December 1999
No. 139

TAUNTON'S

Fine WoodWorking

Bench chisels: in the test lab and on the workbench

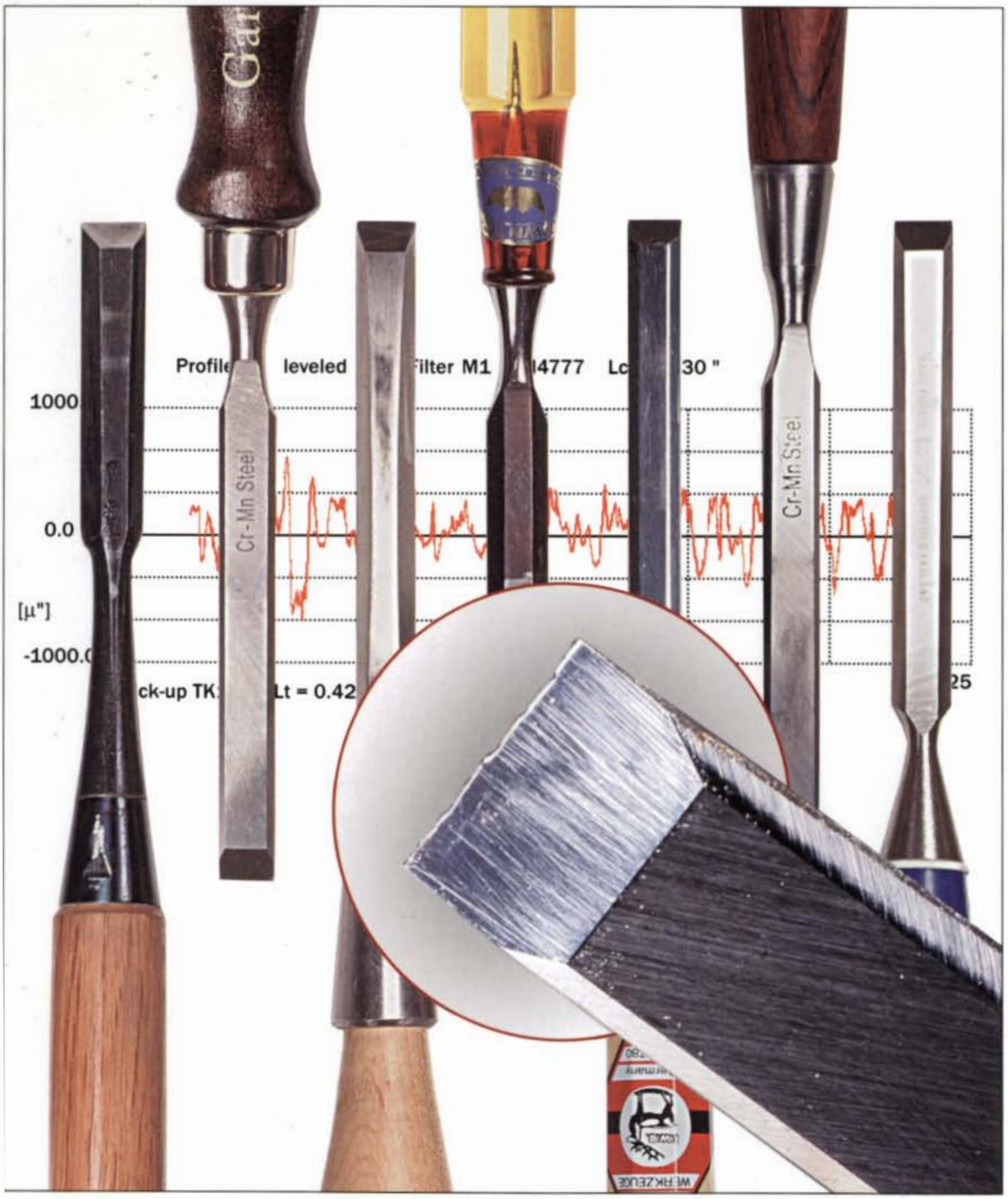
Solid maple entertainment center

Designing table legs

Router collars: inexpensive, indispensable

A small, elegant box

Versatile workbench



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Fine WoodWorking®

Departments

On the Cover:
We put 17 different ½-in. bench chisels to the test, first in a laboratory, then in the shop. To find out which chisels fared the best and see how they ranked in the toughness test, *turn to p. 52.*

Tablesaw kickback, p. 70

Router template collars, p. 80

A versatile workbench, p. 98

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Articles

A low-cost spray booth, p. 84

Maple entertainment center, p. 86

Contributors

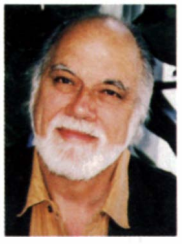

Jimmy McHugh

Pat Warner ("Router Template Collars") has figured out a way to make routers do the work of many woodworking tools and machines. When he isn't making furniture in his garage shop on a quiet street in Escondido, Calif., he is writing, often for *Fine Woodworking*. He has written 70 magazine articles and three books, the latest of which is *Router Jigs and Fixtures* (Popular Woodworking Books, 1999). Warner manufactures offset router bases and is host of his own all-router web site, www.patwarner.com.

Peter Turner ("Entertainment Center in Quartersawn Maple") just finished boxing up his shop in preparation for the move from a large cooperative workshop to the spacious confines of an oversized two-car garage at his new home. He and his wife, Colleen, take turns playing with their daughter, Morrigan, while the other is at work. In his spare time Turner scours back issues of *Fine Woodworking* for articles on how to lay out, wire and heat a garage workspace.

Roland Johnson ("Small-Shop Power Feeders") lives in the heart of Minnesota, a region renowned for its long winters, ferocious blizzards and deep snow. Johnson includes among his essential woodworking tools a 1955 Allis-Chalmers WD-45 tractor, equipped with a 6-ft.-wide snowblower and front-end loader. Without "Big Al," Johnson wouldn't be able to keep clear the ⅜-mile-long driveway to his shop. During the warmer months, Johnson and his wife, JoAnn, enjoy raising vegetables on their 40-acre homestead.

Keith Allen ("Mock-ups Quicken the Design Process") came to woodworking as a second career in 1989. Before that, he taught mathematics (he holds a Ph.D.) and computer science at several universities for 18 years. He builds one-of-a-kind furniture for clients in and around Raleigh/Durham, N.C. He's also active in several regional arts-and-crafts guilds, building and exhibiting what he calls "fun-iture."



Graham Blackburn ("Designing Table Legs") grew up in London, where his grandfather was a cabinetmaker and his father a builder. He came to the United States in the mid-1960s to study composition at the Julliard School of Music but soon moved to Woodstock, N.Y., where—in addition to continuing a music career playing flute and saxophone with various musicians, including Van Morrison and Maria Muldaur—he built his own house and started designing and building custom furniture. He has written and illustrated more than a dozen books on home building and woodworking, including the recently published *Traditional Woodworking Handtools* (available at www.blackburnbooks.com) and still finds time to conduct workshops.

After one year of art school, **Darryl Kell** ("Strategies for Curved Work") left the ceramics studio and went into business making cabinets and doing interior renovations. A few years later he was drawn into furniture making. While he was in the process of trying to solve a design problem in veneer, the vacuum press was born. Fellow woodworkers admired the tool and pestered him to make them one, too. The vacuum-press business eventually became all-consuming. Keil runs his business from a shop next door to his home, where he and his wife homeschool their children and also raise chickens and vegetables and keep several beehives.

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Letters

Call for entries
In an effort to showcase more of your work and inspire those readers who are looking for furniture project ideas, we plan to add a new department to *Fine Woodworking*. This department will feature a gallery of finely crafted pieces, with an emphasis on functional furniture. Entries should include photos of the piece and information on dimensions, materials and finish used and a little bit about techniques used or an interesting story about the inspiration, design or construction of the piece. This is a chance to have your best work featured in an issue of *Fine Woodworking*. Send submissions to: *Fine Woodworking* Gallery, 63 S. Main St., Newtown, CT 06470-5506.

Disagrees with router-table review— Readers of your article on router tables (*FWW* #138, pp. 86-91) might have come away with some doubt about the level of quality of our table and fence. I could go into specifics as to the patented features of our table and fence and the quality of the material and labor that goes into manufacturing each one, but that would take up more space than this letter permits.

Suffice it to say that we have been manufacturing quality woodworking accessories since 1983, and all of the 54 models of router tables we offer come with a lifetime guarantee. This is an important point, as the guarantee of the product reflects the manufacturer's confidence in it. To my knowledge we are the only company to offer such a guarantee. Your readers should know, as do thousands of customers that already own a Woodhaven router table, that we stand behind everything we make. The customer does not have to worry about service for any problem that might arise.

There was an inaccurate statement regarding leg levelers included with leg sets. You list three manufacturers as including these with their leg sets, but we were not among them. We have always included leg levelers with our leg sets.

—Brad Witt, president, Woodhaven, Inc., Durant, Iowa

Beware the waxy joint—A recent "Quick tip" (*FWW* #137, p. 18) needs further qualification. Paul Coppinger suggested that wax be used on a mortise chisel to ease chopping mortises. Unfortunately, most glues do not mix well with wax, and if there is any residual wax in the mortise, the glue bond in the joint will likely be weak. In fact, I was taught to add wax to the areas around, but not directly in, the joint to help ease removal of glue squeeze-out. Because the glue will not adhere to the wax, the dried glue flakes off rather easily. Mr. Coppinger's tip is an excellent one when chopping mortises for unglued joints and perhaps will work equally well with a glue-friendly lubricant substituted for the wax.

—Kevin Schott, Easthampton, Mass.

Tablesaw sled makes him feel safe— It has taken me a long time, but at last I made the tablesaw sled that I first saw in Lon Schleining's article, "A Tablesaw Sled for Precision Crosscutting" (*FWW* #128, pp. 66-69). The article was well-written and descriptive.

For me, the most difficult aspect of the project was making the hardwood runners, because my tablesaw has T-slot miter-gauge slots. However, with some time, made from oak, they work well. Before making the crosscut sled, my blade was only about 7 in. in from the front of my saw. Now, using the sled, I am able to start cutting a board as wide as 17 in. and feel secure. Thanks for the article, and keep them coming.

—Robert W. Smith, Dallastown, Pa.

The Furniture Society wants woodworkers—Thank you for taking note of the Furniture Society's 1999 conference at the Appalachian Center for Crafts. One of the particular successes of this conference was the initiation of a dialogue between contemporary and more traditional makers. Period furniture maker Alf Sharp gave demonstrations on making Queen Anne chairs, Curtis Buchanan lectured on the history of Appalachian chair making, Edward Cooke gave an overview of historic upholstery techniques, and conservators from major decorative arts

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

—Timothy D. Schreiner, editor

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collections discussed their work and its implications for contemporary makers, whatever style they favor. There was a good-spirited discussion on tradition in contemporary work, featuring historian Charles Hummel, art furniture maker Kathrine Siegel and green woodworker Drew Langsner. The Furniture Society is working hard not to limit itself to "art furniture" but to embrace the whole range of makers in the furniture field. We also include teachers, designers, writers, curators, collectors, gallery owners and many who just love individually produced furniture—very much, for that matter, like the readership of *Fine Woodworking*.

—Dennis FitzGerald, president, The Furniture Society

A satisfied recipient is what furniture making is about—Bill Crozier's article, "Cabinets Built for the Long Haul" (FWW #136, pp. 52-57), was very informative. I also try to build everything to last 100 years. I especially liked his wainscot idea to cover the old plaster wall between the upper and lower cabinets. However, I disagree very strongly with Crozier's contention that "building a better mousetrap is what it's all about." Providing the customer with a great product, having them pay you with a smile and having the knowledge that they are satisfied, even delighted, is what it's all about.

—Todd de Burlo, Taos, N.M.

Comments on smoothing planes—Garret Hack's "Smoothing Planes" (*FWW* #136, pp. 38-45) was a relief from the plethora of power-tool reviews inundating the woodworking press. It was a useful, unique and comprehensive look at one of the most essential but never reviewed tools in any craftsman's toolbox. Hack's work is sharp, smooth and cuts quickly to the point. Can we have more?

—William T. Wilkins, Houston, Texas

I enjoyed Garrett Hack's article on smoothing planes. My favorite plane is the old Stanley No. 4, and I tune it the same way Garrett does.

My opinion is the Lie-Nielsen planes are the best value for the money. And for me it takes four to five minutes to tune them to my liking. They need only a few

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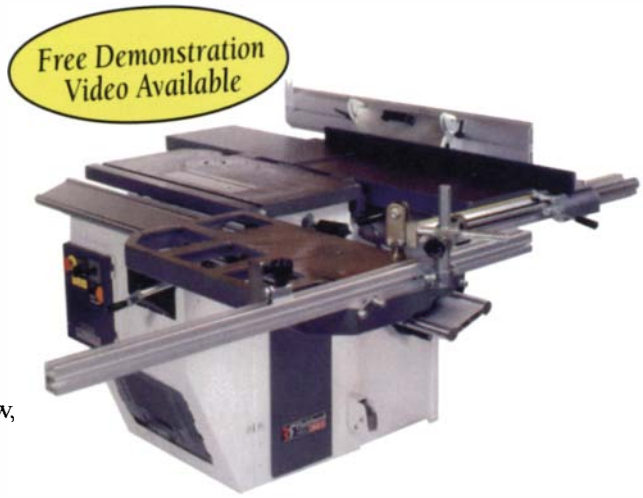

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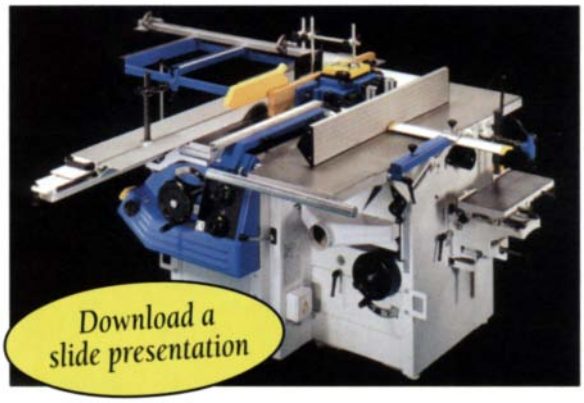

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minutes of honing, and they are ready to perform.

I am disappointed that you put a plane that costs $3,800 in the magazine. Not too many woodworkers can afford it. It is more than two month's wages for a journeyman cabinetmaker. I own most of the planes that Hack reviewed and find the Norris plane is uncomfortable to use for any length of time. The Primus No. 711 took forever to tune.

For me, Lie-Nielsen is number one and then comes the faithful, old Stanley No. 4 with its Brazilian rosewood handles and brass fittings. It is a very comfortable tool to use. *–Frank Klausz, Pluckemin, N.J.*

Woodworking should include historical perspective—I enjoyed Mike Dunbar's essay "Learning from antiques" (*FWW* #136, pp. 88, 90), and I quite agree with him. As a student and writer of poetry for 20 years, I cannot write a poem with any depth or connection to contemporary culture without knowledge of the world's long literary past. Nothing, with the possible exception of modern veneering, takes place in a vacuum.

FWW could do a further service to the woodworking world by including as a regular feature an article on a period of woodworking history or school of design. At least you could introduce project articles with a brief history lesson or include a short, suggested-reading list.

What might really be great would be theme issues. Each of these would include an article on design history, a couple on techniques and tools, a product review, one or more project plans and a finishing piece, as well as your other regular departments and features—all related to a particular style or period, modern or traditional. A little philosophical and aesthetic debate wouldn't hurt, either. How about theme issues each related to the next? After a table-construction issue, for example, a chair-making issue would follow.

Maybe I should say: Don't change a thing. Or, if anything, make the magazine smarter, more challenging and thorough. God forbid that you should dumb-down and mainstream the magazine like your competition did. What a disappointment. To you I say: Keep up the good work. You know how to do it. And I'm learning.

–Richard Carr, Perrysburg, Ohio

Correction—In the article "Arched-Top Cabinet Doors" (*FWW* #138, pp. 76-80), the formulas for finding the correct radius had a few errors: a missing parenthesis and a missing plus sign. The formula for determining radius should be:

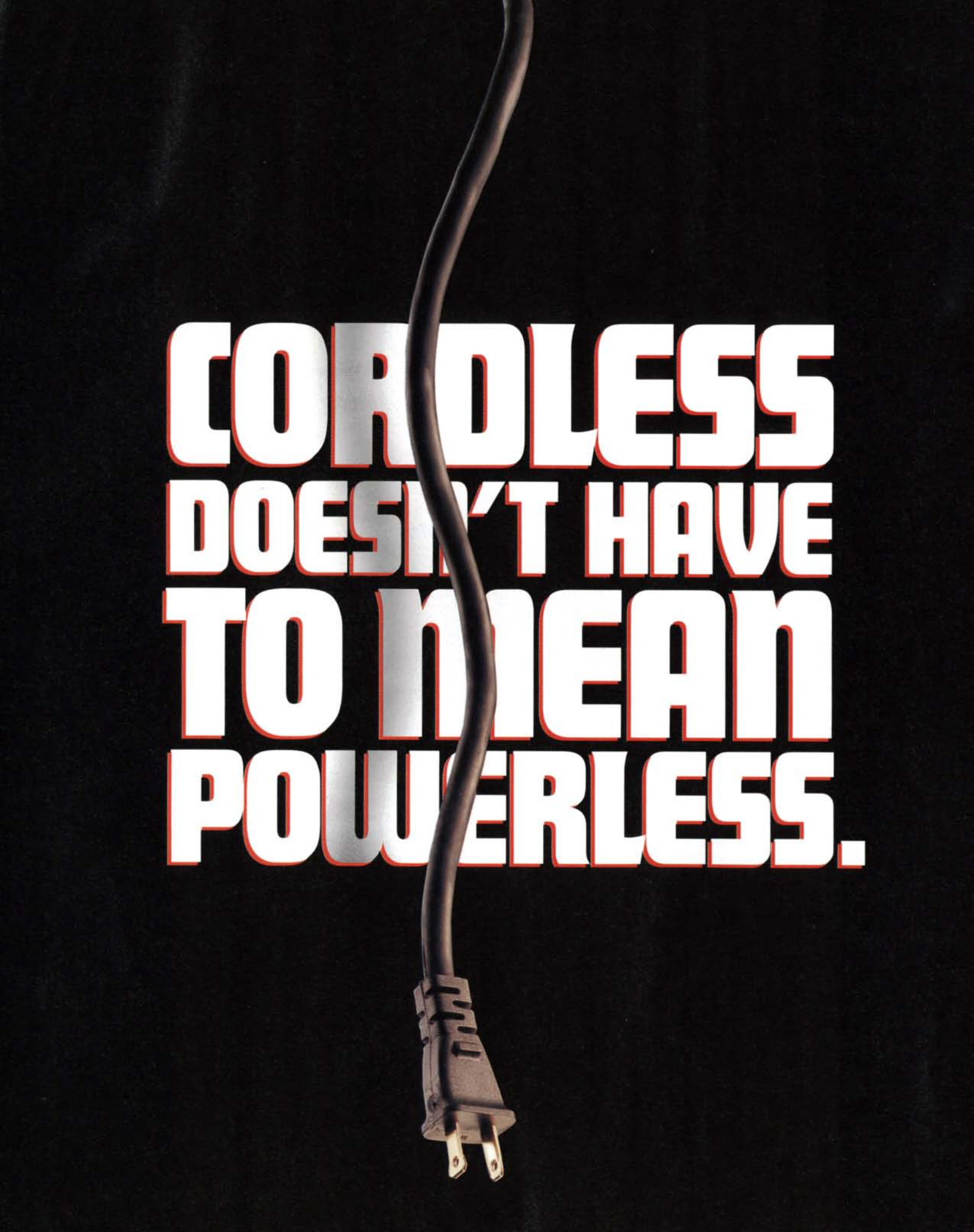
$$R^2 = (R - X)^2 + (L/2)^2.$$

The formula for a 3-in. arc should be:

$$R = 9/6 + L^2/24.$$

Writing an article

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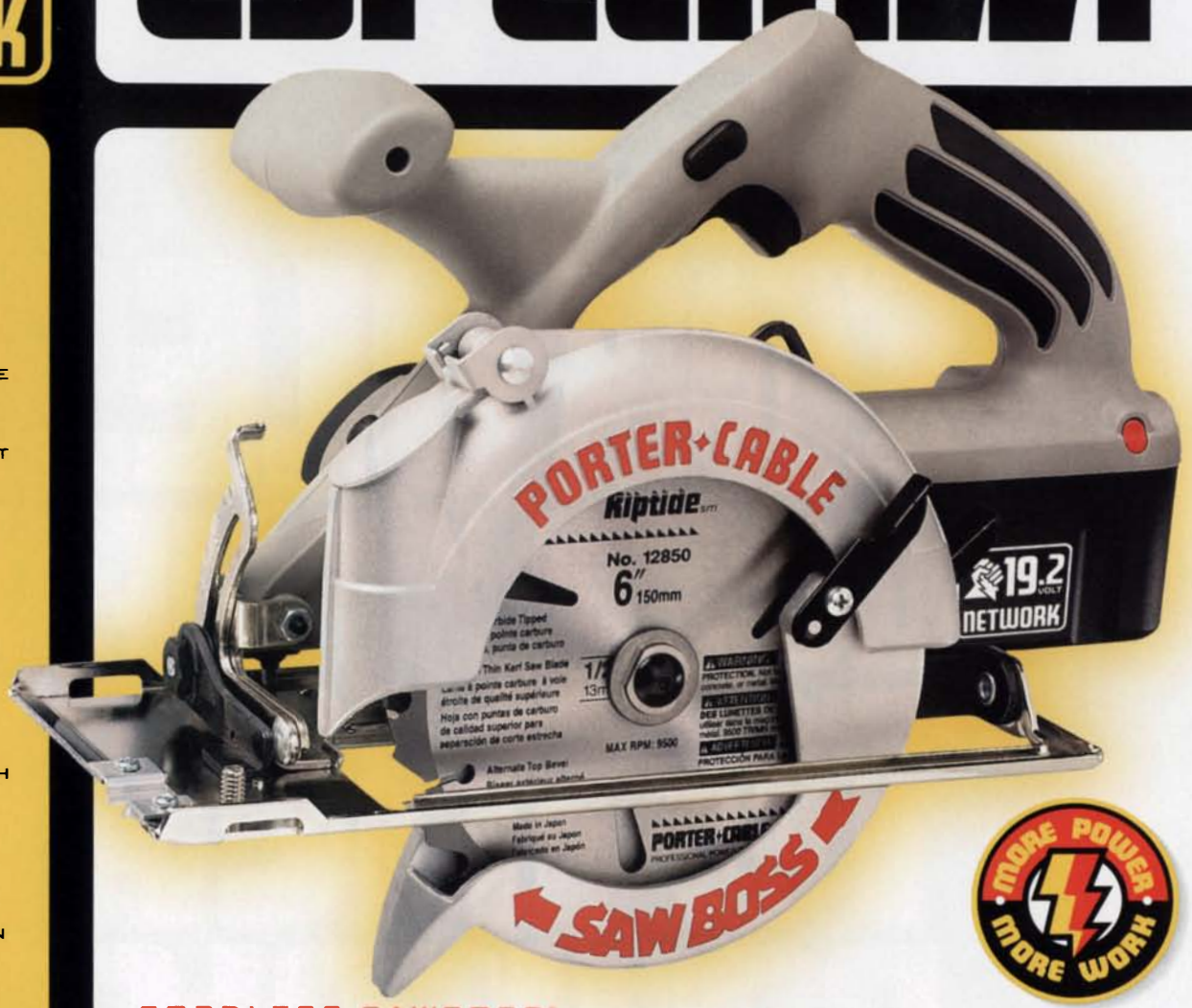

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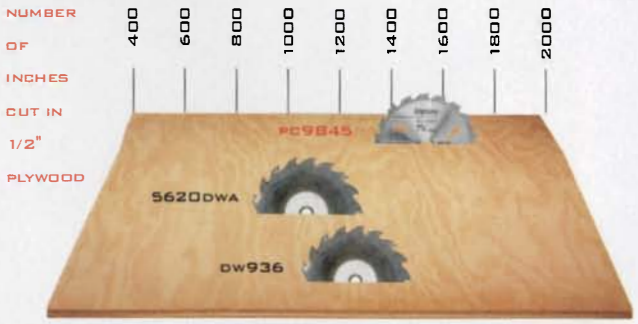

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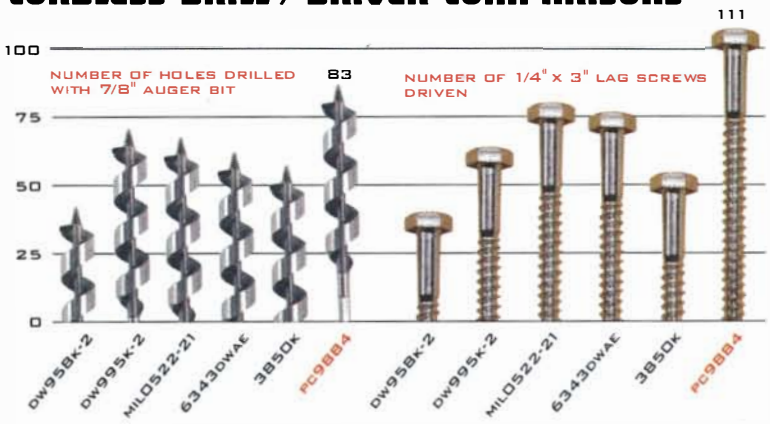

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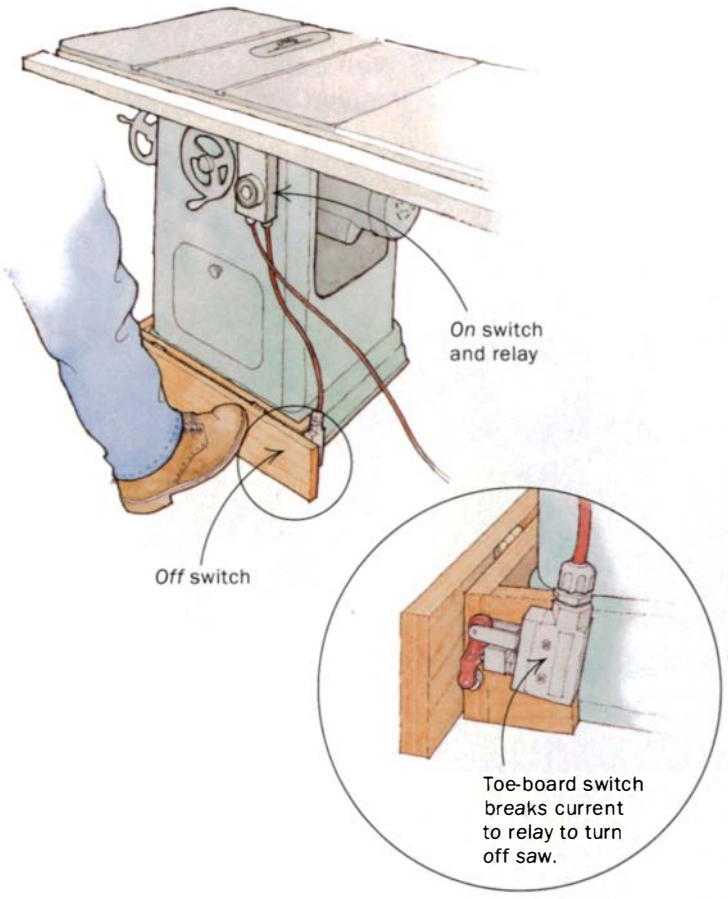
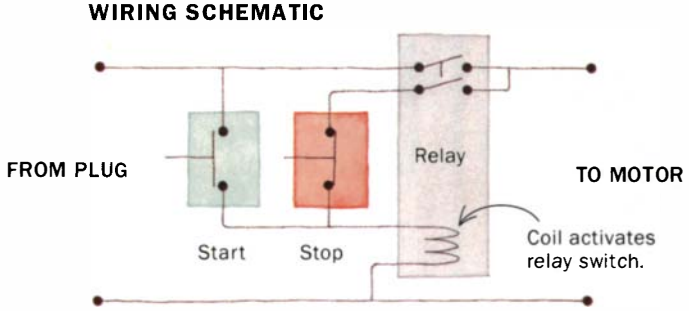
Methods of Work

EDITED AND DRAWN BY JIM RICHEY

Safer tablesaw switch



WIRING SCHEMATIC

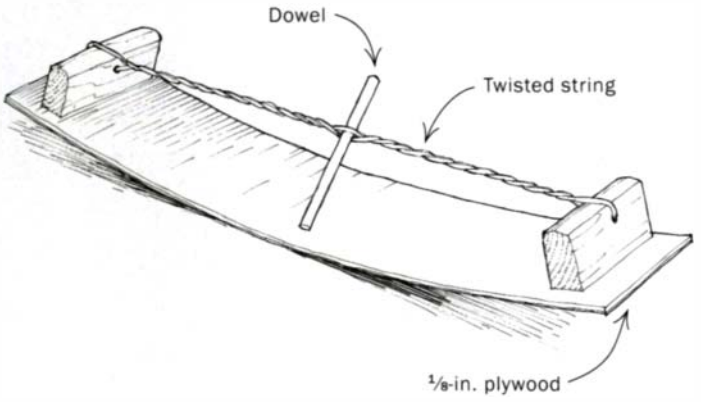


Start switch and relay are in the same box.

In my opinion, conventional tablesaw switches are a potential safety hazard for woodworkers. To turn off the saw, you must first take your attention off the blade (while it is spinning) and then remove your hand from the workpiece. If all goes well with your sawcut, this is not a problem. But when something goes wrong, you may be in trouble. I modified my tablesaw switch to solve that problem (see the drawing at left). I can turn off the saw without taking my hands off the workpiece or even looking away from the sawblade. The major improvement with this setup is that the *on* and *off* functions are at different locations. I turn on the saw with a push button in the conventional location. But to turn off the saw, I tap a toe-board switch along the base of the saw with my foot.

The components of this switching system include a momentary-contact single-pole, single-throw (SPST) normally open switch; a momentary-contact SPST normally closed switch; and a double-pole, single-throw (DPST) relay. The normally open SPST is mounted in the conventional position to turn on the relay. The normally closed SPST is mounted on the base of the saw where it is activated by the toe board to turn the relay off. The relay, which actually controls current to the saw motor, is mounted in a box with the *on* switch. A wiring schematic is shown below left. The relay is also called a motor contactor. The contacts must be rated to carry your saw's current—20 amps are usually enough, but you need to check the rating for your tablesaw motor. The coil voltage should be what is used on your saw—120 or 220 volts a.c. (When in doubt, ask a qualified electrician.) The switches and the relay are commonly available from electrical supply stores for less than $15 each. *—Jamie Buxton, Redwood City, Calif.*

Tensioned fairing board



While reading Lon Schleining's comments about using a fairing board to smooth the outside curve of a coopered door (*FWW* #135, p. 85), I was reminded of the fairing boards used in the boat-building industry to smooth boat hulls. With the simple addition of a string tensioner, you can use the same fairing boards to

A reward for the best tip

Jamie Buxton works as an electrical engineer by day and as an avid woodworker and volunteer for Habitat for Humanity in his spare time. He learned woodworking basics from his father, an academic who grew up on a Nebraska farm. Buxton has been building mostly furniture for family and friends over the past 30 years. His design for a tablesaw switch encourages safety by allowing the operator to keep both hands on a workpiece while turning off the saw. Send us your best tip, along with any photos or sketches (we'll redraw them) to Methods of Work, Fine Woodworking, *P.O. Box 5506, Newtown, CT 06470-5506.*

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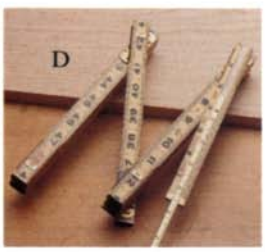

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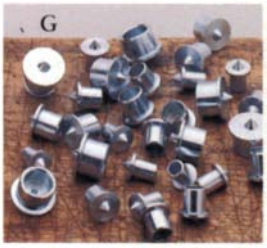

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K / Solid Brass Dovetail Marker

Overall length 2½", it can mark dovetails up to 1" long. 2 ratios: 1:5 for softwood and 1:8 for hardwood. Made in England.

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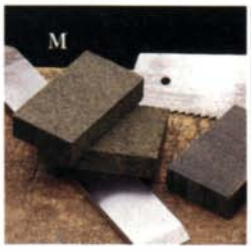

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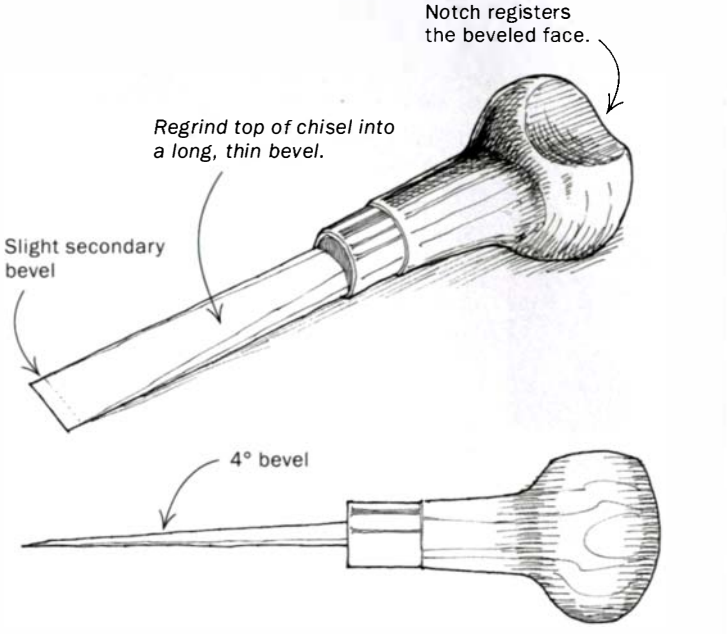
smooth inside curves. Here's how. Make a fairing board from ⅛-in.-thick plywood. It should be 4½ in. wide to fit self-stick sandpaper and about 18 in. long. Glue and screw handles to each end and countersink the screws. Drill a hole through each handle and attach a loop of string. By twisting and tightening the string with a dowel, the fairing board can be tensioned to the exact radius of the curve or a little more to keep the edges from digging in.

—Tom Jamieson, Belfast, Maine

Quick tip: Enlarging an existing hole with a Forstner bit or a spade bit is difficult because the bit will wander. To correct this problem, drill a hole through a piece of ¼-in.-thick scrap and use double-stick tape to secure the scrap to the spot that you want to drill. The scrap will keep your bit from wandering.

—Jeff Vanek, Lansing, Ill.

Shopmade dovetail chisels



In studying the beautifully made dovetails in antiques, it looked as though the waste between tails had been removed by a single, slightly undercut, shearing cut to the center of the drawer side. To replicate whatever system the old-timers were using, I evolved the system that I now use, which is centered around a reground chisel with an extremely long, thin taper. Because the thin taper offers less resistance, you can drive it halfway into the workpiece in one step. This enables you to chop out the waste much faster and cleaner than you can with standard, flat-beveled chisels.

To modify a standard bench chisel, carefully regrind and lengthen the bevel of the chisel until it extends the entire length of the blade. On my chisel the bevel is about 3 in. long and makes a 4° angle. Add a very slight secondary bevel at the cutting edge to give the edge some strength. Although the long bevel does seem to make the edge quite delicate, in 20 years of use I have not chipped an edge so much that it required regrinding.

To use the modified chisel, hold it with the beveled side toward you—I added a notch in the handle just for this purpose. Then make the first strike lightly with the chisel angled slightly away from you. Make all subsequent strikes at 90°. The chisel will have a tendency to angle toward you, which is normal and results in a slight undercut.

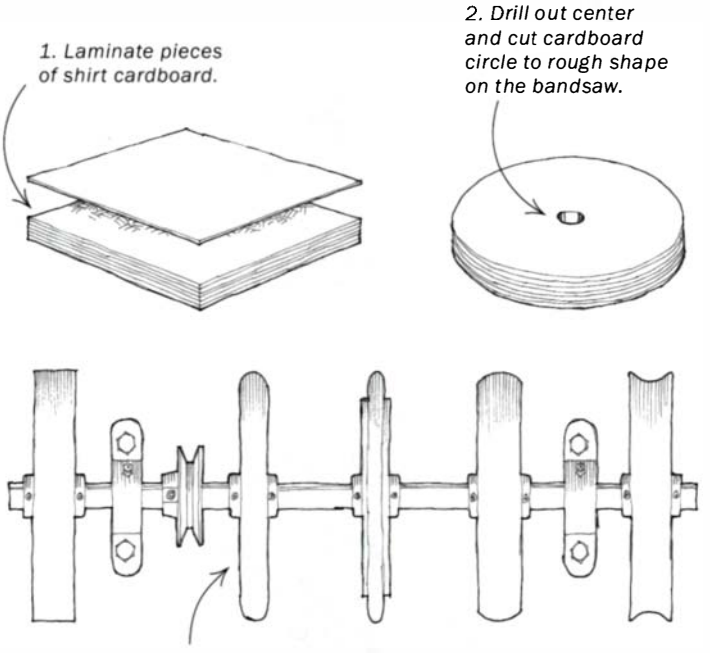
It should take you two to four strikes to drive the chisel to the center of the workpiece. Turn the piece over and repeat the procedure. The last strike will break the remaining wood fibers, and the waste will pop out.

I have two sizes of the reground chisels—½ in. and ¼ in.—which have served almost all of my dovetailing needs.

—Tom Zimmerman, Cambridgeport, Vt.

Quick tip: To create a pattern for a wood patch or inlay, press a piece of aluminum foil into the depression, and then gently run your finger around the outside edge of the depression to obtain an exact image. Use the pattern to trace the outline directly onto the wood you will be using as a patch. *—R.B. Himes, Vienna, Ohio*

Cardboard polishing wheels



I put a sharp, polished edge on my tools with shopmade, laminated cardboard polishing wheels. The wheels are dense, long lasting, easy to customize and inexpensive to make.

To make a polishing wheel, use wallpaper paste to laminate shirt cardboard into a thick plank, ¼ in. to ¾ in. thick, depending upon your need. With a compass, mark the circumference of the wheel and the center. Rough the wheel round with a bandsaw or jigsaw. Drill a hole in the center, mount the rough wheel on a mandrel, or shaft, and true it to shape with a turner's gouge. Now is the time to customize the wheel's profile. If you need the edge convex or concave, cut it to suit. Be sure to wear goggles and a dust mask for this step because cutting the cardboard makes a lot of fine dust. If you

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#ACC 0	8"	4-1/2"	4"	$11.65
#ACC 1	10"	6"	5"	$13.35
#ACC 2	12"	8-1/2"	6"	$15.30
#ACC 3	14"	10"	7"	$19.35

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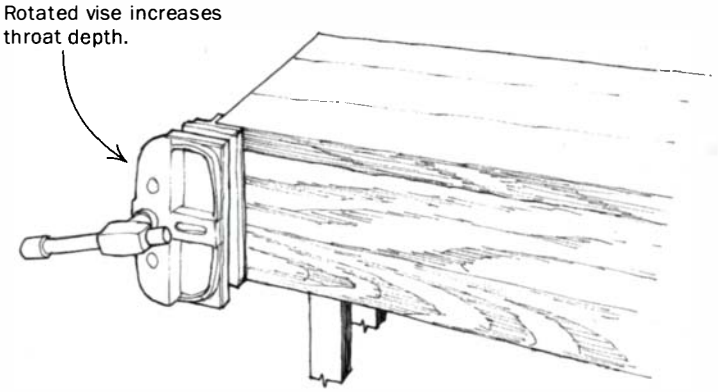
do a lot of carving and need polishing wheels of varying radii, you may wish to mount five or six wheels of different profiles on a mandrel between two pillow blocks.

To use, load up the wheel with polishing compound and carefully press the tool against the wheel with the edge pointing in the same direction as the rotation. The polishing compound made for stainless steel is excellent for carbon steel as well.

—Peter LaMontagne, New Britain, Pa.

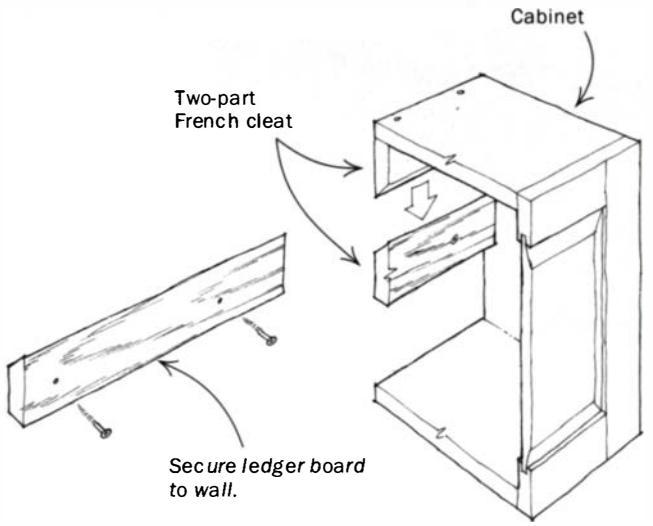
Rotated bench vise



On my workbench I mounted one vise in the normal position and another vise rotated 90° to the first one. The second vise gives me an increased throat depth for holding longer stock vertically.

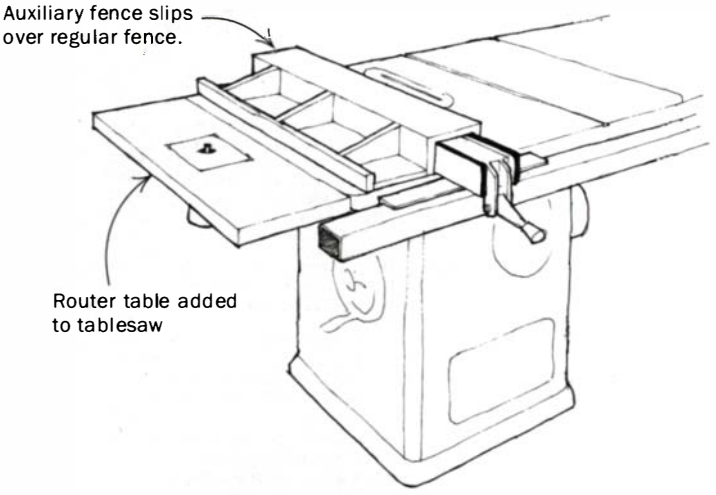
—Richard Griffin, Adrian, Mich.

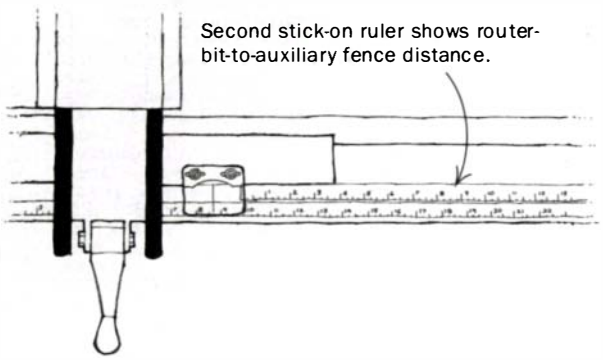
Hanging cabinets with a French cleat



When hanging a mantle or a wall cabinet, I use a two-part French cleat that has several advantages. The system allows me to position the cabinet on the wall without regard to stud locations and also allows for later removal and replacement without serious damage to the cabinet or wall. Another advantage is that the ledger board is much lighter in weight than the full cabinet, so it is easy for one person to level and secure it to the wall. To make the cleat, rip a clear piece of 1x6 hardwood down the middle at 45°. Attach one half of the cleat to the cabinet back as shown in the drawing below left. Carefully level and attach the other half to the wall to serve as a ledger board. Lift the cabinet onto the ledger board and push down on it for a snug fit. *—Jeff Tucker, Kill Devil Hills, N.C.*

Router dado setup on a tablesaw





One way that the Biesemeyer and other similar tablesaw fences have changed the way we work is that the alignment guide is so accurate that you can make quick, confident fence setups by just glancing at the hairline rule. Here's how you can extend this accuracy for making dadoes.

Mount a 3-hp router under an extension table on the left-hand side of the tablesaw. Make an auxiliary rip fence out of plywood that slips over the saw's regular rip fence. The auxiliary fence extends the reach of the rip fence so that it can be moved right up to the router bit.

Next, mount a second stick-on measuring rule to the top of the front fence rail, carefully aligning the rule before mounting it in place so that the hairline on the alignment gauge shows the exact distance between your router bit and auxiliary fence. With this setup you can rip and dado plywood panels for cabinets in no time.

—Garret Brim, Harbor City, Calif.

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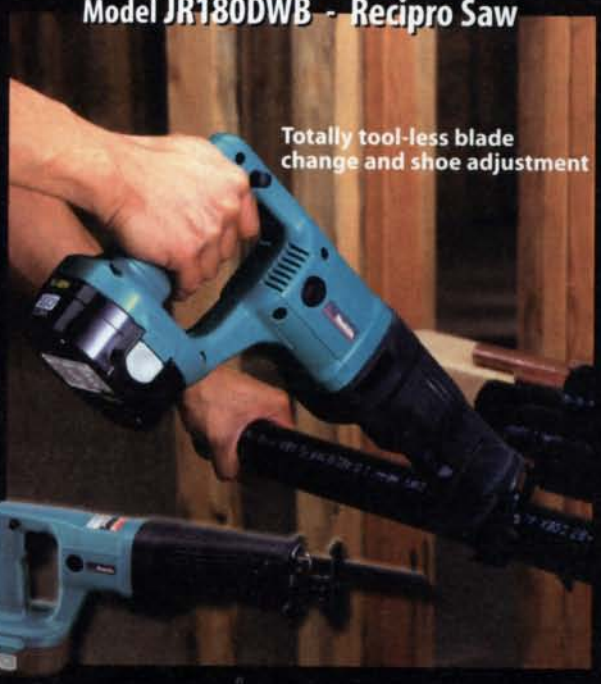

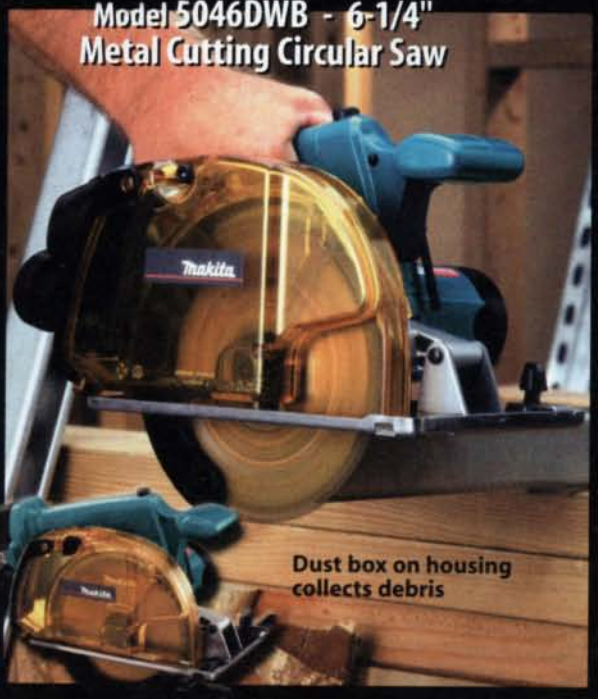

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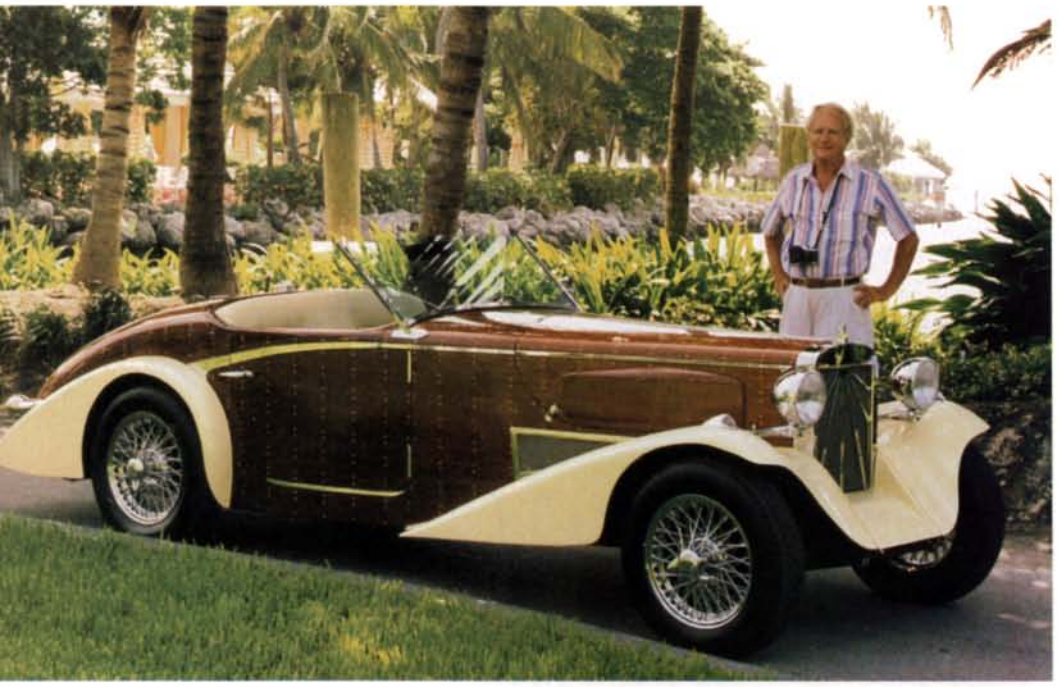

The wooden roadster. *Florida woodworker Roger Cawthorne spent three-and-a-half years and more than 4,500 hours building The Bermuda Special Roadster.*

Roger Cawthorne, a cabinetmaker in Florida and former member of The Guild of Master Craftsmen in England, has just completed a one-of-a-kind wooden car he calls The Bermuda Special Roadster. The Bermuda is not a replica of any particular car, said Cawthorne, but is designed on the concept of "1930s Art Deco with influences from many cars of the time."

The chassis for Cawthorne's roadster is a 1967 Triumph GT-6, but it's the body that's special. The Bermuda's body is made of ½-in. plywood covered with 3-in.-wide, ¼-in.-thick Brazilian mahogany. Cawthorne purchased the mahogany in 19-ft. planks so that the grain would match along the entire body. The mahogany is fastened to the body with epoxy and copper boat nails. The roadster's mahogany body is finished with between eight and 10 coats of clear polyurethane varnish. The fenders are made of ¼-in. plywood over ½-in. ribbing and smoothed with wood filler before the application of many coats of paint.

Skinning the body. *The mahogany skin was fastened to the plywood body with epoxy and wood screws. The screws were later replaced with copper nails, for a more refined look.*

The Bermuda is quite roadworthy. Cawthorne has driven it to car shows in Orlando and Key Largo. He has gotten the roadster up to 80 mph but hasn't gone any faster, he said, "because at that speed, and with an open top, it is rather windy." However, Cawthorne is confident that the Bermuda can handle and maintain speeds of up to 100 mph.

Cawthorne spent three-and-a-half years and 4,500 hours creating this exquisite roadster, working on it mostly in the evenings and on weekends. Ultimately, he would like to make two cars a year. The cost for any potential customer? Between $100,000 and $200,000.

—Christopher Baumann, editorial assistant at Fine Woodworking

Wood webs

"Wood webs" is a place for us to highlight useful and interesting woodworking web sites. If you have a web site related to woodworking that you would like to share with others, send the address to mteague@taunton.com.

Working green wood

If it involves splitting, riving and shaving green wood, the best source of knowledge and information may well be John Alexander, author of *Make a Chair from a Tree* (out of print). At www.greenwoodworking.com you can see work from Alexander and students who've taken his classes on post-and-rung chairs and joint stools, as well as sign up for one of the classes the author teaches from his home in Baltimore, Md. You'll also find numerous articles on chair making and hand-tool joinery and plans for making a tapered reamer or a traditional shaving horse.

On-line forest

If you're concerned with conservation efforts or trying to buy an uncut log of curly maple, there's a good chance you'll find pertinent information at www.forestworld.com. There is a wide range of classified ads and an array of woodworking and lumbering links. While there, sign up for a trial membership or consider an on-line subscription to *Woods of the World,* which contains detailed information on up to 910 wood species and products—common names, common uses, where they grow and their characteristics.

Classical carving site

To see work and learn from top carvers Ian Agrell and Adam Thorpe, click to www.agrellandthorpe.com. At this site you can order instructional videos and handcrafted carving tools or locate book suggestions and carving tips. You'll also find information about attending Agrell and Thorpe's school, The School of Classical Carving in Mill Valley, Calif., and examples of student work.

Photos, this page: Mike Perry (top); Roger Cawthorne (bottom)

An Emperor's Bed on borrowed time

An elaborate gift. *Built in mahogany, this Emperor's Bed was a gift from China to a Connecticut man in appreciation of his guidance in rebuilding the Chinese economy.*

The details. *Inside and out, this bed features intricately carved and through-carved panels, depicting everything from dragons to landscapes.*

Shop space on loan. *To build this reproduction bed, a team of six Chinese woodworkers rented shop time at The Woodworkers Club in Norwalk, Conn.*

As a way of thanking S.L. Chen for the immense contributions he's made to the restructuring of the Chinese economy, the Chinese government decided to bestow a gift upon his family. To make the gift, a reproduction of the Emperor's Bed, a small team of Beijing woodworkers was sent to America in search of temporary shop space. Thanks to The Woodworkers Club in Norwalk, Conn., the craftsmen didn't have to travel far from the Chens' Greenwich, Conn., home to find a space.

The Woodworkers Club, one of seven such businesses spread across America, is a shop you can join just as a weightlifter would join a gym. Though members typically work only for a few hours at a time and sporadically throughout the week, those making the Emperor's Bed required a little more commitment. For three months, one corner of the shop was consumed with immense slabs of mahogany, beautifully through-carved panels and busy craftsmen.

Despite the substantial language barrier, franchise owner John Matchak said he could learn volumes by studying the Chinese craftsmen's joinery and watching them work. "As far as traditional woodworking goes," Matchak said, "it was nice to watch them use technology in a way you don't associate with this kind of work. They'd move from a router to a carving knife without a second's thought."

—Matthew Teague, assistant editor of Fine Woodworking

Photos, this page: Matthew Teague

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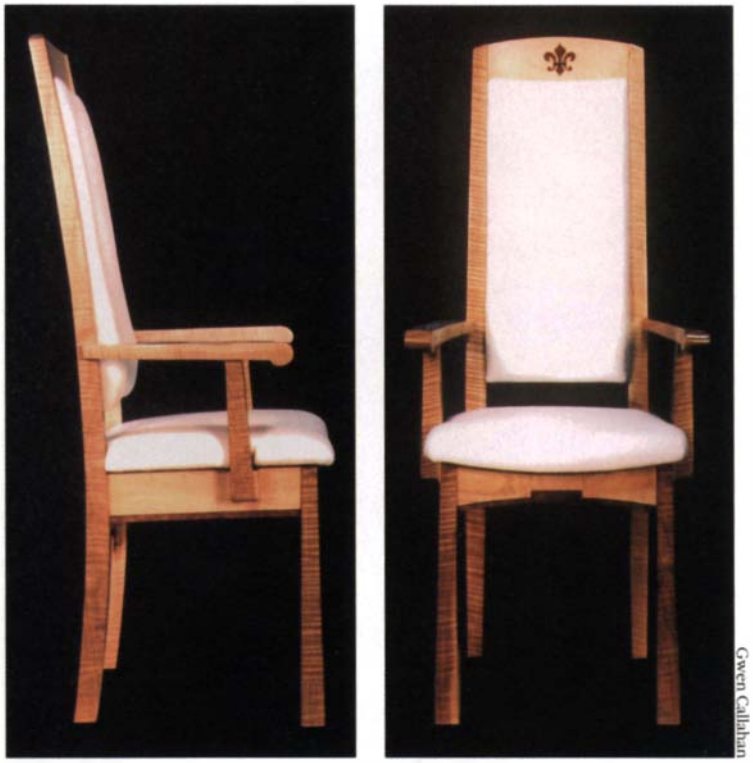

Gwen Callahan

Taller and wider. *This curly maple chair is wider and taller to fit the special design requirements of a chair made for the pope.*

A chair fit for the pope

When it comes to designing a chair for Pope John Paul II, not just any chair will do. Not only must one consider the honor of such a task but the practical aspects as well. The Holy Father's vestments require that the chair be wider than normal. And instead of the average chair height of 18 in., the pope's should be 22 in. or 23 in. so that he can get in and out of the chair with as little hip stress as possible.

When called on to build two such chairs for the pope's recent visit to St. Louis, Joseph Eultgen, a furniture maker in nearby Maryland Heights, Mo., was glad to have taken a class at Peter Korn's Center for Furniture Craftsmanship. "Without the class I took with Bob DeFuccio, I could have never designed a chair that was so comfortable and still fit so many special needs. Within a two-week intensive, hands-on course, DeFuccio teaches the workmanship of chair design that includes curved seats and backs with lumbar support."

Under DeFuccio's guiding spirit, Eultgen designed and built a pair of beautifully crafted chairs in curly maple. On the crest rail he inlaid a *fleur de lis* symbol of Carpathian elm burl and ebony. The seat and back are upholstered in white linen. A lifelong Roman Catholic, Eultgen took great pride in designing chairs for the pope. "It was a way of connecting with the pope on a spiritual and personal level."

–M.T.


Lynn Rybarczyk

From firewood to best of show

Bill Churchill scours firewood yards for chunks of wood he can carve into sculptures. When he found one huge piece of unfamiliar wood recently, he was struck by its beauty and by the fact that it had once been nurtured by the earth—just as humans and animals are.

Using his chainsaw, angle grinder, die grinder and a variety of hand tools, he turned this reddish, figured chunk of still-undetermined species into three sculptures. All have the same name, "Of One Earth," with an additional signifying characteristic: strength, nobility or grace. "Of One Earth—Grace" was chosen as best of show by *Fine Woodworking* at the San Diego Design in Wood competition.

The Anaheim, Calif., carver's accomplished use of wood grain, wood texture and different finishes to express personality made "One Of Earth—Grace" stand out among an excellent field.

—Tim Schreiner, editor of Fine Woodworking


Bill Churchill

Best of show. *Bill Churchill carved three pieces from one chunk of wood of an undetermined species. The piece on the far left took best of show at the San Diego Design in Wood competition.*

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Switch Ergonomics The large, easy-access on/off switch eliminates fumbling around when you're ready to start or stop cutting operations.

Powerful & Space Efficient The 1 3/4 hp TEFC Induction motor provides the power you need to cut the toughest hardwoods. And unlike other saws in the category, we put the motor in board and out of your way, making it easy to store against the wall when not in use.

Easy Dust Collection The DW746 is equipped with a dust collection port making it easy to connect your saw to your vacuum or dust collection system.

Sliding Table Accessory Option Unique, high-capacity/high-accuracy sliding table cross-cutting system delivers 30" of cross-cutting capacity at 90°, and makes large, angled cross-cuts quick and easy. When not in use, this unit stores away without leaving any cumbersome mounting hardware in your way. A solid ground, cast-iron table, industrial slides and a precision mitering guide delivers the quality and accuracy you demand.

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Tools & Materials

Chinese-style planes from Australia

Planes from Down Under. *The H.N.T. Gordon & Co. smoothing plane, left, and palm smoothing plane, right, both have removable handles.*

Chinese-style planes haven't caught on with Western woodworkers the way Japanese planes have. But that may change if people get a chance to try planes made by H.N.T. Gordon & Co. Haven't heard of them? That's because they are made in Australia and have only recently been imported.

Terry Gordon makes only eight styles of planes at the moment; I tried the Chinese-style smoothing plane and a tiny palm smoothing plane, both with removable handles. Some of the other planes in his line, such as the shoulder planes, are Western in design.

The 8¼-in.-long ironwood body of the Chinese-style smoothing plane is gracefully shaped, and the sole is dead flat. Additionally, the sole is fitted with a brass rub plate at the mouth. Because the mouth opening is so small and the 2-in.-wide iron is set at a steep 60°, the plane, which does not have a chipbreaker, leaves a beautiful, tearout-free finish. The little palm smoothing plane, which is 4¾ in. long with a 1⅜6-in.-wide blade, is every bit as effective.

Gordon designed his planes specifically for the difficult-grained woods found Down Under, but his planes excelled at North American hardwood timbers as well.

Gordon makes his planes of exotic woods such as Macassar ebony, gidgee, desert rosewood and mulga. His tools have no moving parts; irons are adjusted with a small hammer. The Chinese-style handle takes some getting used to. I skinned a few knuckles until I held the tool just so. But the handles on the smoothing planes are removable, and the tools can be used as such, which I came to prefer. The planes can be worked with either push or pull strokes.

Gordon planes are available from several mail-order outlets, including Garrett Wade (800-221-2942), Japan Woodworker (800-537-7820) and Woodcraft (800-225-1153). The smoother costs $135; the palm smoother costs $110. *—Anatole Burkin*

New tools for the millennium

Manufacturers unleashed a lot of new tools for professionals and do-it-yourselfers this summer. Here are some of the interesting things we saw at the AWFS Woodworking Machinery and Furniture Supply Fair in Anaheim, Calif., and the Hardware Show in Chicago.

Welcome to the age of 24-volt cordless tools

Bosch and DeWalt are neck and neck in a power race. Each company has a line of 24-volt tools, the most powerful on the market. Bosch's lineup includes a drill-driver that will deliver up to 500-in. lbs. of torque, a 6½-in. circular saw and a reciprocating saw. DeWalt's 24-volt line includes similar tools with an extra twist: The tools can be plugged into a wall socket using an optional a.c. converter. It should be noted that Skil, Bosch's DIY line, also has the a.c. converter technology available.

Big tablesaw from DeWalt

DeWalt also introduced a 10-in. stationary woodworker's tablesaw. The model No. DW746 comes with a 1¾-hp induction motor, and an effective European-style dust shroud is fitted below the cast-iron tabletop. The basic saw is expected to sell for under $900. Outfitted with an optional cast-iron sliding table with 30-in. of crosscutting capacity, outfeed and extension tables, the saw may sell for under $1,600.

Stationary tablesaw from DeWalt. *The 1¾-hp saw is available with many options, including a sliding table.*

The first cordless miter saw

Not to be outshined in the cordless-tool arena, Makita showed off the first battery-

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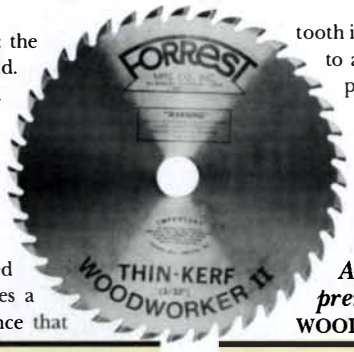
A quarter of a million satisfied woodworkers agree: the Forrest Woodworker II blade is worth its weight in gold. Maybe more. And it doesn't take a jeweler to see why. It rips through thick hardwoods with no scratches or tearouts. Miters and cross-cuts with flawless precision. It makes short work of one-sided laminates and splintery oak plywoods . . . flawlessly. In short there are sawblades . . . and there are Forrest blades.



Here's why. The hardness of C-4 carbide, combined with the low breaking point, of C-2 carbide, creates a tooth that's as permanently tough as it is sharp. Once that tooth is hand-brazed to the plate, the blade is hand-straightened to a perfect flatness—and an astonishing ±.001" runout for peak performance.

Sawing is believing. Prove it to yourself— completely without risk! Call (800) 733-7111 today for your chance to try a premium Woodworker II blade or any other Forrest blade in your own shop.

"The ONE BLADE THAT LEAVES A SMOOTH-AS-SANDED SURFACE." Outperformed 36 other premium blades, both foreign and domestic, **WOOD magazine test, Sept. 1998, pg. 45.**

FORREST WOODWORKER II: 6"-14" dia. avail.

All-purpose—**tablesaws and portable circular saws.**
Special 10% Discount! Take 20% off second blade of your choice.
EDITORS' CHOICE AND TOP RATING OVER 18 COMPETING SAW BLADES.
The 10"x40T earned the Editors' Choice Award for the best performance regardless of the price. See* American Woodworker *April 1998 pp 68-69.

	Sale Price	10% Off First Blade	20% Off Second Blade
14" x 40 T x 1"	~~$149~~	$134	$119
14" x 30 T x 1"	~~$139~~	$125	$111
12" x 40 T x 1"	~~$129~~	$116	$103
12" x 30 T x 1"	~~$119~~	$107	$ 95
10" x 40 T x 1/8" or 3/32"	~~$119~~	$107	$ 95
10" x 30 T x 1/8" or 3/32"	~~$99~~	$ 89	$ 79
9" x 40 T	~~$109~~	$ 98	$ 87
9" x 30 T	~~$99~~	$ 89	$ 79
*8 1/4" x 40 T x 3/32"	~~$99~~	$ 89	$ 79
8" x 40 T 3/32"	~~$99~~	$ 89	$ 79
8" x 30 T 3/32"	~~$89~~	$ 80	$ 71
7 1/4" x 30 T 3/32"	~~$69~~	$ 62	$ 55
**6" x 40 T 3/32"	~~$89~~	$ 80	$ 71

*NEW for Sears & Makita Tables Saws **NEW for Saw Boss

BLADE STIFFENER
Make all your blades cut better and quieter with a blade stiffener!
4" $21 5" $24 6" $25

FORREST DADO-KING: 6"–12"

Unmatched Precision on Every Dado Cut!
The Forrest Dado-King gives you flat-bottomed grooves and no splintering–even when crosscutting oak plys and melamine. This award-winning set comes with six 4-tooth chippers (including 3/32" chipper), two 24-tooth outside blades plus shims. Cuts 1/8" to 29/32"grooves.

Free $21 value
10" BLADE RUNNER
CARRYING CASE!
Protects and holds up to 10 blades. Shipped with 6", 8" or 10" Dado Sets.

	Sale Price	10% Off First Dado	15% Off Second Dado
6" set	~~$269~~	$242	$229
8" set	~~$289~~	$260	$245
10" set	~~$349~~	$314	$297
12" set	~~$449~~	$404	$382

NEW "EASY-FEED" STANDARD DADO

For solid hard and soft woods only! (No plys, no melamine!) 8" D, with positive hook 24 tooth blades & 2 tooth chippers and shims, Cuts 1/8" to 13/16" wide

LIST	SALE	10%	15%
$249	$218	$196	$185

DURALINE HI A/T: 7 1/4"-16" dia. avail.

Cuts melamine PERFECTLY. Our best PLYWOOD blade. 220 mm & 300 mm available.

For absolute splinter control!! 8", 7 1/4" & others available	Sale Price	10% Off First Blade	20% Off Second Blade
10" x 80 T (5/8" or 30mm K)	~~$159~~	$143	$127
12" x 80 T (1" hole, 5/8" K)	~~$181~~	$163	$145
14" x 80 T (1" hole)	~~$197~~	$177	$158
14" x 100 T(1" hole)	~~$226~~	$203	$181
16" x 100 T (1" hole)	~~$243~~	$219	$194

2-4 Days Sharpening ON ALL MAKES OF CARBIDE BLADES

CHOP MASTER BLADE: 6 1/2"-15" dia. avail.

Specially designed for **sliding compound miter, miter chop, and radial saws.** New specs, 5° neg. pts. & flat, runs out less than .001/.002 for perfect, tight, smooth, splinter-free miter joints!

	Sale Price	10% Off First Blade	20% Off Second Blade
6 1/2" x 40 T x 5/8" Delta, Sidekick & others	~~$ 99~~	$ 89	$ 79
8 1/4" x 60 T x 5/8" Sears, Delta, Ryobi	~~$109~~	$ 98	$ 87
8 1/2" x 60 T x 5/8" Hitachi, DeWalt, Ryobi, Freud TR125	~~$119~~	$ 107	$ 95
9" x 80 T x 5/8" Delta & others	~~$129~~	$ 116	$ 103
10" x 80T x 5/8" Delta, Bosch, Hitachi, Makita, Ryobi, AEG & all	~~$139~~	$ 125	$ 111
12" x 80 T x 5/8" Delta,Hitachi, Makita, B&D, Sears & all	~~$149~~	$ 134	$ 119
14" x 100 T x 5/8" Makita, Ryobi	~~$189~~	$ 170	$ 151
15" x 100 T x 5/8" Hitachi, Ryobi	~~$199~~	$ 179	$ 159

WOODWORKER I: 7 1/4"-14" dia. avail.

Designed for **radial arm or tablesaws**–fine crosscut.

	Sale Price	10% Off First Blade	20% Off Second Blade
8", 8 1/4", 7 1/4" x 60 Tooth	~~$109~~	$ 98	$ 87
10" x 60 Tooth	~~$129~~	$116	$103
12" x 60 Tooth	~~$139~~	$125	$111

EXTRA BONUS! 9 AT $5 EACH!

(Use one coupon per blade or dado.)

Buy a blade or dado and get $45 worth of **sharpening discount coupons** from Forrest, good on any make blade or dado set you own. The first 100 customers will receive a **FREE Picnic Table Plan & Router Poster.**

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dado $8
stiffener $2

EXCLUSIVE OFFER

Select one of these items FREE when placing an order for any sawblade or dado from this ad.
You must mention you saw this ad in *Fine Woodworking* magazine, when ordering.
Hurry! This spe ial offer is limited while supplies last on orders placed by 12-31-99.

Unconditional Money-Back Guarantee

Use any of these blades for a month. If you are not completely satisfied, return the blade for a complete refund. No other blade company will make that kind of guarantee—because there's no other blade like a Forrest blade!

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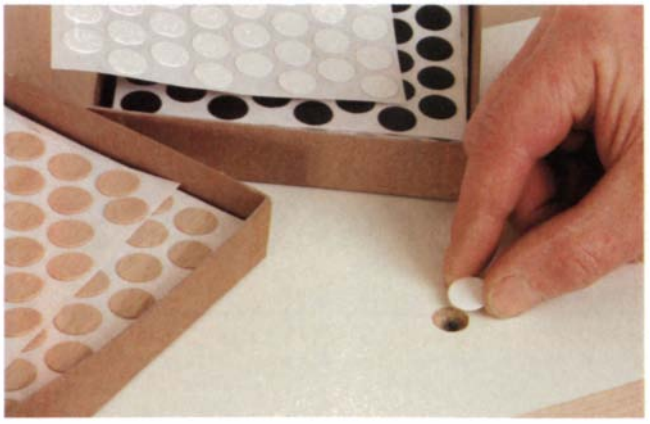
SEE OUR INTERNET STORE AT: woodmall.com OR stores.yahoo.com/forrestman

Fast cover-up for screw holes



Stick-on screw-hole covers. *FastCaps come in PVC and real wood. Custom colors can be ordered, too.*

Kitchen cabinets are typically hung by screwing through the back of the carcase or through a ledger strip. But what do you do with all of those exposed screw heads. A new product called FastCap solves the problem. FastCaps are self-adhesive dots available in both PVC or real wood. They come in a variety of sizes and colors to match melamine, laminates or wood products. Custom colors are also available.

Although the caps are about the thickness of a business card and sit proud of the workpiece, inside the recesses of a cabinet they virtually disappear. For more information about FastCaps, contact the manufacturer at (888) 443-3748. —*A.B.*

Redesigned Jesada router bit passes our test

Give Jesada credit for tenacity. And customer service. Following the company's poor showing in a test of straight router bits (*FWW* #136, pp. 84-89), Jesada's president, Carlo Venditto, did something about it. He ordered his engineers to redesign all of the company's straight bits, a "major reengineering," in his words.

And the effort paid off. I had a colleague order one of Jesada's redesigned bits (model No. 612-627), and we sent it out to the same shop as our earlier test. A CNC router was programmed to cut rows of grooves in melamine-coated flakeboard to see how long the bit would last and how cleanly it could cut.

Jesada's new bit ranked among the top performers. The company's straight bit showed excellent performance at the beginning of the test (0.16 chips per ft.) and did well near the end (3.0 chips per ft.) for an average of 1.58 chips per ft.

The critical difference in the new design can be seen in how the shank is machined. Less metal has been ground away, especially at the neck, which virtually eliminates vibration and runout. "Now we have eight times more body at the neck than the original bits," explained Venditto. The test results place the redesigned bit among those that averaged 2.0 or fewer chips per inch: Amana, CMT, Freud, Oldham Viper, MLCS, Ridge Carbide/Liberty and Whiteside.

Metal makes the difference. *Older Jesada straight bits (left) had too much metal machined out of the shank. New bits (right) are much stouter in cross section, which eliminates vibration.*

Many readers asked about the speed and feed rates of the original test. A lot of information we gather never gets into print because of space limitations. But because so many of you want to know, here are the numbers. The CNC router was set to run at 18,000 rpm, and the feed rate was 6 meters per minute (about 18 ft. per minute), a pretty comfortable rate if you were moving stock or a large router by hand. —*A.B.*

New tools (continued)

powered sliding compound miter saw. The tool, with a 7½-in. blade, weighs only 23 lbs., which may make it attractive to trim carpenters on the move. The saw can cut stock as large as 2½ in. by 7½ in. at 90°. A company spokesman says the saw, with a fully charged nickel-metal-hydride (Ni-MH) battery, will make up to 200 cuts through 4-in. crown molding, or 100 cuts in 2-in. by 4-in. pine. Also in the 18-volt Ni-MH line are three 6½-in. circular saws with dust shrouds, a reciprocating saw and several drill-drivers.

The first cordless sliding compound miter saw. *Makita's 7½-in. saw runs off an 18-volt Ni-MH battery.*

How about 19.2 volts?

Porter-Cable created a niche by picking an unused bandwidth—19.2 volts—for its line of beefy cordless tools. New this year are a hammer drill, work light, 6-in. circular saw and drill-driver. The 2-amp-hour batteries come with soft-pulse chargers, which minimize heat buildup, the enemy of batteries. Three new 14.4-volt cordless drills and three 12-volt cordless drills were also introduced, as well as improved brad nailers and narrow crown staplers.

A drum sander from Delta for less than $1,000

Delta International has a new version of the Unisaw to be priced at $1,299 after rebate. The model No. 36-810 is the basic 3-hp Unisaw, but it comes with the UniRip T-Square fence, taken from the company's contractor's saw. Also new from Delta is a cantilever-design (open on one end), 18-in. drum sander that will cost about $900, including the stand. Delta also introduced an aluminum 10-in. compound miter saw, an 8-in. imported jointer, a

THE FASTEST FINEST FINISH.

DEWALT HEAVY-DUTY SANDERS

DW411

Heavy-Duty 1/4 Sheet
Palm Grip Sander

DW423

Heavy-Duty 5" Random Orbit Sander
With Electronic Variable Speed

DW431

Heavy-Duty 3" X 21" Electronic
Variable Speed Belt Sander

DW421

Heavy-Duty 5" Random Orbit Sander

DW421

Finest Finish
Patented, Controlled Finishing System maintains pad speed on or off of the material

3/32 orbit diameter provides tight orbital patterns

Reduce Vibration
Dual-Plane Counterbalance for more comfortable use

Fastest Finish 2.0-Amp
2.0-Amp motor with 12,000 orbits per minute

95% Dust Collection
Built-in dust extraction adapter attaches to standard shop vacuums

Durability
Dust sealed switch and 100% Sealed Ball Bearing Construction prevents dust contamination

The DEWALT Heavy-Duty Sanders were designed to produce the fastest, finest finishes possible on all kinds of materials. Take the DW421 Heavy-Duty 5" Random Orbit Sander, which features the patented DEWALT Controlled Finishing System to maintain pad speed and virtually eliminate gouging. Its 2.0-Amp motor provides maximum sanding speed while being extremely comfortable to use. And, features like the dust-sealed switch, contribute to longer tool life. If greater control is needed, there's the DW423 Electronic Variable Speed sander (7,000 to 12,000 opm). The electronic variable speed keeps the sander running at a constant speed under load. For fine finishes, the DW411 palm grip sander has a 2.0-Amp motor with 13,500 opm. And for faster removal, the DW431 Belt Sander provides a compact and lightweight unit for sanding vertical surfaces or tight spaces. So choose the best sander for the job. Choose DEWALT. Guaranteed Tough.™

For more information, call 1-800-4 DEWALT or visit our web site at www.dewalt.com.

DEWALT®
High Performance Industrial Tools

READER SERVICE NO. 221

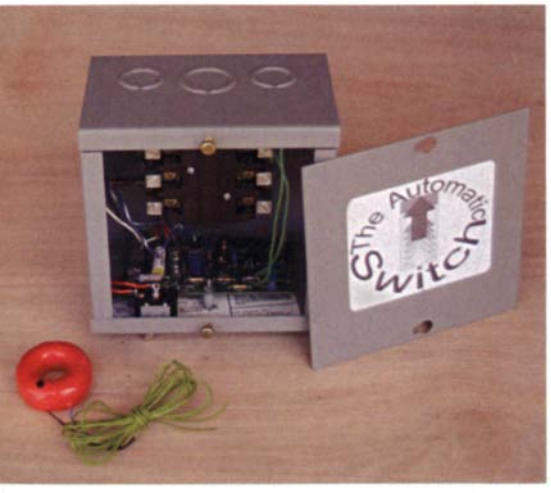
Automatic dust control

How many times have you turned on a power tool and not bothered to simultaneously power up the dust collector because it didn't seem worth the extra hike across the shop? Well, the Automatic Switch solves that problem. As its name implies, the switch automatically turns on the collector every time a tool is powered up.

The Automatic Switch consists of a relay box that is mounted on the wall near the shop's main electrical panel. A doughnut-shaped sensor is placed in the electrical panel, and the load, or hot, wire for each circuit that powers a dust-collected tool is run through this sensor. The sensor detects current flow and sends a signal to power up or shut down the dust collector on demand.

The switch is best for a shop where tools are on dedicated circuits. Otherwise, other tools (or appliances, in the case of a typical home shop) may set off the dust collector. (Tools or appliances drawing small amounts of current won't set it off.)

If you have a good working knowledge of home wiring, the system is relatively simple to install. If your electrical abilities fall in the realm of changing light bulbs and flipping breakers, an electrician can have the system up and running in a few hours. The switch will set you back $249, plus shipping. To order, call the manufacturer, Blowpipe Supply, at (800) 475-1288 or (978) 475-1188. *—Roland Johnson*



Electronic switch powers up the dust collector. *The Automatic Switch detects when power tools are turned on, and it in turn fires up the dust collector.*

New tools (continued)

20-in. professional scroll saw and a 16½-in. drill press with an exterior depth stop.

Professional wood lathe

Jet Tools and Equipment has decided to paint all of its tools white because of strong customer preference. Besides the new paint scheme, Jet has introduced several new tools, including a professional woodworking lathe. The model No. JPWL-42 comes with a 2-hp motor and two variable-speed ranges, 0 to 1,070 rpm and

A big lathe from Jet. *The model No. JPWL-42 has a 2-hp motor and will turn bowls up to 36 in. dia.*

0 to 3,200 rpm. The lathe has a 21-in. swing and 42 in. between centers. Additionally, work can be turned on the outboard side of the headstock, which will handle stock up to 36 in. dia. It is expected to retail for about $2,500. Other new tools include a home-shop shaper, updated contractor's saw and 6-in. jointer.

If I had a Hammer

From the Austrian factory that produces Felder tools comes a less pricey line named Hammer. Combination machines, shapers, sliding tablesaws, mortisers and jointer-planers are among the offerings. The Hammer line is aimed at the recreational woodworker and small shop. For example, a 12-in. sliding tablesaw, model No. K3, costs $3,490. Information is available by calling (800) 700-0071.

Heavy metal from Austria

If you're looking for the biggest, baddest, most expensive combination machine on the planet, a Knapp might suit your needs. Made in Austria, the machine, which goes by the name Signature Series by Laguna Tools, weighs almost a ton and a half. It comes with a sliding table, jointer-planer, tilting spindle shaper and mortiser and will set you back at least $20,000 ($28,000 fully loaded). Knapp also makes jointer-planers and other dedicated machines. For more information, contact Laguna Tools (800-234-1976), the importer.

A circular saw for any position

Milwaukee has come out with the first adjustable-handle, 7¼-in. circular saw. The handle has eight positions, allowing the user to adjust it for maximum comfort, depending on the height of the workpiece. To keep the 15-amp tool under 10½ lbs., the saw is built with a magnesium blade cover and aluminum baseplate. The saw costs about $135 with a case. Milwaukee also added to its 18-volt cordless line a cordless Sawzall and several drill-drivers.

Two-sided diamond benchstones

Diamond Machining Technology, Inc., has introduced the first set of two-sided diamond benchstones. Called the DuoSharp, the plates are available in two sizes (8 in. by 2⅝ in. or a jumbo 10 in. by 4 in.) and a variety of grit combinations. An optional

Dual-grit diamond benchstones. *DMT's DuoSharp stones come in two sizes, and a special holder will also be available.*

base will also be available to fit the stones. For more information, call the company at (800) 666-4368.

Tapes and toolboxes from Stanley

Stanley has a tape measure with an improved hook end that allows the user to catch stock from the top, bottom or side.

Cash Coatings finishes

Aqua-Seal and Aqua-Cote are industrial-grade water-based acrylic finishes designed for use with spray equipment. I hadn't heard about these products from the Wisconsin-based Cash Coatings Co. until recently, so I thought I would give them a try.

I sprayed a mahogany panel with one coat of Aqua-Seal, a sanding sealer, and topped it with two coats of Aqua-Cote gloss finish. Overall, I was very impressed with both products. The sanding sealer is easy to spray, dries quickly, causes very little raised grain and is easy to sand.

Aqua-Cote atomizes well and forms a smooth coat that exhibited good depth and clarity. The company sells the product in different viscosities. If you're using high-pressure, low-volume (HVLP) spray equipment, be sure to mention that when ordering; otherwise, you may have to thin the product to get proper atomization.

The finish adhered well to an oil-based stain, passed a heat-resistance test and scored very high in a stain-resistance test. (Windex and Fantastik both dulled the finish slightly.) The cured finish was relatively easy to rub to a nice shine, filled the pores of the mahogany surprisingly well, and, best of all, had the warm, amber color associated with traditional solvent-based finishes. The color comes from the sanding sealer. If you prefer a "whiter" finish, simply use the topcoat as a sealer.

The finish sells for about $30 per gal. or $10 per quart. The company also sells compatible stains. For a distributor, call (888) 729-1591 or (608) 222-2445.

—Andy Charron

New tools (continued)

Called the Fat Max, the tape measure also has an extrawide 1¼-in. blade, which allows a standout of 11 ft. (maximum extension before folding). There's also a new line of cleverly designed plastic tool totes from Zag, a recent Stanley acquisition. The Tuff Mate, for example, serves as both a large-wheeled toolbox and miniwork-bench, complete with clamps.

Why didn't I think of that?

Bench Dog, a manufacturer of router tables, has introduced what's sure to be a hot seller for years to come: the Blade-Loc. This ingeniously simple device is a half-moon-shaped plastic hood that locks down the tablesaw blade when tightening or loosening the arbor nut. Blade-Loc fits over the raised blade and holds it firmly

An easier way to remove a tablesaw blade. *The Blade-Loc holds a sawblade securely while wrenching the arbor nut.*

without damaging the teeth or marring the tabletop. Priced at $19.95, Blade-Loc is available through Bench Dog (800-786-8902) and CMT (888-268-2487).

Router-table height adjuster

JessEm Tool Co., maker of the Rout-R-Slide router table, has a new device, the Rout-R-Lift, a height-adjustment system for router tables. The device raises or lowers the router in measured increments using a crank lever that fits into the top of the table. The Rout-R-Lift is solidly made of aluminum and includes a baseplate insert. It's expected to sell for about $200. For more information, call (800) 436-6799.

Bandsaw guide for curved work

Carter Products has a new bandsaw guide specifically designed for cutting curves. Called the Stabilizer, the guide (a single, grooved wheel) takes the place of both the upper and lower guides when using blades that are ¼ in. wide or less. Stabilizers are available to fit most popular saws and cost about $70. Call (888) 622-7837.

DIY nailers from Stanley-Bostich

Stanley-Bostich has added a line of imported pneumatic finish nailers. The tools include two 18-ga. brad nailers, a narrow crown stapler and a 16-ga. finish nailer. Prices range from $99 for the small brad nailer to $179 for the 16-ga. tool. The nailers drive a nail just as well as Stanley-Bostich's more expensive line of nailers, the main difference being that they aren't made to last as long as the professional tools. That makes them ideal for woodworkers who only occasionally need a pneumatic nailer.

Quick-change systems for drills improve

As more bits and drill accessories become available in hex-shank models, several companies are upgrading their quick-change connectors. Makita, Bosch and Jore Corp., which makes Stanley's Fast-Change Connector, will introduce new units this year. They all are designed for one-handed operation when loading or releasing ¼-in. hex-shank bits. Bosch's Clic-Change is one of the smallest of the new units, yet it has very little wobble for a drill extension. Jore and Insty-Bit are also introducing 7/16-in. quick-change connectors to accommodate beefier bits.

Two new shop aids

If you've ever shattered a fluorescent bulb with a piece of lumber in your shop, sending tiny shards of glass into your hair and down the neck of your shirt, you'll want to check out a new, safer fluorescent bulb from General Electric. Called Cov-R-Guard, the bulb is "wrapped" with a 15-mil-thick casing that will contain glass shards should the bulb be smashed.

The WD-40 company now sells Lava Heavy-Duty Hand Cleaner Towels. The premoistened, reinforced towels will remove glue, stain, paint, caulk, putty, mechanical oil or grease and automotive grime without water or rinsing afterward.

—A.B. and Tim Schreiner

THE PERFECT EDGE.

DEWALT HEAVY-DUTY ROUTERS

DW625
Heavy-Duty 3 HP
VS Electronic Plunge Router

DW610
Heavy-Duty 1-1/2 HP Router

DW621
Heavy-Duty 2 HP
Electronic Plunge Router

DW621

95% Dust Collection
Exclusive, built-in, dust extraction column attaches to standard shop vacuum

Quality Finish
Electronic Variable Speed (8,000 - 24,000 rpm) for constant speed under load

Fast and Accurate Depth Setting
Rack and Pinion microfine depth adjustment starting at 1/256"

Versatility
Converts from fixed base to plunge with the lock-down knob

Control
Rubber-coated knobs have built-in plunge-lock and on/off switch

Durability
100% Ball Bearing Construction

Power
2 Horsepower Motor

Capacity
Accepts 1/4" and 1/2" collets

The DEWALT Heavy Duty Routers deliver accuracy, durability, power and the most innovative features available. For example, the DW621 includes the industry's first built-in dust collection system. It can also convert from a fixed base to a plunge router with the twist of the left knob. The DEWALT line includes the DW625, which boasts 15 amps and a 3 horsepower motor. Additionally, it contains phosphorous bronze guide bushings for a smooth and even plunge. Our fixed-base router, the DW610, won the 1998 Wood Magazine Editors' Choice Award and our Plunge Router, the DW621 won the American Woodworker's Editors' Choice Award for 1998. So get the best of all worlds, and get a DEWALT heavy-duty router. Guaranteed Tough.™

For more information, call 1-800-4 DEWALT or visit our web site at www.dewalt.com.

DEWALT®
High Performance Industrial Tools
READER SERVICE NO. 219

Sanding blocks have lifetime guarantee

Sup-R-Sander sanding blocks come in three grits—coarse, medium and fine—equivalent to 60, 80 and 120 grits, respectively. Sup-R-Sanders use a tungsten-carbide abrasive, the same material found in router bits. Best of all, the blocks come with a lifetime replacement warranty.

I put Sup-R-Sanders to hard use shaping the ends of a run of hardwood slats to about a ⅜-in. roundover. To my pleasant surprise, the blocks are good as new.

The blocks clog and have to be cleaned regularly with a manufacturer-supplied brush. A few strokes is all it takes to renew a block when sanding nonresinous woods. Sanding a finished piece of wood causes the blocks to clog quickly, but they can be cleaned by soaking them in hot, soapy water, ammonia-based window cleaner or mineral spirits. Sup-R-Sanders are available from the manufacturer (708-418-5042) and at select Sears stores. Blocks cost $10; a set of three is $25. *—Jim Tolpin*

Sup-R-Sander blocks come in three grits. *Tungsten-carbide particles are brazed onto a thin steel base, which is glued to the block's plastic body.*

ORDER 1-800-328-0457 MAIL ORDER HOURS M-F 7:00-5:30 C.S.T. SAT 8:00-1:00

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		217 155
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/ extra knives		329
36-865	Versa Feeder Stock Feeder		249
36-220	10" Compound Mitre Saw		294 199
37-070	6" var/spd Bench Jointer		351 265
14-650	Hollow Chisel Mortiser with chisels and bits		380 249
17-900	16-1/2" Floor Drill Press		490 329
17-924	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
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 589
33-830	10" Radial Arm Saw		851 729
37-285	NEW 6" Jointer w/ stand		424 345
37-380	NEW 8" Professional Jointer		1500 1129

Single Stage Dust Collectors

50-850	1-1/2 HP, 1200 CFM		Sale 295
50-851	2 HP, 1500 CFM		Sale 495

The following tools have a $50.00 rebate! Price shown is before rebate.

36-475	10" Platinum Edition Contractors Table Saw w/ 30" unifence, cast iron wing, 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
28-255	14" Platinum Edition Band Saw - 1 HP w/ mobile base, 18" rip fence, & 3/8" blade	Sale	849
31-280	Sanding Center w/ stand	Sale	789
37-190	6" Deluxe Jointer	603	445
37-195	6" Professional Jointer	625	539

MILWAUKEE TOOLS

6527-6	Sawzall with case	343	169
6537-226	527 w/quick lok blade change	224	179
0407-22	12V Drill w/kyls chuck&2 batt	380	179
0224-1	3/8" Drill 4.5 amp magnum	236	136
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	128
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	112
5399	1/2" D-hdle Hammer Drill Kit	356	225
5397-6	3.8" v/ spd Hammer Drill Kit	275	145
5371-6	1/2" v/ spd Hammer Drill Kit	360	194
6145	4-1/2" Grinder 10,000 rpm	179	105
6494-6	10" Compound Mitre Saw	585	279
6266-6	Top Handle Jig Saw	315	159

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-off	10" 80	114	68
LM72M010	Ripping	10" 24	69	39
LU73M010	Cut off	10" 60	84	49
LU87R010	Thin Kerf	10" 24	72	48
LU88R010	Thin Kerf	10" 60	88	55
LU98R010	Ultimate	10" 80	128	78
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
C10FCD	NEW 10" dual bevel Compound Mitre Saw	550	265
NV45AB	Coil Roofing Nailer	935	379
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	95
DA391DW	3/8" angle Drill Kit 9.6V	341	139
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	255
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	169
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	Sale	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	309

SENCO AIR NAILERS

SFN30	NEW Finishing Nailer w/ cse	459	229
SNS45	Stapler 7/16" crown, 1" - 2"	540	365
SLP20	Pinner w/cs 5/8 -1-5/8"	422	179
SKS	Stapler 5/8 - 1-1/2"	390	239
SN70	Framing -Clip Hd 2 - 3-1/2"	725	449
SN65	Framing -Full Hd 2 - 3-1/2"	709	375
SN600	NEW Framing 2 - 3-1/2"	699	379
SFN40	Finish Nailer 1-1/4 - 2-1/2	569	349

BOSTITCH AIR NAILERS

Model	Description	List	Sale
N80S-1	Stick Nailer	Sale	299
RN45	Coil Roof Nailer 3/4 - 1-3/4	845	339
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	135

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	13.95	78.95
#2	12"	8-1/2"	26.75	15.75	88.95
#3	14"	10"	33.85	19.95	114.95

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

PANASONIC CORDLESS

EY6431NQKW	NEW 1/2" 15.6V drill kit with two 3 amp-hr Ni-Mh batteries, 45 minute charger, & case	369	205
EY6431FQKW	NEW 1/2" 15.6V drill kit with two 2 amp-hr Ni-Cad batteries, 30 minute charger, & case	339	189
EY6407NQKW	NEW 1/2" 12V drill kit with two 3 amp-hr Ni-Mh batteries, 45 minute charger, & case	339	189
EY6406FQKW	NEW 3/8" 12V drill kit with two 2 amp-hr Ni-Cad batteries, 30 minute charger, & case	305	169
EY3503FQWKW	5-3/8" 12V Wood Cutting Circular Saw Kit	500	259

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

STABILA LEVELS

25010	10" die cast Torpedo Level	Sale 21.95
24640	24" Level w/ hand holes	Sale 47.95
24670	48" Level w/ hand holes	Sale 59
24632	NEW "Jambor Set" designed for setting door jambs. Includes 78" level and 32" level	Sale 129

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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	426	149
DW411K	1/4 sheet Palm Sander w/ cse	88	58
DW682K	Biscuit Joiner with case	448	169
DW705	12" Compound Mitre Saw	734	339
DW621	2 HP Plunge Router	400	199
DW677K	3-1/4" Planer with case	268	155
DW431	3 x 21 v/spd Belt Sander	338	188
DW421	5" Palm Ran. Orb Sander	144	75
DW423	Palmgrip Random Orbit Sander - variable speed	170	92

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	99

DEWALT CORDLESS DRILLS

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

Above drill kits come w/ charger & steel case !

DW991KS-2	DW991K drill, DW935 trim saw, 2 XR batteries & case	Sale	345
DW911	NEW jobsite Radio & Charger	Sale	149

DEWALT 18 VOLT CORDLESS TOOLS

DW933K	Jigsaw Kit	468	275
DW938K	Recipro Saw Kit	520	269
DW995K-2	1/2" Drill Kit w/ 2 batt.	Sale	259
DW997K-2	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	399
DW995KC-2	DW995K 18V drill kit, DW938 18V recipro saw, & case	399	

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	279
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 and 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	289
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	155
1584VS	Barrel "CLIC" Jig Saw	288	155
	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	165	98
3725DVS	5" Random Orbit Sander	256	145
3727DVS	6" Random Orbit Sander	266	149
3915	10" Slide Compound Saw	1050	499
3912	NEW 12" Cmpnd Mitre Saw	638	329
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
1617EVS	2 HP Router w/ variable speed - 2 handle	Sale	189
1618	1-3/4 HP Router - "D" handle	Sale	179
1618EVS	1618 router w/ var/speed	360	215
1640VS	NEW Power Tenon Saw	200	129
1640VSK	NEW Power Tenon Saw Kit	370	209
3850K	18V cordless Drill Kit	Sale	255

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

JET TOOLS

JJ60S	6" Jointer - open stand	Sale	429
JJ6CSXW	6" Jointer - closed stand and extra knives	Sale	499
JJ8CS	8" Jointer - closed stand	Sale	1189
JWBS14OS	14" Band Saw 3/4 HP - open stand	Sale	495
JWBS14CSW	14" Band Saw 1 HP - closed stand with rip fence and mitre gauge	Sale	579
JWTS10CW2JF	10" Contractor Table Saw with 30" Jet fence and cast iron wings	Sale	649
JWTS10CW2PF	10" Contractor Table Saw with 30" Exacta fence 1-1/2 HP & cast iron wings	Sale	769
JTAS10X501	10" Tilting Arbor 3 HP Table Saw with 50" Exacta fence, table, and legs	Sale	1399
JDP17MFW	16-1/2" Drill Press 3/4 HP - 16 speed with bits and mortise attachment	Sale	419
DC-650	Dust Collector, 1 HP, 650 CFM	319	199
DC1100	1-1/2 HP, 1100 CFM Dust Collector	425	299

PORTER CABLE

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
691RS	NEW "Ultimate Router Workshop" includes 691, 6931, & 698	Sale	325
693	1-1/2 HP Plunge Router Base	338	188
697	1-1/2 HP Router/Shaper	418	238
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	215
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	69
556	Biscuit joiner w/ 5556 fence.	Sale	135
557	Plate Jointer with tilt fence. Includes 2" & 4" blades for use with standard & face frame plates	400	205
5563	Face frame plates for 557		7.99
7529	NEW 2 HP variable speed Plunge Router	415	209
97529	Above router with guide, dust collection, and case	480	249
7519	3-1/4 HP Router 2 Handle	469	268
7518	3-1/4 HP 5 speed Router	534	295
7539	3-1/4 HP v/sp Plunge Router	534	294
7310	5.6 amp Laminate Trimmer	176	104
97310	Laminate Trimmer Kit comp	336	194
97311	Laminate Trimmer Kit with underscribe base	390	205
7335	5" Random Orbit Sander	254	105
97355	7335 w/ case & dust pick-up.	274	135
7336	6" Random Orbit Sander	259	109
97366	7336 w/ case & dust pick-up.	284	139
332	Palm Grip Rndm Orb Sander	133	62
333	above sander with dust bag.	148	68
333VS	Random Orbit Sander - variable speed	150	88
334	333 Sander with PSA pad	148	68
335	Palmgrip Random Orbit Sander with dual flip pad	Sale	88
310	Production Lam. Trimmer	270	154
347K	7-1/4" "Framers" Circ Saw with plastic case	250	129
743K	7-1/4" "Framers" Circ Saw with case - left hand version	250	129
9737	Tiger Recipro Saw	307	159
9543	NEW Top Handle Jig Saw	300	165
97765	NEW SDS Rotary Hammer Drill	380	199
CDA250	Angle Finish Nailer 1-1/4" to 2-1/2"	500	279
CFN250	Finish Nailer 1" to 2-1/2"	500	279

Porter Cable Pneumatic Nailers

BN125	Brad Nailer -18 ga. 5/8"- 1-1/4"	144	89
BN200	Brad Nailer -18 ga. 3/4"-2"	238	128
FN250A	Finish Nailer -16 ga. 3/4"-2-1/2"	362	185
DA250A	Nailer -15 ga. 1-1/4"-2-1/2"	412	215
FC350	Framing Nailer - clipped head	558	285
FR350	Framing Nailer - round head	558	285
RN175	Roofing Coil Nailer	504	259

Porter Cable Compressors

CF1400	1 HP, 4 gal. Pancake	Sale	199
CF2400	2 HP, 4 gal. Side Stack	Sale	329

Introducing New Porter Cable Cordless Products

9866	12 volt drill kit	Sale	145
9876	14.4 volt drill kit	Sale	169
9884	19.2 volt drill kit	Sale	269
9845	19.2 volt circular saw kit	Sale	275
9884CS19	19.2V drill / saw combo kit	Sale	385

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READER SERVICE NO. 248

An angle gauge that really swings

There are plenty of measuring tools, from cheap plastic drafting triangles to expensive protractors, that can be used to set the angle on a tablesaw blade. They all do a perfectly adequate job. But for sheer elegance and ingenuity, the Beall Tool Co.'s Inclinometer has no match.

The tool is a well-crafted pendulum made of brass and aluminum and incorporates an open pivot bearing for low friction. The Inclinometer can also be used to set a jointer fence. The tool can even be zeroed out in case the machine is on an uneven surface.

The Inclinometer sells for $129. For more information, call (800) 331-4718 or (740) 345-5045. —*A.B.*

Angle-setting gauge from the Beall Tool Co. *The Inclinometer attaches to the sawblade with strong magnets. It can also be used to set a jointer fence.*

Tool-actuated switch from Craftsman

One of the best features on premium shop vacuums is a tool-actuated switch. A tool, such as a sander, is plugged into the vacuum, which in turn is plugged into an outlet. Turn on the tool, and the vacuum goes on automatically. Craftsman has a device that does just that. The switch plugs into a grounded wall socket. It has one outlet for a tool and two "accessory" outlets, one for the vacuum and the other for a light. I found it the perfect solution for collecting dust at my chopsaw. The switch (model No. 924031) costs $19.99. —*A.B.*

Switch simplifies dust collection. *The Craftsman tool-actuated switch automatically turns on a dust collector when a power tool is turned on.*

Anatole Burkin is a senior editor at Fine Woodworking*; Tim Schreiner is editor of* FWW*; Roland Johnson is a woodworker in Sauk Rapids, Minn.; Andy Charron is a woodworker in Windsor, Vt.; Jim Tolpin is a woodworker in Port Townsend, Wash.*

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10" Bench Saw

16" Variable Speed Scroll Saw

9" Band Saw

10" Compound Miter Saw

READER SERVICE NO. 109

Bench-Chisel Review

To get an excellent chisel you have to spend lots of money, but spending lots of money doesn't always mean you'll get an excellent chisel

BY REX ALEXANDER

Look in any woodworking catalog, and you're bound to see chisels priced from $29.95 for a set of four all the way up to almost 10 times that amount. For a very simple tool—a chisel is really just a steel blade attached to a handle—can there be that much of a difference? Frustrated and perplexed by this wide price gap, I gathered up a tool roll full of chisels to answer that very question. For several months I worked with 17 different ½-in. chisels—some with fancy handles, others that looked like sculpture and a few that I wished I'd never bought because they were uncomfortable to use or they required sharpening too often.

Bench chisels are perfect for cleaning out deep mortises, for paring the shoulders of tenons or for dovetailing. More often than not, I reach for a ½-in. chisel for my bench work, so that's the size I evaluated. If you're in the market for a new chisel or, for that matter, a whole set of new chisels, I think it's safe to assume that the quality (or lack thereof) of one brand will extend across the range of chisel sizes. If a manufacturer makes a good ½-in. chisel, it stands to reason that its other sizes will also be good.

Going also by the name of bevel chisel or cabinetmaker's chisel, these long, slender chisels can range in overall length from 8½ in. to 11½ in. Each chisel has a thin blade with beveled sides, which makes it easier to work it in tight places such as the corner of a dovetail. The bevel angle and the total thickness of the blades vary among manufacturers.

A handle can be made of wood or plastic and fits into a socket or around a tang on the noncutting end of the blade. A socket chisel's handle fits into a conical cup forged into the end of the blade, kind of like ice cream in a cone. A tang chisel's handle fits around the forged, thin, noncutting end of the blade, kind of like a Popsicle around a stick. Some chisels have a socket-and-tang combination

for affixing the handle to the blade. A socket-and-tang chisel has a tang on the end of the blade and an auxiliary ring that fits around the blade end of the handle. Many chisels have a metal strike ring on the end of their handles to protect the handles from splitting. A tang chisel with a wood handle has a ring where the tang meets the wood and a strike on the other end.

Japanese chisels differ from their Western counterparts in several ways. Aside from the laminated-steel construction, the blades are typically shorter than Western ones. Another difference is the angle of the blade to the handle. The blade of a Western chisel is straight and is mounted parallel to the length of the handle. The blade of a Japanese chisel has a slight curve forged into its flat back (see the top left photo on p. 57). As a result, the back of a Japanese chisel rests closer to the work at hand; a small point perhaps, but some people like the way this makes the chisel feel in their hand. A Japanese chisel has a hollow-ground back that makes it easier to flatten the back.

Forging and steel

Today's chisels are either hand-forged or machine-forged. The majority of tools I tested were machine-forged. Machine-forging is a mechanized production method that involves gas furnaces for heating, huge drop hammers for forming and conveyors that automatically take the chisel to different stations for annealing, tempering and grinding.

Hand-forging is the traditional approach. First, a blacksmith heats steel at a forge. He removes the heated steel and then stands at an anvil and hammers the chisel blank to shape. The blade is then annealed, a process in which the steel is returned to the forge, heated red hot and then slowly cooled. Tempering comes next—slightly heating the steel and then quenching in water or oil. Tempering gives the blade its hardness, elasticity or workability.

Japanese chisels are forge-welded, a hand-forged laminating process of joining soft and hard steel. The thicker, soft steel supports the thinner, hard steel that comprises the cutting edge.

A general rule is that hand-forged chisels, which take a lot of time to make by hand, are more expensive than machine-forged chisels. In blacksmithing, as in woodworking, time is money.

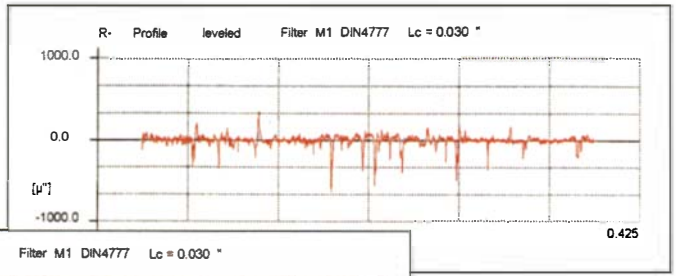
Controlled and uncontrolled testing

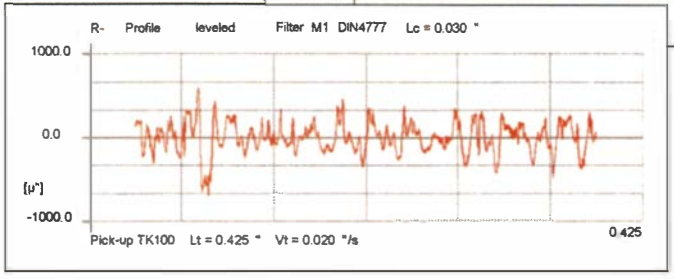
I used all 17 chisels as I built a series of white oak desks, Western cedar cabinets and 10 curly maple chairs. I cut dovetails, cleaned out mortises, corner-chiseled rabbet joints, pared end grain on tenon shoulders and even removed partially cured glue from panels. Obviously, my hands are different than yours, as are my work habits and techniques, but while using all of the chisels, I was concerned with how comfortable the tools felt, how balanced they felt and how well the steel performed. Aside from my subjective comments about the look, feel and perfor-

TESTING THE CHISELS

The great equalizer. *In the real world, tough steel is more important than hard steel. To gauge the toughness of the chisels' blades, the author took them to a testing lab that measures blade roughness by drawing a minute stylus along the chisels' edges. Each chisel was measured twice: once after sharpening and a second time after the chisel was driven 30 times into a white oak board by a hammer head dropped 6 in. above the chisel's handle.*

BEFORE





AFTER

Measured twice, rated once. *The chart above shows a stylus-generated reading after sharpening a chisel but before the toughness test. At left is a typical chart after the test. The more jagged the line, the rougher the chisel's edge.*

Photos, except where noted: Michael Pekovich; this page (right): Jefferson Kolle

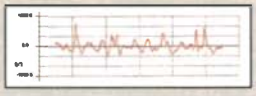
BENCH CHISELS EDGE TO EDGE

HOW THE CHISELS WERE RATED

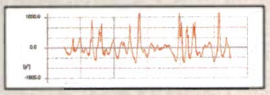
After 30 hammer blows in a jig, all but three chisels had dulled cutting edges. In the box that accompanies each chisel photo, the jagged red line is a graphic representation of that chisel's edge after the blows. A flatter line indicates a tougher edge and thus a higher toughness ranking; one being the best and 17 the worst. In some cases, the differences between ranks is miniscule. A real-world rating of excellent, good or average is awarded and explained in the text.

Blue Steel
(800) 537-7820
½-in. chisel: $38
Rockwell hardness: 67C
Toughness ranking: 2

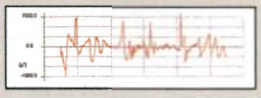
Barr Specialty Tools
(800) 235-4452
Set of four chisels: $300
Rockwell hardness: 61C
Toughness ranking: 5



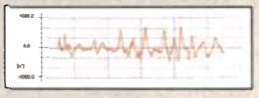
Crown Tools
(800) 249-8665
Set of four chisels: $39.96
Rockwell hardness: 59C
Toughness ranking: 7



Craftsman
Available at Sears stores
Set of five chisels: $29.99
Rockwell hardness: 60C
Toughness ranking: 9



Garrett Wade
(800) 221-2942
Set of six chisels: $59.95
Rockwell hardness: 61C
Toughness ranking: 11



mance of the chisels, I wanted to devise a more controlled test of the steel in each chisel. I started by taking all of the chisels to a local manufacturing plant for Rockwell-hardness testing.

After I got the Rockwell-hardness numbers, I wanted to settle in my mind a question that had been vexing me for some time. I knew that hard steel is also brittle steel, and a brittle edge can chip under duress. Most catalogs tout the Rockwell-hardness numbers of their cutting tools as a badge, an indication of superior steel. What I wanted to determine was a blade's toughness—how long it would stand up under use between sharpenings.

I made a device to hold a chisel's blade vertically against a piece of white oak. And I made a guillotine-like chute through which I could drop a 2-lb. hammer head against the chisel's handle, thus driving the blade into the oak (see the top left photo on p. 53). Using a water wheel and a 1,200-grit diamond plate, I hollow-ground and honed a fresh 25° bevel on all of the chisels before testing.

Hommel America is a testing laboratory that uses computer-driven instruments to measure everything from the roughness of a stainless-steel, artificial hip joint to the concentricity of a die for punching out aluminum beer cans. They had the perfect instrument for measuring the roughness of a chisel edge. The machine works by dragging a stylus along the ½-in. cutting edge of a chisel, taking 9,500 readings of peaks and valleys in the edge. The instrument measures in micron inches—1 micron in. is equal to 1/1,000,000 in. The sharpened and honed blade of a high-quality chisel deviates in peaks and valleys from a straight line by approximately 250 micron in. Hommel America's instrument represents a roughness reading as a jagged line; the rougher the edge, the more jagged the line. To correspond to the jagged line, the instrument computes a number that indicates in micron inches the mean height of the peaks and valleys of a measured surface. The higher the number, the rougher the surface.

The roughness of each chisel edge was measured twice—once when it was freshly sharpened and again after dropping the hammer head, from a height of 6 in., a total of 30 times, which is about the number of blows I thought it would take for the average woodworker to mortise three cabinet hinges.

The surprising results

Armed with a before and an after roughness reading of each chisel edge, I subtracted the before mean number from the after mean number. This change in roughness reading was used to designate the toughness of a chisel's cutting edge as excellent, good and average. I was amazed by the results. There is a huge difference in the way the chisels performed. Here's my evaluation of the tools, in alphabetical order: After a brief description of each chisel, a single-word designation—excellent, good or average—indicates how the tool did in the toughness test.

Barr Specialty Tools—Handmade in McCall, Idaho, this chisel is very expensive—it costs $300 for a set of four—but it is a delight to hold and behold. This well-balanced tool comes buff polished out of the package. The side edges of the chisel were knife sharp, which I don't like, but I was able to knock off the edges fairly easily with 120-grit sandpaper. The chisel sharpens easily, and the cutting edge lasted a long time. Good.

Blue Steel—This small Japanese chisel—only 8½ in. long—is well balanced and a pleasure to use. After 30 blows with the hammer head, the cutting edge on this chisel, like two of the other Japanese chisels, showed virtually no signs of wear. Excellent.

Craftsman—I've owned several Craftsman butt chisels that would hardly hold an edge, so I was pleased to find that the steel in this chisel has been improved. The handle is, to put it nicely, awkward.

Almost 2 in. longer than the blade, the thick, black plastic handle has a circumference of more than 4 in. Average.

Crown Tools—All of the surfaces of this English-made chisel—the quality blade and the acrylic handle—are beautifully smooth and polished. The tool has a nice balance and is a joy to use. It feels good in my hands. Good.

Garrett Wade—This well-balanced, house-brand chisel, made in Czechoslovakia, has an iron-ringed beech handle and is touted in the Garrett Wade catalog as a "superb value." Given the chisel's performance, I'd say they are right. Average.

Harris Tools—I had high hopes for this chisel sporting a cocobolo handle. The blade looks surprisingly like the Garret Wade house brand, and in fact, both blades bear the marking, "Cr-Mn Steel." An employee at Garrett Wade said he " believed both chisels are made at the same plant in Czechoslovakia." Average.

Hirsch—This German-made chisel has an eight-sided, steel-banded hornbeam handle. The blade looks remarkably similar to the one in the Two Cherries chisel (above), the only difference being that the Hirsch chisel has a little Elk stamped into the blade near the tang while the Two Cherries chisel has (surprise, surprise) two cherries as its stamp. I called Highland Hardware, a dealer of Hirsch chisels, and was told that the two brands are "made side by side at the same plant." Good.

Iyori—This Japanese chisel arrived very sharp and ready to go from Highland Hardware. The chisel's 11½-in. length felt too long for me, but it would be great for someone who likes long-bladed tools. Excellent.

A Japanese chisel has a curve in the blade. *Unlike a Western chisel's blade that is held in a straight line to its handle, a Japanese tool, like the one shown in the foreground, has a slight curve forged into the blade, which lets the blade rest closer to the work.*

Hollow-ground back makes for easy flattening. *All Japanese chisels have elliptical areas relieved from the back side. With less steel to remove, flattening the back of a Japanese chisel during sharpening is easier.*

Japan Woodworker—As is the case with many Japanese chisels, this one came with an unseated strike ring at the end of the handle. Seating the ring is just a matter of giving the end of the handle a few hammer whacks to mushroom the wood around the ring. Unlike the other Japanese chisels I looked at, this one was in the middle of the pack in the toughness test. Average.

Lee Valley—This tool was chipped right out of the package. Once I sharpened it and put it to use, it did moderately well. Balance and feel are good. Average.

Marples Blue Chip—The Marples-brand chisel is the Ford Taurus of chisels; you can find them in lots of catalogs and woodworking stores around the country. But in the toughness test, it did not do as well as most chisels in this review. The molded blue vinyl handle of the ½-in. chisel I tested felt comfortable. Average.

Pfeil—I have several friends who own Pfeil carving tools, and they think Pfeil tools are the greatest, so I was looking forward to trying out this Swiss-made chisel. It may be a small point, but this chisel's large-diameter round handle keeps the blade from touching the bench at any point. I found that the chisel was always rolling around on the bench, something that none of the other tools did. This chisel ranked below all others in the toughness test. Average.

Robert Sorby Gilt-Edge—A rosewood handle and a tapered brass bolster make this an expensive chisel that's beautiful to behold. Too bad the steel isn't better quality. Average.

Robert Sorby Octagonal—Another offering from the venerable English toolmaker, this chisel has a brass-ringed, contoured, octagonal rosewood handle. This chisel is beautiful, the balance is great, and it even has a shock-absorbing leather cushion between the tang and the handle. Average.

Stanley 5002—It looks like a Marples Blue Chip, feels like a Marples Blue Chip, and the blade tested just like the Marples Blue Chip. Average.

Two Cherries—The round, steel-banded hornbeam handle on this chisel has a flat section cut along its length top and bottom, making the tool well balanced and comfortable to hold. Good.

White Steel—In the controlled test, it was hard to tell the difference between this Japanese chisel and the Blue Steel Japanese chisel. A marvelous performer. The White Steel chisel costs a few dollars less than the Blue Steel. I asked the folks at Japan Woodworker about the difference between the two, and I was told that the hand-forging processes were similar, but the steel was different. They said the Blue Steel chisel has a more durable edge and will hold up better in abrasive woods like teak or exotic hardwoods. Excellent.

More than one way to mount a blade. *The top chisel is a tang chisel, in which the handle fits around the blunt end of the blade. The handle on a socket chisel fits into the blade (middle). A socket-and-tang chisel (bottom) has a tang forged on the end of the blade that fits into the handle and an auxiliary socket ring at the blunt end of the blade that fits around the handle.*

Conclusion

There is no denying the durability of the steel in the three top-scoring Japanese chisels: White Steel, Blue Steel and Iyori. The blades on these chisels were still sharp, and the blade of the White Steel chisel could still shave hair from my arm after the hammer blows. All of the other chisels, good and average performers alike, had rolled and/or chipped edges after the hammer blows.

I'd caution you against rejecting a certain brand of chisel just because it didn't do as well as some of the others in the toughness test. None of the chisels I looked at are junk. The difference between similarly ranked chisels is miniscule. When you're considering buying a new chisel, its balance, its cost and how it feels in your hand are important. If one chisel's blade is not as tough as another's, all that ultimately means is that you'll have to sharpen it more often. And ask yourself this: What's the point of buying a chisel made of super-tough steel if it feels lousy in your hand? □

Rex Alexander works wood and plays music in Brethren, Mich.

Mock-ups Quicken the Design Process

Same-sized models of chairs can solve problems before they cause a deadlock in the shop

BY KEITH ALLEN

Compared to any other furniture, chairs are more difficult to make. They're hard to design and hard to build. They need to be as lightweight as possible to make them easy to move around. Yet they also need to be strong to survive almost certain abuse. Most furniture designs begin with two-dimensional drawings, but drawings can fail to capture the complexities of a three-dimensional object such as a chair, and drawings are worthless for determining comfort.

To my mind, the chair maker's ultimate challenge is psychological. After surmounting all of the obstacles to design and construction, the custom chair maker is then called upon to produce precisely repeated multiples. I regard this boredom factor as the most difficult aspect of chair making.

For chairs, I usually dispense with drawings and begin instead with three-dimensional mock-ups. I can test-drive a good mock-up for comfort, and I can better assess how the chair is going to look. The mock-up can reveal any structural weakness early on as well as provide a convenient basis for precisely cloning multiples if I have more than one chair to make.

I make mock-ups of inexpensive, even junk, material. The parts are typically fastened together with butt joints, using a few toenailed screws per joint. I use #2 square-drive screws, 2 in. to 3 in. long, and predrill pilot holes and countersinks for the screw heads. Cutting a dry biscuit joint in the pieces being joined often makes it easier to align them during assembly.

You can easily change the dimensions and the joint geometry of

Photos: William Duckworth

mock-up parts by trial and error, as the chair design evolves experimentally. A compound-miter saw is a useful tool for this process. I record angle setups directly on the pieces as I cut them. The resulting mock-up is strong enough to test for comfort, and the temporary joinery gives me a good feel for whether permanent joinery will be strong enough to withstand likely abuse.

Make the transitions in stages

I've learned to make mock-ups in two stages. During the first stage, I determine the size and geometry of the parts and resolve ergonomic issues: how wide to make the front of the seat, for instance. In the second stage, I concentrate on form and aesthetic details: Should the top edge of the crest rail be rounded over or left square?

The first stage usually requires a minimal rough-shaping of relatively few pieces, such as the seat and back. When that's done, I'm almost ready for the transition from design to construction. I can simply disassemble the mock-up and use the sized pieces to produce blanks for however many chairs are needed. In making the actual chairs, I replace all of the screwed-together joints in the mock-up with routed mortises and loose tenons.

In the second stage, I test aesthetic ideas directly on the mock-up by trying one design detail on the left-hand side and another detail on the right-hand side. Because making blanks for the final chairs from highly shaped pieces can be cumbersome, I usually clone the mock-up between the two stages. Design decisions made when working with the second-stage mock-up rarely require any change in the overall size of parts.

The two-stage mock-up process not only provides a natural transition between design and construction, but it also helps me organize the process better and concentrate on one problem at a time. Also, construction of the actual chair is easier because the process roughly shadows the design process: Cut blanks, rout joints, shape parts, sand, assemble and finish.

Experience has proved this method useful

I've used mock-ups to great advantage, as demonstrated with the two projects shown here. Both of these jobs called for making sets of eight upholstered dining chairs to go with dining tables that I had made for the clients. In each commission, building the mock-up took me about three days, and building a set of eight chairs from the mock-up took about two weeks, working alone.

I built the set of mahogany chairs (see the bottom right photo on the facing page) in a style derived from traditional Queen Anne elements. The client handled the upholstering chores and experimented directly with the mock-up, attaching webbing and padding to it, to decide on the appropriate cushioning. With the finished chairs, I provided slip seats for the upholstery. The set of bird's-eye maple and cherry chairs is quite contemporary, what I call a "George Nakashima-meets-Gerrit Rietveld" sort of style (see the top right photo on the facing page). Upon viewing the mock-up, and at my suggestion, the client decided to replace two front legs with a single, central, vertical support. Modifying the mock-up was painless.

Upholstery—foam and fabric on plywood inserts—was the client's responsibility. After using the mock-up to produce chair blanks, I reassembled it and delivered it to the client, along with the plywood inserts for all of the chairs. While I worked on the chairs, and with a deadline fast approaching, the client took the mock-up and inserts to the upholsterer for a test sitting to determine just the right cushioning. The upholstered inserts were ready by the time I completed the chairs. On delivery day, using four metal tabletop fasteners per chair, I installed all eight inserts within an hour. Having the mock-up available for the upholsterer's use probably saved the client a week or more in total project time.

Designing in three dimensions. *For both sets of completed chairs shown on the facing page (top and bottom, right), the author cut to the chase in the design process by skipping the drawing stage.*

An efficient chair maker is a happy chair maker

While no method can eliminate all of the tedium of some projects, the efficiency of my mock-up method has reduced the boredom factor for me to a tolerable level. I once either dreaded taking on chair commissions or simply rejected them. Now, the mock-up helps me solve design problems and communicate with clients better than drawings or full-blown prototypes ever did. This method makes me feel so efficient and organized that I'm planning to use it for a few speculative pieces of furniture. □

Keith Allen designs and builds custom furniture in his shop on a 50-acre farm near Raleigh-Durham, N.C.

A Small Elegant Box

Pinned lap joints and shaped sides refine a basic design

BY GARY ROGOWSKI

Simplicity in design is often mistaken for having a simple mind or a lack of ideas. Accuse me of this innocence, but I still prefer shapes to be more modest than bold. Because of this inclination, I've always found Japanese design to be inspiring, especially traditional designs for packaging. When I wanted a new joinery project for students attending my woodworking school, I recalled a bamboo sushi container made with simple lap joints. I changed the design to use alder instead of bamboo and to include a bottom lined with rice paper. I left out the fish.

The first step in this project is to decide on the proportions of the box. It's surprising how different a box looks when you change the proportions from, say, 2:1, to 5:2 and to 8:5 (the classic golden mean). Try some basic outlines on a piece of paper to see the difference. Then mill up some stock ½ in. thick and 2 in. wide.

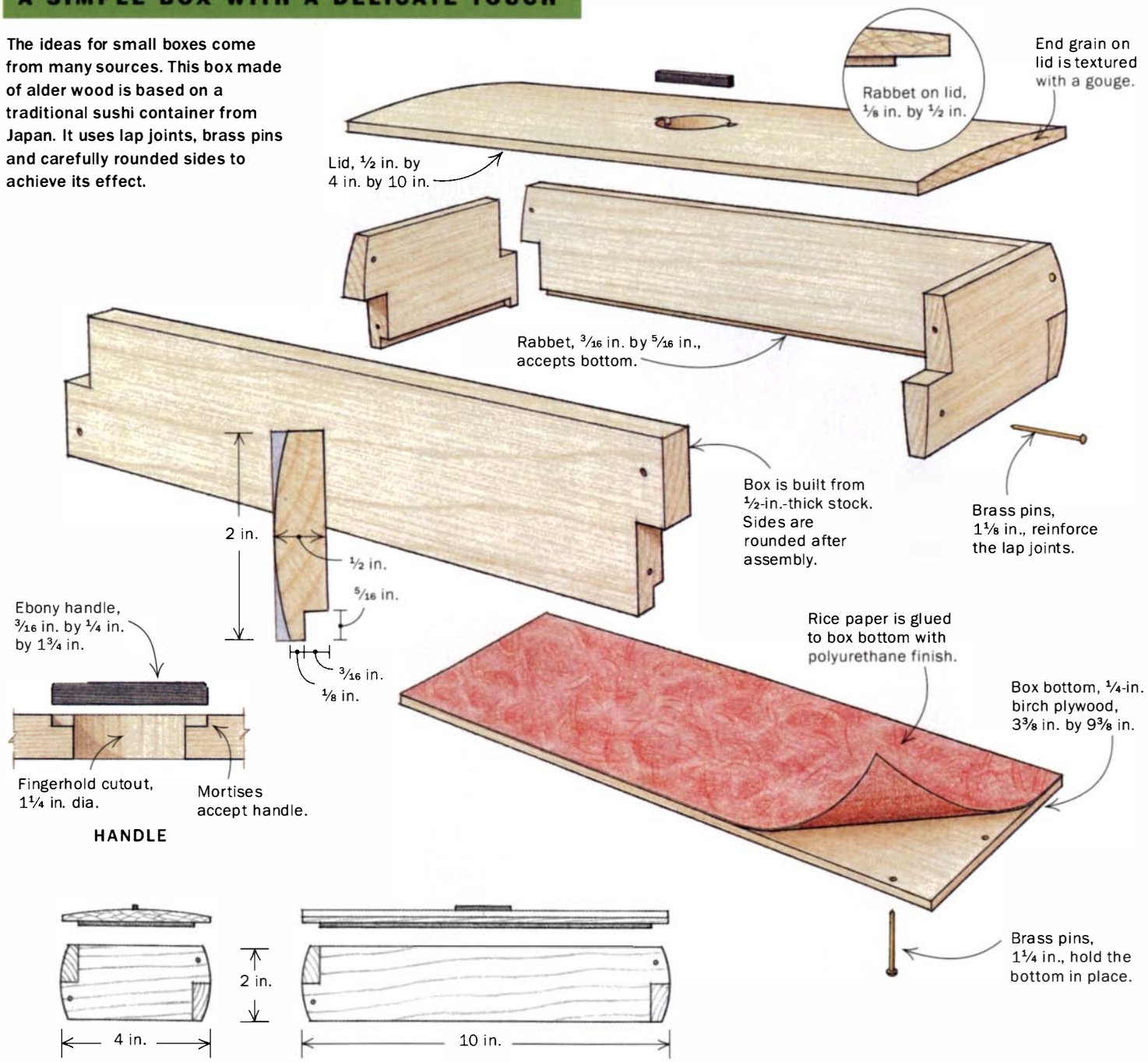
Lay out the lap joints at half the height of the stock (1 in. in this case) and mark them with a square. Then lay out the depth of cut with a marking gauge set to cut just less than the thickness of the stock. Cutting the depth of the fingers to just less than the thickness of the stock enables you to clamp up right over the joint, making it much easier to glue up. The long grain rather than the end grain will be left proud so that it won't get in the way of your clamp pad.

When it comes to arranging the lap joints at each corner, you can stagger the fingers

Photos: Matthew Teague

A SIMPLE BOX WITH A DELICATE TOUCH

The ideas for small boxes come from many sources. This box made of alder wood is based on a traditional sushi container from Japan. It uses lap joints, brass pins and carefully rounded sides to achieve its effect.



around the box: For this box I placed one upper finger and one lower finger on each side piece, which looks good to me. Or you can cut both fingers on the upper or lower half of each side. It's up to you, but bear in mind that when you stagger the joints, it's a much tougher glue-up. Any clamping pressure on the sides tends to collapse them in toward each other, so it helps to glue up the box with the bottom in place to act as a spacer. The easier method aligns the sockets and fingers opposite each other so that each side is held in place by the other when pressure is applied.

Cut lap joints and rabbets

Pull out your tablesaw and dado blade, if you must, but lap joints and rabbets are just as easily cut with a good dovetail saw and a paring chisel. Just remember that these simple joints have very little gluing surface, so they must fit well to gain any strength from the joint. For added strength, I reinforce the joints with 1⅛-in. brass pins after glue-up.

The rabbets to accept the bottom are easily cut on a router table. Because I built the box with staggered joints, I cut the 3/16-in. by 5/16-in. rabbets for the bottom into each piece, with a stopped cut at the finger end and a through-cut at the other. End these stopped cuts well in from the end so that you lessen the chances of blowing out the short grain on the sides. The rabbets are squared up with a chisel before the box is assembled. Though this is a small box,

Drawings: Vince Babak

BOX BUILDING WITH LAP JOINTS AND RABBETS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2


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4


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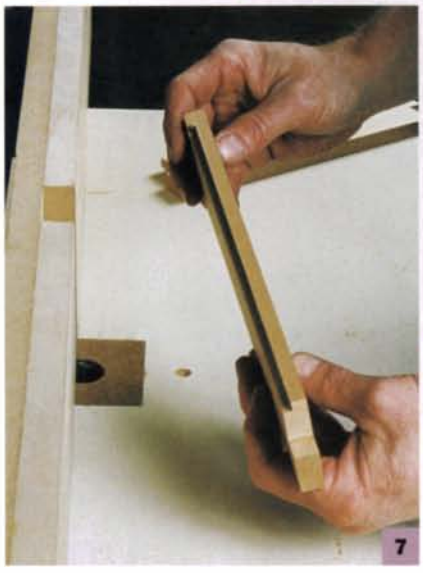
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8

1. Lay out the lap joints. *To lay out the fingers, use a marking gauge set to just less than the stock thickness.*

2. Make the first cut. *Use a dovetail saw to cut a kerf at half the width of the stock.*

3,4. Follow the chiseled line. *Establish a shoulder line using a paring chisel and cut away the excess.*

5. Clean up with a chisel. *Square up the joint with a paring chisel.*

6. Mark from the joint, not from a ruler. *With one shoulder cut, lay out the mating lap joint directly from the stock.*

7. Stopped rabbets on the router table. *Using a straight bit and stop block (not shown) on the router table, cut a rabbet in the bottom of the sides—be careful not to blow out the end grain. Use a paring chisel to square up the corners of the rabbets.*

8. An army of clamps. *After a dry run with the clamps, lay out the pieces and apply glue to the fingers and shoulders. Add clamps one by one, and check frequently to make sure the box stays square and that every joint closes.*

glue-up takes more clamps than you might imagine. Make sure that pressure is evenly distributed and that everything is square, then leave it clamped up overnight.

Shape the sides with a handplane

The next day, round the sides of the box with a sharp plane—I use either a low-angle block plane or a No. 3 smoothing plane (see the top photo on the facing page). Because you're planing end grain, work in from the corner, even if it means planing against the long grain. You can clean up any tearout by carefully planing in the proper direction once the bulk of the shaping has been completed.

Draw pencil marks around the edges so you can gauge how far in you want to shape. I round in about one third of the thickness of the stock, leaving the middle of the box sides the full ½ in. thick. Be careful at the bottom edges because too much shaping will weaken the wall covering up the rabbet.

Start to round out near the edges of the sides first and work your way back toward the middle until you get a nicely rounded shape. Finish up the shaping with a newly honed blade set for a very fine shaving, and be careful of any potential end-grain problems.

Shape the lid and handle

The lid is cut out exactly the same size as the overall dimensions of the box before being shaped. Once the box sides have been shaped, the box lid will overhang the sides nicely. Rabbet the lid on the router table so that it fits just inside the box. Place the lid over the edge of a bench hook and clamp it so that you can round it with your plane (see the inset photo on the facing page). Again, use a pencil line to gauge how far to round the lid. After shaping,

SHAPING THE BOX

Rounding the sides. *A small block plane cuts in across the end grain. First, a bevel is established, then the entire side is rounded to a fair curve. A pencil line prevents mistakes by showing how much of the stock should be planed away at the edges of the box.*

Shaping the top. *The author uses a bench hook and a block plane (above) to round the top to a fair curve.*

carve the end grain of the lid with a gouge (I use a No. 3) for an attractive bit of texture.

Before shaping the lid, drill a 1¼-in. fingerhold in the center of the lid and rout grooves to accept a handle. I use a 3/16-in. straight bit in my router table to make these stopped cuts. Chisel them out square and fit a contrasting wood as the handle. I used ebony as the handle for this alder box and left it a bit tall in the grooves. I make the same box out of walnut and use holly for the handle. It helps to do all of your staining before gluing the handle in place.

Add details to refine the box

There are a couple of other details I add to this simple box. I glue rice paper to the bottom using a water-based polyurethane finish from Varathane as the glue (see the photo at left). I put the finish on the bottom and the oversized rice paper, then press them together. No clamping is required. When dry, trim the rice paper exactly to size. The bottom sits in the rabbets and is nailed in place with brass pins. I use a slightly longer pin to nail each of the lap joints. Such thin stock has a tendency to split, so predrill the holes for the pins with an undersized bit. Then carefully tap in the pins, protecting the underside of the box with a towel or a scrap piece of carpet.

Polyurethane finish acts as glue. *The author brushes a coat of polyurethane onto a sheet of rice paper and the box bottom, then lays the paper on the bottom and lets it dry.*

This alder box is bleached to give it a bone-white look. I use a couple of coats of a commercial two-part bleaching solution. After bleaching, I clean the wood with a water-dampened rag. The walnut boxes I make are ebonized using a stain made up of white vinegar and a piece of old steel wool. I give the solution a few days to mix up, strain out the steel wool particles and then wipe this stain onto the walnut with a rag. The amount of darkening that occurs will depend upon the tannin in the walnut, and at this stage it can look a little drab. But as soon as you put a clear coat over it, the beauty of the stained walnut really pops. I pad on a few coats of clear blond shellac as a final touch to this very simple design. □

Gary Rogowski is a contributing editor to Fine Woodworking.

Strategies for Curved Work

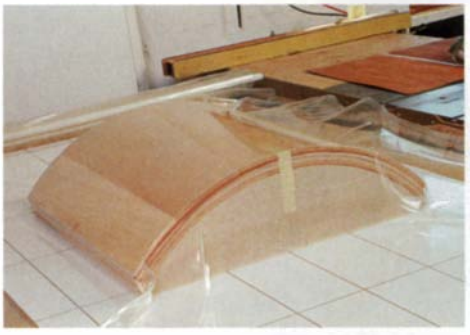
A vacuum press provides speed and muscle, reducing the need for lots of clamps and forms

BY DARRYL KEIL

The traditional method of making curved, laminated parts such as doors or aprons requires male and female forms and a barrel of clamps to squeeze the layers into shape. Or you can use a single form and a vacuum press, essentially a sealed plastic bag connected to a vacuum pump. A vacuum press speeds up production, does away with cumbersome clamps and reduces the amount of material needed for forms.

Although I've done it a thousand times or more, every time I fire up my vacuum press and see the bag shrink itself around a project, contorting wood into a new shape, I'm awed by the power of Mother Nature. Atmospheric pressure, when properly harnessed, can generate more force than any other tool in my shop.

On average, an object in a vacuum bag experiences about 12 psi, which really doesn't sound like much. But the numbers quickly add up as an object gets larger. For example, I made a form for laminated credenza doors measuring 24 in. by 27 in. The vacuum press delivered a cumulative pressure of 7,776 lbs., almost 4 tons, over this form. I couldn't duplicate that kind of clamping force even if I parked my tractor on top of a glue-up.



In the bag. *A vacuum press simplifies the job of building forms and clamping curved parts during glue-up.*

As a manufacturer of vacuum-press systems, I get a lot of calls from people who run into difficulties with the process. Over the years I've developed a number of methods that help ensure good results. These include building strong forms, choosing the proper core materials and glues and preparing veneers for trouble-free bonding. Whether you use one of a number of commercially made systems or build your own vacuum press (see *FWW* #99, pp. 74-75), these techniques apply.

Make forms rigid in the right places

The shotgun-like blast of a form imploding under full vacuum presents a powerful lesson in how *not* to build a form. But getting it right isn't always so obvious.

I make forms using plywood, particleboard and bending plywood. Convex forms are the most common ones used in vacuum veneering. With a convex form you can make doors, table aprons, even half columns. A vacuum bag works best around a convex form.

Concave forms present special problems because the vacuum bag tends to lock at the high points, bridging over concave sections. If a project does call for a form with a concave section, press the concave section into place before turning on the press. I tell

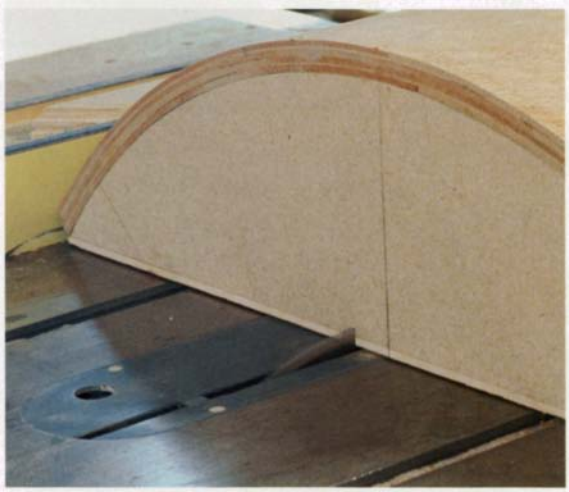
Photos, except where noted: Anatole Burkin; this page (top): courtesy of the author

SIZING PARTS FOR TYPICAL FORMS AND CORES

When calculating the radius of the ribs, remember to subtract the thicknesses of the finished stock plus the skin of the form to get the correct arc.

A good rib joint. *Forms must withstand great forces. Use 3/4-in. particleboard or plywood for ribs. Place them 6 in. on-center, and add blocking to the ends.*

Skin deep. *Nail or screw two layers of 3/8-in. bending plywood over the ribs. Make the form slightly larger than the workpiece's final dimensions to allow for trimming.*

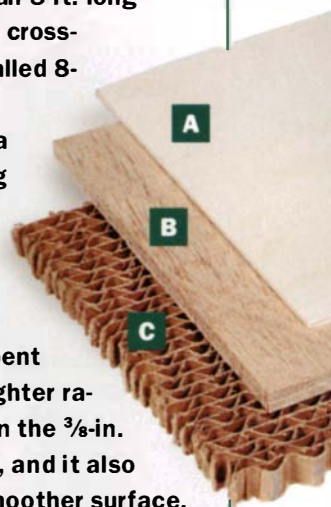


Cut a slot on the underside of the form. *The slot allows air to be evacuated from inside the form when it is under vacuum.*

Core materials for curved work

In curved veneer work, I use bending plywoods for the substrate or core. The most commonly used cores are 1/8-in. Italian poplar plywood (see A below) and 1/4-in. or 3/8-in. lauan bending plywood (B)—a common brand is called Wigglewood.

These plywoods may be ordered with long grain, called 4-by-8 (makes an 8-ft.-long tube), or cross-grain, called 8-by-4 (makes a 4-ft.-long tube). The 1/8-in. plywood can be bent into a tighter radius than the 3/8-in. plywood, and it also has a smoother surface.

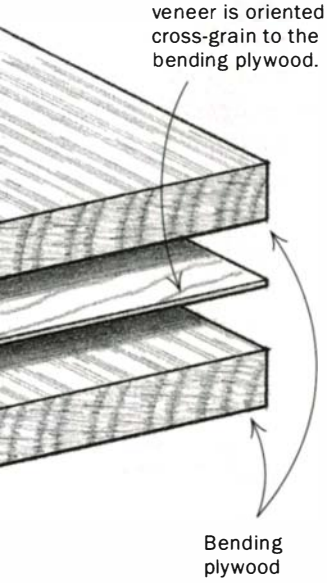


If a project requires parts that are light in weight, you may want to consider thick, resin-impregnated kraft-paper honeycomb (C) for the core material. The honeycomb must be sheathed with 1/8-in. bending plywood and edge-banded with either plywood or solid stock.

Drawings: Vince Babak

GLUING UP THE CORE

Tape the core layers onto the form before putting them into the vacuum-press bag. *A typical core consists of two layers of 3/8-in. bending plywood with a sheet of backer-grade veneer sandwiched (cross-grain) in between.*



Help the vacuum bag do its job. *Press the core down as the bag draws a vacuum.*

people just to climb up on the bag and stand on the form, then turn on the press.

Design the piece first, then dimension the form—Accurate, detailed drawings are a must when working with curves. From these drawings you can figure out the dimensions of a form. When working with curved parts, the radii of the inside and outside faces of parts are different. That's also true of a form (see the drawing on p. 65). Make the form about 1 in. longer and wider than the final dimension to allow for trimming the glued-up pieces.

A form consists of a base, interior ribs and blocking, and a layer or two of "skin."

Choosing the right glue

A foam roller spreads glue evenly. *The author prefers two-part urea resin glues for curved work because the glue, once cured, is very rigid.*

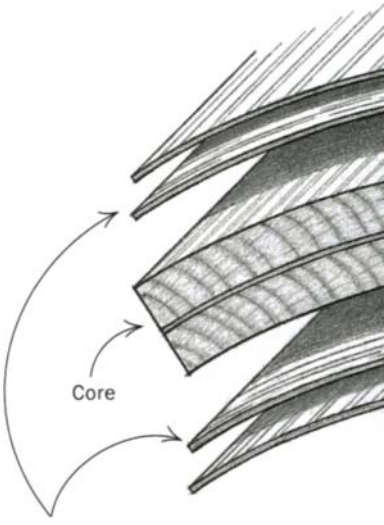
Urea resin glue is ideal for veneering, especially when working with curved forms. Urea resin comes in two forms, a liquid resin that is mixed with a powdered catalyst and a powder that mixes with water. Both types of glue are easy to work, have long open times and become very rigid when cured. Rigidity translates into less springback.

Epoxy and polyurethane glues may also be used, although they are more difficult to apply because of their thick viscosity. Both also produce more bleed-through. The first time you have to sand and scrape epoxy off veneer will probably be your last.

White and yellow polyvinyl acetate (PVA) glues don't dry as rigid as the aforementioned glues and have short open times, making them a poor choice for curved work. Contact cement is also a poor choice because it remains flexible when cured.

VENEERING THE SIDES

Once the core has cured, glue on the inner and outer skins of veneer. *The author uses two-ply on both the front and back. Two-plies help eliminate problems such as wrinkling and bubbling. Also, they can be sanded before glue-up.*



Two layers of veneer (two-ply) glued cross-grain to each other are used on both faces of the core.

If the ribs are spaced too far apart or there isn't enough skin strength, a form will distort and possibly implode. A distorted form will distort a glued-up part. Distortion may also result in poor pressing, which results in poor adhesion between laminations.

The base is a sheet of ¼-in. to ¾-in. plywood or particleboard (the thickness is not that critical). Ribs are ¾-in. plywood or particleboard (see the top photo on p. 65). Ribs should be placed 3 in. on-center when using one layer of skin; 6 in. on-center when making a double skin.

The skin is made of one or two layers of ⅜-in. bending plywood. This material bends only one way and remains fairly stiff in the other direction. Avoid using ⅛-in. bending plywood for forms because three layers of it do not equal the strength of one layer of ⅜-in. material. Each layer of ⅛-in. plywood will flex independently under pressure and produce a wavy form.

Cut the base first and make sure the corners are square. Then cut the ribs and nail them to the base. The ribs on the ends of the form require additional bracing because the force of the vacuum places equal pressure on all sides of the form. Place vertical cross braces between the outside ribs and their neighbors, approximately 10 in. on-center.

Nail or screw the skin onto the ribs (see the bottom left photo on p. 65). When nailing, apply a bead of glue to the two outside ribs so the nails alone do not bear the inward pressure. If using screws, countersink them and fill the depressions with putty.

Last, cut a slot in the underside of the form by running it across the tablesaw. Raise the blade just high enough to cut all the way through the bottom of the form (see the bottom right photo on p. 65). The slot will allow air to escape from the inside of the form when a vacuum is drawn.

How much glue is right? *A finger swiped across the glued surface should produce a shallow ridge.*

Prepare the core

I build most curved parts in two steps. First I lay up the core (for more on core materials, see the story on p. 65). Once that cures, I apply the veneer. Trying to do it all at once can be a frantic undertaking. Because I do it in two steps, I don't waste veneer if something goes wrong with the core.

Cut the core stock, leaving an extra ¾ in. all around for trimming. Make the top piece of bending plywood a little wider because it will have a slightly larger radius. To help stiffen the core, sandwich a sheet of backer-grade veneer between the plywood (see the drawing on the facing page). Orient the veneer cross-grain to the

TRIMMING THE WORKPIECE

Trim one end of the workpiece using the form as a guide. *The author uses a router with a long, flush-trimming bit.*

Cut the other end parallel to the first. *Masking tape applied to the veneer helps prevent tearout. Crosscut the router-trimmed side again, if necessary, using the tablesaw.*

Use the form as a sled for making rip cuts. *To get the proper angle, a strip of wood has been tacked to the base of the form. Make the first cut proud of the line and check the angle. Tilt the blade as necessary.*

plywood. To keep parts lined up, draw a centerline down the apex of the form and mark the center of the core plies.

After applying glue to the core parts, place them on the form. Apply tape to keep parts from shifting (see the top photo on p. 66). Mark both the form and the core again to remind yourself which way the core was placed on the form. (Later, when gluing on the veneer, return the core to the same spot on the form for a good fit.) Place everything in the bag and run the vacuum.

Wood and wood products don't always come out of a glue-up exactly the way you want them. There's usually a small amount of springback. It's impossible to calculate how much; let experience be your guide. When laminating ⅜-in. bending plywood, don't be overly concerned if the part comes out of the press and suffers what seems like excessive springback. Once you add the two-ply face veneers, it will likely hold its shape. On the other hand, laminated ⅛-in. plywood tends to hold its shape better because of the extra plies.

Glue two-ply veneers onto the core

I call two-ply veneer, or two-ply, curved-panel insurance. It's an extra step, but one that protects your project. Two-ply consists of a face veneer and a backer-grade veneer, such as mahogany, glued cross-grain to one another (see the drawing on p. 67). I sandwich two-plies between hardboard and glue them up using the vacuum press (see the top photo on p. 67). Two-plies are also available commercially.

There are many good reasons for using two-plies: (1) Problems in the face veneer, such as bubbling or wrinkling, can be repaired from the back side before gluing the veneer onto the core. (2) The ⅜-in. bending plywood has a rough texture, and a single sheet of veneer glued over it may telegraph that texture. Two-ply won't. (3) When gluing the two-ply to the core, minor areas of poor adhesion will be bridged by the two-ply and will not wrinkle or bubble. (4) Last, two-ply is stiff enough to be taped to a workbench and sanded while it's still flat. Sanding curved surfaces, especially concave areas, is difficult.

When veneering, treat both faces of the core the same way. If you glue a two-ply to the face of the core, glue a two-ply to the back as well; otherwise, the project will warp. Glue both the face and back two-plies to the core in one pressing. Spread

Edge-banding can also be ironed in place. *Coat the edges of the core and veneer with yellow glue and let them set for an hour before ironing.*

APPLYING EDGE-BANDING

Clamp edge-banding veneer onto the ends of the workpiece. *The author clamps directly to his workbench.*

the glue on the core, not on the veneer, which would curl. Then place the back two-ply on the form, place the core over it, and the face two-ply on top. Tape the top edge to the form to keep it from slipping, and place the assembly in the bag. No cover sheets are required.

Trim the finished piece using the form as a guide

Once the face veneers have been glued onto the core, the piece must be trimmed square before edge-banding can be applied. In the case of a typical glue-up, such as a door, there are four edges to trim. To get the first reference edge, clamp the piece to the form, leaving a slight overhang, and trim one end using a router and a flush-trimming bit. Simply let the bit's bearing ride along the edge of the form (see the top photo on the facing page).

It's next-to impossible to keep a router from tipping slightly while moving along a curve, but don't worry if the cut has a few minor dips. Next, trim the opposite side on the tablesaw using either the rip fence or a crosscut sled (see the middle photo on the facing page). Then flip the workpiece and make a final pass on the router-cut side.

The other two sides are ripped on the tablesaw using the form as a sled (see the bottom photo on the facing page). Depending on the shape of the form, it may be necessary both to tip the form and to tilt the sawblade. Nail a strip of wood to the underside of the form to get the proper lift. Check the angle and make a trial cut, proud of the line. Make adjustments, if necessary. Cut the other side by flipping the workpiece around on the form.

Edge-banding goes on last—Although I don't like to use yellow glue for bent parts, it's perfect for edge-banding. Where possible, I clamp edge-banding in place (see the right photo above). But some parts can be difficult to clamp. In such cases, apply glue to the edge of the lamination and the edge-banding, let it set for about an hour, then attach the edge-banding using a household iron (see the left photo above). The heat reactivates the glue. Immediately after ironing, rub the edge-banding with a block of wood to help seat the veneer.

For your first curved project, start with something small, like a curved drawer front or the top of a jewelry box. Once you feel confident with curved-panel components, you may have a hard time not including them in your work. Curves bring life to furniture. A piece with sinuous lines seems poised to go somewhere. With the addition of highly figured veneers, it's poised to go somewhere in high style. □

Darryl Keil owns and operates Vacuum Pressing Systems in Brunswick, Maine.

SOURCES OF SUPPLY

BERKSHIRE VENEER CO.
29 Locust Hill Road, Great Barrington, MA 01230; (877) 836-3379

CERTAINLY WOOD
13000 Route 78, E. Aurora, NY 14052; (716) 655-0206

CONSTANTINE'S
2050 Eastchester Road, Bronx, NY 10461; (800) 223-8087

FLAMINGO SPECIALTY VENEER CO.
356 Glenwood Ave., E. Orange, NJ 07017; (973) 672-7600

FLEXIBLE MATERIALS
11209 Electron Drive, Louisville, KY 40299; (502) 267-7717

MERCURY VACUUM PRESSES
P.O. Box 2232, Fort Bragg, CA 95437; (800) 995-4506 or (707) 964-7557

QUALITY VAKUUM PRODUCTS
43 Bradford St., Concord, MA 01742; (800) 547-5484

VACUUM PRESSING SYSTEMS
553 River Road, Brunswick, ME 04011; (207) 725-0935

BY LON SCHLEINING

Tablesaw

Many have experienced it,

IN A BLINK OF AN EYE,

it fly across the shop don't usually know what caused it. It all happens so fast that it's over by the time they realize it's occurred.

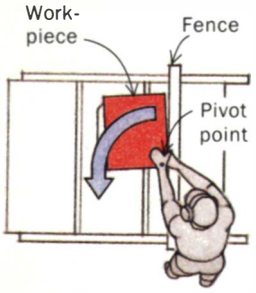
Before I let my students get near a tablesaw, I do a little dog-and-pony show to demonstrate the dangers of kickback. Using styrofoam to represent a piece of plywood, I show how the cut should be made and then what occurs if the piece drifts away from the rip fence. Crouching out of the flight path, I simply let go of the piece for a second, and off it goes.

A kickback occurs when the leading corner of a piece being cut rotates away from the rip fence. The piece then gets caught up between the back of the blade and the fence. As the back of the blade—the part that cuts upward—begins to gnaw into the freshly cut edge of the piece, the piece quickly rotates, getting caught diagonally between the fence and the blade. The corner of the piece closest to the operator and against the rip fence is the pivot point around which a radius cut is made. The piece then acts like a pole-vaulter. Rotating further and moving faster now, the piece rides up and over the blade and is hurtled into the air to the left side of the blade. If you're lucky, it will fly over your left shoulder. If you're not lucky, a board with a few horsepower of force behind it will hit you. This is also why it is such a bad idea to stand to the left of the operator and watch him work.

Afterward, you'll usually spot a crescent-shaped cut on the bottom of the piece. This crescent cut is the result of the piece rotating as it crosses over the top of the blade.

1,2 *The author stands in a normal position to begin the cut, but for demonstration purposes, he moves out of the way before allowing the workpiece to kick back. Do not try this yourself.*

3,4 *As the piece veers slightly away from the fence, it binds up between the fence and the blade. Though the gap between the fence and the piece is too small for the camera to pick up, it is enough to cause plenty of trouble. The back of the blade lifts the piece*



A shopmade splitter

BY KELLY MEHLER

Most woodworkers understand the importance of a zero-clearance insert and either buy blanks or make their own. To add a splitter to one of these inserts, I just glue a piece of wood into the slot behind the blade. The splitter stock should be the same thickness as the blade and should fit in the mating slot the raised blade cuts in the throat plate. The splitter is most effective when it is placed closest to the back of the blade. Because the blade progresses toward the back of the insert as it is raised for thicker cuts, I suggest at least two inserts—one for cutting thin stock, up to about 1 in., and another for thick stock.

To make an insert for thick stock, you must elongate the slot by flipping the insert end for end and then raising the blade. This allows you to place the splitter farther back on the insert. I always drill a finger hole in the insert for easy removal. A short adjustment screw can be embedded into the side and/or end of the insert to take up any play in the fit, and the splitter can be sanded.

The important thing is to align the right edge of the splitter

Drawing: Vince Babak

Kickback

but few know why it happens

sure the piece is firmly in contact with the fence throughout the cut. The critical time is often just after the front of the blade has cut all the way through the piece. The waste lies on the table rattling against the blade, distracting you from the very real task of keeping the piece firmly against the rip fence until it is well past the blade. A moment's inattention and ...

After the class understands the danger of kickback, I repeat the operation with

YOU HAVE TROUBLE

off the table, with the back corner of the piece (against the fence and closest to the operator) acting as a pivot point.

5 *The piece rides across the spinning blade and is catapulted into the air.*

6,7 *With a few horsepower of force behind it, the piece bullets across the room until it crashes into something. The author would have risked being hit had he stood where an operator normally stands.*

8 *The crescent shape on a piece that kicks back is the result of the piece riding across the top of the spinning blade. Using a splitter almost eliminates the chance of this happening.*

It's as if you drew a circle with a compass, putting the center point at the corner closest to the operator and against the fence.

Certain types of cuts are more prone to kickback than others. A square piece being trimmed is the most likely to cause trouble, because any drift away from the fence will cause the piece to bind. Any piece cut against the rip fence that is either square or rectangular (with a width approaching at least half or more of its length) is a very hazardous cut. Typically troublesome pieces are drawer bottoms and small parts.

But if the piece is kept solidly against the rip fence and pushed all the way through the cut and beyond the blade, it's unlikely that a kickback will occur. Keep your eyes on the rip fence just past the blade to make the splitter and blade guard in place. When I let go this time, nothing happens. Then I use a push stick to force the piece away from the rip fence and into the blade. Again, nothing happens. This is because the splitter prevents the rotation of the piece away from the fence.

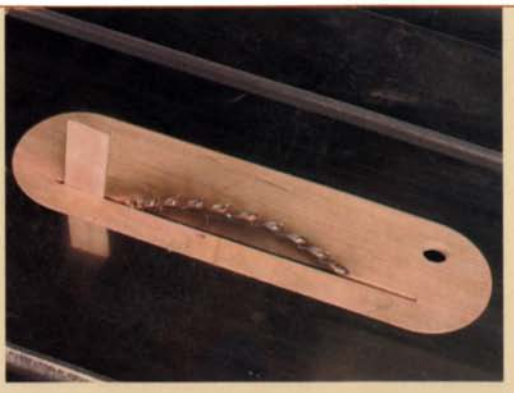
Kickbacks can be prevented. They are virtually impossible with an antikickback splitter in place. The splitter keeps the stock solidly against the rip fence and prevents any rotation toward the blade. Without this rotation, kickback is virtually unheard of. Use the splitter that came with your saw, buy an after-market splitter or make one (see the story below), but don't make cuts on the tablesaw without one. □

Lon Schleining teaches woodworking and builds custom stairs in Long Beach, Calif.

with the right side of the blade (the side closest to the fence). This keeps the workpiece against the fence for a smoother cut. Also, it virtually eliminates the chance of kickback.

I make the splitter by slicing a piece of hardwood and trimming it until I get a tight fit in the slot. Then I glue it in place. I make my splitters out of hardwood, but there is no reason why they could not be made of aluminum, plastic or any other durable material. □

Kelly Mehler is a woodworker in Berea, Ky., and the author of* The Table Saw Book *(The Taunton Press, 1993).



Simple but safe. *A splitter is essential to any safe shop, but it doesn't have to cost a thing. Flip a zero-clearance insert end for end and raise the blade to elongate the slot. Fit a piece of hardwood tightly into the slot and then glue it in place.*

Photos: Joe Romero (top row); Matthew Teague (bottom)

Designing Table Legs

Learn from the past to build for the future:

A short history of styles shows the elements of design

APPROPRIATE MATERIAL

Some styles just beg for a particular wood species. For example, simple, square oak legs look great on a Mission-style table.

LIGHTNESS

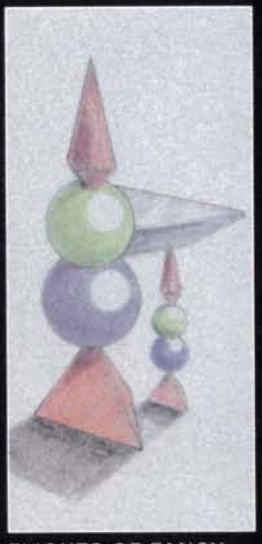
For a Shaker side table with a large overhang on the top and a narrow skirt, plain pine legs, tapered on two sides, lend a delicate look.

SOLID GROUNDING

A weight-bearing library table built in dark walnut needs hefty legs, a solid skirt and bottom stretchers to support heavy loads of books.

SOBRIETY

A Federal writing table built with deep walnut and mahogany tones calls for a restrained, classical leg design with stringing and a shaded holly inlay.



FLIGHTS OF FANCY

Polychrome geometric solids add visual interest and a sense of humor to this large dining table of post-Memphis design.

BY GRAHAM BLACKBURN

More often than not, legs are the defining features of a table. Once you decide on the shape and color of a tabletop, making it is largely a question of providing the required surface area with the chosen stock. But the support for the tabletop is a different matter. Table legs—whether in the form of monolithic blocks, single pedestals, trestles or in groups of three, four or more—may be provided in a bewildering array of forms. The variety of legs is virtually endless, both from stylistic and construction standpoints.

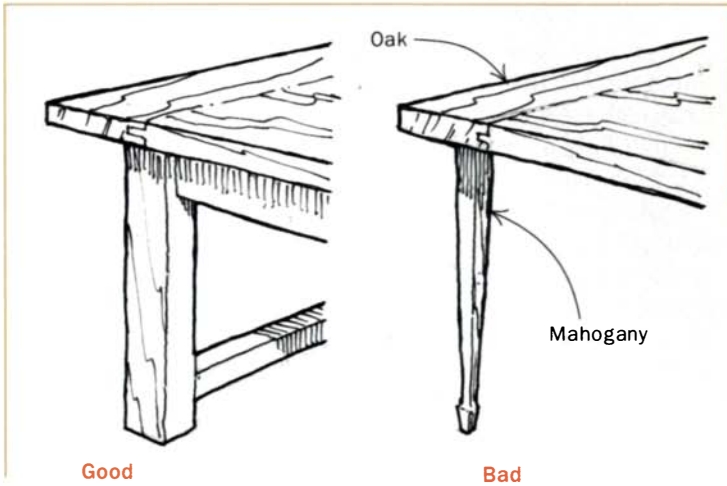
Providing reliable support may be the most fundamental requirement demanded of any leg, but deciding on an appropriate form and shape requires a reasoned understanding of the table's function and style. Whether you are designing with a certain period look in mind or venturing out into original designs, there is something to be learned by studying the furniture of the past. Frequently, period styles

are characterized by features that produce distinguishing effects. If the purpose of these effects is understood, they can be duplicated in original designs that don't represent any particular period.

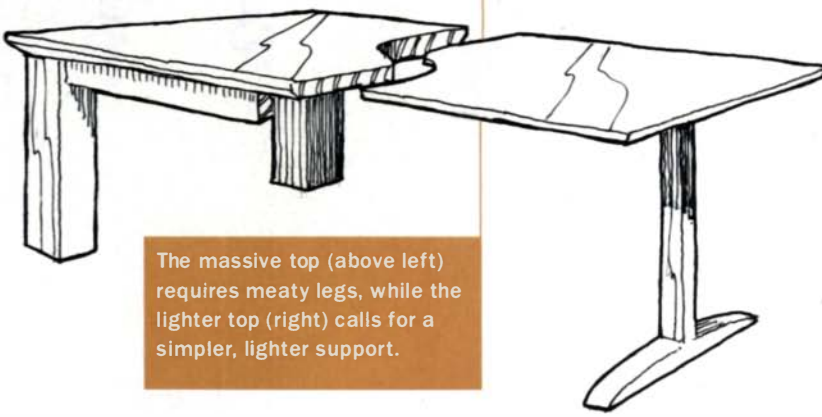
When planning a leg design, consider a few basic concepts that guide the process. Is the wood choice appropriate for the table design? Do you want the table to appear solidly grounded or delicate and refined? Should the table appear formal or relaxed? This article presents an overview of leg types, as well as their functions and construction methods, to make choosing a style and design easier for every table builder.

Function and form

Very often a table's use will determine much of its leg design. The legs on a dining table, for example, must make sitting at it convenient: No matter how handsome any given leg may be, if it prevents a comfortable seating arrangement, it will be a functional failure. Similarly, if it is to be a heavy-load-bearing library table, it should not have delicate, spindly legs. A table that must be movable, adjustable or expandable should not rest on massive, stretcher-bound legs.



STYLISTIC APPROPRIATENESS
Near left is a Federal-style leg (perfectly fine in its own right) that's unhappily married to a Mission-style table. The square leg at far left is a more fitting choice.



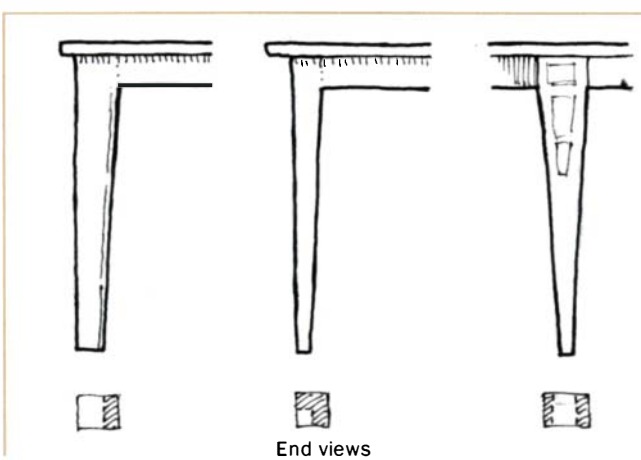
The massive top (above left) requires meaty legs, while the lighter top (right) calls for a simpler, lighter support.

After a table's function has been taken into account, the question of style remains. Sometimes this merely means designing legs that are coherent with the table's essential character—stout, sturdy legs for a chunky, heavy-duty piece or delicate legs for a refined piece—but more often than not the table will contain references to a particular period or style. Adding inappropriately designed legs can result in an awkward combination that will spoil an otherwise soundly constructed piece.

Words like "inappropriately" and "awkward" may sound dangerously subjective, but in fact, style can be analyzed and understood quite objectively.

Design guidelines—When attempting to reproduce a particular period or style, wood choice is one of the main concerns. Mission pieces, for example, were traditionally made of solid oak—a material that accounts for much of the character of this style. To reproduce the Mission style, oak is the obvious choice but not necessarily the only option. If you choose to build in another wood, it should be for a sound reason. Woods close to oak in color and grain pattern, such as ash or elm, may complement the design. Or you may want to soften the heavy look of this style by altering the scale or by building in a lighter wood like cherry, but you should realize that you're no longer building a period piece.

A table may also have the appearance of being solidly grounded, or it may take on a more delicate look. A leg that rests on a solid base and is joined to other legs by low rails or stretchers gives the appearance of sturdiness. Using a substantial foot at the end of a leg also makes a table appear balanced and solid. A tapered leg, whether plain, square or turned, will give the look of delicacy, even of floating. This idea can be developed further by altering the



DESIGNING TAPERS
A shallow taper on one side (left) affords an elegant line without sacrificing the look of strength. Adjacent sides can be tapered to produce a light appearance (middle). Or opposite sides can be tapered (right) and the legs inlaid to achieve a period look.

Drawings: Author

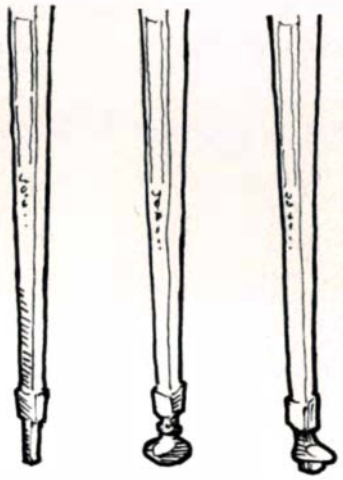
LEGS MARCHING ACROSS TIME

A survey of tables, from Gothic to present times, shows a progression from simple to ornate and, in some cases, back to simple again.

From left to right: **trestle table** made of pine and ash in a medieval design ; **long joined table** in red oak with classically turned legs and a carved guilloche border on the apron ; **"thousand-leg" table** made of walnut, yellow pine and white pine, complete with gatelegs and numerous turnings

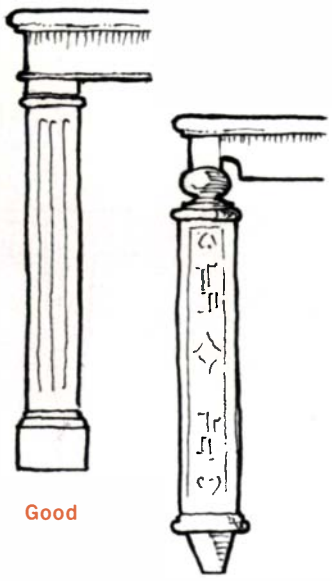
FEET MUST FIT THE STYLE

Adding a foot to a table leg can help ground a piece. The pad foot (right) and bun foot (middle) are inappropriate for this Federal-style leg from the late 18th century. This design calls for a simpler foot (left), lightening the piece and making the table appear to float.



DETAILS MUST WORK TOGETHER

The leg on the far right is composed of disparate elements—a turned fret pattern, poorly proportioned foot and bun head—that fail even though they all are from the same (mahogany) period. The leg on the left is modified for a more successful design: a substantial square foot on a simple fluted leg with an appropriate head.



form of the taper: for example, tapering a square leg on one, two, three or four sides.

A classically designed leg in the Federal style might be more appropriate for tables requiring a dignified appearance. Conference tables, library tables or formal dining tables often need this sense of sobriety. But there is also room to be playful. Flights of fancy embodied in curvilinear pieces, both regular and free-form, can transform an ordinary table into a contemporary expression of individuality.

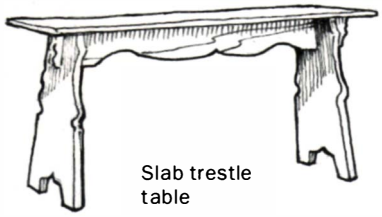
Whatever style you choose, make sure that it is environmentally compatible. This simply means that you must take the surroundings into account—either locally, in terms of the pieces directly around it, or globally, in terms of the larger surroundings in which the piece will live. Sometimes, of course, none of this is known to the maker, and you can do no more than aim to be as true as possible to the piece's own character—square legs on square tables, for example.

Designing legs that are appropriate to a particular era requires that you recognize the design parameters underlying the style. Knowing how particular styles developed, the features and techniques that were used and the characteristics the builder was after will help you design legs that are comfortable and right on any given table. It will also steer you away from infelicitous mistakes like trying to graft Jacobean legs onto a Chippendale piece.

From Gothic to contemporary: a brief history of legs

What follows is a chronological look at some of the major periods of Western furniture. It should provide not only a broad outline of the more important styles but also tell you what to look for when you're trying to decide whether a particular leg detail will be appropriate for the situation at hand.

Gothic/medieval—Apart from various esoteric pieces from antiquity, such as Egyptian chairs found in pyramid tombs and Greek and Roman furniture known primarily from artistic representations, furniture from the 14th and 15th centuries constitutes the first period from which actual examples are readily found. These were vigorous, if not violent,

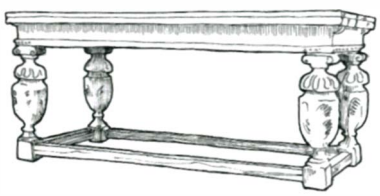

Slab trestle table

VERY OFTEN THE TABLE'S USE WILL DETERMINE MUCH OF ITS LEG DESIGN.

times, and the furniture that remains is, appropriately enough, decidedly sturdy, relying largely on heavy hardwoods such as oak and chestnut.

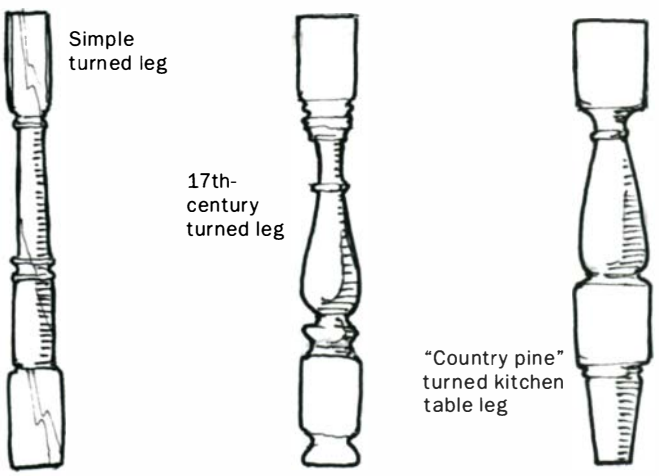
Early tables often were placed upon trestles for mobility. These "proto-legs"' were often ecclesiastical in character. They were sometimes carved with graceful Gothic tracery, using intersecting circles to form pointed arches and other geometrically inspired shapes. More commonly, they consisted of pairs of simple slabs, occasionally made single and supported by one broad foot.

The age of oak—As more permanence was achieved, "joined" tables became common in the 16th century. Dining tables were invariably massive, with large legs typically joined near their bottoms by sturdy stretchers that served not only to strengthen the legs but also to provide a place to rest one's foot—off a drafty and perhaps dirty stone floor. Early types employed a central stretcher connected to pairs of legs. This stretcher system has the advantage of providing plenty of space for the sitter's legs.



Heavy turned and carved legs with bottom stretchers (late 16th century)

Square legs were frequently chamfered and cusped, with square stretchers mortised into them and secured with pegs. Turned legs range from basic cylinders with simple rings and square ends to those with exaggerated shapes sumptuously carved and displaying a variety of motifs—from acanthus leaves to satyr heads.



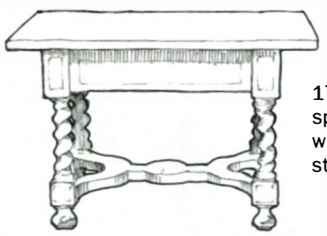
Simple turned leg

17th-century turned leg

"Country pine" turned kitchen table leg

Contemporary uses for legs made in this style might include a single turned and carved leg for a round dining table or simpler versions of the turned variety with square ends used in a kitchen or on a work table—as seen in much so-called "English country pine."

Seventeenth-century walnut—By the 17th century, tables—from large dining tables to smaller altar or writing tables—became more delicate and fanciful. Their legs were no longer merely straight but often curved and exhibiting pronounced turned elements—spirals, double twists, cups and a variety of inlay. Stretchers connecting the legs also became more varied, with lighter, curved pieces replacing the heavy, structural members found on earlier tables. There is a distinct Renaissance influence in much of the carving of this period.



17th-century spiral twist leg with curved stretcher

Double-spiral twist leg

While it is possible to divide the period into numerous categories that vary widely from one to another—such as Jacobean in Europe and Pilgrim Century furniture in America—legs from this period were generally more sophisticated and refined than those from the Gothic/medieval and oak periods. At the same time, the legs were also more inventive and decorat-

LEGS MARCHING ACROSS TIME (continued)

From left to right: **early Queen Anne table** by Janet Collins (photo by Lance Patterson, courtesy of North Bennet Street School); **drop-leaf Pembroke table** in mahogany

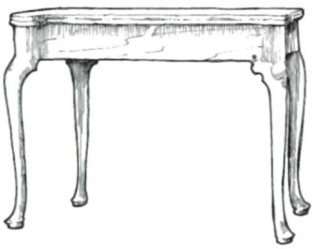
; **Hepplewhite-style gaming table** by Peter Hoffman (photo by Lance Patterson, courtesy of North Bennet Street School); **Shaker breakfast table** built in cherry with swell-taper turned legs by Christian Becksvoort (photo courtesy of Christian Becksvoort).

QUEEN ANNE WALNUT

ed than those of the succeeding periods. The 17th century probably presents the contemporary designer with more choices than any other period, especially if he or she is not constrained by matching or harmonizing the piece with any other furniture or a particular surrounding. While the construction tends to be traditional, the shape, ornamentation and material are susceptible to infinite invention, as a visit to any museum with tables from this period will demonstrate.

Queen Anne walnut—At the beginning of the 18th century, a stylistic reaction to earlier exuberance set in. The so-called Queen Anne style—which lasted much longer than Queen Anne's actual reign—was typified by restraint and a lessening of ornament. More attention was paid to purity of line and elegance of design, and this was particularly typified by the Queen Anne cabriole leg with pad foot and later the ball-and-claw foot, both with minimal carving.

This was the beginning of the classic 18th-century style of furniture, which came to be known in Britain as the Georgian period. In America this period was represented by such luminaries as Thomas Affleck and other Philadelphia cabinetmakers. Many other sought-after makers, such as the Goddards and Townsends of Newport, R.I., were recasting design. These men based their designs on classical paradigms and proportions derived from Greek and Roman architecture.



Card table with cabriole legs and pad feet

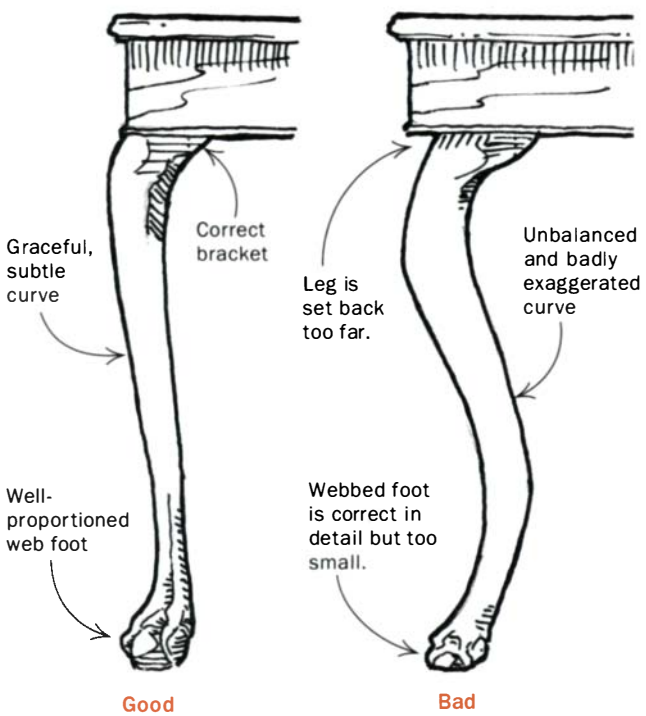
If you wish to design in this style, it is important to learn something about the underlying proportional system that dictates fundamentals—height-to-width ratios, for instance. Start by paying close attention to the wealth of published material that is available on this period.

Mahogany furniture—As the 18th century wore on, there was a return to ornamentation, and by the time of Chippendale, table legs were once again heavily carved with lions' feet, fretwork, flutes and all manner of brackets.

Although successful designs in this style require at least a passing awareness of basic underlying design principles, there are a host of details that identify separate varieties. Often, randomly mixing and matching in an attempt to repro-

CORRECT DETAILS ARE NO SUBSTITUTE FOR OVERALL BALANCE

The cabriole leg at far right is composed of congruous details but designed with no attention to the overall form. Not understanding or being sensitive to the underlying proportional rationale, the builder creates a leg that is misshapen and unhappy. The leg does little to give the table a feeling of comfortable support (it looks like it might easily break) or appropriate elegance. Poorly understood period pieces look silly, but overall form is even more important with contemporary pieces, where the design vocabulary is much more relaxed.



LATE 18TH CENTURY

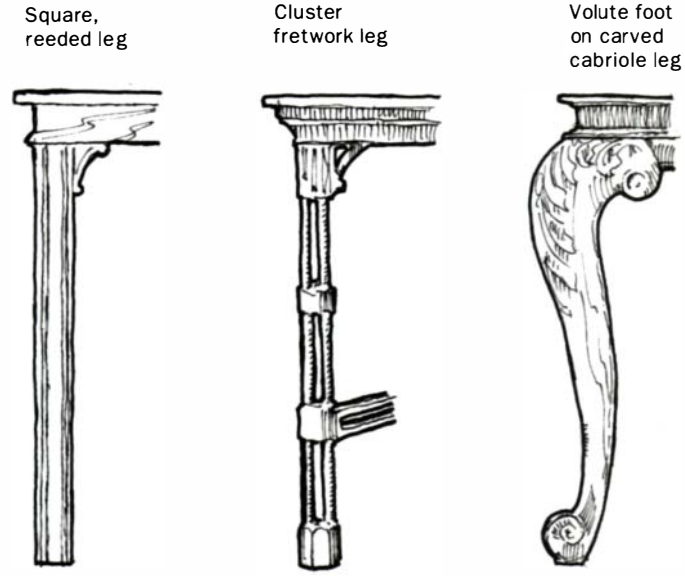
19TH CENTURY

DESIGNING LEGS THAT ARE APPROPRIATE TO A PARTICULAR ERA REQUIRES THAT YOU RECOGNIZE THE DESIGN PARAMETERS UNDERLYING THE STYLE.

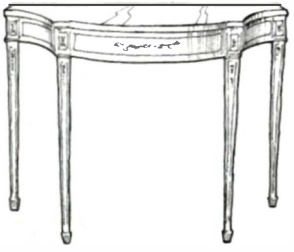
duce the general flavor of this period fails and simply looks silly. But if you choose the details carefully—a particular foot, a certain stretcher type, an overall shape or proportion—and keep an eye on overall balance, both in terms of weight (as implied by the actual size and dimensions of various parts) and form (as constituted by color, wood species and ornamentation, such as carving or inlay), you can produce something new and exciting from ideas that have stood the test of time.

Chippendale silver table (with gallery)

The important thing is to avoid replicating a particular style exactly—such as a New York side table from 1790—and, from a lack of familiarity, giving it something incongruous, such as a Boston foot. Details should always be subservient to the whole. However much a particular detail may appeal to you, do not hesitate to alter or adjust it appropriately for the sake of the design as a whole.



Late 18th century—By the end of the 18th century, designers such as Robert and James Adam, Thomas Sheraton and George Hepplewhite had introduced even more classical elements: stretcherless tapered legs; architectural details such as classically inspired spandrels, pilasters and fluting; and a great deal of inlay in the form of shells, urns, stringing and banding. This was possible, of course, because cabinetmaking techniques—based mainly on veneered construction—had largely overtaken the older forms of solid-wood joinery.



Hepplewhite/Sheraton-style table with stretcherless legs that are tapered and inlaid

Realizing this, you can avoid using these techniques on legs destined for a table designed in an earlier style. Put another way, it is invariably better to restrict your design ideas to those elements that go hand-in-hand with the type of construction being employed.

Nineteenth century—In the 19th century, the general introduction of powered machinery and the large-scale production of furniture began to affect the one-man/several-apprentice shops that had previously been the norm. It was also a period given to stylistic revivals. Consequently, there are as many distinct forms, fads, styles and schools originating from this period as from practically all preceding centuries.

A close look at some of these styles can be instructive. To start

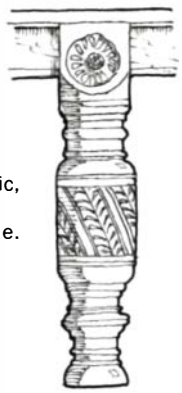
From left to right: **Wendell Castle's 1985 table, "Never Complain,"** made of purpleheart veneer, leather and copper (photo by Mark Haven, courtesy of Wendell Castle, Inc.); **maple end table** made by William Walker (photo by Chris Eden); **slab coffee table** designed and built by George Nakashima in the 1940s (photo by George Erml, courtesy of George Nakashima).

20TH CENTURY

with, the very popular Shaker style is well known as a model of simplicity and unadorned sobriety. Construction is honest and straightforward. Very little is added that does not have an essential structural purpose. This demand for functional furniture results in simple turned or plainly tapered legs sufficient for the job of supporting the table. Legs were usually made from the most practical material at hand, eschewing the use of rare and exotic species that might require additional work. Try using these principles by designing a leg that represents the minimum possible construction for sufficient support.

Shaker table: absolute simplicity

In sharp contrast to Shaker simplicity was mass-produced Victorian furniture, which sought to embody whatever fantastic element was the fashion of the day. This included applied veneer pieces, pressed patterns, gilded incised designs, spindled galleries, machine fluting and coarse carving (often on two-dimensionally shaped members). One well-known example of revivalist fashion is furniture inspired by the designer Charles Eastlake, who was responsible for introducing the principles of the English design reform movement to America. Originally conceived as a reaction against the melodramatic red plush and extravagant furniture of midcentury, this resulted in a series of more simplified styles drawing upon earlier models, such as Modern Gothic and Queen Anne Revival.



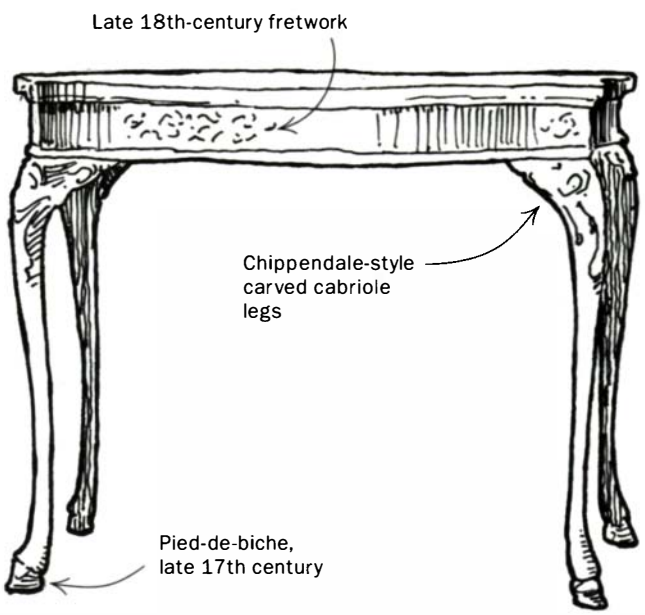
Victorian table leg is an eclectic mix of Gothic, Tudor and Romanesque.

Today, much of this furniture can seem excessively busy, but it serves the contemporary designer as a model of how earlier elements can be reinterpreted. Although some of the results may be seen as a travesty of the pieces that inspired them, it is instructive to observe how they present a coherent identity when reinterpreted and incorporated into new work. This is another important idea to bear in mind: a well-designed leg—of whatever style—will stand on its own merits as long as you have fulfilled the structural requirements and have conceived the leg *and* the table as a whole.

Twentieth-century contemporary—With the arrival of the 20th century, several factors converged

OVERALL FORM IS MORE IMPORTANT THAN CORRECTNESS OF DETAIL

This table is composed of elements—such as the fretwork skirt, heavily carved knees and biche (deer) feet—that are all from different periods, making the table stylistically incorrect. But the design works because the overall form is graceful, and the various components make structural sense.



KNOWING HOW PARTICULAR STYLES DEVELOPED, THE FEATURES AND TECHNIQUES THAT WERE USED, AND THE CHARACTERISTICS THE BUILDER WAS AFTER WILL HELP YOU DESIGN LEGS THAT ARE COMFORTABLE AND RIGHT ON ANY GIVEN TABLE.

to create a landscape that was, at least superficially, even more puzzling for the designer. On one hand, the 19th century's infatuation with rediscovering old styles—from Gothic to Turkish—had produced an almost limitless number of confusing design ideas. On the other hand, there was a severe reaction to everything overly ornamented and complicated. The Arts-and-Crafts movement's return to simple craftsmanship—starting with designers such as William Morris and continuing across the Atlantic to people such as Gustav Stickley in upstate New York—had produced, by comparison, a spartan and four-square approach that foreshadowed the later Bauhaus movement of the midcentury. Added to these diverse approaches, the increase of machinery, new methods of production and changing market conditions (due, especially, to World Wars I and II) all provided an extremely fertile ground for a variety of new styles.

1920s Art Deco (Ruhlmann table)

Some lines of development continued the simple approach. Out of the Arts-and-Crafts movement came designers concerned with honesty, simplicity and good workmanship. People such as Edward Barnsley, Allan Peters and even James Krenov have continued to embody this approach. At the other end of the design spectrum, a purely artistic spirit produced the fluid and nature-inspired shapes of the Art Nouveau movement, which merged with the increasingly modern ideas of the Art Deco movement. This resulted in the exciting use of new and different materials, including sharkskin, aluminum and laminates. Designers such as Jacques-Emile Ruhlmann and Wendell Castle have expanded our ideas of what can be achieved if the constraints of traditionalism are laid aside.

More recently there has been a flowering of talented new designers produced by a renewed interest in high-quality woodworking. There are now schools in Britain and America where the making of well-constructed and well-designed furniture—both contemporary and traditional—is taught.

The result has been a century with more choices than ever for the designer. It would seem that anything goes. But for all of the apparent variety, the fundamentals of good design remain; overall harmony, structural sufficiency and balance cannot be ignored.

Krenov-style silver table

James Krenov's furniture may be well-known for its sensitive and delicate attention to overall harmony of color and grain, George Nakashima can be appreciated for his use of natural forms, and the Memphis style may stand out by virtue of its uncompromising and radical approach to color and geometrics, but all three of these superficially different approaches succeed because their fundamental concern is with the given piece as a balanced whole. The successful and varied elements of earlier periods are still important and endlessly instructional.

No matter what construction methods you use, no matter what style you prefer, strive always to design a leg that bears the lessons of the past in mind. Remember, above all, to design legs that are an integral part of the whole piece. □

Graham Blackburn is a furniture maker, illustrator, author and the publisher of Blackburn Books in Woodstock, N.Y.

Router Template Collars

Inexpensive, indestructible and indispensable, these little guides add safety and control

BY PAT WARNER

It's true that a router can sometimes be used freehand. But because it has a dangerously sharp bit spinning rapidly at the end of a powerful motor, a router is more safely used with accessories that help the operator gain control: router tables, edge guides, add-on bases, shopmade and commercial jigs, bits with shaft-mounted bearings or template collar guides. Each brings its own advantages in specific routing situations. But none of these router accessories adds more safety, indestructibility, ease of setup and usefulness at an absolutely cheap cost than template collar guides. I can't imagine being without them.

A good set of seven collars often costs no more than $30. Yet, these little metal bushings that clip or screw into the subbase of virtually any router can simplify most cross-grain cuts—including sliding dovetails, mortises, tenons, dadoes, butt-hinge recesses and stair risers—and can be used for lettering, inlaying and even jointing short stock. The only other piece of equipment you really need in most cases is a scrap of medium-density fiberboard (MDF) or plywood used as a template to guide the collar, and thus the bit, through the cut. Collars come in different inner and outer diameters to accommodate a variety of bits and templates.

Collars are very easy to use

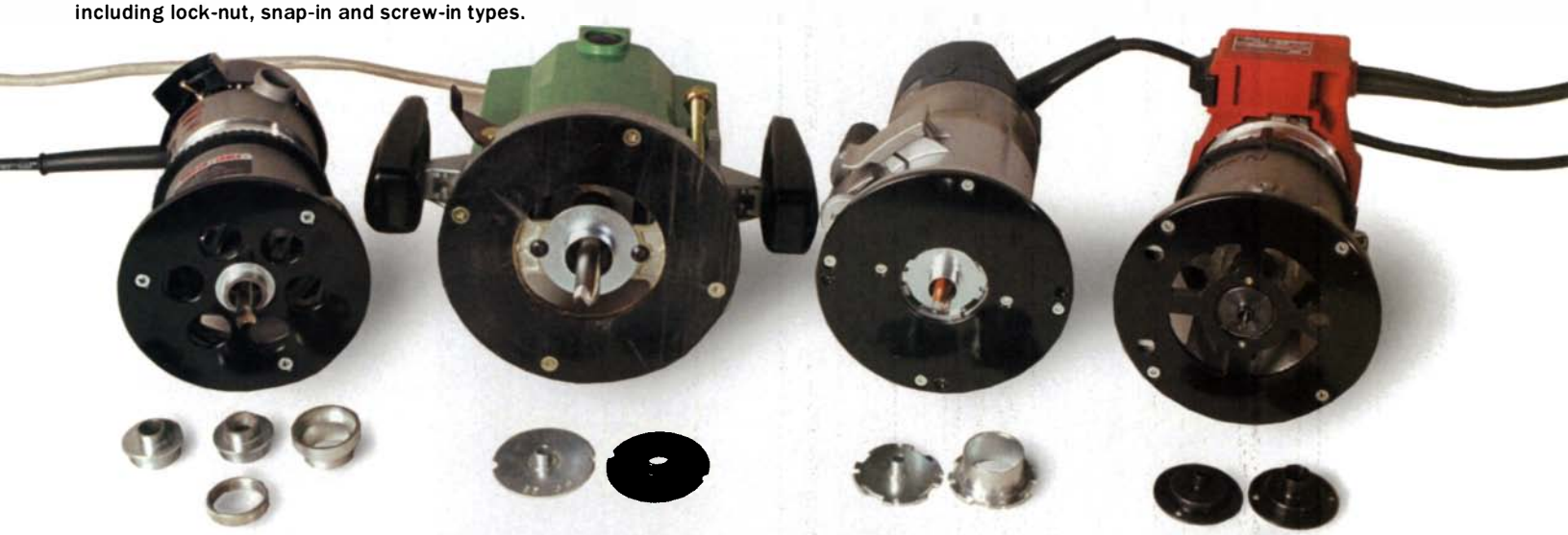
A collar screws or locks into the opening on the subbase of a router and extends below the subbase to ride against a template or jig. With the template clamped to the work or the work clamped to a jig, the collar rides along the template edge. The cut of the bit then mimics the template edge, whether straight or curved.

Router novices often make these cuts with the large router subbase riding against a jointed board or template. But router subbases are notoriously out of round, or nonconcentric. A collar guarantees a much truer cut. For example, many of the dovetail jigs on the market use collar

Photos: Tim Schreiner

What's your collar size?

Router collars come in a variety of fastening arrangements, including lock-nut, snap-in and screw-in types.



The industry standard. *The Porter-Cable screw-in lock-nut system that works in all 1 3/16-in. subbase openings is used by many other router companies.*

A couple of screws. *Some routers with larger subbase openings, such as Makita and Hitachi, offer a system of collars held in by two screws. Each is unique to the brand.*

Quick-change, snap-on collars. *To avoid screws and lock nuts, Bosch's guide system relies on snap-in collars that require only a twist to lock them in place.*

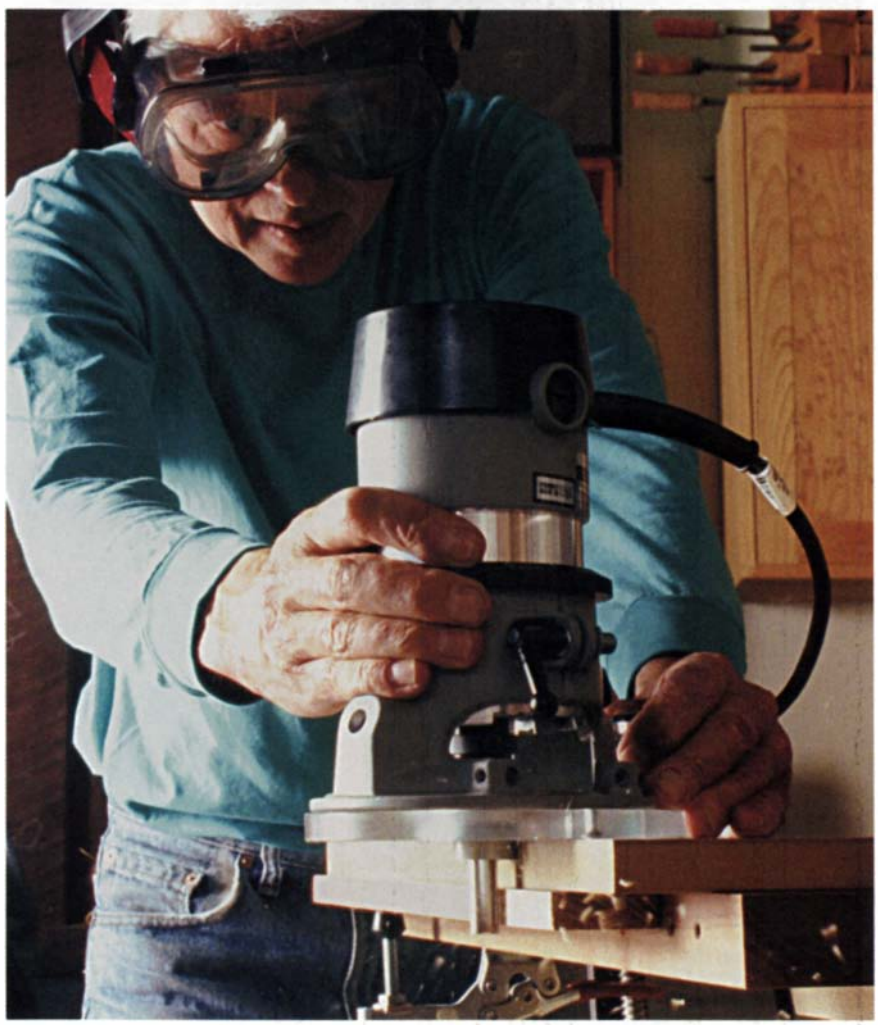
Two-way system. *Milwaukee router collars are inserted from the inside of the subbase and secured with screws. They also accept Porter-Cable collars.*

guides to ensure uniform and tight-fitting dovetails.

One suggestion for using a collar: There is little reason that it needs to extend more than 5/16 in. below the router subbase, because most templates are less than 1/2 in. thick. The extension should always be shorter than the template. Collars often come in 5/8-in. or 3/4-in. lengths, so shorten them with a hacksaw to make them more functional.

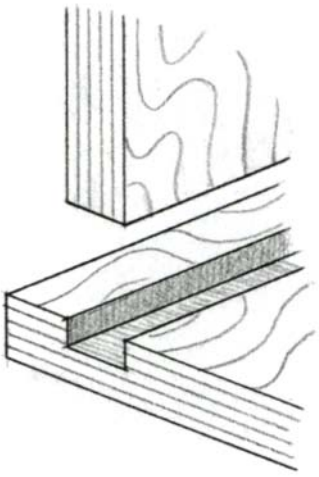
Why not just buy bearing-guided bits?

Bearings are perfectly round, so for exacting work, a bearing-guided bit might be better than a collar. However, the collar is cheaper and more versatile. The collar shields the template, and the operator to some extent, from an accidental cut. I can't tell you how many times I have ruined a template with a bearing-guided bit. A bearing-guided bit also doesn't let you plunge-cut, because the bearing must remain against a template throughout the cut. And one of the biggest advantages of a



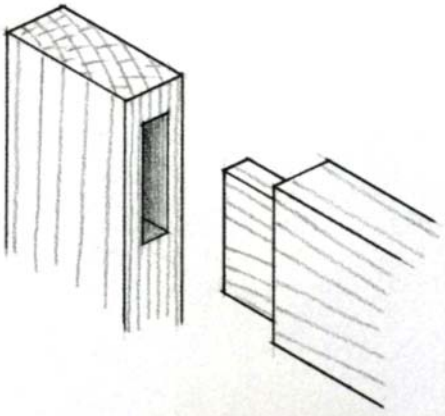
Collars have the edge. *A collar and a perfectly straight, simple template can help a straight or spiral bit put a finished edge on long grain or end grain.*

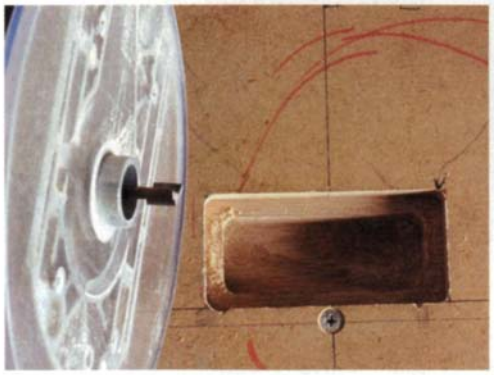
GROOVES AND DADOES



A straight pathway. *There is probably no better way to cut cross-grain dadoes than using a collar. Dadoes deeper than ⅛ in. can be cut in a series of passes. Grooves that run with the grain are cut the same way.*

MORTISES AND TENONS





Lessen the rigors of cutting a mortise. *A simple template clamped to a workpiece or a door will make cutting mortises easy with a collar.*

You need a jig for tenons. *With a shopmade jig that will clamp the work vertically, a collar can be used to cut cheeks and shoulders of tenons at the same time.*

collar-guided bit is that the bit can be exposed below the router at exactly the required cutting depth, where a bearing-guided bit must be fully extended to engage its template.

One of the biggest, yet rarely mentioned benefits of collar template guides over bearing-guided bits is that collars help preserve the lives of the bit and the router motor. When using a collar, any excessive side load is transferred to the collar and subbase rather than to the bit and router, as they would be with a bearing-guided bit.

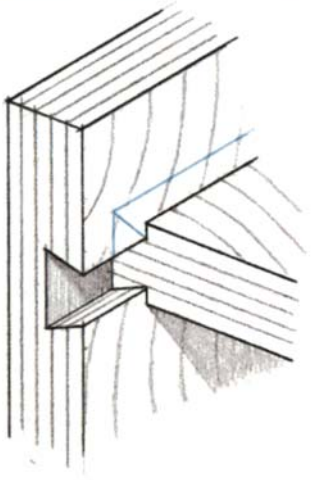
Collars are available for virtually all routers, whether fixed base, plunge, trim or table. The most popular system is also the oldest: the two-component nut and collar ring originally produced by Porter-Cable. The Porter-Cable collars fit routers with a 1 3/16-in. hole in the subbase, including most Porter-Cable, DeWalt, Black & Decker, Skil, Elu and many Hitachi models. Other router companies sell either adapters or their own collar systems—or both (see the top photos on p. 81).

Limitations are minor

There are a few limitations to using a collar, but they can be easily overcome. Using a collar often means that less than half of the router subbase is supported during the cut. This is especially dangerous with plunge routers, which tend to have small subbases and tip more easily. There are a couple of things you can do about this. I think bigger, offset subbases are such a good, safe idea for all routers that I manufacture them on the side. An offset subbase keeps the router flat, stable and under control. With a plunge router, try to use a template that completely surrounds and supports the subbase whenever possible (see the bottom photos on the facing page).

Drawings: Vince Babak

A second, minor problem with a collar is that the bit is rarely exactly in the center of the collar, even though the collar is round. So it is important to keep the same edge of the collar against the template throughout the cut, ensuring a straight result. To help guide the router, draw a line on your template with a marker. Keep the same part of the router subbase, or the handle of the subbase, on that line. For situations in which you need absolute concentricity, use the more expensive, shaft-mounted, bearing-guided bit. But a collar, especially when used with an offset subbase, will be accurate enough for most woodworking cuts.



Sliding dovetails are a breeze. *Using a collar and template is a slick way to cut the slot for a sliding dovetail. The same setup can be used to cut out some of the waste with a smaller straight bit before cutting the dovetail.*

Other limitations—Be careful to set the depth stop on a plunge router so that the spinning collet nut does not hit the inside of the collar. Also, with the popular, two-piece Porter-Cable collar system, the collar can unscrew itself if you move the router around the template in a clockwise direction (an ill-advised climb cut). A little twist with channel-lock pliers before routing will prevent it.

Most collars have a maximum 1⅛-in. inner diameter, so they will accept cutters up to only about 1 in. dia. For general and straight-edge cutting, this matters little, but for some decorative template routing with form cutters, bearing-guided router bits may be required because they are available in cutter sizes larger than 1 in. dia.

Despite these negligible restrictions, when you add it all up, collar template guides really pay their way. They're cheap, safe, versatile and never wear out—a rather rare collection of benefits for such an ordinary accessory. □

Pat Warner teaches router techniques and is the author of Fast, Easy & Accurate Router Jigs *(Popular Woodworking Books, 1999).*

Subbases for added stability

Plunge routers require special attention. *When routing with a collar on a top-heavy plunge router, it is best to attach a larger subbase for safety and stability. Whenever possible, use a template that supports the router on all sides.*

An offset subbase is a good idea. *An offset subbase will help steady a router with a collar attached. You can correct for any lack of concentricity in the collar by keeping the same edge of the collar against the template. Do this by drawing a line on the template and guiding the subbase handle along that line.*

A Low-Cost Spray Booth

Spend your dollars on an explosion-proof fan motor

BY JEFF JEWITT

Spraying a finish in a basement or a garage 20 years ago was risky business. High-pressure sprayers and flammable finishing materials were your only choices, and spraying these without proper ventilation was begging for a disaster. Not only did the risk of a fire or explosion loom large, but overspray was bound to settle on every horizontal surface in the immediate area.

With new high-volume, low-pressure (HVLP) spray equipment that drastically reduces overspray and with new water-based finishes, spraying finishes at home or in a small shop has become a viable option. One problem remains: how to ventilate the overspray. While water-based finishes are less problematic as fire hazards, the buildup of atomized finish and solvent can still be a health hazard. Spraying in an enclosed space without proper ventilation is unacceptable, so that leaves you with only a few options:

- *You can spray outdoors.* The problem with this alternative is that dust, bugs and other airborne debris will often ruin your wet finish. Also, strong breezes may prevent the atomized spray from landing where you want it.
- *You can spray within a well-ventilated area, such as a screened porch.* This is better because you minimize the possibili-

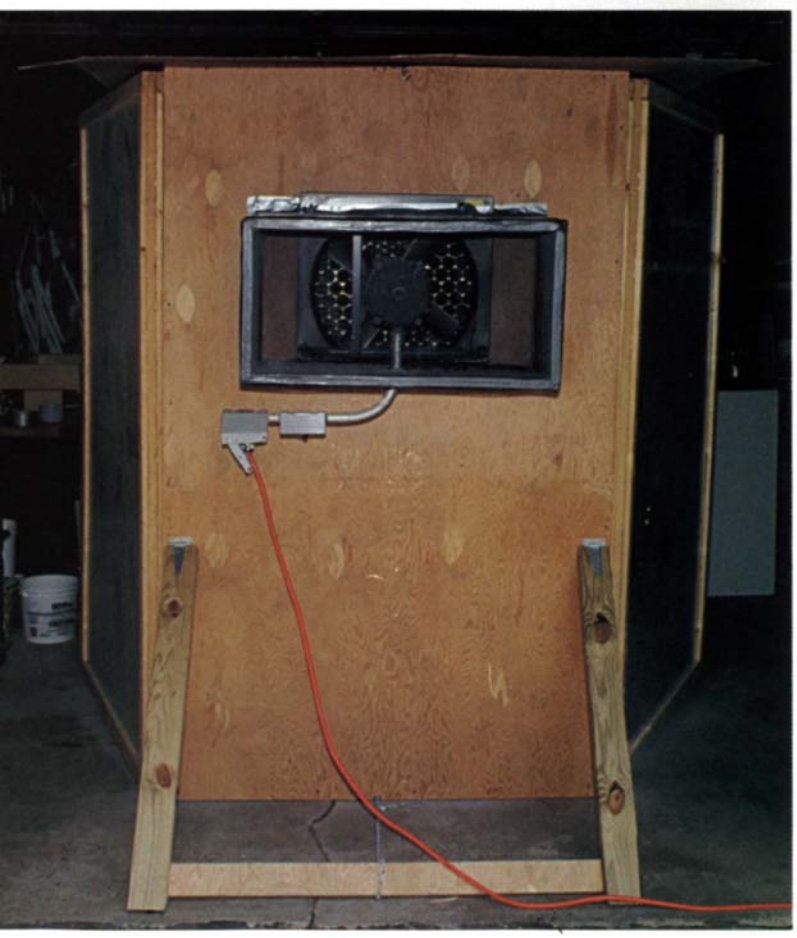
ty of debris landing on your wet finish, and the force of sudden breezes is reduced; but you still have overspray to worry about.

- *You can spray in an enclosed area, such as a basement or a garage, and exhaust the fumes with a fan.* However, basement windows are usually too small to fit a fan that will move enough air, and many garages don't even have windows. A small, portable spray booth solves these problems.

A knockdown booth may be the answer

Professional refinishers use specially designed spray booths to exhaust fumes in their shops, but these are quite costly, with prices starting at about $10,000 and moving upward, depending on all of the bells and whistles. These booths can also take up a large amount of floor space. The knockdown version I made can be built for much less (about $550). It can be set up easily in a garage or a basement with a large window and stored out of the way when not in use.

You don't need to spend $25,000 on a spray booth. *That's what it costs for the industrial-grade unit shown at right, with air exchangers and installation included in that price. A small knockdown booth (below and facing page) is better suited for a shop in the basement or garage.*



The heart of the ventilation system is an explosion-proof motor driving a nonsparking aluminum fan. (I bought one from a local W.W. Grainger distributor. It's rated at ¼ hp, 1,725 rpm, and it moves 2,000 cfm of air at 0 static pressure.) I recommend using at least a 16-in. fan and an explosion-proof motor, even with nonflammable water-based finishes. The fumes may not be flammable, but the fine dust that accumulates around the intake area and the discharge opening is a potential source of ignition. Check local electrical codes for making the proper electrical connections for the fan.

I mounted the fan in a torsion-box style assembly, which is fairly lightweight and plenty strong. I placed furnace filters in a slotted frame over the intake side of the fan to catch overspray. To the main center panel I added two lightweight wings, attached with removable loose-pin hinges, that direct the airflow toward the fan. They also help keep the assembly portable and more stable. A piece of cardboard or rigid insulation placed over the top significantly improves the efficiency of the airflow.

Small details make finishing easier. *A turntable (top) allows you to rotate a workpiece as you spray, which makes the job go faster and the results look neater. This technique is especially effective for spraying pieces that have many sides or odd shapes. A large, vinyl-coated hook to hang the spray gun (bottom) offers a safer, nosparks alternative to metal-to-metal contact, and bright colors make it easy to locate.*

A hinged bracket on the outside of the middle panel keeps the assembly from tipping over while putting it together or taking it apart (see the bottom photo at left). I also added a foil-faced foam shroud to direct the exhaust a little better. The booth should be placed so that the back of the fan exhausts into a large opening—either an open window in a basement or through the garage-door opening. To work efficiently, the amount of air the fan consumes through exhaust needs to be replenished. This make-up air is critical, and it can come from another open window or door to the room.

Small accessories add big conveniences

I use a simple 12-in. turntable that lets me rotate a workpiece as I spray. The turntable is made with steel bearings, and it's mounted between two scraps of plywood. By being able to spin a workpiece as I'm spraying, I can work faster and neater. For heavy objects, I can also mount the turntable on a cart with wheels, to move freshly sprayed pieces out of the booth easily.

I screwed vinyl-coated hooks on the sides of the panels to hang my spray guns. Vinyl is nonsparking, and it tends to hold metal parts a little better. Because of the weight of the hose, guns have a nasty habit of falling over if not hung up. □

Jeff Jewitt writes frequently for Fine Woodworking *on finishing topics. His new Taunton Press book,* Great Wood Finishes, *is scheduled to appear in February 2000.*

Photos: William Duckworth

Entertainment Center in Quartersawn Maple

Curved elements and cove moldings help keep a big case from looking boxy

BY PETER TURNER

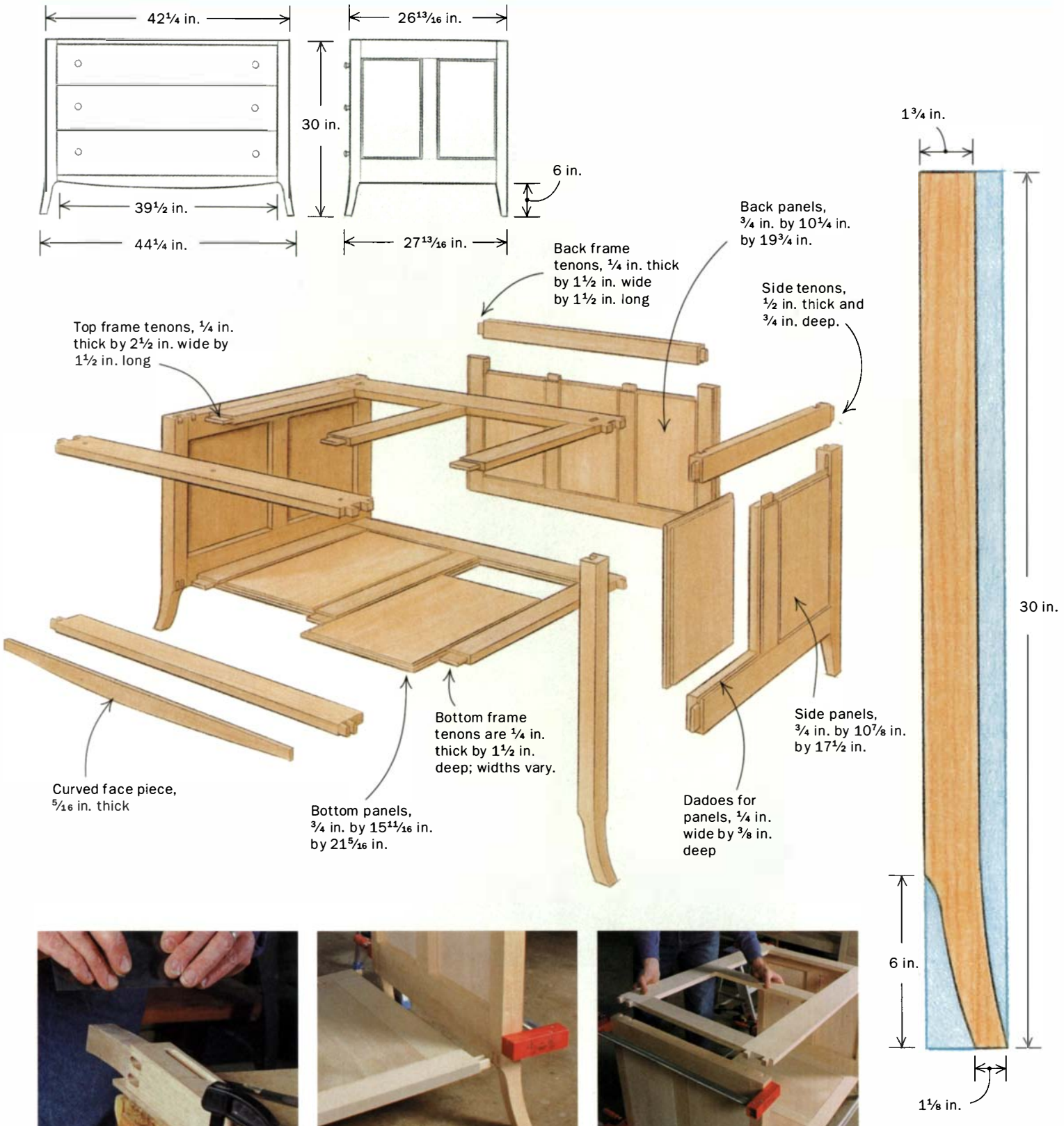
As my 2-year-old daughter, Morrigan, grew and became more mobile and curious, so did the urgency to design and build an entertainment center. My aim was to keep the unit looking more like a piece of furniture than a refrigerator while efficiently housing the television, VCR, and other audio components out of sight and temptation's way.

In an effort to move away from the large, heavy look of a typical entertainment center, my first design ended up as a horizontal case on a skinny, four-legged frame. I eventually scrapped this design because I realized the weight of components, especially a television, would overwhelm such a delicate piece. Instead, the cabinet evolved into a more conventional two-piece structure, with a lower section housing three drawers for storage of CDs and tapes and a slightly narrower but taller upper section enclosed by a pair of doors. I did what I could to keep the piece from getting bulky by maximizing the usable internal space and adding soft curves to the exterior, which help mask its rather hefty dimensions.

I chose cranked door hinges that allow a door to be opened a full 270° instead of pocket door hardware, which would have added several inches to the width of the piece. The curved legs lift the case off the floor and help reduce its visual weight. And to blend the lower case with the upper, I applied cove moldings at the waist and at the crown. I really like the

Photos: Anatole Burkin

FRAME-AND-PANEL BASE



After cutting the mortises, shape the feet. *The feet are cut out on the bandsaw, then cleaned up with a scraper.*

Double tenons join the bottom to the front of the lower case. *A single tenon is sufficient for the rear because the glued-in back panel will add strength.*

The top of the lower case is a simple frame without panels. *Double dovetail joints are used at each corner to ensure the case won't bow.*

Drawings: Bob La Pointe

A spacing guide simplifies the installation of slides. *The guide positions each pair of slides at the correct height for attachment to the inside of the case. Cut the guide down to attach the next pair of slides.*

Removable dividers make the drawers versatile. *Whether you need to store CDs, tapes or videocassettes, the drawers can accommodate all.*

swoop of a cove, which lends vitality to a piece.

To ensure that components such as an amplifier, tuner, CD player and a television would fit inside the upper cabinet, I took a tape measure to my electronic gear. I also checked the dimensions of stereo and TV components at an electronics store. New electronic components are fairly standardized, being about 17 in. wide or less and just a few inches tall. Older components vary more in size. I settled on four 18-in.-wide adjustable shelves that are shallower than the interior of the case, which allows room for routing wires and for air circulation. The cabinet will easily hold half a dozen components plus a 27-in. television. The back of the upper case has a panelless frame, which makes for easy access to wires and lets the heat produced by a television escape.

With the help of a friend, Sam Robinson, I built the cabinet within a narrow time frame—one month—because I wanted to exhibit the piece at the Philadelphia Furniture Show. Sam was assigned the upper case, and I took on the lower box. We kept our fingers crossed and hoped that the bridge would eventually meet in the middle.

Quartersawn maple is the predominant wood used in the piece. The wood was chosen for its light color and subtle grain. Soft maple was used for the drawer sides and one internal frame. The drawer bottoms are made of plywood.

My local hardwood supplier, Dennis Day of Day Hardwoods in Scarborough, Maine, has a knack for finding high-quality wood at fair prices. He supplied me with 200 bd. ft. of quartersawn maple with several pieces close to 8 in. wide, unusually wide for quartersawn stock. The widest planks were used for visible panels and drawer fronts. The narrower stock was used for frames, internal panels and shelves.

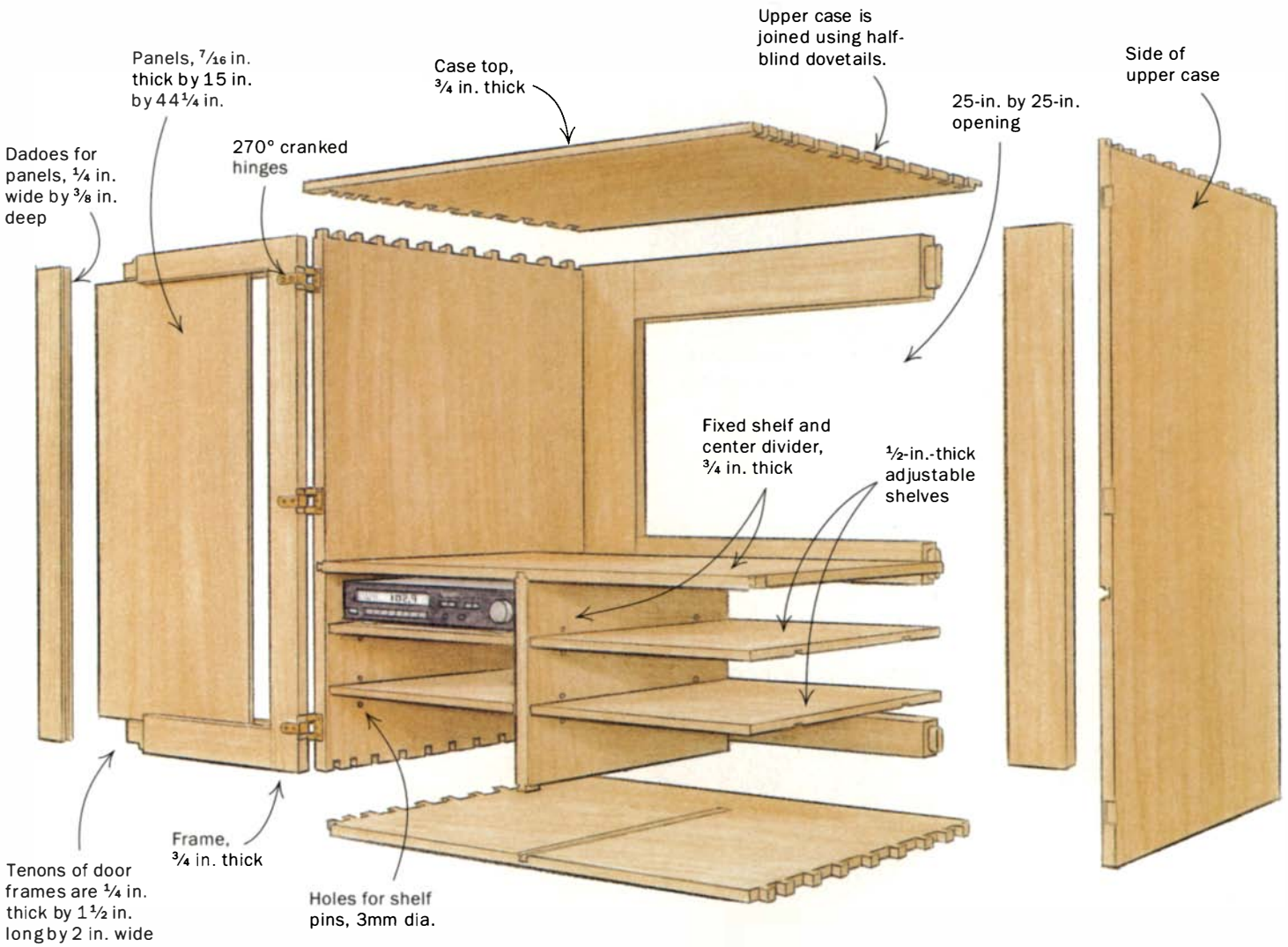
We were unable to locate thicker quartersawn stock, so we used plainsawn 16/4 material when needed, sawing it to best show off the grain.

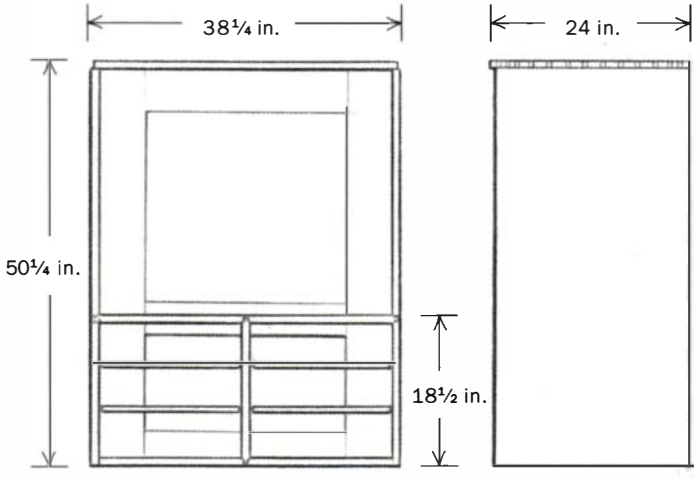
The stoutest timbers are used in the lower case

I rough-cut the 16/4 stock and let it sit a few days to stabilize. It seemed as if this big plank was custom-made for my purposes. I was able to get quartersawn boards for the side frames and coves. The rest of the plank had diagonal end grain, which was used for the legs. Diagonal end grain is ideal for legs because you can orient the stock to show rift-sawn figure on the two exposed faces.

I rough-cut the front legs about 3 in. square; the rear legs were roughed in at 2 in. by 3 in. The flat, inside faces of the legs were mortised to receive the side rails. I used a Multirouter to cut all of my lower case joinery (see "Router milling jigs," *FWW* #130, pp. 62-63). Dadoes were

DOVETAILED UPPER CASE





SOURCES OF SUPPLY

Cranked hinges allow doors to open wide. *Mortises must be cut in the doors and the front edge of the case.*

DRAWER SLIDES

Julius Blum
7733 Old Plank Road
Stanley, NC 28164
(800) 438-6788

Hettich America
6225 Shiloh Road
Alpharetta, GA 30202
(800) 438-8424

HINGES

Hafele
3901 Cheyenne Drive
Archdale, NC 27263
(919) 889-2322

Sugatsune America
221 E. Selandia Lane
Carson, CA 90746
(800) 562-5267

routed into the legs for the panels. I cut the feet on the bandsaw and cleaned them up with a cabinet scraper (see the left photo on p. 87).

The back, top and bottom frames are of mortise-and-tenon construction with routed stopped dadoes for all panels. Double dovetail joints were used to join the top frame to the rest of the lower case (see the right photo on p. 87). I used double tenons on the front corners of the bottom frame to reinforce these joints (see the middle photo on p. 87). Single tenons are adequate at the rear of the case because the back provides additional strength.

The panels were rabbeted along all four exterior edges. The reveal between the panel and frame is slight, about 1/16 in. at the top and bottom and a hair more along the sides. To simplify production, I rabbeted all panels using the same setting. Next, I machined the dadoes in the frames, making them all 1/4 in. wide and 3/8 in. deep. Then I placed slivers of neoprene in the lower rails, which lift the panels to the correct height. Neoprene is available from window-repair companies.

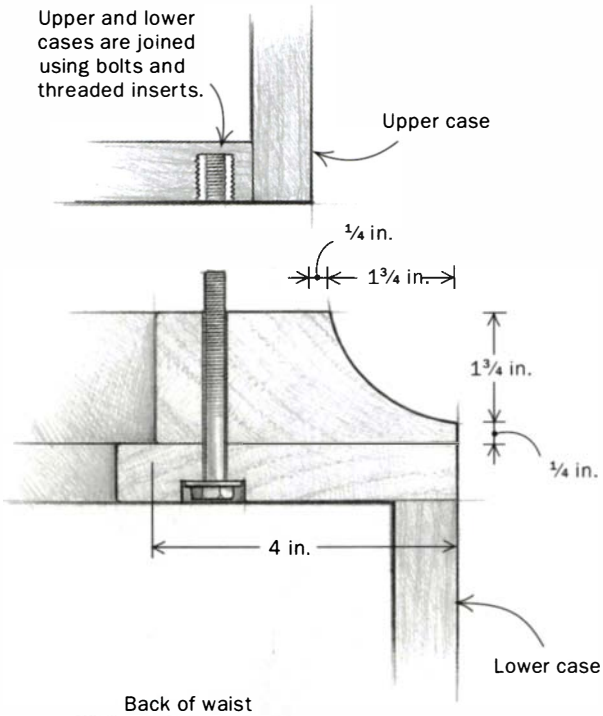
The dry assembly of the lower case was my first opportunity to appreciate the real scale of the piece. I clamped a temporary spacer across the front between the upper corners of the sides to hold them in place. I then placed the completed top frame on top of the case and knifed the dovetail socket placement into the leg tops and upper rails.

After knocking the sides apart, I finished cutting the joinery. Then I glued it together. The back is handplaned to fit. It is glued in place.

A waist molding, built as an open framework, separates the top from the bottom half of the case. Three sides are shaped; the back is square. I cut the cove molding on the tablesaw with the blade at 90°, using a 25° angle of approach and ending up with a final blade height of 1½ in. (For more on cutting coves on the tablesaw, see *FWW* #102, pp. 82-85). I ran the stock facedown to provide a stable riding surface. Small, successive cuts with a grazing final pass are the keys to producing a clean cove safely. No matter how carefully you cut, there's still a bit of cleanup required. I made a custom scraper by grinding a stock scraper to the same radius as the cove. The front corners of the cove were mitered, and the rear corners were butt-joined. I used double #20 biscuits to reinforce all of the corner joints. The completed framework was glued directly to the top of the lower case.

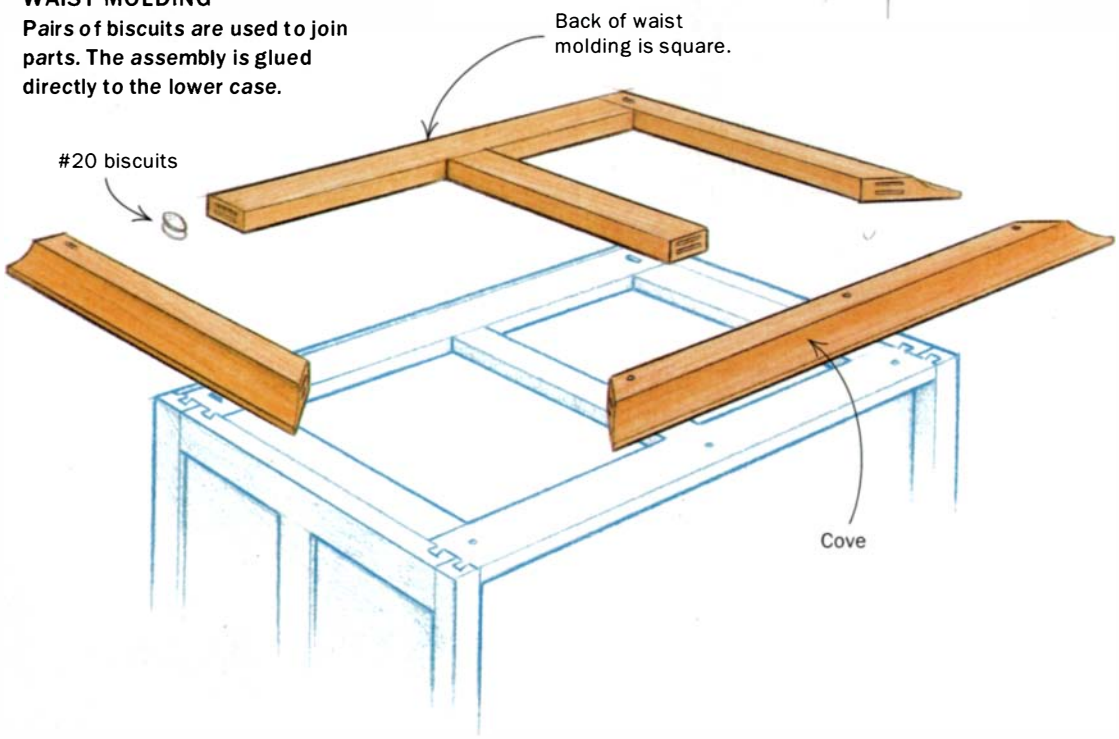
WAIST MOLDING

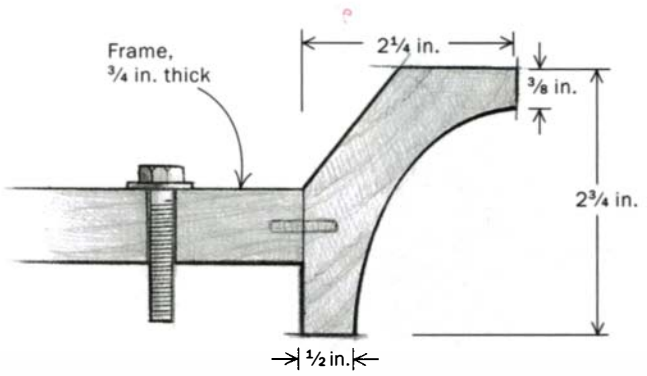
Upper and lower cases can be separated for ease in moving. *Threaded inserts and bolts are hidden from view but make a strong connection.*

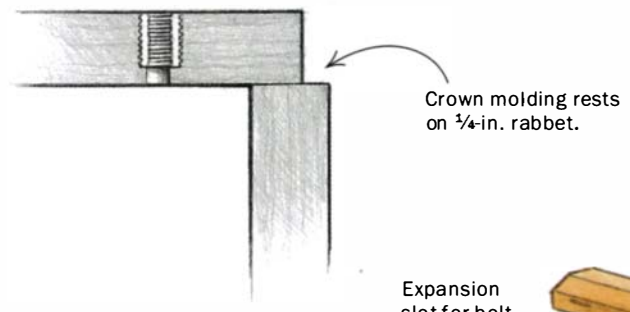


WAIST MOLDING

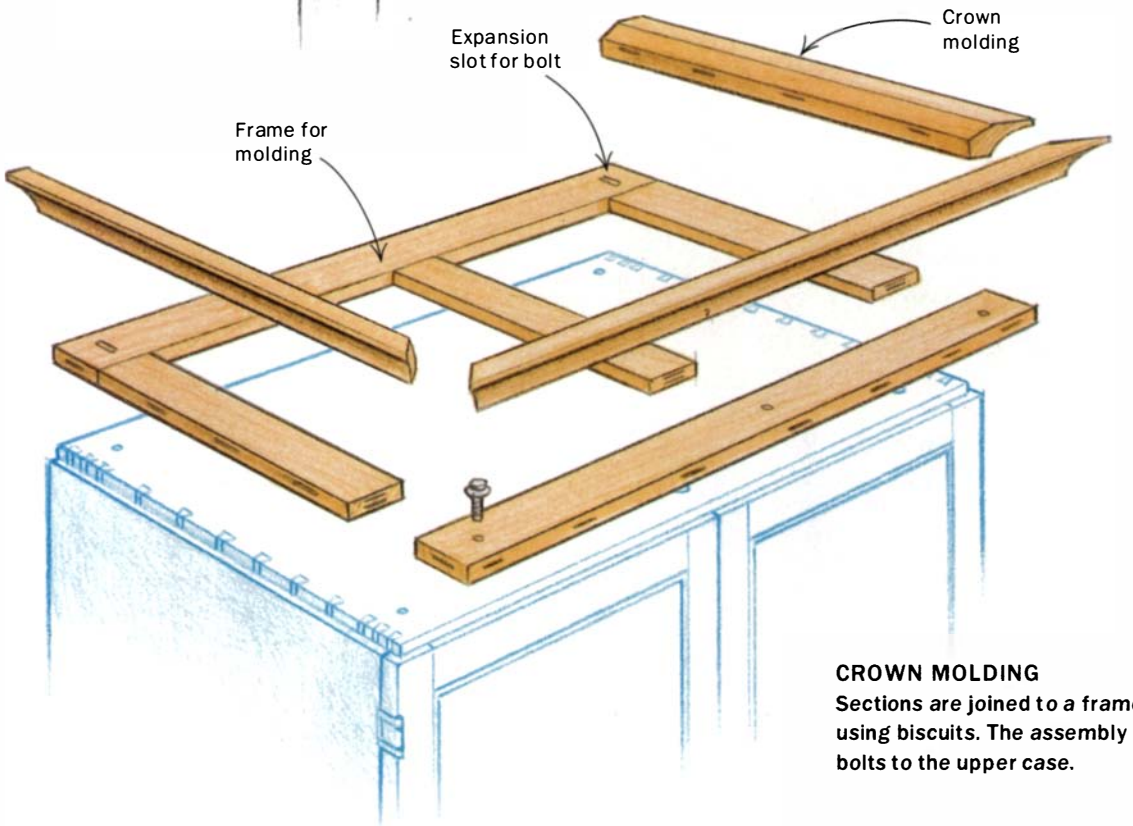
Pairs of biscuits are used to join parts. The assembly is glued directly to the lower case.







Removable molding. *It's much easier to protect the molding if it can be wrapped separately when transporting the case.*



CROWN MOLDING
Sections are joined to a frame using biscuits. The assembly bolts to the upper case.

Biscuits are not needed here because there is plenty of face grain between parts.

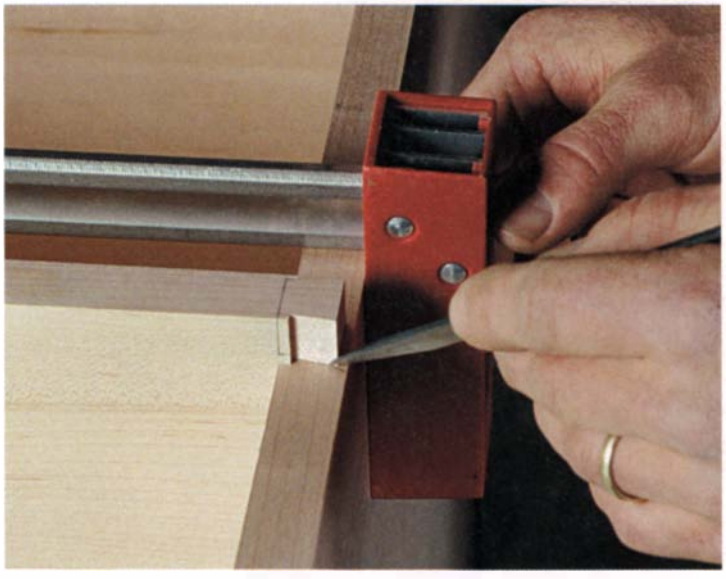
Hidden, full-extension drawer slides are used

The three drawer boxes are all the same size and were built using a Leigh dovetail jig. The drawer fronts were screwed in place from the inside. For visual balance, I graduated the height of the false fronts, with the lower drawer front being the deepest. After cutting all of the dovetail joints, I machined dadoes in the fronts and sides of each drawer for the plywood bottom panel, which is rabbeted along three edges. Then I ripped the bottom inch from each drawer back to allow the bottom panels to extend past the rear edge of the drawer. The bottoms were screwed in place to the rear drawer wall.

I also cut grooves in the front and rear of the upper drawer to hold removable partitions, good for CDs or tapes. The partitions are ¼ in. thick by 4 in. high, and they divide the drawer into six equal channels. I cut these after cutting the dovetails and dadoes. I clamped matching fronts and backs flat on my bench, butting their top edges together. Then, starting in the dado, I routed rounded, ⅛-in.-deep dadoes across both pieces using a ¼-in. core-box bit. After a little trial and error, I cut the partitions to length and rounded over the ends to match the round-bottomed dadoes. I carried the same profile along the top edge. Round dadoes are time-consuming, but I much prefer their softer look. Depending on the size of your CD or tape collection, other drawers could also be partitioned.

I chose Hettich Quadro 30 V6 full-extension slides for their ease of installation, smooth operation and clean look. Each drawer gets a pair of slides, which are screwed to the inside of the case. Two plastic clips, which engage the slides, are screwed to the underside of each drawer near the front. Drawers must be constructed so that their sides project ½ in. deeper than the drawer bottom. The slides are completely hidden by the drawer sides. With this type of hardware, I don't have to worry about whether my drawers will bind in the humid summer heat or get sloppy in the dry air of winter. I particularly like the self-closing action, which kicks in when a drawer is open an inch or less. Blum also makes a hidden drawer slide called the Tandem.

To locate each pair of drawer slides uniformly within the case, I made a spacing guide out of scrap plywood (see the top photo on p. 88). Here's how it



A fixed shelf and center divider strengthen the upper case. *Both the shelf and divider fit into ⅛-in.-deep stopped dadoes. The protruding ears at the front of the shelf and divider are dovetailed.*

Mark the socket of the dovetailed ears during dry fitting. *Clamp the case flat and use a sharp marking knife.*

works: Lay out the location of the slides. Then trim the guide so that when placed inside the case, the slide, when laid on top of the guide, is in position for attachment to the case. The guide ensures that the opposite slide will be at the same level and parallel to the first. Start with the top drawer and cut the guide down for each subsequent pair of slides.

If you use Hettich slides, order their screws, too, which cost extra. I didn't and discovered that standard round-head screws interfered with the action of the slides. To finish off the lower case, I drilled ½-in.-deep mortises for the pulls, then attached the drawer fronts to the drawers with countersunk screws.

I added a curved face piece to the outside edge of the bottom of the case, below the last drawer, which helps tie the case to the curve of the legs. This face piece is glued in place. The pulls are classic Shaker design and made of ebony. The pulls for the upper case have soft tips to prevent dinging the case (see the photos and story on the facing page).

Meanwhile, the upper case is taking shape

While I was busy cutting mortises and tenons, Sam was working away at the long rows of half-blind dovetails that join the upper case. Once he finished the dovetails, he loaded the stock into his van and came to my shop for a dry assembly and test fit. We knocked his case together and placed it on top of my lower unit. Amazingly enough, it sat nice and flat with appropriate reveals on all sides.

The upper case has a fixed shelf, which fits into a ⅛-in.-deep stopped dado. The front of the fixed shelf has two ½-in.-deep ears, which are dovetailed into the front edge of the cabinet. The dovetails prevent the case from bowing. A center divider was attached to the case in a similar fashion, using dadoes and dovetailed ears. To place the sockets for the dovetailed ears accurately, it's best to dry-fit the case with the shelf and divider and mark out their locations with a knife (see the bottom photo at left).

Back at his shop, Sam chopped out the sockets. He also attached threaded inserts into the case. The inserts, in conjunction with bolts, allow the upper and lower cases to be joined. The crown molding was also attached in this way.

Don't come unhinged because of hardware

Sam built the door frames using haunched mortise-and-tenon joints. Panels were constructed using the same methods employed in the lower case. The hinge mortises were marked using a knife, then most of the waste was removed by routing freehand. A chisel and gouge finished the mortises.

We used Hafele hinges (No. 307.04.806) and ran into a few bumps along the way. Because I wanted the doors to be flush to the sides of the case, we mortised the hinges into the outside edges of the doors. As designed, the hinges require that a door be inset from the side of

the case by half the thickness of the hinge. When we hung the doors, they didn't swing open all of the way.

First we thought it was because we had modified the hardware installation. But as it turned out, the problem was with the thickness of the doors. For these hinges to work properly, the doors need to be a hair under ¾ in. thick, or 47/64 in. thick, to be exact. We also discovered that the hinges didn't close properly through no fault of our own. We removed them after a trial fit and found that the hinges were not manufactured perfectly square. We fixed them with a hammer and vise.

After the doors were planed to fit, Sam drilled the mortises for the knobs, which are located at the level of the interior fixed shelf. He also drilled the 3mm-dia. holes in the sides of the case and center divider for Hafele shelf pins (No. 282.06.500). I like these brass pins, which are round and stepped from 3mm dia. to 5mm. dia. Typical shelf pins require larger-diameter holes, 5mm or ¼ in., and it's surprising how discreet the 3mm holes are. Finally, Sam routed short recesses into the shelf bottoms to house the pins and keep the shelves from sliding.

The crown molding is bolted in place

We designed the crown molding as a frame and made it detachable, which comes in handy when the case has to be moved. Sam cut the molding on his tablesaw in two steps.

The lower section of the molding has a bigger radius than the upper sweep. The lower radius was done with a 33° angle of approach with a final blade height of ½ in. The upper radius was done with a 21° angle of approach with a 9/16-in. final blade height. Then Sam blended the transition between the two radii by moving the fence and blade and setting it by trial and error. A scraper was used to clean up the saw marks.

The crown was mitered at the front corners, and butt joints were used elsewhere. Pairs of #20 biscuits were used at all of the joints. The entire frame slips down over the case and rests on a rabbet cut into the sides. This rabbet was cut with a router after the upper case was assembled. Bolts and threaded inserts hold the molding in place.

To finish this cabinet, we sanded up to 220 grit, then wiped everything down with a damp cloth to raise the grain. Once the piece was dry, we finish-sanded to 320 grit.

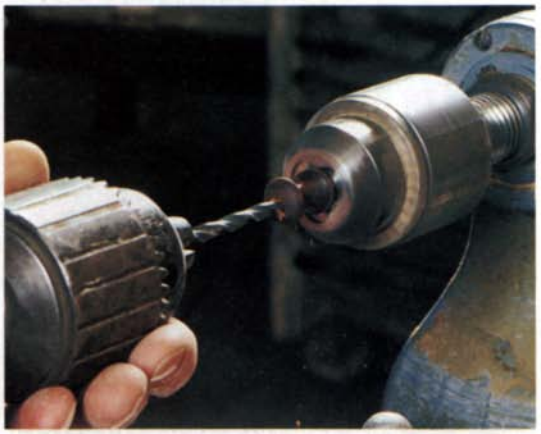
Most of the case was finished with three coats of Bartley gel varnish. We chose this finish because it can be applied by hand, has good durability and does not yellow maple unlike many oil finishes do. The insides of the lower case and the drawers were finished using extra blond shellac. Last, we attached the knobs, and before the epoxy had set, the entertainment center was inside my van, on its way to the Philadelphia Furniture Show. □

Peter Turner builds custom furniture in Portland, Maine.

Pulls that won't ding the case

A door that swings on a 270° cranked hinge is great for access but can be hard on the case. That's because the pulls will smack into the side of the cabinet. To prevent dings I added nearly invisible neoprene bumpers to the upper pulls (see the photos at right).

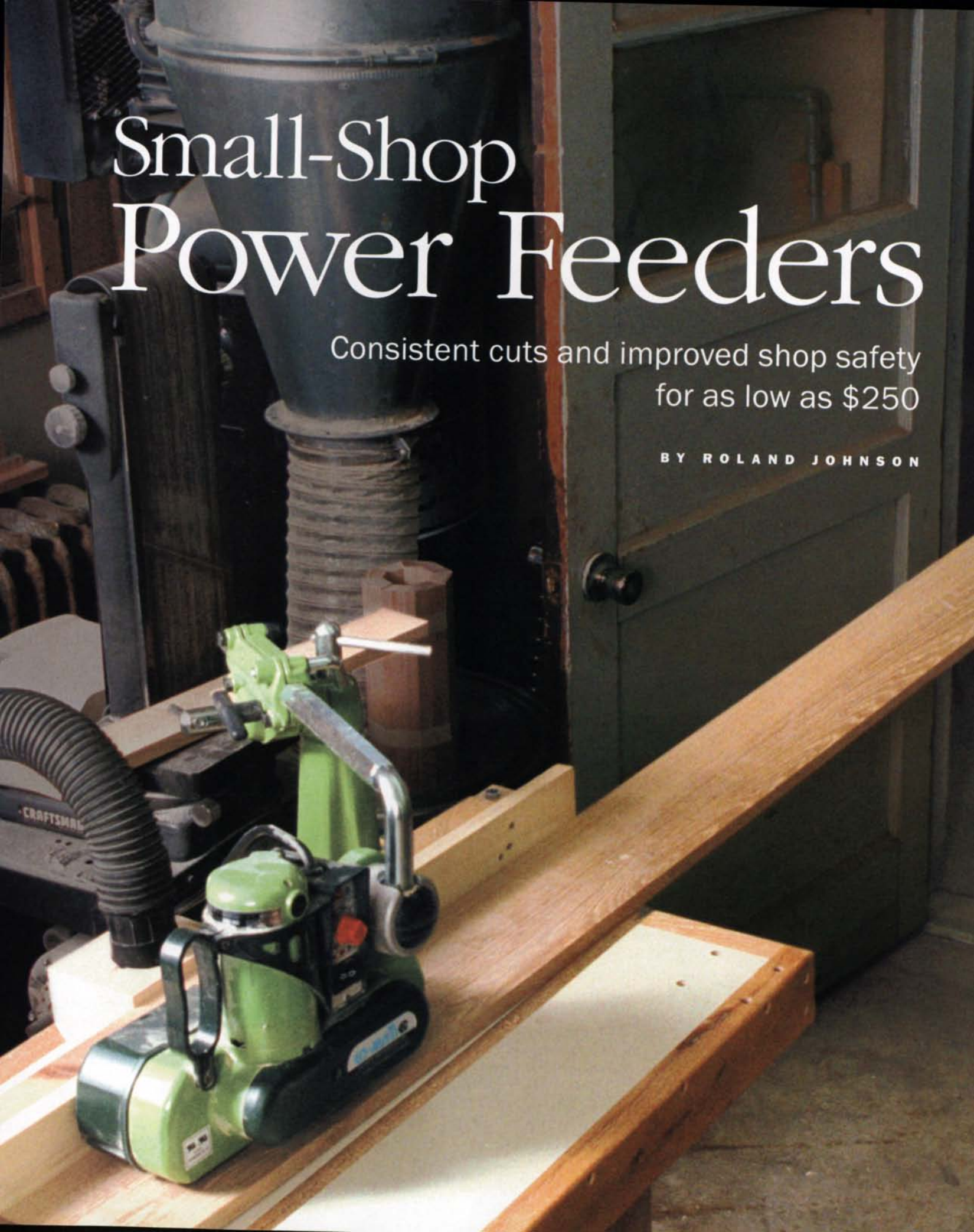
After turning a pull, I drilled a shallow hole in the tip. Using a leather punch the same diameter as the hole, I punched out a disc of black neoprene. The disc was pressed in place. I added a drop of cyanoacrylate glue to help keep it there. The protruding neoprene was trimmed flush using a sharp chisel. Because the pulls contact the sides in a direct line, not at an angle, the neoprene won't leave scuff marks.



Drill a shallow hole in the tip of the pull. *The author uses a ¼-in. brad-point drill bit fitted to a chuck in the lathe's tailstock.*

Punch out a neoprene plug. *Use a leather punch the same diameter as the hole in the pull.*

Press the neoprene into the tip of the pull. *Use cyanoacrylate glue and then trim off the excess using a sharp chisel.*



Small-Shop Power Feeders

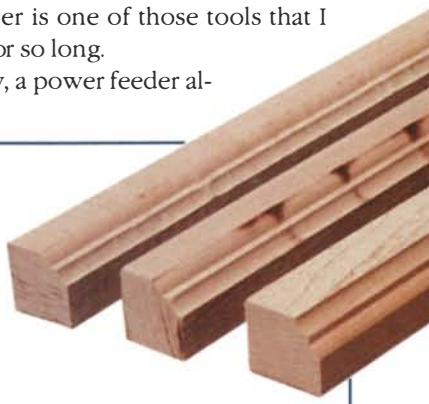
Consistent cuts and improved shop safety for as low as $250

BY ROLAND JOHNSON

A power feeder can run nonstop and doesn't require health insurance. When its fingers, or rollers, get shredded, they cost only a few dollars to replace. Those are three good reasons why the machines are used extensively in commercial woodworking shops and manufacturing plants. Power feeders used to be large and expensive, beyond the reach of small-shop budgets. That all changed three years ago with the introduction of the economically priced, Taiwanese-made Baby Feeder by Co-Matic. Now there are many feeders to choose from, large and small, some costing less than $250.

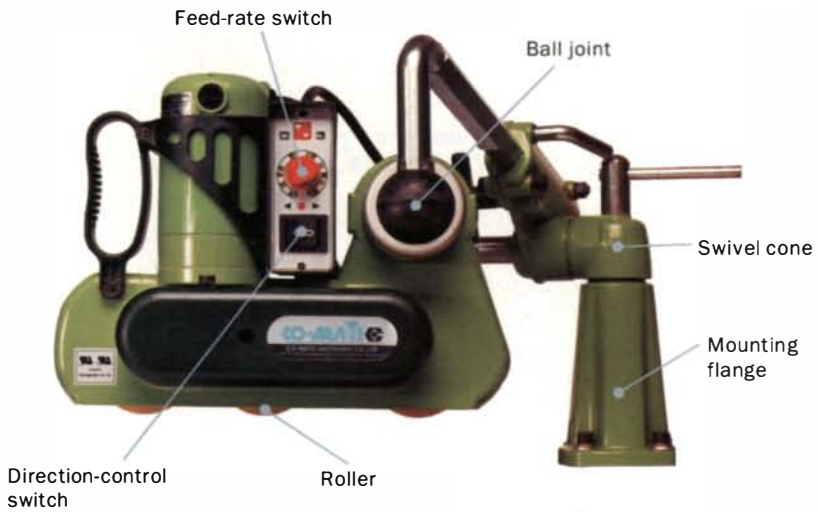
I originally purchased a ¼-hp feeder to produce "weathered" oak boards using wire-brush wheels mounted on a homemade motorized jig. I needed to distress a lot of material, and I didn't want my hands anywhere near the flesh-eating wire wheels. Since then I've used the power feeder for more typical applications such as ripping stock on the tablesaw and running molding on the router table and shaper. The feeder is one of those tools that I wonder how I got along without for so long.

Besides the extra margin of safety, a power feeder al-



WHY USE A POWER FEEDER?

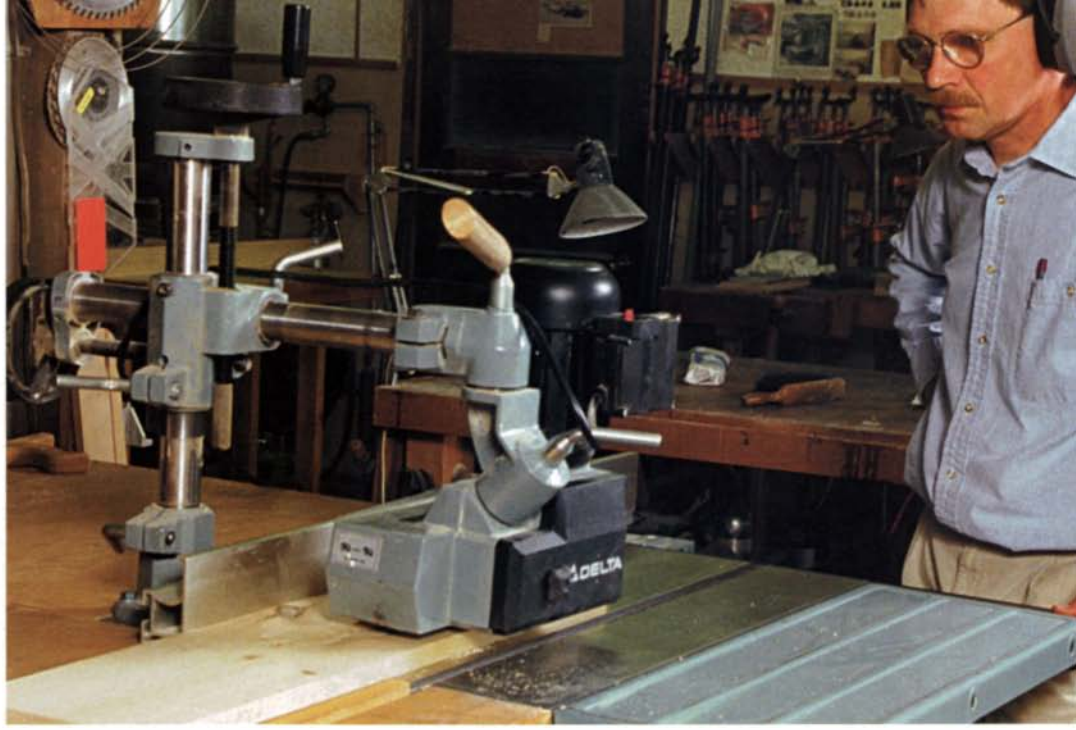
Maintaining a steady feed rate when hand-feeding long stock can be difficult. Chattering (left) happens when stock moves too fast, and burning (center) happens when stock is fed too slowly. A power feeder makes it easier to obtain a smooth cut (right).



A power feeder can be set up to hold stock against a fence or to press it down against a table.

A power feeder is adjusted with a slight toe-in to keep stock from drifting away from the cutterhead.

Power feeders are commonly used with shapers. *Shapers may require large feeders, such as this ½-hp model (above), which is mounted sideways for this application.*



Hands-free ripping on the tablesaw. *A power feeder bolted to the top of a tablesaw (right) eliminates the need for push sticks, keeping hands far away from the blade.*

lows you to adjust the feed rate for optimum results. Scorching, from moving material too slowly, or chattering, when material isn't held down firmly, can be eliminated with a feeder. When feeding stock by hand, especially long pieces, it's difficult to maintain a constant feed rate.

Feeders bolt directly to cutting machines

To work most efficiently and safely, a power feeder needs to be mounted securely to a machine. The most secure way to attach a feeder is to bolt it to the machine (see the photos below).

I drilled and tapped my tablesaw top, on the right outfeed side, to mount a feeder. I imagine many woodworkers don't fancy the thought of drilling holes in a pristine tablesaw top. But cast iron is quite soft and easy to work. Set the feeder base where you wish to mount it, and use a center punch to mark the locations for the holes. Choose bolts slightly narrower than the holes in the feeder's mounting flange to give yourself a little margin of error. Then drill the holes and tap them.

Because my router tabletop is made of particleboard, I used through-bolts and nuts to attach the feeder. For extra insurance, I added an aluminum backer plate underneath to help distribute the stress. A power feeder that uproots itself from a tabletop can cause all sorts of havoc.

MOUNTING A POWER FEEDER

It's best to bolt the feeder directly to the tabletop. *The author drills mounting holes in his router table. An aluminum backer plate (left in photo) helps stiffen the underside of the table, where the nuts are attached.*

Cast-iron tabletop can be drilled and tapped. *Mark the location of the holes with a center punch, then drill and tap holes to fit the feeder's mounting flange.*

Take the time to align a feeder properly

With the power feeder mounted securely to the machine, setup is relatively easy (see the photos on the facing page). A feeder is adjusted to bear pressure on stock in two directions—against a fence and against the machine's work surface. For example, when using the feeder with the rollers facing down, angle them slightly toward a machine's fence. I angle the power head so that the outfeed roller is slightly closer (about ¼ in.) to the fence than the infeed roller. This setup will ensure that stock doesn't creep.

The rollers that push stock past the cutter are mounted on spring-loaded arms. The rollers should be adjusted to bear firmly down on the stock. When I set up the machine, I adjust the rollers so that they retract about ¼ in. when engaged with the stock.

A power feeder can be set up so that the rollers face the fence of a woodworking machine, a typical setup for doing face frames. Angle the outfeed end down slightly, about ¼ in., to keep stock from lifting. And adjust the rollers as previously indicated.

Feed rates are very important to achieving good results. You come up with the correct feed rates through trial and error. Run stock too fast, and you may bog down the cutting machine; too slow, and the cutters may burn the stock. Speed changes are easier on some feeders than on others. Some machines require a manual gear change; others have electronic speed-control dials, which I prefer. Because the density of solid wood can vary even among

ADJUSTING A POWER FEEDER

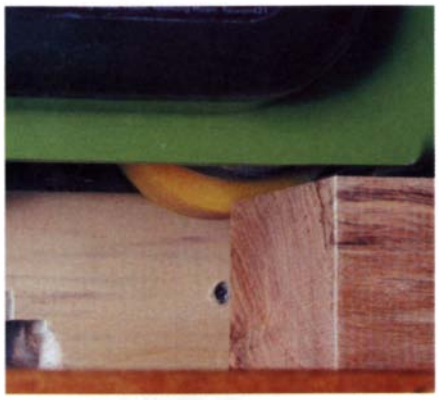
Feeder controls

This ¼-hp feeder is typical of mid-sized and larger feeders in that it has a pair of handwheels for fine-tuning adjustments.

This ⅛-hp feeder utilizes a ball-and-socket joint at the junction between machine and arm. Although infinitely adjustable, it can be a bit cumbersome to align.

A feeder should be adjusted to guide stock in two directions

◀ *Angle the feeder slightly toward the fence on the outfeed side to ensure that stock won't drift away.*



▲ *For a firm grip, rollers should be adjusted so that they'll retract about ¼ in. when engaged with the stock.*

the same species, I think a speed rate that can be adjusted on the fly is a real asset. It certainly will save you some time.

Choose the correct feeder

I use a ¼-hp feeder on the tablesaw and the router table. It's important to match a feeder to the machine. As a rule of thumb, the smaller feeders (up to ¼ hp) match with machines of 2 hp to 3 hp. For machines of 3 hp or greater, get a ½-hp or larger feeder.

I primarily use my feeder for cutting moldings on the tablesaw or on the router table. I also use my feeder when ripping thin stock or short planks on the tablesaw. I have a contractor's saw, so ripping long planks with the feeder tends to bog down the saw because the feeder's slowest speed is sometimes too fast. If I had a 3-hp cabinet saw, I'd get even more use out of my feeder.

Feeders excel at running moldings

Making moldings on a router table is a breeze with a power feeder. Cutters that once gave me problems with tearout and burning now produce beautiful results because I can dial in the correct feed rate and keep it steady. I can also feed the stock backward to the cutter's rotation (climb cutting) if I am having trouble with tearout. When climb cutting, set the feeder with a little extra downward pressure to make certain the stock can't be thrown past the rollers by the cutter.

I also use the feeder with my tablesaw's molding head and for making dado cuts. Because many tablesaw fences lock only at one end, unlike router-table or shaper fences, these fences may flex under the load of a feeder. A fence that flexes may yield poor results and may actually create a dangerous condition. Heavy-duty tablesaw fences are a must.

SOURCES OF SUPPLY

DELTA INTERNATIONAL
(800) 438-2486

GRIZZLY INDUSTRIAL
(800) 541-5537

POWERMATIC
(800) 248-0144

SUNHILL
(800) 929-4321

WILKE MACHINERY
(800) 235-2100

WOODWORKER'S SUPPLY, INC.
(800) 645-9292

WOODWORKING MACHINERY DISTRIBUTORS BY MAGGI
(800) 963-6244

Keep tabletops and fences slippery

A power feeder needs all of the help you can give it. Keep tabletops and fences nice and slippery to reduce friction. I use Bostik TopCoat. Make sure that fences are firmly locked. A power feeder can exert more force than hand-feeding. If cutters begin to dull, send them out to be sharpened.

Resinous woods, such as pine, can gunk up a feeder's rollers with resin and sawdust. Acetone does a good job of cleaning rollers.

Power feeders are probably one of the most misunderstood tools available to smaller shops. They don't mold, cut, plane or join wood, so many of us consider their purchase to be a frivolous investment. After all, we can use our muscles to do the same job. But increased productivity, smoother operation and added safety are reasons enough for me to be pleased with the money I spent on a power feeder. □

Roland Johnson runs a one-man woodworking shop in Sauk Rapids, Minn.

Photos: Anatole Burkin

New-Fangled Workbench

With six pipe clamps and some dressed framing lumber,

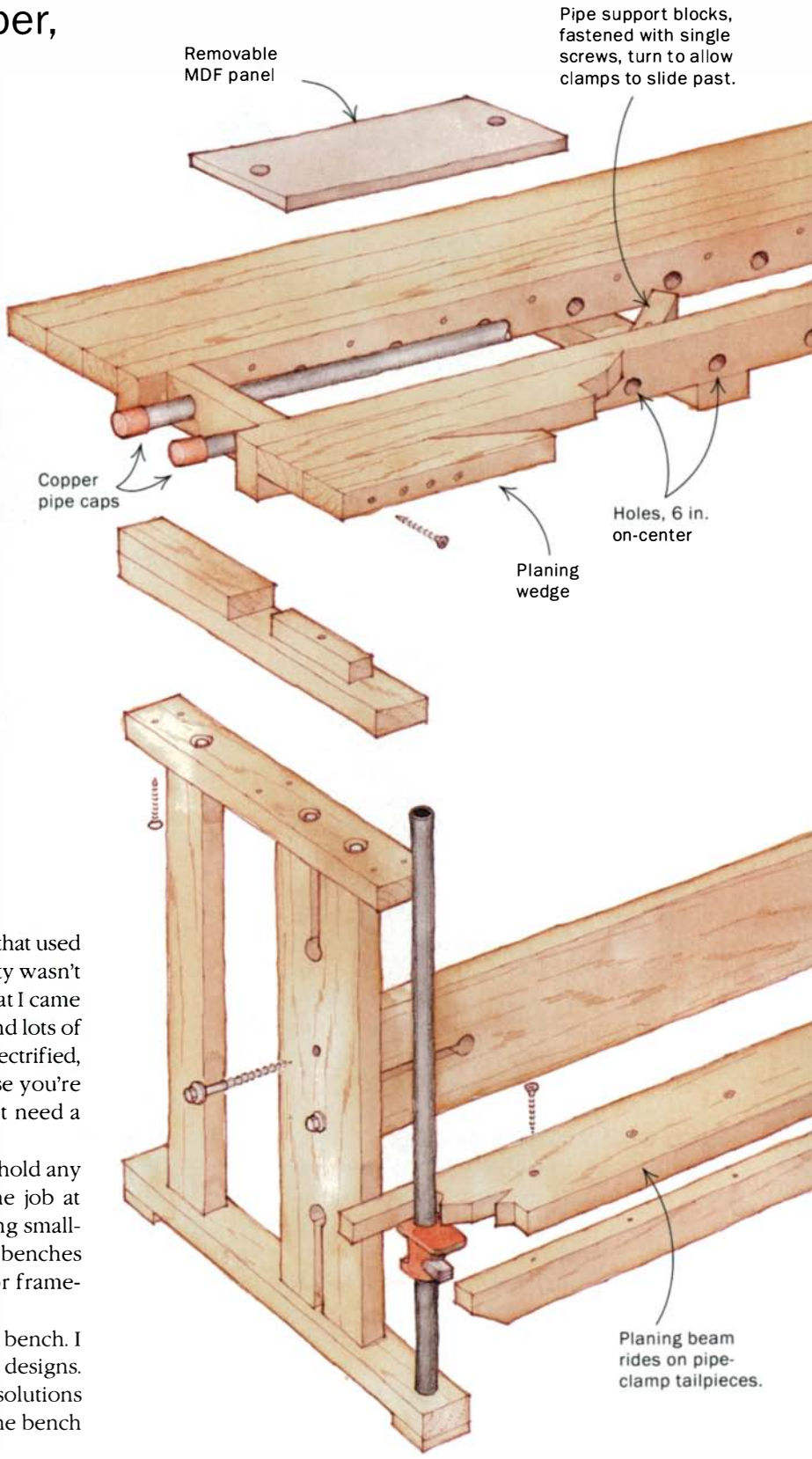
you can make an inexpensive bench that's as versatile as a Swiss Army Knife

BY JOHN WHITE

For five years I worked as a cabinetmaker in a shop that used only hand tools for the simple reason that electricity wasn't available that far back in the woods. One lesson that I came away with was the importance of a good workbench—and lots of windows. I now work in a shop that is, if anything, overelectrified, but a functional workbench is still important. Just because you're driving a car instead of a buggy doesn't mean you don't need a good road to get where you're going.

On a perfect bench, the various vises and stops would hold any size workpiece in the most convenient position for the job at hand. Traditional workbenches are adequate for clamping smaller pieces, a table leg or frame rail for instance, but most benches can't handle wide boards for edge- and face-planing or frame-and-panel assemblies.

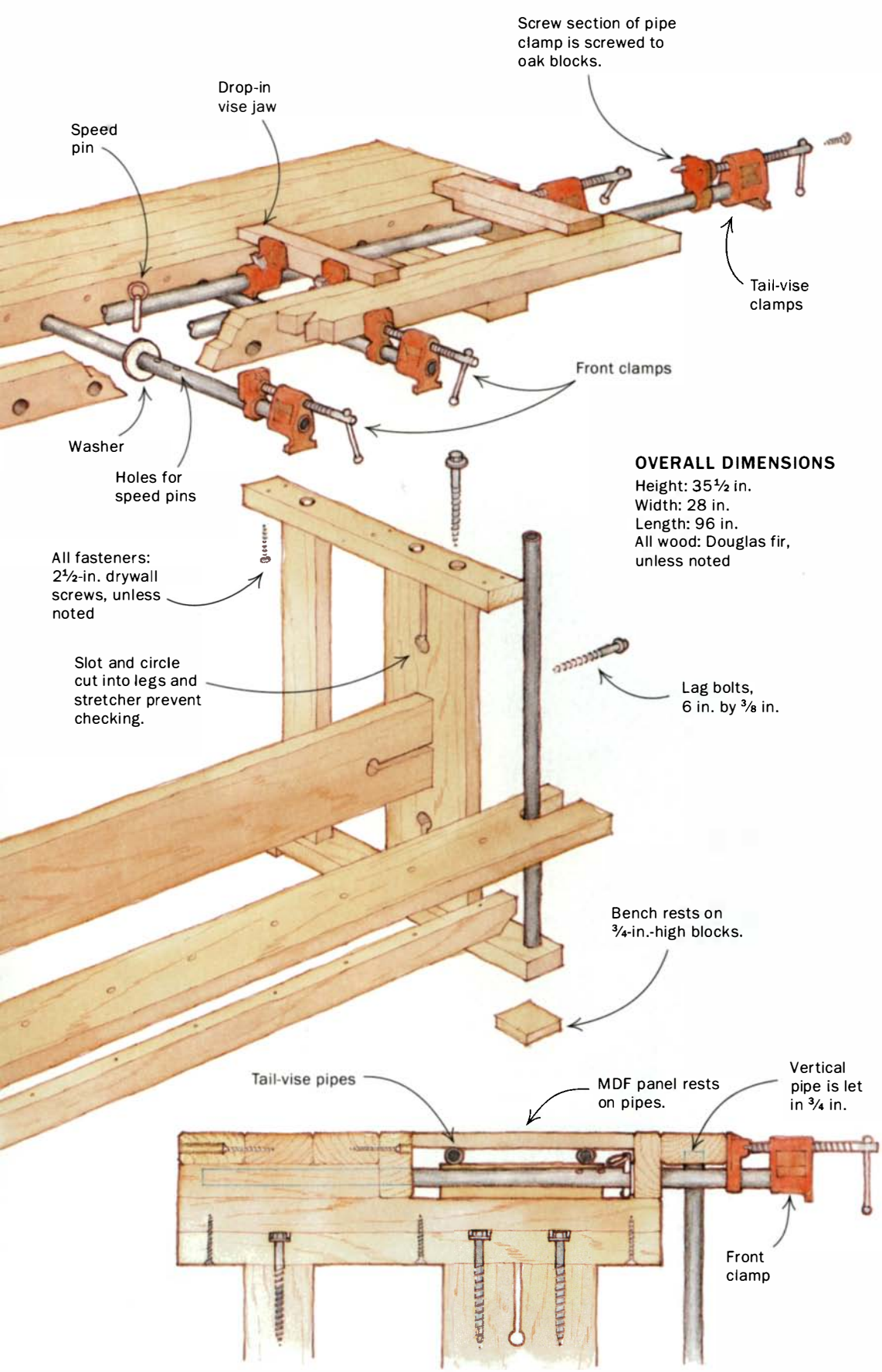
Recently, I moved my shop and needed to build a new bench. I began by researching traditional American and European designs. I found that although our predecessors had many clever solutions to the problems of holding down a piece of wood, no one bench



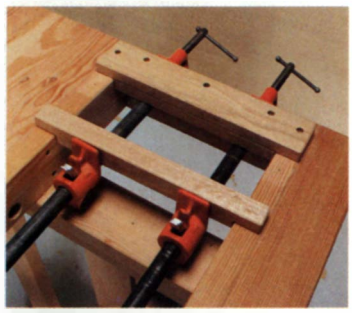
Drawings: Jim Richey

DOUGLAS FIR WORKBENCH

To minimize costs, the author milled workbench stock from Douglas fir framing lumber, sawing clear sections from the center of 2x10s and 2x12s. The bench is fastened with drywall screws and lag bolts. Six pipe clamps in different configurations are used as vises.

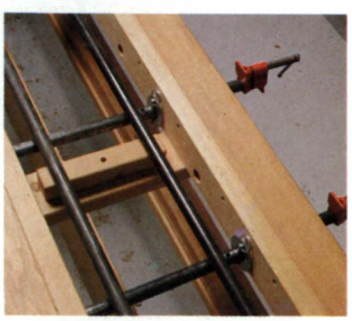


SECTION VIEW



Oak blocks span tali-vise clamps. *The screw ends of the pipe clamps are screwed to the end of the bench through holes drilled in the clamp faces.*

Pipes rest on blocks that turn. *Tail-vise pipe clamps are supported by blocks fastened with one screw. To slide a clamp past, turn the block.*



Front clamps are easy to adjust. *The clamps fit in holes in the bench front and are secured with large washers and speed pins.*

Photos: Jefferson Kolle

Sliding height adjustment. *Pipe-clamp tailpieces slide on cast-iron pipes held captive in the top and bottom of the bench. A T-shaped Douglas fir planing beam rides on the clamps.*

solved all or even most of the problems I had encountered in 25 years of woodworking. Frustrated, I finally decided to design a bench from the ground up.

At first I had no success. A design would address one problem but not another, or it would be far too complex. I was about to give up and build a traditional German bench when I came up with a design that incorporates pipe clamps into the bench's top, the front apron and even the legs.

Planing beam slides on pipes

On the front of the bench is an adjustable, T-shaped planing beam that runs the full length of the bench. It is supported on both ends by the sliding tailpieces of Pony pipe clamps. The ½-in. cast-iron pipes on which the clamps slide are incorporated into the bench's legs. I used Pony clamps throughout this project because they are well made and slide and lock very smoothly.

The planing beam continuously supports the full length of a board standing on edge. The stock for the planing beam can be as narrow as 2 in. and as wide as 30 in. The planing beam can be set to any position in seconds. Of all of the bench's features, the planing beam is the most useful. I use it dozens of times daily when building a piece of furniture.

You've probably noticed that there is no front vise to secure the board being planed. Instead, the force of the plane pushes the workpiece into a tapered planing wedge attached to the far left end of the bench. This is an ancient device, and for handplaning it is far more practical than any vise. You can flip the board end for end or turn the other edge up in an instant with one hand. You don't even have to put down your plane.

To make a shoulder vise when needed, I drilled holes 6 in. on-center along the bench's front rail to mount pipe clamps horizontally. I pair up two clamps with a drop-in vise jaw, which is just a length of 1¾-in. square hardwood. The jaw can be as short as 8 in. or longer than 6 ft. I have several jaws of different lengths.

The front vise can be used with the planing beam supporting the workpiece from below. This is useful because some procedures, such as chopping mortises, drive the work downward through the jaws of a conventional vise, scarring the wood.

Traditional tail vise is replaced with pipe clamps

On the bench's top, two pipe-clamp bars are recessed into a 10-in.-wide well, replacing a conventional tail vise and bench dogs. The clamp-tightening screws project from the right end of the bench, and the movable jaws project ¾ in. above the top. Both the fixed and movable jaws have oak faces. This clamp setup makes it easy to hold down boards for surface-planing because nothing projects above the board's surface to foul the tool. The top clamp bars have a clamping capacity of just over 7 ft.

Blocks of wood support the pipes. Each one is screwed to the frame of the bench

Planing wedge. *When used with the planing beam, long work is held against a wedge-shaped stop at the end of the bench. The harder you push against the work, the tighter it is held in place.*

Lift-out MDF panels. *The panels, cut in different lengths from MDF scraps, make a durable yet disposable center surface for the bench. The panels get removed when the tail-vise pipe clamps are in use.*

with a drywall screw. The single screw allows each block to swing out of the way of the pipe-clamp tailpieces as they are slid to accommodate long work.

The top pipe clamps can also be used to hold panels in place that have other tools permanently attached, such as a vise or an electric grinder. I have a tilting drill-press vise attached to a square of medium-density fiberboard (MDF) that I clamp to the bench for metalworking or for holding a piece of wood to be carved. I plan to design a drop-in router table for the bench; there's enough space between the pipe-clamp bars to fit a small machine.

When the top clamps aren't in use, the well is covered by several sections of ¾-in. MDF that simply drop in and lay on top of the pipes. Because MDF is so inexpensive, I treat the panels as sacrificial surfaces. I cut into them, screw jigs to them, whack them with a hammer, and when they get too chewed up, I toss them. To save my back, I buy precut MDF meant for shelving; it comes either 12 in. or 16 in. wide. This precut stock is useful for all manner of jigs and prototypes, and I always have a few lengths around the shop.

Douglas fir makes a solid bench

The bench, as I built it, is 8 ft. long and was designed to accommodate fairly large work, such as doors and other architectural millwork. The design can be shortened or lengthened, and it could be reversed end for end if you are left-handed.

I built the bench out of Douglas fir instead of hardwood. Douglas fir at its best is a dense, stable wood that machines cleanly and holds fasteners well, important attributes given the way I wanted to assemble the bench.

Wide planks—2x10s and 2x12s—of Douglas fir framing lumber will often be sawn right out of the center of the log, and a half or more of the board will be quartersawn and knot free, with tight, straight grain. By carefully choosing and ripping these planks, you can get some beautiful material for a lot less than the price of even mediocre furniture woods. Some of the trimmed-out wood that isn't good enough for the bench can still be used for other projects such as shelves or sawhorses.

If you start with green lumber, sticker it for a few months to get the moisture content down. To prevent checking, trim the ends to get a clean surface and then apply duct tape over the end grain. Even if you start with kiln-dried wood, give it a couple of weeks indoors to stabilize before starting to cut. Use the best wood for the frame, benchtop and beam, saving lesser quality stock for the leg assembly.

Screw joinery is fast and strong

My method of assembling the bench with drywall screws and lag screws (and no fitted-and-glued joinery) is unconventional, but I've used this style of construction for years. The finished bench is rock solid, and the joinery goes quickly.

Most of the screws were counterbored with a ⅜-in. drill, sometimes quite deeply, to bring the screw heads ¾ in. shy of the edge being joined. On the 3-in.-wide, edge-jointed benchtop boards, the counterbore is 2¼ in. deep. The deep bore minimizes the amount of wood under the screw head, which in turn minimizes the loosening of the joint as the stock shrinks.

After drilling the counterbore, follow up with a long bit to drill a clearance hole for the screw shank. Then line up the pieces to be joined and install the screws a couple of turns to mark the centers, drill pilot holes at the marks in the adjoining piece and assemble the bench.

One of the advantages of this type of construction is that if the wood shrinks and the joints loosen up, you can retighten everything in a few minutes with a screwdriver. I did this about a month after assembling the bench, and it has stayed solid ever since. Don't overtighten the screws. Excessively crushing the wood under the screw's head ruins the resilience that allows a joint to flex slightly and remain tight.

The keyhole slots in the legs and stretcher are functional; as the boards shrink, they allow the wood to flex without cracking. In effect, they are preemptive cracks that look a lot better than the ones that would form randomly otherwise. When you install the lag bolts, drill clearance and pilot holes and go easy on the torque when you tighten them up. The joint will be stronger if you don't overstress the threads in the stretcher's end grain.

Horizontal clamps run full length. *A pair of pipe clamps, running under the benchtop, hold work in the same way as a traditional tail vise.*

The pipes used with the clamps cut easily with a hacksaw or a small pipe cutter. For the smoothest operation of the clamps, clean up any burrs along the length of each pipe with a file and then smooth it down with emery paper. This is a messy operation, creating a staining black dust, so do it away from your woodworking area. Wipe down each pipe with a rag and paint thinner when you are done. □

John White keeps the Fine Woodworking *shop running smoothly.*

Rules of Thumb

BY MIKE DUNBAR

Unnecessary tools

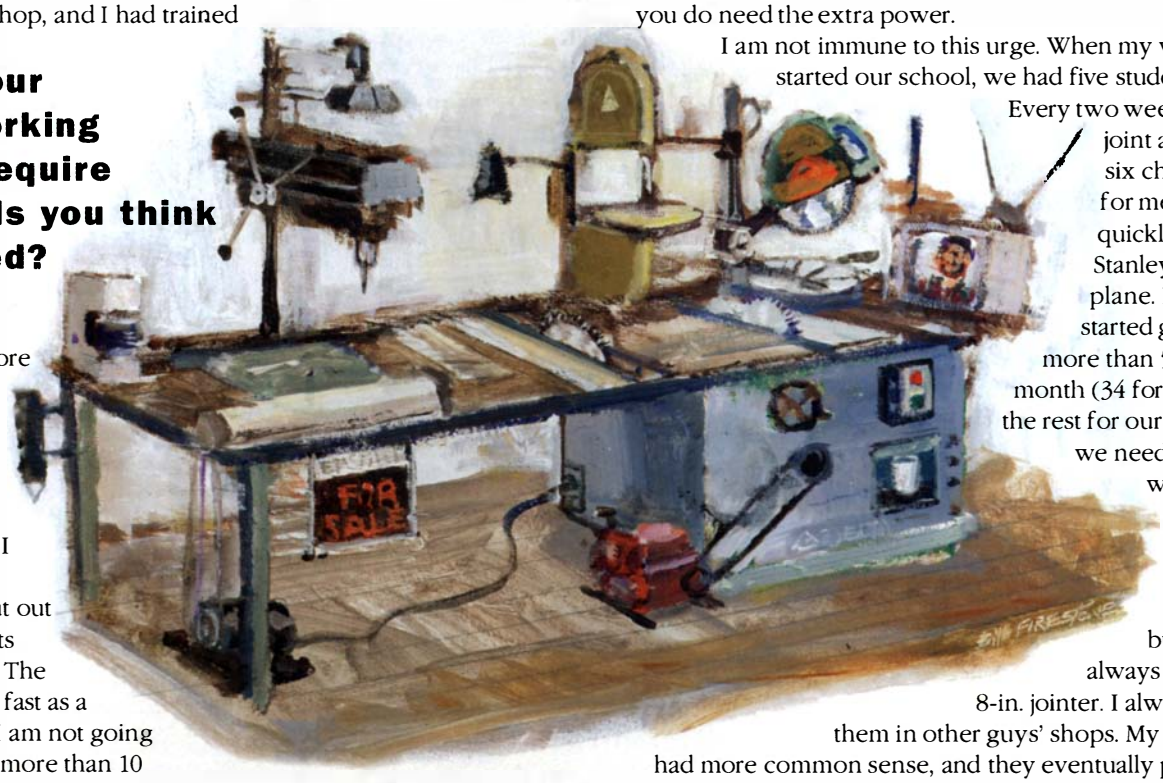
Is there any woodworker whose shop does not have lots of tools that have been used once or twice and are now gathering dust? That woodworker will not be found around here. Like everyone, I have bought my share of tools that I do not use—an often expensive mistake. When students ask me how to avoid buying such a mistake, I tell them this story:

In the mid 1970s I was the chair maker at Strawbery Banke, a Williamsburg-type museum in Portsmouth, N.H. However, I was not an employee, and I was allowed to work in whatever manner I chose. I did not have to re-create the past.

I worked in a one-room shop, about 14 ft. by 14 ft., where I made two chairs each week, always following the same schedule. Every Wednesday morning I cut out the seats with a 25-in. bowsaw. Without fail, one of the tourists would say to me, "You need a bandsaw."

If I was in a good humor—about 50,000 people a year passed through my shop, and I had trained myself to ignore heckling and inanities—I would patiently explain as follows. "No, I don't need a bandsaw. I cut out two chair seats once a week. The bowsaw is as fast as a bandsaw, so I am not going to need it for more than 10 minutes. After that, it is returned to a nail on a wall, where it takes up no space in this very small shop. If I had a bandsaw, it would take up about a square yard of precious floor space. My bowsaw cost me only $45. A bandsaw would cost about 14 times that much. So, as you can see, I don't need a bandsaw."

Does your woodworking really require the tools you think you need?



Today, my wife and I run a school with 16 people per class, all of them cutting out their seats at the same time, so we do need a bandsaw. We have a 14-in. Delta on the classroom floor.

That is the key. Before buying a tool, ask yourself several questions. Does your woodworking really require the tools you think you need? Are there less expensive and more efficient alternatives? Can you learn a skill (like using a bowsaw) and save yourself some money and space?

There are four influences that mislead us into buying the wrong tools. The first is what I call "the Tim Taylor effect." The others are "the how-to TV-show effect," "gadget fascination" and, finally, "the good deal."

The Tim Taylor effect

On the TV show *Home Improvement*, Tim Taylor spoofs our fascination with the biggest and most powerful tools, and those that have the most bells and whistles. I cannot count the number of home shops I have been in where the central tool is a cabinet saw. For most woodworkers, a contractor's saw is more than sufficient. However, the cabinet saw is the more powerful (and expensive) machine. More than 350 students a year come to our woodworking school, and all of our prepwork is done on a contractor's saw. This is not to say no one needs a cabinet saw. If you are working a lot of sheet materials or cutting thick wood, you do need the extra power.

I am not immune to this urge. When my wife and I started our school, we had five students per class. Every two weeks I had to joint and glue up six chair seats (one for me). I did it very quickly with a Stanley No. 7 jointer plane. But once we started going through more than 50 seats in a month (34 for classes and the rest for our own work), we needed a jointer. I wanted to get an 8-in. machine. I don't know why, but I have always wanted an 8-in. jointer. I always admire them in other guys' shops. My wife and staff had more common sense, and they eventually prevailed. We now have a 4-in. jointer in our machine building. The surfaces we joint are all 22 in. long by 1¾ in. wide, and this machine is more than sufficient for our needs. It cost a lot less than my fantasy jointer, and it is also portable. When my guys are done jointing, they store the machine in a corner, leaving more room for other machines and for storage.

The how-to TV-show effect

How-to TV shows are fun to watch. However, they all have sponsors, and usually the sponsors insist that their tools be used. Thus, to satisfy the sponsors, you see projects being made using tools that are not always necessary or the most efficient. Television is a powerful medium. Its moving images make a

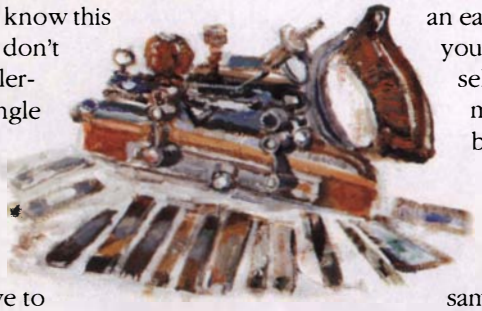
Drawings: Bill Firestone

Rules of Thumb (continued)

lasting impression and leave us assuming that we cannot get along without the tools we see on these shows.

Gadget fascination

Woodworkers are fascinated by tools that seem to do neat tricks and offer us an opportunity to wow our friends. Another urge is to get into the shop and right to work rather than spend a lot of time learning skills. We delight in gadgets that promise to get us to work easily and quickly. Tool companies know this and fill their catalogs with gizmos we really don't need. The one that comes to mind is the roller-skate device used to hold a tool at a fixed angle while sharpening. First of all, holding a tool steady is not hard and can be learned very quickly. (Here's a tip: go side to side rather than front to back or in figure-eights.) Second, the roller skate works only on chisels and plane blades. Woodworkers have to sharpen many other shapes—gouges, for example.



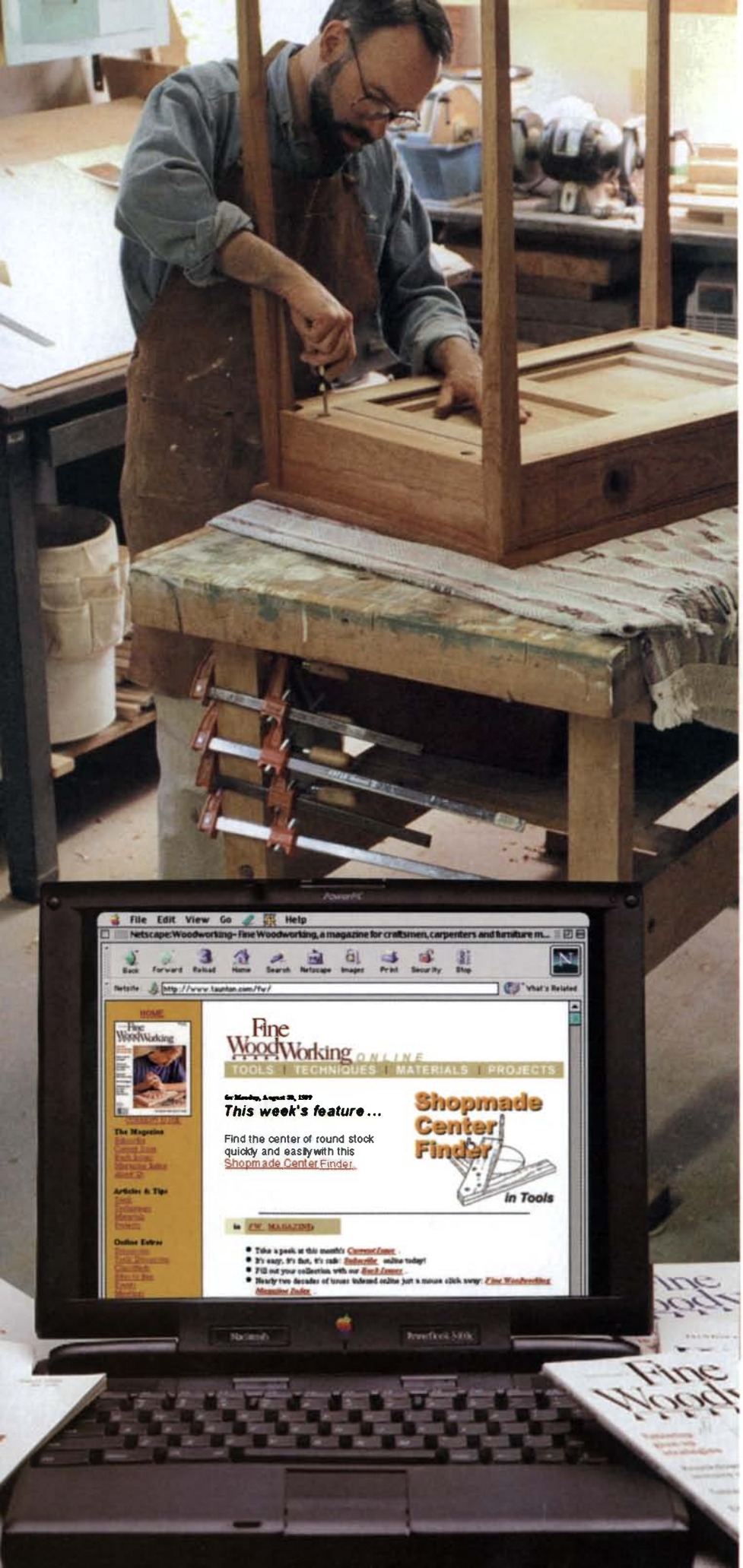
The good deal

Some tools are frequently sold in sets, but you are often better off buying the tools individually. When I bought the drill press for my school, I also purchased a plastic case of twist bits. We only use a handful of sizes. When the bits we use most often got dull or broke, I bought another case of bits. The same thing happened this time, and we ended up with duplicates of all kinds of sizes of bits we never use. Now, we buy individual bits.

The same situation applies to carving sets. You will frequently use only specific carving tools and would be better off buying them individually. However, if you buy a set of bench chisels in four or six common sizes, you will use them all. They are cheaper than the same tools bought individually.

Combination tools are a similar situation. They look like such an easy way to outfit a shop—all of the machines you need in one. However, these machines seldom work as well or as easily as a dedicated machine does, and some of the functions will be seldom used.

Two of the most famous combination tools are the Stanley No. 45 and No. 55. Frequently, students tell me of the great deals they have gotten on these planes. The story is always the same. The plane is still in the original box, and the parts are all there. There is an explanation as to why this happens so often with these hundred-year-old tools. The original owners tried them and, in disappointment, put them back in the box. This was repeated with each owner over 100 years. The parts and the box never got lost because the tool was always stowed away, gathering dust. Every one of the tool's owners would have been better off skipping this "good deal" of many-planes-in-one and buying dedicated planes.



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Q&A

Installing bandsaw tires

I recently purchased a used 14-in. Delta bandsaw and think I need to replace the tires. Neither the new tires nor the manual tell when and how to change the tires. How do I get the old tires off and the new ones on?

—William R. Landry, New Iberia, La.

Bernie Maas replies: Bandsaw tires are not unlike bearings. Some seem to last forever. I bought my 14-in. Rockwell in 1965 and am still using the original set. I put new tires on the machine in the university's woodshop only once or twice in 30 years. The longevity of a tire is governed by the amount of use and material being cut. Shops building aluminum storm windows replace tires more frequently because the metal has an abrasive effect.

If the machine is running fine, leave well enough alone. The best indicator of a failing tire is the inability of the machine to track a blade. But other factors might be in play here. Slop due to worn bearings or guides that are out of adjustment are two items that come to mind. An out-of-round wheel or one with a face that's not perpendicular to its axis might also be a factor. Check for these conditions using a dial indicator. Once fixed, it would be odd for this type of defect to develop anywhere down the road.

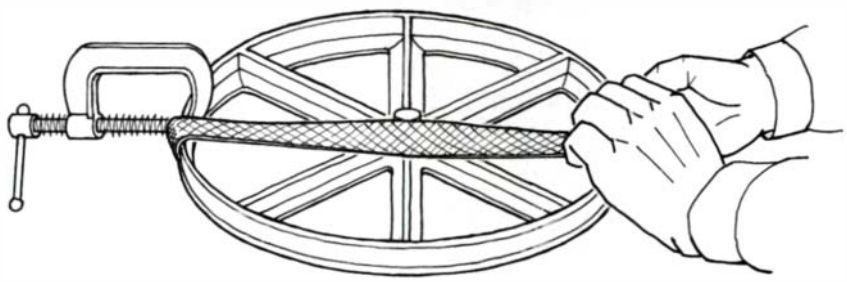
Wear might not be the only causative factor. Urethane tires sometimes develop a groove where the blade sits. Rubber tires develop dry rot. Also, sawdust or filings can work under the tire.

Changing tires is fairly straightforward. In the old days, leather strips were used. These strips would be chiseled off and new ones glued into place; a major undertaking. Today's tires are either rubber or urethane and simply snap like rubber bands into a groove machined or cast into the wheel's rim.

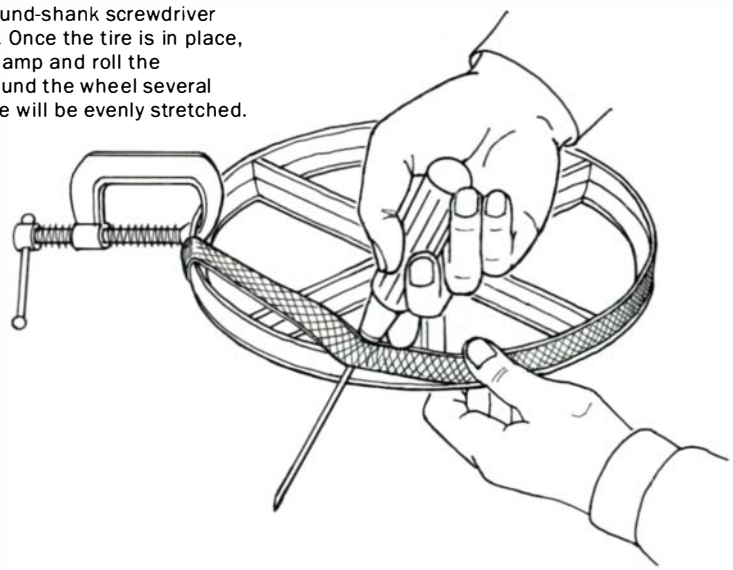
When removing a tire, treat it like a bicycle tire, working it off with a pair of screwdrivers. Take care not to injure the tire. A new set can take a $40 to $50 bite out of your wallet. Check the tire for wear, inside and out. It's possible to turn it inside out and remount it for a few more years of life. Once the tire is off, clean the groove in which it was seated.

For installation, stretch the tire to fit over the wheel (see the top drawing at left). This may take some doing, and an extra pair of hands is helpful. A urethane tire can be quite stiff. It can be made more pliable by soaking it in a bucket of hot water. Then, mount the tire by snapping it into place. Be sure the tire is evenly stretched (see the bottom drawing). [Bernie Mass teaches woodworking at Edinboro University in Edinboro, Pa.]

STRETCHING THE TIRE
With the wheel chucked in a vise, the tire is stretched into place, using an extra set of hands or a C-clamp to secure one side.



GETTING AN EVEN FIT
Walk a ¼-in. round-shank screwdriver around the tire. Once the tire is in place, remove the C-clamp and roll the screwdriver around the wheel several times so the tire will be evenly stretched.



Spray finish at the right temperature

When using an internal mix setup, what temperatures are best for spraying solvent- and water-based finishes?

—Dale Cohn, Houston, Texas

Chris Minick replies: Wood finishes are designed to apply best and yield optimum film properties at temperatures between 65°F and 75°F. Low-temperature application, below 60°F, usually results in poor leveling, a rough, orange-peeled surface and trapped solvent in the dry finish film. Multiple layers of finish containing residual solvent will stay soft for months and can be easily damaged. Conversely, temperatures above 85°F often lead to pinholes in the film caused by solvent popping, poor intercoat adhesion and a cottonlike blush (due to the humidity).

But it's not as hopeless as it sounds. Solvent-based finishes can be easily adjusted in the shop to accommodate these temperature extremes. Simply select fast-evaporating thinners on cold days and slow-evaporating or retarding thinners when the temperature is above 80°F. While solvent-based finishes can be coaxed to form a film at low temperatures, water-based finishes cannot.

All water-based or latex finishes have

Drawings: Vince Babak

a minimum film formation temperature (MFFT in paint lingo), the temperature below which the finish will not form a film. Most finish manufacturers adjust the MFFT to around 45°F, but because the MFFT is not printed on the label, you can't always be sure. I've seen commercial water-based finishes with MFFTs as high as 55°F and as low as 30°F. Adjusting water-based finishes in the shop to account for low-temperature applications is not practical. It's wise to stay within the temperature range recommended on the label.

Remember that both the project to be sprayed and the finish must be at the proper temperature. Warming the liquid finish to 70°F and then spraying it on a 50°F table is just as bad as spraying cold finish on a cold table.

[Chris Minick is a finish chemist and contributing editor to *Fine Woodworking*.]

Three ways to lay out an ellipse

I'm working on a small table design that calls for an elliptical top. Is there a simple way to lay out an ellipse?

—Larry Dane, Houston, Texas

Gary Rogowski replies: Instead of having only one focal point, like a circle, an ellipse has two. And instead of having a consistent radius, an ellipse has major and minor axes along which these focal points lie. Curiously, you can also measure from any point on the ellipse to each focal point, and the sum of those two distances will always be the same, and it will always add up to the length of the major axis: PF + PF1 = constant = AB.

If you know the lengths of the major and minor axes, you can plot out the shape of the ellipse. Let's call our major axis AB and our minor axis CD. Draw these lines on a sheet of paper. Mark the intersection of these lines with an X. The focal points are F and F1.

To use the familiar pencil-and-string method (see the top drawing at right), you must figure out the position of the focal points. The formula is:

$F = \sqrt{a^2 - b^2}$,

where F = the distance XF,

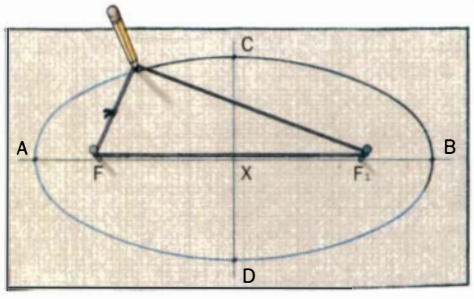
a = AB/2, b = CD/2.

Put nails at the focal points along the major axis and tie a string onto them that is equal to the length AB. Pull the string out tightly with a pencil to mark out the ellipse.

Another, more sure method involves plotting out the ellipse (see the middle drawing below). Take a stick and mark out half of AB (or AX) on it and then mark out half of CD (or CX) between the A and X. Place this stick on your paper so that A sits on the minor axis and C lies on the major axis. Use a pencil to mark at X, and this will mark out one quarter of your ellipse as you move A and C along the axis. Do this on a sheet of folded-up paper, cut out the quarter ellipse with scissors and then open it. Half of the ellipse will be laid out.

A third way to lay out an ellipse is to use a century-old method involving a framing square. Lay the square so that its corner lines up with the intersection of the major and minor axes. Place trammel points at A and C and a pencil at X. Then move the trammel stick along the square and pencil in your quarter ellipse again. Put these same features to work again using a

THREE METHODS, ONE ELLIPSE



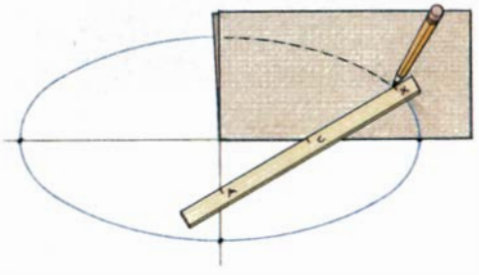
STRING AND NAILS

Using a piece of string held by nails at focal points (F and F1), a pencil marks out the ellipse. Determine the width and height of the ellipse, then use the formula below to determine the placement of F and F1.

F = distance of nail from center (X)

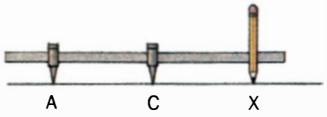
$F = \sqrt{(AB/2)^2 - (CD/2)^2}$

On a stick, plot the points that correspond to A, C and X on the ellipse.

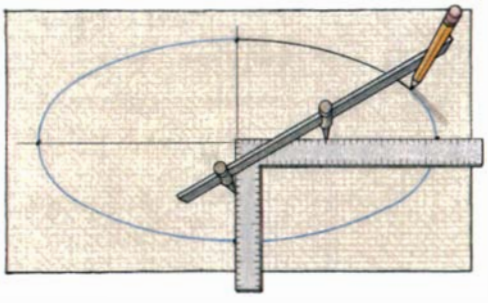


PLOTTING POINTS

As A moves along the minor axis and C moves along the major axis, an ellipse is marked by a pencil at X. Draw one quadrant on folded paper and then cut along the line. The paper unfolds in the shape of half an ellipse.



In the third method, trammel points replace the stick.



POINTS AND A SQUARE

A framing square guides the trammel points along the major and minor axes, while a pencil draws the ellipse. For a perfect ellipse, this process is repeated in each quadrant.

router bit and jig, and you can actually cut out the shape.

[Gary Rogowski is a contributing editor to *Fine Woodworking*.]

Spalting your own wood

I like to work with spalted maple but can't seem to find enough of it. What causes spalting, and is there a way to take ordinary maple and coax it to spalt? Can the process be controlled, or is it something only Mother Nature knows how to manage?

—J.P. Stover, Madison, Wis.

Jon Arno replies: The beautiful, marblelike coloring of spalted maple results from pigments produced by molds as they metabolize in the wood. Because the spores of these molds are virtually everywhere in the atmosphere, all that is needed to coax them to metabolize in the wood is to provide a suitable environment. The two key factors are moisture and temperature.

Ideally, the moisture content of the wood should be kept above 20% but not allowed to go much above the wood's fiber saturation point, which is around 28% for most species. If the wood dries out below about 20%, the molds go dormant, and if the wood becomes fully saturated (waterlogged), the molds cannot get enough oxygen to metabolize. The molds also go dormant if the temperature drops below about 35°F or exceeds 100°F, and they seem to prefer temperatures that stay within the range of 50°F to 90°F.

Exploiting these metabolic requirements in a manageable, low-tech process for actually getting wood to spalt is not all that difficult. If you are dealing with small pieces, one method is to soak them in water, then put them in a black plastic bag and store the bag in a place where the temperature will remain relatively constant in the 70°F to 80°F range.

A nice touch. *This jewelry box uses spalted maple drawer fronts made from stock salvaged from firewood.*

To coax logs to spalt, roll them into a shady place, cover them with dead leaves and periodically spray them with a hose to keep them moist. By trial and error you should be able to fine-tune your methods and learn how to control the process. The biggest risk is letting it go to the point where the fungi that cause rapid decay get established. Periodically check a sample from the batch, and when the

spalting appears to be approaching optimum, mill the logs. The lumber then should be either kiln-dried or quickly stickered for air-drying. Once the wood's moisture content drops comfortably below 20%, say 18% or lower to be conservative, no further spalting will occur.

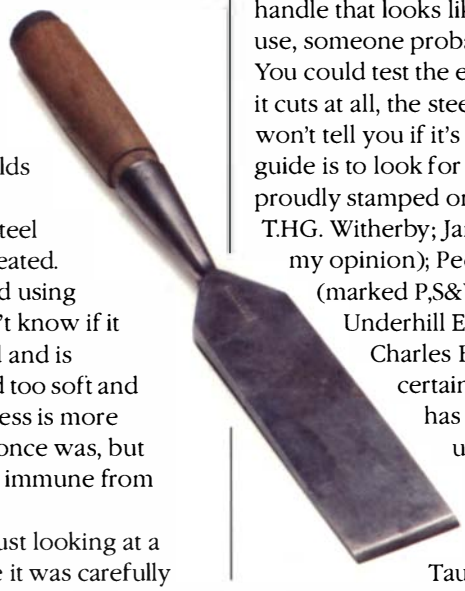
Be careful, though, the fine art of spalting can get to be an obsession. You will find yourself trying all sorts of experiments, like attempting to inoculate a batch by sticking in a piece of previously spalted wood that happens to have exceptionally unique color. Sometimes it works, sometimes it doesn't, but that's another story.

[Jon Arno is a wood technologist and wood consultant in Troy, Mich.]

Finding a good chisel

I've amassed a pretty good assortment of handplanes from flea markets and yard sales, but I've always been wary of buying chisels because, until I use one, I can't tell a good one from a bad one. Is there a way to gauge a chisel's quality without buying it and using it for a week?
—Stanfield Gray, Charleston, S.C.

Garrett Hack replies: There is no easy way to tell a good chisel—or any edge tool for that matter—from a mediocre one. But it's not entirely a shot in the dark, either. While the composition of the steel affects how a chisel sharpens and holds an edge, far more important is how that steel was forged and heat-treated. Short of sharpening and using the chisel, you wouldn't know if it was tempered too hard and is brittle or was tempered too soft and dulls quickly. The process is more scientific today than it once was, but modern chisels are not immune from these same problems.



You can tell a lot by just looking at a chisel. Does it look like it was carefully forged and finished? Are the bevels consistent, the socket (if it has one) robust and in line with the blade? Bring a short straightedge with you to check the flatness of the back. Craftsmen usually fitted their own handles, so this isn't a reliable guide, but if a chisel has a shapely handle that looks like it has seen much use, someone probably valued it once. You could test the edge with a file, and if it cuts at all, the steel is too soft—but this won't tell you if it's too hard. The best guide is to look for a maker's name proudly stamped on a chisel, such as T.H.G. Witherby; James Swan (No. 1 in my opinion); Peck, Stow & Wilcox (marked P,S&W); L&I.J. White, Underhill Edge Tools; and Charles Buck (Buck Brothers is certainly better known but has a reputation for uneven quality).

[Garrett Hack is the author of *Classic Hand Tools* (The Taunton Press, 1999).]

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Master Class

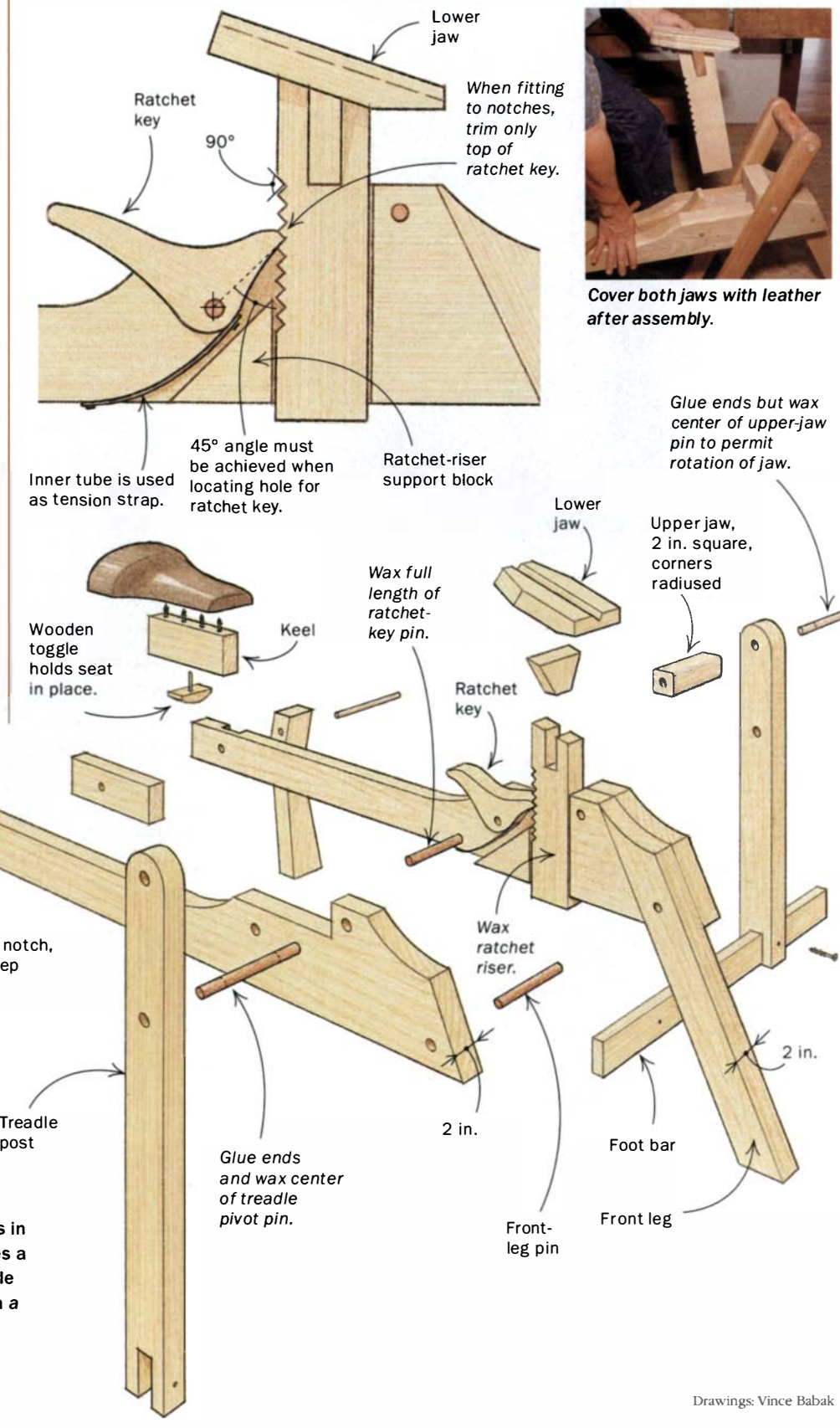
A new breed of shaving horse

BY BRIAN BOGGS

For 15 years I have enjoyed excellent service from my Ulmia cabinetmaker's workbench. It is a massive piece of European beech with enough power to crush most any piece of wood I put in its jaws and enough weight to hold work still for the heaviest planing. But when I want to shape a bent chair leg, I need a lot more holding finesse than any cabinetmaker's bench offers. In fact, any organically shaped workpiece is a challenge for the standard bench, which is why shaving horses are so popular among chair makers.

Most folks think of shaving horses as crude devices useful only for rustic craft. I would have to disagree. A good shaving horse grips a workpiece firmly, releases

Ratcheting head is at the heart of this horse



Cover both jaws with leather after assembly.

EQUINE EVOLUTION

Designed with efficiency and ergonomics in mind, the author's shaving horse features a padded adjustable seat and an adjustable lower jaw among other improvements on a traditional English horse.

Drawings: Vince Babak

and readjusts its grip as quickly as you can move your foot and allows more control and sensitivity for holding parts without bruising them than any other clamping system I know.

A shaving horse is basically a foot-operated clamp. The lower jaw supports the workpiece while the upper jaw presses down on it in response to foot pressure. This is an ideal arrangement for working with spokeshaves and drawknives because the harder you pull with the tool, the more pressure you naturally exert with your feet to maintain your balance. And the more pressure you exert with your feet, the more clamping force you exert on the workpiece.

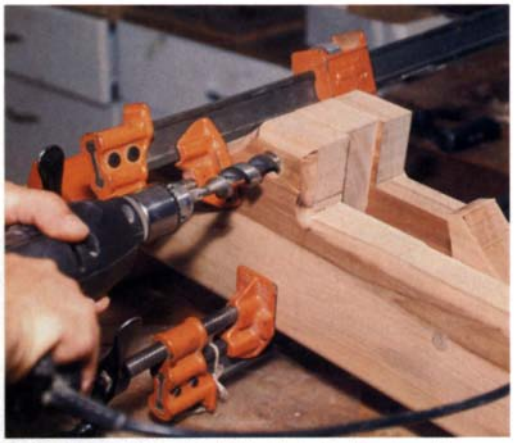
The first horse I made was nailed together from fence planks and modeled on traditional English horses. I've gone through four more since then, modifying the design each time to increase leverage, comfort and versatility. When I injured my back several years ago, the ergonomics and efficiency of the horse became especially important. I researched and experimented with different working positions to find the optimum seat height, seat angle and workpiece elevation, then designed the horse around them.

I ended up with a horse that makes several departures from its old English predecessors. I built it taller and added a tilted, padded and leather-upholstered bicycle-type seat that can be adjusted forward and back. I cut back the front of the horse to allow more clearance forward of the treadle so that curved workpieces could be rotated freely. And I replaced the traditional lower clamping surface with a jaw on a ratchet assembly, which permits quick adjustment of the opening and allows me to keep the work angle constant.

While I think this horse is just right for chair making and suits my frame, you may want to make adjustments to fit you and your work. Start by building the base and saddle. Try getting on and off the horse, and see how it feels. I think the tallest horse you can mount easily is your best height. The taller the horse, the more open the angle of your thigh to your back while you are working, and the less strain on your back. Err on the tall side—you can always shorten the legs.

Next, find the best spot for the clamping treadle. It should swing from a pivot point

Don't glue me in. *The whole length of the ratchet-key pivot pin is waxed before assembly. If the rubber tension strap ever breaks, the pin can be knocked out and the key removed for the repair.*



Delicate drill work. *If the hole for the treadle pivot pin is not accurately drilled, the whole clamping system can be thrown off. Drill by hand from both sides or set up an extension table and use a drill press.*

Watch that squeeze-out. *Glue the ends of the treadle pivot pin but not the middle. Minimize squeeze-out and thoroughly wax the center portion of the pin.*

Go deep. *Be sure the screws through the lower jaw are amply countersunk.*

Wax and rap. *With the ratchet riser in place and well waxed, coat the sides of the riser support block with glue and tap it up against the riser.*

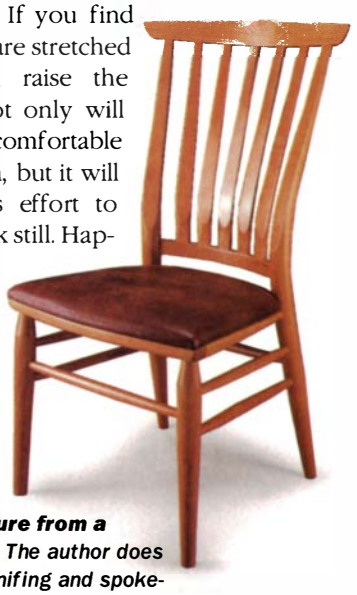
Photos: Vincent Laurence, except where noted

directly above the most comfortable position for your feet, just a little ahead of your knees. You don't want to have your legs fully extended while you are working. When you find the right spot, drill the hole for the treadle pivot pin. Don't cut the treadle to length yet, but fit it temporarily with the foot bar attached. You want the treadle's foot bar to be as low as is comfortable and still clear the floor by about 1 in.

To determine where to locate the upper jaw, you first need to build the ratchet assembly for raising the lower jaw. This mechanism must operate very smoothly and hold securely to be worthwhile, so pay close attention to the alignment of the ratchet key to the ratchet-riser notches. The riser should slide up like a well-made drawer—no resistance but no slop, either. You'll need to plane or scrape the sides of the riser carefully. Wax is helpful, too.

Once you have the ratchet riser in place and working well, it's time to determine the optimal position for the upper jaw. The position of the upper jaw determines the height at which you'll be cutting and therefore the comfort and efficiency of the horse (the lower jaw simply adjusts to accommodate the thickness of the workpiece). The upper jaw is a square piece of stock with rounded corners that is drilled through to accept a pin. For fitting, cut the jaw overlength by ¼ in. so it sits tightly between the treadle posts. Clamp it in place (without the pin) between the treadle posts at about the height of your elbow as you sit on the horse. With a piece of soft wood in the jaws, apply light foot pressure, and take a few practice cuts with a drawknife. Raise or lower the jaw until the cutting action feels natural. Your elbows should be in line with your shoulders, and your shoulders should be relaxed. Then mark and drill the treadle posts for the upper-jaw pin and cut the jaw to its correct length.

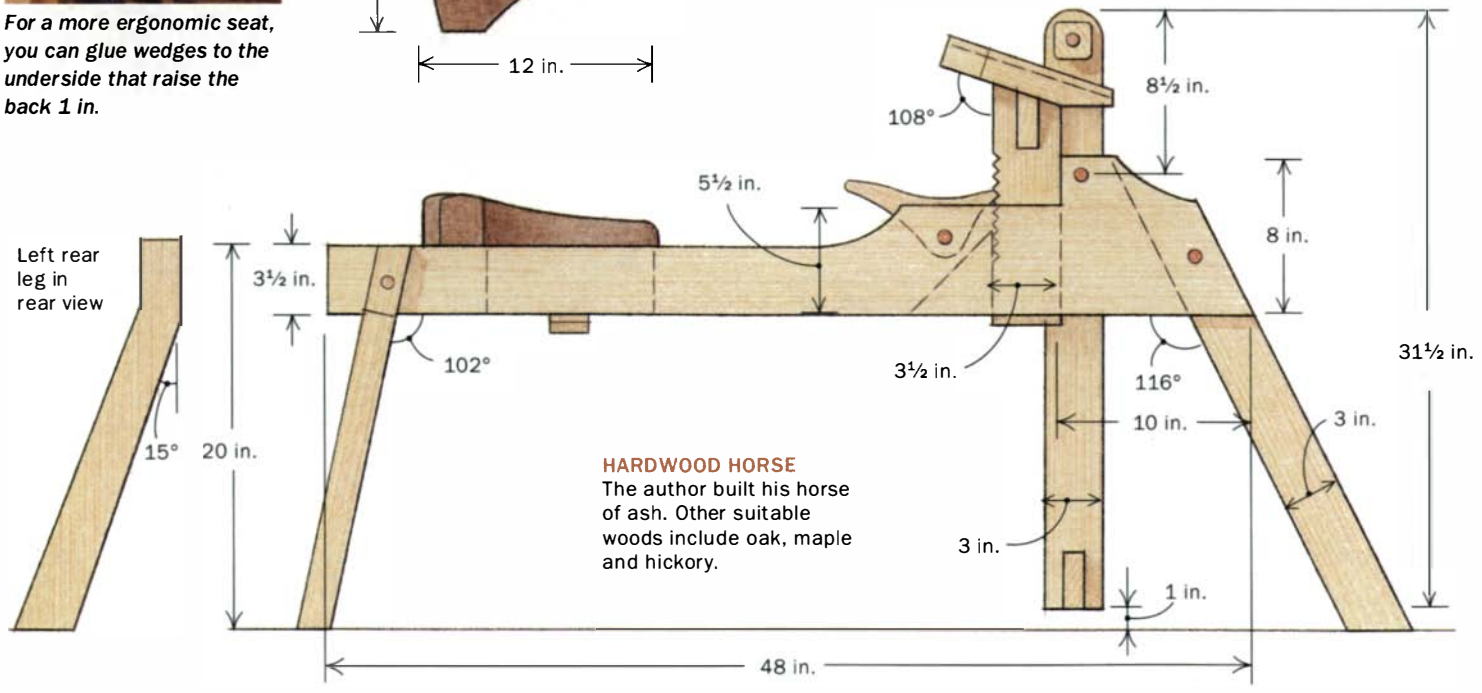
When using this horse, keep the lower jaw in the highest position that will accommodate the workpiece. For best leverage and leg position, the clamping treadle should not need to travel far from the vertical position. If you find that your legs are stretched way forward, raise the lower jaw. Not only will you be more comfortable in this position, but it will also take less effort to hold your work still. Happy trails!



Shapely furniture from a shaving horse. *The author does all of the drawknifing and spokeshaving for his chairs while seated on his shaving horse.*

The essential dimensions of a domesticated horse

For a more ergonomic seat, you can glue wedges to the underside that raise the back 1 in.



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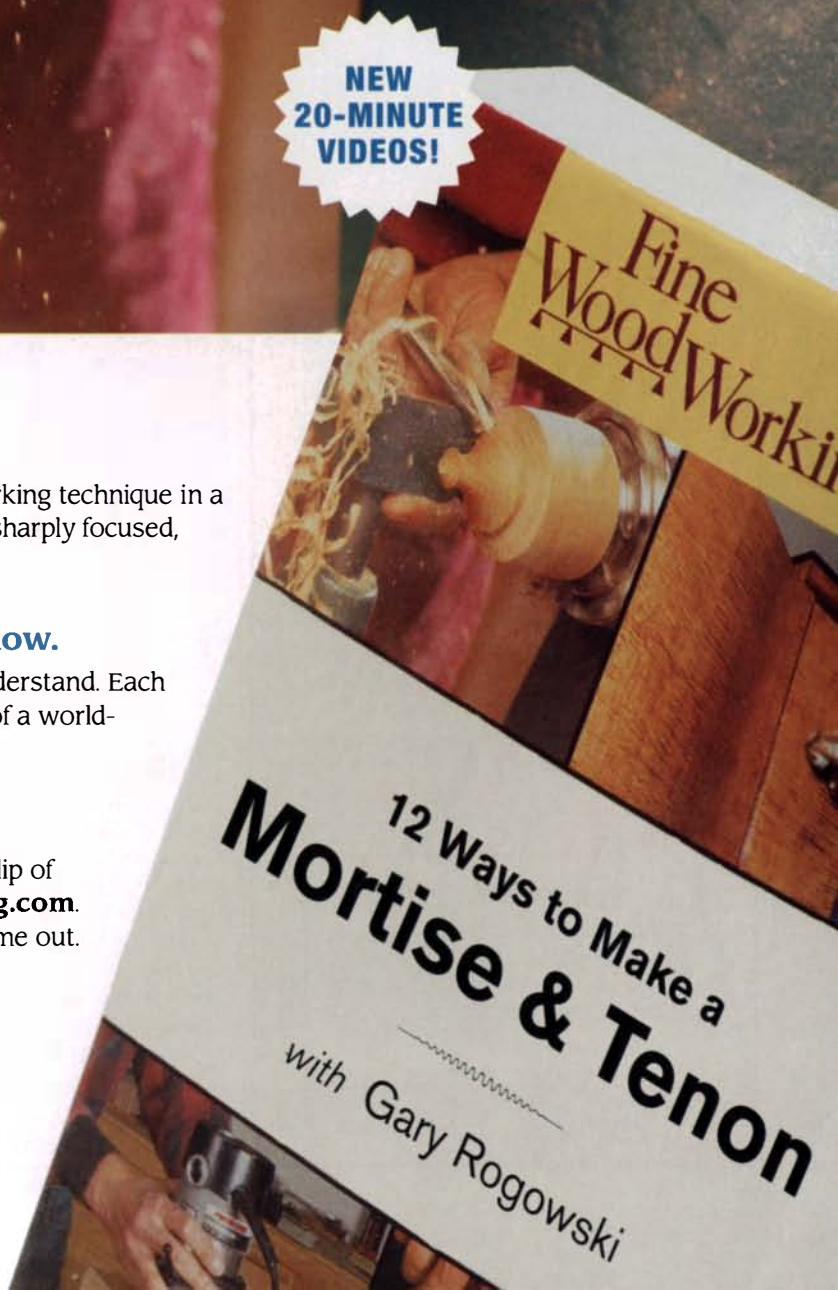

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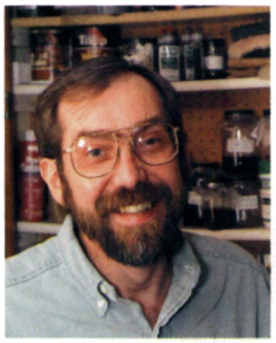
BY CHRIS MINICK

Kitchen cabinet finishes *are* different



If I asked you to place your newly completed heirloom in a room that was occasionally steamy, sometimes hot, sometimes cold, then asked you to douse the piece with acid, smear on some vegetable oil, dunk it in water and clean up the mess with detergent, you might conclude that I was crazy. Yet we subject our kitchen and bathroom cabinets to these conditions daily and expect them to look as good as new for years. Traditional furniture finishes will not survive such an environment for long.

The Kitchen Cabinet Manufacturers Association (KCMA) recognized this problem and devised a rigorous testing ritual to evaluate cabinet finishes. Manufactured cabinets sporting the KCMA logo must be finished with an approved brand. Properly applied, finishes that pass the tests will give many years of protection to kitchen cabinets.

When shopping for a finish for your kitchen cabinet project, it's wise to select one that has passed the tests. Finishes that qualify for KCMA certification will say so in the technical data sheets that accompany the finish; those that failed the tests won't mention it. KCMA-approved finishes are not hard to find. Any paint store that caters to professional finishers will likely sell at least one brand that qualifies.

The Kitchen Cabinet Manufacturers Association (KCMA) devised a rigorous testing ritual to evaluate cabinet finishes.

A look at the choices

Kitchen cabinet finishes come in both solvent- and water-based varieties, offering a range of protection from nearly bulletproof to barely acceptable. As a crude rule of thumb, catalyzed solvent-based finishes outperform noncatalyzed water-based finishes. In a decreasing order of the protection they provide, common cabinet finishes line up roughly as follows: conversion varnish, post- and precatalyzed solvent-based lacquer, water-based lacquer, traditional polyurethane varnish and cellulose acetate butyrate (CAB) lacquer. This sequence holds true for clear and pigmented opaque finishes.

Any approved finish you choose from one of these categories should perform adequately. Your choice should depend upon three things: your finishing expertise, the equipment at hand and how long you expect the finish to last. A properly applied and maintained conversion varnish will provide protection for 50 years or longer, while the life expectancy of a CAB lacquer is usually less than 10 years.

If you don't have spray equipment, you are stuck with only one choice: solvent-based polyurethane varnish. This finish will perform quite well in severe environments, provided that you apply at least three coats. A case in point: About 12 years ago I applied three coats of polyurethane varnish to some beaded redwood boards that cover the walls above our shower. With five of us taking daily showers, that finish still looks good.

Conversion varnish—the best of the bunch

Conversion varnish combines a special alkyd resin with a hard melamine resin to form a high-performance finish. The alkyd portion of the mixture makes the dried finish film tough and flexible. The melamine—similar to the resins used in plastic laminates—enhances the abrasion-, stain- and water-resistance of the finish film. The alkyd and melamine resins form a composite, cross-linked finish film once it has catalyzed and dried. In simple terms, that means it's one tough finish. Cross-linking is a chemical term that describes the density of the intermolecular bonds in the cured finish—the higher the density, the stronger the finish.

This great finish suffers some snags—Even though conversion varnish provides an almost bulletproof finish, all of that protection comes at a price. For one, conversion varnish is real particular when it comes to mixing the catalyst. Too little catalyst, and the finish stays sticky forever; too much, and the film becomes brittle and cracks. Follow the manufacturer's instructions precisely and don't experiment with catalyst ratios, at least not on a project you care about. Most conversion varnishes have a short recoat window. Failure to stay within the allotted time span may lead to poor adhesion between one coat and the next. The solvent-resistant properties of conversion varnish make it difficult to repair, once dinged or scratched, and almost impossible to remove with a stripper, should the need arise.

One other problem with conversion varnish is health-related: The finish emits formaldehyde vapors, a cancer-causing agent. Some brands emit the toxic fumes at several thousand times the established threshold value. To apply this finish safely, you need a respirator rated for formaldehyde emissions and plenty of ventilation. The formaldehyde levels of some brands are high enough that the smell lingers in the dry finish for 24 hours or so, which is not good.

Conversion varnish that gives off a low level of formaldehyde vapors is available, and it's worth searching out. You can request Material Safety Data Sheets from the finish manufacturers to compare formaldehyde levels of different brands. The best I've found list formaldehyde levels at 0.3% to 0.5% by weight. Even with all of these drawbacks, conversion varnish is still the first choice for many custom cabinet shops.

Post- and precatalyzed lacquers

Though not quite as durable, catalyzed lacquer doesn't have many of the problems of conversion varnish and provides more-than-

Photos: Michael Pekovich

adequate protection for kitchen cabinets. Both the post- and the precatalyzed versions are easy to spray, offer a recoat window with little or no restrictions and can be touched up like conventional nitrocellulose lacquer.

The main difference between the two catalyzed lacquers is simply the matter of who adds the catalyst. Post-catalyzed lacquers must be mixed in the shop and used within 12 hours or so to maximize optimum film properties. (The two components, before mixing, have a fairly long shelf life.) Mix only the amount of finish you can spray before it goes bad and discard any leftovers. Precatalyzed lacquer comes premixed from the factory. Simply use what you need and return the rest to the can. The price for this convenience is a shorter shelf life—usually one year from the date of manufacture—and a little less protection than you get with its shop-mixed cousin. Depending on the brand, catalyzed lacquer emits varying quantities of formaldehyde, so you'll need good ventilation and a respirator rated for formaldehyde vapors.

Water-based and CAB-acrylic lacquers vary greatly in durability—Water-based finishes have been a real blessing to small custom shops, and several brands of water-based finishes meet KCMA standards. Tests that I have conducted in my shop indicate that most KCMA-approved water-based lacquers are as durable as solvent-based precatalyzed lacquers. This is especially true for pigmented water-based lacquers, because the pigment enhances the protection qualities of the finish.

Pigmented water-based lacquer is a good choice if you want a solid-color opaque finish on your cabinets. A word of caution, though: Not all water-based finishes are created equal. Most hardware-store-variety water-based finishes will not pass the KCMA tests, even if the manufacturer claims that the finish can be used on kitchen cabinets. For peace of mind, I purchase water-based finishes only from companies with good technical service departments (M.L. Campbell and Sherwin Williams are two that come to mind) and then conduct tests on samples in my own shop, to save me from unpleasant surprises later.

CAB-acrylic lacquer is extremely clear and does not turn yellow over time, so it's a good finish choice for white-washed cabinets. It is easy to spray, inexpensive, easy to repair and hard to goof up, but CAB-acrylic lacquer simply lacks the durability needed to endure some harsh kitchen environments. When applied over a good-quality vinyl sealer, the performance of the finish is better. CAB-acrylic lacquer is great on everyday furniture, but I wouldn't use it on my own kitchen cabinets.

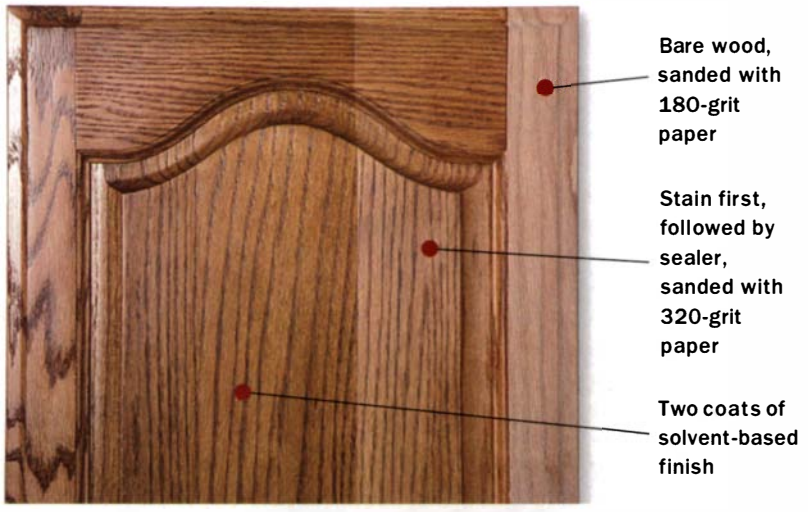
Application tips

Applying these clear finishes to solid wood or wood veneer cabinets is no different than finishing any piece of fine furniture. Stain first, followed by a sealer (vinyl sealers give the best performance with solvent-based finishes that are exposed to severe environments), then two coats of finish will protect your cabinets for years. A light sanding between coats will greatly improve the final appearance of the finished surface.

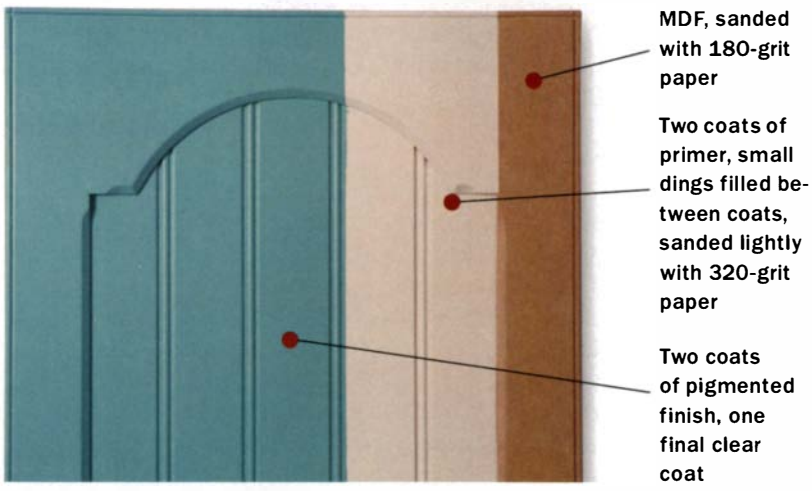
Surface preparation is critical to the final appearance of an opaque finish on medium-density fiberboard (MDF). Solid colors highlight even the smallest surface defects, so a thorough sanding is a must. Routed or cut edges should be sanded smooth with 320- or 400-grit sandpaper. Coarser sandpaper tends to pull small particles of wood out of the board, leaving small holes that must be filled to achieve a flawless finish. The flat, unmilled surfaces should also be sanded with 320-grit paper to remove the surface wax often used in MDF manufacturing and to provide a surface that will absorb the primer coat evenly.

After sanding, the procedure is straightforward. Apply a coat of primer, fill any small dings or holes with fast-drying putty, sand the first coat smooth and then apply another coat of primer. Next, apply two coats of the colored (pigmented) finish, sanding lightly between coats. A final, optional step borrowed from the auto industry will significantly enhance the protection levels of the finish: Spray a coat of clear finish over the colored finish. The clear coat protects the color so that minor scratches and dings do less damage and are less visible.

CLEAR FINISHES ON SOLID WOOD OR WOOD VENEER

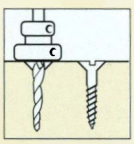


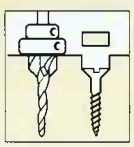
OPAQUE FINISHES ON MEDIUM-DENSITY FIBERBOARD



A selection of drilling products from our full-color 248-page catalog.

A. Drill Bit/Countersink/ Counterbore Boxed Sets



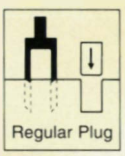


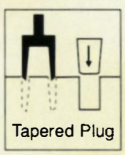
These combination units are specifically designed for woodworkers. The high-speed steel tapered drill bits are precisely ground on a CNC grinder and match the shapes of wood screws so that screw threads grip for the entire length of the screw. Drills are suitable for both hard and soft woods and are about 4″ long. Our countersink/counterbore units are hardened; they are also sharpened after hardening. Used with a stop collar, they let you set the unit for a wide range of screw lengths for everything from flush countersinking to a full ½″ of counterbore.

The set of 5 (for screw sizes #5, 6, 7, 8, and 10) contains 5 countersink/counterbores, 5 taper-point bits, 2 stop collars (⅜″ and ½″), and 2 hex keys. The set of 8 adds the drills and counterbores for screw sizes #9, 12, and 14. Both sets include a foam-lined plastic storage box with space for additional drivers or bits. Individual components are offered in our catalog. Made in USA and France.

FW0150 Boxed Set of 5 **$39.95**
FW0151 Boxed Set of 8 **$59.95**

B. Veritas® Tapered Snug Plug® Cutters





Snug Plug® cutters are designed to cut slightly tapered plugs and shave the sides as they cut, producing very smooth plugs. Just tap the tapered plug into a hole until you meet resistance, then cut off the excess. The result is a plug that fits perfectly, with a nearly invisible line between the plug and the workpiece. It is difficult to believe how nice a plugging job you can do until you actually use one. The set of three includes ¼″, ⅜″ and ½″ dia. cutters. ⅜″ shanks. Made in Canada.

FW0165 Set of 3 Snug Plug® Cutters **$27.95**

Lee Valley Drilling Kit

In good-quality work the proper drilling accessories can make a tremendous difference. This kit, in a tough, foam-lined plastic storage case, is a precision woodworking outfit. It contains five of our top-quality tapered bits with matching countersinks (for screw sizes #6, 8, 10, 12, 14), ⅜″ and ½″ stop collars, two hex keys, and our patented Veritas® ⅜″ and ½″ Snug Plug® cutters to complete the kit. The box also has space for additional drivers or bits. This is a most useful ensemble for any woodworker.

FW0160 Lee Valley Drilling Kit **$54.95**

HSS Lipped Brad-Point Drills

Sharply defined lips provide clean bit entry and smooth sidewalls.

These are the best brad-point drills we have ever offered. Starting with a top-of-the-line American-made twist drill, we reshape and sharpen the tips on a state-of-the-art CNC grinder. Made from high-speed steel, the bits are not subject to burning, and stay sharp about 10 times as long as carbon steel bits. The polished flutes give superior chip clearance, and the sharply defined lips have a slight negative rake angle on the lip tips to score the hole perimeter for clean entry and smooth sidewalls. The bits are extremely accurate in diameter.

We carry an extensive line of individual sizes from 5/64″ to 1″. Our most popular sets are offered here. Shanked to size for bits up to ⅜″ and ⅜″ dia. shank up to ½″. All are jobber length (2″ long with 1″ of fluting for the 5/64″ bit to 6″ long with 3¾″ of fluting for the ½″ bit).

The set of 7 includes sizes ⅛″, 3/16″, ¼″, 5/16″, ⅜″, 7/16″ and ½″ bits and comes in a vinyl pouch. The sets of 12 and 28 are in 64th increments and come in steel index boxes; the set of 12 covers all clearance and tap holes for screw sizes #2 to #16.

FW0140 Set of 3 (¼″, ⅜″, ½″) **$ 18.95**
C. **FW0141** Set of 7 (⅛″ to ½″) **$ 34.95**
D. **FW0142** Set of 12 (5/64″ to ¼″) **$ 24.95**
FW0143 Set of 28 (5/64″ to ½″) **$119.00**

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GRACE VS. GRAVITY

Beauty without brawn won't fly in furniture. Not for long, anyway. You can draw a beautiful piece, but then you have to make it stand up to the forces of gravity, to generations of use and to the occasional indoor rugby match. Hank Gilpin, a furniture maker in Rhode Island, believes in building things to last. Gilpin studied under Tage Frid in the early 1970s and learned traditional structure and joinery from the Danish master. But Gilpin also says, "It's important to avoid having the effort of construction evident in the final piece." Gilpin's approach is distilled in the center front leg (left) of a sideboard in plain and figured maple, built recently with the help of Ken Scherdell and Sylven Medyesy (flanking Gilpin at left). As a piece of structure, the leg is an encyclopedia entry on strong, appropriate joinery and structural integrity. But with the joints closed and the sideboard assembled, the leg is just one more smooth line in an essay on visual grace.

Photos: Jonathan Binzen