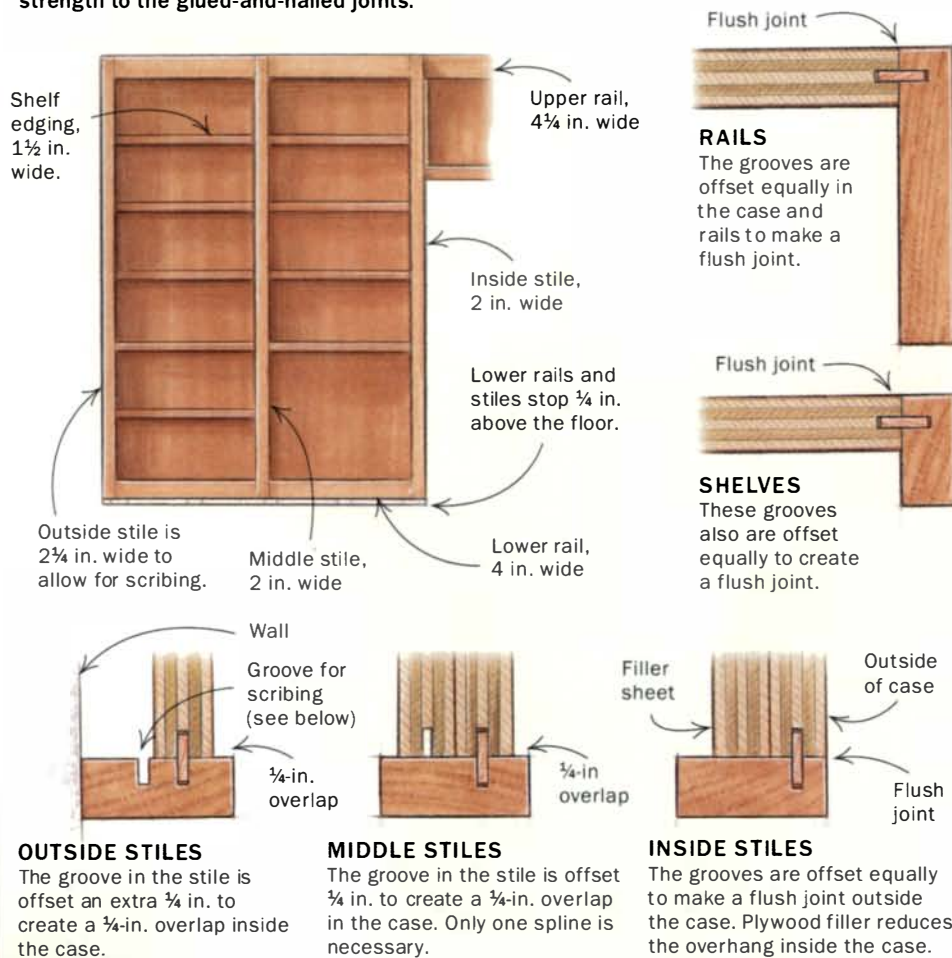
### Install level bases

The bases for built-ins always should be separate from the cases. That way, you can



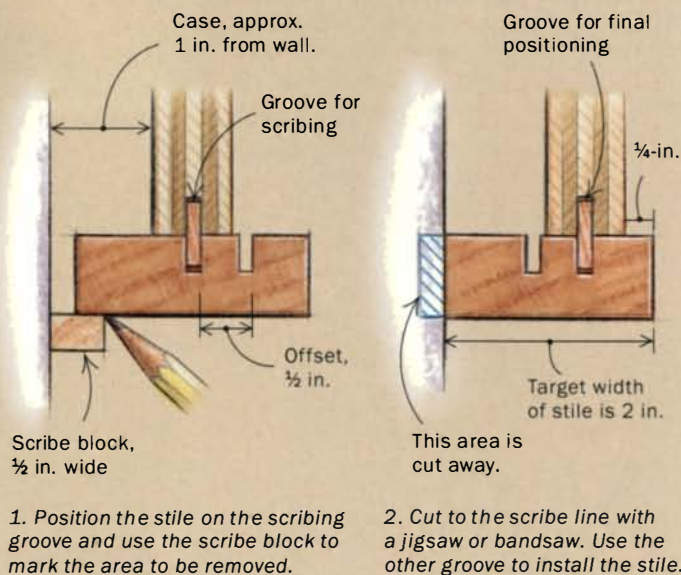
## SPLINES ADD STRENGTH AND EASE ASSEMBLY

All of the frame pieces receive  $\frac{1}{8}$ -in. splines, which serve a number of functions: They locate the pieces precisely on the cases, hold them in place during dry-fitting, and add some strength to the glued-and-nailed joints.



A two-groove sequence makes scribing a cinch. First, make the outside stiles  $\frac{3}{4}$  in. wider to accommodate walls that are slightly bowed. Cut the first groove for final positioning, and cut a second one for scribing.

## Extra groove makes scribing easy



## 1. DRY-FIT THE FACE FRAMES



**After scribing the outside stile to the wall, put the remaining stiles in place. Their long splines should secure them during the dry-fit.**

level the bases independently of the larger, more cumbersome cases. There are lots of simple ways to make structural bases for built-ins. Stud lumber can work in many situations; just mill it straight beforehand. But I generally screw together simple boxes from the scrap  $\frac{3}{4}$ -in.-thick plywood that's left over from the cases.

Start with a target height—in this project it was the floor of the cases—and work from there. Whatever the target height, the rough base should be built  $\frac{1}{2}$  in. shorter to allow for dips in the floor and for shimming up to the target height.

If the base molding is going to touch the floor, it should be milled  $\frac{1}{2}$  in. wider than the finished dimension to scribe it to an uneven floor. In this project, I tacked a small shoe molding onto the base molding, which eliminated having to scribe the base molding to the floor.

For this unit, I started by shimming one of the two bases level (see the photos on p. 64). If possible, determine which side of the room is highest overall, and start on





**Fit the rails.** Starting at the outside cabinets, mark and fit the upper and lower rails and the edging for the fixed shelf. Then move to the inside cabinets.

that side. To level the second base to the first, I stretched a length of mason's cord from the outside corner of the first base to the outside corner of the second (a laser level also will work), then raised the second one up to the stringline. Once leveled, a base can be screwed to the floor or the wall studs. But in this project, because the bases needed to be shifted slightly when the entire row of cabinets was brought together, I let them float. Once the bases are in place, it's a good time to locate and mark the wall studs.

**Install the cases**—Set the cases on their leveled bases, and screw them together. Attach the cleats that will support the center cabinet and the desktop. Position the center cabinet and clamp it to the side cabinets. Screw through the walls of the center cabinet to attach it to the side cabinets. Next, set the main desktop slab on its cleats and snug a clamp across the two cases to true up the entire assembly.

Now the entire unit can be attached to the wall. Because I had access to the top of the cabinets, I drilled through the tops at an angle into the studs. I also screwed through the case backs underneath the fixed shelves.

**Install the lighting next**—Before the face-frame parts, moldings, doors, and desktop are in the way, install any lighting or power strips that you desire.

For the set of cabinets in this project, I used small, surface-mounted halogen lights, which are shaped like hockey pucks and available in home centers. I mounted



**Prepare the face-frame pieces for installation.** Chamfered edges hide inconsistencies at the joints, allowing you to prefinish the parts in the shop and nail them on one at a time.

one underneath the top of each open case, hidden behind the top face-frame rail. These throw some light onto the recessed shelves below. I also mounted one atop each cabinet to throw soft light into the 1-ft. space above the cabinets. The lights are

hidden by the crown molding, as is the four-way outlet that was installed above the cabinets by an electrician.

## Mill and dry-fit the face-frame pieces

With the cabinets installed, I proceeded to dry-fit the face-frame pieces to the cases. Traditional kitchen-cabinet face frames are built as independent frames, held together either with mortise-and-tenon joints or pocket-hole screws, then applied to the cases. With some built-ins, this is a sensible approach. But building large face frames is awkward and unnecessary.

Instead of having flush, glued joints at the intersections of the face-frame panels, I chamfered the edges of all the parts and the ends of the horizontal pieces, leaving a small V-groove wherever parts come together, to hide any minor inconsistencies. As a result, I was able to cut and dry-fit all of the face-frame pieces to the installed cabinets but finish them in the shop on my bench.

With all of the face-frame pieces in place—dry-fitted at this point—you can

## 2. INSTALL THE FACE FRAMES

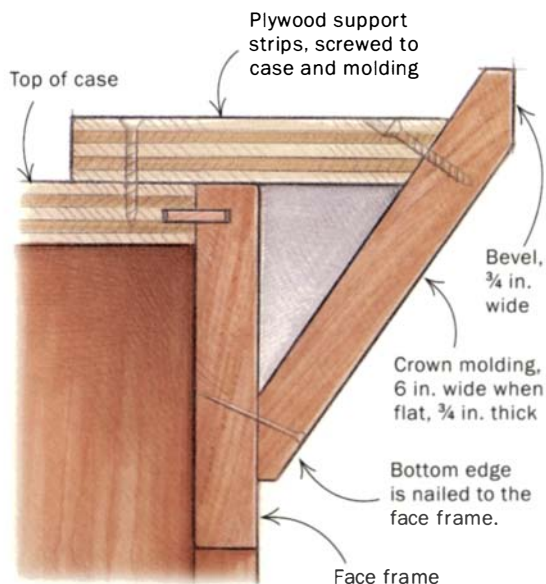


**Start with the innermost stile.** This joint must be flush. Adjust the alignment as you nail on the piece. Shoot through a thin piece of cardboard if your gun has a tendency to dent the surface (inset). Later, fill the nail holes with colored wax.





## CROWN AND BASE MOLDINGS



### CROWN MOLDING

record the exact openings for the mitered frame doors. The idea is to avoid trimming the doors to fit, as mitered doors must be trimmed equally on all four sides to maintain their symmetry. If you make the doors before at least dry-fitting the face frame, you may end up with uneven miters or uneven gaps around the doors.

#### Finish and install the face frame

Sand and finish all of the face-frame stock, along with the base- and crown-molding stock. The face-frame parts on most large built-ins are nailed to the cases because it is difficult to clamp and glue face frames to installed cases. I filled the nail holes with wax colored to match the wood tone. I removed the excess wax by rubbing hard with a clean rag.

Working from the stile nearest the center—with its flush joint—I reinstalled the precut, prefinished face-frame parts using a pneumatic nail gun for speed. If you don't have a nailer, you can predrill and nail on the parts with #6 finish nails. I also ran a quick bead of glue into the spline grooves.

#### Fit and install the moldings

Base molding seems like it should slap on easily and quickly, but that's rarely the case with built-ins. Miter any outside corners first; here I started with the return pieces under the desk. Then cut the end that meets the wall, scribing it to fit if necessary.

Last, cut or scribe the bottom edge of the piece to bring the top edge of the base molding to the target height.

#### Installing crown molding is trickier—

The crown molding is a flat piece of 6-in.-wide stock with chamfers cut at the bottom and top edges (see the drawing above). The chamfer at the bottom determines the angle at which the crown projects from the case; I chose 35°. Pieces of plywood attached to the top of the cases support the upper half of the molding. Basically, I nailed the bottom of the molding in place, then screwed the support pieces to the back of the molding and to the tops of the cases.

I added some glue to the outside miters when everything was ready for final nailing. The squeeze-out cleaned up easily from the finished wood. I nailed the miters together, then went back and added nails along the rest of the molding to secure it to the cases. I finished by screwing on the support blocks behind the top edge.

#### Make and install the doors

The doors on this project are mitered frames around a 1/4-in.-thick plywood panel. The mitered look suits this project's contemporary, angular demeanor, and the walnut splines added after assembly will ensure the joints stay tightly closed.

You can use off-the-shelf plywood for the panel, but the back side of the wood is

### A trick for mitering crown molding



**Use a sample block to break down the angle.** The 6-in.-wide molding won't fit in the miter saw when tilted into its 35° position. But you can fit a smaller version of the molding in the miter saw, tilted against the fence. Set the fence to 45°, and make a cut (left). Then lay the molding flat on the saw (right) to find the proper fence and blade angles for cutting the real thing, which must lie flat.

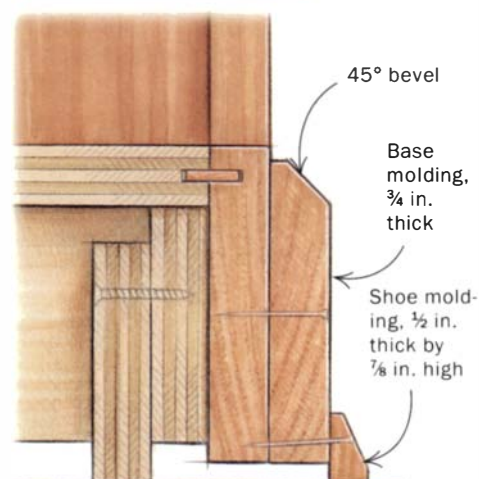
likely to be pretty shabby. To get clean faces in and out, I veneered both sides of a plywood panel, making a nice bookmatch from sequential leaves of veneer.

I used biscuits to align the faces of the miters during assembly. The biscuits add some strength to the joint but would not be sufficient without the splines.

Make a simple jig for the tablesaw (see *FWW* #151, p. 49), and cut slots through the mitered corners. Clamp a tall auxiliary fence to the tablesaw fence to keep the jig from tipping. Then plane stock for the splines.

**Hang the doors—I** chose cup hinges for their versatility and ease of installation,

### BASE MOLDING







**Make test cuts to fine-tune the fit.** You will have to reverse the saw fence to cut the opposite angle.



**Work from the center out.** Clamp blocks to the face frame to ensure an even reveal. On the return pieces, fit the miters first, then dry-fit the pieces and mark their lengths. The front pieces will be trickier. You must nibble away at each end to creep up on a good fit.

though traditional butt hinges would work just as nicely. Cup hinges are classified according to the relationship between the door and the case part they are hung from—inset, full overlay, or half-overlay. The doors on the center cabinet are full overlay, while the bottom doors are inset—with a twist. Because the cabinet side is set back from the edge of the face frame, I had to block out behind the face frames to create a flush surface for an inset hinge.

### Make and fit the desktop

The desktop is a solid slab of 8/4 cherry planed to 1½ in. thick. It rests on cleats screwed to the case sides. I wanted the ex-

tended portion of the desktop to overlap the face frame, angling outward to meet the inside edge of each stile and connecting the desktop visually to the fixed shelf. But cutting clean, precise notches in a single slab would have been impractical.

Instead, I glued up one slab for the entire desktop, then ripped off the front, overlapping section. I crosscut the back section to the same length as the top cabinet and dry-

fitted it on its cleat to mark the location of the front of the cabinets. After ripping the back flush with the front of the cabinets, I glued on the longer front extension piece and did another dry-fit to lay out the angled ends. Last, I slid the desktop into place and screwed through the cleats to attach it. □

*Tony O'Malley makes furniture and built-in cabinetry in Emmaus, Pa.*



**Install the base molding.** Starting with the return piece, shim the molding up to its proper height and mark the miter (above). Cut the return, and mark and cut the front piece, then nail the moldings in place. A small shoe molding will hide the gap below (see the drawing at left).





# Quick and Sturdy



1

**Drawer sides mate with dovetail slots in the drawer front.**



2

**Drawer back sits in dadoes in the sides and is secured with nails.**



3

**Plywood bottom slides in from the back.**



4

**Nail keeps the bottom from moving when the drawer is opened.**

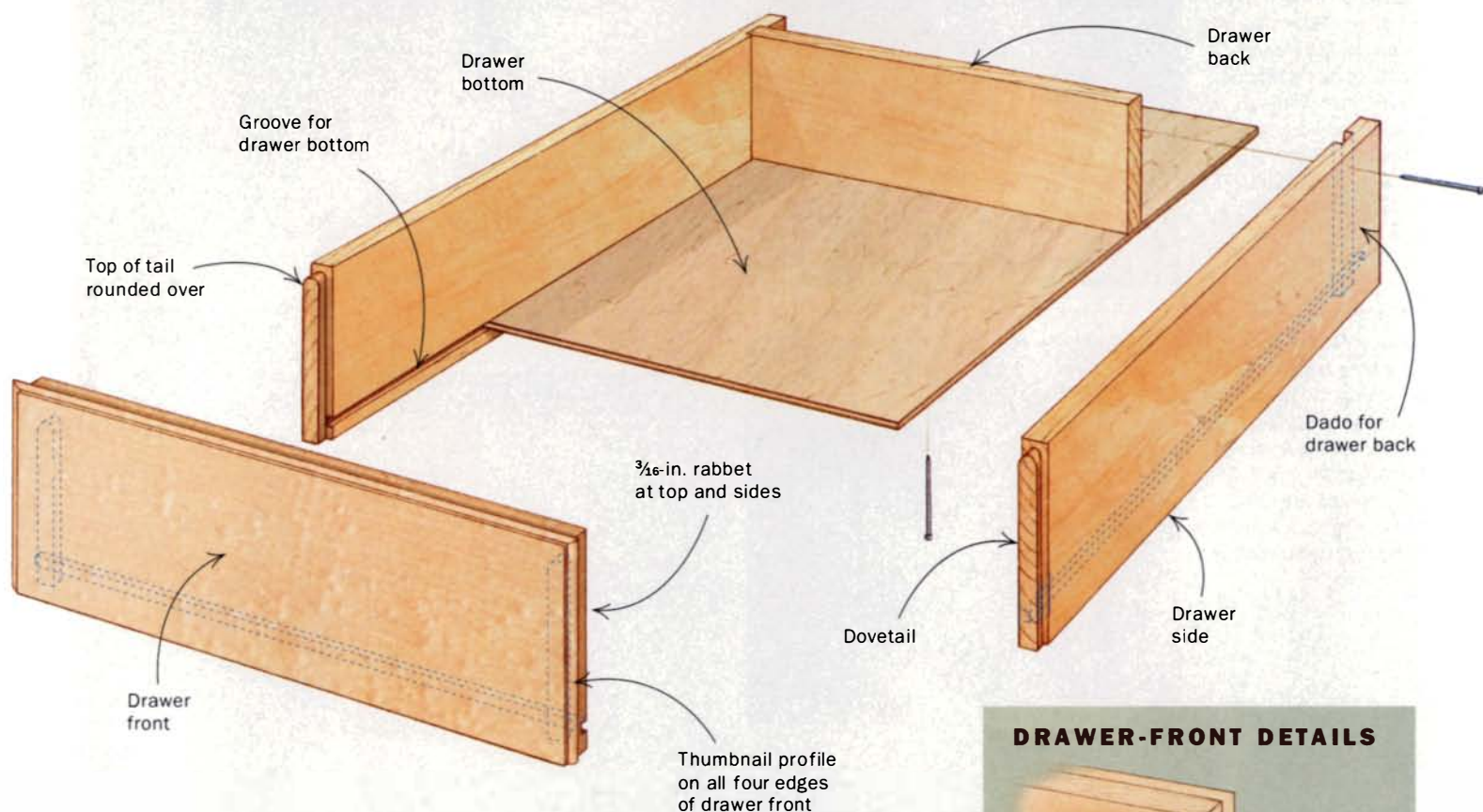




# Drawer Construction

Build elegant drawers in record time

BY LONNIE BIRD



**M**y wife and I recently moved into a new home. You guessed it—it was time to build yet another set of kitchen cabinets. I wanted to build strong, natural-wood drawers with an uncluttered look, and I wanted to do it fast. I knew that traditional hand-cut dovetailed drawers would require too much time and fuss to make. And I'm not a fan of router dovetail jigs; they're time-consuming to set up and produce machined-looking joints that don't quite satisfy me.

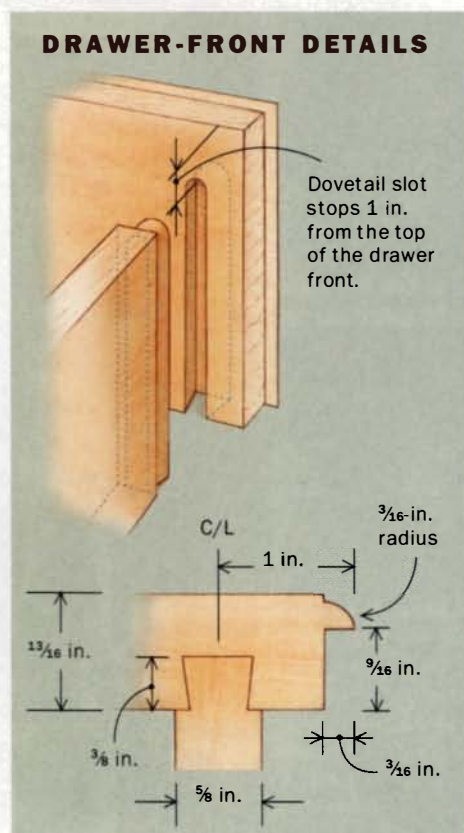
After careful consideration, I came up with a drawer design that was strong and quick to make. I used sliding dovetails to connect the sides to the drawer front. The drawer back sits in dadoses in the sides and is nailed in place. With this simple system I was able to mill the stock, cut the joints,

and assemble and fit 13 drawers in just one day (though I confess it was a long one).

## Start with precise measurements

I measured the height and the width of each opening to determine the size of each drawer front. I wanted lipped drawers, so I added  $\frac{3}{16}$  in. to the measured height and  $\frac{3}{8}$  in. to the measured width. This gave me a  $\frac{3}{16}$ -in. overhang on the top and sides.

I made the sides 1 in. shorter in height than the front to accommodate the side-mount nylon roller runners I chose for this project. To install each drawer in its opening, I would need the extra space that this distance (between the top of each drawer side and the drawer front) affords the rollers, which are proud at the bottom. Each drawer back was sized

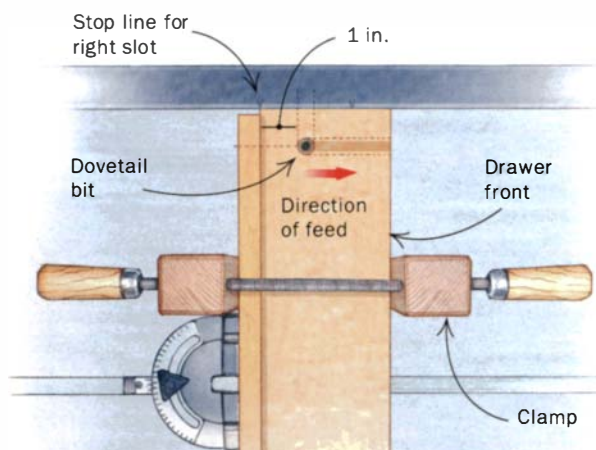




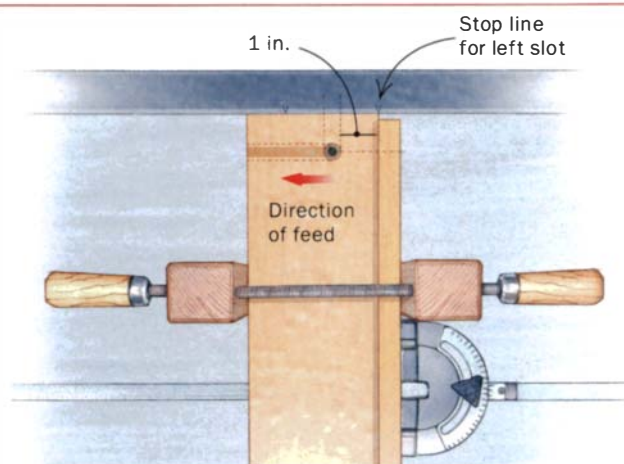
# SLIDING DOVETAILS CREATE STRONG, INVISIBLE JOINTS

## RIGHT AND LEFT DOVETAIL SLOTS ARE CUT IN OPPOSITE DIRECTIONS

**The right slot is routed left to right.** When pushing the workpiece left to right, you are feeding stock in the direction of the bit's rotation (called a climb cut). In this direction, the cutter wants to push the work away from the fence. A clamp and a miter gauge keep the work on track.



**The left slot is cut right to left.** When pushing the workpiece right to left, the bit pulls the work securely against the fence. Still, it's a good idea to clamp the work to the miter gauge to ensure accuracy.



the same as its corresponding sides and was trimmed later. Why I did this will become clearer to you when the groove is cut for the bottom.

### Cut the dovetail slots, and machine the tails

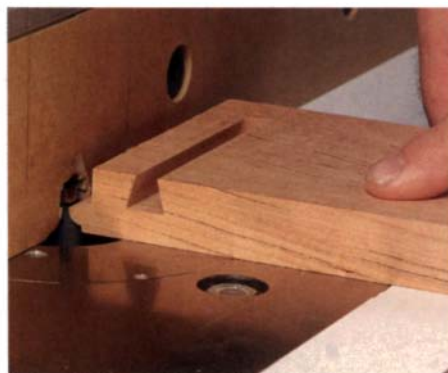
The sliding dovetails are  $\frac{1}{2}$  in. wide and centered on the  $\frac{3}{8}$ -in.-thick poplar sides. The first step is to cut the dovetail slots in the

back of each drawer front. To hide the joint, the slots begin at the bottom edge and stop 1 in. from the top edge. To locate the center of the slot, I added  $\frac{3}{16}$  in. for the lip, plus  $\frac{1}{2}$  in. for the drawer slide, plus  $\frac{3}{16}$  in. (half of the side thickness). This positioned the slot's center 1 in. from the end of the drawer front (see the detail drawing on p. 71).

I cut the slots on the router table using a  $\frac{1}{2}$ -in.-dia.,  $14^\circ$  dovetail bit. I set the fence 1 in.

from the center of the bit and marked a line on the fence to indicate when to stop feeding the workpiece. I didn't attach a stop block to the fence because the drawer fronts are of different widths. Finally, I clamped each workpiece to a miter gauge. The first stopped cut is made left to right, in the direction of the bit rotation (called a climb cut). When climb-cutting, the router wants to push the work away from the fence. The

**Rabbet to create a lip.** Once the dovetail slots and tails have been cut and dry-fitted, use a straight bit to rabbet the top and side edges of the drawer front. This creates a  $\frac{3}{16}$ -in. lip.



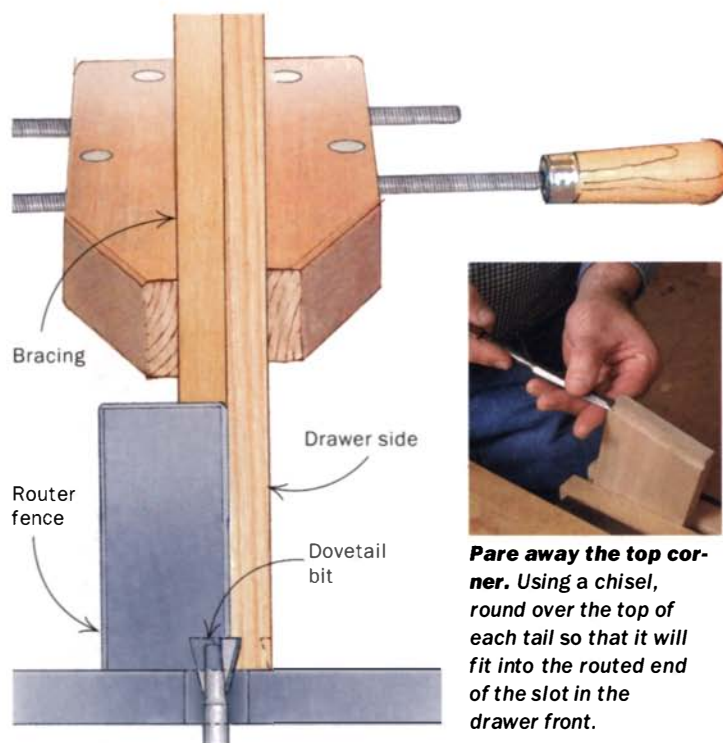
**Route the thumbnail profile on all four sides of the drawer front.** In this operation, the thumbnail bit will attack the grain from four directions. To avoid tearout, proceed slowly but decisively when making your cut.





## SETUP TO CUT PRECISE TAILS

For a strong joint, the tail must be snug in the slot. Too loose, the joint will be weak; too tight, the tail will split the drawer front. With the router fence properly set, clamp the drawer side to another piece of wood for bracing. Slide the bracing along the top of the fence to steady the cut. Each face of the tail is cut in a single pass and produces a precise fit to the drawer-front slots.



**Pare away the top corner.** Using a chisel, round over the top of each tail so that it will fit into the routed end of the slot in the drawer front.

clamp and the miter gauge hold the workpiece tightly against the fence; without them, the cut would be unsafe. To cut the slot on the opposite end, the workpiece is fed right to left, against the bit's rotation.

Then, using the same bit, I prepared to cut the tails. As a matter of habit, I made a couple of test cuts on stock of the same thickness to dial in the depth. It is important to make practice cuts before cutting a whole stack of drawer sides. I buried most of the bit in the fence, stood the practice piece on end, and took a pass at each face. During assembly, the two surfaces slide together. Remember, though, that water-based glue will swell the tail, adding to the difficulty of assembly, so the fit of the tail to the slot is critical. Once I achieved a snug fit, I went ahead and cut the dovetails on all of the drawer sides.

Once the dovetails were made, I changed out my bit and routed the drawer-front rabbets, cutting the top and sides only,  $\frac{1}{4}$  in.

deep and  $\frac{1}{4}$  in. wide. Then, with a thumb-nail bit, I profiled the drawer-front edges.

### Cut the remaining joints

At the tablesaw, I cut dados on the sides to accept the drawer back. Then I ripped  $\frac{1}{4}$ -in.-wide grooves  $\frac{5}{16}$  in. from the bottom of the sides and fronts to accept the drawer bottom. To ensure a perfect fit, I raised the blade after cutting the grooves, then I ripped the drawer back to width. The drawer bottom slides into the grooves and caps the bottom edge of the drawer back.

### Assemble and glue the drawer

I began assembly by lightly coating the dovetails with glue. Then I tapped each tail into its slot with a deadblow mallet. You have to work quickly here; if the joint seizes, you will not be able to assemble the drawer completely.

Once the sides have been installed in the front, I determined the length of the

back. I looked to the drawer front, where the distance is fixed, and measured the distance between the sides. Then I added the depth of the dados on the inner faces of the drawer sides. After laying out these dimensions on the back, I crosscut it to length and nailed it into the dado.

The drawer bottom slides into the drawer box and is secured to the lower edge of the back with a nail. I used  $\frac{1}{4}$ -in.-thick birch plywood for the drawer bottom. Plywood will bear the kind of weight and abuse expected of a heavy-duty drawer, whereas natural wood of the same thickness will mar or split. With the bottoms in place, I attached the metal runners and slipped each drawer into its opening.

With these methods, you'll be able to build strong, durable drawers in record time. □

*Lonnie Bird teaches woodworking near Knoxville, Tenn. You can find information about his classes at [www.lonniebird.com](http://www.lonniebird.com).*



#### FILLET



A band or flat, usually vertical, that's located above or below a molding profile.

#### QUARTER-ROUND



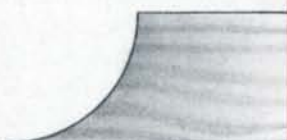
A convex curve that is one quarter of a circle.

#### QUARTER-ROUND WITH FILLET



A convex curve that is one quarter of a circle with a vertical flat.

#### COVE



A concave curve that is one quarter of a circle.

#### COVE WITH FILLETS



A concave curve that's one quarter of a circle with a fillet above and/or below it.

#### TORUS



A convex semicircle also referred to as a half-round.

#### THUMB



A convex curve made up of two connecting curves of different radii.

#### CHAMFER



A bevel cut (usually 45°) made into a right-angled edge.

#### ASTRAGAL



A small torus with a fillet above and/or below it.

#### CYMA REVERSA



An ogee (S-shaped) curve that starts and ends in a vertical plane.

#### CYMA RECTA



An ogee (S-shaped) curve that starts and ends in a horizontal plane.

#### SCOTIA



A concave curve made up of two connecting curves of different radii.

# An Illustrated Guide to Crown Moldings

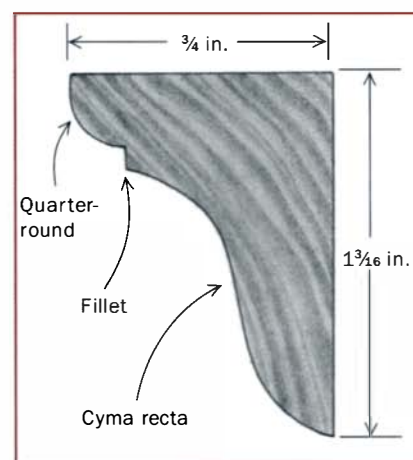
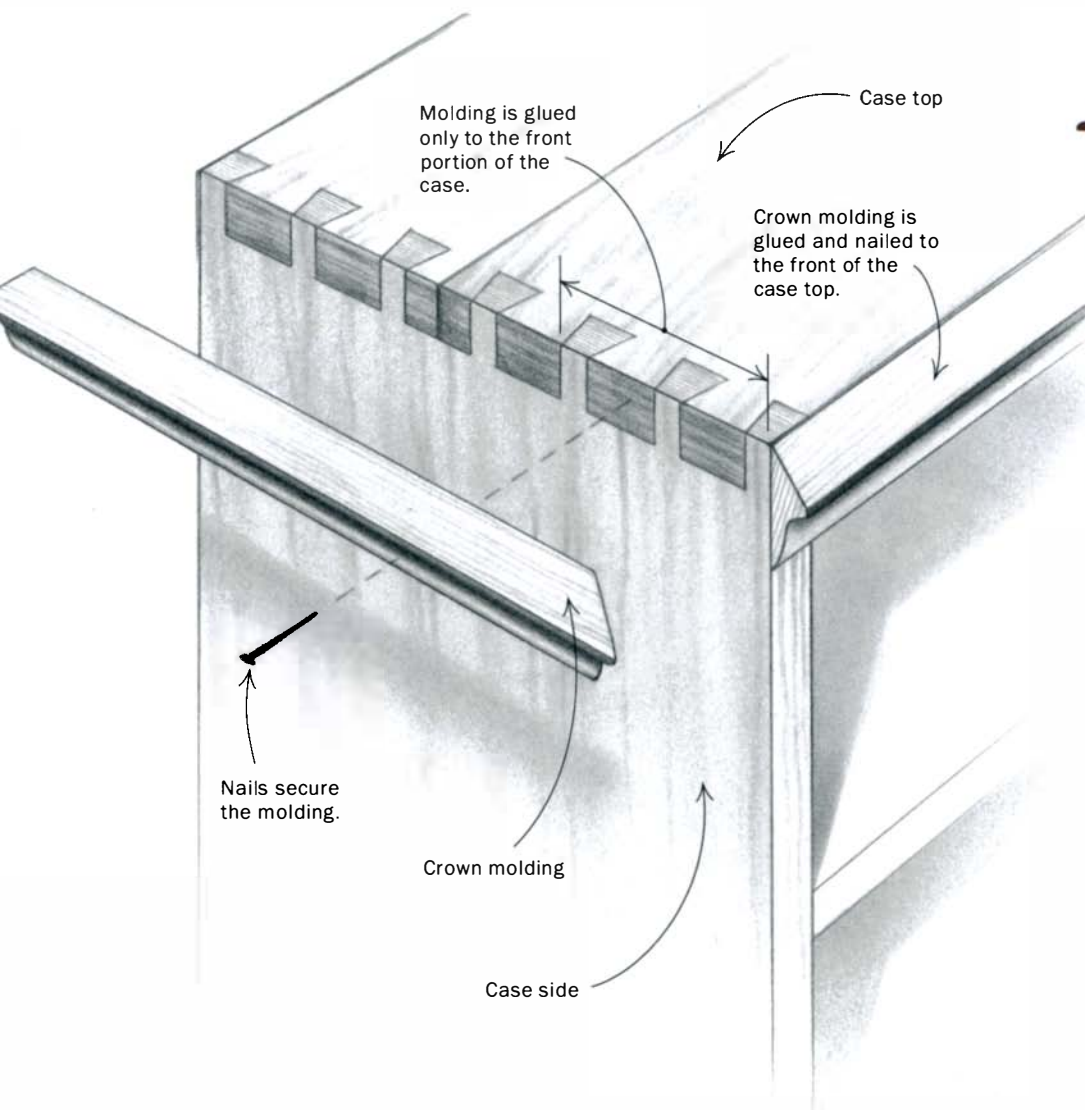
Combine classic profiles  
to match any period or style

BY PHILIP C. LOWE



## WILLIAM AND MARY PERIOD, 1690-1730

The crown moldings from the William and Mary period reflect the simple hand tools available to craftsmen of that era. Examples such as this one found in the Philadelphia area are scarce because not many were made. Although the crown is diminutive when compared with the waist molding, this is a balanced, well-integrated composition that is highly representative of the period.



Throughout the history of cabinetmaking, applied moldings have made substantial contributions to the aesthetic enhancement of case pieces. Combinations of cove, quarter-round, and ogee moldings reflect light and create shadows, adding a lot of visual interest to a piece. The crown, or cornice, also can have a practical function. For instance, I have seen them outfitted with secret drawers.

Without the horizontal finality of a crown molding or the lyrical interest that a broken pediment or a swan-neck pediment provides, the top of a case piece would stand without presence, creating a sense of lightness or weakness. In later periods, builders gave the top of a case piece the visual grounding by creating an assembly of elements known as the entablature, a term that comes from Greek and Roman architecture.

In furniture, the entablature is a composition of individual molding profiles at the top of the piece. The entablature, combined with

a plain cornice or a complex broken pediment above, adds a feeling of weight, giving the eye another place to rest and another point of interest to explore.

### How moldings define the period

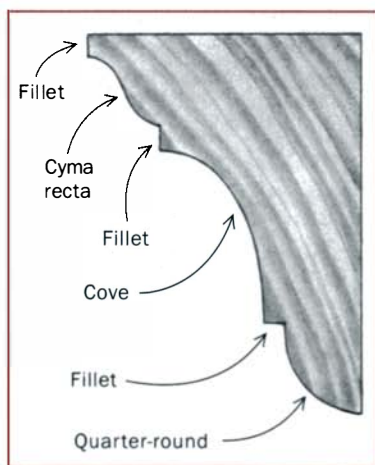
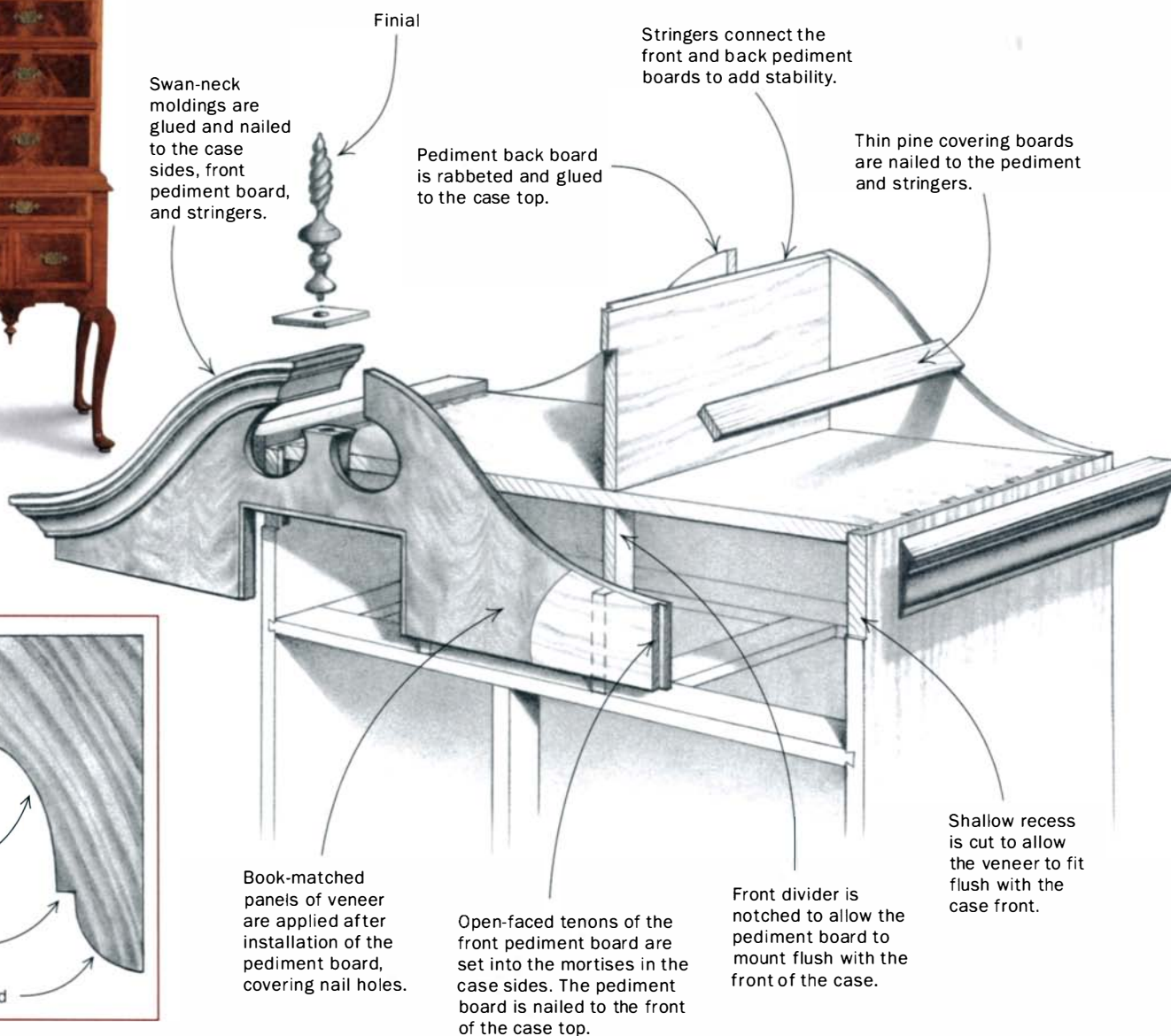
As I gaze at a masterpiece of 18th-century furniture, my appreciation for it is two tiered. Initially, I am struck by an overall presence imparted by the size and proportion of the piece. Even an untrained eye can detect an ill-proportioned piece. When a piece looks right, it feels right, too.

Upon closer examination, my eye travels upward, along the piece's lines and embellishment. I begin with the shape of a cabriole leg or base molding. I move on to the horizontal definition provided by the waist molding; it is a kind of aesthetic breather that prepares the eye for the vertical shift required to make a comfortable transition to the upper case. Finally, my eye is



## QUEEN ANNE PERIOD, 1720-1765

The swan-neck pediment often found on pieces from Boston's north shore is unique to the Colonies and a defining element of the Queen Anne period. This justly famous form became popular in America for its sweeping grace and beauty, which, in turn, give a sense of rhythm to a composition that would otherwise seem a massive or ponderous form.



guided along the converging angled lines or sweeping curves of the pediment.

The first settlers in America brought with them European styles, such as William and Mary, Queen Anne, Chippendale, Hepplewhite, and Sheraton, which deeply influenced the furniture and architecture produced by early American craftsmen. When I look closely at the crown moldings of American furniture, I am compelled to interpret them in my own work. However, to make faithful reproductions, it is necessary first to break down and define the elements that make up these moldings. In this article, I provide examples from the William and Mary, Queen Anne, Chippendale, and Federal periods. This visual glossary of elements and representative pieces will help you develop the vernacular and the

know-how to identify and reproduce accurate crown moldings in your own workshop. Note that the periods and dates are approximations. Also, styles overlap, and elements from more than one era often are present in a single piece of furniture. Each period produced certain styles of crown moldings, with makers within a period devising their own interpretations of the style. So it is impossible to make hard-and-fast definitions.

The following case pieces feature crown moldings that are representative of four distinct periods in different regions, including Philadelphia, Pa., and Boston, Mass., as well as Boston's north shore.

**William and Mary highboy**—The one-piece cornice of this highboy (shown on p. 75) is made up of a reverse thumb molding



## 21st-century method to build a swan-neck molding

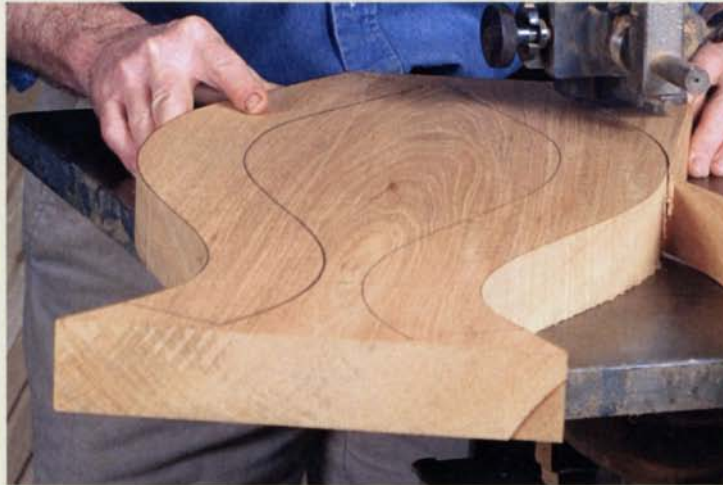
Today's craftsmen can make swan-neck moldings faster by relying on power tools. Some handwork, however, still is required for this challenging task. Begin by making a full-size pattern of the molding (I made mine from  $\frac{3}{8}$ -in.-thick plywood). When making the shapes, match them to available router cutter profiles as best you can.

A molding such as this can be made from a single, solid slab of 8/4 mahogany, dimensioned to 12 in. by 26 in. Both halves can be cut from this piece. When laying out the moldings, be sure that you will be cutting the lower edge of the molding and working your way up on each face of the slab. Working from the top down would require you to position the wood between the fence and the cutter, a dangerous practice that should be avoided.

Cutting out each piece first also is a bad idea because they would rock as the shapes near completion. It is better to cut each face from the solid foundation of the slab. Also, remember to leave an extra 3 in. or so at the lower ends so that they can be mitered later.

### MAKE SMOOTH CURVES

Bandsaw to the two outer curved lines that represent the lower edge of each molding. Then, in this order, shape the molding using a spokeshave, a



**Start with a large 8/4 slab.** Bandsaw the lower edges of both moldings from one slab, which provides a stable platform during routing.

**Rough out the blank on a router table.** A straight bit is used to remove the bulk of the waste in a series of steps.



**Next, cut the cove.** Take multiple passes using a large half-round (core-box) bit.



**Cut the cyma recta.** Start with a  $\frac{1}{4}$ -in.-radius roundover bit. Finish with a  $\frac{3}{4}$ -in. half-round (core-box) bit.

**Use a chisel to carve the top edge.** To avoid tearout, always carve from the the convex, high point of the curve to the low point of the concave area.



rasp and a file (for spots that the spokeshave can't reach), and finally a card scraper. Take the time to finish this face before cutting. If there are bobbles in the molding face, the router bits will copy those bumps along the way.

Next, use a marking gauge to lay out the various elements in the moldings.

### BUILD A BIRD'S-BEAK JIG FOR CURVED ROUTING

To steady the workpiece for routing, I made an auxiliary fence with a bird's beak deep enough to accommodate the arc of the curve. A centerline on the face of the outer edge of the bird's beak is the single line of contact between the molding and fence as the molding is pushed through the cut.

Use a straight bit to rough out the work. These cuts leave a series of steps in the molding. Next, use a  $1\frac{1}{2}$ -in. half-round (core-box) bit to cut the large cove. Then use a  $\frac{1}{4}$ -in.-radius roundover bit to cut the first half of the cyma recta and finish with a  $\frac{3}{4}$ -in. half-round (core-box) bit.

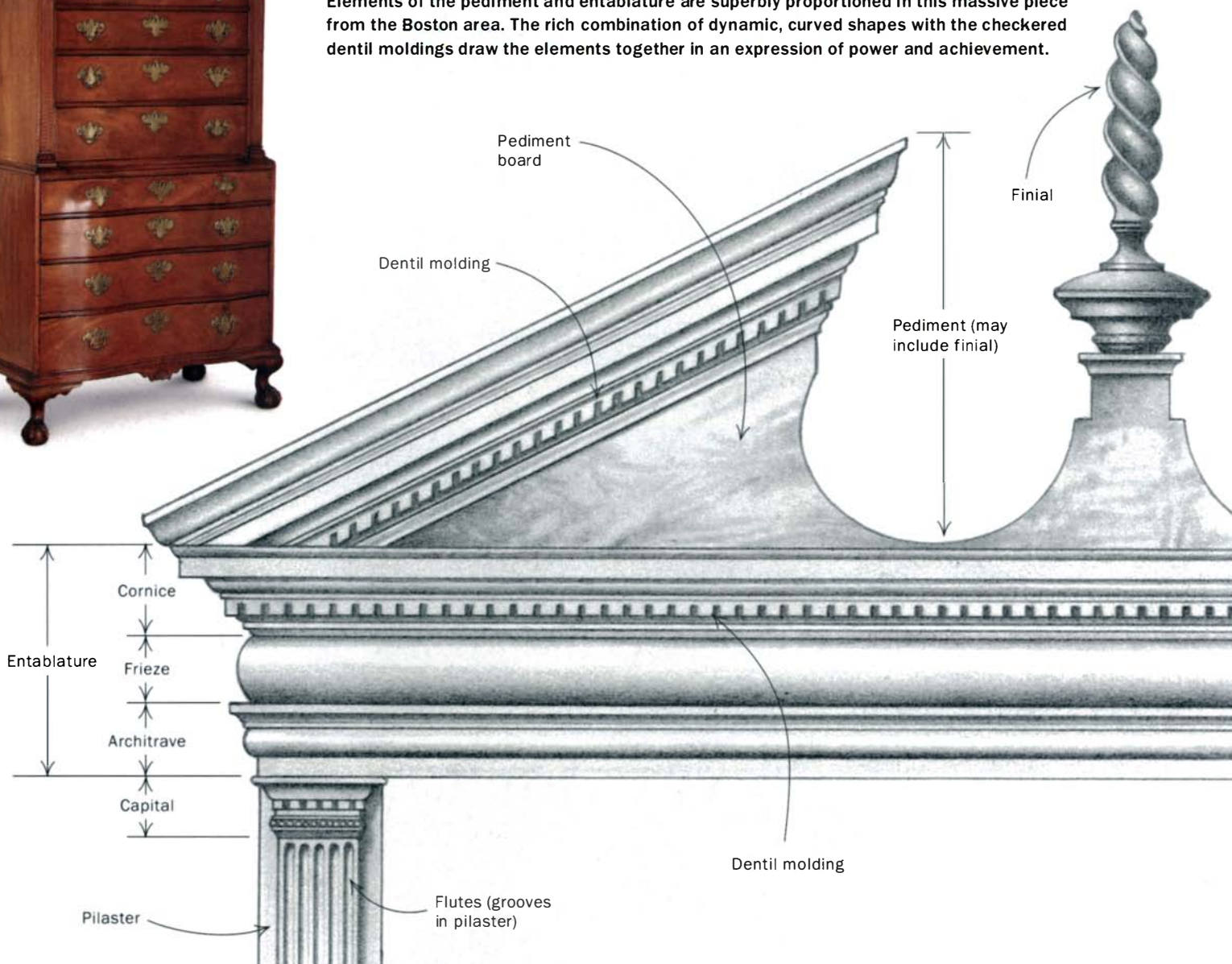
### CARVE THE REST BY HAND

The quarter-round has to be hand-carved because its height is beyond the reach of most router bits. I carved this quarter-round with a 1-in. chisel, finishing with a card scraper.



## CHIPPENDALE PERIOD, 1755-1785

Later examples of the Chippendale style reflect the classical architecture of the time. Elements of the pediment and entablature are superbly proportioned in this massive piece from the Boston area. The rich combination of dynamic, curved shapes with the checked dentil moldings draw the elements together in an expression of power and achievement.



and fillet placed above an ogee, or cyma recta. Although it may appear that these moldings were made with large molding planes, I believe that the cabinetmaker of this period would have used three separate planes. The coffin or smoothing plane would have been used to bevel the board, to create a chamfer, and to round off the tip of the thumb molding and the convex part of the ogee. For the fillets, a rebate would have been the plane of choice, and a hollow would have been used to cut the concave shape in the ogee.

I find this molding particularly striking in spite of its drawbacks. It lacks proportion between the waist and the cornice moldings. The waist is much larger in scale when compared with the cornice. Yet, overall, it has a commanding effect.

**Queen Anne highboy**—The swan-neck pediment is a defining element of the Queen Anne period. It starts with two fillets sand-

wiching a cyma recta (see the drawing on p. 76). These elements are supported by a cove, followed by another fillet. The pediment then is completed with a quarter-round at its base.

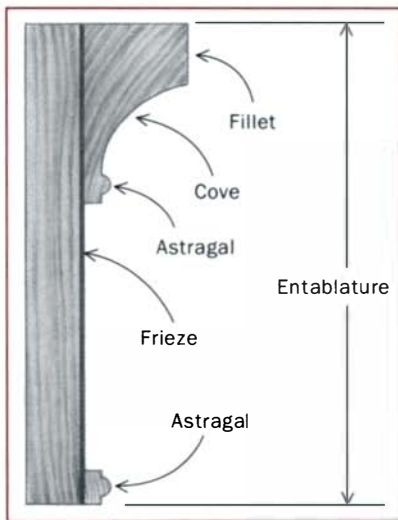
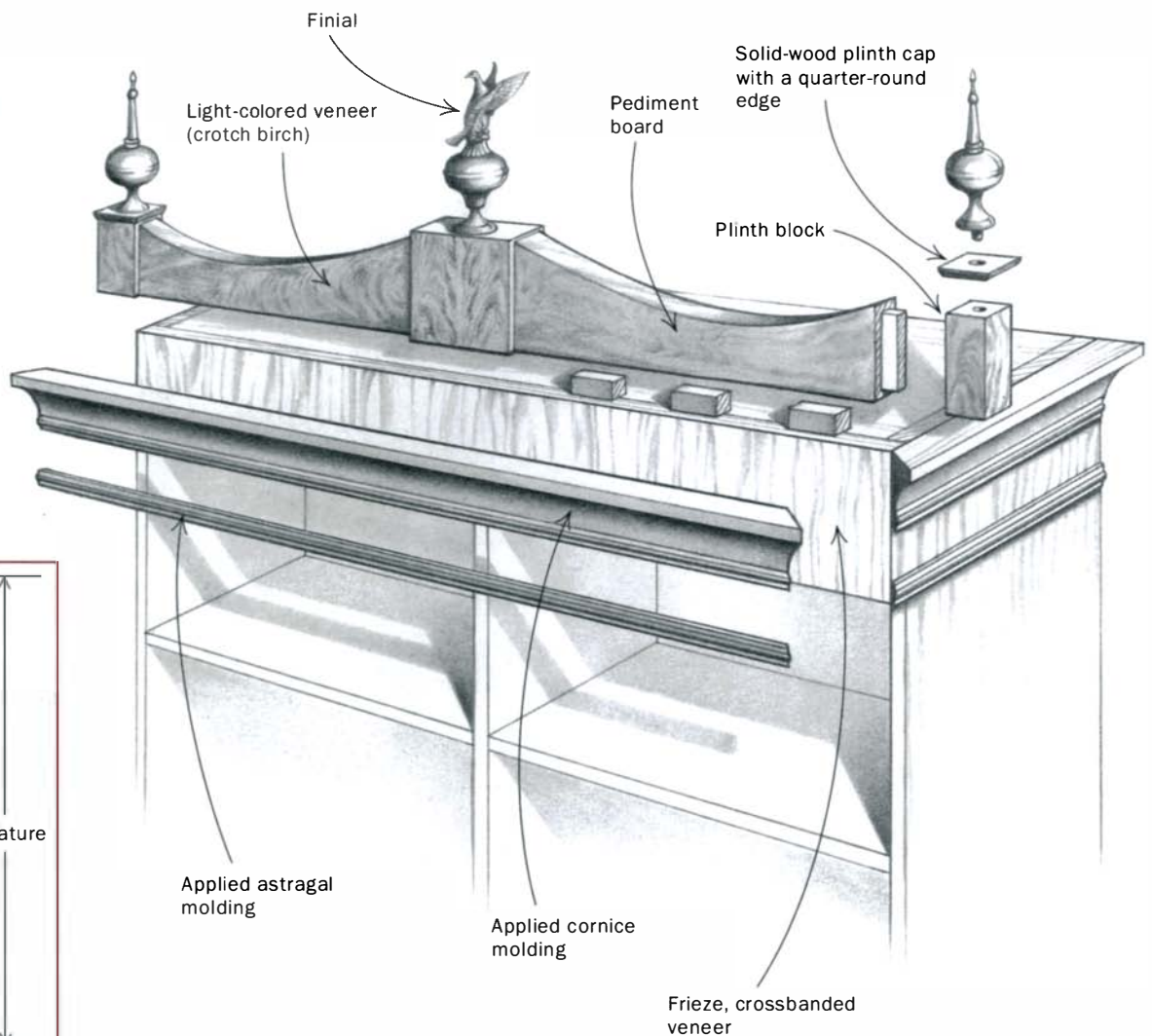
In the mid-1700s, the swan-neck pediment was made up of one piece shaped almost exclusively with carving tools and scrapers. This represents a high level of skill because the craftsman had to saw a graceful S-shape while taking a profile from the side cornice molding and successfully carrying it along this dramatic swan-neck shape.

**Chippendale chest-on-chest**—Chippendale moldings transitioned from the Queen Anne period in a couple of unique ways. In most regions, the use of the swan neck continued into the Chippendale style; however, later examples reflect the classical architecture of the time.



## FEDERAL PERIOD, 1775-1815

Federal casework, often built in Boston and on Boston's north shore, shows a toning down from the elaborately composed cornices of previous periods. Instead, makers of the era relied heavily on the use of highly figured, contrasting veneers, which added great visual interest to their pieces.



The broken pediment illustrated on the facing page is a stunning representation of this evolution. The moldings on the pediment of this chest-on-chest are the same as those in the entablature—but with the addition of a cyma recta on the very top. The cornice sits upon a pulvinated (slightly curved) frieze. The architrave is a stacked series of fillets and cyma reversas. All of this is carried by a classical pilaster (a half column attached to the front of the case), which leads to the base molding and the pedestal that sits inside the waist molding.

**Federal desk with secretary**—The Federal period really can consist of Hepplewhite and Sheraton furniture; both English styles influenced furniture design in the New Republic during this time. Federal casework shows a toning down from the elaborate cornice designs found in earlier periods.

The pediment of the piece shown above is made up of three pedestals and a connecting pediment board. The two end pedestals are capped with a solid-wood plinth cap with quarter-round edges and brass finials. The central pedestal has the same treatment, but perched upon it is the symbol of the Republic—the American Eagle. The use of crotch birch, veneered and inlaid, gives striking contrast. The veneered pediment lightens the overall appearance. The maker of this piece still employed a restrained entablature with the use of the fillet and cove on top of a bead with fillet. The frieze is crossbanded mahogany veneer (veneer applied vertically), and the architrave a mere astragal. This period relied heavily on the use of veneers and the contrasts they provide. □

*Philip C. Lowe runs The Furniture Institute in Beverly, Mass. For more information on classes, go to [www.furnituremakingclasses.com](http://www.furnituremakingclasses.com).*



# Chair Making Simplified

Basic side chair won't compromise comfort, strength, or style

BY GARRETT HACK

Even the most basic chair must support a body comfortably and be strong enough to take lots of rocking and rolling. This likely involves angled joinery; add some grace to the design, and you're probably working with curved parts as well. A lot of woodworkers shy away from making chairs, but there are many good reasons for building them. Design a dining table or a desk, and it seems only fitting to complete the project by building the chairs, too. Dealing with angled joinery and curved parts exposes you to making patterns, full-scale drawings, mock-ups, and thinking in three dimensions. Also, chairs are great for improving hand skills such as fitting joints and smoothing curves.

By design, this chair is not overwhelming in its joinery or curves. Build one or two, and you'll soon be tweaking the design and construction to suit your own tastes and needs.

Rather than steam-bending or laminating parts, I designed all of the curves to be sawn from 8/4 stock. To give the back a dramatic splay toward the top, I used a design trick common to chair makers: rotating the curved rear legs inward by 4°. Also common to many chairs, the seat narrows toward the back to give it a graceful look and tilts slightly backward for comfort.

By carefully working out the curve of the rear legs, the tilt of the seat, and the taper and angle of the front legs, I was able to keep the joinery square in the side view, avoiding compound angles in most cases. This type of chair requires a slip seat, basically an upholstered platform that sits in a rabbet in the seat rails. You can make your own (go to [www.finewoodworking.com](http://www.finewoodworking.com) or see *FWW* #163, pp. 54-58) or just cut out a plywood platform and bring it to an upholsterer.

## Choose chair stock wisely

Strong and beautiful chairs can be made from a variety of woods. Mahogany and walnut have been high-style choices for centuries. Ash, maple, beech, cherry, and oak are equally good in terms of strength, although each has a unique color and



## CUT OUT AND SHAPE THE LEGS



Using the side template, cut all of the legs from one wide 8/4 board to ensure uniform color (left). Lay out the legs for best grain orientation and strength (above).

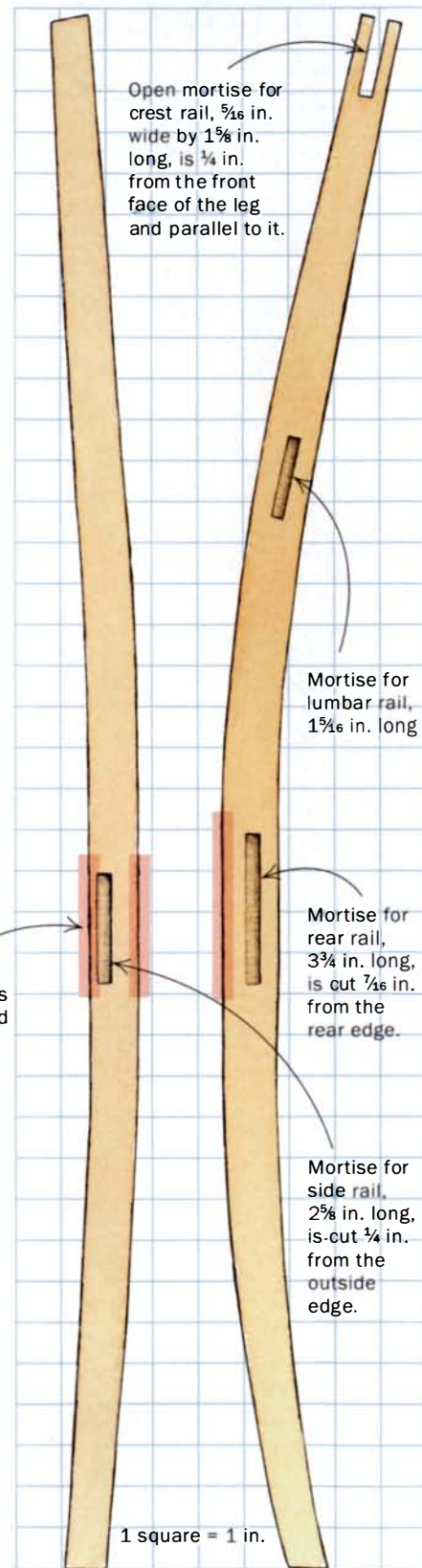
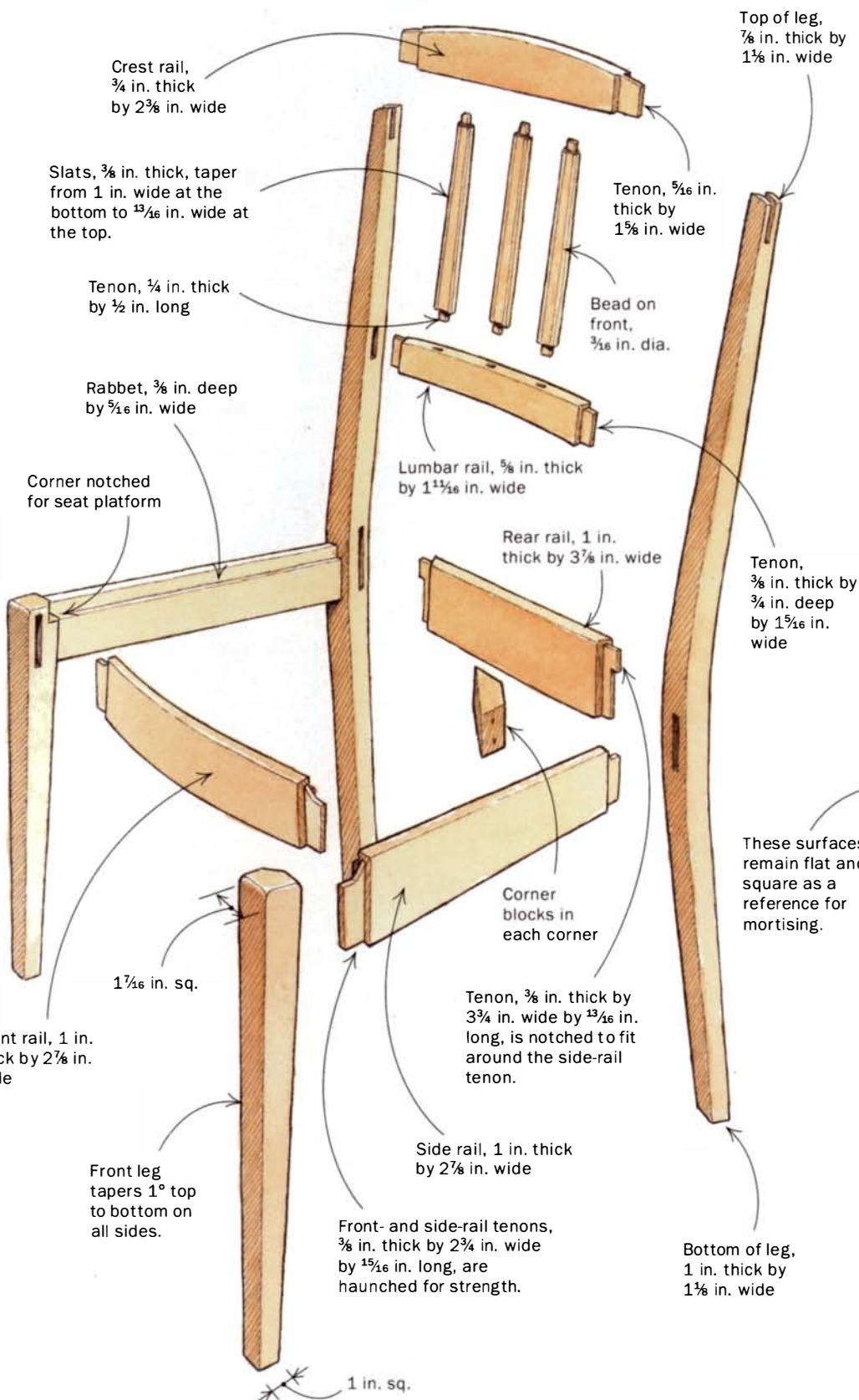


## FULL-SIZE DRAWINGS AND TEMPLATES AID CONSTRUCTION

Building a comfortable, attractive chair is never easy, but these joints have been simplified as much as possible. Most are angled in only one direction. In the front seat rail, the curve is cut after the joinery has been laid out and cut. Make a full-size drawing and templates for each part to keep track of lengths, curves, and joinery. The lengths of the upper rails and slats are determined after the base of the chair has been built and dry-fitted.

### LEFT REAR LEG

$1\frac{7}{16}$  in. thick by  $1\frac{5}{16}$  in. wide at seat rails,  $37\frac{1}{8}$  in. long



FRONT VIEW

SIDE VIEW



## ANGLED MORTISES ARE CUT WITH A ROUTER JIG

Aside from the crest rail, the mortises in this chair are angled, and the tenons are straight. Most of the mortises are cut with a plunge router, with the legs wedged at the appropriate angle in a box-type jig. The mortises are squared up by hand.

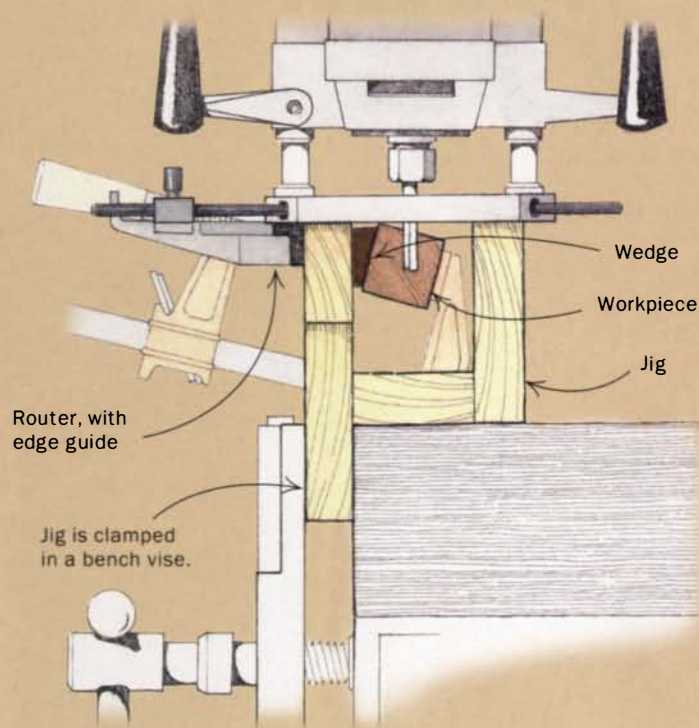


### JIG SIMPLIFIES ANGLED MORTISES

This jig is a simple, open-ended box made of thick hardwood. Small wedges help clamp the workpiece in place, with its upper face parallel with the top of the jig. The router and its edge guide ride on top of the jig.

Horn for clamping workpiece to jig

Tongue is clamped in vise.



**The side-rail-to-front-leg mortise.** Wedge the leg at 9° in the jig and place a block under the leg for extra support. Note where the entire box is being squeezed to hold the leg in position.



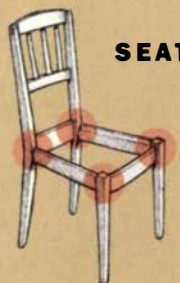
grain that impact the design. Softer woods are to be avoided. For this chair, I chose white ash because of its exceptional strength along the grain and its pronounced grain pattern. However, white ash is tough to work. Cherry or walnut are more forgiving with more subtle grain patterns.

Both 8/4 and 5/4 stock are required, ideally from the same tree for harmonious color and grain. Wide stock will yield more parts with less waste if you stack the curved rear legs side by side and cut the front legs from the odd shapes in between. Plan on cutting extra legs for trial setups and for backup in case of miscuts. Grain that follows the outline of the leg is ideal. Avoid wild grain that angles sharply off edges and defects that might weaken parts.

### Make full-scale drawings, then patterns

To help manage all of the parts and joinery in a chair, a full-scale drawing that includes front, side, and seat views is invaluable. It's





## SEAT-RAIL MORTISES

Wedges position the workpiece for the proper mortise angle. The outside face of the leg is placed against the wedge, and the top face is parallel to the top of the jig, lengthwise.

1

Rear leg is rotated 4°.

Rear rail

Tenons overlap at the corner.

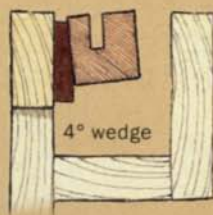
Side rail

TOP VIEW

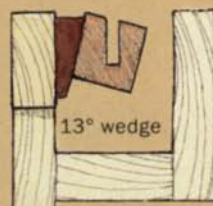
Tenons are mitered at the corner.

Front rail

4



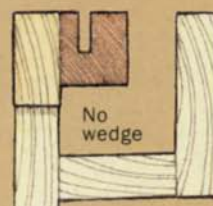
1 REAR RAIL TO REAR LEG



2 SIDE RAIL TO REAR LEG



3 SIDE RAIL TO FRONT LEG



4 FRONT RAIL TO FRONT LEG

Side rails are angled 9°.



## LUMBAR-RAIL MORTISES

The curved, angled block (foreground) is necessary for firmly clamping the curved rear leg in the jig and setting the mortise angle at 4½°.



## CREST-RAIL MORTISES

The open mortise for the crest rail must be parallel to the front face of the leg. Cut it on the tablesaw using a tenoning jig and a dado set. An extra block prevents tearout at the back of the cut.



on the full-size drawing that I work out all of the curves, the dimensions of parts, and the joinery. I then make patterns and lift dimensions directly from the drawing, making fewer errors than I would by measuring alone.

Thin wooden patterns are useful for more than just helping to cut out the parts with pleasing grain. They also allow me to refine the shape of each part before cutting into my stock. And it is on the pattern where I mark out the locations of the joinery for transfer to the actual legs. Later, when fitting the crest and lumbar rails to the rear legs, I use other, simpler patterns to get the angles of the shoulders and tenons right. In the end, the stack of patterns becomes a record to refer to if I build this chair again.

### Cut out and shape the rear legs

Cutting out the rear legs requires two patterns: one for the side view and another for the front view. Both include reference sur-

faces (see the leg templates on p. 81), which are flats where joints are cut and flats that help orient the leg when mortising.

On 8/4 stock, lay out and cut the side view first. I cut each of the legs from the rough plank to yield parts as thick as possible and to avoid the labor of milling what will be waste. Bandsaw the legs about ¼ in. oversize in width and about 1 in. extra in length. Joint and thickness the rear legs to 1¾ in., retrace the pattern (which you can shift a little to improve the grain), and bandsaw, just leaving the layout line.

There are no tricks to shaping the rear legs; just compare the pattern and leg, and plane and spokeshave off the high spots. Use the bandsaw marks to guide you, taking them off evenly, as they should be square across the surface. Pay particular attention to the reference surfaces, keeping them flat, square, and precisely aligned with the pattern. Before cutting the rear legs in the front-view profile, lay them face up and choose the best right and left



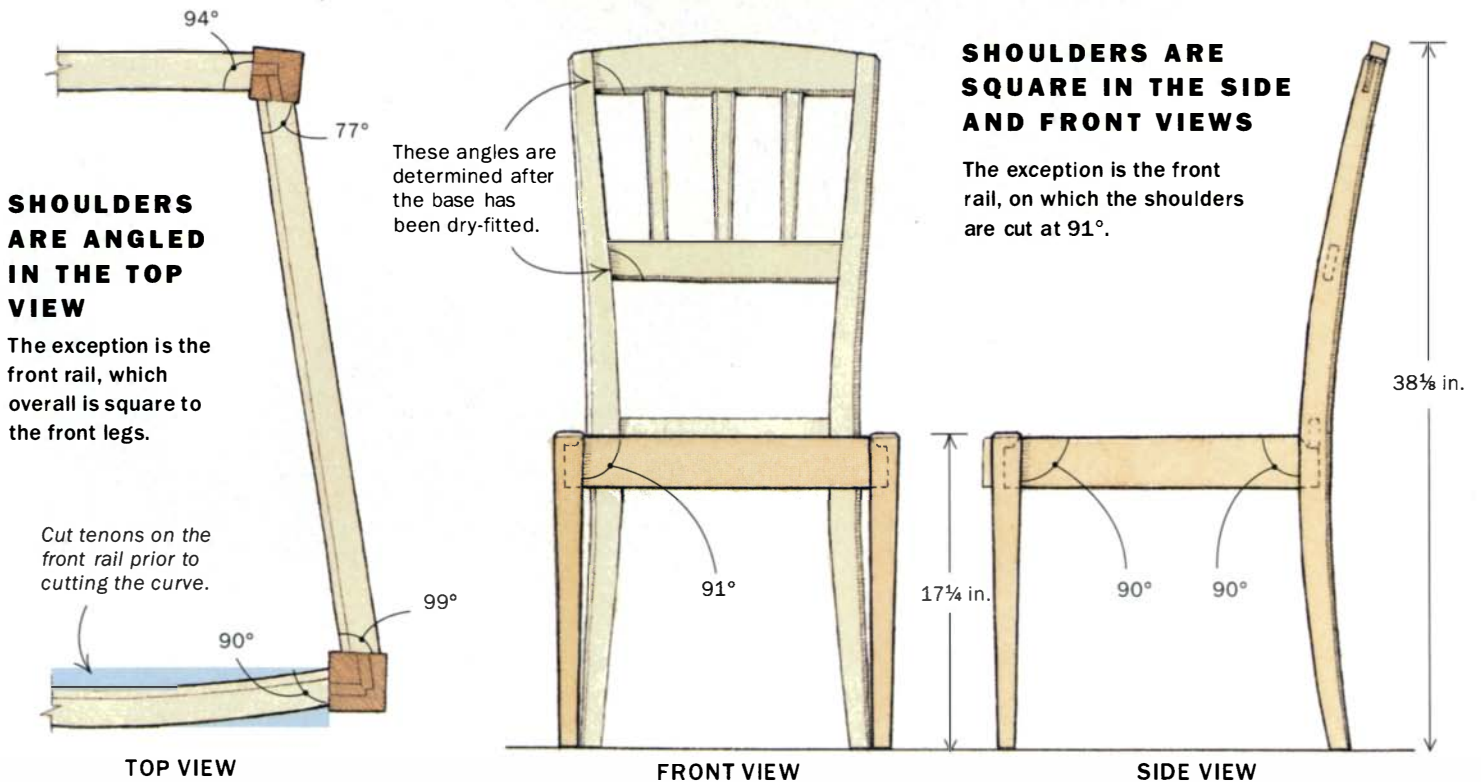
## TENONS ARE SHAPED ON THE TABLESAW

The tenons are straight on every piece except the crest rail, but all of the shoulders are angled in one direction or another to mate with the mortised pieces. Lay out every joint clearly to avoid mistakes when setting up and orienting parts on the table saw.



**Lay out the angled shoulders.** On the front rail, the shoulders are square in one direction (left). But a bevel gauge set to the angle of the leg taper ( $1^\circ$ ) is necessary for laying out the vertical shoulders (right).

**Cut the cheeks first.** Use a tenoning jig on the table saw and stay shy of the shoulder lines.



legs from the pair. Then trace the front-view pattern, bandsaw, and smooth the shape with a plane and a spokeshave.

### Now, cut and taper the front legs

The front legs on this chair are tapered on all four sides from the top to the bottom, unlike some other chairs that have flat areas at the top for a simpler joint with the rails. One advantage of the unbroken taper on all sides is that the best-looking faces can be chosen after tapering the leg. Plus, I believe the unbroken taper gives a more refined look to the chair.

On the front rail, cut the tenon shoulders at an angle ( $1^\circ$ ) that will make the centerline of the front legs plumb.

### Join the seat rails to the legs

To add strength to this chair, the side rails should be 1 in. thick. The extra thickness will be hidden beneath the seat, but it allows for large and strong tenon shoulders. Cut the front rail out of  $8/4$  stock so that it can be shaped into a pleasing outward curve after cutting and fitting the joinery.

The key to a good chair is tight-fitting joints. Sloppy or under-





**Now cut the shoulders.** Set the miter gauge to 1°, being careful not to angle the cut in the wrong direction. The curve is cut after the joinery has been completed.

size joints are going to fail eventually. I've repaired lots of those chairs. It's not too much trouble to haunch the tenons that go into the front legs for maximum resistance to racking forces. On the other hand, the rear tenons can be nearly full height with only small shoulders on the top and bottom to hide any slight defects in the mortise. The tenons on the front and side rails are mitered together inside the legs for maximum length and strength. To strengthen the mortises, I made the front legs a bit higher than the rails, and then rounded their tops. In the rear, the side-rail tenons, which are the most critical joints in the chair, are cut to the full depth of the mortises. The wider rear-rail tenons are notched around them.

**Angle the mortise, not the tenon**—For the most part, both angled and straight tenons are equally strong, except for an extremely angled tenon with weak short grain. That said, I chose straight tenons rather than angled ones for this chair because I knew I would make fewer mistakes laying out, cutting, and fitting them. Basically, every tenon is in line with its workpiece. Also, it is just as easy to cut angled mortises with a plunge router and a box-type jig as it is to cut angled tenons on the tablesaw.

However, there is one part that must have angled tenons: the crest rail. For the best appearance, the open mortises in this bridle joint must be square to the tops of the legs, an angle that requires angled tenons. But I have a neat way for laying out these tricky tenons.

**Cut the mortises first with a router jig**—The router jig for the mortises is a simple, open-ended box made of thick hardwood (see pp. 82-83). The parts are clamped inside with their upper face parallel with the top of the jig. Various wedges and angled blocks are used to locate and clamp the legs in the proper positions. Then the plunge router rides along the top of the box, with its edge guide riding the outside edge. Afterward, the ends of the mortises are squared by hand to accommodate square tenons.

Cut all of the chair's mortises before any of the tenons. Use the



**Dry-clamp the seat frame.** After hand-fitting all of joinery in the seat frame, clamp it together and fit the upper crosspieces to the actual chair.

leg patterns to lay out the top and bottom of each leg and the location of each mortise, including the ones for the lumbar rail. Each mortise has a face that it is cut into and an adjacent reference face that is clamped against the mortising jig. At the top, leave the front legs long by at least ¼ in. to strengthen the mortise while fitting the rails (when a little extra twisting could split it).

One important tip: Because most of these mortises meet another mortise inside the leg, the bottom of one mortise is the side of its neighbor. Thus, cutting a mortise too deep weakens the adjacent joint by cutting into some of its cheek glue surface. To keep the joints strong, set the router depth to come up a bit short for both mortises, then chisel away by hand the small step left at the bottom.

**Tenons on the tablesaw**—A ¾-in.-thick tenon on a 1-in.-thick rail is a good compromise between tenon strength and ample



## DRY-FIT THE BASE, THEN BUILD THE BACK

The rails and slats in the upper part of the chair (the chair back) are fitted to the rear legs after the base of the chair has been assembled and dry-fitted. The rails go in first, then the slats are arranged by eye and fitted to the rails.

### 1 FIT THE LUMBAR RAIL



**Make a pattern for fitting the lumbar rail.** Plane the ends of the template until it rests perfectly at the base of the lumbar mortises. This is now a record of the shoulder angle and the location of the tenons.



**Determine the vertical angle of the shoulders.** With the pattern resting at the base of the mortises, use a bevel gauge to record the angle. Align the gauge's fence with the opposite mortise to keep it in line with the workpiece.



**Lay out the tenons.** Use the pattern to lay out both the tenon shoulders and the beginning of the cheeks. These tenons are straight. Then use the bevel gauge to lay out the vertical shoulders.

### 2 FIT THE CREST RAIL



**An added twist for the crest-rail template.** These tenons are angled, so after fitting the pattern between the legs to find the shoulder angle, fit mock tenons into the mortises and glue them to the pattern.



**Lay out the crest-rail tenons.** Use the pattern to lay out the cheeks and shoulders. Flatten one side of a pencil to ensure an accurate transfer.

shoulders. Cut only the seat-rail tenons at this time; hold off on the upper crossmembers. There is no telling exactly what the dimensions and angles will be in the upper part of the chair until the bottom has been joined and dry-fitted.

Before cutting the tenon cheeks on the tablesaw, clearly mark the shoulder angles with a pencil. Also, remember that the front rail's tenons will be set back from its front face to allow for later shaping. Cut the cheeks with a tenoning jig on the tablesaw and cut the shoulders using a miter gauge, with the blade and miter

gauge angled as necessary. Cut very close to the layout lines but leave a little extra for fitting by hand.

Another important tip: There are a lot of angles to deal with and a lot of parts to flip around in various positions on the tablesaw. To avoid mistakes and to be sure the cut is going in the right direction, make an intermediate cut well shy of your layout line when you get each part into position.

To miter the tenons within the front-leg mortises, assemble a rail and leg. Then reach in through the opposite mortise and mark the beginning of the miter. Next, take apart the joint and hand-cut the miter from this line to the tip of the tenon so that there is no chance of the miters meeting inside and keeping the shoulders from coming up tight. Do the same thing in the rear legs, where the rear-rail tenons must be notched out to butt against the side-rail tenons.

**Fitting and sculpting the seat frame**—After the joinery has been fitted on the seat rails, the front rail can be shaped into its curve. Make a pattern from the drawing, checking that it is symmetrical around a centerline. Trace the outside curve on the rail, bandsaw close to the line, and smooth it into a fair curve. Then bandsaw the inside of the rail parallel with the outside curve, leaving it the same



### 3 FIT THE SLATS



**Clamp on the slats to find a pleasing array. Then mark their angles and tenon locations on the lumbar and crest rails.**



**Drill out the waste and chop the mortises in the lumbar and crest rails by hand. Fitting the slats and the crest rail is the most challenging part of the construction, as all must seat simultaneously in their mortises.**

thickness as the other seat rails. To accommodate a slip seat, cut a rabbet around the front and side seat rails. This can be done on a router table with a small curved fence or a bearing-guided rabbeting bit. To see where the rabbets hit the front legs, dry-fit the seat frame. This is where the front legs must be notched to accommodate the seat platform. Do not glue up the seat frame yet.

#### Fit the back in steps

The next job is to cut and fit the lumbar rail, the crest rail, and the three small slats. One of the advantages of the bridge joint on the crest rail is that the slats can be fit last, after the rest of the chair has been glued up.

First, cut the open mortises for the crest rail on the table-saw with a tenon jig and dado blade. These deep slots are cut parallel to the front faces of the legs. Clear layout lines will help prevent mistakes.

**Cut and fit the crossmembers**—Because of the curve of the rear legs and the splay between them, the length of the lumbar rail and crest rail and the angles of their tenon shoulders can't be read easily from a drawing. I use patterns to determine these. The crest rail is the only part with angled tenons. These require a new twist on the template technique to record the angles and location of the tenon cheeks. The crest rail is exposed, so it is critical to get a good fit. Last, cut the curves in the crest and lumbar rails using a pattern.

**Cut and fit the three slats**—Make the slats and form their delicate beads, leaving them a bit long. Then clamp them in front of the crest and lumbar rails. When you have their positions right, make lines on the slats for the shoulder angles and tenon locations; then lay out the mortises and the overall angle of each slat on the lumbar and crest rails. A router setup is cumbersome, so lay out the mortises, drill out the waste, and chop them by hand.

Now you can assemble and glue everything but the crest rail and slats. Place glue to get no squeeze-out, as this is easier than trying to clean up dried glue later. Glue up the chair sides first, then connect them with the front- and rear-seat rails and the lumbar rail. Measure the diagonals between the lumbar rail and seat rail to check that the assembly is true.

Fit the shoulders and length of the slats between the crest and lumbar rails. This is tricky because the crest rail must bottom out in its mortises at the same time the shoulders of the slats are butting up tight to the lumbar rail and crest rail.

If you cut one of the slats too short, you can drop the entire crest rail by deepening its mortises in the rear legs.

Now glue up the crest joints and slats. Glue blocks, fitted carefully into each corner of the seat frame, will stiffen the chair considerably and offer a convenient place to secure the slip seat. Finish and wax the chair. Finally, make the slip-seat platform slightly smaller than the space within the rabbets to accommodate two layers of fabric wrapped around each edge.

Building this chair will not be as hard as you think. If you tackle it in steps—with drawings, patterns, and patience—the joinery will come together fine. Build one chair, and you'll build another. □

*Garrett Hack is a contributing editor.*



# Current Work

**Current Work** provides design inspiration by showcasing the work of our readers. For more details and an entry form, visit our Web site at [www.finewoodworking.com](http://www.finewoodworking.com). Send photos and entry forms to **Current Work**, *Fine Woodworking*, 63 S. Main St., Newtown, CT 06470.

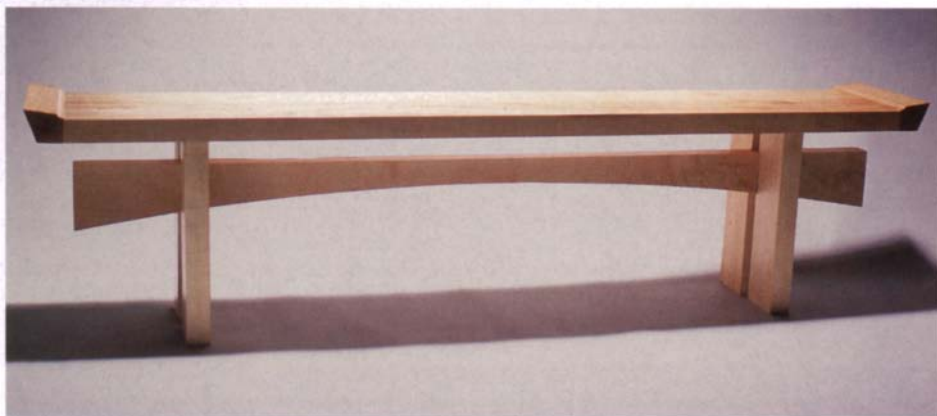


## ◀ **Paul Schürch** Santa Barbara, Calif.

This round extension dining table and accompanying chairs were built as a private commission from the Northwest Fine Woodworking Gallery for a Seattle-based Microsoft manager. Made of mahogany, the table and chairs feature a marquetry motif of Pacific blackberry with inlaid ladybugs, frogs, butterflies, and opal flower buds. The marquetry, which is on the table's outer ring and each of the chair backs, comprises a laurel burl field with walnut burl, tulipier, poplar, elm, maple, purplewood, tulipwood, and black pear with stone inlays of marble, turquoise, bloodstone, and opals. The table measures 72 in. dia. by 29½ in. tall; however, with three 24-in. extensions put in, it becomes a mammoth 6 ft. by 12 ft. The table and chairs have a conversion lacquer finish. Photo by Wayne McCall

## **Jeff Flaim** Long Beach, Calif. ▶

After finishing a large bookcase, Flaim chose to build this maple bench (12 in. deep by 72 in. wide by 16 in. tall) because he wanted to make something small with straightforward joinery. The inspiration behind this piece came from a Hank Gilpin article in *Home Furniture*. "In the article, Gilpin expressed his love of benches to show off the 'plankiness' of wood," said Flaim. "I combined this concept with my love of Japanese furniture to achieve the final result." The finish is Danish oil.





**Kai Fuhrmann** Portland, Ore. ►

Fuhrmann got the idea for the shape of this occasional cabinet (17 in. deep by 17 in. wide by 62 in. tall) "by thinking of the elegant curves of a woman's body." The cabinet is made of eastern walnut and features abalone flower inlays on the outside of the doors. It is finished with a hand-rubbed oil mixture.



◄ **Evan Cost** Audubon, Pa.

This briar-root hollow vessel is 5½ dia. by 7½ in. tall. "It's hard to get inspiration from a raw briar root," said Cost, "but I let the wood take me where it wanted, especially when I started running into the common problem of rocks in the wood." The vessel has an oil finish.



**Phillip Recht** West Bend, Wis. ►

Recht made this cherry cabinet with rosewood pulls (19 in. deep by 37 in. wide by 24 in. tall) as his door and drawer case project for a 12-week intensive course he took at The Center for Furniture Craftsmanship in Rockport, Maine. Designed to serve as a sofa end table, the cabinet has curved corner chamfers and surfaces in varying planes. It is finished with three coats of an oil-and-varnish mixture. Photo by Jim Dugan







◀ **Robert Stanlaske** Olympia, Wash.

Stanlaske made this captain's desk (15 in. deep by 19 in. wide by 9 in. tall) to fulfill his case-piece requirements at North Bennet Street School. After seeing a photo of the desk in Lon Schleining's *Treasure Chests* (The Taunton Press, 2001), Stanlaske visited the Mystic Seaport Museum in Connecticut, where he was allowed to measure the original. Made of mahogany, maple, and pine with brass accents, the desk took approximately 400 hours to complete and is finished with an oil-and-varnish mixture. Photo by Lance Patterson



◀ **Chris Finn** Bellevue, Wash.

Modeled after an antique French birdcage, Finn's maple version (22 in. deep by 26 in. wide by 64 in. tall) was made as a gift. The black-painted cone finials add an architectural look to the piece. The table and maple portions of the birdcage are finished with a clear varnish.

**Richard Gies** Kennett Square, Pa. ▶

Interested in furnishing their 1830 Quaker farmhouse with circa 1780-1850 pieces, Gies and his wife borrowed elements from three period pieces to design and build this chest-on-chest (21 in. deep by 42 in. wide by 70 in. tall). It is made from a primary wood of walnut and secondary woods of birch and poplar. Gies and his wife decided to work the fluted quarter columns into the design because he wanted to learn how to make them. The chest has a stain and tung-oil finish.





**Joseph H. Willard** Pittsford, N.Y. ►

Willard, an art dealer by trade, builds furniture on commission as a side business. This walnut piecrust table (31 in. dia. by 29¼ in. tall) was built for a client who had just bought his wife a tea set. The table's crotch figured top was made from three pieces of the same board. The finish is varnish oil. Photo by Bruce Litloff



**Stephen Warning** Kelso, Wash. ▲

Warning, a judge by profession and a woodworker by avocation, built this jewelry cabinet (11 in. deep by 19 in. wide by 60 in. tall) for his wife, Angela. It is made of primary woods of padauk and fir and secondary woods of fiddleback maple, mahogany, and cocobolo. The calligraphy of the Chinese poem was done by a friend and roughly translates as, "He who carves the Buddha never worships it." The cabinet is finished with a varnish, oil, and turpentine mixture.

**Tips for photographing your furniture**

1. Clean and dust the furniture.
2. The furniture will appear more three-dimensional if it is lit so that each plane has a different brightness. Take care, however, to avoid excessively bright highlights or dark shadows.
3. To be sure the photos will be free of distortion, avoid the use of wide-angle lenses, and photograph with the camera positioned even with the center of the furniture both vertically and horizontally.
4. Use 35mm color print (negative) film of moderate speed (ISO 200-400). If you're using a digital camera, shoot at the highest resolution and place the image on a CD.
5. Photograph the furniture from several angles. Include some head-on shots, as well as some shots that show both the front and side of a piece.
6. Keep the background simple. A cluttered or otherwise distracting background may draw the viewer's attention away from the subject.



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## How yellow glue works



You'd think that after 3,000 years scientists would know why adhesives stick things together. The truth is they don't: Different theories abound, but nobody really knows for sure.

These arguments are of more than academic interest to woodworkers. Knowing how glue works will help you get the best results when using it.

### Why glue sticks: a brief chemistry lesson

Adhesion is an extremely complex process; no single theory can fully explain the phenomenon. Dozens of theories have come and gone through the years, but currently the most popular for polyvinyl-acetate adhesives (PVA) are the mechanical-interlocking theory and the specific-adhesion theory.

Mechanical adhesion is fairly straightforward: The liquid adhesive flows into the pores and crevices in the wood's surface, then dries. The resulting hard, little glue fingers hold the two boards together. While this lock-and-key effect undoubtedly occurs, the strength of the bond produced by mechanical adhesion is too low to explain the high bond strength (around 3,500 psi) in most joints bonded with PVA wood glue. Clearly, something else also occurs as the adhesive sets.

That extra something is explained by the specific-adhesion theory. Specific adhesion involves the interaction of the adhesive and the wood on a molecular level. A little chemistry is needed to explain this phenomenon: Cellulose molecules in wood contain an abundance of hydroxyl groups, the same chemical groups found in alcohols. PVA molecules are rich in carbonyl groups. During the curing process, the cellulose hydroxyl groups link with the adhesive carbonyl groups through a force known as hydrogen bonding. These bonds hold the boards together.

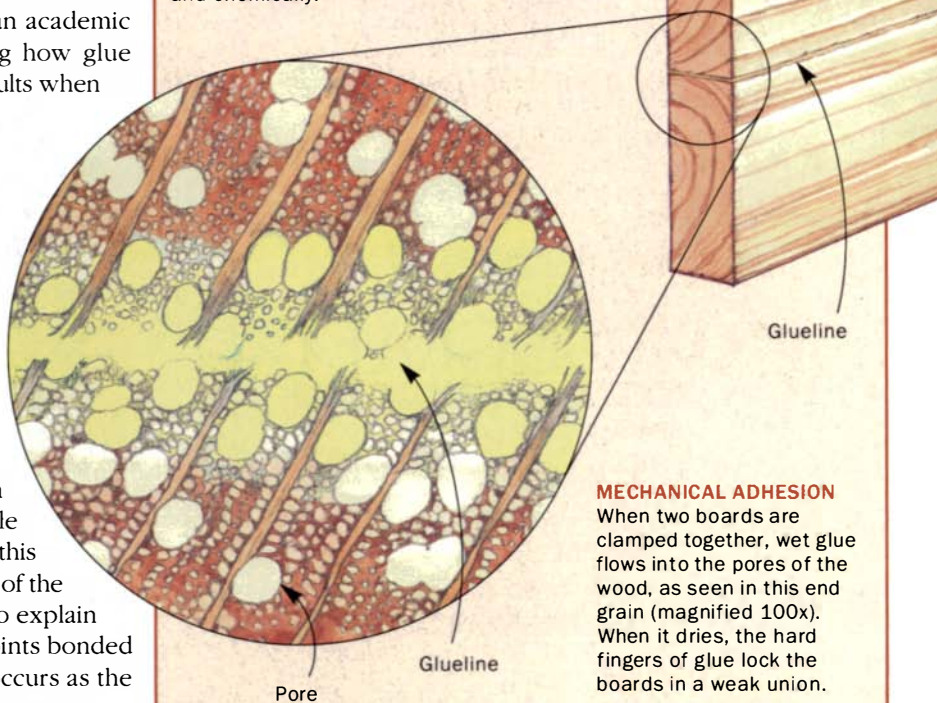
You may recall from high-school chemistry that the strength of a typical hydrogen bond is only about one-tenth the strength of a covalent bond (the force that holds individual molecules together). So scientists often view hydrogen bonds as weak bonds. Even so, they are strong enough to form permanent wood-to-wood joints. Long ago, a professor of mine put these bonds into perspective: "If covalent bonds are thought of as a lasting, stable marriage, then hydrogen bonds can be thought of as just good friends."

### When yellow glue and wood combine

It is hard to imagine woodworking without adhesives. Furniture builders have been gluing together wood for several thousand years. For most of that time, animal glue of one sort or another was their only option. That changed about 50 years ago with the introduction of PVA adhesives. Among woodworkers, yellow, or aliphatic-resin, glue is the best-known variety.

### GLUE STICKS IN TWO WAYS

Scientists theorize that yellow glue bonds together wood in two distinct ways, mechanically and chemically.

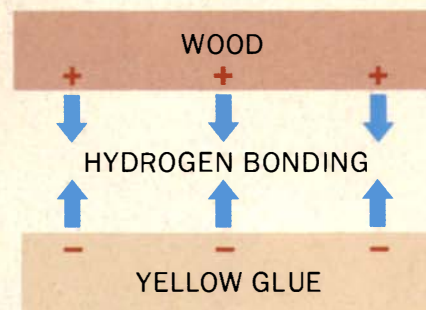


### MECHANICAL ADHESION

When two boards are clamped together, wet glue flows into the pores of the wood, as seen in this end grain (magnified 100x). When it dries, the hard fingers of glue lock the boards in a weak union.

### CHEMICAL ADHESION

Positively charged hydroxyl groups on the wood's surface are attracted to the negatively charged carbonyl groups in the yellow glue in a process known as hydrogen bonding. This is the main force that makes yellow glue a strong adhesive.



To make yellow glue, vinyl-acetate monomer is mixed with water, a catalyst is added, and then the mixture is heated to produce PVA. Surfactants, which aid penetration, pigments, and specialty ingredients are added to produce a workable wood adhesive.

When a thin film of yellow glue is spread between two pieces of wood, a dramatic transformation takes place. Initially, the adhesive between the two boards is more water than polymer particles. Clamping pressure, coupled with the surfactant in the adhesive, causes the liquid glue to wet the wood, followed quickly by penetration of the water into the top layer of wood fibers. Capillary action continues to draw the water and polymer particles into the wood until the top cellular layers of the wood are saturated with glue. With the water drawn from the joint, the remaining polymer



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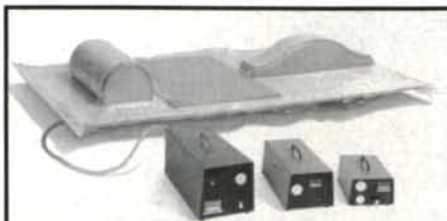
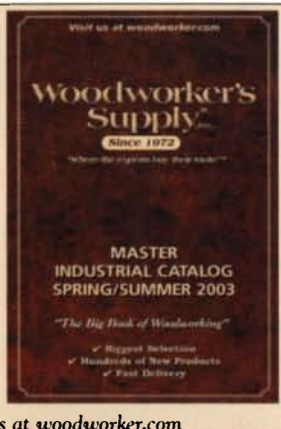
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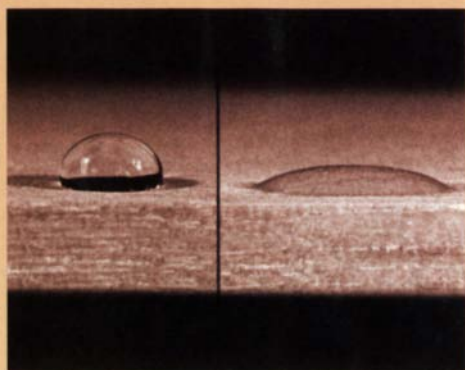


# A Closer Look (continued)



*To achieve a good bond, the glue must penetrate the wood easily. If the components were milled several weeks before being assembled, lightly sand the areas to be glued to remove surface contaminants.*

## SAND BEFORE GLUING



**Testing for penetration.** Two drops of water were applied to this board and photographed after 30 seconds. The sample on the right had recently been lightly sanded.

particles coalesce into a continuous adhesive film. The adhesive bond is complete when all of the water in the adhesive film and the surrounding wood has evaporated, usually in about 24 hours.

Although joint design, the type of wood, and surface contamination all influence the strength of the adhesive bond, nothing has more impact than “wetting.” Simply put, wetting is the intermingling of the liquid adhesive and the wood fibers on a molecular level. The wood and the glue must blend together, or no bond will form. Good joint design and proper surface-preparation techniques will guarantee failure-free adhesive bonds every time.

## Strong joints start with surface preparation

Wood is not a homogeneous material but rather a conglomeration including cellulose, hemicellulose, lignin, resins, oils, minerals, and colorants. Most of these materials (called wood extractives in the adhesives trade) decrease the ability of the adhesive to wet the wood. Removing these extractives from the wood surface before gluing is necessary to achieve a strong bond.

Edge-jointing the boards or cutting the joints immediately before applying the glue is the best way to remove contaminants. Unfortunately, the extractives start to migrate back to the surface as soon as the board clears the jointer. The longer you wait between jointing and glue-up, the lower the bond strength. A two- or three-day wait is no big deal, but check for extractives if more than two weeks have passed. Place a drop of water on the edge to be glued, then time how long

it takes to soak into the wood. If it takes more than 30 seconds, lightly sand the wood with 180-grit paper. Sanding removes the accumulated extractives without having to rejoin the board.

**Oily woods are a special case**—Oily tropical hardwoods like rosewood, teak, or cocobolo are difficult to bond with yellow glue. A common practice among woodworkers is to wipe the joint with solvent before gluing, in an attempt to remove the oils and allow the glue to bond to the wood. I have used this trick in the past, but I never was satisfied with the strength of the joints. I believe that the evaporating solvent pulls more oil to the surface than it removes. This article gave me the excuse to test my theory.

I jointed a ½-in.-thick rosewood board, crosscut it into six 4-in. lengths, and left the strips in the shop for two days. The first pair was glued and clamped without any additional treatment. I wiped the second pair with lacquer thinner, let them dry for two hours, then glued and clamped them. The final pair was sanded lightly with 180-grit paper before gluing and clamping. The test results were interesting: It took nearly an identical amount of force to break the untreated first pair and the solvent-wiped second pair: 892 psi and 888 psi, respectively. As I suspected, wiping with a solvent had virtually no effect on the bond strength. Looking at both samples under a microscope, I found in each case the dry adhesive had peeled cleanly off the wood without removing any wood fibers.

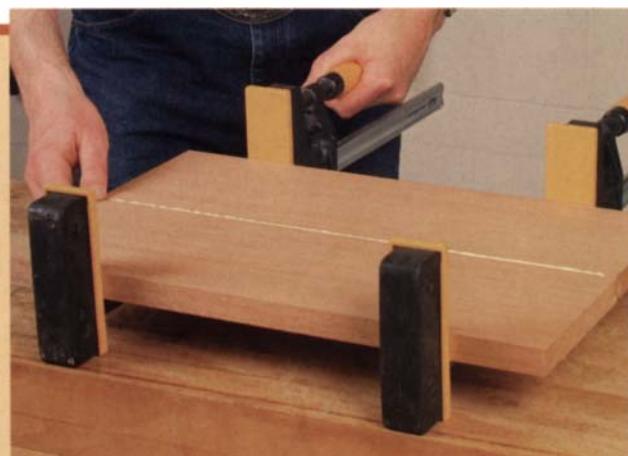
On the other hand, a force of 1,290 psi was required to break the sanded joint—about a 45% improvement in strength. Under the microscope it was clear that some fibers had been pulled out of the wood. To put this result into perspective, forces in the neighborhood of 3,500 psi are needed to break the bond of non-oily woods like oak or walnut. A few years ago, I switched to epoxy adhesives, which give a joint strength of 2,500 psi on oily woods, and have not had a joint failure since.

## A few gluing tips

Keep these points in mind when gluing any kind of wood: Yellow glue is not a gap-filling adhesive; snug-fitting joints are required to

## APPLY THE RIGHT AMOUNT OF GLUE AND PRESSURE

**Sufficient glue.** Apply a thin, even bead of glue to both edges. You have about five minutes of open time before the glue skins over, hindering adhesion.



**Even pressure.** Each clamp is applying about 2,000 lb. of pressure. To give an even 200 lb. per linear inch of pressure over the length of the boards, space the clamps about 10 in. apart. You should produce a thin, consistent bead of glue squeeze-out.



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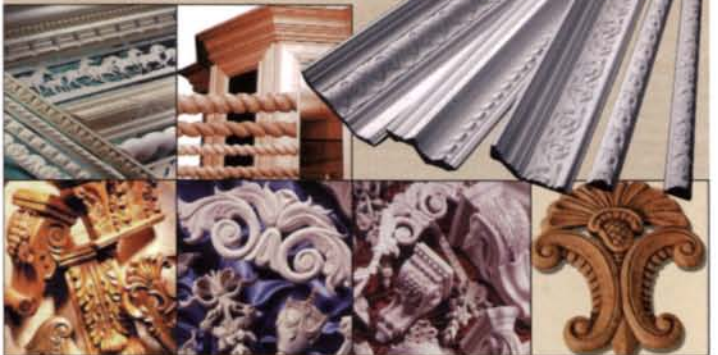


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# A Closer Look (continued)



**Not the solution.** Wiping oily tropical woods with a solvent prior to gluing does not improve the performance of yellow glue.

## GLUING OILY WOODS

Yellow glue does not work well on oily woods such as teak or rosewood. Sanding the joint prior to gluing yields some improvement, but a better method is to employ epoxy instead.

| WOOD/TREATMENT                       | BREAKING POINT |
|--------------------------------------|----------------|
| Untreated oily wood                  | 892 psi        |
| Oily wood wiped with lacquer thinner | 888 psi        |
| Oily wood sanded prior to glue-up    | 1,290 psi      |
| Oily wood glued using epoxy          | 2,500 psi      |
| Non-oily wood                        | 3,500 psi      |

achieve the best bond. The force needed to push a dowel into a hole with only your thumb, and then to pull it out with just a slight effort, indicates how tight dovetail and mortise-and-tenon joints should fit.

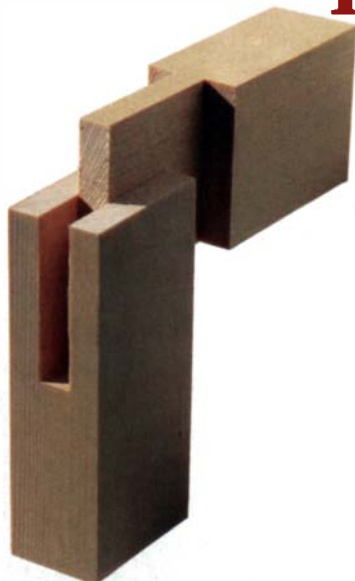
Edge-glued boards must be snug over their entire length. Don't rely on clamping pressure to pull together warped boards; this puts undue stress on the glue line, which may result in joint failure.

The best glue joints are formed when a thin, even layer of glue is spread on both mating surfaces. This ensures that both sides of the joint are wet with adhesive before clamping. A thick mass of glue

results in a weaker joint. Clamping holds the pieces together and keeps the joint aligned while the glue sets. Proper clamping pressure comes with experience. Too little pressure, and the pieces fall apart when the clamps are removed; too much, and the wood is crushed, nearly all of the glue squeezed out, and the joint left weak. Franklin International, maker of Titebond wood adhesives, recommends 175-psi clamping pressure for softwoods and 200 to 250 psi for hardwoods. The average pipe or bar clamp applies about 2,000 lb. of pressure when moderately tightened. If you really crank the clamp, you can get up to 3,000 lb. Apply enough glue and pressure to form a small bead of adhesive along the joint, let the assembly dry, then scrape off the dry glue with a cabinet scraper.

End grain poses a problem when gluing miter joints: It is so porous that the liquid glue wicks away from the joint before it has a chance to set. No glue in the joint means that no bond is formed. The solution is to paint the end grain with glue diluted with one part to four parts of water. The diluted glue (sometimes called glue size) acts like a primer to partially seal the end grain, reducing wicking. Let the glue size sit for a minute or two, scrape off any excess, and then glue the joint following your normal method. □

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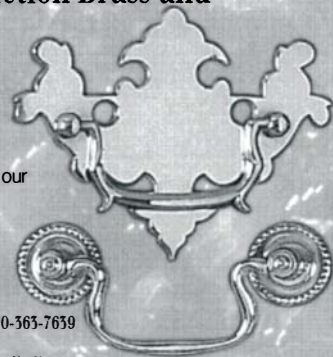
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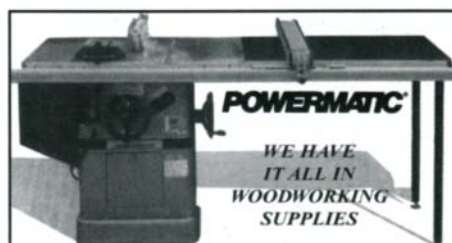
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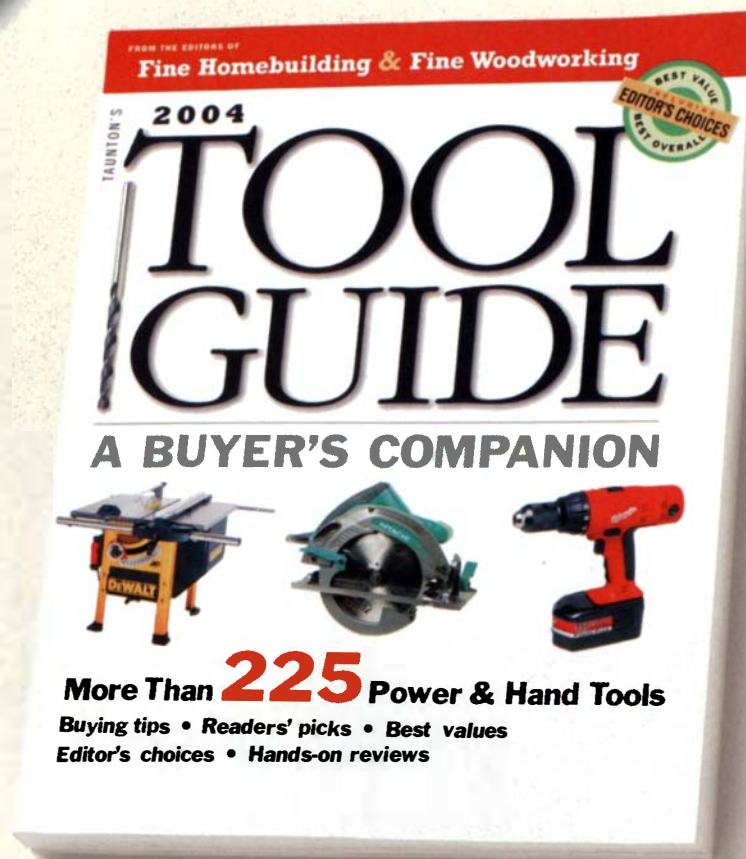
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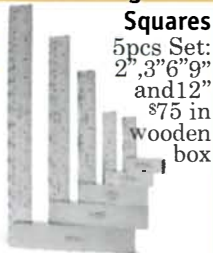


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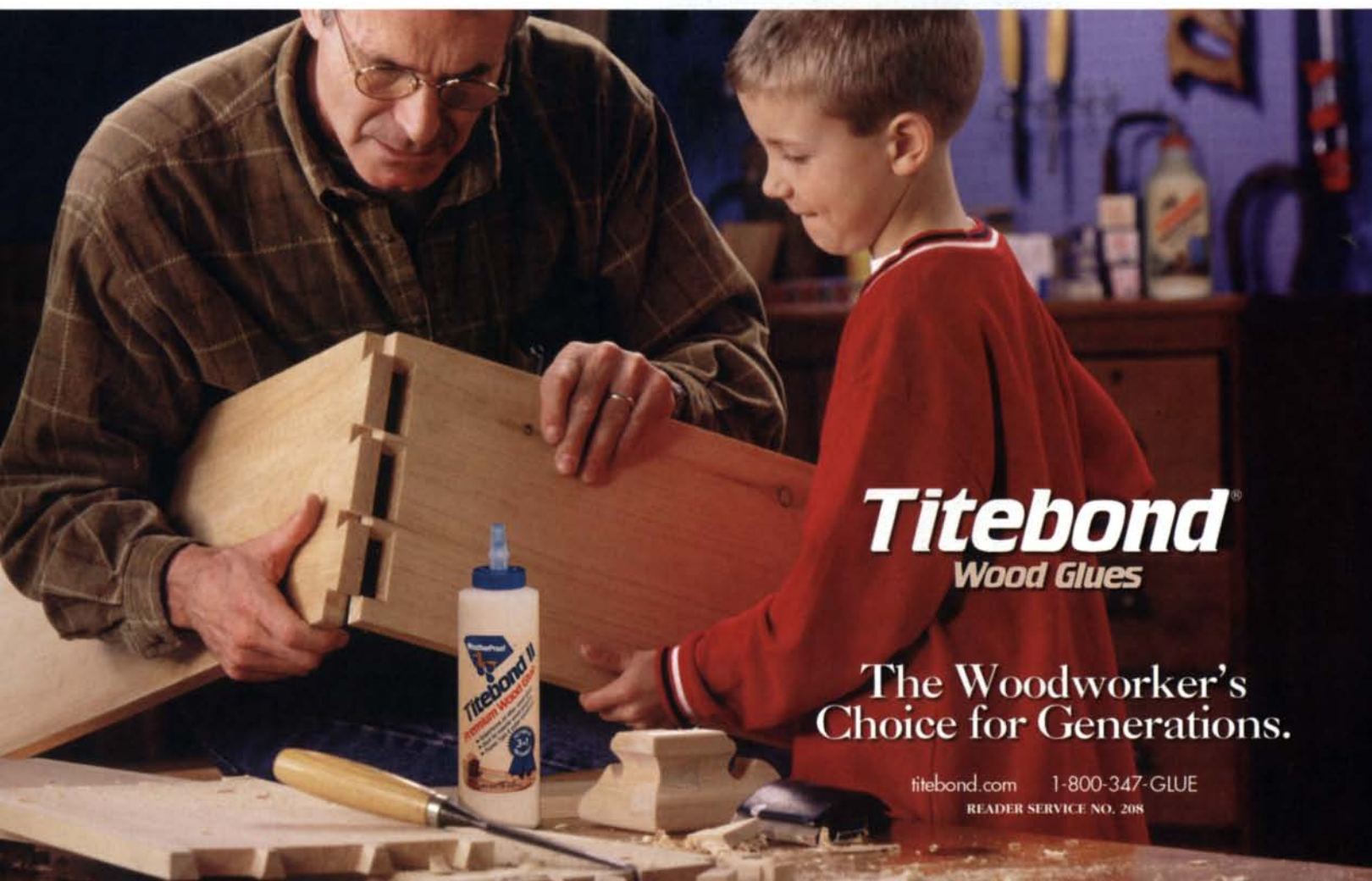
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# Q & A

## Storage for unfinished projects

*I am in the middle of building a hall cabinet. I have cut all of the mortises and dry-fitted a few tenons, but I am not yet ready for assembly. And now, I have to travel overseas and won't be able to get back to my project for several months. Is there anything special I should do to preserve my work while I'm away?*

—Frank Stone, Portland, Ore.

**Steve Rowles replies:** First, cover the open mortises with masking tape. I like the blue Safe-Release Painters' Masking Tape made by 3M. It seals well, and even after a long time, it remains easy to remove. Sealing the open joint and areas of freshly cut end grain will keep the newly cut fibers from absorbing ambient moisture. On an open wood joint and small end-grain areas, masking tape acts as a kind of sealing wrap against degen-

eration. If you take this measure before you store the work, you won't have to retrim the mortises or tenons to get a good fit and strong glue bond when you assemble the piece.

Other than that, cover your work with a blanket to shelter it from sun and dust, and put it in an area without marked swings in humidity to preserve it. [Steve Rowles is a woodworker living in Sedgwick, Maine.]

## American masters?

*I would like to know the definition of the term "master cabinetmaker" as it*

## Tape over joinery before long-term storage.

*When leaving unfinished projects for long periods of time, use tape to seal open joints and freshly cut surfaces. Then cover and store the piece in a shaded environment with balanced humidity.*

*applies to woodworkers here in the United States.*

—Scott Dobek, Monticello, Fla.

**Ian Agrell replies:** No organization in the United States bestows the title of master cabinetmaker. But in the United Kingdom, there is the Association of Master Carvers, an organization of about 35 carving shops that is more than 100 years old. To be considered for membership, you would have your work scrutinized by the group; then a vote is taken by the membership at the annual general meeting. Because there is no similar organization in the United States, anyone can call himself or herself a master woodworker, a master furniture maker, or whatever—and they do. If you meet someone

## THE BOARD-FOOT RULE

*I can't seem to remember how to determine board feet of lumber. Can you help?*

—Lou Battista, Durham, N.C.

**Ford Reid replies:** A board foot is a unit of volume 1 in. thick by 12 in. wide by 12 in. long, or 144 cu. in. The board footage of any board is determined by multiplying the board's thickness by its width by its length, all expressed in inches, and then dividing the product by 144 cu. in.

Although it is theoretically a precise measurement, it is in practice an approximation at best, if not simply a convention. Trees, being what they are, almost never yield planks that are uniform from end to end. Depending on the adjustment of the mill saw and the skill of its operator, a rough board might vary an eighth or more in thickness from end to end.

[Ford Reid builds furniture, boats, and "whatever needs to be built" in Richmond, Va.]



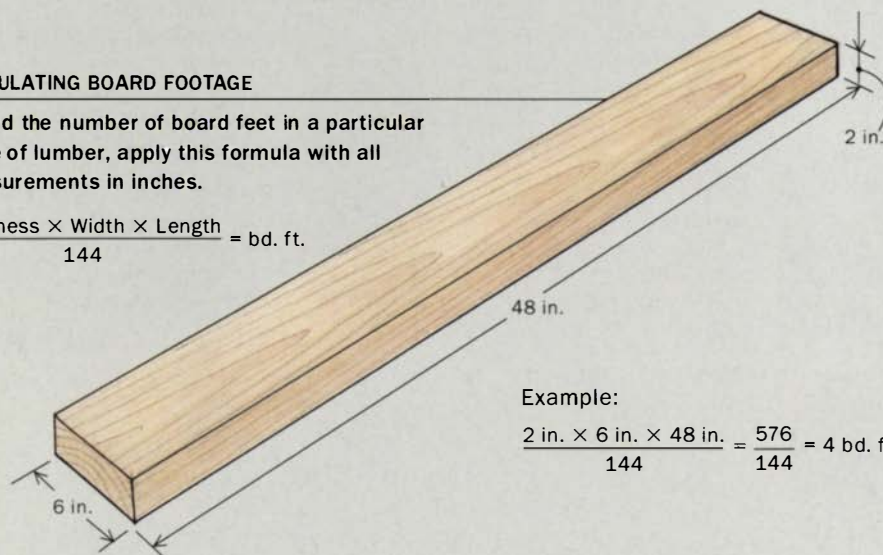
### WHAT IS A BOARD FOOT?

One board foot is the conventional unit for determining lumber sales in the United States. Simply put, a board foot is a unit of volume 1 in. thick by 12 in. wide by 12 in. long.

### CALCULATING BOARD FOOTAGE

To find the number of board feet in a particular piece of lumber, apply this formula with all measurements in inches.

$$\frac{\text{Thickness} \times \text{Width} \times \text{Length}}{144} = \text{bd. ft.}$$



Example:

$$\frac{2 \text{ in.} \times 6 \text{ in.} \times 48 \text{ in.}}{144} = \frac{576}{144} = 4 \text{ bd. ft.}$$





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who uses such a title, ask him or her who bestowed the honor. If it was the person's mother or a local newspaper, you can then make up your own mind.

That is not to say that there aren't a number of world-class woodworkers in the United States—there just isn't an organization to recognize them formally. If there were, and the membership was valid because the election process was stringent, it would have just as much authority as my British association. [Ian Agrell is a British master carver in Mill Valley, Calif.]

## Knife adjustment on a planer

*While milling a small parcel of wood, I noticed that the boards were planed unevenly from side to side. Upon closer inspection, I realized that one end of the cutterhead of my benchtop planer is higher than the other. Any suggestions?*

—James Murphy, Dublin, Ireland

**John White replies:** The likely problem—and it is a fairly common one—is that the cutterhead isn't parallel to the planer's table. Planer cutterheads occasionally are misaligned when they're assembled at the factory, or they can slip out of line afterward, especially if an attempt is made to change the height of the head while the head lock is engaged.

The fix is fairly straightforward: The cutterhead is positioned by two drive screws, one on each side of the head. Normally, both screws rotate together to move the cutterhead up and down. The drive screws are synchronized with each other by a linkage: a chain, cogged belt, or gear drive, depending on the design of the machine. To realign the head with the table, the linkage must be disconnected so that the screws can be turned independently to make the repair. It's possible that the planer's manual will take you through the alignment process; if not, use the following instructions.

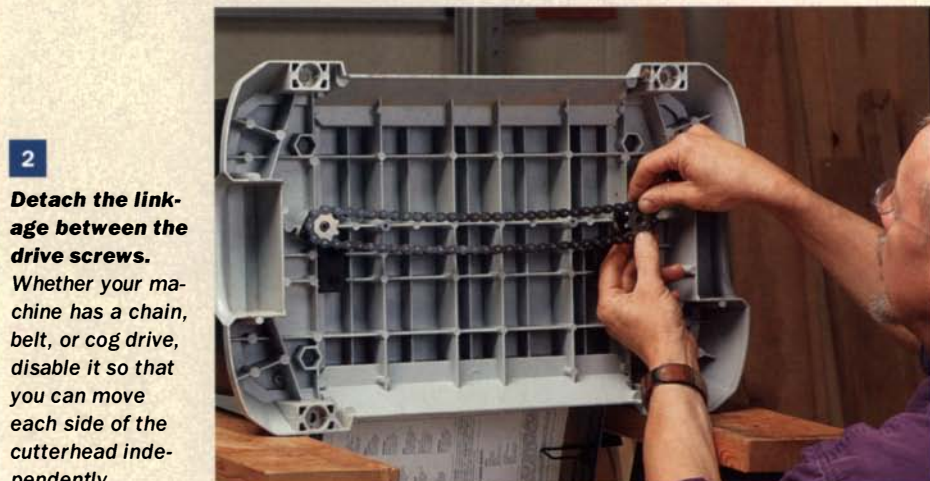
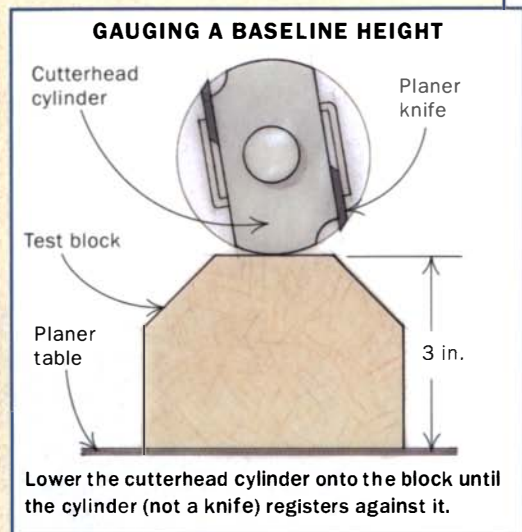
The connecting linkage is either under the top cover of the machine or, more commonly, under the table. If the linkage is under the table, you can get at it by flipping the machine on its side and removing a cover on the bottom. Once you've located the linkage and figured out how to disconnect it (usually a simple

## ADJUST A BENCH PLANER TO MAKE PARALLEL CUTS

Correcting a cutterhead that is out of parallel to the planer bed requires disengaging the drive chain and adjusting each end of the cutterhead independently.



**1** **Use a block to gauge a baseline height.** Place a shopmade block under the cutterhead cylinder opposite the crank handle. Rotate the handle until the cylinder just touches the block.



**2** **Detach the linkage between the drive screws.** Whether your machine has a chain, belt, or cog drive, disable it so that you can move each side of the cutterhead independently.



**3** **Adjust the other side of the cutterhead.** Raise or lower the cutterhead until the block touches the cutterhead cylinder on the side below the crank. Now that the height on each side matches, reattach the linkage.



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process), you're ready to set the cutterhead parallel to the table.

To gauge the height of the cutterhead cylinder, make a test block. It should be around 3 in. high to give you working room under the cutterhead cylinder. The top edge of the block is angled away from the center flat to clear the infeed and outfeed rollers. If the linkage is under the planer's table, you can set the machine on a pair of sawhorses to allow access to the linkage while the machine is upright. With the linkage still hooked up and the machine unplugged, raise the cutterhead cylinder to clear the test block, then bring down the cutterhead cylinder so that the end opposite the crank handle just grazes the top of the test block. Rotate the cutterhead by hand so that the flat on the block registers against the cutterhead cylinder (see the drawing on p. 106).

Once you have one end of the cutterhead cylinder touching the block, disconnect the linkage and move the block to the other end of the cutterhead cylinder. Turn the drive screw on the second end so that the block is again just touching the surface of the cylinder. Now go back to check and adjust the height of the opposite end, because it probably will have shifted slightly.

Work back and forth until both ends of the cutterhead cylinder bear equally on the test block. Once you're satisfied with the settings, reconnect the linkage, but don't turn the drive screws any more than the minimum needed to engage the teeth of the connecting linkage.

[John White is the author of *Care and Repair of Shop Machines* (The Taunton Press, 2002).]

## White oak for outdoor furniture?

*I need to build a set of outdoor chairs for my patio, and I am considering using white oak. I have some indoor furniture made from red oak, and I like the looks of it. But how will white oak stand up to the great outdoors?*

—Alvers Swanson, Milwaukee, Wis.

**Greg Rössel replies:** When pondering a wood's suitability for outdoor application, it is handy to look to the sea. Marine joinery is exposed to punishing and changing climatic conditions—sun, rain, saltwater, rot, and abrasion—as great or

greater than most outdoor furniture will ever face. If you wish to use oak for outdoor furniture, white oak (*Quercus alba*) will stand up to just about anything the weather will throw at it.

The wood isn't really white but rather a subtle cream that, with a clear finish, develops a warm amber tone. White oak is relatively heavy—the charts place it at 46 lb. (dry) per cu. ft. Green, it tips the scale at 62 lb. That makes white oak heavier than ash, mahogany, or teak. It is tough, and it holds fastenings well. Screw holes should be properly drilled and the fastenings well-lubricated to prevent them from seizing and twisting off. The wood has high strength, and if the stock is well selected, it steam-bends well.

The single greatest edge that white oak has over red is that the heartwood pores in white oak are plugged with a growth called tyloses. This means that liquids won't be able to enter the wood. Red oak,

on the other hand, is like a bundle of open pipes. Capillary action (wicking) can draw fresh water right into the board. Indeed, you can stick the end of a short piece of red oak into water and blow bubbles, or even blow smoke through it.

Be sure to finish white-oak furniture with a UV-resistant varnish or translucent wood finish. Unfinished, white oak will slowly turn a silver-gray.

[Greg Rössel is a boatbuilder, author, and teacher who lives in Troy, Maine.]

## Should I show my work online?

*I shop for woodworking tools on the Internet because I can find tools not available at any of the dealers nearby. It got me to thinking: How hard would it be to sell my furniture on the Internet?*

—Brandon Liddell, Half Moon Bay, Calif.

**Darrell Peart replies:** I asked that same question back in 1995 when my local

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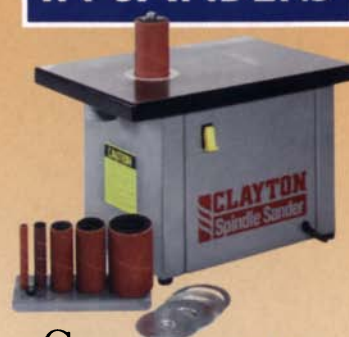
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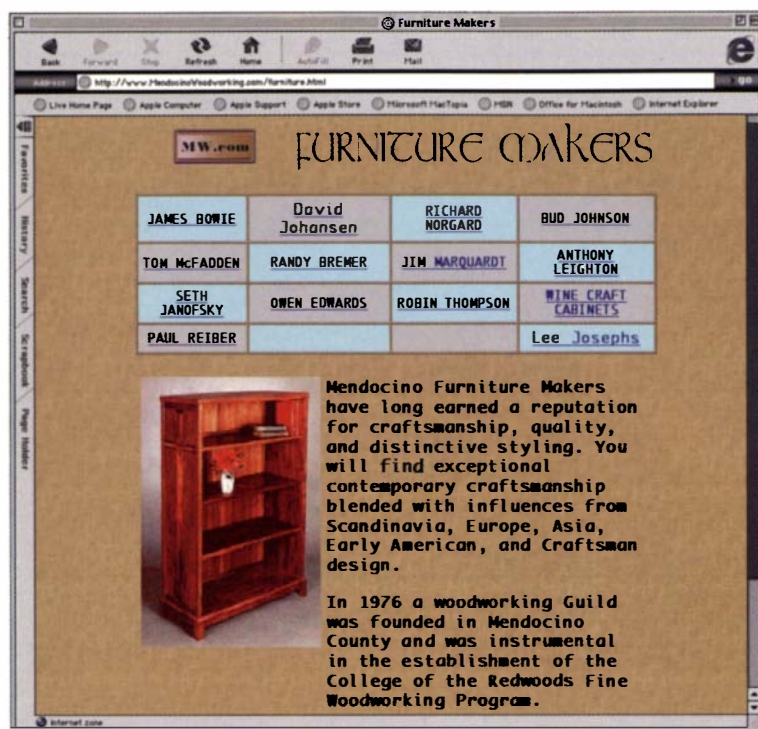


gallery closed its doors. I didn't want to search for another gallery, so I decided to put photos of my work on the Web and find my own customers. The biggest benefit of having the site to display and sell furniture is that I can direct potential customers to my portfolio just by handing them a business card with my Web address on it.

Even if you are computer illiterate, it's possible to get on the Web. You might know a professional Web developer who will make you a site in exchange for a piece of furniture. That's what I did. You also can inquire with local woodworking groups, which sometimes create sites to post photos of work by their members. I know a few that do this for free or for a donation. In Mendocino, Calif., local artists have access to a free site at [www.MendocinoWoodworking.com](http://www.MendocinoWoodworking.com). All they have to do is submit photos and a typed biography to get online.

Finally, don't be afraid to build a Web site on your own. Find a company on the Internet that sells Web-site addresses (about \$20 per year) and buy one. These companies, known as domain-name resellers, also have services to build a simple site that is linked to your Web address. That usually costs another \$5 per month because you are basically renting space on the Internet. Any way you do it, you end up with a portfolio that just about anyone can view.

[Darrell Peart makes custom Arts and Crafts furniture in Auburn, Wash. He's online at [www.furnituremaker.com](http://www.furnituremaker.com). You can read more about this topic at [www.finewoodworking.com](http://www.finewoodworking.com).]



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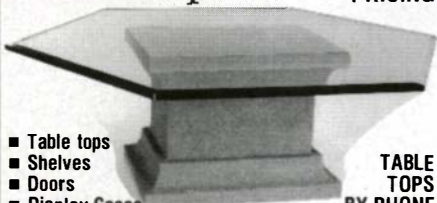
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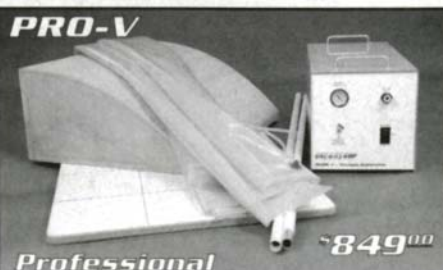
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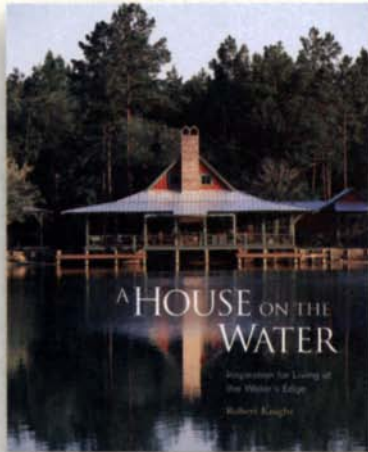
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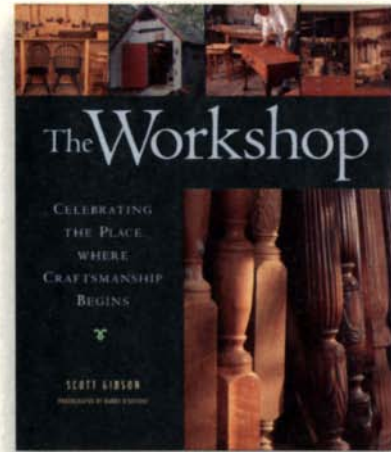
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Many woodworking catalogs offer pre-made bandings and inlays. However, you are limited to the varieties that are available, and most of these lack the crisp detail that is achieved by making your own.

Your own banding can be as challenging as you want to make it. The two bandings covered here are straightforward but very attractive. The first is a simple checkerboard pattern, which is common in Federal furniture and can vary in size and color. I made this pattern with ebony, holly, and holly veneer. Historically, more widely available maple would have been substituted for the solid holly. However, the maple yellows slightly as the wood oxidizes.

The second banding I made is a herringbone. This was the most common pattern used in the William and Mary and Queen Anne periods. The two woods are maple and kingwood. The herringbone banding is a bit more complex than the checkerboard but shares many of the same steps.

### Design considerations

Appropriate dimensions for banding are determined by its use and location. Wide bandings ( $\frac{3}{8}$  in. to 1 in. or more) are appropriate on table and case tops. Smaller bandings ( $\frac{3}{16}$  in. to  $\frac{1}{2}$  in.) typically are used on other furniture components for their fine detail and subtle effect on the lines of a piece.

No matter which style you choose, all bandings start in a similar manner. To keep the pieces manageable, you produce a brick of the desired pattern and then take slices off the edge. The thickness of the brick determines the width of the banding, and the width of the brick's lam-

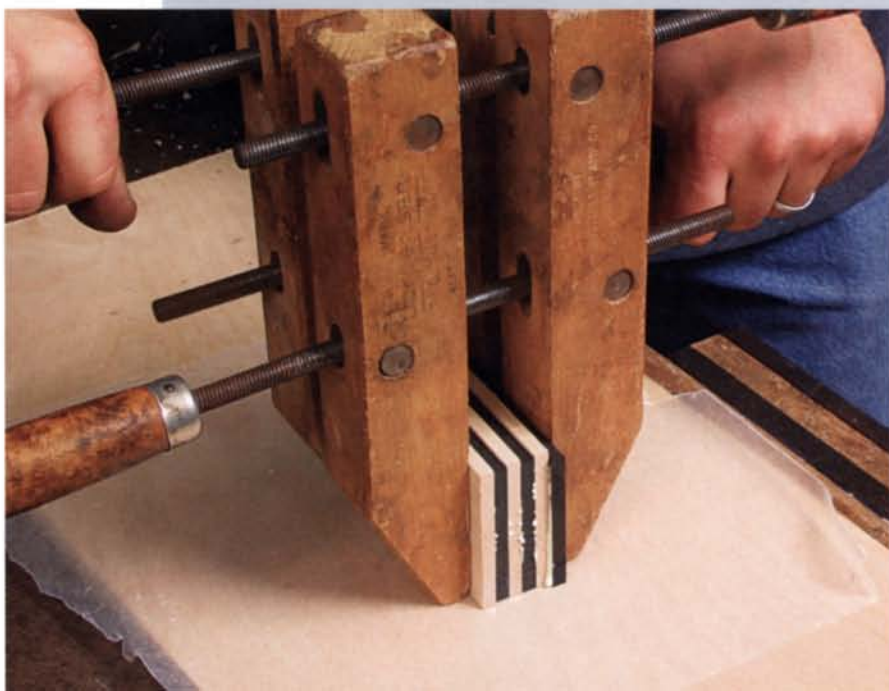
### ALL BANDINGS START AS A BRICK



**Mill the layers.** It is very important that the thickness of all pieces be uniform.



**Cut the layers into pieces and make a brick.** Glue up as thick a brick as you can crosscut on the tablesaw or miter saw. Begin and end with different colors. Evenly apply glue and clamping force, and square up one end when dry.





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## A CHECKERBOARD PATTERN

**Slice the brick.** Glue on a waste block as shown to maximize yield. Then use a stop block to make sure these slices are the same thickness as the individual layers.



inations determines how many strips it will yield. I'll tackle the checkerboard pattern first.

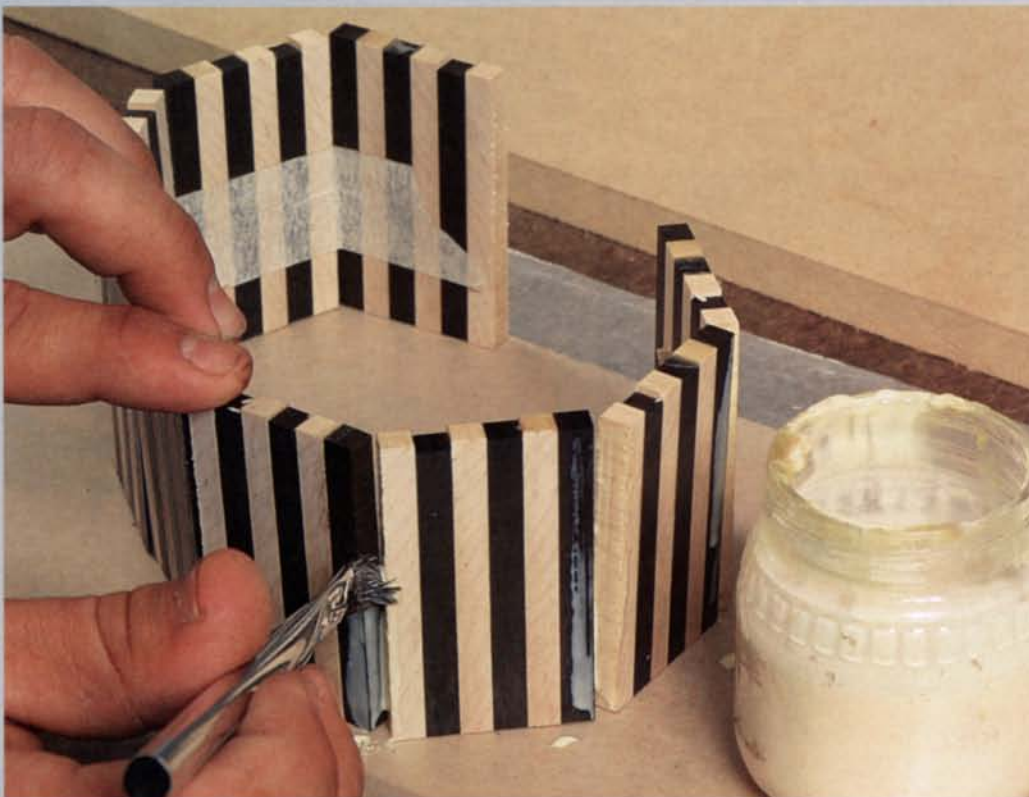
### Checkerboard pattern is straightforward

First, the two species of core stock must be resawn to rough thickness. Send all of the pieces through the thickness planer at the same time to ensure that the material is a uniform thickness. Glue up a stack of these layers, alternating colors, ending with the opposite of the first. Make the stack as high as the cutting capacity of your tablesaw or miter saw will allow. Then cut off slices of the stack to the same dimension as the thickness. Use a stop to make sure each slice is the same width.

On a clean, flat surface like a piece of medium-density fiberboard (MDF), alternate the pieces in a row to create a manageable pack about 12 in. long. Stretch masking tape across



**Assemble the slices into a pack.** Use masking tape to pull one side together (above). Then open the joints and spread glue (right). Now lay the pack tape-side down, which closes the joints, and tape the other side. Last, clamp the pack between layers of wax paper and MDF. For longer bandings, repeat the process to join these two packs into a longer one.



**Add the outer layers.** Glue veneer onto each side, with the pieces oversize to allow for shifting. Then clamp up the complete core between layers of wax paper and MDF.



**Slice off the finished bandings.** Note the setup of the tablesaw: Use a thin blade to maximize yield, a zero-clearance throat insert with a clipped brad acting as a splitter, a featherboard above, and an extra piece of stock glued onto the core to keep fingers clear of the blade.



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# Master Class (continued)

the joints of each pack and pull the pieces together tightly. Now flip over each pack and open the joints like an accordion. Spread glue evenly into the joints, press the pack flat again, and wipe off any excess glue. Tape this side closed. Sandwich the packs between wax paper and use another layer of MDF and some clamps to keep the packs flat until they are dry. For longer bandings, join packs together just the way you joined individual pieces.

The outer layers of veneer should be cut oversize to allow for any shifting that may occur during glue-up. After spreading the glue, I use the same wax paper and MDF setup as before. Use plenty of clamps to squeeze out the excess glue and prevent air pockets.

## Herringbone pattern is cut on an angle

Like the checkerboard, the herringbone pattern begins with resawing solid stock and thickening it uniformly. Again, the pieces are stacked and glued, but this time they

are crosscut with the blade at an angle. This angular cut is the basis for the herringbone pattern. It is necessary to make two cores for this symmetrical pattern. At this stage, one of these cores could be made into a rope pattern (one half of the herringbone) simply by laminating the veneer onto both sides and slicing to thickness.

For the herringbone pattern, laminate both cores together, alternating the darker and lighter blocks and making the diagonal lines point like an arrow. Once the glue has set, glue on the two outer layers of light-colored veneer.

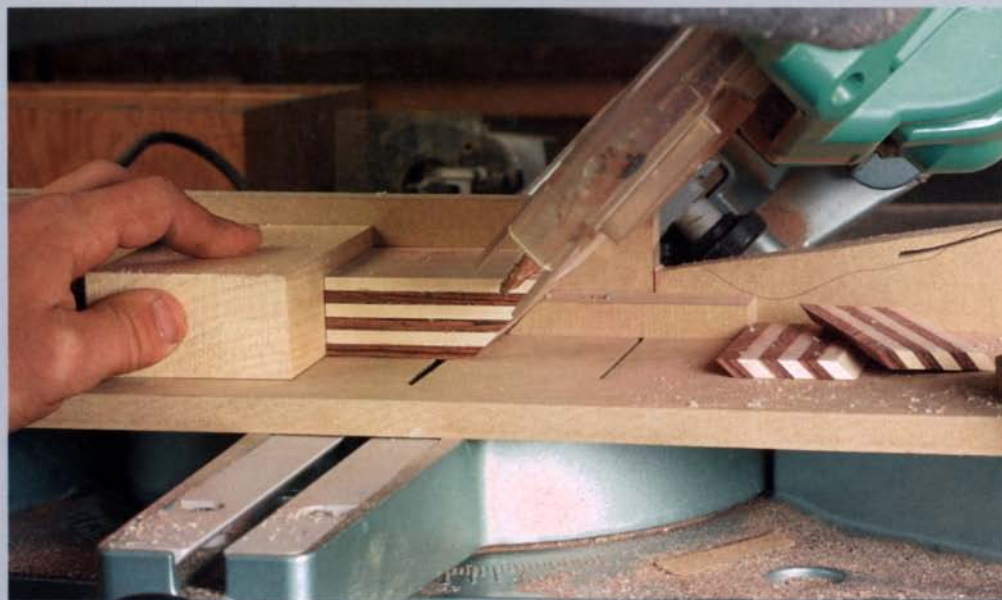
## Slice off strips on the tablesaw

Before slicing off the first strip on the tablesaw, joint one edge of the brick for a square, straight starting point. Also joint the far side of the brick and glue on a scrap piece of wood. This waste block will keep your hands away from the blade when you approach the end of the brick and will allow you to maximize the yield.

Set up the tablesaw with a blade that's  $\frac{1}{16}$  in. thick; you can use either a steel one made for cutting veneer or a carbide circular-saw blade. For cleaner cuts, use a pair of blade stabilizers on the thin blade. It's also important to make a zero-clearance insert and to place a clipped brad into the insert to act as a splitter. Last, a featherboard is required for safe cutting.

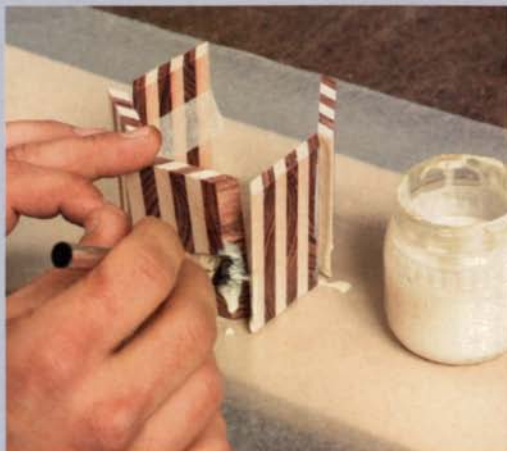
Rip the first piece of banding and check its thickness before proceeding. It is good practice to leave the banding slices a little heavier than needed so that they can be scraped flush after being applied. If the blade is cutting cleanly, continue to cut the whole brick into banding. Store excess banding in a shipping tube or some other container to keep it from breaking over time. □

## A HERRINGBONE PATTERN



**Crosscut the stacks on an angle. This creates the diamond-shaped blocks of color.**

**Two packs form one core.** Glue up and clamp the packs as before. When the two packs are dry, stack and clamp them as shown to create the herringbone pattern. Last, glue on the outer veneer.





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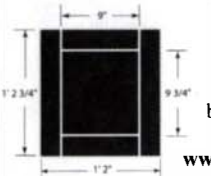
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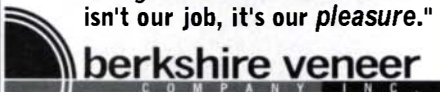
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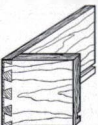
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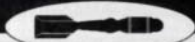
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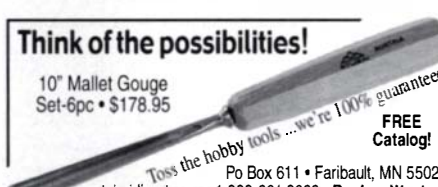


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# Finish Line

## Touching up defects and mistakes

BY JEFF JEWITT

I've been refinishing furniture for more than 25 years, so I have become quite adept at covering up mistakes, mostly other people's but also some of my own. In this article I'll share with you some of the commonly available touch-up products, and show you a sampling of the techniques I use to add back color. Many of these techniques work just as well on new furniture, whether touching up faults that occur during construction or making repairs once finishing has started.

### A short list of supplies

For years professional finishers have used finely ground dry pigments mixed into a fast-drying finish to blend custom colors for on-the-spot repairs. These powders are available through mail-order sources, such as Touchup Depot (866-TUDEPOT; [www.touchupdepot.com](http://www.touchupdepot.com)). The advantage of using a dry, inert powder is that it will mix with any finish. I prefer to mix colors with shellac over anything else, mostly for its quick drying time. If shellac dries too fast for your liking, you can substitute a slower-drying finish such as brushing lacquer or varnish.

Easier to find are fluid artist's acrylic colors, which can be purchased in just about any shade imaginable from an art store or from [Woodfinishingsupplies.com](http://Woodfinishingsupplies.com). Because fluid acrylic colors do not have a thick consistency, they are easy to use with the small brushes required for touch-up work. Acrylic colors can be mixed with a water-based finish, which makes a good touch-up medium and doesn't pose any problems with finishes applied over it.



Acrylic colors also can be mixed with faster-drying shellac; while it's not specifically recommended by the manufacturers, I have had no problems with this method.

It's not necessary to get dozens of colors for touch-up work. You should have raw and burnt umber, and raw and burnt sienna. These earth colors are naturally transparent. I also use black, yellow, and red. Red and yellow tend to be on the bright side, so they're used mostly with the earth colors to modify them. White should be used sparingly because it's opaque. Apply it mainly for disguising dark areas that you want to lighten.

You should have at least two sizes of artist's brushes: a #1 and a #4. The smaller #1 is used for painting in the wood grain, and the larger #4 is used for painting background areas. I prefer sable brushes because they keep a nice pointy tip, but there are some

### BLEND AWAY GLUE SPOTS

Glue left on this frame-and-panel door (photo above) caused a light spot when the stain was applied. To fix this, Jewitt mixes color pigments into shellac, then uses artist's brushes to blend away the problem.



**Begin with the background color.** With the larger #4 artist's brush, add the background color to the glue-spot area.



**Add the grain.** With the smaller #1 brush and a darker pigment, join up the grain lines across the area being repaired.



**Blend the colors.** If necessary, use the background pigment to blur any remaining line between the glue-spot area and its surroundings.



## PAINT OVER SANDED EDGES

A typical mistake is to cut through a stain when sanding a partly finished piece. An easy repair is to use a matching artist's acrylic color and brush it on to touch up the scar.



very good synthetic brushes, which have the advantage of being easier to clean.

### The techniques for touching up

In general, most touch-up situations will require you to make a dark area lighter or a light area darker. Moderating defects that are too light are the easiest techniques to master, so I'll describe those first.

**Disguising glue spots**—Despite your best efforts at avoiding excess glue or cleaning up any squeeze-out, there may be areas that you missed. If you don't see the problem until after the stain has dried, a series of steps will blend the area into the rest of the piece (see the photos on p. 129). First, select a pigment that roughly matches the background color of the surrounding area, and mix it with some blond dewaxed shellac in a paper cup. Use the sides

of the cup as a palette and, with a #4 artist's brush, apply the color to the light area.

Next, use a #1 artist's brush to paint some fine lines to simulate the wood grain. It's surprising how just reconnecting the broken grain lines tricks the eye. If your eye still is drawn to the light area, revert to your background color and #4 brush and fade the color into the darker surrounding area. The aim is to blur any sharp boundary between the dark and light areas.

**Concealing wood fillers**—When I have to use wood putty to fill a hole or other defect, I don't worry about finding colored putty to match the finished wood. Instead, I use only natural-colored putty, which I blend in once I stain or apply the first coat of finish. Wipe on a single coat of blond shellac to discover the finish color of the wood. When using cherry, remember that the wood darkens with age, but pigment doesn't, so apply a color that initially will be darker than the surrounding wood. In general, err on the side of darkness when mixing a pigment.

**Touching up sand-throughs**—Another common mistake is sanding through the finish on the edges of a piece. Oil and other in-the-wood natural finishes are easy to fix because you can just reapply more oil, but on a stained surface or clear-coated natural surface with a film-forming finish, you'll have to add color. To do this, mix the appropriate artist's acrylic color and clear finish. Use the edge of a brush to paint the surface's lighter edge (see the photo at left).

**Blocking out darker areas**—When you have a dark area such as a wood defect or filler that is stained too dark, the solution is to block out the area by painting over it. Several applications of different shades usually will be necessary to mimic the surrounding wood. For example, to conceal a sap pocket in a cherry board, begin by sealing the entire surface with shellac to provide a color reference for selecting the pigments. Don't make the touch-up look too perfect from a close perspective. Instead, with the tip of the #1 brush, dab different-color dots on the repair (see the photos below). When viewed from a distance, the paint dots blend together to make the repair less discernible. □

## BLOCK OUT DARK AREAS

Dark spots, whether from a defect in the wood or a filler that is stained too dark, need to be covered and toned in.



**Background color.** Dab the surface with the tip of the brush to create a series of dots, which from a distance will blend together.



**Adding color.** Use a smaller brush to add dots of the secondary, or lesser, colors in the surrounding wood.



**Blend it in.** If your dabbing technique was a little crude, blend the colors together with a few gentle strokes of the shellac-dampened brush.



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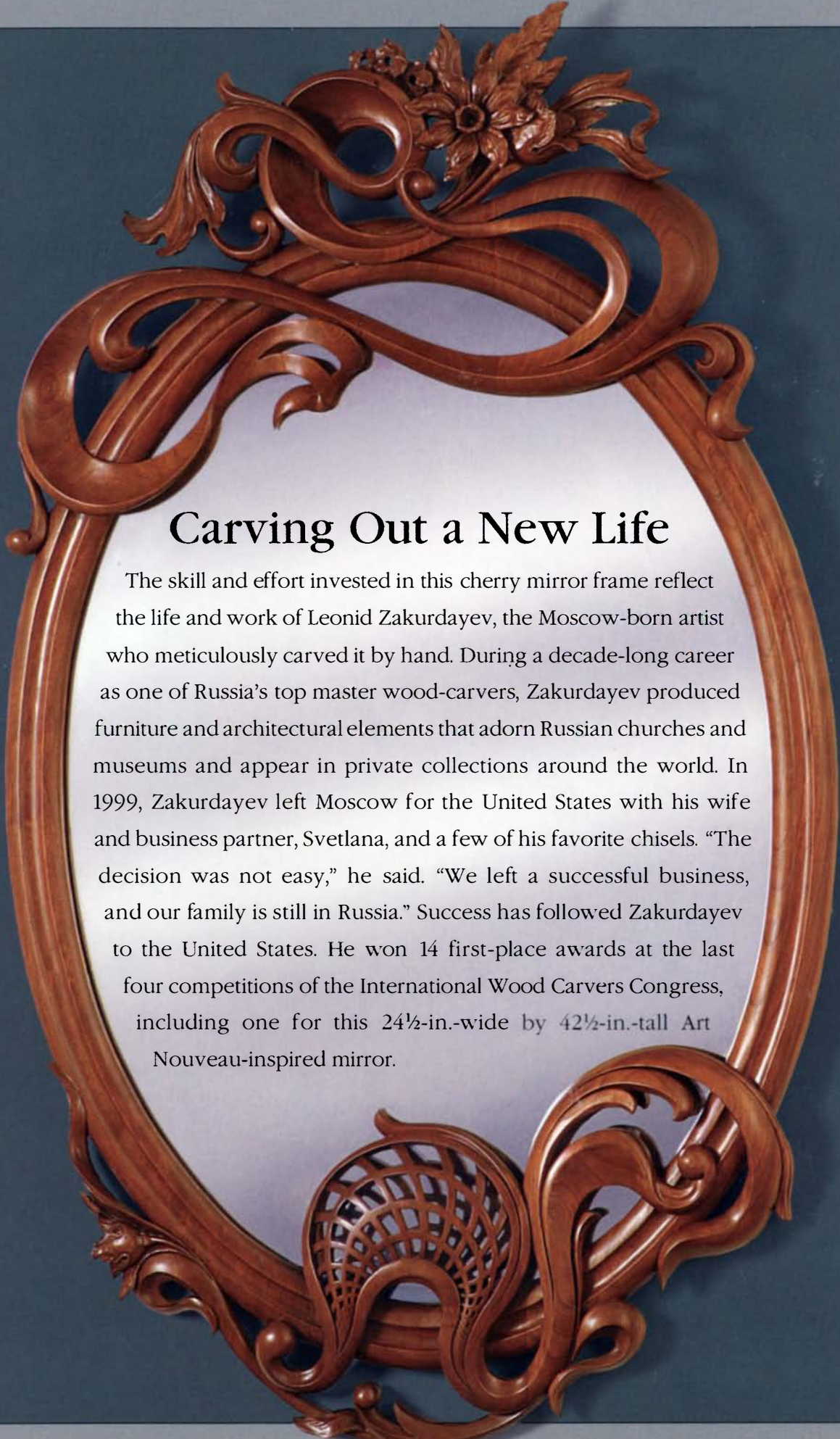
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## Carving Out a New Life

The skill and effort invested in this cherry mirror frame reflect the life and work of Leonid Zakurdayev, the Moscow-born artist who meticulously carved it by hand. During a decade-long career as one of Russia's top master wood-carvers, Zakurdayev produced furniture and architectural elements that adorn Russian churches and museums and appear in private collections around the world. In 1999, Zakurdayev left Moscow for the United States with his wife and business partner, Svetlana, and a few of his favorite chisels. "The decision was not easy," he said. "We left a successful business, and our family is still in Russia." Success has followed Zakurdayev to the United States. He won 14 first-place awards at the last four competitions of the International Wood Carvers Congress, including one for this 24½-in.-wide by 42½-in.-tall Art Nouveau-inspired mirror.