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October 2004
No. 172

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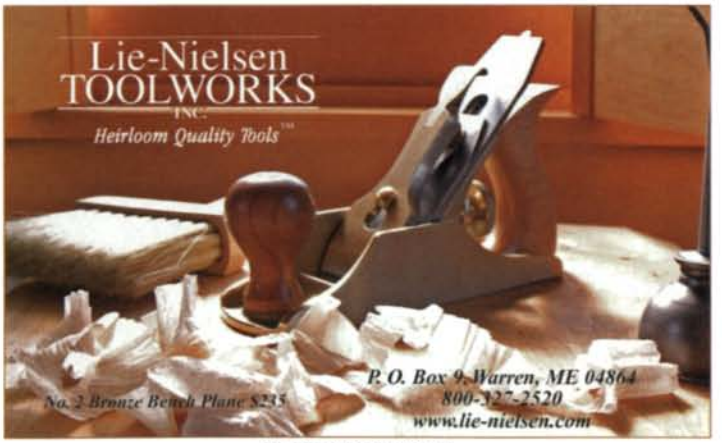


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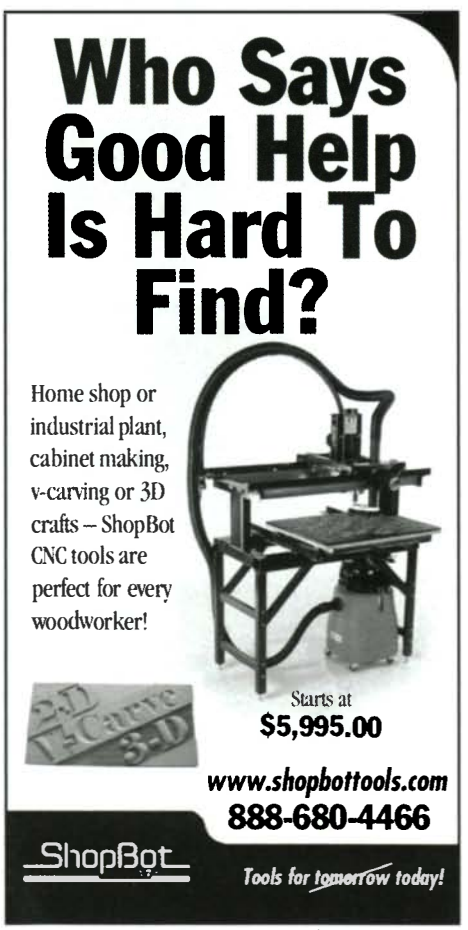


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# Departments



**On the Cover:**
*In our latest tool test, we review an assortment of bar clamps, choosing the best from each category.*
*See p. 62*
*Photo: Michael Pekovich*

*Build a Shaker blanket chest, p. 46*

*Cabinet doors that slide smoothly, p. 58*

*Turned drawer pulls add character, p. 82*

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# Articles



*Handplane tune-up, step by step, p. 36*


*A professional finisher's favorite products, p. 42*



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# Contributors

**For more than 15 years, Brian Boggs (A Closer Look) has been teaching students how to make chairs with hand tools. To make the handwork easier, Boggs designed several spokeshaves, which are now being produced by Lie-Nielsen Toolworks. His creative mind also has been working on improving production techniques, which often means making his own equipment. After inventing a machine that prepares the bark that Boggs weaves for chair seats, his big project for this year is converting a 36-in. bandsaw into a sawmill.**

**Charles Durfee's** ("A Shaker Blanket Chest") first experience with wood was as a carpenter, but he didn't progress much beyond sawing 2x4s to length and pushing up walls. The real exposure began while building wooden boats in Maine a few years later. Traditional workboats were the ultimate in form following function. When his interest turned to furniture, he found the Shaker design aesthetic, based on the same principle, particularly satisfying. Most of Durfee's work has been relatively spare and unadorned, but of course functional. "In the 25 years I have been building furniture," he said, "I have rarely reproduced a Shaker piece exactly; but its influence has seeped into most all of my work. Simplicity can be a gift indeed."

**Tim Albers** ("Bar Clamps, Head to Head") spends his days as the chief financial officer of a food-processing company. When not at work, he takes his woodworking seriously, making furniture for family and friends. What he means by "for family and friends," Albers admitted, is that he builds whatever he feels like and then gives it to someone. He also is a confessed tool junkie, always looking for ways to add new or refurbished tools to his cramped workshop.

**Teri Masaschi** ("Favorite Finishing Products") owns and operates The Tijeras Collection, a restoration and refinishing business near Albuquerque, N.M. Her extensive knowledge of finishing means she is in growing demand both to write about and teach the subject. Her classes at woodworking schools across the country include three courses at The Center for Furniture Craftsmanship in Maine. Brought up in New England, Masaschi said she has had no regrets trading the humid summers and long winters for the dry conditions in the Southwest, despite the continuing drought there and the constant threat from wildfires in the woods that surround her home.

**Allan Breed** (Master Class) has been fascinated by old buildings and furniture since his early teens and has been copying Colonial American furniture full-time since 1976. Deciphering tool marks and methods of construction in New England pieces has been his motivating passion and the subject of many lectures to collectors and dealers over the years. Breed recently began passing on his knowledge of hand-tool use at The Breed School, where he teaches five-day classes in carving and traditional cabinetmaking from May through November. Go to www.allanbreed.com for more information.

**Gregory Paolini** ("CAD on a Budget") designs and builds custom and reproduction furniture and cabinetry with help from his wife, Ramona. "I never had any formal training in woodworking. I inherited some hand tools and began making some really, really bad things," he said. His woodworking has progressed so much that two decades later, he is a juried Roycroft Artisan. Paolini lives minutes away from the original Roycroft Campus in western New York.


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# Letters

### Remembering Tage Frid

Two things I purchased shortly after I started woodworking as a hobby were a subscription to *Fine Woodworking* and *Tage Frid Teaches Woodworking /Book 1: Joinery*. The magazines always were read and kept in my front foyer bookcase. Frid's book was on my shop shelf. It was the tool I used to build the pieces the magazine inspired. I've had the book for more than 20 years, but last year it received a significant improvement. My wife worked as a nurse at the home where Frid was a resident and asked him to sign my worn, stained copy of his book. The signing brought a smile to his face, despite his failing health. I was going to build a dovetailed (pins first) wall case for the book, but I think it belongs with the rest of my tools in the shop. Thank you for years of pleasure, Mr. Frid.

*—Chris Hughes, Newport, R.I.*

### An advocate of fun

It was interesting to read the comments of Tom Hartford in his letter "Don't take the fun out of *Fine Woodworking*" (*FWW* #170, p. 10). I find myself in complete agreement with him and credit him with providing me with the motivation to write this long-overdue letter. It appears that you have some subscribers who only enjoy finding a minuscule fault with your articles. These people most probably never have bought anything they were truly satisfied with, and criticism is their way of life. I subscribe to your magazine because I enjoy learning about new products, better woodworking techniques, and the accomplishments of talented craftsmen. Continue to maintain the high quality of content. If I find I have nothing better to do than write you with criticisms, feel free to stop sending me any further issues.

*—Jim Doran, Hamburg, N.Y.*

### Bandsaw guides revisited

The drawbacks of steel, solid-block bandsaw guides were mentioned recently in the review "18-inch Bandsaws" (*FWW* #170, pp. 64-71). However, I have found that these basic guides handle resinous woods far better than wheel or bearing guides. Solid blocks will knock the resin buildup off the side of the blade, and resin won't build up on the guide system as on wheel or bearing guides.

*—Brian T. Derber, Presque Isle, Wis.*

### The gritty truth about granite

I am writing in response to the letter "Inexpensive alternative to use with abrasives" in *FWW* #171 (p. 10). The writer raised some questions about the granite plates sold by Woodcraft, where I work. The granite plate is fine when used properly, that is, abrasive side of the paper up. A light spritz from a misting bottle or a few drops of water are all that is required to affix the sheet to the plate temporarily. As you move up in grit, simply peel off the paper, rinse (not wipe) any slurry that may wash onto the plate, and apply the next grit. The manufacturer's caution advises that you not apply fine-grit honing compounds or other stones (or similarly abrasive materials) directly to the face of the plate.

If you truly want a lower-cost alternative to the plate, we have customers who swear by using ⅜-in.-thick or greater float glass. Others use medium-density fiberboard (MDF), which is probably a little less reliable but more cost efficient. I have tried both of these, and although I find that the float glass is more accurate, MDF will do in a pinch.

*—Phil Bourassa, Plymouth, Mich.*

### Keep it square

I would like to add one more technique to Ernie Conover's informative article on the best practices for drilling (Rules of Thumb, *FWW* #170, pp. 24, 26, 28). A simple technique to square a handheld drill and bit to your workpiece is to stand a cheap picture-frame mirror close to your work so that the drill and bit are visible in the mirror. Tilt the drill a little, and you quickly will see where perpendicular lies.

*—Pat Severin, Issaquah, Wash.*

### Likes and dislikes

Bill Howorth's letter "Where's the dust?" (*FWW* #169, pp. 8, 10) was just perfect. I, too, have been struck by the "perfect" shops of your authors and likewise have endured comments from my spouse about how messy and dusty my shop is. I hope Howorth writes again soon about the woodworker's condition.

I also agree with Alan K. Tope's letter "Stick to the title" (*FWW* #169, p. 10). I subscribe to *Fine Woodworking* to learn about advanced techniques. I can find the basics in a number of other places.

Keep up the fine work.

*—P. Michael Henderson, Tustin, Calif.*

### Planes as paperweights?

I thought the last issue (#171) was great. There are some beautiful planes I would love to have—but I would use them as paperweights. My husband has to be on constant guard. I argue that not being a woodworker shouldn't be held against me, and that beautiful tools please me just by being close by. He is not moved. Oh, well. I guess I understand. I wouldn't like to have my standing mixer or chef's knife end up in his workshop just so he could look at them.

Seriously, the issue was beautiful. I particularly enjoyed the article about Hank Gilpin.

*—Maria McKee, via email*

### No fan of nails

Other than for the decorative effect of exposed heads, nails by any standard have virtually no place in fine furniture—indeed, in any furniture other than thrown-together junk. I cannot imagine how the same issue of *Fine Woodworking* could contain both an homage to Tage Frid and an article (Rules of Thumb, *FWW* #171, p. 88, 90, 92) that is so antithetical

**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*

***Writing an article***

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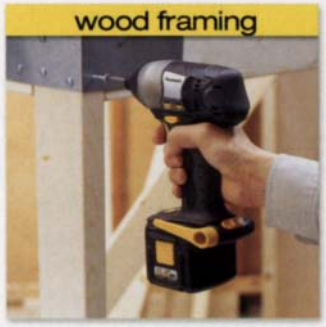



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to the design and construction principles he espoused.

The reasons why nails are inappropriate go far beyond aesthetics. Contrary to the article, nails in fact are lousy fasteners. Nails are good only for pinioning—preventing lateral movement between two pieces. Nails are not good for preventing two pieces from separating.

Cut nails do more damage to wood fibers than wire nails, not less. Wire nails spread the fibers, while cut nails sever them. Cut nails only hold better in wood because their surface is rougher than the surface of wire nails. However, neither type of nail is permanent enough for use in furniture. The natural expansion and contraction of wood will work all nails loose.

The only way to use nails in furniture is (a) where they can't be seen, and (b) together with glue. Cleats? Never. Moldings? Never. Set nails and fill the holes with filler? Poor idea, since it is not possible to match colors precisely enough to camouflage the holes perfectly. Attach a cabinet back? Bad idea.

*—Fred Blum, via email*

**EDITOR REPLIES:** By all means, skip the nails for your own work if you don't like them. Yes, they are old technology. So is wood—it splits, warps, and discolors, and, dare I say, is not the perfect material. I agree with you that nails are inappropriate for most contemporary furniture, Garry Knox Bennett's 1979 cabinet (see p. 24) notwithstanding, but they are perfectly correct for period work.

### A fan of shellac

I appreciated the article by Peter Gedrys on using shellac finishes ("Versatile Shellac," *FWW* #166, pp. 40-45). Nothing gives you the ability to look into the wood like a polished shellac finish.

Shellac also is excellent as an undercoat and will enhance the natural beauty of wood. It works well as a sanding sealer and will give you a smooth finish more quickly, no matter what other finish you topcoat it with. When used as a sanding sealer, shellac is best applied by spraying.

Any refinisher will tell you that when you need to remove a finish cleanly, you should be thrilled when there is shellac under it. If you have a problem and need to start from scratch, your finish will strip off easily when there is an undercoat of shellac. And last, when padding shellac, I have found that cheesecloth is not a must. Wool socks or sweaters can be used for the pad. Wool retains fluid well, keeping your pad from getting too wet.

*—Nikki Palesh, Hudson, Wis.*

### The good old days

Look back at the first eight or 10 issues of *Fine Woodworking*—they were in black and white. Those issues are so cool! No one is appalled because the tablesaw does not have a guard and a splitter on it. How about a commemorative issue in black and white?

*—Lonnie Waldrip, Mullin, Texas*

### Special thanks

Often in our busy lives we fail to take the time to thank those who have had a significant, positive influence on us. That is the purpose of my letter to you, to thank you and your staff for helping me learn skills that have enriched my life.

I recently retired, having served close to 30 years as a special agent of the F.B.I. Prior to that, I was an officer in the Marines. Back in 1975 my wife gave me a subscription to a new magazine, *Fine Woodworking*. My professional life involved a great deal of confrontation, ugliness, and evil. *Fine Woodworking* provided me with a respite from my important yet taxing work and offered me an opportunity to craft useful and beautiful items. I began with no skills whatsoever and advanced by reading each issue cover to cover, then experimenting with projects and tips.

Most magazines are read and disposed of. I have all of the *Fine Woodworking* issues and frequently refer to the index of articles as I begin a new project. I am not a highly skilled artisan, but I have crafted numerous cabinets and furniture pieces over the years that fill my house and those of my family and friends. Please remember that most of us will never be Krenov or Maloof, but we are people whose talents are challenged and who benefit the most from your exceptional publication.

*—Chuck Grelecki, Crown Point, Ind.*

### Attention drill-press makers

Recently, I was browsing in my local Woodcraft store when I noticed the drill presses. Woodworkers still use drill presses that are used by steel-working tool shops and metal fabricators. They are not designed for the woodworker! The woodworker can use them, but it is analogous to driving a Ford Model T when one could drive a T-Bird.

I often have considered buying a drill press, but it is a throwback. Instead, I use my almost 50-year-old Shopsmith for both horizontal and vertical drilling as well as light-duty routing.

Let me list a few features that a woodworking drill press should have:

1. It should have a variable-speed feature that operates easily.
2. It should be capable of high rpm for minor routing operations.
3. It should have a good-size table, perhaps square, with a removable fence that can be used in either the X or Y dimension.
4. The plane of the table should rotate and be accurately indexed at 0°, 45°, and 90° so that one could drill end grain with the table in the 90° position.
5. It would be helpful if the table could move in or out relative to the column (but one cannot have everything).

*—Ed Mullikin, Roanoke, Va.*

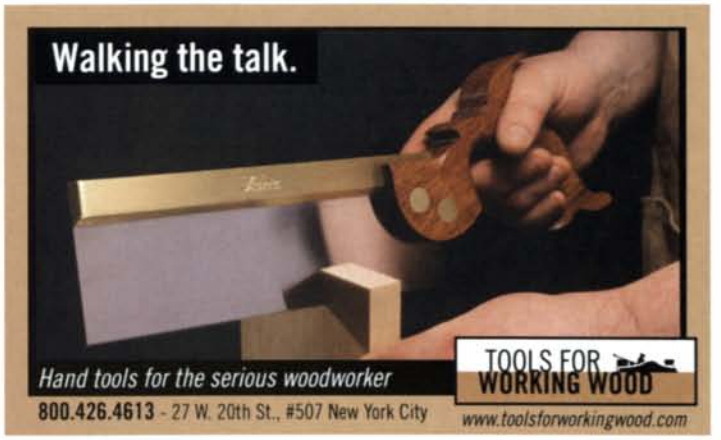
### Corrections and clarifications:

In "An extraordinary patina finish" (Master Class, *FWW* #170, pp. 100, 102, 104), the description of two examples did not match the photos. On p. 104, the copper-leaf panel (reddish green) is on the right, and the Dutch metal leaf (light, chalky yellow and green) is on the left.

In the article "Shoulder Planes Reviewed" (*FWW* #171, pp. 42-47), the bedding angle of the blades on the Gordon planes should have been listed as 60°, not 65°.

In the article "Laminate Trimmers" (*FWW* #171, pp. 68-73), the contact information for Freud America Inc. is for a retailer. To contact Freud directly, call 800-472-7307 or visit www.freudtools.com.

In the Finish Line "Altering the colors of dyes and stains" (*FWW* #171, pp. 113-114), we left out information on the source of the color wheel pictured. The one shown is from The Color Wheel Co. (541-929-7526; www.colorwheelco.com).

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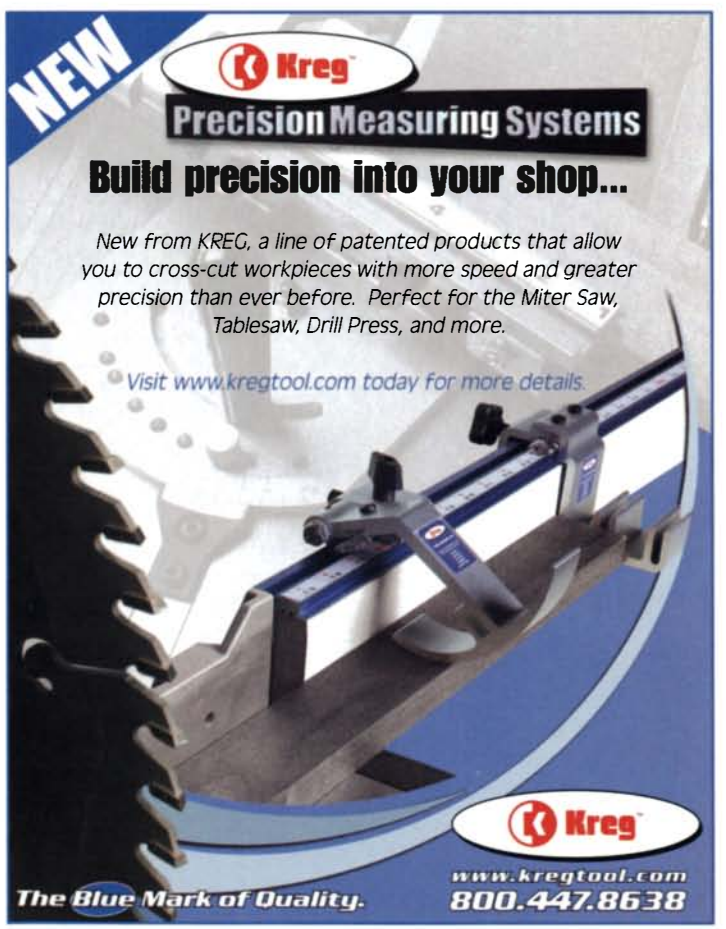


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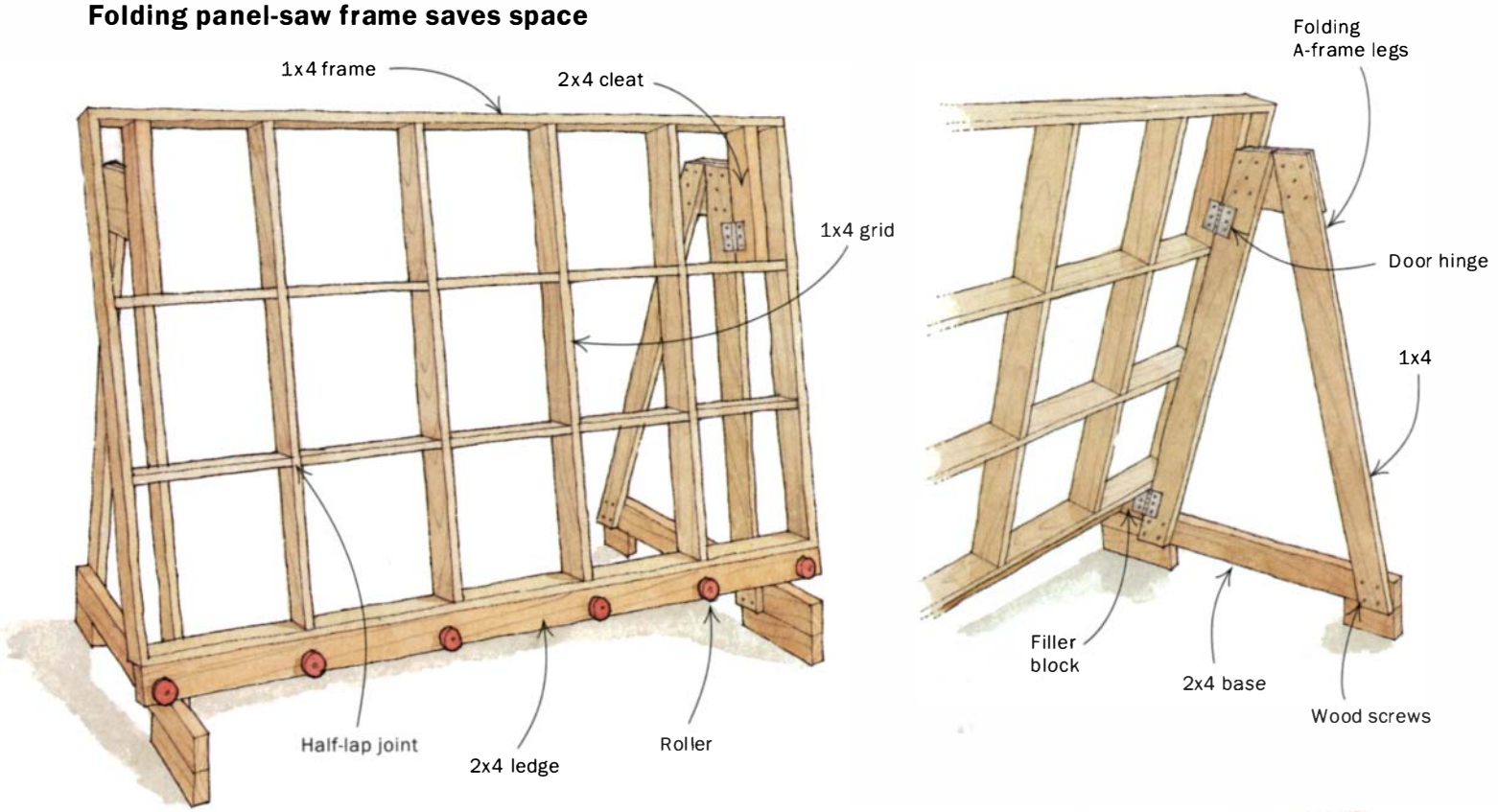
# Methods of Work

EDITED AND DRAWN BY JIM RICHEY

## Folding panel-saw frame saves space

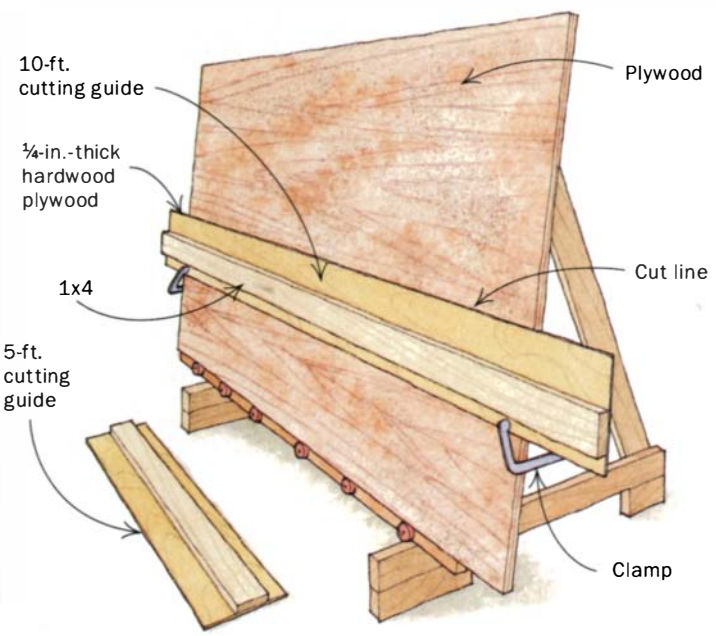



Cutting down full sheets of plywood has always been a hassle. I don't have room in my shop for a commercial panel saw, so I built a version of one that works well and folds flat against the wall when not in use.

To make the fixture, first build a grid by butting and screwing 1x4s on edge. Half-lap joints connect the grid parts. The ends of the grid parts are screwed to the frame. In use, the saw cuts into the front edges of the grid, so keep any screws well back from those edges. Use lag screws to mount a 2x4 ledge to the bottom edge of the grid and drill holes for six rollers—I salvaged wheels from a pair of kid's roller-skates found at a yard sale—to support the sheet.

Next, build the folding A-frame legs by gluing and screwing lx4s to a 2x4 base. The legs should support the grid at about 80° to the ground. Size the legs so they don't overlap each other when folded flat. Also, extend the feet forward of the rollers for stability.

Before the legs can be mounted, you need to attach a pair of 2x4 cleats to the frame and screw a filler block to the ledge to help transfer the weight of the sheet to the legs without stressing the




### *A reward for the best tip*

*A machine-design engineer by profession, Ivan Helmrich does his woodworking in a small basement shop, where he uses mostly hand tools. He also enjoys making tools. For his winning tip, he'll receive a set of hand-forged bench chisels from Barr Specialty Tools (www.barrtools.com). Send 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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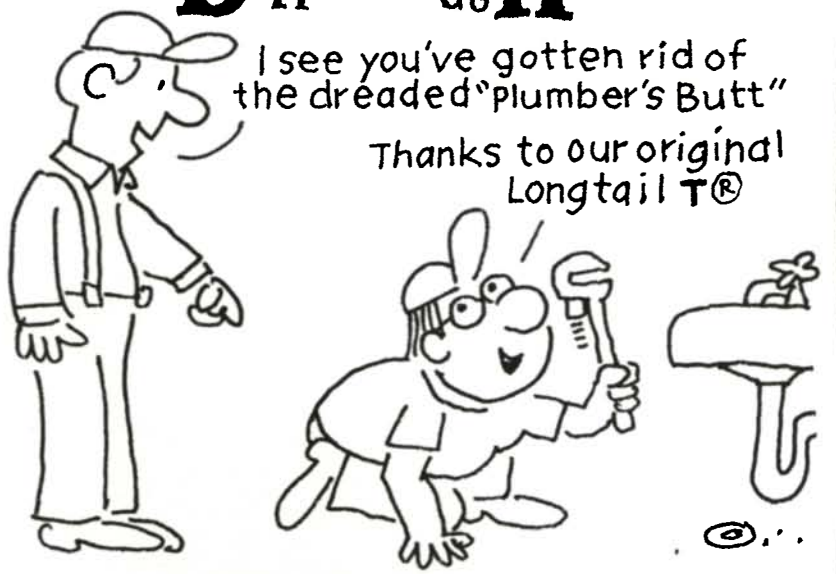


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grid. Use door hinges to mount the A-frame legs to the cleats and the filler block.

A pair of cutting guides—a five footer and a 10 footer—completes the project. Each guide is made of a 1x4 glued to ¼-in.-thick hardwood plywood. Cut the plywood wider than necessary and let the first cut with your portable circular saw clean up the edge.

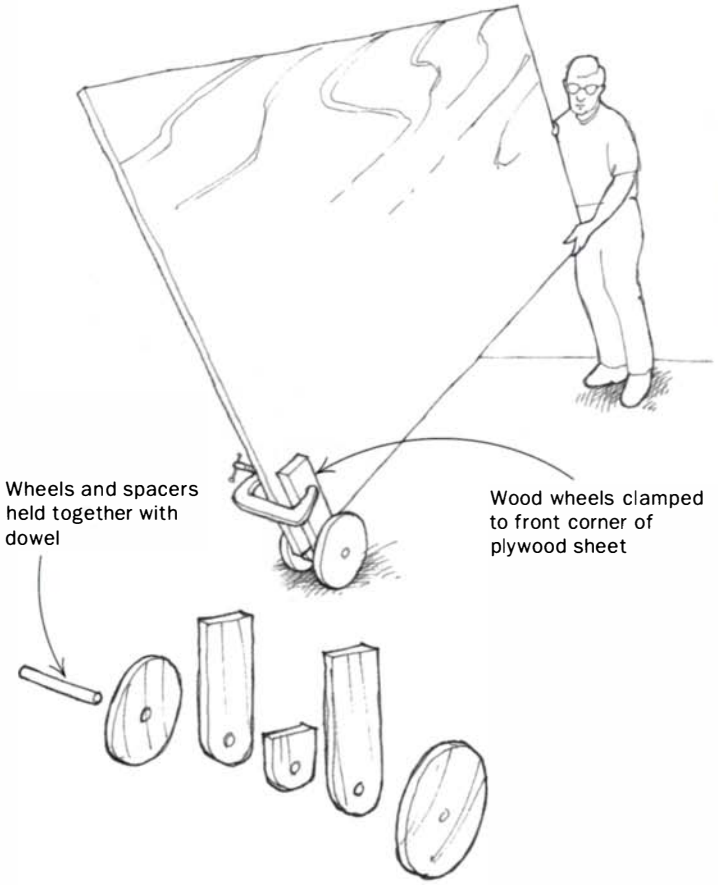
To use, mark both ends of the cut line on the sheet and clamp one end of the guide close to the line. Carefully line the other end right to the other mark. Then go back to the first mark and put the edge of the guide right on it. Secure the sheet to the grid below the cut line with a third clamp to keep the sheet from moving during the cut. Then add a clamp above the cutline to prevent the upper piece of plywood from pinching the blade during the cut. Finally, set your saw depth to no more than ¼ in. more than the sheet thickness and make your cut.

*—Ivan Helmrich, Kansas City, Mo.*

**Quick tip:** The metal shims that come with stacked dado sets are cumbersome to use and difficult to remove from the arbor. I use masking tape instead. The low-stick blue tape works best because it can be removed easily. One layer of tape equals about 0.005 in.

*—Gregg Kerber, Sammamish, Wash.*

## Wheels for moving sheet goods

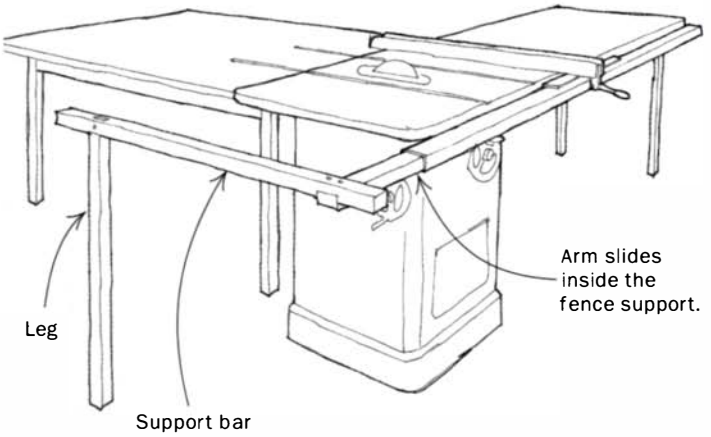



I often need to carry 4x8 sheet goods between two workshops at the school where I teach woodworking. It's usually not a problem when help is available, but there are occasions when I find myself confronted with the problem of moving a number of sheets on my own. We use a lot of ¾-in.- and 1-in.-thick plywood, and the sheets can be quite heavy.

So I made a set of wooden wheels that could be clamped to the front corner of the sheet. With the wheels in place, I simply pick up the back of the sheet and walk it to its destination with ease.

*—Martin Collins, Lisduggan, Waterford, Ireland*

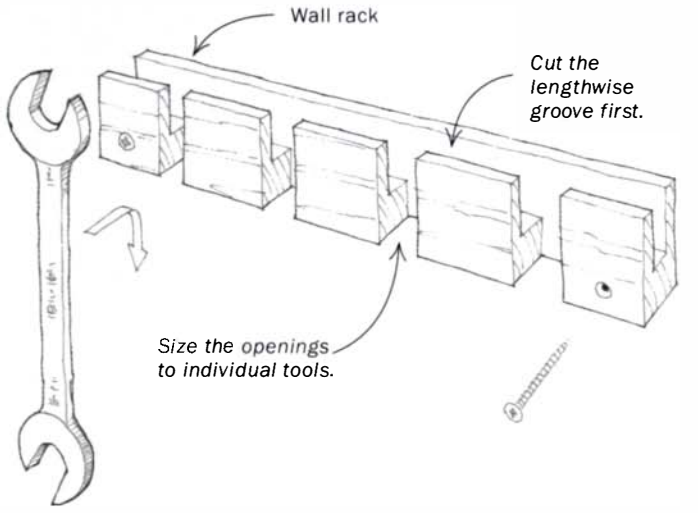
## Support for ripping plywood




I use this simple support to aid in cutting full sheets of plywood on the tablesaw. The support consists of three parts—an arm, a support bar, and a leg—and it's easy to make. Size the arm to fit inside the square tubing of the fence rail on your tablesaw and join the parts so that the support bar is the same height as the saw table. When it is not being used, the support rests against the saw table. To use the support, just pull it out to whatever width you need.

*—Vern Tator, Friday Harbor, Wash.*

## Wall rack for open-end wrenches




I tried all sorts of holders for the tools I need in my shop, but none of them was completely satisfactory. I prefer a wall rack that positively indicates whether a tool has been returned after use. I built this rack to store open-end wrenches. The rack works well and could be adapted to other types of tools.

To make the rack, first cut a groove down the center of one edge

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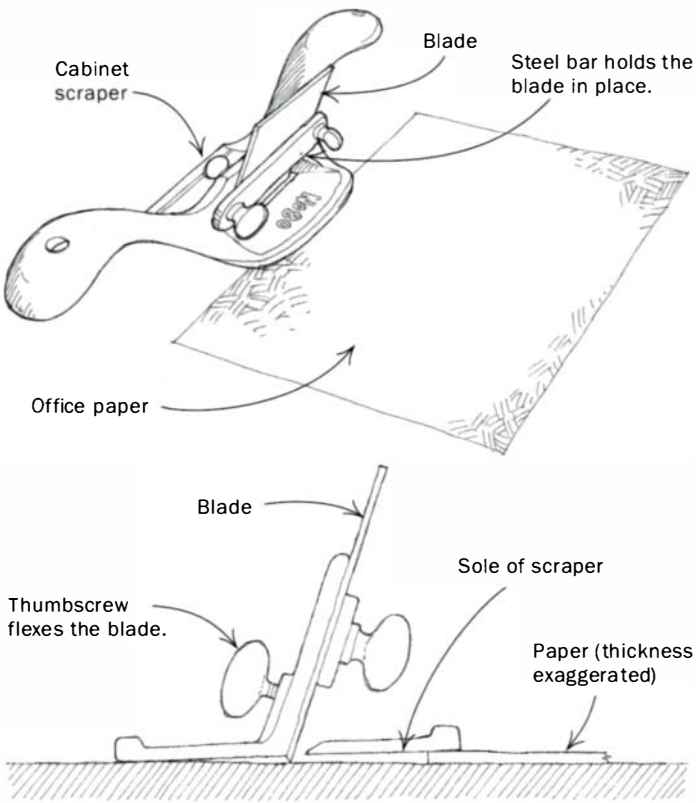
of a piece of solid wood. The groove should be wide enough to hold the largest wrench in the set. Now, spread the wrenches along the workpiece, spacing them more or less equidistant from each other. With a pencil, mark the width of the shank of each wrench on the edge and cut a notch in the face of the workpiece for each wrench as indicated by the pencil marks. To complete the rack, drill a couple of mounting holes at both ends.

*—Lary Shaffer, Scarborough, Maine*

**Quick tip:** Twist bits make great feeler gauges. For example, if you want a 3/32-in. clearance between door and jamb, just slip in the shank of a 3/32-in. twist bit. The best part is that you probably already have a complete set of bits in your shop.

*—Ed Diepenhorst, Holland, Mich.*

## Setting a cabinet-scraper blade



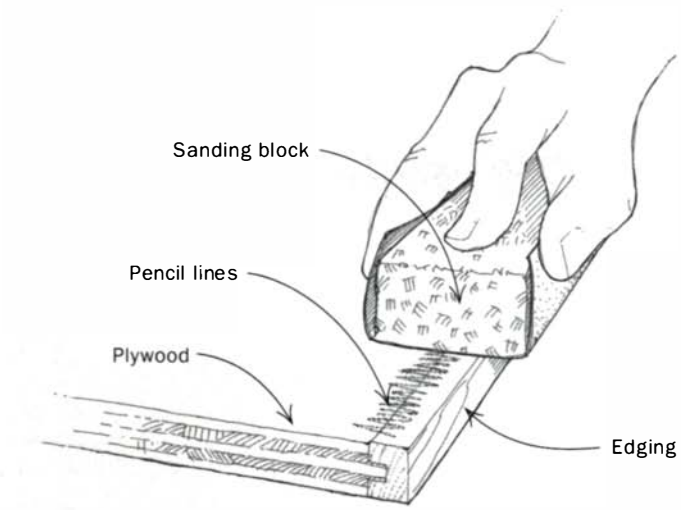

The blade of a Stanley No. 80 cabinet scraper is held in place by a small steel bar that is secured by two screws in the body of the scraper. On the other side of the scraper, the user can tighten a thumbscrew that flexes the blade in the center, which affects how coarse or fine the shavings will be. Consequently, a short portion of the edge of the scraper blade does most of the work, and that part of the blade rapidly loses its sharp edge.

Here's a way of setting the blade that will ensure the whole of its cutting edge is effective. Start by properly preparing the cutting edge—file, hone, and burnish it. Round over the corners with a fine file. Place the scraper, sole down, on a reliably flat surface, such as the machined top of a tablesaw. Tilt the sole ever so slightly by placing a strip of ordinary office paper under the front edge. Firmly hold down the scraper and slip the blade into position so that its cutting edge rests on the flat surface. Tighten each of the two screws on the steel bar that holds the blade in place, but don't tighten the thumbscrew.

The scraper is now ready for use and will remove silky shavings half the thickness of the paper used to tilt the sole.

*—Brian Addis, Pretoria, South Africa*

## Sanding solid-wood edging on plywood

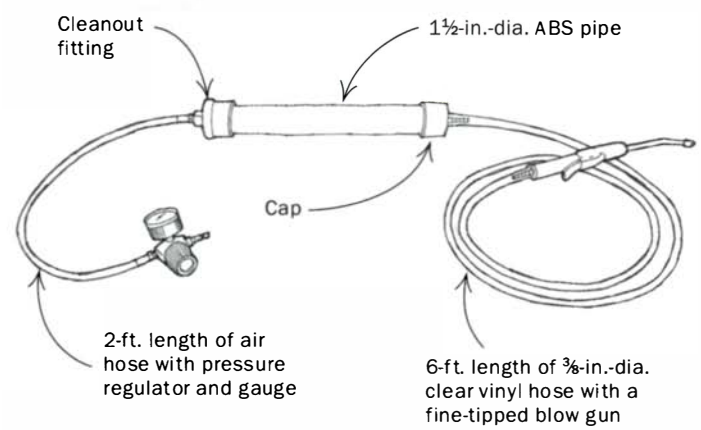



When applying solid-wood edging to veneered plywood, I always cut the edging a little wider than the thickness of the plywood. So once the edging has been applied, it sits slightly proud (usually about 1/64 in.) on both sides of the plywood. That allows me to sand the edging perfectly flush with the plywood.

When sanding the edging, however, it's easy to inadvertently cut through the thin plywood veneer. To avoid the problem, I scribble pencil lines across the edging and veneer. Then I sand the edging while watching the pencil lines. When the lines on the veneer side begin to disappear, I know the edging is flush. Any sanding beyond that point is done very cautiously.

*—Eric L. Mynter, Remsen, N.Y.*

## Air-powered glue applicator




I have seen air-powered glue applicators in large commercial woodworking shops but have yet to see one made for home use. So I took a look at the basic principle behind the system and designed my own. I started with a 12-in. length of 1½-in.-dia. ABS

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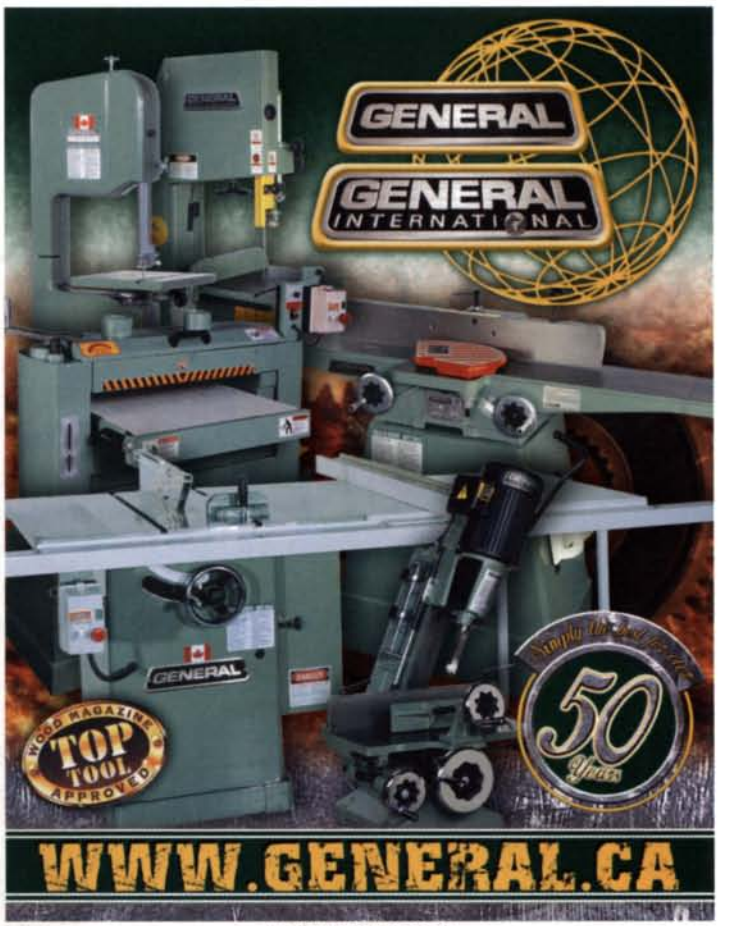


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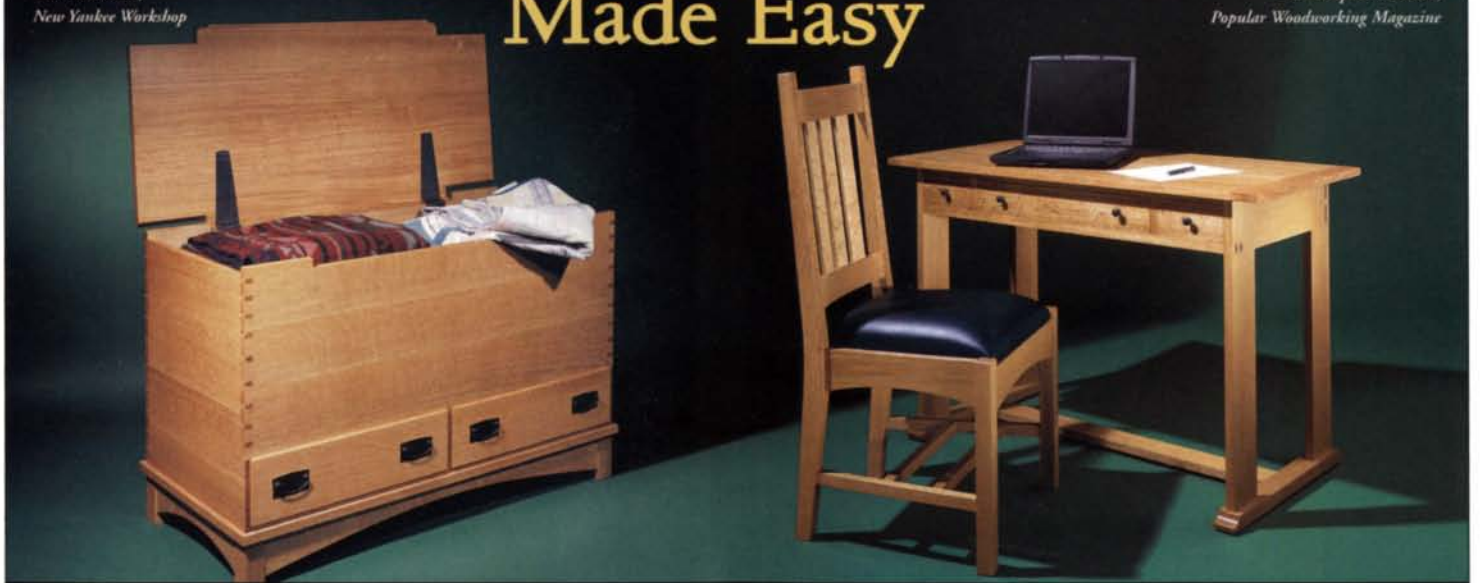


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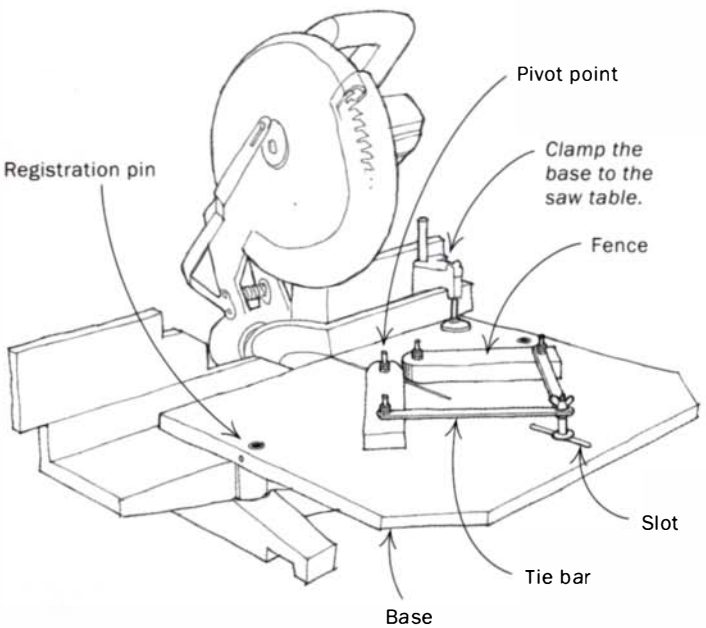
pipe. After gluing a cleanout fitting on one end and a cap on the other, I drilled and tapped the center of each to accept a ¼-in. pipe thread. On the cleanout end, I installed a 2-ft. length of air hose with a pressure regulator and gauge on the end. The cap end was fitted with a 6-ft. length of ⅜-in.-dia. clear vinyl hose and a fine-tipped blow gun.

To use, I fill the pipe at the cleanout-fitting end with yellow glue. Then I hang the pipe in a convenient place and apply 5 psi to 10 psi of air pressure. When the trigger is pulled on the blow gun, the glue comes out in a nice, even flow. The tool is especially great for getting glue into tight spaces, such as mortises and corners.

*—Scott Frankland, Bedford, N.S., Canada*

## Adjustable jig for cutting miters




While installing trim in my slightly out-of-square family room, I struggled to get outside miter joints that fit accurately. So I built a miter-saw jig that can cut a miter to any angle within a few degrees of 45°. The jig can be used for other woodworking situations where corners aren't quite square.

Registration pins on the plywood base fit into holes in the saw table, automatically ensuring that the jig is properly aligned each time I use it. A pair of fences on the jig works in tandem. One end of each fence, the end nearest the blade, pivots on bolts that connect through the base. The other end of each fence pivots on steel tie bars, with the other end of the tie bars attached to a slotted pivot point in the base.

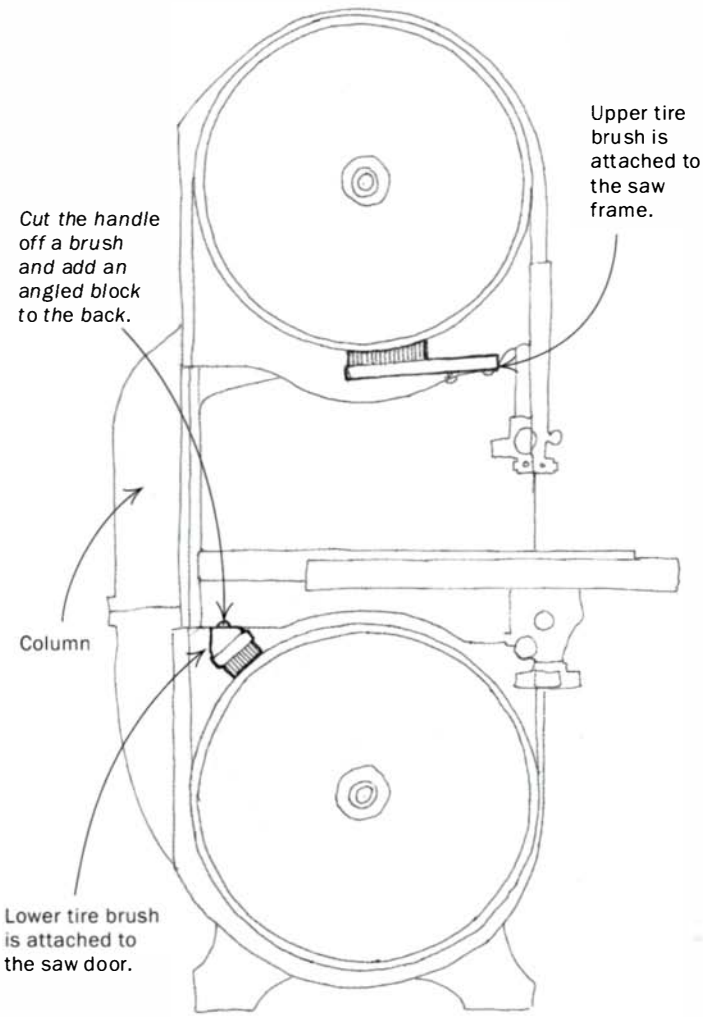
Sliding the pivot point front-to-back in the 2-in.-long slot allows the fences to move enough to create angles slightly more or less than 90°. (Note: Short fences, 8 in. to 10 in. long, work only for small trim.) Make the fences and the tie bars exactly the same length and locate the adjustment slot exactly in line with the blade; otherwise, the cuts won't come out correct.

The jig is easy to use. First measure the angle of a wall with a sliding bevel. Then use the bevel to adjust the two fences to the measured angle. Lock the fence securely.

Now place the trim piece against a fence and make the cut. To cut the other side of the miter, place the next trim piece against the opposite fence. The result is a tight-fitting miter joint, even if your walls are a little out of square.

*—Neil Bough, Elkhart, Ind.*

## Brushes keep bandsaw tires clean




After I bought a new bandsaw, I was surprised how quickly the sawdust built up on the tires, causing vibration and tracking problems. So I decided to do something to keep the tires clean. After a little head scratching, I came up with this solution, which uses small, wooden-handled, natural-bristle vegetable brushes I found at a local hardware store for about $3 each.

I simply attached the brushes so that the bristles would remain in contact with the moving bandsaw tires. How you mount the brushes on your saw will vary with the design of the saw cabinet. In my case, for the bottom wheel, I attached the brush to the inside of the door so that it bears on the tire just in front of the column. For the brush to fit, I had to cut off the handle and glue a 45° block to the back of the brush. I located the top brush in the lower part of the top cabinet as shown. The brushes not only keep the tires clean, but they also have the added benefit of acting as a brake for the blade when I turn off the saw.

*—Tom Witzig, Annandale, Va.*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# Notes & Comment

## A golden milestone

Christian Becksvoort, a contributing editor to *Fine Woodworking*, reached a major milestone in his woodworking career this year. In March, he shipped his 500th commission—a 15-drawer chest—to a buyer in upstate New York.

The tall, slender piece is one of the most challenging designs to build in his Shaker-inspired catalog, Becksvoort said. It includes nearly 300 hand-cut dovetails and 190 individual parts. In the nearly 20 years since he began building furniture, Becksvoort has kept detailed records on every piece he builds; he registers them in a leather-bound book at the end of each year.

In addition, he dates each of his pieces with a silver dollar hidden in its interior. But for his quincentennial commission, Becksvoort substituted the silver dollar for a 2004 1-oz. gold coin. "It's a handsome little coin," he said of the medallion, which features Augustus Saint-Gaudens's depiction of "Liberty" holding a torch in one hand and an olive branch in the other.

With 500 commissions under his belt, Becksvoort doesn't know how many more milestones he plans to celebrate. "I'll probably hit 750, but I don't want to promise anyone my 1,000th piece," he said.

*—Matt Berger, associate editor*

***Worth its weight in gold.*** *To commemorate his 500th commission (right), Becksvoort hid a 1-oz. gold coin in the frame of a drawer.*

## Australian furniture maker honored at Philadelphia show

Tony Kenway, a furniture maker from Coorabell, New South Wales, Australia, was chosen as this year's Best New Artist in Wood at the 10th Annual Philadelphia Furniture and Furnishings Show, held in April.

The award, which comes with a $1,000 prize, was presented by Anatole Burkin, editor of *Fine Woodworking*. "Kenway's work has an organic quality that beckons you. He has a keen eye for design and has assembled a team of superb craftsmen to produce his exquisite pieces," said Burkin.

To see more of Kenway's work, visit his Web site at www.tonykenwayfurniture.com.

***Armchair in Tasmanian blackwood.*** *Much of the timber Kenway uses is salvaged from private properties in Australia.*

**Nature, Form and Spirit: The Life and Legacy of George Nakashima** *by Mira Nakashima. Harry N. Abrams; 2003. $75. 275 pp.*

George Nakashima is best known for his autobiography, *The Soul of a Tree*, for inventing the modern idea of a woodworker, and for his influential furniture style, which features large hardwood slabs and timbers. His talent and accomplishments, however, extended far beyond furniture making. He was an architect/builder who could design an innovative structure and see the job through.

Making a great companion to her father's autobiography, *Nature, Form and Spirit* offers a daughter's personal memories and her access to unseen work and unpublished photographs and drawings. Mira Nakashima is an accomplished furniture designer in her own right and runs the family business in New Hope, Pa.

This artistic biography and family history will reel in woodworkers and nonwoodworkers with its story of a life committed to beauty and quality. *—Asa Christiana, managing editor*

***A woodworking life in pictures.*** *Intimate, compelling photographs distinguish Mira Nakashima's book on the life and work of her father.*



Photos, this page: Courtesy of U.S. Mint, used with permission (top left); Karen Wales (center); Billie Badans (top right); David Young (chair)

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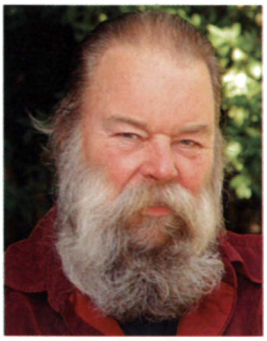
## Bennett wins Furniture Society's Award of Distinction



***Six-foot padauk case with a message.*** *In making this precious piece (left) less precious, Bennett (above) whacked a nail in the top cabinet door, marking a defining moment in studio-furniture history back in 1979.*

Garry Knox Bennett, a California artist-craftsman, received the Furniture Society's 2004 Award of Distinction at its eighth annual conference, held in June at the Savannah (Ga.) College of Art and Design.

The award, given for lifetime achievement, acknowledges Bennett's contribution to the world of studio furniture. The Furniture Society, established in 1996, sponsored the three-day conference, which explored the role of studio furniture and technology in our society.

Bennett came to furniture making by way of sculpture and metalwork. His padauk cabinet with a nail hammered in a finely crafted door appeared on the back cover of *Fine Woodworking* (*FWW* #24): a counterculture statement that generated much controversy.

***Asymmetrical elements typify Bennett's work.*** *This mixed-media Owl desk (right) incorporates hardware Bennett made, a painted back board, underlighting, and wedged joinery.*

## Oregon school offers training from afar

***One-on-one instruction.*** *Rogowski (right), director of the Northwest Woodworking Studio, gives advice on gluing up panels to Dave Galas, a student in the Mastery Program.*

The Northwest Woodworking Studio in Portland, Ore., is a traditional woodworking school in many ways. A variety of five- and 10-week classes is offered throughout the year, as well as one- and two-day hands-on workshops and evening lectures.

The school also offers one-on-one Mastery Programs that are unique in the field, according to its director, Gary Rogowski, who started the school in 1997. The Resident Mastery and Distance Mastery Programs are for working people who build out of their own shops and can devote 10 to 20 hours per week to their projects. Over the course of a two-year program, Mastery students design and build 12 pieces, visiting the school for lectures, demonstrations, and critiques with Rogowski. While the resident program is for students who live close enough to make weekly visits to the school, the distance program is geared toward students from across the country, who attend three times a year, for three- to five-day intensives.

Dave Galas, of Eugene, Ore., who began in the Distance Mastery Program and has switched to the Resident Mastery Program, said that while the courses require a strong sense of "self-motivation, the breadth of what is taught is impressive, especially for a part-time program."

For more information, call the school at 503-284-1644 or go to www.northwestwoodworking.com. —*A.C.*



Photos, this page: M. Lee Fatherree (top left, right); Alison McLennan (portrait); courtesy of the Northwest Woodworking Studio (bottom)

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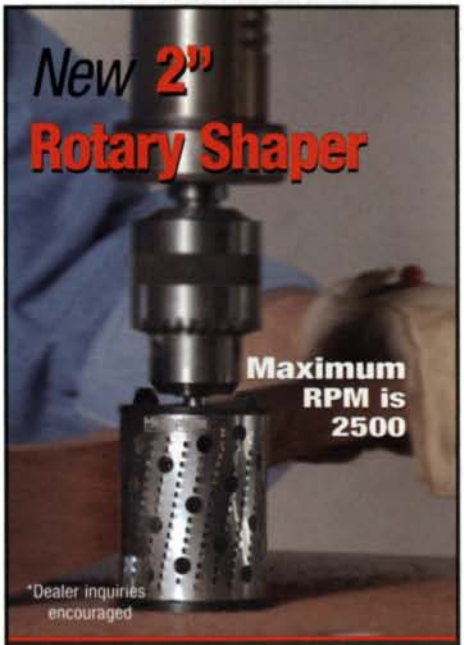


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BY BRIAN BOGGS

# Sharpening and using card scrapers


***A well-tuned scraper.*** *With polished edges and a small burr, it takes only a light push (left) to get clean shavings off almost any wood surface. To remove marks from the previous pass, pull the scraper with the blade angled toward you (above) to produce very light shavings and, in turn, a flawless surface.*

I started using scrapers more than 20 years ago, and I'm still learning some of their nuances. But I'm convinced they are essential tools for woodworkers. Card scrapers are ideal for lightly cleaning up areas of torn or gnarly wood that no other tool can deal with. This is not to say that scrapers cut better than planes; they seldom do. On really difficult grain, though, a scraper can finish a surface where almost any smoothing plane will need follow-up work.

Scrapers range in thickness from 0.016 in. (0.4 mm) to 0.042 in. (1 mm). I prefer to use 0.032-in. (0.8-mm) scrapers. The 0.020-in. (0.5-mm) and thinner scrapers flex nicely to smooth out hollows, but they make it harder to maintain a flat surface. With thick scrapers, it is easy to gouge a groove in the wood with the corners, but for heavier work, their stiffness is a virtue.

## How a card scraper works

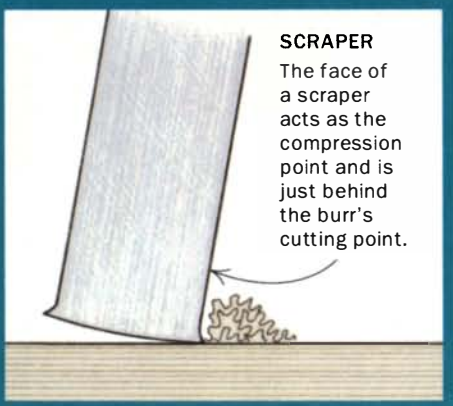
Scrapers and planes both attempt to do the same thing: cut wood without tearing the surface (see the drawings at right). Planes do this with the edge of a sharp blade and a separate part called a chipbreaker. Scrapers cut with a burr edge, and the face of the scraper acts as the chipbreaker.

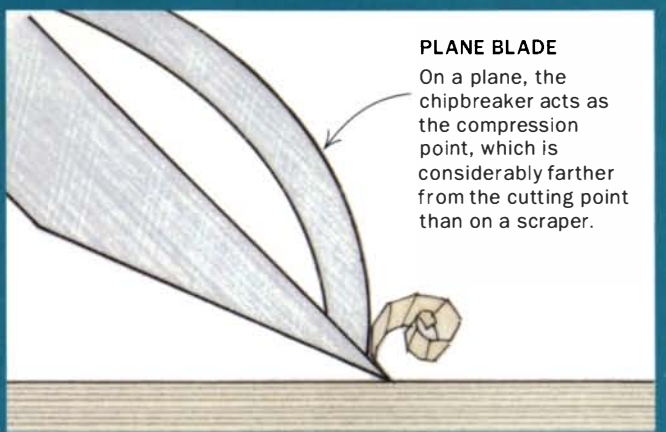
As the shaving forms, it immediately encounters the near vertical face of the scraper. Before the shaving can lift off the workpiece, it is compressed between the uncut wood ahead of the

**Watch it on the Web** — To see a video of the author preparing a card scraper, go to www.finewoodworking.com.

### SCRAPER VS. PLANE

Both the scraper and the plane blade slice wood and then compress the shaving before it can lift and cause tearout. The scraper compresses the shaving while it is still short, so it is less prone to cause tearout on difficult woods.



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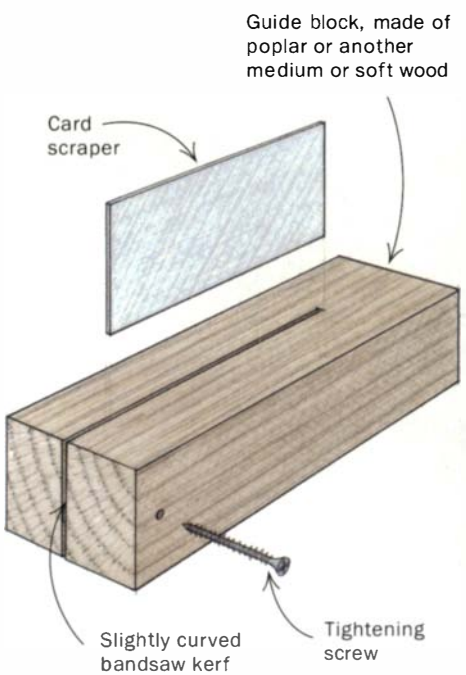
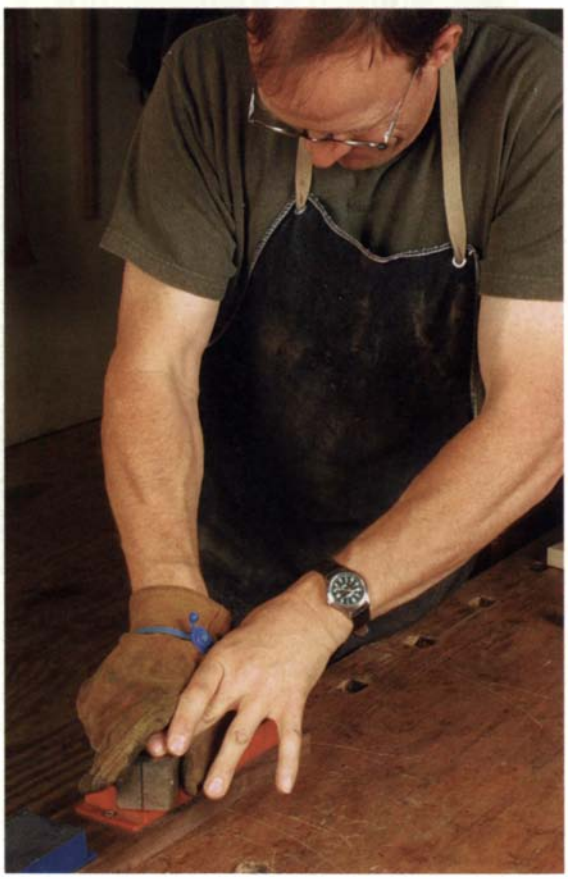
## SHARPENING A SCRAPER

### STEP ONE: SMOOTH THE FACE AND EDGES

***Hone the sides of the scraper.*** *Polish the sides of the scraper on a fine diamond plate or sharpening stone.*



***Hone the edges.*** *A guide block helps hone the edges of the scraper 90° to the sides. The scraper should fit loosely enough that it can be pushed onto the sharpening stone.*

tool and the face of the scraper. The angle of the face of the scraper determines how compressive the force is. It also determines how deeply the burr will bite into the wood. Therefore, as the scraper is angled forward, it takes a more aggressive cut yet works extra hard to compress the larger shaving and minimize tearout. The downside is that the extra downward force actually crushes the pores as the scraper moves along, leaving a slightly fuzzy surface behind. The solution is to follow with a lighter cut, made with the scraper more upright, which will exert less downward force and leave a cleaner surface. A good way to maintain this higher angle and take a lighter cut is by pulling the scraper toward you.

The most common mistake when using a card scraper is to try to remove too much material. Beginners tend to create an enormous burr on the scraper and then angle the blade forward, hogging off vast shavings. Not surprisingly, their thumbs get hot from the friction, and they find it difficult to maintain the flat plane of the surface of the workpiece.

You can use all four edges of a card scraper, so as soon as you feel the blade getting warm, turn it over and use another edge. The burr will last longer if it is kept from overheating.

### Preparing a scraper

Sharpening card scrapers is one of the tasks that frustrates even experienced woodworkers, but I use a couple of jigs that get rid of the guesswork.

Most if not all scrapers need a lot of honing when new. Cheaper scrapers need initial work on a medium (325-grit) stone, but a fine (600-grit) stone is good for better scrapers. Just put all of your fingers right over the edge and hone away until the sides and edges of the scraper are smooth and meet at 90° (the sequence is shown at left). Now it's time to form the four cutting burrs. Lay the scraper on a piece of wood about 1¾ in. from the edge. With an oiled burnishing rod resting on, and at about a 45° angle to the edges of the scraper and the wood, stroke the scraper a couple of times. This stretches out the corner of the scraper so that a longer burr can be turned.

The burr on a well-tuned scraper is so small that I can't tell what angle it actually is, but I think it is less than the 5° normally recommended. To help create the perfect burr on a scraper, I use a wooden guide block, which also is used for honing (left). Place the scraper in the guide block so that the top edge protrudes between 1/32 in. and 1/16 in. (see the bottom drawing on p. 30) With the guide block locked in a vise, slide the burnishing rod across an edge of the scraper with the rod angled forward so that it rolls the burr off the edge.

With a well-honed scraper edge, the



Drawings: Vince Babak

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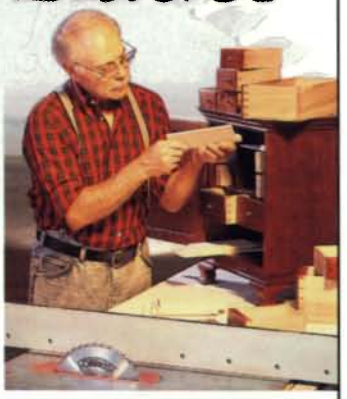

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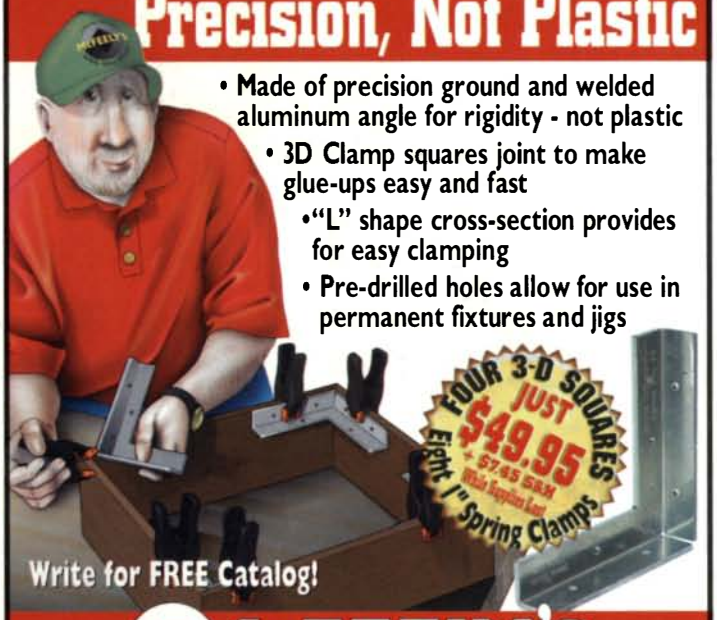


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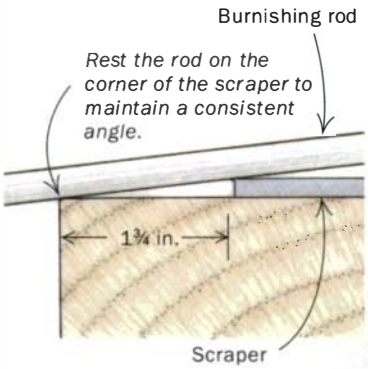
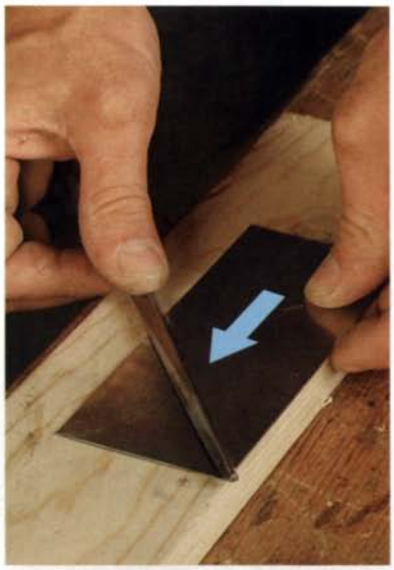
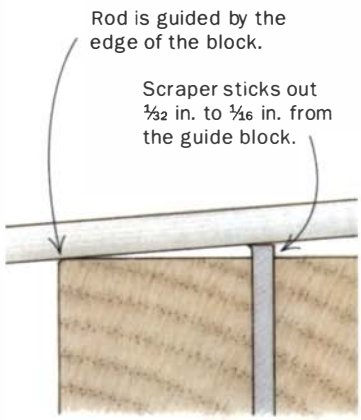
## SHARPENING A SCRAPER (continued)

### STEP TWO: CREATE A BURR ALONG THE EDGES




***Stretch the edge.*** *Push the burnisher along the side of the scraper to draw out a burr.*






***Roll the burr.*** *With the scraper in the guide block, slide the burnisher at a 45° angle to roll the burr off the edge. It should take only one or two passes.*

weight of your hand and forearm should generate enough pressure to turn the burr. The rod has only a small area in contact with the scraper, which translates into a lot of pressure per square inch. The more passes you take, the more you will roll the burr, thus changing the cutting angle, so try to get the job done with one or two passes.

**Renewing a scraper—**You can repeat the stretching and rolling steps two to six times without rehoning, depending on the type of wood and the amount of material you are removing. Eventually, the edges of the scraper will become hardened from the burnisher, preventing a new burr from being rolled. Unlike a new scraper, before this used scraper can be rehoned, the work-hardened metal must be filed away. Lay a single-cut bastard file on the bench and stroke the blade over it, perpendicular to the file. You'll feel the file start to cut easily as soon as the work-hardened surface of the scraper is removed.

To remove the file marks and to square the edge, place the scraper in the wooden guide block. Apply even pressure on both the blade and the block to keep the scraper square to the diamond plate (see the bottom photo on p. 28). As you do this, keep checking the edge until it develops a uniform shine. Remove the scraper from the block and repeat the face honing with very light pressure until the wire edge is removed. Now you can stretch and roll new burrs using the burnishing tool.

It may take you a few tries before mastering your card scrapers, but stay with it. You will be rewarded with greater efficiency and a more enjoyable finishing process on all your projects. □

## The burnishing tool is crucial

**As important as anything else in scraper sharpening is the condition of the burnishing rod. It needs to be a very hard steel that is polished and scratch-free. I rounded the edges and polished an old triangular file, but Lee Valley makes a good teardrop-shaped burnishing rod. The slightest nick in the rod will tear off a burr instead of putting one on, so protect your burnisher and treat it as you would your best chisel.**

**I also have used the shank of a solid carbide router bit with very good results. You either can use it with the guide block described above, or you can make a jig and insert the bit into the angled hole (see the photo at right). Because the bit should be oiled when used as a burnisher, it is best to choose an old bit or remove all of the oil before using it in a router again.**

***An alternative jig for rolling a burr.*** *A carbide router bit is placed in a hole angled down 2° to 5°. The scraper is pulled through a bandsawn kerf across the bit, creating a burr on the scraper.*

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READER SERVICE NO. 185

## Laser-guided drill press

Sears/Craftsman has introduced a new 15-in. drill press with a unique feature. It uses laser technology—Craftsman calls it Laser-Trac—to shoot a pair of lines that intersect with the centerline of the chuck.

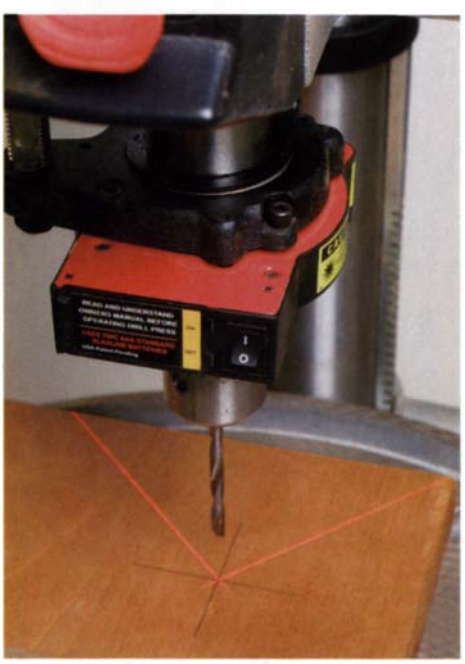
The laser system is turned on and off with the flip of a switch. Two AA batteries provide the power.

To use Laser-Trac, first mark the centerpoint of a hole on the workpiece. Then simply align the mark with the intersecting laser lines and drill the hole.

Curious to find out how well Laser-Trac worked, I gave the drill press, Craftsman model 229250, a good workout in the *Fine Woodworking* shop. At the end of the day, I concluded the laser system has both pluses and minuses.

On the plus side, the laser worked well with short bits (about 2 in. or less) with small diameters (about ¼ in. or less). The short bits allowed me to drill with the workpiece relatively close to the chuck.

The minuses were revealed when I used long bits or any bits with large diameters. Such bits partially blocked the path of the beams. As a result, the intersecting laser lines didn't show up on the workpiece unless it was positioned well below the bit.



***"X" marks the spot.*** *Because the intersecting laser lines are directly in line with the centerpoint of the bit, it's an easy matter to align the bit with a hole to be drilled.*

Because the quill then had to travel farther than normal to drill a hole, I had to reach back to grab a second or sometimes even a third crank handle to lower the quill the extra distance; a process that often can be awkward.

Another point here: The laser lines were not perfectly sharp, making it difficult to consistently and precisely align the mark on the workpiece with the intersecting laser lines. In addition, as the workpiece moved farther from the bit, the lines became wider and even less sharp. That said, however, the test holes I drilled were rarely off by more than 1/32 in.

So is the laser guide worth having? If you drill a lot of small holes that don't need to be dead-on every time, I think you'd find the Laser-Trac feature helpful. But if you regularly use long or large-diameter bits, the laser guide won't offer much help.

The drill press itself proved to be a serviceable machine. Its ⅝-in. chuck operated reasonably smoothly. Runout measured 0.004 in., compared to an average of 0.005 in. when we tested nine 15-in. to 17-in. drill presses a year ago (see *FWW* #162, pp. 68-73). The rack-and-pinion table lift worked comfortably, thanks in part to soft, molded handles.

Belt changing was easy enough, allowing 12 different speeds, ranging from 250 rpm to 3,100 rpm. The quill lock and depth stops worked effectively, and the handles can be repositioned to the left of the machine, a nod to all us southpaws.

Using a ¾-in.-dia. Forstner bit, I was able to drill 1-in.-deep holes without any sign of the belts slipping or the 120v, 8-amp motor bogging down. I also was able to drill a 1-in.-deep hole with a 2-in.-dia. Forstner bit, but I had to slow the feed rate slightly to prevent the motor from stalling.

*—Tom Begnal is associate editor.*

**CRAFTSMAN 229250**

800-697-3277; www.sears.com

| | |
|---|---|
| PRICE | $320 |
| CHUCK-TO-POST DISTANCE | 7⅝ in. |
| TABLE SIZE | 13¾ in. square |
| QUILL STROKE | 3⅛ in. |
| MOTOR | ½ hp |
| NUMBER OF SPEEDS | 12 |
| WEIGHT | 167 lb. |
| RUNOUT | 0.004 in. |

## New jigsaw has clever features

**Bosch recently introduced a jigsaw, model 1590EVSK, that has two features I quickly learned to appreciate: easy blade changing and effective blade support.**

**Adding a blade is simply a matter of inserting it into the chuck until it snaps into place. To remove it, push a button and swing a lever just above the blade. The blade immediately ejects, without any need for pulling or tugging. Indeed, it can be done with only one hand. Anyone who has ever tried to remove a hot or broken jigsaw blade will appreciate this system.**

**I also liked the unique precision-control blade-guide system, which is designed to prevent the blade from wandering during a cut. The blade sits in a three-point blade holder, similar to earlier Bosch jigsaws, but this one also has two small arms that come down and clamp the blade as close to the cutting surface as possible. This enabled me to turn corners—even in hardwoods—without the blade wandering too much.**


**The rest of the features are fairly standard. Speeds are adjustable from 500 to 2,800 strokes per minute. The jigsaw has constant-response circuitry, so when you run into knots or dense wood, the 6.4-amp motor maintains the selected speed. I ran this tool through every piece of wood I came across—countless feet of plywood, 2x4s, and 1-in.-thick oak and cherry—and it never bogged down.**

**To protect worksurfaces, the Bosch saw comes with a nonmarring overshoe for the foot. Also, an antisplintering insert helps prevent tearout. Inserts like these are common on jigsaws nowadays, and they do make a difference. For the cleanest cuts, turn off the orbital action (there are four orbital settings) so the blade cuts straight up and down, and pop the insert in place.**

**After using this saw, I had two minor complaints. The action of the lever to adjust the foot for bevel cuts was a bit clunky. Second, the lock-on switch, located conveniently above the power switch, often required two or more tries to get it to lock into position.**

**The 1590EVSK jigsaw sells for about $170. For more information, contact Bosch at 877-267-2499 (www.boschtools.com).**

***—Matthew Teague is a writer and furniture maker in Nashville, Tenn.***


***No-fuss blade changing.*** *It's quick and easy to change blades on Bosch's new 1590EVSK jigsaw.*

## Getting a grip on cord management

Although I'm hardly a neat freak, I do try to have things reasonably organized in my shop. To that end, I like to keep extension cords and long power-tool cords neatly coiled and secured.

Over the years, I've used various types of ties and wraps to keep long cords from doing their own thing, but none has worked quite as well as a relatively new product called Cable Clamp. The two halves of the clamp are made from a tough plastic and joined with a stainless-steel pivot pin. To close the clamp, simply squeeze the two halves of it together. To open it, squeeze the trigger and slide the halves apart. It takes only seconds to do both.

Cable Clamp is available in three sizes. Expect to pay about $1.50 for the small size and $2.50 for the large. For more information, contact Cable Clamp at 727-528-1000 (www.cableclamp.com).

*—T.B.*


***Easy on, easy off.*** *The Cable Clamp is easy to use; just push the two halves together. Squeezing a "trigger" separates them.*

Photos, except where noted: Tom Begnal

## Bostitch brad nailer is lightweight and jam-free

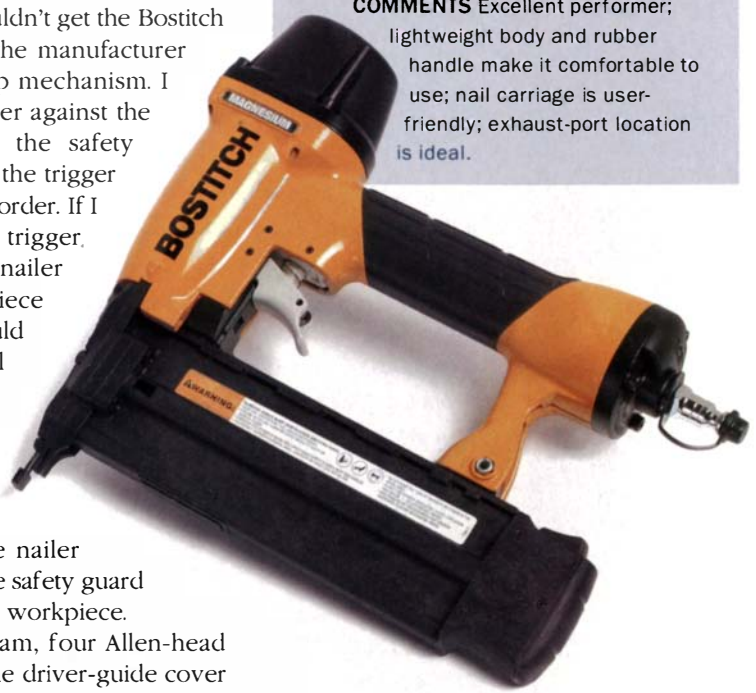
In the January/February 2004 issue of *Fine Woodworking* (#168), Roland Johnson reviewed 18-ga. brad nailers. Shortly after that issue had gone to press, we learned Bostitch had introduced a new nailer, so I spent some time using it in our shop.

The body is made of magnesium, a strong and lightweight metal alloy. At 2.1 lb., this nailer is more than 3 oz. lighter than the plastic body of the Paslode T200-F18—the lightest nailer Johnson reviewed.

Try as I might, I couldn't get the Bostitch to jam. It has what the manufacturer calls a sequential trip mechanism. I had to place the nailer against the workpiece, depress the safety guard, and then pull the trigger to fire a nail—in that order. If I didn't let up on the trigger while placing the nailer against the workpiece again, the nailer would not fire. This model can be converted to fire on contact with an optional kit. In the contact mode, once the trigger is pulled and held, the nailer will fire each time the safety guard is pressed against the workpiece.

Should the nailer jam, four Allen-head screws that secure the driver-guide cover will have to be removed. An Allen wrench, supplied with the Bostitch nailer, mounts on the back of the nail carriage. Some nailers reviewed in *FWW* #168 use latches to secure the driver-guide cover, a system that is more convenient.

| BOSTITCH BT200K-2 | |
|---|---|
| **PRICE** $100 | **Weight** 2.1 lb. |
| **DEPTH-OF-SET ADJUSTER** | Dial |
| **DRIVER-COVER REMOVAL** | Four screws |
| **SAFETY GUARD** | In front of nose |
| **EXHAUST PORT** | Beneath air coupler at rear |
| **BELT HOOK** | None |
| **COMMENTS** Excellent performer; lightweight body and rubber handle make it comfortable to use; nail carriage is user-friendly; exhaust-port location is ideal. | |




***Smallish nose is a plus.*** *A small nose on the Bostitch BT200K-2 allows the user to place nails more precisely.*

A small nose on the Bostitch nailer made it easier to place a nail precisely, although the front-mounted safety guard slightly impeded my view. The depth-of-set adjuster dial on the front of the nailer was easy to read and use. A release lever on the nail carriage made it a breeze to open and close with one hand. The carriage also has a view port to keep track of the nail supply. When it dwindled, the view-port window flashed a red-flag alert.

Most brad nailers exhaust compressed air through the top of the head. In a welcome change, the Bostitch nailer exhausts air through the handle and out the back, so it doesn't hit the operator in the face.

For more information, contact Bostitch at 800-556-6696 (www.bostitch.com).

*—William Duckworth is associate editor.*

***Upscale doweling jig.*** *The Dowelmax jig produced precise dowel joints for our reviewer.*

## Versatile doweling jig

The Dowelmax from O.M.S. Tool Co. bills itself as a "precision engineered joining system." Based on my experience with the tool, I'd have to agree. Although at first glance it resembles the more common self-centering dowel jigs available at most hardware stores, a closer look reveals a well-thought-out and versatile design.

The jig consists of a central drill guide that contains a series of five equally spaced, ⅜-in.-dia. guide bushings. Dowelmax also offers ¼-in.-dia. guide bushings as an option. Each side of the drill guide has a pair of removable threaded posts that accept an array of fences, shims, and clamping brackets. The interchangeable accessories make it possible to use dowel joints in almost any situation. Although the jig came with a couple of shims for joining pieces of different thicknesses, it was simple to mill my own shims for less-common dimensions.

The jig also came with a stop collar for setting the hole depth, an indexing tool for drill-hole alignment, and an adjustable gauge used to increase the distance between holes. A drill bit included with the jig was sharp and drilled many holes into hardwood (wenge) with no sign of dulling.

With all the accessories, including a bag of fluted dowels, the jig sells for about $190. For more information, contact Dowelmax at 877-986-9400 (www.dowelmax.com).

*—Mark Edmundson is a furniture maker in Sandpoint, Idaho.*



Photos, this page (bottom left, center): Rodney Diaz

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READER SERVICE NO. 171

# Handplane Tune-up

## Step-by-step instructions to get maximum performance from any plane

BY DAVID CHARLESWORTH

There is a well-kept secret in fine cabinetmaking. Most new planes should be treated as a kit of parts, not as a tool ready for fine work. Recently, while reviewing a new jack plane, I set the plane to take a 0.001-in.- or 0.002-in.-thick shaving—a setting not unreasonable for planing figured hardwood—but it was impossible to plane a straight edge. The cause of the problem, I discovered, was the plane's sole, which was 0.003 in. hollow in its length.

Unaware of these flaws, many woodworkers are frustrated by the performance of their shiny new planes; I certainly was when I started out, and my new students have the same problem.

In the heyday of English plane making, a plane made by Norris or Spiers cost a cabinetmaker one to three weeks' wages, so perhaps we should not expect too much from that new Stanley or Anant costing the equivalent of a few hours' wages. The good news is that spending a few hours tuning up these planes will result in an


**LEVER CAP**
Smoothing the underside allows for easier depth adjustment.

**CHIPBREAKER**
Reshaping the top and the bottom allows shavings to slide up and over the chipbreaker instead of getting stuck.

**BLADE**
A replacement blade made from A2 cryo steel will keep an edge longer than the original blade.

**FROG**
The frog connects the blade to the body. Poor contact with either will result in vibration and chatter.

**PLANE BODY**
The sole must be perfectly flat to cut shavings thin enough to read newsprint through. The contact points with the frog must be flat.

### THE PARTS OF A PLANE

**For a handplane to cut cleanly and without chatter, the parts must be machined to high tolerances and fit together perfectly. You are unlikely to find this precision on a mass-produced plane. However, refining the fit of the parts and replacing the blade will soon have your $80 plane cutting like a $300 model.**



Drawings: Jim Richey

outstanding improvement in their performance. The methods I'll describe can be applied to any Bailey-type plane with a metal body, whether old or new.

### Invest in a replacement blade

The quickest way to improve a plane is to purchase a high-quality A2 steel replacement blade that has been cryogenically treated. These blades are available from Ron Hock and Thomas Lie-Nielsen (see Sources on p. 40), but if you buy from the latter, be sure to order the 0.095-in.-thick blade because the thicker 0.130-in. blade may not fit in your plane. Even the 0.095-in.-thick blade will be significantly thicker and stiffer than a stock blade, greatly reducing vibration and chatter.

### Fit the frog to prevent distortion

The first step in the tune-up process is to disassemble the plane, remove the frog, and check its seating—the four contact points between the body and the underside of the frog. A badly seated frog screwed down tight will distort the thin area of the sole just behind the throat of the plane.

To determine how well the surfaces fit, work the relevant areas of the body casting with a black felt-tip pen. Remove the fore-and-aft adjustment plate, press the frog in place, and slide it back and forth. The ink will be scraped off where the surfaces make good contact. If the frog rocks, only two diagonal points are making contact.

Work on the contact points until you achieve about 60% contact on all four surfaces. Although it is slow, I prefer to scrape rather than file the contact points of the sole casting. With a file, it's easy to remove too much material and ruin the tool. If you don't have an engineer's scraper, you can make one by grinding a 6-in. file so that the last inch of the two flat sides is slightly hollow, while the end has a convex profile.

To perfect the fit, apply pinches of 180- or 220-grit silicon carbide and a drop of water to each scraped surface. Work the frog to and fro for a few minutes, leaving the surfaces matte gray. Aim for 90% contact.

**The top of the frog comes next**—With many new planes, you may find a pro-

## FIT THE FROG

**The frog connects the blade to the body of the plane. It is important that the frog seats securely to the body and provides a flat mounting surface for the blade. A properly fitted frog goes a long way toward reducing chatter.**

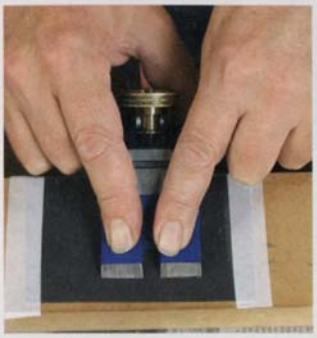
### 1 SCRAPE HIGH POINTS

*Use an engineer's scraper to remove the high points and enlarge the areas of contact where the frog is seated to the plane body.*

### 2 GRIND THE SURFACE


*Apply a small amount of silicon-carbide powder to each contact point, add a drop of water, and then slide the frog back and forth to give the metal a smooth finish.*

### 3 SMOOTH THE TOP

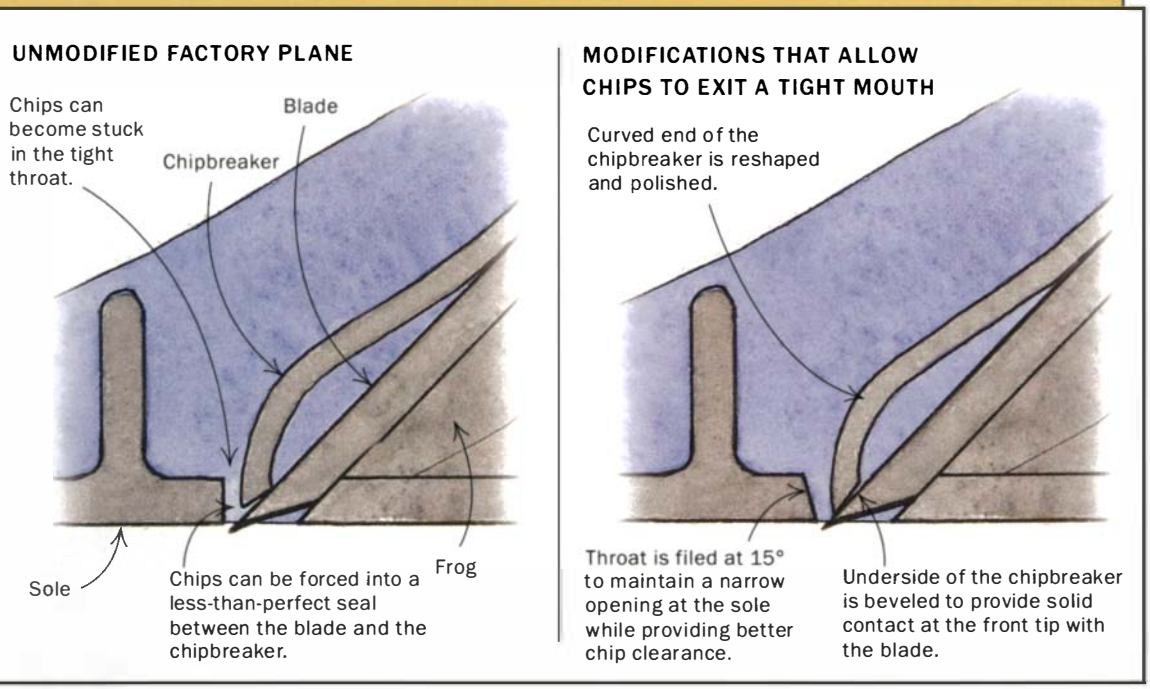


*After marking the top of the frog with a felt-tip pen, grind it on 240-grit wet-or-dry paper stuck to a smooth, flat surface. The center felt-tip lines should be removed.*


Photos: Mark Schofield

## MODIFY THE THROAT FOR CLOG-FREE PLANING

**A narrow mouth helps prevent tearout but in an unmodified plane is likely to also trap shavings in the throat. Filing the front edge of the throat at a 15° angle and refining the shape of the chipbreaker provides more room for shavings to escape.**




### 1 ANGLE THE THROAT

*To prepare the throat for filing, mark the sole with a black felt-tip pen, then scribe a line as close to the mouth as possible (above). Then clamp the plane body in a vise, angling it 15° from vertical. Keep the file parallel to the top of the vise and gradually file the throat back 15° (right) until the new bevel reaches the scribe line.*

nounced hollow in the critical area on top of the frog that supports the blade just behind its bevel. This hollow can cause chatter during planing. A rough surface also may impede smooth blade adjustment. It is not necessary to remove every scratch from the top of the frog; just aim for an overall flatness.

Begin by taping 240-grit wet-or-dry paper to a flat surface. Draw lines across the top surface of the frog with a felt-tip marker and use the marks to gauge your progress. Rub the frog back and forth on the sandpaper, being careful not to rock the casting. You will have to work the top of the slope by hand with a small block wrapped in sandpaper because of the protruding lateral adjuster rivet. Take the opportunity to ease any sharp, ragged edges of the casting with a fine file.

I also like to polish the contact points of the Y adjustment lever, where they touch the turned groove of the brass adjustment wheel. Sometimes the finish on the Y lever is rough from sand casting, which eats away at the wheel's soft brass, causing increased backlash over the years.

### Refine the throat to prevent trapped shavings

Begin by filing the front edge of the throat. Degrease the sole and blacken the area next to the mouth's front edge with the felt-tip marker. Scribe a light line across the sole as close as possible to the existing

## 2 MODIFY THE CHIPBREAKER

*Slightly bevel the bottom of the chipbreaker on a diamond stone or other medium-grit honing stone. Maintain the proper angle by resting the end of the chipbreaker on a scrap of wood (right). Then shape the top of the chipbreaker by clamping it in a honing guide and working it on a stone (bottom left). Reposition the chipbreaker in the jig to create a series of facets that will be honed and polished further to form a gentle curve (bottom right).*

front edge. Use this line as a reference for the next step, filing the throat.

Grip the plane body at 15° in a vise. It is vital that the jaws of the vise squeeze only where the sides of the casting are supported by the crosswise rib. Pressure in any other position might snap the brittle, cast sides of the plane.

Concentrate on keeping the file horizontal, using the top of the vise jaws as a guide. As you file, a bright surface will indicate where metal has been removed. Gradually, a minute wire edge is formed on the sole of the plane. Check the scribed line as you go to be sure you are keeping the mouth even and narrow. Take special care not to remove metal from the sides. A fine 00-grade file will give a smooth finish and crisp, square corners. Next, polish with 600-grit wet-or-dry sandpaper, then rub the mouth with metal polish and steel wool for a wonderful result.

**Hone the chipbreaker**—Chipbreaker edges are one of the areas of a bench plane with the most variable quality. The underside of the chipbreaker must make perfect contact with the blade to prevent shavings from getting trapped between the two surfaces. To ensure this, slightly bevel the bottom edge by grinding it on a diamond stone or 240-grit wet-or-dry paper. Support the chipbreaker on a piece of wood to maintain the correct angle (see the top photo above). Examine the result by checking that no light shows between the chipbreaker and the back of the blade.

The top of the chipbreaker also must be reshaped. Remove metal by setting the chipbreaker in a honing guide, at 45°, and working it on a diamond stone. By extending the projection from the guide 3⁄32 in. several times, you'll form a series of flats that can be blended by hand using 400-grit paper. The final step is to polish the surface with metal polish so that wood shavings slide over the surface unimpeded.

**Work on the lever cap**—The underside of the front edge of the lever cap often has a rough, sand-cast finish, which can be smoothed by rubbing on 240-grit wet-or-dry sandpaper taped to a flat surface. A smooth lever cap clamps the blade more securely and makes adjustments easier.

### Assemble the plane and adjust the frog

Before reassembling the plane, oil any unpainted cast surfaces under the frog to prevent rust. The fore-and-aft adjustment plate sometimes needs a sideways twist to center the frog in the body. Tighten the frog's holding screws gently so that the fore-and-aft screw will drive the frog forward and backward. To determine the correct position of the frog, insert the blade and adjust it for a fine even or balanced shaving. Drawing a small piece of wood across the mouth helps show where the blade is cutting.

Now examine the mouth from the underside of the plane: The edge of the blade must be parallel to the front edge of the mouth. If it is not, twist the frog without disturbing the lateral adjustment lever until the blade is parallel to the mouth. Last, drive the frog forward to reduce the opening of the mouth. I suggest 0.020 in. or a full 1⁄64 in. for beginners. Experienced woodworkers can set the opening to 0.006 in. for their favorite fine finishing plane. For small adjustments it sometimes is easiest to tighten one of the frog's holding screws so that the frog pivots on this point. Be pre-

## FLATTEN THE SOLE

**Mark the toe, both sides of the mouth, and the heel. When these four lines are sanded away at the same time, the plane is ready to use. On a flat surface such as float glass, stick down a few different grades of wet-or-dry sandpaper. With the blade installed but backed off, flatten the sole by sliding the plane over the sandpaper.**

pared for a few attempts to get the position of the frog exactly right.

When you are satisfied that the blade is parallel and that the mouth has the correct opening, remove the blade without disturbing the frog so that the frog's holding screws can be set to final torque. Don't use too much force, because it might crack the thin sole adjacent to the back edge of the throat. Tighten only to prevent movement.

It is best to set up all of the working tensions and retract the blade before flattening the sole, as it is possible that the pressure exerted by the lever cap will affect the shape of the sole. (This is particularly true for rabbet, shoulder, and block planes.) The lever-cap screw should be set so that the lever action is firm but can be operated without straining your thumb.

The lever-cap screw often fits loosely in the tapped hole in the frog. As you extend and retract the blade, it rocks forward and backward, contributing to backlash. Solve this problem by counting the number of turns it takes to remove the screw, degreasing it, adding a few drops of Loctite medium-strength blue threadlocker to the hole, and then inserting the screw with the same number of turns.

### Make certain the sole is flat

Flattening the sole will improve the plane's performance more than any other single step. For flattening, I use a piece of ½-in.- or ⅜-in.-thick perfectly flat glass known as float glass. The glass is slightly flexible and may pick up errors from the surface it is sitting on, so check it with a precision straightedge and shim with sheets of newspaper. It is preferable for the length to be minutely hollow rather than convex, just enough to slip a cigarette paper under the middle of the straightedge.

Apply sheets of wet-or-dry paper to the glass with spray adhesive, leaving a ½-in. gap between adjacent sheets. In most cases start with 100-grit paper, but for a No. 7 or No. 8 plane, or even a No. 5 that's badly out of shape, start with 60 grit. Work up through 150- and 180-grit paper, finishing with 240- or 320-grit paper. Flattening is perfected on the coarsest grit; subsequent finer grits are purely to polish out the previous grit's scratches. The coarser grits may be used dry and vacuumed during use, but kerosene (known as paraffin in some countries) is necessary to stop the 240 and 320 grits from clogging.

To judge flatness and progress, draw lines across the sole with a black felt-tip marker. The most important areas are the toe, the heel, and the areas just in front of and behind the mouth. If these lines disappear at the same rate, the plane is flat enough to perform really well.

**Remove sharp edges and protect the metal from rust**—I create a 1/64-in. bevel on the edges of the sole on the final sandpaper used and file the front and back to a wider 30° bevel. The last area to bevel a little is the back edge of the throat, which can otherwise scrape the wood.

Vacuum up any metal particles, then rub the sole vigorously with 0000 steel wool and metal polish. Finish the sole and the sides of the plane witih several coats of a paste wax that doesn't contain silicone, as this gives good protection against corrosion. At the end of every session, before the plane is put away, I rub camellia oil onto the unpainted sides and sole. Before use, I remove the oil with a cloth.

It is time for some test shavings on tight-grained wood such as cherry or maple. With a properly sharpened blade (see the facing page), shavings 0.001 in. thick, the sort you can read newsprint through, should be easily obtainable. □

### SOURCES OF SUPPLY

**REPLACEMENT PLANE BLADES**

Hock Tools
www.hocktools.com; 888-282-5233

Lie-Nielsen Toolworks
www.lie-nielsen.com; 800-327-2520

*David Charlesworth teaches woodworking in his shop on the north coast of Devon, which is in southwest England.*

# Preparing a new plane blade

Even if you have bought a replacement blade, the back still may need flattening, and the tip certainly will need sharpening. I prefer to use artificial Japanese waterstones. The procedure for flattening the back of a plane blade is identical to flattening the back of a chisel (see *FWW* #169, pp. 32-33), except for a final polishing on an 8,000-grit stone.

### FLATTEN AND POLISH THE BACK OF THE BLADE

A flat back forms half of a clean, straight, sharp edge and creates a smooth surface for the chipbreaker to seat against.

The slurry on the surface of a polishing stone creates a powerful suction against the surface of a plane blade. I mount a piece of wood to the top of the blade with double-faced tape to act as a handle. Once I am ready to polish the back of the blade on the 8,000-grit stone, I can see no benefit in polishing more metal than is necessary for a razor-sharp edge, so I came up with what I call the ruler trick.

Having created a slurry on the surface of the 8,000-grit stone with a nagura, I stick a 0.5-mm or 1/32-in.-thick stainless-steel, 6-in. ruler on the right-hand, long edge of the stone. After being slid to and fro a couple of times, the ruler sticks by surface tension. It is important to keep the top surface of the ruler dry. The plane blade is placed crosswise so that its edge is about ¼ in. off the left-hand edge of the stone with the middle being supported on the steel ruler.

Gentle pressure is applied with three fingers, just behind the top of the grinding bevel, and the blade is drawn back no more than about ½ in. from the edge of the stone. I usually use about 12 to 15 strokes for a normal resharpening, but a new blade may need a few repeats to establish a polish. This is seen as a narrow band, immediately adjacent to the cutting edge. The fact that a 1° bevel has been imposed at the tip of the flat side has no noticeable impact on a plane blade's cutting ability, and a great deal of time and effort has been saved.

### SHARPEN THE BEVEL

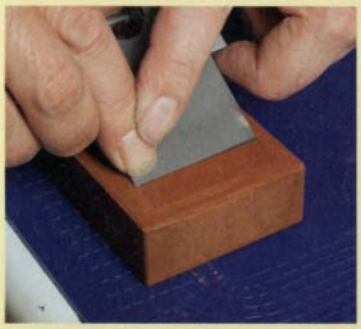
I like to sharpen my finishing blades with a very slight convex profile to avoid leaving sharp lines on the wood between adjacent strokes of the plane. Using a vise-type honing guide with a narrow support wheel, establish the desired angle, and then draw the blade back on an 800-grit stone. Apply pressure first on the left side of the blade for eight strokes, and repeat with pressure on the right side. Next, move the pressure point closer to the center of the blade and use four strokes on each side. With pressure in the center, use only one stroke. If you highlight the bevel with a felt-tip marker before starting, the resulting curve will show up as a shiny steel band.

When you are happy with the profile, move to the 8,000-grit stone to polish the bevel, using all of the same pressure points. Finally, remove any wire edge by giving the back a few strokes on the same stone, employing the ruler trick.

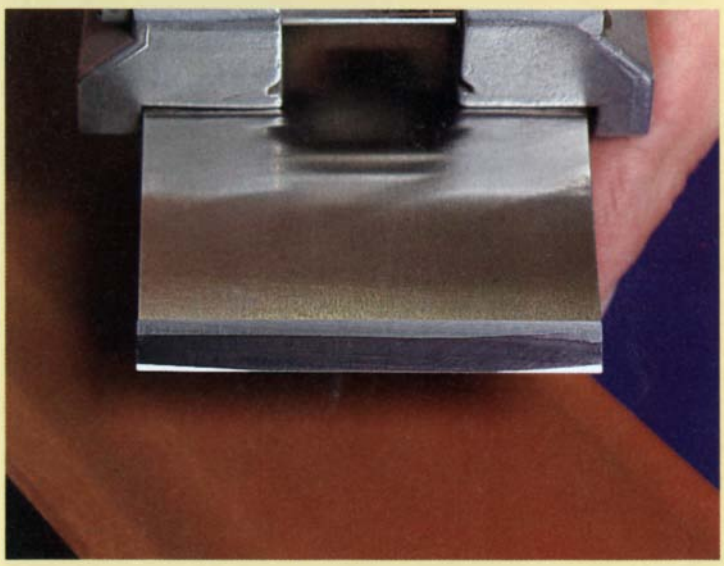
### FLATTEN THE BACK

*For better leverage, use double-faced tape to attach a small piece of wood to the plane blade to act as a handle (below). On the finest stone, rest the middle of the blade on a very thin ruler so that only the very tip of the blade's back is polished, saving a great deal of time and effort (right).*

### HONE THE BEVEL



***Create a curved edge.*** *By concentrating pressure first on one side of the blade and then on the other, the cutting edge acquires a slightly convex profile.*



***Refine the curve.*** *Darkening the blade with a marker makes it easy to gauge your progress. When you have achieved the profile you want, move to the finest stone and repeat the process.*

# Favorite Finishing Products

## A pro reveals the best abrasives, finishes, and repair products on the market

BY TERI MASASCHI

When it comes to finishing, woodworkers are creatures of habit: They find a finishing product that works, and nothing will convince them to try anything else. The product might be something the next-door neighbor recommended, or perhaps the helpful salesman at the hardware store said his grandfather swore by it. However, folklore and second-hand information sometimes can get outdated or be mediocre in the first place. In recent years, many new products have been added to the wood-finisher's arsenal: Simply switching to these new materials while keeping the same methods of application will result in a better and sometimes faster finish.

Before using any of these products, make certain that you try them on a sample board. You should be doing this already, but I am always surprised by the number of woodworkers who use the kamikaze approach to finishing: spend 10 months building a piece and 10 minutes ruining it by using it as their sample board.

While building a project, save cutoffs to use for testing your finishes. Through this simple idea, you will get the best from these products and avoid much stress and disappointment.

*Teri Masaschi is a professional finisher who lives near Albuquerque, N.M.*

### What can possibly be new in sandpaper?

**It seems as though nothing changes in sandpaper—the same old rocks glued to paper scratching off the wood. However, sandpaper has come a long way since the glass paper or garnet paper our fathers and grandfathers used. The latest improvement is Norton's 3X brand, which Norton claims cuts three times faster and lasts three times longer than traditional sandpaper. For once, the marketing slogan is close to being true. Compared with regular sheets of silicon-carbide paper, 3X paper loads up far less quickly, thanks to its stearate, or anticlogging, coating. The paper also seems to stay sharp longer and requires less pressure than other papers.**

**The 3X paper comes in grits ranging from 60 to 400, making it suitable for sanding bare wood as well as sanding between coats of finish. Although a little pricier than generic brands of sandpaper, the cost of 3X is well worth it because it saves time while sanding and achieves superior results.**


***Generic sandpaper clogs fast.*** *After just a few passes, this standard grade of 320-grit paper has already lost its cutting power, and finish has lumped on the paper.*

***Norton's 3X paper is better.*** *This piece of 320-grit paper is still sharp and displays no evidence of clogging, even after sanding a 6-in. by 30-in. section of a board.*

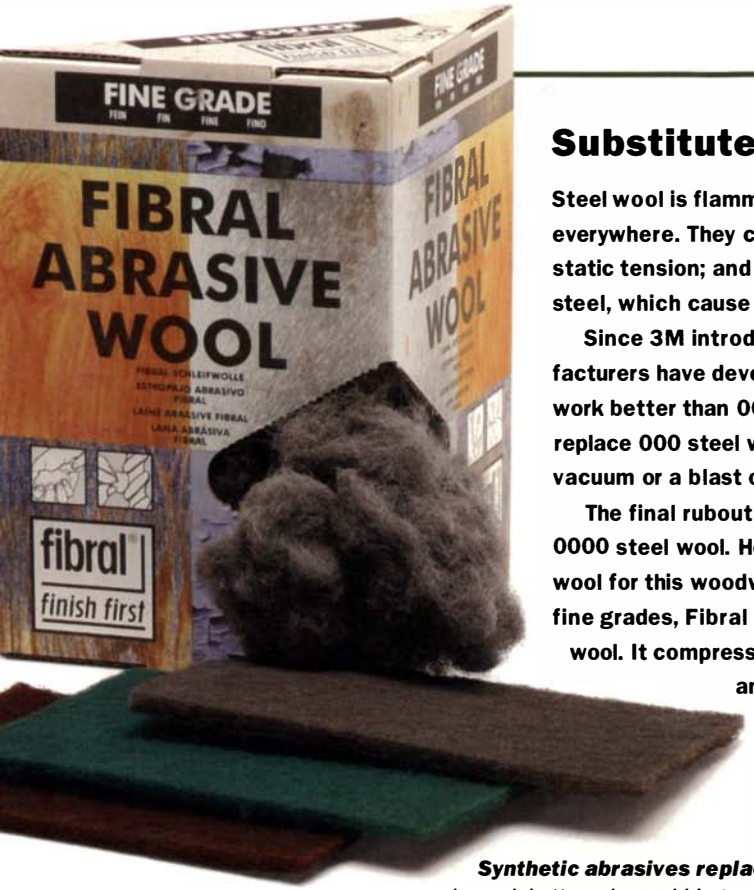
Photos, this page (left, bottom middle, bottom right): Mark Schofield

## Substitutes for steel wool won't stain wood

Steel wool is flammable and messy. When used, little shards of steel break away and get everywhere. They can lodge deeply in open-grain woods; they cling to everything through static tension; and water-based finishes can be ruined by the oil in steel wool and bits of steel, which cause rust stains.

Since 3M introduced the green Scotch-Brite nylon pad, the company and other manufacturers have developed a range of abrasive pads suitable for woodworking. Maroon pads work better than 00 steel wool for smoothing finishes between coats, while gray pads replace 000 steel wool. In both cases the grit shed by the pads is removed easily with a vacuum or a blast of compressed air.

The final rubout of a finish to produce a satin luster used to be the exclusive practice of 0000 steel wool. However, now a synthetic steel wool called Fibral is challenging steel wool for this woodworking job. Available in coarse, medium, and fine grades, Fibral is used in the same manner as steel wool. It compresses less than steel wool, lasts longer, and the shed particles are easier to clean up.




***Synthetic abrasives replace steel wool.*** *Abrasive pads work better when rubbing out coats of finish, and a new kind of abrasive wool now matches the results of the original steel wool for the final rubout.*

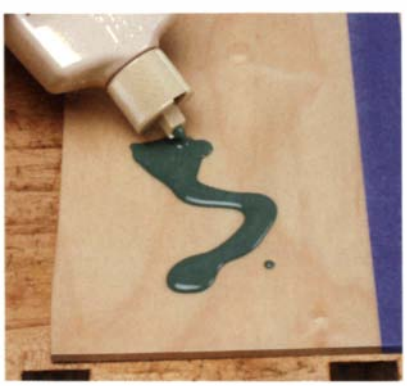
## Automotive compounds polish better than pumice and rottenstone

Products used for polishing a painted surface on a car must be very good because of the flawless surface customers expect. The abrasives used to achieve that shine can be used on most wood finishes and are above and beyond the old pumice and rottenstone traditionally used by wood finishers.

These automotive finishes are applied the same way as the traditional methods. The finished surface must be leveled first by wet-sanding with 600-, 1,000-, and 2,000-grit paper. After wet-sanding, use an automotive compound instead of pumice. The product is ready to use right out of the bottle, and it can be applied with a cloth, which absorbs most of the surplus, so cleanup is much easier than wiping off pumice/oil sludge.

For a wet-look gloss, swirl remover or final finishing liquid produces a super shine that even an expert finisher would be challenged to match with rottenstone. Meguiar's, 3M, and Transtar all make great products that can be found at automotive stores.


***A black, oily mess.*** *Rottenstone is the traditional material used to rub out a finish to a high gloss. But it requires rubbing oil and creates a black slurry.*



***As shiny as a new car.*** *For a really high gloss, rub on some swirl remover. Designed for auto finishes, it can be applied with a cloth, and any surplus is easily wiped away.*

Photos, except where noted: Michael Pekovich; this page, bottom and middle right: Mark Schofield

## Wipe-on finish with greater protection than plain Danish oil

**Oil finishes are very popular with woodworkers in part because of their ease of application. A Danish-oil finish involves flooding the surface, keeping it wet for at least 30 minutes, and possibly sanding in the finish. Then any surplus is wiped off, leaving a finish that is soaked into the wood rather than a film on top of the wood. The problem is that this type of finish offers the wood very little protection from moisture, and adding additional coats makes only a modest improvement.**

**A better choice is Waterlox Original Sealer/Finish. An oil-and-varnish mixture, this product has a resin content of 26%, compared with 11% in Watco's Danish oil. Waterlox can be applied with either a cloth or a brush, and in both cases the surplus does not have to be wiped off. While you won't achieve the totally open look of an oil-only finish, the resulting surface will have superior water and scratch resistance and will be easy to maintain. When it gets worn or is damaged, simply clean the surface with minerai spirits and reapply the Waterlox.**

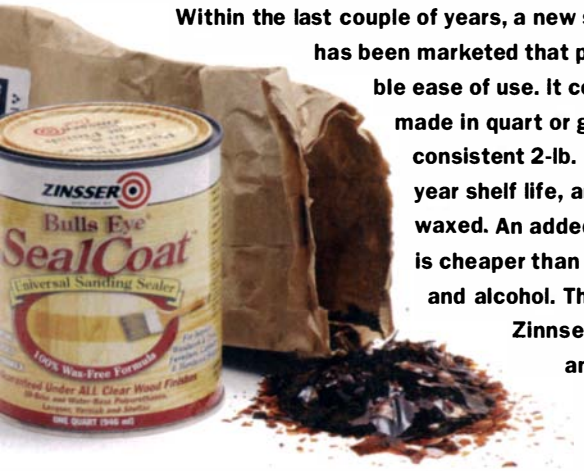

***A faster-building finish.*** *Because Waterlox has a higher resin content than typical Danish-oil finishes, it builds faster and offers more protection, whether wiped or brushed on.*




Photos, this page: Mark Schofield

## Premixed shellac saves time, effort

Shellac, being one of the oldest wood finishes, is surrounded by much folklore and tradition. The old way was to buy dry flakes of shellac, which come in various grades and colors, and dissolve them in alcohol before use. Mixing and waiting for flakes to dissolve takes time, however, and the finish has a shelf life of only 6 to 12 months. Additionally, some grades of shellac, such as seedlac, require filtering to remove contaminants.




Within the last couple of years, a new shellac product has been marketed that provides incredible ease of use. It comes ready-made in quart or gallon cans, is a consistent 2-lb. cut, has a three-year shelf life, and is 100% de-waxed. An added bonus is that it is cheaper than buying flakes and alcohol. The product is Zinnser's SealCoat, and no workshop should be without it.

SealCoat is a very pale yellow or super-blond shellac. If you desire to replicate the browns, reds, and oranges of other grades of shellac, simply add color with alcohol-soluble dye concentrates such as TransTints or Wizard Tints. With dyes, the range of colors available is almost limitless—anyone for green shellac? Your method of using shellac—French polishing, padding, brushing, or spraying—will not change, but using SealCoat will make the job a whole lot easier.


***Any color you want.*** *SealCoat's blond shellac comes ready to use right out of the can. By adding concentrated dyes, you can replicate different grades of shellac such as buttonlac or seedlac.*

REPAIRS

## For repairs, epoxy is easier to apply than burn-in sticks

Repairing a damaged piece is not only distressing, but it's also hard to master. A traditional method of repair is the use of burn-in sticks, which are melted with a hot knife, allowing the molten resin material to flow into the damaged area. However, the material sets immediately, so you have to overfill the repair area and then level it with a razor blade, a chisel, or an abrasive.

Other problems include air bubbles that are revealed when the repair is leveled, and the fact that the smooth, shiny surface of the repair sometimes contrasts with low-luster or open-grain finishes. The entire process is time-consuming and requires practice.

***Knead the two-part epoxy together.*** *Use a small knife to force the epoxy into the damaged area. Use a cleaner that contains butyl cellosolve, such as Simple Green, to remove any surplus.*

You can speed up and simplify the process by using epoxy sticks. These two-part epoxy products come in a "cookie dough" roll. Slice off the amount you will require for the repair, knead it until the two parts are mixed, and apply it to the void with an artist's knife. While it is still soft, clean off and level any surplus by rubbing it off with a rag moistened with Simple Green. The repair can be ready for use in as little as five minutes. Although epoxy sticks come in several colors, for the best color match you probably will need to touch up the repair using a pigment color and shellac applied with an artist's brush. There are no shiny spots or air pockets, you can shape the epoxy to match profiles, and there is no risk of getting burned on a hot knife.

### SOURCES OF SUPPLY

**WATERLOX, SEALCOAT, WIZARD TINTS, ABRASIVE WOOL AND ABRASIVE PADS, NEUTRAL-COLORED EPOXY STICKS, SMALL SPATULAS**
Woodworker's Supply
www.woodworker.com;
800-645-9292

**TRANSTINTS, PINE OR MAHOGANY COLORED EPOXY**
Woodcraft
www.woodcraft.com;
800-535-4486

**NORTON 3X SANDPAPER**
The Home Depot

Photos, this page (top right, bottom left): Mark Schofield

# A Shaker Blanket Chest

## Dovetails, figured wood, and traditional moldings enhance this timeless piece

**BY CHARLES DURFEE**

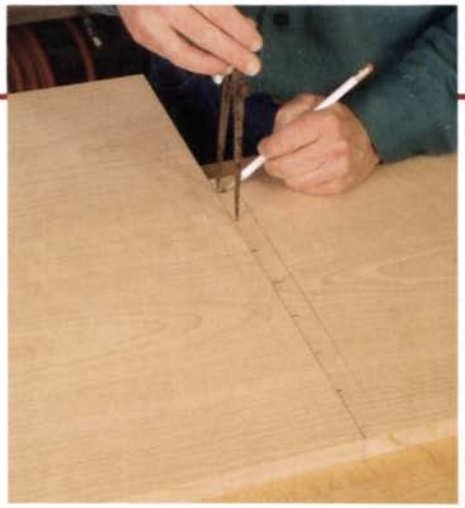
The earliest storage chests were simple boxes made of six boards. As they evolved, a base, or plinth, was added to lift them off the floor and give them aesthetic appeal, while molding the edges created a more finished look. However, anyone who used such a chest soon found that they had to fish around for small items that ended up on the bottom. To solve this problem, furniture makers added first one drawer, and then two or even three drawers. Finally, the lid was eliminated, leaving a full chest of drawers as we know it today.

During the evolution from blanket box to chest of drawers, the grain in the sides changed from horizontal to vertical. Many of the single-drawer versions exhibit an intermediate stage in this evolution, with vertical grain in the sides nailed to horizontal grain in the



Photo, this page: Michael Pekovich

## DOVETAIL THE CHEST



***Lay out the dovetails.*** *Use a pair of dividers to lay out the dovetails evenly. The spacing on the front corners may need to be slightly different from the spacing on the rear due to the presence of the drawer.*

***Extend the layout to the end of the board.*** *After marking the tails on the face of the board with a sliding bevel, extend the lines across the end of the board using a square and a knife. The knife cuts will help guide the saw as you cut.*

***Line up the boards.*** *Before laying out the pins, ensure that the boards are flat and meet at 90°.*

front, which probably is the only way they could be joined. In this piece, the older style with all horizontal grain is retained, which enables the front, back, and sides to be joined with dovetails. As long as the sides don't get too tall, this is a superior form of construction: Seasonal wood movement results in the parts moving together, instead of against each other.

### Match the dimensions to your hand-picked boards

Although the Shakers probably would have used painted pine, modern woodworkers may prefer the natural look of fine wood. I used some excellent single-log Pennsylvania cherry with lots of curl, nicely matched in grain and color.

You may need to adjust the overall dimensions if you want to use specific boards in particular places. In this case, I made the overall height a bit less than planned so that I could use an exceptionally fine single-width board for the front. You can lay out the actual dimensions on a story stick, using one face each for height, width, and depth. The story stick will give you all of the information necessary to begin construction, so you won't need any drawings.

After double-checking to ensure planning and layout make sense, mill and glue the boards for the front, sides, back, top, and drawer front. Leave the inner bottom oversize; it should be sized to just fit into its grooves. In addition, you can make up the bottom frame-and-panel. Remove any dry excess glue and flatten the boards using planes or sanders and a straightedge. To save

***Mark the pins from the tails.*** *With the boards secure, use a sharp pencil to transfer the location of the pins. A flashlight helps you see into the corners.*

Photos, except where noted: Mark Schofield

time, I take the parts to a local mill shop and run them through a thickness sander.

With the case front, back, and sides cut to size, run the grooves for the inner bottom (on the front, the groove technically is a rabbet). The grooves need to be stopped before the ends and carefully aligned from the top so that all four grooves match up. I use a ¾-in. straight bit in a plunge router and run the tool against a straightedge to ensure a straight cut. Make the rabbet for the frame-and-panel bottom in the same fashion, stopped at the rear corners only.

### Construct the carcase with dovetails

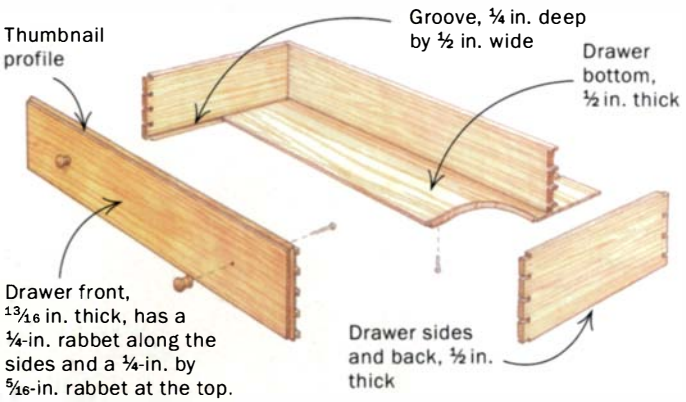
There are a lot of dovetails to cut in this project, so you might as well decide on a method of cutting them and stick with it. If you use a router setup, make sure the jig can handle the long row of the rear corners or has a way to index setups. I cut the dovetails with hand tools, which mostly is an exercise in sawing and marking accurately.

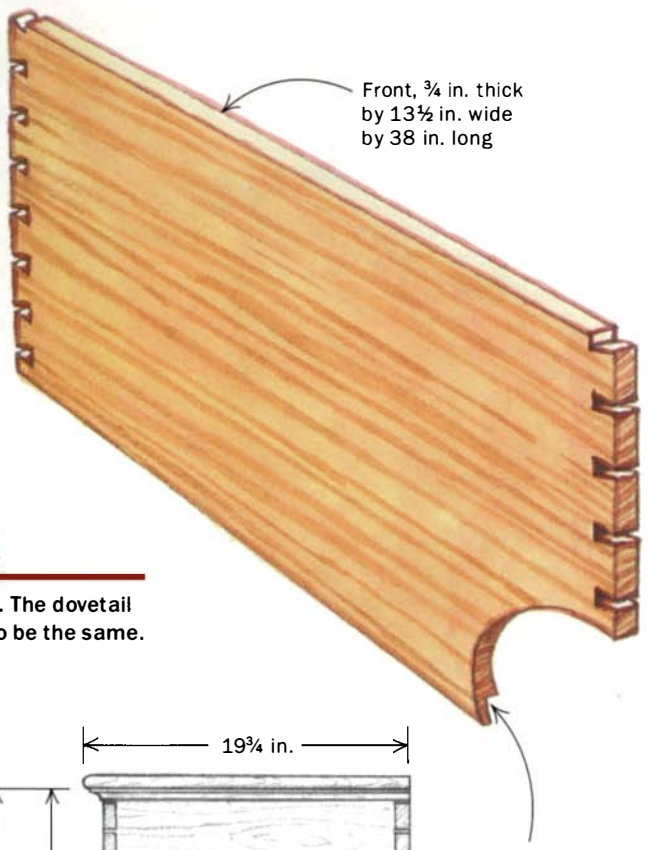
When laying out the joints, aim for a spacing between pins of about 1¾ in. on center. This chest has the peculiar problem of the front and back rows being different lengths, due to the drawer opening. Try to have the front series end with a small half pin or a small half tail, for appearance's sake. Make your scribe marks on the front edge of the sides down to the drawer opening only.

When cutting the dovetails, orient the outside face of the side toward you. Begin sawcuts at the top back corner; come across the top edge to set the saw in and then down the front face at an angle, keeping the saw completely in the kerf. Then finish the cut by raising the handle gradually. To ensure the cut is made to its full depth, I follow an old-timer's practice of cutting slightly past the scribe on the back side. After cutting the tails, check that they are

**LIPPED-FRONT DRAWER**

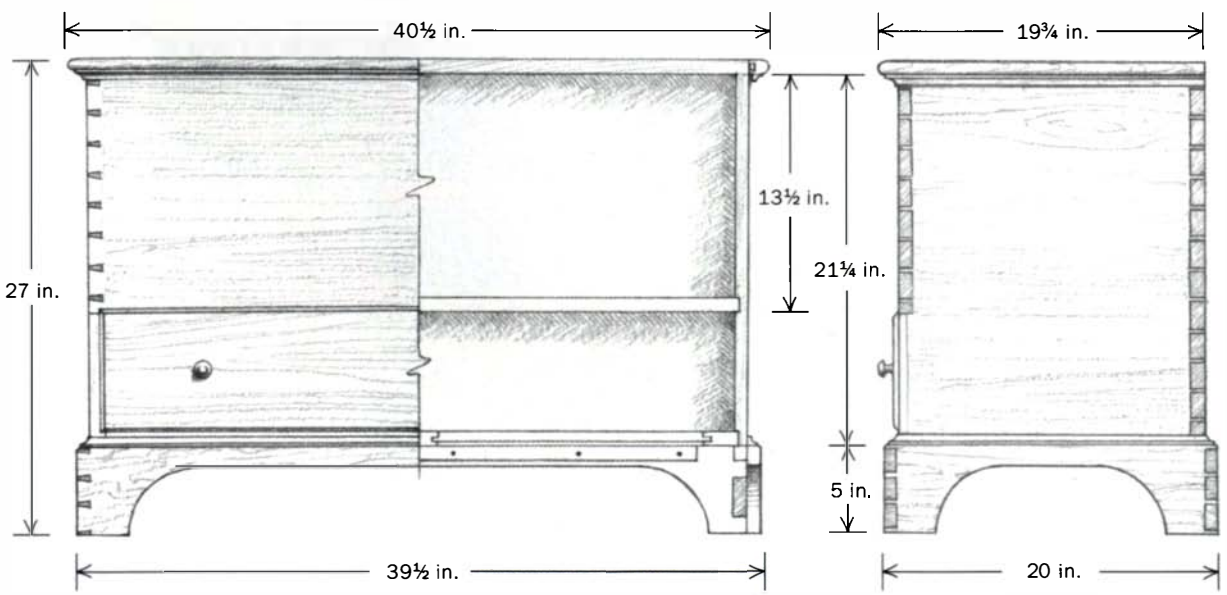
The cherry drawer front is lipped on the top and sides. The sides, back, and bottom of the drawer are made of a secondary wood.

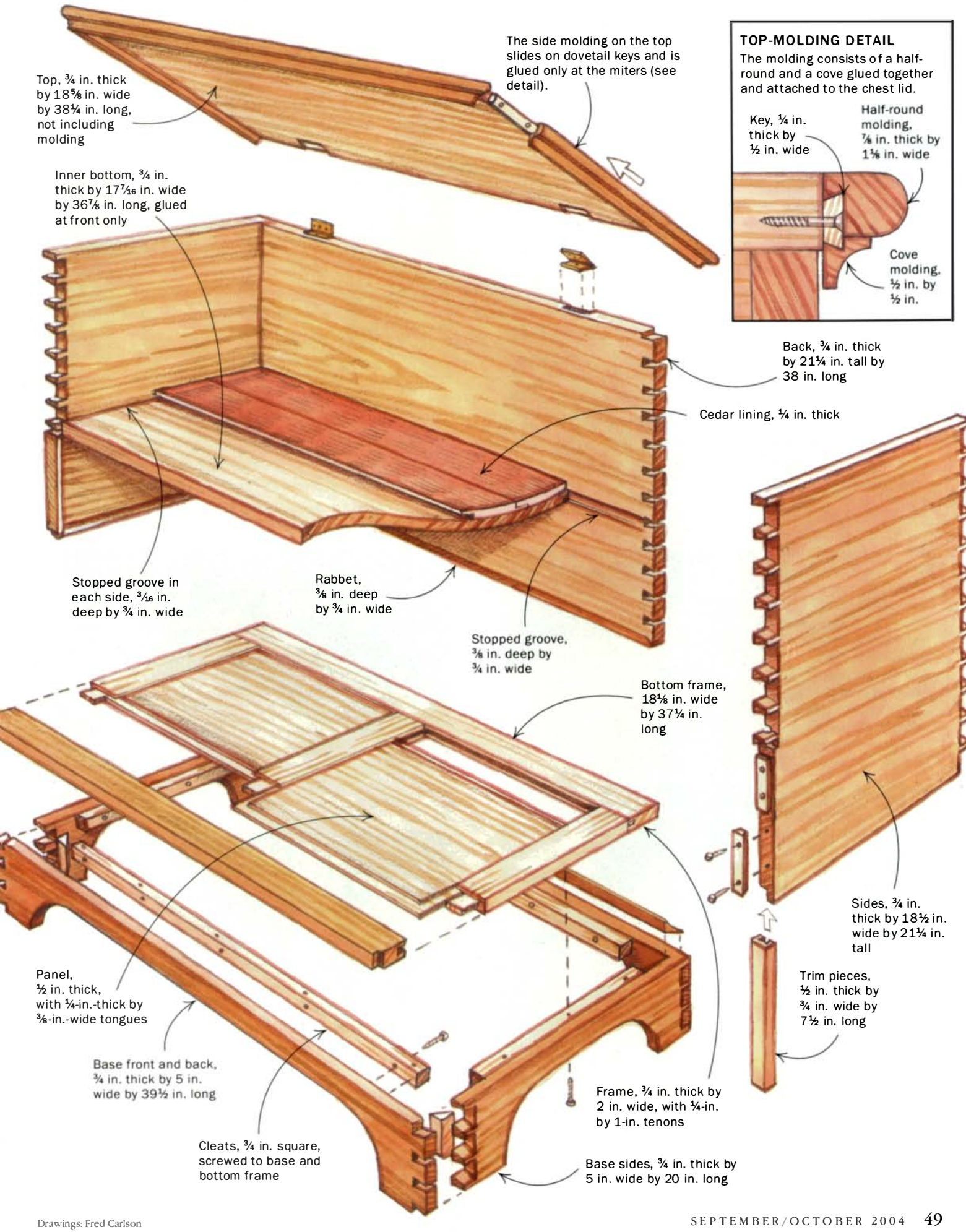



## DOVETAILED BLANKET CHEST WITH A DRAWER

**Because of the drawer, the front corners have fewer dovetails than the rear corners. The dovetail spacing may be slightly different on the back than on the front but should appear to be the same.**

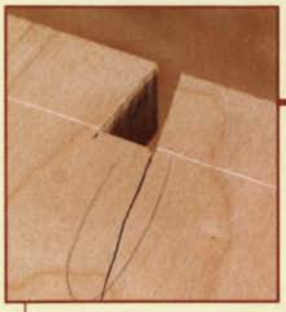





Drawings: Fred Carlson

# When things go wrong with your dovetails

**Hand-cut dovetails should not be perfect, and indeed rarely will be. However, some faults that occur during fitting or assembly need to be repaired because they detract from the overall appearance of the piece.**



## WHEN A TEST FIT CRACKS THE WOOD

When dry-fitting dovetails, it takes only one pin that is too tight to cause a crack. This needs to be repaired before the two boards are dovetailed together. It's difficult to force glue down into the crack. But by placing the board half hanging off the bench and then flexing it while pushing the glue into the crack with your finger, you can work the glue in from both sides until the joint is saturated. Place waxed paper over the joint to protect the clamp that keeps the two sides of the crack parallel, and then place another clamp across the board to pull the crack together.

***Repair a crack.*** *While flexing the board up and down, force glue into the crack (right). Use one clamp to keep both sides of the crack aligned, with waxed paper between the glue and clamp; then close the crack with another clamp across the board (below).*

## UNSIGHTLY GAPS BETWEEN PINS AND TAILS

Don't despair if there are gaps on either side of the pins and tails. If the gaps are very narrow, you can repair them by inserting some glue and peening the tail or pin with a ball-pein hammer. The blows spread out the end grain until it fills the gaps. This method requires that the tail or pin protrude at least 1/16 in., because it will be necessary to plane away the crushed surface end grain.

If the gaps are wide, the best way to fill them is by tapping in a thin wedge lubricated with a little glue. After the glue has dried, saw off the protruding part of the wedge and smooth the surface with a block plane. The end grain of the wedge will be an almost perfect match with the pin or tail.

***Peen small gaps.*** *Small gaps can be filled by inserting a little glue and then hitting the pin or tail with a ball-pein hammer. Do this before planing the pins flush so that the hammer marks can be removed.*

***Shim larger gaps.*** *A narrow wedge driven into the gap beside a pin will make an almost invisible end-grain repair.*

square and do any necessary paring. In this way, any adjustments to get a good fit are done only on the pins.

**Use the tails to mark the pins—**When marking from one part to the next, make sure that the front and back are perfectly square to each side, and that the grooves line up so that the inner bottom will be able to slide in. I use a very sharp pencil lead extended from a lead holder for marking. It leaves a fine line, is much easier to see than a knife scribe, and doesn't accidentally cut the tail.

With the case dovetailing done, cut the recesses for the trim pieces on the lower front edges of the sides.

### Dry-fit the carcase before final assembly

When dry-fitting the case parts, push the joints together as much as possible by hand, then use a rubber mallet. When the joints are almost there, resort to clamps. You walk a fine line when fitting exposed dovetails: Too tight, and you risk splitting the wood; too loose, and you leave gaps between the pins and tails. Fortunately, splits and gaps can be fixed (as shown on the facing page).

For the glue-up, I make special clamp cauls (see the photos at left) to span the pins because they protrude somewhat. To make the glue-up less nerve-wracking, break down the process into steps. Assemble the front, the two sides, and the inner bottom as a unit first. The front edge of the inner bottom is glued only to the front rabbet (the rest is unglued to allow for seasonal movement). If necessary, cut a temporary spacer to hold the rear edges in the correct alignment. The second step is to glue on the back. When the back is dry, fit and glue the base frame into the bottom rabbet.

### Conceal the end grain with trim pieces

With the carcase assembled, cut a notch in the base frame at each front corner for the trim pieces. On original Shaker chests, these trim pieces as well as the moldings simply were nailed on, which

## ASSEMBLE THE CHEST IN STAGES

*Gluing this many dovetails is stressful enough without trying to do all of them at once. Before you start, make some cauls on the bandsaw to fit over the protruding pins. (1) First glue the front to the two sides and slide in the inner bottom, gluing the front edge into the rabbet and allowing the rest to float. (2) When this first assembly has dried, glue on the back, again using the cauls. (3) When the back is dry, fit and glue the frame-and-panel base into the bottom rabbet.*

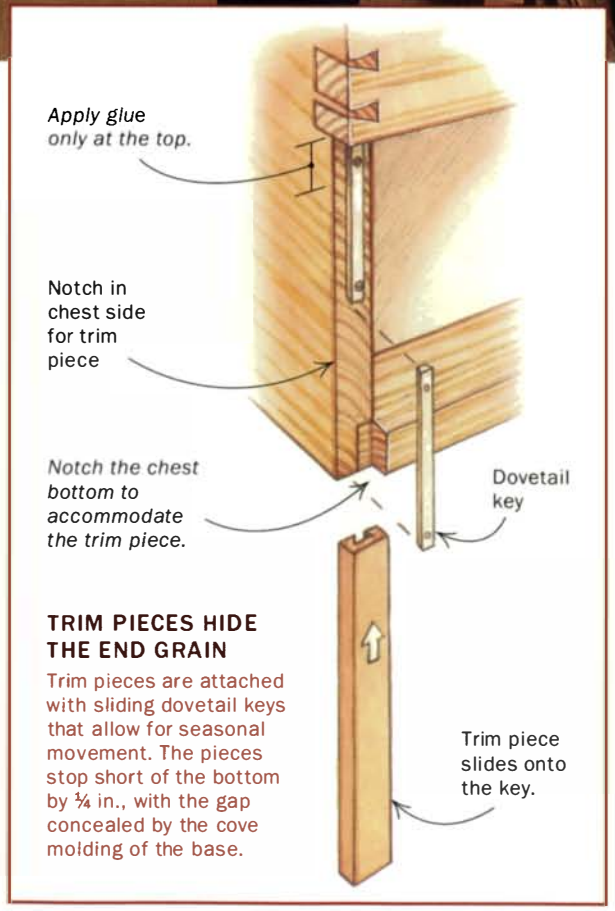
not only caused seasonal wood-movement problems but also were aesthetically unpleasing in an unpainted piece. A more elegant solution is to attach these cross-grain parts with sliding dovetail keys (see *FWW* #170, pp. 50-58). I vary this method slightly, screwing the key on beginning at the inboard end and pulling off the molding, fastening as I go. The segments are cut out and the molding slid back on with glue at the inboard end. Leave the bottom end of the trim pieces about ¼ in. short of the case bottom to allow for seasonal expansion. The cove molding will cover the gap.

### Build the base and the top before attaching the molding

On this chest, the base runs around all four sides, as opposed to most early-American chests that have bracket bases on the front and sides only. Saw the dovetails first, and then cut out the profile on the bandsaw; you can save the cutouts to use as clamp cauls. Nail a plywood template to the back of the base pieces and clean up the profile on the router table with a top-guided bearing bit. Screw cleats to the inside of the base and drive screws through the cleats to attach the base to the chest.

Because the moldings overlap the top edge of the case, the top should be sized so that the front clearance is proportional to the amount of seasonal wood movement. I built this chest in the winter, and the wood's moisture content was 6%, so I sized the top with a minimal clearance of a strong 1/16 in. (3/16 in. to ¼ in. should be sufficient clearance for a summer-built chest).

The top molding consists of a half-round and a cove made on the router table and then glued together. While you're at it, make some extra cove molding for the base. The front piece is mitered and glued to the top, while the sides are installed over dovetail keys, with glue at the miters only.


**TRIM PIECES HIDE THE END GRAIN**

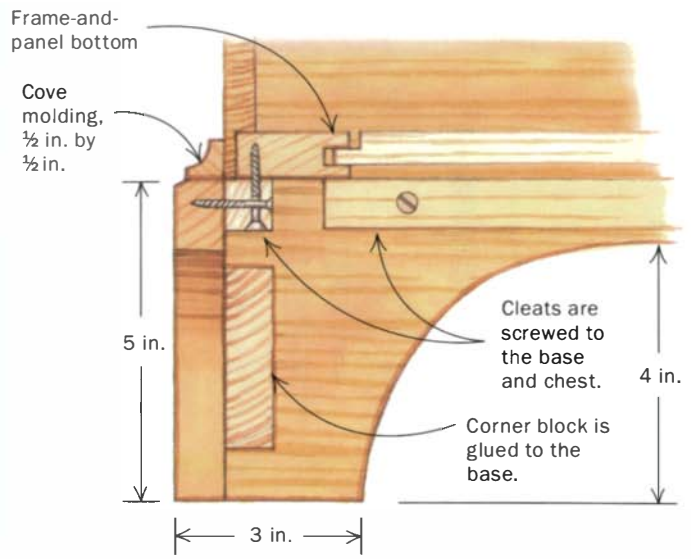
Trim pieces are attached with sliding dovetail keys that allow for seasonal movement. The pieces stop short of the bottom by ¼ in., with the gap concealed by the cove molding of the base.



## CAP THE END GRAIN

***To conceal the end grain, the sides are notched adjacent to the drawer, and trim pieces are attached over dovetail keys. (1) After assembling the case, notch the case bottom where it intersects the sides. (2) Then screw the dovetail key to the case using the trim piece to aid alignment. (3) Finally, saw apart the key to allow for seasonal movement of the case. Glue the trim piece only at the top.***

## INSTALL THE BRACKET BASE




The drawer front is in the traditional style, lipped on the top and sides and molded all around. The sides and back on my drawer are quartersawn pine, and the bottom is poplar. You can find quartered stock at any lumberyard—just look through a stack of boards for ones with growth rings perpendicular to the board's face.

Cut the drawer front first, with its side rabbets trimmed so that they just fit into the opening. The top rabbet needs to have only about 1/16 in. of clearance, because seasonal movement of the drawer will be in the same direction as the case. Cut the dovetails by hand, but use a Forstner bit to drill out the bulk of the waste between the half-blind pins.

### Attach the hardware and finish the piece

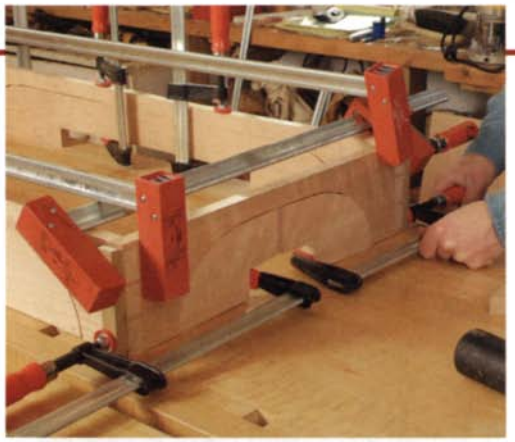
By now you will have something that looks like a chest. The top is secured with mortised-in butt hinges. I used extruded-brass hinges from Whitechapel (307-739-9478; www.whitechapel-ltd.com), but you may opt for a more authentic style with thinner leaves. When the top is fastened, find the location for the stay. I used a brass chain, which isn't strictly traditional Shaker but still shares a similar simplicity. (For more on installing lids, see *FWW* #161, pp. 46-51.)

Throughout the construction process, you should have been planing, scraping, and/or sanding to all but the final passes. I generally take out machine marks (including the tracks left by the thickness sander) with a handplane and scraper. The final work is done with a 220-grit disk in a random-orbit sander.

I used Minwax Antique Oil, but any oil/varnish mixture will work well. The first coat is always exciting—the figure fairly jumps off the surface—but it also reveals any dents, dings, and glue splotches that should be wet-sanded with finish using 220- or higher-grit sandpaper.

After the finishing is completed, add the thin cedar lining in the chest bottom. I used some leftover western red cedar clapboards. I planed them down, shiplapped the edges, and tacked them in, leaving them unfinished. Years hence, a light sanding will refresh the smell, allowing me to recall the pleasure of building this piece. □

*Charlie Durfee builds furniture in Woolwich, Maine.*



***Save the waste piece.*** *After cutting the profile of the base, save the offcuts, which can be cut in two and used as clamping cauls when gluing together the base.*

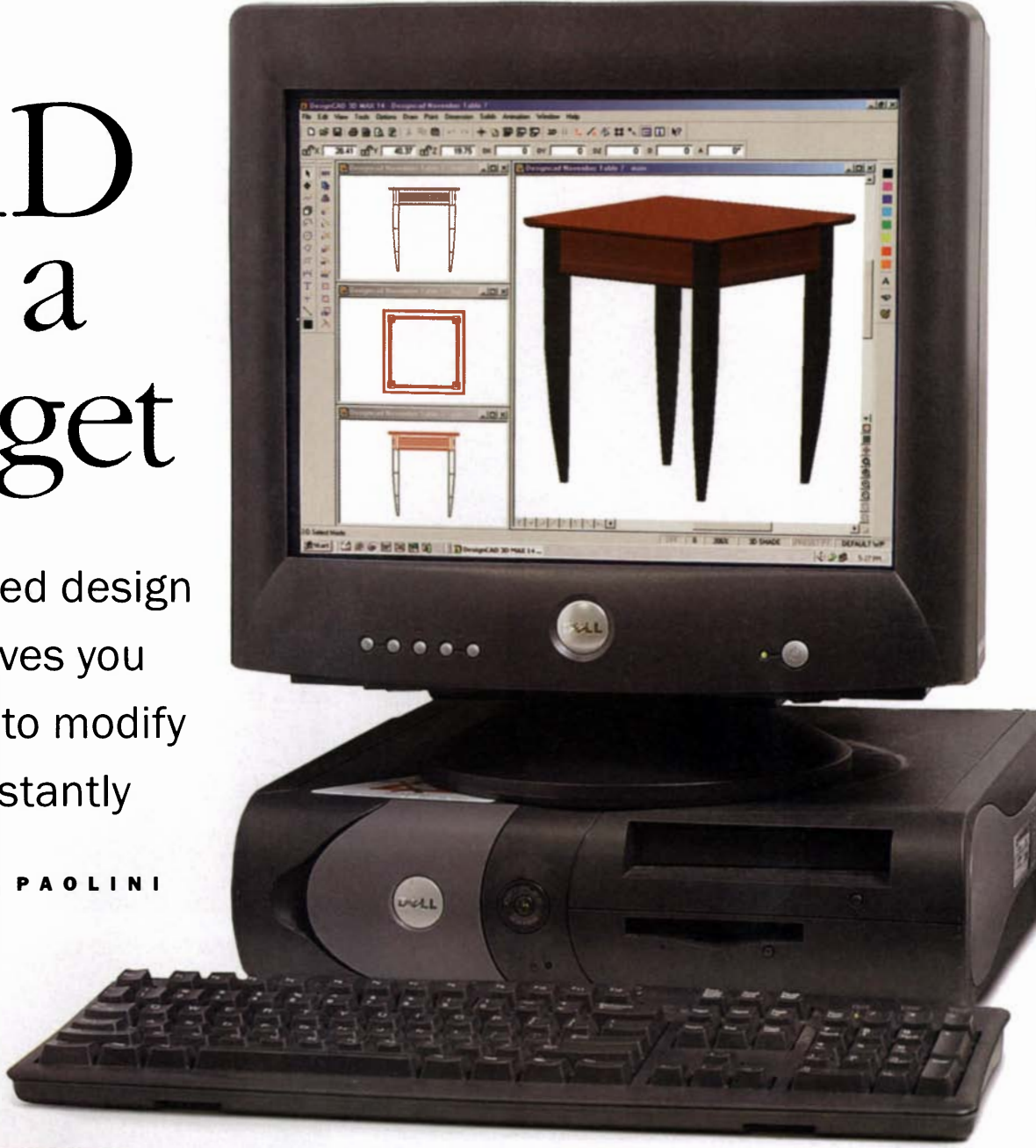
***Attach the cleats.*** *Screw cleats to all four sides of the base. Then drive screws up through each cleat to attach the base to the chest.*

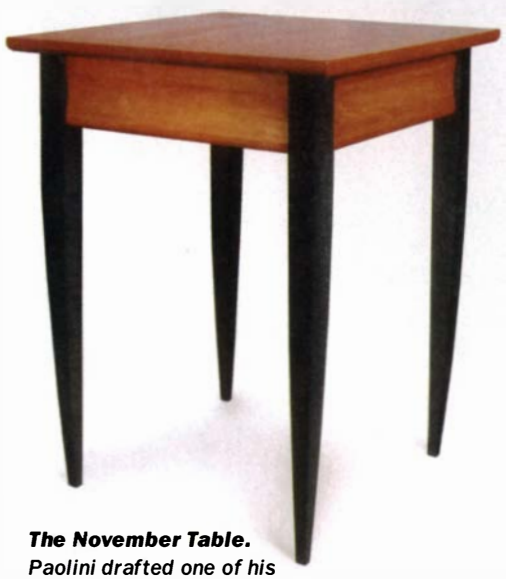
***Fit the molding.*** *Because the grain on the chest runs horizontally, the base molding can be glued to both the base and the sides.*

# CAD on a Budget

## Computer-aided design software gives you the flexibility to modify designs instantly

BY GREGORY PAOLINI





***The November Table.*** *Paolini drafted one of his tables using five affordable CAD programs and then compared the results.*

While I enjoy drawing plans by hand, I've come to embrace the benefits of designing furniture on my computer with computer-aided design (CAD) software. A nice CAD program can cost less than a set of basic drafting tools, and design mistakes can be fixed with just a click of the mouse.

With CAD, you can change a design quickly without redrawing the entire piece. You can draw a furniture part, such as a table leg, one time and copy and paste it to create matching parts. Tasks such as adding a drawer, increasing the height of a piece, even changing styles can be performed with a few keystrokes. Also, you can print variations of a design to compare with the original.

In addition, everything you draw is in proportion; the computer scales the drawing to fit your screen so you know what the piece will look like before ever stepping foot in the workshop. And if you're inclined, you can take the CAD file to a printer and have it plotted full size.

For this review, I looked at the five popular CAD programs that are available for less than $100. Due to my background in mechanical design, I at first was concerned that my knowledge of drafting and CAD would affect my judgment. I trained on AutoCAD, the industry standard in design



Photos, this page: Anthony Szlis (left); Matt Berger (top)

software, and worried that my familiarity with the program would make an objective review difficult. But to my surprise none of the programs shared AutoCAD's concepts and commands, including the two programs that were made by the same software manufacturer. As a result, I faced each program with the same learning curve.

### 2-D or 3-D?

Because of their low cost, right off the bat I knew that the software wouldn't be as powerful as the industrial-strength programs that typically cost between $500 and $3,500. When choosing from this affordable field of software, you need to ask yourself what you ultimately want to accomplish. Are simple 2-D black-and-white sketches adequate? Or are you planning to plunge into the world of 3-D drawing?

With 2-D software, you are able to design a piece from three views: the front, top, and side. If you are interested in making only measured drawings that you can use in the shop, you won't go wrong with basic 2-D software.

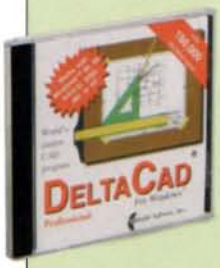
The more advanced 3-D programs allow you to draw a piece not only in the front, top, and side views but also in perspective. However, because you are adding depth to each piece, there is a lot more to 3-D drawing. For example, in 2-D software, a roundover on a tabletop is depicted with a horizontal line and a vertical line joined with a quarter circle. However, in 3-D, you have to tell the computer to draw the roundover along the entire length of the object. All of the 3-D programs have the option to design in 2-D until you are more comfortable with the concepts. Make the decision between 2-D and 3-D up front, because switching software later on can mean learning a new program all over again.

You also must make sure that your software of choice is compatible with your computer. I used a semi-outdated personal computer with the bare minimum requirements for running these programs: A Celeron 500-MHz processor, 256 MB of RAM, running the Windows 2000 operating system. It performed fine rendering 2-D drawings, but it slowed down considerably when rendering the 3-D drawings.

### Put to the test

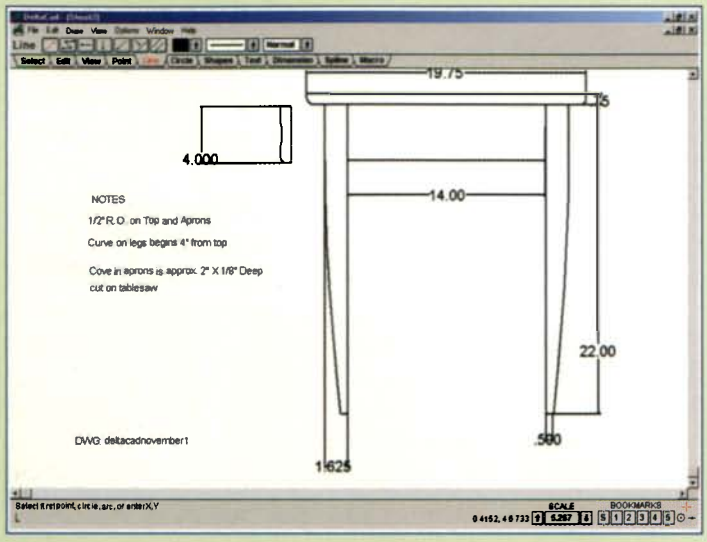
To evaluate each program, I chose one of my table designs as the test subject (see the bottom photo on the facing page). The

## 2-D CAD PROGRAMS




### DELTACAD PROFESSIONAL

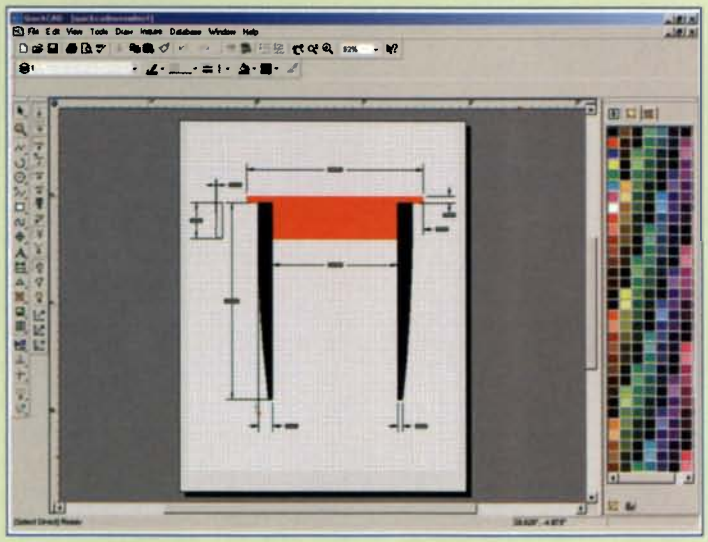
**I was skeptical about DeltaCad Professional when it arrived. The software was packaged in a regular CD case, and the only printed documentation was a sheet showing keyboard shortcuts. After a painless installation, I began my first built-in tutorial, which took about an hour, where I was instructed how to draw a calculator. Another hour later, I had finished my drawing of the test table, complete with dimensions.**



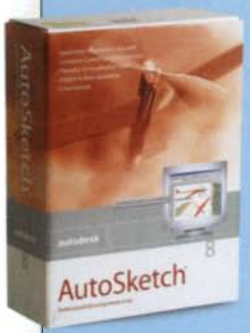

***A great entry-level program.*** *DeltaCad is easy to learn and has many of the features available on more expensive programs, such as layering.*


### QUICKCAD 8

**"Impressive" was my first thought when I picked up QuickCAD 8 and studied all of the features touted on its cover. However, when I delved into the program, my opinions changed. The instruction manual was extensive and featured about 20 "Fast Track" tutorials that teach the basic commands. While it gave me an idea of how to draw squares and circles, it never really explained how to combine all of these entities into one drawing. QuickCAD could have benefited from a better tutorial.**

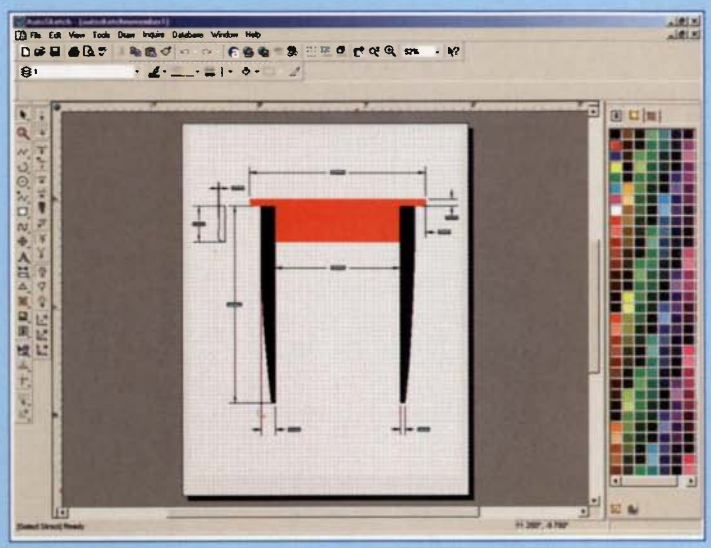


***Takes time to master.*** *QuickCAD is a very powerful program, but be prepared to put in some study time.*




## AUTOSKETCH 8

**AutoSketch 8, made by the same company that makes QuickCAD, is almost a carbon copy of its counterpart. It comes in similar packaging, offers the same level of instruction, and sports the same user interface. The only difference, besides the price, is that AutoSketch features 3-D effects. It allows you to draw 3-D shapes; however, you cannot render a 2-D drawing in 3-D. I spent about 30 hours over the course of a month trying to use the feature, and the only thing I had to show for it was a few more gray hairs. I threw in the towel and came to peace with the fact that I was not going to draw the table in 3-D.**



***Difficult.*** *Paolini was unable to master the 3-D effects feature even after an exhaustive evaluation of AutoSketch.*

table incorporates curves and coves, which I felt would make for a more challenging test. Over a period of four months, I put the programs through their paces.

I had planned to give each piece of software equal playing time, but the simple 2-D programs required significantly less time to learn than the 3-D programs. So I decided to make the best drawing I could with each program while keeping notes on the process along the way.

All of the programs I tested require basic knowledge of the Windows operating system, but they don't require you to know the general concepts of CAD. That's where the software's tutorials and instructions come in handy. You also may purchase additional books and tutorials that can help you learn how to use some of these programs.

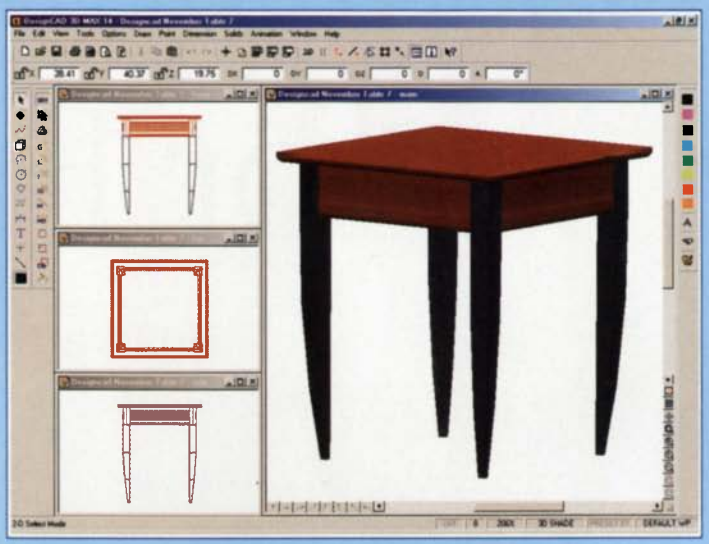
A few important CAD features are available in each program. Each allows you to draw in layers, useful when drawing plans with a multitude of parts and dimensions. Layers allow you to hide, manipulate, or delete individual parts without affecting the rest of the drawing. (They are much like transparencies layered on top of each other.) When drawing in CAD, you can use one layer for the basic drawing, another layer to list all of the dimensions, and a third layer for joinery. You then can hide individual layers if the drawing gets cluttered.

With each program you can sketch lines arbitrarily, and then dimensions are added automatically. You also can make lines by first typing in their dimensions. I prefer to employ the latter method and do my sketching ahead of time with a pencil and some paper.

| Program | Manufacturer | Price | Supported file formats | User manual | Difficulty level | Training and design time | Overall rating |
|---|---|---|---|---|---|---|---|
| **2-D CAD PROGRAMS** | | | | | | | |
| DELTACAD PROFESSIONAL | Midnight Software 206-361–0796 www.deltacad.com | $39.95 | DXF | None, but built-in tutorials were very useful | Beginner | Two hours | Good |
| QUICKCAD 8 | Autodesk 800-440-4198 www.autodesk.com | $49 | DXF, DWG, JPG, BMP, WMV | "Fast Track" tutorials teach the basics, and some help features are integrated into the software | Intermediate | 10 hours | Good |
| **3-D CAD PROGRAMS** | | | | | | | |
| AUTOSKETCH 8 | Autodesk 800-440-4198 www.autodesk.com | $99 | DXF, DWG, JPG, BMP, WMV | "Fast Track" tutorials teach the basics, and some help features are integrated into the software | Advanced | 30 hours | Poor |
| DESIGNCAD 3D MAX V14 | IMSI 800-833-8082 www.imsisoft.com | $99.95 | DXF, DWG, WMV | Extensive manual and three training CDs that practically hold your hand through the learning process | Beginner | Nine hours | Excellent |
| TURBOCAD DELUXE V9.2 | IMSI 800-833-8082 www.imsisoft.com | $99.95 | DXF, DWG, JPG, BMP, WMV | Extensive manual and basic built-in tutorials, but plan on putting in some hours to learn 3-D | Intermediate | 22 hours | Good |


## DESIGNCAD 3D MAX V14

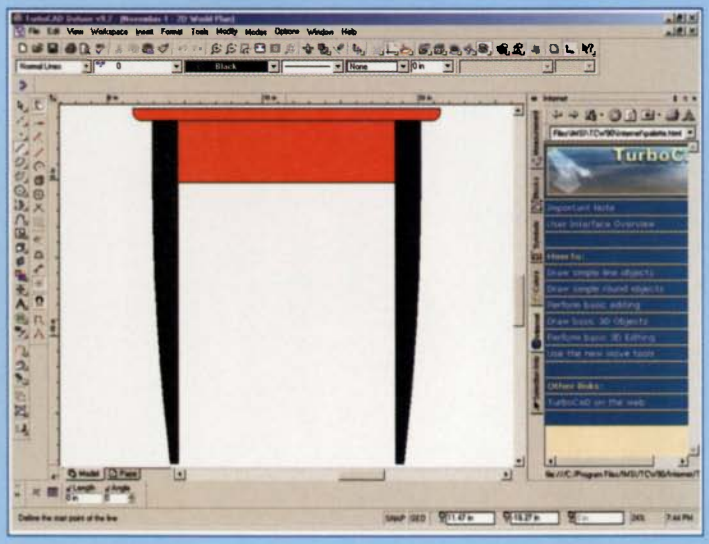
**I liked everything about DesIgnCAD 3D MAX V14, from the tutorials to the final renderings It produced. It came with an Inch-thick manual In addition to three training CDs that cover CAD fundamentals, 2-D drawing, and 3-D rendering. The Interactive training CDs were Incredible, and after a few hours I was very comfortable drawing In the program. I spent about nine hours with DesIgnCAD and was very pleased with the results of the table I drew. It left nothing out and was a very complete representation of the actual piece.**



***Solid performer.*** *DesignCAD features wood graining, multiple views on one screen, and realistic 3-D renderings.*


## TURBOCAD DELUXE V9.2

**A very powerful 3-D rendering program, TurboCAD could have benefited from training CDs or more In-depth tutorials. The software has built-In help features that guided me through the basics of drawing and CAD, but It required a big Investment of my time to learn. I spent about 22 hours with the program before I was pleased with the results of the finished 3-D drawing. My SOO-MHz processor fell short of the recommended system requirements, so It took a little longer to load than It should have. Fully rendered 3-D views taxed my outdated computer, but It performed fine In 2-D.**



***Views in 3-D (left) and 2-D (right).*** *TurboCAD also integrates Web tutorials and some prerendered parts, such as screws and bolts.*

Besides 3-D capabilities, the major differences between the programs lie in the learning curve and in the manuals that came with each program. Other differences were in the details. For example, DesignCAD 3D MAX allows you to color the parts with wood grain. The programs also differ in the variety of file formats in which you can save your projects. The more file formats available, the easier it is to share and transfer files. For instance, many printers can plot a full-size CAD drawing if the file is saved in a DXF file format compatible with the industry standard AutoCAD.

### Pick of the litter

Without question, my favorite program was DesignCAD 3D MAX V14. The folks at DesignCAD not only made a powerful design program but also intended on making sure their customers could use it to its fullest potential.

However, if you never plan on moving into the 3-D world, DeltaCad offers an easy-to-use interface, with enough built-in training to accomplish your 2-D goals. It also has many of the same features found in more expensive software packages.

CAD is like any other tool in your shop—the more you use it, the better you'll get at it. Practice, and before long you'll be making professional drawings and expanding your design horizons. □

*Gregory Paolini makes Arts and Crafts-style furniture in his workshop in Buffalo, N.Y.*

# Sliding Doors for Furniture

## Build attractive doors that slide smoothly

BY SETH JANOFSKY

I like to use sliding doors in my work. If they are appropriate for a cabinet I'm making, I'll often choose them over hinged doors. Sliding doors can be either more or less sophisticated in their design and proportions, but making the tracks and fitting the doors are pretty straightforward.

A well-made sliding door is a pleasure to use. When built properly, even a large door will slide almost effortlessly. Although it involves wood sliding on wood, a good door might as well be running on ball bearings. And, speaking for myself, I appreciate not having to go through the tedious process of carefully mortising for hinges and fitting and refitting to get the doors just right. Another convenient attribute of sliding doors is that they are not attached to the cabinet but can be lifted in and out of their tracks at any time.

For practical reasons, however, sliding doors sometimes are inappropriate. Think about the ways the cabinet will be used. Sometimes it's desirable to have all of the doors on a cabinet open at once, in which case hinged doors are a better choice.

The proportion of the doors is another consideration. As a practical guideline, doors will slide well when their height is less than two and a half times their width. As with drawers, the longer the door's running surface relative to its height, the smoother the sliding action.

Doors run much more smoothly when they do not actually rest on the bottom of the grooves in the lower track, but rather on a small ledge. This is achieved by

Photo, this page: Seth Janofsky

adding a rabbet at the top and bottom of the door, leaving thick tongues at those locations, and then cutting the grooves to fit the tongues. I usually place this rabbet along the front edge of the door, though most Japanese cabinet doors have this ledge along the back. The tongue does not bottom out in the lower grooves, leaving a gap for crud to gather without derailing the door or scarring the wood.

## Start with the tracks

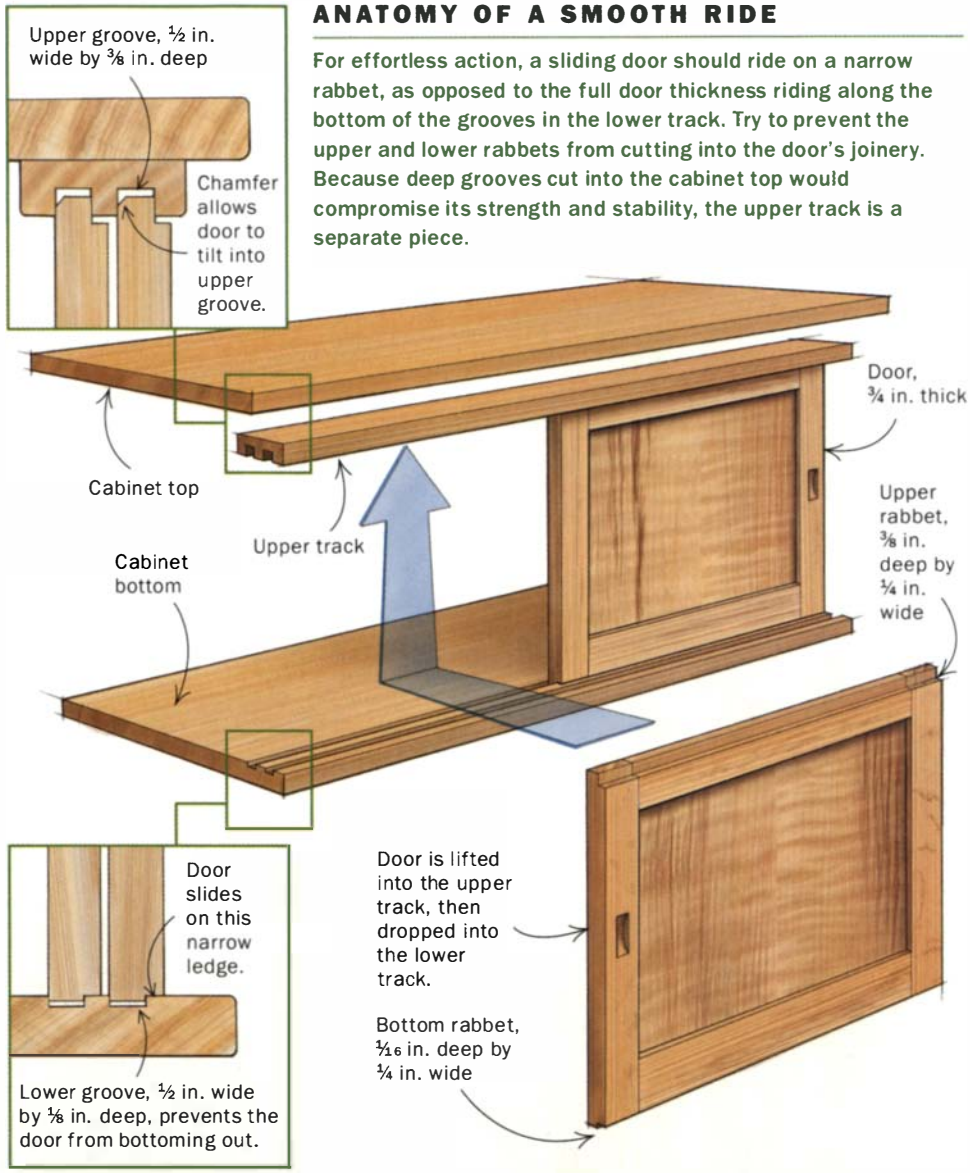
The first thing to note is that the grooves in the lower track can be quite shallow and still function well (in most furniture projects I make the grooves between 1/16 in. and 1/8 in. deep). But the grooves in the upper track need to be considerably deeper—not only to prevent the door from falling out of the cabinet but also to allow the door to be lifted off the lower track for installation and removal.

I usually make the upper grooves 3/8 in. to 1/2 in. deep. This allows for at least a full 1/4 in. of penetration in the grooves when the door is in place. If you've never made this kind of door before, it can be helpful to draw the doors and tracks full-size in cross section to be sure that the grooves in the tracks will be aligned and to imagine how the doors will work when being lifted in and out of the tracks.

Generally, the shallow grooves of the lower track are cut into the cabinet bottom. Depending on your choice of cabinet joinery, this may require that you cut stopped

### ANATOMY OF A SMOOTH RIDE

**For effortless action, a sliding door should ride on a narrow rabbet, as opposed to the full door thickness riding along the bottom of the grooves in the lower track. Try to prevent the upper and lower rabbets from cutting into the door's joinery. Because deep grooves cut into the cabinet top would compromise its strength and stability, the upper track is a separate piece.**




## CUT GROOVES FOR THE TRACKS WITH A DADO SET

***Cut grooves for the lower track.*** *These shallow grooves can be cut directly into the cabinet bottom.*

***Cut grooves for the upper track.*** *These are deeper than the lower ones and go in a separate piece so as not to weaken the cabinet top.*

***Install the upper track.*** *Be sure that the grooves in the track are aligned with the corresponding grooves below.*

Photos, except where noted: Asa Christiana; drawings: Chuck Lockhart

## RABBET THE DOORS AND TRIM THEM TO FIT

***Rabbet the door to fit the grooves.*** *The bottom and top rabbets are of different heights to match the corresponding grooves.*

***Fit the door to the grooves.*** *Plane the edges and the rabbets so that the door slides smoothly and the bottom rides on its rabbet, not on its lower edge.*

***Install the doors.*** *After waxing the track grooves, lift the door into the upper groove, then let it drop into the corresponding lower groove.*

grooves, in which case the router is best. Make sure not to overshoot your mark. The ends of the grooves can be squared up even with the cabinet sides after assembly.

If the joinery on your cabinet is such that the side overlaps the bottom, you have it easier: You can just run the grooves straight through the bottom. A dado set is excellent for this.

**The upper track is a separate piece—** A cabinet top above a set of sliding doors is by its nature a relatively long expanse of unsupported wood, even when there is a center divider behind the doors anchoring most of the top. Experience has taught me that the deeper upper grooves can destabilize the top. I've seen extreme cases in which moisture changes and a bowed top allowed the door to fall out as it was slid to the center. Making the upper track separately and gluing it to the underside of the cabinet top is a more sound approach.

That being said, in small cabinets or when the top is very thick, the upper track sometimes can be cut directly into the top, just as the lower track is cut into the bottom.

Last, you need to plan the right amount of space between the track grooves, allowing for the fact that the doors are thicker than the grooves. The doors shouldn't need more than 1/16 in. of space between them, unless you are using the mortised-in type of pulls that protrude slightly from the door (see the bottom photo on the facing page).

### Two options for doors

As with most doors, it is a good idea to set aside the wood for them and build the case first. Once you know the exact sizes of the opening and the grooves, you can build the sliding doors to fit.

Sliding doors usually are of two types of construction: plywood or veneered doors with solid edging or frame-and-panel doors. Solid-slab doors are to be avoided because they are prone to warping with moisture changes. If a hinged door cups a bit when the humidity changes, it still will swing well enough; but if a sliding door cups, it stops in its tracks. So make sure all of the parts are square, straight, and stable before cutting joinery and assembling the doors.

**Hints for veneered doors and panels—** Although I often prefer the look of frame-and-panel doors, sometimes plywood or

veneered doors are the best choice. The first thing to do is to edge the core with solid wood, making the edgings wide enough to allow the rabbets to be cut away when the doors are fitted to their tracks. Also, consider carefully which type of finger pull to use.

For all veneered doors, but especially for sliding doors that ride in a snug track, make the front and back veneers of the same material and thickness. If you don't believe that different veneers can be a problem, try making a panel with a ⅛-in.-thick veneer of yew on one side and a ⅛-in.-thick veneer of Port Orford cedar on the other, as I once did, and then expose the panel to a change in humidity. Suffice it to say that a little warp can create big problems.

**Frame-and-panel doors**—Frame-and-panel construction is a little more complicated, because in determining the size of the rails and stiles, you must take into account how much of the rails will disappear into the upper and lower tracks. This obviously will affect the appearance of the door. Also, when using the overall cabinet opening to figure the width of the door panels, it's easy to forget that the center door stiles will overlap. The trick is in the initial figuring of the dimensions.

After checking and rechecking the dimensions, I make the doors about ⅛ in. oversize so that I can trim and square them perfectly during final fitting. Any more trimming than that, and the proportions of the rails and stiles will be noticeably off in the finished door, and the center stiles won't line up accurately, one behind the other.

### Pulls should be flush or nearly so

Frame-and-panel sliding doors don't need finger pulls because they can be opened and closed with light finger pressure on the edge of the door frame. But I think pulls are a nice visual accent and make doors look like, well, doors. So I typically use them (see the photos and drawing at right).

I prefer the mortised-in pull, although it takes a bit more time to build. It gives me the opportunity to add a nicely harmonizing wood to the cabinet design. □

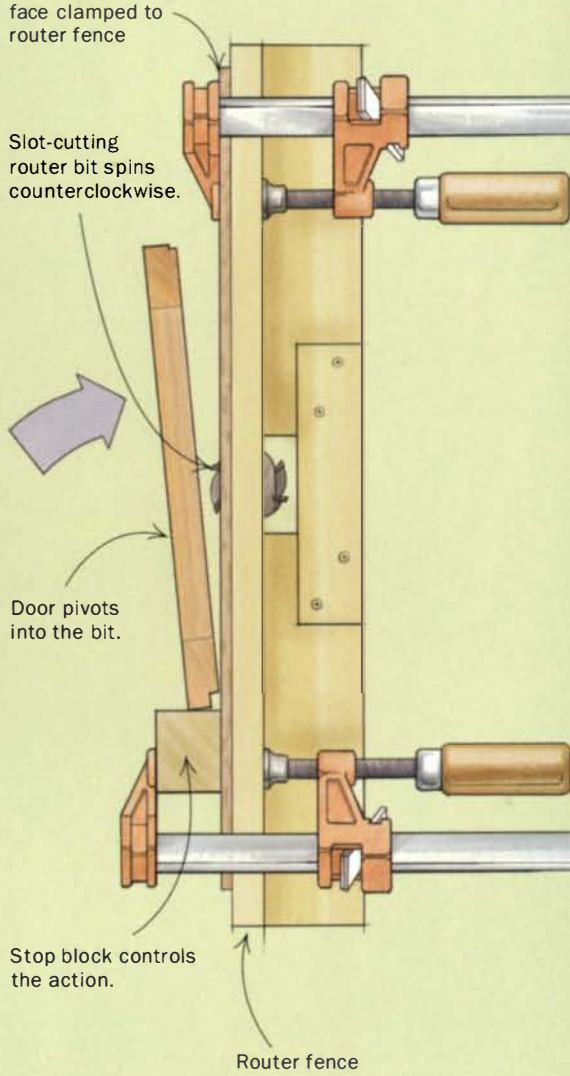
*Seth Janofsky is a furniture maker and photographer in San Francisco.*

## Two ways to make sliding-door pulls

**Because sliding doors look best when the clearance between them is minimal, a handle or pull shouldn't protrude very far from the door. Janofsky favors a simple finger pull, cut in one of two ways.**

**OPTION 1**
**Cut directly into the frame**
This method is the quickest but involves the most risk to the finished door.

***Pivot the door into the bit.*** *The cutting force will want to send the door to the right, so clamp a block on the fence to anchor that end of the door. Test the setup on scrap before risking a finished door.*

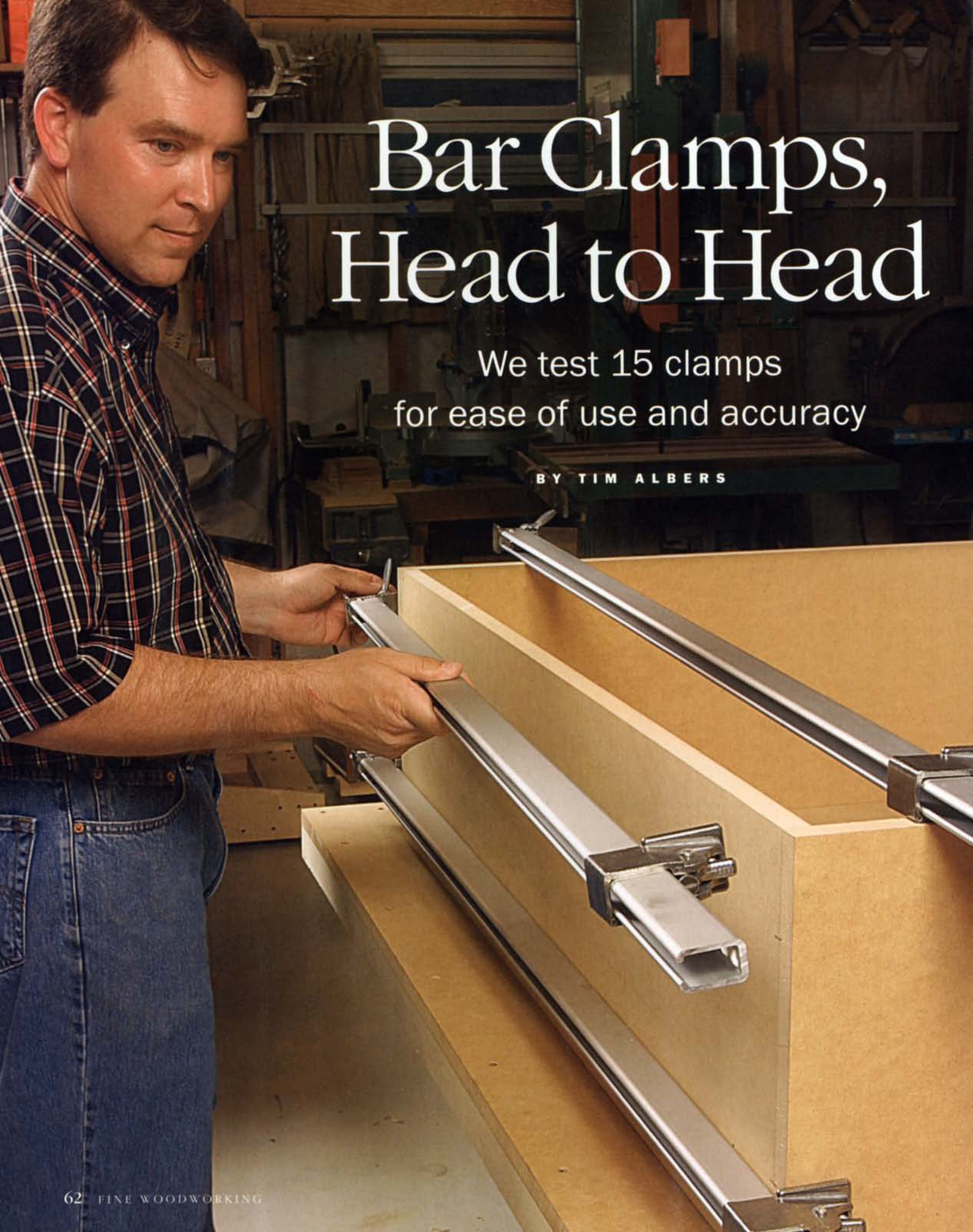



**OPTION 2 Mortised into the frame**
This method is more time-consuming but less risky because the pull is cut into a separate piece of wood, which in turn is mortised into the door frame. Tip: Cut the notch into a wider board, and then rip away and crosscut the desired block.

# Bar Clamps, Head to Head

## We test 15 clamps for ease of use and accuracy

BY TIM ALBERS



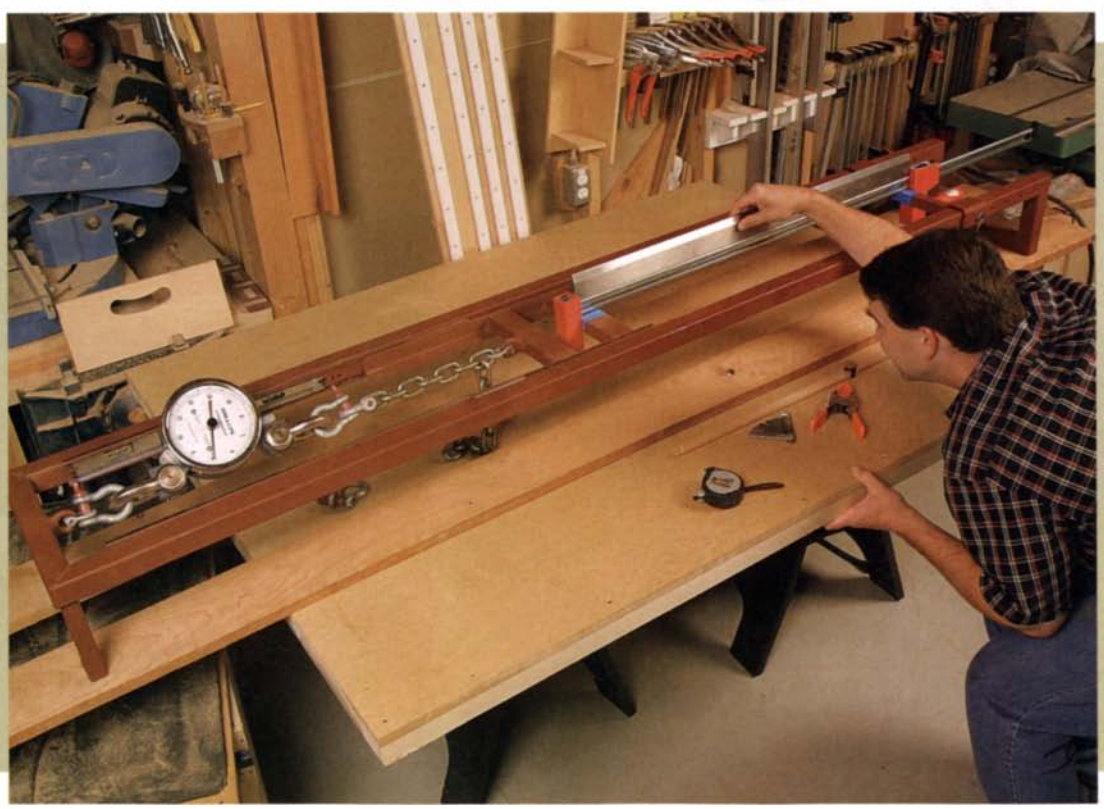
Most woodworkers would list the tablesaw, the bandsaw, or the router as the most important tool in the shop. In fact, most woodworkers start out by purchasing one of these tools. Yet the predominant tool in the workshop actually is the bar clamp, which is used in almost every facet of cabinetmaking and furniture construction.

While a single clamp may not be a large investment—prices range from $15 to $50—a full set of clamps can cost as much as a tablesaw. And the investment is a critical one, because having the right clamp for a particular glue-up can be the difference between success and failure.

Although the bar clamp is seemingly basic, the variety of styles and features can cause even the most experienced woodworkers to scratch their heads. I surveyed the major tool catalogs and Web sites and found that bar clamps fall into four major categories—pipe, parallel jaw, aluminum bar, and steel bar—with each type being a bit better at one task or another. So, after testing all of the clamps, I selected some of the best and put together my recommendations for a basic set, which includes representatives from several categories.

For all models, I tested the 48-in. version, a standard size. First, I built a testing fixture (below) to measure the deflection in both the bar and the jaws when applying various levels of force. I used 600 lb. of force as a standard setting, which would be enough to clamp 3 sq. in. of joint area with most hardwoods. Then I used a set of four of each type of clamp to assemble a simple, medium-density fiberboard (MDF) carcase (joined with biscuits) and a large poplar panel, looking at ease of use and the resulting flatness and squareness of the finished product.

*Tim Albers is a woodworker and machine refurbisher in Ventura, Calif.*

## CLAMP TESTER

***Albers built a steel testing rack that uses a scale to indicate clamp force. He tested each clamp for flex (left) and the resulting deflection of the clamp jaws (below), as well as the amount of force that could be comfortably applied by hand.***

Photos, except where noted: Rodney Diaz; facing page and this page (bottom row): Asa Christiana

## PIPE CLAMPS

**Largely unchanged for 75 years, pipe clamps are versatile and inexpensive workhorses. They are sold as clamp fixtures for use with either ¾-in.- or ½-in.-dia. steel pipe, which is inexpensive and can be cut to any length. I reviewed the heavier-duty ¾-in. fixtures.**

**A certain amount of play is necessary to allow the tail fixture to slide freely on the pipe, and on all of the pipe clamps, this play resulted in the tail jaw being racked back to an angle greater than 90° when pressure was applied. On all models the multiple-disk clutch mechanism in the tail fixture gripped the pipe solidly. All of the clamps caused the carcase sides to bow under normal pressure, though clamping pads or cauls would correct this. When clamping flat panels, all of the clamps caused significant cupping. I was able to reduce cupping by alternating the clamps above and below the panel.**

**As an inexpensive extralong clamp, nothing compares to the pipe clamp. You can have a few sets of fixtures and buy multiple lengths of pipe. Of the models surveyed, the Jorgensen and Rockler clamps offered the least amount of deflection. I named the Rockler Best Overall because of its wider, more stable base and ample clearance for its screw handle.**

***Columbian/Wilton's tail problem.*** *When used on a benchtop, the tail on this pipe clamp is very difficult to disengage. Albers had to reach under the clamp to unlock the clutch plates.*

**COLUMBIAN** (soon to be Wilton)
www.jettools.com; 800-519-7381
**Price** $13
**Screw travel** 2¼ in.
**Jaw deflection** Significant
**Jaw squareness** Poor
**Comments** Manufactured by WMH and soon to be sold under the Wilton name, this is a close copy of the Jorgensen pipe clamp (below), but its fit and finish were not at the same level, and it didn't operate smoothly. Similar to the Jorgensen, clearance between the screw handle and the workbench can be an issue.


**IRWIN NO. 224134**
www.irwin.com; 800-464-7946
**Price** $13
**Screw travel** 2¼ in.
**Jaw deflection** Minimal
**Jaw squareness** Poor
**Comments** The Irwin's head assembly attaches to the pipe by means of a clutch mechanism, as opposed to screwing onto the end of the pipe. While this allows the use of unthreaded pipe, the entire head fixture spun when I tightened the screw. Also, the plated screws didn't operate freely, likely contributing to the spinning head.

**JORGENSEN NO. 50**
www.adjustableclamp.com; 312-666-0640
**Price** $13
**Screw travel** 2 in.
**Jaw deflection** Minimal
**Jaw squareness** Fair
**Comments** The Jorgensen's jaws exhibited the least deflection of the models tested, and the screws on this clamp and on the Rockler (right) were the smoothest. While the clamp does have a small foot that holds it in an upright position on a workbench, there is very little clearance between the screw handle and the bench.

**ROCKLER SURE-FOOT PIPE CLAMP**
www.rockler.com; 800-279-4441
**Price** $15; $48 for four clamps
**Screw travel** 2¼ in.
**Jaw deflection** Minimal
**Jaw squareness** Fair

AUTHOR'S BEST OVERALL CHOICE

**Comments** The Rockler clamp is similar to the Jorgensen model (left), but it has a much larger base, which keeps the clamp upright and far enough above a workbench to allow for ample room to turn the screw crank. Another unique feature is the small lip on the underside of the base, which makes the clamp easy to hang and store on a simple shopmade rack.



Photo, this page (top): Asa Christiana

## PARALLEL JAW CLAMPS

**The newest additions to the clamp market, these bar clamps are commonly referred to as parallel jaw clamps because they are designed to keep the clamp jaws parallel to each other when pressure is applied. The Bessey K Body, from American Clamping, was the first such clamp on the market—about 15 years ago. Within the last few years, both Gross Stabil and Adjustable Clamp have begun selling similar models.**

**The clamp jaws on all three models showed far more accuracy—over a much longer jaw—than any of the other types of bar clamps. All three models have steel jaws covered in plastic, which resists glue and is non-marring if kept clean. Another unique feature on all three models is a removable head that can be reversed to convert the clamp into a spreader for pushing apart joints.**

**However, while all three models have cylindrical wood handles that are comfortable and compact, they make it more difficult to apply heavy pressure when needed. This can mean more clamps are required to glue up large or thick panels. Also, their weight—only steel bar clamps are heavier—can be a factor when many clamps are used on large assemblies. It's also important to note that these clamps cost two or three times more than the other types.**

**I would pick the Bessey or Gross Stabil models for my shop, but i gave the top grade to the Bessey clamps on the basis of price.**

***Parallel clamps offer long, accurate jaws.*** *For some glue-ups, this means fewer clamps are necessary to apply even pressure along the glue joints.*

### BESSEY K BODY

www.americanclamping.com; 800-828-1004
**Price** $40 (50-in. model)
**Screw travel** 1⅛ in.
**Bar flex/Jaw deflection** Minimal
**Jaw squareness** Excellent

### JORGENSEN CABINET MASTER NO. 8048

www.adjustableclamp.com; 312-666-0640
**Price** $40
**Screw travel** 1⅛ in.
**Bar flex/Jaw deflection** Moderate
**Jaw squareness** Excellent

### GROSS STABIL PC2

www.grossstabil.com; 800-671-0838
**Price** $45
**Screw travel** 1¾ in.
**Bar flex/Jaw deflection** Minimal
**Jaw squareness** Excellent

**COMMENTS** It was hard to pick a favorite from among this group. All of the clamps were capable of assembling a cabinet carcase or flat panel with little, if any, cupping. On the testing jig, the Bessey and Gross Stabil clamps showed less bar flex and jaw deflection than the Jorgensen clamp, but in all cases this was minimal. My only minor complaint about the Jorgensen Cabinet Master is that the sliding jaw occasionally did not engage and grip the bar, but a simple jiggle of the handle usually took care of the problem.

Photo, this page (bottom left): Asa Christiana

## ALUMINUM BAR CLAMPS

**Aluminum bar clamps are built around a U-shaped aluminum extrusion. The head fixture is permanently attached to one end, and the tall fixture slides along the length of the clamp, locking into shallow notches. It's immediately noticeable on these clamps how much lighter they are than any of the other types, which can be a real plus on a large project that must be moved or a small glue-up that could be pulled out of whack by heavy clamps.**

**The Universal and Rockier models stood out among this group. They exhibited acceptable bar flex and jaw deflection and did a better job of gluing up a flat panel than the other two. The clamp handles on the Rockier and Universal caused less fatigue than the Jet and Jorgensen models. I slightly preferred the simple handle and the closer notch spacing on the Universal.**

***The Jet aluminum bar had too much flex.*** *Because the extrusion on the Jet clamp is thinner than the other models in this group, it showed an unsatisfactory amount of bar flex and jaw deflection under normal working conditions.*

### WMH/JET NO. 709831

www.jettools.com; 800-274-6848

**Price** $25

**Screw travel** 1½ in.

**Positive stops** Every 1 in.

**Bar flex/jaw deflection** Severe

**Jaw squareness** Very good

**Comments** The Jet clamp allowed an unacceptable amount of bar flex and deflection in the clamp jaws. After about six tests, the Jet clamp became bent permanently, and the notches for the tail fixture were distorted. Last, I found that occasionally the clamp head would bind on the bar when tightened.

### JORGENSEN NO. 3548

www.adjustableclamp.com; 312-666-0640

**Price** $25

**Screw travel** 1½ in.

**Positive stops** Every 1 in.

**Bar flex/jaw deflection** Significant

**Jaw squareness** Very good

**Comments** The Jorgensen clamp offers adjustment notches with 1-in. spacing and a small base similar to the Universal. The screw has a thin sliding handle that was hard on the fingers and didn't allow as much pressure to be applied as the handles on the Rockler and Universal models. Also, the screws on the Jorgensen didn't travel as smoothly as the others.

### ROCKLER SURE-FOOT

www.rockler.com; 800-279-4441

**Price** $24; $87 for four clamps

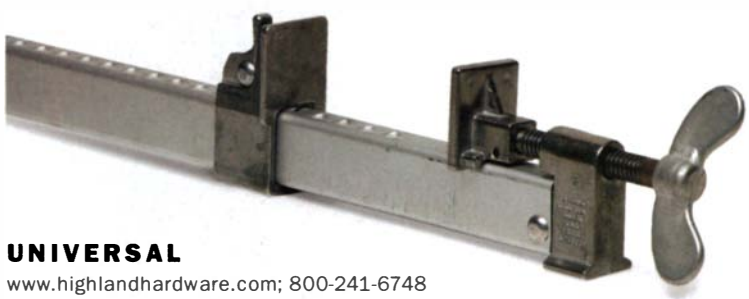
**Screw travel** 1¾ in.

**Positive stops** Every 1 in.

**Bar flex/jaw deflection** Minimal

**Jaw squareness** Excellent

**Comments** The Rockler clamp uses an extrusion almost identical to the Universal model except that the notches are spaced farther apart. Both the head and tail assemblies on the Rockler feature large, stable bases on the workbench. Also, the head assembly features a large, convenient crank handle. A 48-in. extension kit is available for $19.



### UNIVERSAL

www.highlandhardware.com; 800-241-6748

**Price** $27

**Screw travel** 1½ in.

**Positive stops** Every ⅝ in.

**Bar flex/jaw deflection** Minimal

**Jaw squareness** Excellent

**Comments** At 3 lb., this is the lightest of any of the other aluminum bar clamps I looked at. The screw handle is a compact wing shape yet offers a solid and comfortable grip. Another nice feature on the Universal is that the notches for locking the tail jaw are spaced only ⅝ in. apart, the closest of any models, meaning less adjustment of the screw mechanism.

AUTHOR'S BEST OVERALL CHOICE



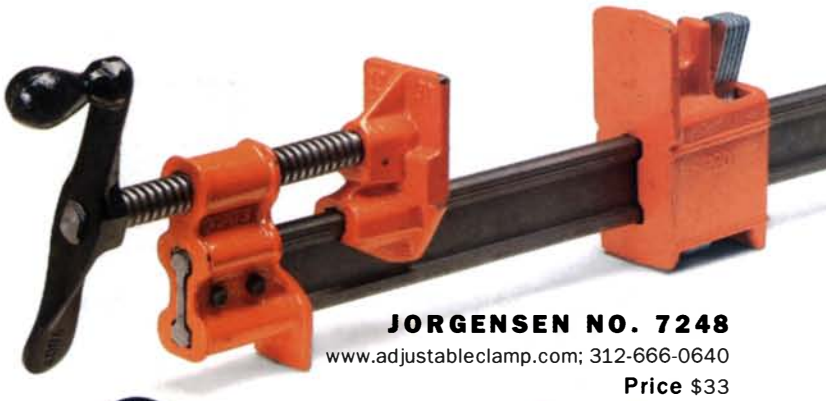
Photo, this page (top): Asa Christiana

# STEEL BAR CLAMPS

**These are the heavyweights of the clamping world. With stiff bars and large crank handles, steel bar clamps can apply significant pressure with negligible bar flex and jaw deflection. In fact, the Jorgensen and Wetzler models were able to max out the 2,000-lb. limit of my testing fixture. However, with their great strength and large handles, it is very easy to apply too much pressure to a joint, starving it of glue and causing unnecessary distortion in the assembly. The problem of excessive force is compounded by the fact that all of the jaws are canted inward at an angle significantly less than 90°. All of the models produced acceptable results when assembling a flat panel but tended to deflect and bow the sides of the MDF carcase. In general, these very heavy clamps make large assemblies unwieldy. Basically, they are overkill for most applications.**

**The Jorgensen I-Beam clamp got top honors in this category for its ease of use, strength, and stability on a workbench.**

***Steel bar clamps have inaccurate jaws.*** *On all models, the jaws tended to push the box sides inward (above), creating poor glue joints.*



## JORGENSEN NO. 7248

www.adjustableclamp.com; 312-666-0640

**Price** $33

**Screw travel** 3 in.

**Positive stops** None; clutch mechanism

**Bar flex/jaw deflection** Not measurable

**Jaw squareness** Poor

**Comments** This clamp uses a heavy I-beam with a sliding tail assembly that engages with a multiple-disk clutch mechanism. The tail slid easily on the bar and provided a very positive grip. The T-handle and screw are stout, but there is very little clearance when turning the handle over a workbench.

## WETZLER NO. 52T

www.wetzler.com; 800-451-1852

**Price** $38

**Screw travel** 3 in.

**Positive stops** None; cam mechanism

**Bar flex/jaw deflection** Minimal

**Jaw squareness** Poor

**Comments** The head fixture has an alignment pin that helps keep the jaw perpendicular. However, the tail jaw tilts forward, like the jaws on the other steel bar clamps.There was little clearance for the Wetzler's T-handle above a workbench, and the base was not stable.


## WMH/WILTON NOTCHED-BAR CLAMP (I-BEAM)

www.supplymscdirect.com; 800-645-7270

**Price** $43

**Screw travel** 5 in.

**Positive stops** Every ¾ in.

**Bar flex/jaw deflection** Minimal

**Jaw squareness** Poor

**Comments** The tail assembly on this model locks onto the bar via a spring-loaded lever that engages small notches spaced closely on the bar, making it one of the fastest to adjust and tighten. However, the offset handle shape tended to twist the clamp on the workpiece and bumped into the workbench.

## HEAVY-DUTY T-BAR

www.woodcraft.com; 800-535-4482

**Price** $19.99 (42-in. model)

**Screw travel** 5½ in.

**Positive stops** Every 3 in.

**Bar flex/jaw deflection** Minimal

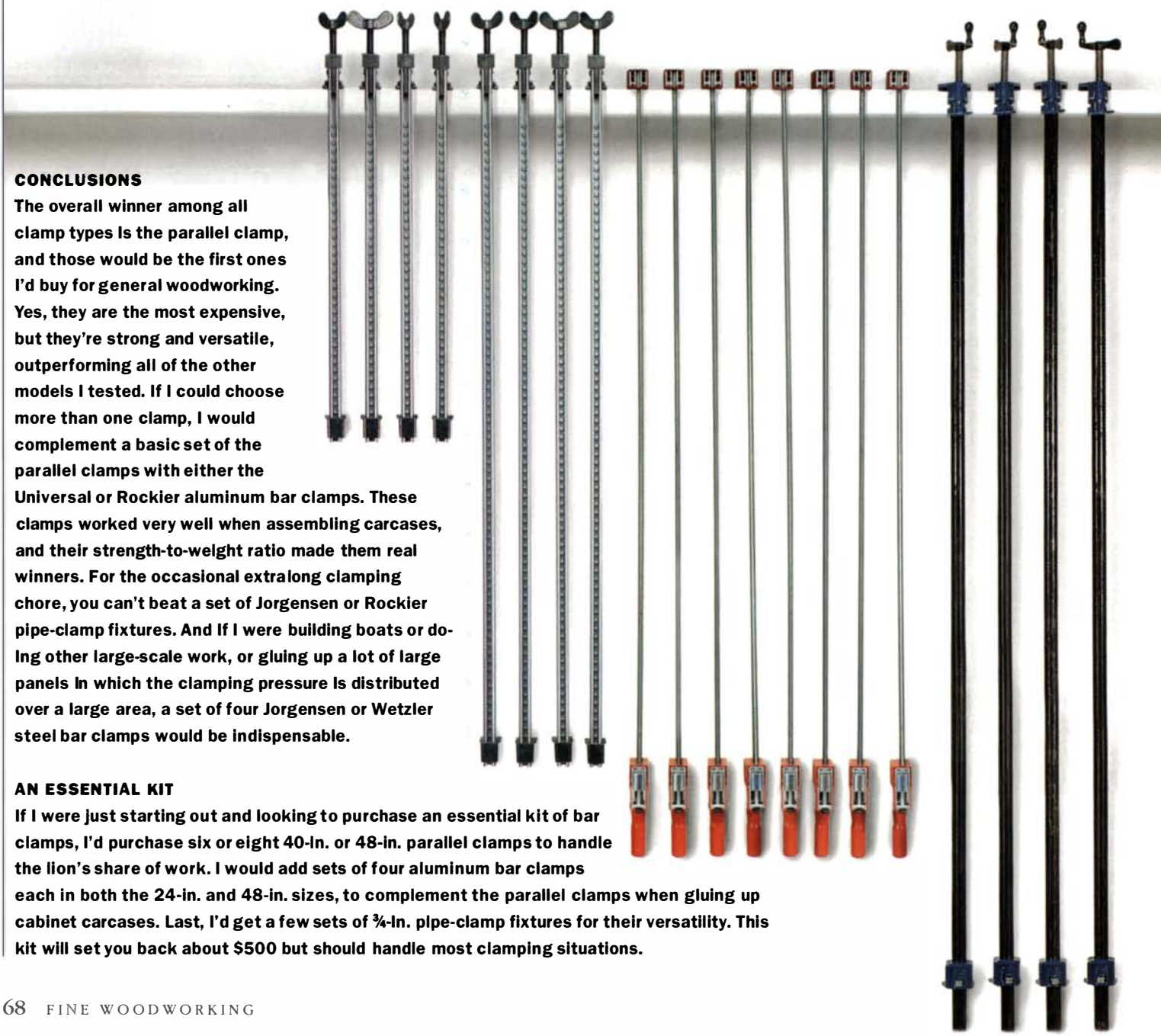
**Jaw squareness** Fair

**Comments** The tail assembly attaches to the bar with a removable pin. While simple to use, the positive stops are 3 in. apart, meaning a lot more turning of the screw. On the other hand, its two jaws came closest to 90°, and its wide base provided solid footing.

Photo, this page (top left): Asa Christiana

## The right clamp for the job

| MODEL | WEIGHT | RIGIDITY | JAW SQUARENESS | BEST USES | MAXIMUM FORCE | COMMENTS |
|---|---|---|---|---|---|---|
| ¾-IN. PIPE CLAMPS | Medium | Very good | Fair | Long clamping chores | 1,200 lb. | Offers versatility and value but lacks precision |
| PARALLEL JAW CLAMPS | Medium | Very good | Excellent | Almost all applications | 600 lb. | Limited force can mean more clamps, more weight, and more expense |
| ALUMINUM BAR CLAMPS | Light | Very good | Very good | Cabinet carcases, large and small | 800 lb. | Good combination of lightweight, strength, and accuracy |
| STEEL BAR CLAMPS | Heavy | Excellent | Poor | Large panels | 2,000+ lb. | Great strength, but weight and crooked jaws limit usefulness |



**CONCLUSIONS**

**The overall winner among all clamp types is the parallel clamp, and those would be the first ones I'd buy for general woodworking. Yes, they are the most expensive, but they're strong and versatile, outperforming all of the other models I tested. If I could choose more than one clamp, I would complement a basic set of the parallel clamps with either the Universal or Rockier aluminum bar clamps. These clamps worked very well when assembling carcases, and their strength-to-weight ratio made them real winners. For the occasional extra long clamping chore, you can't beat a set of Jorgensen or Rockier pipe-clamp fixtures. And if I were building boats or doing other large-scale work, or gluing up a lot of large panels in which the clamping pressure is distributed over a large area, a set of four Jorgensen or Wetzler steel bar clamps would be indispensable.**

**AN ESSENTIAL KIT**

**If I were just starting out and looking to purchase an essential kit of bar clamps, I'd purchase six or eight 40-in. or 48-in. parallel clamps to handle the lion's share of work. I would add sets of four aluminum bar clamps each in both the 24-in. and 48-in. sizes, to complement the parallel clamps when gluing up cabinet carcases. Last, I'd get a few sets of ¾-in. pipe-clamp fixtures for their versatility. This kit will set you back about $500 but should handle most clamping situations.**

# Perfect Mortise-and-Tenon Joints

## A plunge router, a tablesaw, and a couple of jigs make the process almost foolproof

BY JEFF MILLER

The mortise-and-tenon joint is one of the strongest woodworking joints. For maximum strength, a mortise-and-tenon joint needs good contact between long-grain surfaces; those are the surfaces on the sides of the mortise and the cheeks of the tenon. That means the long-grain surfaces must be flat, smooth, and parallel. And, just as important, the fit between those surfaces must be snug.

My techniques for cutting mortise-and-tenons have served me well for years. The mortises are cut with a plunge router, a straight bit, an edge guide, and a shop-made jig. Tenons are cut on the tablesaw with a tenoning jig. The machine work generally produces a fit that's right on. If it isn't, the final fitting is done with a few hand tools. All of the techniques are simple and efficient, and they result in perfect-fitting joints.

### How snug is snug?

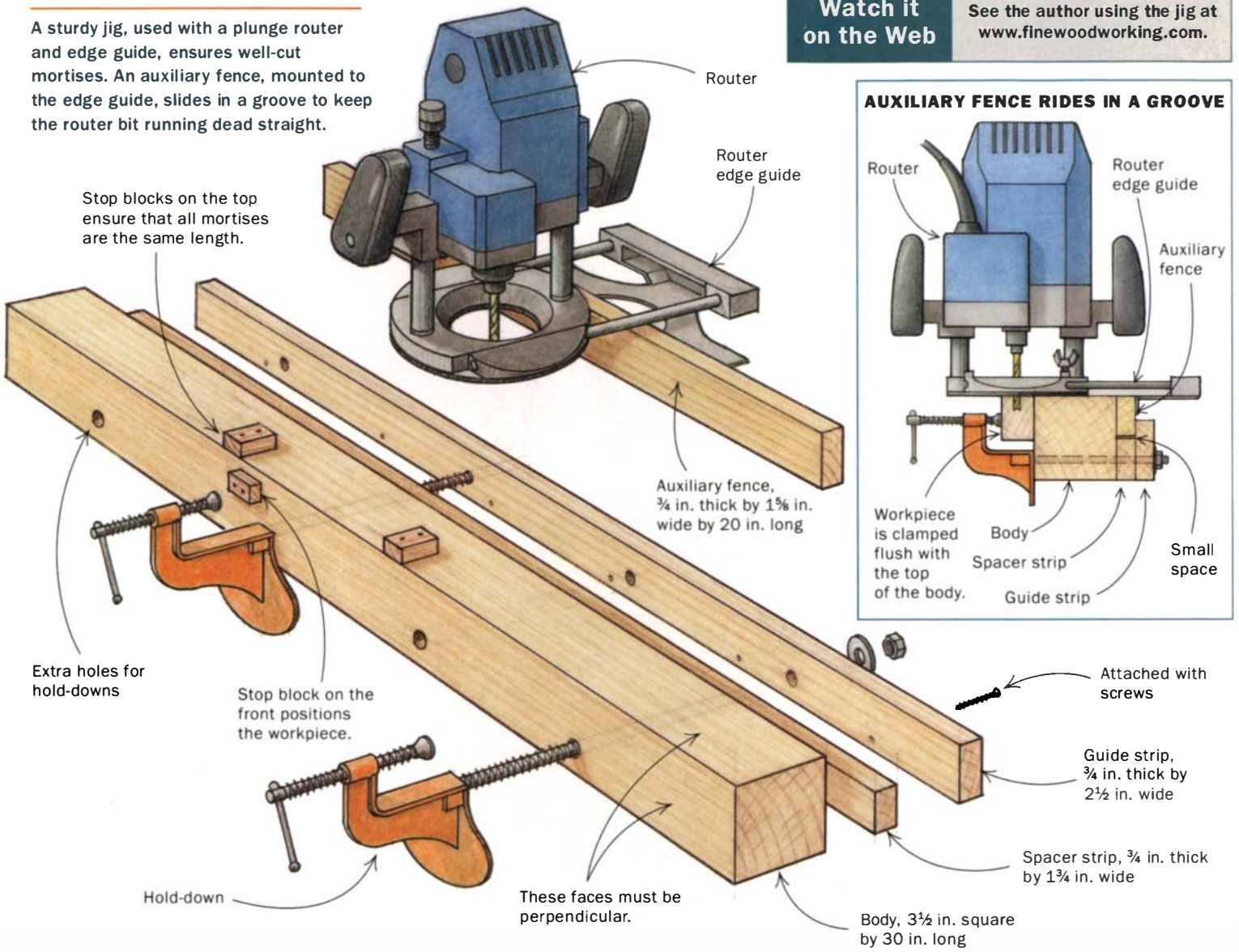
A snug fit allows for a very thin layer of glue (0.002 in. to 0.004 in.) between the contact surfaces once the joint has been assembled. If the fit is too tight, as the tenon is slipped into the mortise, almost all of the glue ends up squeezed to the bottom of the mortise, resulting in a glue-starved joint—one that has little strength. Too loose

Photo, this page: Kelly J. Dunton

## A SIMPLE MORTISING JIG

A sturdy jig, used with a plunge router and edge guide, ensures well-cut mortises. An auxiliary fence, mounted to the edge guide, slides in a groove to keep the router bit running dead straight.

**Watch it on the Web** See the author using the jig at www.finewoodworking.com.




### AUXILIARY FENCE RIDES IN A GROOVE




## CUT MORTISES FIRST

Once the jig is made, it takes little time to rout a mortise. A standard straight bit works just fine, although a spiral upcut bit does a better job clearing chips from the mortise.

***Clamp the workpiece to the mortising jig.*** *A pair of sturdy hold-downs anchors the workpiece to the jig.*

***Set the bit depth.*** *With the desired mortise depth marked on the workpiece, adjust the bit depth on the router.*

***Center the bit.*** *After marking the location of the mortise, adjust the edge guide to center the bit in the mortise.*



Drawings: Vince Babak

a fit, and there isn't enough surface contact for a good glue bond.

A joint is too tight if a mallet or clamp is needed to put it together. It's too loose if it goes together with little or no resistance. A joint that's just right goes together by hand with only a moderate amount of pushing and wiggling.

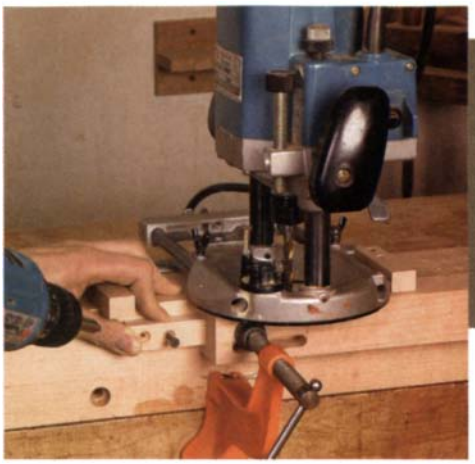
One more point here: The end of the tenon shouldn't extend to the bottom of the mortise. To allow room for excess glue, cut the tenon about 1/32 in. shorter than the depth of the mortise.

Keep in mind, though, that it's difficult to get perfect-fitting mortise-and-tenons if the stock isn't properly prepared. So make sure the moisture content isn't too high or low. And be sure to mill all of the parts on a jointer and thickness planer, or by hand, until each workpiece ends up flat, straight, and square.

## Cut the mortises first

In general, it's best to cut the mortises first and then cut the tenons to fit the mortises. First, though, you need to get a few things together, and you need to make a jig.

**Use a plunge router and a straight bit**—A plunge router, rather than a fixed-base router, is pretty much a must to cut mortises. Any effort to tip the bit of a fixed-base router into a workpiece to create a mortise is not only dangerous, but it's also likely to produce an inaccurate cut. A mid-size (1½ hp to 2½ hp) plunger is sufficient, as this technique creates mortises by making lots of light cuts.



### A stop block for multiple mortises

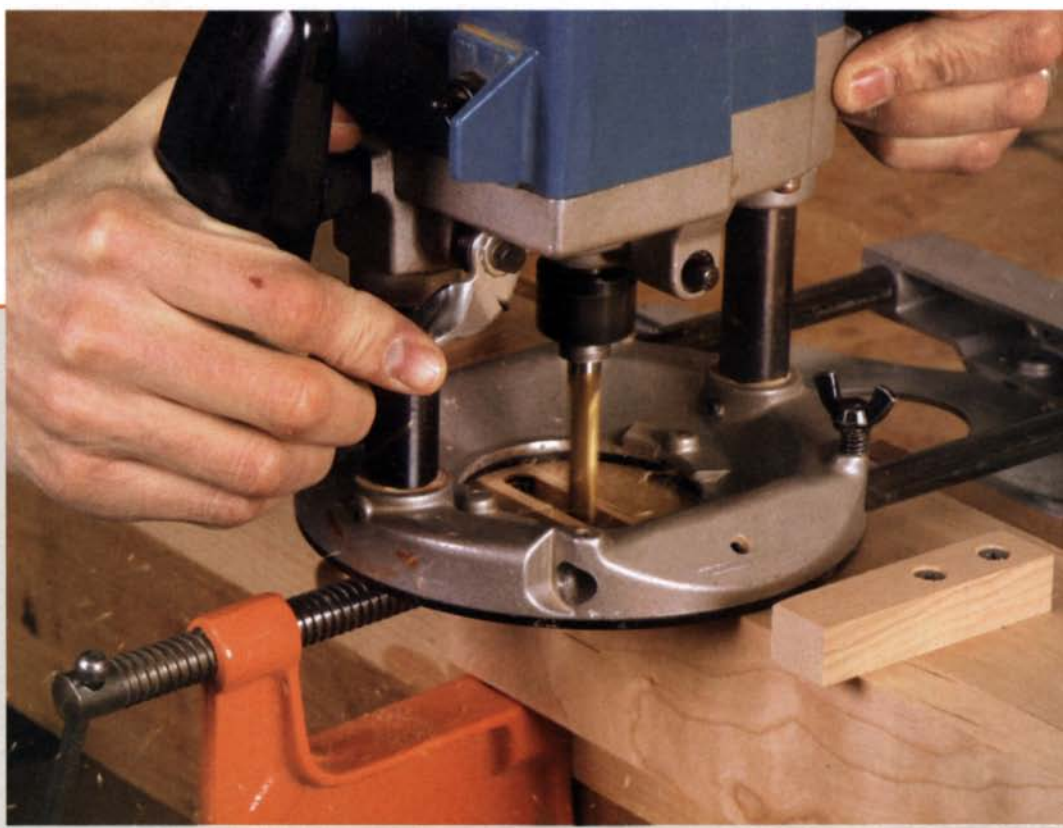
When several identical workpieces require mortises, Miller adds a stop block to the front of the mortising jig (facing page), allowing him to position each piece quickly.

The diameter of the router bit determines the width of the mortise. For example, a ¼-in.-wide mortise is cut with a ¼-in.-dia. bit; and a ¾-in.-wide mortise is cut with a ¾-in.-dia. bit. You also could choose a mortise width that requires moving the router over and taking extra passes to widen the opening. But because straight bits are available in so many sizes, you can usually find one to match the mortise width you need.

**Make a jig to guide the router**—It's important to support and guide the plunge router as it cuts. A jig goes a long way toward providing the necessary support, ensuring a well-cut mortise. The jig I use is very simple (see the drawing on the facing page), with just three wooden parts: a body, a spacer strip, and a guide strip.

A pair of hold-downs made by The Adjustable Clamp Co., style No. 1600 (312-666-0640; www.adjustableclamp.com), are used to secure the workpiece to the body. With the hold-downs in place, the jig accepts stock up to about 2¾ in. wide. To work with wider stock, simply remove the hold-downs and secure the workpiece with a couple of C-clamps.

You'll also need to make a wooden auxiliary fence to attach to the edge guide of the router. The auxiliary fence offers two benefits. It increases the length of the edge guide, providing extra support during a cut. And



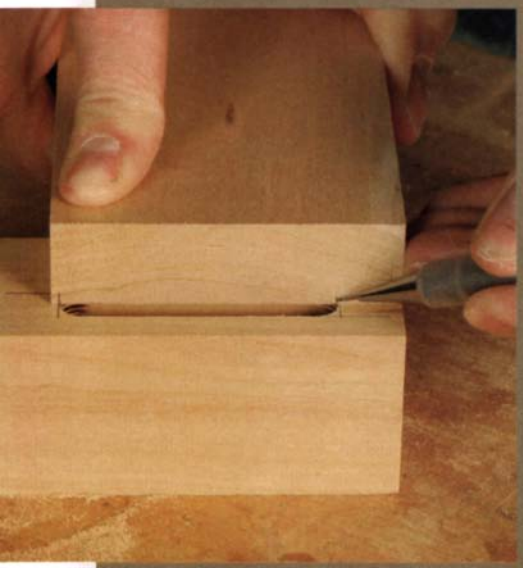
***Take light cuts until you reach the final depth.*** *To produce smooth, straight-sided mortises, make multiple passes with the router, with each pass removing no more than 1/32 in. of stock.*

***Stop blocks establish the mortise length.*** *Stop blocks on each side of the router base limit the travel of the base.*

Photos, except where noted: Tom Begnal

## Use the mortise to lay out the tenon

Butt the end of the piece to be tenoned against the mortise, then mark the tenon length (left) and thickness (right).



because the auxiliary fence fits into a groove created by the spacer and guide strips, it prevents the edge guide from shifting away from the body, and that means the router can't wander from a straight-line cut.

In use, the fence slides back and forth in the groove. The clearance between the fence and the groove should be no more than the thickness of a sheet of paper. To help the parts slide easily, I like to add a thin coat of wax to both the groove and the auxiliary fence.

**Using the jig to cut mortises—**Once the initial setup has been completed, it takes just a few moments to create each mortise. Start by laying out the location of the mortise on the workpiece. Then clamp the workpiece to the body of the jig. Make sure the top surface of the workpiece is flush with the top of the jig.

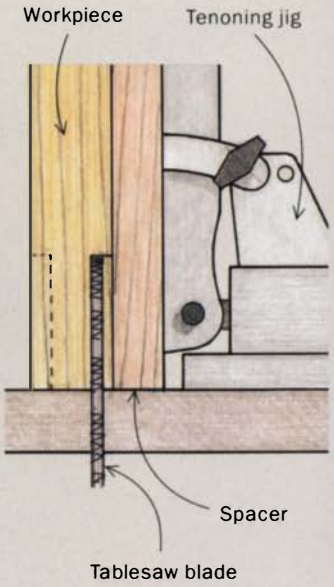
Adjust the plunge-router depth stop to establish the final depth of cut. Next, place the router on the body of the jig, with the auxiliary fence of the edge guide in the groove. Now adjust the edge guide until the router bit is centered in the mortise.

## CUT TENONS LAST

### 1 INSERT THE SPACER

***Spacer makes tenons of uniform thickness.*** *The spacer should be a hair thinner than the width of the mortise plus the width of the sawkerf.*

### 2 CUT THE FIRST CHEEK




***Clamp the spacer in the jig and against the scrap stock in back.*** *Adjust the jig to line up with the tenon mark, then cut the first cheek.*

Next, screw two stop blocks to the top of the jig, one on each side of the router base. The stop blocks help save time and improve accuracy, even when cutting just one mortise. Position the blocks so that the bit stops when it reaches each end of the mortise.

When cutting mortises in more than one workpiece, add a stop block to the front of the jig. Locate the block so that when the workpiece butts up to it, the mortise is positioned exactly where it needs to be relative to the two upper blocks.

Now you're ready to start cutting. Try not to remove more than 1/32 in. of stock per pass. That's the secret to a well-cut mortise. Cuts deeper than 1/16 in. sometimes can cause the bit to deflect slightly, which can produce a mortise with rough sides. Also, the sides are less likely to be perfectly straight or flat. Deflection also can make the mortise slightly wider than the bit diameter.

As you cut, move the router smoothly back and forth, using the stops to limit the mortise length. After each pass, lower the bit another 1/32 in., then engage the plunge lock and cut again. Continue cutting and lowering until you reach the depth-stop setting that represents the full mortise depth. Although it requires lots of passes, the process is surprisingly quick. It takes some practice to get comfortable with this technique, but the mortises that result make it well worth the extra time and effort.

## Cut tenons to fit the mortises

With the mortises cut, you can start working on the tenons. Once again, you'll need the aid of a jig. But this time, all of the hard work is done using a tablesaw rather than a router. The tenoning jig supports the workpiece as it passes vertically over the blade, helping to create a pair of cheek cuts that are flat, straight, smooth, and parallel.

Almost any sturdy tablesaw tenoning jig will work, as long as the guide bar is snug in the miter-gauge slot. A sloppy fit can affect accuracy. Also, the jig must hold the stock perpendicular to the saw table in two planes: front to back and left to right.

A general-purpose blade works fine here. But it must be sharp. Keep in mind, though, that even a sharp blade forced to work too hard is likely to deflect and produce tenon faces that are not parallel. So don't feed the stock too aggressively. To help prevent tearout, back up the workpiece with a piece of scrap stock (see the photo for step 3 below).

Key to this system is a shopmade wooden spacer that's used with the tenoning jig. The spacer is sized so that the thickness of the tenon is established in just two cuts: one with the spacer in place and one with it removed. The spacer automatically creates the tenon thickness you want, no matter where the tenon is positioned on the end of the board. Also, because you always reference off the same side of the workpiece, the spacer prevents any variation in the thickness of the workpiece from affecting the size of the tenon.

The thickness of the spacer should be a hair less than the width of the mortise plus the width of the sawblade kerf. A dial caliper proves handy here.

I usually do the initial setup of the tenoning jig using a throwaway test piece that matches the thickness of the workpiece. To avoid confusion, mark one face of each workpiece as the working face. That way,

**3 REMOVE THE SPACER AND CUT THE SECOND CHEEK**

***Spacer-free second cut.*** *After making the first cheek cut, remove the spacer and slide over the workpiece to clamp it directly against the jig.*

**4 CUT THE TENON SHOULDERS**

***Use the miter gauge and a stop block.*** *For consistent tenon shoulders, clamp the stop block to the rip fence and make the shoulder cuts using a miter gauge.*

## Fine-tune the tenons for a perfect fit

The edges of the tenon are rounded over with a rasp to match the rounded ends of the mortise (top). A tenon slipping into a mortise sometimes can squeegee glue from the mating surfaces; applying a light chamfer all around the end of each tenon minimizes the problem and helps ensure a strong joint (center). A perfectly fitted tenon will slide in with only moderate hand pressure and not fully slip out of its mortise when held upright (bottom).

you can orient each piece correctly as you insert it in the jig.

Next, use one of the mortises to mark the tenon on the test piece. Once marked, add the spacer to the jig, then clamp the test piece, making sure the working face is against the spacer. Raise the blade to equal the tenon length. Adjust the tenoning jig as needed to make a cut at the marked line. Now, make the cut in a single, smooth pass.

After the first cut, remove the spacer and reclamp the workpiece with the working face against the jig. Then make the second cheek cut.

The shoulder cuts are made with the miter gauge. Set the blade height to cut just shy of the tenon cheek. You might have to change the height of the sawblade for each tenon cheek if the tenon isn't centered on the workpiece. Clamp a stop block to the rip fence to establish the distance from the end of the tenon to the shoulder cut.

The miter gauge also is used to make the shoulder cuts on each edge of the tenon. I then use a chisel or a tenon saw to make the two vertical cuts that establish the final width of the tenon.

At this point, the tenon is squared, while the mortise is rounded. Although you can use a chisel to square the mortise corners to match the tenon, it is much easier to round the tenon corners with a rasp. The last thing I do is apply a light (1/32-in.) chamfer all around the end of the tenon.

### Make adjustments to get a perfect fit

Cutting a mortise-and-tenon includes many variables, ranging from the grain of the wood to the accuracy of measurements to the sharpness of the cutting tools. So despite all of my best efforts, I sometimes end up with a joint that doesn't fit as well as I'd like. When that happens, a little hand-tool work soon has the joint fitting just right.

A tenon that's too fat can be thinned in a number of ways. The best approach often depends on how much material has to be removed. It's best to avoid going back to the tenoning jig at this point because, when making trimming cuts, all of the cutting force is on one side of the blade, and that can cause the blade to deflect slightly. If the blade deflects, you end up with a tenon that's slightly tapered.

**Machinist's vise can help sometimes—** A joint that fits together, but only after the

## Three ways to trim a fat tenon

**Pressure from a vise sometimes can thin a slightly thick tenon just enough to fit comfortably in a mortise (left). A shoulder plane can do a good job shaving small amounts of material from the cheek of a tenon (center). A router plane is an effective cutter. In use, the sole of a router plane bears on the face surface of the workpiece, so the tenon is just about certain to end up flat and parallel (right).**

parts have been subjected to lots of difficult pushing and wiggling, needs only a slight adjustment. When that's the case, I'm often able to create a perfect fit simply by squeezing the cheeks of the tenon in a heavy-duty machinist's vise. This can take a lot of force if the tenon has some size.

**Rasps or sandpaper work, too, but use care**—A joint that can't be fully fitted together is going to need more than a simple vise squeeze to produce a good fit. It means some material has to be removed from the tenon cheeks.

A rasp can do the job. So, too, can a piece of sandpaper glued to a flat block of wood. However, both of these methods have pitfalls. In particular, unless you're very careful, the cheeks are likely to end up rounded over slightly. Also, it's difficult for rasps and sandpaper to get into the corner of the shoulder and the cheek.

**Handplanes are the best option**—One of the most effective tools for thinning tenons is the shoulder plane (also called a cheek plane or rabbet plane). It's a unique tool that can cut right up to the shoulder of the tenon.

When cutting with a shoulder plane, remove an equal amount of material across the full width of the tenon. Before getting the hang of the tool, it's not uncommon to have little, if any, material removed at the beginning of a cut, and too much material removed at the end of the cut.

Another good tool for shaving the cheeks of a tenon is the router plane. I like the tool because, as it cuts, the base of the plane rides on the face of the workpiece. That means the cheeks are going to remain flat and parallel to the workpiece faces. But it takes some practice to get comfortable with the blade-adjustment process, and the plane typically needs a lot of tuning.

Tenons aren't always too thick after they come off the tablesaw; sometimes they end up a bit too thin. When that happens, the joint usually can be salvaged by gluing a patch of wood to one or both cheeks. If necessary, plane the cheek perfectly flat before adding the patch. The patch should be thicker than what's needed, so you can plane down the patch for the perfect fit. □

*Jeff Miller builds furniture in his Chicago shop (www.furnituremaking.com). He also teaches and writes about woodworking.*

## Shim a tenon that's too thin

**A tenon that ends up a little too thin can be thickened by gluing a slim piece of stock to a cheek.**

# Pennsylvania Tall Clock

The base and waist support the hood and give this clock stature

BY LONNIE BIRD

PART TWO

When you stop to examine the construction of most tall clocks, the joinery that goes into the casework really is fairly simple. This clock is no exception. In the previous issue of *Fine Woodworking* (#171, pp. 60-67), I covered the joinery and the details that go into making the hood, which is the top case of the three stacked boxes that make up this clock and the one that requires the most work. In this issue, I'll explain how to make the base and the waist—the two cases that support the hood and give this tall clock some of its commanding stature. Compared with the hood, the base and the waist are quite simple in construction.

## Build from the bottom up

Start with the base, and begin by dovetailing the bottom to the case sides. Because the bottom of the base is not visible in the completed clock, I used less-expensive poplar rather than figured maple, the primary wood. When laying out the dovetails, allow room for the rabbet that accepts the back of the clock. The back, also made of poplar, will not be attached to all three cases until the very end—after all of the finishing has been completed, the movement installed, and the doors hung.

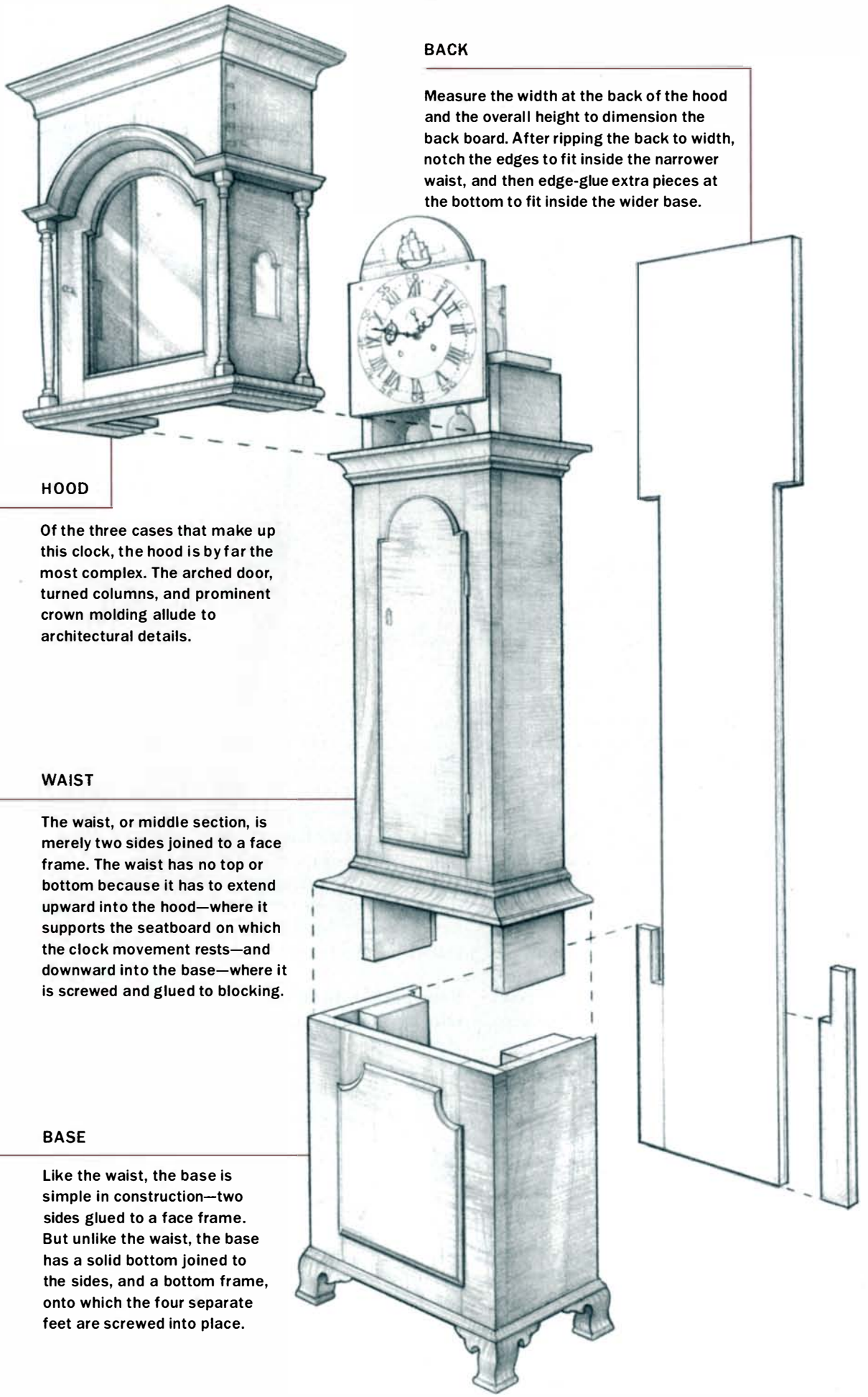
For the face frame of the base, lay out and cut the mortises on the stiles, then cut the tenons on the top and bottom rails to fit. Before gluing together the face frame, cut the decorative curved corners on the top rail that correspond with the front panel that will be added later. The outside rabbeted edges of that panel will cover the inside edges of the face frame, so you don't



Photos: Rodney Diaz

## THREE BOXES AND A BACK

**Building a tall clock may seem overwhelming to some woodworkers, but by breaking down the project into stages, you'll see that it's not very complicated. In the previous issue (#171, pp. 60-67), Bird focused on building the hood for this clock. In this issue, he explains how to build the base and the waist, which are relatively simple.**



### BACK

Measure the width at the back of the hood and the overall height to dimension the back board. After ripping the back to width, notch the edges to fit inside the narrower waist, and then edge-glue extra pieces at the bottom to fit inside the wider base.

### HOOD

Of the three cases that make up this clock, the hood is by far the most complex. The arched door, turned columns, and prominent crown molding allude to architectural details.

### WAIST

The waist, or middle section, is merely two sides joined to a face frame. The waist has no top or bottom because it has to extend upward into the hood—where it supports the seatboard on which the clock movement rests—and downward into the base—where it is screwed and glued to blocking.

### BASE

Like the waist, the base is simple in construction—two sides glued to a face frame. But unlike the waist, the base has a solid bottom joined to the sides, and a bottom frame, onto which the four separate feet are screwed into place.

Drawings: Bob La Pointe

## FIRST, ASSEMBLE THE BASE CABINET

***Join the sides to the bottom with dovetails.*** *The first step in assembling the base is to join the sides to the bottom. Note that the bottom is made of poplar, a secondary and less-expensive wood for parts of the clock that aren't visible.*

***Leave a little extra at the edges.*** *Sides are glued and clamped to the face frame for the base, using simple butt joints and plenty of glue. The face frame overlaps each side slightly and is then trimmed to fit after the glue dries.*

have to be fussy about cleaning up the bandsaw marks left on the edges of the top rail.

Glue up the face frame, allow the glue to set, then glue it to the front edges of the sides and bottom. As you put the face frame under pressure with the clamps, monitor that it sits square to the sides. I like to leave the edges of the face frame slightly proud of the sides and then bring them flush with a handplane and scraper after taking the assembly out of the clamps.

You'll need to build a base frame, ⅝ in. thick, to go on the underside of the base. This frame provides a stable nailing surface for the small molding that gets nailed around the front and sides of the base (covering the edges of the frame) and a place to attach the feet. Glue the base frame to the clock base at the front edge only, attach the remainder with screws, and slot the holes to allow for seasonal movement.

When laying out the base-frame joinery, allow the frame to overlap the case by 1/32 in. on the front and on both sides. By building the base frame oversize, you can trim it flush easily after attaching it to the base: I use a router for that task.

The bracket feet on this clock are almost identical to the ones I used on a Pennsylvania secretary featured in *Fine Woodworking* issues #154, #155, and #156. (For details on constructing these ogee bracket feet, see *FWW* #154, pp. 52-53.) Clamp pieces of the base molding in place on the bottom edge of the base cabinet, to see exactly where to secure the ogee feet. After screwing the feet to the underside of the base frame, you can nail the base molding around both sides and the front of the clock, mitering the two front corners.

### Sides of the waist extend into the base and hood

The middle section, or waist, is just a face frame glued to the two sides. After cutting the mortise-and-tenon joinery on the face frame, cut the arch in the top rail before assembling the frame. Also, cut the rabbets in the case sides that will accept the back, and then glue and clamp the sides to the assembled face frame. Just as I did with the base, I like to leave the stiles of the face frame slightly proud when gluing them to the waist sides, and then trim them flush with a router or a handplane and scraper, after the glue has set.

The sides of the waist extend well beyond the face frame, top and bottom. That extra length gives you a way to connect the three cases that make up this clock.

### Fit the three cases together

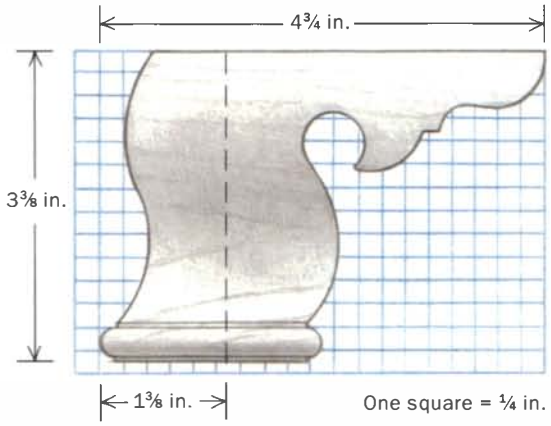
With the cases for the hood, base, and waist built, you're ready to assemble the clock. The upper extensions of the two waist sides support the seatboard—the platform on which the movement rests. Keep in mind that the hood isn't permanently attached to the case; it simply slides off from the front to allow access to the movement. However, the waist and base are permanently attached, using thick glue blocks where they are joined together.

To ease assembly, position the base and waist faceup on the workbench. Measure the difference between the outside width of the waist and the inside width of the base. The thickness of the glue blocks, which also work as spacing blocks, will each be one-half of that difference. Glue and screw the blocks to the inside of the base. Next, adjust the vertical position of the waist, and then glue and screw it in place to the blocks inside the base.

Now add the transitional moldings at each end of the waist. Keep in mind this very important detail: The upper molding

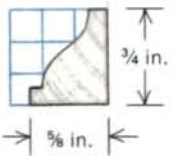
## ALIGN THE BRACKET FEET TO THE BASE MOLDING

**Dry-fit and clamp the base molding in place, mitering the two front corners, as a guide to follow when installing the feet. After that, you can nail the molding in place.**

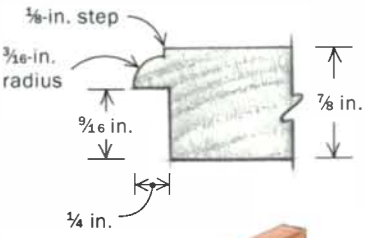



***Add a frame to the bottom of the base.*** *The poplar base frame, screwed to the underside of the case bottom, serves as a stable nailing surface for the small molding that trims out the sides and front of the bottom edge.*

### BASE-MOLDING PROFILE




### BASE-PANEL AND WAIST-DOOR PROFILE

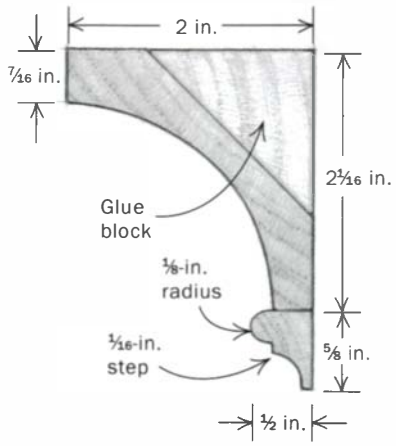


## BUILD THE WAIST AND ATTACH IT TO THE BASE

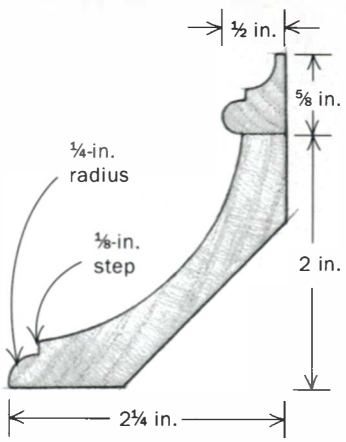
**The waist is simply a face frame joined to the two sides with butt joints, glued and clamped in place. Monitor the joint with a square as you apply pressure with the clamps.**




### TOP-COVE AND BEAD-MOLDING PROFILES




### BOTTOM-COVE AND BEAD-MOLDING PROFILES




***Glue the cove molding to the waist.*** *Clamp scraps of ¼-in.-thick plywood to define the baseline of the molding and to have an edge to push against. For the two side pieces, apply glue to the mitered corner joint and only partially to the bottom edge, near the front, which will allow for seasonal movement in the solid maple sides.*

***Glue blocks join the waist to the base.*** *After assembling the waist and the base cabinets, measure the outside width of the waist and the inside width of the base. The difference divided by two is the thickness at which you should mill each of the two glue blocks. Glue and screw the blocks to the insides of the base cabinet first.*

***Attach the waist to the base.*** *Where the waist sides extend down into the base cabinet, use plenty of glue and screws to secure the two cases to one another. Position them carefully before driving the screws through the waist sides into the glue blocks in the base. Once the glue sets, the waist and base become one cabinet. The bottom cove molding will conceal the gap between the two components.*

will support the hood, so it is a structural element to the clock design, not just a decorative one. Also, exactly where you secure that upper molding to the top of the waist will affect the fit of the movement within the hood, so you want to be precise when laying out the position of the molding.

After mitering and attaching the molding, strengthen it by adding triangular-shaped glue blocks behind it, between the molding and the case. Next, nail a strip of wood on each side of the waist to serve as a kicker. The kickers keep the hood from tipping forward as it is slid on and off the waist. For authenticity, you can use reproduction nails or small cut nails.

After the glue on the triangular blocks behind the top molding has set, slide the hood into position and measure the width at the back of the hood and the overall height to dimension the back board. After ripping it to width, notch the edges to fit inside the narrower waist, and then glue on extra pieces at the bottom to fit inside the wider base. You can use reproduction nails or screws to attach the back board to the rabbets within the waist and base, but wait until you've put a finish on the clock before securing the back board in place.

## Door and lower panel show off the wood

The last step is to construct the front panel for the base and the door to the waist. Both pieces are solid planks rabbeted around the outside edges, with only a small amount of the thickness sitting proud of the face frames. The lower panel is fixed in position (from inside the base, with wood buttons), while the door is hinged and fitted with a lock. The waist door and base panel are both great places to show off figured grain, so you can choose your best stock for the widths required. Avoid using glued-up material because the seams will be distracting.

When measuring for the panel, add 3/16 in. along all four edges for the rabbeted overlaps. The door overlaps its opening, too, but only on three sides: An overlap on the hinge side would cause the door to bind when opened.

Cut the base panel and waist door to size and rabbet the edges. Then shape the edges with a 3/16-in. thumbnail profile—the same profile used on the sides and windows of the hood.

To hold the lower panel in place, I use wood buttons, which allow for seasonal movement. Each button is fastened to the inside of the panel with a single screw and has a lip that catches the inside edge of the face frame. To hang the door, you'll need special hinges for a lipped door. A small half-mortise lock will keep the waist door shut (see "Choosing and Installing a Lockset," *FWW* #162, pp. 80-85). □

### SOURCES OF SUPPLY

**CLOCK MOVEMENTS AND PARTS**

Green Lake Clock Co.
651-257-9166
www.greenlakeclock.com

Merritt's Clock and Watch Supplies
610-689-9541
www.merritts.com

*Lonnie Bird teaches woodworking classes at his shop in Dandridge, Tenn. (www.lonniebird.com).*

# Turned Drawer Pulls

## Making your own knobs is a fast way to add custom details to your furniture projects

BY PHILIP C. LOWE

When a project calls for turned knobs for drawers or doors, I always make my own. I hate paying for something I can make in my shop. But more important, making every element of a furniture piece, down to the knobs, brings a feeling of accomplishment that I don't get from using store-bought parts.

When turning knobs on the lathe, there are two basic methods to follow and a few different ways to add decorative elements. There also are some tricks for making matching knobs.

### Turn long-grain knobs between centers

You have one initial choice when designing a turned knob. Should it be turned on a faceplate or as a spindle between two centers? Spindle-turned knobs are made with the grain running in the long direction and attach to the drawer face with a tenon. In this orientation, you can cut several knobs from one length of stock—ideal when a project calls for multiple matching knobs. This typically is the method I use to turn a knob with a narrow diameter.

**Turn multiple knobs from one spindle**—One popular example of a spindle-turned knob is the Shaker drawer pull. A number of classical profiles exist, but they don't vary a great deal. The one shown at the top of the facing page consists of a tenon, followed by a fillet, an asymmetrical cove called a scotia, and a bead. Some refer to this kind of knob as a mushroom pull.

Begin with 4/4 stock and cut a piece of equal width and thickness. Each knob will require about 2¼ in. of material, so size the length of the material according to the number of knobs you want to make. But don't turn more than four knobs per spindle because it is difficult to create the narrow-diameter tenons on a piece that is too long; the pressure from the tool will create chatter. If I need more than four knobs, I'll turn them from multiple spindles.

Mount the spindle on the lathe and use a roughing gouge to turn a cylinder with a consistent diameter. Then mark off the lo-

# Small knobs

## TURN MULTIPLE KNOBS FROM ONE LENGTH OF STOCK

**Rough-turn between two centers as many as four knobs from a blank. Then cut apart the blank to finish each knob individually.**

***Rough out a blank to a common diameter.*** *Then use a parting tool to turn the tenon end of each knob to the diameter of a standard drill bit. Calipers help achieve consistency.*

***Separate the knobs.*** *Use a skew to cut a small chamfer on the end of each tenon (left). The chamfer helps guide the bandsaw blade as the knobs are cut apart (above).*

cation of each tenon with a pencil, and turn down the area with a parting tool to the desired diameter. Choose a diameter that is equal to a standard drill bit, as this will make it easy to mount the knobs on the drawer fronts.

After each tenon has been turned to the correct diameter, cut a small chamfer with a skew chisel into the end of the tenon where it meets the next knob on the spindle. This will make it easy to separate each knob. Remove the spindle from the lathe and cut off the individual roughed-out knobs at the bandsaw.

**Separate the knobs for the finish work—**With the chuck mounted in the

Photos, except where noted: Matt Berger; facing page: Kelly J. Dunton

## TURN INDIVIDUAL KNOBS TO COMPLETION

**Mount one knob at a time in a Jacobs chuck and mark the fillet, the cove, and the bead. The pencil marks and calipers help achieve consistent results while turning.**

***Remount a knob blank.*** *Clamp the tenon end in a Jacobs chuck and turn the base of the knob to a diameter greater than that of the tenon.*

***Mark for the cove and bead.*** *Cut grooves at the pencil marks with a skew.*

***Turn the cove.*** *Use a spindle gouge to turn the asymmetrical cove, also known as a scotia.*

headstock (I use a Jacobs chuck), insert the tenon end of a knob into the chuck and tighten it. Once you've determined the profile of the knob, mark the points where the fillet, cove, and bead will begin and end. You can do this with a pencil while the lathe is running.

Turn the knob to the desired profile, checking for consistency with calipers along the way. I use a parting tool to cut the flat, a skew to cut the rounded top, and a ¼-in. gouge to cut the cove. When you are satisfied with the shape, sand the knob to a final finish. I use 120-, 150-, 180-, and 220-grit sandpaper, wetting the wood with a rag and letting it dry between each grade.

To make additional knobs, follow the same steps and use calipers to match the diameters of each section to the first knob.

### Customize a chisel to reproduce a rosette

Once you've mastered the basic knob, you may want to experiment with different styles and ornamentation, such as a rosette pattern. The trick is being able to reproduce the pattern on multiple knobs. One way to do that is to grind a cutter to match the profile of the decoration. For instance, to cut a rosette pattern I use a scraper custom-ground for that purpose (see the top right photos on the facing page).

Make the cutter from an old, worn-out mill file. Grind one of the cutting surfaces smooth and then determine the shape you would like it to take. Half of the profile is ground into the end of the converted file along with a 10° angle sloping back from the cutting edge.

Once you are nearly finished turning a knob, use the custom scraper to cut the rosette pattern on its face. It's pretty hard to go wrong here; the only thing you need to be concerned with is positioning the scraper in the same location for each knob. If you hold the scraper too close to the center of the knob, the rings will have smaller diameters than a rosette cut with the scraper positioned farther away from the center.

### Accent a knob with contrasting wood

Another method for decorating a knob is to add an accent with material of a contrasting color. One striking example is to use a maple plug in an ebony knob (see the bottom right photos on the facing page). Feel free to experiment with material other than wood. In my work I've used all sorts of accents, including a ham bone right from the dinner table.

Rough out the knob's profile, leaving extra material on the end grain. Mount a ⅜-in. drill bit in the tailstock with a second Jacobs chuck. Slowly drill into the face of the knob until you've hollowed out the core to about ¼ in. deep.

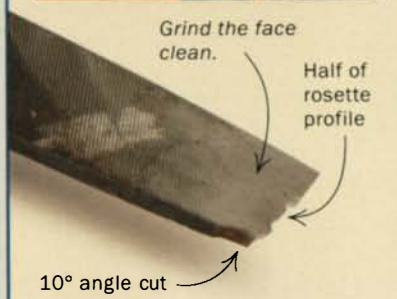
Use a plug cutter the same size as the knob hole to cut the plug. (For a knob with a large diameter, the plug could be turned between centers.) Then glue the plug into the knob with epoxy. After the epoxy

***Round the face of the knob.*** *A proper cut with the toe of a skew chisel will produce a smooth surface on the end-grain face of the knob (above). Then use the skew chisel like a scraper to clean off the button (left).*

***Sand and finish with the knob mounted on the lathe.*** *Start with 150 grit and work toward 220 grit, wetting and drying between each grit. Burnish with a rag or the shavings from turning and apply a penetrating finish.*

## Custom cutters

**Make your own cutting tool by grinding a profile on an old file to reproduce a decorative cut on the face of a knob. The tool described here was made to cut a rosette pattern.**




***Scrape a rosette on the knob's face.*** *To produce matching rosettes on multiple knobs, be sure to position the tool at the same distance from the center each time.*

## Decorative accents

**Add a decorative element to a knob by plugging the center with a material of contrasting color.**

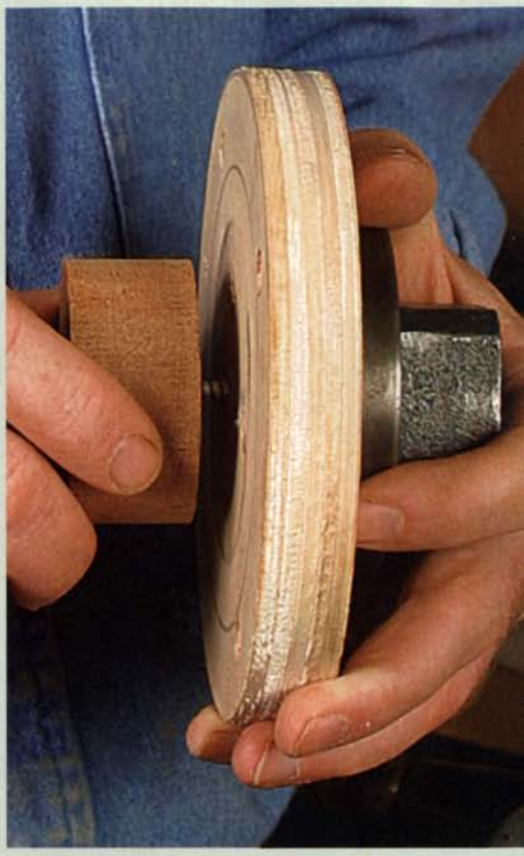
***Drill a center hole in the knob.*** *When the knob is nearly complete, mount a drill bit in the tailstock of the lathe and slowly plunge it into the workpiece while the lathe is running.*

***Plug and trim the end to a finish.*** *Experiment with different woods, materials, and designs.*

# Large knobs

## TURN LARGE KNOBS WITH A FACEPLATE

**Faceplate-turned knobs have the grain running across the face, which allows the grain to blend in better with the face of the drawer. This method is preferred for large-diameter knobs.**



***Make a center-screw faceplate.*** *Plywood screwed to a faceplate is leveled and rounded so that a wood blank can be screwed on and turned round. Drive a lag screw through the hole from behind and screw on the turning blank.*

dries, the knob can be turned smooth and then sanded and finished.

### Use a faceplate to make large knobs

A spindle-turned knob is limited in its size. If it's too large, it can be problematic, because the end of the knob will drink up finish and turn the end grain much darker, which can give an unsightly appearance to the front of a piece. The best way to avoid this is to turn a cross-grain pull with a faceplate. As a result, the grain will blend much better with the face of the drawer front.

On a square block, find the centerpoint and sketch the desired diameter of the knob. Then drill a hole in the center to a depth of about ⅜ in., which will be used to mount the stock on the lathe as well as on the drawer front.

Next, prepare a faceplate for the stock. You will need a faceplate with a center screw, which is used to attach the workpiece. If you don't have a commercial screw-mounting faceplate, you can make one. Screw a piece of ¾-in.-thick plywood to a metal faceplate and then turn the plywood round on the lathe. Then mount a drill bit in the tailstock of the lathe with a Jacobs chuck, and slowly drive the bit into the faceplate while the lathe is running. This will give you a through-hole that is centered perfectly. Next, screw a sheet-metal screw or ¼-in. lag screw into the hole from behind, effectively creating a center-screw faceplate; the screw should be sized to fit in the hole on the wood blank. The protruding end will screw into the hole drilled in the workpiece.

With the workpiece in place, cut its profile following the same steps described earlier to cut the long-grain pull. However, use scraping tools rather than spindle-turning tools because you are turning mostly end grain. Spindle tools may grab the end grain and chip or split off a chunk of the turning. I use ¼-in. square-nose, ¼-in. round-nose, and ½-in. square-nose scrapers. Mark the location of the fillet, cove, and bead with a pencil, and turn them to the appropriate profile, checking for consistency with calipers along the way. Finally, sand and finish the knob, unscrew it from the faceplate, and attach it (facing page). □

*Philip C. Lowe runs The Furniture Institute of Massachusetts. For more information on classes, go to www.furnituremakingclasses.com.*

***Lay out the elements of the knob.*** *After turning the workpiece round, locate and mark with a pencil the beginning and end of the fillet, cove, and bead.*

***Turn the cove with a rounded scraper.*** *The cove is asymmetrical and spans from the base diameter to the major diameter of the knob.*

***Round the face of the knob.*** *Use a scraper to round over the face of the knob. Polish the shape before sanding to a finish.*

## ATTACHING DRAWER KNOBS



***Long-grain knobs.*** *Fit the tenon through a hole on the drawer face and drive a wedge from inside (inset) into the hand-sawn kerf.*

***Cross-grain knobs.*** *Use a screw with the same threading as the one used to mount the knob in the faceplate.*

# 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. Send photos and entry forms to Current Work, *Fine Woodworking*, 63 S. Main St., Newtown, CT 06470, or email digital images to fw@taunton.com.**

**Richard Oedel** Salem, Mass.

The inspiration for this Sheraton-style, serpentine, gate-leg card table came from viewing a number of period pieces in museums and private collections. The table is made of mahogany and features fiddleback makore, crotch birch, holly, and ebony veneers. "The crotch birch was from a tree harvested specifically for this table," Oedel said. He applied a French-polish finish to the table, which stands 36 in. deep by 36 in. wide by 31 in. tall when open.

**Rob Hare** Ulster Park, N.Y.

When Hare set out to craft this curvy couch (36 in. deep by 108 in. wide by 38 in. tall), he wanted it to include arms that would serve as side tables, much like a Stickley couch. In two-and-a-half weeks, he designed and built this piece out of claro walnut and hand-forged steel. The curves were produced with a coopering method and careful grain matching. The wood is finished with catalyzed lacquer, and the steel with rubbed-in wax.

**Michael Seward** New Park, Pa.

Seward built this chest-on-stand (16 in. deep by 24 in. wide by 74 in. tall) for a gallery exhibition of his work. The stand and door frames are made of curly walnut, and the panels are book-matched walnut crotchwood. "Opening the doors reveals a stack of graduated drawers faced in iridescent bird's-eye maple," Seward said. The piece has an oil and varnish finish.

**Paul M. Pankratz** Midland, Mich.

A retired business executive, Pankratz enjoys producing turned objects. "Nature's contrasting colors, flame patterns, fissures—and yes, even stress cracks—all contribute to the natural beauty of the work," he said. These maple-burl bowls, ranging between 9 in. and 10 in. dia. and between 6 in. and 8 in. tall, are examples of his style. Each bowl has a wipe-on, polymerized tung-oil and urethane finish; the turned and carved feet are dyed to give them an ebony appearance.

**David Beach** Leesburg, Va.

Beach built this Chippendale highboy (25 in. deep by 45 in. wide by 97 in. tall) working from just two photographs that appear in *Southern Furniture 1680-1830: The Colonial Williamsburg Collection* (Harry N. Abrams Inc., 1997). Made of black walnut as a primary wood and maple and poplar as secondary woods, the piece incorporates all of the traditional furniture elements that Beach loves to work with: hand-cut dovetails, carvings, and turnings. Each of the drawers has cock beading and a half-mortise lock with a brass escutcheon. The finish is orange and blond shellac and wax.

**Jonathan Dowling** Worcester, Mass.

As a child, Dowling was surrounded by early-American furniture in his family's home. Inspired by a piece in Albert Sack's *New Points of Fine Furniture: Early American* (Crown, 1993), he built this Philadelphia-style tea table and presented it to his parents as a gift. The mahogany table is 24 in. dia. by 28 in. tall and is finished with oil and varnish.

## Award-winning designs from San Diego

**The pieces on this page represent only a few of the excellent entries in this year's Design in Wood Exhibition at the San Diego County Fair. Each year, *Fine Woodworking* bestows the Best of Show award on one woodworker. This year the prize went to Aaron Radelow for his Art Deco liquor cabinet.**

### Aaron Radelow Escondido, Calif.

***Best of Show,* Fine Woodworking**
***First place, Furniture***
Radelow cited the work of Jacques-Emile Ruhlmann as the inspiration for this liquor cabinet (21 in. deep by 38 in. wide by 46 in. tall) made of amboyna burl, Macassar ebony, and mahogany with bone and ivory inlay and accents. It is finished with French polish.

### Douglas Johnson Julian, Calif.

***First place, Accessories***
Johnson crafted this hanging jewelry cabinet (3 in. deep by 14 in. wide by 24 in. tall) out of walnut and bird's-eye maple. It has a satin lacquer finish.

### Paul Schürch Santa Barbara, Calif.

***Second place, Accessories***
This jewelry box is made of recycled native olive and decorated with marquetry done in mappa, ebony, anagre, poplar, and elm. The box is 12 in. deep by 16 in. wide by 6 in. tall and is finished with lacquer.

### David Blackburn Ventura, Calif.

***Third place, Furniture***
Blackburn's table (15 in. deep by 42 in. wide by 32 in. tall) is made of ipé, verawood, yellow heart, purpleheart, coral wood, jarrah burl, and madrone burl. The table is finished with lacquer.

### John DeGirolamo Ramona, Calif.

***Excellence in Design,* Workbench**
This petite display stand is 10 in. deep by 10 in. wide at the top and 30 in. tall. DeGirolamo designed and crafted the stand out of hard maple and quilted maple, with details in Peruvian walnut.

Photos, this page: Andrew Patterson

**Thomas Wetzel** Middle Grove, N.Y.

Wetzel had been crafting Windsor-style chairs for many years when a client approached him for a curly maple settee. Wetzel suggested extending a sack-back Windsor chair into a settee and designed this one for his client. The bench is 17 in. deep by 60 in. wide by 39 in tall. It is finished with aniline dye and shellac. Photo by Michael Noonan

**Mark Gumprecht** South Dartmouth, Mass.

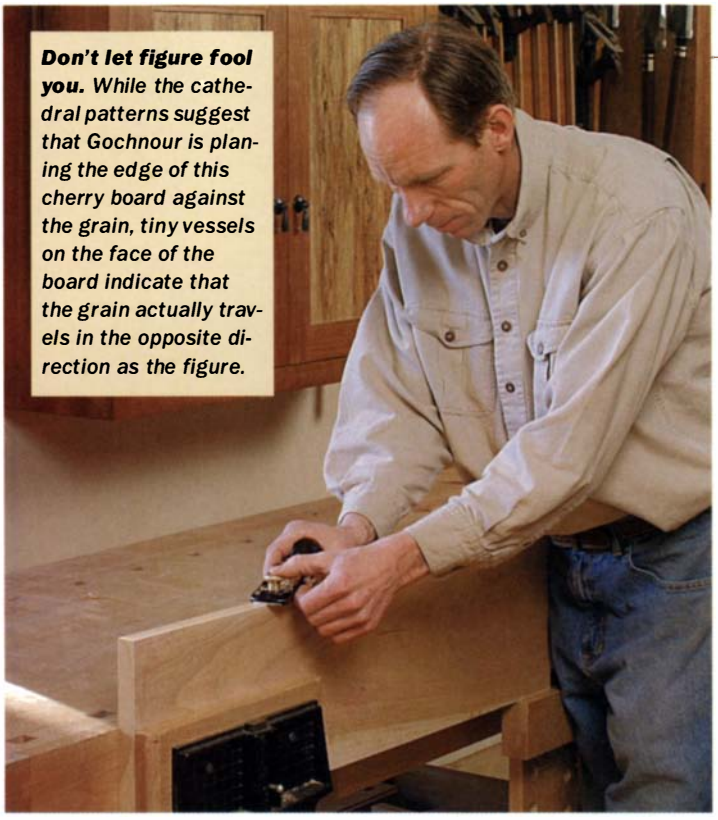
The top of this oval coffee table (21 in. deep by 42 in. wide by 16 in. tall) was inspired by the scalloped latticework on half-oval windows in traditional New England homes. The top is made of 3/32-in.-thick ash and walnut veneer. The upper and lower rims of the base are laminated Honduras mahogany. The table features tambour doors on the front and back and has a wipe-on polyurethane finish. Photo by Pam Clarkson

**Jon Hodal** Penticton, B.C., Canada

Hodal built this front entrance table (16 in. deep by 61 in. wide by 35½ in. tall) of Western maple and walnut for a client. The top is made of 64 curved laminations, with an edge treatment inspired by watching manta rays swim. The table has a hand-rubbed oil finish. Photo by Stuart Bish

BY CHRIS GOCHNOUR

# Determining grain direction



***Don't let figure fool you.*** *While the cathedral patterns suggest that Gochnour is planing the edge of this cherry board against the grain, tiny vessels on the face of the board indicate that the grain actually travels in the opposite direction as the figure.*

Wood's beauty and appeal can be credited to the uniqueness and diversity of its grain. These same virtues, however, turn to vice when it comes to surfacing and smoothing lumber. The secret to achieving smooth surfaces with machine and hand tools is cutting in the direction of the grain. Sometimes grain can change direction on a single board. Depending on the species you're working with, grain direction is not always obvious.

While you have a 50:50 chance of success by guessing which direction the grain runs, you can increase your odds greatly by studying a board for clues, listening and feeling as you mill the wood or work it by hand, and making midcourse corrections when necessary.

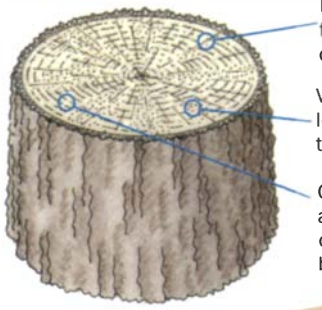
## Rays, vessels, and figure are indicators

You can determine the grain orientation of various hardwoods by observing their physical characteristics. In some hardwoods, you can determine the grain direction by simply looking at the rays, which are wood cells that radiate from the center of a tree to its perimeter. They appear vividly in species such as oak, beech, and sycamore as dark, solid specs of varying lengths. Rays are visible on the surface of a plainsawn board in cross section, sandwiched between the fibers. Therefore, the long, narrow marks point in the same direction as the fibers, making them the most reliable indicator of the direction of the grain.

Rays can be difficult to make out on some species, in which case I look for vessels to determine grain direction. Vessels are wood

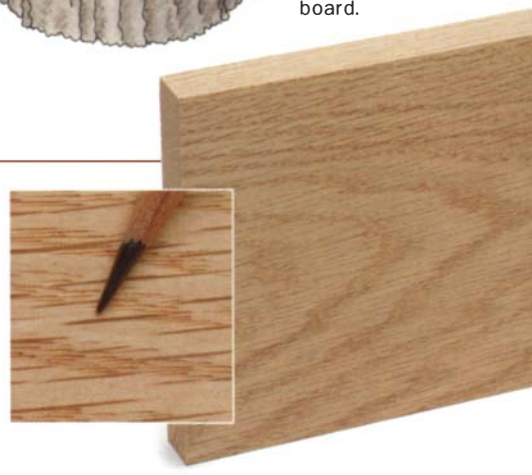
## TO WORK THE EDGE, EXAMINE THE FACE

**Determine the grain direction on the edge of a board by studying the orientation of rays, vessels, or figure on the face. Some species of wood display these characteristics more prominently than others.**




### RAYS

Wood cells that radiate from the center of a tree appear on the surface of a board in cross section as dark specks or lines. The rays on this oak board run opposite the cathedral patterns, proving that figure doesn't always go in the direction of the grain.



### VESSELS

Wood cells that extend linearly on hardwood appear as long, open tubes on the surface and as small, open pores on end grain. Woods such as walnut (shown here), butternut, and mahogany have prominent vessels that make it easy to read grain direction.

### FIGURE

Often referred to as grain, figure is the result of the annular growth rings intersecting with the surface of a board. In species such as alder and maple (shown), rays and vessels are difficult to make out, so reading the figure is the only option to determine grain direction.

Photo, this page (top left): Asa Christiana

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***Glued-up panels pose a problem.*** *It's not possible to examine the edges of a board for grain direction if it's in the middle of a glued-up panel, so you must rely on its figure to guide the way.*

## TO WORK THE FACE, EXAMINE ALL SIDES

There are two methods for determining grain direction on the surface of a board. Once you determine the direction, you can joint or plane the face of a board in the direction of the grain to prevent tearout.


cells that extend linearly in hardwood and appear most prominently in species such as mahogany, walnut, and butternut. They appear on the surface of the board as long, open tubes and on the end grain as small, open pores. Vessels align with the direction of the grain, so identifying the direction vessels travel also indicates the direction the grain travels.

Because many species display neither rays nor vessels to the naked eye, figure (which often is referred to as grain) is the last characteristic I look at to assess grain direction. Figure is created when the varying densities and color of the annular growth rings intersect with the surface of the board. On the face of a plainsawn board, figure often appears in cathedral patterns (see the photo at top right). Most of the time, figure will follow the grain, so it can be used as an indicator. However, it's not uncommon for grain to run opposite the figure, so this isn't always the most reliable source. In woods that don't have prominent vessels or rays, such as cherry, maple, and alder, figure is the best characteristic to go by.

### How to read a board

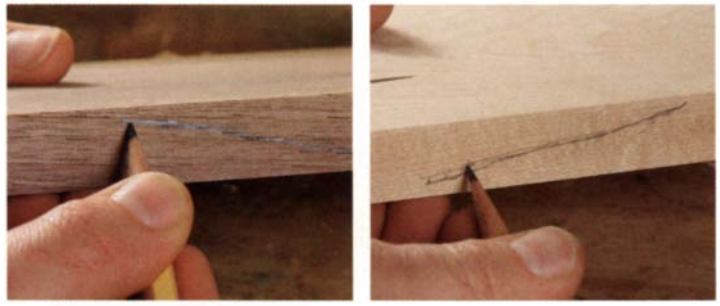
When cutting the surface of a board with a jointer, planer, or hand tools, you should use rays, vessels, and figure to determine the best direction to cut.

A good place to start is to inspect the edge adjacent to the surface you are working. The majority of the time, rays, vessels, or figure will travel diagonally across the edge of a board, revealing the grain direction. This will indicate how a board should be oriented so that the surface cut lays down the fibers in the path of the blade. This same rule can be applied when working the edge of a board. Inspect the adjacent surface to determine the grain direction.

In situations where the edges of the board cannot be seen, such as when handplaning glued-up panels or tabletops, I observe the orientation of the growth rings on the board's end in relation to the cathedral patterns on the surface to determine grain direction. If the growth rings arch upward when looking at the end of a board,

### INSPECT THE EDGE

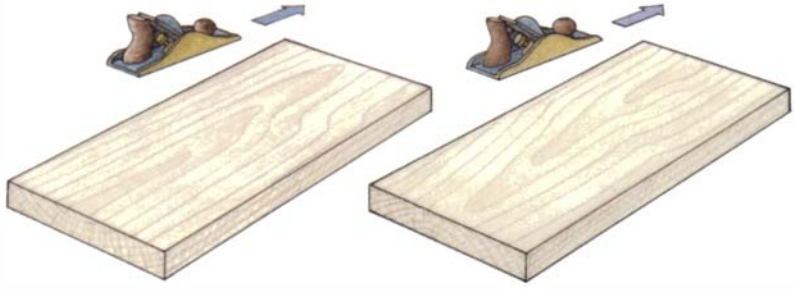
Studying the rays, vessels, and figure on the edge of the board can help determine the grain direction on its face.



***The direction of the vessels on this piece of walnut (left) indicates the direction of the grain and determines which way the adjacent surface should be worked. On a maple board (right), the figure points the way.***

### READ THE RINGS AND CATHEDRALS

The growth rings on the end of the board appear as cathedrals on its face. Together, they create a topographic map of the grain.



If the growth rings arch downward, cut in the direction the cathedrals point.

If the growth rings arch upward, cut into the cathedral points.



Photos, except where noted: Michael Pekovich; drawings: Vince Babak

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your cut should be made into the cathedral points on the surface. If the growth rings arch downward at the end of the board, the cut should be in the same direction the cathedrals are pointing.

### Keep track of grain as you work

When milling lumber, you will have the best success producing smooth, tear-free material if you keep track of the grain direction on each board. When surfacing lumber, mark the edge of the board with a diagonal line that shows the direction of its grain. You can use the mark to determine the orientation of the board quickly when feeding it through a planer or jointer. When planing or jointing the edge of lumber, draw the diagonal mark on the face of the board. This marking system is especially useful when milling large quantities of wood. Make sure each piece is marked properly, and keep the wood stacked with the grain running in a consistent direction.

It's also important to know that the grain runs in the opposite direction on opposing surfaces of a board. So you must flip over the board, end to end, to maintain the same grain orientation. Flipping the board sideways will reverse the grain direction.

### More than meets the eye

While rays, vessels, and figure can be a good indicator of grain direction, some woods invariably will deceive you. Also, it is rare to find a board in which all of the grain is going in the same direction. As I work, I watch, feel, and listen to the progress of my cut, always assessing how the wood is responding to the blade. If I hear the snapping sound of breaking fibers while using machines, I ease up on the speed of the pass, lighten the cut, and try feeding the board in the other direction on the next cut. With properly tuned equipment, moderate cuts, and a slow feed rate, boards with changing grain direction can be accommodated.

Sometimes you will come across a board that tears out in every direction. This is especially the case with highly figured boards, such as bird's-eye maple or curly woods. Once you've discovered that you're going to get tearout in either direction, you can try a few tricks. One is to dampen the surface of the board before passing it across the blade. You also can try sending the board across the blade at a skew; that way you are cutting across the grain rather than attacking it head-on.

Handplanes are more sensitive than machines, so you will feel when a cut is going against the grain. Cutting with the grain should feel smooth, while cutting against it feels rough. Handplaning also is advantageous because you can reverse the direction of your cut when grain changes midway through a board. I try to avoid this practice, though, because I prefer to take long, continuous strokes.

With time, identifying the direction of the grain and working in its favor can become second nature, even with the most complex grain patterns. Keep in mind that in the real world, grain direction can be unpredictable. The goal then is to determine the direction that the majority of the fibers lay and work them in the most favorable direction. □


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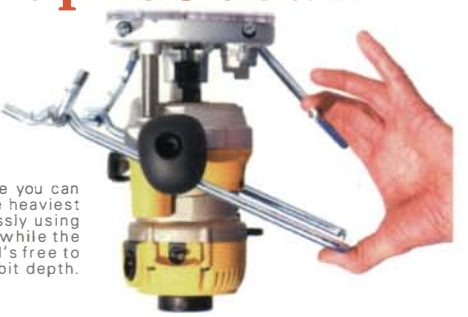

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# Q&A

## Should I seal drawer sides?

**Q** *I am reluctant to finish my drawer sides for fear of the drawers sticking later. Should I apply a finish to them?*
*—Phinneas Sloane, Marblehead, Mass.*

**A** **Mario Rodriguez replies:** Give a light finish to the drawer sides, on the interior and exterior surfaces. Do the same on any other secondary wood, such as the back and bottom of the drawers. A light finish will seal each drawer without causing it to stick.

Apply two to three thin coats of super-blond shellac. Mix three tablespoons of shellac flakes with one cup of denatured alcohol. After the first coat dries, sand it with fine-grit paper, then apply the second and third coats. Rub out each coat with extra-fine steel wool and then finish with a little paste wax.

The result is a smooth, low-luster satin finish that seals the wood and protects the drawer against dirt and discoloration. [Mario Rodriguez is a contributing editor.]


***Use shellac on drawer parts.*** *A light finish on the sides, back, and bottom seals the wood, and a light coat of wax ensures smooth operation.*

## Selecting a bench vise

**Q** *I am trying to choose a bench vise for my workbench. What is the advantage of a traditional wooden shoulder vise over a regular metal front vise?*
*—John Hinyard, Orlando, Fla.*

**A** **Christian Becksvoort replies:** Advantages of the wooden shoulder vise are a less-restricted holding area and wooden jaws, which are less likely to mar the wood being held. Disadvantages are that these vises usually open only 8 in. to 10 in. and aren't suitable for holding small metal or hardware parts.

Large metal vises usually open wider than wooden vises and often have dogs and quick-release mechanisms. To protect your work, you should add softwood jaw pads to a metal vise.

As with any tool, though, personal preference, intended use, and cost are major factors when choosing the best vise for you.

[Christian Becksvoort is a contributing editor.]

***Metal front vise vs. shoulder vise.*** *With a metal vise (top), you often need additional support to hold large pieces. The shoulder vise (bottom) allows the workpiece to extend downward below the jaws, accommodating large pieces such as cabinet doors.*

## Variable-speed motor for a shopmade lathe

**Q** *I'm looking for a variable-speed motor for the lathe I'm building so that I don't have to fuss with pulleys to change speeds. However, I'm limited to 120v household current. What can you recommend?*
*—Glen Farmer, San Diego, Calif.*

**A** **Ernie Conover replies:** If expense isn't an issue, look into a three-phase motor and an a.c. single-phase to three-phase speed controller. This a.c. solid-state controller will take your single-phase house current and deliver three-phase current. For example, it will slow a 1,725-rpm motor to about 57 rpm. You'll have variable speed, though you'll still need a pulley system to have sufficient speed range for general turning. I recommend a low range that would yield a maximum speed of about 1,200 rpm and a higher range that would go to about 2,500 rpm. Depending on the size of your lathe and the type of turning, you may want a third, higher range.

For controllers and motors, look under "Power Transmission" in the Yellow Pages, or go to the Grainger or McMaster-Carr Web sites. Prices start at around $545 for a controller and $180 for a motor. If expense is an issue, then stay with a single-phase a.c. motor and use pulleys to change speed. [Ernie Conover is a frequent contributor to *Fine Woodworking*.]



Photos: Marcia Ryan

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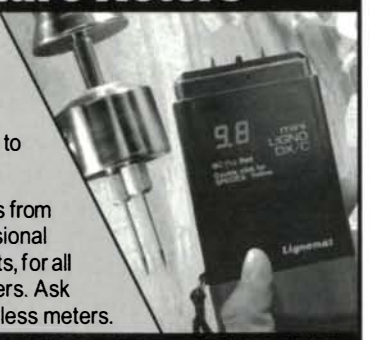

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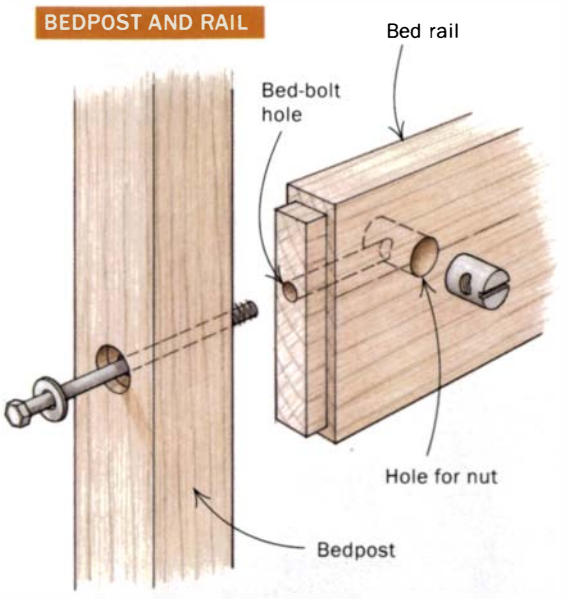
## How to align a bed bolt with its nut

**Q** *I'm installing bed-bolt hardware and need to drill a hole through the bedpost into the end of the bed rail, then drill into the face of the rail to intersect the bolt hole. What's the best way to drill these two holes freehand, with no drill press, at 90° to each other so that they intersect perfectly?*

*—Carl Black, Ont., Canada*

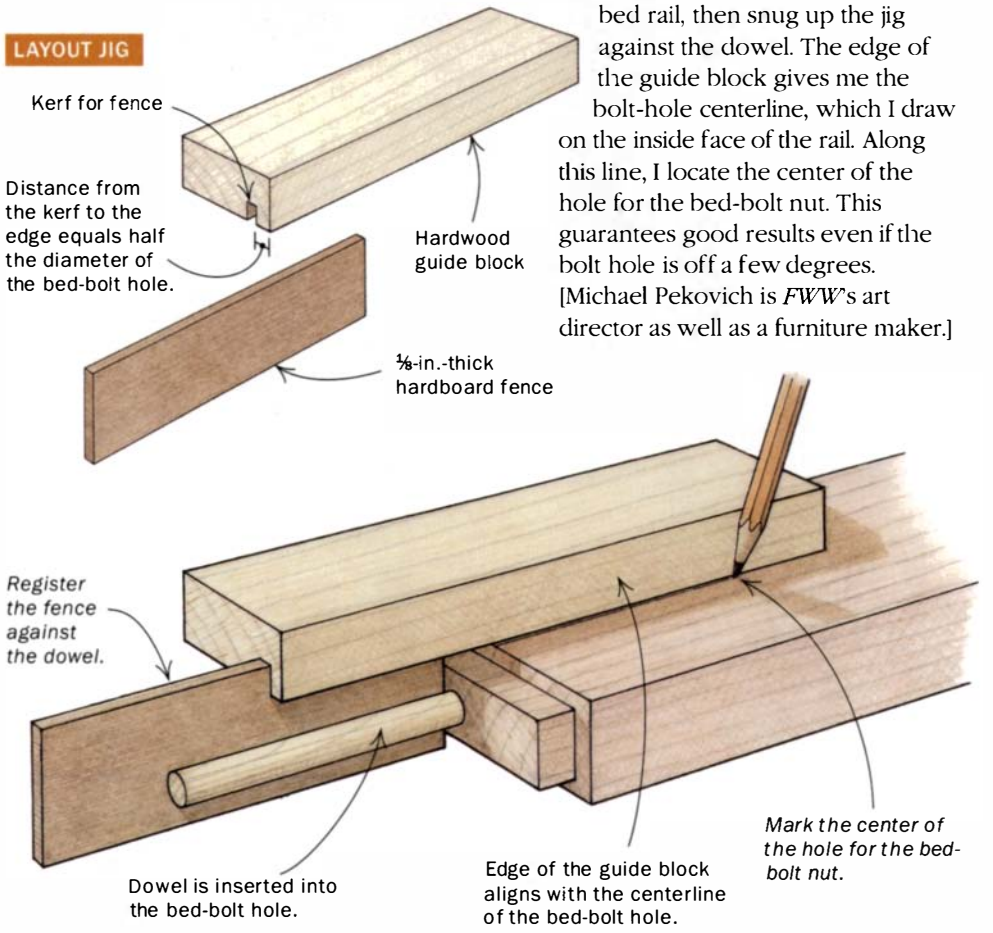



**A** **Michael Pekovich replies:** The bad news is that it's difficult to drill a deep hole at exactly 90° with a hand drill. The good news is that you don't need to drill the holes at exactly 90° to get holes for the bed bolt and its nut to intersect precisely.

I drill the bed-bolt hole into the end of the bed rail as straight as I can. Then, with a dowel and a simple layout jig, I locate the centerline of the hole and the center of the bed-bolt nut.

The jig consists of an ⅛-in.-thick hardboard piece glued into a kerf cut in a block of wood. The kerf is set in from the edge of the block at half the diameter of the bed-bolt hole. I insert a dowel the size of the hole in the bed rail, then snug up the jig against the dowel. The edge of the guide block gives me the bolt-hole centerline, which I draw on the inside face of the rail. Along this line, I locate the center of the hole for the bed-bolt nut. This guarantees good results even if the bolt hole is off a few degrees.

[Michael Pekovich is *FWW*'s art director as well as a furniture maker.]




## Removing wax buildup

**Q** *What is the best way to remove wax buildup on a cherry dining table?*

*—Roy Scudamore, Ocala, Fla.*

**A** **Christian Becksvoort replies:** Wax is best removed with household ammonia.

[Christian Becksvoort is a contributing editor.]

## Problems when planing teak

**Q** *When I plane 4/4 teak on my 15-in. Jet planer, the handwheel spins and decreases the depth of cut as the board hits the knives. I've never had this happen with cherry, walnut, or oak. Is there something I'm missing, or is it the species of wood?*

*—Peter Randolph, Lewiston, Maine*

**A** **John White replies:** I suspect that the problem is caused by the combination of dull blades and the machining of a moderately tough wood such as teak. It is hard to keep blades sharp for very long when machining teak because the fibers contain silica, the main ingredient in sand. The dulling effect of the silica is reduced if the wood is green or at least contains more moisture than kiln-dried stock.

Trying to force dull blades into the surface of a wood as hard as teak will create a higher-than-usual upward force on the cutterhead. The stress and vibration are enough to force the machine's height-positioning screws to rotate backward and the height-adjusting handle to rotate. If the cutterhead hadn't moved, it is likely that its bearings would have been damaged by the excess load, so the slipping of the height setting served as an unintended safety function.

Keep the blades sharp. You might consider using carbide blades, if they're available for your machine, but they'll be expensive. And even with sharp blades, you need to take light passes to keep the load on the cutterhead manageable.

[John White is *FWW*'s shop manager and author of *Care and Repair of Shop Machines* (The Taunton Press, 2002).]



Drawings: Vince Babak

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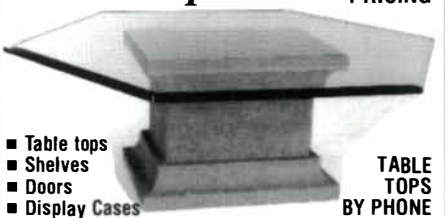

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## Red oak is turning blue

**Q** *I am building a chair out of red oak. To raise the grain before finishing, I misted some water on the surface and prepared it with sandpaper and steel wool. Now my oak is blotchy and bluish in color. Any idea what might be wrong?*

*—John MacKay, Bridgewater, N.S., Canada*

**A** **Chris A. Minick replies:** The blue color is caused by iron contamination. Perhaps the contaminant came from the steel wool or from milling the boards. When sufficient moisture is present, the trace iron particles left on the surface of the wood react with the tannic acid in the wood. That blue-black stain actually is iron tannate.

A diluted solution of oxalic acid will remove the stain. Most hardware stores carry oxalic acid as deck cleaners or in the form of crystals. Follow the manufacturer's directions for proper protection. Dissolve about one tablespoon of crystals in one pint of water to make the oxalic-acid solution. Be sure to use a plastic or glass container to make the solution; the acid will react with metal. Apply the solution with a brush or rag. There's no need to neutralize the acid, but be sure to rinse off the excess thoroughly with water and let the wood dry. Neutralizing sometimes will reverse the reaction of the acid solution, and the blue stain may reappear.

[Chris A. Minick is a consulting editor.]


***Oxalic acid will remove the blue stain.*** *This piece of oak, which was wetted to raise the grain and then rubbed down with steel wool, has turned blue. To get rid of the stain, apply a solution of oxalic acid.*

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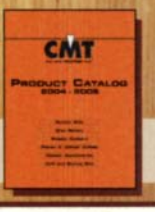


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# Carving leaves on a turned post

BY ALLAN BREED

The ability to carve in the round is useful not only on beds—the Federal example covered here—but also on table pedestals and legs, chair legs, chest columns, finials, clock columns, and other turned work. Often this type of carving is easier for the beginner because the cutting is done with the grain as one works downhill (from the larger diameter to the smaller).

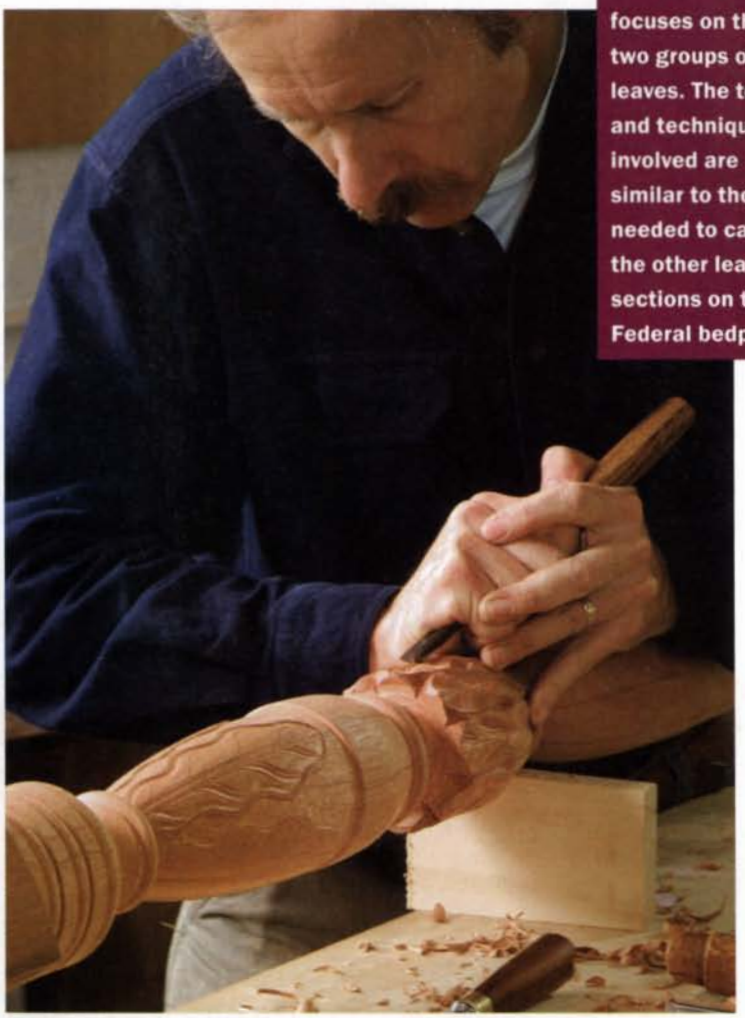
Heavily carved bedsteads were less common in the Colonies than in Europe, where designers such as Chippendale and the team of Ince and Mayhew were concocting regal examples. In the Colonies, though, high-post bedsteads were nearly always plain, hidden by ornate bed hangings.

By the 1790s in the United States, neoclassical taste demanded more ornate bedposts incorporating fluted and beaded sections with leaves carved onto vase- or urn-shaped turnings.

I can't cover all of the elements of this bedpost in one article, so I'll focus my efforts on two carving lessons I think will prove the most useful. Both are leaves—two different versions of corn leaves. If you can master these, you will be able to move on to the more detailed acanthus leaves that fall between these sections. I'm assuming that if you tackle this post, you can handle the reeds and beads involved, or seek out past articles on these areas (try *FWW* #163, p. 65, for a good way to form the reeds).

## Nothing special about the turning

The turning on the post, or shaft, is conventional. In other words, I don't make any allowance for the depth of the carving because the relief usually is quite shallow. I suspect that 18th- and 19th-century shops used the same turned posts for plain and carved pieces, making it easier to respond quickly to the taste and budget of the customer.



This article focuses on these two groups of leaves. The tools and techniques involved are similar to those needed to carve the other leaf sections on this Federal bedpost.

For stock, straight-grain wood will allow predictability and ease of carving. The more figured the wood, the more difficulty you'll have getting clean surfaces. Also, because a carving places the focus solely on the interplay between light and shadow, setting it on a visually complex background is not a good idea. However, many of these beds had fancy veneer applied to the square, flat sections of the posts where it could be appreciated.

There are two turning tricks that will help later to allow a cleaner carving. First, for a clean transition at the base of the leaves, make an extradeep score with the skew. This will allow the waste to break away cleanly when the base of the leaf is carved. Also, it is easier to undercut the end of the bell-shaped section on the lathe



Photos, except where noted: Asa Christiana; photo, this page (right): Dan Gair, Blind Dog Photo

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than it is when carving the tips of those leaves.

### Layout is done with carving tools

After turning, I center the work on a benchtop indexing head used solely for carving, but the lathe also could be used. Some lathes have indexing holes on the head pulley. If yours does not, use dividers and trial and error to walk off the divisions of the leaves. In this case, the sets of eight and four leaves require 16 divisions, serving to outline them and find their centerlines. To continue these divisions lengthwise down the post, use a compass with one leg on the bench or lathe bed and the pencil on the work.

In successful carving, the tools often are used both to lay out and carve the designs. The sweep or shape of each gouge determines each curve and cut. On longer corn leaves, for example, the outline is a series of linked arcs made with a single gouge. Unless the carving is complex, I often lay out the design by eye, trusting the tools and using no paper patterns. Although I must commit to the final shape, doing so will create uniform results on all the leaves and allow faster progress in layout and carving.

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## THE SHORTER LEAVES END IN MIDAIR

The first leaves Breed carves are the wavy corn leaves on the bell-shaped section of the post. They are a bit easier than the others because they drop away into space at their ends, unlike the longer leaves that hug the post and require a smoothly relieved section around them. The actual gouges Breed uses are in parentheses, although the exact sizes of the tools are less important than their general shapes.


***Divide the leaves.*** *Carving begins with a V-tool, sometimes called a V-parting tool (#16-3-mm), used to create a smooth dividing line between the leaves. Stop this cut about ½ in. from the base.*


***Make a divot at the midpoint.*** *To finish defining the undulating edges of the leaves, come in from both sides with a gouge (#5-20-mm), using a rocking motion to chop out a lozenge-shaped area.*


***Carve the centerlines.*** *Use a V-tool (#12-10-mm) to create a deeper cut down the center of each leaf. Continue this cut down to the base of the leaf.*


***Sculpt the bases of the leaves.*** *Invert a gouge (#5-16-mm) to round off the areas flanking the scoop cuts, making the base of each leaf angle slightly inward toward its center.*


***A scoop cut narrows the base.*** *Use a spoon gouge (#9-7-mm) to add scoop cuts between the leaves, which creates the impression of a tapered base on each leaf.*


***Model the faces of the leaves.*** *Make six diagonal cuts (#9-13-mm) from the center to the edge of the leaf. You may have to switch directions to avoid tearout. Anchor your hand and pivot the gouge through the cut.*


***Chop out between the tips.*** *To define the ends of the leaves, start with the V-tool (#12-10-mm), enlarging the divisions between the leaf tips and removing the bulk of the material for the next cut.*


***Soften the hard corners to create a wavy face.*** *Invert a gouge (#3-16-mm) to soften and blend in the hard corners left at the edges of each cut. This is a typical process for undulating areas.*


***Round the leaf ends.*** *Two cuts with a gouge (#5-16-mm) used in the inverted position form the end of each leaf. For cuts like these, a mallet will drive the tool more cleanly than hand power would.*


***Vein the leaves.*** *Each diagonal ripple gets three small veining cuts. Use the backswept V-tool to cut these without tearout. Make a deeper, central cut followed by two lighter cuts flanking it.*

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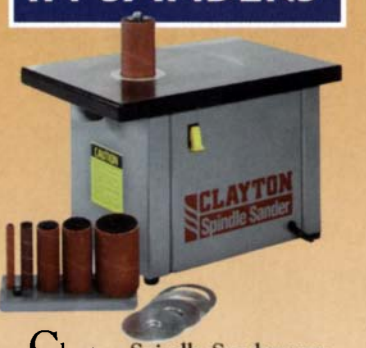


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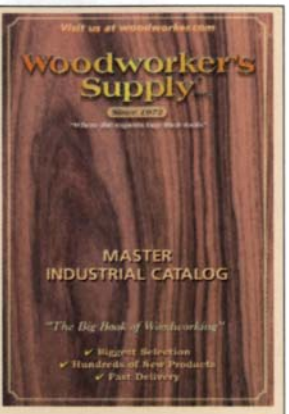


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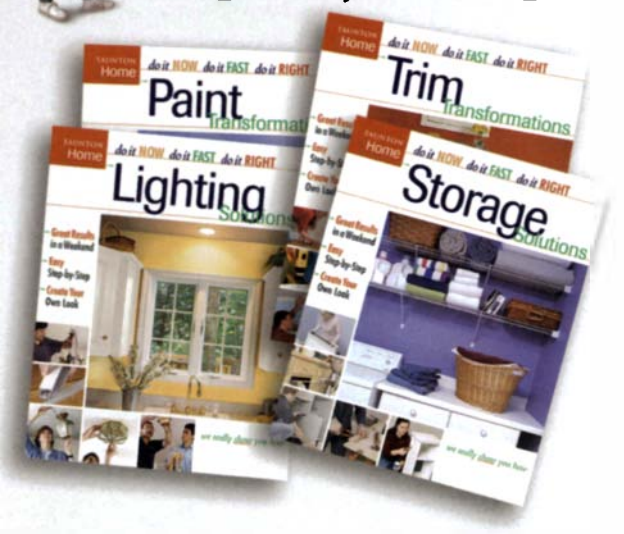


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are used over and over in traditional designs. Don't hesitate to adjust patterns to the tools you have; no one will notice. The important thing is that the work looks consistent and flows well, not that the leaf is the same size as the model.

## A few basics

Short chopping cuts often are made with a mallet. For longer, more continuous cuts, use your two hands only. Rest your front hand on the work as a brake to control the depth of cut. The back hand acts as the gas, and both work together to give both power and control.

It's important here to introduce the concept of safety cuts. A carving tool is a wedge that drives wood in both directions when plunged straight down. Safety cuts are made first, ⅛ in. outside an intended outline, to direct the compression away from the leaf to the waste area.

I usually sand with 400-grit paper at the end. Don't sand every nook; just keep the paper flat and touch the large areas. □

## THE LONGER LEAVES REQUIRE DIFFERENT TECHNIQUES

The long leaves on the post are characterized by shallower, more elongated cuts. The shallow relief around the edges and ends of the leaves presents a new challenge, because it must appear to be as smooth and uniform as the other turned areas.


***A paper pattern sometimes helps.*** *In this case, Breed starts with a pattern of a leaf—cut from a rubbing he made of the original bedpost—tracing it onto the post to get a rough idea of the size, placement, and outline of each leaf.*


***Mark and cut the outline.*** *Create the wavy outline by making a series of linked marks with a gouge (#5-20-mm). Then make safety cuts ⅛ in. outside the line. Last, chop the actual outline, angling the cut slightly away from the leaf.*


***Chisel out the waste between the leaves.*** *Use a large chisel to remove as much material as possible between the leaves. Then, in the narrow areas, finish with a small skew or straight chisel, trying to leave behind a smooth, uniformly deep surface.*


***Simulate the turning motion.*** *At the ends of the leaves, there is room to cut across the grain with a large chisel to create a smoothly rounded surface that appears to be turned. The leaves should appear to float on the post.*


***Two cuts form a central rib.*** *Start working on the face of the leaf next. Use the V-tool (#12-10-mm) to make two long, slightly tapering, adjacent cuts, keeping the layout line intact as a guide.*


***A narrow channel defines the outside edge.*** *Make a pencil line about ⅛ in. from the leaf's edge to mark the edge of the next cut. Start at the point of the leaf and make a fairly deep cut (#11-6-mm gouge). Think of this as a series of linked arcs to create a fluid motion.*


***Continue modeling the leaves.*** *Make a series of deep S-shaped cuts with a V-tool (#12-10-mm) to divide the leaf into sections. Then round the corners using a gouge (#3-16-mm) in the inverted position. The face of the leaf now should bulge outward smoothly.*


***Again, finish with the fine details.*** *Use a V-tool (#12-10-mm) to create veins that fan outward in the S-shaped modeling cuts. As always, change directions where necessary to avoid tearout.*

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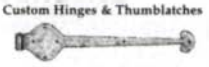

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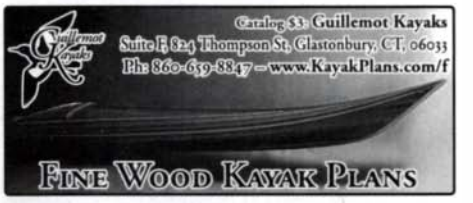


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BY DAN FAIA

# An antique painted finish

Duplicating a 200-hundred-year-old painted finish is a goal for many woodworkers, but the obstacles can seem overwhelming. Many antiques have several coats of paint, often of different colors, because period furniture was updated to follow the fashion of the times: A typical Windsor chair of the 1790s generally would have been painted green; in the Federal period it may have been repainted red or white; while from Victorian times onward, black was the color of choice. Then there is the problem of matching 18th-century lead paints, with their imperfect tones and subtle color differences. Finally, the paint must have a weathered and oxidized appearance with marks from generations of use and abuse.

The dilemma is how to create all of this history via a reasonably simple procedure. The process I follow can transform a project in a few hours from raw wood to an antique ready for use.

## Sand the wood, then dye it

A painted finish needs far less surface preparation than a clear finish. First, make sure all of the excess glue has been removed, then lightly sand the surface with 150-grit paper.

Apply a brown, water-based aniline dye to all surfaces, including the underside of the seat. Adjust the strength of the dye to match your color preference. The maple legs and stretchers, the pine seat, and the oak spindles absorb the dye to different degrees, highlighting the diversity of the woods used in a Windsor chair. However, because most of the surfaces will be painted, the mismatch will not be noticeable.

## Alternate layers of wax and milk paint

Next, consider where the piece will receive the most wear. A table has heavier wear on the edges of the top. A stool's stretchers are a natural resting place for shoes, while a chair's seat and crest rail show the most wear. Sit in the chair, and see what your body does. Look at where your shoulders hit and your feet end up. These are the main places where layers of paint are worn away. To achieve a worn look, generously apply paste wax to these areas.

Prepare all of your milk-paint colors ahead of time. Combine each dry powder and water in a one-to-one mix in a large-mouth lidded container. Shake the container for about a minute, leaving the paint frothy and full of air. Let the paint stand for at least 20

## AGE THE SURFACE BEFORE PAINTING

***Color the wood.*** *Brush the whole chair, including the underside of the seat, with a brown, water-based dye.*

***Wax the wear areas.*** *Rub paste wax onto those areas of the chair that get rubbed the most during normal use.*

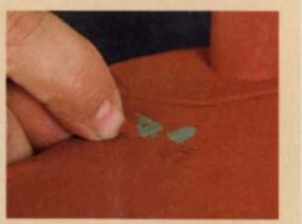
***Apply the first coat of milk paint.*** *Paint the legs and then the back green, leaving the seat until last. Don't worry about perfect coverage.*

***Rub off the loose paint.*** *Use a green abrasive pad to smooth the whole chair and remove loose paint from areas that were waxed (above). Rewax the same areas as before, but allow the wax to cover a slightly larger area so that some of the green paint will be revealed under the second coat of paint.*

Photos: Mark Schofield

## APPLY ADDITIONAL LAYERS OF PAINT

***Apply and flake the second coat.*** *The second coat of paint, red, flakes away from waxed areas to reveal the green.*



***Secret to making an ancient-looking crackled finish.*** *Apply hide glue or Antique Crackle to small areas only. Then apply wax and the last coat of paint.*


## FIRE OXIDIZES THE LAST COAT OF PAINT


***Set fire to your finish.*** *Prepare a 1-lb. cut of shellac (above). Brush it on and have a friend immediately set it on fire (top right). The alcohol will burn off in a few seconds and leave the paint oxidized and aged-looking. Then rub a mixture of paste wax and roofing cement over the whole chair (bottom right) to complete the aging process.*

minutes so that the air can escape, then gently stir in more water until the mixture has the viscosity of a warm milk shake.

Many antiques were painted only where the eye can see, so leave the underside of the seat unpainted. Because some of the paint will flake off and because you will apply additional coats, don't worry about getting perfect coverage. The milk paint will not adhere to the wax, leaving the stained wood exposed through the first coat of paint.

### SOURCES OF SUPPLY

www.milkpaint.com;
866-350-6455

www.woodworker.com;
800-645-9292

First apply Lexington green; when dry, wipe down the piece with a green abrasive pad to smooth the surface and to remove loose paint. Rewax the same areas as before, and extend the wax farther to reach the first coat of paint as well as the stain. The second coat, barn red, is applied and then rubbed with a green abrasive pad in the same way as the first coat.

The third and final coat of wax goes on now. But if you want a crackle finish, apply either hide glue or a glue-based product called Antique Crackle. Apply the glue in feathered brush strokes, bearing in mind that the more glue that's applied, the greater the amount of crackle you'll end up with. Concentrate on small areas such as the base of the spindles, parts of the crest rail, and the edges of the seat.

When the glue has dried, wipe on more wax to cover the stained wood and portions of both previous layers of paint.

### Two more steps in the aging process

Apply the last coat of paint, black. After it has dried, firmly scrub the surface with a green abrasive pad to remove the loose paint.

Matching the old, oxidized paint found on antiques can be a challenge, but I use a method that is quick and effective. Create a roughly 1-lb. cut of shellac (if using Zinnser's Bulls Eye brand, combine it with denatured alcohol in a 1:2 ratio). Brush the shellac onto a small area of the chair and light it on fire. The alcohol will burn off within seconds, leaving the paint with a dull, oxidized appearance with slight texture. Gradually brush and burn the entire piece. To minimize risk, the following precautions should be taken: Always work outside; because the alcohol evaporates fast, have an assistant ignite the liquid using a lighter; keep a fire extinguisher handy; and make sure the flames are out before applying shellac to another part of the chair.

When the whole piece has been treated, rub the surface with a green abrasive pad and remove the dust. Combine some paste wax and 10% roofing cement (not roofing tar, which won't dry), and wipe the mixture over the whole chair, including the unpainted parts. The subtle sheen of the wax evens out the complexities of the layers and textures of the finish. Adding the roofing cement will imitate 100 years of dirt and grime. □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# Case Study

At the end of the 18th century, only the very rich could afford the rare, finely crafted cutlery known as silverware. Wanting to protect their investment, they commissioned decorative knife cases to store and display their knives, forks, and spoons. Steven Lash, cofounder and president of the Society of American Period Furniture Makers, prizes the craftsmanship that went into those cases so much that he painstakingly reproduced these two identical knife cases.

The slant-top lid allows for an orderly display of each piece of silverware, which nestles in a custom-carved opening in the solid mahogany deck. The rest of the case is constructed of white pine and veneered with swirl and crotch mahogany. The curves and pilaster embellishing the front of the box were rough-cut on the bandsaw first and then carved by hand. The modified double lunette banding flanking the pilasters is echoed in the inlay on the underside of the lid as well as on the silver escutcheon.

Photos: Dirk Bakker