June 1999
No. 136

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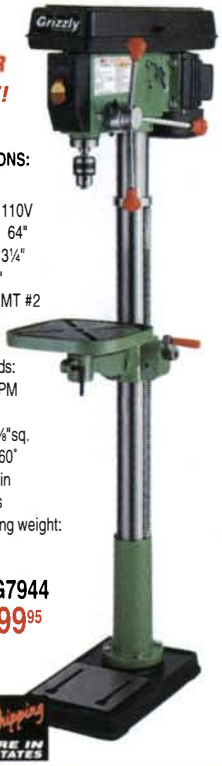

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Photo: Jonathan Binzen

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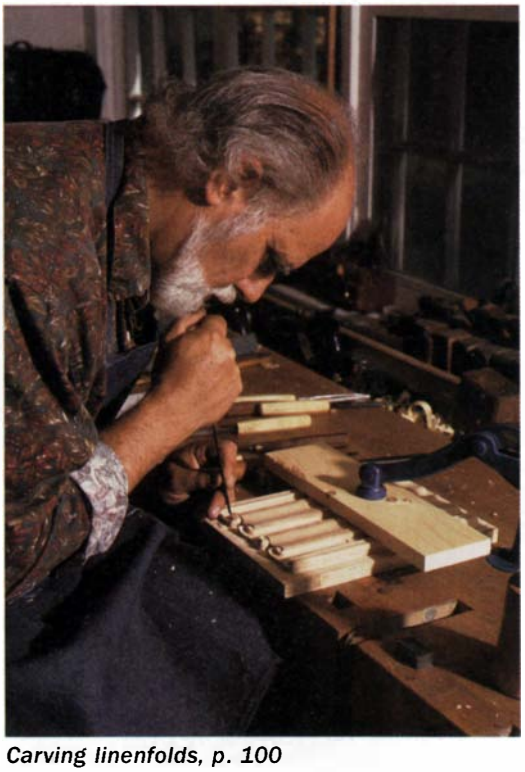

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Contributors

Richard Raffan ("Bowl-Turning Basics") is a professional wood turner best known for his functional bowls. He has written several books for The Taunton Press, most recently *Turning Boxes*. Raffan frequently travels from his home in the Far South Coast of New South Wales, Australia, to teach wood turning in North America and Europe.

Niall Barrett ("Cabinet Saw Test") was schooled in Ireland but began his professional woodworking career in the United States. He lives in Narrowsburg, N.Y., and builds furniture at his one-man shop. Barrett is the author of *Bookcases: Step by Step*, to be published by The Taunton Press (Sept. 1999). Although he's used a number of saws over the years, he prefers European-made saws. He currently owns an older Inca 280.

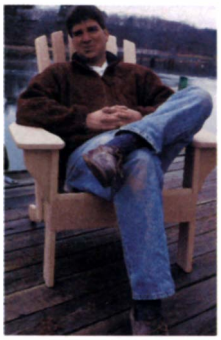
King Heiple ("Sanding Fids") is a retired orthopedic surgeon in Pepper Pike, Ohio, who now spends most of his time woodworking. He also teaches wood turning at Conover Workshops in Parkman, Ohio. Heiple began woodworking as a teenager.

Gary Rogowski ("A Classic Bookcase in the Craftsman Style") is a contributing editor to *Fine Woodworking*. A designer and builder of furniture since 1974, Rogowski has been teaching woodworking for 18 years, including workshops at his own school, The Northwest Woodworking Studio in Portland, Ore. He is the author of *Router Joinery* (The Taunton Press, 1998).

Bill Crozier ("Cabinets Built for the Long Haul") recently took a break from his cabinet shop in Providence, R.I., and his teaching duties at The Rhode Island School of Design to travel to Mexico, where he fell under the spell of a Cuban marimba band. Someday he will go to Cuba with his wife, Miranda. He will go for the music, not for the mahogany.

Graham Blackburn (Master Class) grew up in London, where his grandfather was a cabinetmaker and his father was a builder. He came to the United States in the mid-1960s to study composition at the Juliard School of Music. Before long he was living in Woodstock, N.Y., building houses. He started a furniture shop in the 1970s and began dividing his time between furniture making and playing saxophone and flute on tour with various musicians, including Van Morrison and Maria Muldaur. He's written more than a dozen books on woodworking and home building.

Scott Masi ("Curved Back Adirondack Chair") grew up in West Springfield, Mass., and spent summers on the coast of Maine. After graduating from the Landing School in Kennebunkport, Maine, a boatbuilding school, he made his first Adirondack chair as a wedding present. The next thing he knew, he was making garden furniture, under the company name Chairman of the Board.



Bill Ewing ("Router-Cut Columns") designs and builds furniture and kitchen cabinets. A self-taught woodworker, Ewing is a member of the United Auto Workers Union, having worked the past 28 years for General Motors. Upon retirement, he plans to pursue his cabinetmaking business full time. A Vietnam veteran, Ewing is married and has two grown daughters. His hobbies include golf and reading.

Lon Schleining ("Cabinet Saw Test") is a stairbuilder and woodworking instructor in Long Beach, Calif. He works with a lot of solid stock. His first saw was a contractor-style machine that he used until the motor finally went up in smoke. He currently owns a Powermatic 66.

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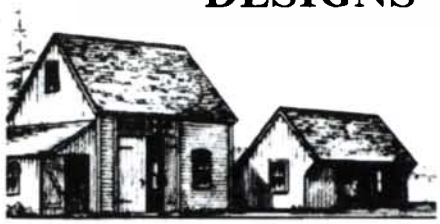

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Letters

It's okay to set a plane on its sole— As John Mitchell suggests in his letter (*FWW* #135, p. 10), the conventional wisdom is that a plane should not be placed on its sole. This idea is so widespread that even people who do not own a plane or know nothing else about using one know this. That Mitchell learned it from an instructor 70 years ago shows us how long the notion has been around. However, like conventional wisdom generally, it is wrong.

The reasoning behind this "wisdom" is that laying the plane on its side protects the cutting edge. When you place a plane on its sole on a workbench, you are placing it on wood—the same material it is used to cut. How can that cause it any more damage than being pushed over a board? When laid on its side, the plane's cutting edge is exposed. Since we all have the habit of letting every tool we have used in the past hour collect on the bench, the real risk is that another tool will come in contact with the plane's exposed cutting edge. This is based on the assumption that the plane is not set sole-down on a pile of other tools. I will admit that in 18 years of teaching, I have frequently seen woodworkers do this. With the exception of a lobotomy, I have no solution for that problem.

—Mike Dunbar, Hampton, N.H.

Manufacturer disagrees with review of finishes—We take issue with Andy Charron's review of "New Water-Based Finishes" (*FWW* #133, pp. 68-73). It is a known fact that oil-based stains such as Minwax must be topcoated within 24 hours (two to 12 hours is preferred) when using a water-based lacquer such as Hydrocote's Resisthane or any other water-based finish.

The blue tint and cloudy appearance of our lacquer and others reviewed in the article is the result of the oil from the stain seeping up from the substrate after the two-day drying time. The water-based topcoat should have been applied within 24 hours, as per label directions, not after two days, as was done when Mr. Charron prepared his test panels. A more objective evaluation would then have been presented in the article.

If you or Andy Charron had ever experienced an engine oil leak onto a driveway, you would have realized that the oil does not evaporate, and it remains on the surface nearly forever. It is unfortunate that this is the second time *Fine Woodworking* has screwed up a potentially beneficial evaluation on water-based finishes.

—Erick Kasner, president, Hydrocote, Somerset, N.J.

ANDY CHARRON REPLIES: It has always been my understanding that oil-based stains such as Minwax must be fully cured before a water-based topcoat can be applied. Otherwise, adhesion might be a problem. I called four manufacturers of water-based finishes and, without exception, they agreed. The consensus was that the stain should dry for a minimum of 24 hours, but the longer, the better. I also contacted Minwax and was told that its stain should be allowed to dry at least 24 hours—but 48 to 72 hours would be even better.

To be certain my test results weren't flawed, I applied Hydrocote Resisthane to a mahogany panel similar to those used in my test for the original article. I followed Hydrocote's recommendations and brushed on the first coat of finish after letting the stain dry for three hours. I then finished the panel exactly as I had before, and as I expected, the results were the same. The finish lacked the depth and color of traditional lacquer and appeared dull, cloudy and somewhat blue. The finish did, however, pass the adhesion test, as it did in my original test.

Based on my research and observations, I can only conclude that the drying time of an oil-based stain has no impact on the color, clarity or appearance of a water-based topcoat. If it did, how would Hydrocote explain that its finish looks the same on the unfinished part of the test board as it does on the stained portion? The type and quality of the resins used in the finish are what ultimately determine its final appearance.

I will not disagree that by letting the stain dry for 48 hours I did not follow the label directions. However, I was testing several different products, and I felt that the only way to get an accurate comparison was to apply them all under the same conditions. In that Hydrocote appeared the same even when I followed the label directions, I stand by my results.

Thanks for appreciation of Alfreda Maloof—I want to thank Jon Binzen for the article he wrote remembering my wife, Freda (*FWW* #134, p. 36). It brought out Freda's love, support and character very well. I have received hundreds of letters since it was published, and I would like to thank everyone who wrote to me with condolences on Freda's death.

Freda played such an important part in what I have done. She was my partner not only in our 50 years of marriage, but a partner in the work I have done. There were times in the very early days when I talked about going back into graphics, and she would say, "No, you can do it. I know you can." I can honestly say that if it wasn't for her, I wouldn't have stuck to it. It was her strength and her faith and belief in me that kept me going, and that's what keeps me going now. I know that her spirit is with me in everything that I do. Blessings and peace to all of you.

—Sam Maloof, Alta Loma, Calif.

As a long-term subscriber I have come to expect excellence from your pages, but I want to comment especially on your appreciation for Alfreda Maloof. James Krenov says we should work with sensitivity, but in a woodworking magazine I ordinarily do not expect that sensitivity to extend to human affairs. You got Alfreda just right and the special relationship between Sam and her. As one of those who have been fortunate enough to know the two of them, I thank you. Writer Jonathan Binzen re-created the special air that surrounded those two, and for a moment those who had not met them got a chance to breathe that air.

—Donald L. Chamlee, Warrenton, Va.

I greatly appreciated Jonathan Binzen's warm tribute to Alfreda Maloof. Too often

Writing an article

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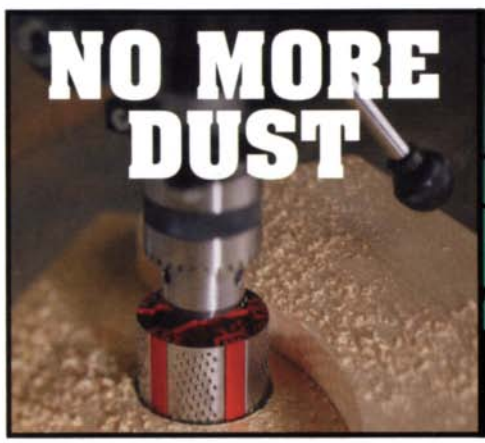

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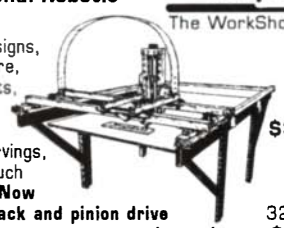

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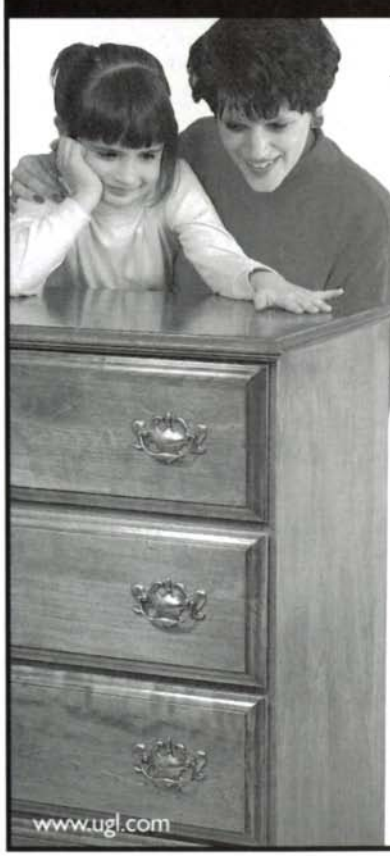

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in our quest for creative and technical excellence, we lose sight of fundamental and precious elements in our lives. I suspect that how we care for our environment, especially our spouses and children, bears directly on the kind of woodworking we do. And I'd guess that what limited success we've managed has often been the result of a team pulling together.

—Jim Lakiotes, Renick, W. Va.

Disagrees with sanding, milling procedure—Thank you for Chris Minick's interesting and valuable first Finish Line column (*FWW* #132, pp. 116, 118) in the October 1998 issue. Unfortunately, the article contains an error in woodworking procedure that I hope you will correct or at least mention to your readers.

The article recommends belt sanding a glued-up tabletop or door before milling the piece to final size. While this sequence has undeniable advantages in terms of milling, it also has the disadvantage of damaging the milling tools. During sanding, microscopic particles of abrasive become embedded in the wood. No matter how well the wood is brushed or vacuumed, all particles can never be removed. In terms of the quality of the ultimate finish, the particles are too small to matter. However, the particles will dull steel, or even carbide, cutting tools, just as dirt particles in tree bark quickly dull sawblades. I found out the hard way. Until I read somewhere about the hazard, it was often my practice to rough-sand components before final cutting to size. This sequence is especially desirable when cutting pieces that will interlock. I had purchased a superb, expensive blade for my 10-in. tablesaw. Instead of remaining sharp for thousands of feet of hardwood cuts as advertised, the blade began to dull far sooner. I had the blade resharpened two or three times by the manufacturer before realizing the cause: sanding before cutting.

Since I began adhering to the rule of making all cuts before any sanding, I have never needed to have my blade resharpened.

All cuts before any sanding is such a basic woodworking principle that one would think most woodworkers would be familiar with it, but I have not found this to be true. Perhaps lack of formal woodworking education for most woodworkers is responsible. Also, because no woodworking tool remains sharp forever, most woodworkers probably think whatever resharpening interval they experience is normal. Those who have not been following the rule are in for a pleasant surprise once they correct their error.

Let's help spread accurate technical knowledge. As the best periodical in the field, *Fine Woodworking* is the best place to discuss this point.

—Frederic M. Blum, Wynnewood, Pa.

CHRIS MINICK REPLIES: While Mr. Blum's assessment of abrasives is partially correct, his overall point is not. As sandpaper wears, tiny particles ranging from submicron to a few microns in size shed from each abrasive mineral grain. The majority of these tiny particles mingle with the wood swarf created during the sanding process and are effectively removed when the wood dust is tacked from the sanded surface. Inevitably a few particles remain on the wood surface. However, these particles are far too small to inflict serious damage on steel or carbide cutting tools. Second, aluminum oxide, the primary mineral used for woodworking sanding belts, falls below silicon carbide on the Moes Hardness Scale. Aluminum oxide is just too soft to scratch or dull carbide cutting tools.

Article on Ni-MH batteries misled readers—I take great exception to the unbalanced view that Dennis Preston portrayed regarding nickel-metal-hydride (Ni-MH) batteries (*FWW* #134, pp. 72-73). I am a manufacturer of custom battery products for the high-end motion-picture and video industry. Your article misleads readers by presenting the perceived benefits of Ni-MH technology without acknowledging that the chemistry has not been proven over the long term.

The conditions under which cordless tools are used are inappropriate to the sensitive nature of Ni-MH batteries. In

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—Timothy D. Schreiner, editor

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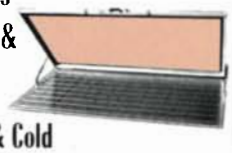

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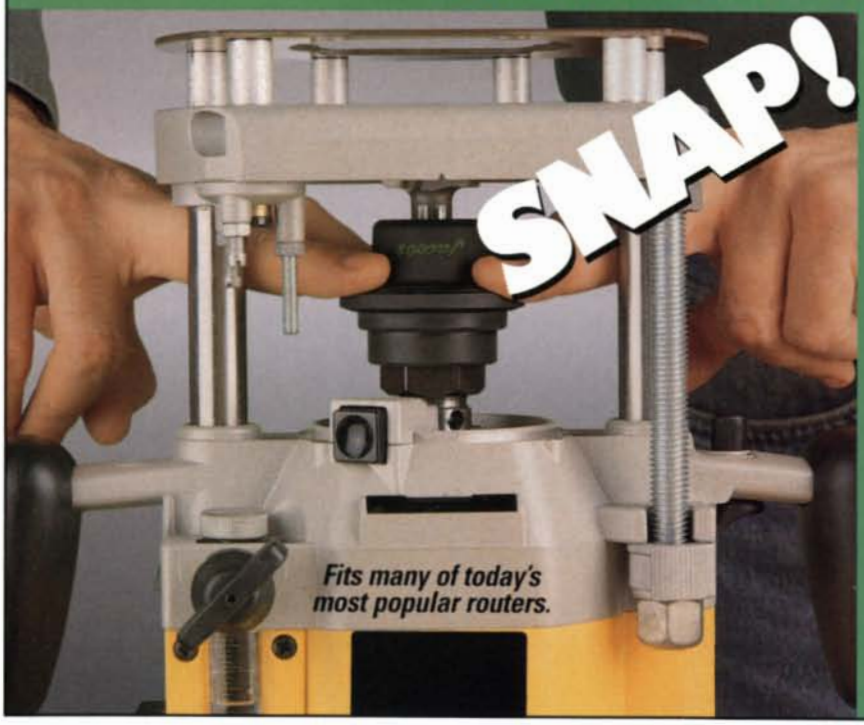

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fact, the headline claim that "Nickel-metal-hydride batteries ... keep a charge longer than nickel-cadmium ..." is absolutely false. Ni-MH batteries have a higher internal resistance that causes them to self-discharge faster than Ni-Cds. In practical terms this means that the user will need to recharge the batteries more often than Ni-Cds to obtain their full capacity. Ni-MH batteries also have greater restrictions on their environmental operating temperatures than Ni-Cds do. Violating the stringent specifications of the Ni-MH batteries will quickly render them useless. At 20% to 25% percent higher cost than Ni-Cds, it's an expensive price to pay.

Panasonic Technical Applications says that "compared to Ni-Cd batteries, nickel-metal-hydride batteries have inferior high-rate discharge characteristics, making them unsuitable for use in power tools or applications requiring high-current discharge."

The amp-hour ratings noted in the article are also ambiguous. I can get Ni-Cd batteries that are 7.8 amp-hours and Ni-MH batteries that are 4.5 amp-hours. It's all relative to the size and make of the battery, a point not mentioned in the article. My suggestion to those considering Ni-MH is to wait until the dust settles. Two or three years from now, the picture might appear different.

—Emery Soos, Toronto, Ont., Canada

DENNIS PRESTON REPLIES: Mr. Soos raises several issues regarding Ni-MH batteries. I'll try to answer them as best I can.

He says that the amp-hour ratings were ambiguous: I should have stated that my reference to amp-hour ratings was based on a sub-C size battery, the size used in most consumer power tools. Yes, Ni-Cd batteries with ratings exceeding 2 amp-hours are available, but they are larger and heavier than the standard sub-C batteries, making them unsuitable for consumer-grade portable power tools.

He says that higher internal resistance leads to quicker self-discharge, requiring more frequent charging: In storage, Ni-MH does discharge a little quicker than Ni-Cd, but the difference is small. Left unattended, both types of batteries will completely lose their charge after three to six months. Recharging restores either type to full operation.

Concerning the point that Ni-MH batteries have greater restrictions on environmental operating temperature, at temperatures between 32°F and 100°F, Ni-Cd and Ni-MH have about the same performance.

Mr. Soos says that the technology has not been proven over the long term: When compared to the 20-year history of Ni-Cd batteries driving power tools, this is true. But Ni-MH has been widely used in cell phones, video camcorders and laptop computers prior to its introduction to power tools.

Ni-MH batteries are more expensive, but pack more power for the same size and weight as similar Ni-Cd batteries. Consumers will have to decide whether that benefit is worth the additional cost.

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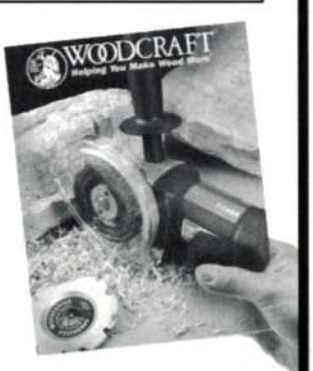

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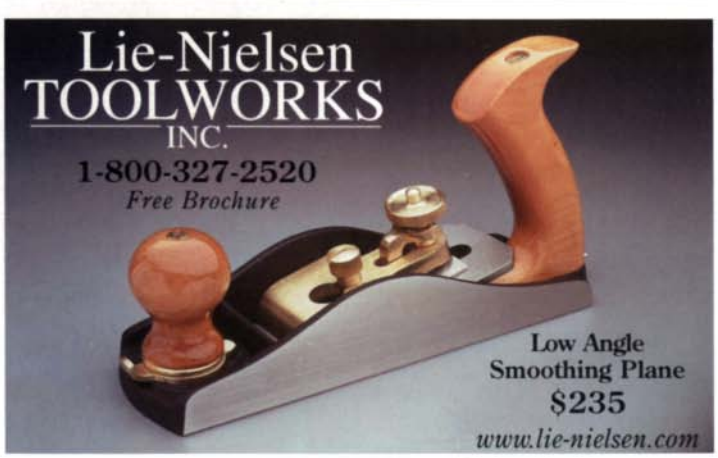

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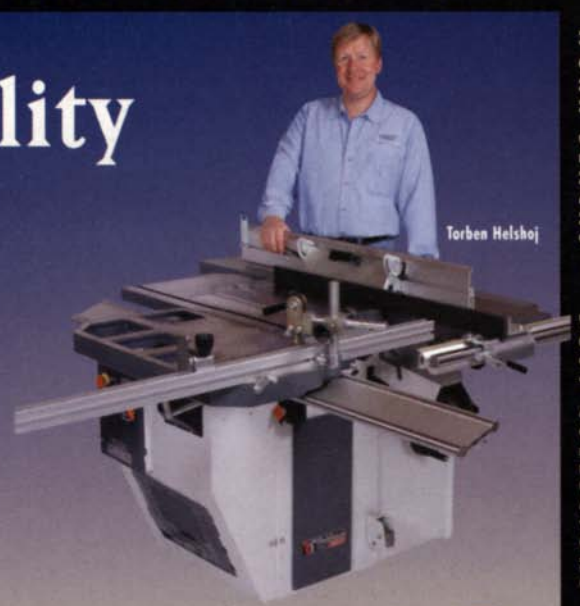

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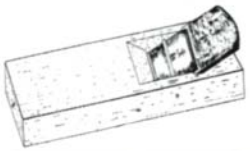

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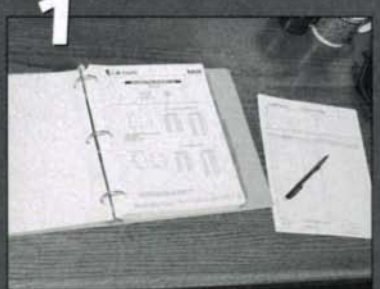

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2

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3

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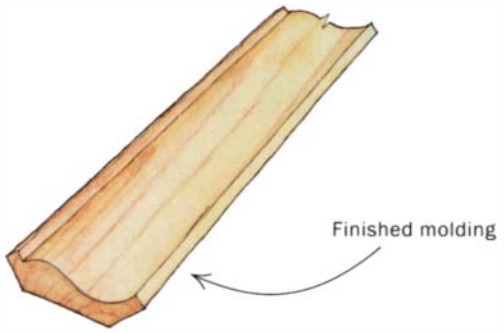
Methods of Work

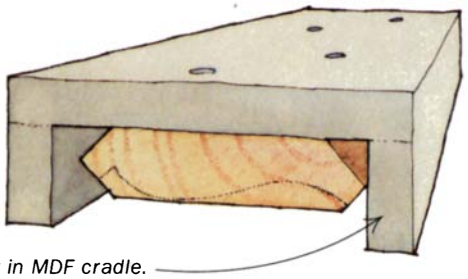
EDITED AND DRAWN BY JIM RICHEY

Copying cornice molding on the tablesaw

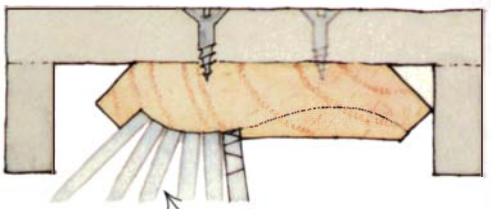


1. Draw cornice-molding profile.

2. Trim edges.



3. Mount in MDF cradle.



4. Shape curved profile with successive saw cuts.

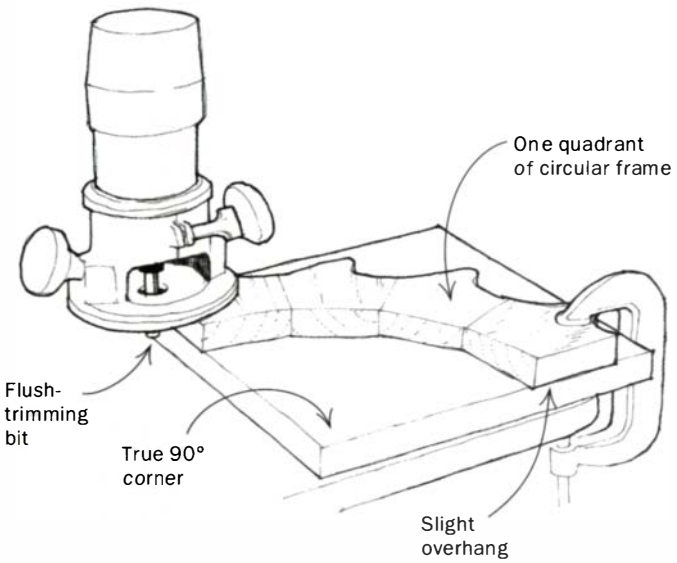
While remodeling a Victorian-style wood-paneled bathroom, I needed one 5-ft. length of cornice molding to complete the job. After striking out with local suppliers and running up some hefty long-distance phone bills, I found that it would cost about $150 to make the custom knives to run one 5-ft. piece of molding.

Recalling the many times I've cut simple cove moldings on my tablesaw, I had a sudden brainstorm that would enable me to make the cornice in my shop. First, I drew the molding profile on both ends of a blank, a little longer than 5 ft. Then I made two 45° bevel cuts on each edge of the blank to define the top and bottom edges of the molding. Next, I built a cradle of ½-in. medium-density fiberboard (MDF)—a bit longer and slightly wider than the workpiece. I screwed the workpiece to the inside of the cradle, facedown, as shown at left. The cradle eliminates the problems that would result from cutting away the surfaces of the molding if I tried to mill it directly, facedown on the saw.

I made a series of cuts to define the profile, working from both sides of the cradle. For each cut, I tilted the blade to cut as close to 90° to the face of the curve as possible. This makes a cleaner profile and minimizes some of the steps and grooves that have to be scraped and sanded away to complete the shape. After some sanding, I had a cornice molding that was indistinguishable from the original and the satisfaction of proving to myself that it could be done. I also saved $150 to boot.

—Ross M. Greer, Alexandria, Ont., Canada

Jointing mitered segments with a router



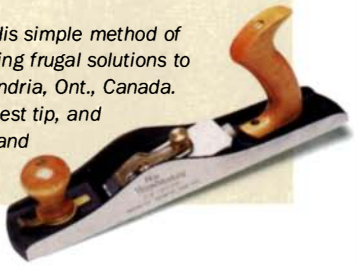
While making a round sunburst mirror frame consisting of 16 segments, I had to miter both sides of each segment at precisely 11¼° on my tablesaw to get a gap-free fit. Rather than trust the accuracy of the saw cut, I came up with another approach.

I started by cutting each segment as close as I could to the proper angle and then glued up four segments at a time to form the

Eric Tadsen

A reward for the best tip

Ross M. Greer is the second reader awarded a hand-engraved Lie-Nielsen plane for the best tip. His simple method of cutting cornice molding (see above) personifies that latent talent most woodworkers possess: finding frugal solutions to otherwise expensive and complicated problems. Ross is a retired newspaper publisher from Alexandria, Ont., Canada. He learned woodworking from his father, who was a pattern maker for the Titanic. Send us your best tip, and you might get a plane just like the one we gave Ross. Send details, sketches—we'll redraw them—and photos to Methods of Work, Fine Woodworking, *P.O. Box 5506, Newtown, CT 06470-5506.*



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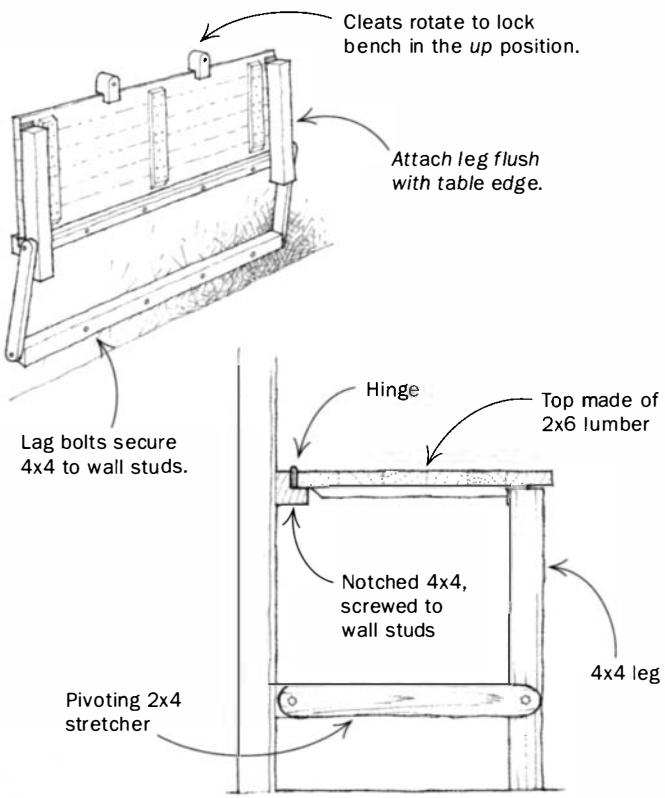
four quadrants of a circle. I then positioned one quadrant at a time on a perfectly square board so that an equal amount of the quadrant overhung each edge of the board. I clamped the quadrant in place and trimmed off the overhang, using a flush-trimming bit in my router.

When all four of the quadrants were trimmed in this way, I dry-fitted them to check for a tight joint that would require minimal clamping pressure. No further trimming was needed, but if it had been, I would have glued up two semicircles and trimmed the edges with a straight board. *—Anthony Fudge, Snow Hill, Md.*

Retracting workbench



When I saw Dave Gillis' retracting workbench (*FWW* #127, pp. 36, 38), it reminded me of one I built years ago in a one-car garage shop. When a friend told me, "You can't make a retracting workbench strong enough or stable enough," I designed this bench to prove him wrong. The bench is screwed to the wall for lateral rigidity and is rock solid, even under heavy loads. When I fold it up out of the way, I have plenty of room to drive my car into the shop. *—Mike O'Banion, Westminister, Md.*

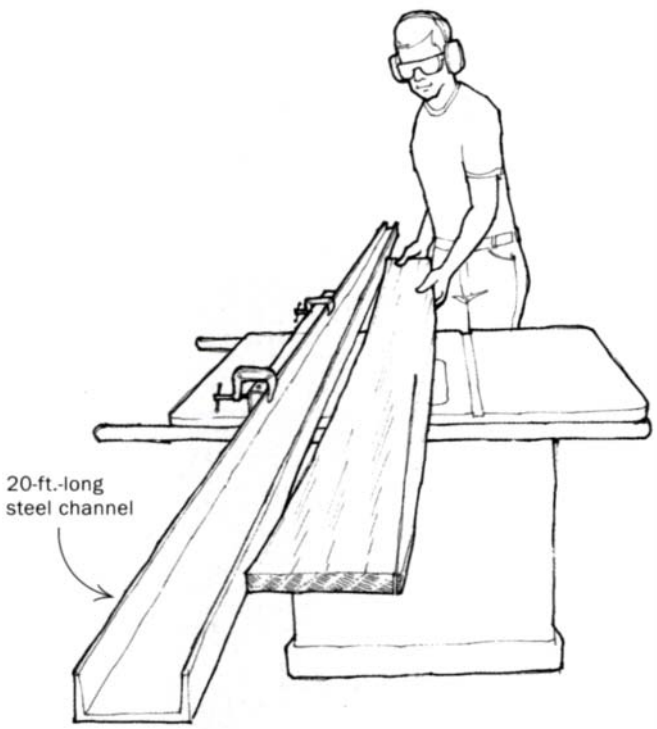
Chip-free melamine cuts

I have been using this technique for producing chip-free edges on melamine-covered particleboard for many years. The technique is a variation of scoring veneered panels with a straightedge to precut the wood fibers and prevent tearout.

I score a line through the hard, brittle surface of the melamine with a carbide-tipped scoring tool commonly available for cutting plastic solid-surface materials. Any chipout from a subsequent sawcut will stop at the scored line. To cut the panel, you can use a tablesaw, a portable circular saw or a jigsaw.

It's important to make the score cut inside of where the sawcut will be. After making the rough sawcut, square the edge to its final line using a straight router bit and a straightedge guide. Carbide-tipped blades are essential. With a little care you can make perfect edges every time, material waste is minimal and, best of all, the technique doesn't require a big investment in new tools or equipment. *—Ben Terlecki, Burlington, Ont., Canada*

20-ft. tablesaw fence



When faced with the task of straightening the warped edges on several hundred feet of 12-ft.-long 1x12 stock (for an order of baseboard), I remembered a previous Methods of Work contribution in which the reader clamped an 8-ft. piece of aluminum channel to the tablesaw rip fence. Then I remembered seeing a straight 20-ft.-long piece of steel channel, ¼ in. thick, at a local metal shop. Without a second thought, I went back to that shop and left with the channel on the roof of my pickup.

I clamp the channel to my existing rip fence as shown above and run the concave edge of the board against the fence so that only the ends touch the long fence. After I've ripped one edge of all of the stock, I remove the auxiliary fence and rip the other edge of the lumber using the regular fence. In my shop, most stock now passes through this low-cost, very efficient, straight-ripping process right after planing. I store the fence overhead on two plywood hooks. I can lower my new 50-lb. helper onto the saw table one end at a time. *—Mike McKenna, Ayer's Cliff, Que., Canada*

Quick tip: A coating from a black permanent marker on the bevel of a chisel will show you exactly where the grinding wheel is touching. The mark doesn't wash off when you dip the tool in water to

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SALE A / Cabinetmaker's Clamps Are Very Inexpensive – And Incredibly Useful

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37F01.20	8"Cab. Clamp (10)	$68.95	$48.95
37F01.30	12"Cab. Clamp (10)	$73.95	$52.95

Combination Set consists of 10 of each of the 3 sizes of clamps. 30 Clamps total- only $4.65 each.

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B / Repointed Carbide Drills & Rasps Are An Incredible Bargain

These ⅛" shank drills, used in the electronics industry, have all been professionally resharpened. The assortment will have some duplications but there are about 20 different sizes and types. All are made in the spiral upcut style. The rasps have penetrating tips. A *phenomenal value.*

50J51.01 Carbide Set of 50 $19.95

NEW C / Anchor Knife Slips Right Into Your Pocket

Made by one of the oldest established knife making firms in Solingen (the heart of German knife making) – a solid tool for recreation or day-to-day use in the shop.

This is not a "fancy" knife – just a solid workmanlike tool that just looks terrific and works really well. Anchor inlaid in brass.

Hand stropped as a final step. Single ready to use 2½"long blade.

10H07.01 Anchor Knife $29.50

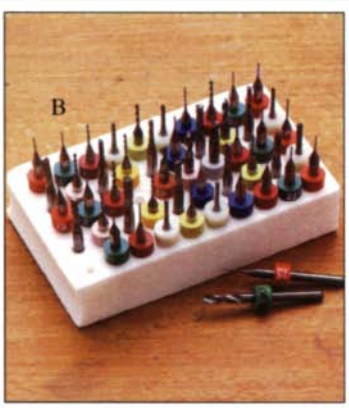
NEW D / A Great Woodworker's Belt Watch

It's a nifty timepiece set upside-down in its leather carrying case, with an integral belt loop. The snap holds it closed until you want to check the time. Then just reach down, snap it open, glance at the face, and snap it back closed again.

A well fitted out craftsmen in grandfather's day carried his watch in his pocket, where it would be safe and clean – if not terribly convenient. Here's a even better solution.

Nothing is on your wrist to be a safety hazard or to be "vibrated-to-pieces" if you are working with machinery. Great for shop work, yard work – you name it.

78W01.02 Woodworker's Belt Watch $64.50



SALE E / Iron Backed Tenon Saw Combines The Best Of Western & Japanese Style Saws

This new saw, with its unique tooth design, works astonishingly well – with a very smooth finish and an exceptionally fast cutting action.

This is a classic Western style tenon saw but with precision diamond cut Japanese-pattern teeth. (A Japanese-pattern tooth design is noted for its very fast cutting properties.) The 12" long blade has 15 tpi, and is set into a ¼" thick solid soft iron back. Depth of cut 3". The body of the blade is .025". Kerf is a narrow .035".

Like all Japanese saws it cuts very smoothly and quickly, but in the Western fashion, on the push stroke. The specially hardened teeth should last a lifetime. Must be used to be believed.

		Regular	*Sale*
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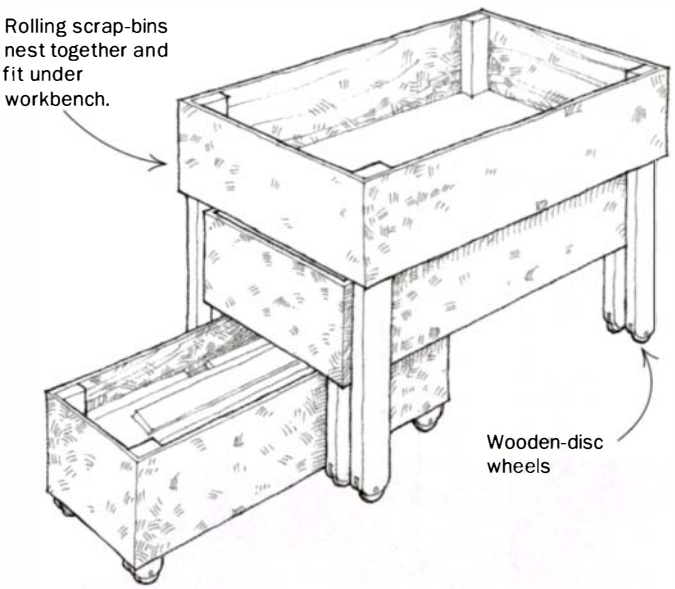
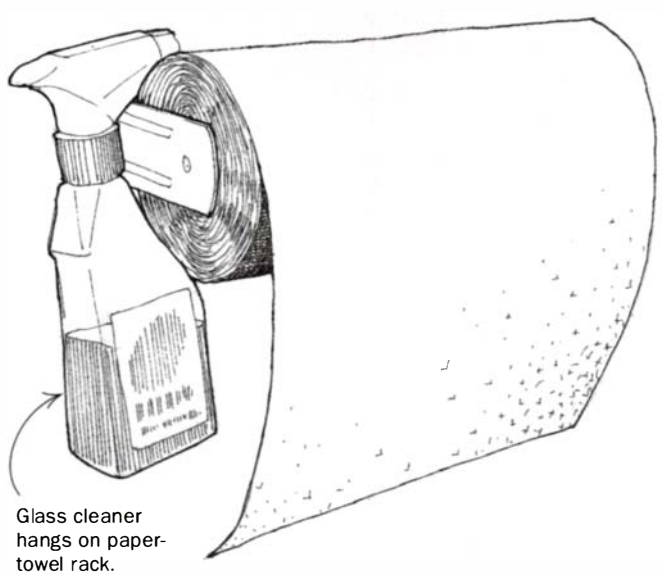
cool it. And when all of the black is gone—right up to the edge—you know you're done. —*Charles Schafer, Annandale, Va.*

Rolling scrap-storage bins



When I needed more room to store wood scraps, I built these rolling bins to fit under my workbench. One advantage to this setup is that I can pull a bin out all the way to get a good view of the wood stored inside. I made the sides and bottoms of the bins from oriented-strand board (OSB) and the legs from yellow pine. The wheels are oak discs. —*Stan Kessler, Ft. Wayne, Ind.*

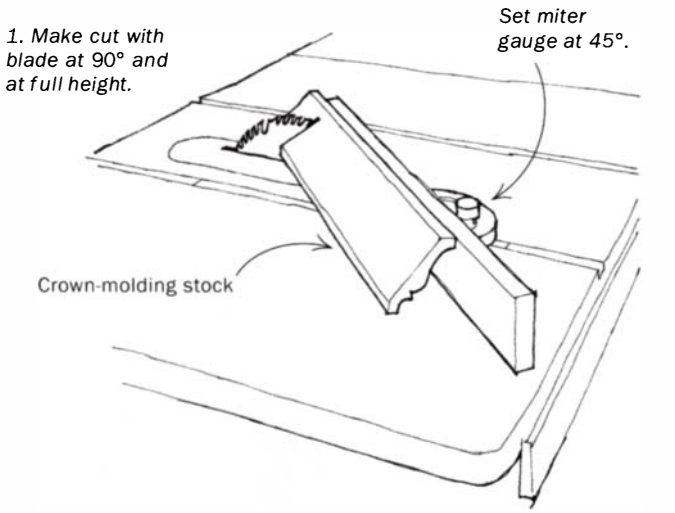
Eye-protection cleaning station

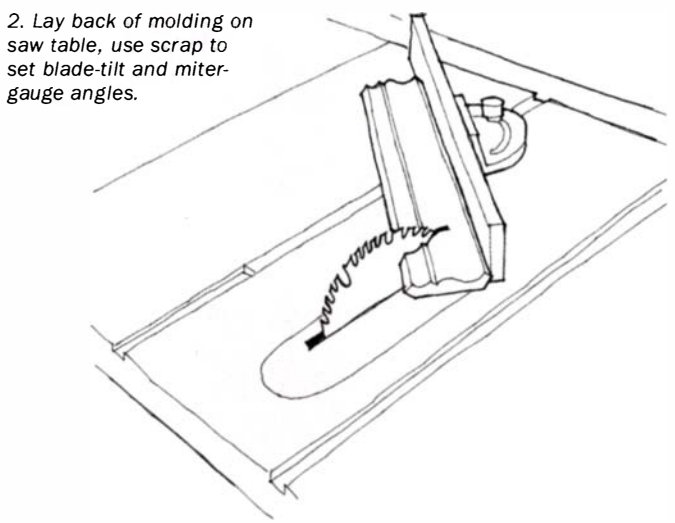


No one in my shop likes to wear eye protection. Glasses and goggles get fogged up and scratched, and they attract dust like magnets. But after having debris surgically removed from my left cornea, we all got serious about eye protection. Now we hang a bottle of glass cleaner on a paper-towel dispenser to make an eye-protection cleaning station. The ammonia in the glass cleaner seems to repel dust and keep the lenses from fogging up.

—*Chris Black, Clifton, Va.*

Compound miters made simple





Here's a simple, foolproof solution for finding the proper blade-tilt and miter-gauge angles for mitering crown molding on the tablesaw. Set the miter gauge at 45° and the sawblade at 90°. Crank the blade up to full height. Place a scrap of the molding with the top face flat against the miter gauge and the bottom edge flat on the saw table, and make a cut. If the blade cuts all the way through the molding, go ahead and cut the miters using this setup. With most large crown moldings, however, you will find that the blade—even at full height—will not cut through the molding.

If that is the case, you can use the scrap piece as a guide. The cut in the scrap piece, laid flat on the tablesaw, will show you the needed blade-tilt and miter-gauge settings. With the saw turned off, tilt the blade until it just slips into the cut in the scrap piece, then set the miter gauge to fit snugly against the molding. That's it. No calculations are required. —*Tim Hanson, Indianapolis, Ind.*

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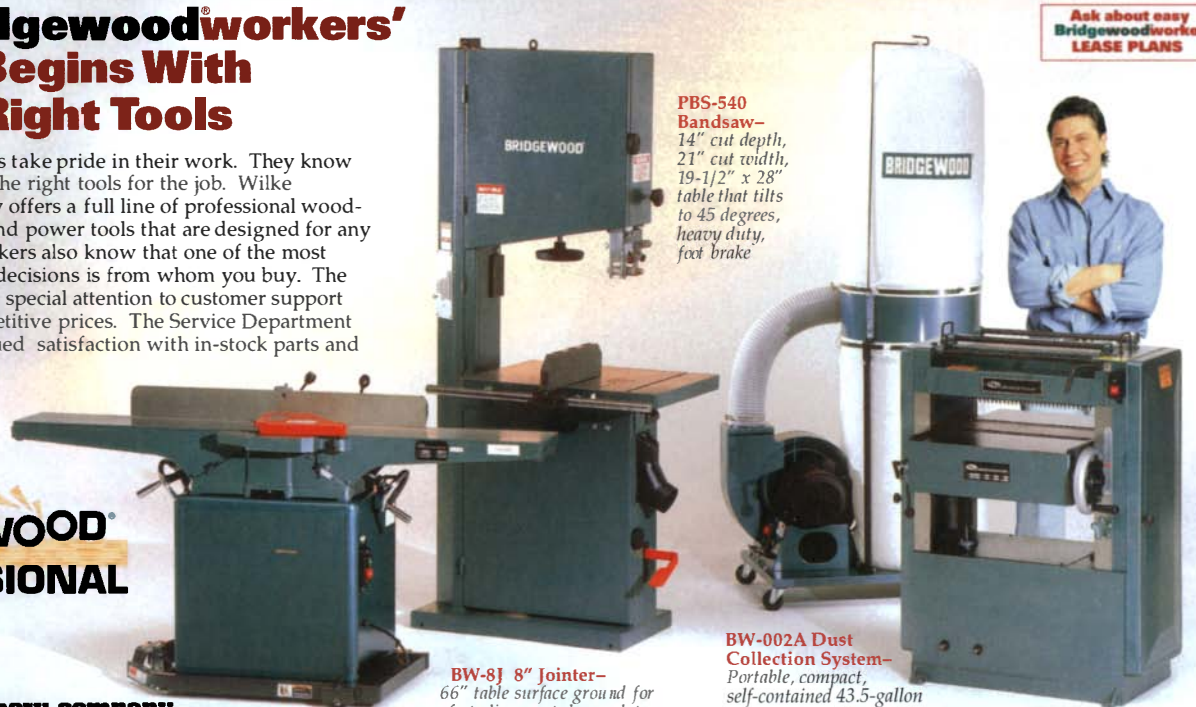

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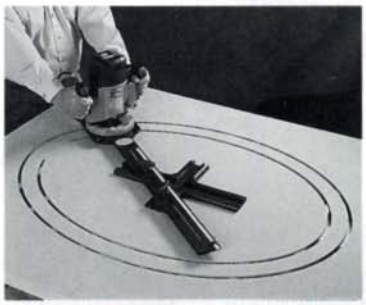

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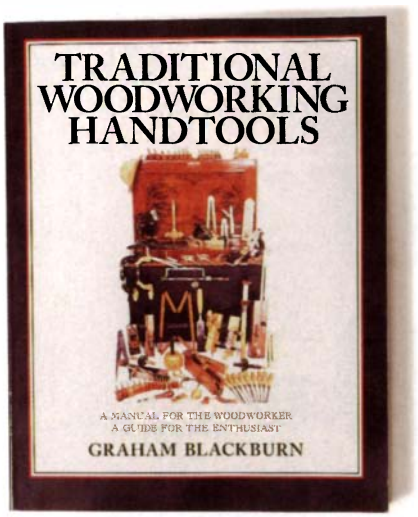
Notes & Comment

New hand-tool manual



Traditional Woodworking Handtools *by Graham Blackburn. The Lyons Press, New York, N.Y. (212-620-9580); 1998. $29.95 softcover; 364 pp. Also available from Blackburn Books, Bearsville, N.Y. (914-679-5958); 1998. $50 hardcover; 364 pp.*

Graham Blackburn has been working wood and writing about it for more than 40 years, with the bulk of his experience concentrated on traditional tools and methods. His latest effort is a 364-page encyclopedia of traditional hand tools.

I've always been skeptical of books the size of a telephone directory, the thickness of which suggests that everything worth knowing about a topic is contained within the covers. But Blackburn's most recent book does indeed examine its subject thoroughly.

Traditional Woodworking Handtools is more than a listing of old tools. Blackburn covers the full range of traditional hand tools, carefully describing the variety of and the differences between even the most arcane and unusual tools of the past three centuries. Here is an author whose practical woodworking experience supports the text of his book. Blackburn has made and restored bench planes, run off miles of molding using molding planes and trimmed miters on a shooting jack. So in addition to identifying a tool and describing its use, Blackburn also throws in bits about his experience with the tool.

Traditional Woodworking Handtools is abundantly illustrated with more than 400 black-and-white line drawings, which were prepared by the author. But the book sorely lacks photographs, which would have enabled the reader to develop a fuller understanding of the magnificent tools Blackburn describes, tools whose beauty and appeal extend far beyond their practical purpose.

Blackburn's book falls squarely between R.A. Salaman's *Dictionary of Woodworking Tools* (The Taunton Press, 1990), which simply identifies each tool and its purpose, and Peter Korn's *The Woodworker's Guide to Handtools* (The Taunton Press, 1998). The question is whether Blackburn's book contains more information than the average woodworker needs. I would have to say yes. For instance, the book devotes almost 30 pages to handsaws. I think Korn's book is a more useful everyday reference, covering the full range of commonly used and widely available hand tools.

On the other hand, Blackburn's *Traditional Woodworking Handtools* is a detailed and fascinating examination of antique tools, offering solid opinions on the pros and cons of each tool.

—Mario Rodriguez, contributing editor to Fine Woodworking

Wood webs

"Wood webs" features useful and interesting woodworking web sites. For additional sites, check out Sites to See at www.finewoodworking.com. If you have a woodworking web site you would like to share with us, send the address to mteague@taunton.com.

Sites on sharpening

For the ultrafine points of sharpening, check out these sites to find a wealth of tool- and knife-sharpening advice and well-honed opinion.

The web site of Hock Handmade Knives (www.mcn.org/a/rhock/hock-home.htm) includes "About Steel," the gospel according to Ron Hock, and a reprint of the sharpening notes that appear on the wrappers of all Hock blades.

Dee Griffin presents his take on sharpening at http://gpvec.unl.edu/public/files/feedlot/sharp1.htm#sharp_f. He offers "tips and info from a veterinarian whose wife and meat cutting put him through college." Although Griffin leans toward knives, his analysis of sharpening is worth a close look.

BladeMaster, maker of leather bench hones, has a web site (www.handamerican.com) that includes a treatise titled "Honing Techniques For Knives, Chisels & Plane Blades."

At the The D&S Scary Sharp System web page (www.mv.com/ipusers/gunterman/SCARY.HTM), you'll find a long discourse by Steve LaMantia on the sharpening of plane blades with sandpaper, as it originally appeared in the newsgroup rec.woodworking.

The Japan Woodworker has loads of sharpening information on its web site (www.japanwoodworker.com). Go to the Resources hyperlink for "How to Sharpen Japanese Chisels" and others.

Shaker boxes in cyberspace

Out there in cyberspace is a nifty table for dimensioning oval Shaker boxes, based on the work of John Wilson, who teaches a course on Shaker box-making in Charlotte, Mich. Wilson's information has been posted by Bruce Perry at www1.shore. net/~bperry/shaker.htm.

Photos: Marc Vassallo, except where noted

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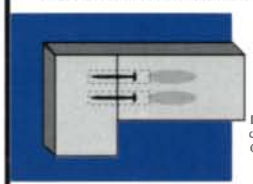

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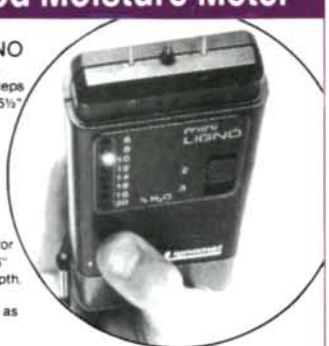

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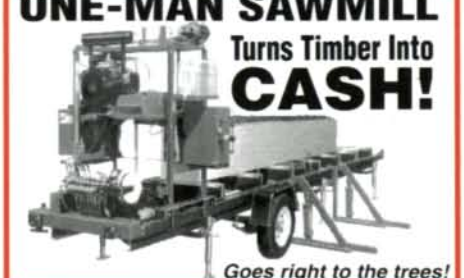

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Wine-soaked bow-arm chair

Back in 1990, Whit McLeod learned that the Italian Swiss Colony winery in Asti, Calif., was doing away with its wood barrels in favor of steel tanks. This was no small salvage project; the winery had a storage capacity of more than 6 million gal., all in wood barrels and with some dating back to the 1890s.

McLeod, who runs a woodshop in Arcata, Calif., obtained a number of redwood barrels, which he broke apart and sold to Smith & Hawken, the garden-products company. McLeod kept 36 white oak barrels. Each barrel was 8 ft. long and 8 ft. in dia. and held more than 2,500 gal. of wine. The quartersawn staves are 12 in. wide at their widest.

Photos: Robin Robin Photography

***Seeing red?** The dark color on the back posts and front brackets is red wine, soaked into the wood during the years it served as staves for barrels used to age wine.*

McLeod and his crew have been working with the oak staves since they got them, turning them into Morris chairs and bow-arm chairs. Before kiln-drying and milling the wood, McLeod steams the staves and presses them flat with an old plywood press. To make a bowed arm for a chair, McLeod steams a flattened stave and then bends it opposite from the direction it was bent on the barrel; among other things, this puts the outside face down so that any black marks made by the iron bands of the barrel won't show on the chair. But McLeod doesn't hide the wood's origin. In fact, he subtly highlights the wine-stained inner faces of the staves, as well as the minor nicks and knife marks the wood as endured over the years. The chairs have been a big hit in wine country.

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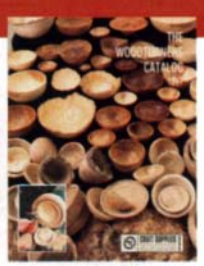

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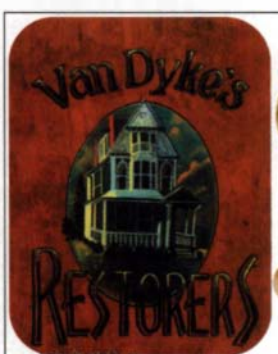

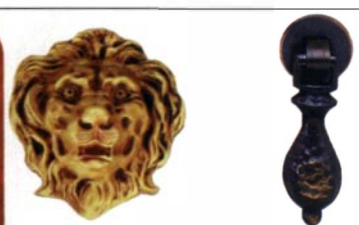

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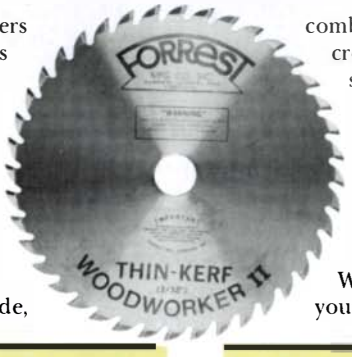

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12" x 40 T	~~$129~~	$116	$103
8" or 8 1/4" x 40 T	~~$99~~	$ 89	$ 79
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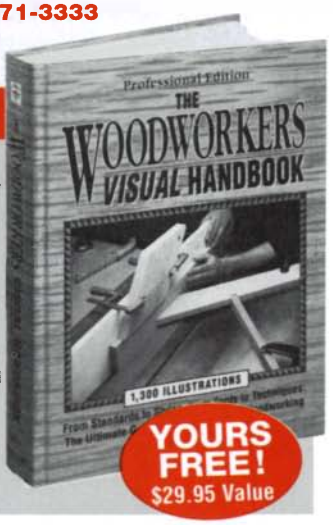

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Calisthenics for ailing joints. *Over the years, students of Gary Rogowski have cut scores of dovetails for a warm-up exercise he calls the three-minute dovetail.*

The three-minute dovetail is an exercise I've started my woodworking students on for the past few years. It's like doing big circles on your drawing pad before beginning to sketch. It's a warm-up, but it's also a great way to demystify a dovetail joint. No tape measures, squares, sliding bevels or marking gauges allowed: just a pencil to lay out your tails and half pins, a dovetail saw to cut the joint, a coping saw to remove the waste and a chisel and mallet for chopping. A three-minute dovetail doesn't have to be perfect. In fact, I've seen every possible way of screwing up this simple corner joint. But it's a great way to help people realize how much of woodworking is learned by trial and error and by repetition. By the way, I don't expect my students to make the joint in three minutes. That's what I shoot for.

—Gary Rogowski, contributing editor to Fine Woodworking

Forks and spoons

Each year, the Wharton Esherick Museum in Paoli, Pa., holds a thematic woodworking competition and exhibition. Last year's contest and show, Simple Seating, featured three-legged stools. The theme for the 1999 competition/exhibition is Forks and Spoons. For information and an application, send a self-addressed, stamped envelope to Wharton Esherick Museum, P.O. Box 595, Paoli, PA 19301-0595.

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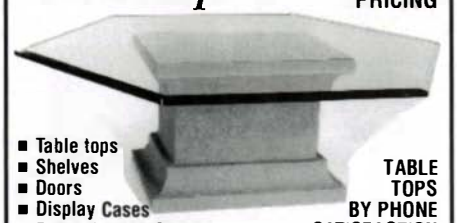

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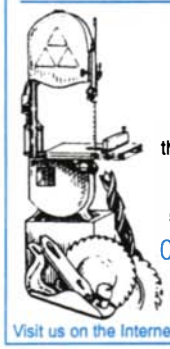

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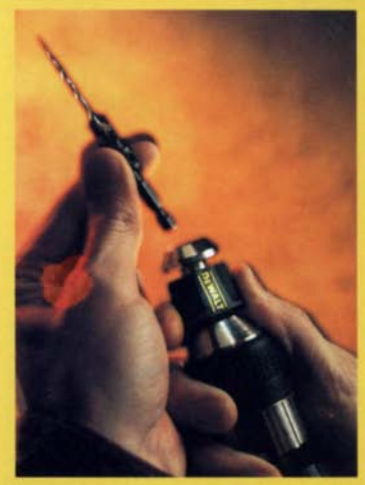

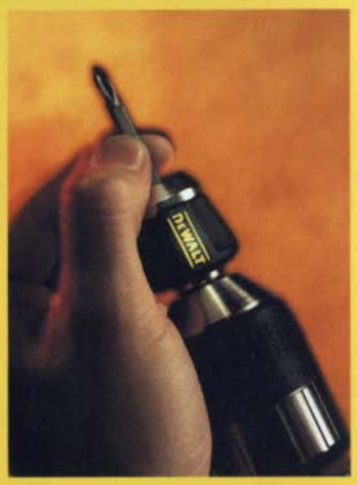

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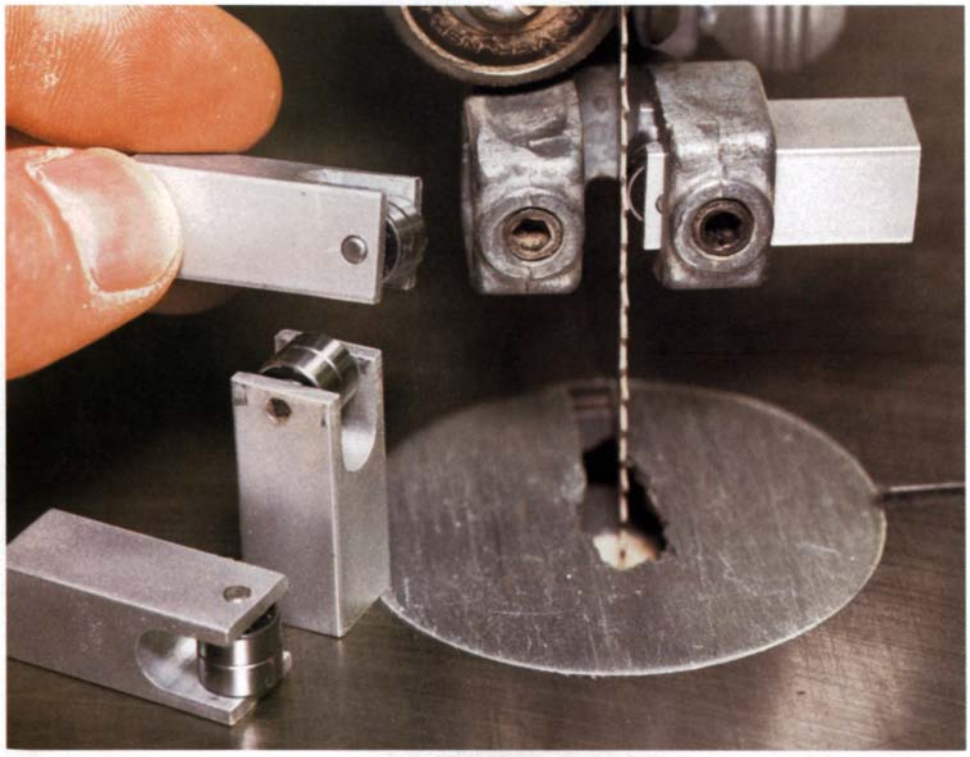

Replacement bandsaw guides. *Bandrollers incorporate sealed ball bearings set in an aluminum housing and fit into standard guide-block holders of most midsized (14-in.) bandsaws.*

For years Carter Products has ruled as *the* company offering high-quality aftermarket ball-bearing guide system for bandsaws. Now there's another choice: Bandrollers by Iturra Design.

Invented by Louis Iturra, a woodworker and machinist, Bandrollers are available for 14-in. Delta bandsaws and similar imported machines. Bandrollers take the place of the standard steel guide blocks, which can heat up and reduce the life of bandsaw blades.

Bandrollers fit into existing guide-block holders. That's especially nice if you own a Delta saw because you can still take advantage of Delta's fine-adjustment screws after installing Bandrollers.

Bandrollers can be set so that their sealed ball bearings just touch the blade, helping reduce blade deflection, especially important when making tight-radius cuts or when resawing.

Iturra recommends that you not use Bandrollers with blades less than ¼ in. wide. A set of four costs $58. Contact the manufacturer at (888) 722-7078. *—Anatole Burkin*

A cordless drill made to be held

While doing frame repair at an upholstery shop a few years ago, I frequently had trouble getting a cordless drill into a dark recess of a frame because the handle-mounted battery got in the way. Fein's new ½-in., 12-volt variable-speed cordless drill/driver, the ABS 12-2 EUQ, might have solved my problem. This drill has the exclusive feature of allowing you to mount the battery on the handle or on the back of the motor.

This T-handle-style drill has a sleek look, which translates into comfortable ergonomics. The forward/reverse switch is located above the trigger and is easily operated with the thumb and index finger.

With the battery mounted on the bottom of the handle, the drill has good overall balance but is best suited for vertical work. Pop the battery on the back of the motor housing, and the tool is perfectly balanced for doing horizontal work. (You can work vertically with the battery mounted on the back of the motor, but if you're pushing hard, the tool can get a bit wobbly.)

The 4.2-lb. drill delivers no-load speeds of 0 rpm to 340 rpm and 0 rpm to 1,200 rpm. The torque clutch has 12 settings. A keyless chuck provides a positive grip on round bit shanks without slipping under load. The drill kit comes with a case, two nickel-cadmium batteries and a charger. It takes about 80 minutes to recharge the batteries. The ABS 12-2 EUQ sells for $265 and is available through Fein Power Tools, Inc. (800-441-9878 or www.fein.com).

—Christopher Baumann

Fein drill gets into tight quarters. *The battery on this 12-volt drill can be attached either to the base of the handle (right) or to the back of the motor (left).*

Photos: Anatole Burkin, except where noted; bottom, this page: Michael Pekovich

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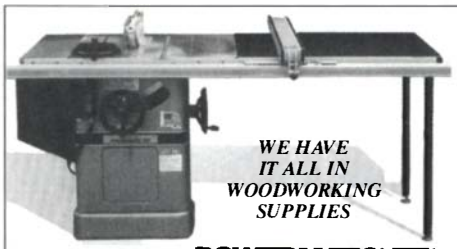

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New router offers better balance and less noise

Two-hp router from Bosch. *The 1617 EVS router comes with speed control, microadjuster and a quick-release magnesium base.*

Bosch has redefined the midsized, fixed-base router with the introduction of the 1617 EVS, a 2-hp variable-speed machine. The body and base are made of magnesium, which at 7.7 lbs. gives the tool a low weight-to-horsepower ratio.

The router is well balanced without a trace of resonance or vibration at any speed. A newly designed fan makes this one of the less noisy routers on the market. Its ergonomics are acceptable, and the electronics elegant.

The motor can be inserted into the base in either of two positions, which gives you a couple of options on where the on/off switch ends up being located. Removing the motor from the base is a bit awkward at first because you have to pull, then twist, and grooves on the base could use some deburring. A quick-release lever on the base locks the motor in place.

The router has a height-adjustment range of just under 2 in. There's both a coarse adjustment lever and a fine microadjusting screw. The ½-in. and ¼-in. collets are well made and firmly grip bits. Other notable features include the ability to center the cutter to the diameter of the subbase (with an optional centering cone) and maple knobs. Overall, the 1617 EVS is a good machine and excellent value. The router sells for under $190. *—Pat Warner*

Inlay material spreads like putty

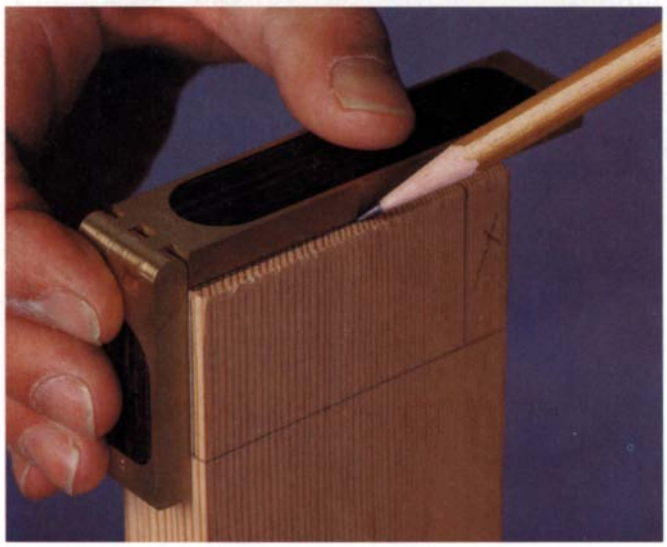
Inlaying crushed minerals such as turquoise can be a painstaking exercise. A new product, Inlace, changes all of that. Invented by Dr. David Bostick, an optometrist and avid wood turner, Inlace is a polyester resin, much like auto-body filler, that comes in many colors and textures. Once sanded smooth, it looks a lot like the countertop material Corian.

Inlace comes in two parts, a puttylike resin and liquid hardener. After mixing the two parts, the goop is dabbed into a precut groove. Or you can build up the material on the edge of a bowl or vase using tape and cardboard forms. Inlace cures in about eight hours and afterward can be cut, turned, filed or sanded, just like wood. It's tough and sticks fast to dry wood.

Bostick is constantly experimenting with new formulations and has a number of additives that allow you to alter colors and textures. Inlace sells for $30 per 8-oz. container and is available through Woodcraft (800-225-1153). *—A.B.*

Goes on like putty, works like wood. *Like auto-body putty, Inlace consists of a resin and hardener. The two are mixed and spread with a putty knife.*

Bridge City saddle squares simplify layout



An easier way to mark a board. *Bridge City Tool Works' saddle squares are hinged to wrap around the edge of a workpiece.*

I've been marking right angles—rather precisely, thank you—across a workpiece with a try or combination square since my first day in junior high school shop. But for making adjacent square lines in nearly half the time with practically infallible precision, a saddle square from Bridge City Tool Works can't be beat.

The square has two hinged surfaces that square themselves around the corner of a workpiece, which allows you to mark both faces of the workpiece at once.

Because the two planes or "blades" of the saddle square are broad and flat, an accurate layout is practically guaranteed around the corner of the board. You will especially appreciate this tool when marking across the end of a board. Another version of the saddle square features two blades with angled sides (one at 8:1 and the other at 6:1) hinged to a straight-sided blade. This tool is used to mark dovetails.

Bridge City offers four varieties of saddle squares. The smallest, a 2-in. model, costs $64. The dovetail saddle square costs $104. For availability, contact Bridge City Tool Works at (800) 253-3332. *—Jim Tolpin*

Bottom photo, this page: Craig Wester

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READER SERVICE NO. 103

Well-made benchtop planer from Powermatic

This planer does good work. *The Model 312 planer has large infeed and outfeed tables and a locking cutterhead, which virtually eliminates snipe.*

The Powermatic Model 312, 12½-in. benchtop planer might look familiar because it comes out of the same factory producing planers under other names. But the Powermatic has some differences worth noting. For one, the infeed and outfeed tables are longer, which helps support stock, and the base has a wider footprint, providing added stability. The result is a machine that does good work with very little snipe.

The powerhead slides on gibs on all four of the steel posts. The front gibs can be locked with little plastic handles. But by keeping them a shade loose, I didn't have to lock and unlock them every time I changed the depth of cut.

The planer's head and base are substantial aluminum castings, the sides are molded plastic, and the top is a steel stamping. The cutterhead carries a pair of reversible steel blades. There isn't a lot of extra metal in the blades, but you might be able to hone them once if you didn't have any substantial nicks to remove. Replacement blades cost $30 per set.

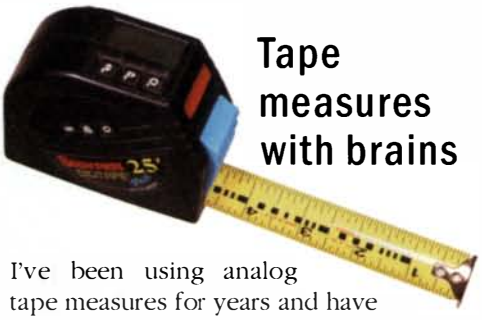
Blade replacement is easy. A cutterhead lock and a pair of pins automatically align each blade. Before removing the blades for the first time on the machine I tried, I had to file away some burrs on the pins left over from manufacturing. Powermatic's customer-service department gave me useful advice and offered to send a set of free replacement blades if the originals got nicked while correcting the problem.

In addition to the stock cutterhead shroud, the planer comes with a dust chute, sized for 4-in. pipe. The two screws attaching the shroud are undersized, and you will have to treat them gently to avoid stripping them out when reinstalling the shroud after a blade change.

The manual says the maximum depth of cut is ⅛ in., but a label on the powerhead warns against taking more than a 1/16-in. cut, which is more accurate. For the best surface quality, remove only about 1/32 in. (or less) at a time. The machine comes with a thickness scale, but I found it difficult to read. The planer can handle boards up to 12½ in. wide and 6 in. high. The machine sells for about $400. *—John White*

Anatole Burkin is a senior editor at Fine Woodworking; *Christopher Baumann is* FWW's *editorial assistant; Pat Warner is a woodworker and author from Escondido, Calif.; Jim Tolpin writes and works wood in Port Townsend, Wash.; John White is* FWW's *shop steward.*

Tape measures with brains



I've been using analog tape measures for years and have gotten along just fine without batteries. So it was with skepticism that I tried a couple of new digital measures, the Digitape Plus, made by Starrett, and the first "talking" tape measure, the Repeater, by Zircon.

My greatest fear—that the gizmos would break the first time they fell—proved unfounded. Both have taken a number of spills onto a concrete floor and still work.

The 25-ft.-long Digitape Plus has several features I grew to like. For example, when you're in an awkward position, trying to get an inside measurement, it can be difficult to get a good line of sight on the tape's blade. The Digitape Plus will record the blind reading for you, taking into account the width of the tool's base. A memory feature will record up to three measurements.

The Digitape Plus has a switch that will flip the digital reading 180° so that you can measure from any direction and not have to read numbers upside down. Additionally, you have a choice of five ways of taking readings: inches with fractions (accurate to 1/16 in.), inches and feet, decimal inches, decimal feet or centimeters. The blade, however, reads only in fractional inches.

The Repeater (also 25 ft. long) doesn't have a digital display, but it does have an electronic voice recorder, pretty handy when you're on a ladder taking several measurements at once. You can record up to 20 seconds of messages with the tool.

The Digitape Plus sells for $45 (800-344-4827); the Repeater goes for $30 (800-245-9265). *—A.B.*

Electronic tape measures. *The Digitape Plus by Starrett has an electronic readout and many functions, including the ability to record data as well as read in metric units. The Repeater by Zircon has a voice-recording chip and holds up to 20 seconds of information.*

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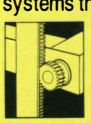

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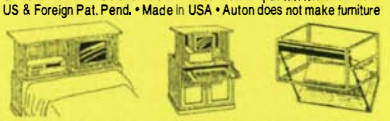

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READER SERVICE NO. 168

Smoothing Planes

New planes out of the box, tuned up and tested—a look at the spectrum of smoothers, from $27 to $3,800

BY GARRETT HACK

A Stanley No. 604 Bedrock smoothing plane—vintage 1910—is always on my bench. The plane is a handy size for smoothing a board, shooting the edge of a drawer, cutting a tapered leg and many of the other daily planing tasks. I have other old smoothers, Norrises and Spiers, heavy planes I keep tuned to take whisper-thin shavings. Most of my planes—not just the smoothers—are old. But when I demonstrate these tools in my classes, invariably I am asked which new smoothing plane I would buy. Not really knowing how to answer, I decided to examine a range of new smoothers.

Even though I limited my selection to western, cut-on-the-push-stroke style planes, the variety of smoothers I tried was astoundingly wide. The selection isn't exhaustive, but the ones I picked run the gamut in terms of their construction, their function and how much they cost. One is made of beech, another of laminated nickel. One has a replaceable blade the size of a shaving razor; another has an iron that could anchor your rowboat. One can be had for under $30 and delivered overnight; another will set you back some $3,800 and cost you a year's patience, too. Yet these planes were all built to do the same job. My question was, how well do they do it?

I gave each plane a quick tune-up (see the story on the facing page), and then I put them to work. I used each one on softwoods and hardwoods, calm grain and ornery. I planed pine, poplar, curly maple, abrasive teak and a pile of cherry wainscoting to see how the planes behaved and how their irons held up.

Although smoothing planes can be used successfully for all sorts of planing tasks, they are designed to perform best at taking

an already flat surface to a fine finish. A good smoothing plane can create a surface as smooth as if it were polished, giving wood an unmatchable clarity and depth in a fraction of the time it takes to sand or scrape. The best smoothers have plenty of mass, wide, thick irons, short, thick bodies and tight throat openings. Mass keeps the plane hugging the surface, and just as with old cast-iron woodworking machines, lots of mass dampens vibration and gives stability to the cutter. A thick iron remains stiff and engaged in the wood despite resistance for the smoothest, chatter-free cut. A smoothing plane doesn't need the long body of a jointer or a jack plane because its job is to smooth more than to flatten. Rather, it needs a compact body that is easy to grasp and control, one that concentrates the forces of your upper body, through your hands, close to the cutting action of the iron. A tight throat, or one that can be adjusted to be tight, creates pressure on the forming chip very close to the blade, permitting very thin shavings to be taken and minimizing tearout.

Plane makers have met these criteria in very different ways over the years. They have made wooden planes, metal planes and planes that combine the two materials. Each type has its virtues and drawbacks, and for this article I've tried smoothers in all three categories.

Three styles of smoothers

For centuries, wood was the material of choice for smoothing planes. It was a natural choice because it was plentiful, it worked easily, and it provided that silky, sublime feeling of a wood sole upon wood. Even fashioned from dense woods such as beech or lignum vitae and supplied with thick irons and cap irons, such planes were light enough to be comfortable to use all day, which they once were. But a wood body required maintenance. It could warp or crack, and as the sole wore away through use and repeated flattening, the tapered throat opening eventually widened, and performance suffered. Although they represent only a sliver of the market, there are still fine wooden planes being made.

The logical solution to the problems of a wooden-bodied plane was a more durable sole. That is just what Leonard Bailey and the Stanley Tool Co. were thinking when they introduced cast-iron planes for everyman just after the Civil War. In addition to long-wearing soles, these planes introduced easy-to-use cutter adjusters and a price so economical that no other planes could compete. Along with the cast-iron body and the low price came some compromises. The plane had a thin (easier to hone) iron, which was bedded against an adjustable frog screwed to the sole, an arrangement that invited some cutting vibration. The frog was designed to hold the blade at a 45° angle, which was better for smooth-planing softwoods than for hard ones, for which a slightly steeper bed angle is preferable. In these and other ways, the Bailey smoothing plane was designed more for general carpentry than for planing difficult figured wood. Furniture makers and cabinetmakers quickly adopted the plane anyway, but the compromises of the design left open a window for competition at the top end of the market.

Through that window came the British Norris-type planes, easily the most beautiful and best performing of all smoothers. Called infill planes, they combined the virtues of a metal sole and sides with the tactile pleasure and stabilizing mass of dense rosewood handles (the infill). On the best of them, the sides and the soles were dovetailed together. Traditionally, infill planes were coffin sided—wide in the middle to accommodate a wide iron and narrow at the ends to reduce sole drag. With minute throat openings, irons as thick as 3/16 in. and enough mass to make you take notice when you hefted one, these planes were capable of achieving a polish no other design quite measured up to. Their major drawback was their cost. When introduced in the early 1900s, a Norris smoother would have cost a craftsman a week's wages; a Stanley at the time cost about a day's pay. As you will see on the following pages, today the disparity is just as wide.

Garrett Hack is the author of The Handplane Book *(The Taunton Press, 1997).*

Fine tune-up

My procedure for tuning each plane was the same. I carefully unpacked the plane, looked over any instructions, examined it for unusual features and noted how the parts were set. I twirled adjusters and took frogs apart to see how they mated with soles. I lapped the back of

each iron and honed the bevel. I smoothed the curved leading edge of cap irons and flattened their front edge to fit them to the iron.

Finally, I lapped the plane soles, noting how long it took to get them flat. To lap the plane soles and irons quickly and accurately, I used abrasive paper glued to a dead-flat machinist's true table. I worked through the grits from 120 to 600 before finishing on my oil stones.

Watch it on the web!

See Mario Rodriguez tune a handplane at www.finewoodworking.com

Photos: Jonathan Binzen

STANLEY NO. 4, RECORD NO. 4 ($55)

	Stanley	Record
Weight:	3 lbs., 12.75 oz.	4 lbs., 3.75 oz.
Length:	9⅝ in.	9¾ in.
Blade thickness:	0.080 in.	0.085 in.
Made in:	England	England

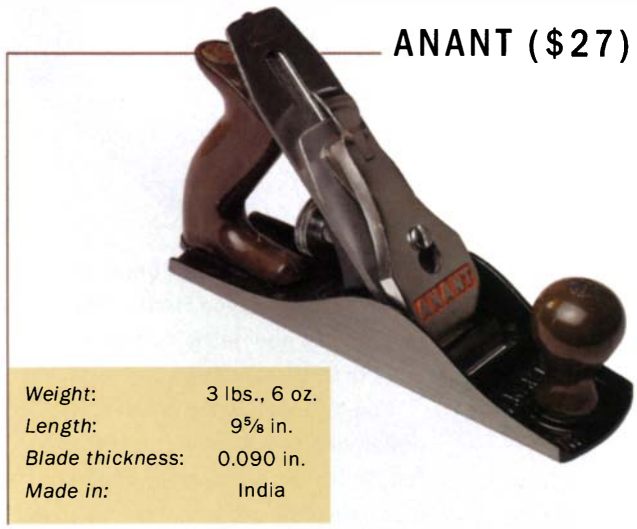
Leonard Bailey devised most of the details of these cast-iron planes 125 years ago, and the planes have been sold by Stanley virtually unchanged ever since. Record and many other manufacturers recognized a good thing and copied them. Except for the beautiful blue color of the Record, its slightly heavier casting and a screw cap vs. Stanley's traditional lever cap, these two planes look nearly identical, and their performance was quite similar as well. Once tuned, they both planed well in softwoods, which is what they were designed to do. On harder woods, whenever adverse grain conditions arose, they had problems. In curly maple, for instance, they could plane but only with some tearout. They simply do not have the overall mass or blade stability to overcome the stresses of more difficult cutting. Still, these widely available planes are versatile and durable and a very good bargain.

In small but important ways the Record smoother is the better of the two. Overall, the parts are a little better finished and fit, adding up to a plane that tunes up more quickly. The Record even improves upon the original in small ways such as a front knob that is tapered to seat firmly in a boss that is cast into the body of the plane. The surface grinding of the Record's sole was quite coarse, but it was flat (lapping time: 15 minutes). The Stanley sole was warped and quite hollowed down its entire length (lapping time: well over an hour, and even then there were hollows left).

The Stanley iron took about an hour to lap and hone; the Record took 15 minutes. Both irons held an edge well. The proper bevel angle for the blade is stamped onto the Record cap iron so the iron can easily be compared; on the Stanley it is stamped not quite so handily on the iron itself. The end of the Stanley cap iron was ground quite blunt (vs. the Record's nice, smooth shape) and clogged readily until I remedied it.

Both planes came with good instructions, explaining the basic tuning they definitely needed. One feature common to the planes shocked me: Their plastic handles felt as good as the rosewood handles on some of my other planes. Even so, I'd prefer rosewood.

ANANT ($27)



Weight:	3 lbs., 6 oz.
Length:	9⅝ in.
Blade thickness:	0.090 in.
Made in:	India

The Anant is a copy of the Stanley-Bailey, but compared to the Stanley or the Record, the Anant is less enjoyable to hold and certainly to behold. The first things I noticed about the plane were the handles. Made of plastic, they have prominent casting ridges, which irritate your hands as you plane. Many other details of the Anant—the sloppy adjuster and its pressed yoke, the blade badly out of flat, the rough cap iron—betray mediocre workmanship.

None of this surprised me, considering the plane's price. But in other ways the Anant did surprise me. I expected a nightmare when it came to flattening the sole—surface grinding is costly, and manufacturers try to save money by keeping it to a minimum—but it lapped flat quite easily. And the frog fit the machined area of the body well. Unfortunately, the frog is secured with poor-quality screws and thin, soft washers, so I was reluctant to really tighten the screws. If you buy an Anant, replace the screws and washers and make or buy replacement rosewood handles, or at the very least smooth off the rough casting ridges on the plastic ones. Despite its lack of refinement, the Anant is still a reasonable copy of a very solid design. With a couple of hours of tuning, it's a serviceable plane for softwoods and well-behaved hardwoods. The Anant is available through Woodworker's Supply, Inc. (800-645-9292).

The story was in the details. *Coarse-threaded screws and flimsy washers for the frog were typical of the Anant's mediocre detailing. The leading edge of the cap iron was rough and blunt, making chips clog.*

LIE-NIELSEN NO. 4 ($250)

Weight:	4 lbs., 10 oz.
Length:	9½ in.
Blade thickness:	0.115 in.
Made in:	Maine

By now, Lie-Nielsen's reputation as a maker of Stanley-pattern planes that are better than the originals is well established. This No. 4 smoother based on Stanley's old top-of-the-line Bedrock is no exception. Everywhere you touch the tool the impression of precision and quality is reinforced.

The main advantage of the Bedrock design is that the frog has a long, tapering underside that mates solidly with a similar wedge-shaped area of the sole (see the bottom photo at right). The result is better support for the iron, less chatter and, due to the method of connecting them, simple adjustment of the throat opening. With its throat set tight, the Lie-Nielsen No. 4 approached (but did not quite match) the planing quality of the $3,800 Holtey (see p. 45).

The Lie-Nielsen (pronounced LEE NEEL-son) comes in a choice of manganese bronze or ductile iron, a tough modern cast iron. I bought the bronze version, as much for its beauty as for its slightly greater weight, which helps a smoothing plane maintain momentum and overcome cutting resistance. In softer woods, this plane breezed, cutting almost effortlessly. And in cherry and maple, even where it encountered difficult grain, it did admirably, too, outperforming my favorite vintage Bedrock—perhaps because of the new plane's thicker iron.

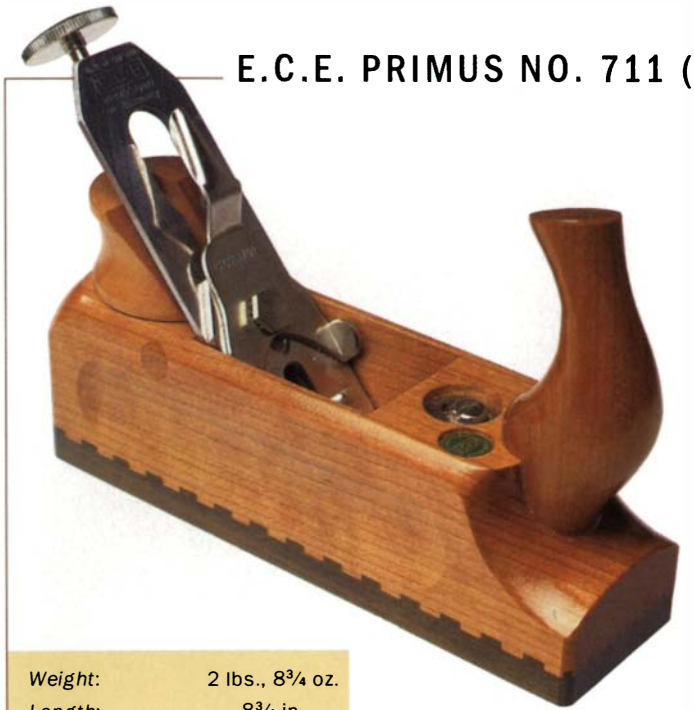
You can't use the Lie-Nielsen right out of the box, but your gratification won't be delayed very long. Ten minutes of lapping, and the sole was dead flat. The iron, about half as thick as a standard Stanley iron, lapped flat and honed sharp in about half an hour and held a good edge. The cap iron took 10 minutes to tune. Less important but useful if you want to use the plane on its side as a shoot plane, only one of the sides was square with the sole. (Of the planes I tested, only the Record had both sides square to the sole.)

Lie-Nielsen (800-327-2520) also makes a low-angle smoothing plane, the No. 164, which sells for $235. Stanley originally devised the No. 164 for cutting end grain, and the Lie-Nielsen version I tried handled that job well. It also planes well on face grain that is well behaved, but when grain gets tricky, the tearout is terrible.

Excellence all over. *Superb workmanship is evident everywhere you look on the Lie-Nielsen, with its solid bronze castings, precise machining and careful finishing. It planes beautifully, but the aesthetic ride is just as smooth.*

The Bedrock is better. *The frog of the Lie-Nielsen (right), based on the Stanley Bedrock design, mates in a long, flat plane with the plane body. This solid mating produced better cutting stability compared with the two-step contact on the frog of the Stanley (left).*

E.C.E. PRIMUS NO. 711 ($190)



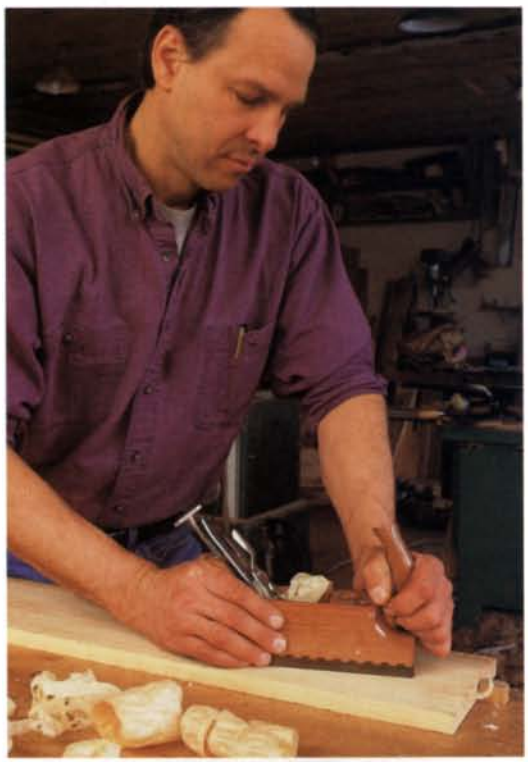
Weight:	2 lbs., 8¾ oz.
Length:	8¾ in.
Blade thickness:	0.112 in.
Made in:	Germany

European-style wooden planes have all but disappeared, but fortunately the German Primus is helping keep the breed alive. With a tough lignum vitae sole joined to a pear body with dozens of tiny fingers, it is patterned after traditional horned planes. Quite modern, however, is its unusual blade adjuster, its tough chrome-vanadium iron and its movable toe piece for fine-tuning the throat opening. Together, the old and new features result in a plane that is very comfortable to grasp, feels wonderful to use, is easy to maintain and performs almost as well as the best.

The Primus No. 711 is quite light but planes extraordinarily well. The thick iron is well supported, bedded not against a separate frog but against the body of the plane. The nicely shaped horn and a groove around the back of the plane that fits your thumb and forefinger make for a firm grip and great control.

The Primus has a unique blade adjuster as sensitive and positive as rack-and-pinion steering on a sports car. I found it awkward at first—and it didn't help that I cut myself getting the iron out—but I soon got the hang of it. A heavy spring pulls the iron against the bed of the plane, and an adjuster screw works the iron up or down. Far less elegant is a regulator attached to the cap iron that levers the iron side to side to align it with the sole.

The iron lapped flat quickly and held an edge very well. The cap iron needed a little more work to smooth its leading edge and to hone it to fit the iron. As for the sole, it was flat. Had it not been, a pass or two with a finely set jack plane would have trued it up in seconds. And whereas sole wear opens the throat of most wooden planes over time, the adjustable throat of the Primus allows you to keep it set as fine as you like. If you have never experienced the wonderful feel of a wooden plane, try this one. David Warren Direct (800-724-7758) imports the Primus and all other E.C. Emmerich tools. Primus planes are cheaper in some catalogs.

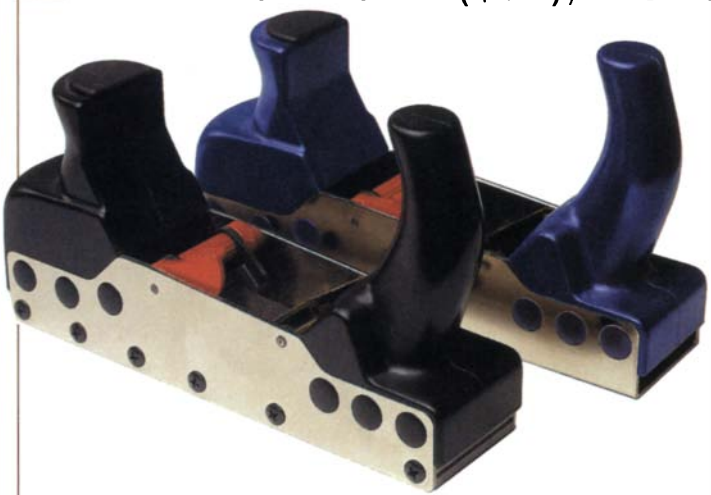


New, but nice. *The grip required for a traditional horned plane like the Primus is quite different from that for a typical cast-iron plane, but the Primus is so comfortable that the change comes naturally.*

Unusual adjusters. *In place of a lever cap, the Primus has a tightening bar controlled from the rear of the plane to hold the iron in place. The author found the depth adjuster very responsive, but he was less impressed with the lateral adjustment mechanism.*

Keeping body and sole together. *The Primus' hard-wearing lignum vitae sole is bonded to the plane's pear body with an unusual finger joint. The sole's adjustable throat enables one to take the finest of shavings.*

RALI BLACK NICKEL ($90), BLUE CRAFTSMAN ($45)



	Black Nickel	Blue Craftsman
Weight:	2 lbs., ½ oz.	1 lb., 3¾ oz.
Length:	8¾ in.	8¾ in.
Blade thickness:	0.029 in.	0.029 in.
Made in:	Switzerland .	Switzerland

Compared to Stanley-style bench planes, these Rali planes are as different as they could possibly be. The Rali plane bodies, made with Swiss precision, are plastic-and-steel space-age versions of traditional European horned smoothing planes (like the Primus). As different as they look and feel, however, the biggest departure is at the cutting edge: Ralis use small, replaceable blades instead of the traditional iron. Looking like thick razor blades with two cutting edges, they pop easily and securely into place and—get this—*never require honing*. (Replacement blades cost $7.50 for two.) The blades are foolproof: A blade fits into its holder only one way and, when locked into place, is perfectly aligned with the sole. Along with an intuitive depth adjuster, this arrangement enables a novice to leap over the learning curve associated with tuning a plane and get right to work.

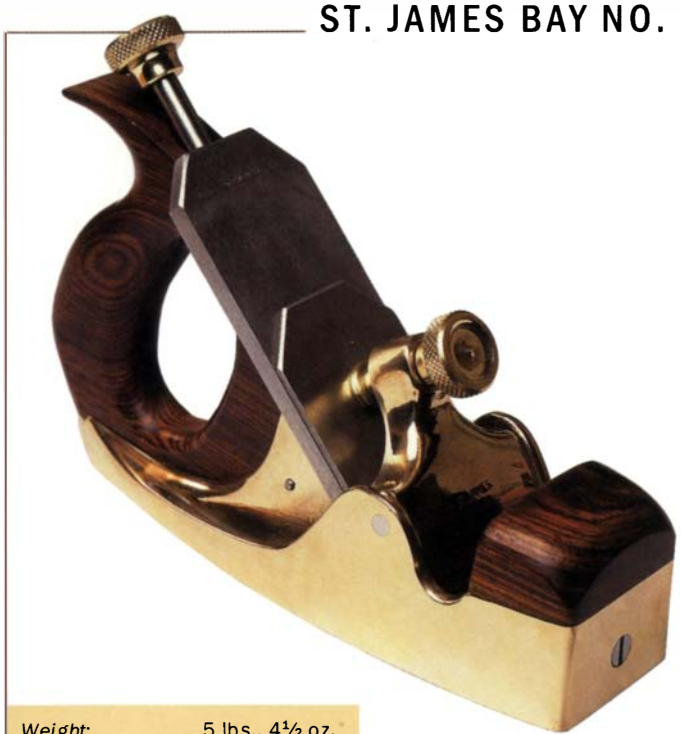
And in the right wood, the work will be fun. I found that the Ralis cut nicely when the wood and the grain were at their most compliant: planing the edges of pine and poplar boards, for example. But at the slightest hint of difficulty in the material, the Ralis were out of their depth.

There is a big jump in performance between the two models. The Black Nickel has a vertically laminated sole (80 laminations and quite flat) that adds needed weight to the plane, and its adjustable throat is a plus, although even at its tightest it was four to five times wider than I would have liked for taking fine shavings. The Blue Craftsman has a pressed-steel sole (quite warped) and a gaping, nonadjustable throat, which encourages tearout in all but the most easily worked timbers. While I appreciated their foolproof usability and comfortable grip, the Ralis are better suited to a carpenter trimming a door than to a furniture maker smoothing a panel. Rali planes are available through Woodcraft Supply (800-535-4482).

Perfect placement. *Rali's two-sided replaceable blades never need honing and drop into place easily and exactly on tiny metal posts. Once locked in and swung down into cutting position, a blade is perfectly aligned with the sole of the plane.*

Open wide. *Both Rali models have throat openings too large for good smooth-planing. The Blue Craftsman's thin sole (right), made of sheet steel, was quite warped; the Black Nickel model (left) has an adjustable throat and a much heavier sole laminated from nickel.*

ST. JAMES BAY NO. 51 ($470)



Weight:	5 lbs., 4½ oz.
Length:	8 in.
Blade thickness:	0.250 in.
Made in:	Arizona

I have always appreciated the quality and superior performance of infilled British smoothing planes, especially those made by Thomas Norris early in this century. They are heavy, with thick irons and comfortable handles—all of the important virtues of a smoothing plane. So it was with great anticipation that I waited months for one of St. James Bay Tool Co.'s custom-made smoothing planes (the No. 51) based on a Norris pattern.

There's no doubt this plane looks good and feels good, but it in no way measures up to the quality of its namesake. Take the iron. Sure, it's thick, but it took more than an hour to lap it flat and even more time to regrind the bevel to 25°. Once it was tuned, I took a stroke on curly maple, and it produced a fine shaving—superior to the work of the Lie-Nielsen. But after just a half dozen strokes, the iron was dull.

The adjuster works well enough, but because of the way the handle is made, the adjuster controls only depth (it should also regulate lateral alignment); at one point the adjuster fell apart, and I had to make a repair to continue planing. The screw cap is a handsome casting, but it employs a loose foot (similar to the pad jaw of a C-clamp) to clamp the iron in place. This was one essential part sure to get lost in a pile of shavings. The quality of the finish on the rest of the plane showed that hours of handwork went into making it, but I would have preferred it look a little less flashy and work a whole lot better.

St. James Bay (800-574-2589) also sells raw or machined castings for this and other planes, and the company offers its planes in a variety of bed angles. My advice would be to buy the company's castings and make a plane yourself. I know a craftsman who has done just that, and he's extremely happy with the results. He points out, however, that although the finished plane works like a dream, making one is not a matter of snapping together a kit: He bought machined castings and spent some 40 hours building the plane. The castings and all other parts he needed came to $250.

Jazzy, but can it carry a tune? *The St. James Bay is a dead ringer for the Norris plane it emulates, but the author was disappointed in the details of fabrication and performance. The channel for the depth-adjuster rod is too narrow to permit lateral adjustment, and the screw cap's separate foot is difficult to insert and easy to misplace.*

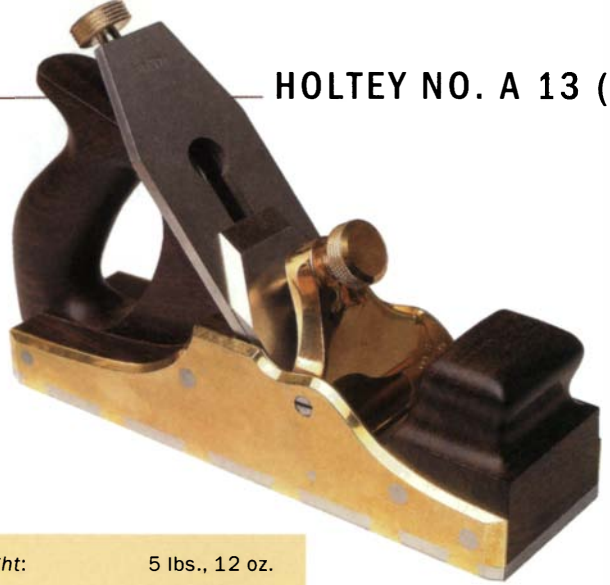
Replacement irons

You can't make a silk purse out of a sow's ear. When applied to handplanes, this old adage held up reasonably well until several small manufacturers began selling beefed-up replacement irons. These thick irons are better able to hold up to cutting stresses, reducing chatter and letting a plane glide through difficult grain.

To see how replacement irons would affect the performance of lower-priced planes, I got irons from Hock, Holtey and Clifton and tested them in the Anant, Record and Stanley smoothers. The results were dramatic. Suddenly, each one was planing far better than it had before.

Among the irons, I liked the Holtey ($70; 0.110 in. thick) for its tough A2 steel, which stays sharp a long time. The Clifton ($59.95; 0.117 in. thick) lapped flat in about a half hour and held an edge

HOLTEY NO. A 13 ($3,800*)



Weight:	5 lbs., 12 oz.
Length:	9 in.
Blade thickness:	0.190 in.
Made in:	England

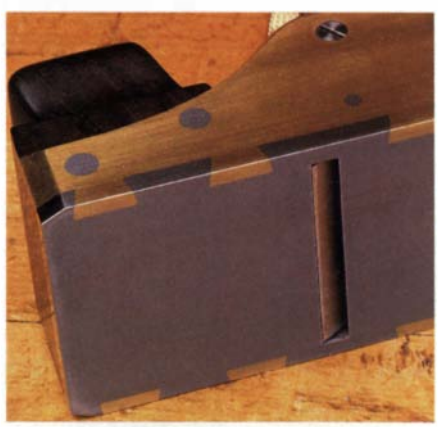
*Depends on exchange rate

Handsome cap iron. *Faceted and burnished at the top and shaped to a smooth, chip-deflecting curve at the bottom, the Holtey cap iron is a blend of beauty and function. Befitting its stature as a collector's tool, the Holtey comes in a heavy, green baize drawstring bag.*

Forget for a moment about the price tag, equal to a few woodworking machines or dozens of other hand tools. Forget about the year or so wait. Just take a look: The Holtey Norris-style No. A 13 is one beautiful plane. That planes are still being made with such impeccable craftsmanship—in the grand tradition of the best British smoothing planes—is worthy of appreciation in itself. The price is indeed staggering, but it should be weighed against the enjoyment of using this plane and the many generations it will last.

Karl Holtey (pronounced HOLE-tie) builds planes largely by hand. Using a construction method once common for the best planes, he dovetails the steel sole and gunmetal sides together (no small trick—the dovetails are flared in both directions) and infills the interior with rosewood. Typical of his attention to detail, he drills the infill for oversized sleeves and rivets through the sleeves so that wood movement won't affect the bedding and stability of the iron.

The iron is made of superior A2 steel, an alloy with fine grain structure (to hone to a very keen edge) and abrasion resistance. It stays sharp a long time. It's bedded at 50°, which provides a slight advantage for planing the most difficult woods. The silky smooth adjuster, similar to a Norris' with depth and lateral movement, is extremely precise—it deepened the cut a tiny 0.015 in. for every complete turn.



Sole mates. *Dovetails cut with the extraordinary craftsmanship typical of the plane lock the Holtey's gunmetal sides to its steel sole. With the throat adjusted extremely tight, as here, the plane will take gossamer-thin shavings with minimal tearout in the toughest woods.*

There are many more details that Holtey has worked out in this plane, but let me just say that it works wonderfully, as well it should. Can it handle woods others can't? Yes. Once you have tried it, there might be no turning back. It's just a matter of rethinking that second car. Contact Holtey at (603) 362-6146.

very well. The Hock iron ($28.75; 0.095 in. thick) came wrapped in excellent tuning instructions, and it tuned up easily. It did not impress me as much as the Clifton or the Holtey, but it is still an improvement over standard blades. Hock and Clifton irons are available through Garrett Wade (800-221-2942); Lie-Nielsen and Holtey are available from the manufacturers.

Too late to include in the wider test, I discovered that Lie-Nielsen also makes a replacement blade ($30; 0.095 in. thick) that fits Stanley-style smoothers. I tried it in a Record No. 04 and found it to be on par with the Hock in overall quality.

All four irons made a big difference, but the real turbo-charging came when I fitted Clifton's two-piece cap iron ($23.75) to the Clifton blade. One part of the cap iron screws to the blade, and the other part lifts away for honing. The cap iron's weight and wide contact with the blade provide extra mass and stability. And the cap iron doesn't clamp against the blade with any pressure. Other cap irons do, which can bow the blade so it rocks (minutely) with every plane stroke. My initial skepticism was swept aside when I tried the Clifton blade and cap iron and found that even the $27 Anant was suddenly performing in the same league as Lie-Nielsen's Bedrock smoother. Thus turning the old saying about a silk purse, well, on its ear.

A Classic Bookcase in the Craftsman Style

Of the many qualities that help define the Arts-and-Crafts style, perhaps the most apparent is straightforward and honest joinery. Wedged joints and through-tenons show the world how a piece was made. Open-grained woods like white oak give a piece an unabashed look, perhaps even a rustic quality that says, "Here's what I am—sturdy, well-made furniture." No abstractions get in the way, no conceptualizing need be done. This frank simplicity is just the style the progenitors of the Arts-and-Crafts movement in England hoped for—a style in direct counterpoint to the machines and machined look of the Industrial Age and its products—and it's just the style for the bookcase I made to fit in my bungalow.

The bookcase is just 50 in. high and 31 in. wide. Quartersawn white oak, the quintessential Arts-and-Crafts material, was clearly the wood of choice. For the sides and shelves, I glued two boards together, then scraped and sanded them. Wedges made of the same oak secure the through-tenons to the mortised sides and give the bookcase its strength and honest face.

Mortise-and-tenon joinery usually requires precise fitting; however, these long through-tenons need to be a bit loose to fit easily through the mortises. The wedges provide holding power at three locations. The back of the wedge pushes against the outside face of the side. This does nothing until the angled front of the wedge starts to press against the angled slot cut into the tenon. Then the wedge pulls the tenon through the joint until the tenon shoulders lock against the inside face of the case side.

Wedged tenons and clean lines dignify this oak original

BY GARY ROGOWSKI

Cut mortises with a plunge router and template

I cut the mortises using a plunge router, a ⅝-in. straight bit, a ¾-in. template guide and a mortising template (see the top photos on p. 49). The template, made of ½-in. medium-density fiberboard (MDF), is milled as wide as my case side and with perfectly square ends. First mark the centerline of the template. On this centerline, lay out the mortises. Cut the mortises with a ¾-in. straight bit on the router table, using a fence with stops clamped onto it. Cut the two outer mortises using the same stops and fence setting; flip the board over to cut the second one. For the center mortise, simply move the stops over to the proper position. If the template is square, the mortises will locate properly and be the same size. Finally, glue and screw a fence onto one end of the template.

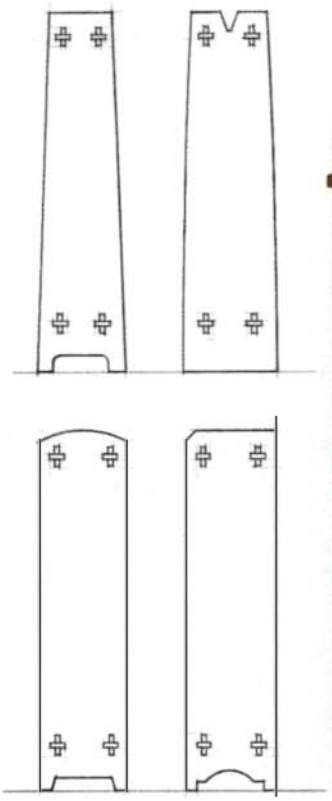
Only the centerlines of the mortises need to be laid out on the case sides. Clamp a side to the bench, align the centerlines on the template with the centerlines on the side and clamp the template in place. Next, set the bit depth. Put a folded index card on the benchtop and rest your router on the edge of the case. Then zero the bit down to the card and set the turret stop on the router to its lowest depth. This setting will allow you to rout almost through the case side but without blowing out the mortise or marring your benchtop. Then set another turret stop for the center mortises, which aren't through-mortises.

After routing, chop the mortise corners square with a chisel. I found that the standard 25° angle on my chisels really took a beating in this oak; they looked like I had been prying nails with them. To get through the job, I adjusted each chisel's edge about 5° with a secondary bevel. When chopping mortises, remember to pull the chisel back hard to the mortise wall to keep it lined up. You want these corners to be cut square and neat. I use a block of wood as wide as my mortises to check each for consistency. I also bevel the edges of the mortise with my chisel to give a nice shadow line and to prevent tearout when fitting the tenons.

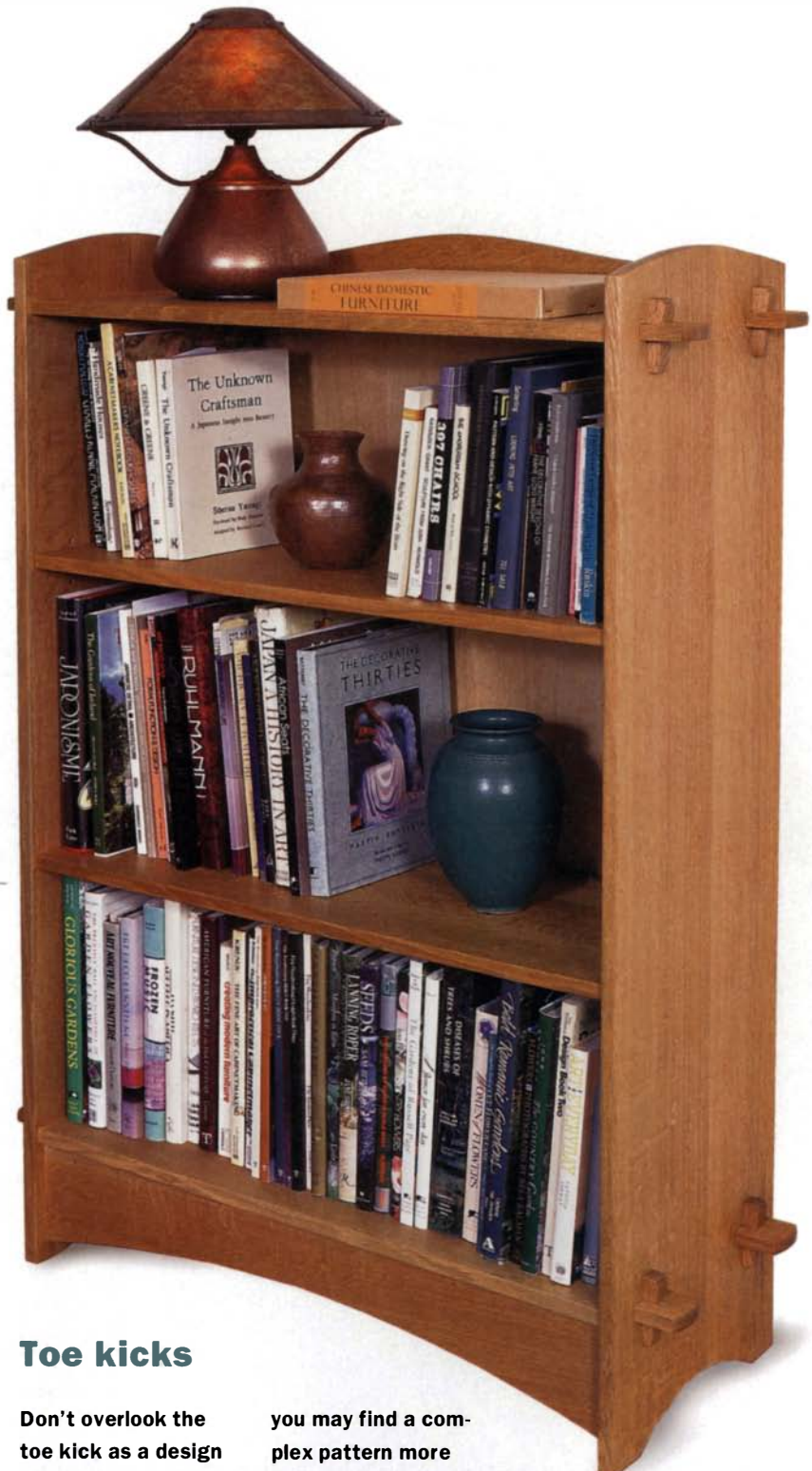
Cut tenons and wedges to fit easily

Cut the cheeks and shoulders of the tenons with a plunge router and a straight fence (see the bottom photos on p. 49). The fence

Profiles



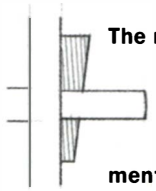
The way the bookcase is shaped on its sides and rails strongly influences the appearance of the piece. Try drawing out a few shapes on cardboard to see them full scale. Flat or beveled bottom edges, simple indents, shallow arcs or other combinations of shapes all lend a certain feel to a piece. My advice is to keep the shaping details consistent throughout. So a negative shape cut out of the bottom of the sides can be nicely recalled at the top, in the toe kick or in the backsplash.



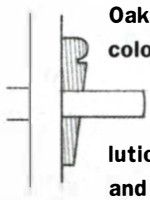
Toe kicks

Don't overlook the toe kick as a design element. It greatly influences how the bookcase "stands" and can also help tie all of the pieces in the case together. A toe kick can be of a simple design, but you may find a complex pattern more suitable. The toe kick on this case echoes the shallow arc of the top rail; arcs also appear in the sides, at both top and bottom. The motif is a unifying element.

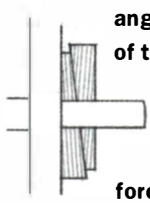
Wedges



The material of the wedges and their shape and placement can really make a difference in the look and feel of the bookcase. Using a contrasting species, like darker rosewood, gives the wedges a visual punch. But be sure the wedge material is as tough as the white oak.

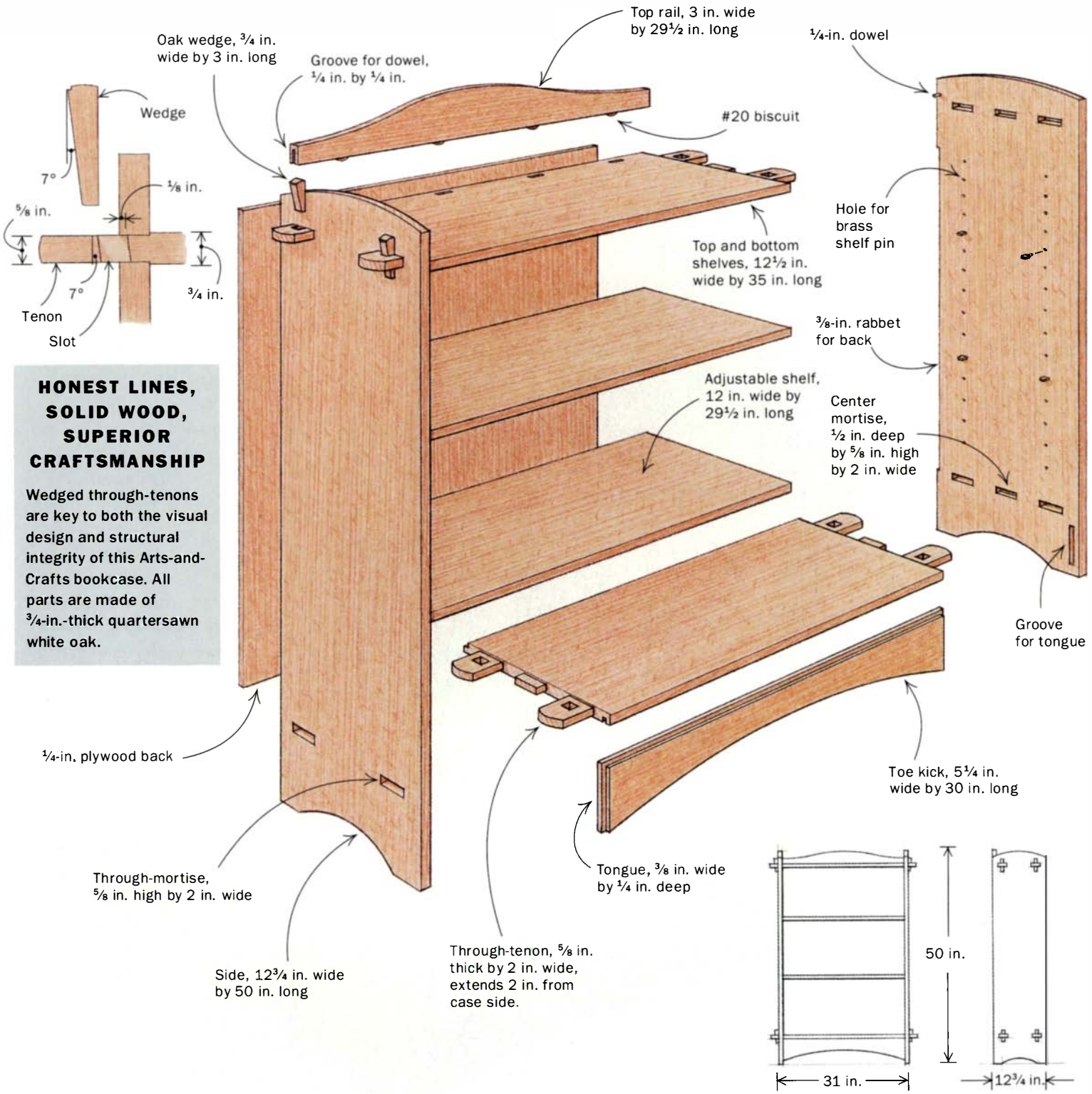


Oak wedges can be colored to provide contrast. An ebonizing solution of vinegar and rusty nails or steel wool will give oak a color anywhere from a dusky gray to black, depending on the solution and the amount of tannin in the oak. Wedges can be shaped any number of ways. Double wedges allow you to mortise straight through the tenon at no angle.



The angle of the wedges themselves creates the necessary force. The number of wedges can be varied to suit your taste; for instance, you can put three wedges at the bottom and two at the top.

Photos: Marc Vassallo



HONEST LINES, SOLID WOOD, SUPERIOR CRAFTSMANSHIP

Wedged through-tenons are key to both the visual design and structural integrity of this Arts-and-Crafts bookcase. All parts are made of ¾-in.-thick quartersawn white oak.

rides tightly against the end of the board to locate the tenon shoulder. Cut one face of all of the boards about 1/16 in. deep and back to the tenon depth, then cut the second face so that the tenons will fit easily into the mortises. Next, on the bandsaw, rough out the waste between each of the tenons. Then reset your router bit to the full depth of the board and, in several passes, cut the shoulders between the tenons.

I set up the router table with a fence to finish-cut the roughed-out edges of the tenons so that they slide easily through the mortises. Use a rabbeting plane to pare the tenons down on both their faces and edges. The fit should be smooth; you shouldn't have to fight the joint home, nor should you be able to see Paris through the gaps. Work one tenon at a time until you can push all of the joints home by hand.

Dry-assemble the case, then mark the outside face of the case side onto each tenon. Be sure to locate the end of the slot for the wedges ⅛ in. in from this line so that part of the slot lies inside the face of the case side. If you cut the slot flush with the case side,

Drawings: Vince Babak

the inside face of the slot will push against the wedge, preventing it from providing a totally snug fit.

Next, make a mortising template to router-cut the wedge slots in the tenons. The slot needs to be angled on its front edge, so glue a 7° angled block to the bottom of the template. Your plunge router will then rout at that angle. Rout each wedge slot with a ¼-in. straight bit and a 5/16-in. o.d. template guide, and chop its corners square with a chisel.

To make all of the wedges the same size and angle, you'll need to make a simple tapering jig for the bandsaw. Cutting out the triangular shape of the wedges on a 3-in. by 5-in. piece of ¼-in.-thick scrap ply gives you a place in which to hold your wedge stock as you pass it by the blade. Move the fence over to the proper spot and cut all of the wedges. Next, plane each wedge edge until the wedge fits easily through the mortise. Then clean up the angled face until it just starts to snug up when it's about 1 in. above the top face of the tenon.

Have a plan before assembly and glue-up

Once the through-tenons on the shelves fit easily into the mortises on the case sides, it's time to add a top rail, or backsplash, above and a toe kick below. The toe kick needs to be strong, just in case it gets used as it was so aptly named, so rout stopped grooves into the case sides and a through-groove into the bottom shelf, referencing off each board's back edge. Then rout a tongue into the toe kick so that it can slide home after the case is glued together.

The top rail doesn't need the strength of a tongue-and-groove joint, so after the case is together, glue the rail onto the top with biscuits. To keep it from twisting, add two dowels to the case sides. These dowels fit slots cut into the ends of the top rail. For easy assembly, use the offcuts from the top rail and toe kick as clamping blocks when gluing up these two curved rails.

Shape the bottom of the case sides on the bandsaw and finish with a template router. Rabbet the case sides for the back on a router table. For a long-grain cut like this, a climb cut—one made with the rotation of the router bit—can help avoid tearout. File the shaped edges slightly round, then scrape and sand the entire case with 180-grit paper. Raise the grain with a damp rag and resand to get rid of any puffed fibers.

Nothing will save you more from heart palpitations and profuse sweating than planning out a strategy for glue-up. Dry-fitting your case and laying out your clamps, glue, hammer and wedges will help make this assembly an occasion for whistling.

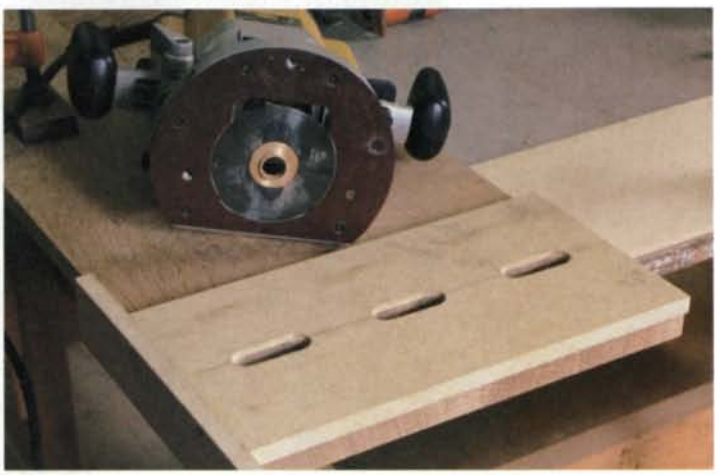
Glue up one side at a time. With one side in place but unglued, apply glue to the tenons of the other side, gluing only the long grain. Don't over-glue these joints or you'll have a mess to clean up. Clamps pull everything in tight, with maybe a wallop or two from a dead-blow hammer.

After clamping, place the wedges and bang them home. I use a metal hammer for this because the sound it makes will change when the wedge is in far enough. Do not bang the wedge past this point. You'll bust out the short-grain end of the tenon. This is why I left the tenon ends poking through the case sides at a relatively long 2 in. This much wood provides enough room to put in the wedges safely. □

Gary Rogowski, a contributing editor to Fine Woodworking, *teaches a class on building this bookcase at The Northwest Woodworking Studio.*

MORTISES

Router-cut mortises rough out quickly. *With this template (below), you don't have to mark mortises on the case sides, just the centerlines. Use a folded index card (right) to set your router depth so that the bit will not break through the sides when cutting mortises. Pop out the thin waste with a chisel.*



TENONS

A router with a fence cuts clean shoulders between tenons. *First, bandsaw the waste between the tenons.*

An angled block sets the bevel. *With the template tipped 7°, your router will automatically bevel the slot in the through-tenon to accept a tapered wedge.*

Sanding Fids

These shop-made tools work like curved detail sanders, without a power cord

BY KING HEIPLE

A FID IS PERFECT FOR SMOOTHING ONE CURVE INTO ANOTHER.

The author (top) uses a fid to refine and blend the curved ankle of a curly maple cabriole leg. Cementing cork or neoprene on the taper (right) adds pliability and makes it easier to smooth curves.

A fid is traditionally a tapered wooden tool that's used by sail makers to stretch holes in canvas or to stretch and size rope grommets. In Italy, furniture makers developed a similarly shaped tool for sanding wood. I saw a picture of a sanding fid a few years ago, and I have since made several versions of this curiously named tool.

Fids turn out to be widely useful in the shop, and making one is a quick and straightforward project, even if you have only very basic wood-turning skills. Fids are particularly useful for sanding carvings, furniture legs and turnings with varying coves, as well as for fairing one compound cove curve smoothly into another.

As anyone who's used a drum or disc sander knows, supported sandpaper lasts two to 10 times longer than handheld sandpaper. Even better, with a fid you can use almost any sandpaper or sanding cloth, without the need for snap locks, hooks and loops or adhesive backing. And you can change from one grit to another in about 10 seconds.

My fids happen to be cherry, because I like tools to look good and feel nice, but even a construction-grade 2x2 would work fine. The handles can be of any design that meets your fancy, from a straight cylinder to something better than mine. Each of my two longer fids has a

6½-in.-long tapered portion, and my shorter fid has a 3-in.-long tapered portion. The thicker of the long fids tapers from 1 13/16 in. dia. to 7/16 in. dia.; the thinner one tapers from 1 1/16 in. dia. to ⅜ in. dia. The short fid is 2¼ in. dia. at its base and tapers ¼ in. over its 3-in. length, about as close to a true cylinder as you can get and still lock on sandpaper tightly.

The degree of taper is not critical, and you may need to turn several variations, but the taper must be uniform—that is to say, flat—or your fid will not hold sandpaper tightly or support it well. Once you have turned the fid on the lathe, go to the bandsaw and cut a kerf exactly down the middle of the fid, from the narrow end of the taper to the handle. Keep the kerf as straight as possible. The kerf may have to be sanded a bit, but slightly rough inner surfaces will help it hold the paper.

A reusable sandpaper pattern is easy to make. Take a piece of paper at least as long as the taper and wrap it around the fid. Holding the paper snugly, run your thumbnail up the kerf on one side of the taper, and also mark the length of the taper. Unwrap the paper, and you'll have the pattern for your fid, but you must add ⅜ in. to each long side for the fold-in flaps. Now spray the paper pattern with adhesive and mount it on a scrap of plywood or pressboard. Cut this pattern out, sand its edges and label it. Use the pattern to cut a set of sandpaper fid covers in varying grits, and you'll save time in the future. Very lightweight sandpaper (A weight) does not stay on a fid well, but heavier sandpaper and sanding cloth work beautifully.

Lately I've taken to cementing either a ⅛-in. layer of cork or a ⅛-in. neoprene sheet to the taper. Either material adds just enough compliance to the surface to make the sanding of transitions from one curve to another smooth and easy. I suspect there will be those who say, "Just use a dowel or your finger." But I enjoy turning fids. And a fid makes a useful addition to your tool chest and to your vocabulary. □

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MAKING A FID

You need only basic turning skills to make a sanding fid. The first step is turning the handle. It can be any design that suits you. Once you've turned the handle, work on the tapered portion with a large roughing gouge skewed at 45°. Take a light cut, starting at the tip and gradually backing up (photo 1).

No matter what your desired degree of taper, it's important that it be smooth. Any bump or curve will prevent a close fit of the sandpaper, and dips will create unsupported soft spots. As you develop the taper, check the flatness frequently using a straightedge (photo 2).

It helps to set the lathe's tool rest at the angle you wish to achieve. Then gradually develop your taper parallel to the rest. Take a finishing cut when the taper is essentially complete (photo 3) or finish smoothing with sandpaper.

Turn the corners at the base and tip with a spindle gouge (photo 4), then finish the fid while it's still on the lathe.

The next and last step is to cut the kerf on the bandsaw (photo 5). For safety, grip the handle of the fid with a parallel jaw clamp. Saw as straight as possible up the center of the taper from the tip to the base.

King Heiple is a retired orthopedic surgeon and a lifelong woodworker.

Photos: Facing page, left, bottom and right: Marc Vassallo; all others: Ernie Conover

Cabinets Built for the Long Haul

Overbuilt? Maybe. But these cabinets, styled after designs from the last century, will last way into the next one.

BY BILL CROZIER

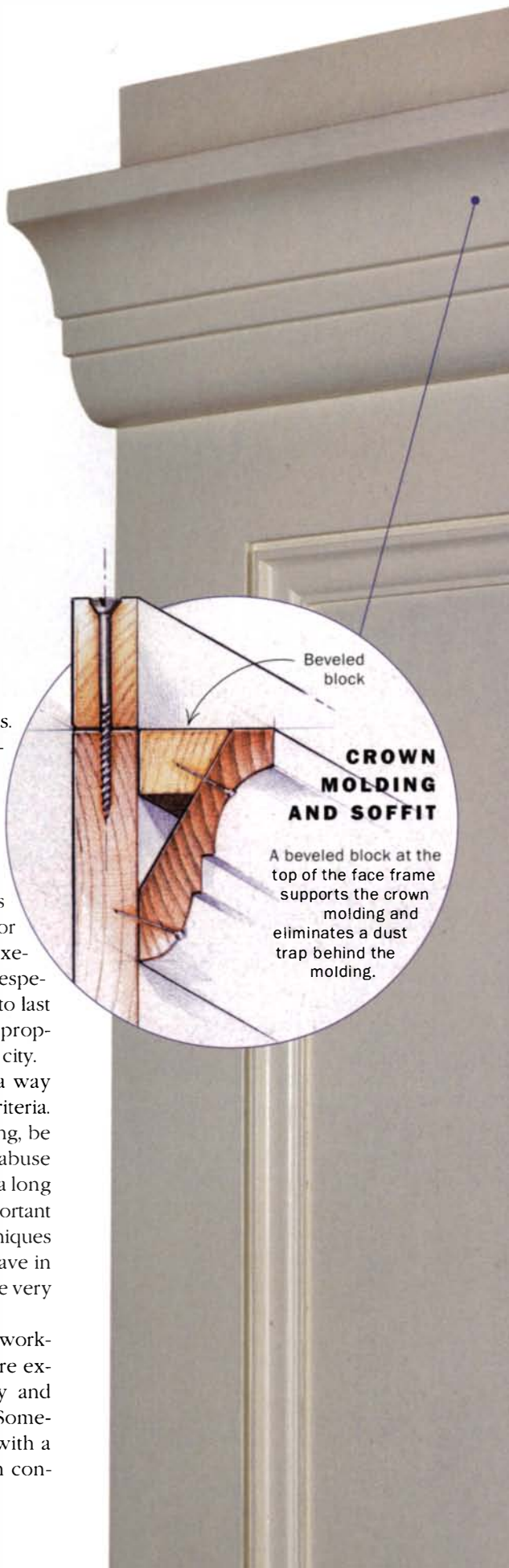
For the past several years I have had a lot of clients in New York City, about 175 miles away from my cabinet shop in Providence, R.I. When I finish the cabinets in the shop, everything gets packed in my truck, and I head down Interstate 95, one of the most heavily traveled roads in the country. Some of the roadway bumps are more like jumps, and some of the potholes are more like sinkholes. It's a jarring ride, and if you're not going 65 mph, you're in danger of getting run off the road by everyone else who's going even faster.

Cauling all clamps. *Strips of wood, called cauls, are placed between the clamps and the face frame to prevent marring. The author uses numerous clamps when gluing the face frame to the cabinet's plywood carcase.*

Typically, the cabinets I build require the fitting and hanging of numerous doors and drawers. And as anybody who has hung even one door or drawer knows, precision in the execution is of the utmost importance, especially if the job is going to be made to last for a long time, to continue to work properly and to survive the trip to the big city.

I construct cabinetwork in such a way that the final product meets many criteria. The cabinet must be incredibly strong, be very, very square and take lots of abuse without showing signs of wear over a long period of time. The last and most important criterion is that the construction techniques be based around machinery that I have in the shop. Most of the systems I use are very low tech.

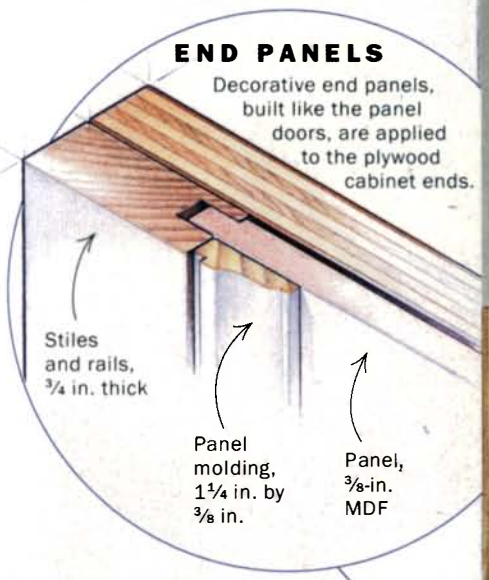
Increasingly, it seems, many woodworkers think that if they get bigger, more expensive machines, the productivity and ease of construction will improve. Sometimes this is the case, but anyone with a small core of simple machinery can con-

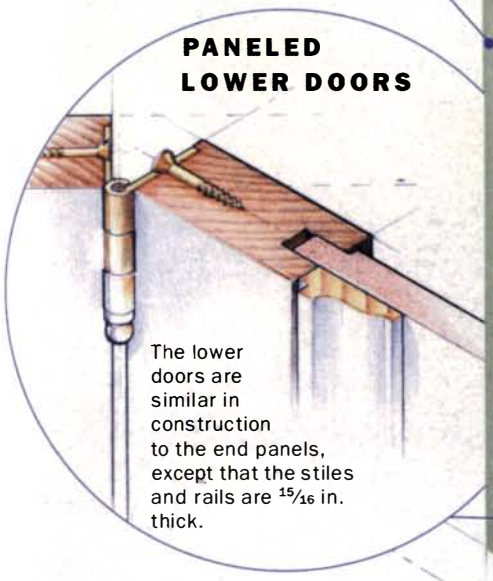


MOLDED STILES AND RAILS FOR GLAZED DOORS
Long, 1½-in. by 5/16-in. tenons provide more gluing surface than a standard coped joint with a stub tenon.
FRENCH LAP JOINT ON DOORS
A beaded half-lap joint, called a French lap, adds a decorative touch to upper and lower cabinet doors.

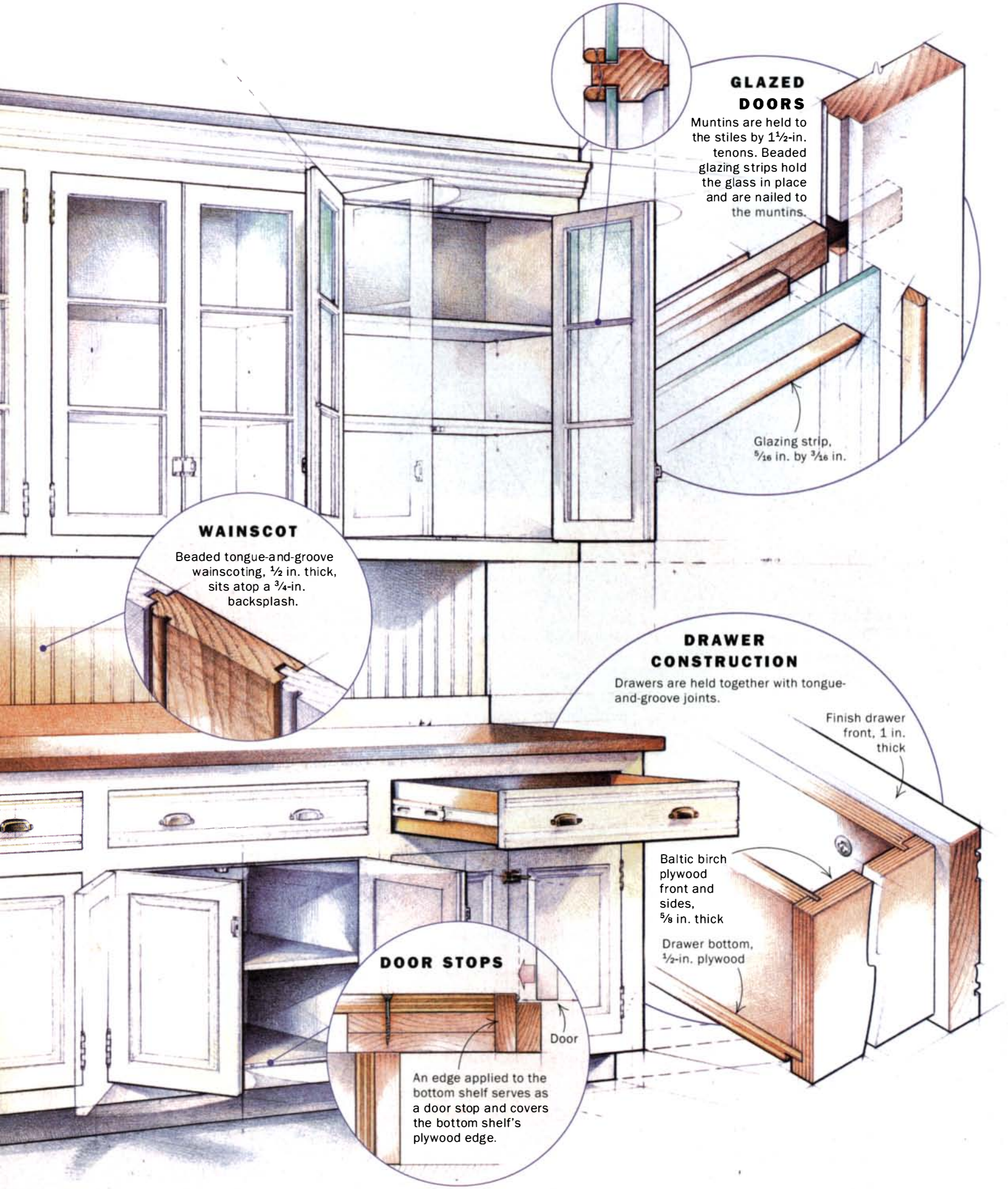
BULLETPROOF CABINETS

There are no shortcuts in these cabinets. The author admits that his materials cost a little more and his techniques take a little longer than the industry standards. Inch-thick face frames and doors, full mortise-and-tenon joinery and quality hardware are some of the hallmarks of his cabinetry.





Drawings: Bruce Morser



Photos: Jefferson Kolle, except where noted; this page and on p. 53: Scott Phillips

An ancient machine in a low-tech shop. *The author uses a 60-year-old single-end tenoning machine to mill cabinet parts. Aside from this machine, his shop is decidedly low tech. Good materials, solid joinery and quality hardware make his cabinets bulletproof.*

struct cabinets of superior strength and durability quite easily.

Good materials make a good cabinet

Lots of time spent building a cabinet can be wasted by using anything but the best materials available, in the selection of both solid wood and sheet goods as well as in the choice of hardware.

A lot of the cabinets I build get painted. To some, the term "paint grade" implies that the materials and the construction techniques used can be less than the best because everything gets covered by coats of paint. Aside from the fact that I use medium-density fiberboard (MDF), which is more stable than solid wood, for the door and end panels, the only difference between a painted cabinet and an unpainted cabinet is the paint. And in fact, the design of a painted cabinet may be more important than that of an unpainted one. In a painted, monochromatic cabinet, one's eye is not taken in and possibly swayed by beautifully finished hardwood; rather, one sees the clean lines and sculptural beauty of the cabinet's design.

All plywood is not the same—I build all of my cabinets with ¾-in.-thick plywood for the sides, bottoms and tops. I use veneer-core plywood of the best possible grade with a face veneer of either maple or birch. And because veneer glue seams can show through a painted surface (on the interior of clear-coated cabinets—varnished, lacquered or polyurethaned—you'll see a continuous veneer seam), I always specify that at least one side of the plywood be a WPF, or "whole piece face veneer." This means that there are no glue seams in the veneer on the good side of the sheet. Random glue seams can lead to a somewhat haphazard appearance.

I use ½-in.-thick maple or birch WPF veneer-core plywood for cabinet backs. A ½-in.-thick cabinet back is far superior to the ¼-in.-thick industry-standard back. It adds structural integrity to the cabinet and doesn't sound hollow if you bang it. Lots of cabinets with ¼-in.-thick backs are mounted to the wall through ¾-in. wood cleats screwed across the backs of the cabinets. The cleats dictate where the cabinets can be screwed to the wall, and they break up the clean lines inside the cabinet.

All pieces of a cabinet carcase are dadoed for alignment and glued and screwed together. I run a ½-in. dado around the perimeter of the carcase's back to accommodate the ½-in.-thick plywood back. The back is then screwed and glued directly onto the rear of the cabinet. This creates a strong, square, bulletproof plywood box.

For painted kitchen cabinets, I build all of my drawers using ⅝-in.-thick Baltic birch plywood for the sides and ½-in. plywood for the bottoms. The multiple veneers of the Baltic birch, free of voids, look sharp as drawer components. I clear coat all drawers with a conversion varnish.

For the lower door and end panels of my cabinets, I use ½-in. MDF, rabbeted to fit into the 5/16-in. dadoes in the stiles and rails.

Buy 5/4 soft maple for face frames and doors

A well-constructed face frame will give the front of a cabinet strength and durability, and all of the pieces will stay smooth and flush. A poorly assembled face frame will result in joinery that does not remain flush, and it can look shabby very quickly; remember, the wood is constantly moving.

I buy 5/4 soft maple for all face-frame and door parts. Soft maple is not only more stable than poplar, but it also is considerably harder, takes paint exceptionally well and is only slightly more costly. I have also noticed over the years that when I try to paint over the dark portions of poplar—those black and purple streaks that occasionally appear—it takes more than two finish coats of paint to cover them. Soft maple has a consistent off-white color.

Typically when I start a job, the first thing I do is rough-mill the face-frame, door and drawer-front stock to 1⅛ in. thick, sticker it and let it sit. Then I go about my business of constructing the plywood portions of the cabinets, which, depending on the size of the job, can last from one to six weeks. During this time, the solid stock can sit around, twist, move or do whatever it is going to do before I finish milling it.

I make all of my face frames and drawer fronts a full 1 in. thick. The stiles and rails for the doors are milled to 15/16 in. thick. The difference in thickness between the face frame and doors allows me to use unobtrusive 1/16-in.-thick vinyl door bumpers for the flush-mount doors.

A 1-in.-thick face frame is much more stable than the industry's standard ¾-in.-thick frame, and the extra thickness allows for stronger joinery possibilities and more options for different molding thicknesses on the doors and end panels. Plus, it looks better; you immediately see that it is stout.

I use full mortise-and-tenon joints on my face frames. To make the mortises, I use a Multico hollow chisel mortiser, which is a

fairly inexpensive machine to purchase new, and it is really fantastic. I tenon all of my pieces using a ca. 1935 Fay and Egan Lightning 505 single-end tenoning machine, but tenons are also easily made with a tenoning jig on the tablesaw. All mortises are 1⅜ in. deep, and the tenons are 1¼ in. long. I haunch all face-frame tenons so that the surface of the face frame remains flat and smooth over time.

After a dry assembly, the face frame is glued together. I take the utmost care to glue it up square. The openings in the face frame are where all of the doors and drawers are to be hung. If things are not parallel and square, the job of hanging doors and drawer fronts will soon become frustrating and difficult.

After the face frame has been glued together, the front and back are handplaned, scraped and sanded smooth. Then I glue the frame onto the front of the plywood carcase, using either nails or biscuits for alignment. I place the carcase on its back on sawhorses and use every clamp I own for the glue-up. Remember, the edge of a piece of veneer-core plywood has only 50% glue surface, because half of the veneered core is end grain and will not accept glue. So a really good glue-up with lots of clamps and even pressure everywhere is of the utmost importance.

The glazed upper doors and paneled lower doors are built with mortise and tenons. And I make my drawers as five-sided boxes, adding a separate, full-inch drawer front to cover the ends of the slides.

Quality hardware is a good investment

Adjustable cup hinges have been popular in kitchens for the past couple of decades. Sure, they're easy to install, and you can adjust them every which way, including loose, and that's my problem with the things. The doors look great when they leave the shop, but inevitably the hinges go out of whack. Subsequently, every cup-hinged kitchen I've seen has doors as crooked as a witch's teeth.

I hang all of my cabinet doors on high-quality, removable-pin butt hinges. I buy top-quality Baldwin, Vin-Morris, Merit, Ball and Ball, Brusso or Whitechapel hinges. The hinge knuckles are machined and not rolled, so there is no play in the swinging action of a door. I usually use a Stanley roller catch and vinyl bumpers that soften the closing of the door. Spend the time hanging the door correctly, and it will stay that way forever.

Don't skimp on drawer slides; for a few dollars more per pair, you get an infinitely better product. I have used epoxy-painted Accuride slides for years and find them well made and easy to install.

Granted, the materials and procedures laid out here may cost slightly more and take a bit more time to complete, but in the end, building a better mousetrap is what it is all about. To make products more affordable, many manufacturers use cheaper materials and take shortcuts to make the company more profitable. I believe that the better-built product will prevail. □

Bill Crozier builds his cabinets in Providence, R.I.

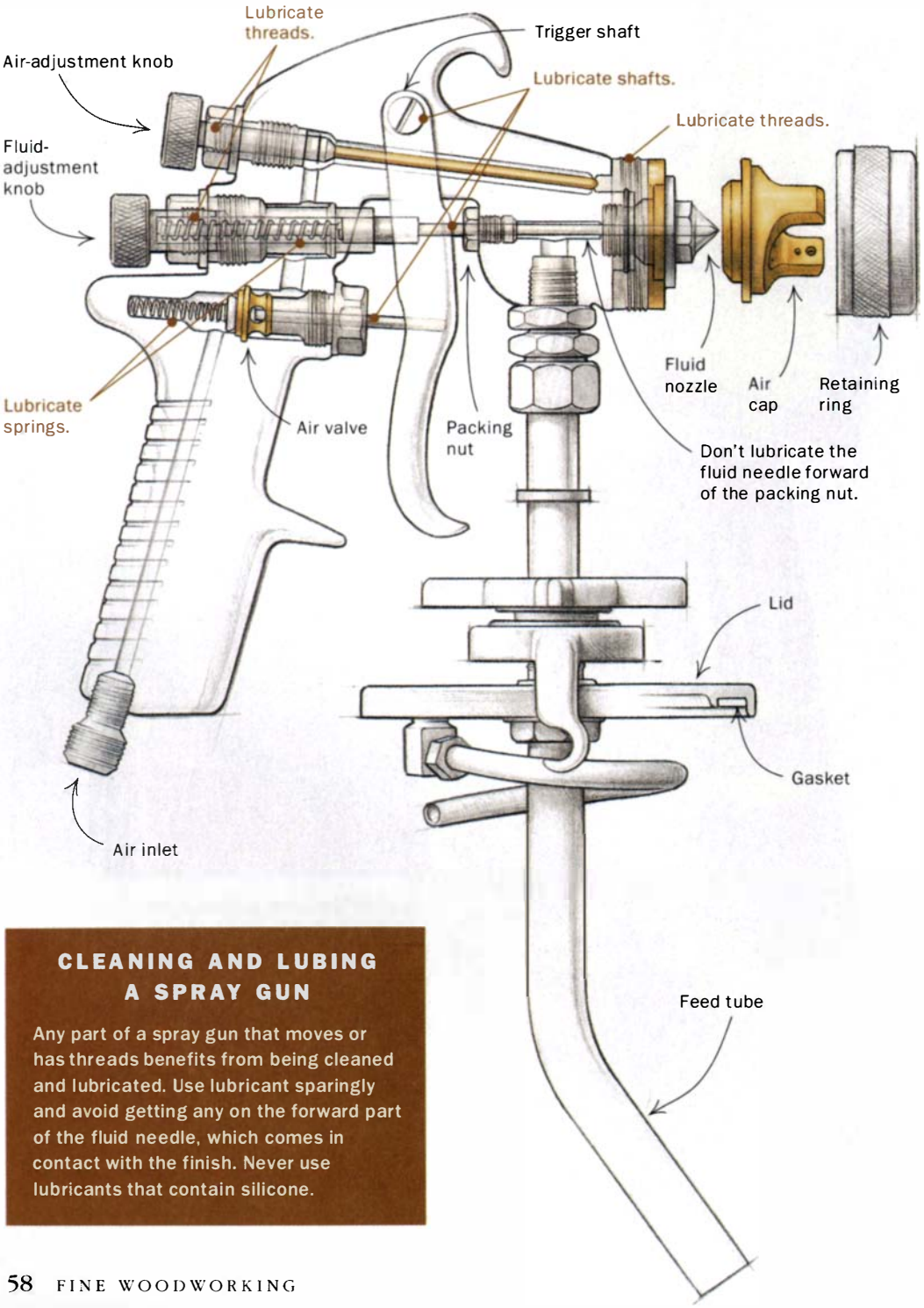
Similar designs, different applications. *The author builds lots of cabinetry for turn-of-the century New York City apartments. Shelves in glazed upper cabinets line up with door muntins.*

Photos this page: Author

TLC for Spray Guns

Simple cleaning and lubrication keep a spray gun in top form

BY ANDY CHARRON



CLEANING AND LUBING A SPRAY GUN

Any part of a spray gun that moves or has threads benefits from being cleaned and lubricated. Use lubricant sparingly and avoid getting any on the forward part of the fluid needle, which comes in contact with the finish. Never use lubricants that contain silicone.

When I first began spray finishing, I was thrilled with how easy it was to lay down smooth, blemish-free topcoats with any material imaginable. I was less thrilled with dismantling the gun and cleaning it after each use. I let neglect run its course, and it wasn't long before the gun protested by spitting instead of spraying.

A spray gun needs a little tender, loving care to perform well. The maintenance doesn't take that long, and it sure is faster than trying to remove built-up finish that's turned into an epoxylike glaze. Cleaning and lubrication methods are pretty similar for spray guns commonly found in small shops, whether they be high pressure, high volume low pressure (HVLP) or turbine powered.

Wood toothpicks make good cleaning tools

Cleaning tools that come in contact with a spray gun should be stiff enough to remove gummy finish but not hard enough to damage the gun. Most gun manufacturers sell cleaning kits that include a skinny brush that fits inside hard-to-reach places. An old toothbrush works well, too. I also keep plenty of round wood toothpicks on hand for picking specks of finish out of hard-to-reach areas, like deep inside the horns of an air cap.

After washing out the cup, thoroughly clean the gasket that

Drawing: Bob La Pointe

Some disassembly required. *To get at places where finish tends to gum up a spray gun, partly disassemble it. Small brushes and wood toothpicks make good cleaning tools.*

goes between the cup and gun (see the left photo below). With a gravity-fed gun, the cup remains fixed; just remember to clean the cap and make sure the vent hole is clear.

Next, unscrew the air cap and look around for dried or gummy finish. This is where a wood toothpick will come in handy (see the middle photo below). Don't use wire or metal materials because they can damage the gun. If the dried finish does not budge with the prodding of a toothpick, use a soft brush and lacquer thinner to dissolve the finish. Poor spray pattern or atomization often can be traced to a dirty air cap.

If your gun hasn't been thoroughly cleaned in a while, you may have to take it apart to get at gummed-up parts. A long, skinny brush dipped in lacquer thinner can be used to clean the inside of the gun (see the right photo below). Smaller parts can be soaked in lacquer thinner. But remove any rubber O-rings because lacquer thinner will cause them to swell. Although the O-rings will eventually shrink back to normal, you can damage them if you try to reassemble the gun when the rubber is swollen. Replace any O-rings that are torn or abraded.

Special steps for when you switch finishes

If you spray both water- and solvent-based finishes through the same gun, you need to take additional precautions. Water-based finishes can dissolve dried lacquer or lacquer thinner, just as lacquer will dissolve water-based finish left in the gun. The result is usually not pretty: A hunk of gunk splats on the tabletop as you make your last pass with the spray gun.

When switching from solvent-based finishes to water-based products, first clean the gun with lacquer thinner. Next, run denatured alcohol through the system, followed by water. When switching back, reverse the process.

Lube anything that moves

Cleaning a gun removes some oil from critical joints, so replace the lubricant regularly. The lubricant should be designed for spray equipment and contain no silicone. Silicone ruins finishes by creating depressions known as fisheyes. Once silicone has been introduced into your gun, it is difficult to remove, so be careful what type of lubricants you use both in and around your equipment. If you don't have spray-gun lubricant (available from paint suppliers), petroleum jelly will do. Don't get lubricant on the forward part of the fluid needle. □

Andy Charron operates Charron Wood Products in Windsor, Vt.

Clean the gasket. *The gasket needs to be free of debris; otherwise, the gun will not seal properly and will leak when tipped.*

Clear the air passages. *Wood toothpicks won't damage the precisely machined air-cap orifices, which can get clogged with finish.*

Remove the air cap and fluid nozzle. *The inside of the gun is best cleaned with a skinny brush soaked in lacquer thinner.*

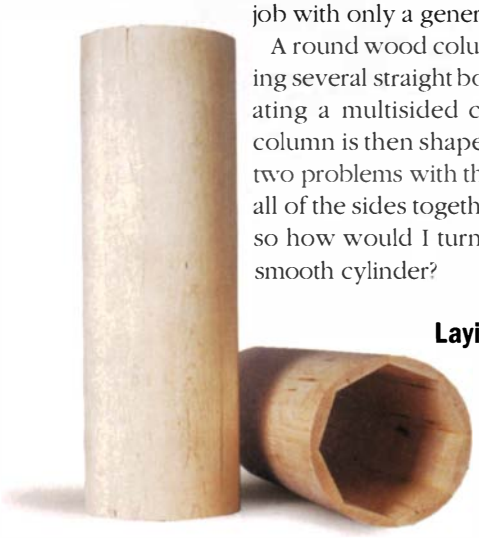
Photos: Anatole Burkin

Router-Cut Columns

With two simple jigs, you can make large, wood cylinders without a lathe

BY BILL EWING

A customer recently asked me to build a round column to support a peninsula countertop that he was adding to his kitchen. The 10-in.-dia., 30-in.-high column would be capped on each end. I knew there would be some difficulty building a round column out of wood, but as I do so often, I took the job with only a general idea of how to proceed.



A round wood column is typically made by joining several straight boards together in a circle, creating a multisided column. The outside of this column is then shaped into a cylinder. I could see two problems with this project: How would I glue all of the sides together? And I do not own a lathe, so how would I turn a multisided column into a smooth cylinder?

Laying out the column

My first steps were to determine the number of sides required and to check the stock thickness. Eight sides seemed about right, and I had ¾-in.-thick maple. I have learned that time spent at the drawing board pays huge rewards in the shop, so I begin by making a scale drawing of the column cross section.

The edge bevel angle needed to join the eight sides is 22½°, and the side width measured about 4⅛ in. I took special notice of the remaining stock thickness at the completed column joints (about ⅜ in.). This seemed a little thin, but with tight-fitting joints, I felt that it would be strong enough. For a larger column, you would need either thicker wood or more sides.

Make test cuts to get the right bevel angle

Once the scale drawing is complete, it's time to make some sawdust. When bevel-ripping both sides of a board, I like to leave the edges blunt. A narrow, flat edge registers against the rip fence better than a feathery thin one. Rip nine boards: eight pieces for the column and one piece to cut up for test-fitting. Crosscut the test board into thirds, which gives you three chances to get the fence position and blade angle just right. Tilt the blade to 22½°, set the fence to leave a narrow, 1/16-in. blunt edge and rip both edges of one test board. Next, crosscut this test board into eight pieces. Test-fit these pieces, then adjust the blade angle and fence position

as necessary. By the third try, I had an octagon slightly more than 10 in. across with tight-fitting joints. Once you have the settings right, rip bevel edges in the remaining eight pieces. Because cross-cutting the finished column would be difficult, I cut the sides to length at this point.

A holding fixture ensures precise alignment during glue-up

The challenging part of making columns this way is gluing up all eight sides at once. Looking at the cross-section drawing, I reasoned that by creating a fixture to hold every other side in a fixed position, the remaining four sides would float, or slide, into place, creating tight joints (see the photos at right). The holding fixture is simply two plywood octagons separated by a 2x4. The octagons are designed to support every other column side, providing a hard registration surface for clamping. The other four sides of the octagon do not contact the remaining column sides.

To make the octagons, cut two squares from ¾-in. plywood, making the size equal to the inside distance between opposing sides of your test-piece setup. Then draw centerlines on both sides of each square. Next, cut the corners off the square so that the floating sides of the column won't contact the plywood.

Mark centerlines on the ends of four of the test pieces and clamp these to the edges of the plywood, aligning the centerlines of the plywood to the centerlines of the test pieces. Then, move the remaining four pieces into position and check the fit. If the plywood fixture ends are cut accurately, the segments will fit perfectly. Correct any discrepancy by trimming the edges or adding shims. Be sure to add or remove an equal amount of material from all four edges of both plywood pieces.

Then cut a 2x4 shorter than the column by 1½ in. Center and screw one plywood octagon to one end of the 2x4 and temporarily clamp the remaining plywood octagon to the opposite end. Make sure the registration edges of both octagons are aligned. Then place this assembly horizontally on your bench. Adjust the clamped end until its position mirrors the position of the opposite end and both ends rest on this surface without rocking. Screw the clamped end in place, and the fixture is ready to use.

Assemble the side pieces

Next, mark centerlines on both ends of four sides of the column, clamp them to the holding fixture and nudge the centerlines into alignment with the lines on the octagons. Then, place the column on its side and tape the remaining sides into place, making sure all of the ends are flush with each other.

Once you're sure everything fits perfectly, remove the taped sides and glue them back into place one at a time. Begin by using tape to hold the nonclamped sides temporarily in place. Then add more clamps and wrap the assembly with rope. Gluing this many pieces at once is usually a character-building experience, but with four of the sides already secured to the fixture with clamps, this should go smoothly. After the glue has dried, remove the clamps and tap the holding fixture with a hammer until one of the plywood ends clears the column. Unscrew this end and then drive the fixture in the opposite direction until it's free.

Circle-cut the fixture support

Now to the matter of turning this eight-sided column into a cylinder: I knew I could make circular discs with a router. Because a

SIMPLE JIG AIDS GLUE-UP

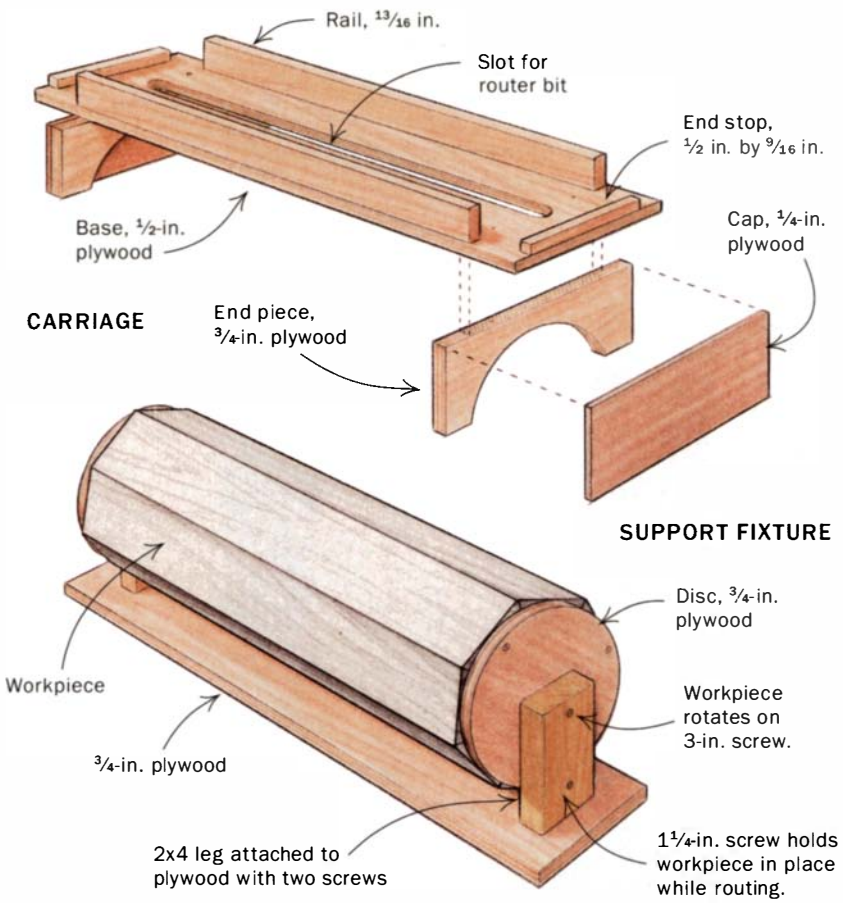
This holding fixture helps the author glue up the column sides. The fixture is simply two plywood octagons separated by a length of 2x4. The plywood octagons support every other column side, providing a hard registration surface for clamping.

Clamp four sides. *Every other side of the column is clamped to the holding fixture. The remaining sides float into position.*

Add tape. *The tape temporarily holds the non-clamped sides in place.*

Add more clamps and tie it off. *The combination of clamps and rope holds the assembly solidly together.*

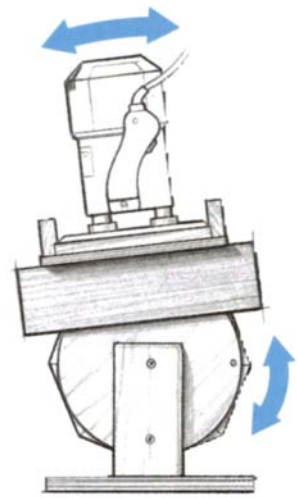
Photos: Dennis Preston



USING THE JIG

Make one left-to-right pass, return the router to the left, nudge the carriage slightly around the column, then make another pass.

When the carriage reaches the point where it will soon slip off the column, stop and reposition the column.



disc is the end view of a cylinder, I guessed there would be a way of generating a cylinder using discs as a guide. With a 10-in. plywood disc mounted at each end of the column as the reference surface, a carriage could span the length of the column and ride on these discs. Traversing along the carriage, the router could then mill the faceted column into a cylinder. Use a plunge router mounted on a circle-cutting base and a 1/4-in.-dia. bit to make the two discs.

Next, make two end pieces for the carriage. The end pieces ride on the discs, so match the concave curve of the pieces to the convex curve of the discs. Use the scrap from the discs as a template to make the end pieces. Using a 1/4-in.-dia. router bit, slip a 3/4-in. bearing with a 1/4-in.-dia. hole over the bit, as described in *FWW* #75, pp. 59-61. The bearing rides against the scrap piece while the bit cuts a perfect mate for the discs.

Make the jig

With the carriage end pieces sitting on the discs, the 1/2-in. plywood base must be as close as possible to the high corners of the column. That's because the router bit must extend through the base to the finished surface of the column. This leaves the top of the jig very thin—about 1/2 in. Glue a 1/4-in. plywood cap to each end of the carriage for reinforcement.

Complete the carriage by attaching side rails and end stops for the router. The jig must be long enough that the router bit can cut the full length of the column. The exact length of the jig and position of the side rails and end stops will be determined by the size of your router base.

To hold the column in position, I built a support fixture out of 2x4s and plywood. Secure the column to the fixture by driving a long screw through each 2x4 leg and into the center of each disc. To keep the column from rotating during the routing process, drive a screw through one 2x4 leg and into the disc near its outer edge. This screw is loosened to allow gross rotation of the column between router cuts and then retightened, locking it in place.

Round the column one pass at a time

Place the carriage on the column for shaping. The snug, friction fit between the discs and the end pieces of the carriage holds the jig together. For a smooth finish, use a 1-in.-dia. bottom-cleaning bit. Lower the bit until it just clears the discs and make one left-to-right pass, return the router to the left, nudge the carriage slightly around the column, then make another pass. The more passes you make, the less sanding will be required. When the carriage reaches the point where it will soon slip off the column, stop and reposition the column. Continue in this manner around the column, incrementally bumping the carriage over to cut the next pass, then rotate the column, progressively reducing the eight-sided column to a cylinder. Once the column is round, put the carriage aside and sand the column smooth while it's still on the support fixture. □

Bill Ewing is a custom cabinetmaker in Girard, Ohio.

Drawings this page: Bob La Pointe

Making tapered columns

A tapered column requires several modifications to the basic procedure: ripping tapered sides, making a different glue-up fixture and fitting two different diameter discs and jig ends.

I use a simple, fixed-angle plywood jig on my tablesaw first to rip a straight taper on all of the sides, then to bevel the edges (see the drawings below). Begin by ripping the test side ¼ in. wider than the other sides. Rip the remaining eight sides slightly oversized. With the rip fence set, use the tapering jig and cut one edge of each piece. Now, nail the test-piece offcut to the tapering jig. This ensures that the second edge of each side will be cut to the identical angle. Placing the tapered edge against the jig, adjust the rip fence and cut the second edge on all of pieces.

On a tapered column, plywood forms provide uniform clamping pressure. *Tap them in place with a hammer.*

Tilt the saw arbor. By again using eight sides, the bevel angle remains at 22½°. Using the tapering jig (offcut piece still attached), position the work against the jig so that the edge being cut is parallel to the blade. Adjust the fence and cut the bevel on one edge of each piece.

Next, flip the tapering jig end for end, but don't move the fence. Rotate the sides 180° and cut the second bevel in each piece. When pushing the jig and working through the saw, you want to push on the work, not the jig.

After all of the sides have been tapered and beveled, the next step is the glue-up and clamping operation. Usually, clamping any object with tapered sides poses a problem. In this case, however, the sloping sides are an advantage because you won't need an internal holding fixture for the glue-up. Begin by dry-assembling the column using tape to hold the sides together. An extra pair of hands is helpful here.

Next, measure the outside distance across two opposing sides of the column at 8-in. to 10-in. intervals along the length of the column. Using these measurements, draw the corresponding octagon on a piece of ½-in. plywood. Be sure to leave at least 2 in. of material around the outside edges for strength. Now, cut out these shapes and slide the plywood forms over the column.

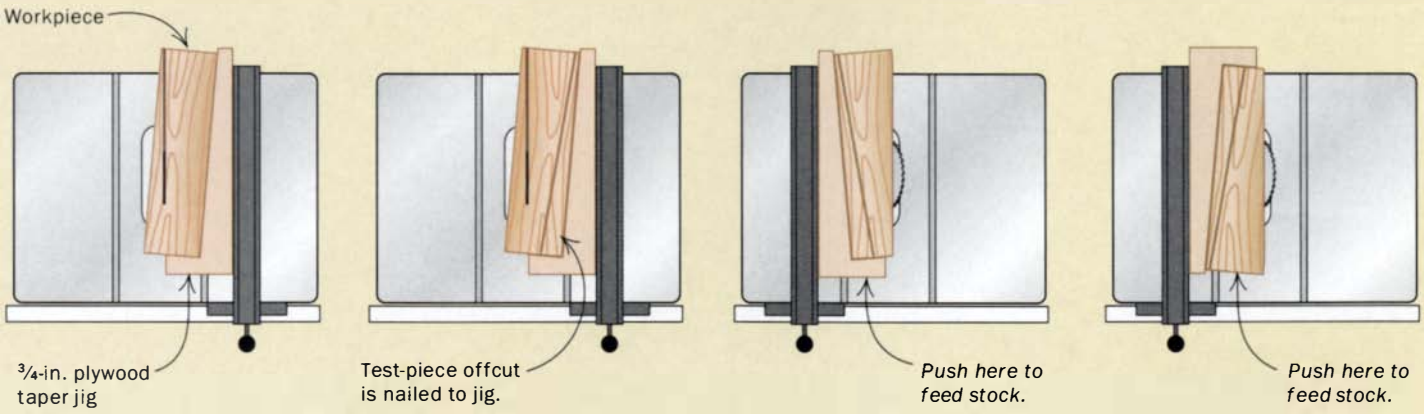
When everything fits properly, remove the plywood forms and tape. Now, apply glue to the edges and tape the sides. Slip the largest form over the column and tap it down. Be sure that the sides are properly aligned during this process. Tapping these forms down with a hammer generates a great deal of clamping pressure, and it forces the column into the correct shape. Repeat this procedure with the remaining plywood forms. For additional clamping pressure, you can place bar clamps across the ends of the column.

After the glue has dried, remove the forms and clamps. Make an appropriately sized disc and corresponding carriage end for each end of the column.

The rest of the jig is built the same as it was for cylindrical columns. The carriage will sit at a slight angle because of the taper. This may look awkward, but it won't affect the performance of the jig. Complete the routing process as described for the cylindrical columns.—*E.W.*

TAPER AND BEVEL THE SIDE PIECES

The author uses a two-step procedure on his right-tilting tablesaw to cut the side pieces for a tapered column. Separating the taper cutting from the beveling operation allows more leeway for achieving tight-fitting joints.



1. Rip one edge of all pieces. Save offcut from test piece.

2. Nail test-piece offcut to jig. Flip work over, reset fence and rip second edge on all pieces.

3. Reset fence, tilt blade and bevel one edge on all pieces.

4. Don't move fence. Flip jig end for end, rotate stock and bevel second edge.

Drawings this page: Michael Pekovich

Milk Paint

A traditional painted finish that improves with age

BY
MIKE DUNBAR

Woodworkers have used milk paint since antiquity. It remains a desirable finish today for the same reason it was favored by the ancients and every generation of woodworkers in between. Milk paint is quick, easy and forgiving. It results in a rich, lustrous and complex finish that improves with time. Still, it can be applied in an afternoon. Milk paint is not difficult to use, but it is different from regular paint. And to get the best results, you need to understand those differences.

Milk paint does not chip like regular paint, nor does it produce the boring, perfectly uniform color of modern products. Instead, it has subtle differences of shading that make it much more like the lead- and oil-based paints used in centuries past. As a piece of furniture finished in milk paint ages, worn paint becomes polished and takes on different levels of sheen. The final effect is subtle, lively and complex. Because of the way this wear plays with light, a milk-paint finish actually gets better as it ages.

Milk paint is nothing more than a mixture of lime, casein, clays and any one of a variety of earth pigments. In the past, woodworkers mixed their own milk paints using simple formulas handed down from one generation to another. Today, it is far easier to buy it from The Old Fashioned Milk Paint Co. (436 Main St., Box 222, Groton, MA 01450-0222; 978-448-6336). The manufacturer offers a palette of 16 different colors.

The paint arrives in powder form and is mixed with water. It has a distinctive smell, but it is not disagreeable. There are no fumes during use, and it can be washed down the kitchen sink when it comes time to clean up. The manufacturer warns that prolonged exposure to lime can

Photos: This page, left: Matthew Teague; all others: Michael Pekovich

A forgiving finish that wears well. *Long the finish of choice for chair maker Mike Dunbar, milk paint provides a deep, textured surface to the blanket chest at left. Eighteen years ago, the rocker (above and at right) was covered in three layers of paint, then left to age with distressed dignity. The signature colors of milk paint (see the Shaker boxes at left) take on a beautiful patina as they age.*

burn wet skin and injure eyes. In 25 years of use, I have never experienced either of these problems. I think of the finish as perfectly safe.

What makes milk paint so different from more common products is the fact that milk paint is water based. Oil- and latex-based paints are much thicker than milk paint and sit as a skin on the surface of wood. When struck or scratched, these paints will chip. Being water based, milk paint has far less body and lays on in thinner coats. Also, much of the water-based milk paint soaks into the wood, so it does not chip. In normal use, it will only wear.

Milk paint bonds well only to fresh, raw wood or to itself. I have never had good luck using milk paint over another finish. If a chair has been left unfinished for a long time so that the exposed wood has case-hardened or if areas of the chair are sealed from dirt and oil from human hands, I don't use milk paint.

On the other hand, there are a number of neat tricks available when using milk paint. New colors can be created by mixing the contents of different packages. A favorite finish among chair makers is to paint a chair with several coats of different

An easy mix. *For the blanket chest (above left), powder and water were mixed in equal amounts. But milk paint can be thinned even more to create a colored wash or wiping stain.*

Shaken, not stirred. *In a jar salvaged from the kitchen, the author mixes paint by shaking it as a bartender would mix a drink.*

Time spent now is saved later. *Prewetting the wood raises the grain. Sanding leaves a smooth surface ready to absorb paint.*

Choose fillers carefully. *Milk paint won't adhere to prefinished surfaces, but it will bond to a latex filler.*

colors—the most common sequence being Lexington green, barn red and pitch black. Over time, the wear caused by repeated use will cut through the various colors, creating a close approximation of the old paint that is so prized by antique collectors. Pitch black over barn red produces a subtle tortoiseshell appearance.

You can also vary the results by changing the amount of water you add. Thinned with one-and-a-half parts water to one part paint, it works well as a colored wash. Thin it even more, and it makes a nice, colored wiping stain. On reproduction pieces made of cherry, I frequently apply a coat of red mixed this way. Brush the mixture onto only one area at a time, let it sit a minute and wipe away the excess with an absorbent cloth.

Gearing up to paint

As I said, to make milk paint, just add water to the powder. The manufacturer recommends a one-to-one mix. I mix it in a clean, wide-mouthed jar. The wide mouth makes it easier to dip the brush. You can mix the paint with a stirring paddle driven by an electric drill, but I just shake it up like a bartender making a whiskey sour. The action of shaking will result in a paint that is frothy and full of air, like whipped cream. Let it sit for about an hour to allow the air to escape. The solids will settle slowly, so stir it before you start painting and regularly throughout the process.

If you want a smooth surface, strain the paint through an old pair of panty hose or a strainer purchased at a paint-supply store. Unstrained milk paint leaves a slightly grainy finish. It is more matte, like an exceedingly fine sand paint.

Once a packet has been opened, the powder will slowly absorb moisture from the air and lose its ability to bond with wood. Therefore, never buy large quantities, only what you need. The unused product will last a lot longer if you seal the bag carefully and store it in a dry environment.

A cheap brush is all you need. *A natural bristle brush—bought for $1 at the local hardware store—is used to apply all coats.*

Mixed milk paint also goes bad. It is a good idea to use it only on the day it is mixed. If you are not able to complete the finish in one day, you can stretch the mixed paint's working life by keeping it in the refrigerator. After two days, throw it away.

I generally prepare my project while the froth is settling out of the paint. Milk paint has almost no body and will not fill small holes the way oil or latex will. If your project has any blemishes, fill them with a latex filler, which will accept the paint.

Because milk paint is water based, it will raise the grain of the wood, making it necessary to sand between coats. To save time, raise the grain well before the first coat, using a spray water bottle, available at any hardware store. The trick is to wet the surface thoroughly but not as if you were washing a car. If the water puddles or runs, you are being too liberal.

During the wetting, any glue spills or smears that would prevent the milk paint from bonding will become visible and can be removed with a scraper or pocketknife. Allow the surface to dry completely. Then before applying the first coat of milk paint, finish-sand the wood and dust it with a clean, soft cloth.

The first coat seals, and the second coat covers

The manufacturer recommends applying the paint to a wet surface, but I skip this step because of the prewetting and sanding procedure I just outlined. In my experience, the water used to moisten the wood thins the paint so much that a third coat is

Excess paint turns to dust as it dries. *A gray Scotch-Brite nylon pad knocks off any rough spots in the second coat.*

usually required for complete coverage. So you end up doing more work in the long run.

When it comes time to paint, wear an apron to protect your clothes and put down a layer of newspaper or builder's paper to protect your workbench. Milk paint dries quickly and is difficult to remove once it dries.

Milk paint can be applied with a natural bristle brush—the cheap ones with unfinished wood handles and blond bristles. During the first coat, numerous bristles will pull loose and stick in the paint. Flick them out with your fingernail. If you miss any, don't worry; they brush away without leaving a blemish when the paint is dry.

Milk paint draws into the wood almost as quickly as it makes contact. This means that you cannot successfully draw it as you can an oil- or latex-based paint. The action is more like daubing. Do not let milk paint puddle on the wood. Brush it vigorously and work it to a thin film so that it spreads and absorbs uniformly.

Fortunately, even if the paint puddles or runs, you still won't have a blemish in most cases. When the paint dries, the thick areas become crusty. Generally, excess dried paint will brush away as a powder. At worst, you may have to break up the crust with your fingernail.

The tendency of milk paint to soak into the wood makes it difficult to cut in—the process of drawing a fine line of paint with a brush. It is not impossible to pick out areas or parts in a different color, but you do have to be careful. If possible, paint different-colored parts separately before assembly.

Milk paint dries through evaporation. This means that on large pieces, some sections will dry before you even get started on others. It's important that you allow the entire piece to dry completely. Drying time is a function of the shop's environment and will take longer on a muggy summer day than in a heated shop in the winter.

Thinned linseed oil over flat paint. *A mixture of five parts boiled linseed oil and one part paint thinner is brushed on as a final coat. Excess is wiped away with a lint-free rag.*

The first coat will look like something the cat dragged in. It will be splotchy and uneven. This is no time for a faint heart. If you are trying to achieve a very smooth surface, rub down the first coat with a maroon Scotch-Brite nylon pad. You can use 000 steel wool, but it leaves a lot of steel dust.

Rinse out your brush with running water and store it in a jar of water, so any paint left on the brush doesn't dry. Before applying the second coat, remove excess water from the brush by wiping it over the paper on your workbench.

Because the paint is no longer being absorbed so quickly, the second coat usually covers in less time than the first. This time the paint flows more like an oil- or latex-based product. You still need to spread the paint in a thin, even coat.

As with the first coat, the second coat of milk paint can send the first-time user into fits of panic. The paint dries dead flat—flatter than anything you have ever seen—and you can still see brush overlaps and areas that you touched up. Again, have courage. If you want a very smooth surface, rub the second coat with a gray Scotch-Brite nylon pad. Or rub hard and vigorously with a soft cloth.

Oil overcoat holds everything down

An oil overcoat has two purposes. First, it pulls the whole finish together and gives it a darker but deeper rich color and luster. Second, it protects the finish from spills that can cause spots on raw milk paint. I mix roughly five parts boiled linseed oil to one part paint thinner. Apply the mixture with a cheap natural bristle brush. Wet all of the painted surfaces on the piece. Overlaps and thin areas in the paint will stand out for several minutes, but they slowly blend to a uniform color. Let the oil stand for about 10 minutes. Then wipe off as much as you can with a soft, lint-free rag. Allow the oil to dry for two days before using the piece.

Some people apply a coat of wax after the oil dries, but I prefer to leave it as it is. The young finish is beautiful but has no character. Character develops with time. Use the piece as you would normally, and enjoy the increasingly subtle and complex finish. □

Mike Dunbar teaches Windsor chair making in Hampton, N.H., and is a contributing editor to Fine Woodworking.

Bowl-Turning Basics

You don't have to be a master on the lathe to turn a useful, handsome bowl

BY RICHARD RAFFAN

The beauty of a well-balanced bowl lies in subtle details. A bowl that's meant to be used should invite human touch. Making one isn't beyond the means of even a beginner, as long as he's armed with a nice piece of wood and a few design concepts. And unlike other woodworking projects that require joinery and glue-ups, you can turn a small bowl in an hour or two.

Taken in profile, the upper half of the bowl is turned with a gentle concave curve. The lower half is shaped with a reversed curve. Under typical overhead lighting, the reversed curve creates a shadow that emphasizes the bowl's form. The angle where the two concave curves intersect has a practical function, too: It provides a wide lifting surface. A shallow foot lifts the bowl, both physically and visually. And on the inside, the rim is undercut slightly, emphasizing the form and a sense of containment.

A center-screw faceplate is a quick way to fix wood to the lathe for shaping the outside profile. When the bowl is remounted by its foot and is hollowed, I use a set of step jaws, which accepts three different foot diameters. I use a ½-in. spindle gouge for shaping the profile and a deep-fluted ½-in. bowl gouge for hollowing. A ⅜-in. spindle gouge comes in handy for detailing the foot. I use scrapers to clean up tool marks and tearout. For this bowl, a pair of 1¼-in. or 1½-in. scrapers is used, one skewed for the outside curve and the other radiused for the interior. For sanding, I use handheld sandpaper and a portable drill fitted with sanding discs.

First, rough out the profile

Mount a bandsawn disc on a screw-center chuck. Set the lathe's tool rest about center height at an angle across the bottom corner

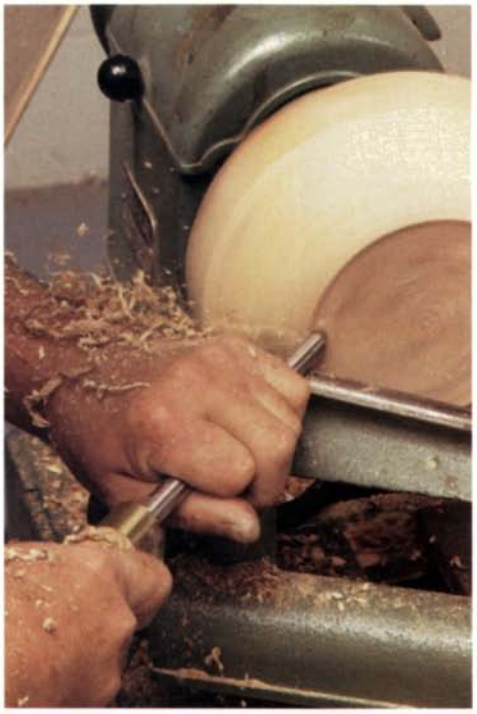
Use a firm grip and a light touch

The keys to tool control lie in using your whole body to guide the tools and not forcing them. Never force a tool's edge into the wood. Let the wood come to the tool. Ease the tool into the spinning blank and let the lathe do the work.

I prefer to keep my lower hand on a tool's handle near the ferrule. The rest of the handle gets tucked under my forearm, which makes the tool feel like an extension of my arm. My upper hand keeps the tool on the tool rest and fine-tunes the trajectory of the cut. Try to keep the handle against your side, and move with the tool so that your weight is behind it. This way, in the event of a catch, your body can absorb the impact.

A gouge should slice—not rip or scrape—wood. In most cases, the cutting edge performs best when presented at about 45° to the surface of the workpiece. To get a clean cut with a gouge, hold it horizontally, pointing in the direction of the cut, and keep the bevel against the wood. The position of the bevel is important for control because it acts as a secondary fulcrum (the primary is the tool rest) from which to pivot the edge. The moment the edge enters the wood, there should be a

The outside profile of the bowl is shaped first. *Begin by taking material off the corner. Don't worry about tool marks at this point; just rough out the shape with a ½-in. spindle gouge.*



True the edge of the base. *Have the gouge on its side with the flute facing the base. Squeeze the edge into the wood. When the ticking noise stops, you have a trued edge.*

True the rest of the base. *Rotate the gouge so that the flute faces outward, and take a light shear cut from the rim to the center.*

of the blank. Spin the blank by hand to make sure it clears the tool rest. You may be tempted to true the outside of the disc first. Don't bother. Instead, begin by removing waste at the corner just above the foot, using the ½-in. spindle gouge (see the left photo above).

Place the gouge on the tool rest and roll it over to about 45° with the bevel facing the wood and the handle dropped about 15° to 20° below horizontal. Plant your left hand firmly on the rest over the tool, using it as a fulcrum against which the tool can pivot as you start the cut. Position your fingers so that they deflect the shavings. Move the handle with your body rather than with your hand: You'll get more power and control with less effort. Once the edge is cutting, start to squeeze the tool left along the rest with your left hand. By squeezing with the left hand as the edge pivots left, you take a broad sweeping cut, and you can adjust the thickness of the shaving by rolling the tool slightly with your right hand (see the drawing on p. 70).

Spindle gouge with a fingernail grind

This is a shear cut: As the tool moves forward, it slices into the wood. You're hogging away lots of material, and the surface will develop ridges. Adjust the rest frequently to maintain a gap of ½ in. or less between it and the workpiece. Don't worry about the quality of cut at this stage. All you're doing is roughing out the profile (see cuts 1 through 7 in the drawing on p. 70).

Shape the base and foot next

For a bowl to sit properly, its base must be perfectly flat, or better yet, slightly concave. I use the ½-in. spindle gouge to rough out

smooth surface against which the bevel can rub. Any blemish on this surface will be telegraphed to the cutting edge. If you get chatter marks, you need to go back to a smooth section of the curve, usually near the base, and start again, riding through the bumps and across the dips.

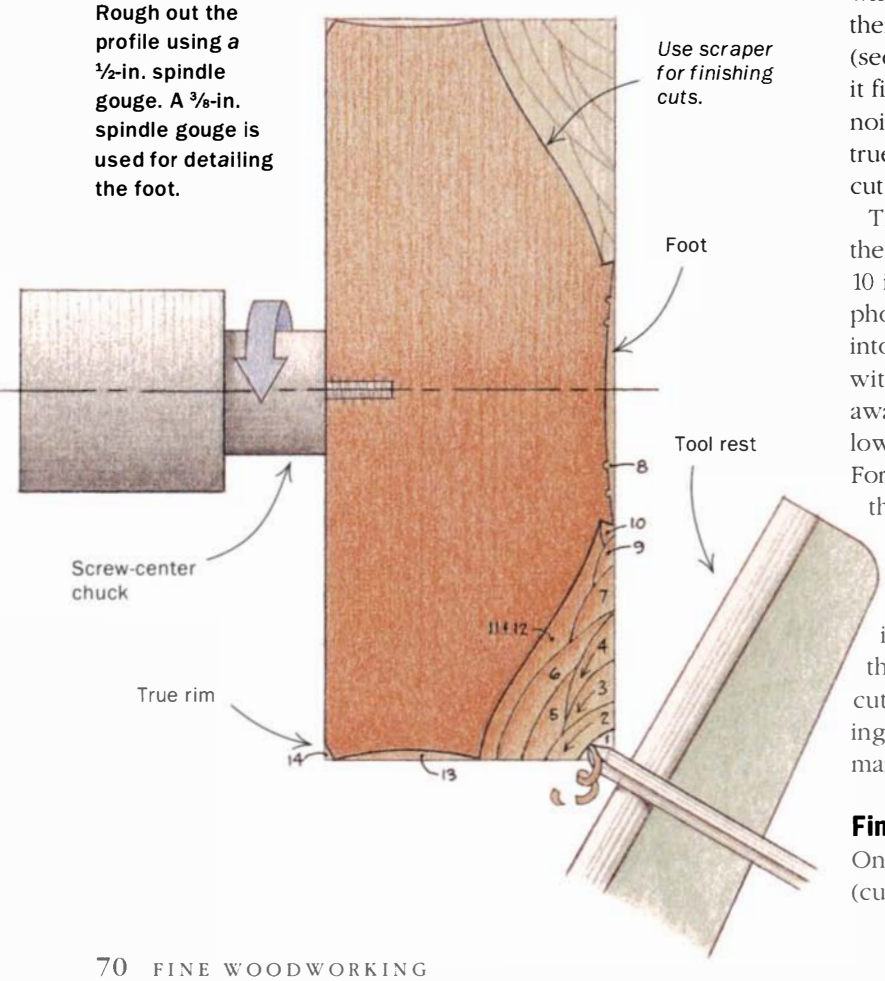
The trick to getting flowing curves using a scraper is to have the radius of the edge slightly tighter than the radius of the curve you want to cut. Only a small portion of the edge contacts the wood at one time. You're just asking for a catch if you try to cut with the entire edge of a wide scraper. Use scrapers only to stroke a surface, letting the wood come to the tool rather than forcing the edge into the wood. The angle at which a scraper is held to the tool rest also influences its performance. If you hold a scraper horizontally on the tool rest, it doesn't cut very aggressively. Many beginners think the solution is to apply more pressure. The result is usually a catch. Lift the handle up slightly and just brush the scraper against the wood.—*R.R.*

Photos: Anatole Burkin

Mark the size of the foot. *With the lathe running, lay the dividers on the tool rest and center them over the foot. Scratch a shallow groove onto the foot using only the left leg of the dividers. If you're on the money, the right leg of the dividers will line up, too. If it doesn't, make another mark. Don't let the right leg of the dividers touch the spinning workpiece.*

Clean up the corner of the foot. *With the ⅜-in. spindle gouge on its side, remove material right up to the lines left by the dividers.*

STEPS TO TURNING THE OUTSIDE OF THE BOWL



the base and foot (see cut 8 in the adjacent drawing). It's easy to remove more wood than necessary when truing the base, so here's what to do. Lay the tool on its side as you did for the roughing cuts, then gently squeeze only the tool's edge into the rim of the base (see the middle photo on p. 69). Don't push the handle away. Hold it firmly against your body while cutting. Once the tick-tick-tick noise stops, you have a trued surface. With the edge of the base trued, roll the tool 180° so that the bevel rubs the wood for a shear cut from the edge into the center (see the right photo on p. 69).

Then use a pair of dividers to transfer the chuck-jaw diameter to the workpiece (see the left photo above). Next, make cuts 9 and 10 in the drawing using the nose of a ⅜-in. gouge (see the right photo above). The fingernail grind on this tool enables you to get into corners and tight spots. Start the cut with the gouge on its side, with the bevel aligned in the direction of cut (the flute will face away from center). The handle should be dropped 35° to 45° below horizontal; use your left hand to pin the tool firmly to the rest. For maximum control, bring the edge through an arc into the wood by raising the handle and then moving the tool forward across the rest only when the handle is near horizontal. If the gouge isn't right on its side, a catch is near certain as the wood bears down on the unsupported inside edge. Go gently in cuts 9 and 10 in the drawing, gradually reducing the diameter of the foot until you reach the marked diameter.

Bowl gouge with a nonfingernail grind

Finish the profile with a few final passes

Once the foot and base are complete, finish the bowl's profile (cuts 11 and 12) with a series of shear cuts. Using the ½-in. gouge,

Drawings: Vince Babak

Finish shaping the profile. *Working from the base of the bowl to the top, take a series of shear cuts with a gouge (left). Clean up using a scraper (right).*

Hand-sand the profile. *Keep your hands on the lower half of the bowl; the motor cover makes a good arm rest.*

work from the smallest to largest diameter. The portion of the cutting edge doing the work lies 45° to the wood.

To start the cut, use the same arcing technique as you did when turning the foot. If you get chatter marks, you're pushing the tool too vigorously into the wood. If the bevel isn't rubbing, you will get ridges. You cannot start a shear cut right at the top of the foot with a ½-in. gouge because there isn't room to rest the bevel. Take a very delicate shear cut against the grain here using the long nose of the ⅜-in. gouge, or try the right corner of a square-end scraper.

Cut the upper curve in from each end to limit the possibility of unsupported grain splintering, particularly on the top edge. Again, start the cut with the ½-in. gouge on its side and bring the edge through an arc into the wood. A good shear cut will leave the surface ready for sanding (see the left photo above), but you're not always that lucky. If there are patches of slightly torn grain, try shear scraping (see the middle photo above). Sanding out torn grain can take hours.

I generally hand-sand the profile (see the right photo above). Work through the grits beginning with 100, then on to 150, 220, 360 grit and finer if you feel so inclined. With the sanding completed, stop the lathe and slop mineral oil liberally over the bowl's surface. Then hold a block of soft beeswax against the spinning wood to build up a thin layer. Last, apply a soft cloth to the spinning bowl, which melts the wax into the pores. This is a safe finish for bowls that will be used for serving food.

Scraper

Remount the bowl and hollow it

The wonderful thing about the new chucks introduced to the market in the last few years is that they allow you to remount the bowl by its

It's always best to err on the side of caution and start the lathe at a slow speed. Seemingly solid blanks of wood, which may have internal splits or voids, can explode if run too fast.

Bowls up to 10 in. dia. can be started at about 700 rpm to 800 rpm. Once the blank is trued and balanced, you can go up to a maximum of 1,200 rpm. Blanks under 7 in. dia. can safely be spun at 1,200 rpm to 1,500 rpm, even when roughing. But if you feel nervous or the blank vibrates violently, lower the speed. And always stand well clear of the line of fire when first turning on the lathe.—*R.R.*

Watch it on the web!

See a video of the author turning the inside of a bowl at www.finewoodworking.com

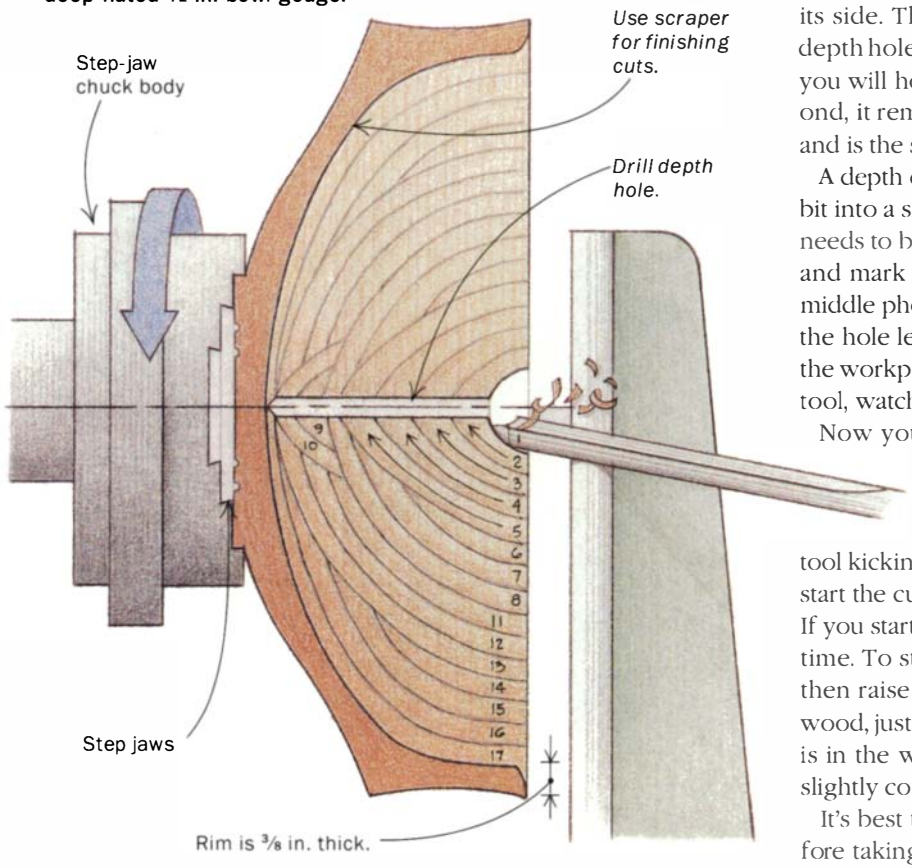
Rechuck the bowl by its foot. *A four-jawed chuck with step jaws won't mar the workpiece.*

Measure the depth of the bowl. *Leave about ½-in. thickness in the base.*

Push the drill bit into the hole left by the screw chuck. *A depth drill is simply a ¼-in. or ⅜-in. bit jammed into a shopmade handle.*

STEPS TO TURNING THE INSIDE

Hollow out the inside after remounting the bowl by its foot. Take progressively deeper cuts using a deep-fluted ½-in. bowl gouge.



foot without leaving any marks (see the left photo above). That's why it's possible to finish the outside completely before tackling the interior. I own several sets of step jaws, which will clamp around any size foot, 8 in. or less.

After remounting the bowl, true the top using a bowl gouge on its side. Then drill a depth hole in the center of the bowl. The depth hole does two things. First, it establishes the depth to which you will hollow, saving constant stops to measure as you go. Second, it removes the center of the blank, which is difficult to turn and is the source of many catches.

A depth drill can be made by inserting a ¼-in. or ⅜-in. twist drill bit into a shopmade handle. Measure the amount of the bowl that needs to be hollowed, leaving about ½ in. of material in the base, and mark the depth drill. Use your thumb as a marker (see the middle photo above). Then turn on the lathe and push the bit into the hole left by the screw-chuck center until your finger reaches the workpiece (see the right photo above). When withdrawing the tool, watch out: The metal and shavings get surprisingly hot.

Now you can get on with the hollowing using a deep-fluted ½-in. bowl gouge (see the left photo on the facing page). Usually I work from the rim toward the center (see the drawing at left). The real hazard here is the tool kicking back as you start the cut, but this is easy to avoid if you start the cut with the gouge on its side and the flute facing center. If you start with the gouge flat and the flute up, it will catch every time. To start the cut, drop the handle 30° to 40° below center, then raise the handle to bring the edge through an arc into the wood, just as you did when roughing out the profile. Once the tool is in the wood, keep the bevel rubbing and rotate the tool very slightly counterclockwise to get larger shavings.

It's best to rough-cut the bowl, then assess the situation. So before taking cut 17 (see the drawing), use calipers to measure the

Rough out the inside. *Use a deep-fluted ½-in. bowl gouge held at about 45° and work from the rim to the center.*

Smooth the interior. *Use a scraper to clean up tool marks and tearout.*

A faster way to sand. *Power-sand using flexible sanding discs in a portable drill. Sand from 100 grit to 380 grit.*

thickness of the wall and base. If you have a problem with the bowl running out of true or being off center or warping, now is the time to fix it by truing the upper curve of the profile. This bowl is designed with a flat rim. It's important that the inner and outer lips of the rim be turned on the same axis or the rim will be elliptical and look terrible.

When you come to the final shear cut (17), the bowl wall is somewhat flexible, so if you push too hard you'll have chatter marks unless you have your hand on the outside of the bowl to equalize the pressure of the tool. On the final cut with the ½-in. gouge, go as far around the curve as possible in one sweep with the bevel rubbing. Then switch to scrapers, which are easier to control, to finish the curve and bottom of the bowl. Aim for a ⅜-in.-thick rim. Slim the wall thickness slightly on either side of the profile angle.

It is possible to shear cut right to the bottom of the bowl with a gouge, but I prefer the better control of a wide scraper with a radius slightly less than the curve of the bowl (see the middle photo above). You'll find cutting a broad curve easiest using a broad-radiused scraper rather than one with a narrow, round nose. Although the scraper is 1½ in. wide, use only about ½ in. or less of the edge at a time; otherwise, a catch is likely. This is not a molding tool. Keep the tool flat on the rest and sweep the edge through a broad arc to keep the curve flowing. Cuts should be light. Don't even think of scraping up the side toward the rim: The thin wall will flex and catch, and the bowl will likely blow apart. (With practice, you *can* shear-scrape this area.) Any small ridges or chatter marks in this area can be eliminated by heavy sanding.

Sand and finish the inside

I power-sand the inside of the bowl using cloth-backed self-adhesive discs mounted in a handheld drill (see the right photo above). The power tool not only speeds up sanding, but it also helps maintain the sweep of the internal curve, especially across the bottom where hand-sanding often leaves a bump at the center. Right-angle drills are the easiest to control, but you might not be able to justify the expense for just a few bowls.

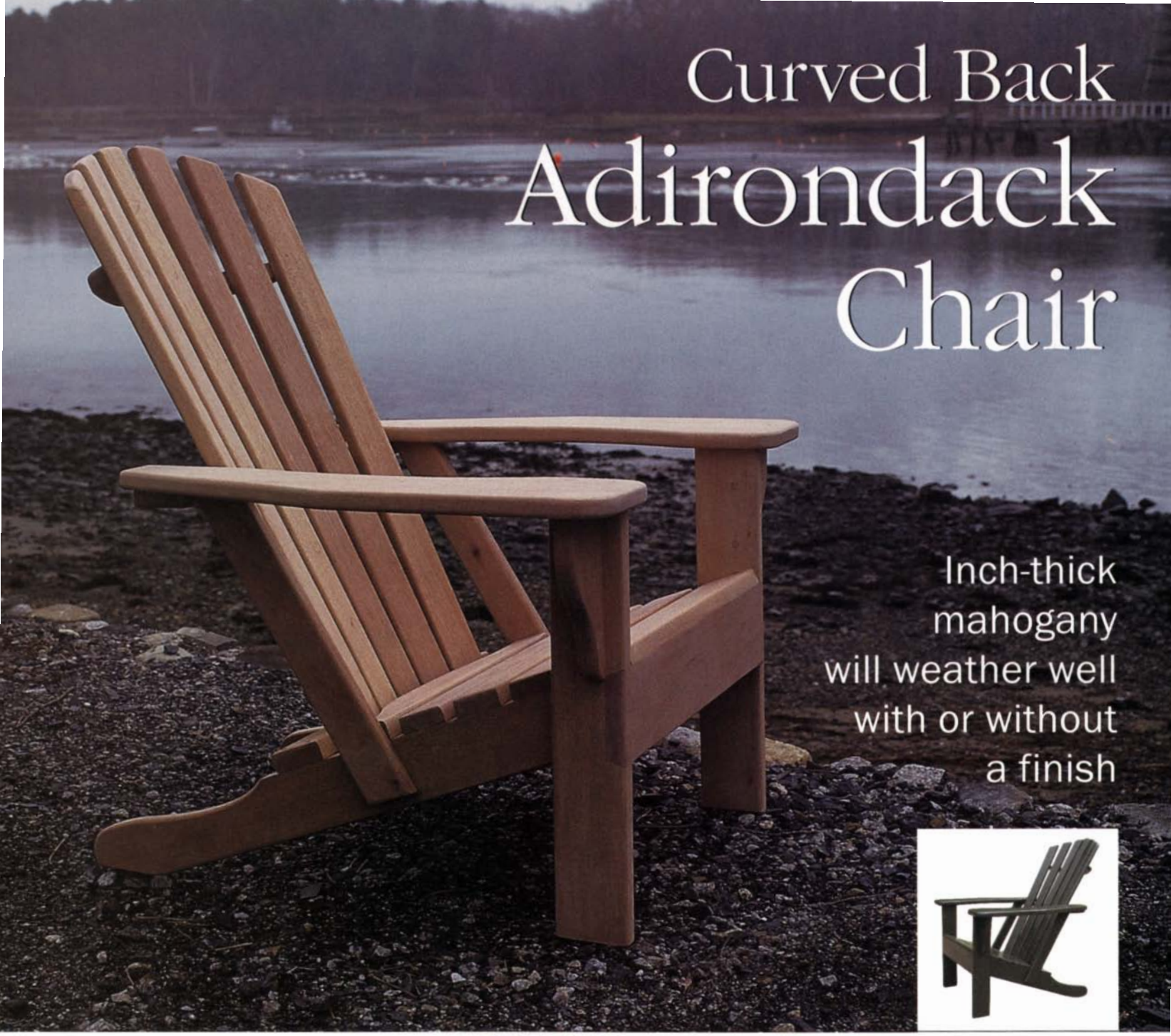
If you do hand-sand and a bump develops across the center, stop the lathe and rotate it slowly by hand, sanding across center using a soft sanding pad to back the abrasive. A piece of foam rubber or rolled-up cloth works well. This ensures that the very center gets as much attention as the rest of the inside. Finish the inside of the bowl as you did the exterior, with mineral oil and beeswax.

Apply the finish. *For a food-safe finish, apply mineral oil and beeswax to the bowl, then burnish to a sheen with a clean rag.*

Wood is a wonderful knock-about material. A bowl like this handled with care will survive us all and look better for use. Wash it using detergent and hot water. And remember that whilst the first dent or stain of daily use is is a minor disaster, a thousand make a patina. □

Richard Raffan is the author of several books and videos on turning. He lives in Malua Bay, NSW, Australia (New South Wales).

Curved Back Adirondack Chair



Inch-thick mahogany will weather well with or without a finish

BY SCOTT MASI

My grandfather, who is almost 90 and not as spry as he used to be, pointed out to me that the comfort of a chair isn't just based on how good it feels when you sit in it but also on how easy it is to get out of. A beanbag chair is a good case in point. Sitting in one might be as comfortable as being in the womb; but getting out of one is about as difficult.

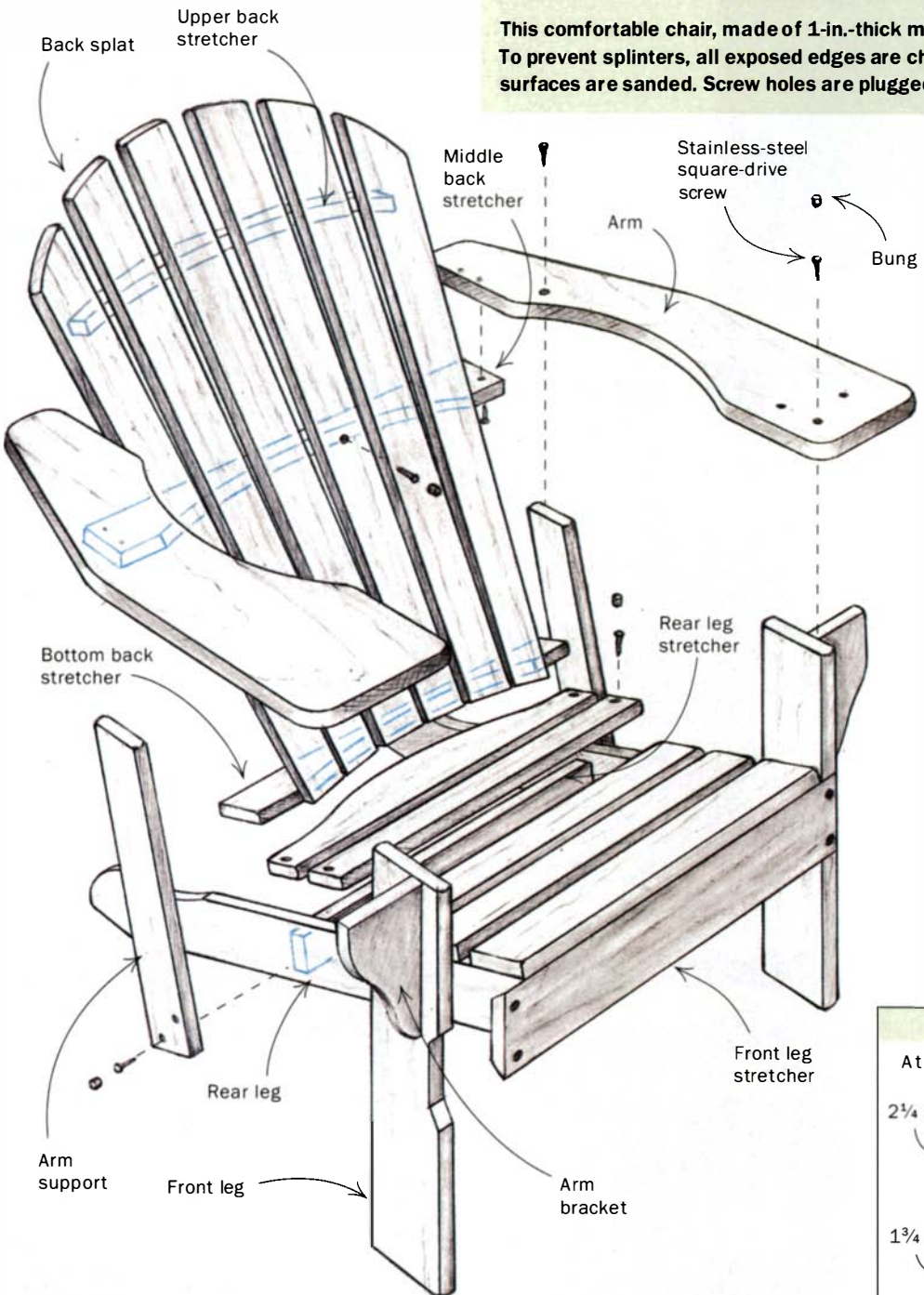
When I finished boat-building school, I sort of fell into the Adirondack-chair business by accident. The first chair was made as a wedding present. The design was adapted from an old chair my mother had bought at a yard sale. The chair was such a hit with the newlyweds that they quickly wanted a few more. Word got around that I was making the chairs, and the next thing I knew, I was in business. I'm not sure how many Adirondack chairs I've made by now, but it has to number in the thousands. I have patterns for all of the pieces and several simple jigs for the construction. After all of the pieces are cut and sanded, it takes me about 45 minutes to put a chair together.

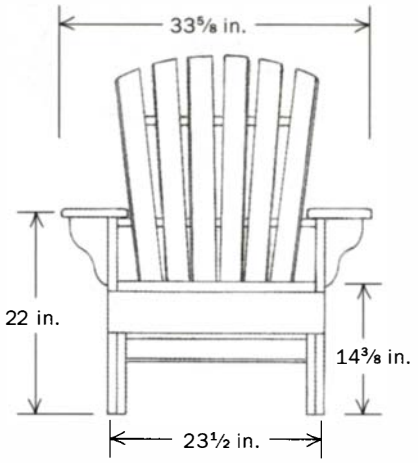
Mint-julep arms and a comfortable slope

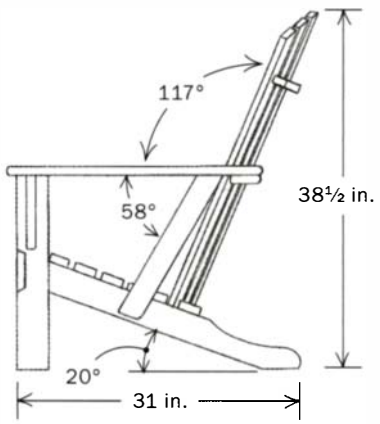
There are as many different designs for Adirondack chairs as there are mosquitoes in the Adirondack Mountains. All of the old chairs had arms wide enough to rest a drink on, and most of them had a

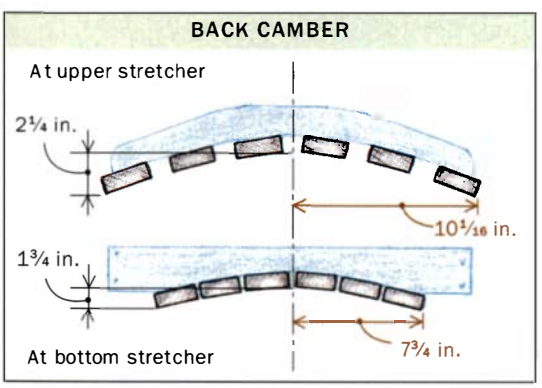
MAHOGANY ADIRONDACK CHAIR

This comfortable chair, made of 1-in.-thick mahogany, has a curved back and a flat seat. To prevent splinters, all exposed edges are chamfered with a ¼-in. roundover bit, and all surfaces are sanded. Screw holes are plugged with epoxy-coated bungs.









flat seat and a flat back. Many of the newer designs employ curves in the seat and the back.

An early prototype of my current chair was built with a deep curve to the seat. The chair looked graceful, but to get out of it my grandfather had to scootch way forward in the seat, grab the ends of the arms and hoist himself to his feet. In the process of hoisting, he pulled the chair's back legs off the ground, and when he stood up and let go of the chair, the legs crashed back to the ground.

It occurred to me that a flat seat would allow the sitter to be higher off the ground and thus would make getting out of the chair much easier. Besides, people are factory equipped with a padded seat and a bony back. The chair I now make has a gentle fanned and curved back that conforms to people's unpadded backs and a flat seat that doesn't have to conform to their padded bottoms.

Trace, cut, rout, sand

It's best to trace all of the curved pieces on this chair—legs, arms, arm brackets and back stretchers—from patterns and then cut them on a bandsaw. After roughing out, screw the curved patterns to the pieces with two drywall screws and then use a pattern-routing bit on a router table. For unpainted mahogany chairs, it's important to pay attention to what side the pattern is screwed to.

Drawings: Mark Sant'Angelo

Front stretcher is let into the front legs. *Both long edges of the stretcher are ripped with the saw tilted 20°—the same bevel at which the rear legs meet the front legs. A simple jig (right) holds the front legs at the proper spacing.*

For instance, be sure to screw the pattern to the underside of the arms so that you don't have unsightly holes in the finished surfaces. For painted chairs, where you can fill surfaces with marine putty before painting, the screw holes don't matter as much.

The importance of sanding—Imagine that you've just taken the new Stephen King novel and a tall glass of iced tea out to sit on the lawn for some summertime relaxing. You sit in your favorite Adirondack chair, and "Yeow!" you get a splinter in your factory-equipped padding. There goes the afternoon. Adirondack chairs are meant to sit outside. Whether on a covered porch or set out in the middle of a lawn, they see a lot of weather. Wetting and drying cycles can wreak havoc on wood: raising grain, raising splinters, raising the ire of those people who get the splinters.

I spend a lot of time routing a ¼-in. radius on all exposed edges and sanding the parts of my chairs before I even put them together. And then, after they are assembled, I sand them one final time. A good deal of the chairs I make get painted. If you look around at outdoor painted surfaces, you'll notice that paint usually fails at sharp edges where the paint is thinner. The corner boards of a house are a good example. On the other hand, paint on rounded surfaces is much less likely to chip.

Trust your eyes and your fingers

I want to say a few words about my assembly methods. I don't spend a lot of time making layout lines on the Adirondack chairs I build. Granted, I've built a lot of these things, but I've always trusted my eyes and my hands to guide me during assembly. For instance, rather than spending time measuring and finding centers, I'll simply hold a piece in place, judging with my hand as to whether the piece is centered before I drill a hole and screw it in place. I build the chair on a bench, and the flat surface ensures that the chair won't rock when it's all done.

It's amazing how accurate your hands are if you'll only trust them. You can feel whether a reveal is equal faster than you can by measuring it, and I'll bet my tactile tolerances are within 1/16 in., if not within 1/32 in. If I ever see anyone measuring my chairs with a micrometer instead of sitting in them and enjoying them, I'll chase them into the ocean with a stick.

Build the chair from the ground up

It may seem obvious, but I've found after making a thousand or so chairs that the way to put the things together is in three sections: first build the legs and seat; then the arms and supports; and then the back. Several simple spacing jigs facilitate assembly.

Legs and seat—Aside from the stretcher, which is let into the two front legs, all of the pieces of the chair are butted and screwed to each other. The front stretcher is cut on both edges at 20°—the same angle at which the rear legs meet the front legs—so that the first slat on the seat sits flush on the back legs and on the front stretcher. A block of wood cut to the distance between the inside dimension of the two front legs makes it easy to assemble the front stretcher. Coat the ends of the stretcher with marine epoxy before you screw it to the legs. The epoxy is incredibly strong, and as a general rule, I glue all major chair joints before fastening them with stainless-steel square-drive screws.

Once the stretcher is attached to the front legs, screw the back

Spaced out. *Spacer blocks, attached to a longer piece of wood, are used to set distances between seat slats. The curved slat (on the bench) conforms to the curve of the chair's back.*

Arm supports butt into arms and rest against middle stretcher. *The curved stretcher holds the arms apart at the proper distance. The chair's back splats will be screwed to the stretcher.*

Building the back. *A jig holds the bottom and upper back stretchers while the author screws on the back splats. He uses spacer blocks at the bottom and middle of the splats.*

legs to the front ones right behind the front stretcher and then attach the rear stretcher between the back legs. The base of the chair will now stand on its own, and it's ready for the seat slats. To help achieve consistent spacing between slats, use a length of scrap with 11/16-in.-thick spacer blocks screwed to the bottom.

Arms, brackets and supports—After the legs and seat slats have been screwed together, it's time to turn to the arms and arm brackets and supports. The backs of the arms are held apart the proper distance by a piece that doubles as a middle back stretcher. The back stretcher's front edge is bandsawn at 30°.

I coat the top end grain of the front legs with epoxy before attaching the front of the arms with 2½-in. screws. Epoxy on end grain! I can hear you laughing in your beard. Contrary to what you might believe, epoxy has amazing holding power on end grain. I once had to disassemble a finished chair, and after removing the screws into the end grain, the arms still wouldn't come off the legs. I used a lot of force pushing on the backs of the arms to break the glue bond, and when it finally broke, the wood in the arms broke but not the glue joint. So much for woodworking heresy.

Once the arms and brackets have been attached, screw the arm supports in place so that they butt against the front edge of the middle back stretcher. Then turn your attention to the curved back.

Curved back—The back has to be made as a separate section and then slid into place as one piece because the screws that hold the back splats to the bottom back stretcher are inaccessible once the seat slats are in place.

I build Adirondack chairs in lots of 10 or more at a time, so I've made a plywood rack that makes it easy to align the back splats to the curved stretchers. For one chair, you don't need to go through this trouble. For the first chair I made, I screwed the back together and then traced a fair curve across the top of the back splats. When I got a curve that pleased my eye, I unscrewed the splats from the back, cut the angles on the splats and then routed the edges.

When you have the black splats screwed to the bottom and upper stretchers, you should bung the screws that attach the splats to the bottom stretcher because, as mentioned before, the screws will be inaccessible once the back is attached to the chair. The back section should slide in over the middle stretcher that also serves to hold up the backs of the arms. Drill and screw through the back splats into the middle stretcher, and aside from finishing, the chair is done.

Finish up

After a chair has been completely screwed together, mix up another batch of marine epoxy. Coat the bungs that cover the screws, then tip the chair over and paint a thick coat of epoxy on the bottom of the four legs. Even though the chair is made of mahogany—a rot-resistant wood—some extra protection on the end grain can't hurt.

After a little final sanding, the chair is finished. The chair in the photos was left unfinished, and on Maine's coast, the chair will eventually turn gray. Some customers want their mahogany chairs painted, and I make a lot of pine chairs that also get painted. I spray on two coats of primer and two coats of finish for my chairs. What I've found works best is to use latex paint on the pine chairs and alkyd paint on the mahogany ones. □

Scott Masi makes Adirondack chairs and garden furniture in York, Maine.

Photos: Jefferson Kolle

Cabinet Saw Test

A review of 10 heavy-duty cabinet saws from Europe, North America and Taiwan

BY NIALL BARRETT
AND
LON SCHLEINING

Few tools are as central to a workshop as a tablesaw. Buying one is not a decision woodworkers take lightly, and it's no surprise that heated debates over cabinet saws take up a lot of bandwidth on Internet woodworking discussions, including *Fine Woodworking*'s own, Knots. With hundreds—if not thousands—of dollars' price difference among models, people want to know what they're getting (or not getting) for their money. That's what we wanted to find out, too.

We've used many models of tablesaws over the years, from contractor models to larger industrial machines. Like all woodworkers, we've gotten used to working in our individual ways, and there's no denying that we have our preferences. But as we prepared to spend several weeks poring over a roomful of saws, we cleared our heads and imagined ourselves in the market for a heavy-duty cabinet saw, something you trade up to when a contractor's saw just isn't enough. We made a list of the features we were looking for, which included the following:

- Plenty of power to rip through 8/4 thick hardwood without blinking
- A tough, accurate, easy-to-read rip fence
- Safety features that would help keep body parts intact
- Ease of assembly and adjustments
- Confidence that parts and service are but a phone call away
- A nice fit and finish to make us feel good about spending our hard-earned money.

Although we looked at 12 saws, we performed our most extensive tests on 10 cabinet saws: Bridgewood BW-12CS, Delta Unisaw, General 350-1, Grizzly Industrial G1023ZF, Inca 2200, Jet JTAS-10, Lobo TS-1010, Powermatic 66, Sunhill TAS-12 and Transpower/CP Tools TSC-10HK. The Delta and Powermatic are made in the United States; the General in Canada; the Inca in France (it was originally made in Switzerland); and the rest in Taiwan. (For our impressions of two European-made sliding-table saws, see the story on p. 84.)

What sets a good tablesaw apart from a lesser one can be quantified to a certain extent. Parts such as the table and arbor flange (the part the blade rests against) can be measured to see how perfectly flat they've been machined. Rip fences can be checked for

accuracy and stiffness. But subjective criteria also play an important part when choosing a tool. These factors include the overall fit and finish, whether a saw has a left- or right-tilting blade and the ergonomics of safety equipment.

We approached the 10 cabinet saws the same way a typical buyer would. We uncrated them and read the instruction manuals that came in the boxes. Then we assembled them. And finally, we cut wood. Along the way we took lots of notes and compared features. The two of us didn't always agree on what we liked best, but

About the authors

Fine Woodworking **has frequently relied on editorial staff to review large machines, mainly because the job is a time-consuming undertaking that's best done with several people in a large shop. But in this case, two of our authors, Niall Barrett**

Niall Barrett

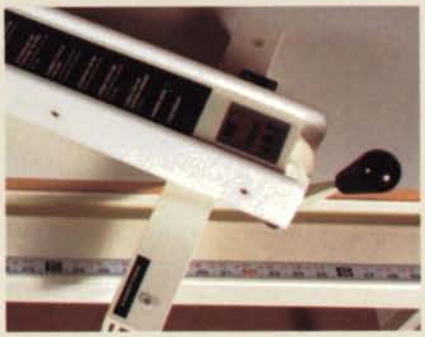
Lon Schleining

and Lon Schleining, proposed to take on the task. They made a convincing case for why they were right for the job, and we agreed. Between them, they have more than 50 years of woodworking experience. Niall is a native of Ireland and a New York furniture maker. Lon teaches woodworking and builds custom stairs in California.

What they looked at

Tabletops were checked for flatness. *Feeler gauges were used to measure any gap between the top and a straightedge placed across it at a variety of angles.*

Arbor flange was checked for runout. *A dial indicator was placed against the arbor-flange face and zeroed, then the arbor was rotated. Variations were noted.*



Fences were checked for accuracy. *A good fence is a critical component and must be rigid and easy to read.*

The saws got a once-over for safety. *On/off switches should be large and easy to reach.*

Photos: Anatole Burkin, except where noted; above and portraits at right: Michael Pekovich

we were pretty much in sync when it came down to what we found undesirable.

Assembly isn't overly complicated

Because these tools weigh about 400 lbs. each, assembly is usually a job for two people. Many of the parts are easily assembled by one person, but others, such as cast-iron table wings, are more safely handled by having a helper on hand.

Instruction manuals vary in quality, but we didn't run into any real snags. We were amused by the section of the Lobo manual devoted to the rip-fence alignment. It appeared to have been copied, photos and all, from the Jet manual, whose fence is distinctively different but has some similar adjustment mechanisms. The manuals that stand out as examples of clarity and comprehensiveness are produced by Delta, Grizzly, Inca, Jet and Powermatic. All of the machines come with motors already installed, although the buyer must supply a plug in most cases.

Tabletops were checked for flatness

We used a 30-in. straightedge and feeler gauges to check the cast-iron tops for flatness in several directions (see the top photo on p. 79). The Jet top is so flat that we couldn't even measure a discrepancy; most of the tops ranged from 0.004 in. to 0.008 in. out of flat (either dished or crowned in places), and the only two to score in the teens were the Grizzly at 0.013 in. and the Sunhill at 0.018 in. (a hair over 1/64 in.).

Although we can't really say if it makes an important difference, it's worth noting that the Powermatic tabletop has the most highly polished surface, almost a mirror grind, which makes it look like it's chrome plated. The polish is a reflection of the overall excellent fit and finish of the Powermatic.

Most of the tabletops are about 27 in. or 28 in. deep; the exceptions are the Bridgewood (29 in. deep), the Sunhill (30 in. deep) and the Inca (31 in. deep). Most of the saws come with a pair of extension wings that are about 8 in. wide; the exceptions are the Bridgewood, whose extension wings are 11 in. wide, and the Jet and Transpower, with 10-in.-wide extension wings. The Delta, as supplied, has one extension wing. Nonmetal wings are an accessory on the Inca, whose one-piece tabletop is 27⅜ in. wide.

We used a dial indicator to check the arbor-flange faces for runout (see the second photo from the top on p. 79). All of the flanges registered less than 0.001 in. of runout. That's good. A true arbor is important because it ensures the blade (assuming it, too, is flat) will not wobble and cause a sloppy cut.

We also checked whether the zero and 45° stops were adjusted correctly at the factory and if the tabletop was adjusted so that the miter slots were parallel to the blade. Again we were pleased to find that all of the saws were delivered ready to go.

Search for a ripping good fence

The most stunning differences among the saws are the quality differences in rip fences. (For more on tablesaw fences, see *FWW* #133, pp. 50-57). While you could certainly cut wood with any of the fences supplied, some of them are a source of frustration.

Among the best fences are the Biesemeyer, which is available on the Delta, and the similarly designed T-square fences on the Bridgewood, General, Inca, Jet and Powermatic. All of these fences are rigid, ride smoothly over the rails and have hairline cursors that are easy to read. (The Delta is also available with the Unifence, which we didn't test.)

The Powermatic Accu-Fence is the heaviest of the T-square fences and has a feature that shows forethought by the designers. Should you damage the facing, you can replace it by removing bolts, accessible from the underside of the fence (see the right photo below).

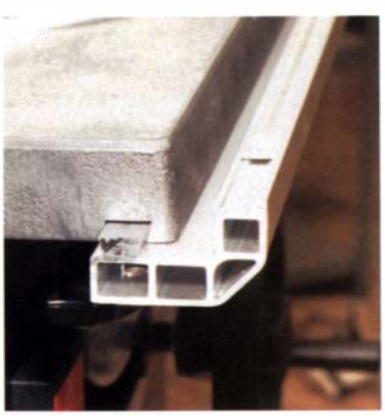
The Jet Xacta fence face is also easy to remove. Additionally, the Xacta fence's cursor has a built-in magnifier—which is a good idea—but false readings are possible if you're not standing directly over the magnifier. That's because the cursor is positioned too high off the measuring tape. The most simple fix would be to add shims be-

Bridgewood BW-12CS

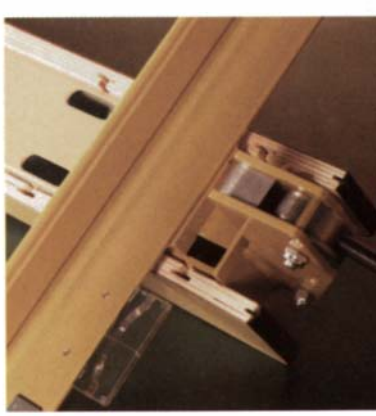
Blade size: 10 in. or 12 in.
Blade tilt: Right
Fence: General T-square (52 in.)
Price: $1,600
Warranty: One year
Contact: (800) 235-2100

Niall: Of the saws in this price range, the Bridgewood gives you a lot for the money. The saw has a large table and interchangeable arbor spindles for both 10-in. and 12-in. blades.

Lon: This is my favorite of the 12-in. cabinet saws. The fit and finish are excellent. The instruction manual, however, incorrectly described spindle changeovers, which could result in damage to the parts. We called the company, and to its credit, we were given proper instructions over the phone.



The Inca 2200 has movable fence rails. *The front and rear rails ride in dovetailed keyways. The design allows you to use the fence's full rip capacity on both sides of the blade.*



The Powermatic Accu-Fence has a removable face. *Bolts, accessible from the underside, make replacement easy.*

Delta Unisaw

Blade size: 10 in.
Blade tilt: Left or right
Fence: Biesemeyer (52 in.); Unifence also available
Price: $1,600
Warranty: Two years
Contact: (800) 438-2486

Niall: Based on the criteria we looked at, you can't go wrong here. It has an excellent fence and good fit and finish.

Lon: Although the dust port is an accessory, the machine has added features such as a two-wrench arbor and brackets and hooks for storing the miter gauge, rip fence and wrenches. The parts and service departments, however, are sometimes hard to reach on the phone.

General 350-1

Blade size: 10 in.
Blade tilt: Right
Fence: General T-square (52 in.)
Price: $1,600
Warranty: Two years
Contact: (819) 472-1161; also available from Wilke Machinery (800) 235-2100

Niall: This Canadian-made saw has a solid overall feel and good fit and finish. But the design of the dust collection needs improvement. There's no internal ramp leading to the dust port, which is a foot above the floor.

Lon: This saw comes nearly ready to go to work. I really like that the extension wings are attached at the factory and shimmed level. This is a saw you can receive in the morning and put to work by lunch.

tween the cursor and its mounting bracket, thereby lowering it.

The Inca has an ingeniously designed fence (see the left photo on the facing page). It consists of extruded-aluminum rails that slide into dovetailed keyways cast into the underside of the tabletop. That means you can work with the fence far to the left or right of the blade or anywhere in between. A sliding measuring scale makes it easy to zero the cursor no matter where the fence rails are positioned. You can remove the rails in about 30 seconds by loosening four locking knobs, a plus for anyone with a small shop or garage who needs to stow his machinery out of the way. The fence itself is similar to other T-square fences: It has a three-point clamping head and a steel box beam. Attached to the beam is an extruded-aluminum sliding section that can be positioned at three different heights as well as forward or back (much like Delta's Unifence). Although we noted some flex in the fence, it has a clamp knob at the rear that can be tightened when working with heavy stock, which alleviates the problem.

The lowest-price saw, the Transpower, has the poorest-quality fence. It rides stiffly across the rails, which are lighter than the rails used on the other T-square fences, and the aluminum extrusion used on the face of the fence can be deflected with only moderate pressure.

The Shop Fox fence on the Grizzly initially impressed us with how smoothly it tracks across the rails. But we were not happy with its performance. The Shop Fox is complicated to adjust and doesn't always lock down perfectly parallel to the blade. Because it bumps up against the mounting bracket of the splitter at the rear of the machine, rip cuts thinner than 1¾ in. are impossible unless you remove the safety equipment. Also, the stick-on measuring tape came loose in places after only two weeks.

The fences supplied with the remaining saws work okay, but they aren't quite up to the standards set by the better T-square fences found on the aforementioned machines.

Why I like left-tilting saws

On a saw with a left-tilting blade, you can make miter cuts using the rip fence on the right side of the table and never worry about trapping the workpiece or an offcut between a tilted blade and the rip fence.

On a saw with a right-tilting blade, where the fence is also placed to the right, there's a greater chance for violent kickback if the trapped stock or offcut should twist slightly and make contact with the teeth of the blade. You can move the fence to the left side of the blade to avoid this problem, but most rip fences (the Inca excepted) have limited cutting capacity to the left side of the blade. Another way is to set up a tablesaw jig that has a recess for the offcut (see *FWW* #129, pp. 62-65), but that creates more work.

If your work never calls for this kind of cut, then ignore the debate of right tilt vs. left tilt. Otherwise, you might consider left-tilt saws made by Delta, Jet and Powermatic.—*L.S.*

Safety features are worth noting

After years of using tablesaws, we're familiar with those rare but frightening moments when we wished we had an easy-to-reach off switch.

The best combination of switch style and location can be found on the Delta Unisaw (special edition model). The switch has a nice, big mushroom-shaped off button (see

Grizzly Industrial G1023ZF

Blade size: 10 in.
Blade tilt: Right
Fence: Shop Fox (24⅜ in.)
Price: $1,095
Warranty: One year
Contact: (800) 523-4777

Niall: This is a perfectly adequate saw as far as the saw itself goes. I like the large, solid metal handwheels. The miter gauge can be adjusted for a snug fit to the slot. The fence, however, needs to be reengineered.

Lon: This seemed like a lot of saw for the money until I used the fence, which didn't always lock perfectly parallel to the blade.

Inca 2200

Blade size: 12 in.
Blade tilt: Right
Fence: Inca T-square (25 in.)
Price: $2,999
Warranty: Five years on mechanicals; one year on electronics and drive belts
Contact: Garrett Wade (800-221-2942) or Injecta Machinery (888-593-2453)

Niall: I love the sliding-rail T-square fence system on this machine, which allows you to enjoy the full ripping capacity on both sides of the blade. The miter gauge that comes standard is easy to adjust accurately and is a cut above what's supplied with the other saws. The fin-type splitter moves with the blade, a better design than that found on the North American and Taiwanese saws we tested.

Lon: I really like the movable rails of the fence, too. Although the standard fence limits the cutting capacity to only 25 in., you can buy a set of longer rails ($300) if you need them. The dust-collection system is easily the best of the saws in this group. Overall, the fit and finish are excellent, except that the throat-plate opening and miter slots need to be deburred. The Inca is the most expensive saw in its class, but you do get the aforementioned extra features as well as a carbide-tipped Forrest blade and the longest warranty.

the bottom photo on p. 79), and the unit is located toward the front of the saw, where you can reach it with a knee or hip in an emergency. The General has a similar mushroom-shaped off switch, but the box is attached to the saw's cabinet, which requires a longer reach. The switches on the Grizzly, Jet and Powermatic are also close to the front rail, within easy reach.

Splitters and guards—It's amazing that most saw manufacturers still haven't designed a blade guard and splitter that is as least as functional as a good rip fence. The North American and Taiwanese saws have similarly designed systems. A piece of sheet metal serves double duty as the splitter and the framework to which are attached anti-kickback pawls and a blade guard. Do these systems work? Yes, they do, and you should keep them on your machine whenever possible. But we know that many woodworkers remove them, setting themselves up for potential injury. And why is that? The answers vary, but the most common reasons are that the guards reduce your view of the blade, and with the guards attached it is awkward or impossible to make very narrow rip cuts, dadoes or rabbets.

Splitters prevent kickback by keeping the kerf open when ripping solid stock. Splitters also prevent stock from rotating away from the rip fence. After using the European saws, we grew fond of their fin-style splitters, which move up and down along with the sawblade. We like them because they can be kept in place when cutting dadoes or rabbets using a standard blade. (You may have to remove them when using a stacked dado.)

Miter gauges—Miter gauges supplied with most cabinet saws are pretty basic affairs, and that's why there's such a huge aftermarket business in miter gauges. All of the machines have T-slot miter gauges, which allow you to back the gauge slightly off the table without it falling to the floor. The General's miter gauge stands out as the beefiest of the bunch. Grizzly's gauge has setscrews tapped into the bar to adjust its fit to the slot.

But the best miter gauge comes with the Inca. It's the same one sold as an accessory by Woodhaven (800-344-6657) of Iowa, and it has a FastTrak adjustable face attached. The miter gauge has precisely machined presets for common angles, and the extruded-aluminum FastTrak has a flip stop.

If you plan to do a lot of crosscutting on any of the other saws, we'd recommend either making a sled (see *FWW* #128, pp. 66-69) or buying an aftermarket miter gauge.

Inside the saw: power, noise, dust and more

All of the saws we tested run on 230 volts. All of the machines have plenty of power to rip planks of 8/4 hardwood with ease when using a sharp blade. These big motors are one of the main advantages of buying a cabinet saw vs. buying a contractor or benchtop model. The motor ratings vary from 12.4 amps to 15 amps, but the manufacturers list them all at 3 hp. Higher amperage doesn't necessarily mean a more powerful motor (see *FWW* #135, pp. 72-74). That's because a motor's efficiency rating and other internal dynamics determine how much of the current actually goes toward producing horsepower.

We checked the machines for noise levels (using the same blade), and there's not a lot of difference among them. When measured from about 3 ft. away, our sound meter registered about

Bottom photo, this page: Courtesy of Garrett Wade Co.

Jet JTAS-10

Blade size: 10 in.
Blade tilt: Left or right
Fence: Jet Xacta (50 in.)
Price: $1,400
Warranty: Two years
Contact: (800) 627-4538

Niall: This saw is an excellent buy at $1,400. The fit and finish are good. The tabletop and wings are slightly larger than many of the other 10-in saws.

Lon: Little refinements, such as a reinforcing bracket for the switch, show attention to details. There is really very little to criticize about this saw. I even like the new white paint scheme. The machine is priced right, you have the option of left or right tilt, and with a little tweaking, the fence's cursor can be improved.

Lobo TS-1010

Blade size: 10 in.
Blade tilt: Right
Fence: Lobo T-square (50 in.)
Price: $1,099
Warranty: One year
Contact: (800) 786-5626

Niall: This saw has a cast-iron throat plate, as is found on larger industrial machines. But overall, the fit and finish of the machine are mediocre. The miter gauge has a flimsy, thin scale that is crudely trimmed.

Lon: There are lots of sharp edges on the castings, a lack of attention to detail. The paint was chipped in places and was touched up with a different shade of white. On the other hand, the fence, a T-square style, is the best of the saws priced right around $1,000. Our saw was damaged in shipping, not necessarily the fault of the manufacturer, and when we called to get a damaged part replaced, the company said it had none in stock.

90 dB. None of the machines are particularly noisy, but don't dispense with the hearing protection just yet.

Enclosed cabinets help with dust removal—Most cabinet saws have a ramp inside the base that slopes to a dust port for hooking up to a dust collector, another advantage of a cabinet saw over an open-based contractor saw. The General, however, is the only saw without an internal ramp. Also, the General's fiberglass dust port, which is part of the motor shroud, is up so high that a foot of sawdust will accumulate inside the base. Delta is the only manufacturer to charge an extra $55 for a dust-port hookup.

The Inca has the best dust collection. Inside the cabinet a ducted shroud surrounds the lower part of the blade. A hose runs from the shroud to a 4-in. dust port in the base of the machine. Additionally, there's a smaller dust port connected atop the blade guard.

Blade changing is easier—The days of wedging a block of wood against the blade to loosen the arbor nut may not yet have

A spot check on service and parts

When you lose or break a part on a cabinet saw, you have to deal with the manufacturer to get a replacement. To replicate that scenario, we called the parts departments of the North American and Taiwanese saw manufacturers and ordered an arbor nut to replace the one our dog swallowed. We wanted to find out how long it took to get through on the phone and whether the part was in stock.

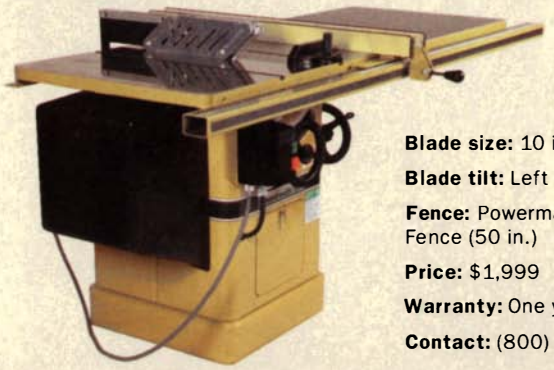
Additionally, we called all of the companies and asked a simple technical question: How do we tighten the motor drive belt?

We got an arbor nut from all manufacturers within 10 days. The fastest response came from General (via Wilke Machinery Co.), Grizzly and Sunhill, whose parts arrived in three days. We had difficulty getting through to Delta's parts department the first time we tried; either the line was busy or we were put on hold. We tried another day and got through in a few minutes. We were told the reason we had trouble getting through was that Delta gets about 1,000 calls a day. Maybe they need more clerks.

We were also able to find out how to tighten the motor drive belt. In most cases the call took only a few minutes; a few calls required patience.

When we called Delta, we were asked to leave a message, and someone called us back two hours later with the information. We could not get through to General; after many attempts, being put on hold, then being disconnected, we gave up. But when we called Wilke Machinery Co., which sells General tools along with its own Bridgewood line, we got good customer service. *—N.B. and L.S.*

Powermatic 66



Blade size: 10 in.
Blade tilt: Left
Fence: Powermatic Accu-Fence (50 in.)
Price: $1,999
Warranty: One year
Contact: (800) 238-4746

Niall: The saw just has the look and feel of an industrial-quality machine. The tilt and blade-height adjusters work effortlessly.

Lon: This is the heavyweight in the test, literally. The saw has a massive cast-iron trunnion, and the fence is bigger than anything else we looked at. The machine also comes with a high-quality SystiMatic carbide-toothed combination blade.

Sunhill TAS-12

Blade size: 10 in. or 12 in.
Blade tilt: Right
Fence: Sunhill (30 in.)
Price: $1,700
Warranty: One year
Contact: (800) 929-4321

Niall: I like the generous table size and the ability to switch the arbor spindles for either a 10-in. blade or a 12-in. blade. But for the price, I'd expect a higher-quality fence.

Lon: The extra blade capacity is a good feature, but the fence is difficult to repeatedly set parallel to the blade. This saw could use a little more attention to detail. Lots of machined edges had not been deburred, so you can cut yourself.

passed, but the end is near. Delta's arbor now has a flat machined into it for a second wrench, which makes blade changing easier. We also found this style arbor on the Bridgewood and Jet, but surprisingly the manuals didn't mention the feature, nor was a second wrench supplied. The Inca has a hole machined through the arbor spindle. By sticking a pin through a matching hole in the tabletop, the arbor can be locked in place when changing the blade.

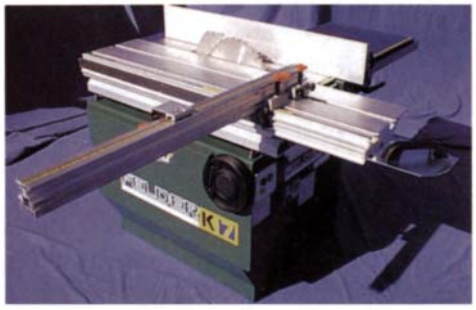
The Bridgewood comes with interchangeable arbor spindles, a ⅝-in. spindle for 10-in. blades and a 1-in. spindle for 12-in. blades. The Sunhill is sold as a 12-in. saw, but a ⅝-in. spindle will also fit. Spindle changes on these machines take only a few minutes. The Inca is a 12-in saw. (If you wish to use a 10-in blade, a machinist can open up the arbor hole on a blade.) The extra inch of cutting depth offered by a 12-in. saw can be a real plus.

Tablesaw trunnions affect accuracy, vibration—A trunnion is the structural member inside the saw to which the arbor spindle is attached. When you crank the tilt- or height-adjusting wheels, the trunnion moves, too. Adjustable locking screws stop the trunnion at 90° and 45° to the tabletop. To cut with precision and with a minimum of vibration, a saw's trunnion and interconnected components must be machined to fairly close tolerances. You can get an idea of how snug everything fits together by locking the tilt and height adjusters, then attempting to wiggle the motor. We found

Two sliding tablesaws from Europe

A sliding table is an option that can be added to most cabinet saws, but some machines have sliding tables that are integral to their design. We looked at two such saws, the Felder K7 (from Austria) and the Rojek PK 300 (from the Czech Republic), both with right-tilting blades.

A sliding table is essentially a large miter gauge, which is why these saws don't have slots for miter gauges machined into their tables. A sliding table provides a more secure platform for larger stock and a smoother cutting motion, which results in better accuracy and less strain on the operator. These saws cost a bit more, but that's because they have more features, including improved dust-collection systems.



FELDER K7

FELDER K7

This is an impeccably engineered saw. It comes close to matching the precision of a good-quality metalworking machine. Move the sliding table a few inches, and you get the feeling you've entered a new dimension in woodworking. We detected absolutely no play in the table, even though it glided effortlessly along its track.

For a busy shop or the hobbyist who demands the best, the Felder seems to be worth its $5,890 price tag. The rip fence is extremely rigid and heavy and requires a bit of muscle to move. The locking mechanism is unique: A lever is attached to a cam, which locks to the underside of the fence rail. This saw is delivered completely assembled, including the 48-in. sliding table.

The blade guard and splitter are typical of European saws and work very well. We especially like the guard; unlike the other European guards made of opaque plastic, this one is clear, giving a good view of the blade, which is 350mm (approximately 12 in.). The dust-collection system is a typical European configuration: Below the blade a shroud draws dust away to a dust port; another dust port is connected to the

Bottom photo, this page: Courtesy of Felder USA

Transpower/CP Tools TSC-10HK

Blade size: 10 in.
Blade tilt: Right
Fence: Transpower (30 in.)
Price: $825
Warranty: One year
Contact: (800) 654-7702

Niall: The lowest priced of the lot. The fence operates roughly and isn't tough enough for a 3-hp machine.

Lon: I thought this might be an okay low-budget saw until we installed the fence, which is difficult to slide along the rails. Also, the rails and extrusion on the face of the fence ought to be much stiffer to keep them from deflecting.

that the Bridgewood, Delta, General, Inca, Jet and Powermatic saws have the snuggest-fitting trunnion components.

After using all of the saws and comparing their features, we found that price does make a difference. Good fences, nice fit and finish and precision in machining cost a little extra. For a tool that you buy once and hope never to replace, it probably pays to shop for the best features, not the lowest price. □

Niall Barrett builds custom furniture at his shop in Narrowsburg, N.Y. Lon Schleining is a stairbuilder and woodworking instructor in Long Beach, Calif. John White, who maintains Fine Woodworking's *shop, also contributed to the article.*

The authors' picks

Lon: For the money, the Delta Unisaw is a first-class saw in terms of workmanship, reputation and resale value. If I were on a tight budget, I'd seriously consider the Jet. Although it doesn't have as long-lived a reputation as the Unisaw, it appears to be a well-made machine, and time may indeed show it to be a solid performer. The Inca 2200 is very tempting; I really like the way the fence system was engineered, and if I ever have to move to a smaller shop, I'd consider this saw. My absolute favorite machine, however, remains the Powermatic 66. Everything about it is a little beefier, and in my mind, the more iron, the better.

Niall: My pick for overall value in this group has to be the Jet JTAS-10. Judging from the attention paid to details on this saw, my gut feeling is that it's well made. But over the years I've become so fond of my older Inca saw that if it melted down in a fire, I would have to replace it with another. The Inca is not priced for everyone, but I've become used to its accuracy and finesse. It comes with features that are accessories for most other saws. For example, the Inca's rip fence can be repositioned as far to the left as to the right of the blade. The miter gauge has flip stops and a sliding head. After using an Inca, most stock cabinet saws feel crude by comparison.

blade guard. The saw can be ordered with many options, including a bigger sliding table and long rails for the rip fence. The machine comes with a three-year warranty (except belts) and six-year warranty on the sliding table. For more information, contact Felder USA at (800) 572-0061.

ROJEK PK 300

This is a nicely designed 3-hp, 12-in. saw. The modest sliding table is best used for finish-cutting predimensioned stock. The weight of a half-sheet of ¾-in. plywood causes the sliding table to sag slightly, making it difficult to get a true 90° edge. But if you're using smaller stock, the saw would be a good choice. (Rojek's larger saws have a reticulating arm beneath the sliding table to handle heavier loads.)

The fence is solid and locks by way of a levered screw that butts up against the rail. Reading the scale is awkward, because the reading is taken off the edge of the fence's thick, cast-iron microadjuster. The face of the fence is extruded aluminum, and it can be slid forward or backward.

The fit and finish are very good, and many provisions have been made for accurately setting up the machine. For example, the saw has leveling feet, and the tabletop itself has leveling adjusters. Belt tensioning is adjusted via a screw. There's good access to the inside of the machine, and it comes with a complete tool kit for adjusting all of the parts. The manual, however, is poorly translated, but when we called the importer, we were given good instructions over the phone. Rojek incorporates all of the very effective dust-collection and safety features we've come to expect from European saws. Imported by Tech Mark (800-787-6747), the machine, with a sliding table and extension table, costs $2,685. It has a one-year warranty on mechanicals and a six-month warranty on electronics.—*N.B. and L.S.*

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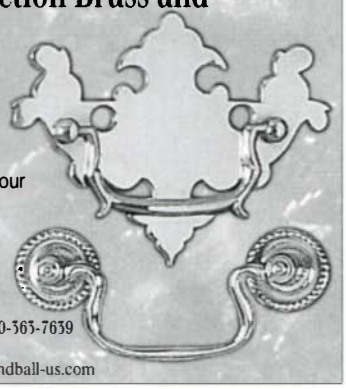

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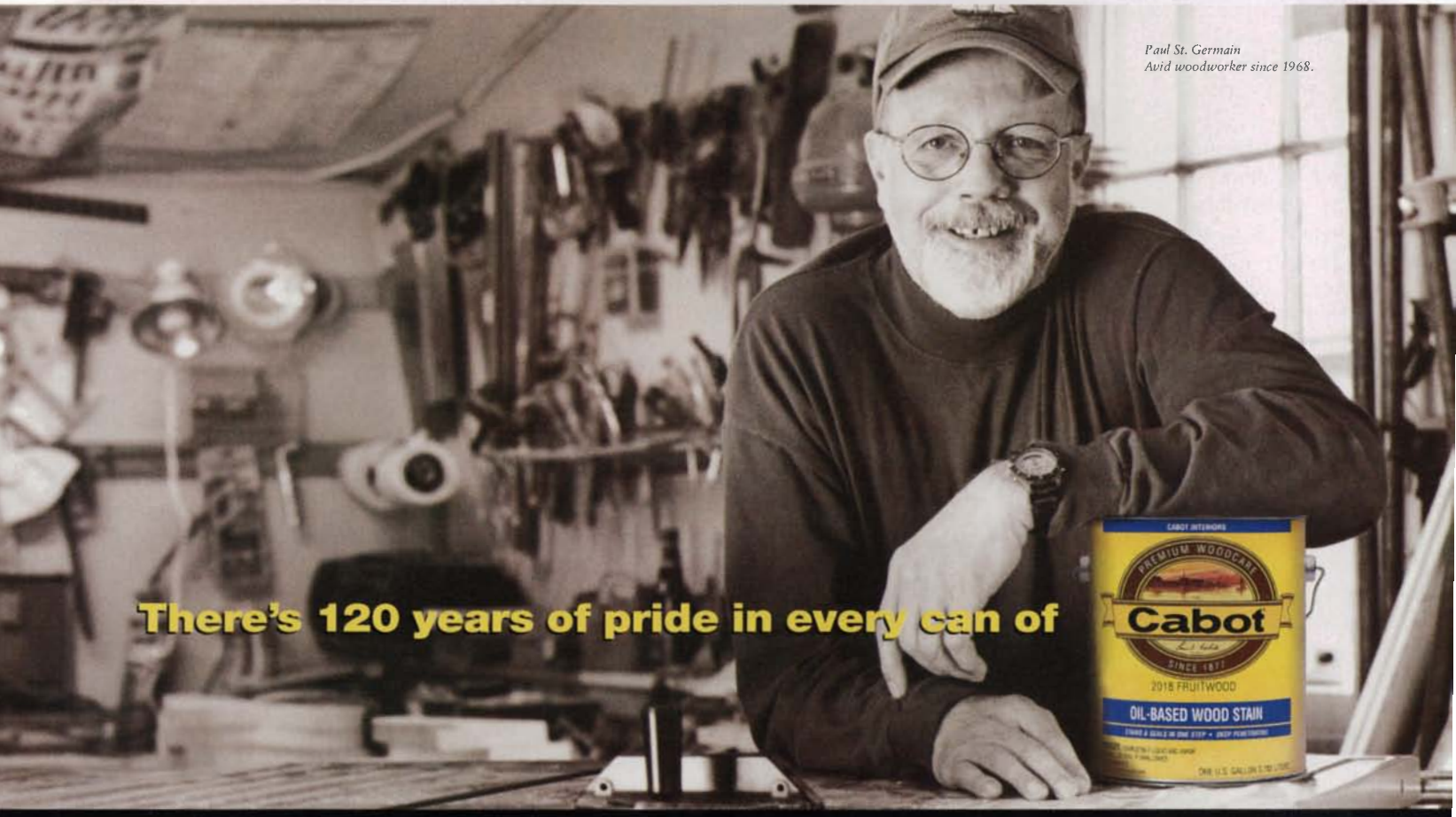

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Rules of Thumb

BY MIKE DUNBAR

Learning from antiques

As in geopolitics, woodworkers who do not know history are doomed to repeat its mistakes.

While learning to become a painter, an artist studies art history. And a musician studies the classics before trying to write symphonies. Part of learning to be an architect is studying the history of architecture. For some reason, many woodworkers approach design by jumping in feet first. Before they have learned to cut a joint, they want to create their own designs.

Not only do many woodworkers ignore furniture history, but some also actually express hostility to it. They profess a keen appreciation for the clean, straight lines of 20th-century furniture while dismissing furniture made in the past as a bunch of fussy antiques. I recall a well-known woodworker who, about a decade ago, claimed he wanted to make furniture that owed nothing to the past. None of this makes any sense to me.

How can one successfully design furniture without a working knowledge of what has been done before? Earlier woodworkers have a lot to offer us. Before the Industrial Revolution, furniture making was a career path that promised a good income, status in society and upward mobility. In other words, these were bright guys. They were not rustic bumpkins we can easily dismiss but rather highly skilled practitioners of the craft we pursue.

Few of these early craftsmen were self-taught, having served apprenticeships where they learned from their masters. Through this training they tapped into a huge body of accumulated knowledge that had been passed down from master to apprentice for centuries. Furthermore, a 17th-, 18th- or early 19th-century furniture maker lived at a time when there were more woodworkers per capita than at any other time in history. Handmade woodwork was as omnipresent as automobiles and computers are today. These craftsmen lived and breathed woodworking and in a lifetime learned more than most of us ever will.

Because theirs was an oral tradition, much of the early craftsmen's knowledge is lost to us. The only place some of it remains is in the furniture they left us. These fellows worked out designs that are timeless. Even if period furniture does not appeal to everyone, the designs still speak to a large number of people across the centuries—perhaps even to our own potential customers. Many museums acquire and display the work of these craftsmen. Collectors drive prices into the millions of dollars for period furniture pieces. There is too much here to dismiss easily as having no relevance in designing today's furniture.

The old guys obviously had some tricks to teach us. For example, they had systems of ordering and proportioning furniture that date back to the classical Greeks and that will remain useful until evolution changes the way the human brain works. Some of us might rediscover these methods but only after a great deal of trial and error that could easily be avoided by a little reading and a few trips to some museums. Seems to me a good investment in time.

Conversely, these fellows tried many things that failed. Once something had been determined a failure, stylistically or structurally, it was discarded and not passed on. Therefore, if something was not done in the past, warning bells should go off in our heads, for bad design in the past is still bad design today. While it is possible that some new approaches to design can still be discovered (especially when using modern materials), the greater risk is in creating square, hexagonal and triangular wheels. In other words, as in geopolitics, woodworkers who do not know history are doomed to repeat its mistakes.

When you study furniture history, you become aware of its broad tapestry. You also become aware that late 20th-century woodworkers have focused on just a few of its threads. We are so involved with the grain patterns in wood that we remain largely ignorant of the host of other ways that wood has been used in the past—ways that are frequently more sophisticated than simply cre-

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ating unadorned rectangles to show off the grain. Do not misunderstand: I am not demeaning the glorious figure that exists in wood. In fact, to appreciate better the use of grain, I suggest you examine the veneer work done in the Neoclassical, Classical and Restoration periods. It simply has not been equaled before or since.

It is always difficult to sort out furniture that is based on good design from that which is merely fashionable. Studying furniture history helps. Good design is timeless; fashionable is transitory. It's funny, but if you watch an old movie—something as recent as 10 years old—and look in the background, the once-fashionable furniture seems remarkably out of date. That vinyl-covered sofa with the big buttons looks like an Edsel. Fashions change, but we go right on reproducing classic period designs. While there is nothing wrong with making fashionable furniture—and many of us make a good living doing so—you should know the difference. That way, your designs result from informed and conscious decisions.

It is always difficult to sort out furniture that is based on good design from that which is merely fashionable. ... Good design is timeless; fashionable is transitory.

You do not have to go to school to study furniture history. A good way to start is by subscribing either to *The Magazine Antiques* or to *Maine Antiques Digest*. There are plenty of survey books about period furniture. A particularly good one is Wallace Nutting's *Furniture Treasury* (Macmillan, 1933). Check your local library. Of course, nothing beats the real thing. There are good antique shops everywhere. And no matter where you live, it's quite likely that the local art museum has some furniture.

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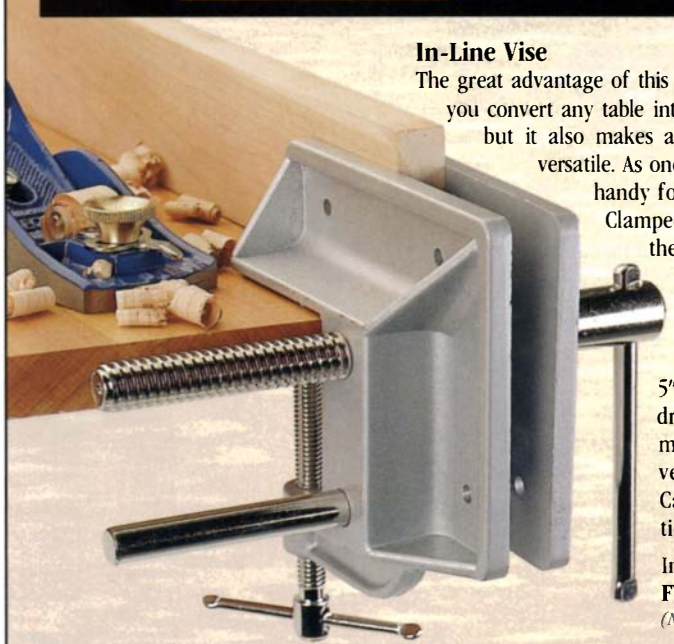

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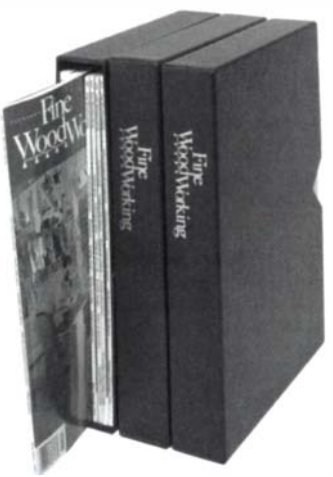

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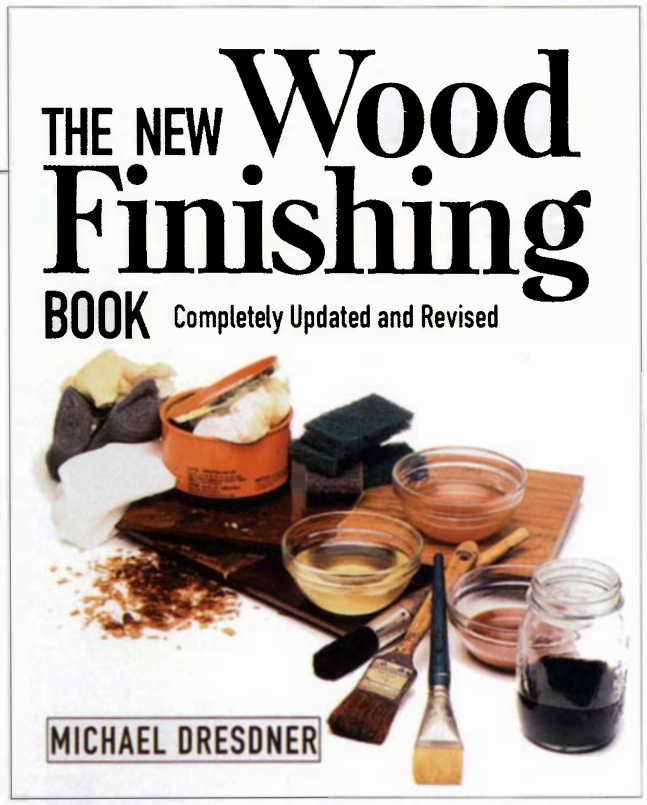

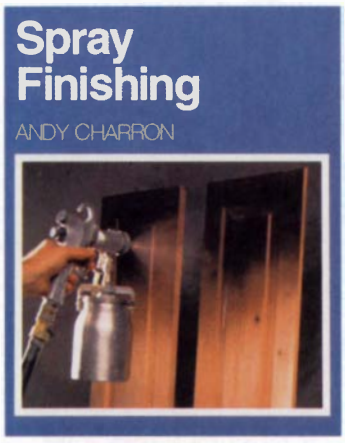

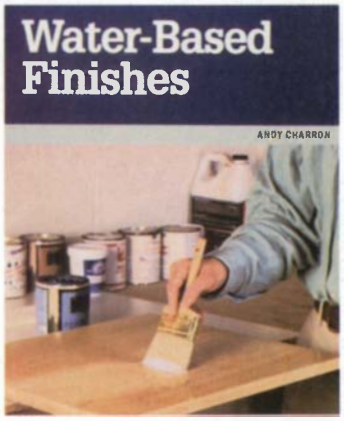

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Q & A

A beaded frame and panel

I enjoyed Garrett Hack's article on cutting beads (FWW #134, pp. 40-44). I'm making a bed and would like to add a bead to the frame-and-panel headboard and footboard. How do I cut the beads so that they match up between rail and stile? —Buz Phillips, Raleigh, N.C.

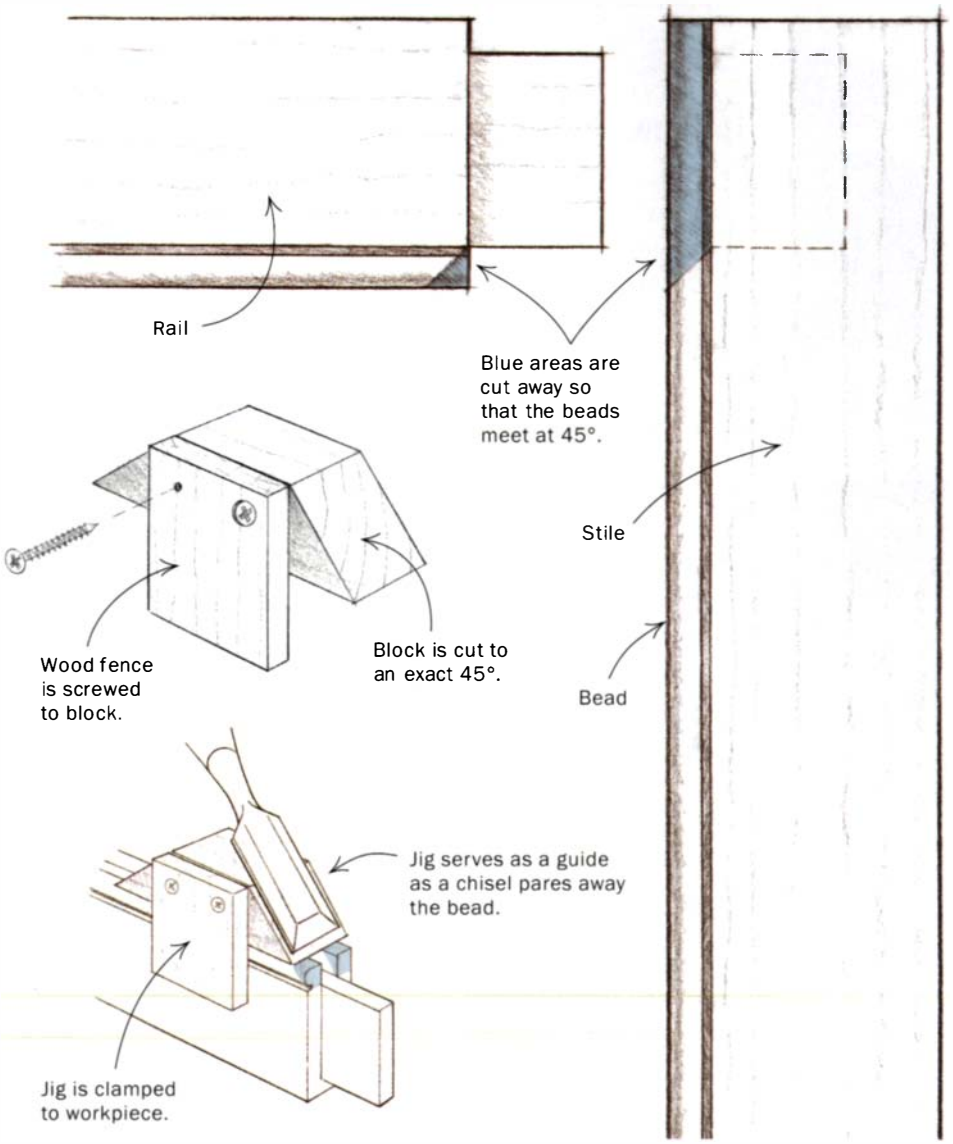
Garrett Hack replies: A bead is a fine detail to cut on the inside edges of a frame and panel. The bead eases the rail and stile, molds a transition to the panel and creates a decorative line. The problem is cutting the mortise-and-tenon joints so that the beads miter easily.

The trick is to cut away part of the stile (or the rail on some designs) to create a new shoulder line for the joint. Essentially, you cut away the entire bead to the depth of the quirk, the small groove cut parallel with the bead. For this reason it helps if the beads are all cut a consistent width. I also use a simple jig, a thick scrap block with an exact 45° miter cut on the ends and a fence along its length (see the drawings below). I clamp the jig to the edge of the stiles and rails, then use a chisel to miter the beads.

First, cut all of the beads. Let's say it's a ¼-in.-wide bead. You then have to allow an extra ½ in. in the length of the rail because both ends will be ¼ in. deeper into the stiles when you cut away the bead. Lay the rail over the stile to mark for the miter, then saw the stile to the depth of the quirk, leaving a miter mark for later reference. The rest is careful handwork (or a router jig if you're so inclined), using a chisel, coping saw or chisel plane to cut the bead away to the new shoulder line. The shoulder must be square with the face of the stile. It's easier to cut the shoulder if you have a bead cut on both faces of the door, but I rarely do. Instead, set a marking gauge to the depth of the bead (¼ in.). Marking from the inside edge of the stile, strike a line for the depth of the shoulder on the back side of the stile. Then cut the mortises and tenons, use the jig to cut the miters on both stile and rail, and trial-fit the joint. If need be, pare either miter a little to improve the fit. [Garrett Hack is a woodworker in Thetford Center, Vt.]

BEAD-MITERING JIG

A simple jig is used to remove portions of the bead, making a tight-fitting joint where rail meets stile.



Mineral spirits or turpentine?

I use a mixture of polyurethane varnish, tung oil and thinner for most of my finishing. I have always used the cheapest thinner I can find. Is there anything wrong with that? What would be the benefit of using a more expensive brand of thinner or even turpentine? Kerosene is still less expensive than mineral spirits. Would it be all right to use it as a thinner for my varnish? —Ernst Kallenbach, Gainesville, Fla.

Chris Minick replies: Oil-based varnishes are very forgiving finishes. They will tolerate just about any petroleum-based thinner, mineral spirits, paint thinner, VM&P naphtha, kerosene, turpentine and even alcohol.

However, oil-based varnishes are designed to work best when mineral spirits is used for thinning. Substituting an alternate thinner will significantly affect the drying time and application properties of a finish. For instance, kerosene evaporates about three times slower than mineral spirits and will significantly delay drying time. Kerosene also has a lower "solvent power," which affects flow out of the finish. Worse yet, the wrong thinner may even compromise the ultimate durability of the dry finish film. Turpentine often contains dissolved

Drawings: Michael Pekovich

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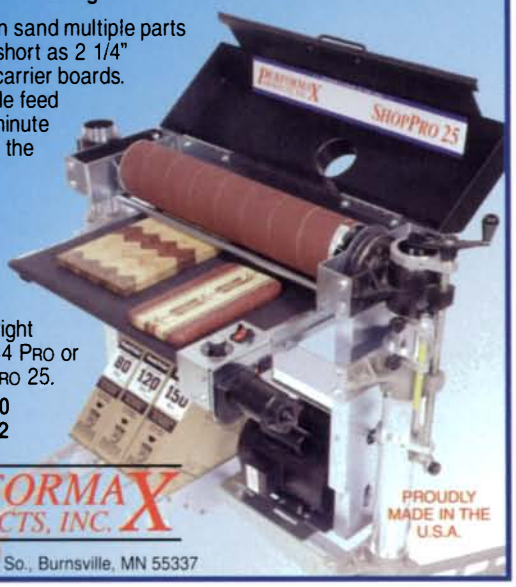

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rosin. Rosin, even in small amounts, will decrease both hardness and durability of the dry varnish film. My advice is to stick with mineral spirits. Better to pay a few dollars more for thinner than to screw up a project that took weeks to build.
[Chris Minick is a finish chemist and contributing editor to *Fine Woodworking*.]

Chair Doctor glue

I have some chairs in which the joints are starting to loosen up. I was thinking of using Chair Doctor glue to repair them, but I've never used it before. Does Chair Doctor work, and is it the best product to use for the job?

—Tyler Johnson, Austin, Texas

William Tandy Young replies: Chair Doctor was introduced in 1996 and is often confused with another product named Chair-Loc, which has been on the market for years. Chair-Loc is not an adhesive; it introduces moisture to a joint, which swells it tight, but Chair-Loc doesn't bond the joint once it has swelled. It often loosens after the moisture dissipates.

Chair Doctor was formulated both to swell and bond a loose joint. It's a water-based acrylic adhesive with a thin consistency that allows it to flow readily inside a joint and seep into hard-to-reach areas to promote better bonding. Once it dries, it's fairly soft and durable, not hard and brittle, which is good for chair joints that get flexed and stressed. Chair Doctor is also reversible with water after it dries.

I would not use Chair Doctor to repair any joint that can be taken apart. The best way to repair such a joint is to clean it and reglue it with hide glue. Also, I wouldn't use Chair Doctor to repair a loose hide-glued joint that won't come apart. Instead, inject hot water to reconstitute the dried glue inside the joint and, if possible, inject some fresh, thinned hide glue.

I would use Chair Doctor to repair a loose joint that won't come apart and that was glued with a synthetic adhesive such as polyvinyl acetate (PVA). In such a joint, the gluing surfaces inside are coated with dried glue that can't be reconstituted with water. Chair Doctor, being an acrylic, has a better chance of bonding to such surfaces than most other glues. However, the old glue may also prevent Chair Doctor from penetrating and swelling the wood, so the repaired joint may not develop maximum tightness.

A quick fix. *Chair Doctor glue injected into loose, squeaky joints first swells the wood fibers, then bonds them tightly in place.*

Photo: Michael Pekovich

My main reservation about Chair Doctor is that after it dries, the moisture it has introduced will dissipate, and the wood in the repaired joint will shrink. Whether or not the adhesive can keep the wood bonded as it shrinks is hard to say, because the product is fairly new. I haven't checked a repair that's endured two years of seasonal temperature and humidity changes, which would be a fair test of the glue's holding power.
[William Tandy Young is the author of *The Glue Book*, from The Taunton Press.]

Adjusting a jointer

I recently purchased an 8-in. jointer from a reputable company, but it seems to cut slightly convex edges. The knives are set within 0.002 in. of the outfeed table, but every time I move it, I get either snipe or a taper. I can't seem to find a happy medium. Is it uncommon to have to adjust the gib screws? I'd rather not do this and risk making the problem worse.

—Dan Hoffman, Waterford, Pa.

Kirk Fox replies: The convex edge you are currently getting is caused by one or more of the following: a sagging outfeed table, knives that aren't parallel to the outfeed table or an outfeed table adjusted higher than the cutting arc of the knives.

Even though it's a new jointer, check the knives for sharpness and proper adjustment in the head. The knives should be parallel to the outfeed table. Adjust the knives if they aren't correctly set, and replace them if they're dull.

A loose table gib will cause a table to sag, throwing the infeed and outfeed tables out of parallel and making it nearly impossible to joint a straight edge. If they aren't parallel, loosen the gib screws (found on the back side of the jointer) and retighten them, starting with the lowest screw. The tables should be snug but should slide smoothly. Be careful not to overtighten the gib screws, because this can crack the machine castings.

If the outfeed table is set higher than the cutting arc of the jointer knives, the jointed edge will be forced up onto the outfeed table, producing a convex edge. If the outfeed table is set below the cutting arc of the jointer knives, the jointed edge will become concave, with a snipe cut on the last inch of the board's

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edge. I've found that an outfeed table set around 0.006 in. below the cutting arc is the ideal setting for most jointer work; however, the tolerances required for straight edges in panel glue-ups is going to be closer to 0.003 in. below the knives.

Always drop the outfeed table below the cutting arc of the knives and then raise the table. This keeps pressure on the elevation screw, preventing the table from dropping out of adjustment when the jointer is running. With this in mind, and with the measuring aid of a dial indicator, drop the outfeed table below the knives and reraise the table approximately 0.015 in. below the cutting arc.

Remove the dial indicator and joint the edges of two boards. Then test for "straightness" by holding the edges together. The outer points of the boards' edges should touch first, with a gap visible in the center of the joint. The gap in the center of the jointed edges should be around 1/64 in. for boards 2 ft. or shorter in length and 1/16 in. for boards 10 ft. or longer. By raising the outfeed table in increments of 0.003 in. or less, an ideal spring joint with a slightly concave edge and no noticeable snipe can be attained.

Even though more than one clamp will be used when gluing short panels, one clamp, set 6 in. from one end, should be sufficient to hold two properly jointed edges together. With only a quarter turn of clamping pressure, the two outer edges should touch first, and a gap of 0.003 in. (the thickness of a piece of paper) should be visible in the center of the panel. If another quarter turn of the clamping pressure doesn't pull the center of the joint tight, readjust the outfeed table 0.001 in. higher.

Don't get discouraged. The difference of 0.001 in. can make a big difference, especially when edge-jointing short lengths of lumber. With practice and the use of a dial indicator, this difference can be visibly measured, and the outfeed table can be accurately set for a wide range of jointing applications.

[Kirk Fox runs Fox Millwork and Woodworking in Washington, Mass.]

Losing your temper

How can I tell if I've burned a blade on the grinder? How can I remedy and prevent it? —Eddie Groff, Phoenix, Ariz.

Mario Rodriguez replies: When excessive heat builds up at the grinder, it turns tool steel blue, rendering it too soft to hold an edge properly. There is no quick fix for this problem—you can't restore the proper temper by popping the tool in the oven for 30 minutes with last night's leftovers. According to Ray Larsen's *Tool Making for Woodworkers* (Cambium Press, 1996), the only true remedy is to repeat the entire heat-treating process.

High-carbon steel is the steel most often used to make woodworking tools. There are three basic steps for heat-treating high-carbon steel blades: annealing, hardening and tempering. After metal has been forged or machined, annealing softens it. This is done by heating the metal to 1,350°F (cherry red), then burying it in ashes or sand to cool slowly.

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DELTA TOOLS

Model	Description	List	Sale
31-750	NEW Bench Random Orbit Sander	Sale	199
28-150	NEW 9" Bench Band Saw	Sale	155
50-860	850 CFM Air Cleaner	Sale	239
31-695	6" Belt/9" Disc Sander	441	299
23-710	Sharpening Center	217	149
31-460	4" Belt/Disc Sander	198	119
40-560	16" 2 speed Scroll Saw	230	129
40-540	16" var/spd Scroll Saw	249	159
11-990	12" Bench Drill Press	255	184
11-090	32" Radial Bench Drill Press	405	279
43-505	1/2" Bench Router/Shaper	398	299
22-540	12" Bench Top Planer	Sale	259
22-560	12-1/2" Planer w/extraknives		329
36-865	Versa Feeder Stock Feeder		249
36-220	10" Compound Mitre Saw	294	199
36-240	10" Sliding Mitre Saw	589	439
37-070	6" v/spd Bench Jointer	351	265
14-650	Hollow Chisel Mortiser	380	249
17-900	16-1/2" Floor Drill Press	490	329
17-924	NEW Mortise Chisel Kit	Sale	65
36-285	8-1/4" Builders Saw w/stand	Sale	275
34-555	Sliding Table	487	315
36-250	10" Slide Compound Saw	825	455
31-780	Oscillating Spindle Sander	253	194
31-780K	31-780 w/ 31-781 spindle set		209
46-700	12" Wood Lathe	575	479
40-650	Q3 18" Scroll Saw	Sale	389
36-905	30" Unifence	346	259
36-906	50" Unifence	444	319
36-444	10" Contractors Table Saw	Sale	579
37-195	NEW 6" Professional Jointer	625	539
33-830	NEW 10" Radial Arm Saw	851	729
36-455	10" Contractors Table Saw w/ 30" unifence, cast iron wing, 34-914 table board, & carbide blade	Sale	849
22-675	DC380 15" Planer	Sale	1175
28-275	14" Band Saw 3/4 HP	Sale	595
28-280	14" Band Saw 1 HP motor with enclosed stand	Sale	739
28-270	14" Band Saw 1 HP w/ 50-274 mobile base, 28-855 rip fence, & 28-266 cool blocks	Sale	849
31-280	Sanding Center w/ stand	Sale	789
37-190	6" Deluxe Jointer	603	445

Single Stage Dust Collectors

50-850	1-1/2 HP, 1200 CFM	Sale	285
50-851	2 HP, 1500 CFM	Sale	489

MILWAUKEE TOOLS

6527-6	Sawzall with case	343	169
6537-226527	w/quick lok blade change	224	179
0407-2212V	Drill w/kyls chuck&2 batt	380	175
0224-1	3/8" Drill 4.5 amp magnum	236	134
0234-6	1/2" Drill 4.5A mag 0-850 rpm	255	134
0235-6	1/2" Drill w/keyless chuck	255	139
0244-1	1/2" Drill 4.5A mag 0-600 rpm	255	139
0222-1	3/8" Drill 3.5 amp 0-1000 rpm	213	125
0228-6	3/8" Drill 3.5 amp 0-1000 rpm	207	124
0375-6	3/8" close quarter Drill	255	148
0379-1	1/2" close quarter Drill	288	168
6546-6	Screwdriver 200 & 400 rpm.	150	89
6547-6	6546-6 w/bits,1/4" chuck & cs	185	109
5399	1/2" D-hdle Hammer Drill Kit	356	219
5397-6	3.8" v/ spd Hammer Drill Kit	275	145
5371-6	1/2" v/ spd Hammer Drill Kit	360	194
3107-6	1/2" v/spd right angle Drill Kit	411	239
6142	4-1/2" Grinder w/cse & acc	224	132
6490-6	10" Mitre Saw	496	269
6491	6490 w/ carbide blade & bag	594	345
6494-6	10" Compound Mitre Saw	585	319
6266-6	Top Handle Jig Saw	315	159
6496-6	10" Slide Compound Saw	1050	569

FREUD CARBIDE TIPPED SAW BLADES
5/8" Bore - Industrial Grade

Item	Description	Teeth	List	Sale
LU72M010	Gen Pur. A.T.B.10"	40	69	42
LU82M010	Cut-off 10"	60	93	32
LU84M011	Comb 10"	50	78	45
LU85R010	Super Cut-off10"	80	115	68
LM72M010	Ripping 10"	24	69	39
LU73M010	Cut off 10"	60	84	49
LU87R010	Thin Kerf 10"	24	72	48
LU88M010	Thin Kerf 10"	60	88	49
LU98R010	Ultimate 10"	80	128	68
LU91M010	Compnd Mitre 10"	60	88	54
F410	Quiet Blade 10"	40	95	54
SD308	8" Dado - Carbide		230	119
SD508	8" carbide w/case & shims		344	172
FB100	16 piece Forstner Bit Set		338	194
94-100	5 pc. Router Bit Door System		320	169
FT2000E	Plunge Router		Sale	185

HITACHI TOOLS

C8FB2	8-1/2" Slide Compound Saw	1169	449
C10FS	10" Slide Compound Saw	1627	579
C15FB	15" Mitre Saw	1346	645
NV45AB	Coil Roofing Nailer	935	379
NT32AE	NEW Pinner 5/8" - 1-1/4"	Sale	85
NT50AE	NEW Pinner 3/4" - 2"	Sale	119

MAKITA TOOLS

Model	Description	List	Sale
5090DW	3-3/8" Saw Kit 9.6 volt	280	139
DA391D	3/8 angle Drill 9.6V	166	114
DA391DW	3/8" angle Drill Kit 9.6V	341	175
6095DWE	9.6 volt Drill Kit w/2 batt	Sale	125
6095DWLE2	6095DWE w/flashlight	Sale	139
632007-4	9.6 volt Battery	47	30
632002-4	7.2 volt Battery	39	28

NEW 18 VOLT MAKITA TOOLS

6343DWAE	1/2" Drill Kit	Sale	255
5620DWA	6-1/2" Circular Saw Kit	Sale	259
DK1016	1/2" Drill & 6-1/2" Saw combo kit	Sale	389

CORDLESS DRILLS WITH 2.0 AMP HIGH CAPACITY BATTERIES

6213DWAE	12V 3/8" Drill Kit	325	169
6233DWAE	14.4V 3/8" Drill Kit	358	205
9900B	3"x21" Belt Sander w/bag	347	165
9924DB	3"x24" Belt Sander w/bag	360	175
N1900B	3-1/4" Planer with case	263	142
1912B	4-3/8" Planer	352	205
N9514B	4" Disc Grinder 4.6 amp	118	65
DA3000R	3/8" Angle Drill	355	185
2708W	8-1/4" Table Saw	637	295
6405	3/8" Drill Rev. 0-2100 rpm.	115	65
6013BR	1/2" Drill Rev. 6 amp	270	149
9401	4" x 24" Belt Sander w/bag	458	219
5007NBK	7-1/4" Circ Saw w/ case	250	125
LS1011	10" Slide Compound Saw.	995	429
LS1211	12" Slide Compound Saw	1620	695
3901	Plate Joiner Kit	376	159
3612C	3 HP Plunge Router	492	265
LS1040	10" Compound Miter Saw.	460	259
LS1013	10" Dual Compound Slide Miter Saw	1088	599
BO5010	5" Random Orbit Sander	142	69
LS1220	12" Compound Miter Saw		379
9227C	7/9" Polisher	350	195
SJ401	16" Bench Scroll Saw	300	175
2702	8-1/4" Table Saw	Sale	299
2703	10" Table Saw	Sale	319

SENCO AIR NAILERS

SFN1+	Finishing Nailer 1 - 2" w/ cs	448	299
SNS45	NEW Stapler 7/16" crown, 1" - 2"	540	365
SLP20	Pinner w/cs 5/8 -1-5/8"	422	199
SKS	Stapler 5/8 - 1-1/2"	390	279
SN70	Framing -Clip Hd 2 - 3-1/2"	725	449
SN65	Framing -Full Hd 2 - 3-1/2"	709	369
SN600	NEW Framing 2 - 3-1/2"	699	369
SFN40	Finish Nailer 1-1/4 - 2-1/2	569	359

NEW Accuset Nailers by SENCO

A100LS	Finish Stapler 1/2" - 1"	180	109
A150LS	Finish Stapler 1/2" - 1-1/2"	220	139
A125BN	Brad Nailer 5/8" - 1-1/4"	160	99
A200BN	Brad Nailer 5/8" - 2"	215	139

BOSTITCH AIR NAILERS

Model	Description	List	Sale
N80S-1	Stick Nailer	Sale	325
RN45	Coil Roof Nailer 3/4 - 1-3/4	845	359
N60FN-2K	Finishing Nailer w/ case	557	269
BT35-2K	Brad Tacker 5/8" - 1-3/8" with case, oil, & brads	279	125
MIIIFS	Flooring Stapler 15 gauge	902	539
S32SX-1K	Finish Stapler-1/2" - 1-3/8" with case & oil	269	139

JORGENSEN ADJUSTABLE HANDSCREWS

Item#	Jaw Length	Opening Capacity	List	Sale	Box of 6
#0	8"	4-1/2"	20.35	12.50	69.95
#1	10"	6"	23.30	13.50	73.95
#2	12"	8-1/2"	26.75	15.75	88.95
#3	14"	10"	33.85	19.35	109.95

PONY CLAMP FIXTURES

Model	Description	List	Sale	Lots of 12
50	3/4" Black Pipe	15.45	8.50	94.00
52	1/2" Black Pipe	12.65	6.95	79.00

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EY6100FQKW	12V 3/8" Drill kit w/ 2 Ironman batteries, 15 min. charger, & case	379	179
EY6230FQKW	NEW 15.6V Drill Kit with 2 Ironman batteries, 30 minute charger & case	425	205
EY3503FQWKW	5-3/8" 12V Wood Cutting Circular Saw Kit	500	259
EYC001	EY6100FQKW drill, EY3503FQW saw, 2 batteries, 15 minute charger, and case	Sale	299

BIESEMEYER FENCES

B-50	50" Commer. Saw	443	325
T-SQUARE 52	52" Homeshop	360	275
T-SQUARE 40	40" Homeshop	335	255
T-SQUARE 28	28" Homeshop	325	245

AIRY AIR NAILERS

Model	Description	List	Sale
0241SK	Brad Nailer 3/8" - 1-9/16"	180	98
0626SK	1/4" Crown Stapler 3/8" - 1"	194	89

Above nailers come w/case, fasteners, oil & wrenches

0241/0626
0241 Brad Nailer, 0626 Stapler, case, fasteners, oil, & wrenches
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25010	10" die cast Torpedo Level	Sale	19.95
24640	24" Level w/ hand holes	62.20	47
24670	48" Level w/ hand holes	79.70	59

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DEWALT TOOLS

Model	Description	List	Sale
DW124K	1/2" right angle Drill	590	329
DW321K	Top Handle Jigsaw Kit	300	164
DW364	7-1/4" Circ. Saw w/brake	294	155
DW610	1-1/2 HP 2 handle Router	266	149
DW411K	1/4 sheet Palm Sander w/ cse	88	58
DW682K	Biscuit Joiner with case	448	169
DW705	12" Compound Mitre Saw	734	359
DW621	2 HP Plunge Router	400	199

DW621 comes with Free DW6956 fine height adjuster !

DW675K	3-1/8" Planer with case	292	164
DW431	3 x 21 v/spd Belt Sander	338	188
DW421	5" Palm Ran. Orb Sander	144	74
DW423	Palmgrip Random Orbit Sander - variable speed	170	89

DW421 & DW423 come with Free DW4317 case !

DW272	Drywall Gun, 0-4000, 6.3 amp	160	95
DW276	Drywall Gun, 0-2500, 6.5 amp	160	95

DEWALT CORDLESS DRILLS

DW972K-2	3/8" variable speed w/ two 12V XR batteries	362	184
DW991K-2	3/8" variable speed w/ two 14.4V XR batteries	415	209
DW994KQ	1/2" variable speed w/ one 14.4V XR batteries	458	239

Above drill kits come w/ charger & steel case !

DW991KS-2	DW991K drill, DW935 trim saw, 2 XR batteries & case	Sale	345

DEWALT 18 VOLT CORDLESS TOOLS

DW933K	NEW Jigsaw Kit	468	269
DW938K	Recipro Saw Kit	520	269
DW995K-2	1/2" Drill Kit w/ 2 batt	Sale	259
DW997K	1/2" Drill/Hammer Drill Kit	454	249
DW936K	5-3/8" Saw Kit	458	249
DW995KS-2	DW995K Drill, DW936 Saw and case	Sale	385
DW995KC-2	DW995K 18V drill kit, DW938 18V recipro saw, & case		395

DEWALT BENCH TOP TOOLS

DW708	12" Slide Mitre Saw	Sale	649
DW788	20" Scroll Saw	Sale	469
DW733	12" Planer w/ extra blades	Sale	399
DW744	10" Portable Table Saw	Sale	499
DW756	6" Bench Grinder	164	75
DW758	8" Bench Grinder	184	115

DAVID WHITE INSTRUMENTS

Model	Description	List	Sale
LP6-20A	Sight Level package-20x	329	239
LP6-20XLA	LP6-20A with 9056 tripod and 7620 rod	409	269
LT8-300	Level Transit - 26x	739	539
LT8-300P	above Level with optical plum	869	629
LT6-900	Level Transit - 20x	419	299
LTP6-900	Above Level with tripod & rod	615	395
ALT6-900	Automatic Level - Transit - 18x	666	479
ALTP6-900	above Level with tripod & rod	799	549
AL8-22S	Automatic Level - 22x	583	279
ALP8-22	Above level with tripod & rod	Sale	349
AL8-26S	Automatic Level - 26x	854	325
ALP8-26	Above level with tripod & rod	Sale	389

BOSCH

Model	Description	List	Sale
1587VS	Top Handle "CLIC" Jig Saw	292	139
1587AVSC	1587VS Saw Kit with case and *New* Progressor blades	Sale	149
1584VS	Barrel "CLIC" Jig Saw	288	149
	Bosch Metal Case for above Jig Saws		24
	Bosch 30 blade assortment for Jig Saws		29.99

1584VS or 1587VS
with steel case and 30 Bosch blades Sale 175

1295DH	5" Random Orb Palm Sndr.	145	89
1274DVS	3"x21" v/spd Belt Sander.	301	175
1278VSK	1-1/2"x12" Belt Sander	218	129
1275DVS	3"x24" v/s Belt Sndr	379	219
1276DVS	4"x24" v/s Belt Sndr	408	229
1194VSRK	1/2" v/ spd Drill w/ case	303	159
1613EVS	2HP v/s Plunge Router	369	199
1634VSK	Recip Saw 10.5 amp	335	185
3315K	12V T-handle Drill Kit	345	159
3615K	14.4V Drill Kit	354	174
3107DVS	5" Random Orbit Sander	165	98
3107DVSK	3107DVS with case	195	118
3725DVS	5" Random Orbit Sander	256	145
3727DVS	6" Random Orbit Sander	266	149
3915	10" Slide Compound Saw.	1050	479
3912	NEW 12" Cmpnd Mitre Saw	638	299
11224VSR	7/8" SDS Rotary Drill	404	229
1703AEVS	5" Grinder - 8.5 amp	245	145
1347AK	4-1/2" Grinder with case	159	92
1638K	Drywall Cut-out Unit	165	105
1617	1-3/4 HP Router - 2 handle	Sale	159
1617EVS2	HP Router w/ variable speed - 2 handle	Sale	189
1618	1-3/4 HP Router - "D" handle	Sale	179
3850	NEW 18V cordless Drill Kit with 2 batteries	Super Sale	269

JDS AIRTECH AIR CLEANERS

Model	Description	List	Sale
750	12"x24"x28" 1/4 hp 200 CFM - 750 CFM	Sale	249
8-12	20"x24"x44" 1/3 hp 800 & 1200 CFM	Sale	479

RYOBI SPECIALS

RE600	3 HP Plunge Router v/spd	500	235
BE321	3" x 21" v/spd Belt Sander	310	139
	Above sander comes with sanding frame		
WDS1600	16" x 32" Drum Sander	980	569
	Above sander comes with stand		
JM80K	Plate Jointer with case	218	99

JET TOOLS

JJ60S	6" Jointer - open stand	Sale	429
JJ6CSX	6" Jointer - closed stand	Sale	489
JJ8CS	8" Jointer - closed stand	Sale	1189
JWP124P	12" Benchtop Planer	Sale	299
JWBS14OS	14" Band Saw 3/4 HP - open stand	Sale	479
JWBS14CS	14" Band Saw 1 HP - closed stand	Sale	545
JWTS10JF	10" Contractor Table Saw with 30" Jet fence 1-1/2 HP	Sale	549
JWTS10CWPF	10" Contractor Table Saw with 30" Exacta fence 1-1/2 HP	Sale	769
JTAS10X501	10" Tilting Arbor 3 HP Table Saw with 50" Exacta fence	Sale	1399
JDP17MF	16-1/2" Drill Press 3/4 HP - 16 speed	Sale	449
DC-650	Dust Collector, 1 HP, 650 CFM	319	219

PORTER CABLE

9444	Profile Sander Kit	220	99
9444VS	Var/spd Profile Sander Kit	207	119
690	1-1/2 HP Router 8 amp	278	149
6931	Plunge Router Base	139	85
693PK	690 and 6931 plus case	Sale	199
9690	690 Router with case	Sale	159
691	1-1/2 HP Router D handle	303	168
693	1-1/2 HP Plunge Router Base	338	184
697	1-1/2 HP Router/Shaper	418	235
698	Heavy Duty Shaper Table	238	135
352VS	3x21 v/s Belt Sander w/bag	321	175
9352VS	Above sander with case	Sale	189
360	3"x24" Belt Sander w/ bag	397	214
360VS	360 Sander w/ variable speed	429	229
362	4"x24" Belt Sander w/ bag	412	225
362VS	362 Sander w/ variable speed	446	239
9125	3-1/4" Planer Kit w/ case	250	145
505	1/2 sheet Pad Sander	249	139
330	Speed Block Sander 1/4 sheet	120	68
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steel is hardened—heated to 1,350°F again, then quickly quenched in soft water (low in minerals). Hardened steel is too brittle to work and must be tempered (softened slightly) to make the edge tougher and less likely to chip and fray. Done immediately after hardening, tempering also relieves any stress in the steel caused by hardening. For most blades, tempering can be performed with a propane torch. Heat is carefully and slowly directed about ¾ in. from the cutting edge. There is a gradual color change in the blade, from a faint straw (400°F)—a good temper for fine tools such as small carving chisels—all the way to a full blue (590°F)—a good temper for heavy tools such as adzes and axes. When the desired temperature is reached, the tool is quickly quenched again in soft water to complete the job. Remember, this process works only on tools made of high-carbon steel. It will not work on tools made of other steels, such as turning tools made of high-speed steel.

Heat-treating can be tricky. The best solution is to use the right tools and techniques so that you avoid burning blades in the first place. The most critical piece of equipment is the grinder. I use a 10-in.-dia., slow-speed (1,725-rpm) grinder. Cheaper, conventional grinders operate at 3,450 rpm, a speed more suitable for shaving down bolt heads than for sharpening woodworking tools. By reducing the speed of the grinder, I immediately reduce the odds of burning my tools by half. At a slower speed, I also have more control over the process.

The next important factor is the coarseness of the abrasive wheel. I find that a 60-grit aluminum-oxide wheel cuts slowly enough to give me plenty of control yet fast enough to keep me from falling asleep. The abrasive wheel must also be regularly dressed and cleaned with a star or diamond-tipped (wheel) dresser. With frequent use, the surface of the abrasive wheel becomes clogged with steel particles that reduce the cutting capability of the wheel and promote heat buildup, leading to a loss of temper.

To keep the blade cool during grinding, I frequently immerse the blade in cold water. Rapid agitation helps ensure that every bit of heat has been taken out of it. Final honing removes any coarse scratches left on the blade.

If you still manage to burn a tool, don't worry. Rather than grinding down past the damaged steel, Tom Lie-Nielsen recommends simply using the blade as it is. By upsetting the temper, the optimum working characteristics of the steel have been disturbed. The blade still cuts, just not as well. The worst scenario is that you'll make frequent trips to the grinder. Eventually, you work past the damaged metal. As you do, a gradual improvement in the performance of the tool is evident. [Mario Rodriguez is a contributing editor to *Fine Woodworking*.]

Do you have a question you'd like us to consider for the column? Send it to Q&A, Fine Woodworking, P.O. Box 5506, Newtown, CT 06470-5506 or e-mail it to fwqa@taunton.com.

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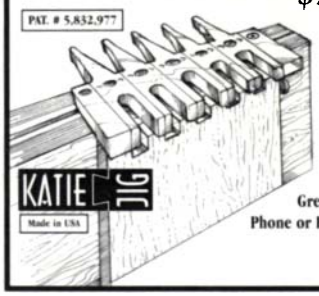

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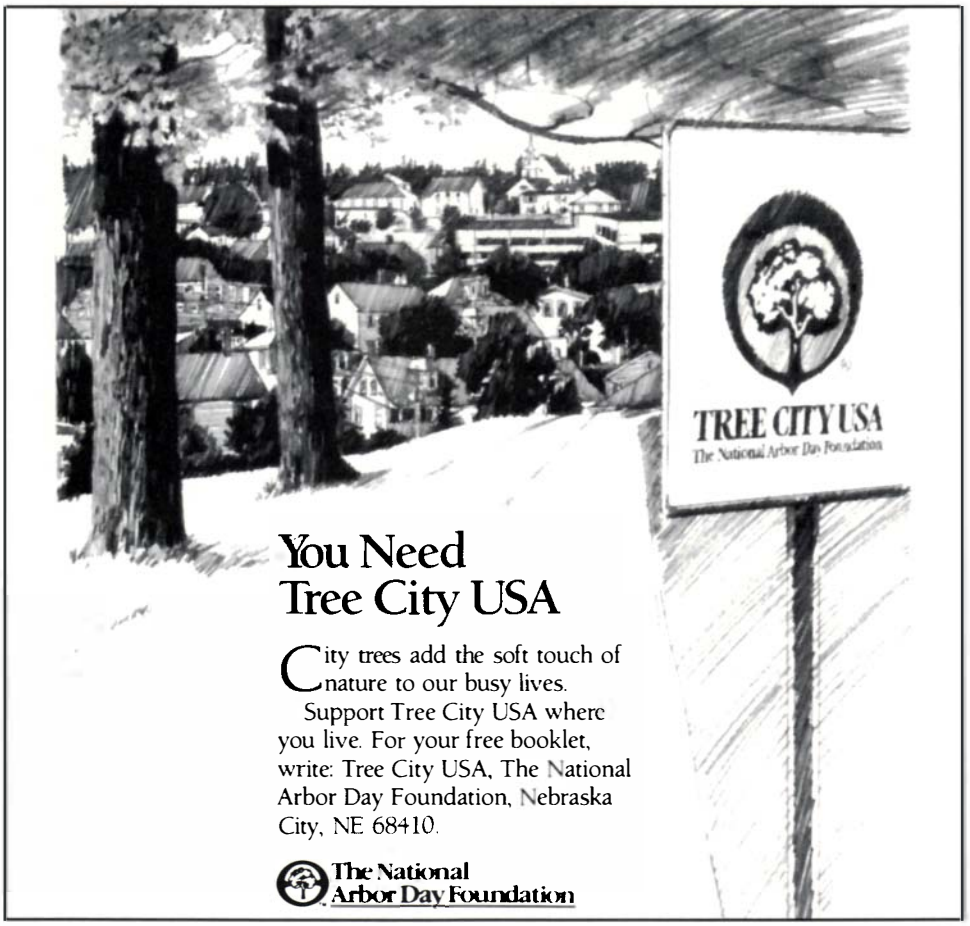

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Master Class

Unfurling a classic linenfold carving

BY GRAHAM BLACKBURN

There is a special thrill to be enjoyed on producing your first linenfold from a solid piece of wood. The variety of patterns ranges from simple parchment folds to multilayered linenfolds. Edge treatments range as well, from a barely implied outline to a virtuoso display of overlapping and undercutting. Although this ancient means of decorating a panel can take many forms, linenfold does not have to be inordinately complicated.

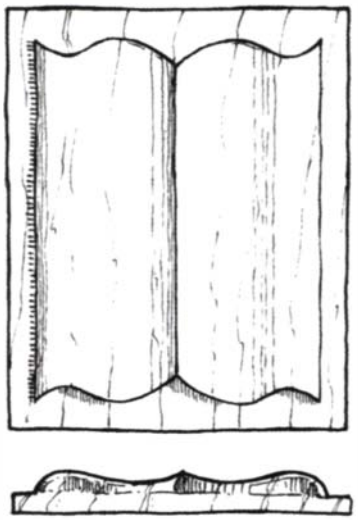
It is appropriate to start by making a parchment fold, because this is where the linenfold phenomenon began. Gothic joiners exploring the frame-and-panel system saw that a panel, necessarily thin at the edges to fit into the frame grooves, was strengthened if they thickened its center. Their panels often had a thick central rib, and someone had the idea of stylizing such a panel into something resembling an open book and, later, the folds of a hanging curtain.

Most medieval work was done with oak and walnut, in which crisp edges can be easily formed. Greater detail is possible with more finely grained wood (such as maple, boxwood or lime). But depending on the pattern, linenfold can work perfectly well in almost any species from apple to zircote.

The procedures are essentially the same for all panels no matter how complicated. The tools absolutely required are few and, apart perhaps from a wooden round plane (which has a convex blade and sole), they

Watch it on the web!
See the author carve a linenfold at www.finewoodworking.com

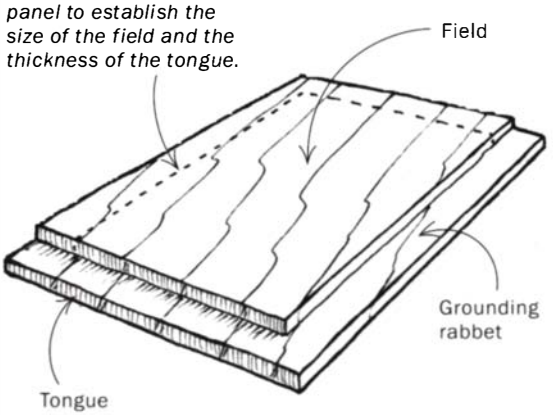
A BASIC PARCHMENT-FOLD PANEL



Gothic joiners developed the linenfold carving as a means of decorating the panels of doors, cabinets and wainscoting. The parchment fold, the simplest form of linenfold, is generally cut in light relief. Its top and bottom edges are cut straight down to the grounding rabbet, or slightly undercut.

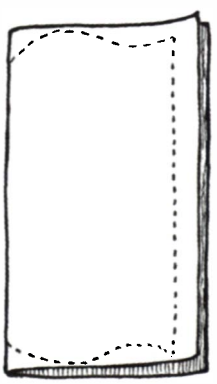
1. ESTABLISH THE FIELD

Rabbet four sides of a panel to establish the size of the field and the thickness of the tongue.

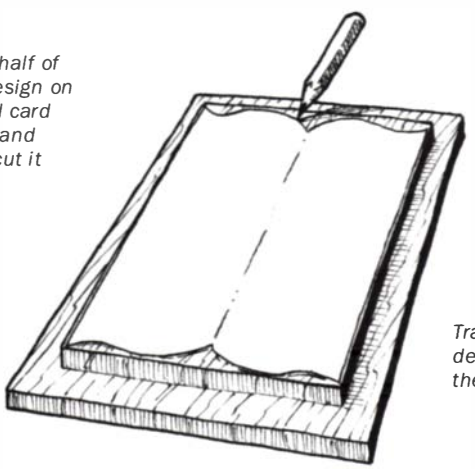


Delightful rabbets. *A tablesaw or router will make fine rabbets, but cutting them by hand is half the fun.*

2. LAY OUT THE PATTERN



Draw half of the design on folded card stock and then cut it out.



Trace the design on the field.

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are basic to every woodworker. Although I explain the process as a hand-tool operation, machines would work as well, and there is no reason not to use whatever method and tool armory you enjoy best.

Start the parchment fold by making a rabbet around the face of the panel. This will both define the field—the portion of the panel that will be carved—and create a tongue to fit in the groove of the surrounding frame. The carving will look best if it's a comfortable distance from the edge of the frame, so make the rabbet amply wide. By rabbeting only on the carved face of the panel, I locate the tongue at the back and create a panel whose carved face will be proud of the surrounding frame. Flush and recessed panels may be achieved, of course, by altering the placement of the tongue.

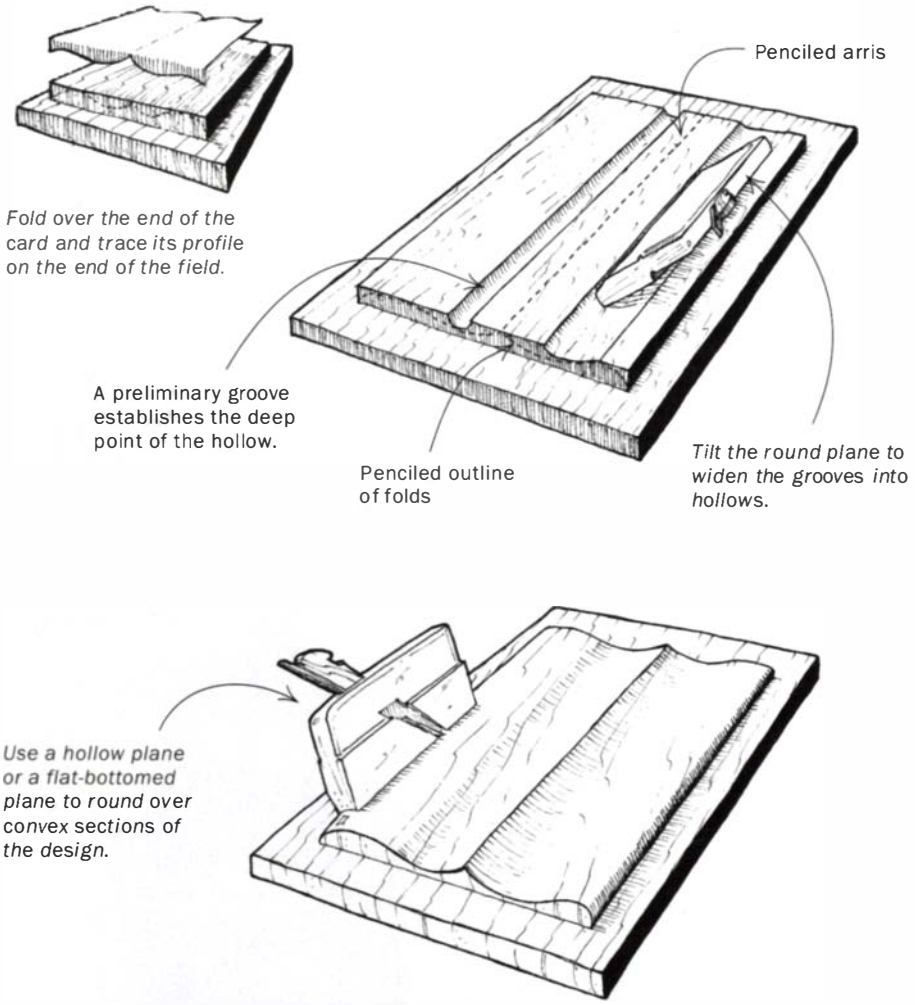
With the field established, cut a piece of card or paper to the size of the field. Fold the card in half and draw half the design, centering the design on the fold. Then cut out the pattern. Unfold the card, and you have a perfectly balanced design. Place it flat on the face of the field and trace the pattern. Now fold back the end of the card and trace the pattern on the end grain of the field—this will guide the depth of your planing.

Parchment folds are generally carved in relatively light relief; there is very little wood to remove. The concave sections are scooped out first, and then the convex areas are rounded over. Begin by cutting grooves at the deepest parts of the design. The grooves can be cut with a router, on the tablesaw or by hand with a plow plane. The method is unimportant; their function is merely to guide the round plane as it is used to turn them into smooth hollows. With experience, you will be able to dispense with the grooves and guide the round plane by hand quite accurately along a pencil line.

It is ideal to have a selection of hollow planes and round planes ranging from ¼ in. to 2 in. wide, but a single round plane can be made to form a flute several times its own width by tilting it to one side or the other as you push it forward. To form the arris at the center rib, approach the line from either side in turn, tilting the round plane so that it cuts more sideways than downward. To adjust and smooth the overall concave profile, skew the tool as you work.

For very tight convex curves, a narrow hollow plane (one with a concave sole and blade) is useful. But to round over the larger

3. SHAPE THE FIELD



4. CARVE THE ENDS

Retrace your steps. *After shaping the top surface of the panel, retrace the template (above) and then chop the ends to shape (right).*

Photos: Strother Purdy; drawings: Author

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folds, any straight plane, such as a small block plane or shoulder plane, can be used. Although an appropriately sized hollow plane will make quick work of round sections, beware of using one that is narrower than the required round section because the corners of the iron will dig in and make nasty scores. Any hollow plane larger than the required round section, on the other hand, will present no difficulties.

Because most of the template's outline will now have been removed, replace the card template and retrace it. Use straight and curved chisels to chop and pare away material to the curving end line. When you've cut all the way down to the level of the rabbet, the panel is complete.

For more complicated linenfold patterns, the procedure for forming the hollows and rounds is the same as for the parchment fold. If you work designs with tight folds, a backsaw can be used to cut a groove at a slant, which can be enlarged, if necessary, with a file or a scratch stock made for the purpose. As with all linenfolds, remember that perfect arrises and perfectly formed profiles are not necessary: You are imitating cloth, after all.

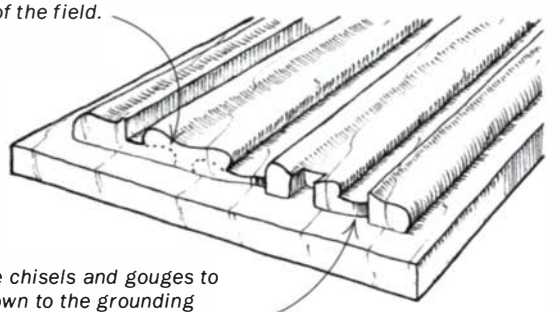
A major difference between parchment fold and linenfold is in the treatment of the end. The first step is to draw the outline of all the various overlapping folds on the top undulating surface. Continue the grounding rabbet up to the outermost outline, cutting straight down almost to the ground level—but not quite, because the outline will be slightly undercut to give the folds a more realistic appearance.

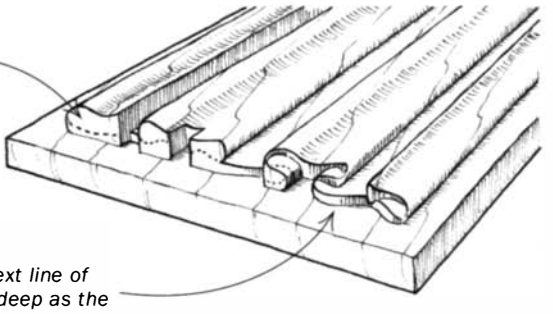
Now draw the different heights of the various fold overlaps on the newly defined vertical end. Once again, cut in from this end, but only down to the level of the marked overlaps rather than at the level of the ground. When the various levels of the folds have been carved out using appropriately sized gouges, undercut the vertical sections slightly, starting a little below the top surface of each section so as to suggest the thickness of linen that has been folded over itself.

Depending on the pattern, you may have to draw the various outlines several times, because each operation necessarily removes parts of the line. If you cut the same pattern repeatedly, you may eventually be able to dispense with the lines altogether, working like a sculptor who envisions the form within the carving block and removes the waste around it.

BEYOND THE BASIC LINENFOLD

The multilayered linenfold developed from the simple parchment fold. Despite being more complex, the linenfold is made using the same basic procedures.





A lot of back and forth. *Carving the ends of a multilayered linenfold requires repeatedly redrawing the contours of the design on the top and ends when the old pencil lines have been chopped away.*

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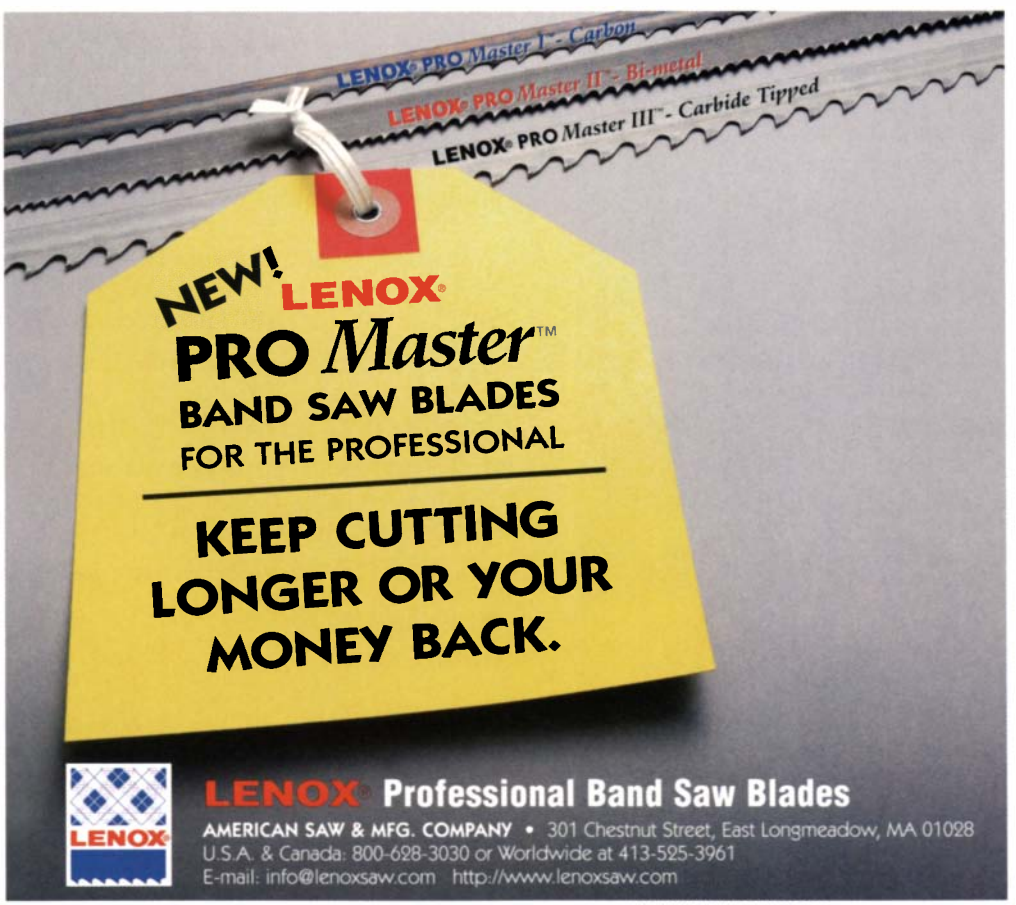

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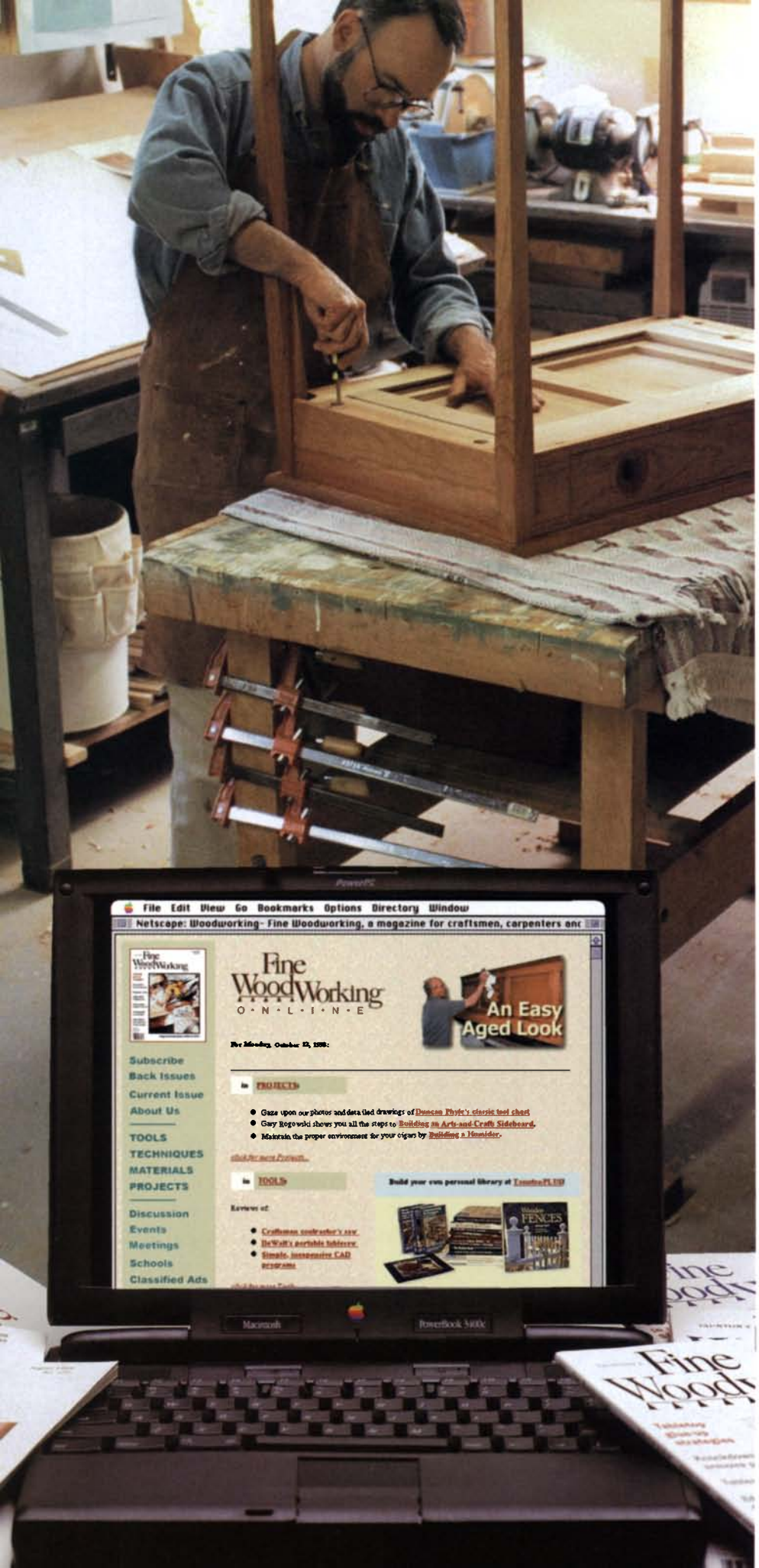

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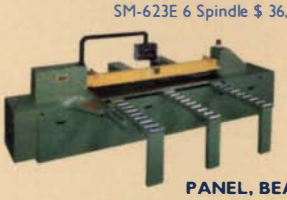

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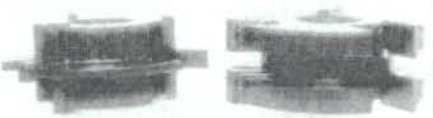

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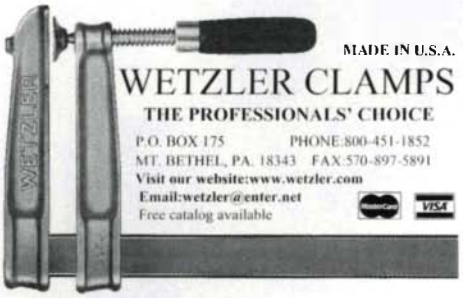

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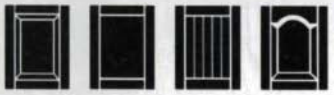

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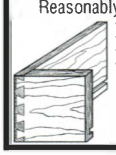

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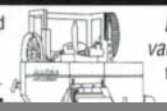

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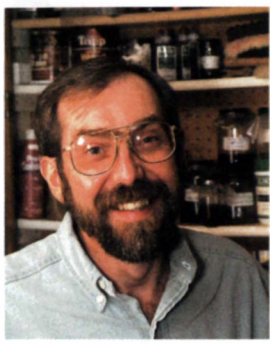
BY CHRIS MINICK

Hazardous chemicals in the workshop



Finishing stinks. That's right. The stuff we use to finish our fine projects smells bad. Worse yet, large quantities of finish fumes can be harmful to your health. But just because you can smell it does not mean it will harm you. There's no need to stop finishing or to don a space suit. A good fan, the proper respirator and a little knowledge about chemicals will keep you and your family safe.

It is relatively easy to judge the safety hazards associated with normal woodworking activities like cutting, drilling or milling. You can see the hazards and take steps to eliminate them. The hazards associated with finishes or other chemicals in the shop are harder to see. Most woodworkers know to wear gloves when working with stains and finishes, but many lack the training necessary to make accurate safety judgments when it comes to chemical fumes in the shop.

Where to find the warnings

The Occupational Safety and Health Administration (OSHA) recognized this problem and now requires all manufacturers of finishing materials to provide a Material Safety Data Sheet (MSDS) for each product. The MSDS gives all of the information necessary to use the product safely: the hazardous chemicals contained in the product, protective equipment required (glove type, respirator type, etc.), known health hazards associated with the product, first-aid procedures for overexposure and emergency telephone numbers. Additional information about fire hazards, spill or leak cleanup, compatibility data (materials that shouldn't be mixed with the product) and waste-disposal procedures are also included. MSDS information packets are supplied only if requested to purchasers of retail products, such as the finishes you buy in your local hardware store.

Unfortunately, there is no established format for organizing the information in an MSDS, so reading and interpreting one can be a confusing ordeal. OSHA has prepared guidelines that are supposed to make interpreting MSDS information easier; a copy can be obtained from your local OSHA office (see also "Reading a manufacturer's safety sheet" on p. 63 of *FWW* #80). I've compiled a quick-reference chart (see p. 118) for my shop that lists the vital information for the finishes and chemicals that I keep on hand. The information in the chart was gleaned from manufacturers, OSHA and the National Institute for Occupational Safety and Health (NIOSH). This list is fairly complete, but if I come across a chemical that is not on it, I can often find MSDS information about the chemical on the Internet (a few sites are listed on p. 118).

What's in the chart

The first two columns contain the chemical name and the finish it's found in. The next three columns, PEL, STEL and odor threshold, relate to the safety of the chemical, based on OSHA standards.

PEL (permissible exposure limit) is the amount of the substance—expressed in parts per million (ppm)—in the air that a normal, healthy adult can be exposed to in an average workday, without adverse health effects. Generally, the smaller the PEL, the more toxic is the substance.

STEL (short-term exposure limit) is the concentration of the substance (in ppm) that you can be exposed to for 15 minutes without adverse effects. In plain English, how much material is that? It varies for each substance, and it also depends on the size of your shop. For VM&P naphtha in my shop (20 ft. by 22 ft. by 8 ft.), a STEL of 400 ppm would be about 6½ oz. of naphtha evaporated into the air. That doesn't sound like much, but it's more than I use to thin a quart of varnish for spraying.

Odor threshold is the lowest concentration of vapors at which most people can smell the chemical. Odor-threshold values are very useful in the shop. Most of the chemicals that woodworkers are exposed to have very good warning properties: You can smell them long before they pose a serious health risk, but there are exceptions. Two common shop chemicals, methylene chloride (found in paint strippers) and methyl alcohol (a major component of some non-grain-raising stains), have extremely poor warning properties. You are already well past the safe limit by the time you smell these chemicals. Put on a protective mask and ventilate the shop *before* opening the bottle.

Knowing the **evaporation rate** and the **vapor pressure** comes in handy for selecting a thinner solvent for a finish. The evaporation-rate column lists the information usually found in an MSDS, and it represents the rate at which a substance will vaporize when compared to a known standard, such as that of butyl acetate (buac). When I spray varnish, I want a fast thinner, so I choose VM&P naphtha (1.6). But for brushing varnish, I want a slower thinner, so mineral

Photos: William Duckworth

SOME SHOP CHEMICALS AT A GLANCE

MSDS SITES ON THE INTERNET

www.ilpi.com—Interactive Learning Paradigms, Inc.
www.msc.cornell.edu/helpful_data/msds.html—Cornell University
www.ehs.ohio-state.edu/htmls/MSDS.html—Ohio State University
www.sherwinwilliams.com—Sherwin Williams Co.
www.ppgaf.com—Pittsburgh Paints Co.

Material	Found in	PEL/TWA (ppm)	STEL (ppm)	Odor threshold (ppm)	Evaporation rate (buac = 1)	Vapor pressure (mm/Hg)
Water	Waterborne finish	UNK[1]	UNK	UNK	0.82	23.7
Ethyl alcohol	Shellac solvent	1,000	1,000	84	1.6	44
Acetone	Wood putty	500	750	62	14.47	186
Isopropyl alcohol	Premixed shellac	400	500	19	1.44	32.8
Ethyl acetate	Lacquer thinner	400	400	32	4.5	13
VM&P naphtha	Varnish	300	400	NA[2]	1.6	15
Odorless mineral spirits	Oil-based paint	300	375	NA	0.17	1.2
Methyl ethyl ketone	Lacquer thinner	200	300	17	5.7	77.5
Methyl alcohol	NGR[3] stain	200	250	690	5.9	96
Butyl acetate	Lacquer thinner	150	200	0.68	1	8.4
Isobutyl acetate	NC[4] lacquer	150	150	1.9	1.4	15
Mineral spirits	Paint thinner	100	500	30	0.12	3.1
Ethyl benzene	Fast-dry varnish	100	152	0.6	UNK	10
Dipropyleneglycol methyl ether	Waterborne finish	100	150	4.4	0.01	0.1
Toluene	Lacquer thinner	100	150	11	1.8	28
Xylene	Fast-dry varnish	100	150	40	0.74	8.8
N-methyl-2-pyrrolidone	Waterborne finish	100	100	UNK	0.06	0.5
Lacquer thinner	Lacquer thinner	50	150	NA	NA	33
Methyl amyl ketone	NC lacquer	50	100	0.19	0.4	2.14
Styrene	Auto-body putty	50	100	0.15	0.52	6.2
Methyl isobutyl ketone	Lacquer thinner	50	75	0.88	1.63	15
Methylene chloride	Paint stripper	25	125	230	14.5	350
Diphenylmethane diisocyanate	Polyurethane glue	0.005	0.054	UNK	UNK	0.0001

PEL: Permissible exposure limit **TWA:** Time-weighted average (8 hours, OSHA standard) **STEL:** Short-term exposure limit
[1]Unknown [2]Not applicable because it is a mixture [3]Non-grain-raising [4]Nitrocellulose

spirits (0.12) is my choice. Vapor pressure is reported in millimeters of mercury (mm/Hg) and relates to how quickly a material evaporates, which affects how quickly you are exposed to the vapors. Substances with vapor pressures greater than 20 evaporate quickly; those with less than 15 evaporate slowly.

Play it safe in the shop

My strategy for dealing with solvent hazards is simple. First, I use the chart to select a solvent that has the highest PEL and is compatible with my finish and application method. For instance, for a spray-applied alcohol stain, I choose ethyl alcohol (PEL 1,000) over isopropyl alcohol (PEL 400). Likewise, methyl ethyl ketone (PEL 200) is a better choice for cleaning the adhesive residue from an abrasive back-up pad than toluene is (PEL 100).

Along with choosing a finish carefully, I ventilate the shop and wear a high-quality respirator. I use a 20-in., three-speed fan for ventilation. On low, the fan moves 1,300 cu. ft. of air per minute—a complete air change in my shop every three minutes. On high, the fan changes the air once a minute. With the fan running, hazardous concentrations of solvent vapors never get a chance to build up. I use a simple, carbon-filled odor mask when brushing finishes and a cartridge-type organic respirator for spraying.

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FINDING THE LINE BETWEEN FURNITURE AND SCULPTURE

In this era of the furniture-maker-as-artist, a lot of celebrated furniture edges toward pure sculpture. Odd, then, to come across some eminently functional furniture and find out that it was made by a sculptor. Jeff Kellar's delightful furniture exhibits an artist's flair for form but is constrained by a furniture maker's disciplined struggle for utility. Kellar, who was a full-time furniture maker in the 1970s and 1980s, when he won a string of best-in-show awards at top-flight craft shows for his spare, elegant furniture, spends most of his time these days making sculpture in his home studio near Portland, Maine. When he does make furniture, it is furniture on strict orders from function. "I was never interested in making furniture with a sense of humor or furniture as a comment on furniture," he said. "The only reason I make furniture is that I am interested in the function." Kellar's writing desk in wenge and mahogany and his checkerboard chair in wenge and white oak were on view in a recent show at Icon Gallery in Brunswick, Maine.

Photos: Top: Jonathan Binzen; portrait: Zack Gaulkin