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Shaping with a Router

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Four tablesaws with special crosscutting features, like Makita's sliding table shown above, are reviewed on p. 52. Cover: Jeff Dale tells how he shapes large, heavily contoured parts with a router and jigs on p. 44. Cover photo and photo above: Sandor Nagyszalanczy.

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, Conn. 06470-5506.

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Mastering the scraper—The articles by E.S. Martin and Pat Buford about sharpening scrapers in *FWW* #91 elicited quite a response. I suspected we would get some mail on this subject because I knew that most woodworkers share the same kind of frustration with sharpening a scraper that Martin and Buford described in their articles.

When I was introduced to a cabinet scraper by my first shop partner, Eddie Gnaedinger, back in the early 1970s, I was amazed that I'd never encountered this basic woodworking tool before. I figured that sandpaper manufacturers must have conspired to keep this handy device a secret for fear that it would drastically reduce sales of their products.

For months, I continued to find new uses for my scraper and raved that it was the most used tool in the shop. But despite my vigorous testimonials, I managed to avoid learning how to sharpen it. Like Martin and Buford, I tried but never had much luck. Instead, I kept an eye on Eddie, and whenever I saw him sharpening his scraper, I'd mosey over and suggest that, in the interest of efficiency, he might as well sharpen mine too.

Eventually I learned to prepare the edge and turn a burr on a scraper that would roll up a thin shaving and remain sharp for a reasonable period of time. And later, I found myself assuming the role of the designated scraper sharpener for other shopmates who were just being introduced to this wonderful little workhorse.

Although I haven't entirely abandoned my sandpaper-manufacturer-conspiracy theory, I've come to appreciate the fact that scraper knowledge isn't general knowledge but is instead passed from woodworker to woodworker—a kind of rite-of-passage into the secret society of woodworking. Here are three letters in response to Martin's article from readers offering their perspectives on sharpening a scraper. *—Jim Boesel is executive editor of* FWW

Free at last—I was pleased and relieved to see the article on sharpening scrapers in *FWW* #91. For years, I've been filing a flat (90°) edge on my scrapers and not raising a burr because it never seemed to work very well when I tried it. The scrapers seem to work wonderfully without a burr, but I've always looked over my shoulder (figuratively speaking) because I felt guilty about not doing something I thought I really should be doing. I'm going to continue *not* making a burr, but I won't feel guilty anymore.

—Abijah Reed, Newton Centre, Mass.

Using the right scraper for the job—I read with interest the article on sharpening scrapers in the December issue of *FWW*. It struck home because I have been using file-sharpened cabinet scrapers for quite a while now. And just like the author, frustration with getting and holding a good burr using the traditional techniques led me to this simple method.

However, there were two minor flaws in the text. First, it should have been pointed out that a filed scraper edge can never leave the same kind of surface on wood as one that has been filed, honed and burnished. Many craftsmen scrape their surfaces to perfection in preparation for finishing instead of using sandpaper. When the light strikes the surface of these finished pieces, the wood comes to life. You know you are looking at a surface that sandpaper has not touched. Such a surface cannot be achieved with a filed scraper because the marks left by the file on the scraper's edge will be transferred to the wood. A filed scraper should be viewed as a preliminary way of dressing down a surface speedily and efficiently. Then you should either expect to do some sanding or you should give your project a few strokes with a properly burnished scraper to bring it to perfection.

The second flaw was in the suggestion that a single scraper be used both for fine finishing and glue scraping. You should have separate scrapers for various tasks: a thick one for glue, a file-sharpened one for rough work on wood and a burnished one for fine work. Over the years I've acquired a collection of scrapers of various sizes, thicknesses and qualities of steel. Because I've become aware of the subtleties of each, there will always be one scraper that has just the characteristics I need for a particular job.

—Thomas Wissback, Galesburg, Ill.

A fool-proof method?—My method for sharpening a scraper takes some of the guesswork out of the process. The secret is a 2-in.-thick-maple block about 12-in.-sq. with one end cut clean and square and sanded smooth. I use this end as a registration surface when filing, honing and burnishing the scraper's edge.

Begin by clamping the block to a workbench or table. Lay the scraper flat on top of the block and press a fine file against the block's smoothed end. Now, press the scraper lightly against the file; swing the file back and forth a few times to remove the old burr or any nicks and to square the scraper's edge. Repeat this on each edge of the scraper, and then do the same with a coarse stone followed by a fine stone. A drop or two of oil on the scraper will lubricate the stones and will also help when you get to the burnishing phase. Next, lay the coarse stone flat on the scraper and rub a bit on both sides to remove any burr that you've created. Finish with a fine stone against the end of the block again.

At this point, you can feel that the edge is square and the corners are very sharp. Now, while pressing the scraper down on the block, hold a burnisher at about a 5° angle, and take a few light strokes on the scraper's top edge. Run your knuckles along the end of the block to help maintain the slight angle; I usually let the scraper overhang the end of the block a bit while burnishing and adjust the overhang to help set the correct angle.

I can put a good edge on a scraper in about four minutes, including taking out the equipment and putting it away again. The block gives the correct angle so there is no need for great care. And the swinging motion of the stone means there is no tendency to wear a groove in it. *—David Golber, Los Angeles, Cal.*

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Troubled by current trends—Recently, I set some time aside to visit several woodworking shows and galleries. I wasn't sure what I was looking for but I knew there was a trend that was making me uncomfortable.

Now that I've had a chance to look around and talk to people, I'm beginning to get a handle on what's wrong. I think it's this: Woodworking isn't art and never will be. The painter who's fortunate enough to become a hot item can expect to make a decent living or even get rich, but people won't pay that kind of money for woodwork, no matter who made it. However, woodworkers, who by definition are starving, refuse to believe this. After all, wealthy art patrons are their only hope. Therefore, woodworkers strive vigorously to make their work into art.

This has led to a vicious spiral. Galleries and museums are asking art curators to jury their shows. These people choose works by academic criteria. The result is a collection of works that are funky, brightly colored, shocking and whimsical—anything but subtle. Lack of function is considered avant-garde.

Up and coming woodworkers see this trend and build accordingly. At design schools, like Parsons and Pratt, the professors adjust their own work to suit the trend, and students at these schools are tacitly encouraged to build carbon copies of their teachers' work. So it all looks the same.

Don't get me wrong. I'm not bitter because my own work is being ignored. It's not. In a gallery filled with purple boxes with spikes and orange beads, my rocker is the first thing people ask about (and often the only thing that sells), which is an object lesson in itself. The finer points that make woodworking such a challenge—elegance, warmth, finesse, comfort—are also what make well-crafted furniture a joy to live with over the long term. There is still plenty of room for innovation within these constraints.

—Jeremy Singley, East Middlebury, Vt.

More on Krenov's students—Looking at your article on James Krenov's students' work was a sheer delight. Special attention should be paid to Mr. Radenkov's marquetry cabinet, which is so fine that I'd be tempted to sell my house and car to buy it. I was also impressed by Page Sullivan's cabinet; it's nice to see a woman's work represented.

All the pieces in the article illustrate how well the students have learned Mr. Krenov's basic philosophy of cabinetmaking. However, I wish there had been more pieces shown and more close-ups of some of the cabinets. I also would like to have read a bit about how each student's personal philosophy on cabinetmaking compares with Mr. Krenov's approach. There's got to be someone else out there who feels that a Krenovian-style cabinet would certainly not be hurt by incorporating some well-proportioned and well-placed chip or relief carving, to add to the artistry of the whole piece without detracting from the subtle beauty of a fine-grained wood.

—Dave Kolanek, Wolcott, Conn.

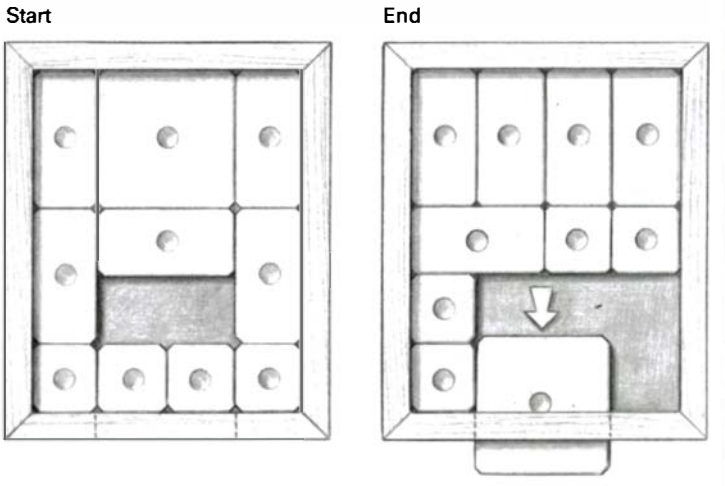
Woodcarver blade interferes with grinder switch—I recently purchased a Bosch right-angle grinder for use with a Ryobi Woodcarver blade. It didn't take long to discover that the design of the switch on the grinder makes the combination dangerous: When the switch is on, cutting debris accumulates under the switch so that it will not turn off. I suspect that this problem could also occur in any other application that created large quantities of debris, such as rust scaling. In addition, because the Bosch switch is similar to the one on my Makita grinder, and presumably to many other small hand grinders, it is likely that most such grinders will have the same problem.

I'm now using the grinder plugged into a portable switch-controlled outlet box, so I don't have to rely on the tool's switch to turn off the power. This solves the problem, but a first-time user could be caught by surprise.

—Bruce Winterbon, Deep River, Ont., Canada

Even more puzzling—The sidebar "A sliding-tile puzzle" by Robert Stirling (*FWW* #91) was most interesting. The very similar plan was published in a 4-H woodworking manual (*Woodworking—Beginner*, Cooperative Extension Service, Purdue Univ., West Lafayette, Ind. Publication 4H 442) several years ago, and I have made many of them for gifts.

With only minor alterations, another much more difficult puzzle can be made, making it a two in one. To make the alternate puzzle, one of the long rectangular tiles is replaced with two small square tiles, and the large square tile is made thinner so that only it will exit the tray through a slot in one end of the frame. More than 50 moves are required to move the large square from the upper center to the bottom center (see the drawing below) where it will slip through the slot. So many moves are involved that when you are successful, you've forgotten how you accomplished it.



The tiles move easier if they are a bit larger than Mr. Stirling's. I make the small squares 2 in., the rectangles 2 in. by 4 in. and the large square 4 in. The large square should be about 3/16 in. thick while the other tiles are all 3/8 in. The slot should be flush with the floor of the tray so the large tile exits easily, but the others are retained. My name for this puzzle is *Le Game*. It is really challenging and is handy for a coffee table or in a waiting room to keep guests occupied.

—O. H. White, Medaryville, Ind.

Bits and braces—As a youth, I had the same question as Noah Birnel (in *FWW* 91, p. 26): How do you fasten an auger bit into the chuck of a bit brace? I grew up thinking the jaws should grasp the bit's squared-and-tapered end. But the bit would often fall out of the brace when I tried to remove it from the work, and I could rarely get the bit straight enough or the chuck tight enough with my young hands.

Then as a young man, I discovered the secret. The squared-and-tapered end of the bit fits neatly into a square socket located deep inside the chuck. The jaws of the chuck grasp the round shank of the bit, keeping it perfectly straight and centered. Although it is possible to pull the bit out of this socket, the jaws prevent it from coming all the way out of the chuck, even in a very tight hole.

This discovery served me well for more than 25 years until I read Richard Starr's reply to Birnel's question. It prompted me to re-examine my old Craftsman brace to see whether or not I was crazy. Sure enough, I learned something new—there are two possible positions for the bit. About 3/8 in. inside the chuck, the face of each jaw has a molded depression shaped to fit the squared-and-tapered end of an auger bit exactly. On my brace, it requires a strong light and close inspection to see these depressions. They allow the bit to be held farther out of the chuck than does the socket deep inside, thus allowing one to drill a slightly deeper hole. But even in this position, the outer ends of the jaws still grip the rounded shank, centering the bit and preventing it from being pulled out of the brace.

I suggest that Birnel examine the chuck of his own brace closely. A

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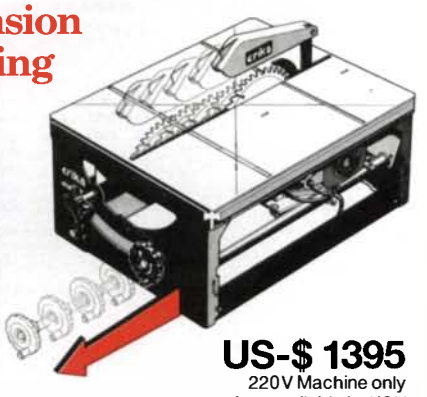

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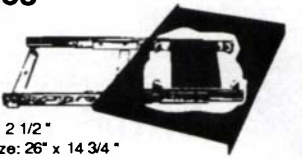

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well made tool will allow him to center the bit perfectly, provide a tight enough grip on the squared part to withstand the tremendous forces that an auger bit must sustain, and never let the bit fall either out or farther in. If his bit brace cannot do this, he should get a new one. *–Hugh C. Lauer, Concord, Mass.*

More on glue shelf life–As the principal developer of Elmer's glue, I would like to comment on Mr. Mustoe's discussion on the stability of yellow and white glues ("Q&A," *FWW* #91). I wish to point out that thickening of the glue during storage is not due to further polymerization as stated. The major ingredient in both types of glue is a polyvinyl acetate emulsion made by polymerizing vinyl acetate monomer in an aqueous suspension.

There are two reasons for thickening and subsequent gelation and solidification: 1) loss of moisture by diffusion through the normally used plastic container; and 2) hydrolysis of residual amounts of unpolymerized monomer into acetic acid. Partial collapse of the container sometimes occurs because of the first phenomenon. The hydrolyzed acetic acid imparts a vinegar-like odor to the glue and promotes further hydrolysis of the polyvinyl acetate into additional acetic acid and polyvinyl alcohol. This eventually leads to gelation and solidification.

The shelf life of these glues could be improved by using a plastic container with a coated or built-in moisture barrier, which would minimize thickening due to moisture loss. Such containers are already used in the food industry. In addition, methods are available for reducing concentrations of unpolymerized monomer to trace quantities. This should be the responsibility of the polymer emulsion manufacturer. Mr. Mustoe's comments on recovering thickened glue are quite correct so long as the glue has merely thickened and is still flowable and hasn't reached the gel or solid state.
–Sidney J. Baum, Camarillo, Cal.

Stabilizing tools on wheels–In his article "Working in a small space," *(FWW* #91) Scott Landis says that Dick Sellew "simply rolls the tablesaw out of the way" when he needs more space in his tiny workshop. I've thought about mounting my workbench on rollers for the same reason, but the only rollers I'm familiar with rely on brakes to keep them set once they are in position.

I can't imagine that the brakes on rollers would provide the kind of stability that a tablesaw or a workbench would need when I'm sawing or planing away. It seems to me that the rollers would need to be on jacks of some sort so that the object being moved could be lowered to the floor once it's where you want it.

I'm wondering if any *FWW* readers know if that kind of jacking system is available or how to put one together.
–Charles Klaveness, Hempstead, N.Y.

Magic box–When I was a boy, I had a Chinese "magic box" in which I kept my silver dollars. To open the box, I slid a ½-in.-wide horizontal piece of the end to the right that allowed the whole end piece to move down, so the top could move across the end...and then I forget. The end result was access to a thin velvet-lined tray that would hold just six silver dollars.

I'd appreciate hearing from anyone who knows what these little boxes are called and where I could find plans to build one or where to buy one so I could take it apart and figure it out.
–Marsh Terry, Rolling Bay, Wash.

Computer software price corrections–First of all, I'd like to thank you for mentioning The Woodworkers' Store as a source for computer software in your January/February 1992 issue ("Computers in the Shop" by Sandor Nagyszalanczy). Unfortunately, I'm also writing to identify a few errors we found in the article.

Under the subheading about panel optimization programs, incorrect prices were given for both Plywood Planner and Casp'er. Plywood Planner was listed at $29.95 and Casp'er at $149.95. Plywood Planner has sold for $49.95 since we introduced it to the mail-order market 18 months ago. The price given for the 2.0 version of Casp'er reviewed in the article was correct, but that version is out of date and has been replaced by Casp'er 3.0, which we now carry and which sells for $249.95.

The other errors were technical in nature and relatively minor, but I'd like to take this opportunity to correct them. The article stated that Casp'er was limited to laying out parts on a plywood sheet up to 145 in. sq., but actually the sheet size is unlimited. The article also suggested that both programs were limited to specifying fractions down to sixteenths of an inch and in metrics down to millimeters, but either program will work to thousandths of an inch (or millimeters) or smaller. Finally, Plywood Planner, like Casp'er, can save layouts to diskette.

I hope these corrections will help eliminate any misunderstandings on the part of readers who wish to purchase either of these programs for developing cutting diagrams on a personal computer. *–Steve Krohmer, product manager, The Woodworkers' Store, Rogers, Minn.*

Update on Sources

Vacuum pumps–The Vaccon Co. Inc., which sells compressed-air powered vacuum devices used for vacuum-bag veneering and shopmade vacuum hold-down jigs, has moved since they were listed as a source in Michael Dresdner's article on compressed-air systems in the May/June 1990 issue of *FWW*. Here is their new address and telephone number: PO Box 324, Medfield, Mass. 02052; (800) 848-8788.

Landing net bags–For readers who plan to build a landing net, like the one described in Geoffrey Carson's article in *FWW* #92, here's another source for net bags: Bob Marriot's Fly-Fishing Store, 2770 Orangethorpe Ave., Fullerton, Cal. 92633; (714) 525-1827. They carry Broden nets, which are soft, black cotton in sizes based on the length of the frame.

Kiln manual–A new edition of the Dry Kiln Operator's Manual, Agricultural Handbook 188, published by the USDA Forest Service's Forest Products Laboratory is now available. The manual describes both the basic and practical aspects of kiln drying lumber and substantially updates and expands the 1961 edition. The 274 page book includes a new chapter on energy in kiln drying and also covers topics ranging from wood properties and drying defects, to kiln maintenance and lumber stacking and loading.

Copies of the new manual are available for $14 from Superintendent of Documents, Government Printing Office, 710 N. Capitol St., Washington, D.C., 20402-9325. Include the complete title and stock number 001-000-04576-8 when ordering.

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–John Lively, publisher

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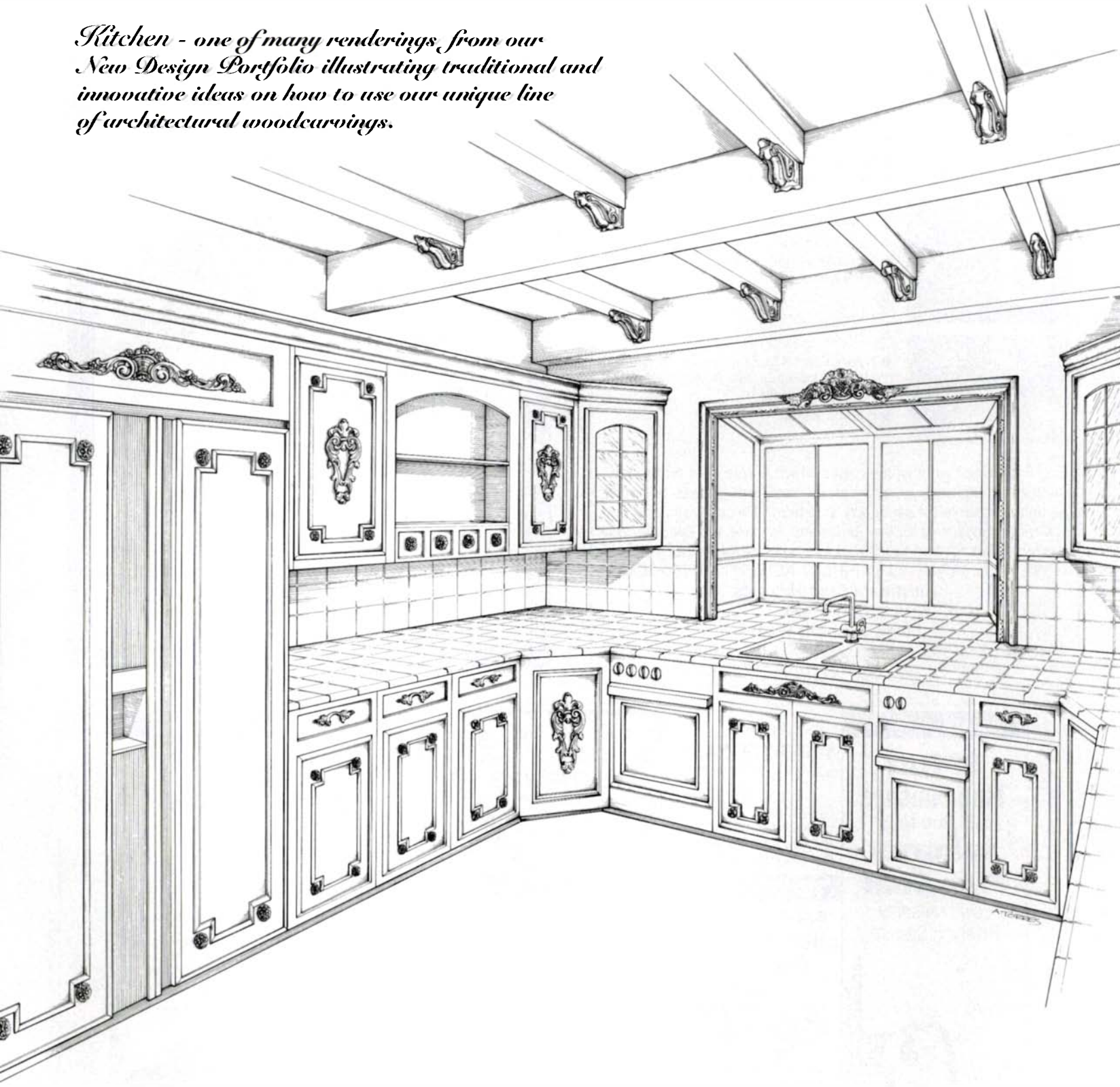

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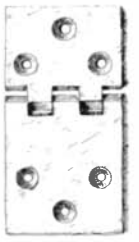

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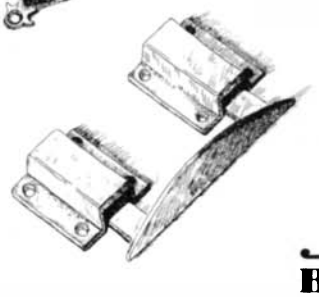

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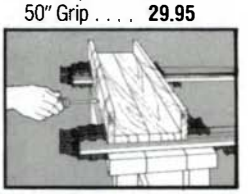

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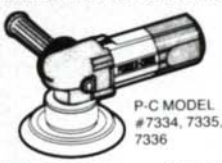

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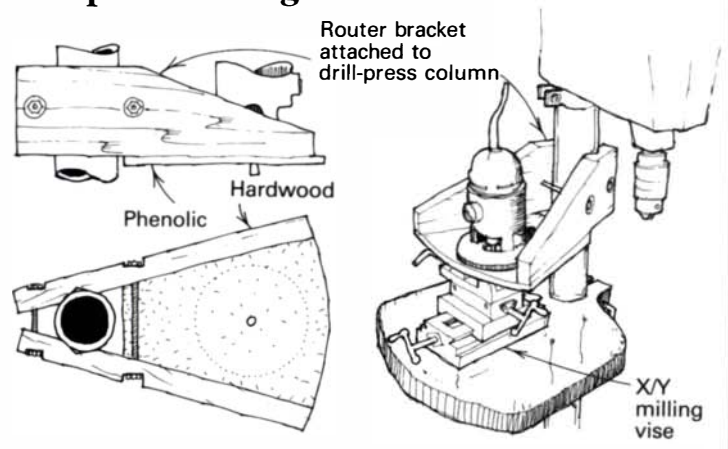


This method grew out of my need to make some small, precise wooden prototypes a few months back. First I purchased one of those X/Y milling vises and clamped it to my drill-press table. Then I made a simple router bracket that locks onto my drill-press column. The permanently attached bracket, which swings out of the way for drilling, enables me to quickly and easily set up for milling whenever I need to.

For the bracket, I chose phenolic for the baseplate because of its flatness and rigidity and 2-in.-thick hardwood for the arms. I made the hardwood arms first and clamped them to the column with threaded rod. Then I screwed the baseplate to the arms.

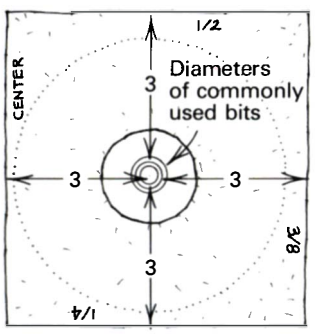
To use the milling machine, I first make a crude height adjustment between the vise and router by moving the drill-press table up or down, and then I make precise adjustments with the router itself. For quick router attachment and removal, I purchased an extra router base that I keep screwed to the jig.

–Michael J. McGinnis, Santa Rosa, Cal.

EDITOR'S NOTE: The following two methods describe ways to use an asymmetrical router base to solve different setup problems.

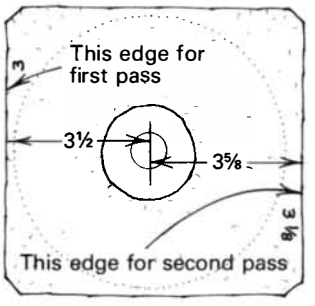
Asymmetrical router base simplifies setups

Roff's router base



Trivino's router base

Offset for cutting ⅝-in.-wide groove with ½-in.-dia. bit



I used to get frustrated with the inordinate amount of time it took to set up my router for even the simplest cuts. The main problem was that the distance from the edge of the router base to the bit was always some weird dimension like $2^{19}/_{32}$ in. So recently, while making some new custom router bases out of Lexan, I got an idea. I cut the rectangular base so that each edge of the router base will be exactly 3 in. from the edge of one of my standard bits. For example, if I am using a ¼-in. bit, the edge marked ¼ in. will be exactly 3 in. from the edge of the bit. I also made one edge 3 in. from the center of the bit, which is frequently useful (see the drawing, above left). In addition to writing the bit size on each edge, I color-coded the edges with permanent marking pens to help me remember which bit/edge I am using. To make the base, I cut the Lexan slightly oversize, and then, after mounting the router and making test cuts, I ran the base over a jointer to carefully trim each edge to the exact offset needed.

–Derek Roff, Albuquerque, N.M.

Router base for grooving in two passes

Recently, I needed to cut a large number of ⅝-in. grooves across several large pieces. Because I dislike using cutters larger than ½ in. in my small router and because I wanted to minimize the number of router-fence setups, I quickly designed and cut the asymmetrical router-base plate shown in the drawing.

The theory is quite simple. Simply vary the base's offset by the amount you want to enlarge the groove. In my case, I wanted to enlarge the ½-in. groove to ⅝ in. So I cut the base 3½ in. from the center of the bit on one side and 3⅝ in. on the other, a difference of ⅛ in.

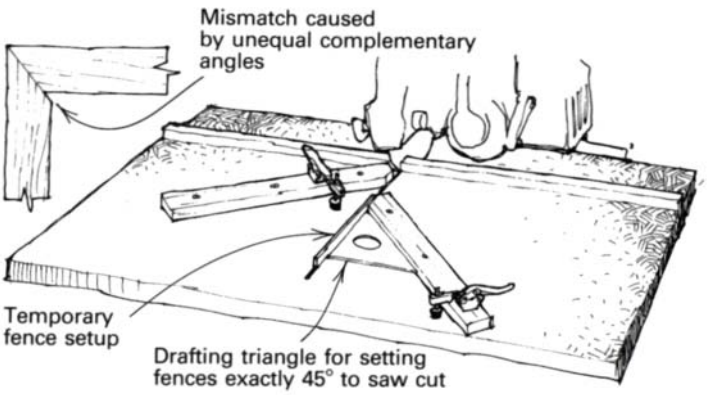
To use the fixture, set a fence parallel to the line of cut, make one pass with the first edge against the fence, and then make another pass with the second edge against the fence. One setup, two passes, one odd-size cut.

–Allen Trivino, Rochester, N.Y.

Quick tip: Measuring tablesaw-blade height for a dado or groove cut can be a problem, especially if the blade insert is not exactly level with the tabletop. Instead, mark the desired height on the face of a scrap board that is longer than the insert, and clamp the board to the fence flush on the table with the mark centered over the blade opening. Lower the blade and position the fence so that when the blade is raised, it will skim the face of the scrap. Turn on the saw and raise the blade until it just touches the line.

–Dario Biagiarelli, Kirkville, N.Y.

Improved radial-arm saw miters



In "Methods of Work," *FWW* #86, Steven Springston describes a method of sawing picture-frame miters using complementary angles. Although Mr. Springston's method will produce a perfect 90° angle, if the saw's 45° setting is off much, the technique may produce miters with faces that don't match. This problem can be especially troublesome on highly detailed moldings. By contrast, my method, illustrated above, uses the actual cut line of the blade for its registration and avoids the mismatch problem.

Clamp an auxiliary table on the main sawtable, and cut a ⅛-in.-deep sawkerf into the table. Into this kerf insert a ¼-in.-wide strip of ⅛-in.-thick hardboard to act as a temporary setup fence. Place a 45° drafting triangle against the fence, and use it to set the position of the left-side fence. Screw the fence to the table so it overlaps the kerf a bit; it will be trimmed later. Flip the triangle to the opposite side of the hardboard, and repeat the procedure described for the right-side fence, as shown in the drawing.

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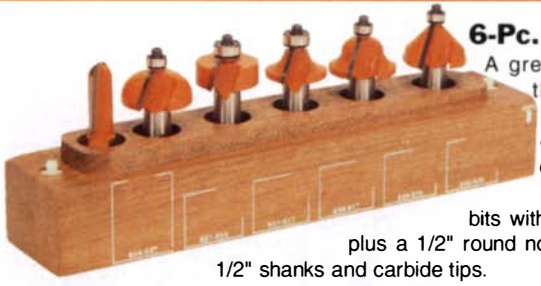

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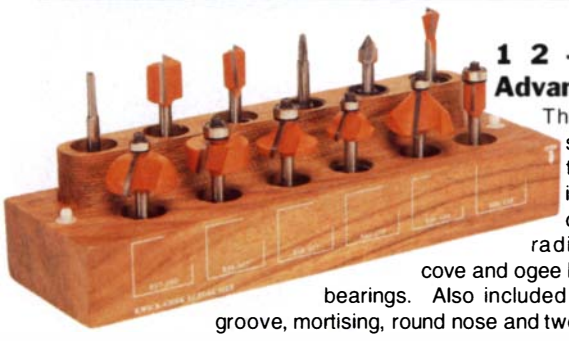

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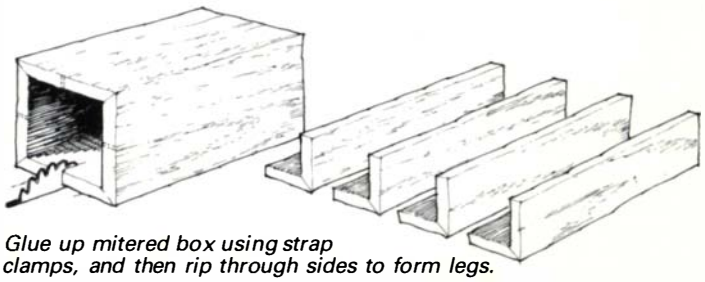
Place the right-side fence back far enough to allow room between the fences for the workpiece. The best miter cuts are made if the workpieces are held firmly in place on the table. To accomplish this, install toggle clamps on the fences. Bear in mind that the right toggle clamp will interfere with the saw's motor unless it is placed well back on the right-side fence. To finish the setup, remove the hardboard insert and cut through the fence overlaps. You are now ready to produce perfect miters.

—Tom Stipanovich, Cambridge, Ont., Canada

Quick tip: Use a good pencil sharpener on the end of a dowel to form a point that can reach into an inside corner to remove fresh glue. You can also sand the tip of the dowel at an angle and use it to clean out dado grooves.

—L. Frederick, Aspen, Colo.

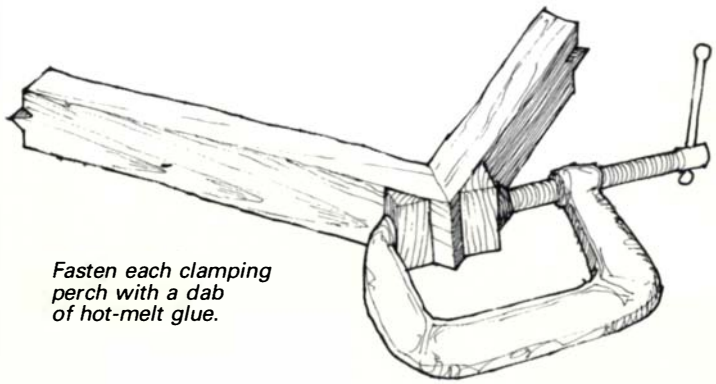
Gluing up mitered legs



Glue up mitered box using strap clamps, and then rip through sides to form legs.

I designed a coffee table with 3-in.-wide, L-shaped legs mitered at the corners. But with my small selection of clamps, I couldn't figure out an easy way to glue up the mitered leg joints. Then I got an idea. Instead of making each leg separately, I made all four at once. The trick was to glue up a long mitered box using strap clamps and then to rip through the middle of each side to form the four legs. *—Steven H. Klotz, West Bloomfield, Mich.*

Hot-melt glue blocks

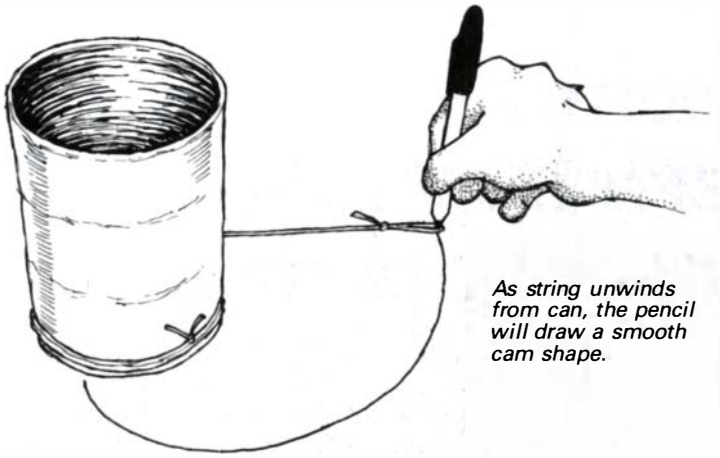


Fasten each clamping perch with a dab of hot-melt glue.

Mitered glue joints are almost impossible to clamp even using expensive corner clamps and other jigs. Here is a simple way to apply pressure exactly where it is needed. Cut two triangular blocks from scrapwood. Glue these onto the outside of the pieces to be mitered to create two parallel clamping perches. The trick is to use only a dab of hot-melt glue to fasten the perch. Now assemble the joint using common C-clamps to apply pressure across the joint. The hot-glued perches stay in place nicely but can easily be popped off later with a chisel. A few strokes with sandpaper removes any glue residue, and then the joint is complete. *—Larry Morse, Framingham, Mass.*

Quick tip: A clean collet is an absolute must to avoid the disasterous consequences of a router bit slipping up or down in the collet when routing. A gun cleaning kit for a 22-caliber weapon has everything you need: a small brass brush and patch cleaning swabs that fit just right in the collet. *—L. Frederick, Aspen, Colo.*

Laying out cams with string

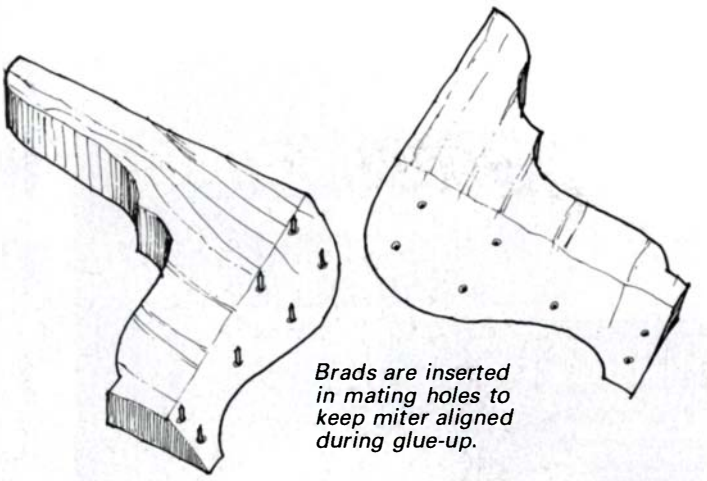


As string unwinds from can, the pencil will draw a smooth cam shape.

The easiest way to draw a cam is to use the unwinding string principle—tie a string around a cylinder of suitable size to create the desired cam shape. Aluminum food cans are often about the right size. First, tie a length of string around the can, and tie a loop in the end of the string. Then wind the string fully around the cylinder, and place a pencil in the loop with the point where the cam is to begin. Unwind the string by moving the pencil away from the cylinder. The point of the pencil will scribe a cam that expands in proportion to the diameter of the cylinder. Because the distance from the center of the cam increases at a constant rate, the resulting cam will have a smooth and controlled action.

—E. W. Carson, Blacksburg, Va.

Metal pins eliminate miter slippage



Brads are inserted in mating holes to keep miter aligned during glue-up.

This method of using metal pins to prevent miter slippage during glue-up is good on odd-shaped mitered pieces, like the bracket feet in the sketch, that might otherwise require special clamping jigs.

Start by placing one of the joint halves, miter side up, on the drill-press table. Select a bit the same size as an 18-gauge brad,

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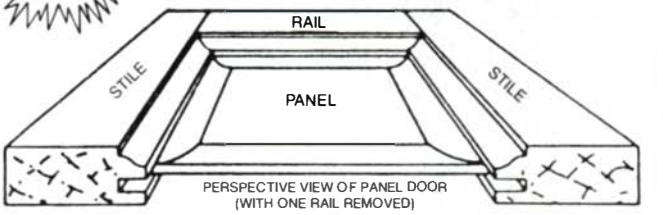

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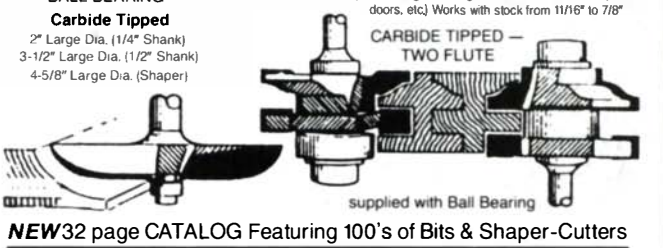

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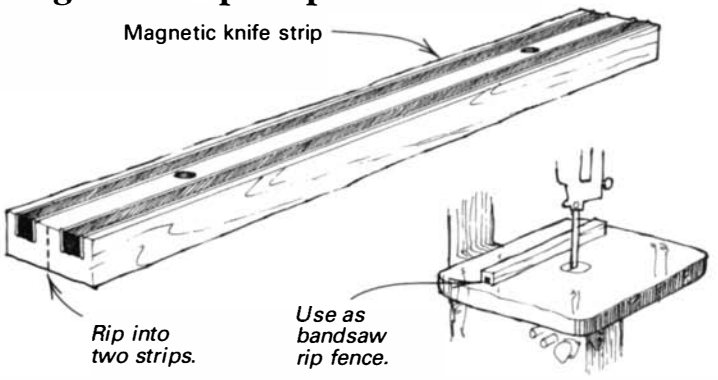
and begin drilling shallow holes in the miter face in a pattern that suits the job. Place brads in these holes, nip the heads off flush with a side cutter, and then fish each brad out of its hole and reverse it end for end so the point is up. Now align the two halves of the mitered molding, and push straight down on the sharp pin points. The mating half will have an exact layout for drilling a matching set of pin holes.

After the holes have been drilled in the mating half, remove the original pins. Put new brads in the original holes, cut these to a suitable length and reverse them to put the points up. I find it helpful to countersink each of the holes slightly, to help each pin "find" its matching hole and ensure the assembly goes smoothly.

The joint can now be put together dry and pressed tight. If you have been careful, the joint will fit almost perfectly. A slight overlap can usually be corrected by a small amount of pressure or twisting. *–J.A. Binns, Tucson, Ariz.*

Magnetic shop helper

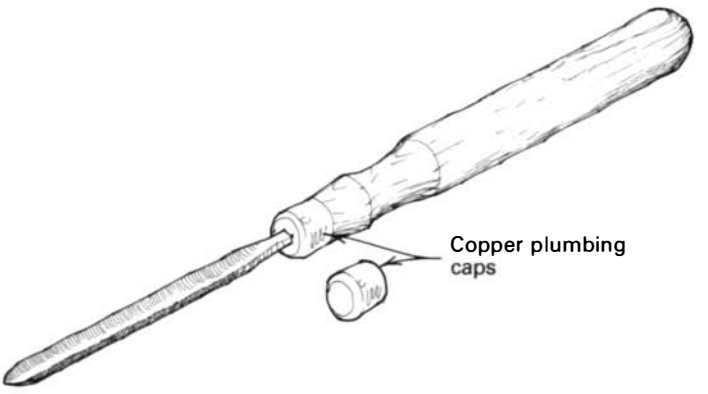


The multipurpose magnetic strip I use in my shop started from one of those inexpensive two-track magnetic knife racks found at kitchen-gadget stores. I bought one of the racks, ripped it down the middle to form two strips and then sanded the fresh edges to remove the sawmarks.

I use one of the strips as an instant fence on my bandsaw for ripping small strips of wood. The strips also can be used to position jointer blades at the right height during replacement, as a fingerboard with a piece of flexible plastic attached to one side, and for pinning plans or drawings flat on a steel surface.

–Jim Van Dreese, Wiconsin Rapids, Wisc.

Plumbing caps as tool ferrules



I use common hardware-store copper plumbing caps for ferrules on my custom turning tools. To use the caps, I turn a tenon on the tool handle to fit the inside diameter of the cap.

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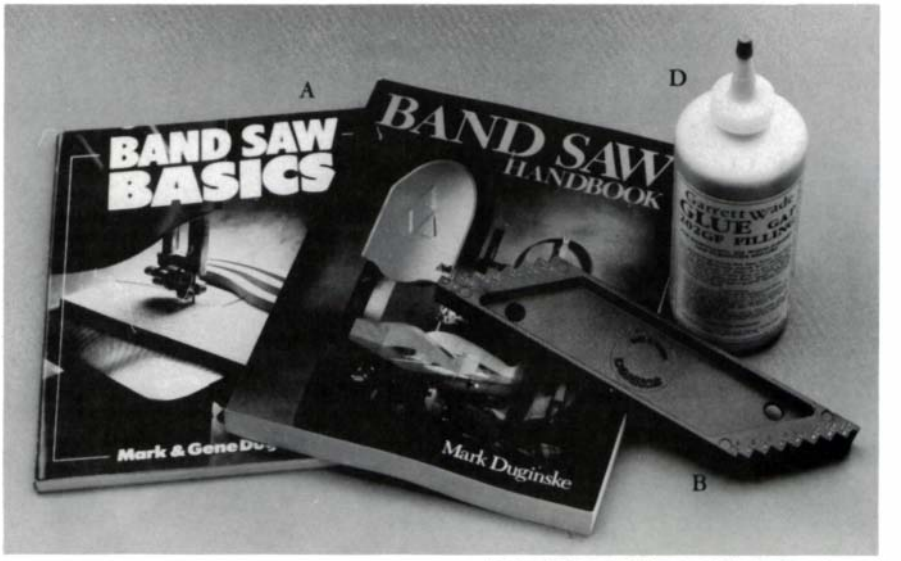

A / 2 Band Saw Books *by Mark Duginske*
Learn what makes your bandsaw tick. Tune-up and maintenance; blade selection, tracking and tensioning; plus cutting methods for various woods and other materials. Hundreds of tips and shortcuts. Unlock your saw's potential.

02L09.03	Band Saw Basics	$ 9.95
16L04.02	Band Saw Handbook	$16.95

B / The Saw Setting Gauge That Can Be Read From Any Position
Most gauges have at least one or two main weaknesses. They either rest partially on the insert plate which is usually not the same height as the main table, or are so thin that it is difficult to ensure that teeth are being gauged at the top of the arc. This gauge is made from machined ¾" thick Aluminum and is 9" long. With ¼" graduations on one end and ⅛" on the other, it will indicate any height from ⅛" to 2". Most useful for table saws but also handy for routers. The markings are vertical on one face and horizontal on the other, so you can read them easily and accurately.

71K26.02	Saw Setting Gauge	$17.95

D / Our 202GF Gap Filling Glue Fills Gaps
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62J01.01	1 pt. 202GF	$ 7.25
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C / 1/16" Super Narrow Blades
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33K12.01	1/16" Scroll	$14.95
33K12.02	¼" Cabinet	$10.95
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72" Blades (Shopsmith)		
33K13.01	1/16" Scroll	$13.40
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E / The "Blind Nailer" Used To Be A Staple In Every Finish Carpenter's Tool Box
This unique tool allows you to set nails or brads invisibly. Slip the special chisel, with its finger nail shaped cutting edge, into the positioning jig and tighten the clamping screw. Place the flat sole on the wood and strike the end of the chisel with a firm tap with the palm of your hand. The Blind Nailer will lift a perfect small chip from the surface. Hammer your nail or brad in and then glue the chip back in place.

44K01.04	Blind Nailer	$19.95

F / Special Bandsaw "Cool Blocks" Prolong Blade Life & Increase Accuracy
Made of a special graphite impregnated Phenolic laminate, this set of 4 replaces your upper and lower side blade guides. Cool Blocks run cooler and are more slippery than conventional steel guides. Since they can be set actually touching the blade, they give you better control of the cut.

Model		
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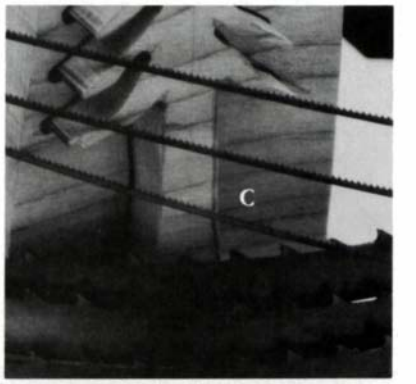
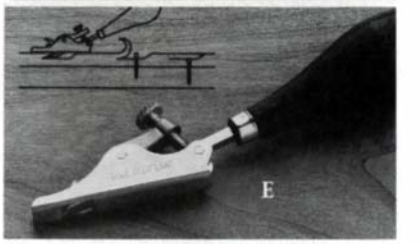
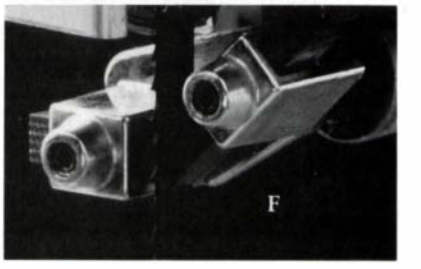
33K09.02	"B" Sears 12"	$11.95
33K09.04	"D" Shopsmith	$12.95
33K09.05	"E" Old Sears (¼" Rd.)	$11.95
33K09.06	"F" Jet 14" (fits Delta copies)	$11.95
33K09.20	"K" New Tilt-Head Sears	$16.95







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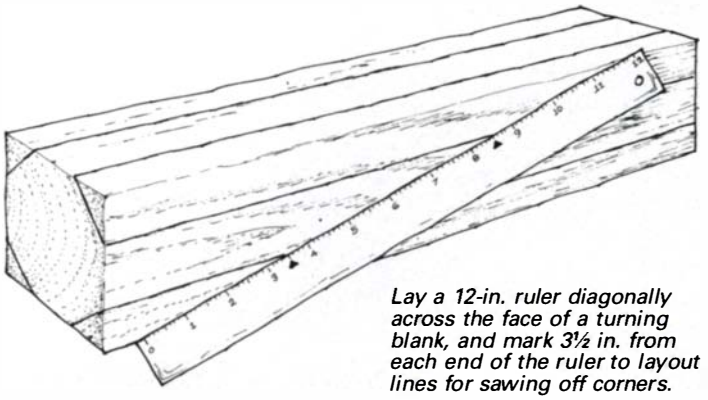
Then I drill (and file if necessary) an opening in the cap to fit the shank of the tool. After fitting the tool to the handle, I polish the cap and spray it with a clear sealer to keep it looking good. The caps, which average about 40 cents each, are available in sizes from ¼ in. dia. up to 2 in. dia.

—Wayne Knuteson, Murray, Ut.

Preparing octagonal spindle stock

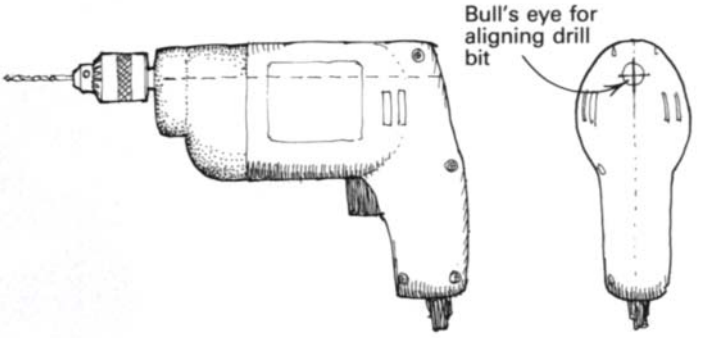


Lay a 12-in. ruler diagonally across the face of a turning blank, and mark 3½ in. from each end of the ruler to layout lines for sawing off corners.

Here is a quick method of marking the amount of corner stock to be removed from a square blank you want to turn on a lathe. Simply lay a 12-in. ruler diagonally across the timber with the zero mark aligned with one edge and the 12-in. mark aligned with the opposite edge. Then mark points at 3½ in. and 8½ in. Lines drawn through these points and parallel with the stock's edges will indicate the amount of stock to be removed to convert the square section into an octagonal form.

How does this method work? The proportion of 3½ to 12 (or the easier to work with 7/24) relates to the geometry of an octagon almost exactly. *—J.H. Walker, Aspendale, Victoria, Australia*

Drilling accurate holes



After drilling a couple of chair-seat spindle holes at the wrong angle, I came up with a simple solution to improve my angle alignment accuracy. Using a flexible steel rule, I followed the line of the drill bit to the back of the drill, and with a fine-point felt marker, drew a horizontal axis line across the case seam at the center of the back. This gives me a perfect bull's eye to line up the desired angle. *—Bruce A. Goddard, Kennedy, N.Y.*

Methods of Work buys readers' tips, jigs and tricks. Send details, sketches (we'll redraw them) and photos to Methods, Fine Woodworking, *PO Box 5506, Newtown, Conn. 06470-5506. We'll return only those contributions that include an SASE.*

Osage orange and its aliases

In this geographical area we have a wood the "old timers" refer to as bodock (pronounced with a long O and accented on both syllables). These old timers value the wood for use as fence posts because it won't succumb to termites and other insects. Can you tell me anything about this wood and lend advice about its use? ***—Donald E. Rutledge, Pulaski, Tenn.***

Jon Arno replies: I'm almost certain the wood you are describing is Osage orange, *Maclura pomifera*, a member of the mulberry family, Moraceae. The name *bodock* sounds like a corruption of *bodarc* (or *bodark)*, which is, in turn, an Anglicized form of the French term *bois d'arc*, meaning "wood of the bow." When the early French settlers spread north from New Orleans they encountered the Osage Indians who used this species for making their bows. This species was originally found only in the south central United States, native to eastern Texas and parts of Oklahoma, Arkansas and Louisiana. It is a small- to medium-size tree, seldom growing more than 50 ft. tall, with gnarly, thorn-protected branches and large, round clusters of fruit about 4 in. to 5 in. dia., which look like rough-skinned green oranges. Prior to the introduction of barbed wire in 1874, Osage orange was planted by farmers throughout the Midwest to create what were descriptively referred to as "pig-tight" hedges, and now the tree may be seen growing along fence rows as far north as Chicago and east to the Atlantic seaboard.

With an average specific gravity of 0.76 (ovendry weight/green volume), Osage orange is heavier and harder than any of our native hickories, but like the hickories, it is extremely elastic and resilient. The sapwood is white in color, while the heartwood is a vivid yellow when freshly cut, aging over time to a warm, amber gold. The pigment that gives Osage orange such a bright color is water soluble, and by boiling the wood chips, the early settlers were able to extract a dye for use with home-spun fabrics. Since the wood of Osage orange can be confused with that of black locust, *Robinia pseudoacacia*, the boiling of wood chips serves a modern purpose in helping to separate these two species because the yellow pigment in the latter is not easily dissolved in water. Because Osage orange is a ring-porous wood, it has a very attractive figure to complement its stuningly brilliant color. It's definitely a real challenge to work, especially with hand tools, but the results can be rewarding.

[Jon Arno is a wood technologist and consultant in Schaumburg, Ill.]

Bandsaw-blade tracking problems

My 14-in. Delta bandsaw refuses to cut true when I run narrow blades. To remedy this, I'd like to fit the saw with Thompson Model 236.2 conical blade guides. Do you know if this modification will improve performance or correct blade drift? ***—Roderick K. Shaw, Jr., Tampa, Fla.***

Mark Duginske replies: It can be very disturbing when a bandsaw will not cut in a straight line parallel with the saw table. This phenomenon is called either *lead* or *drift*. There are a number of possible causes for blade drift, but fortunately, the problem is often remedied or is greatly decreased by tuning up the saw.

The best place to start is to properly align the bandsaw wheels. The wheels should be in line with each other when the blade is tensioned. This is particularly true of wider blades that are normally used for making straight cuts. This is described in detail in an article on bandsaw wheel alignment in *Fine Woodworking* #75. Next, the guides and thrust bearings must be adjusted accurately; this is a must for straight cutting. Both thrust bearings have to support the back of the blade evenly. The distance between the blade and the thrust bearing should be about .015 in. or 1/64 in., except for the 1/8-in. and 1/16-in. blade, which should be against the bearing. Because the guide post rarely goes straight up and down, the top guides and thrust bearing should be readjusted every time the post is moved.

The blade guides are adjusted after the thrust bearings are set. Metal guides should be adjusted until they're .004 in. (the thickness of a dollar bill) away from the blade. If you've fitted your bandsaw with non-metal guides that contain a dry lubricant, such as Cool Blocks, the guides can be set in contact with the blade. This decreases the tendency of the blade—especially narrow blades—to deflect sideways, which can lead to blade drift. Also, for straight cuts, make sure that the blade you are using is sharp; use your dull blades for curved cuts.

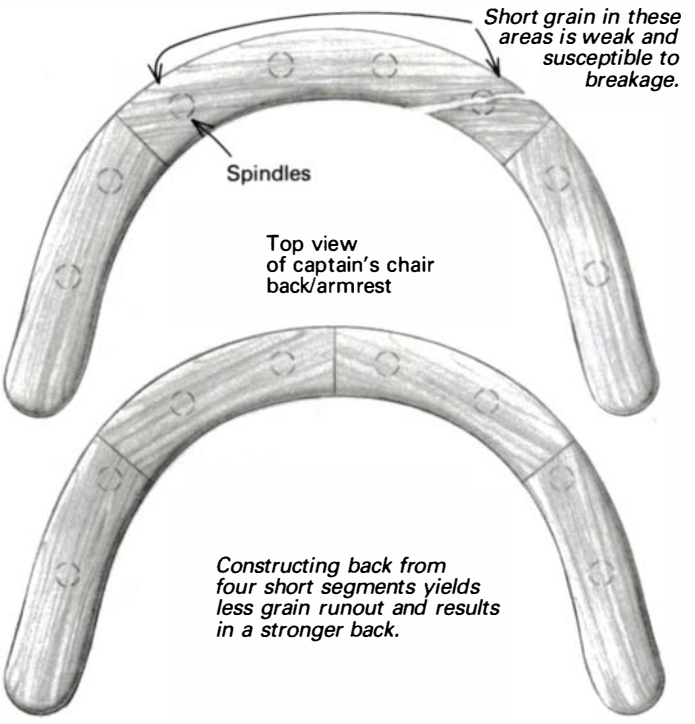
Even with good guides and a carefully adjusted saw, you might still experience some blade lead. First, it's best to work with the lead rather than fight it. First, test the saw to see which way the blade has a tendency to lead. Do this by putting a mark about ½ in. from the edge on a 2-ft.-long board. Then, cut along this line and feed the board about 12 in. into the blade. You may have to angle the board slightly for the board to follow the line. After cutting 12 in. along the line, stop the saw, and keep the board at the same angle that you fed the board to get a straight cut. Measure this angle and set your bandsaw's rip fence to it.

[Mark Duginske is a woodworker, teacher and author who lives in Wausau, Wisc.]

Broken back due to short grain

While I was gluing the backrest/arm assembly atop the spindles on a captain's chair I was building, the back cracked. These breaks occured in the same place on each side: near the ends of the middle segment of the three-piece back. If you can make some suggestions as to how I can repair the arm, I'd be most appreciative. ***—M. Radin, Los Angeles, Cal.***

Sandor Nagyszalanczy replies: As far as I can tell from your description and photos, the problem with your captain's chair's backrest has to do with short-grain failure. By making the entire backrest/arm assembly from only three segments, as shown in the sketch below, the ends of each segment run mostly across the grain. As you discovered, these areas of short grain are inherently weak. Even if you hadn't broken the backrest by driving the spindles into it, the back would've likely been broken by someone leaning back in the completed chair.



I think the easiest strategy for repairing the chair is replacing the entire backrest assembly. Since you used yellow glue, I'm afraid there's no easy way to remove the backrest from the spindles. Some woodworkers have successfully used lacquer thinner

to soften aliphatic resin (yellow glue) that hasn't dried too much, but since the glue in your chair has had time to dry, this is an unlikely solution. You may have to hammer off the old backrest and reshape the ends of the spindles. When making the new backrest, fashion it from four segments instead of three (see the drawing). Each of these segments will have a shorter arc and less short grain, therefore the new backrest will be stronger.
[Sandor Nagyszalanczy is managing editor of *Fine Woodworking*]

Painting polyurethaned kitchen cabinets

I have oak veneer kitchen cabinets, stained dark and finished with what is most likely polyurethane. Can you recommend a durable, white-pigmented surface coating to finish these cabinets without stripping them down to bare wood? Could sufficient build be achieved to eliminate the grain pattern? Would epoxy or Imron be candidates?

—W. J. Zaborchak, Roanoke, Va.

Chris Minick replies: Certainly, a two-part epoxy paint such as Imron catalyzed finish or Sherwin Williams' Polane, would be excellent choices for refurbishing or upgrading your existing kitchen cabinets. The finish produced by any one of these systems will far surpass the National Kitchen Cabinet Association (NKCA) standards for food-stain resistance and durability. But, unless you are very familiar and comfortable with spray application of reactive finishing materials, avoid these finishing systems. It takes a lot of patience and practice with these finishes to achieve acceptable results. But fortunately, an acceptable refurbishing alternative does exist.

Ideally, any restoration project should include removal of the old finish, as this gives you the widest choice of subsequent finishes. Finishing over the existing polyurethane varnish on your kitchen cabinets narrows your choices to either pigmented oil-base alkyd or uralkyd products. These are materials that bond satisfactorily to cured polyurethane varnish. To simulate the modern high-gloss plastic-laminate look, follow the steps below. If you would like the existing grain patterns to show in the final finish, omit the grain-filling step.

First, remove the cabinet doors (and face frames if possible). Thoroughly wipe all surfaces with lacquer thinner to remove any condensed cooking oils or other contaminants. Now scuff-sand the existing finish with 180-grit sandpaper and apply a quality grain filler to the doors and face frames. Paste grain fillers, especially the oil-base type, take a very long time to dry, so allow at least two days drying time before proceeding. Sand the dried doors and face frames with progressively finer sandpaper to 220-grit. Wipe the surface with a tack cloth to remove any remaining sanding dust. Finally, brush apply two or three coats of a high-gloss, slow-drying alkyd enamel. Brand names are unimportant, but I personally think that Sherwin Williams' All Surface Enamel would work best in your situation. Regardless of the brand used, allow several days for it to cure before reinstalling doors and face frames. Although this finishing system would not pass the NKCA durability tests, it offers adequate protection for everyday use. If the finish does become damaged, recoating is an easy task.
[Chris Minick is a product development chemist and amateur woodworker in Stillwater, Minn.]

Speed controllers for AC-only Motors?

In the "Q&A" section of* Fine Woodworking *#85, Ed Cowern wrote a reply regarding speed control of universal or DC motors. Is there also a means of controlling speed of AC-only motors?

—Steven J. Moerlein, Knox, Ind.

Ed Cowern replies: Speed controls offered for universal motors will not work with induction motors. The speed of an induction motor is set by the way the motor is wound (number of magnetic poles) and the frequency of the power being used. In most of North America, the frequency is 60 cycles while overseas most power is supplied at a frequency of 50 cycles. Speed controls for universal motors change only the voltage to the motor. In induction motors, used on most fixed power tools, adjusting the voltage will decrease the torque available from the motor for starting but will not control speed.

The only effective way to change the speed of power tools with induction motors is by changing the frequency to a different value, and this is an expensive process. The most practical way to change the speed of an induction motor in a small shop is to employ mechanical means, such as step pulleys. By using a matching pair of step pulleys on both the motor drive shaft and the arbor shaft of the machine, you can choose from three or four (depending on the pulleys) different speeds as quickly as you can slip the V belt from one position on the pulleys to another.

[Ed Cowern is an electrical engineer and president of EMS, a company that distributes Baldor electric motors.]

Drying spalted logs

I have a supply of logs that are damp and many of which contain lovely spalted wood. Should I resaw the logs into lumber now and stack the resulting boards under pressure to minimize warping, or should I let the logs dry naturally first?
—Robert K. Moxon, M.D., Columbia, S.C.

Bruce Hoadley replies: I would end coat and then resaw the spalted logs into slabs, flitches or boards *now*. Make sure to saw the stock slightly thicker than what's desired for use, to provide shrinking and dressing allowances. Sawing the logs now and initiating drying will arrest the development of the fungi and prevent extensively spalted areas from progressing to the advanced decay stage. Further, the best pieces can be selected and given special attention in drying; the badly decayed or unspalted portions can be discarded. As with any material, stacking in well-stickered, weighted piles will enable the most efficient drying with minimum warp.

[Bruce Hoadley is professor of wood technology at the University of Massachusetts at Amherst and a contributing editor to *FWW*]

Sheet goods and formaldehyde safety

I own a small cabinet shop in western Washington and have been building cabinets for nearly 20 years. The growing popularity of particleboard sheetgoods, such as Kortron and melamine, now widely used in casework, has made me more concerned about exposure to the formaldehyde that's said to be offgased by these products (my customers are concerned too). How much of a health threat is there from working with these sheetgoods? ***—Joe Ciskowski, Eastsound, Wash.***

Chris Minick replies: The subject of the release of formaldehyde from manufactured wood products has been researched for years by both particleboard manufacturers and government agencies. A brief explanation of where the formaldehyde comes from and what can be done about it is in order. Formaldehyde is liberated from the adhesive used in the manufacture of particleboard, medium density fiberboard (MDF), and hardwood plywood during the adhesive bonding step of the production process. Some of this formaldehyde becomes trapped in the wood product and is slowly released to the atmosphere over a period of several months.

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discomfort. Fortunately for most healthy individuals, these symptoms show up well below the 0.4 ppm Threshold Limit Value (TLV), and steps can be taken to ventilate the area before the formaldehyde vapors become a health threat. A recent study by the Furniture Industry Research Association has shown that the formaldehyde levels in furniture factories and warehouses were below the safety limits and posed no particular hazard to workers in the factories.

In your customer's homes where particleboard cabinets have been installed, the formaldehyde problem can be minimized by simply varnishing the exposed surfaces of the particleboard or MDF with an alkyd varnish. This treatment does not eliminate the formaldehyde, but rather slows down the emission rate to a level where normal household ventilation will prevent the build up of vapors. An alternative would be to use exterior-grade wood products when building furniture and cabinets. Exterior and waterproof wood products are manufactured with a different adhesive system; thus, trapped formaldehyde is avoided. Additional information about formaldehyde in wood products can be obtained from the Hardwood Plywood Manufacturers Association, 1825 Faraday Dr., Reston, Va. 22090.

[Chris Minick is a product development chemist and amateur woodworker in Stillwater, Minn.]

Damping noisy sheet-metal machinery stands

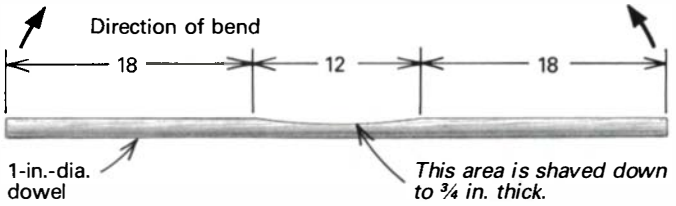
Some of my machines that are on sheet-metal stands don't have that nice quiet sound like other similar machines I have seen elsewhere. My machines seem to rumble and boom to a distracting degree. ***—Herbert Weiner, Sarasota, Fl.***

Robert Vaughan replies: Assuming all the fasteners on the machine are tight, my first guess is that the machine may not be sitting square on the floor. If a shim or two doesn't solve the problem, then I would look at the sheet-metal stand. While the machine is idling, feel the sides of the stand and press in on different places to see if there are any changes in the sound. If you feel one of the panels vibrating more than the others, put a wood stiffener on it. To do this, cut a couple of 3-in.-wide (or wider) strips of plywood and coat one side of each with construction adhesive. Now squish them in place on the inside of the stand wherever the panel was vibrating (space permitting). Wedge or tape the strip in place with sticks as necessary, and let the adhesive dry for about a day. This technique usually does the job for me.

[Bob Vaughan is a contributing editor to *Fine Woodworking* and a woodworking machinery rehabilitation specialist in Roanoke, Va.]

Bending dowels

I'd like to know how I can bend a 4-ft.-long, 1-in.-dia. dowel into a U-shaped rod with a 6 in. inside diameter. I plan to reduce the diameter of the dowel in the middle prior to bending, as shown in the drawing below. What advice can you give me on doing the job, and do I need a jig to keep the rod in shape after bending? ***—Jim Ward, Denham Springs, La.***



Drew Langsner replies: You have chosen an ambitious wood-bending task. The dimensions of the material and the radius of the curve approach the limits that wood can be bent. Here are several

suggestions for going about this project: First, I would not use hardware-store dowels because they are usually maple, which is sometimes used for bending, but is only a moderately good candidate. Better woods to use include white oak, red oak, hickory or ash. Second, commercially made dowels are produced with little regard to alignment of the wood's fibers. The result is that most dowels will have a fair amount of grain runout. It would be best, if possible, to make your own dowels, starting with rough blanks split with a froe from straight-grain stock. If you saw the blanks out, use stock with very little grain runout. You can make the dowels by turning them between centers on a lathe or with a router fixture as described in Ken Well's article in *FWW* #90. If commercially made dowels are your only choice, look through the available selection carefully, pick the very best and be ready for many bending failures.

As with commercial wood bending, you will need a steamer and end straps to prevent failure on the exterior of the bends (see my article on bending green wood in *FWW* #64). You may find that you'll have to make the center bent section of each rod much thinner than your diagram illustrates—perhaps ⅜ in. thick. If your bends fail, consider laminating the rods from several thinner sections. Once you do succeed, the bends can be held in place by tying the ends with wire or string for an hour after steaming.

[Drew Langsner is an author, farmer and woodworker living in Marshall, N.C.]

Gluing rosewood veneer

I am having difficulty applying rosewood veneer to a particleboard substrate. I first wipe the rosewood with lacquer thinner and then coat both surfaces with three layers of Constantine's veneer glue. After several days, I had numerous bubbles develop where the rosewood veneer separated from the substrate. I have been told to treat the rosewood with two coats of veneer glue diluted with thinner so that the solution will soak into the pores and prevent leeching. Another suggestion I've heard is to size the rosewood with a 50/50 mixture of wood glue and water. Wouldn't this cause severe buckling? Also, since the wood glue is water based and the veneer glue is thinner based, would the bond hold? ***—Brian Hayward, Huntington, N.Y.***

George Mustoe replies: Areas of delamination (bubbles) are a rather common problem when contact adhesives are used for veneering. These glues remain somewhat flexible after curing, and have relatively low strength. In particular, contact adhesives are very vulnerable to "creep." Under continual stress, the rubbery glue layer stretches and eventually gives way. With veneers, the most common form of stress is shrinkage or swelling due to humidity changes, but delamination problems can also occur when veneer has been bent to follow a curved surface. These problems tend to be greatest with thick veneers, which shrink and swell more and contain greater stored stress if they are applied to a curved surface. In addition, oily woods like rosewood and teak are more susceptible to glue bond failure than less resinous species.

The advice you received of using a solvent to remove excess oil from the rosewood is a good one, but as you've discovered, it may not do the trick. Similarly, treating the wood with diluted adhesive or some other sealer can be helpful, but don't expect any miracles. Instead, consider using a different type of adhesive.

You need a glue that contains no water, since moisture is likely to cause the veneer to buckle during curing. You also want an adhesive that sets to form a rigid, creep-free bond. The best choice would be one of the common woodworking epoxies that sell for about $20 to $30 a quart. Some formulations are sold expressly for

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7537	2-1/2 HP D-Handle Router	215.
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7539	3-1/4 HP VS Plunge Router	269.
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362	4"x24" Dustless Belt Sander	189.
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9164VSR	3/8" Mighty Midget VSR Drill	105.
9166VSR	1/2" Mighty Midget VSR Drill	115.
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11215DVSR	3/4" Dustless Bulldog VSR SDS Hammer	289.
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1942	Heavy Duty Heat Gun	72.
1604	1-3/4 HP Router	129.
1606	1-3/4 HP D-Handle Router	155.
1608LX	Laminate Trimmer w/ Deluxe Guide	105.
1608T	Tilt Base Laminate Trimmer	105.
1609	Offset Base Laminate Trimmer	125.
1609K	Installers Trimmer Kit	179.
1609KX	Deluxe Installers Trimmer Kit	229.
1611EVS	3-1/4 HP EFC VS Plunge Router	239.
1272D	3"x24" Dustless Belt Sander	175.
1273D	4"x24" Dustless Belt Sander	185.
1273DVS	4"x24" VS Dustless Belt Sander	199.
1370DEVS	6" VS Random Orbit Sander w/Access.	299.
3270D	3"x21" Dustless Belt Sander	139.
3283DVS	5" Dustless Random Orbit Sander	95.
1581DVS	VS, Var. Orbit Jigsaw, Dustless	159.
1582VS	VS, Var.Orbit Jigsaw w/CLIC	135.
1581VS	VS, Var.Orbit Jigsaw. D-Handle	135.
1632VSK	VS Panther Recip. Saw Kit	145.
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0222-1	3/8" VSR Drill, 0-1000 RPM	104.
0224-1	3/8" Magnum Holeshooter, 0-1200 RPM	110.
0234-1	1/2" Magnum Holeshooter, 0-850 RPM	112.
0239-1	VSR Keyless Chuck Drill	119.
0244-1	1/2" Magnum Holeshooter, 0-600 RPM	112.
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5925	3"x24" Dustless Belt Sander	219.
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6014	1/2 Sheet Finishing Sander	117.
6016	1/4 Sheet Finishing Sander	49.
6215	16" Electric Chainsaw	169.
6232	4-3/4" Bandsaw w/Case	275.
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LU87M010	10" x 24T Thin Kerf	37.
LU88M008	8" x 48T Thin Kerf	49.
LU88M010	10" x 60T Thin Kerf	43.
LU91M008	8-1/2" x 48T Miter Saw Blade	38.
LU91M010	10" x 60T Miter Saw Blade	49.
LU98M010	10" x 80T TCG	68.
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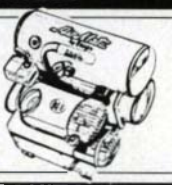

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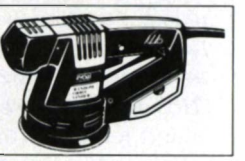

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N3824AR	1" Crown Roofing Stapler	329.
NT65A	16 Ga. Finish Nailer 3/4"-2-1/2"	319.

SKIL

2735-08	3/8" VSR 12v Cordless Drill Kit, w/2 Bat.	135.
77	7-1/4" Wormdrive Saw	145.
5860	8-1/4" 60o Wormdrive Saw	169.
3810	10" Miter Saw	225.
1605-02	Plate Joiner Kit	119.

READER SERVICE NO. 14

use with oily woods, but any of the standard brands should give good results for veneering, such as System Three, West System, Suncure and Armstrong A/B (check with your local hardware store and building or boating supply for sources).

However, epoxy is considerably less convenient to use than a contact adhesive. You'll need to devise a way to apply even clamping pressure and a defensive strategy for coping with messy squeeze-out. It helps to apply the epoxy thinly and to have rubber gloves and lots of rags. Use denatured alcohol during cleanup, not acetone (which is extremely flammable) or methanol (which has very toxic vapors that pass right through an organic-vapor respirator). As a reward, though, you should get a glue bond that lasts forever.

[George Mustoe is a geochemistry research technician at Western Washington University in Bellingham, Wash.]

Identifying an old tenon maker

Everyone loves a mystery, even woodworkers. Recently, I ran across an antique hand tool I can't identify. The tool is about 10 in. tall with a square, tapered drive shank, obviously made to be chucked in a hand brace. The tool has an intricate cam-adjustment mechanism for increasing or decreasing the size of the opening on its bottom and a pencil-sharpener-like blade offset to the side, probably for the purpose of peeling off wood. The tool bears the trademark C.N. Stearns and has a patent number stamped on it. Can anyone tell me what this tool was used for? ***—John A Macdonald, Los Osos, Cal.***

Richard Starr replies: It's a hollow auger, made for cutting a round tenon on the end of a stick. They were used by wheelwrights, chairmakers, laddermakers and other artisans who preferred to cut tenons with a tool mounted in a brace rather than whittling them out by hand or turning them on a lathe. The advantage of a hollow auger is that once it is set up correctly, it can quickly and repeatedly chew out accurate-size tenons. A disadvantage is that if you are careless while using the tool, you can cut a tenon that is not parallel to the axis of the part. But if you happen to *want* a tenon that is off-axis, for example, to correct for an inaccurately bored rung hole in a chair leg, a hollow auger may be the only tool that can easily do the job.

Your Stearns' adjustable hollow auger is one of the many clever designs that can cut tenons anywhere between ⅜ in. to 1¼ in. and larger. Fixed-size hollow augers, most of which carry two cutters, were also made around the same time. Though the fixed-size tool is designed to cut a specific diameter, the blades can be moved to give a tighter or looser fitting tenon. Both styles are easy to find at flea markets or through dealers of old tools.

To use the tool, first prepare the part for tenoning by chamfering its end until it just fits in the throat of the hollow auger. You can do this with a drawknife or spokeshave, but it's easier with a spoke pointer, which is a cone-shaped tool that fits in a brace and works like one of those pencil sharpeners kids carry in their notebooks. You can find detailed suggestions for using hollow augers in my book *Woodworking with Your Kids* published by The Taunton Press.

[Richard Starr is a teacher and author living in Thetford Center, Vt.]

Flattening a surface with a handplane

Please explain how it is possible to obtain a flat surface with a handplane. ***—James L. Dunlap, Hartsville, S.C.***

Lance Patterson replies: To accomplish this task, the board or panel must be supported well enough so that it doesn't flex or rock from the action of the handplane. Also, the tightening of

READER SERVICE NO. 155

a vise or clamp can sometimes distort a board. If either of these conditions occur, your planing efforts will be futile. Therefore it's best to lay the piece on a bench positioned against stops in the direction you'll be planing. For rough lumber or glued-up panels that are cupped or twisted, I recommend you plane some stock off the offending corners or edges on the underside of the panel, to allow the work to sit well on the benchtop. I do not recommend the use of shims. I've seen many students fooling around with shims to keep a board from rocking, but they always seem to get poor results. It is much more efficient to spend a few minutes for localized planing on the reverse side.

Generally, the priorities for flattening a surface are to first, get rid of wind (twist); second, cup (straightness across the grain); and third, bow (straightness along the grain). With the crowned surface up (cup downward) and the work well supported on the bench, correct any major twist with local planing on the high corners. Use a long plane, 22 in. or more, that's in good working order, with a flat sole and a sharp, straight cutting edge. The stiffness and length of the plane will not allow cutting in hollow areas. And the large sole of a plane that is held down well at the beginning and end of each cut prevents dubbed or waning edges.

Proceed with very systematic planing across the grain of the board to eliminate the crown and bow. Even the most difficult woods and grain patterns can be handplaned across the grain, and the motion and direction of the plane won't be dictated by any uneveness in the grain. Most often the plane should be lined-up perpendicular to the grain, but it may be skewed one way or another for a better cut in certain cases. If you have more than 3/16 in. of wood to remove, I recommend using a scrub plane across the grain. A scrub plane has a curved cutting edge that removes stock quickly; then it's easy to flatten the surface with your long plane.

Systematic planing with overlapping passes will allow a 22-in. plane to read off of previous straight cuts to produce a flat surface. It is good to turn the board and plane from the other edge after a few passes over the surface. Allow the plane to find the high spots by keeping the sole firmly on the surface.

Normally boards are only planed with the grain for the final smoothing. You'll know the board is fairly flat if a large plane takes a fine shaving equally from everywhere on the entire surface. On some figured woods that have difficult grain patterns, the final smoothing with the grain should be done with a handheld scraper or scraper plane.

You must remember that the surface you have flattened will not remain truly flat: It is the nature of wood to change with humidity changes, so have realistic expectations. Perfection is a myth. Good joinery and construction practices, such as the use of frame-and-panel doors in cabinetry, are designed to hold boards flat.

I take a lot of pride in my ability to plane even the most difficult woods flat. I truly enjoy the physical activity of planing large surfaces, and I agree with Windsor chairmaker Michael Dunbar that this is the best time to see the pristine beauty of the freshly sliced wood (a privilege of woodworkers). The handplane is an amazing tool. I hope you come to enjoy using it as much as I do.

[Lance Patterson is the director of the furniture and cabinetmaking program at the North Bennet Street School in Boston, Mass.]

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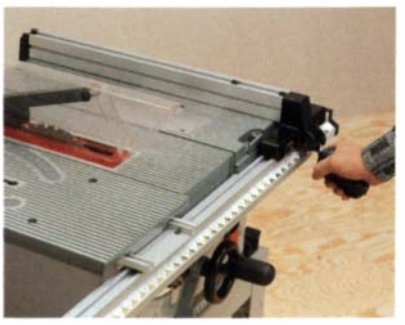

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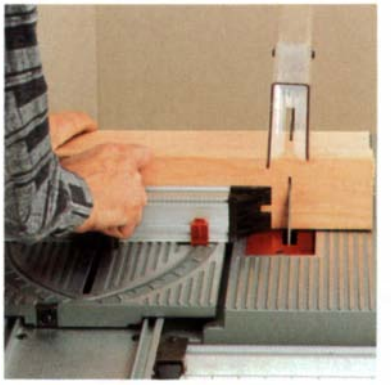

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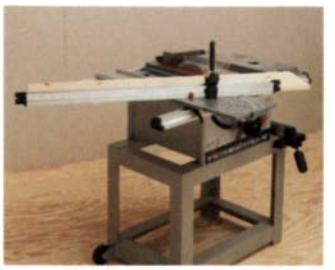

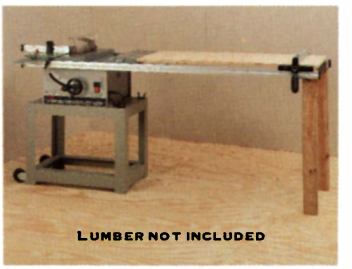

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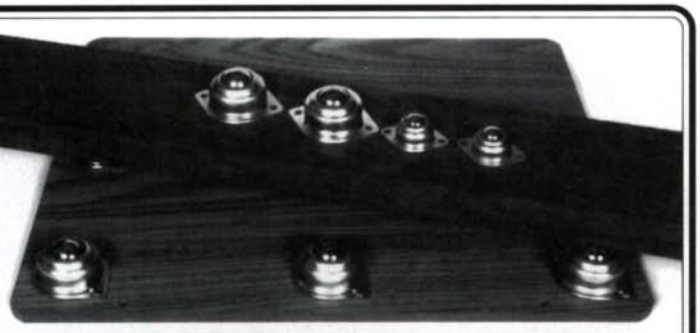

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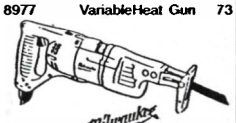

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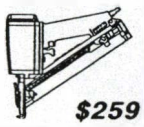

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Photo: Paul Schraub

Shaping with a Router

Jigs and bits for large joints and profiles

by Jeff Dale

***A simple box jig** that holds the workpiece and supports a router with a large subbase is the basis of the author's system for shaping large parts with a router. The parts for the post-and-rail face frame on the 6-ft.-tall armoire on the facing page were trimmed, shaped and mortised with a router and box jigs.*

Producing large contoured parts without a shaper is a tough proposition. Doing so economically is even tougher because most clients won't pay for the long hours it takes to do the job with hand tools. Fortunately, the shaping, rounding and mortising operations on large parts can be done efficiently with a router, templates and jigs. I say *fortunately* because much of the character of my furniture, such as the armoire in the photo on the facing page, comes from the subtle curvature of the parts that are template routed from heavy stock. For example, the crest rail and corner posts for the armoire are made from 12/4 lumber and the top and bottom rails from 8/4 stock. Additionally, I used jigs for routing the large mortise-and-tenon joints that join the armoire's frame members, for routing the dadoes that attach the frame to the carcase and for routing the large finger joints that join the armoire's solid-wood carcase. The ease and uniformity of performing these operations with router jigs is especially helpful when I need to make multiples of each part for several armoires, as I have done on occasion.

The best part of my large-member shaping and joinery methods is they require only shopbuilt plywood jigs and standard, off-the-shelf router bits and ball-bearing pilots. (Router bits are available from most large tool stores and many mail-order catalogues, including Eagle America, PO Box 1099, Chardon, Ohio 44024). In the following pages, I'll describe my various router setups in detail, using the process of making the heavy face frame for my armoire as an example (the construction of my armoire is briefly discussed in the sidebar on p. 46). You can apply the same basic router methods when building other frame-and-carcase pieces, such as chests, desks and cabinets. I'll also share a few tricks I've learned about router jigs in general that should help you make better use of your router, in lieu of having a shaper in your shop.

Template-routing parts in multiple passes

Creating shaped parts with a template is a very useful technique: simply attach a template to the workpiece, chuck a piloted flush-trimming bit in the router, and run the bit's bearing around the template's edge while the cutter trims the piece to exact size. However, shaping very thick frame members, such as the 4-in.-thick crest rail on my armoire, easily exceeds the capacity of even my largest router. Therefore, I have developed a technique using several standard router bits (see the top photo on p. 46) and doing the routing in multiple passes.

First, the templates for routing the curved frame members must be made. I start by making full-size drawings of the front elevation of the cabinet or furniture piece showing the profile of all frame members and joinery. On pieces that are mirror symmetrical (like my armoire), I only draw half of the piece. Next, I trace the outlines of each frame part onto ⅛-in.-thick Italian-poplar plywood (I use 1/16 in. thick matte board for smaller drawings). This plywood is very soft, so I can cut out the patterns with a knife. To make the actual router templates, I trace these patterns onto ½-in. or ¾-in.-thick Baltic-birch plywood and flip the half patterns as necessary to get a full template. After cut-

ting out the templates with a bandsaw, I clean up the edges and fair the curved areas using my stationary belt sander. Then I make sure that the templates for parts with mating edges or joints fit together accurately, which is essential in fitting the top door rails, the top frame rail and the crest rail. I also check to see that templates align correctly where the frame members intersect at the joints.

When all templates are precise, I trace their outlines onto the stock and cut out the parts on the bandsaw, sawing about 1/16 in. outside the lines. When all of the parts are rough cut, I position each template atop its corresponding blank and secure it with double-faced tape and small finish nails, which should be short enough for easy removal. On parts that will receive plugged screws, like the posts on my armoire, these holes provide reference marks for the screw holes. Otherwise, I put the nails near the edges so that the holes will be eliminated when the part is rounded over later. Before nailing down the template on long parts, I apply double-faced carpet tape to help prevent any un-nailed areas of the template from deflecting during routing. I also use double-faced tape to secure the blank to a plastic-laminate work surface to avoid clamps that would interfere with routing.

On heavy frame members, the first router pass is taken using a 1½-in.-long, 1⅛-dia. straight bit with a 1⅛-in.-OD pilot bearing slipped over the shank, just above the cutter. With the router riding atop the template and the bearing guided by the template, I take a light pass all the way around the blank in the direction the bit wants to pull (clockwise when the bearing is above the cutter). Then I make a second pass in the opposite direction. This results in a smooth cut with very little tearout or burning. I use a Porter Cable variable-speed router set to one of the middle-speed settings to get the best cut with my relatively large-diameter bit. In spots where the cutter must negotiate a corner, I often reverse routing direction momentarily to prevent the bit from cutting directly against the grain.

***Routing thick frame members,** such as the crest rail shown here, requires multiple passes with standard straight bits and pilot bearings, both above and below the cutter.*

Next, I increase the bit's depth of cut and take a second pass, routing from the same side. For this pass, the bit's bearing rides against the surface of the blank, guided by the contour of the previous template-guided cut. These two passes will complete the shaping process on medium-thick parts, such as the posts. However, a third pass is needed to shape the wide crest rail that tops off the front of the armoire. This final pass is made from the other side of the workpiece, using a bottom-piloted 2½-in.-long spiral-cutting flush-trimming bit. This third pass references against the surface created by the second pass (see the photo at left).

Rounding the frames

To give the frames of my cabinets and furniture pieces a more sculpted look, most of the edges are partially rounded over with a large-radius bit. For this operation, I use a special box-like router jig (as shown on p. 45) made from hardwood and hardwood plywood. The jig consists of two rails (a little wider than the thickest part the jig will be used for) screwed to a base. The rails, which support a router fitted with an oversized Plexiglas base plate, stabilize the router during the cut. This is necessary because narrow parts don't offer a wide enough surface to directly support the router. The box should

Armoire construction: frame and carcase

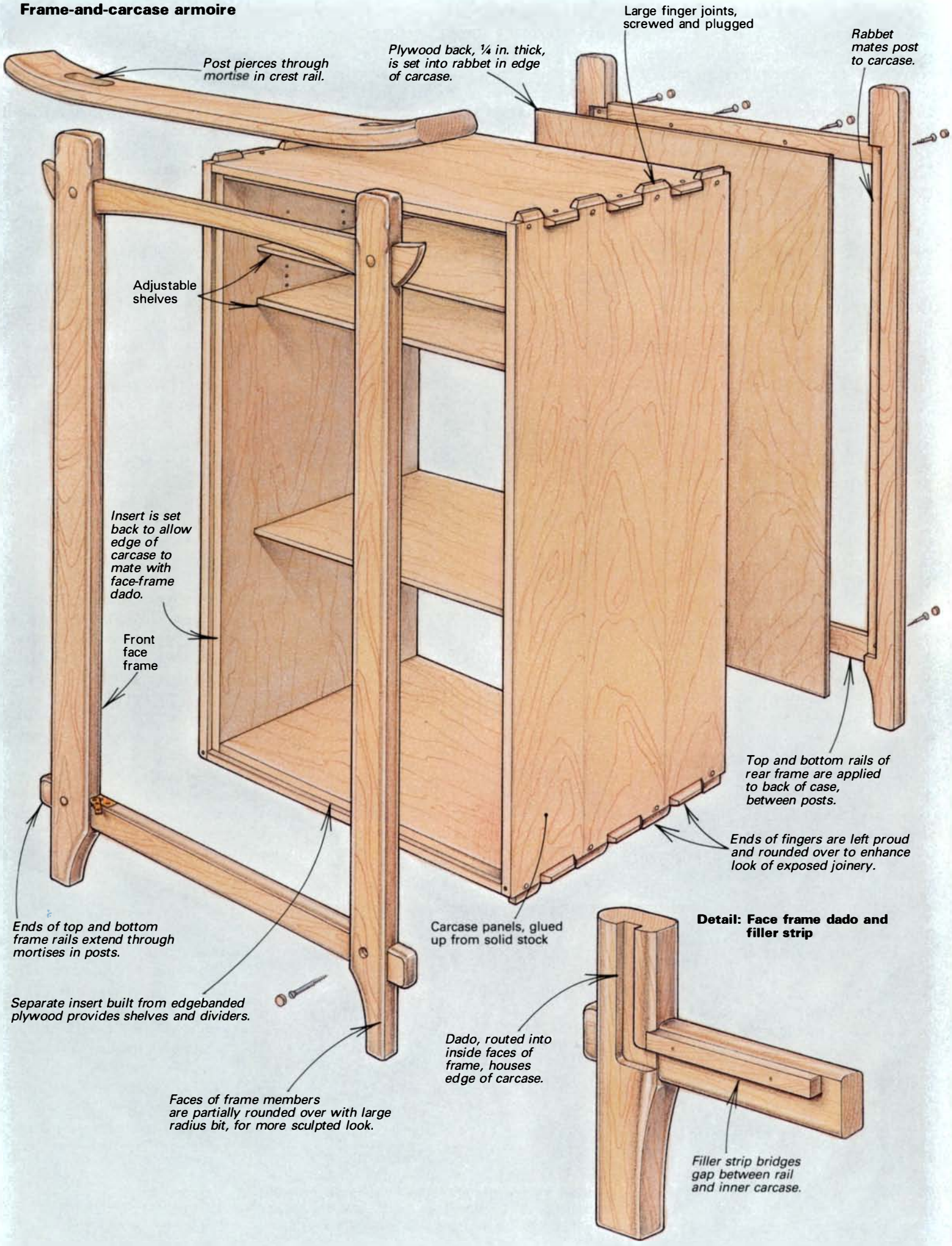
***To rout the carcase's strong finger-joint corners,** Dale uses a large finger template made from ½-in. plywood. He saws out the waste first, routs using the template and a flush-trimming bit and squares up the corners with a sabersaw and chisel.*

The armoire in the photo on p. 44 and the drawing on the facing page is built with a hybrid construction: a sculpted face frame with corner posts, top and bottom rails, and a crest rail attached to a solid-wood carcase that's finger joined together. The heavily shaped posts extend below the bottom of the carcase and act as short legs to raise the armoire off the ground. All of the armoire's front face frame members are through mortised together. Because the large rounded ends of the members have no tenon shoulders to limit penetration, the joints are secured with screws. The wide crest rail is mortised to fit over each post and sits on the top rail. The face frame provides a strong, rigid place to mount the knife hinges for the armoire's frame-and-panel doors, and the door's curved top rails match the soft curvature of the top frame rail. A dado routed in the back of each front post provides a mechanical joint with the edge of the carcase. The back frame is similar to the front frame, but its posts are rabbeted to fit over the carcase, and the rails aren't mortised into the rear posts—they are simply glued and screwed to the carcase between the posts.

I build the carcase from wide, solid-wood panels, joining the corners with large finger joints that are left proud, rounded over and pinned (to be consistent with the exposed joinery in the frame). I rough out the finger joints with a sabersaw, and then rout them with templates, as shown in the photo at left. The cabinet's back is a piece of ¼-in. hardwood plywood (matching the primary wood used) set into a rabbet routed into the back of the carcase and overlapped with the back frame. A plywood insert built separately and slid into the carcase before the frame is attached creates the dividers inside the armoire. By using an insert, I can produce several outwardly identical armoires at once (saving time by producing like parts with the same setups) and fit them with various inserts to adapt the piece to suit the needs of different clients. In addition to the traditional use of an armoire to hold clothing, I've also used the same frame and carcase as an entertainment center by adding an insert that accommodates a television and stereo equipment.

—J.D.

Frame-and-carcase armoire



Detail: Face frame dado and filler strip

Drawing: David Dann

be wide enough so that two parts, such as two posts, can be screwed to the base of the jig side by side. With this setup, you can rout both parts at the same time. Parts like the armoire's posts are screwed to the jig through the holes that mounted the templates earlier.

For most of my large-frame shaping, I use a 1½-in.-radius roundover bit fitted with a 1⅛-in.-OD pilot bearing. This choice of bearing allows only the upper third of the cutter to make contact with the work, so the face of the part isn't rounded over completely. This edge treatment has a crisper look than a regular piloted-roundover bit creates.

Routing dadoes in shaped pieces

I build my carcases by applying the heavy, shaped face frame to the front of a solid-wood carcase. To make this connection strong and positive, I rout dadoes in the back of the frame's posts that lock onto the vertical edges of the carcase (see the drawing on p. 47). With a few alterations, the same box jig I use for rounding the edges can also be used to support the shaped workpiece and guide the router during dadoing. Two workpieces can be held in the jig at one time, just as during edge shaping; however, when dadoing, an additional plywood template is fitted between the parts, as shown in the photo at right. This piece is constructed from two narrow strips of plywood that form a T shape. The T's vertical piece is clamped between the two parts, which are secured in the box jig with pairs of opposing wedges, driven against one another between the inside of the jig and the edge of the workpiece. The top of the T is the surface that the router rides on, and its edge is the template that guides a top-piloted router bit all the way around its perimeter, routing dadoes in both workpieces at the same time. The wedges provide a surprising amount of clamping force, but for extra security you can also screw the parts to the jig or use double-faced tape to keep them in place.

For dadoing the posts, I use a pilot bearing with the same outside diameter as the cutting radius of the bit. The bearing is slipped over the bit's shaft, just above the cutter. When everything's ready, I rout the dado in several passes, lowering the bit each time, to reduce the possibility of blowing out grain at the edges and to get a really clean cut. By changing bits and the shape of the template to suit your application, this setup can be used for routing dadoes, flutes or other grooves for many different kinds of jobs, such as routing the stiles for louvered doors.

Routing mortises through heavy stock

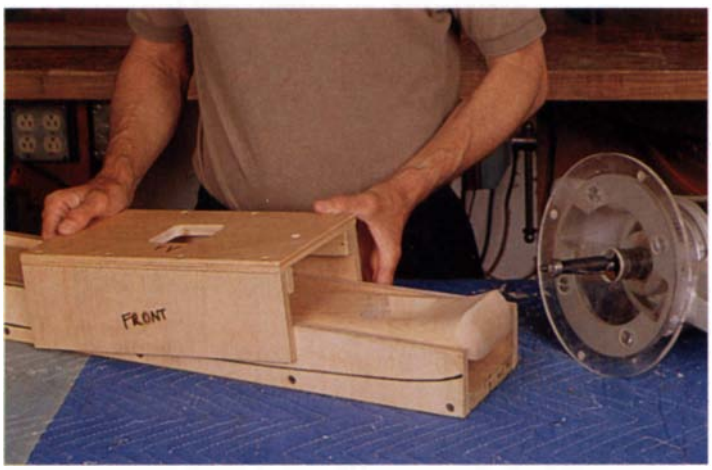
Besides the shaping, much of the character of my armoire's frame comes from the large-scale mortise-and-tenon joinery: Big through mortises in the crest rail allow the top ends of the posts, which are shaped like tenons, to intersect. Also, the ends of the top and bottom rails pass through mortises in the posts. I template routed all of these mortises using a couple of different box jigs in conjunction with piloted straight-router bits. My setup can easily be adapted to practically any large-scale mortise-and-tenon joinery.

***The box jig**, used for shaping the edges of the armoire's frame members, is also used for routing dadoes in the front posts for attaching the solid-wood carcase.*

I begin by marking the outline of each frame member's mortise, and then I drill out the waste just inside the marked lines with a 1-in.-dia. bit. For my armoire's crest-rail mortises, I use the box jig shown in the bottom photo. The jig has cutouts exactly matching the profile of the desired mortises at each end of the box. The workpiece is screwed into the plywood box through its bottom, and then the box is flipped upside down, and a ¾-in.-dia. straight bit (top piloted by a bearing the same diameter as the cutter for flush trimming) is plunged in to rout about half way through the mortise. The whole assembly is then flipped back over and a separate box template is centered directly above the mortise and screwed to the sides of the box jig. This new template has a square hole about ¼ in. larger all around than the desired mortise. (The exact size is not crucial here because this box just provides a platform for the router.) Now I use a 2½-in. long, ¾-in.-dia. spiral-cutting bit fitted with a flush-trimming bearing below the cutter. The bearing now rides against the surface of the previous router cut as I take a pass to complete the through mortise.

Labeling your jigs for next time

After I finish a piece and put the jigs away, it might be months before I use them again. Therefore, I put notes and drawings directly on each jig that remind me how the jig was used and what procedures I followed to get the job done. This lets me repeat these operations without having to figure out everything all over again. I draw directly on the jig with a pencil or marker pen. I write the dimensions and name of the part that the template or jig was used to process and mark the location of mounting screws or pins. I also include a full-size drawing of each router bit (or bits) used and information about the bit, such as the depth of cut, the size of the pilot bearing and, for multiple bits, the order they were used. Finally, I mark the best routing direction and speed on template surfaces, often noting the grain direction and marking places where I should reverse routing direction to avoid tear-out. When I'm done, I lacquer over all my writing, both to prevent it from being obscured or wearing off and to create a slicker surface to help the router glide more easily. □



***Through mortising frame parts** is done by routing from two sides using a box jig with a template cutout for the first cut and a removable platform to support the router for the finish cut.*

Jeff Dale is a furnituremaker in Petaluma, Cal.

Paulownia

A transplanted hardwood that grows like a weed and works like a dream

by John H. Melhuish, Jr.

Paulownia trees are a miracle of growth. *Even in areas with poor soil, the trees can grow to be nearly 60 ft. tall, like the one shown in the photo above, in a relatively short time. You can gauge this growth by the inset photo, which shows a woman standing next to a one-year-old tree. Despite this rapid growth, the wood is easy to dry and can be worked within a few weeks of harvesting.*

Paulownia, a light-colored hardwood revered for centuries by Japanese craftsmen because of its workability and beauty, may someday be the wood of choice for many American woodworkers and an economic boon for loggers in the Southeast. Not bad for a tree that apparently slipped into the United States accidentally, in the form of seeds used for packing material.

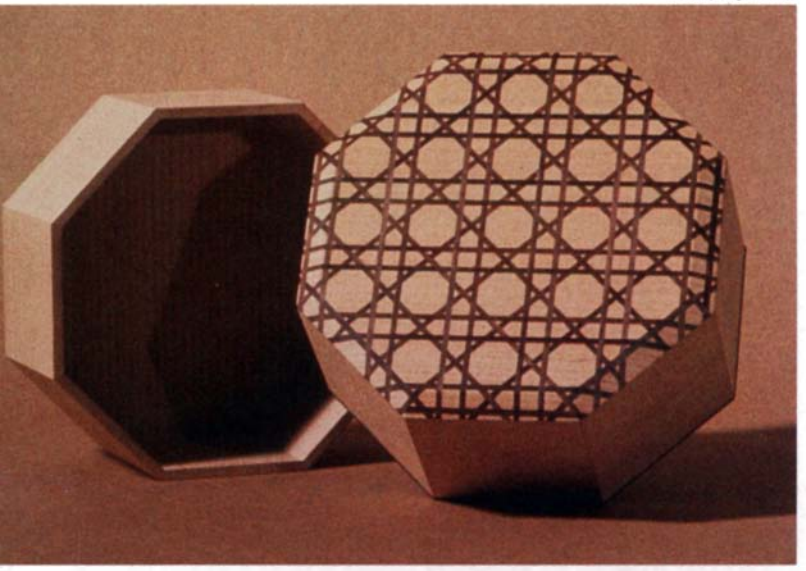
I first became interested in paulownia wood while working for the U.S. Forest Service on projects to reclaim land that had been strip-mined. Loggers and environmentalists were enthusiastic about the paulownia development in mined-out areas. The trees grow at an astounding rate, from seed to 10-ft.-tall in six months (see the inset photo at right), and they grow best in areas with poor-quality soil. I, along with other researchers, feel that it is important to find good uses for the lumber once the trees have outgrown their usefulness as soil stabilizers on the strip-mined lands. Because few American craftsmen have worked with the wood, I asked some local woodworkers to try it. You can see some of their results in the photos on p. 51. So far the results of our early woodworking experiments have been promising.

A stable wood with a long tradition

Paulownia is a lightweight but very strong, very stable wood that's easily worked with sharp tools. It has a satiny surface that stains and finishes very well and an open grain that resembles oak or ash (see the bottom left photo on p. 51). The color of the wood itself varies according to where the trees grow and when they are har-

Top photo: Dick Burrows; inset photo: John Melhuish

Photo: Joseph Eirich



The box above, made by Isaburo Wada, a sixth-generation Japanese craftsman, demonstrates paulownia's stability. The precisely fitted top takes eight seconds to lower itself on a cushion of air.

vested. Darker-colored stock is produced in the warmer southern states where the trees grow very fast. The slower growth in the more northern states produces a lighter color and finer growth rings, which are preferred by wood buyers. The color of stock from both regions is better if the stock is harvested in January or February, when the sap is down.

In addition to the local woodworkers' experiences, we have also been impressed with the beautiful paulownia objects crafted by the Japanese. Traditionally, paulownia was used to build *kotos* (harps) because the wood's specific gravity is about 0.28 (compared to 0.40 for yellow poplar and 0.60 for white oak), and this low density contributes to the wood's superior acoustical quality. Also paulownia has long been incorporated in high-quality furniture such as the *tansu* (a wedding chest). The wood for a bride's tansu often was harvested from a paulownia tree planted by the woman's father at the time of her birth.

Because the wood is virtually unaffected by changes in humidity, the Japanese could build to very tight tolerances, which is especially important when making ceremonial containers and other special boxes. According to tradition, every important or sacred object in Japan is housed in a custom-built box. Some items are enclosed in a series of boxes, each one documenting when the object was passed from one generation to the next. Paulownia is preferred for the best boxes because the wood can absorb a great deal of water before any moisture soaks through, and it's so stable that the lid can be mated to the body of the box with a piston-like, virtually waterproof fit (see the photo above).

Also, compared to other fast-growing hardwoods, paulownia is relatively easy for a craftsman to dry without elaborate equipment. The lumber air dries with a minimum of bow or twist and virtually no cupping, casehardening or honeycombing (although small surface checks occur occasionally). One recent study concluded that "the high dimensional stability and fast drying rate of paulownia lumber make this species the easiest-to-dry commercial wood currently growing in the United States."

A stowaway takes root

But, it was the tree's easy-to-grow nature that was largely responsible for the species development in this country. A native of China, paulownia probably came to the United States in the mid-1800s. One popular theory is that in the days before styrofoam peanuts, paulownia seeds, which are very tiny and light (1.75 million seeds per pound), were used as packing material to cushion dinnerware shipped from the Orient. The wispy seeds escaped and took root when the china was unpacked. The trees probably first appeared along the Potomac River in the Washington, D.C., area but have since spread as far as the Pacific coast. However, Kentucky, Tennessee, West Virginia and an area as far north as Ohio and as far west as Illinois are most likely to produce high-quality wood.

The value of paulownia in the United States was not recognized until 1970 when Japanese wood buyers driving through Virginia noticed the trees growing wild. The trees had been nearly eradicated in Japan by a viral disease, so the buyers were especially excited to discover the old-growth trees and began extensive searches by helicopter to locate all of them. Single trees sold for $3,000 and up; one prime specimen reportedly sold for $20,000.

Because of the potential economic value, tree farmers have begun establishing paulownia plantations in the eastern United States. The seedlings thrive in disturbed sites such as road cuts, surface mines and other poor or marginal land. The trees have deep taproots, prefer well-drained and south- or west-facing locations and can grow to more than 60-ft.-tall, with trunks that are 1 ft. to 2 ft. dia. and larger. The leaves of juvenile trees are sometimes 3 ft. wide, but they are somewhat smaller on adult examples. The showy trumpet-shaped flowers of the adult tree are usually violet-colored and appear in the spring, before the leaves emerge. The flowers form 10-in.-high stalks, which resemble delicate reindeer antlers. In the fall, seed pods resemble bunches of grapes.

Much more research is needed to ensure that the trees produce good lumber. The fast-growing tops of the tree, for example, are susceptible to winter kill in the cooler growing zones. This can cause the tree to produce many spreading branches, which decreases the quality of lumber unless special pruning and other silvicultural techniques are used. High-grade paulownia lumber currently sells for about the same price as walnut, but it's unclear if those prices will remain stable or if overseas buyers will consider the new trees as valuable as old-growth paulownia trees, nearly all of which have been harvested.

My hope is that paulownia will grow in importance as wood technologists and craftsmen continue to use it for construction, furniture, crafts and musical instruments. I encourage you to try it. In some areas it may be known as Kiri, princess tree, empress tree, royal paulownia (the species was named in honor of Anna Paulovna, daughter of Czar Paul I of Russia and wife of King Willem of the Netherlands), or elephant-ear tree. The first time you see a young paulownia, you'll likely favor the elephant-ear title because of the tree's floppy leaves. □

John H. Melhuish is a retired researcher for the U.S. Forest Service, Northeastern Forest Experiment Station and lives in Berea, Ky. *He would like to express his appreciation to B.J. Truett and M.E. Melhuish for their assistance in preparing this article.*

Sources of supply

Many mills and lumber companies in the South have paulownia lumber. Here are a few to contact.

Parks Log Co., Inc., PO Box 403, Highway 64 E., Fayetteville, TN 37334; (615) 433-5595.

Bailey and Sons Timber Co., Route 1, Hornbeak, TN 38232; (901) 538-2174.

H and H Logging, 198 S. Fork Terrace, Glasgow, KY 42141; (502) 646-2779.

S. B. Hackney Lumber Co., Route 6, Lebanon, TN 37087; (615) 444-3480.

U.S. craftsmen discover paulownia's virtues

by Warren May

My first experience working with paulownia was last year when I had several locally grown logs slab sawn at a nearby mill. Surprisingly, after air drying the green wood in my shop for only three weeks, the paulownia was dry, stable and ready to fashion into my speciality—Appalachian dulcimers (see the bottom photo at right).

The small logs were given to me by U.S. Forest Service researcher John Melhuish, who proposed that my shop investigate the commercial possibilities of this local wood. I was intrigued from the start because I had been hearing rumors about Paulownia for some time. I first became aware that such a wood existed about 10 years ago. I came across it on a price list from one of my suppliers of musical-instrument wood. One of my employees at the time was from a sawmill family here in central Kentucky, and he told me that every sawyer he knew was looking for these trees (presumed to be the male of the *Catalpa*) because the elusive golden wood would yield vast sums (by the pound) on the export market.

Once we started working with paulownia, the excitement, curiosity and information about this strange wood grew daily. People brought us articles about paulownia from newspapers and magazines and our super light, good sounding dulcimers caught on. Every cut-off scrap was saved to give to visiting woodworkers, collectors and hobbyists. This wood had an almost magical quality surrounding it. No wonder it has been prized so highly for centuries in the Orient.

In our shop we have found paulownia wood to be very light, but firm. It joints, planes, scrapes and sands very well, without the fuzzing or tearout that occurs in some pines or soft grades of mahogany (see the photo below). Carving and sculpting paulownia with sharp tools is a real joy. The grain pattern of the smaller trees was very strong with some curl around select knots, which I maneuvered into sound holes on many of my dulcimers. When bending the ⅛-in. strips for my dulcimer sides, I found that they needed to soak in water for only a few seconds before they practically melted around my forming jigs.

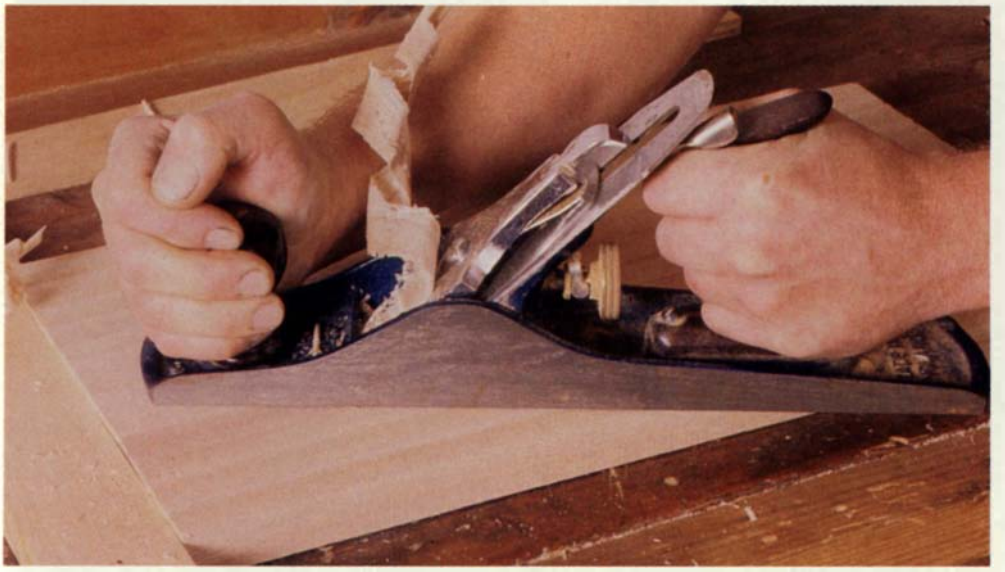
Several dulcimers later, paulownia continues to be user friendly. A few of the dulcimers were given as gifts by the state of Kentucky to Japan and China. My father-in-law has made sculpted-inlay jewelry boxes using the easily shaped small pieces for contrast with walnut and cherry. And one of my woodworkers has built wonderfully functional, lightweight briefcases of paulownia, with a urethane finish for durability (see the top photo). We have also finished paulownia with lacquer and with a linseed oil/polyurethane mixture with topcoats of either lacquer or varnish. The first coat of finish firms the surface quite well for additional coats.

Certainly paulownia is not the perfect wood for every project. It is very soft compared with other hardwoods, light in color and has a very strong grain pattern. Sanding without a block may cause an uneven surface, and it lacks the weight of traditional hardwoods. But user satisfaction and high-public interest coupled with the fact that one can harvest this tree and use almost every inch of it within a matter of weeks really does make paulownia worth its weight in golden color. □

Warren A. May owns and operates a woodworking shop in Berea, Ky.

***Paulownia's light weight** makes it an ideal choice for a briefcase, like the one above, built by John Kennedy of Berea, Ky. And Warren May's paulownia dulcimer, below, takes advantage of the wood's excellent acoustical qualities.*

Photo: Dick Burrows



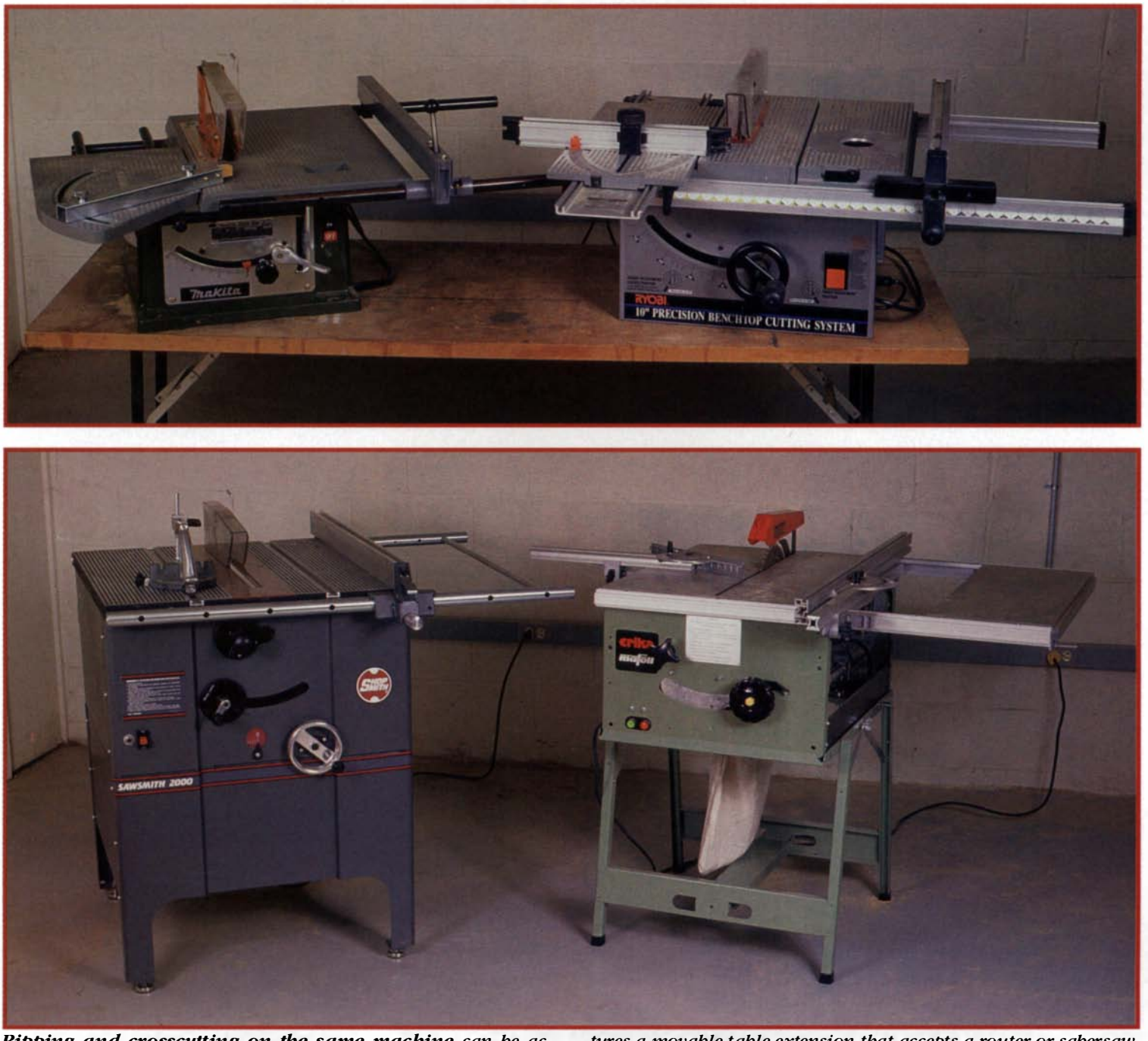
***Paulownia can be easily worked with sharp tools**, and can be planed to a satiny surface that needs little or no sanding before finish is applied.*

Photos except where noted: Warren Brunner

Double-Duty Tablesaws

Four machines with special crosscutting features

by Sandor Nagyszalanczy



***Ripping and crosscutting on the same machine** can be accomplished easily and accurately on any of the four saws featured in this article. The top photo shows the Makita Model 2711 (left) and the Ryobi BT3000 (right); both are portable benchtop saws that crosscut using a sliding table. Additionally, the Ryobi features a movable table extension that accepts a router or sabersaw. The bottom photo shows the Shopsmith's Sawsmith 2000 (left) and the Mafell Erika (right) with its optional stand. These saws crosscut via a sliding carriage that moves the blade through the stationary workpiece like an inverted radial-arm saw.*

Photos: author

One of the pleasures of woodworking is buying new tools and machines. Who can resist the temptations offered by glossy machinery catalogs? But those dreams don't come cheap: A new tablesaw or jointer can cost as much as an annual family vacation, and your shop may not have the acreage for separate machines for each woodworking task. One solution is to choose machines that will serve double duty. Combination machines, such as the jointer/planer, have been filling that role in small (and even not-so-small shops) for years. Now there are four saws on the market, shown on the facing page, that are designed not only for ripping, like a standard tablesaw, but also for crosscutting wide and long stock with ease and accuracy, thus eliminating the need for a separate chop saw or radial-arm saw. Two of these saws, the Ryobi BT3000 and Shopsmith's Sawsmith 2000, are relatively new to the market. The other two saws, the Makita Model 2711 and the Mafell Erika have been on the market for several years. In terms of price, the saws span a wide range: the American-manufactured Ryobi sells for around $550, the Japanese Makita is less than $500, the American Shopsmith is about $700 and the German-made Mafell is the Mercedes-Benz of the group, at around $1400. The machines further distinguish themselves by the way they crosscut and miter. The Makita and Ryobi machines feature a sliding table that supports the stock while it's fed past the blade. The Mafell and Shopsmith have an ingenious sliding carriage whereby the entire saw arbor and motor are pulled past the stationary workpiece. This article will examine the capacities and features (summarized in the chart on this page) as well as the performance of all four saws. However, I'm not comparing equivalent machines, and differences in design and price will probably make one saw better suited to your needs than another.

Capacities and features

	Ryobi BT3000	Makita 2711	Shopsmith Sawsmith 2000	Mafell Erika
Weight (lbs.)	75	71½	160	85
Motor Amps	13	12	13	14
Depth of cut, 90°	3 9/16	3 9/16	2⅜	2⅝
Crosscut cap. @	17	15¼	12	11 (38)*
Ripping cap.	24 (72)**	24	24 (50)**	24
List Price	$1,112+	$868+	$699	$1,395

@ ¾ in. stock at 90°
* With optional sliding crosscut table
** With optional guide rails
\+ Actual selling prices 35% to 50% less.

Basic anatomy

Physically, the Ryobi and Makita are designed as benchtop saws, which are compact, transportable and light enough for one person to carry. The Mafell is a bit heavier but can be used with its optional folding stand as a stationary or job-site saw (an optional steel stand is also available for the Ryobi). The Shopsmith is designed to be a stationary machine, with a screw-together sheet-metal stand. As they came out of their shipping cartons, the Mafell, Makita and Ryobi tablesaws required only minor assembly before they were ready to cut, and the Ryobi came with an excellent instructional video. Conversely, the Shopsmith required extensive assembly guided by a well-written but lengthy 67-page manual.

The bases of the Shopsmith, Mafell and Ryobi are all made from pressed sheet metal, while the Makita's base is a large, high-impact-plastic casting. Although I thought the plastic might prove less durable than sheet metal, the Makita held up well when I performed an informal durability test by bouncing the saw around while loading it in and out of the back of a pickup truck. All four saws have cast aluminum-alloy tabletops and extension tables, and the Makita and the Ryobi have aluminum sliding tables as well. The Ryobi features a removable table extension that also functions as an accessory table with a router or sabersaw (see the photo on p. 54). The Mafell's cast table has a male dovetail around its entire perimeter that accepts guide rails to fit the saw's extension tables, crosscutting gauges and rip fence.

All four saws have straightforward controls located on the front of the base. The Ryobi and Shopsmith have crankable handwheels for raising and lowering the blade and setting the bevel angle (one wheel serves both purposes on the Ryobi). The Mafell and Makita have locking levers instead of handwheels for tilting the blade, but I still found them easy to set. However, the Makita's blade-height handwheel lacked a crank handle, which made adjustments tedious. All the saws have tilt-locking levers and large, tilt-angle gauges, making it possible to set bevel cuts accurately to within a degree; the pressed-in scale on the Mafell was hard to read, and its pointer couldn't be adjusted. All the saws have adjustable tilt stops for square and 45° cuts, except the Mafell, which has stops that are a part of the pressed-steel carriage and not adjustable. While the Mafell's stops were dead accurate during my trial, I'm surprised such an expensive saw doesn't allow for adjustments. The Makita sports an easy-to-read blade-height scale, but Mafell and Shopsmith have scales on their blade guards that were only approximate. None of these tablesaws have blade-height locks, but they seemed to keep their settings anyway.

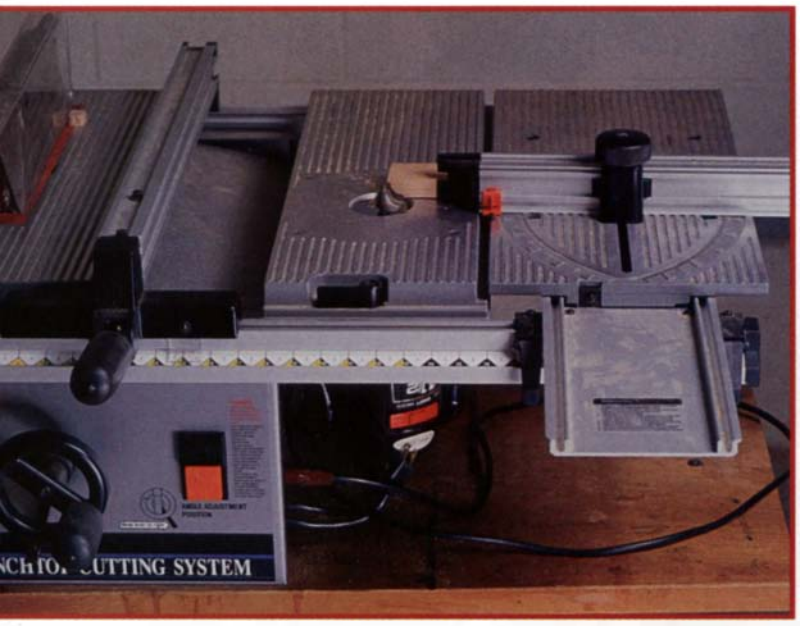
The Shopsmith's motor controls have a toggle-style on/off switch, while the other three saws have on/off buttons with large, raised *off* buttons, which I prefer because they're easier to hit in case of an emergency. All the saws except the Mafell feature some kind of switch-locking key, which can be removed to prevent use by an unauthorized person. The switch box on the Ryobi has an external outlet that allows the saw's motor to be unplugged. A router or sabersaw, mounted in the extension table, can then be plugged in and controlled by the saw's on/off switch—a great idea.

Three of the saws, the Shopsmith, the Mafell and the Ryobi, provide for dust collection. The Shopsmith's dust port connects to a standard 2½-in.-dia. shop vacuum hose, whereas the Ryobi and Mafell can be used with either a vacuum hose or with an optional dust bag. These bags collected a surprising amount of sawdust and chips on each saw.

Crosscutting: sliding tables vs. sliding carriages

The important distinction among these saws is their method of crosscutting, and each method takes some getting used to. As already mentioned, the Mafell and the Shopsmith crosscut by means of a sliding carriage that moves the blade. Both saws have a knob on the front that's directly connected to the carriage. Pulling the knob (a button in the center of Mafell's knob must be depressed first) slides the entire carriage and blade assembly forward to cut through the stationary workpiece (see the photos on pp. 54-55). A spring on each saw returns the carriage to the back of the saw after the cut. In my crosscutting trials, both carriages slid smoothly on their tubular ways, thanks in part to felt wipers that keep chips and sawdust from fouling the action. For ripping, each carriage pulls forward about halfway and locks in position. This leaves the pull rod knob on the Shopsmith protruding about 5 in. from the front of the saw at groin level, which could pose a painful hazard.

To hold the stock stationary during crosscuts, the Shopsmith uses a miter-gauge device in a standard ¾-in. by ⅜-in. table slot (it's the only saw of the four that has a table slot). A separate lock-



***The Ryobi's versatile sliding table** (above) can be mounted to the right of the extension/accessory table and used for guiding the workpiece past the bit.*

***To crosscut on the Mafell** (right), you first pull the entire carriage and blade through the cut. Pushing a button in the center of the blade-height adjustment knob releases the sliding carriage.*

ing device holds the gauge in the slot, and a hand-trigger grip on the gauge clamps the workpiece securely to the saw table (see the photo at left on the facing page). While the gauge's compass has adjustable 90° and 45° stops, I didn't find the gauge's short fence (only 5¾ in.) long enough to crosscut longer boards accurately without adding a longer auxiliary fence.

The Mafell has an extensive crosscutting system, offering several different gauges and fences that can attach anywhere along the edge of the tabletop or guide rails. The basic gauge that holds the workpiece stationary has a 13⅜-in.-long fence and a compass with detents that accurately stop at multiple settings between 0° and 180°. For stabilizing extremely long boards, an optional 40-in.-long fence bar attaches to the gauge, and a flip-up stop slides on for repetitive crosscuts. After I set up a pair of gauges on the Mafell to different angles, I used them to do a number of complicated angled cuts and was able to attach or remove the gauges from the saw without having to reset the angles. I found this to be very convenient. For large panel work, Mafell also offers an optional sliding table.

The Ryobi and Makita use sliding tables for crosscutting: The workpiece is held against a miter fence (adjustable for cuts to 45° in either direction) and slid past the sawblade (see the photo at right on the facing page). With the fence set at 90°, I could crosscut a ¾-in. panel up to 17 in. wide with the Ryobi and 15¼ in. wide with the Makita. Both tables slid very smoothly on adjustable plastic glides; the Ryobi's table rides on extruded-aluminum rails, while the Makita's rides on steel rods. However, the Makita's table has felt wipers that need to be oiled occasionally, which I found to be messy. Both tables can be locked on their rails, and their miter fences can be removed fairly easily when changing over to the ripping mode. The Ryobi's 18-in.-long miter fence can be replaced by an optional 40-in.-long auxiliary fence (it can also be used for a rip fence) for cutting extra-long stock or large panels. Both sliding tables feature large compasses for setting precise miter angles, but the Makita lacks a stop for square cuts. A Ryobi innovation is that their sliding table can be attached or removed from the guide rails in seconds via quick-release clamps. Further, this table attaches either to the left of the sawtable (normal for crosscutting) or to the right of the accessory table (see the photo at left above), which is great for jobs like routing tenons or coping. An optional accessory kit includes a router-table fence and a circle cutting jig.

Rip fences

Like many standard tablesaws, the Makita and the Shopsmith both have tubular steel rails to which their rip fences lock at the front and back of the saw. The Makita has a 28½-in.-long pressed-steel fence bar, while the Shopsmith's 35-in.-long fence bar is an aluminum extrusion; both are pre-drilled so that auxiliary fences can be added. While both rip fences allow a 24-in. rip capacity and locked satisfactorily, the Shopsmith lacks any sort of scale-and-pointer assembly, and its fence needs to be locked front and back with separate controls, which made it time-consuming to set. Shopsmith's Pro model comes with longer rails, for ripping up to 50 in., and their more expensive models, the Deluxe and the Ultra, come with the higher-quality Excalibur rip fence.

Both Ryobi and Mafell use extruded-aluminum rails and fence bars and are capable of ripping up to 24 in. wide. The Ryobi's rails slide into the front and back of the saw and lock via built-in levers (extension rails are available to boost rip capacity to a whopping 72 in.). The Ryobi's 23½-in.-long fence bar looks and locks somewhat like a pint-size Biesemeyer T-square fence, but unlike the T-square, the Ryobi also locks to a rear rail. The Ryobi fence also has a precise-setting crosshair cursor, and the fence can be lifted from anywhere on the rails, not just at the ends. I liked the comfort of the Ryobi's fat foam-padded locking handle, but its best feature is the dual-numbered scale on its front rail. Once it's zeroed, the black scale is used for setting rip cuts, and the yellow scale is used with the accessory table.

While it is accurate, the Mafell's rip fence is somewhat time-consuming to use because you must walk around to the back of the saw to get to the small fitting on the underside of the fence bar that locks the fence at the rear. Further, the fence lacks a cursor assembly (the saw table does have an embedded scale,

***The Shopsmith's miter gauge** (left), with its hand-triggered hold-down clamp, secures the stock during a cut. After pulling the blade through the cut, a spring returns the carriage.*

***The Makita's sliding crosscut table** (above) can accommodate ¾-in.-thick panels up to 15 ¼ in. wide. After the adjustable miter fence has been set, the table and workpiece slide past the blade for the cut.*

which can be lined up with the fence for narrow rip cuts); therefore, wide rips must be set using a tape measure.

Motors, sawblades and guards

Cutting power requires a balance of motor size, speed and blade design and thickness; each of the four saws achieves this balance in a slightly different way. All four saws run on regular 110v power. The Shopsmith and Mafell saws have induction motors (typical for stationary machines) that drive their blades directly at 3450 RPM. After I noticed that the Shopsmith's motor had no protective housing, I called Shopsmith's product manager, Tim Silvers, who told me that this wouldn't damage the motor's working parts and that eliminating the housing allows a greater depth of cut—2⅜ in. at 90°. Even though the direct-drive Mafell has a fully covered motor, it achieves a greater depth of cut (2⅝ in.) by using a large-diameter, 280mm blade (about 11 in.).

The Makita and Ryobi tablesaws use universal motors, like the ones found in portable power tools. These motors run faster than induction motors—about 18,000 RPM, so they're geared down before the blade. Ryobi uses a pair of toothed belts, Makita has a gear drive. Offsetting the motor from the arbor allows for an impressive depth of cut (3⁹⁄₁₆ in. for both saws), enough to crosscut a 4x4 in one pass. But universal motors are noisier than their induction-driven counterparts, so hearing protection is a must.

To put their power to work more effectively, the Ryobi and Shopsmith come with thin-kerf carbide blades because the less material the blade must remove during the cut, the less power required to drive it. Further, the Ryobi's Freud blade has an anti-kickback design that also limits feed speed, which prevents the blade from stalling during a demanding cut. The Makita's chisel-tooth steel blade removes a thin kerf as well, but the surface it leaves after the cut is relatively rough. The Mafell has a standard-kerf (about ⅛ in.) carbide blade, which performed well and left an extremely smooth finish. While the Makita and Ryobi use standard 10-in.-dia. blades with ⅝-in.-dia. bores (the Mafell's 280mm blade also has a ⅝ in. bore), Shopsmith's 10-in. blade has a 1¼-in. bore. The Shopsmith's blade is high-quality, but it'll probably be hard to find locally, which may be a problem if you need a replacement in a hurry. The arbors on the Makita and Ryobi are long enough to handle dado sets, but the Shopsmith's arbor is not. Because the Mafell doesn't have a throat plate, it can't accept cutters that are much wider than a regular sawblade. Both Shopsmith and Mafell motors have an electronic blade brake; the gearing slows the blade on the Makita and Ryobi after they're switched off.

The conventional blade guards, with splitter and anti-kickback assemblies, on the Ryobi and Makita worked well for ripping but were awkward for crosscuts and miter work. Mafell has the most practical guard system: a self-aligning rip guard that's easy to install (one thumbscrew) and a second snap-on blade protector completely houses the blade for crosscuts. The Shopsmith's guard was difficult to align, and it often bound the workpiece during cutting.

Cutting performance

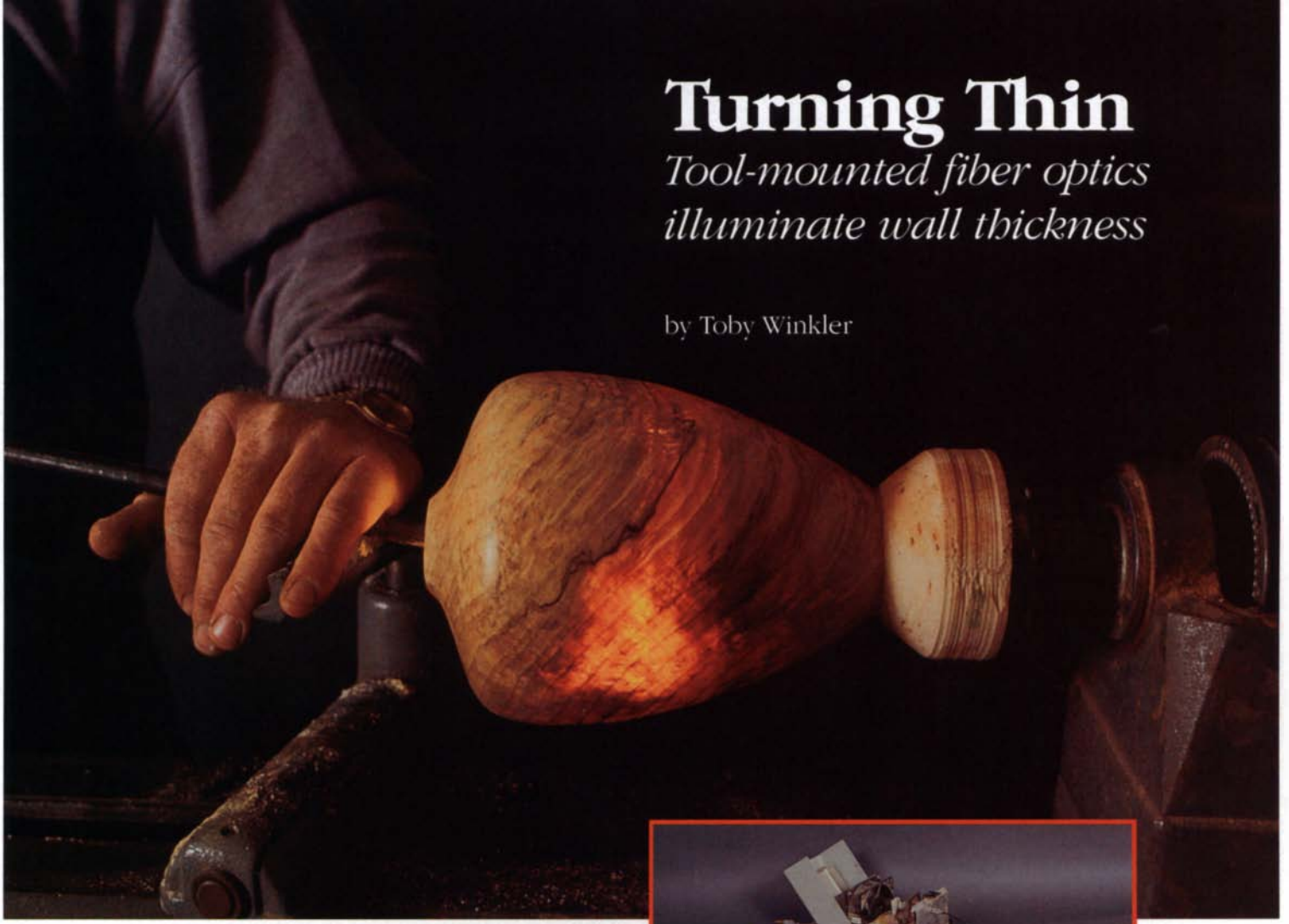
While they may not gobble through wood like their cast-iron brethren, all four of these versatile tablesaws are capable of doing some impressive work. All were able to handle rips and crosscuts in 8/4 oak without bogging down too much. In my trials, I found the Shopsmith to have the most cutting power of the four saws. However, the Mafell cut only slightly less aggressively, and I preferred its overall level of quality and precision. Contrasting the two lower-priced saws, the Ryobi seemed to labor more when cutting thick hardwood, despite its excellent blade, and the Makita seemed to have more cutting zip (even with its lower-amperage motor). Still, compared to the Makita, I think the Ryobi offers higher quality and more features for the money. □

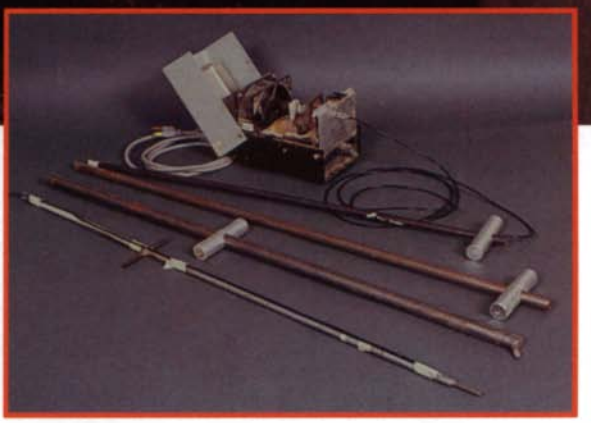
Sandor Nagyszalanczy is managing editor of FWW. *For more information, contact: Mafell, 80 Earhart Drive, Unit 9, Williamsville, N.Y. 14221, (716) 626-9303; Makita, 14930 Northam St., La Mirada, Cal. 90638, (714) 522-8088; Ryobi, 1424 Pearman Dairy Road, Anderson, S.C. 29625, (800) 525-2579; Shopsmith, 3931 Image Drive, Dayton, Ohio 45414, (800) 543-7586 ext. 12.*

Turning Thin

Tool-mounted fiber optics illuminate wall thickness

by Toby Winkler





Winkler uses fiber-optics to illuminate the interior of a vase, *so he can judge its wall thickness from the outside. With his lathe spinning in reverse, he hollows the vessel (above) with his tool's cutter. An aluminum handle slides over the steel shaft to provide a T for more torque control and to vary the tool's balance.*

Winkler's fiber-optic system consists of a light source and guide *(inset). The source is a 150-watt projector bulb with a parabolic reflector, a rheostat and a 4-in.-dia. computer fan. The flexible light guide (3/32-in. glass-fiber bundle) can fit any of the 3/8-in.- through 1-in.-dia. slotted steel shafts shown.*

I enjoy watching people's reactions when they lift one of my semi-closed, hollow vases that weighs only a few ounces. They look startled when the piece seems to almost float away. Achieving lightweight work like this can be tricky because it requires turning very thin walls. So I devised a simple method for gauging wall thickness by shining a light through the wood from the inside out with a tool that utilizes fiber optics. I named my prototype tool "Tinkerbell," after the pixie from Disney's version of *Peter Pan*, because in a darkened shop, the flickering light that emanates from a vase looks uncannily like Tinkerbell captured in her jar (see the large photo above).

The idea of using light to determine wall thickness came from a fellow-Massachusetts woodturner, Paul Fennell (see the sidebar). I found Paul's early technique of shining a high-intensity light through a vessel from the outside effective, but a bit awkward. I had difficulty looking down the length of my turning tool inside the turning vessel. So I began to think about a new tool that could shine the light from the inside out. The tool needed to have a long steel shaft with a tool-steel cutting edge inserted at its end and an intense light that could shine near the cutter but be directed from the handle. A small, conventional light bulb was not an option because it would not be durable enough to ride on the end of the cutting tool.

Fiber optics suited my needs exactly. These glass-fiber bundles, which carry undiffused light, have a polished end where the light is emitted. The rods have an aluminum or stainless-steel sheath at their ends, and the rest of the shaft is encased in PVC. I use a light generator (a 150-watt projector bulb) to supply light to the guide, which is a 3/32-in.-dia. by 8-ft.-long fiber-optic bundle (see the inset photo above). My light guide fits tightly into a machined slot in the shaft of the tool, much like the closing of a Zip Lock bag. The guide's tip can be positioned down to about 1/2 in. from the cutter tip. By changing from a 3/32-in. to a 3/16-in.-dia. fiber cable, I can increase the light by a factor of four and alter the light's spread by using various lenses at the tip.

Turning a "light" weight vessel

I start by mounting a blank between centers and roughing the outside shape. Then I attach the blank to a faceplate and bring it to its final outside form. Next, I rough out the interior, stopping frequently to clean out the sawdust with a shop vac. The rough-hollowing is complete when the wall thickness is from 1/2- to 3/8-in. thick.

Photos this page: Charley Robinson

Once a vase is rough-hollowed, I begin to thin out the wall at the top of the vessel. I set my lathe spinning in reverse, and then turn off the shop lights and turn on "Tinkerbell." When working blind in a deep, hollow form, it's easy to catch a tool tip and either hurt yourself or damage the work. Therefore, to be safe, practice using lighted tools on open turnings to get a clear notion of how they work before trying them on semi-closed forms. When a wall has been thinned to about ¼ in., a smudge of light will appear from inside. The exact thickness varies from one species of wood to another. As the wall becomes thinner, the entire top surface of the vessel will begin to glow from within (see the photo at left). For an 8-in.-dia. by 10-in.-tall vase, 3/32 in. is a good final wall thickness to strive for. To avoid distortion as the wood dries, I work as quickly as possible from start to finish. It's also helpful to turn a small piece or to turn a large piece of green wood to ⅜-in.-thick, and then allow the piece to dry before final thinning of its walls. While keeping the glow from the light the same intensity, I check thickness at the top with calipers and work down the sides to the bottom. To reveal my cuts at the vessel's bottom, I pull the light guide 6 in. back from the tip of the tool to get more light spread. When the interior of the vase is complete, I carefully part it from the faceplate and reverse-chuck the piece to finish the outside of the bottom. □

Toby Winkler builds staircases in Grafton, Mass., and is founding president of the Central New England chapter of the American Association of Woodturners.

Sources of supply

The following companies manufacture components and accessories that can be used for lighted turning work.

Industrial high-intensity lamps for an external light source:
Sunnex, 87 Crescent Road, Needham, MA 02194; (800) 445-7869.

Light generator* and fiber-optic cable for an internal light guide:
Fiber Technology Inc., Prototype Department, 1 Fiber Road, Pomfret, CT 06258; (203) 928-0443.

Binocular magnifier:
Donegan Optical Co., 15549 W. 108th St., Lenexa, KS 66219; (913) 492-2500.

*Many photo-supply shops also carry lamps, bulbs, rheostats, parabolic reflectors and muffin fans. Or try a local garage sale to pick up an old slide projector.

A hand-held light guide

by J. Paul Fennell

Hollowing a thin-walled vessel through a small opening is essentially blind turning. Following David Ellsworth's lead, many experienced woodturners develop a feel for gauging wall thickness using calipers and sound. These mechanical and acoustical techniques didn't work well for me, so I began experimenting with an idea I saw in one of Richard Raffan's books—using wood's inherent translucency under a strong external light to gauge wall thickness. After much trial and error, I was able to adapt the idea to turning closed forms by shining a light from the backside of the lathe with my work spinning in reverse. Working from the opening to the bottom of the turning until the wall became translucent, I would compare the glow color to what had already been turned. I wore a pair of optical (binocular) magnifiers (see the Sources of supply box) to help me see what I was doing at close range and often resorted to muscle-tiring contortions to peer down the length of the tool to watch the wall being cut.

There were other problems with this method too. The glare from the lamp was annoying and the heat accelerated the distortion of the wall as it got thinner. When I began using a fiber-optic cable as a "cold" light guide to illuminate the vessel's interior, these problems, as well as the contortions needed to look inside the turning, vanished. The fiber-optic concept was developed by my friend Toby Winkler, but my variation is to hold a light-emitting tip just inside the vessel's opening, unattached to a turning tool. My left hand holds both the cutting tool's shaft and the fiber-optic cable together on the tool rest. My right hand directs the handle of the cutting tool in a conventional fashion. When the wall is sufficiently thin, the entire vessel glows (see the photo below). Once there is an even glow color from the opening to the base, the wall is uniformly thin with no bumps or ridges.

My intent is not to see how thin I can turn. Instead, there is a point when a vessel reaches a desirable lightness and delicacy without jeopardizing its structural integrity. All but the darkest woods glow when turned thin enough. Generally, high moisture or resin content in a wood enhances this property. Gauging a wall's thickness requires knowing how much translucency to expect from a particular wood while it is spinning, so that color variations due to the grain or mix of heartwood and sapwood are blended. A highly translucent wood, like green maple, glows almost white, whereas cocobolo appears deep red. In the case of green maple, the problem is leaving the wall too thick; with cocobolo, the concern is cutting the wall too thin. □

J. Paul Fennell is a professional woodturner from Topsfield, Mass. He sells his vessels through galleries nationwide.

***When lit from within,** the walls of Fennell's turnings (right) are thin enough to cause the entire vessel to glow like a Japanese paper lantern.*

***In daylight (below)** you can't tell that the 6-in.-dia. masur-birch vessel has 1/16-in.-thick walls and weighs only 4 oz.*

Photos this page: J. Paul Fennell

Wiring a Home Shop

Additional circuits and outlets get your motors running

by Grant Beck

Electricity is the lifeblood of power machinery, but if you work in a converted garage or basement shop, chances are that blood isn't flowing very well. It seems small shops never have enough power outlets, and no matter how well laid out the shop is, there's rarely an outlet within reach of a powertool's cord when you need it. Fortunately, rewiring is a job almost any woodworker can handle, with a little knowledge and a good dose of caution.

Although this article won't tell you exactly how to wire a shop from scratch, it will take you through the steps necessary to add new circuits and outlets to an existing electrical system. In addition, I will give you an overview of what to consider when determining your wiring needs, both for now and for the future. Even if you decide to hire an electrician to do the work, you'll still need to define your electrical needs and provide him with a layout drawing, so you'll get the job done correctly and economically.

Before you begin, here's a sobering reminder: When improperly handled, electricity can kill you. Therefore, do not attempt any of the procedures described in this article unless you are completely sure of what you are doing. Also, please read the sidebar on p. 60 on electrical safety. If you have any doubts, hire an electrician; it may seem costly, but the price is negligible compared to what you'd pay if the worst happened. Another important point: Making just about any change to an existing electrical system requires a permit from your local government planning office, but most municipalities will let homeowners do their own work.

How many circuits and outlets do I need?

The first step in planning additional circuits and outlets for your shop is to figure out how much power you'll need. To start, make a list of how many amps each stationary machine in your shop uses, along with what voltage that machine runs on, 110v or 220v single-phase (this article won't cover 3-phase power). The motor's size and voltage are found on its information plate. To calculate how many amps your breaker box must carry to run your shop, I follow this simple rule of thumb: add up the amperages of all the

machines and divide by two. If your shop is on the same electrical service as your home, you may have to hire an electrician to help determine if your existing service can handle your shop or if you need your service upgraded and a larger box installed.

Once you've determined each tool's power requirements, you'll need to figure out where the stationary machines will be located or where power tools will be used, and make a drawing of your shop, like the typical shop sketch below. Draw in the location of the circuit breaker box, your workbench, doorways and windows, and label each machine with its amperage and voltage.

Before locating the outlets, you must determine the number of separate circuits you'll need. I've found that because most small shop's circuits are wired with 12-gauge (ga) wire, the general rule to follow is that a circuit with a 20 amp breaker should not carry a load of more than about 15 amps. Without this buffer, normal operation might trip breakers, as motors can draw more than their specified amperage upon start-up. In one-man shops, where only one tool is to be used at a time, a single circuit may have outlets for several power tools or machines, even if their individual power requirements exceed 15 amps. In a multiple-person shop, machines that might be run simultaneously should have separate, dedicated circuits (only one outlet per circuit). If the machine doesn't use the full capacity of the circuit, a spare outlet on the same circuit can be handy. For instance, circuit #7 in the drawing powers the lathe and has an extra outlet that could be used for plugging in a right-angle sander for power sanding a spinning turning. Workbench areas should have several outlets to allow multiple handtools to remain plugged in. If there's a chance that several of these tools will be run at the same time, an outlet on a separate, dedicated circuit should be included (see circuit #10 in the drawing) and used with higher-amperage power tools, such as a plunge router, circular saw or a bench grinder.

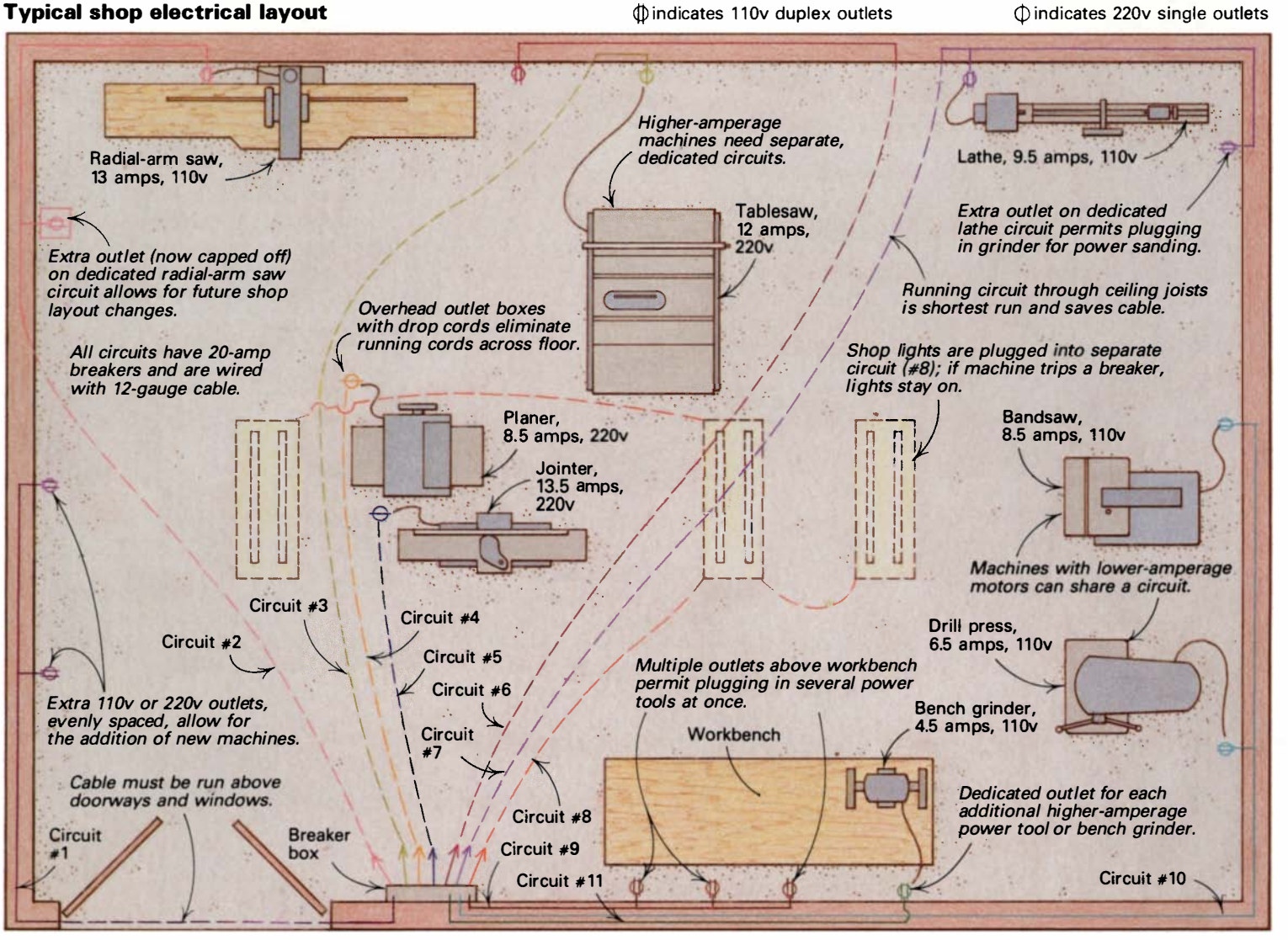
Large machines with more powerful motors in the 1-HP to 3-HP range, such as tablesaws, planers and shapers, also require dedicated circuits. Most electrical codes require this as well. If a motor can be wired to run on either 110v or 220v, wire it for 220v operation. The reason is that doubling a motor's voltage causes its amperage requirements to drop in half. Therefore, you can use 12-ga wire to run circuits to 220v motors in lieu of switching to heavier (and more expensive) 10-ga wire to satisfy a 110v motor's higher-amperage requirements.

Location of outlets

While you may be tempted to locate your outlets so that each is closest to the machine it services, it's a good idea to spread them out as uniformly as possible to accommodate future needs. A few extra 110v outlets, evenly spaced around the room will allow you to use portable tools away from the workbench or connect new machines in the future.

As mentioned earlier, in the area near your workbench you will need more outlets placed closer together than in the rest of the shop. However, regular outlets cannot be moved if you decide to relocate your bench. But you can get around this problem by mounting an outlet strip on the workbench, as shown in the photo

Typical shop electrical layout



Photos: Sandor Nagyszalanczy; drawings: Vince Babak

*A **multiple-outlet power strip** is an economical way to add extra outlets to a workbench, and it speeds up work because you can leave several portable power tools plugged in at a time. Most power strips have a built-in circuit breaker, in case there's an overload.*

at left. Due to the large number of outlets on a power strip, it probably should be fed from a dedicated wall outlet (most strips have their own built-in circuit breaker). To increase the flexibility of your wiring plan in case you want to rearrange your shop, you can wire two or more outlets on the same dedicated circuit, and then fit only the one in current use with an outlet; cap off bare wires with wire nuts and install a blank cover over unused outlet box(es), as illustrated in the drawing of circuit #2. In case a new machine is brought in or the layout changes, the extra outlet can be made active and the currently active one capped off.

Outlets in the ceiling are fine for machines like the planer and jointer, where the hanging cord doesn't get in the way. If you ever work with big sheets of plywood, avoid dropping an overhead line to the tablesaw, because sooner or later it'll be in the way. Don't place outlets in the floor, even if it seems most convenient. These outlets can fill up with sawdust and become a fire hazard. Locating outlets on the wall about 42 in. above the floor will keep them above most workbenches and accessible behind stationary tools.

The lights in a shop should be on a dedicated circuit so that you won't be plunged into darkness if you overload a power tool and trip a breaker. So if you add new lights in your shop, wire the new lights on a separate dedicated circuit; don't tie them into the existing

The shocking truth about electrical safety

by D.L. Rogers

Before crawling out on a tree limb, you can evaluate the potential risk: Is the height 6 ft. or 60? Is the limb alive or dead? Is the ground below you soft turf or a pile of bricks? However, no one can determine the risk of electrocution at any given moment when working on live electrical wiring. This household friend that lights your shop and powers your tools can kill according to an obscure set of rules that should be understood by anyone who uses or works with it.

Electrocution is possible because electricity can pass between any two conductive objects: If you have your feet on the ground and touch an electrical part, you are offering the current a path through your own body. Normal skin oils and perspiration are good electrical paths through the pores and into your body, which is full of highly conductive fluids (electrolytes). These electrolytes are constantly changing; hence, you can't determine exactly how conductive your body is at any given moment.

Electricity sometimes kills by severely damaging body tissues and altering the electrolytes, which your muscles (including your heart) depend on for operation. This type of electrocution can be caused by large doses of either AC or DC power. However, the most insidious and lethal consequences of electricity can arise from relatively low levels of AC current.

A shock below 100 milliamps (ma) may cause no sensation at all or a very painful sensation, often resulting in a drained or nervous feeling. But an electrical current of about 100 to 200ma (the amount of current it takes to power a dim nightlight) may override the heart's electrical signal. This can change the heart's normal rhythmic beating into a weak flutter known as ventricular fibrillation. In this state, your heart can't circulate your blood, and you may die unless emergency medical technicians arrive in time to restore your normal heartbeat.

Ironically, receiving a larger shock isn't always fatal. Above 200ma one may experience paralysis, excruciating pain, unconsciousness and tissue damage. Obviously, the higher the current the greater the tissue damage (which can be the sole cause of death if extensive enough). Therefore, someone may survive a high-amperage electrical shock with the loss of a foot or an arm, while a much weaker shock may cause fatal heart failure.

All of the above should convince you that working on electrical wiring is not a task to be taken lightly. Fortunately, a few precautions should keep you out of trouble: First, *never* work on live electrical wiring. Always turn off the electricity at its main distribution box, and as an added precaution, put a sign on the box telling others not to turn anything on without checking with you. If you're unsure of how to turn the power off, you can't handle the rest of the job either, so consult a professional electrician. Some people will tell you, "Sure you can work on a 110v-electrical circuit while it's hot—just don't touch the black wire and the white wire at the same time." While you can get away with this most of the time, being careless only once can lead to disaster. Second, whenever you're wiring up a new tool or machine and must plug it into an old-fashioned two-prong receptacle, don't cut the ground pin off the plug. Instead, use a three-prong adapter and connect its ground screw according to directions. Finally, if you're installing new circuitry in your shop, consider Ground Fault Circuit Interrupter (GFCI) breakers or outlets. While considerably more expensive, GFCI devices will break an electrical circuit in a few milliseconds when a ground leak of less than 50ma—well below electrocution potential—is detected. You'll be mildly shocked, but you'll live to tell about it. □

Dan Rogers is an electrical engineering consultant in Spring, Tex.

lights unless they are on a dedicated circuit (see circuit #8 in the drawing). As a rule, don't exceed 1600 watts on one 20 amp circuit.

Wiring supplies

Once you've arrived at a feasible layout, you may decide to do the wiring work yourself. After you've obtained a permit (check with the building desk at your local city or county planning office), you'll need to purchase the following items: cable, circuit breakers, outlet boxes and outlets with corresponding outlet covers. In addition, you'll need wire nuts to splice wires together, cable staples and clamps to secure wiring to walls and studs, and cover plates to conceal unused outlets.

The most convenient way to wire a non-commercial small shop is to use non-metallic sheathed cable (one popular brand is Romex). Such cable comes in a variety of gauges and configurations; 12/2 AWG (American Wire Gauge) has two insulated 12-ga wires—a black and a white one—along with a bare ground wire, all enclosed in a plastic jacket. For 220v runs up to 15 amps, the same cable comes in 12/3 AWG. This has an additional red insulated wire because 220v circuits require an additional hot wire. For wiring circuits to handle even larger loads, you'll want to use 10/2 AWG or 10/3 AWG, which contains higher-capacity 10-ga wire. When calculating the amount of wire you'll need, be generous. Allow enough at the breaker box to reach any area inside, and allow an extra 6 in. at each outlet (both going in and coming out if the wire will feed subsequent outlets). Finally, add a few feet to each circuit run because when installed, the cable will dip and sag and, therefore, the required length will be a little more than the measuring tape revealed earlier.

Generally, when wiring with 12-ga cable, plan to buy a 20-amp breaker for each new circuit. To determine the type of circuit breakers you need, check your breaker box (breakers that fit one make of box won't fit another). Although they're considerably more expensive, you might wish to install special Ground Fault Circuit Interrupter (GFCI) breakers on circuits that take power outdoors or to damp areas. These have a special circuit that trips the breaker to prevent electrocution any time there's an improper leak of electricity to ground. If you have an older home that has a fuse box instead of circuit breakers, you'll probably have to hire an electrician to upgrade the entire system.

The type of outlet box you choose will depend on the walls of your shop. If you have exposed studs, buy the boxes—either metal or plastic—that come with nails attached for hammering them onto the studs. If the walls are finished, you will need boxes that have

What about extension cords?

To gain a few extra feet of mobility while using a portable power tool, you might be tempted to use a short extension cord, like the one the bedroom lamp plugs into. But all extension cords are not created equal. If you use the wrong cord, you can damage your tool or even burn down your shop.

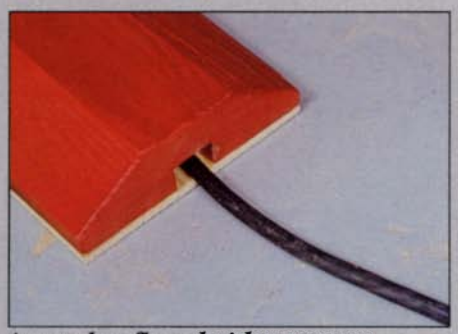
There are two major things to remember when selecting an extension cord: wire size and cord type. The chart on this page shows common wire sizes and their current carrying capacity and cord types. The amount of current your tool uses will be noted on its specification plate. If it is listed in watts instead of amps, just divide the number of watts by the tool's voltage to determine the amps. Using a wire smaller than what is needed for your tool can cause the tool and cord to overheat. And if there is a worn spot in the cord, excess heat will find it fast. A burnout in the cord can start a shop fire while a burnout in the tool means costly repairs. The rating for cord type—heavy, medium or light duty—should be printed on the cord's jacket; if it is not, assume that the cord is an SPT-1 or SPT-2. Cords not rated for exterior use should not be used in wet conditions or strong sunlight.

Once you have selected the cord you need, buy the proper plugs and connectors. They should be rated for at least as much current and voltage as the cord and be sized to fit the cord. Twist-style connectors are often a good choice for running portable power tools, especially if you work on a ladder where the tool coming unplugged is inconvenient or dangerous. Wire the plugs in the same configurations as the outlets that feed them.

If you plan to run an extension cord to a bench or stationary tool, you must route it carefully and secure it to walls and ceilings properly. Avoid passing the cord over any sharp or narrow edges that could cut through the insulation. Keep the cord in place with either insulated cable staples or support loops made in sizes to fit most cords. Do not bend the cord over nails since this often results in broken wire strands within the cord, which you cannot see.

Extension cords are a common culprit for trips and falls in home shops. If you must pass an extension cord across a walkway at floor level, make a simple wooden bridge, as shown in the photo on this page, by ripping a 30° bevel in both edges of a board that's at least 4 in. wide. Then, plow a dado on the underside to act as a raceway for the cord. To make the bridge more visible, paint it bright red or yellow.

—*G.B.*



***A wooden floor bridge** protects an extension cord from damage while preventing shop occupants from tripping over it.*

Extension cord amperage ratings

Wire gauge	Amps @ 50 ft. cord	Amps @ 100 ft. cord
18	10	7
16	13	10
14	15	13
12	20	15
10	30	20

Extension cord types

Cord type	Applications	Duty rating
SPT-1, SPT-2	Lamps, small appliances	Light*
SPT-3, SJ, SJT,	All purpose	Medium†
SJEW-A, SJOW-A, SJTW-A	All purpose weatherproof	Medium†
S, SE, ST	All purpose	Heavy‡
STW-A, SOW-A, SEW-A	All purpose, weatherproof	Heavy‡

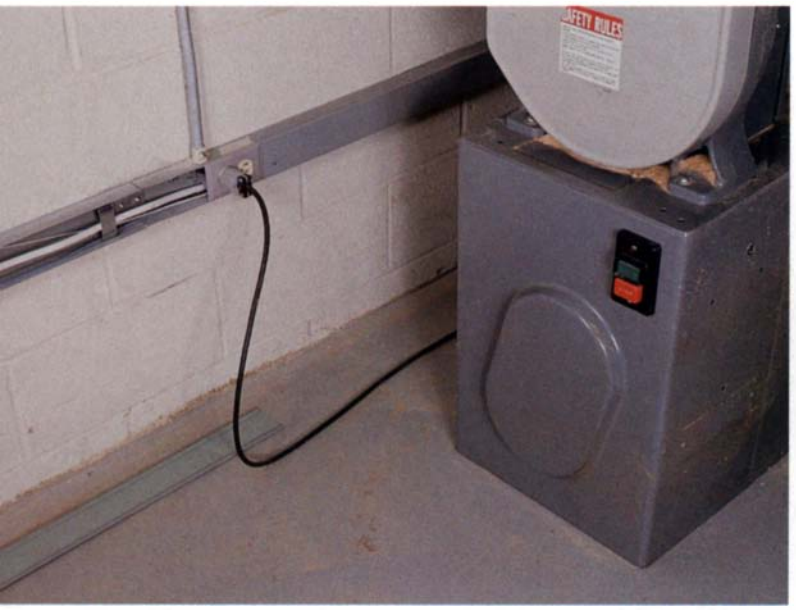
* Cord should not be moved, stepped on or abused.
† Cord can be moved around on smooth surfaces; it can withstand some abuse.
‡ Cord can be dragged around, stepped on, etc.

pinch-type grabbers that lock into the paneling on dry wall. For cement or masonry walls wired with either a flexible or rigid conduit, you'll need metal boxes with ½-in. knockouts. Some 220v outlets require special boxes, so make sure you get one that matches your outlet. And since there are many styles of outlets available, make sure they match the correct voltage and amperage for the application. Most 110v tools use standard three-prong outlets. Twist-style outlets that prevent plugs on overhead outlets from falling out are available for either 110v or 220v plugs.

Wiring the circuits

The best way to install and wire your outlets depends on the construction of your shop and variations in your local electrical codes. In a shop with unfinished walls (exposed studs), first nail the outlet boxes according to your layout drawing. To rout the cables, you must drill a hole through each wall stud between the breaker box and the outlet (a ½-in. hole is about right for 12-ga cable). Routing cables across the ceiling, through the joists will save wire, because you can pick the shortest route to the desired outlet. When running the wire through wall studs, place holes 4 in. to 6 in. above or below the outlet boxes, and center them to prevent the cable from taking a screw or nail when the walls are sheetrocked. Wherever the cable must go around a corner, drill three holes: one into the face of each of the corner studs on the adjacent walls, and a third drilled diagonally into the corner to intersect the other two. This last hole cleans up the inside corner created by the first two holes, allowing the cable to round the turn. When routing the cable down the length of a stud or joist, keep it centered and staple it about every 3 ft. Feed each circuit's cables through the holes and into the boxes. Secure each cable with a staple near the hole before going on to the next box. Leave at least 6 in. hanging out of each outlet box, and leave enough cable at the source end of each circuit to go into the breaker box, but don't put it in for now.

If you have finished walls, you'll need to rout wires into the walls by drilling down from the attic through the top plate or up from the basement or crawl space through the bottom plate. If you have concrete or masonry walls, you'll have to install conduit or some type of surface-mounted raceway for the wires. Raceway systems, such as the one in the photo at left, cost many times more than conventional wiring but are convenient and flexible. If you choose a raceway, be sure to check the system's current capacity: Many raceways are designed only for home or office use with low-amperage items like lamps or computers.



A raceway is a practical way to run new outlets along a concrete wall. *By removing the metal cover, as shown here, new circuits can be wired and outlets moved or added at any time.*

An overhead outlet brings power to a tool that's located away from a wall, *and eliminates the need for the cord to run across the floor where it might be in the way. Special strain-relief hardware (see the detail) secures the drop cord, and twist-fitting plugs and receptacles on the cords keep plugs from falling out.*

Installing the outlets

With the cables in place, you are ready to strip the ends of the wires and install the outlets. Outlets normally have a strip gauge molded into the body to show how far back to strip the wires, but if not, strip the wire ¾ in. Wire each outlet as specified on its package, or check a basic wiring guide. On a three-prong 220v system, the white wire may not be used; if not, fold it back out of the way as you install the outlet (do the same with that wire in the breaker box). After wrapping the wire around each screw and tightening it, install the outlet by folding the wires accordion style. Finally, install the outlet plates or covers. Cords dropped from overhead boxes require special strain-relief hardware, as shown in the photos at left.

Installing the breakers

The last step to completing your new circuits is to install the breakers. *First, make absolutely certain the power to your box is off. If you're uncertain about this (or any other step), delegate the job to a professional electrician.* After removing the cover, snap the new breaker in place. Next, you'll need to punch out appropriately sized knockouts in the breaker box to allow the cables to be routed in. Feed the cables into the panel, pull them snug and tighten the cable clamps at the knockouts. Now strip the ends of the wires and connect each circuit: The black wire goes to each corresponding breaker (black and red on 220v circuits), all white wires attach to the neutral bar and ground wires normally go to a separate bar. Put the cover back on the breaker box, and turn off all the breakers. Then with the main power on, turn each circuit on one at a time. This will tell you immediately if there's a problem, such as a short, and which circuit it involves. Now you're ready to test the outlets, and get back to your woodworking projects. □

Grant Beck is an electrical engineer in West Jordan, Utah.

Clamping with Wedges

Tapered pieces can clasp or cleave

by Percy W. Blandford

Like many woodworkers, I have found myself needing more clamps than I owned. Because of that, I began to use wedges as clamps, much like medieval artisans and builders who didn't have any alternatives. Thanks to my early boatbuilding experience, I learned how useful clamping with wedges can be and have since been able to apply wedge-clamping techniques to all my woodworking. And of course, cutting wedges from scrapwood is cheaper, and in some cases simpler, than using expensive metal clamps. In this article, I will discuss the most useful wedge-clamping methods I have employed, but first, I'll explain some basic wedge principles.

Wedge actions and properties

Whether you realize it or not, every time you drive in a screw or thread a nut onto a bolt, you are using wedge action. The threads of a screw or bolt can be considered a wedge of considerable length wrapped around a cylinder (see figure 1). If the thread is unwound, you get a long wedge with a very shallow slope (angle). Because of this, screws and bolts rely on many revolutions to advance themselves. But due to its shorter length, a plain wedge requires a steep angle to advance an object appreciably.

Optimum wedge angle is hard to calculate. A steep-angle wedge produces more movement, but requires more driving force. Plus, steep-angled wedges are more likely to slip than shallow-angled ones. Most of us rely on experience to choose a wedge's angle, but for most clamping operations, a wedge that rises about 1 in. in 6 in. makes a good choice. Cabinetmakers might compare this with the average dovetail pitch of 1 in 7.

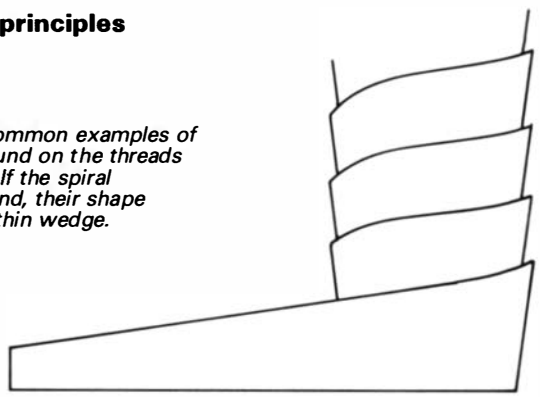
A wedge's surface is also an important consideration. On the one hand, a wedge with a saw-cut surface has friction to resist slipping, which is good for clamping applications, but it is not as easy to drive as a wedge with a planed surface. On the other hand, a wedge that is meant to be removed periodically, such as those that are used in knockdown joinery (see the sidebar on p. 65), should have a smooth surface. And for a very slippery surface, naturally oily woods, like teak or lignum vitae, can be used to make self-lubricating wedges.

Single vs. folding wedges

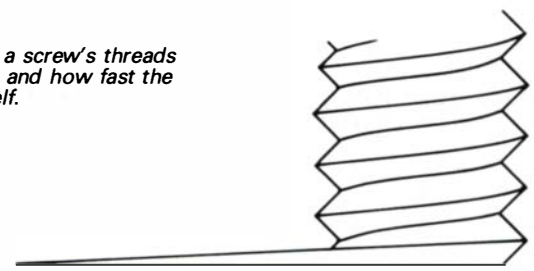
For most clamping operations, you can choose between two types of wedge arrangements: a single wedge or folding wedges. When you drive a single wedge, as shown in figure 2A on p. 64, the movement is mostly in one direction toward whatever the wedge bears against. But single wedges can cause problems because there can be some lateral movement as well. When you need to exert pressure perpendicular to a wedge's base without causing lateral movement, you can use a pair of folding wedges (see figure 2B) that have the same shallow slope, rather than using one steep wedge. By driving each wedge in turn, you get a good thrust (preferably against a pad to protect the workpiece), with much less sideways force exerted. Since the two bearing surfaces are parallel, the action is like a screw-action clamp, but with a little improvisation, you can get into places that won't allow for conventional clamps. Figure 2B shows how folding wedges are used to edge-glue boards. Just screw or nail a block down, put pads against the work and tighten with folding wedges. Place the pads so the wedges will start with an overlap of about 2 in. on the thin ends. The thickness of one or both pads can be altered to suit the wedges, and usually, 6-in.-long wedges are adequate. By using

Fig. 1: Wedge principles

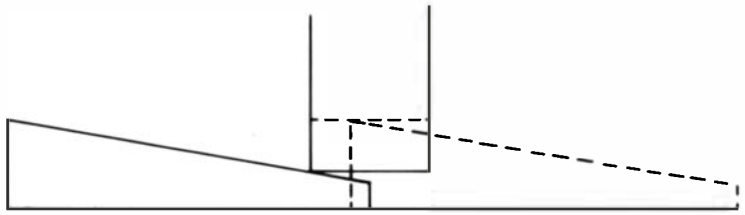
One of the most common examples of wedge action is found on the threads of a screw or bolt. If the spiral threads are unwound, their shape resembles a long, thin wedge.



The pitch (slope) of a screw's threads determines how far and how fast the screw advances itself.



Similarly, the slope of a wedge governs the amount and rate that an object will be moved. The slope also influences how easily the wedge can be driven.



Drawings: author

wedges with blocks secured to deck framing, similar tightening can be achieved when laying down boat planking or house floorboards.

Wedges as bar clamps

The simple wedge action described previously will work for many clamping operations. However, when gluing up boards to make a tabletop, or other wide panel, there is a risk of the boards bowing or popping up. To remedy this, you can make a bar clamp with battens on the top and bottom to obtain even pressure and to keep the boards flat, as shown in figure 2E. A series of holes in the battens allows them to be used on a variety of jobs. Pressure can come from a single wedge or a pair of wedges at one or both ends. Another type of bar clamp can be made by knotting a piece of rope around whatever has to be compressed and driving a wedge under the rope at each side (see figure 2F).

Wedges in other clamping applications

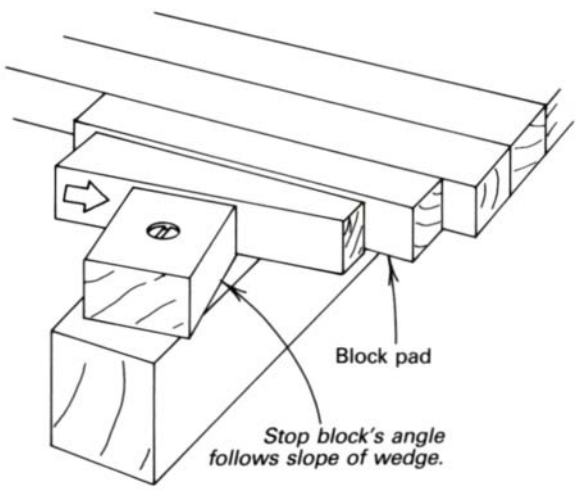
Because they can be sized and placed to fit the situation, wedges are particularly well suited for specialty-clamping jobs, such as large bent laminations. As shown in figure 2D, cauls can be cut to match the shape of the desired bend, and wedges can be used to force the laminates against a form that is mounted on a baseboard. With a little ingenuity, specialty clamps can be fashioned for other projects, too. For instance, in traditional clench-built or lapstrake boats, the overlapping planks need to be clamped a good distance in from an edge. For these clamping jobs, I make a simple, long-reach clamp (see figure 2C) that consists of a couple of boards bolted together. A thick wedge driven into one end forces the other end tight. Usually, I locate the bolt at the center, but positioning it towards the wedge can increase the clamp's leverage.

This is just a sampling of how wedges can be put to work around the shop. In addition to the more familiar wedge uses, like jacking structures, moving heavy objects, plumbing door casings or leveling machinery, there are many other wedge-action possibilities. So keep wedges in mind the next time you need an extra pair of hands, or you're confronted with a challenging clamping job. □

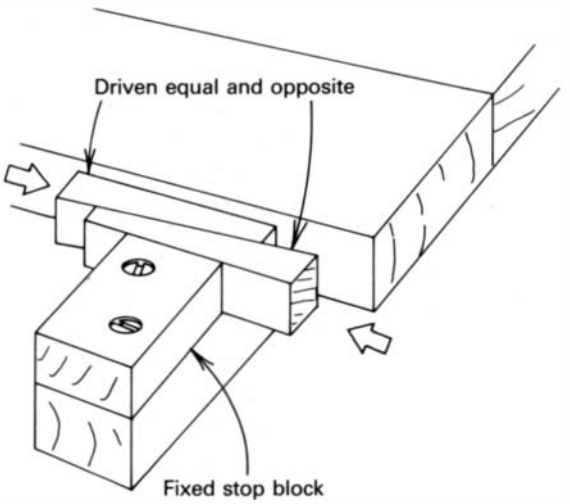
Percy Blandford lives in Warwickshire county in the U.K. and has been designing boats and writing about woodworking since the end of World War II. All the drawings are by the author.

Fig. 2: Wedges in clamping applications

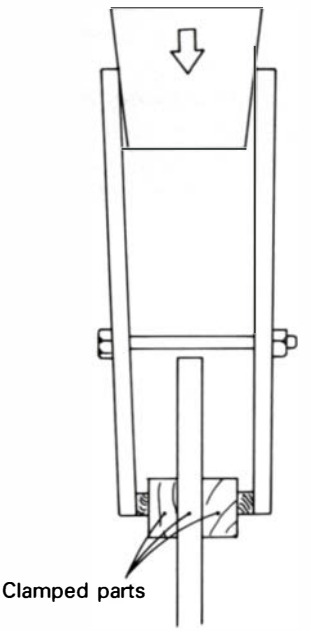
A: Single wedge



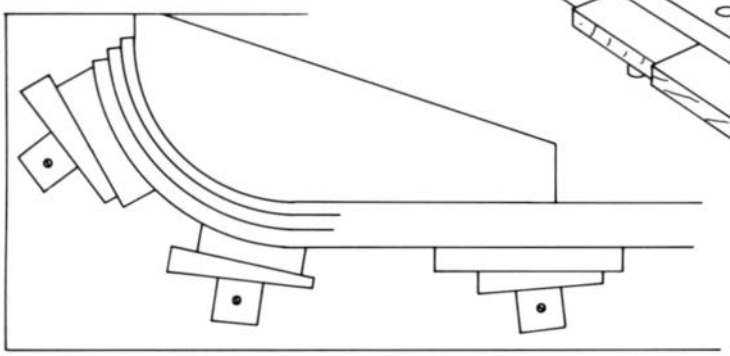
B: Folding wedges



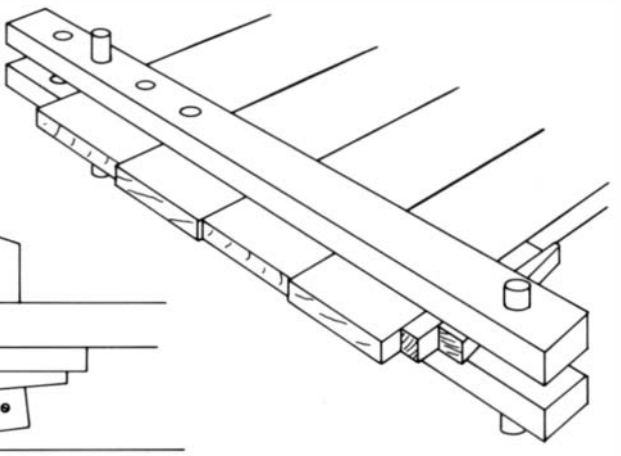
C: Long-reach C-clamp



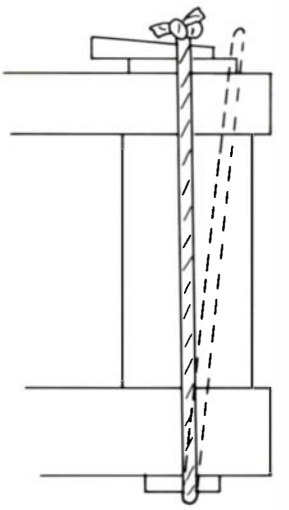
D: Steam-bending form (plug and caul), or bent-lamination clamp



E: Adjustable batten as bar clamp



F: Rope loop as bar clamp



Integral wedges enhance joinery and ease assembly

Most woodworkers are familiar with wedges that lock tenons in mortises. The wedged through-tenon and the diagonally wedged square tenons, shown at right, are common examples. These drawings also show other types of wedges or tapered pins that are integral parts of a joint and that aid assembly (or disassembly) as well. I will briefly describe the wedged joints shown here and give you a few tips for applying them.

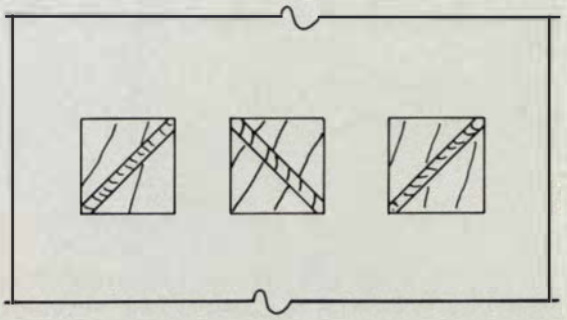
The strength of a **wedged through-tenon** is increased by enlarging the outside of the mortise so the tenon can spread, as shown in the drawing. To reduce the risk of the tenon splitting, drill small holes at the ends of the wedge kerfs. When you're using **diagonal wedges**, locate the mortise away from a component's end to avoid splitting out the mortise stock's long grain.

For joints that have to withstand considerable stress but do not need to be disassembled, **blind wedges** can be used within a stopped mortise. Flair the mortise by undercutting the sides as shown, and use short wedges with a steep taper. Experiment with the mortise taper, the wedge size and the kerf width to ensure a tight joint.

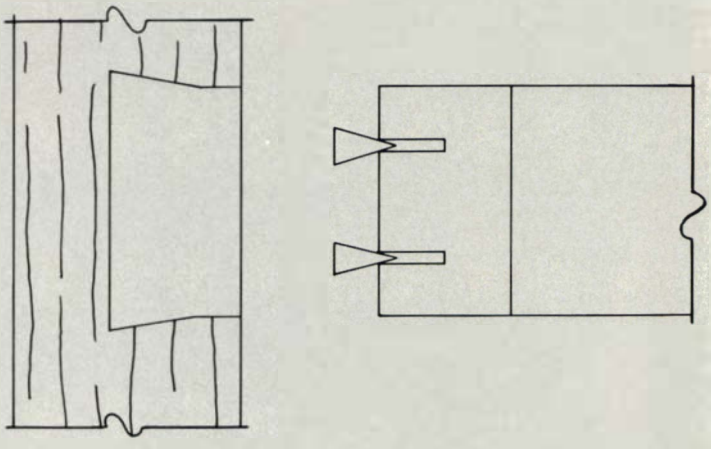
Timber framers and furnituremakers often use **offset pegged tenons**. On these joints, wedge-shaped draw pins pull the tenons tightly into their mortises because of offset holes in the tenon and mortise stock. First, drill through the mortise stock. Next, mark a corresponding hole in the tenon, but offset it toward the shoulder; about 1/16 in. for close-grained hardwoods, and 1/8 in. for softwoods. Now, taper one end of your dowel pin and drive it through the assembled joint, as shown. The wedge action of the pin will draw the tenon shoulder tight. When the dowel's full cross-section is through the joint, cut off the surplus.

Removable wedges (or pins) for knockdown joinery can be plain or decorative, and they can go through square or turned parts, as shown. Make sure there is plenty of extra tenon length beyond the wedge hole, since there can be considerable thrust on a small amount of short grain. Undercut the hole just enough so the wedge won't bottom out, but will push against the surrounding wood. When you make the wedge, allow for shrinkage (you can always plane a shaving off later), and leave it long as well. Removable wedges for wooden tools can be fashioned in a similar way. If you use a shallow slope (1 in 8 or 9), wedges can usually be tightened or loosened by hand. —*P.B.*

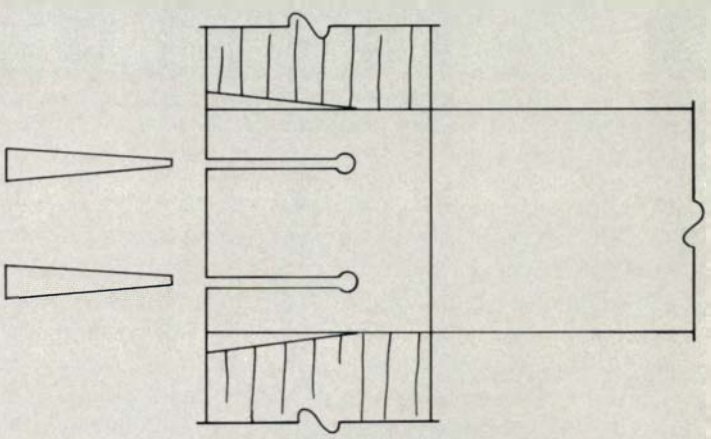
Diagonal wedges



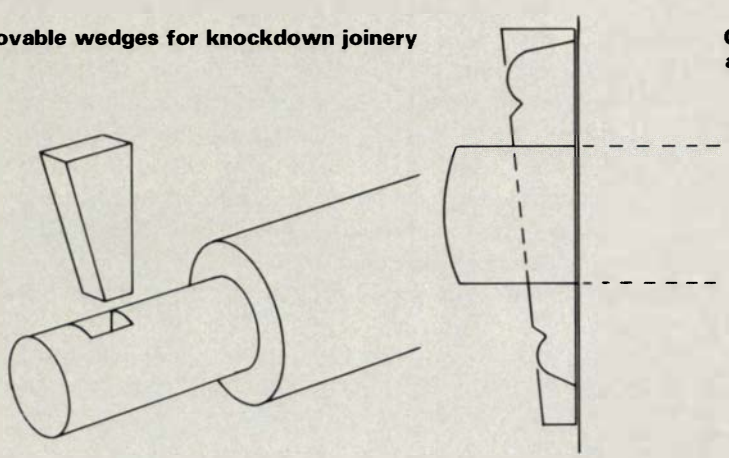
Blind wedges



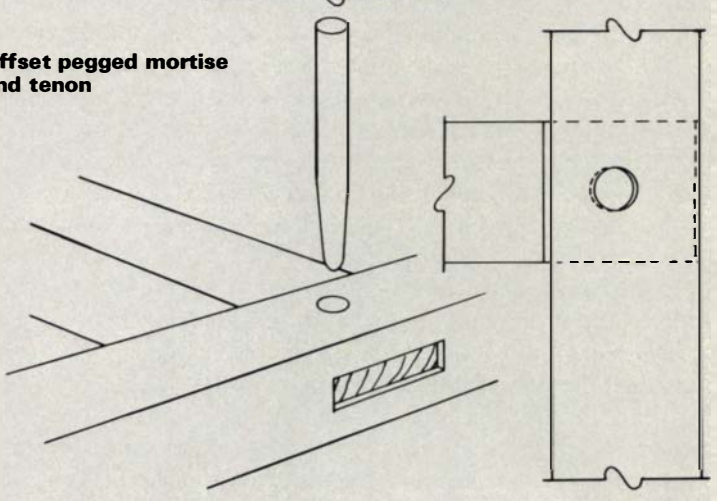
Wedged through-tenon



Removable wedges for knockdown joinery



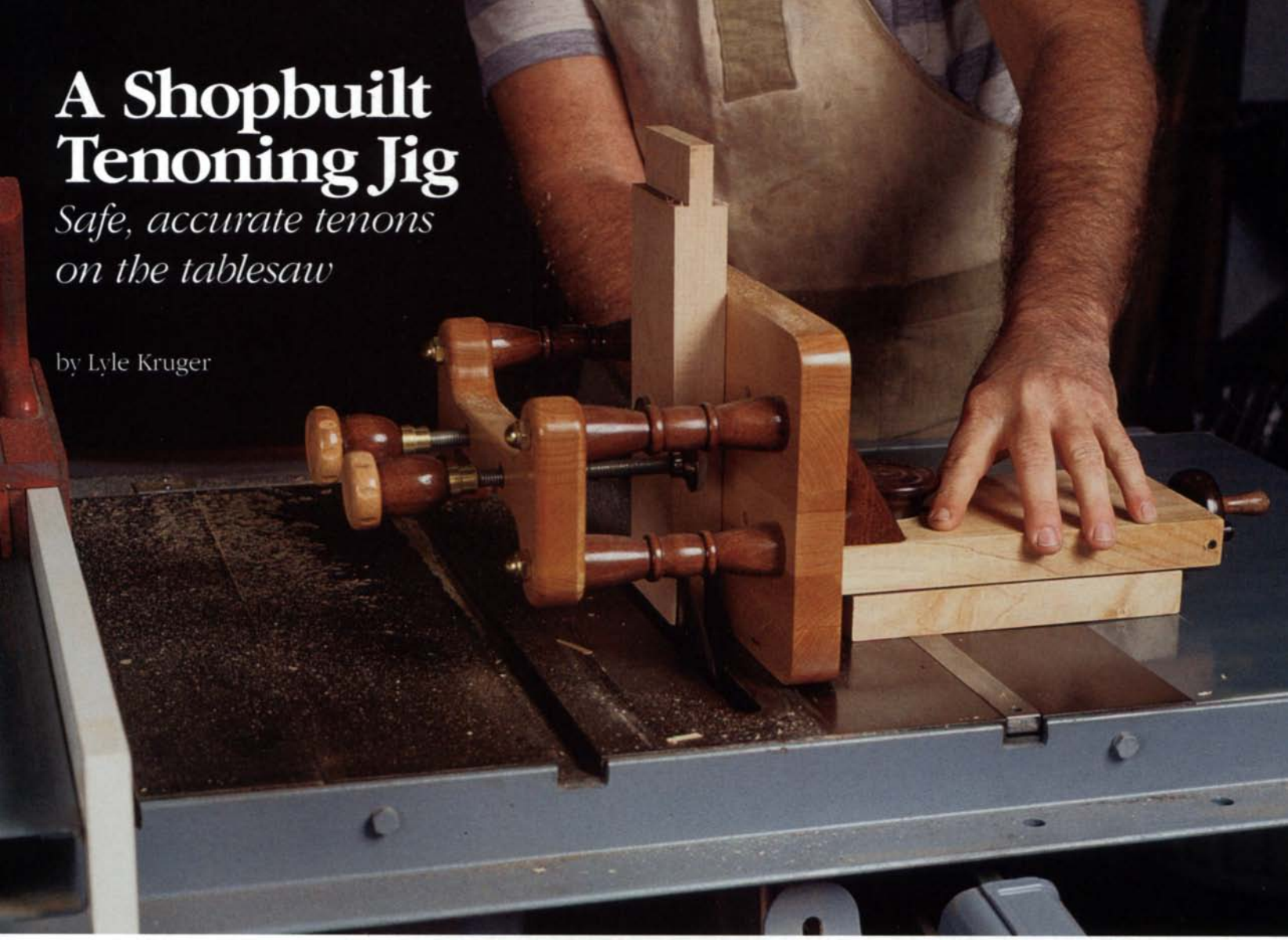
Offset pegged mortise and tenon



A Shopbuilt Tenoning Jig

Safe, accurate tenons on the tablesaw

by Lyle Kruger



***Accurate, consistent results are virtually guaranteed** with this sliding tenoning jig. With the workpiece securely clamped to the face of the jig and the face perpendicular to the table, precisely parallel tenon cheeks are cut easily and safely.*

Cutting tenons on the tablesaw is a quick, efficient way to get the job done. However, trying to slide a long, narrow frame member on its end by the sawblade can be risky. And keeping the rail or stile perpendicular to the table, which is necessary if you're to obtain parallel cheeks, isn't a given either—even with a high auxiliary wooden fence.

To address these problems, I decided to build a sliding tenoning jig, as shown in the photo and the drawing. Although it looks fancy, the jig is a simple affair. Besides, I see no reason why the jigs and fixtures we create for our tools can't be heirloom quality, like the old planes we love to collect. The jig consists of two maple halves, with walnut strips glued into V-grooves in the top half. The top half slides on these ways against the bottom half to adjust the tenon's thickness. A butcher-block face, glued and doweled to the top half of the base and to triangular walnut brackets, provides support for the workpiece, and a clamping assembly holds the workpiece in place. This jig allows me to cut tenons safely, quickly and with a much greater degree of precision than I could freehand.

What follows is a brief description of some of the key steps in building the jig. I'll focus on the more critical aspects of the construction and let the drawing provide basic information. If you build the jig, size it to accommodate the type of work you plan to do and to fit your own saw. The placement of the bottom half of the jig with respect to the miter-gauge slot depends on the distance between slot and blade on your saw. On my tablesaw the blade is 4⅜ in. from the miter-gauge slot, so I positioned the bottom half of the jig so that the face of the jig when fully retracted is 2⅛ in. from the blade. This is the largest shoulder I can leave with my jig. Since I'm mainly using it for frame-and-panel work, this is more than adequate.

The heart of my jig is the ⅜-16 threaded rod to which I epoxied a T-nut set into the center of a walnut handwheel. Because the threaded rod has 16 threads per inch, turning the handwheel advances or retracts the top half of the jig with micrometer-like precision, moving the clamped workpiece closer to or further from the blade at a rate of 1/64 in. per quarter turn. To make precise incremental adjustment possible, I cut four shallow notches in the handwheel. These notches, 90° apart on the wheel, capture the spring-loaded detent to the left of the wheel, indicating the 1/64-in. increments. I could have cut eight notches into the handwheel, but it's easy enough to approximate position between notches if any slight adjustment is necessary.

The threaded rod passes through a copper thrust plate that's screwed into the top half of the sliding portion of the jig. The threaded rod is held in place by the thrust plate, which is captured between the handle's T-nut and a ⅜-in. nut. The nut is fitted snug against the back side of the thrust plate and pinned to the threaded rod. The fit of this nut against the thrust plate must be loose enough to allow the threaded rod to turn freely but without any play that would compromise the accuracy of the movement.

Ways and means

When the jig is properly adjusted and the locking knob is clamped tight, the sliding walnut ways keep the body of the jig from racking or twisting, thus ensuring alignment of the workpiece to the sawblade–assuming, of course, that both the face of the jig and the blade have been made parallel to the miter-gauge slot.

The walnut ways must be exactly square, however, or the jig will rock back and forth. Achieving this squareness on such small stock proved a little tricky. Using a jointer or planer would have been dangerous, and the ways weren't dead-on coming off the tablesaw. To solve the problem, I made a small but effective vertical thickness sander by clamping an auxiliary fence to my drill-press table ⅜ in. from a 3-in. sanding drum. If you're trying to take off a good bit of wood, you should start with the fence set back from your final dimension, and move it in incrementally.

I wanted the walnut ways attached to the jig rather than free-floating, so I glued them to the top half of the jig. To prevent the exposed portions of the ways (and the corresponding grooves) from being coated with finish when I sprayed the jig, I covered them with masking tape. Wood on wood generates far less friction than plastic on plastic.

A couple of caveats, a bit of hindsight and a tip

To achieve consistent, precise results, the face of the jig must be perpendicular to the saw's table; it's essential, therefore, that the two triangular walnut brackets that support the fence be cut at exactly 90°. Care must also be taken during assembly to ensure that the lower half of the jig is mounted in such a way that the face of the jig is precisely parallel to the sawblade. And finally, though it may seem obvious, you should position the bottom T-nuts on the face of the jig (used to secure the workpiece clamping assembly) high enough so there's no danger of the blade hitting the threaded rod that passes through the clamping-assembly spindles.

I constructed the top half of the body from one piece of 1-in.-thick stock. In retrospect, I realize that it would have been much easier to have made this part by gluing together two pieces of ½-in. stock after routing the mortises for the guide block and the spring-loaded detent. Instead, I had to bore the detent's mortise on a drill press with a hollow-chisel mortising attachment and rout the guide-block mortise nearly 1 in. deep.

You can expand the versatility of this tenoning jig by putting extra T-nuts in the back of the face for future add-ons. For example, by adding a 45° plate (a clear-acrylic drafting triangle, drilled and mounted on the jig's face with spacers), you can cut mitered tenons for picture frames and small boxes. If you have a miter-gauge slot in your router table, you can also use the jig for mortising or for routing dovetail-splined corners. □

Lyle Kruger is a professional land surveyor and an amateur woodworker and metalworker in Effingham, Ill.

Sliding tenoning jig

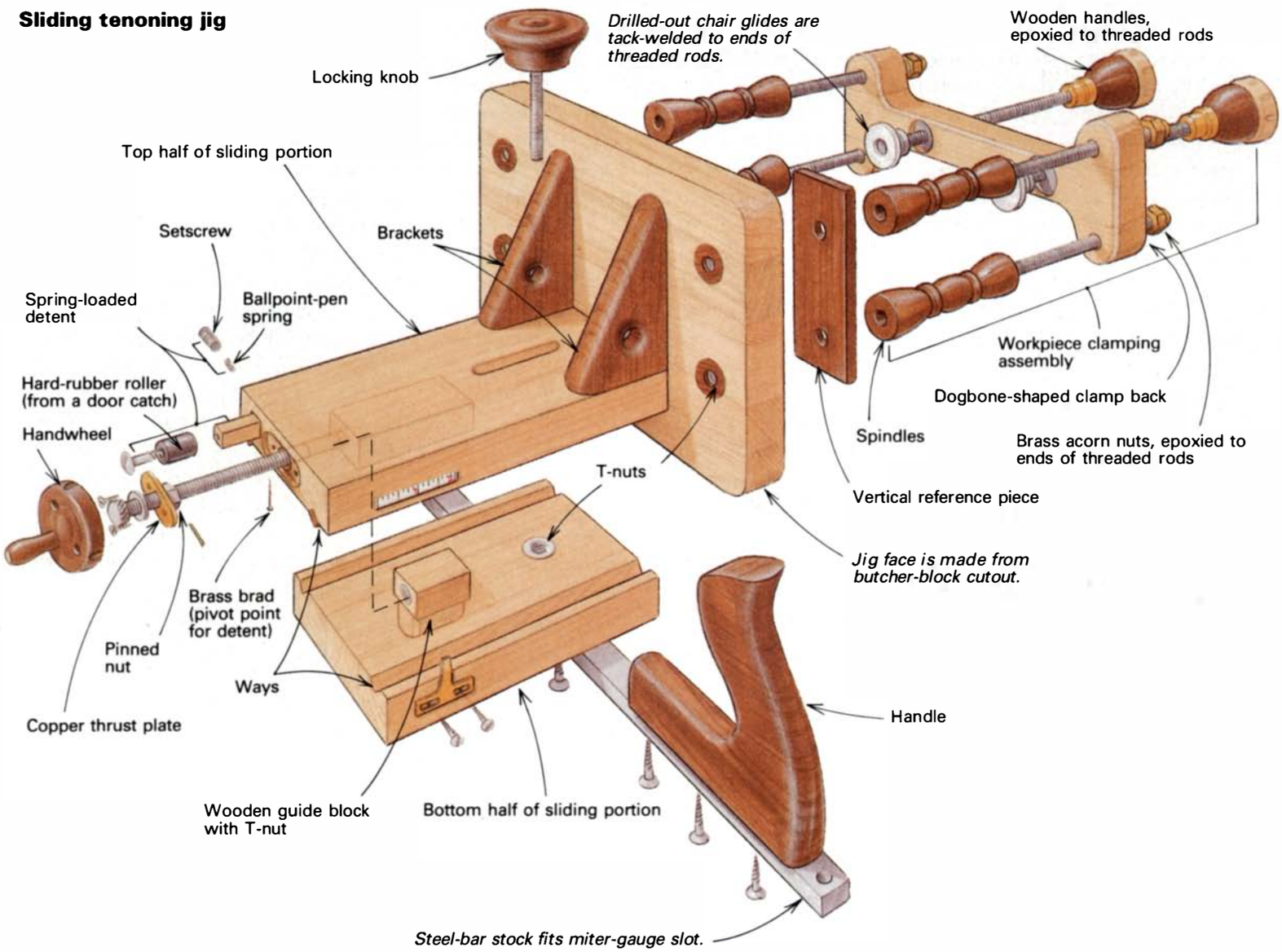


Photo: Dick Burrows; drawing: Bob La Pointe

Convertible Furniture

Tables designed to lead dual lives

by Edward R. Monteith

Some pieces of furniture literally work. The tambour of a rolltop desk, or even a rocking chair, allows—or perhaps even demands—human interaction. Similarly, but in a more subtle manner, the game table, shown in the photos on the facing page, and the spinet desk on p. 71 are hard workers. Both perform double duty and do so gracefully, but unlike a rocker or a rolltop, they hide their alter egos. Perhaps the element of surprise is partially responsible for my satisfaction in owning them; when visitors comment on my hall tables, they're fascinated and drawn in by the transformations that occur. Designing and building these tables was satisfying as well. In describing them, I'll provide you with the critical concepts and relationships that make these pieces of furniture work, so you can build similar pieces that suit your particular needs.

An expanding game table

Annoyed for years by a card table that swayed like a tall pine in a gale, I had often considered building a sturdier model. In addition, I was fed up with having to burrow through an overstuffed coat closet to drag out my old folding table. And I wanted a table that provided more playing surface than standard models but didn't dominate my living room.

During a visit with friends, an 18th-century Dutch game table caught my eye. Its rails folded on two sides, allowing it to transform from a full-size card table into an attractive side or occasional table that's only half as large. Even though the Dutch table was more than 200 years old and the hardware was somewhat worn and loose, it was still remarkably sturdy. I decided to try my hand at building a similar table. Rather than using reproduction hardware, I substituted contemporary, precision hardware (for a far sturdier table), and I adjusted the size to fit my needs. Since that first effort, I've built two more of these tables (see the photos on the facing page). The actual construction was relatively straightforward, but the design required a bit of thought.

Dividing up the folding rails—The most critical aspect of the design was determining the lengths of the various pieces of the folding rails. Figure 1 (see the facing page) illustrates the requirements for the folding rails. I found it easiest to work backward from the desired final dimensions of the tabletop. On the basis of comparison with existing card tables, I decided to build my table 34 in. sq. when open and half that width closed. A 2¼-in. overhang all around gave me a base that's 29½ in. sq. when open and folds to 12½ in. when closed. I arrived at these numbers unscientifically; the table's proportions when closed pleased my eye, and I knew it would provide plenty of space when open for cards, tea and such.

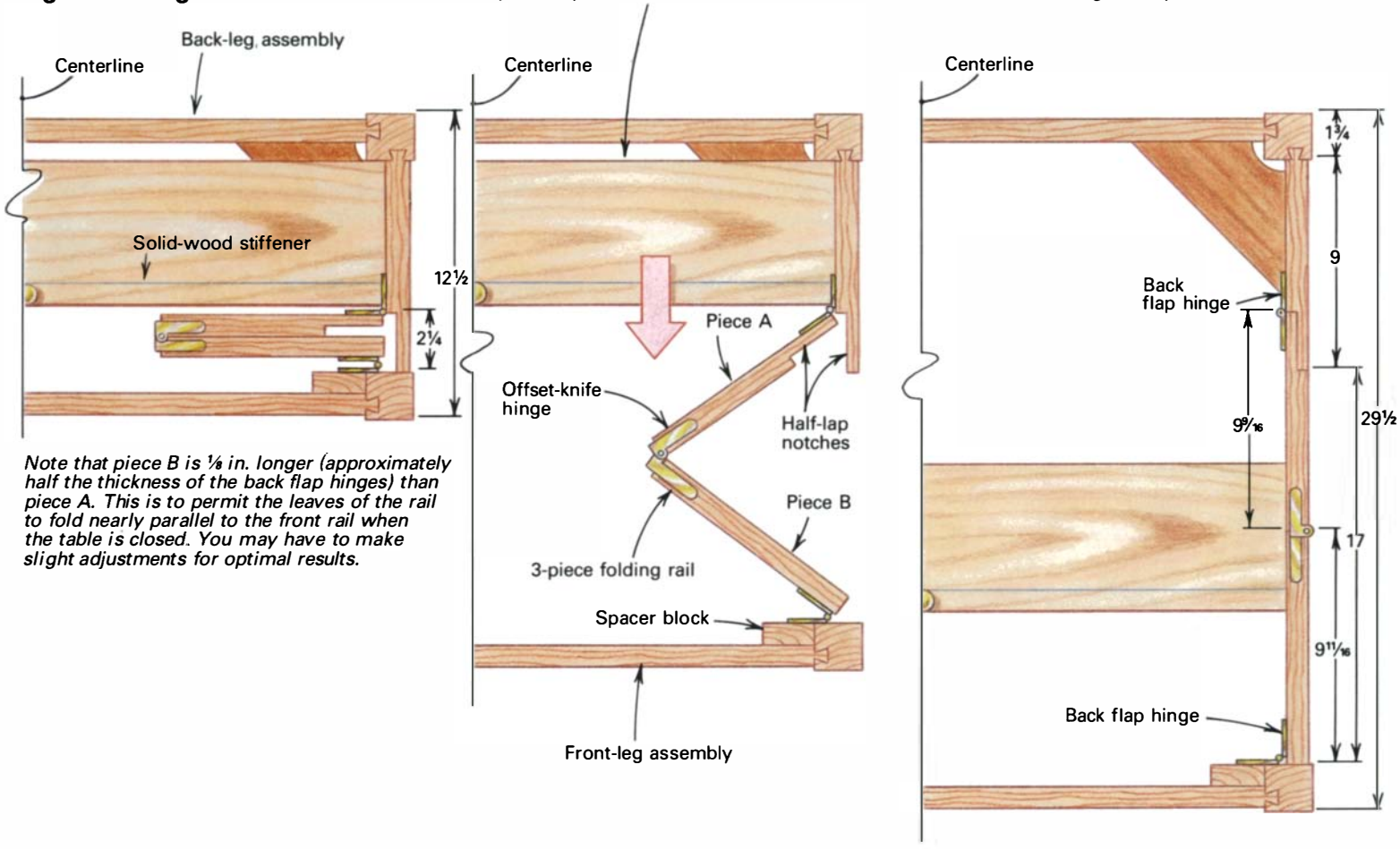
Having established these dimensions, I simply subtracted 9 in., the distance between legs when the table is closed, from 26 in., the length of the front and back rails between the legs. This gave me 17 in. as the correct overall length for the *exposed* portions of the two remaining pieces of each folding rail when the table is open (see figure 1). However, this is only the exposed overall dimension. A half-lap notch cut into the back rail piece and the corresponding notch cut into the middle rail piece hide the folded rails when the table is closed up and help stiffen the back-to-middle rail-piece joint when open. For the table to close properly, these notches must be long enough to accommodate the thickness of the two folding rail pieces and the front back flap hinge when folded (see figure 1). For my table, I cut the notches 2¼ in. long, which gave me a little play. Adding this 2¼ in. to the 17 in. gave me a total of 19¼ in. for the middle and front rail pieces on each side.

At this point, common sense might tell you simply to halve that number to give you the proper length for each of the remaining pieces of rail. You wouldn't be far off the mark. I've found, though, that cutting the front rail ⅛ in. longer than the middle piece prevents the folding rails from binding in the corner. This is because the back flap hinge isn't mortised into the front leg and spacer block, so the end of the front rail piece must extend past the center point of the hinge pin, if the rail is to butt up snugly against the leg (see the drawing at right). Therefore, the front rail piece must be ⅛ in. longer (the approximate width of a hinge leaf), if it and the middle rail piece are to fold parallel to the front rail and not bind.

Milling the parts and installing the hinges—Once I'd worked out these relationships, I felt comfortable beginning construction. I cut the leg blanks to 1¾ in. sq. by about 28 in. long, which left me an inch for trimming the legs to final length and removing chuck marks from the top ends after I'd turned them. I turned the legs and trimmed them to length. Then I cut the ½-in. sliding-dovetail mortises for the fixed front and back rails (and for the fixed back end of the folding rails) on my router table using wooden stop blocks and running a test cut on a piece of scrap first.

***A 200-year-old Dutch table** was the model for the author's interpretation, shown above and at right. An ingenious folding-rail system allows the table to do double duty as a simple hall table most of the time and as a game table when the need arises.*

Fig. 1: Folding card/side table



Note that piece B is ⅛ in. longer (approximately half the thickness of the back flap hinges) than piece A. This is to permit the leaves of the rail to fold nearly parallel to the front rail when the table is closed. You may have to make slight adjustments for optimal results.

Photos: Sandor Nagyszalanczy

When milling the rail stock, I left it slightly wide so that I could trim away any tearout along the edge that might result from routing the sliding dovetails. I then selected and routed the face side of all my sliding dovetails. I reset the fence for the other half of each dovetail, checked the cut on a piece of scrap and made some minor adjustments to get a good, snug fit in the dovetail mortises in the legs. Satisfied with my cut, I routed the back side of the dovetails on all rails. Before cutting the two folding rails into three pieces each, I routed dadoes near their bottom inside edges to accommodate the ¼-in. plywood spreader that slides forward and locks the rails open. I then cut each folding rail into three pieces, as described above, and marked them so that the grain on the rails of the assembled piece would be nearly continuous.

Proper hinge installation is as essential as is determining the requisite lengths of the folding rail pieces. I routed mortises for the offset-knife hinges that join the front and middle section on my router table, and then I cut the half-lap notches on the back and middle rail pieces. After installing the offset-knife hinges into the mortises, I mounted the back flap hinges on the overlapping back and middle rail pieces. It is essential that this hinge is mounted with its pin perpendicular to the top edge of the rail, so the rail won't bind and so the tabletop will sit flat.

Next, I glued and clamped the leg-to-rail dovetails. After they dried, I inserted the ¼-in. plywood spreader into the dado near the bottom of the rails and screwed the front pieces of rail to the front legs and to a spacer block. Again, it's very important that the hinge pins be perpendicular to the rails. After assembling the base, I cut and installed diagonal corner braces to keep the corners rigid.

Because I've found it easier to work with narrow boards when drilling deep mortises (like those required for the three Soss hinges I used to connect the two leaves of this tabletop), I ripped the innermost board of each leaf to about 3 in. wide and routed the mortises for the hinges before gluing up the leaves. Two hinges might have been adequate, but the third hinge should help prevent the leaves from warping. Once the hinges were installed, I glued up both leaves and finish-sanded them. The tabletop is attached to the base with a screw through each of the diagonal corner braces. The screw holes should be elongated to allow for cross-grain movement.

A spinet desk goes undercover

The first true spinet desks were made for school use in the 1830s by fitting cast-iron cabriole legs to melodeon cabinets (boxes which contained the innards of an organ-like instrument). The desk I used as a model was made at a later date, though, and is a simple box with a front panel hinged to a folding top. Turned wooden legs are attached to the box's bottom with hanger bolts, and the interior of the box contains a slide-out writing surface and pigeonholes for paper storage. Time has taken its toll on this piece, leaving it a bit wobbly, but the desk's ability to transform from utilitarian writing desk to demure hall table captivated and inspired me (see the photos on the facing page).

I wanted to build a similar piece that retained the style and character of the original, but was more stable. I accomplished this by using sliding dovetails (as on the game table) for all leg-to-rail joints except for the front fascia piece, which I tenoned into mortises in the front legs (shown in figure 2 on the facing page). I also wanted a larger writing surface that would be more suitable for adults, so I increased all dimensions of the piece proportionally. The resulting piece is a simple, yet elegant desk, and the writing surface (and any attendant mess) can be hidden in a moment by pushing it in and then folding the top down.

Assembling the desk—The drawing on the facing page shows the desk's construction and the relationship of the parts. I first glued and clamped the back rail and legs and the front fascia and legs together; I let them dry, and then glued the front and back assemblies together with the side rails. Next, I screwed the cleats that support the writing surface all around the inside of the box. The cleats are flush with the top surface of the front fascia and the side cleats are notched to fit around the legs.

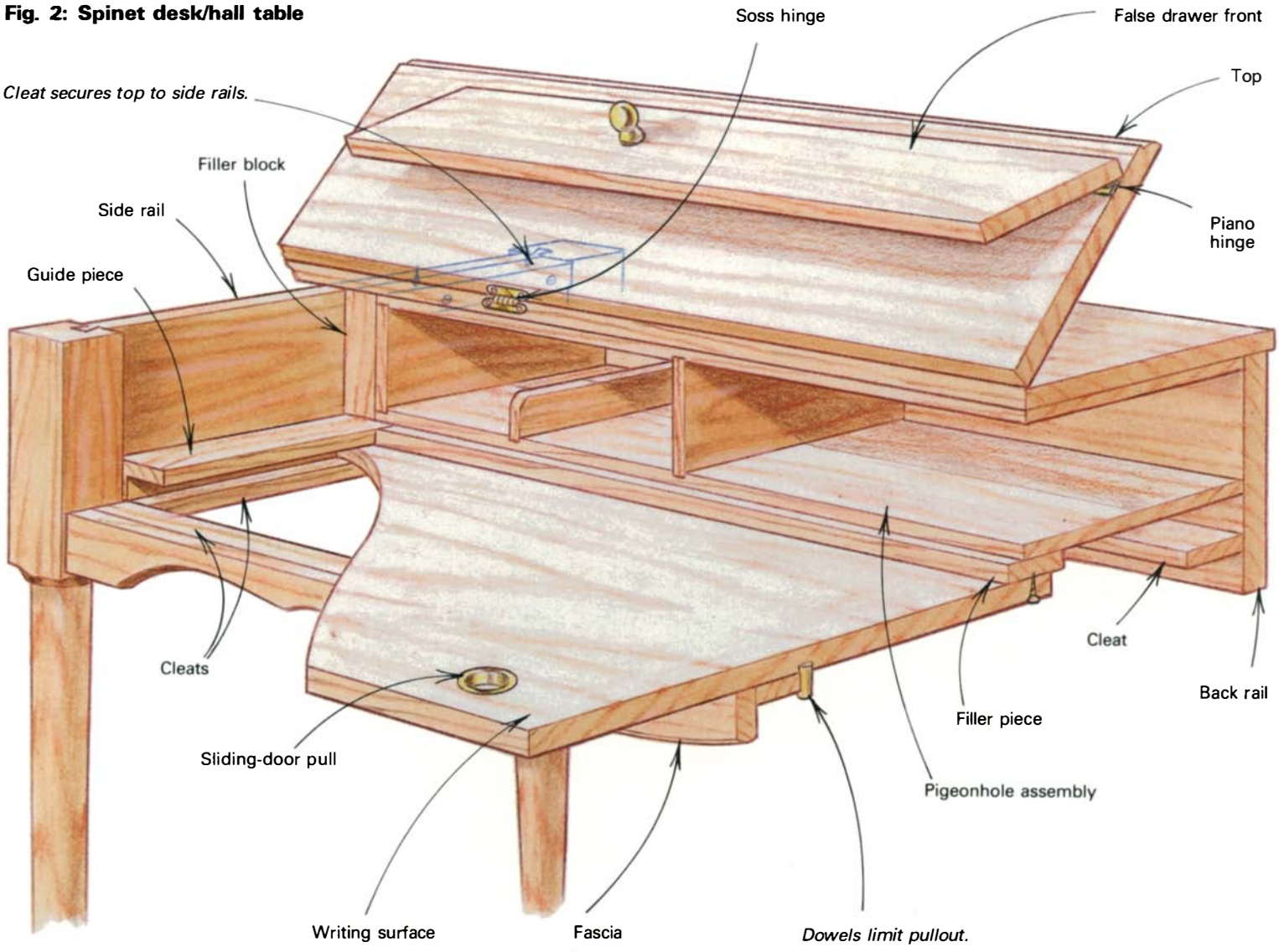
To fill the gap between the side rails and the inner surface of the legs, I glued and screwed L-shaped guide pieces (one piece of wood routed out) to the side rails. The guide's vertical arm comes just flush with the inside edge of the legs, and the horizontal arm extends beyond the legs to form a pocket between itself and the side cleats so that the writing surface can slide freely. These guides also support the removable pigeonhole assembly. I constructed the assembly from ⅜-in. stock and designed it to accommodate standard writing paper and envelopes as well as to provide miscellaneous storage. With the pigeonhole assembly in place on the writing surface guides, I measured for filler blocks on either side and for the top cleats, through which I screwed the back leaf of the folding top. The filler blocks and top cleats were screwed to the side rails through elongated holes to allow for wood movement.

I'd glued up the writing surface ahead of time so that it would be ready to trim to size when it came time to assemble the desk. I used a glue joint tongue-and-groove bit to rout the ends of the boards and the end caps, but I only glued the end caps to the main field of the writing surface in the middle, to allow for expansion and contraction. Now, with the box assembled and the guide pieces installed, I trimmed the writing surface to fit neatly between the front legs and to set back far enough to allow the false drawer front to close flush with the fascia. Two short dowels glued into the bottom of the writing surface, as shown in the drawing on the facing page, act as stops, and a brass sliding-door pull is mortised into the top. To fill the space between the pigeonhole assembly and the writing surface, I glued and screwed a narrow filler piece (about 1½ in. wide) to the writing surface so that it would protrude about an inch beyond the pigeonholes when fully open.

The top consists of two equal-width leaves joined with Soss hinges, like the top of the game table. To mount the top, I ran screws up through the top cleats at either side of the box and into the back leaf. Then, with the top closed, I marked the underside of the front leaf for the false drawer front, cut the front panel to fit and attached it to the front leaf with a piano hinge.

Ed Monteith is a hobbyist woodworker who lives in Pebble Beach, Cal. All the hardware used in the expanding game table and in the spinet desk was purchased from Woodcraft, 210 Wood County Industrial Park, PO Box 1686, Parkersburg, W. Va. 26102-1686; (800) 225-1153.

Fig. 2: Spinet desk/hall table



With the cover up, *it's a work station; with the cover down, it's a simple and unobtrusive table. This combination hall table/spinet desk helps to maintain order in the author's house. Although the design is based on an old school desk, Monteith sized the piece for himself, increasing all dimensions proportionally. The pigeonholes, too, were adapted for modern use to fit standard envelopes and stationery.*

***More than 5,000 hours of labor** went into this columbarium, designed by Gerald Harbinson and built by Century Guild of Durham, N.C. It's 9½ ft. high by 16 ft. long and contains 500 cremation urns. For this project, 100,000 bd. ft. of oak were picked through, and 3,500 pieces of custom hardware were made.*

From Artiture to Architure

Functional furniture with an architectural form

by Vincent Laurence

When Art Carpenter used the term *artiture* in 1983 (*FWW* #38) to describe art that looked like furniture, but was nonfunctional, he didn't intend it to be wholly disparaging. The term gained that connotation, however, as woodworkers who valued craftsmanship over cleverness came to disdain objects that *appeared* to be furniture and commanded exorbitant prices, yet had no practical value.

The four objects on these two pages (and the silver chest on the back cover) *are* all functional furniture and architecture as well. Furniture design has always borrowed from architecture: pediments, cornice and columns are as common on furniture as they are on buildings. But these pieces represent actual buildings, or portions of buildings—not merely details from those buildings. From Gothic to Modern, with a couple of stops along the way, here's a mini-tour of buildings as furniture—or is it *architure?* □

Vincent Laurence is an assistant editor at FWW.

Photo this page: Richard Faughn

"Hey mister, that's a pretty cool chair," *was one 6-year-old's response to Stephen Perrin's* Empire Chair. *His first piece as a professional furnituremaker (following 20 years as a graphic artist for television), the maple rocker has been featured in several magazine and newspaper articles and was on the cover of the invitation for a group furniture show. The base of the back is screwed through the seat, and four brackets of 6/4 stock are tenoned into mortises in both the seat and this base. The building's mass was then mortised 1½ in. into the base.*

Photo: Ryan Cohen

Photo: Michael Baciu

New York? Chicago? Los Angeles? *No, just an imaginary city according to Dave Rudolph, its maker. This table is one of five in a series called* 'E' Ticket *(as in the kind you get at a carnival) that depict frozen moments in the evolution of a city from the early 20th century (pictured here) to well into the 21st century. The 6-ft.-long tables, made of pine and finished in lacquer, now reside in a suite of offices in Beverly Hills, Cal.*

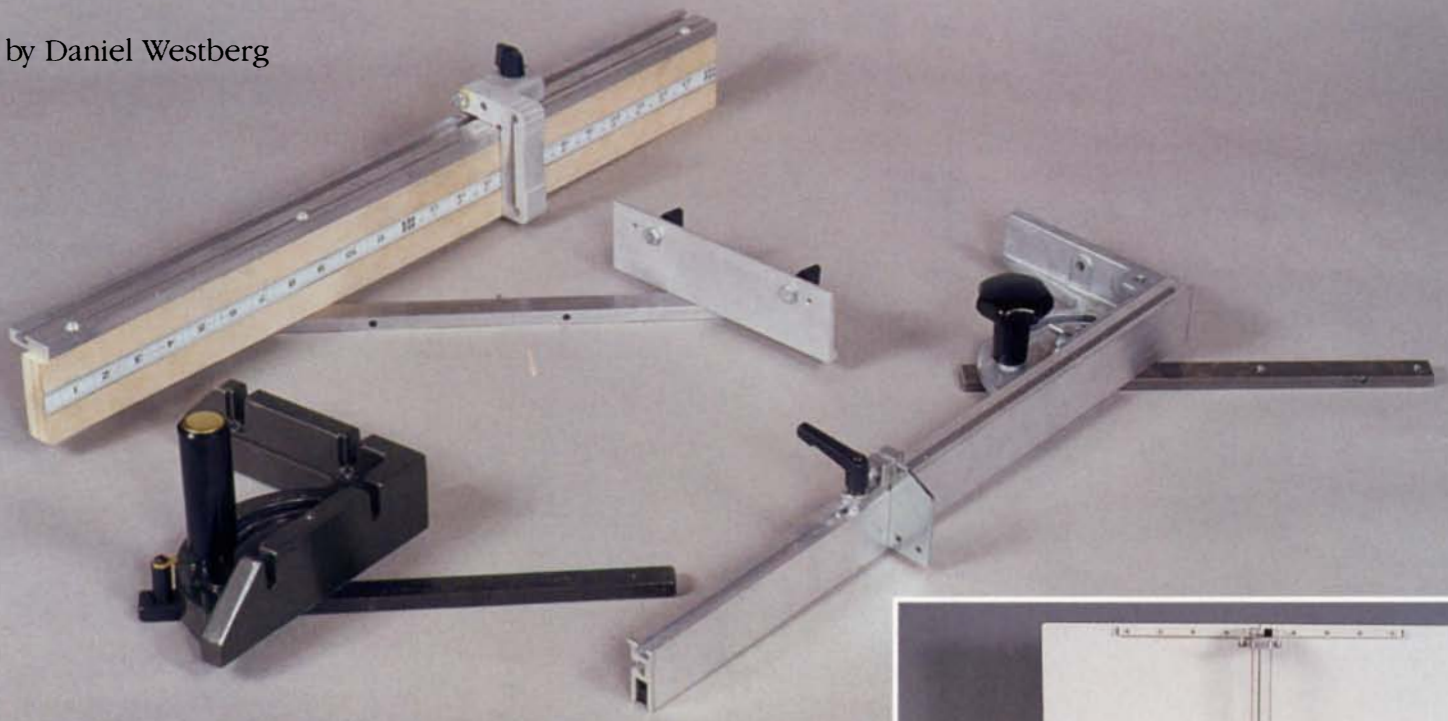
Photo: Lance Patterson

North Bennet Street graduate Stephen Alexander *wanted more of a memento of his school days than a sweatshirt with the school's name printed on it. The trompe l'oeil chest pictured here is the result. All first-year students make a tool box, but Alexander's goes considerably beyond the requisite norms of thoughtful design and impeccable joinery. Collecting stone chips and photographing a number of Boston edifices to obtain the right shade for his "sandstone" finish was a start. For the faux carving on the chest's side, Alexander made a clay model and placed lamps strategically to create shadows.*

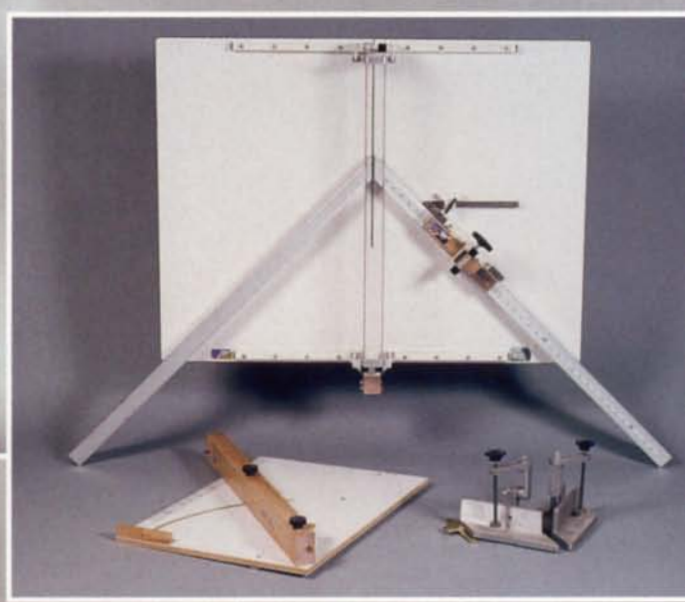
After-Market Miter Accessories

In search of the perfect angle

by Daniel Westberg

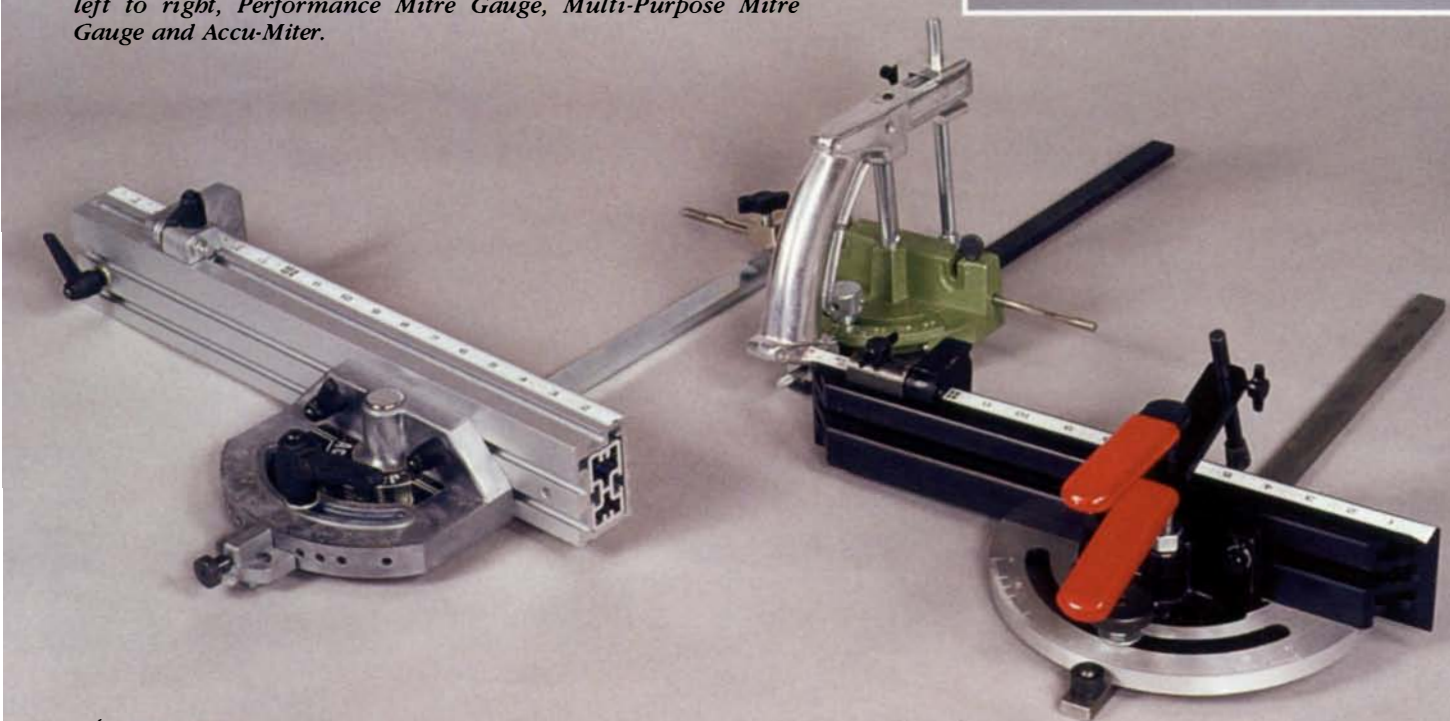


The three miter gauges above use complementary angles *to achieve accurate 90° joints. From left to right, FasTTrack, which is an assembly of optional parts; Perfect Miter, which requires adding a fence; and Right Angle Miter Gauge, which comes complete as shown in this photo.*



Sliding tables generally offer good control *and help to reduce stock movement because of the large contact surface between the table and the stock. At right, T-Square is in the background, Dubby is front left and Perfect Miter is front right.*

Although similar to stock miter gauges, *these units offer various improvements, such as quick-acting hold-down clamps, adjustable stop blocks and fences, and preset angle stops. From left to right, Performance Mitre Gauge, Multi-Purpose Mitre Gauge and Accu-Miter.*



How often have you fussed with your miter gauge when trying to make accurate angle cuts? First you set it; then you check it; then you set it again. And after further fine tuning and trial cuts, you still find gaps at some of the joints during assembly. This all-too-common frustration in my custom-furniture shop led me to investigate why these problems persisted and what I could do about them.

I found three primary areas that influence the accuracy of miter cuts: the tablesaw setup, the stock preparation and the miter gauge itself. In this article, I will concentrate on the after-market miter aids, like the gauge shown in the photo at right, and the sliding tables that the manufacturers promise will solve all your problems. The sidebar on this page introduces some points to consider for aligning the tablesaw, accurate stock preparation and tablesaw techniques that will make any miter gauge perform up to its full potential.

The miter gauge

A miter gauge is generally provided as standard equipment with a tablesaw and is a necessity for safely crosscutting and mitering on the tablesaw. The gauge consists of a bar that rides in a machined slot on the tablesaw top, a fence assembly that pivots right and/or left, a protractor-style scale for setting the gauge to various angles and a lock knob to hold the fence in position. Many of these gauges have built-in stops to allow quick setting to the more commonly used angles.

Assuming that the tablesaw is properly aligned, a miter gauge's performance depends on how well the bar fits the machined slots in the tablesaw and how accurately the fence's angle can be set. Unfortunately, stock miter gauges usually fall short in both departments (see the sidebar on p. 77 for tips on fitting the bar to the slot). These inadequacies have resulted in a flood of after-market miter-gauge tools, accessories and tables.

In my search for the perfect miter, I tried several replacement miter gauges, shown in the top and bottom photos at left, that promised to be better than a stock gauge. I also looked at three sliding cutoff tables, shown in the middle photo at left, that ride on the tablesaw top. Although these miter gauges are similar in appearance to standard equipment, many incorporate innovative improvements. The chart on the next two pages provides an overview of the features of each gauge and of the sliding cutoff tables. The discussions of the specific features that follow, will help you to determine which of these devices best suits your needs.

Complementary-angle miter gauges

Three miter gauges, the Kity Right Angle Miter Gauge imported by Farris Machinery, the Perfect Miter Square II from Leichtung Workshops, and the FasTTrak by Rib Mountain Tool Works (shown in the top photo at left) use adjacent 90° fences for cutting complementary angles. (Two angles are complementary if they add up to 90°.) When making a rectangle, as in a picture frame, using complementary angles will result in a true 90° corner. If the angle of the first fence is set at 46°, the adjacent fence will automatically be at 44°. This works very well within a limited range of 1° or 2°. However, as one angle becomes smaller, the length of its mitered face becomes longer, and as the other angle becomes larger, its mitered face becomes shorter. This difference quickly becomes noticeable, particularly on wide stock or contoured moldings because the details on the face of the moldings won't line up.

I found Kity's gauge to be the most versatile and complete of the complementary-angle miter gauges. As standard equipment, it includes a fully adjustable right- or left-angle protractor scale and a 20-in. fence with a flip stop for repetitive length cuts. This tool

***A miter gauge is essential to safely crosscut and miter** on the tablesaw. Here the author uses a FasTTrack miter gauge, with adjustable fence and micro-adjustable flip stop.*

Keys to accurate tablesaw mitering

The four keys to accurate miters on a tablesaw are a well adjusted saw; a high quality, sharp blade; proper stock preparation and good work techniques.

Required adjustments: The first order of business for accurate cutting on any tablesaw is to fine-tune the adjustment of the sawblade in relation to the table and its machined miter-gauge slots. The blade should run true in three axes, all of which depend on the alignment of the sawblade's arbor to the tablesaw top. The blade must be parallel to the miter-gauge slots and square to the tabletop, and the arbor must rotate with no runout. (For more on making these adjustments see Mark Duginske's article "Tuning-Up Your Tablesaw," *FWW* #78, pp. 69-73.)

The sawblade: Even if your tablesaw is aligned properly, blade runout can still occur if the blade plate is warped. I check for a warped blade by clamping a dial indicator to the tabletop with its tip against a smooth part of the blade. Then I rotate the blade past the indicator by pulling on the drive belt. Some blade manufacturers, such as Forrest Manufacturing Co. (461 River Road, Clifton, N.J. 07014), make precision ground plates called blade stiffeners-dampeners that mount on the arbor next to the blade and help reduce runout. For crisp, clean cuts, the blade must be sharp.

Stock preparation: Preparing the stock so that it is flat and opposing faces are parallel to each other is critical. If the wood has a bow or twist, it will not rest flat against the miter-gauge fence or tablesaw top.

Method of work: Though it may seem obvious, any wood chips or debris caught between the fence and the stock also will affect the accuracy of the cut. The compounding effect of even a small error adds up as each piece is machined.

Another problem that can arise when mitering is a slight movement or creeping of the stock as it is fed through the blade, resulting in a cupped or bowed cut. This creeping can result from a change in hand position as the arm extends to feed the stock or from the force of the blade. When the miter gauge is used in the open position (tilted away from the blade, as shown in the photo above), the blade tends to push the stock away from it. I feel this is a safer option than using the miter gauge in the closed position, where the blade tends to pull the stock into it. Also, in the open position, a stop on the miter fence will counteract the force of the blade to eliminate creep. I combat creep when working without a stop by gluing a strip of abrasive to the fence face. I leave ⅛ in. between the bottom of the abrasive and the bottom of the fence to aid in easy removal of sawdust and chips. For critical miters, I clamp the stock to the fence.—*D.W.*

produces clean miter joints with no gaps in normal picture-frame size stock, and *not* incidentally, it comes with the best instructions for assembly and use.

One problem with the complementary-angle design used by both Kity and Leichtung is that when mitering one end, the stock must be held against the trailing fence of the gauge. In addition to the normal tendencies for the stock to creep away from the blade when the workpiece is held at an obtuse angle to the blade (I call this the open position), the force of the blade also pushes the stock away from the rear face of the miter gauge. After making this first cut, the stock is flipped around the gauge to miter the other end with the workpiece held at an acute angle to the blade (the closed position). For smaller stock, these operations aren't a problem, but for larger boards, it's more difficult to hold the stock without creep, especially for the first cut.

The FasTTrack from Rib Mountain Tool Works is a new concept in miter gauges: individual components can be combined to form a complete gauge or added to an existing miter gauge. The bar component comes with a fixed 90° angle, to which an adjustable fence can be attached, or with two fixed 45° angles, one at each end of the bar (see the photo on p. 74). By switching the adjustable fence from one end of the bar to the other and changing the gauge from the left to the right of the blade, both complementary cuts can be made with the gauge in the open position. The bar has adjustable Cool Blocks for fitting it to the slot (see the sidebar on p. 77). Mounting tracks and stop blocks are available to customize the unit.

After-Market Miter Gauges and Sliding Tables

Product name/Manufacturer	Guide Bars Number and Length	Uses Complementary Angles	Angle Adjustments	Preset Angle Stops	Fence Position Adjustable	Fence Length/ Extended Length	Stop Block
Miter gauges							
Accu-Miter JDS Co., 800 Dutch Square Blvd., Suite 200, Columbia, SC 29210 (800) 382-2637, (803) 798-1600	1 20"	No	Yes	15°,22½°, 30°,45°, 90°	Yes	18 in./34 in. 24 in./46 in.	2 Flip stops
Kity Right Angle Miter Gauge Farris Machinery, 320 N. 11th, Blue Springs, MO 64015 (800) 872-5489, (816) 229-3055	1 12"	Yes	Yes	No	Yes	20 in./N/A (39 in./N/A optional)	Flip stop
Perfect Miter Square II Leichtung Workshops 4944 Commerce Parkway, Cleveland, OH 44128 (800) 321-6840, (216) 831-6191	1 12"	Yes	Yes	No	N/A	N/A	None
Multi Purpose Mitre Gauge Penn State Ind., 2850 Comly Rd. Dept. 68, Philadelphia, PA 19154 (800) 288-7297, (215) 676-7609	1 16"	No	Yes	45°,90°	N/A	N/A	Sliding rod
FasTTrack Rib Mountain Tool Works 1300 Cleveland Ave., Wausau, WI 54401 (715) 848-1122	1 17"	Yes	Fixed 45° or fixed 90°	N/A	Optional fence is adjustable	24 in./N/A	Optional flip stop
Performance Mitre Gauge Vega Enterprises, Route 3, PO Box 193, Decatur, IL 62526 (800) 222-8342, (217) 963-2232	1 20"	No	Yes	No	Yes	16 in./N/A 24 in./N/A	Flip stop
Sliding Tables							
T-Square Miter Sliding Table Biesemeyer, 216 S. Alma School Road, Mesa, AZ 85210 (800) 782-1831, (602) 835-9300	2 30½"	Yes	Fixed 45° or Fixed 90°	N/A	N/A	40 in./N/A 36 in./N/A	Yes
Dubby In-line Industries 661 S. Main St. Webster, MA 01570 (800) 533-6709, (508) 949-2968	1 24"	No	Yes	90°	No	31 in./N/A	Sliding rod with micro adjustment
Perfect Miter Trend-Lines, 375 Beacham St., Chelsea, MA 02150 (800) 767-9999, (617) 884-8951	2 5"	Yes	Fixed 45°	N/A	No	7 in./N/A	None

Adjustable vs. fixed fences

The method of adjusting the fence to cut various angles is another consideration. Some of the units have a fence that is permanently fixed at a preset angle, usually 45°. Although you can consistently cut one angle accurately with a fixed fence, you would need a separate gauge or table for each different angle that you need to cut. An adjustable protractor head or fence is more versatile than a fixed fence, and some of the adjustable units have preset stops so that frequently used angles can be quickly reset. Of course, adjusting the fence introduces another variable that can affect the accuracy of the cuts.

In addition to being adjustable for any angle, many of the miter gauges' fences can be moved closer to the blade to fully support

	Stock Clamp	Suggested Retail Price	Comments
	Optional quick release or pneumatic	$149.00 or $164.00	Guide bar is optional. $14.95 Guide bar is optional. $14.95
	No	$84.95	Finger joint attachment available — $59.95
	No	$49.99	User must supply fence.
	Quick release	$45.00	User must supply fence.
	No	$40.00 $40.00	Complete setup shown in photo on. p. 74 costs $121.95. This is the only device that provides a means to adjust guide bar to tablesaw slot.
	Quick release	$135.00 $146.50	Easy to read protractor scale, but degree indicator is imprecise.
	No	$345 $295.00	Good for large, heavy stock. Good for large panels.
	No	$119.95	Right and left hand models may be connected to form large table.
	Threaded clamp	$49.95	Potentially dangerous if metal base contacts moving blade.

Photos: Charley Robinson

Adjusting the bar's fit

While I've often felt that a better tool would enable me to do better work, financial reality usually dictates I make do with what I have. So before deciding to replace your miter gauge, take a look at how its performance can be improved. The key to consistently accurate results is to fit the miter-gauge bar to the tablesaw's slot with no side-to-side play. The simplest solution is to use a longer bar, which will spread the play over a greater distance, reducing the overall side movement.

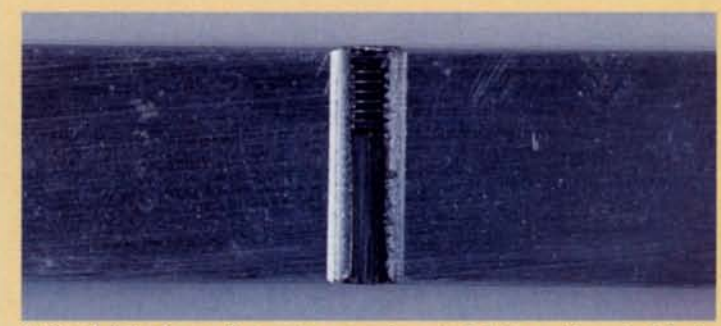
Home-and machine-shop remedies: A bar that is too tight, a rare occurrence, is easily fixed by lightly filing the sides until it fits or by having a machinist grind the bar about 0.002 in. narrower than the slot. The bar also may need to be straightened because the grinding process can bow the cold-rolled steel, from which most bars are made.

A loose bar is more common and more difficult to overcome. You can use a center punch to expand the metal along the side of the bar for a tighter fit, but be careful, excessive force may stretch the bar and cause it to bow.

Another option is to have a machinist mill 2-in.-long adjustment slots about ⅛ in. from one edge of the guide bar. Then a setscrew, tapped into a hole in the bar's other edge, can be used to expand the bar to fit the miter-gauge slot. This option provides a greater and more precise range of adjustment than the center-punch method and allows for readjustment if necessary. After any modification, file sharp edges or burrs to avoid premature wear of the slot. For a smooth sliding bar, clean and wax it with a good, non-silicone machine wax, such as Kity Speed ($4.95 for 2½ oz. or $19.95 for 18 oz.), imported by Farris Machinery.

Commercial corrections: Bob Kressel of Rib Mountain Tool Works has an innovative and cost-effective method for fitting the bar to the slot. He first surface grinds one edge of the miter-gauge bar straight. Then he drills and taps four holes in the bar and places a graphite-impregnated plug (Garrett Wade's 3/16-in.-dia. Cool Blocks) with socket setscrews in these holes, as shown in the photo below. The setscrew adjusts the plug to remove any play between the miter bar and slot, and the graphite provides free and easy movement. Kressel charges $20 for these services, including return postage.

The Incra Miter Slider by Taylor Design Group, Inc. (PO Box 810262, Dallas, Tex., 75381) is an 18-in.-long, extruded aluminum bar, with two adjustment points that can expand the bar up to 1/64 in. The Miter Slider retails for $12.95 and comes with plans for shopbuilt sliding-crosscut tables; it also can be adapted to fit some miter gauges. The major drawback of the Miter Slider is that if you need to cut a board wider than about 10 in., one of the two adjustment points will be withdrawn from the miter-gauge slot, and the bar will pivot about the other point. *—D.W.*



***A Cool Block and a setscrew** inserted into a threaded hole machined in the miter-gauge bar, as shown in this cutaway view, can eliminate play between the bar and the tablesaw slot, thus improving the performance of any miter gauge.*

the stock. This results in smoother cuts than if the stock were extended 2 in. or 3 in. past the end of the fence. Most of these fences also include a stop block that can be set for cutting repetitive lengths. Of these, the flip-down stop blocks are the most convenient because they are easy to set and can be quickly moved out of the way for other cuts without changing the setting. Multiple stops make for rapid cutting of picture frames, tenons or any work that requires repetitive cuts to different lengths. Stop blocks also help control stock creep when used with the miter gauge in the open position. However, be aware that a mitered end can lift a stop block and affect the accuracy of the cut when the wedge-shaped end is butted against the stop. For difficult-to-control stock or when cutting critical miters, a stock clamp, like those on two of the units in the bottom photo on p. 74, not only helps control creep but also provides a margin of safety by keeping your fingers away from the blade. A quick-release clamp is ideal for this because it's easy to use and provides a convenient handle for guiding stock through the cut.

The JDS Co. has combined many of these features in their well-made Accu-Miter. The fence on this tool is adjustable 50° right or left and has a tapered, spring-loaded plunger that positively locks the fence at five commonly used angles. At first this tool appears quite bulky, but in use its mass helped to stabilize large workpieces, which results in clean cuts at any angle. The 18-in. fence, with scale and flip-up stop, has an additional 16-in. extension stop that's housed internally. The large cast protractor scale and optional manual clamp make this tool a pleasure to use.

Sliding tables

Sliding tables consist of a platform that slides on the tablesaw top, a guide bar (or bars, depending on the platform's width) screwed to the bottom that rides in the miter slot, and a fence on top to locate the stock at the desired angle. The platform lifts the stock off the saw table, thereby reducing friction and creep, but the platform also reduces the depth of cut by its own thickness.

For this review, I looked at three very different sliding tables: the T-Square Miter Sliding Table by Biesemeyer, the Perfect Miter by Trend-Lines and the Dubby by In-Line Industries. Biesemeyer's and Trend-Lines' models both use two guide bars, which practically eliminate all side-to-side play. Biesemeyer's model is available with a 45° or 90° fixed fence; the large, heavy-duty table yields clean, precise cuts. The heft and dimensions of this tool make it the best for handling big stock, and the 90° model is excellent for panel work.

The size of Trend-Lines' Perfect Miter is well suited to cutting stock up to about 2 in. wide. But due to the short fences and small table, the unit is clumsy when trying to cut long stock or wide pieces. And the threaded-rod hold-down clamp is much slower and not nearly as convenient as a quick-release clamp. I also feel this tool is potentially dangerous. The wooden wedges that clamp

Cut-off table to handle small pieces

by C. E. Rannefeld

I like to turn polychromatic bowls that are made from a variety of different wood species. To make the blanks for one of these bowls requires gluing up hundreds of pieces of wood. But to produce invisible gluelines when assembling all these pieces, the angles must be precisely duplicated and the cut surfaces absolutely flat. Of course, the first step is a well-tuned tablesaw and a blade that is sharp, balanced and free of vibration. But the key to obtaining consistently accurate miters is the precision sliding table for the tablesaw, shown in the drawing at right. Although similar to other sliding tables, this one has a few unique features. The fence can be adjusted for stock position as well as a wide range of angles. Also, a toggle clamp holds both the stock and the cut-off for clean, accurate cuts. The sliding table is relatively easy to build, and most of the construction details are obvious from the drawing, but I'll discuss some of the not-so-obvious details and other special considerations in the building of this table.

The sliding table is a large plywood jig that slides back and forth across the top of the tablesaw parallel to the blade. Two cleats screwed to the underside of the plywood slide in the miter slots of the saw table to guide the jig. The cleats must slide freely but, at the same time, fit snugly in the slots. I made my cleats from hard maple because it wears well and is fairly stable; however, they also could be made of steel, aluminum or even polyethylene, a hard, self-lubricating plastic.

I prefer a base that's about the size of the saw top; anything smaller limits the type of cuts that can be made and a larger one becomes too bulky and cumbersome. A high-grade plywood platform that is between ½ in. and ¾ in. thick keeps the weight down yet provides sufficient rigidity with a minimum reduction in depth of cut.

I reinforced the front of the jig (the side that is pushed into the blade first) with a 1-in.-thick maple fence that's about 1 in. taller than the maximum cutting height of the sawblade. The arched opening in the fence allows the blade to be tilted for compound miters, while the cutout on the right side of the fence lets me miter long boards by passing them through this hole. A 1-in.-sq. hollow aluminum tube, with ⅛-in.-thick walls screwed to the top of the fence, and an aluminum angle, screwed to the back edge of the platform, further stiffen the jig.

My original cut-off jig had fences nailed to the plywood base that I adjusted by tapping with a hammer. But I have found that the box-joined fence and stop block, shown in the drawing, are more accurate and much easier to set. The bolts that secure the box joints can be adjusted to eliminate any play in the fence. Extra mounting holes for the carriage bolts that hold the fence and stop block to the jig will increase its versatility.

When cutting miters, hand pressure alone is inadequate to hold the stock because the slightest movement can affect the angle of the cut or leave blade marks that will show up later in the glueline. Also, because most of the pieces I cut are small segments, it is too dangerous to try to hold them by hand. Therefore, I added a toggle clamp to the jig to safely hold both the stock and the segment. To increase the capacity, I mounted the clamp on a 1-in.-thick base block, and then replaced the bolt that held the rubber pressure foot with a longer carriage bolt of the same diameter. I also replaced the rubber foot with a wooden pressure block, which bears on the stock directly over the sawblade. The pressure block is faced with a ¼-in.-thick wooden pad, secured with double-faced carpet tape, so it's easy to replace.

To cut segments like those shown in the drawing, I prepare my stock flat and square and then miter the end to the desired angle. The first cut-off is thrown away and the stock is flipped so that the front edge is now against the fence and the just-mitered-end butts tightly against the stop fence. After making the cut, release the clamp and remove the segment. Flip and reposition the stock in the same manner, and clamp and cut again. Repeat this procedure until you have all the segments you need. □

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in the miter-gauge slot and act as a stop block to prevent the cast-metal base from contacting the sawblade have a tendency to move each time the tool makes contact with them. An unwary user might find that the stop block had moved enough to allow contact with the blade, which could damage the blade or injure the operator.

Unlike the other two sliding tables, Dubby by In-Line Industries operates on one side of the blade only and, therefore, uses only one of the guide slots. However, the 24-in.-long guide bar spreads side movement over a greater distance to minimize side play. Because the cutoff is unsupported by the sliding table, the weight of a long cutoff could cause the wood to split just before the cut is complete. To avoid this and the possibility that the split piece could fall into the blade, I pull any cutoff longer than about 12 in. away from the blade when using this tool. Dubby's fence is easy to set accurately between 0° and more than 50°, due to the large, easy-to-see angle scale along the left edge of the table. Although the stop block built into the fence of the Dubby is somewhat clumsy, it has the greatest range of all the tools, and the micro-adjust mechanism makes it easy to make minute changes. Dubby is available in a right- or left-handed model.

Conclusions

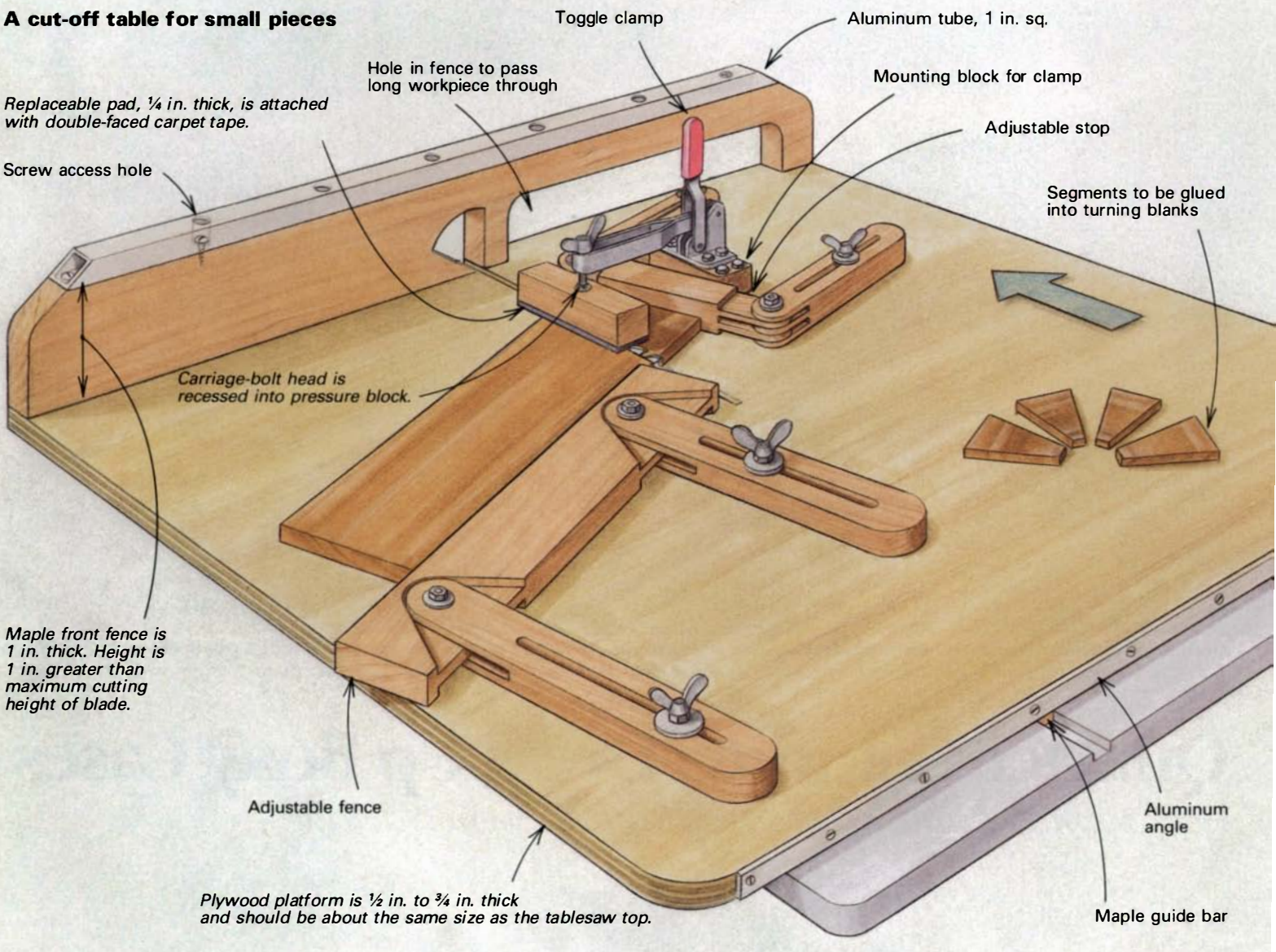
Weighing all the features, I think Rib Mountain Tool Works' adjustable Cool Blocks in the bar (see the sidebar on p. 77) is the single most important advancement found in after-market miter gauges. The performance of many stock miter gauges and several after-market gauges could be improved with this one simple and inexpensive modification.

Although none of the reviewed tools addressed all of the problems with cutting accurate angles, some of these products help tremendously for specific types of work. If most of my work involved cutting small stock for frames, the complementary-angle feature of the Kity makes it the fastest and most convenient. The FasTTrak is very accurate, but switching the fence and gauge around makes it slow and cumbersome. Although the sheer quantity of components can make the FasTTrak system confusing, this flexibility allows an innovative user to apply these components to a variety of shop tools, such as the drill press, chop saw or radial-arm saw. A user who requires full-range adjustability in a heavy-duty miter gauge would be most satisfied with the JDS Accu-Miter or the Dubby. For working with panel goods, Dubby is my tool of choice.

Before making any decisions on whether or not to buy one of these tools, list your own shop needs and rank them according to the type of work you do the most. Then refer to the features and options in the chart on pp. 76-77 to help determine which tool best fits your particular application. □

Daniel Westberg is a custom furnituremaker and woodworking instructor. His company, Potomac Wildwoods, is located in Minneapolis, Minn.

A cut-off table for small pieces



Drawing: Bob LaPointe

A blend of machine work and handwork produces traditional-style quarter columns. *After turning a blank down to a cylinder and adding a double-bead detail on each end, Mac Campbell reeds the column with a scratch stock while it's mounted on the lathe.*

Quarter Columns Dress Up Boxy Cases

How to make and inset a traditional corner detail

by Mac Campbell

Inset quarter columns add interest to an otherwise plain or boxy carcase. In addition to providing decoration through reeding or other surface detailing, quarter columns, like pilasters on a building, supply a strong visual framework. From the front, a viewer sees an element with some mass, rather than just the edge of a side panel framing a piece's drawers or doors. And since these columns are inset into the corners, instead of the face of a piece, they also relieve the blank expanse of wood commonly found in casework sides.

Best of all, quarter columns aren't difficult to make, and the procedures can easily apply to less traditional column forms for casework corners or even for architectural woodworking. To show how this corner treatment can add a distinctly classical motif to an otherwise ordinary period piece, I'll describe how I prepared and shaped a pair of reeded columns for a traditional-style chest of drawers (see the photo at right). Also, to underline the basic methods involved in insetting quarter columns, I'll explain how I framed and installed them in the chest.

Quarter columns as a whole

The best way that I've found to make quarter columns is to form a full column blank by gluing up four identical pieces of square stock with newspaper between each joint. Then the blank is mounted on the lathe, and its central section is turned to a cylinder with a pair of beads at each end, which define the transition from the cylinder to the square ends. (These beads become the column's base and capital.) If the column is to be reeded or fluted, this work is done before removing the column from the lathe (see the photo on the opposite page). Finally, the column is separated into quarters and two of them are cut to length and installed at the carcase's front corners.

Choosing and gluing up four quarters

Even though there are no strict rules for column size, I've found that 2-in.-dia. columns are the right proportion for a 30-in.- to 36-in.-high piece of furniture, like my hall chest. If you use a 2-in.-dia. column body, you'll need a 2⅝-in.-dia blank to allow for the top and bottom beads and for squaring up the blank after glue-up. To make up a column blank, surface four pieces of your chosen stock. For my chest, I selected mahogany stock that measures 1 5/16-in.-sq. by 4-in. longer than the finished column length. Select stock with a straight grain that's free from unusual grain patterns. Swirls and other striking figures won't show up well because of the column's vertical lines, and they will make hand-reeding much more difficult.

Before gluing up the four pieces to form the column, make sure that each of the four corners to be glued together are exactly 90°. Then spread glue on both pieces of wood, and lay a single layer of newspaper between them before clamping. Since the glued surfaces will have to be scraped clean later, choose a glue that sands well when dry (I use High-Performance PVA from Lee Valley Tools Ltd., 1080 Morrison Dr., Ottawa, Ont., Canada, K2H-8K7). I like to glue up the stock in two pairs, joint one face of each glued-up pair, and then glue those faces together. Once the glue is fully dry (preferably overnight), dress all four sides so that the blank measures 2⅜ in. sq., and the gluelines are still centered.

Although it has never happened to me, it is possible that a turning tool's edge could dig into the spindle (column) and break apart its paper-and-glue joints, sending wood all over the shop. Therefore, as a safety measure and as some cheap insurance against having your work ruined, I recommend screwing the four clamped pieces together. I drive two screws each way near both ends, but well away from the ends of the usable column (see the photo on the facing page).

Reeded quarter columns, inset in corner ledger strips, lend a bold, yet elegant touch *to the front of the author's 30-in.-high chest of drawers (above). The carcase relies on period details, like the columns, cock beading, carved feet and brass pulls to offset its otherwise simple box form.*

Hand-scraped vertical lines are the effect that the author intended *for this chest's corners (right). The beads at the top and bottom serve as the column's capital and base. To clean out the ends of the reeds that the scratch cutter won't reach, Campbell uses a ⅛-in. skew chisel, which further enhances the work's hand quality.*

Turning and shaping a full column

Mount the turning blank on the lathe with both the headstock and tailstock centers aligned at the glue-joint intersection. Turn the column round (except for the ends); then turn the top and bottom beads. Although most of the cylinder's surface will be removed during the reeding process, sand the column at this stage to remove small irregularities that might deflect the reeding cutter. To reed the column, you'll need an indexing head for your lathe with at least 24 divisions (48 is preferable). If your lathe doesn't have a built-in indexer, you can rig up one. (See the sidebar on p. 83 on reeding with a scratch stock.)

Quartering a column

After the column is reeded, remove it from the lathe and withdraw the safety screws from the ends of the blank. To divide the column back into quarters, hold the column upright on the floor, and tap a chisel into one of the gluelines (see the photo on p. 82). The seams part quite easily, leaving a layer of paper and glue on each surface, which can be cleaned with a scraper, sander or anything that removes the hardened glue.

Photos this page: author

Campbell's quartering method resembles firewood splitting. *The glueline is cleaved easily due to the layer of newspaper between.*

Framing for quarter columns in a chest of drawers

All stock is ¾-in. thick, unless noted.

Section through quarter column

Framing a carcase for quarter columns

Because many carcases are constructed like a chest of drawers (see the drawing above), the framing provisions I made for the chest's quarter columns should work for most casework furniture. You must lay out your carcase with a square recess in each front corner to accommodate the columns. I stopped my carcase sides 1 3/16 in. short of the front of the cabinet so that the columns' 1⅛-in.-radius beads would be set back slightly from the side and face of the chest. This is also the time to select the joinery for the drawer partitions or dust boards and the case's top and bottom. The dust boards on my chest are joined to the sides with sliding dovetails. The dovetail slots can be cut all the way through to the front of the two sides since they are later covered by the columns. I attached the bottom to the sides with dowels and half-blind dovetailed a subtop to the tops of the two sides. The top is fastened with screws driven up through the subtop.

To form the inset corners where the quarter columns sit, you'll need to make a recessed ledger strip for each column (see the drawing above). Each ledger strip must be rabbeted so that it will form a square inside corner of the appropriate size when glued to the case side. To form the 1 3/16-in. recesses in my chest, I cut a 7/16-in.-deep by 1 3/16-in.-wide notch in both ¾-in. by 2-in. ledger strips, and then glued them to the ¾-in.-thick case sides. Be sure to align the rabbeted edge of each ledger strip with the front edge of each side. When the glue is dry, clean up any squeeze-out, and make sure the inside corners of the column recesses are square. If they're not, use a rabbet plane to adjust each corner as needed. Next, you'll need to notch the carcase bottom and the dust boards at their front corners to accommodate the ledger strips. This cut-out should be smooth and square since the ledger joints will be exposed at the front of the chest along the column. After the ledger strips are in place and the ledger notches are made, you are ready to assemble the carcase.

If you chose the same joinery as I used, begin by connecting the sides to the bottom. Once that dowel joint is clamped tightly, insert the dust boards (from the back side) until they stop against the ledger strips. The front edges should be flush with the front of the ledger strips. While it's possible to cut sliding dovetails along the inside edge of the ledger strips to join them with the dust boards, I just drive a screw through the ledger into the end of the dust board. The screws draw the joints up well, and the quarter column covers them. The lower front trim is glued to the bottom's front edge (which stops ¾ in. shy of the cabinet front) and screwed through the ledger strips at both ends. Since the ledger strips protrude inside the cabinet, you'll have to add drawer side guides to the inside of your carcase. I glued-and-screwed 2-in.-long dust-board offcuts across the width of the sides, just behind each ledger strip and slightly above each dust board.

Insetting a quarter column

To fit the columns after the chest is framed, cut two quarters to length. After spreading glue on the column's two inside surfaces, clamp them to the ledgers. With proper padding, each column can be clamped from its reeded surface to the inside corner of the ledger strip, which applies pressure to both glued faces. Clean up any squeeze-out immediately with a wet rag or after the glue has dried with a chisel and scraper. □

Mac Campbell builds custom and reproduction furniture in Harvey Station, N.B., Canada, and is a regular contributor to FWW.

Reeding with a scratch stock

To reed (or flute) quarter columns, some woodworkers use a router mounted in a carriage that rides along the lathe. But I prefer the look I get from reeding by hand with a scratch stock secured to a shop-made tool post. (See the photo below.)

The setup: Before fashioning a tool post and cutter, you'll need a level platform parallel to the centerline of your workpiece when it's mounted between centers. On lathes with a split, flat bed, just remove the tool rest supports and bolt a piece of ¾-in. plywood to the bed (see the photo below). If your lathe has a single-tube bed, a piece of plywood supported from the lathe stand and held to the bed with U-bolts or pipe straps will probably work fine.

The tool post to hold your scratch stock is simply a T-shaped block of hardwood a few inches longer than the distance from your lathe's center to the plywood work surface. (Rounding the tool post's corners isn't essential, but your hands will appreciate the extra effort.) To clamp the cutter, make a bandsaw cut down the center of the T and put a couple of bolts above and below the cutter. Allow enough space for the cutter to be precisely positioned when the column is mounted on the lathe.

The cutter can be shaped from an old scraper blade. A profile that cuts a groove and two half reeds, rather than one that makes a full bead at each pass, hides any irregularities in the diameter of the column or in the indexing divisions of the lathe. Determine the diameter of the reeds (mine are ¼ in.) and divide that number into the column's circumference. Round this answer to the nearest whole number that is divisible by four; this is the total number of reeds around the column. Note that the total number of reeds has to be evenly divisible into the number of divisions on your lathe's indexing ring to give you the number of increments that you rotate the column for each reed. Now use a round file to make the two fillets (each fillet will form a half reed) in the cutter, and bolt the cutter to the post.

The method: To begin scraping, first rotate the column until the endgrain glue seams are horizontal and vertical. Then rotate it to the nearest index mark, and lock the indexing head. Place the scratch-stock post on the plywood bed and align the cutter, so its point falls precisely on one of the column's gluelines. Tighten the bolts that secure the cutter to the post, and wax the bottom of the tool post and the top of the table. Now the post will slide back and forth smoothly as the cutter scrapes the column.

For the first reed, release the indexing pin and rotate the column the proper number of increments so that you will have a half reed at the edge of the quarter section you're working on. Slide the scratch stock along the auxiliary table, dragging the point along the column, as shown in the photo on p. 80. Move in the direction that produces the smoothest cut; this usually varies as the column is rotated. If the cutter starts to chatter, use a rabbet plane to smooth the chatter marks from the surface, and then continue reeding. Also, if there is spiral in the grain, cut in the direction that tends to force the cutter down. As I have discovered, it is painfully easy to allow the cutter to ride up, which will leave a nasty spiral scar.

Continue cutting until the full depth of the cutter is reached, and then rotate the column the number of increments you previously calculated. Repeat this process all the way around the column. You could reed just two quarters, but I do all four so that I can choose the best pair. When you've finished with the scratch stock, clean up the ends of the reeds with carving tools (I found that a ⅛-in. skew chisel does the job). Make sure that all the lathe work is completed, including any needed sanding, before removing the blank.

A shop-built indexing plate: If your lathe doesn't have an integral indexing ring, you can make a plywood indexing plate, which is screwed to the headstock end of a spindle, independent from the lathe itself. To use the indexer, you'll need a rigid clamping arm (with a pointer) and a level surface next to the lathe. This can be a floor-standing tool rest, a piece of wood attached to the lathe stand or whatever works for your setup. You can make the plate by mounting a plywood disc as part of the spindle setup and by turning the plywood to a true circle at the same time you turn your spindle (see the photo below).

The easiest way to mark off the plate's rim in 48 or more equal segments is to wrap a piece of non-stretch tape or paper around the disc's rim, mark off the exact circumference, remove the tape and divide it into the desired number of segments. Then, wrap the tape around the plate again, and transfer the marks to the edge of the disc, drawing radius lines from each mark to the center.

To use the indexer, simply line up a mark with the clamping-arm pointer, as shown in the photo below, and C-clamp the two together. *–M.C.*

Campbell cuts reeds with a scratch stock *made from a scraper blade that's bolted in a saw kerf in a T-shaped tool post. The tool post slides on a plywood platform attached to the lathe bed.*

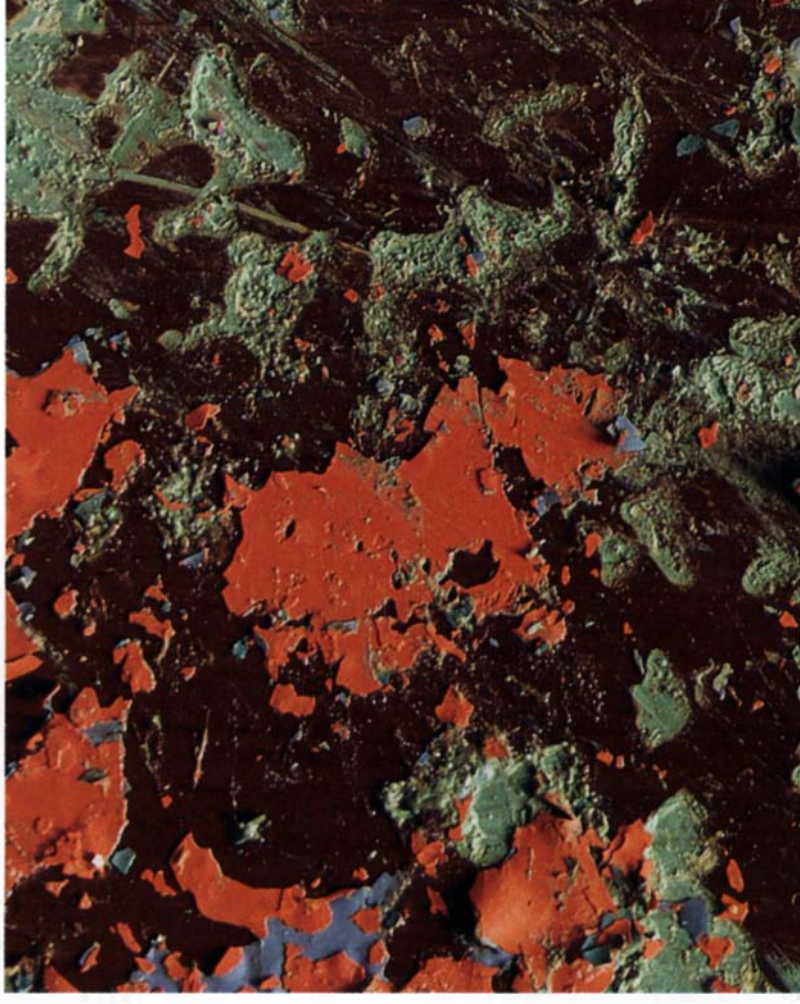
For lathes without indexing rings, *a shop-made indexing plate can be attached to the headstock end of a spindle, independent from the lathe itself. A rigid pointer arm is needed to use the indexer.*

Photos except where noted: Alec Waters; drawing: Bob La Pointe

Removing an Old Finish

A chemical stripper will do the work for you

by Michael Dresdner



Refinishing has developed a bad reputation over the years, and most people view it as a troublesome and messy task. But, there are times when it is the best, if not the only way to restore the beauty of a good but worn piece of furniture. Of course, if your table or chair is an antique and its rich patina and worn finish are part of its pedigree, you should never touch it without first checking with a museum conservator or other expert.

If you just want to spruce up the more ordinary furniture most of us live with, refinish away. Actually, the process is much less daunting than you might expect, if you remember that refinishing consists of two simple steps: stripping an old finish and putting on a new one. Once the old finish is off, you are merely at the first step of the finishing process, just as if you had built the piece yourself, and it is no harder to finish old wood than it is to work on new wood. In fact, it is often easier, since the sanding has already been done for you by the original finisher.

Choosing a stripping method

You have several options for removing a finish, but the three most common methods involve scraping it away with abrasives, melting it with heat or dissolving it with chemical solutions. For almost every case the average woodworker might encounter, I'd recommend removing the finish chemically, which is both the simplest and most controllable method and the one I'll discuss in detail. You might think it would be easy to remove a finish with sandpaper, a cabinet scraper or (heaven forbid) a piece of glass, but you'll regret it. Using glass is dangerous, and sanding or scraping makes hard work of a simple operation. In addition, sandpaper and scrapers don't know when to stop; they usually remove wood along with the offending finish.

Melting a finish with a propane torch or heat gun is even less appealing. First of all, the heat is likely to release some very harmful vapors. In addition, heat, like sandpaper, is sadly non-selective and will cheerfully burn wood along with the finish. In some cases, industrial polyester finishes won't budge under any chemical remover, so heat may be your only resort. But be extra careful; wear an organic-vapor mask, goggles and heat-resistant welders' gloves. Work outdoors or with the windows open, a fan blowing and a fire extinguisher handy.

In contrast, chemical removers only affect the finish and not the wood. Most commercial strippers won't harm even old veneered wood or destroy already weak glue bonds. And your local paint or hardware supplier can help you find a stripper that meets your needs fairly precisely and with a minimum of potential health hazards. I'll talk more about the different chemical removers in the sidebar on page 86.

Tools for refinishing

In addition to a chemical stripper, you'll need some other equipment, most of which you probably already have around the shop. Those big, old splayed brushes you've been saving, without quite knowing why, are perfect for applying the chemical solution. It doesn't matter if they are clean or crusty. You'll also need a scraper or putty knife for scooping off the goo. It's a good idea to round the corners of the putty knife, so they won't dig into the wood. Gather up some wood shavings from the planer or jointer, a wooden dowel sharpened to a point in a pencil sharpener and a few stiff, nylon-bristle scrub brushes. You'll also need some coarse (0 or 1) steel wool, or better yet, some 3M Scotch-Brite general-purpose hand pads, a handful of rags or paper towels and a few containers—old steel or porcelain bowls, or even large tin cans. Then grab a stack of old newspapers, and put a drop cloth over the floor or anything else you want to keep clean.

You'll also need some masking tape to cover any unfinished areas, like the insides and sides of drawers. Before you apply the stripper, remove any hardware from the furniture, and take

enough of the piece apart so that you can work on horizontal surfaces as much as possible. Be sure to cover the screw holes for drawer or door handles from the inside with masking tape to prevent drip through.

Let the paint remover do the work

The key to easily removing an old finish is to let the paint remover do the work while you take it easy. You'll need to keep the furniture surfaces wet with stripper until the old finish is completely off. With liquid strippers, that means immersing the wood in the solution or continually rewashing it to keep it wet. Unless the piece is small, or you have extra time to kill, you'll probably find a semi-paste stripper will lighten your work load. These thick solutions flow less quickly than the liquid strippers, so they are easier to control, especially on vertical surfaces. Also, the semi-paste removers contain either waxes or clays that rise to the top and form a crust that slows down the evaporation of the active solvents, thus keeping the remover wet and active longer. That means you don't have to keep going back to rebrush the remover. In fact, if you do rebrush, you'll break up the crust and defeat its purpose.

To apply the semi-paste remover, shake the can a few times, lay a rag over the cap to block any spurts and open the cap slowly to release the pressure gradually. Pour some remover into one of your cans or bowls, and daub it all over the finish with your biggest, floppiest brush (see the photo at right). After applying a nice thick coat, *leave it alone.* Remember to take full advantage of the remover. Make sure the entire surface is wet; if you see any dry spots, go back and daub on some more paste.

Now sit down and enjoy at least a 10- to 15-minute break, but keep an eye on the stripper. If any dry spots develop, re-wet them. If you let the mixture of finish and remover dry completely before taking it off, the resulting crust will be far more difficult to remove than the original finish. After 15 minutes, scrape a small area to see

Apply semi-paste strippers with a big, floppy brush. *Lay a thick coat on but don't rebrush it, or you will break the crust and allow the active solvents to evaporate. Always wear good-quality neoprene gloves when handling strippers that contain methylene chloride or alcohol.*

Chemical strippers will remove paint *or clear finishes without harming the wood's surface. The large photo above reveals what the author found after stripping several coats of paint from the chair in the inset photo—oak with only minor blemishes.*

Photos: Susan Kahn

if the finish comes off to the bare wood (see the inset photo on the next page). If it doesn't, but the remover is still wet, leave it alone for a little while longer. When your test area shows bare wood or when your patience is exhausted, carefully scoop the goo off the wood and onto some of those old newspapers. If the wood is not completely clean in all areas—and don't be surprised if it isn't—re-wet the area with more remover immediately before it dries completely. For carved or fluted areas, grab a handful of wood shavings and scrub them into the softened finish to help absorb and dislodge it. Then take a stiff bristle brush and scrub out the loaded shavings, as shown in the top photo on the next page. In very tight corners, use the pointed dowel to clean out the recesses (see the bottom right photo). If the paint refuses to come out of the pores of large-pore wood, like ash or oak, use the stiff bristle brush to scrub the pores while the remover is still wet. In severe cases you may have to resort to a fine brass-bristle brush to clean the pores. Re-apply the remover as often as needed to make sure everything is dislodged, and give the piece a final scrub with a Scotch-Brite pad soaked in remover just to be sure (see the bottom left photo). Then wipe off the surface with rags or paper towels.

At this point the wood should look clean, but it probably contains wax, silicone or other oils that may impede the finishing process. The wood may also contain old filler and stains you'd be better off without. The best way to remove these contaminants is with a series of solvent washes. Using a clean piece of Scotch-Brite, scrub down the wood with a liberal amount of lacquer thinner, followed by a scrub with alcohol and then one with mineral spirits or naphtha. It is not necessary to wipe off the wood in between washes. If you'd rather avoid working with these flammable solvents, scrub the surface with a solution of water and trisodium phosphate (TSP), a degreaser found in most paint and hardware stores. Just mix the solution according to the directions on the box. It is not as effective as the solvent sequence, but it is better than nothing. Finally, scrub down the wood with a solution of ammonia in warm water (about 2 oz. of household ammonia per quart of water), and then wipe off any excess liquid. During this final wash, the wood should look clean

Methylene chloride strips best, but there are other options

Identifying an old finish is a lot like determining what species is what in a mixed pile of lumber—it's easy if you've had a lot of experience, but frustrating for a beginner. Most finishes look pretty much alike to a neophyte, so rather than having anyone agonize over identifying a finish and selecting a stripper specifically for that finish, I recommend buying a good, wide-spectrum commercial remover that contains enough methylene chloride (a powerful stripping agent) to be classified as non-flammable.

Generally, you'll find a wide variety of removers at any good paint or hardware store. Most of these products fall into one of four general categories.

Paint and varnish removers: These strong solvent mixtures will remove a wide range of finishes and are the ones I recommend most often, especially if the identity of the old finish is not known. Some of these are flammable and most smell and produce annoying and harmful fumes. Most are poisonous if swallowed and contain solvents you should avoid getting on your skin. They're sold both as thin liquids and heavy-bodied semi-pastes, which I prefer because they cling better to vertical surfaces and stay wet longer.

One common thread among these removers is methylene chloride, a very fast and effective solvent. An interesting feature of methylene chloride is that adding it to a flammable solvent mixture can make the mixture non-flammable. Another curious aspect of methylene chloride is that as a stripper, it works from the bottom up rather than from the top down. This means that once the remover is put onto the surface, it drops down through the coating and softens it at the wood line, allowing most finishes to peel off in sheets rather than turning into sticky gunk. That can translate into less material waste and easier disposal. When working with these materials, observe the safety precautions outlined in the sidebar on p. 88.

Wood refinishers: A refinisher is a thin, watery mixture of common finish solvents, usually alcohol, toluene and acetone, which dissolves shellac, lacquer and some varnishes but has little effect on most paints and polyurethanes. To see if the material will work on your finish, apply some refinisher to a small, obscure spot, and see if it melts the finish. If the refinisher turns the old finish into a liquid, you have a few options: move the finish around with rags or abrasive pads to "re-knit" an old checked or cracked surface, remove most of it and leave only the barest sealer coat, or keep washing down the wood until the old finish is completely gone. Admittedly, leaving only a partial finish that still looks good will take some practice. Because refinishers contain only solvents and no waxes, they leave the wood surface clean and ready to refinish. On the down side, refinishers are very flammable, create lots of solvent vapors, evaporate quickly and generally smell awful.

"Safe" strippers: The new so-called safe strippers utilize solvents that are considered to be much safer than their predecessors, but they are not as effective on all types of finishes. Some manufacturers specify that their material works on only one class of finish, such as oil-based materials; others offer two or more different formulations to cover all the bases. Generally, these strippers are thick, slow drying and non-flammable; they have very little odor and won't burn or harm bare skin. (One company offers a product so gentle to the skin that it can be used as a hand cleaner.) The fumes that do come off are regarded as safe so that work can be done indoors. The trade-off is that these strippers work slower than methylene chloride or harsh solvent mixtures and frequently cost more. But they are the ideal choice for people who are particularly sensitive to hard solvents or people who must work indoors.

Caustics: Certain types of paint, such as milk paint, won't respond to most solvents but can be softened with strong acids or alkalies. Caustic strippers, like lye, were the most common type before methylene chloride mixtures were developed, but they have virtually died out along with the milk paints that necessitated them. Some people still like the idea of using lye to remove paint, but it can burn and discolor wood if it's left on too long, soften some glues and seriously raise the grain of old wood. More importantly, it will seriously burn skin and eyes, and the fumes are antagonistic to the nose, throat and eyes. Take precautions and, above all, keep your wits about you and watch where the lye splashes. Better yet, select another method. —M.D.

After waiting 10 or 15 minutes, *use a plastic scraper to see if the finish will come off to the bare wood (inset photo above). If there are several coats of paint, as there are on the chair shown here, you may have to remove the goo, and apply another coat of the stripper.*

In hard-to-reach places on turned or carved parts, *rub a handful of wood shavings into the softened finish to help remove the residue. Then scrub out the shavings with a stiff bristle brush (large photo above).*

Scotch-Brite pads are ideal for scrubbing down the wood *with a final coat of stripper, as shown at right, and for washing the surface clean with lacquer thinner after all the finish has been removed.*

A sharpened dowel is handy *for cleaning stripper and finish residue from very tight corners, as shown in the far right photo.*

and the color should be somewhat uniform. If the water wets the wood unevenly or leaves splotchy areas, not all the residue has been removed. Go back to the paint remover and repeat the stripping- and rinsing-solution sequence outlined above. When the wood is clean as a whistle, let it dry overnight.

Cleaning up

That sludge you've collected on the newspapers, rags, steel wool and paper towels is considered toxic by most communities, and shouldn't be treated as normal trash. Check your local regulations before disposing anything. Your community may have a special collection site for used oil, paint and solvents. If it's going to end up in a landfill, let the residue dry completely prior to disposal. The residue will become hard and crusty, which is less damaging than the solvent-laden sludge. Before the residue hardens, you can clean your brushes, putty knives and even the Scotch-Brite with lacquer thinner, but disposing of the dirty lacquer thinner will be regulated just like the sludge.

Removing stains

Even though the wood is now free of finish, it may still be marred by both intentional and accidental stains, which you may want to remove. Intentional stains are whatever dyes or pigments the first finisher applied to the wood; accidental stains are the various water rings, ink spills, uneven sun fading and other marks of age and use. Many people feel that these accidental stains add character and history to furniture and should remain under the new finish, but for the most part, these are the same people who believe that old furniture should never be refinished. Though not all stains and discolorations can be removed, there are ways of dealing with some. First, let's deal with the intentional stains.

Wood stains are either pigments or dyes. Most, if not all, of the pigments should have been removed by the solvent scrubs; whatever is left now is likely to remain forever. But most aniline dyes can be denatured by using either commercial decolorant solutions or chlorine bleach, which is sold in grocery stores as laundry bleach. These bleaches are generally rather weak concentrations (usually a 5% solution), so they will work slowly and require several applications to remove the dye. You can make a stronger solution by mixing swimming-pool chlorine (sold under various names) into water. The label on the pool treatment will indicate the percentage of active ingredient, usually 65% to 85% of either calcium or sodium hypochlorite. Get the highest percentage available. Add the white crystals to a glass jar of hot water; let them sit a few minutes and stir occasionally. Keep adding the pool treatment until no more will dissolve and a layer of white residue settles to the bottom of the jar. Wear rubber, protective gloves, and use a synthetic sponge to flood the wood surface with the warm mixture; then let it dry overnight. In the morning, you'll see a layer of dried crystals on the wood, which should be washed off to remove the stain. A second wash will be even more effective.

Oxalic acid (sometimes sold in liquid form as deck brightener) is often effective on water rings and ink stains and on "silvered" weathered wood. But it works best for quickly and completely removing the blue/black iron stains often found when oak and other high-tannin woods contact iron hardware or nails. Make sure you remove the nails or hardware before bleaching, or you may create new stains as the wood dries. If you can't remove the nails, countersink them, and putty over the holes before you apply the oxalic acid.

Both stain removal processes require a lot of water, which often raises the grain of the wood. Although it is usually not necessary to sand wood when refinishing, it will probably be necessary after stain removers are used. Use a very fine sandpaper (220-grit or finer) and scuff-sand quickly and lightly. For turnings and carvings, use Scotch-Brite pads instead of sandpaper. □

Michael Dresdner is a finisher in Perkasie, Pa. This article was adapted from his forthcoming book, The Woodfinishing Book, *to be published in the fall by The Taunton Press, 63 S. Main St., PO Box 5506, Newtown, Conn. 06470-5506.*

Fresh air and common sense reduce refinishing hazards

Every paint-remover manufacturer suggests that you work in a well-ventilated area, but few explain what that means. I think the ideal situation is a shady area outside in 75° weather with a light breeze, but ordering good weather is difficult. If you can't strip outdoors, open the windows, and turn on a fan to bring in fresh air and to carry off any contaminated air. Unless you've chosen a so-called safe remover, stripping furniture is not a wintertime activity. Ventilation is particularly important with methylene chloride. When you inhale the fumes, your body metabolizes them to carbon monoxide. This is not good for anyone, but it can be particularly dangerous to heart patients who should avoid the chemical totally. Goggles are good to protect your eyes from splashes, and good-quality neoprene gloves are essential to protect your skin. Both alcohol and methylene chloride can be absorbed through the skin, and methylene chloride in particular will carry with it heavy metals, such as the lead often found in old paints. Also, if you're working with flammable compounds, avoid sparks and flames.

Even if you're working outdoors on an ideal spring day, I'd suggest closed shoes (not sandals), long pants, long sleeves and a plastic apron to protect against splashes. Buy extra-long gloves, and turn the ends up into a cuff when you put them on. That way, when you lift your hands, the paint remover will run into the cuff and not down your arm. (Remember, some of these chemicals can burn sensitive skin.) Finally, use common sense; if the smell of the stripper starts to sicken you or makes you dizzy, *stop*, get some fresh air and a new game plan.

When working with dry bleach crystals, wear a nuisance-type dust mask when you handle the irritant and when you subsequently sand the wood. Though neither chlorine nor oxalic bleaches are severe caustics in solution, gloves and goggles are always in order. Most bleaches will "eat" natural fiber brushes and rags, so use synthetic sponges and brushes (nylon or polyester).

If these warnings have you wondering whether refinishing is really worth all the trouble, you have one other alternative. Look in the yellow pages and find a commercial furniture stripper to handle the job. But make sure the company specializes in wood stripping because outfits that work mostly with metals frequently use caustic strippers, and these may loosen glue joints and play havoc with the wood grain. —M.D.

Freehand Inlay

A cribbage board provides good practice

by Salvatore Pontecorvo

***The author inlays a separate piece of veneer** for each group of holes on his cribbage boards. He glues a photocopy of the pattern onto the board as a guide for mortising and to align the inlays in the S pattern. An identical photocopy is cut up, glued to small pieces of veneer and used for trimming the inlays. The moment of truth comes when the paper patterns are sanded off to reveal the finished board.*

Most people are very impressed when they see perfectly fitted inlay on a piece of antique furniture. It's natural to assume that the craftsman who inset these small pieces of colorful veneer into a solid-wood surface had years of experience and labored over the final fit. But the truth is with the proper technique, a steady hand and a little practice, just about anyone can succeed at freehand inlay.

The cribbage board in the photo on p. 91 is a good first project for learning freehand inlay. By the time you've mortised the game board and cut and fitted the 24 separate pieces of veneer that make up the S-pattern, you'll either be quite accomplished at inlay or you'll know that it's not for you. The skills that you acquire on this practice piece can then be used to inlay any shape you wish.

My methods are simple: Glue identical patterns onto both the piece to be mortised and the inlay veneer; remove the waste from the mortise with a router and work to the edges with a chisel; cut out the inlays with a razor knife and glue them into the mortises; sand off the paper patterns and sand the inlays flush with the surface. For the cribbage board, drill the holes before sanding off the paper so that any tearout caused by the drill bit can be sanded away when flushing up the inlays. (Cribbage aficionados will note that the board in the photo has 120 holes, so a player only has to go from start to finish once to win.)

Preparations

I begin by making three or four copies of a pattern I've drawn, preferably using 20-lb. bond paper (the heavier paper handles better). It's important to make all copies at the same time and on the same machine because photocopies can vary slightly in size from machine to machine and from day to day and even from different times of day on the same machine. The advantage of doing it this way (over cutting the inlays and then scribing around them for the mortises) is that with a pattern such as I use, it's much easier to align the individual pieces. It's also a substantially faster technique.

The extra copy or copies are backups. In the unfortunate event that you sand through a piece of veneer, you can still save the project from the firewood pile by remortising and recutting the inlay, as long as you have an accurate pattern.

***Routing the mortises** rather than cleaning them out by hand saves time but more importantly, produces mortises of consistent depth with much less effort. The author takes the bit up to, but does not touch the incised line.*

***Trimming the veneer inlays to fit** won't take long if the pattern lines are very fine and the cuts are accurate. Some will fit perfectly without any trimming; some will need just a little sanding; and some will require hairline cuts. A steady hand will save a lot of frustration later.*

***A fence clamped to the the drill-press table** ensures alignment of the holes along the straight sections of the pattern. About two-thirds of the holes can be drilled using the fence; the remaining holes along the curves must be done freehand.*

Once you've made your photocopies, the next step is to glue one of them to your previously thicknessed stock. I use a homemade PVC roller to get a thin, even coat of glue on the wood. After placing the paper pattern on the stock, use a dry roller to flatten the pattern. Make sure you've eliminated any air bubbles, and be careful not to roll the pattern excessively because that can stretch the paper. When the glue has dried, number each of the 24 segments on all photocopies. The numbers *6* and *9* should be underlined to alleviate confusion later.

Now, cut out each of the 24 paper segments—slightly oversize—from the second photocopy. Then glue each paper segment to a piece of veneer, also slightly oversize. I use veneers that are 1/28 in. thick. I don't recommend using thinner veneers because they are more difficult to work with than thicker veneers, and you're much more liable to sand through them. Again, use a thin coat of glue between the paper pattern and the wood veneer. Allow overnight drying of glued patterns before proceeding.

Cutting mortises and fitting inlays

I use a sharp, #11 X-Acto blade to cut the outline of each playing-board section to be mortised. To ensure accurate cuts, I make the first cut with just enough pressure to cut through the paper and lightly score the wood, taking care to keep my cuts at 90° to the surface of the board. This creates a groove that will guide successive cuts of increasing pressure. I also cut each line from both ends to produce sharp corners. Cutting the lines deeper than the thickness of the veneer will make the removal of waste wood easier. The fit of each inlay will depend on how closely you followed the layout lines on the patterns, so go slowly and use care. Also, keep the knife blade sharp, and work with good lighting.

I clean out the majority of the mortise with a router and a single- or double-flute ⅛-in. up-spiral bit, adjusted to a depth just a hair thinner than the veneer. It's a bit risky having to sand or plane the veneers down to the stock, but it's a lot less time-consuming than the reverse. And though it's possible to use a larger diameter router bit, the ⅛-in. bit affords better control and allows a closer approach to the corners (see the top left photo on the facing page). Press one hand (or wrist) down tightly on the board, and use it as a pivot or anchor point for the router. This greatly reduces the risk of cutting beyond the lines. Let the router bit come as close to the lines as you're comfortable with, but don't touch the line. I first outline the perimeter of a section with the router bit, then move the router back and forth to clean the section out. It's important to go slowly at this stage, because a slip here will ruin the whole piece. Complete the final trimming of each mortise with a sharp paring chisel. (I use a ⅛-in. paring chisel because of the curves in the S-pattern, but a wider chisel could be used for the straight sides.) After you complete each section, pencil in its number for reference when inserting veneers later.

Trim each veneer inlay to size using an X-Acto knife (see the bottom left photo on p. 90). Cut the edges that run crossgrain first, and then cut with the grain. Pay close attention to grain direction, especially when cutting curves, and try not to cut diagonally into the grain or the veneer will split. As each inlay veneer is cut, test its fit to the mortise. Light sanding may be required to make the veneer fit properly. You're looking for a tight fit, not a forced fit.

Putting it all together

Once you've cut all 24 mortises and fitted the corresponding veneer sections, it's time to glue the sections in place. Any polyvinyl acetate (PVA) glue will work, but I like Elmer's Brown Carpenter's Glue because it blends better with darker woods. Brush a thin coat of glue into each mortise, and then insert the proper piece of veneer. When all 24 pieces are glued in place, set a sheet of wax paper over the game board, place another board on top and clamp the two together. Let the glue set overnight.

The next step is drilling the holes. For those that fall in a straight line, I clamp a guide board to the drill table (see the photo at left). For holes on curves, I bore freehand using the pattern holes. It's considerably more difficult for the human eye to discern misalignment on curves than on a straight line. I use a 3/32-in. bit and set the depth stop on my drill press to 1/16 in. less than the thickness of my stock. Using a sharp bit at a high speed produces crisp, clean holes.

Until now, all you've been looking at has been white paper with black lines—kind of like looking at the back of a tapestry and seeing only knots and loose thread. Now comes my favorite part of the project, as well as the moment of truth: sanding off the photocopied patterns (see the photo on p. 89). As the wood is gradually exposed, the beauty of the contrasting woods is revealed, along with the accuracy of your inlay work. I use a random-orbit or palm sander and begin with 60-grit sandpaper and work my way to 240-grit. I switch from the 60-grit to 120 as soon as I'm through the photocopy since the coarse sandpaper is quite aggressive in removing material. I try to sand only as much as is necessary to clean up the board. I also finish-sand the bottom of the playing board at this time.

Now that you have two finished surfaces, you can cut the playing board to size and rout a decorative edge bead if you like. At this point, the playing board is complete, but I prefer to use the board as a hinged top to a box. This provides storage space for the scoring pins as well as for a deck of playing cards (see the photo below).

I finish the boards and boxes with one coat of clear-lacquer sanding sealer brushed on. Tung oil makes a good substitute. After the lacquer or tung oil has dried, take 400- or 600-grit wet/dry paper and sand the finish to a silky state. A coat of hard wax (such as carnauba) can then be rubbed on and buffed to a glossy finish. □

Salvatore Pontecorvo is a retired engineer and has been an amateur woodworker since 1959. He lives in Fort Wayne, Ind.

Photo this page: Susan Kahn; all other photos: Vincent Laurence

The Anaheim Woodworking Fair '91

A glimpse of the year's largest trade show

by Charley Robinson

The sheer volume of exhibits at the biennial Woodworking Machinery and Furniture Supply Fair (WMFSF) held last fall in Anaheim, Cal., was almost overwhelming. Nearly every woodworking device you could imagine was on display. And there was something of interest for woodworkers at all levels, from the basement craftsman all the way up to huge commercial operations. Fortunately, I had three days to visit all the booths, because it would have been impossible to see everything in one day.

The WMFSF, held at the Anaheim Convention Center (see the top photo on the facing page) was the largest U.S. woodworking show of the year. An estimated 18,000 people strolled through the 14 acres of exhibits assembled by more than 700 companies from 20 different countries. Although the show was held in the midst of an economic recession, the exhibitors were universally pleased and surprised by their volume of sales. With two days still remaining in the show, Robin Gavoor of Shopcarts said that sales were already three times what the company had expected for their new pivoting-carriage cart that handles sheet goods (See the product review of Shopcart in *FWW* #91, p. 130.) Karen Cody, of Professional Tools, Inc., said, "the visitors to our booth were non-stop." She was also excited by the enthusiastic reception received by her company's new product, the Blade Runner II. Like a panel saw, the setup uses a circular saw for cross-cutting, mitering or ripping. And a router can replace the saw for dadoing or edge-molding dimensional stock and sheet goods.

Although the show had numerous booths displaying mammoth pieces of industrial equipment, I was more interested in the exhibits that showed products sized and priced for home craftsmen or small-production shops. I found three products in this category that I felt were particularly innovative: the RouterMaster, the Modulus scoring-saw attachment and the Tucker vise.

The RouterMaster, a router in a radial-arm format, shown in the middle photo, received a great deal of attention from show-goers. The RouterMaster (distributed by Garrett Wade Company, Inc. and Injecta Machinery/Eagle Tools), has adjustments to hold a plunge router in almost any position, thus allowing a variety of profiles to be cut with a single router bit. The machine works well for straight-line work, and because it can be used as an overarm, plunging-pin router, it is also excellent for pattern work. Jerry Stone of Kent's Custom Cabinets, in Oxnard, Cal., said that the RouterMaster is "spectacular. Because of all the operations it can perform, the tool is just right for the small shop that doesn't have room for multiple machines." The $1400 price tag is indicative of the RouterMaster's quality construction.

Representatives of Sisco Supply Inc. were showing off a new tablesaw accessory, the Modulus scoring-saw attachment, that the company is distributing in the United States for Modulus 2000 Machinery Inc. of Montreal, Canada. The attachment, shown in the bottom right photo, is a two-blade unit designed to make clean cuts on almost any laminated board, up to 1⅛ in. thick. The tablesaw arbor drives the larger main blade, which, through a series of pulleys and a belt, drives the small front blade. The front blade, raised just a few thousandths of an inch above the table, scores the down face of a panel to prevent splintering when the larger second blade cuts through the material. The Modulus attachment makes scoring-saw technology available at a modest price (about $350) without the need to replace an old, favorite tablesaw. It mounts on most 10-in. tablesaws by using the standard arbor nut, so it's easy to switch back to a standard blade for normal operations.

Leonard Lee of Veritas Tools Inc. demonstrated the Tucker vise (as shown in the bottom left photo). Based on the old Emmert patternmaker's vise with jaws that rotated 360°, tilted from vertical to horizontal and adjusted to clamp non-parallel objects, the Tucker extends that concept with a quick-release feature that can be foot activated and vise faces that can be adjusted to automatically accommodate tapered pieces. The old Emmert was cast iron, but this new vise is made of a cast alloy that is stronger, yet much lighter. The Tucker sells for about $500, and the vise is guaranteed against breaking.

I haven't been able to cover all the myriad products designed to make it easier and safer to work in the one-man shop, so I suggest you plan to attend the 1993 WMFSF so that you can see first-hand all of the new equipment. For more information on future shows, contact Ellen Schwartz, exhibit manager, Marketing Association Services, Inc., 1516 South Pontius Ave., Los Angeles, Cal. 90025; (213) 478-0215. If you can't wait until 1993, or if you live on the East Coast, visit the International Woodworking Fair (IWF), a similiar biennial show conducted on an alternating basis with WMFSF. The next IWF will be this August in Atlanta, Ga. For more information, contact the IWF offices at 8931 Shady Grove Court, Gaithersburg, Md. 20877; (301) 948-5730. □

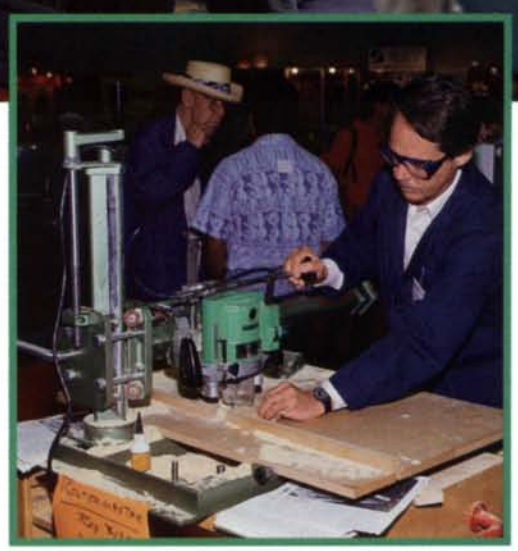
Charley Robinson is an assistant editor at FWW.

Sources of supply

For more information, contact the manufacturers or distributors.

Garrett Wade Co., 161 Avenue of the Americas, New York, NY 10013
Injecta Machinery/Eagle Tools, 2217 El Sol Ave., Altadena, CA 91001
Veritas Tools Inc., 12 E. River St., Ogdensburg, NY 13669
Professional Tools, Inc., PO Box 672525, Houston, TX 77267-2525
Shopcarts, 145 Bluxome St., San Francisco, CA 94107
Sisco Supply Inc., PO Box 9499, So. Burlington, VT 05407

Photos except where noted: Sandor Nagyszalanczy

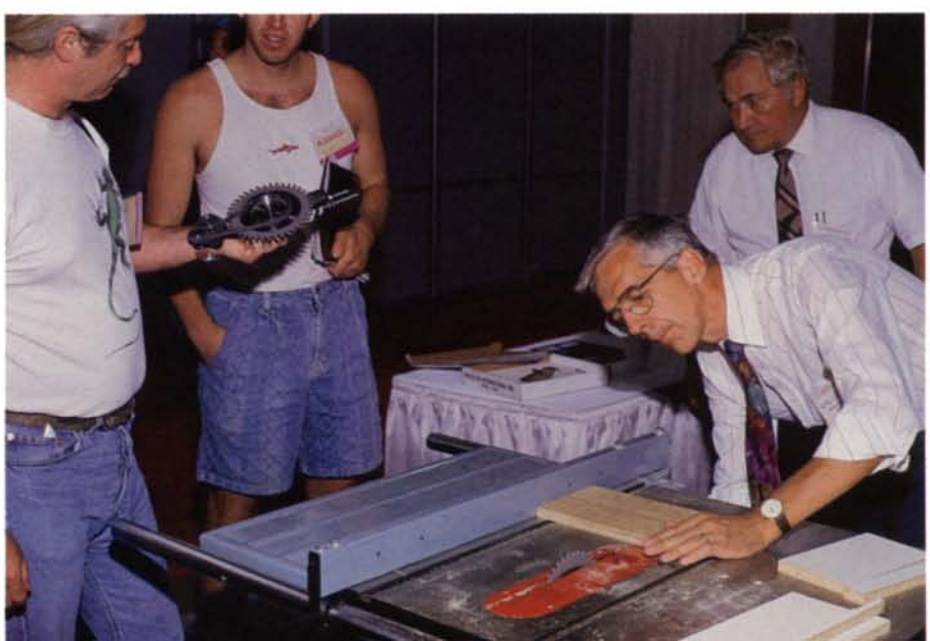


Four halls, *the size of the one shown above, overflowed with equipment and potential customers during last fall's Woodworking Machinery and Furniture Supply Fair held in Anaheim, Cal.*

The RouterMaster, *at left, operated by Garry Chinn of Garret Wade, can rabbet, groove, pin rout, plunge rout and edge rout because of its ability to hold the router in almost any position.*

The Tucker vise, *(shown in the bottom left photo) operated by Leonard Lee of Veritas Tools Inc., rotates a full 360° and tilts from vertical to horizontal. It also has integral dogs, a pivoting front jaw and a quick-release mechanism.*

The Modulus scoring-saw attachment *(shown in the photo below) being demonstrated by Michele Letendre of Modulus 2000 Machinery Inc., eliminates tearout when cutting laminated panels.*



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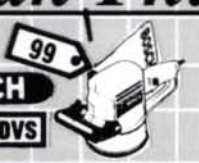

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890-11 10 Gallon, 2 Stage, 2 HP By-Pass S. Steel Vac $289

610-50	10 gal. S.S. cont. vac	179
750-01	300 CFM Tool Mate	249
464-38	12 gal. poly. cont. vac	189

PERFORMAX S/T

Per-ST100 Radial Saw Surface Sander $289

Powerfeed attachment		319
ProMax II	stationary sander	1489
SuperMax	25" stationary sander	2269
SuperMax-25	25"dual drm sndr	2749
SuperMax 37	37" drum sander	2995
SuperMax37x2	37"dual drmsndr	3495

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Zambesi 2' x 6.5' Solid Workbench $799

Deluxe	1.9' x 4.7' workbench	479
Major	2.2' x 5.5' workbench	549
Carver	4.2' x 1.4' workbench	299

The Accu-Miter

Precision Mitre Guage $149

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SENCO

SFN-1 1"- 2" Finish Nailer $278

SN-4	6d-16d frame nailer	468
SFN-II	1-1/2 to 2-1/2 fin. nlr.	398
SN325+	**NEW** 6d to 12d nailer	399
SKS	1/4" crown finish stapler	258
M-II	1-3/8" to 2" HD stapler	348
LS-2	5/8" to 1" brad tacker	258
LS-5	1" to 1-1/2" brad tacker	288
PW	roofing stapler	348
SPS-RFR	roofing stapler	338

Not Available In All States

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Multi-Max 14 With Stand $599

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1581VS Top Handle Jig Saw w/Case & 30 Blades $184

1581VS	top handle jig saw	139
1582VS	barrel grip Clic jig saw	139
1632VSK	VS recip saw kit	145
3050VSRK	3/8 VSR kit w/2 batt	129
3258	3-1/4" power plane	128
1654	7-1/4" saw w/ct blade	118

3283DVS Dustless Random Orbital Sander $99

3283DVSK	**New** 5" random kit	124
1348AE	5" elec. mini grinder	118
1608	laminate trimmer	89
1609	offset base laminate trmr	119
1942	heavy duty heat gun	75

1273DVS 4x24 V.S. Belt Sander $194

1273D	4x24 sander with bag	188
1272D	3x24 sander with bag	175
3270D	3x21 sander with bag	144
1290D	1/2 sheet finish sander	119

1611EVS 3-1/4 HP VS PlungeRouter $229

1611	3 hp plunge router	198
1615EVS	**New** 3-1/4hp VS router	269
1604	1-3/4 hp router	129
1606	1-3/4 hp D-handle router	159
1609K	3 in one trimmer kit	175

1021VSR 3/8" VSR, 0-1100 Drill $95

1022VSR	3/8" 0-1100 XHD VSR	109
1023VSR	1/2" 0-550 hd VSR dr.	109
9164VSR	3/8" 0-1000 m. midget	109
9166VSR	1/2" 0-650m. m drill	118

1404VSR 0-4000 Drywall Driver $74

1405VSR	0-2500 drywall driver	94
1420VSR	0-4000 hd drywall dr	84
1421VSR	0-2500 hd drywall dr	94
1422VSRQ	0-2500 hd tek dr	114

11212VSR 3/4" Bulldog SDS Rotary Hammer $195

11202	1.5 rotary hammer	429
11214VS	1.75 VS rotary hmr	629
11304	Brute breaker hammer	1229
11305	demolition hmr 10 amp	689
11216EVS	SDS-max vs rot hmr	699
11309EVS	SDS-max dmol hmr	649
111310EVS	vs demolition hmr	499

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Mini-ligno E 6-36% 109

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L3507M	3/4hp 1 ph. 1725 TEFC	125
L3506	3/4hp 1 ph. 3450 TEFC	130
L3510M	1hp 1 ph. 1725 TEFC	140
L3509M	1hp 1 ph. 3540 TEFC	160
L3514M	1.5hp 1 ph. 1725 TEFC	175
L3513M	1.5hp 1 ph. 3540 TEFC	195
L3516TM	2hp 1 ph. 1725 TEFC	195
L3515M	2hp 1 ph. 3450 TEFC	240

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N80S-1 16d Stick Nailer $399

N12B-1	coil roofing nailer	419
N80C-1	coil nailer	419
N100S-1	6d-20d nailer	499
N60FN	1-1/4" to 2-1/2" fin. nlr.	339
T28-5	1-3/16" finish stapler	269
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T40S2-CT	roofing stapler	299
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30405	5' fiberglass ladder	69
30404	4' fiberglass ladder	59

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7484	5" random orbital sander	104
1605	**NEW** plate jointer	119
77	7-1/4" worm drive saw	145
5550	**NEW** 7-1/4" circular saw	99
5656	7-1/4" 13 amp circ. saw	119
5660	8-1/4" 60° pro bevel saw	139
5860	8-1/4" 60° rafter master	169

HONDA Power Equipment

EB2200XA 2200 Watt Construction Generator $879

EB3500XA	3500 watt generator	1279
EB5000XA	5000 watt generator	1669
EB6500SX	6500 watt generator	2159
EW171ABI	4000 watt gen./weld.	1879
EB12D	12,000 w. diesel gen.	6999

EX1000A 1000 Watt Generator $599

EM2200XA	2200 watt generator	919
EM3500SXA	3500 electric start	1399
EM5000SXA	5000 electric start	1749
ES6500KIA	6500 electric start	2399

GX140QX 5 HP Horz. w/Oil Alert $319

GX240K1QA	8 hp horz. engine	489
GX340K1QA	11 hp horz. engine	599

For optimum performance & safety we recommend you read the owner's manual before operating your Honda Power Equipment. Connection of generators to house power requires transfer device to avoid possible injury to power company personnel. Consult a qualified electrician.

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121482 12' Multimatic 300 lb. Multi Purpose Alum Ladder $129

121499	16 foot ladder	149
121321	12' Tri-matic ladder	95

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2200 Pump Jack $59

2201	top brace	21
2203	guard rail holder	23
2204	work bench	41
2510Q	adj. wood roof bracket	16
2601Q	**NEW** wall jack	119

Elu

3338 2-1/4 HP Electronic VS Plunge Router $249

3304	1hp VS plunge router	149
2721	1.5hp fixed base router	139
1186	3/8" VS 5 amp Holgun drill	99
1316	1/2" VS 5 amp Holgun drill	109

3380 Jointer/Spliner With Case $245

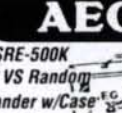
3375	3-1/8" universal planer	159
4024	3x21 VS sander	159
4029	4x24 sander	309
4015	1/2 sheet finish sander	119

Telpro Inc.

PANELLIFT™ Drywall Lift $469

AEG

VSRE-500K 5" VS Random Sander w/Case $154



VSRE-600K	6" random sander kit	159
AVSR-500S	crdlss rand. sander	229
HBSE-75S	3x21 vs belt sander	174
FSPE-100	barrel grip jigsawl	154
BSPE-100K	top-handle jigsaw	164

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1609KX	laminate trimmer kit	209
1195VSR	3/8" 6amp hmr drill	139
1194VSR	1/2VSR 6amp hmr dr.	159

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D1258R-12	12" dovetail jig	275
MMTA-24	24" mortise attach	175
MMTA-12	12" mortise attach	165
LJV	instructional video	29

Makita

6095DWE 3/8", VSR, W/Keyless Chuck $139

6093DWE	3/8", VSR kit	139
5007NBA	7-1/4" saw w/elct. brk.	129
2711	10" table saw w/brake	479
2708W	8-1/4" table saw w/ct bl.	264
122700A	porta table for 2708W	219
LS1030	10" mitre saw	229
2012	12"port. planer w/dust cht	459

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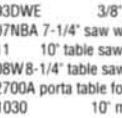

3612BR	3 hp plunge router	165
9820-2	blade sharpener	199
HP2010N	3/4", VSR hammer kit	165
JR3000V	VS recip. saw kit	128
1900BW	3-1/4" planer w/case	118
2040	15-5/8" stationary planer	1369

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2694 7-1/4" Super Sawcat W/Brake $138

2684	7-1/4" sawcat w/brake	128
2685	8-1/4" sawcat w/brake	138
2695	8-1/4" super sawcat w/br.	148
2700	7-1/4" worm drive saw	144
2710	8-1/4" worm drive saw	158

79-034 #400 Workmate $109

2664K	9.6v, 3/8 cyclone drill kit	149
2661K	3/8 VSR 13.2 v Kodiak	249
5991K	3/8VSR 13.2v hmmrgn	279
2681K	VSR 13.2v d. scrugun	259

1349-09 1/2" Timberwolf R. A. Drill Kit $289

1405	3/4" hd reversing drill	379
1321	1/2" HD spade hndl drill	159
1311	1/2" HD VSR Holgun drill	119
1180	3/8" HD VSR Holgun drill	105
2600	3/8 HD VSR drill	85
2660	VSR drywall scrugun	85

3034 7-1/4" Circular Saw $99

2037	0-4000, VSR, 5A scrugun	98
2054	0-2500, VSR, 5A scrugun	148
2059	0-2500, VSR, 5A tek gun	118
2670	1/2" HD impact wrench	139

5014 3/4" Rotary Hammer w/Case $169

5071	3/8" VSR hammer drill kit	139
5073	1/2" VSR hammer drill kit	159
5045K	1-1/2" rotary hammer kit	399
5054K	3/4" D-Hdl. SDS hamm.kt	189
5059K	2" rotary hammer kit	769
5018K	chipping hammer kit	429
5021K	demolition hammer kit	649
5027	breaker hammer	1199

1703 10" Mitre Saw With Bag & C.T. Blade $188

2711	industrial 1/4" sheet sand.	58
3158K	VS orbital jig saw kit	134
3105	VS orbital cutsaw kit	134
4076	Wildcat grinder 6000rpm	139
2750	4-1/2" angle grinder	79

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LT6-900	20 x level transit	249
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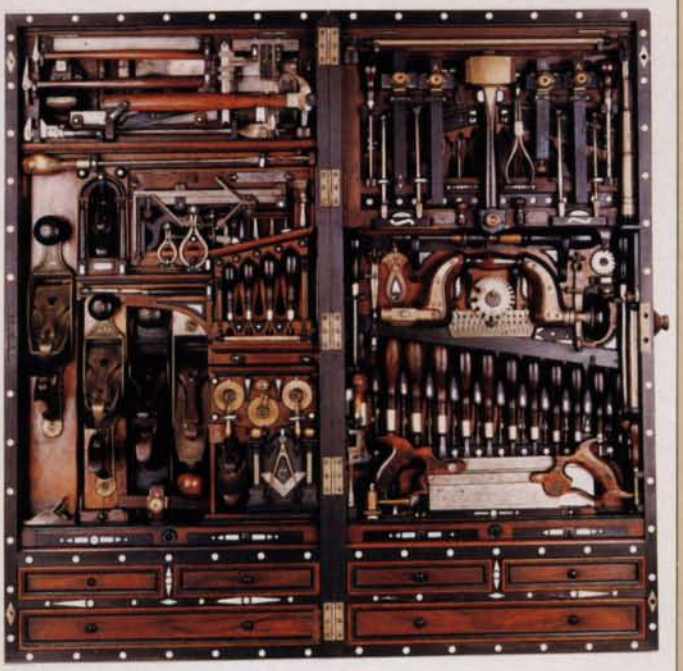

TOOL CHEST LEGACY

If the workmanship in a tool chest is any indication of the maker's talent, then the craftsmanship of master carpenter and stonemason H.O. Studley must have been awe-inspiring. In an oa clamshell box adorned with rosewood, ebony, pearl and ivory, Studley kept both tools he made and a collection of the finest hand tools made prior to 1900, including a complete set of woodworking tools as well as machinist and stonemasonry tools. To pac the 300-plus tools into a case only 19½ in. wide, 39 in. long and 9½ in. deep, Studley devised a jigsaw-puzzle arrangement of flip-up trays, fold-out layers and hidden compartments. Maine native Pete Hardwick now owns the chest, which has been in his family since it was bequeathed to his grandfather by Studley. Hardwick acquired the chest from his brother by trading a 1934 Ford sedan for it. A good trade? It would seem so: Just one tool—the Stanley #1 plane housed in the ebony archway in the upper-left part of the chest—was appraised at $700. Hardwic , a nonwoodworker, plans to sell the chest.

Now available from *Fine Woodworking* magazine

The response to *Fine Woodworking's* July/August back cover was overwhelming. So many of you called or wrote asking for a poster reproduction of the exquisite tool chest by H.O. Studley, that we decided to go ahead and print one up.

We rephotographed the chest and enlarged the photo to fill the 18″ x 26″ poster shown above. Seen at this size, Studley's ingenuity and workmanship is even more apparent.

The poster is printed in full color on the same book-quality stock as the *Fine Woodworking* covers. And we'll mail it to you carefully rolled to keep it suitable for framing.

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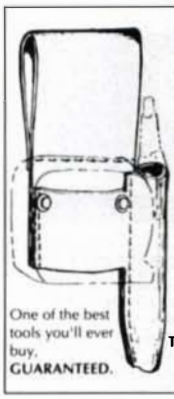

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Listings of gallery shows, major craft fairs, lectures, workshops and exhibitions are free, but restricted to happenings of direct interest to woodworkers. We list events (including entry deadlines for future juried shows) that are current with the time period indicated on the cover of the magazine, with overlap when space permits. We go to press three months before the issue date of the magazine and must be notified well in advance. For example, the deadline for events to be held in March or April is January 1; for July and August, it's May 1, and so on.

ARIZONA: **Classes**–Carving a Cowboy-type Figure with Harold Enlow, March 5–7; Carving a Hillbilly-type Figure with Harold Enlow, Mar. 9–11. Dave Rushlo Wood Carvers Supply, 2530 N. 80th Pl., Scottsdale. For more info contact Dave Rushlo: (602) 994-1233.

CALIFORNIA: **Juried shows**–Contemporary Crafts Market, Mar. 20–22, Fort Mason Center, Herbst and Festival Pavilions, Marina Blvd. at Buchanan St., San Francisco. For info, contact Roy Helms & Associates, 777 Kapiolani Blvd., Suite 2820, Honolulu, HI 96813. (808) 422-7362.
Shows–Sacramento Woodworking Show, April 3–5. Community Convention Center, Exhibit Hall A, 1100 14th St., Sacramento; Ventura/Santa Barbara Woodworking Show, April 10–12. Ventura County Fairgrounds, Commercial Bldg., 10 W. Harbor Blvd., Ventura; Northern California Woodworking Show, April 24–26. San Jose Civic Auditorium, Exhibit Hall, Park Ave. & South Market St., San Jose; San Bernardino Woodworking Show, May 1–3. Maruko Convention Center, 295 North E St., San Bernardino; Southern California Woodworking Show, May 15–17. Long Beach Convention Center, Exhibit Hall 3, 300 Ocean Blvd., Long Beach. For more info. contact The Woodworking Shows, 1516 S. Pontius Ave., Los Angeles, 90025. (800) 826-8257.
Exhibition–International Lathe-Turned Objects: Challenge IV, thru May 31. Craft & Folk Art Museum, fourth floor of the May Co., corner of Wilshire and Fairfax, Los Angeles. Exhibition of 80 objects by more than 60 artists. For more info, call the museum at (213) 937-5576.
Workshops–Woodworking for women. Furnituremaking with hand tools using traditional joinery, weekends. Call for schedule: Debey Zito, (415) 648-6861.
Solicitation–New artists wanted for the Los Angeles Craft & Folk Art Museum Research Library. Used by collectors, curators, architects, designers. For info, contact Craft & Folk Art Museum Library, c/o the May Co., 6067 Wilshire Blvd., Los Angeles, 90036. (213) 934-7239.
Workshops–Various workshops incl. Japanese woodworking, joinery and sharpening. Contact Hida Tool Co., 1333 San Pablo, Berkeley, 94702. (415) 524-3700.

COLORADO: **Workshops**–One- and two-week woodworking and furniture design workshops June thru Aug. Instructors include James Krenov, Sam Maloof and Bill Hochhausen. Summer scholarship and assistantship application deadline: March 13. For free catalog, contact Anderson Ranch Arts Center, Box 5598, Snowmass Village, 81615 (303) 923-3181.
Residency program–Anderson Ranch Arts Center's Studio Residency Program, thru May 15. Offers interactive environment for furnituremakers and designers. Winter studio residency application deadline: May 1. For information, contact Anderson Ranch, PO Box 5598, Snowmass Village, 81615. (303) 923-3181.
Classes–Woodworking and related classes, year-round. Red Rocks Community College, 13300 W. 6th Ave., Lakewood, 80401. (303) 988-6160.
Seminars–Woodworking seminars through May. Contact Woodcraft Supply, 4403 South Tamarac Parkway, Denver, 80237. (303) 290-0007.

CONNECTICUT: **Exhibition**–Containers, March 28 thru May 10. Lyman Allyn Art Museum, New London. For info, call (203) 443-2545.

DISTRICT OF COLUMBIA: **Juried show**–10th Washington Craft Show, April 23–26. Sponsored by the Smithsonian Women's Committee. Smithsonian Institution, Departmental Auditorium, 1301 Constitution Ave. N.W. (across from the National Museum of American History). For more information, call (202) 357-2700.

FLORIDA: **Shows**–South Florida Woodworking Show, Mar. 13–15. War Memorial Auditorium, 800 N.E. 8th St., Fort Lauderdale; Central Florida Woodworking Show, Mar. 6–8. Florida State Fairgrounds, Special Events Center, 4800 U.S. Hwy. 301 North, Tampa. For more info, call the Woodworking Shows: (800) 826-8257.
Meetings–Central Florida Woodworkers Guild, second Thursday of every month, Winter Park. For information, contact Ed Harte (407) 862-3338.
Meetings–Sarasota Woodworking Club. Second Thurs. of every month. For infor, contact Tom Clark, 3544 Oak Grove Drive, Sarasota, 34243. (813) 351-9059.

GEORGIA: **Show**–Atlanta Woodworking Show, Mar. 20–22. Lakewood Fairgrounds, Bldg. 1, 2000 Lakewood Way, Atlanta. Machinery, power and hand tools, free workshops. Contact The Woodworking Shows, 1516 S. Pontius Ave., Los Angeles, CA 90025. (800) 826-8257.
Show–ACC Craft Fair Atlanta, April 23–26. Atlanta Apparel Mart, Atlanta. For info, call American Craft Enterprises: (800) 836-3470.
Fair–Prater's Mill Country Fair 1992, May 9–10. This rural festival takes place on the grounds of an 1855 water-powered mill. Contact Prater's Mill Foundation, 101 Timberland Dr, Dalton, 30721. (404) 259-5765 or (404) 259-3420.
Competition–Design Emphasis '92 furniture design competition, call for entries. Sponsored by and held in conjunction with the International Woodworking Machinery & Furniture Supply Fair '92, Aug. 21–24, Georgia World Congress Center, Atlanta. For info on the competition, contact Shirley Byron, IWF, 8931 Shady Grove Court, Gaithersburg, MD 20877. (301) 948-5730.
Workshops–Japanese woodworking by Toshihiro Sahara. One Saturday each month, year-round. Contact Sahara Japanese Architectural Woodworks, 1716 Defoor Place N.W., Atlanta, 30018. (404) 355-1976.
Courses–Various woodworking courses, Feb. thru May. For info, contact Chris Bagby, Highland Hardware, 1045 N. Highland Ave., N.E., Atlanta, 30306. (404) 872-4466.

ILLINOIS: **Show**–Woodworking World Show, Feb. 29 thru March 2. Illinois State Fairgrounds, Eighth St. and Sangamon Ave., Springfield, 62702. For information, call (800) 521-7623.
Show–Chicagoland Woodworking Show, Mar. 27–29. Odeum, S. Hall, 1033 N. Villa Ave., Villa Park. Machinery, power and hand tools, free workshops. For more info, contact The Woodworking Shows, 1516 S. Pontius Ave., Los Angeles, CA 90025. (800) 826-8257.
Exhibition–The Art of the Fish Decoy, thru Apr. 6. John G. Shedd Aquarium, Chicago. For info, contact Susan Flamm: (212) 977-7170.

INDIANA: **Classes**–Various woodworking-related classes and workshops include general woodworking, lathe, and router seminars. Contact Woodworking Unlimited, 6038 E. 82nd St., Indianapolis, 46250. For schedule call (317) 849-0193.

IOWA: **Juried fair**–22nd annual Art in the Park, May 16–17. Four Square Park, Main Ave., Clinton. Fine arts & fine crafts only. Closing date: March 15. For more info, mail a SASE to Clinton Art Association, Box 132, Clinton, 52733; or call Carol Glahn (319) 259-8308.

KANSAS: **Exhibit**–Wood, Clay, and Paper, March 1–19. Fine Arts Center Gallery, Bethel College, North Newton. Featuring three alumni of Bethel College. For more information, contact Nathan Esau, RR 3, Box 82, Newton, 67114. (316) 752-3777.
Juried show–8th Annual Lenexa's National Art Show, June 12–14. Sar-Ko-Par Trails Park, Lenexa. Entries will be accepted through March 31. For more information, contact Lenexa's National Art Show, 13420 Oak, Lenexa 66215-3652. (913) 541-8592.

KENTUCKY: **Workshops**–Woodturning and joinery instruction. Contact Jim Hall, Adventure in Woods, 415 Center St., Berea, 40403. (606) 986-8083.
Meetings–Kyana Woodcrafters Inc., first Thursday of each month. Bethel United Church of Christ, 4004 Shelbyville Road, Louisville, 40207. (502) 426-2991.

LOUISIANA: **Juried competition**–Lafayette Art Assoc. Annual National Juried Competition of Original Two and Three Dimensional Art, Mar. 3 thru Apr. 7. For more info, contact J.K. Sommer, Lafayette Art Gallery, 700 Lee Ave., Lafayette, 70501. (318) 269-0363.
Show–Woodworking World Show, March 27–29. Municipal Auditorium, 1201 St. Peter St., New Orleans. For more information, call (800) 521-7623.
Contest–Dream On, Louisiana-Pacific's furniture design contest. Entry deadline: March 31. For entry forms with details on how to prepare and submit designs, contact Louisiana-Pacific, Dream On Contest, 111 S.W. Fifth Ave., Portland, OR 97204.

MAINE: **Show**–Woodworking World Show, May 1–3. Portland Exposition Bldg., 239 Park Ave., Portland. For more information, call (800) 521-7623.
Classes–Woodworking for adults and children in daytime, evenings and on weekends. Portland School of Art, 97 Spring St., Portland, 04101. (207) 775-3052.

MARYLAND: **Juried shows**–17th annual Spring Arts & Crafts Fair, Apr. 10–12. Montgomery County Fairgrounds, Gaithersburg; 15th annual Spring Arts and Crafts Fair, May 1–3, Maryland State Fairgrounds, Timonium. For more info, contact Deann Verdier, Director, Sugarloaf Mountain Works, Inc., 200 Orchard Ridge Drive, Suite 215, Gaithersburg, 20878. (301) 990-1400.
Juried festival–Maryland Country Music & Craft Festival, Aug. 15–16. Fair Hill. Submit 5 slides with $15 jury fee. Deadline for entries: April 30. For prospectus and information, contact Carl Hyden, Governor's Office of Art & Culture, (410) 333-4793.

MASSACHUSETTS: **Exhibit**–The Chair Show, thru March 8. Ferrin Gallery, 179 Main St., Northampton. For more information, call Leslie Ferrin (413) 586-4509.
Classes–Woodworking classes, throughout most of the year. Boston Center for Adult Education, 5 Commonwealth Ave., Boston, 02116. (617) 267-4430.
Workshops–Cabinetmaking Apr. 13–17; furnituremaking Apr. 20–24. For brochure contact the Heartwood School, Johnson Rd., Washington, MA 01235. (413) 623-6677.
Seminars–Various woodworking seminars through May. For further info, contact Woodcraft Supply, 313 Montvale Ave., Woburn, MA 01801 (617) 935-6414.

MICHIGAN: **Seminars**–Various woodwoking seminars through May. For more information, contact Woodcraft Supply , Heritage Plaza, 14695 Telegraph Road, Redford Township, 48239 (313) 537-9377.
Show–Woodworking World Show, April 10–12. Michigan Exposition and Fairgrounds, 120 West State Fair, Detroit. For more information, call (800) 521-7623.
Exhibition–Vessels, Mar. 21. The Sybaris Gallery, Royal Oak, (313) 544-3388.

MINNESOTA: **Demonstration**–Joinery techniques, Feb. 22. Dovetails and finger joints. For more information, contact Woodcraft, Plaza at Oxboro, 9741 Lyndale Ave. South, Bloomington, 55420. (612) 884-3634.
Courses–Basic log building, March 20–29; basic log building, April 17–26; graduate session (furniture, railings, finishing), May 11–17. For more information, contact Great Lakes School of Log Building, 3544 1/2 Grand Ave., Minneapolis, 55408. (612) 822-5955.
Juried show–10th annual Upper Midwest Woodcarvers' Exhibition, July 25–31. Blue Earth. For more information, contact Harley Schmitgen, 311 E. 14th St., Blue Earth, 56013. (507) 526-2777.
Seminars–Various woodworking seminars through May. Contact Woodcraft Supply, Plaza at Oxboro, 9741 Lyndale Ave. S., Bloomington, MN 55420 (612) 884-3634.
Juried festival–Entry deadline Mar. 1 for 1992 Minnesota Crafts Festival. Festival dates are June 27–28, College of St. Catherine, St. Paul, Entry fee. Juried from 4 slides, incl. SASE. For info contact MCC-Festival, Suite 308, 528 Hennepin Ave., Minneapolis 55403 (612) 333-7789.

MISSOURI: **Seminars**–Various woodworking seminars through May. For more information, contact Woodcraft Supply, Dierberg's Heritage Place, 12511 Olive Blvd., Creve Coeur, 63141.
Juried exhibit–Turned Visions, May 8 thru June 27. A portion of the sales' commission will benefit the Woodworkers' Alliance for Rainforest Protection. Contact Craft Alliance, 6640 Delmar Blvd., St. Louis, 63130. (314) 725-1177.

NEW HAMPSHIRE: **Classes**–Classes in fine arts and studio arts. Manchester Institute of Arts and Sciences, 114 Concord St., Manchester, 03104.
Classes–Various woodworking classes, year-round. Including antique repairs, carving canes & walking sticks, small boxes, kitchen utensils, lathe-turning, hand-carving, more. Contact The Hand & I, PO Box 264, Rte. 25, Moultonboro, 03254. (603) 476-5121.
Lecture–Bruce Hoadley, Wood Technologist and author, Mar. 28, 1–3 p.m. at the Sharon Arts Center, Sharon. Sponsored by The Guild of New Hampshire Woodworkers. Contact Paul Tuller (603) 563-8884.
Juried exhibition–Guild of New Hampshire Woodworker, the Killian Gallery at the Sharon Arts Center, Sharon. Submission deadline June 19. Exhibition Oct. 19. For more info please contact John Skewes, 132 Drinkwater Road, Kensington 03833 (603) 778-7360.

NEW JERSEY: **Show**–The North Jersey Woodworking Show, Feb. 28 thru March 1. Westfield Armory, 500 Rahway Ave., Westfield, 07090. For more information, contact the Woodworking Shows: (800) 826-8257.
Juried show–22nd annual Peters Valley Craft Fair, July 25–26. Deadline: Apr. 10. For application, send a SASE to Peters Valley Craft Fair, 19 Kuhn Rd., Layton, 07851. (201) 948-5200.
Assistantships–Peters Valley Craft Center assistantships available, June thru Aug. Application deadline: April 1. For an application, write to Peters Valley Craft Center, 19 Kuhn Rd., Layton, 07851. (201) 948-5200.
Trade show–Mid-Atlantic Woodworking & Furniture Supply Show, April 3–4. Atlantic City Convention Center, Atlantic City. For info, contact Trade Shows, Inc., PO Box 796, Conover, NC 28613. (704) 459-9894.
Workshops–Summer workshop program. Courses in blacksmithing, ceramics, fibers, fine metals, photography and woodworking offered in June, July and Aug. For workshop brochure write to Peters Valley Craft Center, 19 Kuhn road, Layton 07851 or call (201) 948-5200.
Auction–C.R.A.F.T.S. of N.J. tool auction Sunday, Apr. 4, inspection starts at 8 a.m., sale at 10 a.m. Contact C.R.A.F.T.S. of N.J., 85 Brunswick Ave., Lebanon, 08833.

NEW MEXICO: **Show**–Woodworking World Show, Mar. 13–15. New Mexico State Fairgrounds, School Art/Flower Bldg., Albuquerque, 87198. For information, call (800) 521-7623.
Seminar and juried exhibition–Seminar with master cabinetmaker James Krenov and an exhibition of fine woodworking, July 10–11. For more info, contact Santa Fe Community College, Community Services, PO Box 4187, Santa Fe, 87502-4187.
Classes–Woodworking classes. Northern New Mexico Community College, El Rito, 87520. (505) 581-4501.
Juried festival–20th annual Southwest Arts and Crafts Festival, Nov. 12–15. Application deadline Apr. 10. For prospectus write to: Southwest Arts and Crafts Festival, 525 San Pedro, NE, Suite 107, Albuquerque, 87108.

NEW YORK: **Shows and fairs**–New York Spring Tabletop Show, April 25–28, 69th Infantry Armory; International Contemporary Furniture Fair, May 17–20, Jacob K. Javits Convention Center. Contact George Little Management, Inc., 2 Park Ave., Suite 1100, New York, 10016-5748. (212) 686-6070.
Exhibits–Albert Paley, thru Mar. 15; Timothy Philbrick, Jonathan Bonner, Mar. 15 thru Apr. 15, Rosanne Somerson, James Carpenter, Apr. 15 thru May 15,. Peter Joseph Gallery, 745 Fifth Ave., New York City. (212) 751-5500.
Symposium–Woodturning by Ernie Conover, Mar. 6–7. For registration information contact Constantine, 2050 Eastchester Road, Bronx, 10461 (212) 792-1600.
Demonstrations–4th annual Wood and Tool Expo, Mar. 21–22. For more information contact Constantine, 2050 Eastchester Road, Bronx, 10461 (212) 792-1600.
Show–Woodworking World Show, April 3–5. Erie County Fairgrounds, 5600 McKinley Parkway, Hamburg. For more information, call (800) 521-7623.
Exposition and conference–Computer-Integrated Manufacturing & Engineering Design Exposition and Conference, Apr. 14–16. For infor, contact Sharon Price, CIME/Design, PO Box 310316, Newington, CT 06131-0316. (800) 451-1196.
Juried show–Woodstock-New Paltz Arts & Crafts Fair, Spring Show, May 23–25, Ulster County Fairgrounds. Contact Scott or Neil Rubinstein, Quail Hollow Events, PO Box 825, Woodstock, 12498. (914) 679-8087 or (914) 246-3414.
Classes–Various beginning and advanced woodworking classes. Constantine, 2050 Eastchester Road, Bronx, 10461. (212) 792-1600.
Meetings–New York Woodturners Association, first Tuesday of each month. Woodturning techniques exhibits, more. The Craft Student League, YWCA, 610 Lexington Ave., New York City.

NORTH CAROLINA: **Show**–High Point Woodworking & Furniture Supply Show, Mar. 6–7, Market Square Tradeshow Center, High Point. For information, contact Trade Shows, Inc., PO Box 796, Conover, 28613. (704) 459-9894.
Exhibition–Splendors of the New World: Spanish Colonial Masterworks, thru Apr. 26. The Mint Museum of Art, 2730 Randolph Road, Charlotte, 28207. For info, call (704) 337-2000.
Workshops–Ladderback chairmaking, March 2–6; Windsor chairmaking, March 16–20. Drew Langsner, instructor. For info, contact Country Workshops, 90 Mill Creek Road, Marshall, 28753. (704) 656-2280.
Video course–Wood Technology, six-lesson correspondence course on the wood industry. For info, contact Ms. Vann Moore, Dept. of Wood & Paper Science, North Carolina State Univ., PO Box 8005, Raleigh, 27695-8005. (919) 737-3181.
Workshops–Woodworking and woodcarving workshops, year-round. For info, contact John Campbell Folk School, Rte. 1, Box 14A, Brasstown, 28902. (800) 562-2440, (704) 837-2775.
Meetings–North Carolina Woodturners, second Saturday of every month. Also, woodturning workshops for all levels. For info, contact Eric Hughes, Rte. 3, PO Box 300, Conover, 28613. (704) 464-5611.

OHIO: **Class**–Wood finishing techniques, March 28. Earl Richards, Instructor. The Hardwood Store, 1813 Dalton Drive, New Carlisle, 45344. (513) 849-9174.
Workshop–Finishes, Mar. 7. Instructor: Earl Richards. Carriage Hill Farm, 7860 Shull Road, Dayton, 45424. (513) 879-0461.

OREGON: **Show**–Woodturning II lathed turned vessels, Mar. 14–Apr. 26. Made in Jefferson Gallery, 3259 Jefferson Scio Drive S.E., Jefferson, 97352. (503) 327-2543.
Seminars–Introduction to Bowl Turning, March 1; Sculptural Marquetry, Mar. 8. Contact Oregon School of Arts and Crafts, 8245 SW Barnes Rd., Portland, 97225. (503) 297-5544.
Juried show–Nehalem Fine Woodworking Show, Aug. 1–31. Artisans's Gallery, 12870 H St. (Highway 101). Slide deadline: June 1. Contact Deborah Kerner, Artisan's Gallery, PO Box 367, Nehalem, 97131. (503) 368-7301.
Meetings–Guild of Oregon Woodworkers, third Friday of every month. For location, contact the Guild at PO Box 1866, Portland, 97207. (503) 293-5711.
Exhibition–Dennis Elliott, Mar. 4–28. Corvallis Arts Center, Corvallis (503) 754-1551.

PENNSYLVANIA: **Seminar**–Wood Technology with Dr. Bruce Hoadley, Feb. 20 thru Mar. 1; Painted Furniture Techniques with Eli Rios, Mar. 21–22; Shellac Finishes with Don Williams, Mar. 28; Queen Anne Furniture Techniques with Norm Vandal, Apr. 4–5; Traditional Gold Leaf Techniques with Bill Adair, Apr. 11–12. Olde Mill Cabinet Shoppe, 1660 Camp Betty Washington Road, York, 17402. (717) 755-8884.
Classes–Woodturning with David Ellsworth. 3-day weekend workshop in private studio. Limit 4 students. Spring schedule: Apr. 3–5, 24–26; May 1–3, 22–24, June 5–7, 12–14. Contact David Ellsworth, Fox Creek, 1378 Cobbler Rd., Quakertown, PA 18951 (215) 536-5288.
Exhibition–Philadelphia Buyers Market, Philadelphia Civic Center, Feb. 21–24. For more info, call (800) 43-CRAFT, ext. 214 or 216.
Market–20th annual Lancaster designer spring art and craft market, June 6–7. Application deadline Feb. 29. Juried. For application send SASE to Lancaster Designer Craftsmen, PO Box 552, Lancaster, 17603. For more info, call Pegge Shannon (717) 291-1173 or Lancaster Designer Craftsmen (717) 295-1500.
Juried exhibitions–Re-Awakening: A Celebration of Spring, May 2–June 7; Stories: The Narrative Art in Contemporary Crafts, Aug. 8–Sept. 20; deadline: March 2. For more info, contact Luckenbach Mill Gallery, 459 Old York Road, Bethlehem, 18018. (215) 691-0603.
Competition and show–15th annual Mid-Atlantic Woodcarving show and competition, Apr. 4–5. Pennsylvania State University-Abington, campus gymnasium, Woodland Road, Abington. For more info, contact the Pennsylvania Delaware Valley Woodcarvers Association, PO Box 69, Willow Grove, 19090. (215) 663-9411.
Show–Woodworking World Show, April 24–26. Montage Ski Area, 1000 Montage Mountain Road, Scranton. For more information, call (800) 521-7623.
Juried festival–Central Pennsylvania Festival of the

Arts, July 9–12. Application deadline early March. For application, call Katherine Talcott, Assistant Director, Central Pennsylvania Festival of the Arts, PO Box 1023, State College, 16804. (814) 237-3682.
Classes–Windsor chairmaking, all levels, weekly and weekends. For more information, contact Jim Rendi, Philadelphia Windsor Chair Shop, PO Box 67, Earlville, 19519. (215) 689-4717.
Juried exhibition–Studio Days '92, Sept. 25–Oct. 4. 9th annual invitional and juried exhibition of contemporary crafts. Open to mid-atlantic artists. Submit 5 slides and fee. For details, send SASE to Studio Days '92, Chester Springs Studio, P.O. Box 329, Chester Springs 19425.

SOUTH DAKOTA: **Convention/exhibition**–Guild of American Luthiers 13th national convention/exhibition, June 24–28, Shrine to Music Museum, Vermillion. For registration form write:Guild of American Luthiers, 8222 S. Park Ave., Tacoma, WA 98408-5226 (206) 472-7853.

TENNESSEE: **Workshops**–Woodturning: Personal Directions with Leo Doyle, March 2–6; Bowl and Plate Turning and Carving with Alan Stirt, March 9–13; Woodturning: Artistic and Functional with Ray Key, March 16–17; March 23–27; Coopering: Tools and Techniques with Rick Stewart, March 16–20. For more information, contact Arrowmont School of Arts and Crafts, PO Box 567, 556 Parkway, Gatlinburg, 37738-0567. (615) 436-5860.
Workshops–Woodcarving, Jess Betschart; Woodturning, John Jordan. For more info contact Tennessee Technological Univ., Appalachian Center for Crafts, Box 430, Route 3, Smithville 37166 or TTU, Box 5106, Cookeville 38505. Call (615) 597-6801/6802 or 372-3051/3052.

TEXAS: **Show**–Woodworking World Show, Mar. 20–22. Villita Assembly Building, Navarro at Villita, San Antonio, 78296. For more information, call (800) 521-7623.
Juried exhibition–17th annual Texas Crafts Exhibition, April 4–5. University of Texas at Austin, Winedale Historical Center. For more info, call (409) 278-3530.
Juried competition and exhibition–2nd annual Furniture of the '90s, Aug. 28 thru Oct. 31. National art furniture competition co-sponsored by American Society of Furniture Artists (ASOFA) and ASOFA Institute. Entry deadline: May 2. For prospectus, send a SASE to ASOFA, Furniture of the '90s, PO Box 270188, Houston, 77277-0188. For more info, contact: Adam St. John, executive director, at (713) 660-8855.

VERMONT: **Conference**– Shaker Conference, Mar. 6. The Vermont State Craft Center at Frog Hollow. For more information or to register, please call the Frog Hollow Craft Center at (802) 388-3177 or write to Ayn Baldwin, Education Coordinator, Vermont State Craft Center at Frog Hollow, Middlebury, 05753.

VIRGINIA: **Exhibition**–Spotlight '92, May 8–July 31. Sponsored by Southeast Region of the American Craft Council and Hand Workshop, Virginia Center for the Craft Arts. For more information, contact Spotlight '92, Hand Workshop, 1812 W. Main St., Richmond, 23220. (804) 353-0094.

WASHINGTON: **Show**–Rocking furniture, thru Feb. 29. Show includes chairs, cradles and swings. Gilman Village Gallery, Seattle; 3rd Annual Goblet Show, call for entries: Feb. and March. For more info, contact Cheryl Peterson, Northwest Gallery of Fine Woodworking, 202 First Ave. South #240, Seattle, 98104. (206) 625-0542.
Juried show–6th annual show and sale, Kitsap County Woodcarvers Club, June 13–14. Kitsap Mall, Silverdale. Contact Chuck Malven, 6015 Osprey Cr., Bremerton, 98312.
Meetings–Northwest Woodworkers Guild, last Wednesday of each month. Contact John Gruenewald 622 9th Ave., Kirkland, 98033 (206) 827-8012.
Seminars–Various woodworking seminars through May. For more info contact Woodcraft Supply, Georgetown Center, 5963 Corson Ave. S. Seattle, WA 98101 (206) 767-6394.

WISCONSIN: **Festival**–20th annual Festival of the Arts, Apr. 12, Interior courtyard of the Fine Arts Building at the University of Wisconsin-Stevens Point, Stevens Point. Juried. For info, call Nancy Whitmire at (715) 344-5661.

AUSTRALIA: **Festival**–Battle of the Coral Sea, May 1–12. The Townsville Area Woodturners Association Inc., P.O. Box 692, Aitkenvale, 4814, Queensland,Australia. For more information contact Neville Hines (077) 73-556 or Mac Goodwin (077) 79 1932.

CANADA: **Show**–Ontario Wood Show, Apr. 24–26, Kinsmen Auditorium & Memorial Arena, Chatham. Contact Cryderman Productions Inc., 136 Thames St., Chatham, Ontario N7L 2Y8. (519) 351-8344.
Show–Woodworking World Show, May 8–10. Atlantic Winter Fairgrounds, Prospect Road, Armdale, Nova Scotia. For more info, call (800) 521-7623.
Classes–Furnituremaking, carving, lathe turning, router and more. Tools 'n Space Woodworking, 338 Catherine St., Victoria, B.C., V9A 3S8. (604) 383-9600.
Meetings–Canadian Woodturners Association meetings, throughout the year. Second Tuesday of each month. Contact Patrick Chen, PO Box 8812, Ottawa, Ont., K1G 3J1. (613) 739-7746.
Meetings–Blue Mountain Woodworking Club meetings, throughout the year. Third Wednesday of each month. Contact Glenn Carruthers, PO Box 795, Stayner, Ont., L0M 1S0. (705) 444-1752.
Meetings–West Island Woodturners Club meetings, second Tuesday of each month. Also, woodturning courses. Contact Eric Webb, 61 Devon Road, Beaconsfield, Que., H9W 4K7. (514) 630-3629.
Meetings–Northern Alberta Woodcrafters Guild meetings, third Thursday, Sept. thru June. Contact Douglas Lobb, 121 Healy Road, Edmonton, Alberta, T6R 1W3. (403) 430-7391.
Seminar–Duck Decoy Carving with Pat Godin, Apr. 8–9. For info contact Tools'n Space Woodworking, 338 Catherine St., Victoria, B.C. V9A 3S8, (604) 383-9600.
Show–Open house and graduate show, Apr. 25–26. Sheridan College, School of Crafts and Design, 1460 Trafalgar Rd., Oakville, Ontario L6H 2L1.
Seminar–Woodturning Design and Technique III, Aug. 1–3, Kelsey Campus, Saskatoon. Instructors: Del Stubbs, Richard Raffan, Giles Gilson, Mark Sfirri. For more information, contact Saskatchewan Craft Council, 813 Broadway Ave., Saskatoon, Sask. S7N 1B5 (306) 653-3616.

ENGLAND: **Classes**–Woodworking classes. Smith's Gallery, 56 Earlham St., WC2. Contact Laetitia Powell, Parnham, Beaminster, Dorset, DT8 3NA. (0308) 862204.
Juried show–Nottingham Woodcarving Competition, May 1–2. Entry deadline: March 13. For more info, contact Mr. R. Flint, hon. secretary, Newark & District Woodcarvers Association, (0636) 707020.

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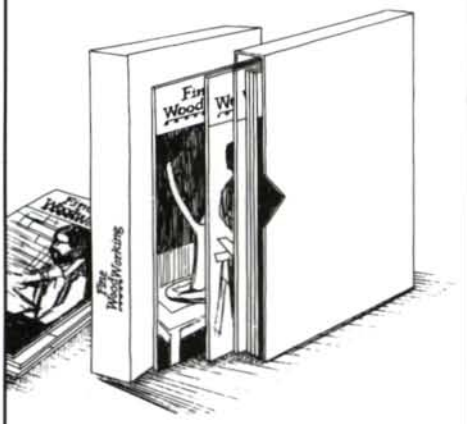

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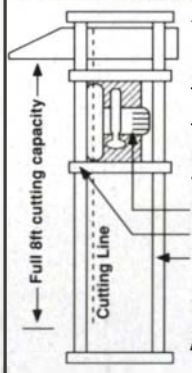

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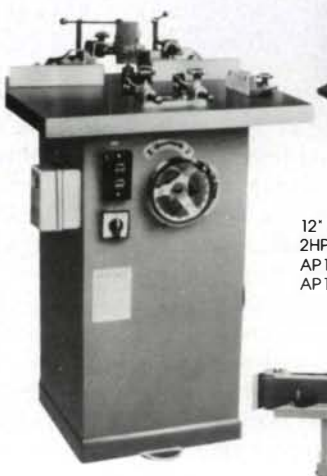

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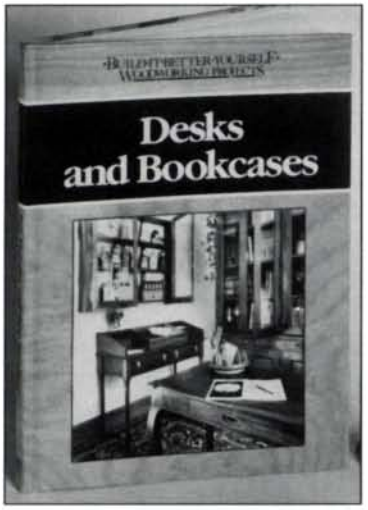
Desks and Bookcases by Nick Engler. *Rodale Press, 33 E. Minor St., Emmaus, Pa. 18098; 1990. $14.95, hardback; 123 pp.*

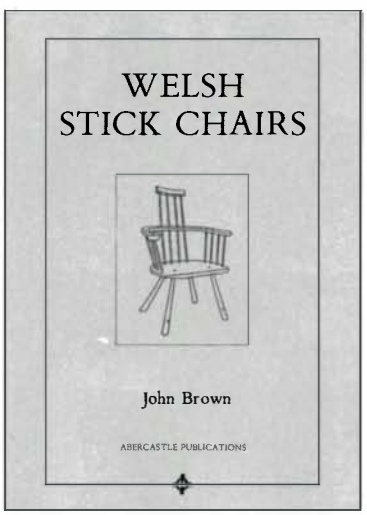


This book contains a total of 13 projects, all related to the office or study-area environment. They range in style from traditionally elegant to crudely functional, and, as you might expect, this diversity brings with it a wide span in the degree of difficulty in building them. At the simple end of the spectrum are a knife box diskette file with a sliding lid and a letter holder with a small drawer on the bottom, which is reminiscent of an Early American pipe box. A little more difficult are a no-frills, adjustable drafting table; a taboret—an end table type of storage caddy on casters; a plain-looking four-drawer oak file cabinet; and a hanging bookcase with easy-to-install surface mounted hinges on its glass doors.

Among the projects that require advanced skills are a writing table with cabriole legs, computer workstation, child's rolltop desk, barrister's bookcase with lift-and-push glass doors, and a huge hutch-like bookcase/cabinet with multiple drawers and both panel and framed glass doors. The last plan in the book is an attractive, 19th century style schoolmarm's desk with turned legs, a lift lid, pigeonholes and lap drawers.

While all the plans are well illustrated, perhaps the most helpful section in the book is a two-page discussion on computer ergonomics, offered in support of the computer workstation design. Engler's tips on the correct height for the keyboard and the convenient placement of other components will save his reader a lot of experimentation. If you're thinking about building a computer workstation, this book is a good place to start. *—Jon Arno*

Welsh Stick Chairs by John Brown. *Abercastle Publications, 2 Back Lane, Fishguard SA65 9LD, Wales; 1990. £6.25, paperback; 91 pp.*



As a Welshman and chairmaker, I found John Brown's book, *Welsh Stick Chairs*, a delightful journey into the history and making of this simple country furniture. Brown was born in the Rhondda Valley in Wales, and this book tells of his return to the region, his work and his interest in Welsh chairs.

From the forward on, I was taken by the author's style and humor: "Previous books on Windsor chairs, if they have referred to the Welsh chairs at all, have called them English regional! Whatever else Wales might be, it's not an English region!" Beginning with the background and circumstances under which the Welsh chairs were made, Brown details how he started to build chairs and shows, with the aid of 40 sharp photos, the step-by-step process of making a Cardigan chair.

I found the construction details a little short on technical information, but the spirit of the text and the photographs and line drawings carry you through this shortcoming. The chair illustrated in the construction portion of the book has fine, solid lines with tall spindles, steambent armrests, hexagonal tapered legs and a simple crest rail. When I catch up on my own chair orders, I plan to make this lovely chair myself. I highly recommend this book to all Windsor-chair makers or enthusiasts. *—Dan Weber*

Shaker Furniture Makers by Jerry V. Grant and Douglas R. Allen. *University Press of New England, 17½* Lebanon St., Hanover, N.H. 03755; 1989. $39.95, hardback; 178 pp.

"All our furniture was ever meant to be was strong, light, and, above all, practical." Such is the way that sister Jenny Wells, quoted in a 1947 article in *The New Yorker*, categorized a century and a half of Shaker craftsmanship. Believing that "their furniture was originally designed in heaven and that the patterns had been transmitted to them by angels," Shaker furnituremakers were limited by strict codes in the practice of their craft, and yet they were influenced, to some extent, by their personal background and training. Until now, the histories of many of these crafters, vital to the understanding of their work, lay hidden in literally hundreds of widespread sources. This book pulls together information from private diaries, letters, Shaker family journals, magazine and newspaper articles, books and photographs. Enlisting the aid of numerous researchers and experts, Grant and Allen have compiled the biographies of 27

individual furnituremakers, ranging in date from 1779 to 1961. As assistant director for collections and research at the Shaker Museum in Old Chatham, N.Y., Grant is well qualified for this task, while Douglas Allen has added his talents as a freelance writer. Together they have written a book that is authoritative and alluring, providing fresh insights into the evolution of the Shaker craft.

While some of the biographies are rather brief, most cover the lives of the craftsmen from admission into Shaker society through their death. Important events are well detailed, and the authors wisely let the research speak for itself by often quoting directly from their sources. Throughout the book, visual impact is added by more than 150 black-and-white photographs and illustrations, most of which highlight important pieces or construction details.

Although a bit expensive, this book has a lot to offer the modern-day furnituremaker. And if you have an interest in Shaker life and style, it should make a welcome addition to your library.

—Loran Smith

Jon Arno is a wood technologist and consultant in Schaumburg, Ill. Don Weber is a furnituremaker and restorer in Mendocino, Cal. Loran Smith is a custom house builder and furnituremaker in Dover, N.H.

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31-050	1" Belt sander 2.0 amp	104	78
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0244-1	1/2" Drill 4.5A mag 0-600 rpm	219	122
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0228-1	3/8" Drill 3.5 amp 0-1000 rpm	179	102
0375-1	3/8" close quarter Drill	219	129
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6511	2 speed SawZall with case	234	134
6750-1	Drywall Gun 0-4000 5 amp	159	93
6507	Original SawZall with case	249	132
6170	14" Chop Saw 15 amp	479	279
6014	Orbital Sander 1/2 sheet	209	116
8977	variable temp. Heat Gun	114	75
5397-1	3.8" var. spd Hammer Drill Kit	239	139
5371-1	1/2" var. spd Hammer Drill Kit	335	188
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6749-1	Drywall Gun 0-2500 5.4 amp	209	117
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LU84M011	Comb 10"	50	76	40
LU85M010	Super Cut-off	80	112	58
LM72M010	Ripping 10"	24	66	38
LU73M010	Cut off 10"	60	82	45
LU87M010	Thin Kerf 10"	24	70	39
LU88M010	Thin Kerf 10"	60	86	45
LU98M010	Ultimate 10"	80	125	69
TK206	10" Framing	24	38	25
TK303	7-1/4" Finishing	40	37	22
TK306	10" Finishing	40	46	27
TK906	10" Combo	50	52	27
SD306	6" Dado - Carbide		215	109
SD308	8" Dado - Carbide		229	119
F0	1-3/4" x 5/8" Biscuit 1000 Qty		32	27
F10	2-1/8" x 3/4" Biscuit 1000 Qty		32	27
F20	2-3/4" x 1" Biscuit 1000 Qty		34	29
FA	Assorted Biscuits 1000 Qty		34	29
FB100	16 piece Forstner Bit Set		331	165
94-100	5 pc. Router Bit Door System		319	159
JS100	Biscuit Jointer with case			159
FT2000	3-1/4 HP Plunge Router			179
FT2000E	3-1/4 HP v/spd Plunge Router		410	209

MAKITA TOOLS

Model		List	Sale
6070DW	3/8" v/spd Reverse Drill 7.2V	130	74
6071DWK	above Drill w/removable batt.	199	105
5090DW	3-3/8" Saw Kit 9.6 volt	256	137
6010DWK	3/8" cordless Drill Kit 7.2V	170	97
6010SDW	3/8" cordless Drill Kit 7.2V	99	59
DA3000DW	3/8" Angle Drill 7.2 volt	251	134
4390DW	9.6 cordless Recip Saw Kit	230	127
6012HDW	2 spd Drill w/clutch-comp	236	125
6092DW	var. spd Drill Kit complete	252	127
6093DW	v/spd Drill w/clutch-complete.	261	135
6093DWL	6093DW Drill Kit w/Flash Lt	299	169
6095DWE	6095DW Drill Kit w/2 batteries	270	139
632007-4	9.6 volt Battery	48	30
632002-4	7.2 volt Battery	40	28
5007NBA	7-1/4" Saw w/electric brake	238	127
5008NBA	8-1/4" Saw w/electric brake	295	158
B04510	1/4 sheet Pad Sander	93	54
9900B	3" x 21" BeltSander w/bag	278	144
9924DB	3"x 24" Belt Sander w/bag	293	159
9045N	1/2 sheet Fin. Sander w/bag	241	129
4301BV	Orb. var. spd Jig Saw 3.5A	289	139
JR3000V	var. speed Recip Saw w/cse	235	129
LS1020	10" Mitre Saw 3.5 amp	560	295
9820-2	Blade Sharpener	387	195
1900BW	3-3/4" Planer with case	217	114
1911B	4-3/8" Planer 7.5 amp	255	139
1100	3-1/4" Planer with case	426	225
9207SPC	7" Sander/Polisher	288	154
3601B	1-3/8 HP Router	256	139
B04550	1/4 sheet Pad Sander w/bag	89	57
DA3000R	3/8" Angle Drill	280	148
HP2010N	3/4" var. spd Hmr Drill w/cse	300	165
2708W	8-1/4" Table Saw	509	265
2711	10" Table Saw with brake	851	489
1805B	6-1/8" Planer Kit with case	717	365
5005BA	5-1/2" Circular Saw	234	135
6404	3/8" Drill Rev. 0-2100 rpm 2 A	104	58
6510LVR	3/8" Drill Rev. 0-1050 rpm	149	83
6820V	0-4000 rpm Drywall Gun 5.2 A	160	90
6013BR	1/2" Drill Rev. 6 amp	258	139
5402A	16" Circular Saw 12 amp	662	345
3612BR	3 HP Plunge Router	377	165
9401	4" x 24" Belt Sander w/bag	337	175
4302C	var. speed Orbital Jig Saw	302	159
5077B	7-1/4" Hypoid Saw	255	138
LS1440	14" Mitre Saw	744	435
LS1030	NEW 10" Mitre Saw	420	225
5007NB	7-1/4" Circular Saw 13 amp	210	114
3612B	3 HP Plunge Router sq/base	377	165
2012	12" Portable Planer	895	455
LS1011	10" Slide Compound Saw	842	445

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LS2	Pinner 5/8" - 1"	351	255
SKS	Stapler 5/8" - 1-1/2"	351	255
LS5	Pinner 1" - 1-1/2"	399	285

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T36-50	Shealth & Decking Stapler	595	305
N12B-1	Coil Roofing Nailer	845	445
N60FN-2	Finishing Nailer	625	355
T31	Brad Nailer	270	164
CWC100	1 HP Pancake Compressor	445	295

SKIL SIZZLERS

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3810K	3810 w/60 tooth Carbide Blade		229
77	7-1/4" Worm Drive Saw	230	144
5825	6-1/2" Worm Drive Saw	255	159
2735-04	12 volt cordless Drill Kit	210	135
2735-04X	2735-04 w/keyless chuck	235	137
1605-02	NEW Biscuit Jointer w/cse	200	119
7584	NEW 5" Rndm Orbit Sander	160	104

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EY571B	var. speed 9.6 volt Drill Kit	239	139
EY571BC	EY571B with case	275	139
EY6207BC	NEW 12 volt 1/2" Drill w/keyless chuck var. spd w/15 min. charger & case	421	215

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M12V	NEW 3 HP var. speed Router	447	225
TR12	Plunge Router 3 HP	354	169
F1000A	12" Planer/6" Jointer	2835	1519
C10FA	10" Deluxe Mitre Saw	538	269
C12FA	NEW 12" Mitre Saw	632	295
C8FB	8-1/2" Slide Compound Saw	899	445
FREUD	LU91M008 8-1/2" Carb bld 48 t	68	43
C15FB	15" Mitre Saw	745	375
FREUD	LU85M015 15"c/bid 108 tooth	180	105

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73-737	7-1/4	24	17.20	9.29
73-757	7-1/4	40	31.30	16.79
73-759	8-1/4	40	44.65	24.99
73-719	8-1/4	22	19.65	11.95
73-715	5-1/2	16	13.70	7.99
73-740	10	32	32.98	15.95
73-770	10	60	67.02	29.95
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9852K Porter Cable New 9852 Drill Kit Includes: extra Porter Cable battery 188

7334K Porter Cable 5" Random Orbit Sander with case & 1 roll 100X & 150X discs 253 152

7335K Porter Cable 5" var. spd Random Orbit Sndr w/case & 1 roll 100X & 150X discs 273 162

7336K Porter Cable 6" var. spd Random Orbit Sndr w/case & 1 roll 100X & 150X discs 278 169

555K Porter Cable Plate Biscuit Jointer with case & 1000 assorted biscuits 339 192

JS100K Freud Plate Biscuit Jointer with case & 1000 assorted biscuits 351 186

1581VSK Bosch Top Handle Jig Saw with case & 30 Bosch blades 305 188

1582VSK Bosch CLIC Barrell Grip Jig Saw with case & 30 Bosch blades 305 188

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T-SQUARE 52	52" Homeshop Fence	249	235
T-SQUARE 40	40" Homeshop Fence	242	209

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#2	12"	8-1/2"	24.95	15.95	81.89
#3	14"	10"	31.61	18.95	104.95
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3706	6"	9.86	6.49	36.55
3712	12"	10.92	6.99	39.75
3718	18"	12.05	7.75	42.99
3724	24"	13.16	8.39	47.75
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1582VSC	NEW CLIC Barrell Jig Saw	265	144
	Bosch Metal Case for above Jig Saws	34	32
	Bosch 30 blade assortment for Jig Saws		26.99
1942	Heat Gun 600° - 900°	111	69
1272D	3" x 24" BeltSander with bag	329	179
1273D	4" x 24" Belt Sander with bag	345	188
11-212VSR	Bulldog 3/4"SDS Rtry Drill	370	205
1194VSR	1/2" var. speed Hammer Drill	264	155
1194VSRK	above Hammer Drill w/case	292	179
1608	5.6 amp Laminate Trimmer	149	89
1609K	Lam Installers Kit with 1609	309	175
1601	1 HP Router	184	110
1602	1-1/2 HP Router	215	124
1603	1/2 HP D-handle Router	252	143
1604	1-3/4 HP 2 Handle Router	236	139
1604K	Same as above w/cse & acc	287	165
1606	1-3/4 HP D-handle Router	273	155
3258	3-1/4" Planer w/blade guard	239	137
3258K	3258 Planer w/steel case	265	148
3270D	3" x 21" Belt Sander with bag	260	148
1273DVS	var. spd 4" x 24" Belt Sander	370	239
1615	NEW 3 HP, Plunge Router	395	235
1615EVSK	NEW 3 HP var/spd Plge Router	460	265
1632VSRK	Recip Saw 8.4 A orb-v/sp	225	148
3050VSRK	9.6V cdls v/sp Drill Kit comp	256	144
3051VSRK	3050VSRK with keyless chuck	266	145
1370DEVS	6" Random Orbit Sander w/case, sandpaper, sponge pad & buffing pads.	481	299
3283DVS	5" Random Orbit Sander	159	109
3283DVSK	3283DVS Kit	220	129

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Model		List	Sale
3338	2-1/4 HP v/spd Plunge Router	427	259
3304	1 HP var. spd Plunge Router	292	185
3375	3-1/8" Univ. planer 7.2 amp	313	159
3380	Biscuit jointer with case	542	258
4024	3 x 21 var. speed Belt Sander	322	199

BLACK & DECKER

1166	3/8" Drill 0-2500 rpm 4 amp	100	65
2600	3/8" Drill 0-1200 rpm 4.5 amp	142	84
1703	10" Mitre Saww/73-770 blde.	313	179
2694	NEW 7-1/4 Super Sawcat	248	154
2695	NEW 8-1/4 super Sawcat	271	158
4011	1/4 sheet Palm Sander	82	59

DAVID WHITE

LP6-20	Sight Level package - 20x	310	198
L6-20	Meridian Level - 20x	290	189
LT8-300	Level Transit - 26x	650	445
LT8-300P	above Level w/optical plum	769	525
LT6-900	Level Transit - 20x	389	245
ALT6-900	Automatic Level - Transit - 18x	549	389
ALTP6-900	above Level w/9066 tripod and 7620 rod	600	439
AL6-18	Automatic Level - 18x	439	319
ALP6-18HD	above Level w/tripod and rod	550	375

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JP-155	6-1/8" Jointer/Planer	611	295
R500	2-1/4" HP Plunge Router	331	139
TS-254	NEW 10" Mitre Saw	397	198
TS-254K	above Saw with acc. kit & B&D 73-770 carbide blade	495	245
AP10	10" Surface Planer 13 amp	820	349
RA200	8-1/4" Radial Arm Saw	520	245
RE600	3 HP Plunge Router	431	205
BE321	3" x 21" var. spd Belt Sander	272	129
SC160	NEW 16" Bench Scroll Saw	261	139
TFD170VRK	9.6V cordless Drill Kit	292	145
TFD220VRK	12V cordless Drill Kit	325	165
JM100K	NEW Biscuit Jointer w/case	431	209
RS115	NEW 4-1/2"v/sp Rdm Orb Sndr	134	75
BT3000	NEW 10" Table Saw	699	549
W660	BEST BUY 7-1/4"Circ Saw 13A	179	95
TSS220	NEW 8-1/2" Slide Comp. Saw	790	449
TS260	NEW 10" Compound Mitre Saw	454	239

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690	1-1/2 HP Router 8 amp	240	134
691	1-1/2 HP Router D-handle	260	142
695	1-1/2 HP Router/Shaper	335	204
696	HD Shaper Table	185	123
351	3" x 21" Belt Sander w/o bag	245	137
352	3" x 21" Belt Sander with bag	255	142
360	3" x 24" Belt Sander with bag	330	182
361	3" x 24" Belt Sander w/o bag	310	174
362	4" x 24" Belt Sander with bag	345	189
363	4" x 24" Belt Sander w/o bag	330	184
315-1	7-1/4" Top Hdle Circular Saw	210	118
9315-1	315-1 comp. w/cs & carb bld	240	135
617	7-1/4" Pushhandle Saw	210	118
9617	617 comp. w/cse & carb blde.	240	135
314	4-1/2" Trim Saw	240	138
97750	1/2" v/spd Hammer Drill w/cse	260	159
9548	X HD Bayonet Saw w/case	320	199
9629	Recip Saw var. speed 8 amp	250	142
9627	Recip Saw 2 speed 8 amp	235	132
666	3/8" HD v/spd Drill 0-1200 rpm	200	125
621	3/8" HD v/spd Drill 0-1000 rpm	170	99
320	Abrasive Plane 3 amp	190	116
9118	Porta Plane Kit 7 amp	360	205
7545	0-2500 Drywall Gun 5.2 amp	185	114
505	1/2 sheet Pad Sander	210	118
7511	3/8" var. speed Drill 5.2 amp	200	112
7514	1/2" var. speed Drill 0-750 rpm	210	119
7515	7514 with keyless chuck	215	124
7549	Top handle Jig Saw 4.8 amp	250	149
330	Speed Block Sander 1/4 sheet	102	58
555	Plate Biscuit Jointer w/case	315	165
345	6" Saw Boss 9 amp	180	104
9345	345 comp. w/cse & carb blde.	220	125
100	7/8 HP Router	175	105
5116	Omni-Jig	400	249
9647	TIGER CUB Recip. Saw	195	115
9637	Full var. spd Recip Saw 8amp	250	138
7519	3-1/4 HP Router 2 Handle	410	224
7518	3-1/4 HP 5 speed Router	475	265
7536	2-1/2 HP 2 Handle Router	355	199
7537	2-1/2 HP D-Handle Router	375	209
7538	3-1/4 HP Plunge Router	410	224
7399	5.6 amp Drywall Cutout Unit	140	85
7310	5.6 amp Laminate Trimmer	150	89
7312	5.6 amp Offset Base Lam Trim	215	122
7319	5.6A Tilt Base Lam Trimmer	170	105
97310	Laminate Trimmer Kit comp	345	188
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73333	NEW Dust Collection system		24.50
693	1-1/2 HP Plunge Router Base.	295	165
6931	Plunge Router Base	120	75
7539	NEW 3-1/4 HP v/sp Plge Router	475	265

NEW CORDLESS

9850	12V 3/8" Dril w/cse 0-400 rpm	240	135
9851	9850 with keyless chuck	240	135
9852	12V 3/8"Drill w/cse 0-1000rpm	210	159
9853	9852 with keyless chuck	210	159
9854	12V 1/2" Drill w/cse 0-360rpm	280	165

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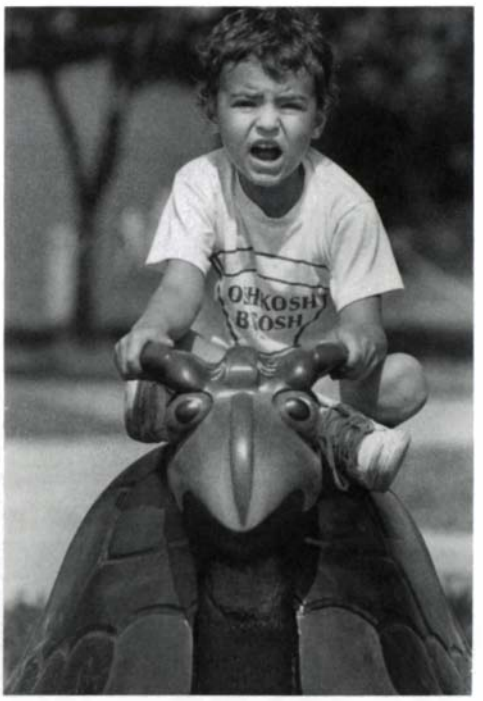
READER SERVICE NO. 22

Playground creatures test woodworkers' skills

Woodworking students at the Rochester Institute of Technology (RIT) School for American Craftsmen face a tough exam at the end of their freshman year. It's then that their spring quarter projects are subjected to the scrutiny of the preschooler's at RIT's Horton Day Care Center. The playground creatures, shown in the photos at right and below, must be tough enough to withstand the normal playground abuse of about 30 kids. In addition, the animals must be able to support the weight of an adult, while meeting the design and craftsmanship requirements of four of RIT's woodworking faculty.

Last spring marked the seventh year the freshmen have been challenged with the rocking-animal project. In addition to the musk ox, kangaroo and turtle shown in the photos, last year's menagerie included a mosquito, dolphin, shark and killer whale. These creatures were conceived on the drawing board, born as Styrofoam models and, finally, evolved into fully developed wooden animals. *—Charley Robinson*



The huge feet on this stack-laminated kangaroo, *created by Dave Garland, eliminated the need for separate rockers. The greatest challenge in building the solid-cherry animal was balancing it to stand and rock properly.*

The 'Atypical Tortise' *that Bill Cochrane carved with a die grinder and rotary rasps required 150 hours to complete. Cochrane chose a turtle because its shape naturally lent itself to a rockerless design.*

This musk-ox, by Ben Hobbs, is stack-laminated soft maple *covered with carpet padding and fake fur. The only visible wood items are the hard-maple horns, the black-walnut hooves and nose, and the bent-laminated ash rockers.*

Photos: A. Sue Weisler

READER SERVICE NO. 72

READER SERVICE NO. 113

READER SERVICE NO. 63

Photo: Bud Latven

This 12-in.-high ebony box with brass accents is representative of Phil Weber's work, which won a first place award in last year's Philadelphia Craft Show.

Photo: Jack Ramsdale

Sweet Dreams II, is a collaborative effort by painter and printmaker Kathy Halton, and furnituremaker Bob Ingram. The pickled white-oak frame is topped with a sand-blasted and clear-finished headboard and footboard. The piece is typical of the high-quality furniture found at the Philadelphia Museum of Art's best fund raiser.

Announcements

Philadelphia Craft Show

The Philadelphia Museum of Art is accepting applications until May 1 for the 16th annual Philadelphia Craft Show. Considered by some to be one of the best retail craft exhibitions and sales in the nation, last year's juried show drew 23,000 visitors to see the work of 190 exhibitors. Although sales for the 20 woodworkers in the show (see the photo above) were brisk, the exposure is even more valuable. As one exhibitor, Bob Ingram of Philadelphia, Pa., pointed out, the sales actually made at the show accounted for only about 10% of the total business he will write as a result of the exposure.

The show, sponsored by the Women's Committee for the benefit of the Philadelphia Museum of Art, is the single largest fundraising event held annually for the museum. For more information on this fall's show, which runs Nov. 5 - 8, contact the Philadelphia Craft Show, Philadelphia Museum of Art, PO Box 7646, Philadelphia, Pa. 19101; (215) 787-5448.

The Guide to Art and Craft Workshops

ShawGuides has released the second edition of *The Guide to Art and Craft Workshops*, a listing of short-term educational programs throughout the world. The guide provides details on workshop content, duration, costs and contacts by state and country. A separate appendix lists workshops by interest group, including over 60 listings for wood. This will be a handy reference for people who want to further their woodworking (or other craft) education but who have only weekends and week-long vacations for their avocation. The guide is available from local booksellers, or it can be ordered directly from ShawGuides, Inc., 625 Biltmore Way, Dept. 1406A, Coral Gables, Fla. 33134; (305) 446-8888 ($18.95, including postage).

The Wood Users Guide

If you're wondering what you can do to help save the tropical rainforest, *The Wood Users Guide* ($7.50 plus shipping and taxes where applicable) published by the Rainforest Action Network, has some suggestions. This book discusses uses, identification and alternatives to tropical woods. Also included is a limited listing of ecologically-minded sources for temperate and tropical woods (mostly California sources). For more information on the book or the organization, contact Rainforest Action Network, 301 Broadway, Suite A, San Francisco, Cal. 94133; (800) 989-RAIN, (415) 398-4404 —*Charley Robinson*

Evil Spirits and the Barley Corn Rule

England's Saint Bede, (673-735) was one of the first scholars to systematically collect all that was known on subjects ranging from grammar to physics. Although Bede spent his entire life in study and contemplation at the monastery at Jarrow, recently fragments of a manuscript attributed to Bede have surfaced that indicate the cleric was a part time woodworker. The remnant is titled, "The Presence of Evil Spirits in the Art and Mystery of Woodworking."

Bede's text begins with a listing of events that happened in his woodworking shop that could not be explained by any "natural reason." For example, he cannot understand why, after measuring a piece of wood twice, the board was too short when cut. He also discusses the disappearance of small objects on his bench. "One is using a tool, it is put down, one looks away and it has disappeared." Of course Bede did not know about the normal physiological blind spot, but even this scientific reason does not explain his persistent frustration. Bede becomes so angry at yet another "spontaneous disappearance," that he hurls a hammer at his bench where he suspects there is an evil spirit. As a result of his action, he records more evidence of "demons." The hammer misses the bench and slides under a cabinet. In frustration he formulates his well-known Barley Corn Rule—if an object falls, it will always land one barley corn (about one-third of an inch) beyond reach. He experiments with other objects by dropping or throwing them to various parts of the room. The results bolster his belief that woodshops afford an "attractive and secure home for the forces of darkness."

Bede also speculated that the evil spirits exist in the wood itself. As an example, he describes the experience of a woodcarver who had carefully chosen a billet of wood for a statue of a saint. All went well with the carving until the final cut was made on the face. The cut revealed a knot that ruined the work. This led Bede to wonder why the last tap on a chisel often causes a nearly finished board to split and how a dent appears with-

out apparent cause on a well-planed plank. Why does a choice piece of wood warp? Why does the bow on a lathe break when the finishing cut is almost completed?

Bede found evidence of evil spirits at all phases of a woodworking project, which led him to ponder: Why do hairs from brushes appear in dried varnish? Why do crude dividers slip, wooden pegs break just below the surface, and why does a gimlet slip and scratch a new altar table?

What if Bede were living today? A longer catalog of strange and frustrating events would add to his list and support his theory. As an example, consider the shop vacuum. Is there anything more worthy of the designation "instrument of the devil"? The noise threatens the hearing, the hose is a snake that coils, kinks and clogs. The electrical cord delights in catching under the casters. And when being emptied, the contents spill on the floor with such ease that there must be an evil spirit directing it.

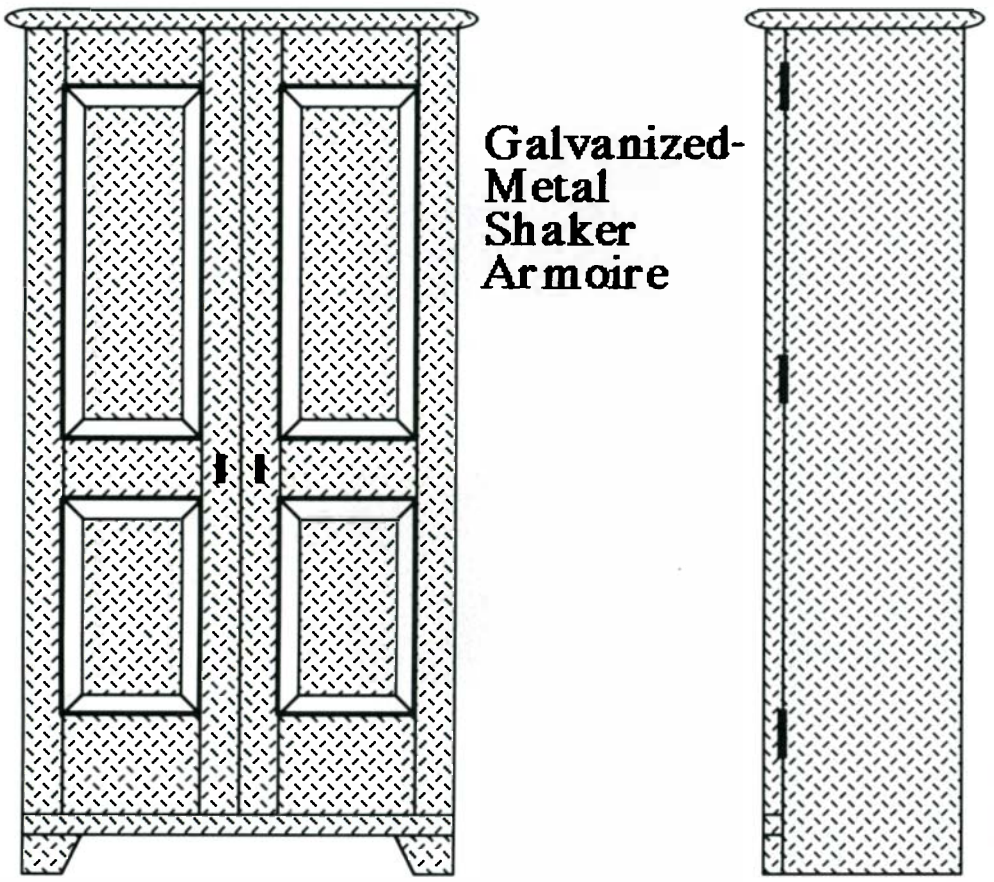
Further, cordless tools fail at the wrong moment, brads and finishing nails sprout metallic whiskers on their points. Straight grain boards suddenly bind the saw and leave a burned spot on the edge that is to show. Glue secretly squeezes out of joints, leaving areas impervious to finish. A design problem that calls for a few minutes uses an hour.

I think Bede was right, or at least he offered an explanation that was based on events that we all have observed in our own shop. So the next time you suspect an evil spirit in your shop, hurl a hammer at any spot in the room, and see for yourself that demons continue to follow the Barley Corn Rule set down by the venerable Bede 1200 years ago.

Saint Bede is buried at Durham Cathedral in England. If you measure the stone that bears his name, you will find it exactly two barley corns out of square.

—Wilbur W. Sauer, Paxton, Ill.

EDITOR'S NOTE: The author extends his apologies to St. Bede for this playful speculation about the saint's life in the 8th century.



Re High-tech woodworking

Although I have a shop full of wonderful tools, I find the realities of raising a growing family place my woodworking time at a premium. But I've found my personal computer to be the perfect solution for addressing my woodworking predilections. And reading Sandor Nagyszalanczy's article "Computers in the Woodshop" (*FWW* #92) prompted me to write and extol the virtues of my own version of high-tech woodworking. The satisfactions derived from designing *and* constructing my woodworking projects using my Macintosh computer and a simple drawing program are enormous.

Consider just a few of the distinct advantages: No warped boards to joint; perfect miter joints every time; no wood movement due to changes in temperature or humidity; and no sawdust to clean up afterward. As the illustration above shows, one can even push the envelope with regard to materials and texture in woodworking. The Galvanized-Metal Shaker Armoire seemed quite fitting as my first high-tech woodworking project because the Shakers were always open to innovative materials and methods of work.

Perhaps the greatest advantage of high-tech woodworking is also its greatest disadvantage: all the finished projects fit on a sheet of paper, but even a full-size armoire isn't capable of storing very much.

—Dean Funabiki, Pullman, Wash.

FWW readers take up the gauntlet

Our readers showed no lack of imagination in accepting the challenge issued in *FWW* #89, p. 104, to ferret out the technique for making the feathered stave bickers, shown in the photo below. David Springett of Warwickshire, England, who sent the original photo to us, thought the feathers could be cut with a knife or chisel but felt this method was too slow to produce the quantity of bickers found in early 19th century Scotland.

Suggestions for bicker construction were received from Scotland, Canada and the United States. Several readers suggested some sort of gang-sawing technique. Others thought the feathering process might have included a combination of jigs or fixtures used in conjunction with a guide for a chisel or knife. J. M. Bruce of Draper, Utah, delivered his idea with such conviction, and such a thick Scottish brogue, that I was sure for a while that he must be right. Bruce said the joints were made by driving a multiple-knife cutter into the edge of a properly moistened stave.

But the first solid bit of information about the bickers was discovered by Trevor Robinson of Amherst, Mass. Robinson sent in a page from an article titled "Traditional Scot-

Photo: Permission of Birmingham City Museum and Art Gallery, England.

***The feathered joints in this Scottish bicker** prompted* FWW *to query its readers on how they might have been made. The responses are a strong indication of how reliant we have become on machinery, jigs and fixtures.*

READER SERVICE NO. 134

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tish Woodware" by Edward Pinto that appeared in the May, 1955, issue of *Woodworker* magazine, (Argus Specialist Publications, Argus House, Boundary Way, Hemel Hempstead, Herts, England HP2 7ST). This single page promised the whole story when it revealed that "...feathering is the unusually clever operation in bicker construction. According to tradition, it was carried out with a penknife: it consists of cutting tapering 'feathers' in the edges of the stave and right through their thickness so that the light and dark woods interlock." Based on the hint that there were more details on the following pages, I contacted the current editor of *Woodworker*, Nick Gibbs, who graciously forwarded the rest of the article, but I was disappointed to find no further hints on how these joints were cut.

Richard Brockbank of Findhorn, Scotland, who knew that the joints were cut with a knife and laid out by eye, probably hit the nail on the head when he pointed out that "In this machine age, we have forgotten the skills that were developed as people worked through seven-year apprenticeships. Everything was done by hand...and there was no way to do something other than the hard way."

—Charley Robinson

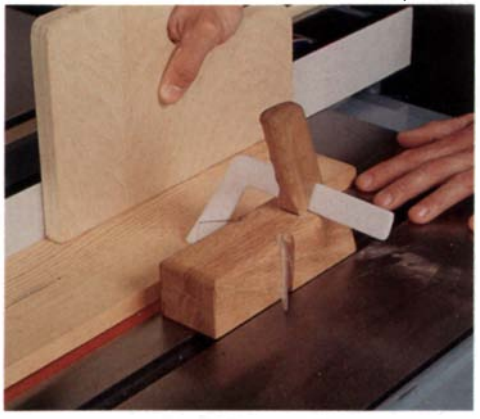
Product reviews

Grip-Tite Magnetic Featherboard, *Mesa Vista Design, 804 Tulip Rd., Rio Rancho, N.M. 87124; (505) 892-0293.*

I was skeptical when a friend showed me an ad for the Grip-Tite magnetic featherboard, but after seeing it demonstrated I bought one. Although it can't replace a fence-mounted hold-down device in all instances, it is quite useful for certain ripping operations.

The Grip-Tite, shown in the photo below, is simply a block of oak with a pair of powerful magnets set into its base. Bendable polycarbonate "wings" protrude from each side to force stock tightly against the rip fence and to help prevent kickback. An L-shaped piece of polycarbonate can be inserted through a slot in the block's handle and used to hold down stock on the saw table. On my cast iron tablesaw, the magnets exert tremendous holding power. You don't have to worry about the featherboard coming loose; it stays in position securely until you sort of swipe at the handle to tip it loose. Because the Grip-Tite utilizes magnets, this featherboard obviously will not work with a saw that has a non-metallic top.

Photo: Charley Robinson



The Grip-Tite magnetic featherboard holds securely to any metal-machine surface. The Grip-Tite not only works well on the tablesaw but also on the jointer, shaper and drill press.

Grip-Tite really shines when ripping thin, narrow stock, such as edgebanding or molding. You just set the magnetic block on the saw table ahead of the blade, tap it over until the wings hold the stock against the fence and center the L-shaped hold-down on the stock. The setup is so easy that you'll tend to use the Grip-Tite even if you're cutting only a few strips.

With the L-shaped hold-down removed, Grip-Tite also works well for grooving the rails and stiles of cabinet doors. In addition, the block provides a physical barrier to keep hands away from the blade (a nice feature when the standard blade guard must be removed). Unlike typical ¾-in.-thick wood featherboards, the wings on the Grip-Tite are 1½ in. high, which makes them much more effective for holding taller stock.

For general ripping, I was less impressed by the device. The stock had a tendency to spring suddenly when it cleared the polycarbonate wings. This was unsettling, to say the least. However, I think placing a second Grip-Tite beyond the blade and using only its hold-down wing would probably alleviate the problem.

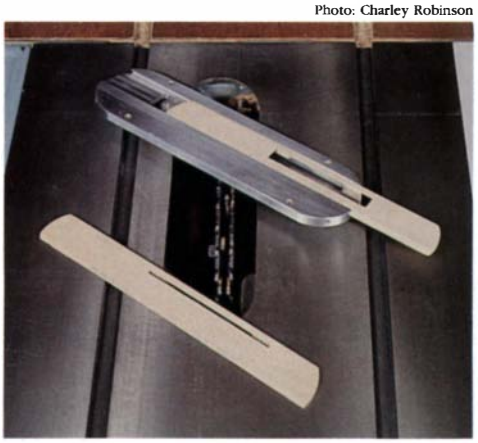
Because the Grip-Tite holds so tenaciously, I also use it as a stop block for cutting tenon shoulders and for limiting the length of cut for kerf-mounted hinges. Having had my Grip-Tite only a short time, I'm still sorting out its possibilities, but already it fills a niche, and I think it's reasonably priced at $29.95 (plus shipping). Grip-Tite is available through several mail-order catalogs and directly from the manufacturer.

—Richard Cauman, Washington, D.C.

Throat Plate, *Wood Dynamics, 15034 N.E. 172 Ave., Brush Prairie, Wash. 98606; (206) 896-9047.*

A tablesaw throat plate that fits tightly to the blade supports the stock being cut and prevents tearout on the bottom face. This is especially helpful when cutting or dadoing plywood and coated sheet goods, such as melamine. Supporting the stock close to the blade even improves the performance of dull blades or those with excessive runout. Also cutting off small pieces is safer because there is no room for chips to jam between the plate and the blade. As an added bonus, the kerf line in a tight-fitting throat plate can serve as an accurate guide for starting cuts.

Photo: Charley Robinson



The Wood Dynamics' throat plate, with a removable oak insert, makes it easy to have a zero-clearance insert for each blade and dado setup. The throat plate greatly reduces tearout as well.

Although many woodworkers make their own plywood throat plates, doing so can be time-consuming because the plates have to be accurately cut, and equipped with a method for leveling them to the table's surface. There are several after-market throat plates available for about $10, but this expense quickly adds up as you buy a new plate for each blade, angle cut and dado setup that you use.

Wood Dynamics' answer to these problems is a high-quality aluminum plate with a dovetailed cutout that holds a replaceable red-oak insert. The plate has adjustments to level it to the saw table and also to remove front-to-back and side-to-side play. Once the plate is adjusted to your saw, it's easy to slide in a new wood insert whenever necessary.

Although this throat plate is expensive ($70 to $85, with two oak inserts), the replacement inserts are less than $2 each (or you could easily make your own). If you use a lot of different throat plates, the time saved by not having to make them may offset the initial cost. And the convenience of sliding in a new insert for each critical cut will improve the quality of your work. Overall, Wood Dynamics' product is a cut above other after-market throat plates. The Wood Dynamics' throat plate is available from Garrett Wade (161 Ave. of the Americas, New York, N.Y. 10013; 800-221-2942) or Barbo Machinery (4617 S. E. Milwaukee Ave., Portland, Oreg. 97202; 503-232-8158).

—Jim Puterbaugh, Portland, Oreg.

Notes and Comment

Got an idea you'd like to get off your chest? Know about any woodworking shows, events or craftsmen of note? Just finished a great project? If so, we'd like to hear about them. How about writing to us? And, if possible, send photos (preferably with negatives) to Notes and Comment, Fine Woodworking, ***PO Box 5506, Newtown, Conn. 06470-5506.***

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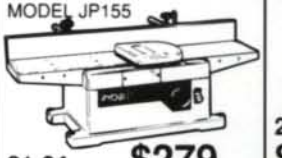
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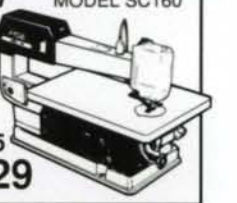
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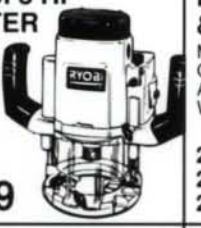
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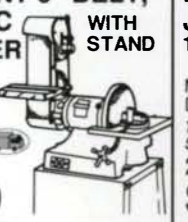
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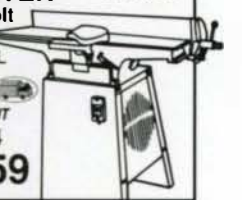
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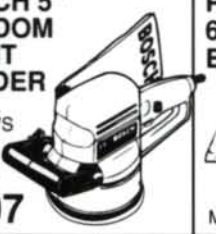
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Photos: Stephen Owen

CARTHUSIAN CANTEEN

Affection for one's alma mater knows almost no bounds in England. The cutlery canteen pictured here–what we'd call a silver chest in the States–is modeled on the Memorial Chapel at the Charterhouse, one of England's oldest and most prestigious preparatory schools. The 3-ft.-long chest was made by Stephen Owen for a Carthusian (former Charterhouse pupil) client whose family has attended the school for four generations. Owen, a graduate of the John Makepeace School for Craftsmen in Wood, Dorset, England, built the chest of native yew felled by a hurricane and supplied by the client. The roof, base and details are ebony, and the chest is lined with burgundy-dyed suede. **(For more examples of architecturally inspired furniture, see p. 72.)**