TAUNTON'S

Fine WoodWorking

December 1991, No.91
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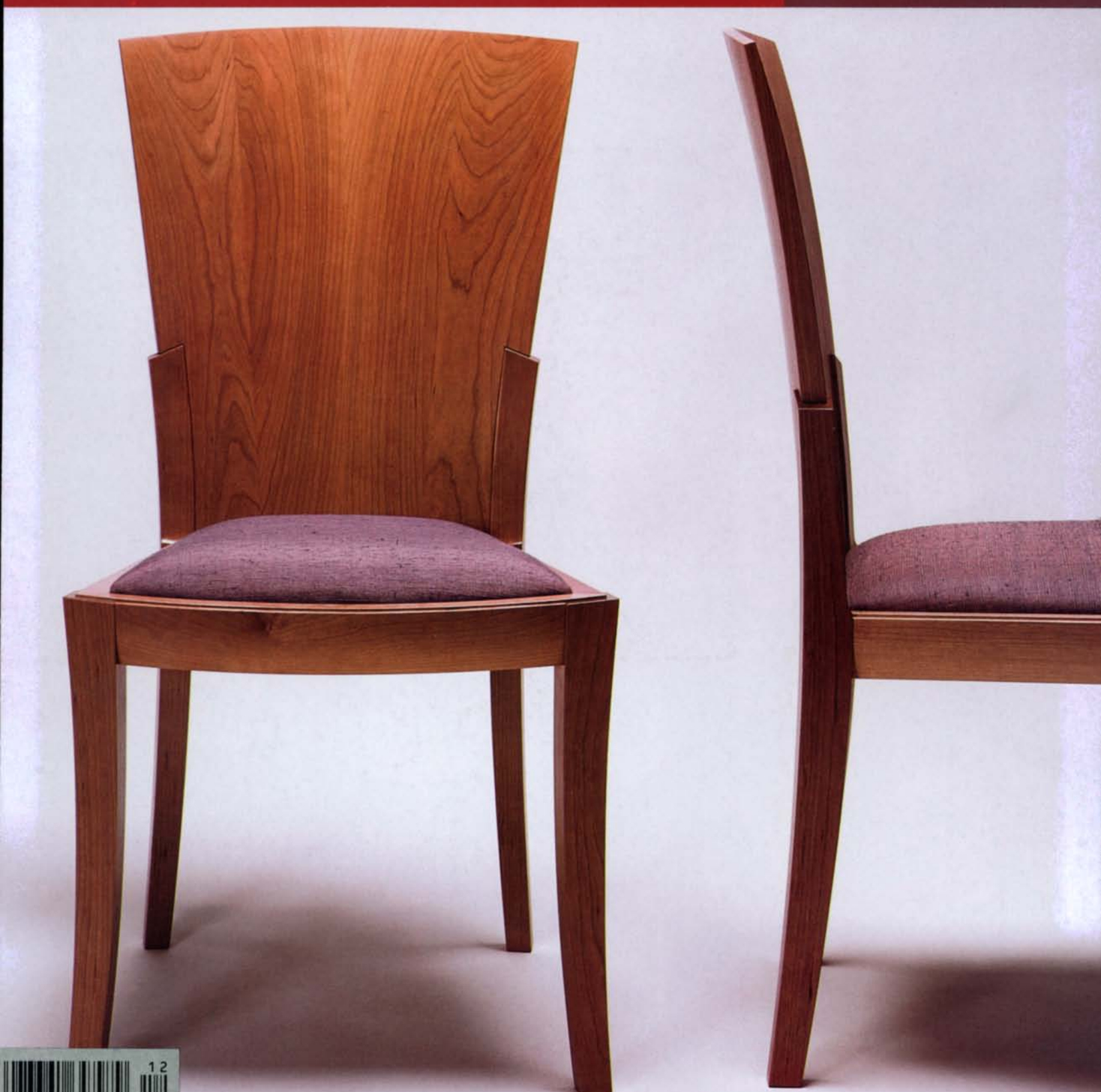
Dehumidification Kiln

Shop Layout

Belt Sander Tune-Up

Building a Sleigh Bed



Krenov Students' Show

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Photo: Gary Weisenburger

Build a dehumidification kiln for drying lumber at home (article on p. 83). Cover: William Walker's chairs were standouts in a show of furniture by James Krenov and some of his former students (article on p. 94). Cover photo: Chris Eden.

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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DEPARTMENTS

ARTICLES

Managing a small shop—Jim Tolpin's "Production Basics for a Small Shop," *FWW* #89, is an interesting read, but it raises more questions than it answers. All of us have spent time rearranging machinery and work flow to improve the economy of process, but there is a point beyond which organizing things becomes an activity for its own sake with no particular cost benefit. Paper organization is equally subject to diminishing returns. For some cultural reason, we associate maximum efficiency with copious record keeping and ritual, often regimented procedure, but it ain't necessarily so. More to the point, efficiency is only one variable in the equation that distinguishes a businessman-artisan from a businessman-operator of a small-scale assembly-line shop.

Mr. Tolpin, whose thoughtful prose neither lectures nor pontificates on the merits of his methods, likes block diagrams, flowcharts and card files to keep his work in order. Others use dedicated computer programs to the same end, and still others, such as myself, manage quite well with a no. 2 pencil and a pocket calculator. What pleases one person is poison to another, and there is no connection I know of that associates these or any other shop methods with long-term prospects of profit or loss.

But there is another point of debate that is less conspicuous and arguably more contentious. In the sidebar to the article, Mr. Tolpin describes pocket-screwed face-frame joints as an example of how he has reduced labor costs. We've all faced similar choices between traditional woodwork and the convenience of dedicated hardware and materials, but like so many other manufacturing contrivances, this one comes too close to the edge for my conservative taste.

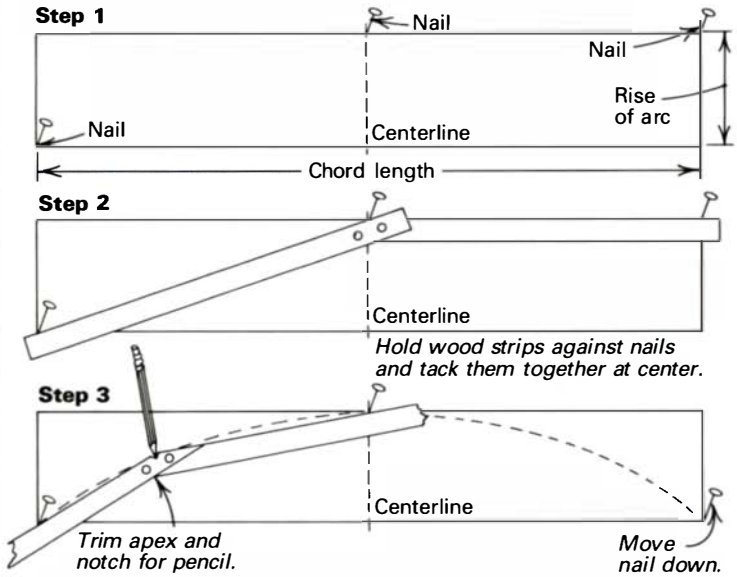
The crucial difference between the one-man shop and a factory is that we can work not just to please our clients, but to satisfy our own standards as well. None of us are in this business to suffer gratuitous losses, but many of us prefer not to subsidize a profit by sacrificing the pleasure and virtue of classic woodwork to a lifeless, production-driven methodology. Mr. Tolpin's description of his professional rebirth is, therefore, less an example of strict competitive necessity than it is an example of an approach that suits his market and his personal preferences. His comments are worth reading, but by no means do they represent an urgent model for contemporary small-shop management.

—Joseph Beals, Marshfield, Mass.

Running on all cylinders—Bruce Crawford's F4U4 Corsair *(FWW* #90), riding those golden contrails, is a glorious tribute to his skills and to the old war-horse that he has modeled. My helmet is off to him.

A word, though, about the text. There never was a nine-cylinder Corsair. It was designed and built around an 18-cylinder R-2800 Pratt & Whitney engine. Some early models made use of a three-blade prop and several late examples built by Goodyear sported 28-cylinder engines. But all F4U4s were powered by R-2800s and swung a 16-ft. four-blade prop. *—Gene Aull, Merrick, N.Y.*

The last word on finding the radius of an arc: Don't.—I've read with interest the letters in recent issues about finding the radius of an arc using basic algebra and geometry. Maybe it was just the environment, or the times in which I served my apprenticeship as a carpenter and joiner (1946-1952), but the mention of an algebraic formula to find the radius of an arc would have met with no uncertain abuse in the shop I apprenticed in. Part of our work consisted of making curved wood forms for brick arches, some of which were so large that if we used a radius method, we would have ended up trying to draw an arc with a 50-ft. radius. The drawings below illustrate the practical method we used 40 years ago to draw an arc, given the distance between brick piers (chord length) and the height (rise) of the arc.



Working directly on the timber to be used for the curved form, first mark the centerline. Then drive three, 2-in.-long nails into the timber, as shown in step 1. Next, place two narrow, thin strips of wood that are a little longer than the distance between the center and end nails against the nails as shown in step 2. Tack the two strips together where they overlap at the middle, and cut away the protruding ends. Now, remove the end nail at the top of the rise and drive it in on the baseline, like the nail at the other end (see step 3). Finally, carve a small notch to hold a pencil at the apex of the bevel formed by the two strips of wood, and place the bevel against two of the nails as shown in step 3. To draw the arc, hold the pencil with one hand, and use your other hand to gently push the bevel against the nails while sliding it along them. Move the bevel to the other side of the centerline to finish drawing the arc.

This method may look like the old-timer's way of doing

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things, but then I suppose I am an old-timer by now.

–R.A. Sharp, Cairns, Queensland, Australia

Kudos for HVLP–Congratulations to Philip Hostetter and Michael Dresdner for their accurate reporting on high-volume, low-pressure (HVLP) spray systems in *FWW* #90, pp. 66-69. Finally the truth is told about comparing HVLP systems to conventional air spraying–they both have advantages and limitations.

As a representative of one of the HVLP suppliers mentioned in both articles, my job is to educate prospective users and distributors on the pros and cons of all spray-application systems. Suppliers who sell HVLP have an obligation to tell potential customers when and when not to use it. Hostetter's and Dresdner's articles will definitely help end users decide which method of HVLP is best for them–either a turbine or a conversion air system. Before purchasing any HVLP system, ask your local distributor to demonstrate the equipment with the coating you'll be using.

–Jerry Hund, Binks Manufacturing Co. Franklin Park, Ill.

A weighty solution–The chess set made by Michael Mode and described in an article in the July/August issue was very nice. However, instead of melting lead solder and dripping it into a hole in the bottom of each piece, he simply could have used inexpensive lead (black powder) slugs purchased from a local gun shop. The slugs I use are ½ in. dia. by ⅝ in. long.

–Bill Creelman, Bremerton, Wash.

Update on ProScale–We were elated to see a review of our ProScale Model 100 digital measurement system in your excellent magazine (*FWW* #89). While we appreciate the mostly positive comments, we must address the two negative points mentioned.

The first point was that the slide bar (we call it the scale) stuck. The reviewer solved this problem by adding a small weight to the top. We have since improved the internal grounding system of the ProScale, which eliminates the use of gravity as the means of allowing the scale to drop when the machine bed is lowered. The newer scales are attached to a machine with a flexible plastic link and screw so that positive movement of the scale is achieved either up or down.

The second point was the frequent replacement of the batteries due to their failure. This is a misinterpretation of the symptoms. On our first production run of the product, the connection between the PC board in the display and the battery clips tended to oxidize. This appeared to result in the batteries failing. In reality, the connection was just going bad; the batteries were still fine. In fact, if the ProScale were left on all the time, the batteries should last for four to six months (we've had them last up to eight months). As soon as this problem was discovered several months ago, we corrected it with anti-oxidant grease and then gold contacts that won't oxidize.

As a final point of clarification, the ProScale doesn't have a memory, as mentioned in the article, because it is always on. Even when the display is turned off, the display and keyboard are merely being disabled to save battery power. Actually, this is a very useful feature, as the ProScale doesn't forget its position, even when the machine is turned off. Otherwise, the ProScale would have to be zeroed to a known point before each use.

–Bruce W. Robbins, vice president of sales/marketing Accurate Technology, Inc., Kirkland, Wash.

No gloves–As a former machinist and toolmaker and present hobbyist woodworker, I strongly disagree with Mr. Sallans' suggestion of wearing a leather glove while sanding toy wheels on his drill press ("Methods of Work," *FWW* #89). Standard safety practice dictates that neither long sleeves nor gloves be worn while operating rotating machinery.

A better solution to the heat problem when sanding spinning work would be to rough-shape the wheels with a medium to fine rasp, and then finish-sand with strips of tape-backed sandpaper that could be held at the ends.

–Steve Trauthwein, Independence, Mo.

Bending for boxes–I think Drew Langsner may have missed the point when responding to a question from Gaylen Garner in "Q & A," *FWW* #89 on steambending ⅛-in.-thick cherry for the sides of an oval Shaker box.

Although Mr. Langsner pointed out the necessity of using straight-grain wood for bending, I think that the real problem is that ⅛-in.-thick cherry is too thick to be bent around a 7½-in.-long oval. With reference to instructions from John Wilson, an experienced Shaker box maker and instructor in Charlotte, Mich., the thickness of wood for a 7-in. box (#3) should be 0.072 in. thick, or a little thicker than 1/16 in. I have had no trouble bending cherry for boxes of this size, and, in fact, I have bent 0.060-in.-thick cherry for a #00 box that is only 2⅝ in. long. I have had the same success bending hard maple, which I understand was used frequently by Shaker box makers.

I also feel that part of the problem is the method of rendering the wood pliable. Again, John Wilson suggests a process of soaking the wood in very hot water for 20 to 25 minutes and then in boiling water for 1 minute. This method results in very flexible wood and may be preferred to steaming as Mr. Garner did.

Last, it could be that ⅛-in.-thick stock was used because that is the thinnest dimension that most small planers will work to. If that is the problem, the solution is to plane the strip to ⅛ in., mount it on a plywood carrier board with double-faced tape and plane to final thickness with very light passes.

–Ken Oldfield, Unionville, Ont., Canada

Who's the boss?–In a letter in *FWW* #89, Lasse Carenvall described customers who have a picture in their heads of what they want and then expect the self-employed woodworker to read their minds. I believe this situation points to a more basic problem, which is that self-employment is inappropriately called "being your own boss." In truth, self-employed individuals have many bosses, and very rarely do they have any training or experience being a boss. Many customers enter the deal regarding contractors as adversaries and avoid letting on how much they want to spend. Others will say things like, "I don't care what it looks like, just make it functional" in the hopes that it will look great and cost little. Small mistakes are not tolerated as they would be in a corporate environment (don't forget our toughest boss–the Internal Revenue Service). While I won't be trading self-employment for a steady paycheck soon, it is a comfort to know that the bridge back hasn't been burned.

–Steve Keller, Carson City, Nev.

Period furniture shortcuts–My family and I had the opportunity to visit the DeWitt Gallery during a recent visit to Williamsburg, Va. What an impressive assortment of colonial furniture! Queen Anne period furniture is a favorite style of mine, and seeing the work of Affleck, Townsend and many other great craftsmen was an inspiration.

I had to smile, though, when I noticed some of the construction details. For instance, all of the quarter columns I saw were pieced together; the straight portions of the columns were produced separately from the more detailed turned pieces at the top and bottom. Also, on the block fronts I saw, the shells were almost always applied. I had to wonder if many of today's purists realize that the "Rembrandts" of colonial furniture-making used these techniques.

I don't think these guys were out to make things any more difficult for themselves than necessary. My appreciation for their

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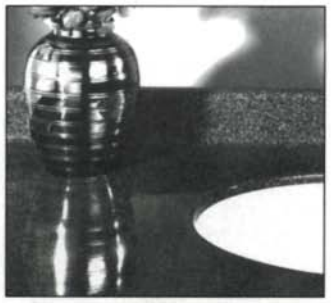

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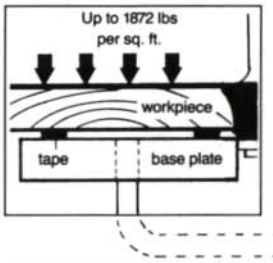

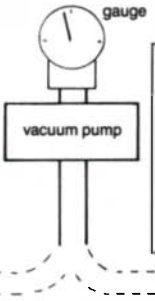

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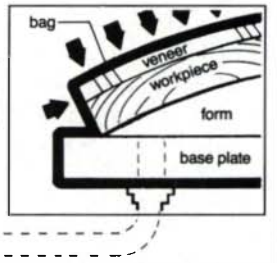

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work has to do with its innovation, aesthetics, quality construction and, most of all, the ability to make a living at it!

–Mark Stebbins, Palm Bay, Fla.

All hide glue is not the same–I'd like to add to Grit Laskin's answer to Nicholas Sarro's question in *FWW* #89 about failed joints on a guitar that was assembled with liquid hide glue.

First, liquid hide glues are not the same adhesive as traditional cooked hide glue, made fresh for each day's work. The strong, rigid and extremely thin glueline of cooked hide glue is prized by violin craftsmen for its great strength under shear loads. Liquid hide glue, on the other hand, will remain permanently flexible due to the additives that keep it in liquid form in the bottle. This flexibility causes it to be prone to failure in both the shear and peel modes.

Second, Mr. Sarro may have used overaged glue. Although the shelf life of liquid hide glue varies with storage conditions, it is not more than one year. After a certain amount of aging, liquid hide glue will not bond properly at all. I have seen store displays of what are obviously very old bottles of liquid hide glue, but unfortunately the bottles are not dated. To add a further problem, the fungicide in liquid hide glue can stain the wood adjacent to the glueline, and in some cases it can leave a very nasty yellow stain, which also causes the affected wood to become brittle over time.

To address Mr. Sarro's problem of regluing the guitar, I suggest trying to remove as much of the liquid hide glue as possible. This will require several washings with warm water, each followed by a washing with commercial laundry bleach. Allow each joint to sit a few minutes before rewashing with more warm water. Repeat this process until no more color comes out. A toothbrush is good for applying the wash if the joint is accessible, but a bamboo splinter or a stainless-steel blade will also work. Any other metal besides stainless steel may leave a stain when it contacts the glue. When thoroughly washed and dried, reglue one joint at a time with traditional cooked hide glue (ground hide glue), available from violin/luthier-supply houses and Stewart MacDonald Manufacturing, 21 N. Shafer St., Athens, Ohio 45701; (800) 848-2273. The residual additives from the liquid hide glue would pre-empt regluing with the yellow PVA glues used by many guitar craftsmen. Violin craftsmen should only use cooked, traditional hide glue for all primary joints.

–David Brownell, Ann Arbor, Mich.

Fine blades for jigsaw puzzles–In *FWW* #88, Anne D. Williams provided an interesting article on making jigsaw puzzles. More than 50 years ago such puzzles were all the rage. I made a lot of puzzles and sold them in wooden boxes to pay my way through college. Williams' description varies but little from my methods back then, though I suspect her product is superior.

In the article, Williams indicated the difficulty of finding suitable blades. I also have had difficulty because the supply of original Hobbies Co. blades from England, which I prefer for fine marquetry and similar intricate cutting, seemed to dry up here in Canada before World War II. But in 1984, while in London on a holiday, I found the source again. Hobbies (Dereham) Limited, Dereham, Norfolk, NR19 2AZ, England, has a large catalog of tools and supplies for small-scale woodworking items, and the company still sells fretsaw blades. I use "O" grade (fine) for most intricate cutting. These blades are 3/64 in. wide, 5 in. long, and have 26 teeth per inch (t.p.i.). They last a surprisingly long time in a smooth-running power scroll saw. Medium-grade

blades are available in sizes 3, 4, 5 and 6, and heavy grades are available in sizes 7 to 11. Blades are sold in packages of 12. The price was less than $2 per package, or $10 by the gross, when I placed my last order in 1989.

—Orville E. White, Victoria, B.C., Canada

Buying bearings—I read Robert Vaughan's well-written article on ball bearings in tools and machinery in *FWW* #90 with much interest. As a retired machine designer and lifetime woodworker, I have some comments that may be of value on the subject.

The greatest cause for bearing failure in small shop tools and machines that aren't used eight hours a day is the age of the lubricant. So when replacing a worn bearing in an older tool, I suggest replacing all the bearings. Bearings bought from a distributor are so cheap that it is not worth the risk of reinstalling an old bearing. Buying replacements from the tool manufacturer is easy, but they can be expensive. More than once I've been quoted a price of around $40 by a manufacturer for a bearing that I ended up buying from a bearing distributor for $7. Because bearings are produced in large quantities worldwide, and are, therefore, quite inexpensive and readily available, tool manufacturers normally use standard bearings.

I must disagree with Mr. Vaughan about the desirability of using extra-precision-grade bearings. Standard-precision-grade (ABEC-1) bearings are really very precisely made; for sizes with smaller than a 1-in. bore, the bore and outside diameter tolerances total 0.0005 in. —Clyde R. Seitz, East Aurora, N.Y.

Cleaning out portable tools with compressed air—I take exception to Lynwood W. Reed's statement ("Editor's Notebook," *FWW* #89) that a blast of compressed air into a portable power tool only tends to aggravate the problem of dust intrusion by driving particles "into the very places from which you want to remove them." In the college shop that I supervise, we find the converse to be true. A good shot of compressed air not only blasts dust and chips out of the machine, but increases its longevity as well. Before we installed an air line in our shop, our portable power tools (we have heaps of them) suffered considerable downtime. The cause was usually dust related: Arcing, caused by dust caught between brushes and commutator, pitted and destroyed commutator faces, and switch contacts would also arc themselves to death.

Since we've had the compressed-air line installed, my students have been blowing the portable equipment clean before putting it away. All of the power tools now run better and last longer. The function of the little blowers that Mr. Reed mentions is not so much to prevent dust intrusion but rather to cool the motor. Neither wiping down nor vacuuming will significantly curtail dust damage. Only a solid stream of compressed air can guarantee a clean motor. *—Bernie Maas, Edinboro, Pa.*

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—John Lively, publisher

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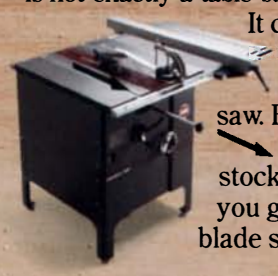

It cuts by pulling the blade through the wood like a radial arm saw. But it's not exactly a radial arm saw. Because it cuts from beneath like a table saw, it doesn't climb the stock like a radial arm saw can. So you get accurate cuts. And with the blade secured you can perform other table saw operations like ripping.

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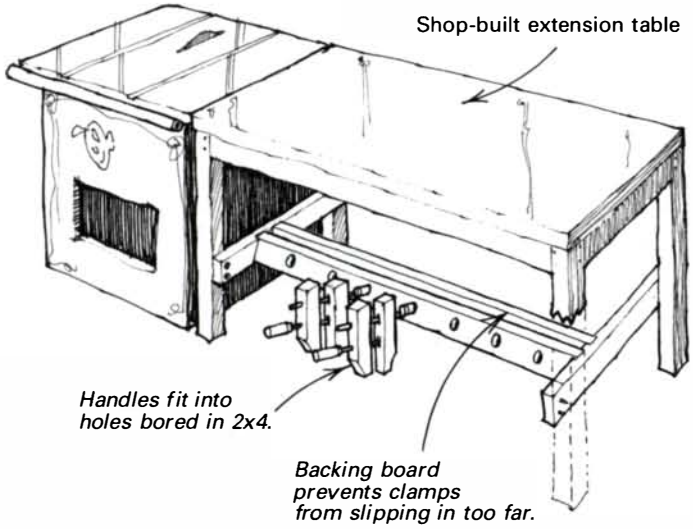
edited and drawn by Jim Richey

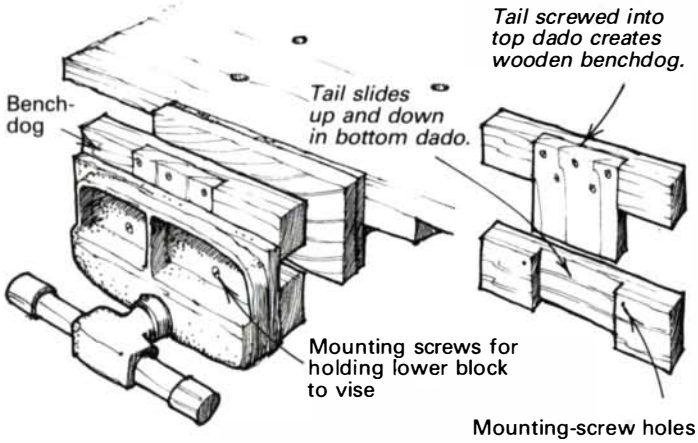
Hand-screw storage



I utilize the space under my tablesaw extension to store hand screws. The system is neat and out of the way, and it allows quick selection of the clamp that is most nearly adjusted to the size I need. To make the storage rack, drill handle-size holes in a 2x4. Then mount the 2x4 at an angle in front of a backing board, which prevents the clamps from slipping in too far.

—Thomas R. Ormsby, Walworth, N.Y.

Shopmade vise dog



When I bought my woodworking vise, I saved a few bucks by choosing a model without a built-in iron dog that could be raised when I wanted to clamp a workpiece on the bench. After years of making do with various work-holding improvisations, I came up with my own system, which is shown in the sketch above.

To make the device, cut a 1-in.-thick hardwood block to match the height and width of your vise's outboard-jaw face. Hold the block in the vise and mark the locations of the jaw's mounting screws. Next, crosscut a dado in the block as wide as possible between the mounting screws. The depth of the dado should equal half the thickness of the wood. Now, rip the block in two just above the mounting-screw locations to make a top and a bottom. Attach a tail to the top piece, as shown in the sketch, to form a T-shaped dog. To complete the construction, take the bottom piece created when you ripped the block in two, screw it to the vise and pop in the dog. The tail of the dog should fit snugly in the dado so that the dog won't slip down after it's pulled up.

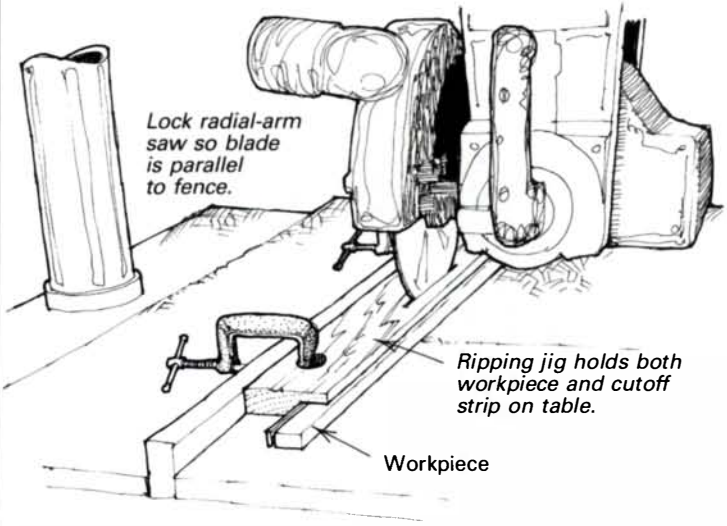
Now, instead of a 1-in.-sq., work-marring steel dog, you have an 8-in.-wide wooden dog that's not likely to damage your work. The width of the dog also makes it easy to hold workpieces securely. And if these advantages aren't enough, keep in mind that if and when the dog wears out, it can be replaced in minutes with scrapwood.

—Robert Spalter, Lake Worth, Fla.

Quick tip: To prevent a piece of veneer from slipping when clamping pressure is applied, go over the veneer with a wooden roller right after laying the veneer on the glued substrate.

—Dario Biagiarelli, Kirkville, N.Y.

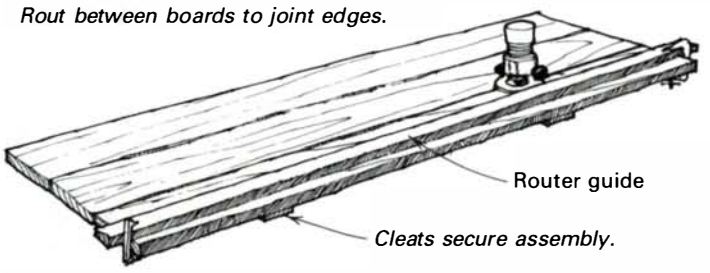
Ripping thin strips on the radial-arm saw



Before I developed this fixture for cutting thin strips, I found that I ruined about as many strips as I kept. The rotation of the blade tends to lift the workpiece or the strip off the table, and, if conditions are not perfect, the strip will catch on the blade and break. This fixture, however, eliminates this problem by holding both the workpiece and the just-cut strip on the table. To avoid problems, cut with a sharp hollow-ground planer blade, set the sawblade parallel to the fence and install a fingerboard before feeding the stock.

—Harold Nachlin, San Diego, Cal.

Jointing long boards with a router



When I needed to joint the edges of several 12-ft.-long boards for gluing up a tabletop, I first tried using my jointer. However, even with auxiliary rollers on both ends of the jointer bed, I was not able to obtain a truly straight edge over the entire 12-ft. length. So I turned to this router-based method and achieved surprising success.

First, lay the long boards on the bench, good-side down, in the desired arrangement. Push the boards together as closely as possible, minimizing wide gaps between edges. Then screw several scrap cleats across the boards, putting at least two screws through the cleats into each board to keep the entire assembly from racking. Finally, scribe a few registration lines across the underside of the boards to assist later in glue-up.

When this assembly is complete, flip it over so that the good sides of the boards are facing up. Then, using a straightedge as a guide and a ¼-in.-dia. straight bit set slightly deeper than the thickness of the boards, rout down the middle of each gap be-

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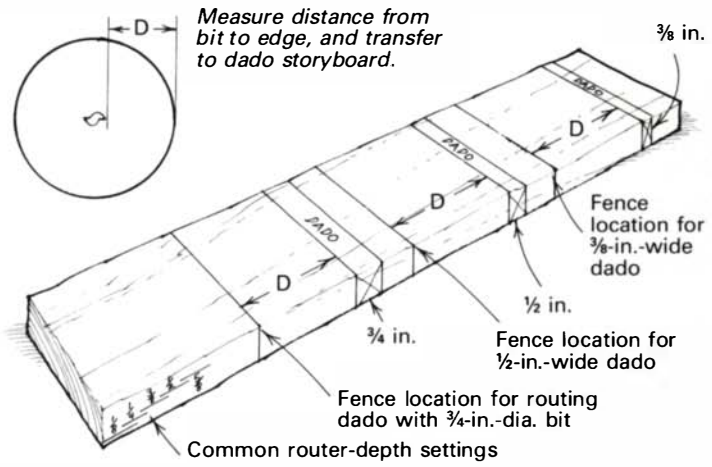
tween boards. This will remove stock from the edges of both boards, leaving a uniform gap between them. Remove the cleats, and glue up the boards as usual. The real beauty of this technique is that the straightedge used with the router does not have to be perfectly straight. Any slight waves or bows will be compensated for by an equivalent wave or bow on the other side.

—Michael A. Mason, Greendale, Wisc.

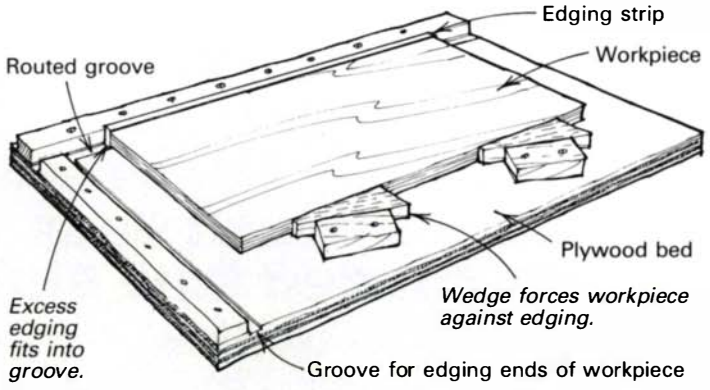
Storyboard for routing dadoes



Here's a quick and accurate method to determine where to clamp a guide fence when routing dadoes. First, measure the distance from the outside of your router base to the edge of the bits you commonly use for dadoes. Now, transfer each of these measurements to a ¾-in.-thick, straight piece of wood, as shown in the sketch. To use the storyboard, simply align the dado lines with the desired dado location, and transfer the fence location mark to the workpiece. Also mark some commonly used depths on the edge of the storyboard to facilitate setting the depth of the bit.

—Keith Schubert, Irvine, Cal.

Wedges for edging plywood



Here is a method that I use to attach ⅜-in.-thick, solid-wood edging to ¾-in.-thick plywood shelves and case members.

To make my edge-gluing fixture, as shown in the sketch above, cut a panel of inexpensive ¾-in.-thick fir plywood to serve as the bed. In this bed, rout a ⅝-in.-wide by 1/16-in.-deep groove about 1½ in. from the edge. Screw a batten along the edge of the plywood so that the batten slightly overhangs the routed groove. Now, saw several wedges, all the same size and taper, and an equal number of rectangular pressure blocks about 1 in. shorter than the wedges. With a sample workpiece in

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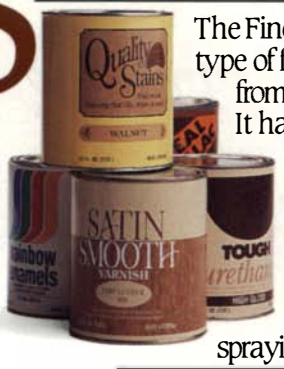

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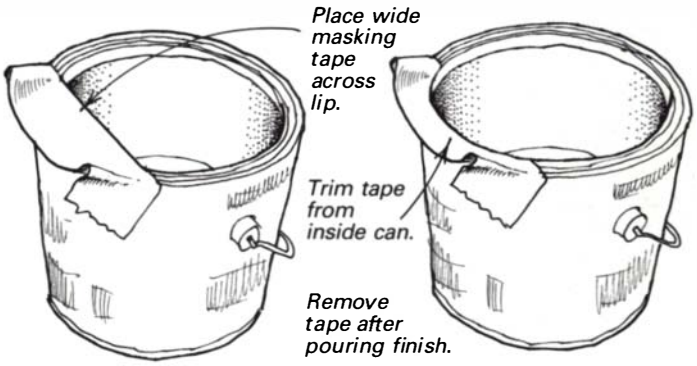
place in the jig, screw the blocks to the bed, as shown, so that the wedges can be tapped home.

To use the jig for ¾-in.-thick shelves, first rip ⅜-in.-wide solid-wood edging from a board that has been planed to ⅞ in. thick. Cut the edging to length, and place it in the groove against the batten. Spread glue along the edge of the workpiece, lay it against the edging and tap the wedges home with a hammer.

After the glue has set, tap the narrow end of each wedge to unclamp the work, and remove the workpiece from the jig. Trim the edging flush with the plywood surface using a router jig or handplane. To edgeband the ends of the workpieces, follow the same procedure, but with the groove and batten located at the end of the plywood bed. *—Abram Loft, Rochester, N.Y.*

Keeping a paint-can lip dry



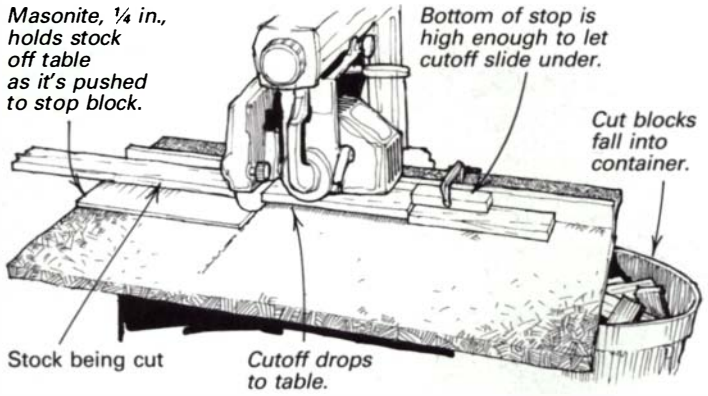
Here's how to keep varnish, lacquer or paint out of the lip of often-opened cans. After wiping the lip dry, apply a piece of 2-in.-wide masking tape across the mouth of the can. Fold down the ends of the tape, as shown in the drawing, to create a dam at the edges. Now trim the tape away from the inside of the can with a razor blade or knife. After pouring out the finish, just strip the tape off to reveal a perfectly clean lip ready for resealing.

—Daniel A. Koblosh, Redondo Beach, Cal.

Quick tip: Bandsaw blades make precise gauges for indexing jigs and marking layouts. For example, a 6-t.p.i. blade is a ready reference for thirds or sixths of an inch.

—Robert Vaughan, Roanoke, Va.

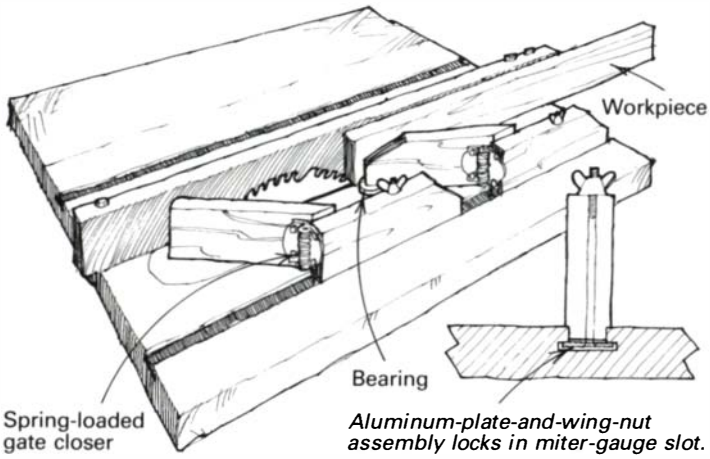
Cutting multiples



When I had to cut hundreds of 8-in.-long blocks, I set up my radial-arm saw with an auxiliary Masonite table and a floating stop block, as shown. I slide stock (already ripped and planed to the

right dimensions) in from the left and over the Masonite until it butts against the stop, and then I cut it. The block drops to the saw table, and the next piece being cut moves it under the stop and along the table. Eventually, the block will fall off the end of the table into a container. —*Gothard Knutson, Fargo, N.D.*

Spring-loaded hold-ins

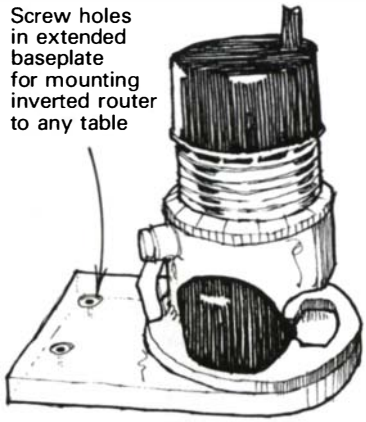


Aluminum-plate-and-wing-nut assembly locks in miter-gauge slot.

This pair of tablesaw hold-ins uses gate-closer springs to apply pressure on the piece being cut. I added an old shaft bearing to the front hold-in to reduce friction. Since my saw has a T-slotted miter-gauge track, I designed the wing-nut-and-aluminum-plate locking device to take advantage of it. On saws that don't have a T-slotted track, just size the hold-ins so they can be press-fit into the miter-gauge track. —*Frank Usher, Nepean, Ont., Canada*

Quick tip: A convenient way to hold Allen wrenches, chuck keys and other small tools to machines is with a small magnet. To prevent the magnet from coming along with the tool when you grab it, wrap a strip of tape around the tool and place that portion against the magnet. The tape will reduce attraction enough so that the magnet will stay put when the tool is pulled off.
—*Dario Biagiarelli, Kirkville, N.Y.*

Router base with extension wing



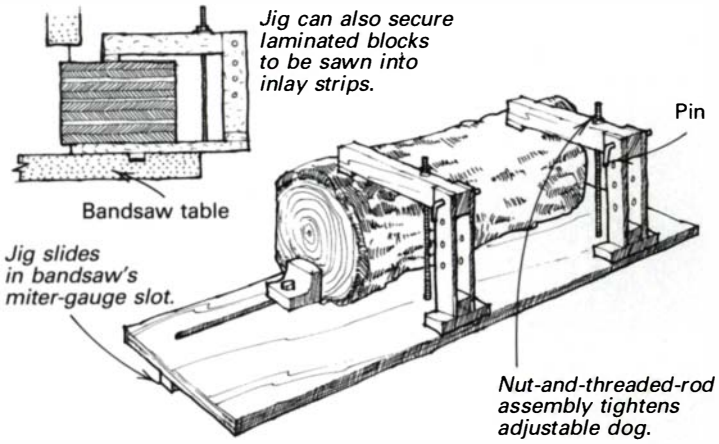
I have only one router, and I wanted to use it as both a table-mounted and hand-held tool. However, I found conventional router tables were too bulky, and frequently mounting and removing the router was too cumbersome. So I created a router base, as shown, with a wing that extends 3½ in. past the tool's base. I made this wing from ½-in.-thick clear-plastic Lexan, and screwed the wing to the router as a substitute for the manufacturer's stock baseplate. With the wing on the router, I can create an instant router table by running drywall screws through holes in the extension wing to fasten the inverted router to any suitable surface, such as a bench, windowsill, dock edge, toolbox or sawhorse.

As an added bonus, when I want to use the router as a hand-

held tool, the extension wing makes it easier to follow guides and keep the router level on narrow work and end cuts.

—Gordon Elliott, Friday Harbor, Wash.

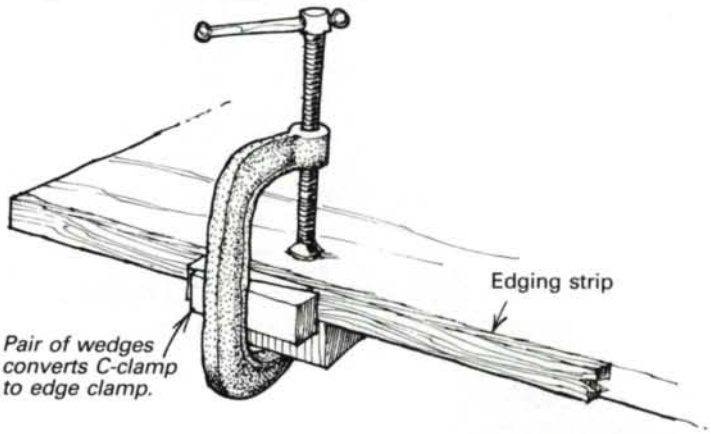
Carriage for bandsawing logs



A "Methods of Work" in *FWW* #84, p. 18 illustrates a carriage fitted with a pipe clamp to hold small logs as they're being bandsawn. The jig I use for this holds the work with two adjustable wooden dogs, rather than a pipe clamp. This versatile jig is also good for resawing square, glued-up stock into thin boards, which I use for inlays and overlays. *—Don Taylor, Deer River, Minn.*

Quick tip: One day I grew frustrated with brushing and blowing sawdust from my radial-arm saw work surface even though my shop vacuum was hooked up to the port in the blade guard. Then a light went on. I simply connected an extra hose to the vacuum's exhaust outlet and taped the other end to the side of the blade guard with the hose aimed down. The air flow keeps the work area clear of dust. *—Bob Maxwell, Washington, D.C.*

Improvised edge clamp



To improvise an edge clamp, all you need is a regular C-clamp and a couple of wedges. If the clamp's back is curved where it hits the wedges, use a block to realign the back to a straight section. *—Don H. Anderson, Sequim, Wash.*

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.*

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2' Pro Rail w/Sensor Module *#SMPR2* **87.**

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PR4	4' Pro Rail w/Module	117.
CC2	24" Carrying Case	10.
CC4	48" Carrying Case	18.

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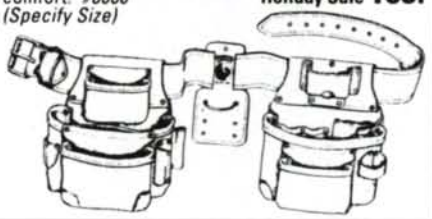


Makita

New! High Torque Cordless Drill With Keyless Chuck

This powerful new 9.6v drill has a maximum torque value of 121.2 in./lbs. at low speed - powerful enough for your toughest applications. 2-speed gear selection with variable speed in either range (0-1100 RPM High, 0-400 RPM Low), along with a 6-stage clutch and keyless chuck makes for effective drilling and driving. #6200DW **155.**

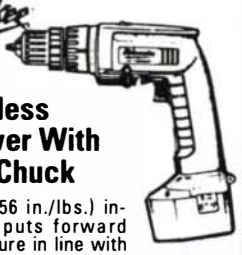
BOSCH

6" Random Orbit Dustless Sander/Polisher Package

The most versatile random orbit tool available. The exclusive two-way drive system provides an aggressive stock removal to ultra-fine swirl-free finishes. 5 amps, 4,800 - 12,000 OPM. *$90. accessory package includes: steel case; 3M sandpaper assortment; sponge pad; and buffing pads. #1370DEVS,* List $481. **Holiday Sale 299.**

Milwaukee

New! 12v Cordless Drill/Driver With Keyless Chuck



Hi-torque (156 in./lbs.) in-line design puts forward drilling pressure in line with the center axis of the drill bit. Other features include: 2-range variable speed (0-1000 High, 0-350 Low) 6-position clutch, 1/2 hour super charger. With steel case. #0402-1 **Holiday Sale 163.**

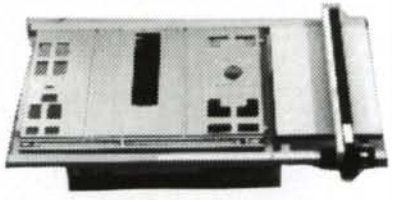
New! RYOBI

10" Table Saw w/Sliding Table

Combines the performance of a stationary tool with the convenience of a bench top saw. *#BT3000,* Reg. $649. **Holiday Sale 549.**

The "Zip Rip"

This rip fence was designed for making bench-top table saws easier to use and to increase their ripping capacity to 24". The Zip Rip is easy to mount and will fit the following models: *Makita #2708...#ZRM, Delta #34-330...#ZRD, Ryobi #BT2500...#ZRR* **99.**



SKIL

Price Break On Plate Joiners

We've never been able to offer a professional-grade plate joiner at a price like this. This full-featured plate joiner offers a powerful 6.0 amp motor, dust collection, double ball bearing blade support, 12 tooth carbide blade, and a front fence adjustable for 90 and 45 degree corners. At this price, no shop can afford to be without one. *#1605-02* **Holiday Sale 119.**

PRAZI

New! Beam Cutter Attachment Installs in Less Than 60 Seconds

This conversion kit will enable you to turn your worm drive saw into a cutting tool with a 12" capacity at 90°. Now you can easily perform rafter pitch cuts, cut stair jacks, or trim arches in thick material in one pass. *#PR-7000* **Holiday Sale 149.**

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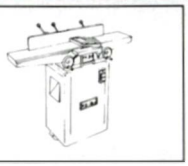
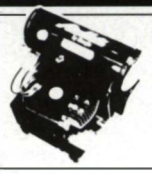


JJ-6CS 6" Long Bed Jointer **419.**

DC-610	1 HP Dust Collector	224.
JBS-14CS	14" Bandsaw, 1 HP	399.
JCS10A	10" Tilting Arbor Saw, 2 HP	895.
JDP-17MF	16-1/2" Floor Drill Press	379.

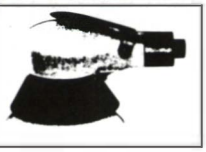
EMGLO



AM39HC4V 3/4 HP Vertical Twin Tank **289.**

AM78HC4	1-1/2 HP Twin Tank	299.
AM78HC4V	1-1/2 HP Vertical Twin Tank	309.
AM99HC4	2 HP Twin Tank	369.
AM834HGHC4V	4 HP Gas Twin Tank	529.
K15A8P	1-1/2 HP Portable Compressor	619.
K2A8P	2 HP Portable Compressor	669.
K5HGA8P	5 HP Honda Gas Portable Compressor	729.

SIOUX



690 5" Air Random Orbit Finish Sander **139.**

690V	5" Dustless Air R/O Finish Sander	159.
8000	3/8" VSR Angle Head Drill	129.
8020	VSR Angle Head Screwdriver	189.
8050	1/2" VSR Angle Head Drill	169.
8300	VS Reciprocating Saw	159.

MAKITA

6095DW 3/8" VSR Cordless Driver/Drill w/ Keyless Chuck **145.**

DA3000DW	3/8" Angle Drill Kit, 7.2v	137.
DA390D	Cordless Angle Drill, 9.6v	85.
4390DW	Cordless Recip. Saw Kit	125.
5090DW	3-3/8" Saw Kit, 9.6v	139.
6093DW	3/8" VSR Driver/Drill Kit, 9.6v	129.
6200DW	3/8" VSR Hi-Torq Driver/Drill Kit	155.
8400DW	Cordless Hammerdrill Kit	149.
DA3000R	3/8" VSR Angle Drill	165.
HP2010N	3/4" VSR Hammerdrill	165.
6302	1/2" VSR Drill, 0-550 RPM	115.
6402	3/8" VSR Drill, Heavy Duty	105.
6404	3/8" VSR Drill, 0-2100 RPM	58.
G5501R	5500w Generator, Electric Start	1449.
GED600	1/4" Die Grinder	70.
9207SPC	7" Electronic Sander Polisher	148.
1100	3-1/4" Planer w/Case	209.
1805B	6-1/8" Planer w/Case	355.
1900BW	3-1/4" Planer Kit	112.
1911B	4-3/8" Planer Kit	145.
9820-2	Blade Sharpener	195.
3601B	1-3/8 HP D-Handle Router	135.
3612BR	3 HP Plunge Router	165.
3620	1-1/4 HP Plunge Router Kit	109.
3700B	Laminate Trimmer	115.

MAKITA cont'd

3705	Offset Base Laminate Trimmer	159.
BD4510	1/4 Sheet Finishing Sander	52.
BD4550	1/4 Sheet Dustless Finishing Sander	57.
9045N	1/2 Sheet Dustless Finishing Sander	129.
9401	4"x24" Dustless Belt Sander	164.
9900B	3"x21" Dustless Belt Sander	145.
9924DBB	3"x24" Dustless Belt Sander	145.
LS1011	10" Compound Miter Saw	449.
LS1030	10" Miter Box	229.
LS1440	14" Miter Saw	435.
4200N	4-3/8" Trim Saw	129.
5007NBA	7-1/4" Circular Saw, Elec. Brake	127.
5077B	7-1/4" Hypoid Framers Saw	139.
5402A	16" Circular Saw	325.
6801DBV	VSR Drywall Screwgun, 0-4000 RPM	95.

2012 12" Portable Planer **455.**

2708W	8-1/4" Table Saw	265.
2711	10" Table Saw w/Brake	475.

RYOBI

RS115 4-1/2" VS Random Orbit Sander **75.**

TFD220VRK	12v Cordless Drill Kit	165.
L120UK	3-5/8" Planer Kit	99.
TFD220VRK	12v Cordless Drill Kit	165.
L120UK	3-5/8" Planer Kit	99.
L1323ALSK	3-1/4" Planer Kit, Long Base	119.
JM100K	Biscuit Joiner Kit	209.
RE600	3 HP VS Plunge Router	205.
R150K	1 HP Plunge Router Kit	104.
R500	2-1/4 HP Plunge Router	155.
TR30U	Laminate Trimmer	88.
BE321	3"x21" VS Belt Sander	129.
BE424	4"x24" VS Belt Sander	168.
B7075K	3"x21" Belt Sander Kit	119.
S500A	1/6 Sheet Finishing Sander	40.
TS254	10" Miter Saw	198.
TS380	15" Miter Saw	365.
AP10	10" Portable Planer	359.
BT2500	10" Table Saw	298.
BT3000	10" Sliding Table Saw	549.
JP155	6-1/8" VS Jointer	299.
RA200	8" Radial Arm Saw	245.

HITACHI

C8FB 8-1/2" Compound Miter Saw w/ Extra 60T ATB Carbide Blade **479.**

DH38YE	1-1/2" Rotary Hammer	429.
M12V	3 HP VS Plunge Router	235.
TR12	3 HP Plunge Router	174.
TR6	Laminate Trimmer	99.
C10FA	Deluxe 10" Miter Saw	275.
C12FA	12" Miter Saw	319.
C15FB	15" Miter Saw	379.
C7BD	7-1/4" Circular Saw, Elect. Brake	135.
W6V2	VSR Quiet Drywall Screwdriver	89.
CB75F	Bandsaw/Resaw	1575.*

HITACHI cont'd

F1000A	12" Planer/ 6" Jointer Combo	1475.*
P12R	12" Portable Planer	625.
P12RA	Portable 12" Planer/ 6" Jointer Combo	829.

HITACHI NAIL GUNS

NR83A	Full Head Stick Nailer	419.
NV83A	Full Head Coil Nailer	429.
N5008AA	1/2" Crown Stapler, 5/8" - 2"	319.
N3824AR	1" Crown Roofing Stapler	329.
NT65A	16 Ga. Finish Nailer 3/4"-2-1/2"	319.

FUJI

HVLP	High Volume Low Pressure Sprayer	649.
MIGHTY-MITE	HVLP Turbine Sprayer	599.

LAMELLO

TOP-10	Deluxe Joining Machine w/Ass't Biscuits	589.
STANDARD-10	Hand Joining Machine w/Ass't Biscuits	429.
COBRA	*NEW!* Plate Joiner	299.
PLATES	#0, #10, #20, 1000/Box	35.

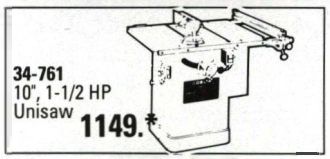
DANAIR

RN16-20	Palm Nailer, Drives to 20p Nail	185.
AH15-M	Auto Hammer	155.

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.

DELTA



34-761 10", 1-1/2 HP Unisaw **1149.***

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34-763	10", 3 HP Unisaw, 1 PH	1359.*
34-764	10", 5 HP Unisaw, 3 PH	1359.*
34-781	10", 1-1/2 HP Unisaw/ Unifence	1329.*
34-782	10", 3 HP Unisaw/ Unifence, 1 PH	1499.*
34-783	10", 5 HP Unisaw/ Unifence, 3 PH	1499.*
31-730	6" Belt/12" Disc w/Electricals	939.*
37-350	8" Long Bed Jointer w/Electricals	1239.*
43-375	3 HP HD Two-Speed Shaper	1459.*

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11-090	32" Radial Bench Drill Press	269.*
11-950	8" Bench Drill Press	145.
11-990	12" Bench Drill Press	185.
14-600	Hollow Chisel Mortiser	469.
17-900	16-1/2" Drill Press	329.*

22-540 12" Portable Planer **418.**

DELTA cont'd

22-661	13" DC-33 Planer w/ #50-274 stand, #32-011 Vertical EMS	1069.*
23-700	Wet/Dry Grinder	159.
28-245	14" Bandsaw w/stand, 1/2 HP Motor, Cool Blocks, Lamp, Blade Pkg.	509.*
28-283	14" Bandsaw w/Encl. Stand, 3/4 HP w/Mobile Base #50-274	689.*
31-460	4" Belt/6" Disc Finishing Machine	139.
32-100	Plate Joiner	285.
33-055	Deluxe Sawbuck w/Legs	589.
33-990	10" Radial Arm Saw	549.*
34-444	10" Contractors Saw, 1-1/2 HP	619.
34-445	10" Contractors Saw/ 30" Unifence w/Electronic Measuring System #32-010	799.*
36-220	10" Compound Miter Saw	235.
36-755	10", 2 HP Tilting Arbor Saw	799.*
37-154	6" Long Bed Jointer w/Electricals	999.*
40-560	16", 2-spd Scroll Saw	184.
43-355	1-1/2 HP, 3/4" Shaper	639.*
43-505	1/2" Bench Router/Shaper	279.
50-179	Dust Collector	329.*

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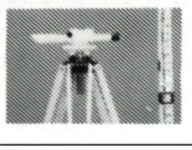
N60FN2	Finish Nailer	359.
M111FS	Flooring Stapler	539.
T31-1B	Brad Tacker	159.
N80S	Framing Nailer	415.
N80C	Coil Framing Nailer	469.

DAVID WHITE INSTRUMENTS



LP6-20 Sight Level Package **194.**

AL6-18	Builders Automatic Level, 18x	318.
ALP6-18HD	Package w/Tripod & Rod	369.
ALT6-900	Automatic Level-Transit, 18x	388.
L6-20	Meridian Level, 20x	185.
LT6-900	Meridian Level-Transit, 20x	245.
LT8-300	Level-Transit, 26x	459.
LT8-300P	Level-Transit w/ Optical Plummet	539.

AEG

HBSE75S	3"x21" VS Belt Sander	179.
VSR500K	Random Orbit Sander Kit	145.
BSPE100K	VS, Var.Orbit Jigsaw Kit	145.
SCR2E-1	VSR Drywall Screwdriver, 0-4000 RPM	89.
V2.5WD	16 Gal. Wet/Dry Vac	159.

LEIGH

D1258R-12	12" Dovetail Jig	255.
D1258R-24	24" Dovetail Jig	299.
MMTA-12	12" Mortise & Tenon Attachment	155.
MMTA-24	24" Mortise & Tenon Attachment	165.
VIDEO	Instructional Video	29.

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READER SERVICE NO. 44

Truing up a grinding wheel

I left a motor-driven whetstone in a small amount of water, and the stone developed a 3/16-in.-high by 3-in.-long lump on one side. Do you have any suggestions for truing up the stone? ***–Dr. Kenneth C. Leenhouts, Waukesha, Wisc.***

Jerry Glaser replies: The only way I know to true the lump on the outside edge of the stone is to use a diamond wheel dressing stick, available from MSC Industrial Supply Co. (151 Sunnyside Blvd., Plainview, N.Y. 11803; 516-586-5600) or a machine-supply shop. These dressing sticks range in cost from $26 to $78 depending on the size of diamond(s). This tool will "round up" a wheel much better than a conventional "star wheel" dresser, which tends to follow the established contour of the wheel. I would guess that your whetstone's wheel speed is probably slow; therefore, care must be taken to traverse the face of the wheel with the dressing stick *slowly,* otherwise you'll form grooves. To begin, bring the stick to the wheel slowly, until the stick only contacts the lump. Remove the lump by pressing the stick gently against the wheel as it passes the diamond. This way, only the lump will be ground away while the wheel's true diameter is being established. One caveat worth noting: Even after the wheel has been trued up, I can't be certain it will stay perfectly round; the wheel may become lumpy again after being immersed in water and used.

[Jerry Glaser is a retired aerospace engineer living in Torrance, Cal. He also manufactures a line of woodturning tools and accessories.]

Auger bits for fast boring in soft woods

I recently acquired some used auger bits (3/8 in., 5/8 in., 3/4 in.), each with a coarse-thread lead screw and only one long spur and one cutter. What are their intended uses? Also, should the jaws of a bit brace grasp a bit just on its squared-and-tapered end, or should they be tightened on the round part of the shank? This first method seems to center the bit better for me, but the bit sometimes falls out as I am pulling it out of the work. Do you know why this is happening?

–Noah Birnel, Olympia, Wash.

Richard Starr replies: Your auger bits are intended for rapid drilling in soft woods. The coarse-thread (or "fast") lead screw pulls the bit ahead quickly, while the single spur and cutter create less resistance than twin spurs and cutters would. Because such an auger takes a deep bite, you'd want to avoid using one in hard wood: It would be too difficult to crank the brace. A single spur-and-cutter bit is also likely to leave a rougher hole than a twin spur-and-cutter bit with a fine-thread lead screw. These days, you're likely to find the fast lead screw with a single spur-and-cutter configuration on long auger bits used for boring holes for electrical wiring, plumbing and other rough carpentry work. Post-and-beam builders also use them for boring peg holes in softwood frames.

As far as tightening an auger bit in your brace is concerned, the inner faces of the chuck's jaws are shaped to grip the squared-and-tapered faces of the auger bit's tang. The jaws should completely envelop the tang in order to center the bit properly and to keep it from falling out. If you're having problems getting the bit to stay in the chuck securely, my guess is that your brace is bent; when your bit is only partially in the chuck, it runs true because it is not gripped securely. Here's how you can correct the tool's alignment. First, chuck a straight auger bit in the brace. (Check an auger bit for straightness the way you test a pool cue—roll it on a flat sawtable or benchtop; a bent bit will wobble as it rolls.) Hold the brace vertically in front of you with the handle directly opposite your eye. Sight the edge of a ruler to see if the axis of the auger bit crosses the center of the brace's head. Then check this again with the handle of the brace rotated off to the side. If either view or both indicate misalignment, you've got some bending to do. I corrected one of my braces by grasping it in a vise and tweaking it using a monkey wrench with cardboard-padded jaws.

[Richard Starr is a teacher and the author of *Woodworking with Your Kids,* published by The Taunton Press in 1990.]

Wearing a respirator against toxic wood dust

I use a respirator with a charcoal filter when working with cocobolo and other exotic woods. When the respirator was new, I was unable to smell the odor of the wood. Now that the respirator is a few years old and still has the original charcoal filters, I can smell the characteristic odor of cocobolo. Is this odor toxic? Should the charcoal filter be replaced? Is filtering out particles sufficient protection?

–Simon Hartman, Denver, Colo.

Dr. Kirk Kundtz replies: Respirators in general are primarily made to protect against organic vapors and dusts, especially those produced by paints, lacquers, enamels and asbestos. There are two basic types of cartridges available for respirators: those that filter dust and those that filter vapors. Some companies integrate the two filter types into one multipurpose cartridge. The first rule of thumb regarding respirator cartridge life is that once you can smell fumes through a respirator, it is time to change the cartridges. A contractor friend of mine tests his respirator daily by donning his mask and putting his face directly over a can of paint; if he smells paint at all, he immediately changes the cartridges. Moreover, the cartridges continue to work even while not being used. Like room deodorizers, they will soak up everything in the vicinity. Hence a second rule: Never leave a respirator open to the air. Secure it in an airtight bag when not in use. For more information regarding respirators, contact either your local Occupational Safety and Health Administration (OSHA) office or the Bureau of Mines.

Wood dust is toxic to the respiratory system in a number of ways, and the degree of toxicity is determined by both the amount and the type of dust inhaled. (For more on this, see my article "Dust and the Woodworker" in *FWW* #83.) The chemical components of trees that are responsible for most allergic and inflammatory problems are compounds such as alkaloids, glycosides, saponins and quinones. Many of these are substances that trees have evolved over the eons as protection against insect predators. Not surprisingly, the exotic wood species tend to contain many such chemical compounds. Cocobolo, as well as kingwood, ironwood and a multitude of other exotics, can cause irritation to the mucus membranes that line the nose and lungs. Symptoms experienced by woodworkers will vary from individual to individual. More severe symptoms include headache, skin rashes, wheezing, facial swelling and conjunctivitis. Fortunately, the majority of woodworkers will experience milder symptoms that tend to resolve quickly once exposure to the dust is stopped. Though a nuisance, the long-term medical effects most woodworkers sustain will be no worse than those experienced by people who suffer from hay fever.

Whether or not you need a respirator equipped with a charcoal filter is difficult to say. If you work with exotic woods often and experience symptoms regularly, I would say that a respirator is in order. If you do choose to use one, be sure that it fits your face snugly. Also, you should change the cartridges regularly. Beyond respirators, of course, there are a number of other simple things that you can do to limit the amount of respirable dust in the shop, such as installing a dust-collection system.

[Dr. Kirk Kundtz is a resident physician in internal medicine at Mount Sinai Hospital in Cleveland, Ohio, and a woodworker.]

Yellow glue's shelf life

I understand that aliphatic resin (yellow) glues—some of the most popular glues used in furniture construction—have a

shelf life of between 9 and 12 months. If this is the case, why don't manufacturers put an expiration date on the containers? Further, how can I tell or test if my yellow glue is still good? What characteristics does old glue take on when it's past its prime, and what are the consequences of continuing to use this glue once it has turned bad?

—Paul McAnulty, San Antonio, Tex.

George Mustoe replies: You're correct in believing that yellow glues seldom survive storage for more than a year. Yellow glues seem to self-destruct even sooner if the unsuspecting woodworker buys a bottle that's been sitting for months in a warehouse or on the hardware-store shelf.

So why don't manufacturers indicate the expiration date on bottles of yellow glue? I can only offer several speculations. For one thing, expiration date marks are a relatively new form of consumer protection, having generally been applied only to food products and pharmaceuticals, for which age deterioration potentially poses health risks. In contrast, most adhesives and wood-finishing products have a finite shelf life, but lack any indication of the manufacturing date or expected working life. A cynic may argue that this policy exists merely to prevent stores from losing money by having to discard old merchandise. But it's also true that the manufacturing date of liquid wood glues can be somewhat difficult to monitor. Typically, the basic ingredients are produced by a major chemical manufacturer, blended and bulk-packaged at another facility, and repackaged and labeled for retail sale by yet another company. Meaningful date coding would require careful record keeping, and there's little economic incentive for merchants to go to the trouble.

Fortunately, it's a fairly simple matter to recognize yellow glue that has exceeded its useful life. During prolonged storage, the liquid progressively thickens as a result of spontaneous polymerization. This increase in viscosity initially makes the glue begin to flow more sluggishly, eventually reaching the point where the wetting ability is reduced so much that the gummy liquid refuses to cling to the wood enough to form a thin, spreadable layer. These changes are readily evident, so there's little chance that you'll accidentally ruin a piece of fine furniture by using old glue. In fact, in the early stages of aging, yellow glue that's started to show signs of thickening can be salvaged by thoroughly stirring in a small amount of water until you have acceptable handling characteristics. You can add up to about 10% water by volume without significantly reducing the final bond strength. However, a prudent long-term solution is to adjust your glue-buying habits so that yellow glues get used up within six to nine months of the purchase date, as it's disheartening to have to discard that gallon-size "bigger is cheaper" container when it begins to have the consistency of tapioca pudding.

By the way, all of these considerations also apply to white wood glues, which are polyvinyl acetate emulsions that have been designed to have somewhat different performance characteristics than yellow glue. However, white glues seem to have a slightly longer shelf life, perhaps because they are formulated to have lower viscosity than their yellow cousins.

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

All about magnolia

Recently, I acquired four large pieces of magnolia wood that had been air dried for four years. Is magnolia considered a hard or a soft wood? Can you give me some information about this lovely wood's characteristics and suggest how I can best use it? *—Dr. Donald C. Bruckner, Ormond Beach, Fla.*

Jon Arno replies: Despite its lack of notoriety as a cabinetwood, magnolia is a good, general-purpose wood with an impressive botanical pedigree and acceptable working characteristics. While it is not a particularly hard wood in the physical sense, it most definitely belongs in the hardwood corner of the plant kingdom. In fact, magnolia is believed to be among the most primitive of flowering plants, and its ancestors date back more than 100 million years. Although magnolias were once plentiful in forests growing throughout the Northern Hemisphere and as far north as Greenland, this ancient family *(Magnoliaceae)* has not fared well. Only two surviving genera are native to the United States, *Liriodendron* (tuliptree) and *Magnolia,* with the latter's two most important timber-producing species being mountain magnolia (cucumber tree) and southern magnolia *(M. grandiflora).* The woods of these three species are similar in appearance and they are often marketed together as "yellow poplar," but they are not identical in every respect. If the timbers you have were cut locally in east central Florida, they are most likely southern magnolia.

Magnolia is a diffuse-porous, fine-textured wood with a rather bland figure and almost no surface luster. However, its gray-green heartwood, sometimes marked with dark brown streaks, contrasts sharply with its stark white sapwood, and the overall effect created by this vivid color combination can be very attractive. Southern magnolia is somewhat heavier, harder and finer textured than the other so-called yellow poplars, but all three have excellent working properties and are all relatively stable in use. Magnolia dries with minimal stress, so neither warping nor checking pose significant problems.

In the furniture business, magnolia has never captured the popularity or prestigious image enjoyed by woods such as cherry, walnut and mahogany, but its functional qualities as an easily worked and dependably stable wood have long been appreciated. In fact, considerable quantities of magnolia are used for framing upholstered furniture and as core stock, buried beneath veneers of more pricey species. Due to its fine texture and diffuse-porous characteristics, magnolia performs well on the lathe, and it will yield an exceptionally smooth finish under varnish or paint. Magnolia can be stained to simulate other woods, but its natural greenish hue is not easy to conquer and so the resulting color may tend to look a bit muddy. This problem can be overcome by doctoring up the stain with some additional red pigment to counteract the green. And finally, while magnolia is a very versatile cabinetwood with a host of potential uses, it is not durable when exposed to weather and should, therefore, be reserved for interior applications.

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

Sealers and fillers

I have collected books and articles about wood finishing, but have yet to find clear answers concerning sealers and fillers. How do sealers and fillers differ and what conditions determine which should be used? Should a sealer or filler be used before or after staining and is the sequence of use different when using a dye vs. a pigment stain?

—Paul C. Richards, Simi Valley, Cal.

Michael M. Dresdner replies: Your questions are worthy of at least an entire article if not a chapter of a book, but I'll try to hit the high points briefly. Fillers are clay-laden mixtures often used to fill the grain of large, open-pore woods, such as oak, ash and mahogany. Generally, fillers are thick liquids or pastes utilizing ground silica that are applied to the wood and then wiped off, leaving the filler only in the wood's pores.

Sealers are usually variations of film-forming clear finishes, such as lacquers, designed to seal wood against further absorption of finish topcoats. Sealers generally contain materials that make them build faster and sand easier than the finish that is to follow, but the drawback is that they are often softer. They can be used on any wood, but are most valuable on softer or porous woods that tend to absorb a lot of finish in the first coat(s). A

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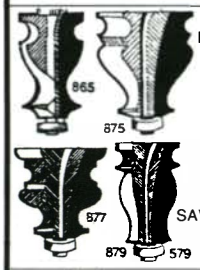

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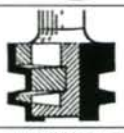

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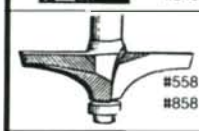

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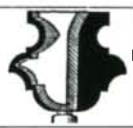

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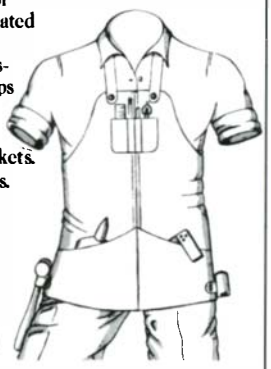

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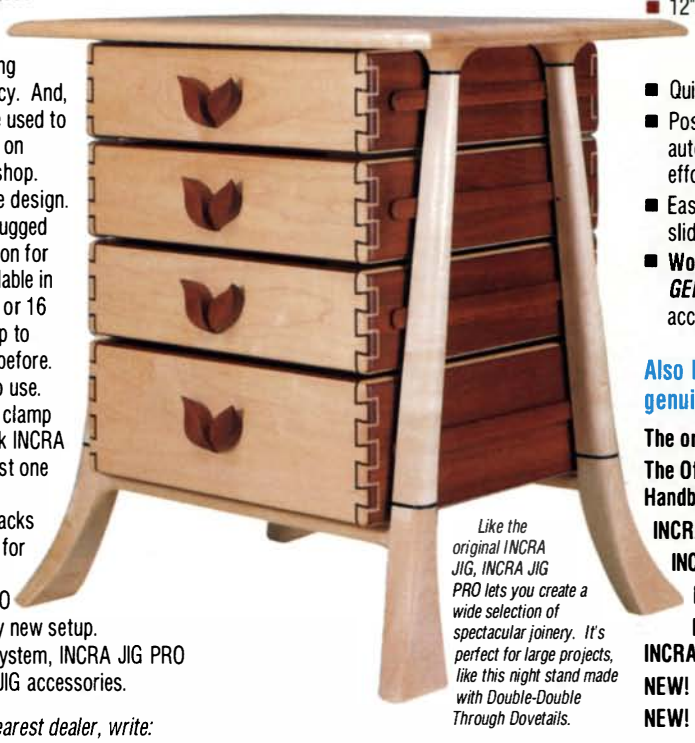

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sealer's relative softness makes it insufficient for exceptionally hard, tight-grain woods like ebony.

As far as a staining-sealing-filling sequence is concerned, staining can take place before or after filling, but because fillers do not accept stain and also do not seal wood, the final appearance will differ slightly depending on which course is chosen. A sealer is always used after the filler coat, because the filler itself demands it, even if the wood does not. If sealer is used prior to staining, the finish will significantly reduce the stain's ability to penetrate and thus color the wood. This is true for both pigmented stains and dyes. One popular finishing sequence on open-pore woods is to stain, coat with one coat of sealer and then apply a contrasting color of filler. Presealing allows the filler to color only the pores and makes the filling process a bit easier, at least with oil-base fillers. With water-base fillers, the sealer coat can be omitted, as long as a water-base dye is used in the first step.

[Michael Dresdner is a contributing editor to *FWW* and a finishing consultant in Perkasie, Pa.]

Thickness-planing a cupped board

When building larger woodworking projects, I often encounter wide boards that have a pronounced cup across their width. I've tried running such stock through a thickness planer, but it doesn't help because the board is pressed flat by the planer's feed rollers during the cut, only to end up thinner, but still cupped. What can I do?

—Jack R. Hall Newport Beach, Cal.

Sandor Nagyszalanczy replies: The most common method used in cabinet shops for removing cup from a board run through the thickness planer involves shims that are tacked to the concave side of the board. The shims prevent the planer's feed rollers from pressing out the cup, allowing a true flat cut.

To use this method, first determine the correct thickness of the shim that's needed by placing a straightedge across the hollow side of the cup and measuring to the deepest part of the cupped board's face. Now rip a narrow shim that is as thick as the cup's hollow and as long as the board. Tack the shim along the center of the cup using a few short brads; a #20 by ½-in.-long brad, driven as close to the ends of the board as possible, should be fine. If the board is to be planed thin, or if you think there is any chance you might plane down into the brads, tape or hot-melt glue the shim in place instead. If you use tape, run strips the length of the shim, not across it, or the tape may be peeled off during planing; if you use hot-melt glue, apply it sparingly so the shim can be easily pulled off afterward. Now all that is left to do is to run the board, shim side down, through the planer; it may take two or three passes to create a flat face wide enough to support the board when it is run through with the cupped side up. Remove the shim, of course. You can also use this method to plane the twist or "wind" out of a board by tacking or gluing short shims at the opposite corners, to allow the board to pass through the planer in a relatively flat fashion.

As an alternative method, in cases where you don't have the luxury of planing the thickness out of a wide, cupped board, you can rip the board down the center, joint it and reglue it to create a flatter surface before planing.

[Sandor Nagyszalanczy is managing editor of *FWW.*]

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335 Great Shop Tips (Wood Mag.)	$10

WOODWORKING PROJECTS

Weekend Projects for Woodworkers	$14
Projects for Woodworkers Vol. I to IV	ea. $12
101 Projects for Woodworkers	$14
176 Woodworking Projects (Workbench)	$14
Making Mechanical Marvels in Wood (Levy)	$14
Making Pet Houses and Carriers (Self)	$9
Doll's House Do-It Yourself (Dodge)	$14
Patterns and Projects for the Scroll Saw (Nelson)	$16

MUSICAL INSTRUMENTS

Guitarmaking: Tradition and Technology (Cumpiano)	$58
Violin Making As It Was and Is (Heron-Allen)	$33
Making Stringed Instruments (Buchanan)	$19
Making Wood Folk Instruments (Waring)	$12
Make Your Own Electric Guitar (Hiscock)	$16

MALOOF; NAKASHIMA FRID; UNDERHILL

Sam Maloof, Woodworker (Soft)	$38
Video - Sam Maloof, Woodworking Profile	$28
Maloof Book and Video Set $64	
Soul of A Tree (Nakashima)	$35
Tage Frid Teaches Woodworking: Book 1, 2, or 3 $20 EA; All 3 for $57	
Roy Underhill - 3 Titles	EA. $12
All 3 for $35	

POWER TOOLS

Router Basics (Spielman)	$9
Router Book (Geller)	$25
Router Jigs, Techniques (Spielman)	$16
Router Handbook (Spielman)	$12
The Router (Rosendahl)	$14
Scroll Saw Handbook (Spielman)	$12
Shaper Handbook (Cliffe)	$16
Scroll Saw Basics (Spielman)	$9
Table Saw Basics (Cliffe)	$9
Table Saw Techniques (Cliffe)	$16
Radial Arm Saw Techniques (Cliffe)	$16
Getting The Most Out of Radial Arm Saw (Rockwell)	$10
Getting The Most Out of Drill Press (Rockwell)	$10
The Complete Book of Stationary Power Tool Techniques (de Cristoforo)	$17
The Complete Books of Portable Power Tool Techniques (de Cristoforo)	$16
Tool Grinding and Sharpening Handbook (Davidson)	$9

JOINERY

Woodjoiner's Handbook (Allen)	$14
Joinery: Methods of Fastening Wood (Self)	$12
Woodworking Joints (Blandford)	$17
Woodwork Joints (Hayward)	$9
Modern Practical Joinery (Ellis)	$18
Contract Joinery (Austin)	$15

NEW TOYMAKING

Making Toy Trains in Wood (Lynn)	$10
Making Classic Cars in Wood (Hicks)	$10
Making Dinosaur Toys in Wood (Wakefield)	$12
How To Make Animated Toys (Wakefield)	$12
Making Vintage Aircraft in Wood (Hicks)	$10
Toymaker's Wooden Vehicles (Buckland)	$12
Blizzard's Dazzling Wooden Toys	$14
The Ultimate Wood Block Book (Bingham)	$12

FINISHING & REFINISHING

Wood Finishing with George Frank	$14
Adventures in Wood Finishing (Frank)	$10
Video George Frank on Woodfinishing	$38
Woodfinisher's Handbook (Allen)	$12
Wood Finishing & Refinishing (Gibbia)	$15
Complete Manual of Wood Finishing (Aughton)	$13

WOODTURNING

Woodturning for Cabinetmakers (Dunbar)	$14
Practical Woodturner (Pain)	$12
The Craft of Woodturning (Sainsbury)	$12
The Practice of Woodturning (Darlow)	$24
Polychromatic Assembly for Woodturning (Brown)	$16
Hand or Simple Turning (Holtzapffel)	$16
Ornamental or Complex Turning (Holtzpffel)	$16
The Woodturners Bible (Blandford)	$16

CHIP CARVING by BARTON

Chip Carving $10; Chip Carving Patterns $10
Video Chip Carving $28; All 3 - $45

MISC. CARVING

Freshwater Fish Carving (Figer)	$28
Carving Fish Decoys (Cottle)	$25
Carving Oarousel Animals (Marlow)	$19
Carousel Horse Carving 1/3 Size (Hughes)	$28
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Decoy Pattern Book (Bridenhagen)	$14
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FURNITURE MAKING

Queen Ann Furniture (Vandal)	$32
Reproducing Antique Furniture (Gottshall)	$38
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How to Build Shaker Furniture (Moser)	$14
Antique Country Furniture of North America (Shea)	$18
Country Projects for Woodworkers (Woodworker's Journal)	$16
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Fine Furniture for the Amateur Cabinetmaker (Marlow)	$14
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VIDEOS *VHS ONLY*


Brad Witt - Router Secrets	$30
Wilson - Making Oval Boxes	$30
Todd - Designing Your Kitchen	$34
Todd - Stair Framing	$30
Gross - Roof Framing Basics	$75
Gross - Roof Framing Advanced	$75
Schuttner - Basic Stairbuilding	$28
Bollinger - Laying Hardwood Floors	$28
Bollinger - Sanding, Finishing Floors	$19
Law - Installing Cabinets, Countertops	$19
Law - Installing Doors & Windows	$19
Rosendahl - Series of 8 Videos on Router Techniques $24 EA; All 8 for	$145
Roger Cliffe - Faceplate Cabinetmaking Series of 5 Tapes $30 EA; All 5 for	$135
Roger Cliffe - Table Saw or Radial Saw Techniques $29 EA; both for	$56
Krenov - Wooden Planes, Cabinet Scrapers	$38
Cummins - Making Boxes	$28
Cummins - Small Shop Tips	$28
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Mehler - Build a Shaker Table	$28
Parko - Make a Blanket Chest	$37
Stubbs - Bowl Turning	$38
Bush - Carving Techniques and Projects	$28
Rogers - Molding and Picture Frames	$22
Rogers - Building Cabinets	$22
Rogers - Building Bookcases	$22
Rogers - Building Tables	$22
Maas - Router Jigs, Techniques	$28
Byrne - 1 Tiling Countertops; 2. Walls 3. Floors $28 EA; All 3 for	$80
Roy Underhill - 1. Shop Planes; 2. Chair-making; 3. Log & Timberframe Bldg.	EA. $38
Klausz - Wood Finishing	$38
Klausz - Dovetail A Drawer	$28
Klausz - Mortice & Tennon Joints	$28
Lowe - Carve A Ball & Claw Foot	$38
Flexner - 1. Refinishing; 2. Repairing Furniture	EA. $28

BOOK & VIDEO SETS

SET CONTAINS 1 BOOK & 1 VIDEO

Cliffe - Table Saw Tech.	$44
Cliffe - Radial Saw Tech.	$44
Savage - Trim Carpentry	$44
Bollinger - Laying Hardwood Floors	$44
Schuttner - Basic Stair Building	$44
Sundquist - Swedish Carving Tech.	$40

CABINETMAKING

Cabinetmaking and Millwork (Feirer)	$45
Making Kitchen Cabinets (Levine)	$17
Video-Kitchen Cabinets (Levine)	$26
BOTH VOOK & VIDEO (LEVINE) $44	
Building Kitchen Cabinets (Cary)	$14
Cabinetmaking, The Professional Approach (Peters)	$28
Cabinetmaking (Calhoun)	$39
Cabinetmaking from Design to Finish (Maguire)	$21
Shelves, Closets & Cabinets (Jones)	$16
The Home Cabinetmaker (Burch)	$19
European Cabinetry (Christ)	$18

STAIR, DOOR MAKING

Modern Practical Stairbuilding and Handrailing (Ellis)	$22
Treatise on Stairbuilding (Mowat)	$22
Basic Stairbuilding (Schuttner)	$14
Stair Builder's Handbook (Love)	$14
Doormaking Patterns & Ideas (Birchard)	$18
Make Your Own Handcrafted Doors & Windows (Birchard)	$16

CARPENTRY; CONSTRUCTION

Carpentry (Lewis)	$19
Guide to Residential Carpentry (Feirer)	$16
Trim Carpentry Techniques (Savage)	$17
The Genius of Japanese Carpentry (Brown)	$23
Harwood Floors (Bollinger)	$17
The Timber Frame House (Benson)	$19
Timber Frame Construction (Sobon)	$12
Roof Framing (Gross)	$21
Wood-Frame House Construction (Anderson)	$13
Building Small Barns, Sheds, Shelters	$12

READER SERVICE NO. 206

Santa Says "Ho! Ho! Ho! . . .

PERFORMAX

FREE FREIGHT

SEC

C4
NEW
Panel Saw
$769

H5 64" capacity panel saw **1195**

Panasonic

EY6005BC
12 V, 1 Hour, Keyless Drill Kit w/2 Batteries
$179

EY6205BC	12v,VSR dr w/case	179
EY571BC	9.6 v,VSR dr w/case	139
EY970B	9.6v batt. w/purchase	39
EY6200BC	12v 1/2"cdls w/case	179
EY503B	2.4v 2 sp. screwdriver	69
E959OH	carrying case	20
EY6207BC12	v,1/2"VSR dr w/cs	219
EY6900BC12	v,3/8" hamr dr. kit	205

HITACHI

NR83A
Full Head Stick Nailer
$419

NR83AA	clipped head stick nlr	429
NV83A	full head coil nailer	429
NV45AB	coil roofing nailer	429
N5008AA	5/8" to 2" HD stapler	329

RYOBI

RE600
3HP VS Plunge Router
$199

JP-155	6-1/8" jointer/planer	299
RA-200	8-1/4" radial arm saw	238
TS380	14" miter saw	369
TS25410	" mitre saw w/c.t. blade	209
BT2500	10" bench table saw	269
RS115	4-1/2" random orb sandr	78
WC101	wood carver blade	40

BT3000 NEW!
10" Sliding Table Saw w/Dust Bag
$549

AP10	10" portable planer	348
R500	2-1/4 hp plunge router	155
R501	2-1/4 hp plunge router	149
R331	2 hp D-Handle router	129
TR30U	laminate trimmer	88
BE321	3x21 VS belt sander	128
BE424	4x24 VS belt sander	165
JM100K	*NEW* plate jointer	205
TFD1702VRK	9.6v cdls kit/2 bat.	145
TFD2202VRK	12v cdls kit/2 bat.	165
SC160	16" scroll saw	145

Emglo

AM78-HC4V
1-1/2 HP Vertical Twin Tank
$319

AM-GAS	gas vertical twin tank	529
AM99-HC4	*NEW* 2hp twin tank	379
AM78-HC4	1-1/2hp twin tank	309
AM39-HC4V	3/4hp v twin tank	299
K15A8P	1.5hp wheelbarrow	629
K2A8P	2hp wheelbarrow	679
K5HGA-8P	5hp Honda whlbrrw	739
045	3/8" x 50' Goodyear hose	20

Milwaukee

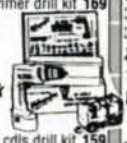
6527 NEW!
Variable Speed Super Sawzall
$165

6125	5" random orbital sander	129
5371-1	1/2" hammer drill kit	185
5365-1	Hawk 1" SDS rtry. h. kit	325
5353	Eagle 1-1/2" rtry hmr kit	525
5660	1-1/2 hp 10 amp router	185
5680	2 hp 12 amp router	215

6507
V.S. Sawzall With Case
$134

6508	VS Sawzall w/case	134
6528	*NEW* VS super sawzall	165
5397-1	3/8" hammer drill kit	139
5375-1	1/2" hammer drill kit	169

0402-1
12 Volt VSR Cordless Kit W/Keyless Chuck
$163



0399-1	12 Volt VSR cdls drill kit	159
0395-1	3/8" VSR cordless dr kit	148
0222-1	3/8" VSR 3.5 amp drill	104
0234-1	1/2"VSR 0-850 magnum	118
0244-1	1/2"VSR 0-600 magnum	118
1676-1	2 sp. hole hawg kit	244

6368
7-1/4" Saw W/C.T Blade, Case and Fence
$135

6305	6-1/4" cdls circular saw	174
6546-1	2 sp cdls screwdriver	79
6753-1	0-4000 VSR screwdriver	84
6750-1	5 amp VSR screwdriver	94
0375-1	3/8" close quarter drill	124

3107-1
VS Right Angle Drill Kit
$195

6145	4-1/2" angle grinder	98
5455	7" 1750 rpm polisher	129
6256	VS top handle jig saw	129
6014	1/2 sheet finishing sander	119
8975	dual temp. heat gun	59

HITACHI

C8FB
8-1/2" Compound Mitre Saw
$439

P12RA	*NEW* 12" planer/6" jointer	779
P12R	*NEW* 12" portable planer	589
D10DFK	9.6v VSR dr kitw/2 bat	159
C15FB	15" mitre saw	379
C12FA	12" mitre saw	299
C10FA	10" mitre saw	269
C7BD	7-1/4" saw w/case	129
M12V	3-1/4 hp VS pl. router	224
TR12	3 hp plunge router	169
CB75F	resaw bandsaw	1599
F1000A	12" planer/6" jointer	1499

WEDGE

SL224 NEW!
24" Rail w/Module
$59

SMPR2	2' pro rail w/mod & cs	98
TR-2	2' level w/module & case	108
TR-4	4' level w/module & case	128
PR4	4' Pro Rail w/mod. & case	118
PR78	78"Pro Rail w/mod & case.	148

DELTA

34-782
3 HP Unisaw w/Unifence & Motor Cover
$1549*

34-782B	3hp unisaw w/Bies.	1569*
34-781F	1.5hp unisaw w/Unif	1349*
34-781B	1.5hp unisaw w/Bies.	1369*
34-763	3hp Jet-Lock unisaw	1379*
34-761	1.5hp Jet-Lock unisaw	1199*

34-445
10" Contractor's Saw w/30" Unifence & EMS
$849

34-445B	10" cont. saw/28" Bies.	849
34-444	10" contractors' saw	619
34-670	10" motorized table saw	389
34-330	8-1/4" bench table saw	229
33-890	12" radial arm saw	1349
33-990	10" radial arm saw	589

28-283
14" Bandsaw W/Mobile Base
$735

33-055	8-1/4" sawbuck w/legs	589
37-280	6" motorized jointer	389
37-154	6" jointer, DJ-15 w/stnd	1089
46-204M	12" 4 spd wood lathe	999
17-900	16-1/2" floor drill press	399
34-080	10" mitre saw	195

43-375
3 HP HD Two Speed Shaper
$1469*

22-66213	" planer w/stand&ems	1179
22-667	13" planer w/stand&ext	1179
31-730	6" belt/12" disc sander	969*
37-350	8" jointer,DJ-20 w/stnd	1299*
46-541S	12" V.S. wood lathe	1499
43-502	overarm router shaper	1499
40-601	18" V.S. scroll saw	699

14-600 NEW!
Hollow Chisel Mortiser
$469

36-220	10"compound mitre saw	235
50-181	2 hp dust collector	618
50-180	1 hp dust collector	418
50-179	3/4 hp dust collector	338
34-897	50" Delta unifence	289
34-915	30" Delta unifence	219
32-100	plate jointer	288

31-380
4" X 132" Edge Sander
$1299

34-995	3 phase stock feeder	799
34-994	1 phase stock feeder	849
34-985	1 phase stock feeder	469
20-150	14" cut-off saw	249

36-755
10" Cabinet Saw
$899

43-355	1-1/2 HP 3/4" wood	699
36-751	10" cab.w/30" Unifence	1069
36-752	10" cab.w/50" Unifence	1149
70-200	20" floor drill press	779
43-275	Onsrude#2003 Inv. rtr	2799

** Price Includes Rebate!*

Kaddies, Inc.

TK
Portable Tool Storage System On Wheels
$179

PORTER-CABLE

7334
Random Orbital Sander w/Case & 2 Rolls Paper
$149

7334	random oribtal sander	118
7335	*NEW* 5" VS random sander	129
7336	*NEW* 6" VS random sander	134
73333	*NEW* sander dust kit	29
505	1/2 sheet finish sander	114
330	speed bloc finish sander	59

97310
Laminate Trimmer Kit
$185

352	3x21 sander with bag	133
360	3x24 sander with bag	179
362	4x24 sander with bag	185
503	3x24 wormdriver w/bag	345
504	3x24 wormdrive sander	325

9853 NEW!
12 V, 3/8" VSR, 2 Speed Drill Kit W/Keyless Chuck
$154

9852	*NEW* 12v, 3/8"VSR, 2sp. kit	154
9854	*NEW* 12v, 1/2"VSR, drill kit	164
9851	3/8"12v drill kit w/keyless	134
9850	12 volt cordless drill kit	134
7511	3/8" VSR 5 amp drill	114
7514	1/2" VSR 5 amp drill	119
7515	1/2" VSR 5 amp, keyless	124
7545	drywall 0-2500 VSR drvr	105

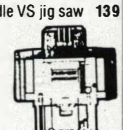
555
Plate Jointer With Case & 500 Assorted Biscuits
$179

555	plate jointer w/case	165
5556	adjustable tilt fence *NEW*	49
5116	16" Omni jig *NEW*	260
7536	2-1/2 hp router *NEW*	204
7537	2-1/2 D hndl router *NEW*	215
7399	drywall cutout *NEW*	79
7310	laminate trimmer *NEW*	89
9118	porta plane kit w/ct cutter	199

9345
6" Saw Boss Kit w/5 Extra Blades
$124

345	6" Saw Boss w/c.t. blade	99
314	4-1/2" trim saw	128
9314	4-1/2" trim saw kit	148
9315-1	7-1/4" saw w/case, ct bl	134
7549	top handle VS jig saw	139

7539 NEW
3-1/4 HP 5 Speed Plunge Router
$265



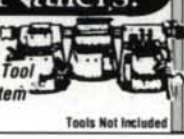
690	1-1/2 HP router	132
691	1-1/2 hp D hdl router	144
696	router-shaper table	118
695	router table w/router	204
97310	laminate trimmer kit	185
7518	3-1/4 hp 5sp router *NEW*	259
7519	3 hp production rtr *NEW*	224
7538	3-1/4 hp pl. router *NEW*	224

9637
Electronic V.S. Tiger Saw Kit
$135

9647	tiger cub with case	115
693	1-1/2 hp plunge router	164
6931	plunge router base	78
97750	1/2" hammer drill kit	155

Nailers.

2655
Original Cordura Tool Belt System
$99 Tools Not Included



PONY AIR

LPN672
Air Palm Nailer With Glove
$94
Drives 6d-50d nails!

JET

JBS-14CS
14" Wood Bandsaw
$419

JBS-18	18" bndsw 2hp w/stand	849
WBS-20	20" wdcttng bandsaw	1899
JSS-6188	6x168 stroke sander	1549
OVS-10	oscillating spindle sndr	1549

DC-610
1 HP Dust Collector
$224

DC-1182	d. col. 2 hp/1180 cfm	429
DC-1883	d. col. 3 hp/1880 cfm	649
EHVS-80	6x89 edge sander	589

JJ-6CS
6" Long Bed Jointer
$419

JJ-4	4" deluxe jointer	299
JJ-8	8" long bed jointer	999
JJ-12	12" long bed jointer	2399

JCS-10A
10" Cabinet Saw With Jet Fence
$895

JTS-12	12" table saw 1.5 hp	549
JTS-10	10" table saw 1.5 hp	479
JDP-14M	14" bench 16 s. press	299
JDP-17MF	17" floor 16 s. press	389
JDP-20MF	20" floor 12 s. press	689

JWB-37P
37" x 60" Wide Belt Sander
$10,249

JWB-25P	25x60 w. belt sndr	7199
JWB-13P	13x60 w. belt sndr	4899
JWB-25PH	25x75 w. belt s.	10899
JWB-37PH	37x75 w. belt s.	12499

JWP-12
12" Portable Planer
$359

JWP-15H	15" planer 3 hp	1049
JWP-208-1	20" plnr 2sp/3hp	1689
JWP-20H-1	20x7 planer 3hp	2679

DELTA

22-540
12", 15 Amp Portable Planer w/Dust Chute
$399

28-180	*NEW* bench bandsaw	169
43-505	*NEW* router/shaper	275
11-090	*NEW* radial drill press	279
28-245	14" bandsaw w/lamp	579

46-700 NEW
12" V.S. Wood Lathe
$429

40-640	*NEW* 20" vs scroll saw	339
23-700	wet/dry grinder	159
11-950	8" bench drill press	145
40-150	15" hobby scroll saw	129
40-560	16" 2 speed scroll saw	184

DEWALT

1707
8-1/2" Compound Mitre Saw
$399

1765	belt/disc sander	429
7770-10	3.5 hp 10" radial saw	869
7790	3.5 hp 12" radial saw	1149

freud

JS100
Jointing System W/Case & 500 Assorted Biscuits
$144*

FRT-2000	wooden router table	169
FT-2000	3.25 plunge router	145*
EB-100	edge banding system	199*
UC-900	5 pc shaper cabinet set	349
94-100	5 pc router cabinet set	159
95-100	5 pc rtr set w/99PK1	199
91-100	13pc 1/2" router bit set	189
90-100	15pc 1/4" router bit set	159

***Price Includes Rebate**

POWERMATIC

1660760
66 Saw 3 HP W/50" Biesemeyer
$1689

1260100	#26 shaper 3hp 1 ph	1599
1000099	#100 planer/12"/2hp	1999
1800205	5hp,18" pl. w/knife gr	4699
1500040	6" jointer 3/4hp 1 ph	1169
1610050	8" jointer 1.5 hp 1ph	1449
1300134	6x48 belt/12" disc sdr	1149
1152825	15"VS dr. press 3/4hp	1329
1410040	14" bndsw 3/4hp 1ph	1229
1790808	25" wide belt sndr	8499

1791000
63 Artisan Saw W/Vega Fence
$699

1791001	63 Artesian w/50" Vega	799
1791020	3/4" wood shaper 1hp	479
1791010	15" scroll s. w/blower	159
1791030	14" bench drill press	329
1791040	14" floor drill press	369
1791050	6" jointer with stand	499
1791060	14" bandsaw w/stand	599

BIESEMEYER

50L12
50" Commercial w/12" Left
$295

52L12	52" homeshop fence	235
40L12	40" homeshop fence	209
28L12	28" homeshop fence	199

Adjustable CLAMPS

8"
Handscrew
$12

1	10" handscrew	13
2	12" handscrew	15
3	14" handscrew	19
4	16" handscrew	25
7224	24" I-bar clamp	17
7236	36" I-bar clamp	18
7248	48" I-bar clamp	20
7260	60" I-bar clamp	23

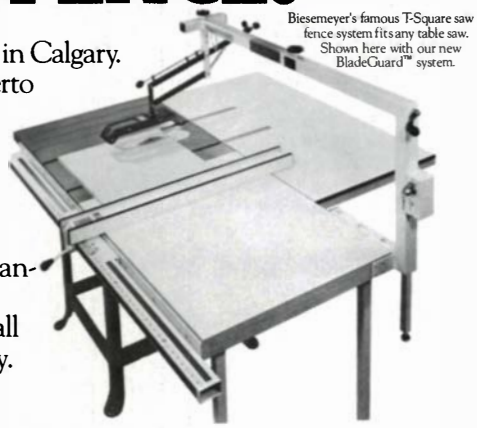
SIOUX

690
Air Palm Finish Sander
$139

658	lever type finish sander	159
8000	3/8" VSR 0-1300 drill	129
8020	electric screwdriver	189

READER SERVICE NO. 201

200,000 REASONS WHY YOU SHOULD OWN A T-SQUARE® SAW FENCE.



Biesemeyer's famous T-Square saw fence system fits any table saw. Shown here with our new BladeGuard™ system.

Over 200,000 in fact. Doran in Calgary. Robert in Brisbane. José in Puerto Rico. Alvise in Milan. The list of Biesemeyer T-Square saw fence owners spans the globe, and continues to grow.

Why so many? Because Biesemeyer sets the industry standard. The T-Square saw fence system cuts precision parts for all your home shop projects. Safely. Affordably.

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Jim Forrest, President and designer microscoping cutting edge.

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This sleigh bed has sufficient detail and variety to challenge any woodworker. *But the shopmade fasteners that make the structure rigid yet allow easy disassembly and the basic construction could be used in a more simplified design.*

Building a Sleigh Bed

Flowing tambours and intricate detailing enhance a classic design

by William Turner

This sleigh bed is loosely based on an Empire period design by Charles-Honoré Lannier, a 19th-century French cabinetmaker. The bed's stately curves and fine detailing combine to create a striking interplay of both movement and stability. The piece is large and bold. Fully assembled with box spring and mattress, it weighs more than 500 lbs.

Besides being critical to the success of the design, the long, sweeping curves in the headboard and footboard offered the greatest challenge in constructing the bed. I'll discuss the techniques I used and suggest some alternative approaches that could net major savings of both time and effort.

Whatever techniques you choose, the overall construction of the sleigh bed is the same. It consists of three separate elements: The headboard and footboard, which are each made of two curved posts, a crest rail and an internal frame upon which the exterior curved surfaces are mounted; the four rails, which bolt together at their corners; and two foot assemblies that complete the bed. These units are all joined together with threaded rods and anchor bolts, as shown in figure 1 on pp. 48-49, to allow the bed to be disassembled for moving. By separating the headboard and footboard from the feet, I was able to avoid major stress points at the critical rail joints common in more traditional bed assemblies. It also made the bed much more rigid.

Working with treasured rosewood and precious design freedom

The bed, shown in the photo at left, turned out to be one of the most interesting and challenging jobs in my 15 years of building custom furniture. By delivery time, I had logged over 1,200 hours in the design and construction of the piece, and I'd spent more than $3,000 for materials and custom tooling. The keen interest of my client, Mrs. James Totten, daughter of Gen. George Patton, added greatly to my enjoyment of the project. An instant camaraderie, born of shared interests, developed from our first meeting. Early on, Mrs. Totten revealed a stack of milled rosewood boards, 8 in. to 10 in. wide and averaging 8 ft. long, that her late husband had brought back from Brazil some 40 years before. She wanted me to use this wood in the construction of her bed. I felt as if I had stumbled upon a buried treasure and was being offered the job of excavating it. From these early meetings, the job developed its own momentum, and I soon began to appreciate what a long and involved project I was in for.

After receiving preliminary design approval based on quarter-scale drawings, I worked up the full-scale drawings, with details of the construction, joinery and carving, as well as the various edge and surface treatments. Although I make most of my design decisions at this point, I try to keep my options open so that I can make changes as the project progresses. I've found that trying to come up with a firm estimate at this stage really dampens creativity by locking me into my original design ideas. I believe that my best work comes when I'm free to make midcourse corrections, allowing the piece to grow and develop just as the trees from which it is built grow.

Veneering and bolting the four rails together

The rail assembly, to which all other components are bolted, consists of head and foot rails, two side rails and three angle-iron slats. The solid-mahogany rails are veneered on the outside with fiddleback mahogany. A large cove molding on top and a continuous band of rosewood along the bottom edge visually connect the bed's headboard and footboard. Oak ledgers screwed to the inside of the rails hold three angle-iron slats. The ledgers and the slats support the box spring and mattress, and the foot assemblies bolt to these ledgers. The four rails are joined by haunched miters and threaded rods.

The endgrain mahogany edging and carved details highlight the flowing lines of the sleigh bed.

My sleigh bed was designed around a standard queen-size mattress-and-box-spring set; if you're going to make this bed, size components according to the spring-and-mattress set you'll be using. To begin, I cut the solid-mahogany rail stock to length for the side and end rails. Next, I veneered the outside faces of the rails with fiddleback mahogany and the inside faces with plain mahogany to stabilize the construction. The cove molding, which is mortised and glued to the top of the rails, was milled from 2-in.-sq. stock for the side rails and 2-in.-thick by 2½-in.-wide stock for the end rails, to accommodate haunched miters, as shown in figure 2 on p. 50. Before cutting the haunched miters, which provide a much stronger joint than standard miter joints, I glued and screwed the 2-in.-sq. oak ledgers to the rails, as shown in figure 2. Then I joined the rails with shopmade fasteners consisting of 5/16-in.-dia. by 3-in.-long threaded brass rods secured with washers and cap nuts. To hide the screws that secure the ledgers, I glued a 1¼-in.-wide band of rosewood into a ⅛-in.-deep rabbet in the outside bottom edge of all the rails. After thoroughly cleaning the rosewood with acetone, I glued it into the rabbets with epoxy. The wood's natural oiliness tends to yield unpredictable results with aliphatic resin (yellow glue).

Carved foot assemblies that carry the load

The feet, with carved scrolls on both the inside and outside surfaces, were dovetailed in pairs to oak stretchers, as shown in figure 2 on p. 50. These foot-and-stretcher units were then bolted through the oak ledgers to the underside of the rail assembly at the head and foot of the bed. I added filler blocks at the ends of the oak ledgers to provide extra width where the bolt holes for the foot assemblies are close to the edge of the ledgers.

Because the bed is so heavy, I was careful to avoid short grain in the curved section when laying out the feet. Also, a carved offset heel on the back edge of each foot moves the floor contact point more directly beneath the load. I cut five 10⅜-in.-long blanks from 4-in.-thick by 10-in.-wide stock for feet; the extra blank was for working out the carving technique. After laying out the shape of the foot and the spirals for the carved volutes on both sides of each blank, the foot's J-shape was roughed out on the bandsaw. The side of the leg was also bandsawn to provide relief for the scroll ends, which rise as they approach the center of the volute. Since time was pressing me, I had good friend and fellow North Bennet Street School graduate Scot Schmidt, of Portsmouth, N.H., carve the feet and the scroll brackets. After gluing the feet to the stretchers that join them together, I drilled and installed anchor bolts, as shown in figure 2 on p. 50.

Shaping and detailing the curved headboard and footboard posts

I believe that the upright posts that form the headboard and footboard are the most

Photos: Rob Karosis; drawings: Bob La Pointe

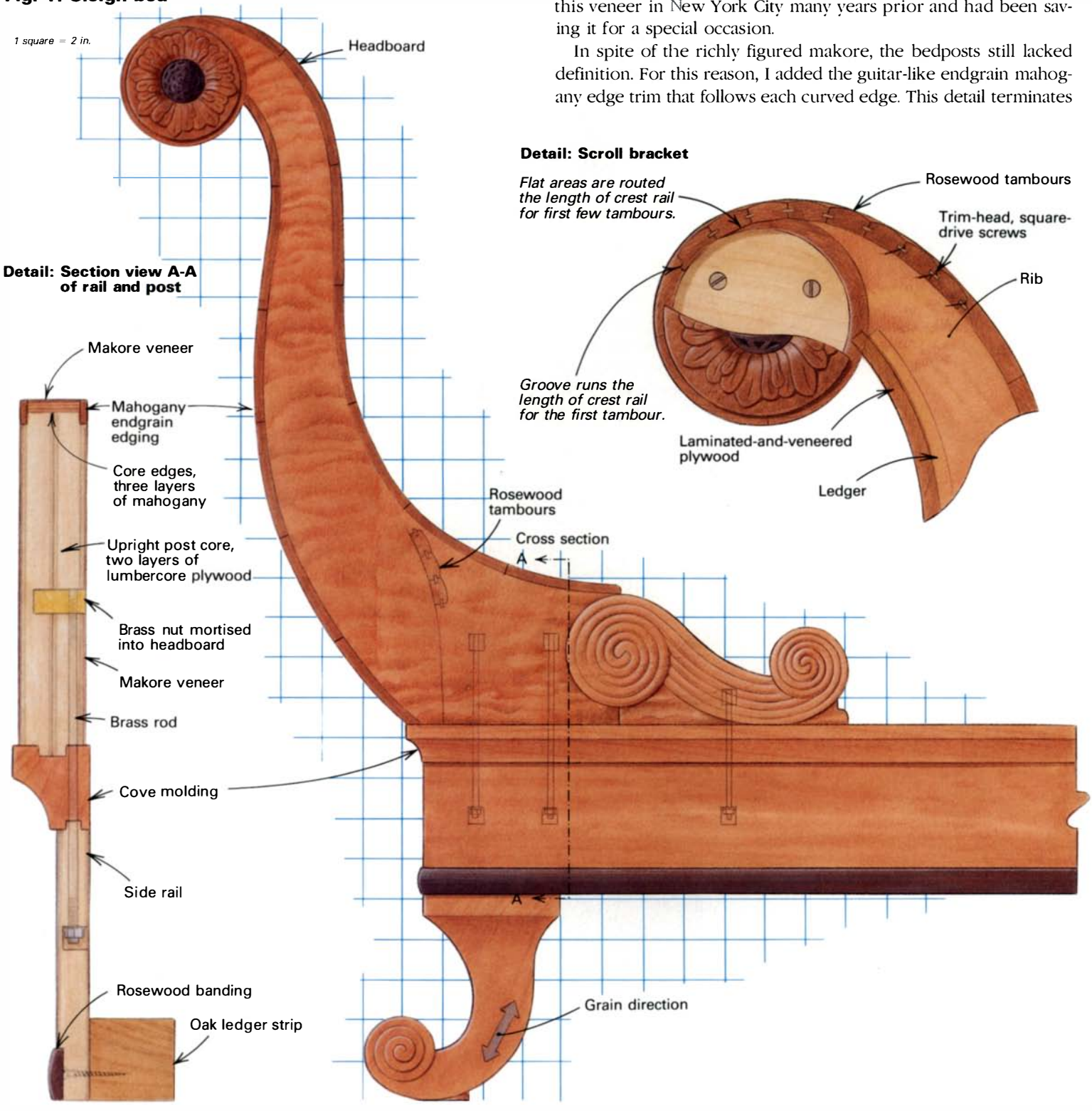
dramatic and important design elements of the sleigh bed. Their shape and angle define the overall piece—too much rake and the bed begins to resemble a brontosaurus, too little and the sleeping space becomes claustrophobic. Given the importance of these elements, the shaping and detailing of the posts became the most time-consuming aspect of the entire project. Since the only differences between the headboard and footboard are the overall size and shape, I'll limit my discussion to the construction of the headboard.

The framework for the headboard consists of two upright posts connected at the top with a solid, turned crest rail that is tenoned and screwed to the posts. The screws are concealed by the carved sunflowers that cap the rails at the top of the posts. A series of five internal plywood frames support both the laminated, veneered panel on the outside of the headboard and the rosewood tambours on the inside, in much the same way an airplane wing is fabricated. Both the headboard and footboard units bolt onto the side rails with threaded rods and captured nuts. Tongue-and-groove joints, as well as brass alignment pins and bushings, ensure the proper positioning of the units on the rails.

Using ⅛-in.-thick plywood patterns made from my full-scale drawings, I marked and cut the ¾-in.-thick lumbercore plywood for the post core. I epoxied two layers of plywood to form a 1½-in.-thick core and covered the edges with a prebent three-ply lamination of ⅜-in.-thick by 1½-in.-wide mahogany to provide stability for the surface veneer. Next, I covered all the showing surfaces and edges with a highly figured makore veneer. I had found this veneer in New York City many years prior and had been saving it for a special occasion.

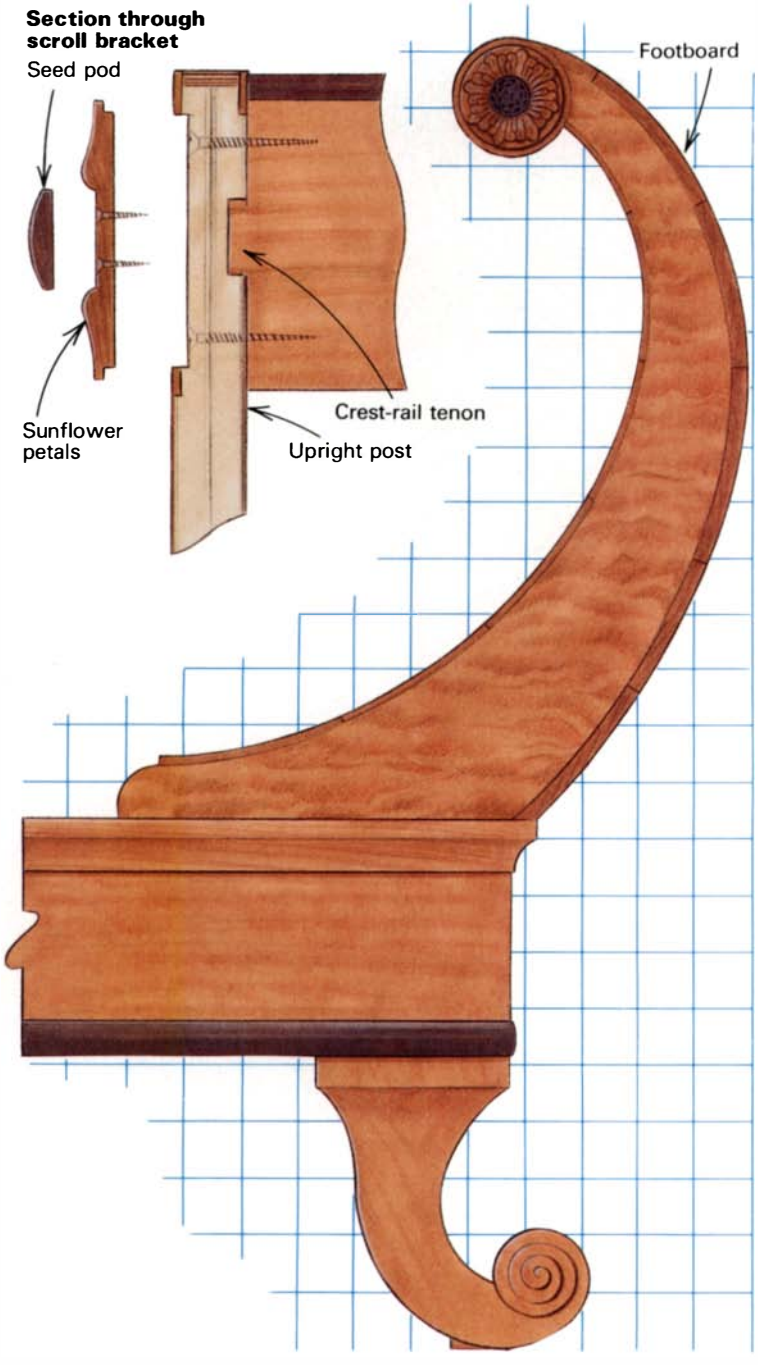
In spite of the richly figured makore, the bedposts still lacked definition. For this reason, I added the guitar-like endgrain mahogany edge trim that follows each curved edge. This detail terminates

Fig. 1: Sleigh bed



in a 360° turn, outlining the endgrain sunflower carving, which is shown in the photo on p. 47. I cut and inlaid the ⅛-in.-thick pieces of endgrain mahogany into rabbets I routed along the edges of the post, as detailed in the sidebar on p. 51. Using endgrain mahogany to outline the posts also offered the structural advantage of easing the hard corners and protecting an otherwise vulnerable veneer joint.

The endgrain edging also creates a visual flow to other key elements of the headboard: The carved transitional scroll brackets at the base of the upright posts. The outside faces of these ⅝ mahogany brackets were carved in dual, reversing spiral patterns, which provide visual relief from the posts' flat surfaces. To make the spiral design stand out, I veneered the field of the brackets with makore matched to the posts. The brackets were glued with polyvinyl acrylate (PVA) to the post core with a pair of ⅛-in.-thick Baltic-birch-plywood splines, as shown in figure 2 on the following page. Shopmade fasteners, similar to the mitered rail bolts, secure the headboard to the rails, and a tongue on the bottom of the brackets ensures proper alignment with the rails.



Slow-turning the large crest rail and assembling the internal framework

After the upright posts were completed and bolted into position, I turned the 6-in.-dia. solid-mahogany crest rail. (The footboard crest rail is 4 in. in diameter.) The size of the crest rail proved too taxing for my lathe, even running at its slowest speed, so I used a variable-speed portable drill to turn the crest-rail blank in the lathe at about 60 RPM. Then I built a jig to support and guide my router parallel to the axis of the lathe and used a ¾-in.-dia. fluting bit to do the cutting work. I turned the basic profile for the sunflower carvings before parting off these endgrain blanks. Next, I turned tenons on the ends of the crest rail that fit mortises drilled into the inside faces of the upright posts. The crest rail was then fit to the posts, and four, 3-in.-long sheet-metal screws were fastened through them and into the endgrain of the crest rail, as shown in figure 1 at left. (I didn't glue this joint in case the headboard ever needs to be disassembled.) To prepare the crest rail to accept the rosewood tambours, I routed flats and a groove in the rail, as shown in the detail in figure 1, to serve as an inset for the tambours and to provide a smooth and flowing transition from one surface to the other. I also routed a slot for the veneered outer panel.

The show surfaces of the headboard are supported by five internal frames, consisting of a ¾-in.-thick plywood rib and a ledger laminated from three layers of ⅛-in.-thick plywood. The frames are spaced evenly across the width of the headboard and span from the crest rail to the top of the end rail. Again, I used patterns taken from my full-scale drawings to lay out and cut the five ribs. The ledgers were then glued and screwed to the rib's edge to form the frames. The two outer frames were screwed to the inside face of the upright post, while the other frames were positioned and then screwed into the bottom of the crest rail. Although the bottoms of the frames are not secured at this time, once the outer face panel and the inner rosewood tambours are screwed in place, the entire structure becomes extremely rigid.

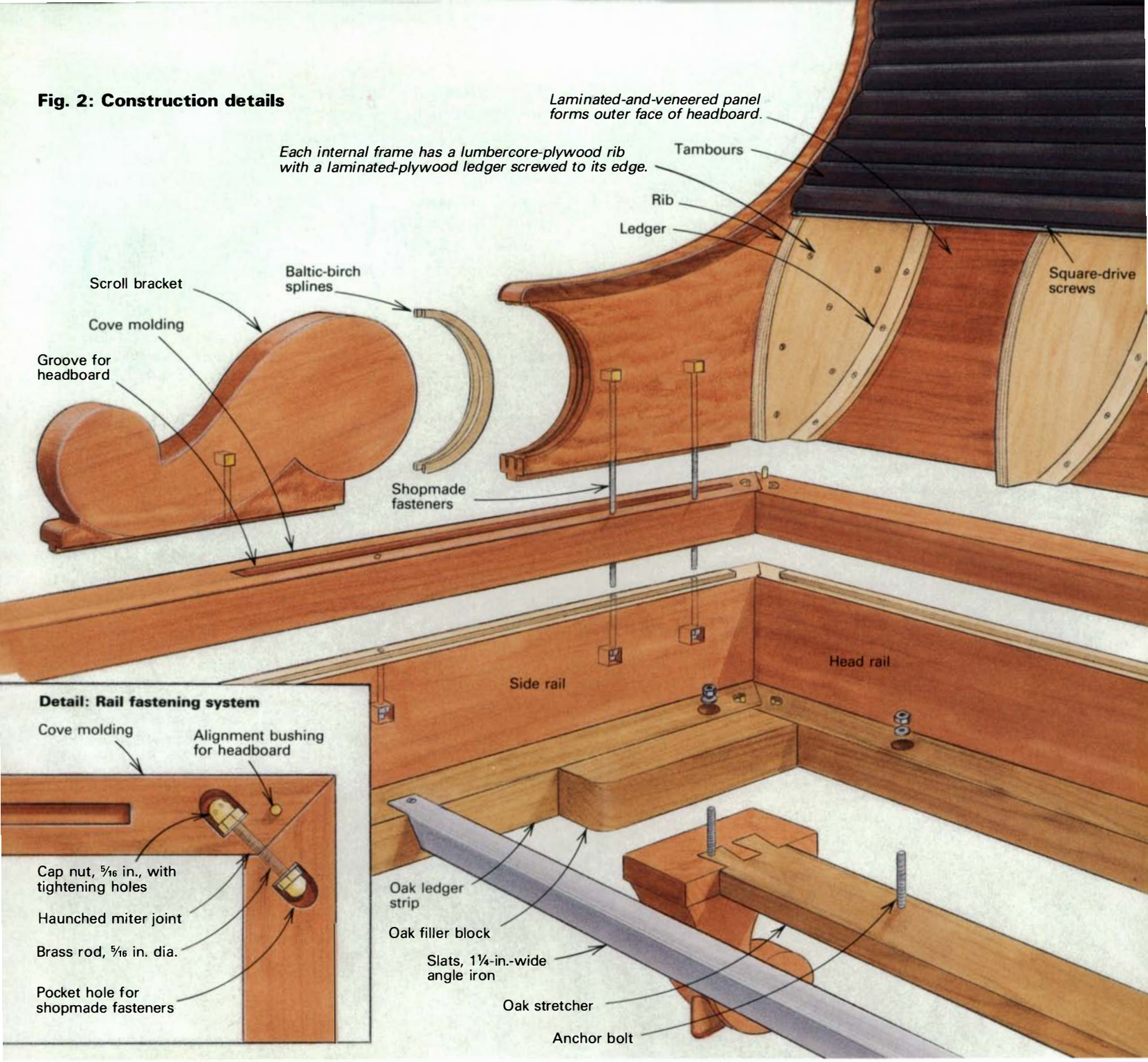
Rosewood tambours, curved laminated panels and some easier alternatives

With the framework complete, the next steps were to form the curved veneered panel for the outer face of the headboard and to apply the rosewood tambours on its inner face.

Bending, laminating and veneering the panel was a complicated and involved procedure that required gluing together three layers of ⅛-in.-thick plywood clamped between a male and a female form to shape the panel to the appropriate curve. As a way to avoid this process and simplify the construction, I recommend the same straightforward technique that I used on the inner face of the headboard to apply the rosewood tambours; this procedure—screwing through a tongue on each tambour into the ribs of the internal frame—is much the same as installing tongue-and-groove flooring. You might also try sliding canvas-backed tambour panels into grooves routed into the upright posts, in the same manner that tambour roll-top desks are made. However, the fit between the tambours won't be nearly as good as the method I used due to the changing radii of the various curves.

As a way of highlighting the rosewood tambours inside, I chose a smooth veneered panel for the outer surfaces of the headboard and footboard. I glued up these core panels with phenolic resin adhesive because of its extended drying time. The cores were shaped by clamping the laminates (three pieces of ⅛-in.-thick plywood) in the vacuum bag between a two-part form. This gave the panels the necessary curvature, which was shaped using spring poles off the ceiling of my shop. Once the cores were pressed into their corresponding shapes between the two forms, the vacuum

Fig. 2: Construction details



pump was turned on. Pressure was maintained throughout the approximately nine-hour set-up period. When the glued dried, the lamination was removed from the press, and the curved surfaces were scraped and faired. Although there was some springback, it proved manageable. Then I repeated the entire process to apply the fiddleback mahogany veneer to the core. After cutting and planing the finished panel so that it fit between the posts, I fit its top to the routed groove in the crest rail and its bottom flush to the head rail.

The rosewood tambours that I used on the inside surface of the headboard are made up of ⅝-in.-thick by 1¼-in.-wide strips, each lightly radiused, scraped and finish-sanded to 600-grit. Fitting and fastening these tambours was the last major procedure in making the headboard. I used splines instead of standard tongue-and-groove joints to allow me to plane both edges of the tambours for a precise fit and to conserve the precious rosewood. I first jointed the approximate edge angle needed for each tambour and then fine-tuned the fit with a bench plane. A 1/16-in. gap between tambours accommodates normal wood movement. After fitting each tambour, I grooved its edges with a slot cutter on my router table.

To install the tambours, I assembled and leveled the bed rails on sawhorses, and then attached the headboard and footboard units. The first tambour, which fit into the recess routed in the crest rail, has a groove in one edge and a lap joint along the other edge that fits the crest rail's routed groove. I epoxied a spline into the groove of this first tambour, forming a tongue, and then predrilled for and fastened "trim-head," square-drive screws through this tongue and into the internal frames. All subsequent tambours were grooved on both edges. The groove on the top edge slipped onto the tongue of the preceding tambour, and, working from the top down, each tambour was in turn fastened to the internal frames through the tongue formed by a spline epoxied into the bottom groove. The tambours continue down below the level of the mattress and terminate just above the head rail.

Final touches: carved sunflowers and preparation for finishing

The final details of the headboard were the carved sunflowers that fit into the recesses at the top of the upright posts. The petals were first carved in the endgrain blanks parted from the ends of the mahogany crest rails. Next, the carved blanks were mounted into their recesses with screws that were in turn concealed by chip-carved rosewood seed pods that fit into mortises in the center of the sunflower carvings. To carve the seed pod, I photocopied the pattern and then glued copies to preturned and fitted blanks with spray-on contact adhesive. Paper patterns not only save time when carving multiples, but also eliminate trying to see pencil lines drawn on dark woods, like the rosewood. By turning the seed pods with slightly tapered sides, I could press-fit and spot-glue them into the recesses in the centers of the sunflowers. This way, I could pry out the seed pods to gain access to the screws for disassembling or repairing the headboard if necessary.

I used different techniques to prepare the various materials of the bed for finishing. I sealed the veneered surfaces with a washcoat of 1½-lb. cut shellac before sanding, working up to a final sanding with 600-grit. I sanded the rosewood to 600-grit and buffed it with a soft brush to draw out the natural oils and give it luster. All the other surfaces were wet-sanded to 600-grit. I finished the bed with eight coats of Livos Kaldet oil, a non-toxic, citrus-base oil finish. (Livos Kaldet oil is available from The Natural Choice, 1365 Rufina Circle, Santa Fe, N.M. 87501; 505-438-3448.) Each coat was applied with a soft cloth, allowed to sit for up to two hours and then wiped dry. I lightly rubbed down each coat with 0000 steel wool. □

William Turner is a professional woodworker in Stonington, Maine.

A vacuum fence for a tablesaw

Inlaying endgrain mahogany edging on my sleigh bed required a special set of patterns and templates and many hours of tedious fitting, gluing and trimming. Between the headboard and the footboard, four different curves received this edge treatment, with each respective curve being repeated four times in order to inlay both the inside and outside edges of each post.

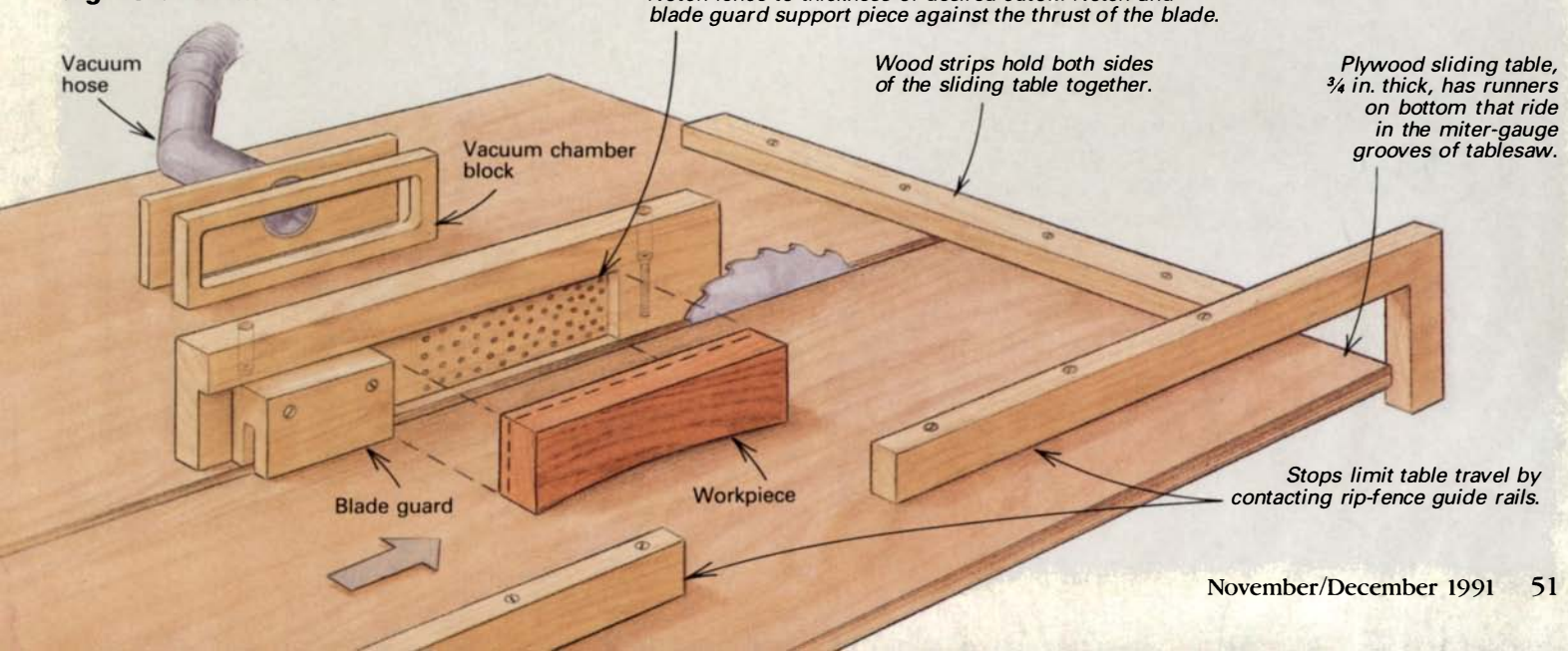
The 0.128-in.-thick pieces of inlay were cut from a 2-in.-long piece of mahogany that was 1¼ in. thick by 6 in. wide. To overcome the hazards of crosscutting such thin pieces from a small block, I developed a vacuum fence, shown in the drawing below, that is screwed to a sliding table for my tablesaw. Suction from an ordinary home vacuum cleaner, which connects to the back side of the fence, holds the blank in position on the face of the fence. I also notched the fence, as shown in the drawing, to counteract the upward and backward thrust of the blade. I had to turn the piece over and make a second pass due to the loss of blade height resulting from the ¾-in.-thick sliding table. Because the thin cutoff is held securely to the fence, the piece won't be thrown back by the blade, and the cutoff won't vibrate against the blade, thus reducing sawmarks. This process yielded a high degree of accuracy and a consistent thickness, as well as minimal waste.

Rather than fitting four different sets of endgrain blocks for each curve, I saved time by first individually hand-fitting the 2-in.-long blocks side by side, to follow each curve of the upright posts. For each of the post's curves, I made up a ⅛-in.-thick plywood template that matched the shape of the upright post ½ in. from its edge. After mitering the edges of the blocks so that they butted together tightly and followed the edge of the pattern, I used spray adhesive to tack the blocks temporarily to the pattern. A ball-bearing-guided flush-trimming bit chucked in my router and run against the pattern trimmed the blanks to match the inner radii of each post's curves.

With the blocks shaped to the curve of the posts, I could then slice off the 0.128-in.-thick pieces, using my vacuum-fence setup, to form the endgrain inlay. I cut five sets of inlays, making an extra set in case a piece was broken in the subsequent operations. I repeated this process to make endgrain inlay sets for the bed's four basic curves, storing the sets in separate parts bins to avoid confusion.

Then, with a ball-bearing-guided rabbeting bit, I routed ½-in.-wide by ⅛-in.-deep rabbets into the corners of the upright posts for the endgrain inlay. After making final adjustments to the fit with a file and plane, I glued, taped and clamped each piece of inlay into its rabbet. When the glue dried, the clamps were removed, and with the bearing-guided flush-trimming bit, I routed the endgrain inlay even to the edge of the posts. Next, I carefully leveled the inlay, which was 0.003 in. proud of the posts, with a mill file and then lightly radiused the corners. Duct tape wrapped around the end of the file helped protect the 1/64-in.-thick makore veneer on the face of the posts. Although the process was long and involved, the effect was exactly what I wanted: The major curves of the bed were outlined and defined. —*W.T.*

Fig. 3: Vacuum fence

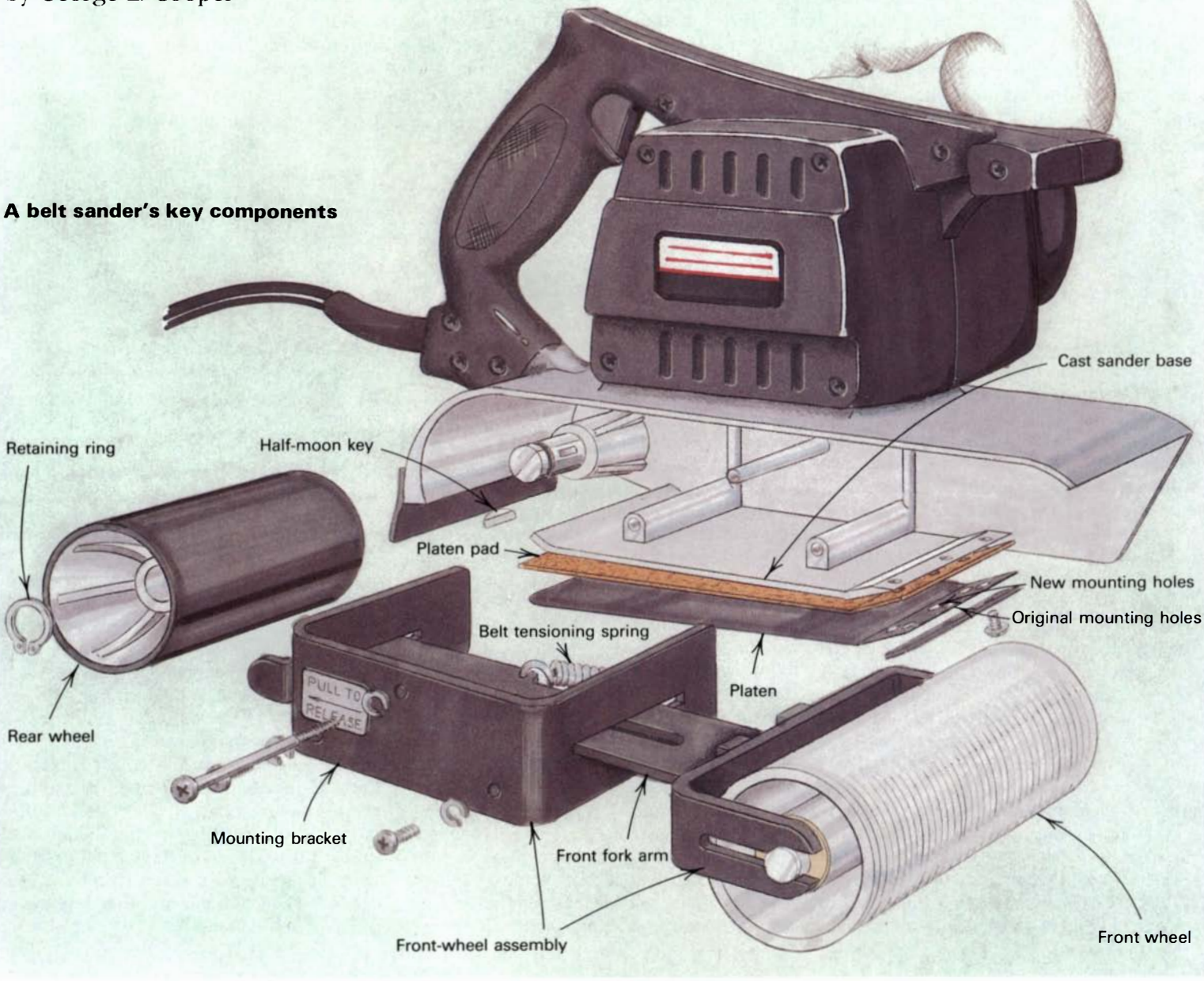


Belt Sander Tune-Up

Flattening the base and aligning the wheels

by George E. Cooper

A belt sander's key components



A portable belt sander can be a real labor saver, yielding an excellent finished surface. But if it's not operated or adjusted properly, a belt sander can be a terrible frustration, leaving scuffs and scratches. Since purchasing a new 4-in.-wide by 24-in.-long belt sander in 1983, I had been plagued with scuff marks on my sanded surfaces. These were most evident on large panels such as tabletops and doors, just the places where a very smooth, defect-free surface is desired. The scuff marks, about 1 in. in diameter, appeared at the forward end of a sanding stroke, and sanding them out with an orbital sander took considerable effort.

I thought my technique was to blame, but I got good results when I tried a different belt sander on a recent project, so I knew the problem must be with the sander itself. After checking the prices of new belt sanders, I decided to take a closer look at mine to try to determine what was causing the problem and to see if I could correct it. My sander, a Sears model 315.11782, is basically a good machine, with sufficient power and effective dust collection. I decided that a tune-up may be worthwhile; it was, and it only took two hours. As I corrected one problem, though, others showed up. A close look at the parts of the sander and how they related to each other revealed the solutions to these problems. Although I will use my Sears sander for illustrating the tune-up procedures I followed, these ideas and techniques will be applicable to most other brands.

Tracking down the problems

When I first bought my Sears sander, I was getting wide marks across the sanded surface at the forward end of the stroke. I discovered that these marks were caused by the platen—a stamped spring-steel sheet bent along the leading edge to accommodate

Photos: Author; drawing: Aaron Azevedo

mounting screws. The screw holes had been punched too far from the bend, causing the leading edge of the platen to bear more heavily on the work than the rest of the platen, thus creating the wide scuffs on the sanded piece. I corrected this problem by drilling a new set of mounting holes, as shown in the drawing on the facing page, making the platen fully tangent to the sanding surface.

Having corrected the cause of my sanding marks, I was surprised when another 1-in.-dia. scuff mark began to appear. Upon disassembling the belt sander to analyze the problem, the cause became immediately apparent. Dust had built up under one corner of the spring-steel platen between the platen pad and the cast base of the sander, and caused a high spot. The increased pressure on that one small area caused the scuffing. Friction between the belt and the platen at the high spot generated so much heat that the pad was actually scorched.

Now I had a new problem. I had to figure out what caused the build up of dust in that one small area. I suspected that the sander's cast base was not flat, allowing dust to enter where the belt was not running tightly against the platen. To check the casting, I placed the sander on a known flat surface with the platen and platen pad removed, and, sure enough, the sander rocked from corner to corner, indicating that the bottom of the casting was not on a flat plane. Furthermore, a check of the front wheel and the rear drive wheel indicated that the axles of these wheels were not parallel to the plane of the sanding surface. To see how far out of parallel these parts were, I simply placed the edge of a 12-in.-long steel ruler lengthwise on the sander's cast base; I pulled the ruler from side to side across the base and noted any changes in the relationship between the ruler, wheels and base. I was sure that flattening the base and aligning the wheels to the flattened base would improve my sander's performance.

***The cast base of a portable belt sander can be flattened on a stationary belt sander** (above). Check the base frequently when flattening it to be sure you are also bringing it into alignment with the rear axle. Hold the portable sander so the plastic drive housing overhangs the edge of the stationary belt to avoid excessive damage to the housing.*

***Twisting the front-wheel subassembly** with a large wrench (shown at right) will align this wheel with the base and the rear drive wheel. This adjustment is a trial-and-error process and should be checked if the sander is dropped or if the belt doesn't track properly.*

Grinding the belt sander's base

The first task was to remove the front-wheel assembly and rear wheel. Just three screws held the front-wheel assembly, but I needed a pair of snap-ring pliers to get at the retaining ring in the center of the rear wheel. I then tapped off the rear wheel, being careful to not lose the half-moon key that prevents the wheel from turning on its axle. The key must be removed from its slot, if it hasn't already fallen out, so that the wheel can be slipped on and off its axle during the following procedure. Because the rear axle is mounted in a casting and is not adjustable, the cast base must be made parallel to the axle at the same time it is being ground flat. I placed the cast base on a flat surface to again determine which corners needed to be removed to make the surface flat; at the same time, I checked for parallelism of the base to the rear wheel. I marked the high areas and then slid the rear wheel off the axle.

I ground the sander's cast base on a 6-in.-wide stationary belt sander with a 60-grit belt. I held my portable sander as though I was using it on the belt of the stationary sander, as shown in the top photo, and concentrated on removing material from the high side to make the base parallel to the rear axle. At the same time, to ensure that the base would be flat, I was careful not to rock the sander. I checked for flatness and parallelism several times during the sanding process to avoid removing too much material. The outer edge of my base was low, so considerable grinding on its inside edge was required. I actually had to sand some of the plastic belt-drive housing before I was able to flatten the cast base fully. To minimize damage to the plastic housing, I held the plastic off the edge of the 6-in.-wide belt. The platen and platen pad should provide sufficient clearance in operation so that the plastic housing doesn't interfere with the workpiece. I continued grinding until I had a fully ground, flat surface that was parallel to the rear axle.

Front-axle alignment

Although correcting the rear-axle alignment required grinding the base, correcting the front-axle alignment was relatively easy. The front wheel is mounted on a subassembly, which includes the belt tensioning device. To begin, I removed the belt tensioning spring from the subassembly and slid the arm of the fork that holds the front wheel all the way back into the subassembly; this prevented the fork arm from being twisted when I adjusted the alignment. With the front-wheel fork extended to the side, I clamped the mounting bracket in a vise. I then placed a large crescent wrench around the front fork arm and carefully twisted it in the direction required to correct the alignment (shown in the bottom photo). I remounted the front-wheel assembly and checked the alignment with a rule across the cast base as before. After a few tries, I had it right.

After reinstalling the rear wheel and front-wheel assembly, I checked to be sure everything was aligned properly with the flattened cast base. I replaced the worn-out cork pad that was originally installed between the cast base and the spring-steel platen with two layers of sticky-back felt that I bought at a craft shop. Although I could have ordered a new cork pad from Sears or cut one from sheet cork (available from craft stores or auto-supply stores as gasket material), I had the sticky-back felt on hand and wanted to try a softer pad. I stuck the felt to the back of the platen, placing one layer on top of the other to make a thickness of about 1/16 in., and then I trimmed the felt to the size of the platen.

A quick test showed that my sander now ran as well as a fine-tuned sports car. Alignment of the wheels and platen cured the scuffing problem and improved belt tracking. □

George Cooper is a woodworker in St. Charles, Mo.

When it comes to planning a layout, a model is even better than the real thing. *You can visualize spatial relationships and evaluate how light affects workspace. Here, luthier John Monteleone experiments with his shop's layout.*

Laying Out a Workshop

Planning for workflow and flexibility

by Scott Landis

Many people begin woodworking by using part of their house—basement, garage, pantry, attic—as a shop. There is no perfect location; one person's dream is another's nightmare. Although you may not have much choice in the location of your workshop, what you do within its walls is entirely up to you. (Unless, of course, you have to share that space with the family car or three other business partners.) Nothing less than your safety, efficiency and enjoyment hang in the balance.

The factors that affect shop layout—from the height of the ceiling to the size of your wallet and the type of work you do—vary greatly. The selection of machinery, for example, relates strongly to layout, as do wood storage and dust collection. In fact, just about everything that goes on in the workshop has something to do with the subject. This was quite evident as I visited dozens of professional and amateur shops to take a close look at the basic systems that constitute most modern workshops. I asked shop owners to explain how they selected and located equipment in order to foster efficient work flow and safety. The workshop, I discovered, is not a static creature. Like the craftsman who uses it, the shop constantly evolves to accommodate the changing needs of its occupants. What follows is a discussion of the principal considerations involved in laying out any workspace. In the sidebar beginning on p. 57, I'll show you three examples from the wide variety of workshops I visited.

Planning the workshop layout

If you've ever chopped tails on both parts of a dovetail joint, you'll appreciate the value of good planning. With all of the elements involved in putting together a shop, which is a lot more complicated than a piece of furniture, you'd be well advised to start with a pencil and paper, and a good eraser.

Before you start sketching floor plans, it's a good idea to make a few priority lists. Begin with your equipment. Make a list of every tool (large and small) you currently own or expect to buy, and rate its importance. Consider not only how much space each tool requires for efficient operation—the most you'll need and how little you can get by with—but also how often you use it and for what sorts of operations. This exercise may reveal some surprising, even unpleasant information. The size or expense of a tool may bear little relationship to its importance in your shop. For example, if you use a bandsaw only for occasional resawing of heavy timber, you may be better off consigning it to the woodshed rather than having it consume valuable shop space.

Take an inventory of materials and hardware, and review how they typically get used up. If you are overrun by a mountain of precious lumber that you rarely use but hate to part with, you might take a hard look at other storage solutions.

The priority lists will generate all the information you need to begin your workshop design. The process should also serve as a catalyst for asking basic questions about your work habits. What temperature are you comfortable working in? What sort of light do you prefer, and how does it vary with different operations? Do you spread your work out or burrow in? Are you neat, or are you a slob? If your dream shop is somewhere in your future and you are currently working in another space, take the opportunity to examine the ways in which the current shop aids or hinders your work. By analyzing your daily routine—how many trips you make to the bench, how many times you start the saw—you'll add valuable layers of information to the plan.

There are several good ways to develop a floor plan. You can outline the perimeter of your shop on a sheet of paper and simply sketch in the equipment, but a method that allows you to move things around and try out many different possibilities is likely to give you the best results. You can cut out pieces of paper or cardboard to represent each tool and move them around on a floor plan until you get a setup you like. Be sure to represent the equipment and the shop space to scale. Carefully consider the direction of feed for each machine and the amount of space required for each operation. A few inches can make a big difference.

Like Maurice Gordon, whose shop is discussed in the sidebar, an increasing number of woodworkers use a computer and design program to lay out their shop. By printing out different versions, they can compare many possibilities. Gordon used a computer-aided design program to work up his floor plan. He entered each machine, bench and other workshop fixture as a separate component in the drawing, so each could be manipulated without affecting the overall floor plan. The program's 256 overlay functions made it easy to develop lighting, electrical and dust-collection plans, just as an architect would use transparent drawing overlays. The program is pricey, and Gordon uses it in his "real-life" engineering business, but less expensive (and perhaps less elegant) drawing programs are available that would work fine for a shop floor plan.

After the floor plan, you might draw some elevations—if not for the entire shop, then at least of some walls. Vertical layout is an important factor in the efficiency of any floor plan, but it is particularly so in a small space where the height of adjacent tools and work surfaces are critical. Elevations will wean you away from the flat plan and get you thinking in three dimensions.

If you have trouble thinking in three dimensions, try making a model. After working for years in a decrepit, dockside machine shop on Long Island, luthier John Monteleone wanted to be sure that his new workshop would be worth the wait. So he started making models—benches first, built to a 1-in. scale. "Things started out simple," he says, and then I got enthused!" He measured each tool and cut the corresponding model out of pine on the bandsaw, sticking the parts together instantly with cyanoacrylate glue and spray accelerator. He spent several days in the process—almost two hours on the thickness sander alone. His results are shown in the photo on the facing page.

Adding flexibility into the plan

Good layout is more than just deciding where to put your equipment. Limited space or a variety of woodworking projects will make flexibility critical in most small shops, while in larger shops or production and specialty shops, where the type of work is more predictable, only certain areas need be flexible. As one woodworker told me, "As much as I'd like to bolt things to the floor, I don't because I never know when I'll have to push something over a few inches to allow for some other operation."

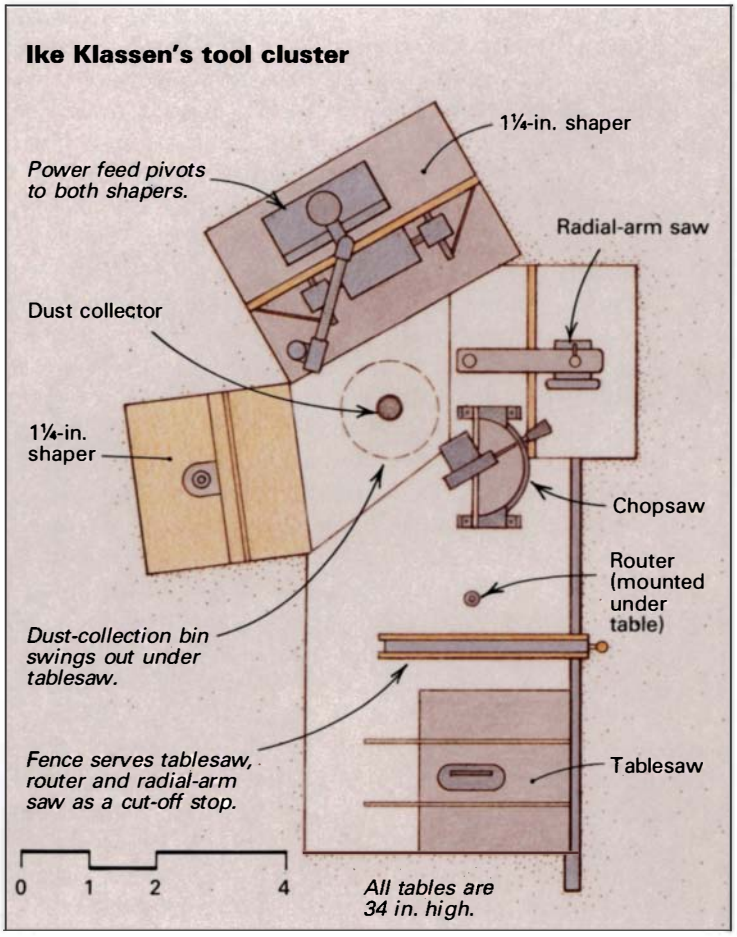
Flexibility is most often expressed in the selection and orientation of machinery. In the majority of shops I visited, the tablesaw occupies a pre-eminent position in the middle of the floor. A tablesaw demands space on all four sides. By contrast, all other major pieces of commonly used woodworking machinery—radial-arm saw, jointer, planer, bandsaw, drill press and shaper—require space in only two or three directions and can be placed against a wall.

Arranging the machines around the perimeter of the shop, or even isolating them in a separate machine room, liberates the bulk of the floor space for a constantly changing flow of shop projects. Flexibility is enhanced by folding outfeed tables or portable outfeed horses and rolling tool carts, clamp caddies and assembly tables.

As important as flexibility is to most shops, good organization also requires a careful analysis of what kinds of things you do repeatedly and in what order. If you make solid-wood furniture, for example, you are likely to follow a similar sequence of operations regardless of whether you're making a highboy or a chair: You saw

Portable benches and a portable shop-built router table allow John Nyquist to make flexible use of his shop space. His workbench sits between the cabinets that hold his hand tools and portable power tools and a 4-ft. by 12-ft. assembly table.

Photos except where noted: Scott Landis



and plane rough lumber to dimension, cut joints and shape parts, assemble them, and then apply finish. Unless you're really pressed for space, it probably makes more sense to put your tablesaw or bandsaw, rather than your finishing area, next to your jointer and planer. If you work mainly with plywood, or do a lot of turning, you can also identify an overall order to your work, one you'll usually, if not always, follow. Determining that order, or workflow, is the first step to finding the best relationships between the components that make up your shop.

Workshop triangles

A useful way to consider organizing workshop space is in terms of work triangles, which describe the relationships between several different tools within a single work area.

Perhaps the most fundamental workshop triangle is formed by the workbench, tool chest and assembly area. The relationship between these elements is apparent in John Nyquist's shop (shown in the photo on the previous page). Nyquist, who builds about 30 pieces of furniture each year in his Long Beach, Cal., workshop, can easily get any hand tool he needs while working at the bench. The tools are arranged in the built-in wall cabinets according to their size, function and frequency of use (similar tools—marking and measuring tools or saws, for example—are grouped together). A low assembly table is accessible to the bench, which may be needed for making final adjustments as the piece is put together.

The importance of the relationship between the workbench, tool chest and assembly area should not be underestimated. Their relative positions will vary widely, of course, depending on the shop space and the nature of the work that's performed in it. Where the work is relatively small and refined, as in some musical-instrument shops, hand tools, workbench and assembly stations are within arm's length of each other.

Power-tool work triangles are at least as variable as bench and assembly triangles. Someone who does a lot of resawing may want an arrangement where the bandsaw, jointer and cutoff saw are close together. A power-tool triangle can be a straight line, which makes for efficient movement between tools. Curtis Erpelding, of Seattle, Wash., situated his tablesaw, jointer/planer, thickness sander and bandsaw side by side in a compact line down the middle of his shop. The machines are oriented so that work is fed across the line (and the shop). That way, Erpelding can push a long board through the tablesaw without having it bump into the jointer. With this arrangement, Erpelding's shop is wide enough to allow 10 ft. of infeed and outfeed clearance on either side of the line.

Figure 1 at left shows a compact work triangle in the center of Ike Klassen's 20-ft. by 24-ft. workshop in Winkler, Man., Canada, in which several tools share the same dust collector and the surfaces of their tables. The 4-ft. by 6-ft. homemade saw table makes it easy to cut large panels in any direction and provides an extended work surface for the adjacent radial-arm saw. A T-square fence serves both the tablesaw and the router (mounted beneath the saw table) and acts as a crosscut stop for work on the radial-arm saw. The two shapers share a single power feed. The tool cluster allows about 10 ft. of clearance on either side of the radial-arm-saw blade.

Dedicated spaces

Separate areas of the shop may be designated to specific tasks, such as carving, metalworking and gluing up. In many shops, I found small, dedicated zones set aside for tool sharpening, their location dictated mainly by good natural light and running water, or by proximity to the bench area or a particular machine. Turners, for example, frequently locate a bench grinder within arm's reach of the lathe.

Every dedicated workspace, of course, implies a loss of flexibility, and the value of the trade-off depends upon the type of operations you perfom in the shop and how frequently you perform them. If you regularly begin your shop routine with a meditative tool-sharpening session, as a few woodworkers I met like to do, a designated sharpening area might make sense, although sharpening stones are easily moved and don't usually require their own bench. Likewise, if your winter shop temperature hovers around 50°F, you may have to set up a separate gluing or finishing room.

It is theoretically possible to divide the entire workshop into a matrix of task-specific work zones, but such an extreme division of space may eventually provide diminishing returns. Many woodworkers speak longingly about an "ideal" workshop in which the machinery would be physically located away from the bench space. Several mentioned visiting workshops in Europe where machine shops occupied separate buildings. Isolating machines from the rest of the shop has an obvious advantage where a number of people share a shop—the machines can be roaring away most of the day and not disturb the concentration of those doing fussy handwork elsewhere.

If you work alone, separating your machines from the rest of your shop may be more a matter of personal style or habit than one of necessity. For example, you may adopt a cautious demeanor when you approach your machinery, while you feel more relaxed or introspective at the bench. Isolating these functions in physically separated quarters may enable you to develop a safe and more efficient routine; such an arrangement will certainly affect the quality of your work and the enjoyment you derive from it.□

Scott Landis is a writer in Coatesville, Pa. This article was excerpted from his new book, The Workshop Book, *published this year by The Taunton Press, PO Box 5506, Newtown, Conn. 06470-5506.*

Drawings except where noted: Vince Babak

Working in a small space

There are as many solutions to the problem of laying out a small workshop as there are creative woodworkers. The following drawings and photos represent three workshops you might find in a garage or basement anywhere across the continent. But in each case, the owner has demonstrated a special ability to shoehorn his priorities into a modest floor plan.

A minimalist shop: At just 12 ft. by 22 ft., Dick Sellew's shop is the smallest professional cabinet shop I saw.

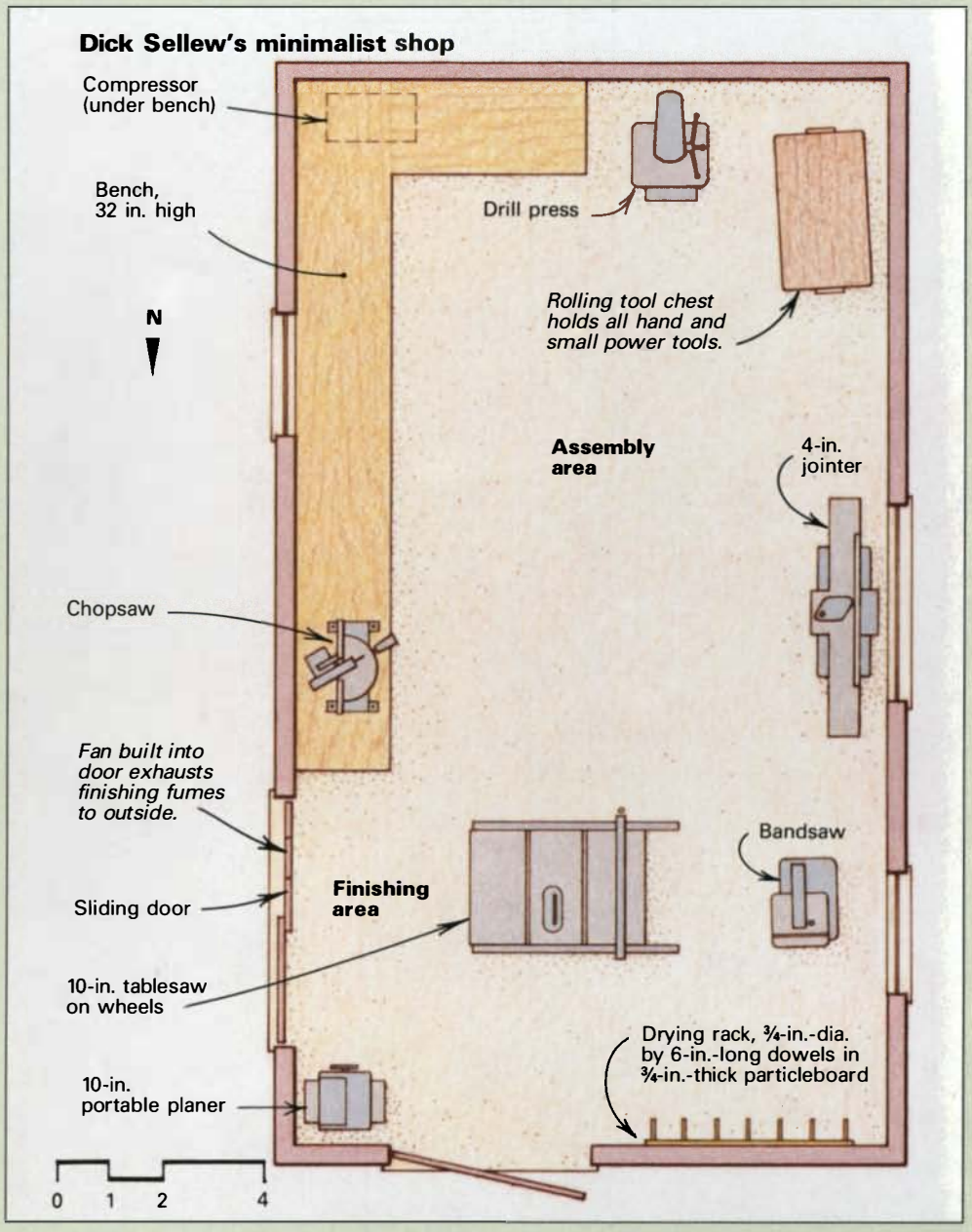
When he set up shop in an old shed in New Marlborough, Mass., Sellew explains, "I wanted to enjoy my work." After 14 years in a San Francisco, Cal., production shop, he was determined to see how little he needed to get by. As a result, he spends less on rent than many cabinet shops spend on sharpening (a mere $20 per month), and most of his machines are cut-rate imports. "I can actually make more money here than I could with state-of-the-art equipment and 10 other guys." And he lands jobs that bigger shops can't touch.

Apart from his tablesaw, which occupies a space near the door, everything else is arranged around the walls. This leaves as much room as possible in the center of the shop for assembly (see the drawing at right). Instead of a shaper, Sellew mounts a large router in a shop-built router table that sets up on sawhorses. When not in use, the setup packs away in a cabinet. A chopsaw fixed to a table along one wall does the cutoff work of a radial-arm saw. An assortment of six tablesaw sleds, or trays, is used to perform a variety of crosscut and miter operations. Planing and edge-jointing are done on a 4-in. jointer and a portable 10-in. planer. When the weather is nice, he puts the planer on a telephone cable spool and works outside (see the photo below).

Open rafters and a gable roof provide storage space and room to swing long boards. Wood is stored in an adjoining shed. Three radiant electric panels on the ceiling heat the shop quickly and consume virtually no space; their white surfaces also reflect light. Sellew sprays finishes right in the front of the shop (he admits the hazardous nature of the practice); he simply rolls the tablesaw out of the way and turns on a fan to blow the fumes outside. A wall-mounted rack near the front door holds the pieces while the finish dries.

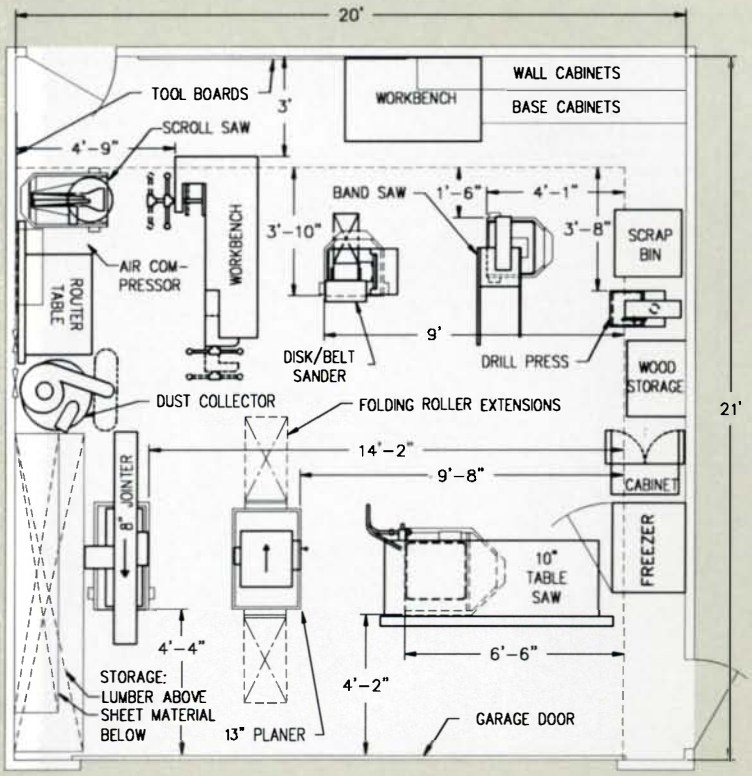
"To be honest, I didn't think it would be as easy as it has been," Sellew says. "But even in a 6,000-sq.-ft. shop, I'd assemble in a space no bigger than this."

Sharing the shop with a car: When Maurice Gordon's only major tools were a Shopsmith and a Sears tablesaw mounted on casters, it was relatively easy to share

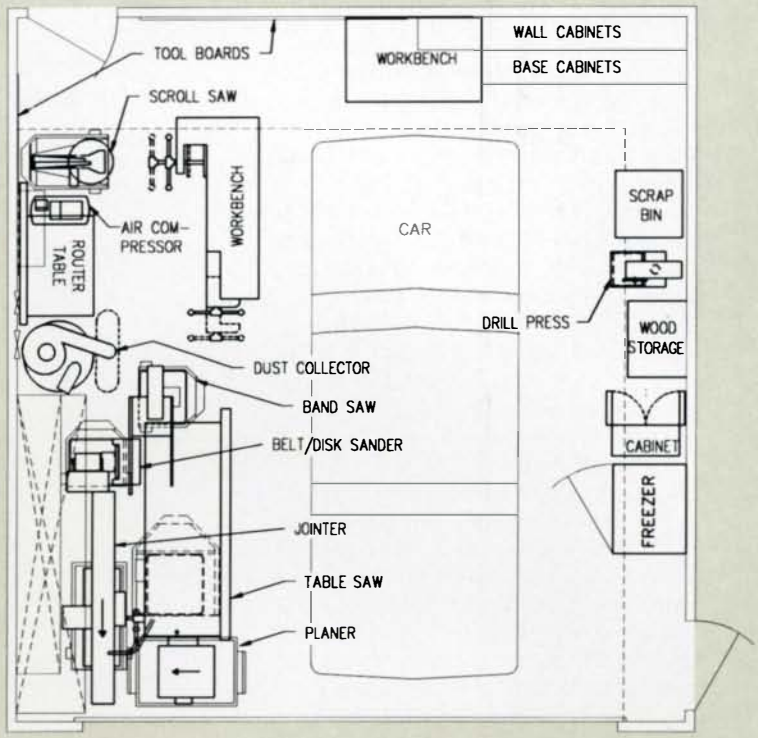


Dick Sellew can handle big projects in his tiny workshop. *In good weather, he moves his planer outdoors. The wood storage shed (on the left) is almost as big as the shop.*

Maurice Gordon's computer-aided shop design

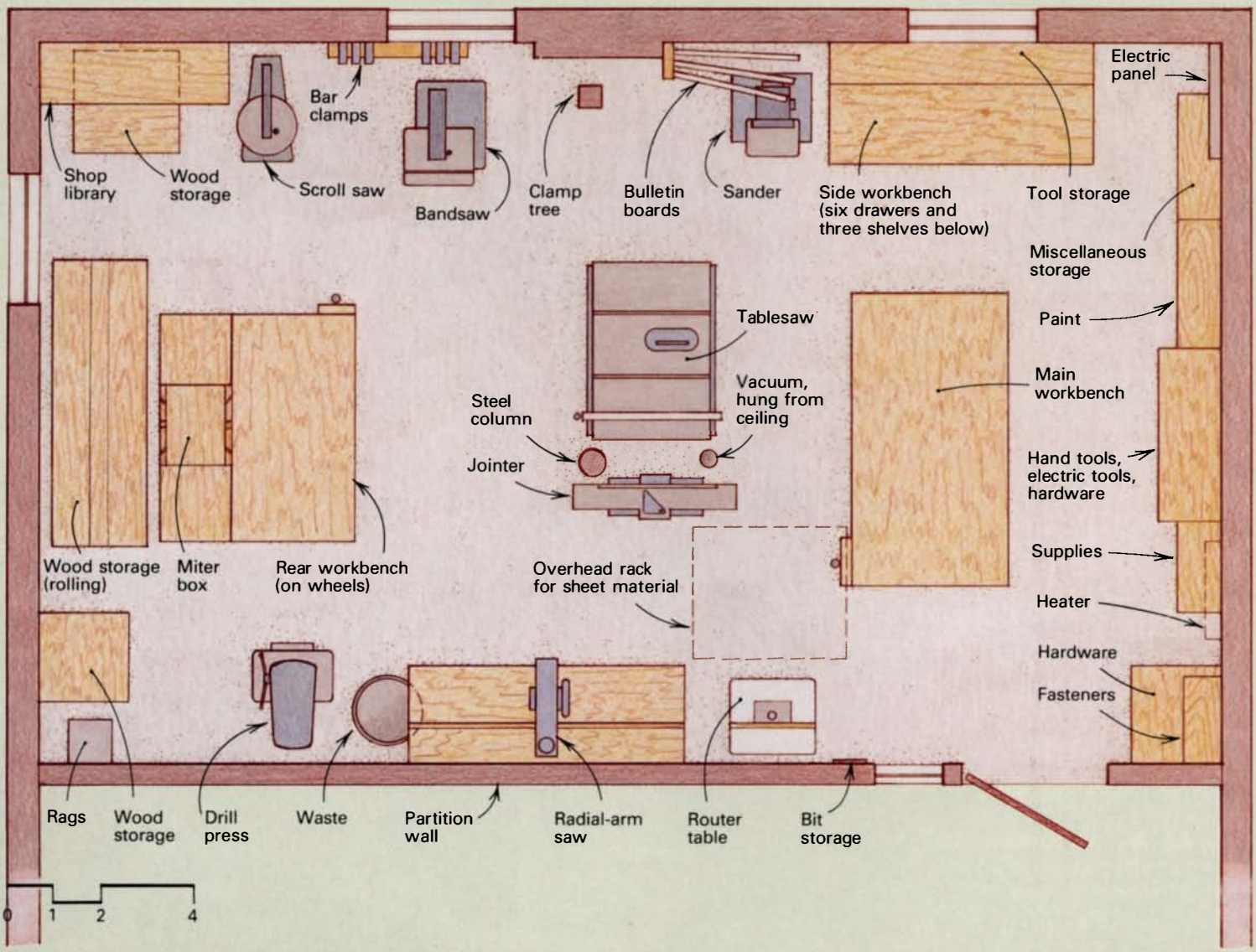


Workshop knocked down for parking



Computer drawings above: Maurice Gordon

Jim Whetstone's basement shop



space with the family car in his Houston, Tex., garage. The situation became more complex, however, as his woodworking turned professional and he replaced his tools with single-purpose machinery.

In 1988, Gordon considered his needs—a full-function shop with sufficient space around the stationary equipment and room for one car when the shop was not in use. That's a tall order for a 420-sq.-ft. attached garage. Gordon used a computer-aided design (CAD) program to organize his power tools, benches, fixtures and storage. The program allows him to move individual outlines of his machinery around on the computer screen to decide where to put the tools. (In real life, the tools that need to move are on rollers.) Using the overlay feature of the CAD program, he also designed a lighting plan for his workshop.

The arrangement, shown in the drawings at the top of the facing page, is not perfect—the garage door must be opened to saw large sheet stock or to surface long boards—but it would be hard to improve. Active and stored tool locations are painted on the cement floor, enabling Gordon to set up the workshop or to knock it down in five minutes.

A well-organized basement shop: Organization and storage are more than a luxury in most basement workshops. Jim Whetstone's shop in New Cumberland, Pa., is as highly organized and economical in its use of space as any I've seen. As the floor plan at the bottom of the facing page shows, Whetstone located his major power tools near the centerline of the shop. Three workbenches surround the machinery, and wood storage is at the far end of the shop. This arrangement allows him to rip 4-ft. by 8-ft. sheets of plywood on the tablesaw and cut 14-ft. lumber on the radial-arm saw. It also provides space to lay out, construct and finish a variety of projects.

The ceiling and partition between the shop and the rest of the basement are of drywall construction, which makes for easy maintenance and sound insulation and aids fire prevention. Electrical boxes hang from the ceiling to keep cords off the floor. For safety and convenience, Whetstone color coded the circuits—red for lights and orange for equipment. To promote order and style, he painted his cabinet cases and door frames green and the doors blue. I was impressed by the number of clever storage ideas he had come up with, one of the reasons he's able to cram so much in such a small space and to keep it neat. Two of these are shown in the top photos above.

Although the shop appears to be complete, according to Whetstone, it has evolved a little bit each year since it was built in 1974. "It is not finished," he explains. "No true woodworker with a reverence for wood, order and quality is ever satisfied with his workplace. It will grow as I grow." —*S.L.*

Creative storage: *Jim Whetstone made a 34-in.-sq. rack (above left) that pivots down from the ceiling to provide access to sheet goods. He stores hand-screw clamps on a 4x4 "tree" (shown above right).*

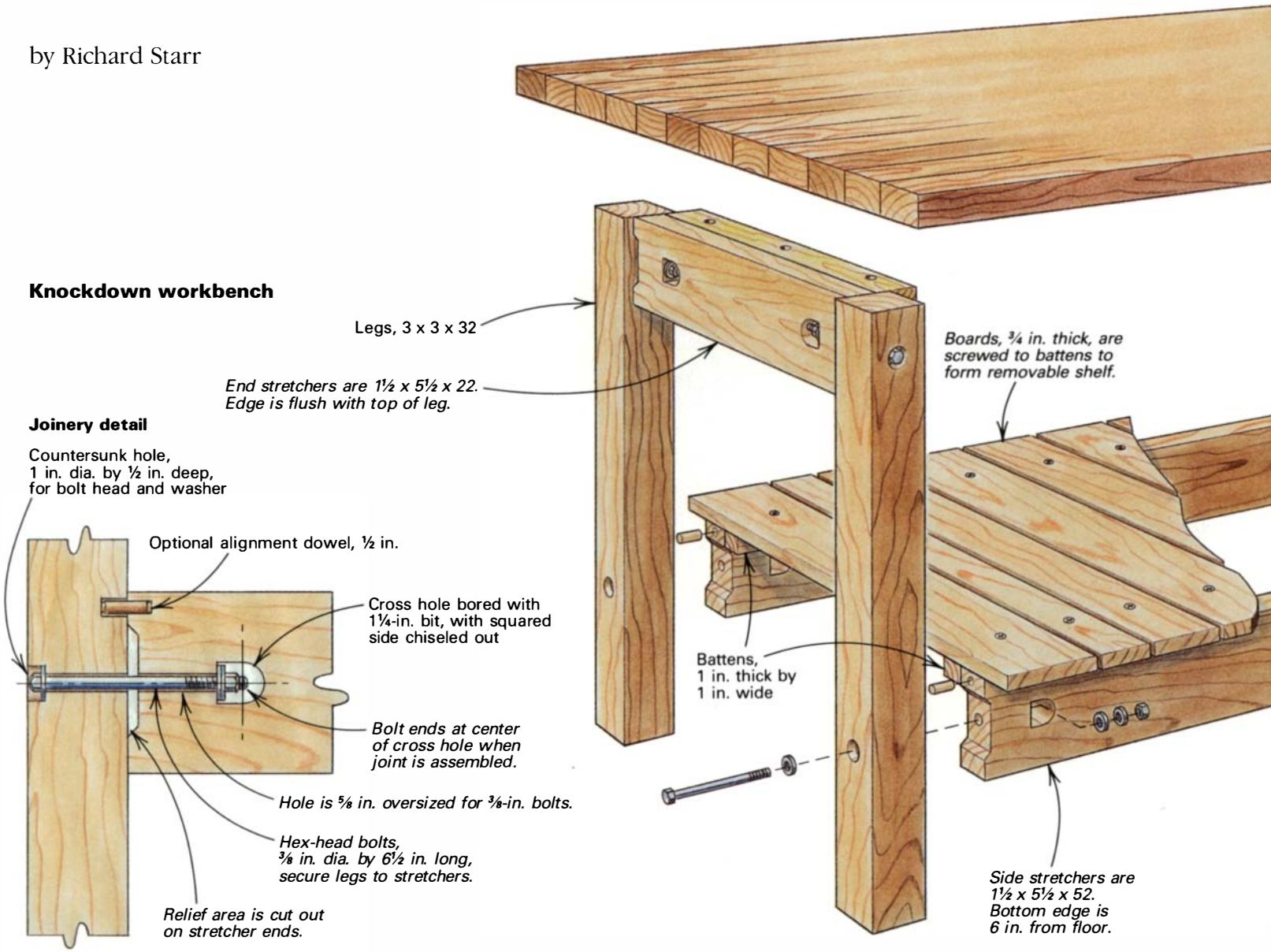
Whetstone gets a lot of mileage out of his small basement workshop *by making sure that there is a place for everything and that everything is in its place. Whetstone has used his ceiling space as efficiently as the floor and walls: Electrical outlets are mounted on the ceiling to keep the cords off the floor, and drill bits are kept handy in a ceiling-hung rack above the drill press.*

Photos this page: James Whetstone

An Easy-to-Build Workbench

Bolted butt joints for rigid construction

by Richard Starr



As a school woodshop teacher, I must often solve problems on the spur of the moment. That's how the design for my easy-to-build workbench came to me. A couple of kids wanted to build a bench as a gift for a neighboring preschool. The bench had to be quick and easy to construct, yet professional looking and, above all, absolutely rigid. When all the elements for a simple, bolt-together frame came together in my mind, I hit my palm to my brow. It seemed so obvious. I wondered why I hadn't thought of it before.

Designing the workbench

The workbench mainly consists of four legs and four stretchers held together with eight identical joints. The joints are easy to cut yet forgiving because they are fastened with common hex-head bolts available at any hardware store. The joint, equally effective in hardwood or cheap construction-grade lumber, is also perfect for many types of knockdown furniture. It's even solid enough for permanent installations, such as a built-in work counter.

The first step in building the frame is to decide the dimensions of the top. This decision should be based on the bench's intended use (a carving bench should have a narrower top than a cabinetmaker's assembly bench) and on the shop space you have available. The bench I built has a 42-in.-wide by 72-in.-long top, good for general woodworking tasks. From these dimensions, I calculated the size of the frame and the length of the stretchers. You can determine the length of each pair of stretchers by subtracting twice the thickness of a leg plus the amount the top will overhang at each end from the length and width of the benchtop. When deciding on the amount of overhang, keep in mind that it's a good idea to leave plenty of room on all sides, for mounting vises and for clamping things to the top. For example, I chose a 7-in. overhang and used 3-in.-thick by 3-in.-wide legs, so my end stretchers were 22 in. long and the side stretchers were 52 in. long. I made my stretchers from 2x6 stock.

I used soft maple for my bench's legs, but you can use glued-up hardwood or construction-grade 4x4s. Cut the legs to a length that equals the height of the bench less the thickness of the top. I find that bench height is largely a matter of personal taste. I'm a six-

Drawing: Mario Ferro

footer, and I like a 34-in.-high bench whenever I'm sawing or planing wood; for small assembly work, though, I'd want the benchtop an inch or two higher. The workbenches in my school shop are 30 in. high, which is right for most adolescents, although younger woodworkers might do best with a 26-in.-high bench.

Making the stretcher joints

The function of a stretcher is to prevent the frame from racking and the bench from rocking, so it's imperative that each stretcher connection be rock solid. A joint held together with a single bolt focuses pressure at the center of the joint, which doesn't adequately prevent the joint from racking. Two bolts are better because they pull the stretcher against the leg closer to the edges, thus keeping the joint square. But you need to buy twice as much hardware, plus it takes twice as long to knock down or assemble the bench. After trying several variations of the bolted stretcher joint, I finally came up with the version shown in the drawing. A single bolt is used for each joint, and an arched relief area is cut out on each end of the stretcher. As the joint is tightened, pressure is focused at the outer edges (like a two-bolt joint), effectively locking the stretcher square to the leg and preventing racking.

To begin making the joints, crosscut the stretchers square and to length, and drill cross holes to provide the space for the nut and washers that are fitted to the end of each bolt. The center of each cross hole is located where the bolt end will be when the joint is assembled. For my bench, I used 3-in.-sq. legs and 6½-in.-long bolts with the heads countersunk ½ in. deep. This places the center of my cross holes at 3½ in. from the end of each stretcher. You should avoid locating the cross holes any closer to the stretcher ends than that or you risk the force of the bolt splitting out the endgrain and ruining the stretcher.

Bore out the cross holes with a 1¼-in -dia. bit, which will leave a hole large enough to allow a box wrench to fit around the nut during assembly. Next, the portion of the hole facing the end of the stretcher is squared up for the nut. I used a try square to mark out the pocket, as shown in the drawing. Then I chopped out the waste with a chisel. If you like, you can whittle or sand the edges of the opening to give them an attractive chamfer.

To locate the bolt holes in the ends of the stretchers, I made a thin-plywood (you could use cardboard) template cut to the same dimensions as the cross section of a stretcher, in this case about 1½ in. by 5½ in. The template is used to mark the center for each ⅝-in.-dia. bolt hole, and then these holes are drilled through until they intersect with the cross holes. A spade bit in a portable electric drill works fine in endgrain, although I prefer to use a modified auger bit in a hand brace. To modify the bit, I just filed the spurs off, and it chewed right through endgrain. I tried to drill accurately by checking that the bit was parallel to the face and edge of the stretcher, and stopping and rechecking frequently. Because the hole is much larger than the bolt, dead accuracy isn't necessary; as I've said, this joint is very forgiving.

If you plan to disassemble and assemble the bench often, you might want to add an alignment dowel on the end of each stretcher. This short, ½-in.-dia. dowel keeps the stretcher aligned during assembly and mates to a slightly oversized hole in the leg.

Next, mark and cut out the relief area on each stretcher end, leaving two 1-in.-long contact areas. A ¼-in.-deep relief is all you need, but if you'd like to add a decorative touch, you can cut a fancy shape; just avoid cutting too near the cross hole or you'll risk splitting the joint when you tighten the bolt. I cut out the relief area on a bandsaw, but you could use a sabersaw or chop out the waste by hand with a chisel.

Use the same template described above to mark the positions of the bolt holes on the legs. Each pair of legs is laid out differently, so be sure to mark carefully. If you choose to countersink the bolt heads, drill the countersunk holes first. A 1-in.-dia. hole matches the diameter of washers normally used with ⅜-in. bolts. Drill the bolt holes oversized—⅝-in. holes for the ⅜-in. bolts—as you did on the stretcher ends earlier.

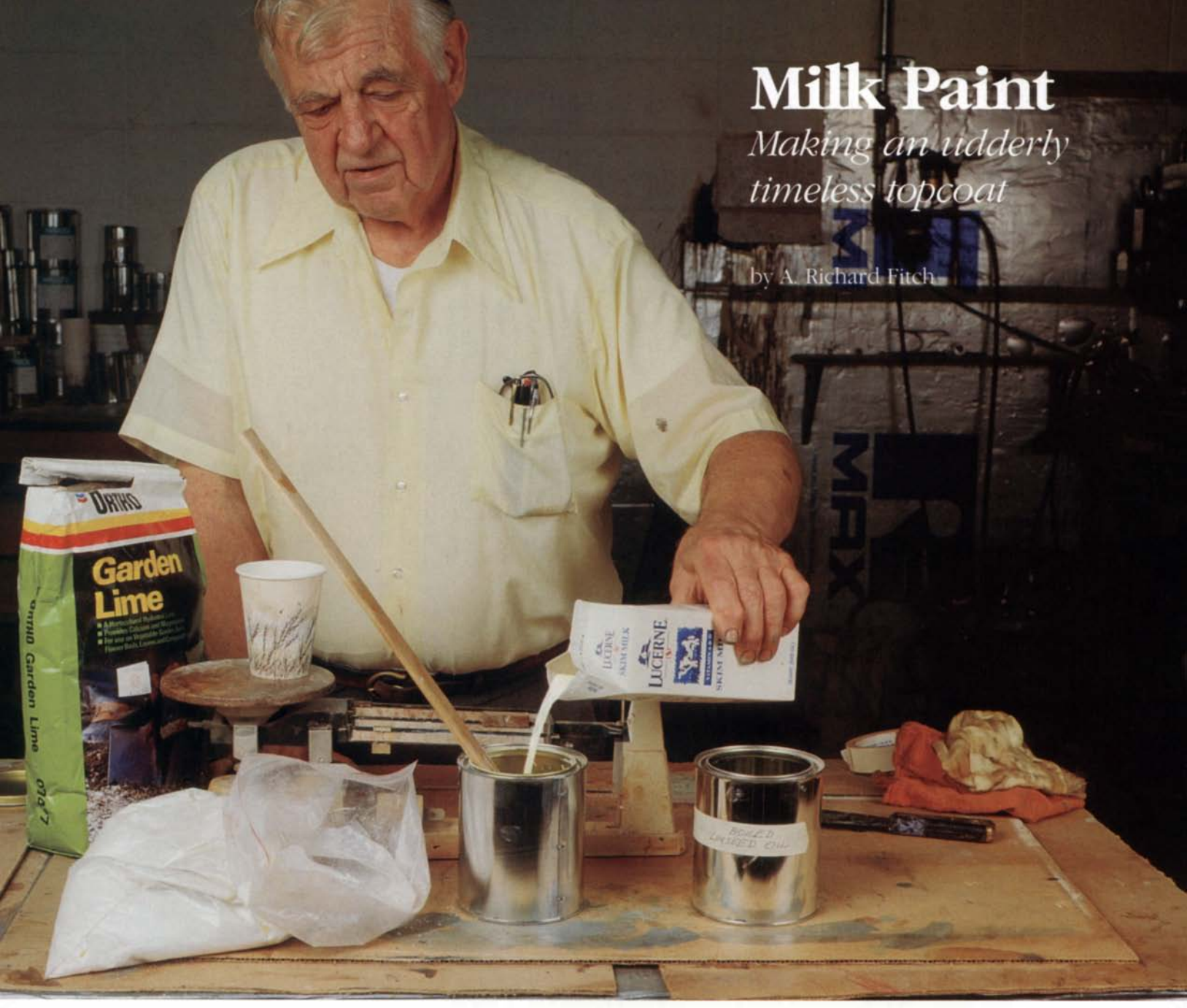
Assemble the bench frame by first bolting together the legs and end stretchers, and then joining them with the side stretchers. The joints will seem loose and sloppy when first assembled; simply position and tighten them using two washers under each nut. You might need to retighten the joints after they've settled for a few days.

Fitting the benchtop

For my benchtop, I glued up some 1½-in.-thick maple I had lying around. An easier (although more expensive) alternative is to buy a length of ready-made butcher-block countertop, available from many building-supply stores, home centers and lumber dealers.

Bolt the top to the frame through a batten glued to the inside faces of the end stretchers (see the drawing). Bore three ⅝-in. holes in each batten, and then fasten the top with ⅜-in. lag bolts and washers. While the battens keep the top flat, the oversized holes allow the solid-wood top to move with changes in humidity. If you want to add a shelf under your workbench, screw battens to the underside of some ¾-in.-thick shelf boards; then drop the shelf in place, as shown. □

Richard Starr is a teacher and author. Building this workbench is the topic of the first show in his television series, Woodworking for Everyone, *on PBS this fall.*



Milk Paint

Making an udderly timeless topcoat

by A. Richard Fitch

Cows' milk has been used to produce paints since the dawn of history. Milk curd (casein) materials were used by artisans of ancient Egypt, China, Greece and Italy. Ancient Hebrews are known to have used milk curd for house painting and decoration. In the 12th-century treatise *The Various Arts,* the preparation and use of milk paint is described in some detail. Casein, or milk-base, paints have been used continually since then—by renaissance craftsmen to produce their superb masterpieces, in post renaissance Europe, in Colonial America, and during the 19th and 20th centuries in the United States and Europe. In fact, the first U.S. paint patent issued in 1865 (U.S. patent 50058) covers a casein product. Casein paints reinforced with tung oil were used for decorative purposes at the 1933 Chicago Century of Progress Exhibition. Surprisingly, U.S. government specifications still included both an exterior and an interior casein paint as late as 1945. And if you add to this long history the fact that milk paint meets the currently fashionable criteria of "all natural" and "environmentally safe," you can easily see why its use for decorative painting has captured the fancy of many contemporary painters and decorators.

The charm of a milk-paint finish is largely dependent on its rather coarse, unsophisticated surface. This characteristic surface produces a pleasing decorative effect on walls in old homes, and it is quite appropriate for unpretentious so-called "use furniture." American colonial, Shaker and Country style furniture are prime prospects for milk painting (see the photo on the facing page). Milk paints may also be used on a variety of plaster, masonry and wood surfaces. Over time, milk paint develops tenacious adhesion to porous surfaces and becomes water-resistant and insoluble in most solvents. In addition, because of its low cost, milk paint is often used as a primer under oil paint.

Milk and casein paints are categorized as types of distemper. Distemper is a British term for paints made from either animal glue or milk protein. In the United States, these products are often called calcimine. Casein, a small but commercially important part of cows' milk, is produced by allowing or causing skim milk to sour and precipitate curd. Commercially, this souring may be accomplished by the addition of mineral acid to skim milk. The curd is then separated from the whey (or liquid), washed to remove butterfat and dried. Granulated casein can then be rendered soluble in water by adding an alkali, such as lime, ammonium hydroxide or potassium hydroxide, to the mixture. This solution is then

Photos: Jim Boesel

***Milk paint is a good choice for Country style furniture**, such as the cherry, hinge-top bench above. The author is sanding through the green topcoat and revealing some of the red undercoat to give the piece an antique look.*

***Yes, milk paint really is made with milk.** Casein, or milk curd, is used commercially for making paints and adhesives. All you need to make your own milk paint (left) is skim milk, lime, chalk or whiting, boiled linseed oil and some pigment if desired.*

mixed with inert pigments, like chalk, whiting or certain types of clay, and color pigments to make milk paint.

For painting furniture and other purely decorative renderings, lime is generally the preferred alkali because of availability, easy handling and the reputation for superior resistance to water. Alkali-proof pigments must be used in the preparation of lime-and-casein paints. A comprehensive discussion of pigments and their various characteristics is beyond the scope of this article, but generally, red or black iron oxides and yellow iron hydroxide are excellent pigments for milk paint. Earth colors, such as umbers, siennas, Venetian red and yellow ocher are also good, as are titanium dioxide, chromium oxides and lampblack. Ultramarine blue and toludine red can also be used. As a rule of thumb, you can trust pigments used to color cement for patios or stucco.

Making your own milk paint

A few years ago, my son, David, was restoring the painted surfaces in an 18th-century house in Pennsylvania when the owners asked him to use milk paint in some of the rooms. In order to satisfy the request, he referred to an old book published in the late 18th century called *The Painters and Varnishers Guide* by P.F. Tingry, a

Recipes for homemade milk paint

Most of the ingredients in the following formulas are available from large suppliers of art materials or paint and decorator-supply stores. Slaked, or hydrated lime, is available as a soil supplement at garden-supply stores. Calcium carbonate, also called whiting, can be substituted for Spanish white in the first recipe. If you don't live near a large paint store, you can mail-order calcium carbonate, casein and alkali-proof earth pigments that are compatible with lime from Johnson Paint Co. Inc., 355 Newbury St., Boston, Mass. 02115; (617) 536-4838.

P.F. Tingry's formulas

The first two recipes are taken directly from P.F. Tingry's *The Painters and Varnishers Guide,* second edition published in 1816 by Sherwood, Neely and Jones, Patternoyster Row, London, England.

Painting in milk (makes about ½ gal.):

skimmed milk—4 lbs.; oil of poppy (or linseed) or nut oil—4 ozs.
lime, newly slaked—6 ozs.; Spanish white—3 lbs.

Put the lime into a clean bucket and having poured over it a sufficient quantity of milk, add gradually the oil, stirring the mixture with a wooden spatula; then pour in the remainder and dilute the Spanish white (whiting) as follows: The Spanish white is carefully strewed over the surface of the liquid. It gradually becomes impregnated with it and falls to the bottom. When the white has fallen to the bottom, it is stirred with a stick.

The paint may be colored with various coloring substances employed in common painting. The above quantity will be sufficient to give a first stratum to a surface of 24 sq. yds.

Resinous painting in milk:

For painting outdoor objects, add to the preceeding composition for painting in milk, 2 ozs. of each of the following:

slaked lime; linseed oil; white burgundy pitch (or rosin)

Put the pitch into the oil, which is to be added to the liquid milk and lime, and dissolve it in a gentle heat. (As an alternative, use 4 ozs. of linseed oil and eliminate the pitch or rosin.)

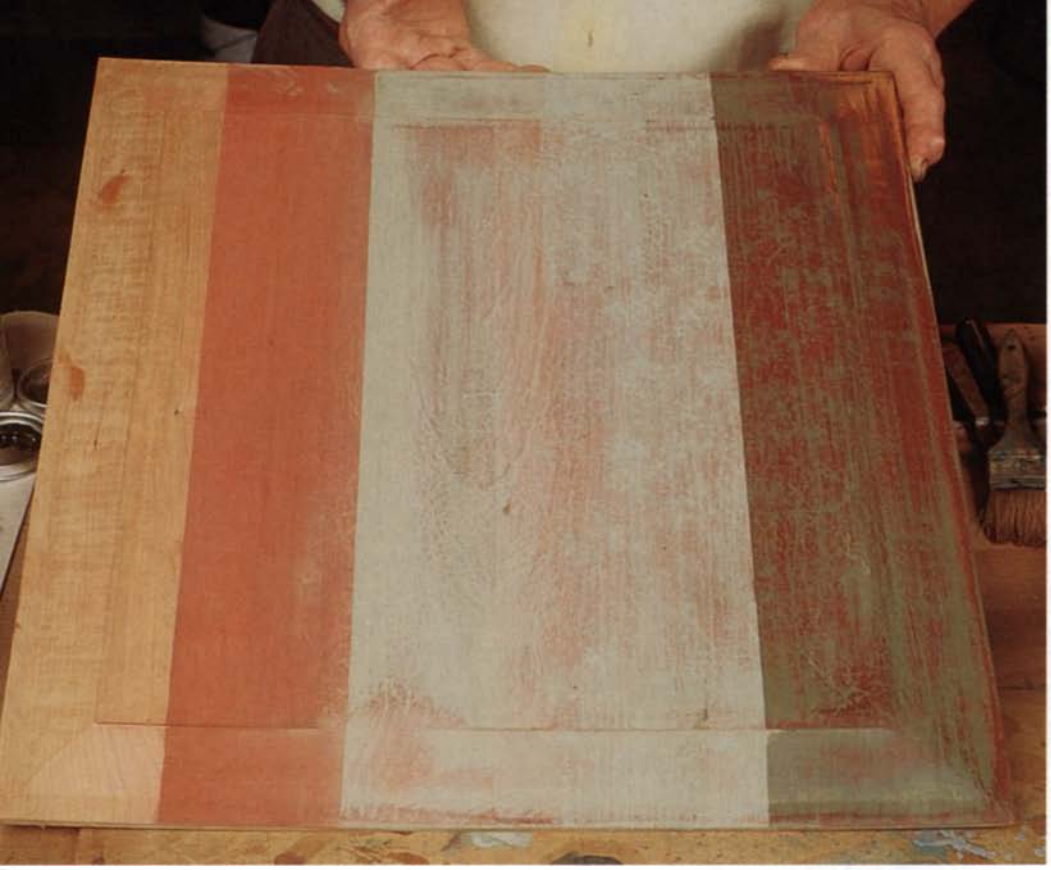
Formula to meet U.S. government specifications for exterior casein paint (makes a little more than 1 qt.):

whiting and color pigment—2 lbs. (combined)
lime—4 ozs.; casein—4 ozs.
water—2½ lbs.; boiled linseed oil—3¼ ozs.

a. Mix thoroughly and sieve dry ingredients.
b. To use, mix 1 qt. cool water thoroughly with dry powder (use mechanical mixing if available). Don't make foam and bubbles.
c. Add oil slowly while stirring constantly.
d. Allow the mix to stand 20 to 30 minutes before use.
e. Adjust consistency with remaining water.

Notes

When making the paint, color pigment can be used to replace 10% to 30% of the whiting, depending on the oil absorption and the strength of the particular pigment. To tint basic white milk paint, mix dry pigments with water to make a light, smooth paste and add it to the paint while stirring vigorously. Distemper paints change color drastically when dry, so always check color after the sample is dry. To extend the usable life of these paints, the older formulas recommend the addition of ⅛ oz. of either oil of cloves or pine oil for each pint of milk. *—D.F.*



***Milk paint will lighten as it dries**, as illustrated by a fresh brush stroke alongside a dry sample of the same color (above).*

***To show the effects of antiquing with milk paint** (left), the author made this step-by-step sample panel. From left to right: bare cherry; one coat of red milk paint (Tingry's interior formula); a coat of green over the red, which is then sanded through a bit; and a strip on which the raised panel edges were rounded over with sandpaper before the first coat of paint, the green topcoat was sanded clear through to the cherry in one corner, and then a coat of varnish was applied to darken the paint.*

professor of chemistry, natural history and mineralogy at the Academy of Geneva. In his book, Tingry enumerated two formulas for milk paint, one for interior use and the other for exterior use (given in the sidebar on the previous page). David purchased skim milk from a local dairy, lime from a garden store, and pigments and whiting from a paint and decorating supplier, and mixed up a large batch of milk paint. The job was a complete success, and the owners were thrilled to learn that the milk in their paint came from the dairy farm right down the road. David's only complaint was that the paint had to be stirred fairly often to prevent the pigment from settling.

I also followed Tingry's recipes to prepare the milk paint for the test pieces and furniture shown in the photos in this article. The basic formula given in the first recipe in the sidebar is for interior painting. Tingry's second recipe is for exterior use and calls for the addition of a little more lime and oil as well as some pitch or rosin. The third formula in the sidebar, which meets U.S. government specifications, is very similar to Tingry's exterior formula except that it is based on mixing commercially prepared casein with water, instead of using skim milk for the liquid. Because of the addition of the extra oil in the exterior formulas, the milk paint will dry with a darker, glossier look than the flat, chalky look of the interior formula. When mixing in the pigment, bear in mind that the color of milk paint lightens a great deal after it is dry, as shown in the above photo at right. If it is stored for a long time, milk paint made from skim milk may develop an ammonia-like odor, which indicates the degradation of the casein. It is best to use milk paint within two days.

If you want to use milk paint for a project but don't want to make your own, dry milk-paint compound that is ready to mix with water is available from The Old Fashioned Milk Paint Co., PO Box 222, Groton, Mass. 01450. This product can also be purchased from Constantine, 2050 Eastchester Road, Bronx, N.Y. 10461 and other finishing sources listed in mail-order catalogs. A 6-oz. can of milk paint from The Old Fashioned Milk Paint Co. is $7.95. It will make about 1 pint of paint when mixed with water, and 12 colors are available. The company also offers a natural gelatin that can be applied between coats of paint to produce a crackle finish. Just like homemade milk paint, this powered milk paint is a child-safe, lead-free finish. However, it may differ slightly from the paint made from Tingry's formula thanks to casein containing less butterfat and to pigment blends of controlled particle size.

Surface preparation and distressing

Milk paint works best on clean, porous surfaces such as unfinished wood, plaster or masonry. It can also be applied over flat latex paint. But if you are going to apply milk paint over other paints or most primers, the surface must have good porosity, which can be achieved by sanding thoroughly with 100-grit or 120-grit paper. When in doubt, apply milk paint over a small area. If it beads up, more sanding is required.

As with all finishing, preparation is of prime importance. If you want a smooth finish, you must paint on a smooth surface. Sand thoroughly, especially endgrain areas; 120-grit paper is a reasonable choice for most purposes, although you may use finer grits on more refined furniture designs. In addition to being smooth, the surface must be clean and free from contamination.

Most Country furniture and other simply designed pieces are enhanced by physical distressing. Believable distressing requires some imagination and some logic. Start by rounding sharp edges and drastically altering sharp corners (as shown on the far right in the above photo at left). You must consider each piece of furniture individually. What areas of the piece receive the most abuse? Logical areas are at or near knobs, locks, handles, feet and lower legs, exposed edges, corners and tops of drawer fronts. If you wish, you can take the distressing a step further by making minor changes in the configuration of turnings or by inflicting dents, scratches, burns and other signs of attrition. Any effect that could normally be caused by accident or hard use is fair game. The degree of physical distressing is somewhat controlled by the style and type of furniture involved. For instance, pine or other softwood pieces are prone to more radical distressing than those made of oak, maple or cherry. Most antique hardwood furniture is in surprisingly good condition. Furniture normally used in the kitchen or pantry will

usually show more severe natural distressing than furniture used in halls, bedrooms or parlors. In all instances, discretion is called for—you must distress, not destroy.

Applying milk paint

Once the project is well prepared and distressed if desired, the rest is relatively easy. First, mix up the milk paint to a proper consistency. According to Tingry, the paint should " ...run or drop from the brush in a thread when taken from the pot. If the color does not form a thread, it is too thick." Then you just apply this paint as you would other types of paint. Use a synthetic fiber or foam brush—a bristle brush is not recommended. Two or three coats are usually required to ensure good color and film strength. Allow the paint to dry overnight if possible, but in a pinch, two to four hours of drying time between coats will usually suffice.

At this point, if you like the color of the paint, leave it alone. If you want the color to be deeper and stronger, you can wipe on Danish oil, tung oil sealer, or a 50-50 mix of boiled linseed oil and mineral spirits. As shown in the photo below left, a large variety of interesting colors can be achieved by wiping on gel stains after the milk paint has dried. You may also finish your project with conventional wipe-on or brush-on oil-base varnish, polyurethane or water-base finish, to add greater depth of color and better durability, especially on pieces for use outdoors.

Decorative techniques

Although milk paint has a matte, somewhat primitive look that is itself completely adequate as a finish, it may also be used to produce many of the decorative effects common on 18th- and 19th-century furniture that are now enjoying a resurgence of popularity. Some of these effects are sponging, spattering, stippling and dry-brush graining. All of these effects are best accomplished with a relatively dry and stiff brush or sponge, which should be blotted on newspaper each time after it is dipped into the paint, to avoid applying too much color (see the top photo below right). Because of the coarse nature of the paint, sponging several coats with different colors will result in a stone-like texture (see the bottom photo below right). If some areas aren't to be painted, such as the molded area around the field of a raised panel, they should be shellacked before the adjacent areas are painted and then cleaned off carefully with shellac solvent after the paint has dried.

I would like to make a prediction. I think the renewed interest in milk paint may well carry its use for decorative purposes right up to the 21st century and beyond. Certainly a useful product that offers us a link with our past and pampers our environment is a strong candidate for survival. □

Dick Fitch is a painting and finishing consultant for The Bartley Collection in Easton, Md.

A stiff sponge can be used to apply different colors *over one another to achieve a stippled or mottled finish (shown top right). When applied this way, the coarse texture of the milk paint has a stone-like quality, as you can see on the painted particleboard tabletop shown bottom right.*

Stains can be applied over milk paint *to increase the range of colors. Below: This whole panel was painted red and then mahogany stain was applied on the left and fruitwood stain on the right. The panel was then varnished.*

A scraper blade can be sharpened in seconds *by holding it at an angle and stroking its edge across a flat metalworking mill file clamped on a bench. Martin tapes a wood strip to the scraper's back for a better grip and tapes the upper edge to protect his hand.*

A sharp scraper produces thin shavings *like those shown above. When all you get is dust, you know it is time to resharpen. The cutting burr produced with Martin's quick sharpening method is ideal for scraping off dried glue and removing sander scratches.*

Sharpening a Scraper

A flat file and a few seconds are all you need

by E.S. Martin

A scraper blade is a multipurpose tool, and in general, it fills the gap between sanding and planing. A scraper has the advantage over a plane because a scraper doesn't gouge or tear out material as easily (see the above photo at right). At the same time, it can remove a tiny blemish in a lacquered surface in a fraction of the time it takes a sander alone. Using a scraper in conjunction with sanding dramatically eases what would otherwise be an onerous chore. Without leaving marks, a scraper can quickly smooth bumps, planer snipes and ripples, and belt-sander scratches. A scraper also excels at leveling wood filler, and as a glueline remover, a scraper is unsurpassed. In addition, it's a nearly foolproof tool for taking out high spots before assembling components. For instance, while cutting dovetail joints, many times either the pins or tails will turn up slightly proud. Or when fitting stock into a dado, it's often necessary to remove a small amount of wood to get just the right fit. When properly handled in such situations, a scraper offers greater control than a plane for removing small amounts of wood, and the procedure is much faster than sanding. However, to perform any of these functions well, a scraper blade must be sharp. Since some of these operations (like scraping glue beads) dull an edge rather quickly, scraper sharpening can become tedious.

Producing a traditional burr (explained in the sidebar on the facing page) requires a file, both medium and fine stones, and a burnisher. After the approximately 1/32-in.-thick edge has been filed, it must be honed on a polishing stone without grooving the stone or wearing it unevenly. Then the burr that becomes the scraper's cutting edge is formed with a burnisher. Because this process requires practice and patience, many woodworkers become frustrated when their scrapers get dull and set them aside.

My attempts to sharpen scraper blades by the traditional method have resulted in edges that would sometimes cut, but took a lot of fussing. Then I unexpectedly found that the scraper would still cut if no burr was drawn. So I filed an edge to 90° and used it as the cutting burr. I conducted a few more experiments with the edge filed at an angle similar to a plane's iron and found that the scraper cut nearly as well as when I had produced a good burr in the customary way. But more importantly, the blade was so fast and easy to sharpen and its final edge was so consistent and effective that the scraper became one of my most used tools.

Over the years, I've refined my process. The simple method I now use to sharpen scraper blades requires only five seconds and consists of several strokes across a flat metalworking file clamped on my benchtop. I hold the scraper at about a 20° angle from vertical so that a wedge-shaped edge will result (see the above, left photo). An entire edge can be renewed in just a few seconds with three or four strokes (presuming that the wedge-shaped edge has already been formed; if not, you can readily accomplish this beforehand with the file). The 20° angle isn't critical, but if the edge is sharpened at a different angle, the inclination at which the scraper is held in use will have to be adjusted somewhat.

Before I begin sharpening my blades, I mark the edge to be sharpened and apply tape to the opposite side. This allows me to quickly identify the cutting edge, and it prevents me from cutting my hand while I'm stroking the blade across the file. A 1-in.-wide

Photos this page: E.S. Martin

Traditional scraper sharpening revisited

by Pat Buford

Every family has one—the person who absolutely refuses to do what he's supposed to do and whatever everyone else wants to do. It's as if he enjoys the attention he gets from being disagreeable. My scraper blade used to be like that. It was the simplest-looking hand tool in my cabinet, yet its behavior was strangely complex.

My first scraper was a Sandvik #475, and it came in its own case. I just pulled it out and used it. It worked well too, for a little while. Then came the moment of truth—honing a new burr. I decided to turn to an expert for advice, so I took a look at *Tage Frid Teaches Woodworking, Book 2* (The Taunton Press, 63 S. Main St., PO Box 5506, Newtown, CT 06470-5506; 1981).

Following Frid's instructions, I put my blade in a vise and filed the edge flat (see the left photo). Then came the stones (see the center photo) and another hour of refining the scraper's edge. At this point, I did as Frid said and tried to raise and turn the burr with the back of a chisel (see the right photo). I couldn't feel a burr. So I went back to the hardware store to get a burnisher. By George, I got a burr this time (more like a claw); I even cut a thumb on it. I tried the burr on a piece of scrapwood. The gash this thing left reminded me of Sherman's march to the sea. I didn't put that rebellious blade in its case; instead, it was a saucer for my coffee cup for months.

Then, one day a co-worker was struggling with the doors on a china cabinet. This guy is a machine man. He has a special electric tool for every job and a thousand attachments for each tool. Anyway, the cabinet's doors had now swelled with the humidity and wouldn't close. As he was searching for a power tool to shave the door, I thought about going over to help with a chisel. But, for some unknown reason, I picked up the scraper that seemed to mock me. I knew that in the right hands it would be a perfect tool for that job.

Of course, the edge of the scraper was as round as an apple; so I clamped it in the vise and produced a flat edge with a few passes of a file. I went right to drawing a burr. Frid had said "Start the burr with four strokes of 4 oz. each on each of the four cutting edges." I had used 140 lbs. on my first attempt! So this time, I estimated 4 oz. and held the burnisher at about 85°. The moment of truth had come. I marched over to the cabinet, and in an almost arrogant tone I said, "Let me help you with that."

I had no assurance that the fool blade would do anything. Nevertheless, I calmly tucked the blade behind the door's lip and pulled it the length. There's no way to describe my feelings as I watched the blade slide along the door's edge as a thin shaving curled itself alongside. A breeze caught the shaving and placed it right at the feet of my machine-loving friend while I paused to examine the door. Its edge was clean and smooth. I was speechless, but my bored expression never changed. "Let me try that," he said, and I calmly handed him the scraper. After a few strokes, he commented on how hot it got. "Sure," I replied, "but you get used to it." □

Pat Buford is a woodworker in Summerville, S.C., who operates a furniture restoration business.

***Filing**—To sharpen scraper blades, Tage Frid first clamps the blade in the vise and files the edge with a fine, flat mill file, wrapping his fingers around the file for control. He files only on the push stroke, and it takes only a few passes before he removes any old burr and produces a flat, square edge.*

***Honing**—To remove file marks on the blade's edge, Frid uses a medium-grit wet/dry carborundum stone without oil. Then he hones with a fine-grit Belgian clay waterstone held askew (shown). He strokes the edge and then each face of the blade 10 times; he repeats the sequence with 9 strokes, 8 strokes and so on.*

***Burnishing**—Frid uses the back edge of a chisel to raise and turn the burr. To prevent the chatter of steel on steel, he puts a few drops of machine oil on the blade and chisel. Then, with the chisel at 85° to the scraper's face, he pulls it the full length, keeping light, consistent pressure to produce a slight, even burr.*

strip of wood can also be taped to the back side of the scraper, as shown in the left photo on the facing page. The scraper is then easier to hold, especially if it becomes warm during vigorous use. For the filing, I like to use a fine-toothed, single-cut mill file, but the more commonly available bastard-cut file works about as well. I've found that holding the scraper at the proper angle with one hand and pushing it across the file with the other works best for me.

Of course, for the scraper to continue to perform successfully, it should be resharpened as soon as it no longer makes a fine shaving. Once you file a few scraper blades, though, you'll realize that their edges are more durable than the burrs produced via the traditional sharpening method. The fragility of the cutting burr formed during traditional sharpening can actually be a disadvantage at times. Since those edges quickly dull when scraping hardened glue, the resulting ragged burr may leave striations when the scraper is later used to smooth out a fine surface. On the other hand, because my filed edges are strong, they work great as dried-glue scrapers—yet they retain their ability to remove scratches. □

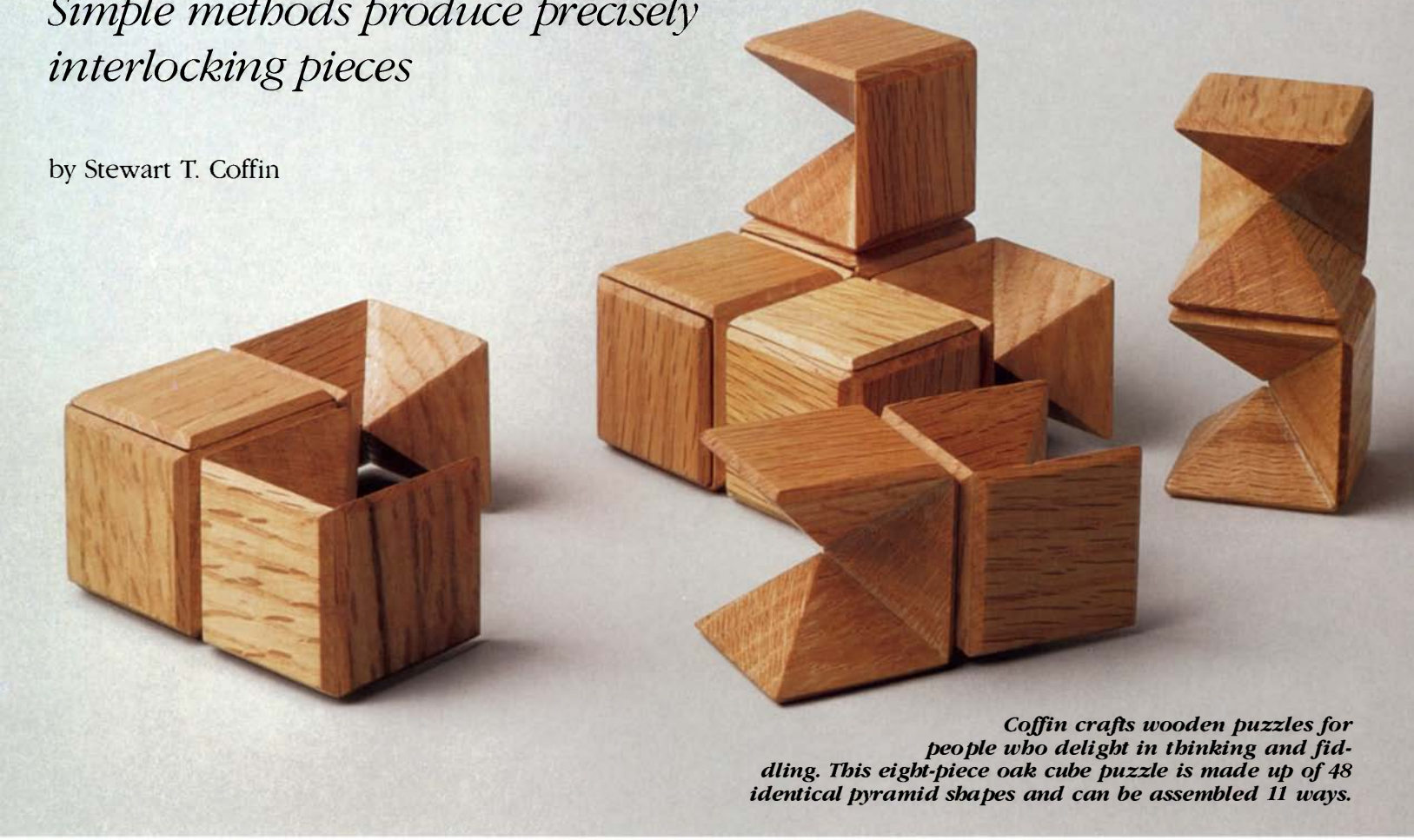
E.S. Martin, a retired engineer living near Mobile, Ala., has been a woodworker for the last 12 years. For more on sharpening scraper blades, see FWW *#58,* FWW *#74 and* FWW *#77.*

Photos this page: Roger Birn

Making a Wooden Cube Puzzle

Simple methods produce precisely interlocking pieces

by Stewart T. Coffin



Coffin crafts wooden puzzles for people who delight in thinking and fiddling. This eight-piece oak cube puzzle is made up of 48 identical pyramid shapes and can be assembled 11 ways.

An accurately crafted wooden puzzle is truly a delight, as a puzzle, a game or just an assembly plaything. And there are plenty of puzzle enthusiasts who are ready for an interlocking puzzle's challenge. I've made and solved many geometrical wooden puzzles over the years, and I've probably learned the most about what makes a good puzzle by watching inquisitive children play with them. The best puzzle designs enlist a solver's creative and analytical mind, and a similar balance of aesthetical and mathematical thinking is needed when making them. Whether you're an accomplished solver or just a curious twiddler, I'll show how to make and solve a cube puzzle, one of my favorites.

Cube-puzzle design

The puzzle I call "Pieces of Eight," shown above, is a combinatorial puzzle that can be assembled into a cube. The cube appears to be made up of eight smaller blocks, but it is actually composed of eight dissimilar pieces, each of which is made from two C-shaped half-blocks (see figure 2 on p. 71). The entire cube requires 16 half-blocks, and each half-block is glued up from three identical and elegantly simple pyramid shapes. Therefore, six pyramid shapes form each whole piece, and 48 pyramids are needed to make the full set of eight pieces to complete the cube.

The cube has 11 solutions, and two of the cube's pieces must always be positioned the same: piece E (see figure 2) acts like a link piece, and piece A, which serves as a keystone to lock the puzzle together, must be inserted last.

Since the pyramid shape is the basic element for making the puzzle's precise-fitting pieces, all pyramids must be the same size and have exact 45° angled sides. I've developed a simple procedure for making and joining these parts. First, I rip stock into right-triangle-shaped sticks with two 45° angles. Next, I crosscut the sticks into pyramids using a diagonal-fence jig. Then, I glue up pyramids into half-blocks before chamfering the block's edges. Finally, pairs of half-blocks are glued to make up the eight pieces before I hand-sand and finish all surfaces. I'll detail each of these steps, but first I'll describe how I make the simple box that encases the cube puzzle, since the same simple C-shaped novelty embodied in the cover's halves is the basis for the puzzle's half-blocks.

The plywood box that serves as the cube's cover (see figure 2) is a simple puzzle itself. The box slides apart into identical halves, but only when it is grasped with the thumb and forefinger of both hands in exactly the right places, which aren't obvious if the cover is crafted carefully. I use ½-in.-thick cabinet-grade birch or poplar plywood to make the cover's six sides, each of which is 3⅞ in. sq. and has 45° beveled edges. Three of the squares are glued up to form each C-shaped cover half.

Materials and puzzle-making considerations

Various woods can be used in puzzle-making projects. Hardwoods are good, although you could use just about any scrapwood to make a prototype. I prefer to display the wood's natural coloring and grain, so I don't use any stains or paints. The puzzle in the photo above was cut from ¾-in.-thick white oak. To better emphasize the grain patterns, I finished the surfaces with lacquer. Plywood is also good since it is stable and consistent in thickness; after you've made a few puzzles, you might want to try some exotic

Photos these two pages: Susan Kahn

woods, which are often fairly stable as well. In any case, choose well-seasoned wood (kiln dried is best) that is free of knots. I try to select boards that aren't warped and have close growth rings. I either buy my stock surfaced, or I'll plane it down to exact size. As long as the wood's thickness is consistent, the stock width can be adjusted to achieve the right-triangle cross-section at just about any thickness of wood. In fact, I've made the puzzle from plywood using truncated pyramid components instead of full ones.

The natural movement of most hardwoods needs to be considered when making these puzzles. Because of the precision to which everything is cut, changes in humidity can cause the parts to shrink and make the puzzle fit together too loosely, or the parts may swell and make disassembly difficult. Therefore, I try to work when it's dry, and I experiment with cuts to get just the right fit. No force should be needed.

Because I use a crosscutting jig, a gluing fixture and a chamfering fixture, no measurements are marked on the wood, which saves time and produces more accurate work. I keep tolerances for hardwood puzzles to within $\frac{5}{1000}$ in., and I check all dimensions with Vernier calipers and a micrometer. I also see that my tablesaw is cutting true by aligning the sawblade parallel with the miter-gauge grooves and then aligning the rip fence parallel with the blade. Of course, cutting pieces this small on the tablesaw can be very dangerous. To avoid kickback and to keep my fingers away from the blade, I always use push sticks when ripping stock. In addition, the crosscutting jig makes chopping the 45° angles safer.

Ripping beveled sticks

Uniformly straight sticks with a 45° right-triangle cross section are essential. Starting with lumber in 3-ft. or 4-ft. lengths and with the sawblade tilted to 45°, I rip one of the stick's bevels. I then reposition the stick and fence so that the next pass produces the stick's opposite 45° bevel at the 1¼-in. width I need. I check the dimensions and angles and make adjustments before ripping the remaining strips. Again, since absolute dimensions aren't critical, but uniformity is, I rip all the strips at the same fence setting.

It's ideal to have two tablesaws: one for ripping the strip's width and bevel, and the other for crosscutting the pyramid piece's length and miter. With only one tablesaw, you could use a combination blade that's suitable for both operations, but I've found that a hollow-ground, no-set blade is best for the crosscutting. I use a $\frac{1}{16}$-in.-thick, 8-in.-dia., 150-tooth alternate-bevel plastic-cutting blade (available from Allkut Tool, 5001 Chase Ave., Downers Grove, Ill. 60515; 800-548-6389). Of course, a sharp blade is essential, so at the first sign of dullness, I have mine sharpened.

Crosscutting pyramids

The best way that I've found to chop strips into uniform pyramids is with a diagonal-fence crosscutting jig, which allows me to make cuts aligned with either side of the fence. A plywood base, with a runner that slides in my saw table's miter-gauge groove, supports a fence that is perpendicular to the saw's table and oriented 45° to the miter-gauge groove (see figure 1 on the next page). With my blade retilted to 90°, I hold the hypotenuse (wide) edge of the triangular sticks against the fence. A holding tray keeps the cut pieces together and away from the sawing action. If I'm going to cut close to the end of the stick, I'll secure the stick to the diagonal fence with a spring clamp and back up the stock with a piece of scrap.

Gauge blocks could be used when advancing the stick a prescribed increment, but I use carefully adjusted stop blocks at the end of the fence. To cut a pyramid, I make the initial 45° cut on the end of the stock with the hypotenuse of the stick against the back side of the fence. Then I place its hypotenuse against the front of

A sliding-tile puzzle

by Robert Stirling

How does one encourage an unemployed lad who hangs around the workshop anxious to get some hands-on woodworking experience? In my case, I invited him to fashion a set of children's building tiles to be used in a wooden puzzle game.

The object of this puzzle is to slide the large square tile from one of the top corners to the opposite bottom corner with the least number of moves and without picking up any pieces. It is also challenging to try to return all the pieces to their origins.

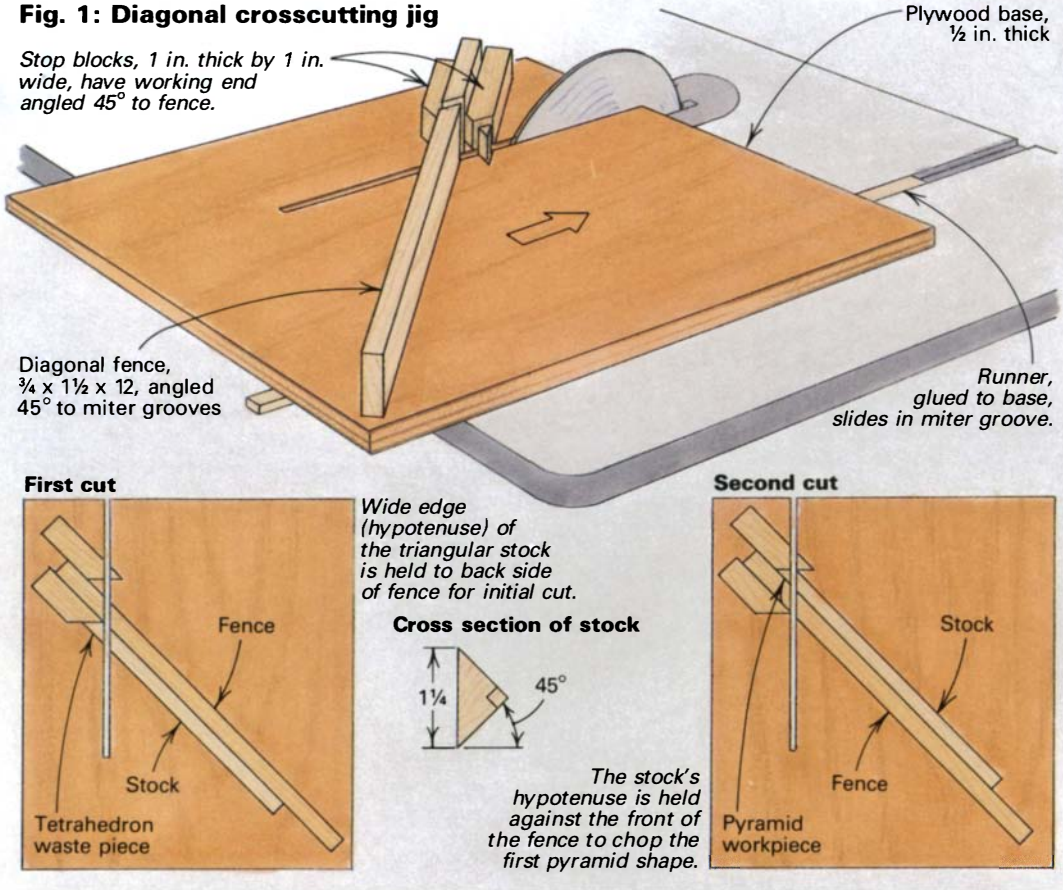
Making the tiles: For the puzzle shown below, teak, mahogany and rosewood were chosen for their contrasting colors and grain, but most hardwoods or stained plywood will do. When planed and sanded, the smallest tiles should be ¼ in. thick by 1$\frac{3}{16}$ in. sq. This basic tile unit width is used for the two small, rosewood squares and the other tile sizes are based around this. The six rectangular tiles (three teak, three mahogany) are equal to two small tiles and measure ¼ in. thick by 1$\frac{3}{16}$ in. wide by 2⅜ in. long. The one large rosewood square equals four small tiles and measures ¼ in. thick by 2⅜ in. sq. To make the pieces easier to maneuver, I recommend drilling ⅜-in.-dia. by ⅛-in.-deep holes at the center of each piece with a standard twist bit, chamfering the corners with a chisel and beveling each piece's edges with a skewed block plane.

Making the tray: The mitered tray that contains the tiles has a mahogany frame that measures 5 in. wide by 6$\frac{3}{16}$ in. long on the inside of the tray (you'll need about 30 in. of frame stock altogether). I used a ¼-in.-thick piece of cabinet-grade mahogany plywood as the tray's back board, and I cut ¼-in.-wide by ⅛-in.-deep dadoes along the inside edges of the four frame members, to hold the back board once the frame is glued together. Suede-flock wall covering, which resembles velvet, can be glued to the bottom of the tray. The puzzle's solution (tile positions) can be outlined with a dark marker on the other side of the back board. □

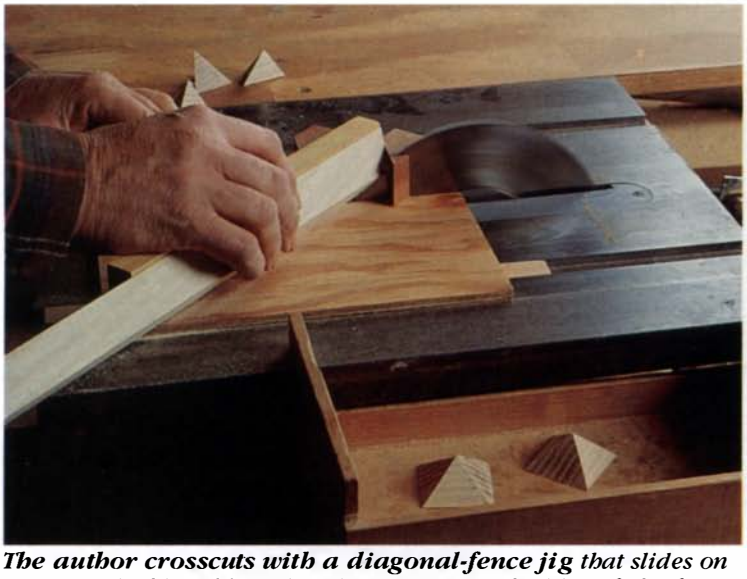
Robert Stirling is a cabinetmaker in Glasgow, Scotland, and builds and sells puzzles and model ships at craft shows.

***Exotic scrapwood was used to make this tile puzzle.** The smallest tile is the basis for other tile sizes. The object is to slide the largest tile from the top left corner to the bottom right corner.*

Fig. 1: Diagonal crosscutting jig



Coffin devised a simple chamfering fixture *that he clamps on his stationary belt sander to consistently bevel block edges. The V-shaped cradle holds the blocks (half-blocks fitted temporarily into minicubes) at 45°.*



The author crosscuts with a diagonal-fence jig *that slides on a runner in his tablesaw's miter groove. Both sides of the fence and two stop blocks are used when cutting stock into pyramids.*

Rubber bands clamp *the glued-up half-blocks, and the first half-block (with waxed inner surfaces) becomes a gluing fixture. Waxed paper over the corners prevents accidentally gluing joints.*

the fence and butt the stock to the angled stop block (see the left photo above). In a repeated back-and-forth sequence, all subsequent sawing with stock at the back of the fence will generate tetrahedron-shaped (four-sided) waste pieces; stock at the front of the fence will produce pyramid-shaped workpieces.

After I've cut out a few pyramids, I check their accuracy and discard any that aren't exact. Any error in sawing is cumulative and becomes evident when gluing the pyramids together, so I make adjustments to my stops before cutting the rest of the pyramids.

Gluing up half-blocks

To form all the puzzle's half-blocks, I glue the adjoining faces of the pyramid pieces, holding the three components together with rubber bands. To ensure strong joints, I check that the surfaces to be bonded mate properly. Then I spread a thin, even coat of yellow (aliphatic resin) glue on both surfaces and allow it to soak in for a minute before bringing the pyramids together. (Endgrain surfaces will need a heavier coat of glue.) Other glues form acceptable bonds, but yellow glues, like Franklin's Titebond or Elmer's Professional glues (available at most woodworking-supply stores), are strong, fairly fast-setting and have the elasticity needed for the side-to-endgrain joints common in mechanical puzzles like this.

The first C-shaped half-block, made carefully and well waxed, becomes a gluing fixture for making all the other half-blocks, as shown in the bottom, right photo above. Using a paper shim or two, I make the fit of the two half-blocks a little loose, to allow for

Photos this page: Dick Burrows; drawings: Aaron Azevedo

any slight errors and to ensure that the puzzle can be assembled in different ways. I work on a flat surface and use a square to help keep things aligned. I use bits of waxed paper over the corners and between joints that I don't want to be glued together accidentally. A good glue-resist is beeswax dissolved in warm turpentine in a ratio that, when cool, has the consistency of whipped cream. I brush on the mixture with an artist's paint brush, being careful not to get any on the surfaces that will be glued later. Before joining the eight pairs of half-blocks, I chamfer the edges to make the puzzle more pleasing to handle and more interesting visually.

Chamfering block edges in a sanding cradle

On my early puzzles I defined the puzzle blocks by easing the corners with a flat rasp. But because the chamfers weren't always consistent, I devised a simple fixture (shown in the top, right photo on the facing page) that clamps on my stationary belt sander. The fixture has two 8-in.-long beveled oak strips that form a V-shaped cradle that spans across the belt (I use 150-grit) and holds the blocks at a 45° angle to the sanding surface. Two pieces of angle iron and some scrapwood shims attached to either side of the sander's housing create flanges to which I clamp two V-shaped holding blocks (fixed at the cradle's ends) to secure the fixture.

To chamfer the blocks, I put a whole block (two half-blocks fitted together temporarily to form a minicube) into the cradle and apply light pressure to chamfer the amount I want. I rotate the block and bevel each edge until all sides of the block's edges are chamfered equally. I repeat the sequence and compare the chamfers until all blocks are identical, and then I disassemble them. Next, I join pairs of C-shaped half-blocks to produce the eight puzzle pieces shown in figure 2. I use rubber bands and spring clamps to hold the glued-up parts together, and I ensure that faces and grain configurations are properly aligned, as I did when I glued the pyramids together to form the half-blocks.

Hand-sanding and finishing the cube

I hand-sand the faces of the cube pieces, breaking the sharp edges and corners with 150-grit paper. Sanding must be done carefully because excessive smoothing can negate the accuracy preserved to this stage. To prevent the pieces from locking up while assembling the puzzle, I finish them as soon as they are sanded. With a camel-hair artist's brush, I apply a thin coat of clear lacquer to seal the wood and enhance its grain and color. I've had the best results with lacquer finishes, and I avoid sticky finishes like shellac and varnish. If the puzzle pieces slide together too easily once the finish is dry, I improve their fit by brushing successive coats of lacquer (or clear nail polish) on the inner working surfaces that need it. Then, to make the pieces assemble smoothly, I rub out the thoroughly dried lacquer with 0000 steel wool, apply butcher's wax and buff the waxed pieces to a fine sheen.

Variations of the puzzle

I discovered that when the oak cube puzzle is properly fabricated, it displays symmetry in grain orientation; in one of the more difficult puzzle solutions, the cube puzzle's pieces can be made and assembled so that the exposed block faces on all of the cube's sides have opposing grain lines (see figure 2 below). If you want to reproduce this puzzle version, pay close attention to the grain directions when you glue the pyramids into half-blocks and again when gluing the half-blocks into whole pieces. Of course, the puzzle also assembles into other figures, such as a Z-shape, by using the full set of eight pieces or partial sets of four or six. For a further discussion of wooden puzzles and how to make them, see *FWW* #14 (pp. 75-77), *FWW* #49 (pp. 38-41) and my book, *Puzzle Craft* (revised in 1989), which is available by writing to 79 Old Sudbury Road, Lincoln, Mass. 01773. □

Stewart Coffin is a retired electrical engineer. The "Pieces of Eight" puzzle described in the text, copyrighted in 1986, is included in Coffin's latest book, The Puzzling World of Polyhedral Dissections *(Oxford University Press; 1990), which is available from the author at the above address.*

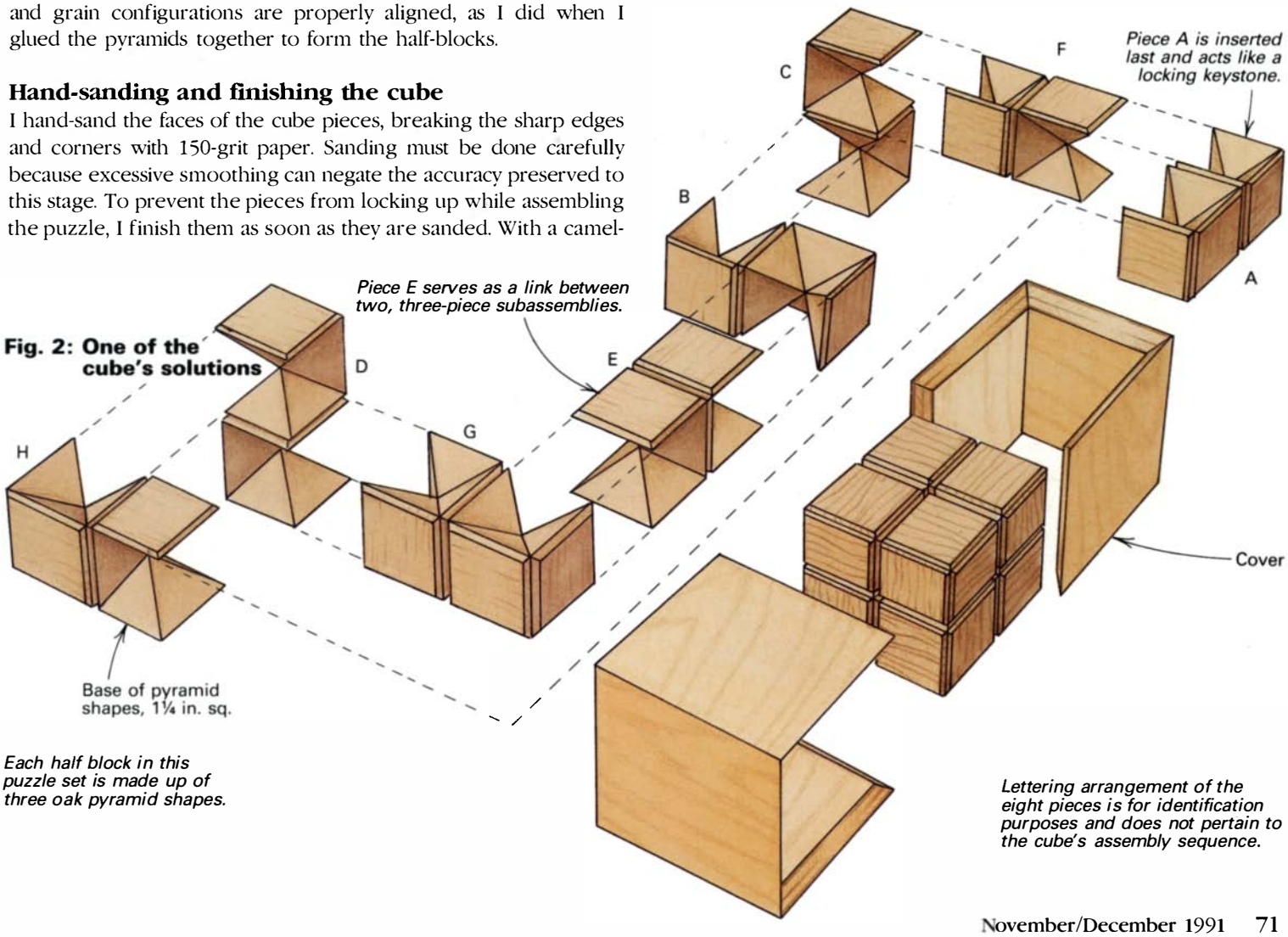


Fig. 2: One of the cube's solutions

Each half block in this puzzle set is made up of three oak pyramid shapes.

Lettering arrangement of the eight pieces is for identification purposes and does not pertain to the cube's assembly sequence.

Twin aprons, tapered legs, edge chamfers and sculpted joinery details *enhance these otherwise simple, clean-lined hall tables. Loose tenons in mortises milled in both the aprons and legs join the base together.*

Refining Table Design with Details

Twin aprons, sculpted joints and chamfers

by Ross Day

With a successful piece of furniture, the closer you get, the more interesting details there are to discover. This was a point stressed by my teacher, James Krenov. I kept that thought in mind when I was designing a table a couple of years ago. I wanted something different from the typical arrangement of a simple apron and tapered legs supporting the top, so I came up with a few variations to enhance the design. First, I split the wide apron into two thinner members, connected midspan with small supporting posts. To add visual intrigue, I joined these twin aprons to the legs at raised-and-chamfered mortise sockets, and chamfered most edges on the aprons, legs and top. Finally, I beveled the tapered legs almost diamond shaped in cross section and allowed their ends to come within 3/64 in. of an inset top that has ebony string inlay, which leads your eye around and through the corner chamfers and the reveals under the top. These design details can be seen in the tables shown at left.

While I was pleased with the look of these details and the way they kept a simple table from resembling a featureless production piece, I wanted a table that could be produced in multiples. Fortunately, I came up with a combination of hand and machine operations for the joinery and details that kept the process efficient enough for limited production pieces and that resulted in work that was up to the standards of the best one-off furniture. The method has been so successful that I've incorporated these details into a number of other tables and casework pieces, including the coffee table and stereo cabinet shown in the photo at right. I don't always employ all of these details; in some cases, I've used just the raised-and-chamfered joint with a single apron, as shown on the nightstand in the bottom, right photo on p. 75. On other pieces, I've doubled up the supporting posts between the twin aprons, for both strength and visual interest.

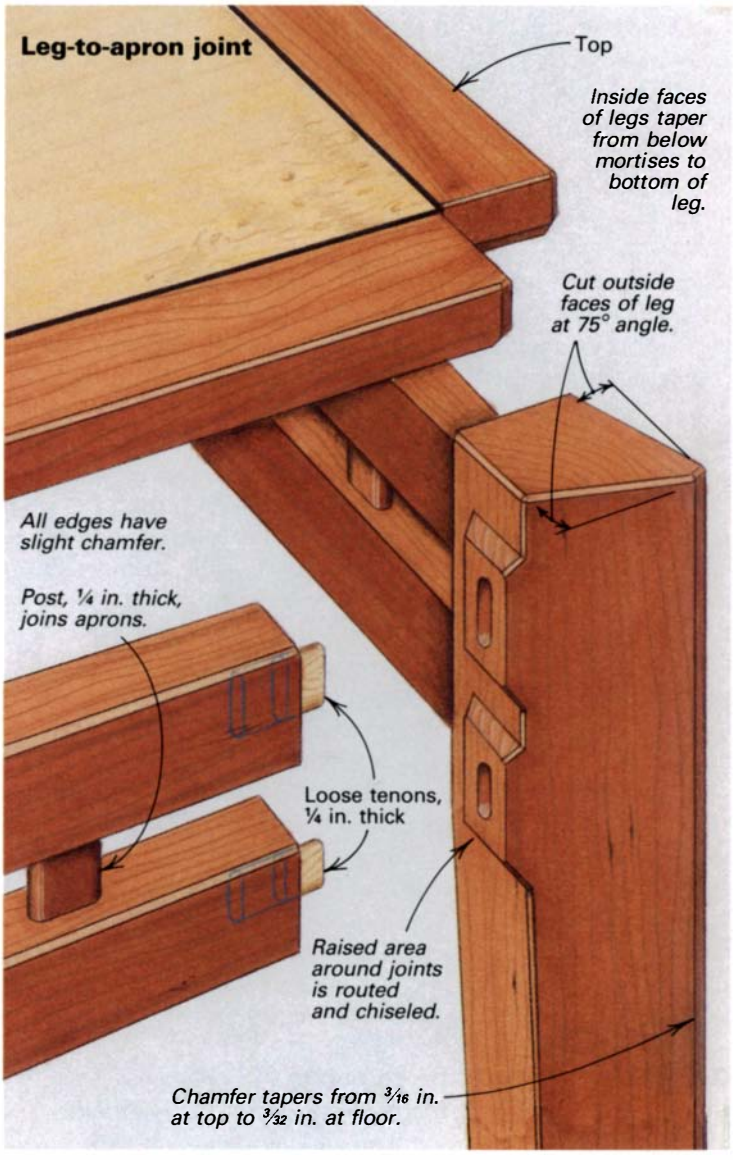
The legs and twin aprons are constructed and joined as shown in the drawing. Both the legs and the ends of the aprons are mortised and joined together with loose tenons. The raised-and-chamfered area is sculpted at the top of the legs after mortising. This detail is created by routing with a Dremel tool mounted in a router-type base and hand-chiseling using an angled block as a guide. I'll take you through the process of making one of my leg-and-apron assemblies for a simple table; you can alter the forms and dimensions to suit the type of furniture or cabinet you wish to build. The process includes cutting out and mortising the legs and aprons, chamfering, final assembly and fitting the top.

Beveling and mortising the legs

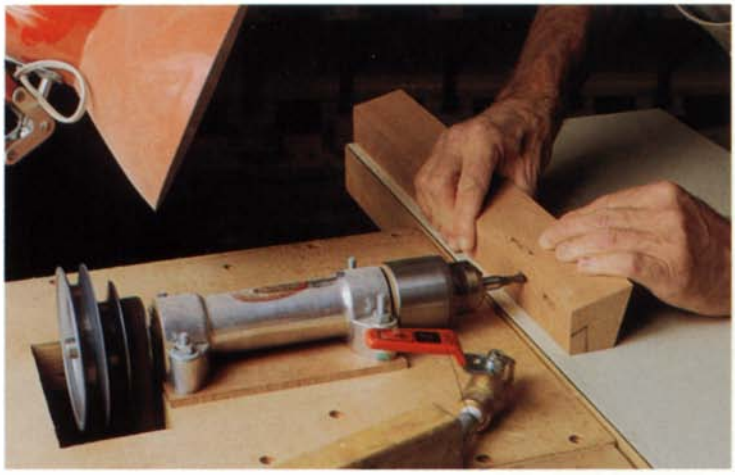
After selecting stock that's thick and wide enough for the leg profile I have in mind, I joint and mill the stock square and cut each leg to final length. Then I lay the four legs on my bench, decide how they'll be paired and which ends will be up or down, and mark each leg with a cabinetmaker's pyramid. This allows me to keep track of each leg's orientation during subsequent operations, and it prevents me from having three left-hand legs. Next, I bevel each leg's two outward-facing surfaces on the tablesaw with the blade at 75°. (For some furniture, I bevel the legs at 85° instead.) Note that these are straight cuts; the tapers are made on the two inner faces later. Finally, I check to make sure the two inside faces are square, and I make any necessary adjustments with a handplane.

I mark out the two pairs of mortises for the twin aprons at the top of each leg, locating them as shown in the drawing. I arrange them so that the upper apron will be below the end of the leg by the thickness of the top. This allows the top of the leg to show, and further enhances its diamond-shaped profile. Next, I plane the outside faces of each leg to eliminate the sawmarks, making sure to keep the surfaces straight and even.

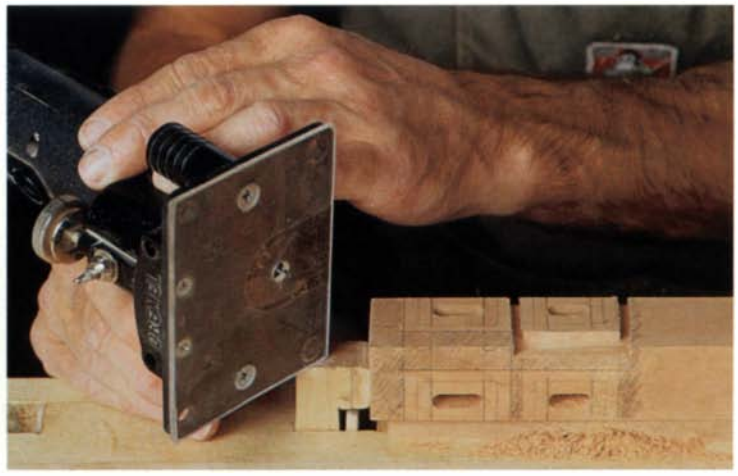
Day's frame joinery and detailing enhance his custom work, *including the white oak coffee table and stereo cabinet shown here. Both pieces feature twin aprons and pairs of connecting posts that span between them. He combined hand and machine operations so that the process wasn't so labor-intensive.*



Photos these two pages: Chris Eden; drawing: Aaron Azevedo



Day's shopmade horizontal mortiser *chops mortises in the ends of the aprons and the sides of the legs. He prefers to work freehand, gauging each mortise's depth by a line drawn on the table.*



The raised areas around the joints are routed *using a Dremel tool fitted with a special router base. A small-diameter end mill removes the waste around each joint prior to chamfering.*

I cut all the mortises using a horizontal mortising table, shown in the photo above left. This shopmade machine uses a mandrel fitted with a drill-type chuck to a fixed shopmade plywood framework. A ½-HP, 1,735-RPM motor underneath the table, which holds the work, supplies power via a V-belt drive. To make the mortises, I mount a ¼-in.-dia. four-flute end mill in the arbor chuck. By using this type of end mill to make shallow passes back and forth, I feel confident mortising without any fences or hold-downs. You *must,* however, use a fence and hold-down if you mortise with a router and regular straight bit; otherwise, the high-speed bit might grab the part and pull your hand into harm's way. You may also do the mortising with hand tools. I make the length of each mortise ⅜ in. less than the width of its corresponding apron member. All the mortises in the legs are about ⅝ in. deep; I put a pencil mark on the horizontal mortiser's table as a depth guide.

Mortising the twin aprons for loose tenons

Next, I mill the twin apron members from ¾-in.-thick stock, ripping the lower one a little narrower (about ⅛ in.) than the upper one. Because I mortise both legs and aprons and join them together with loose tenons, the apron stock is crosscut to exact length. Now, I cut the mortises in the ends of the aprons to receive the loose tenons, centering the mortises with regard to both width and thickness. To keep any minor discrepancies that creep in during mortising consistent, I hold the outside face (marked earlier) of each apron member down on the mortising table. At this time, I also lay out and mortise for the short posts that connect the twin aprons. Depending on the length of the apron, I'll use either one post midspan or two located at visually pleasing intervals. I make the posts the same thickness as the loose tenons (¼ in.) so that I can use the same mortising bit and setup, and also so that I can cut the posts at the same time I cut the tenon stock.

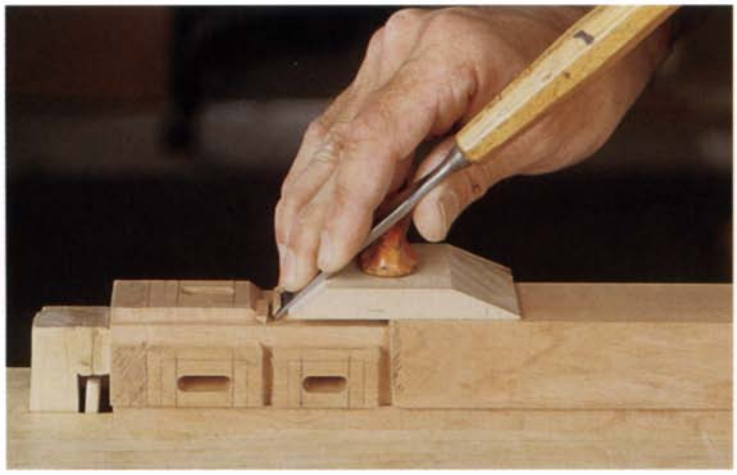
I make the tenon stock by first ripping ¼-in.-thick rock maple strips to the width of a leg-to-apron mortise. Then, using a ⅛-in.-radius roundover bit, I rout all four edges of the strips. Finally, I cut the individual loose tenons to length (about 1⅛ in. in this case) on the radial-arm saw. The tenons can then be glued into their mortises on the ends of the aprons. I also rip a shorter, narrower strip (from the primary wood of the table or case) for the posts, round over the strip's edges and cut the posts to length.

Chamfering around the mortises

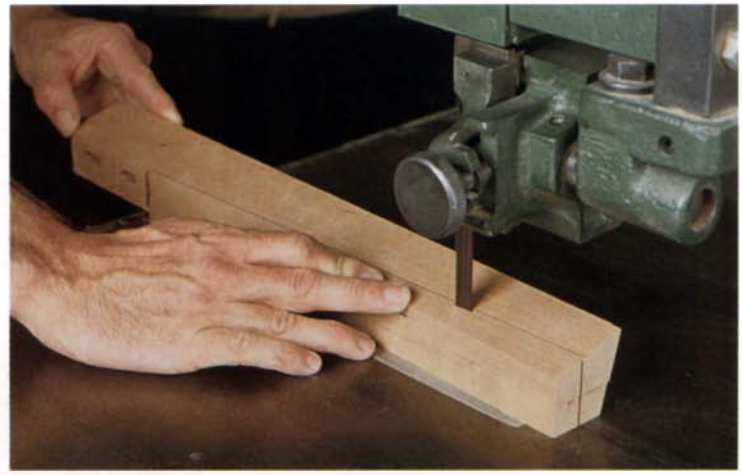
I dry-assemble the legs to the aprons, carefully driving the tenons into their sockets. I make sure that the outside face of each apron fits flush to the angled face of the leg; I plane or scrape any discrepancies. Then I scribe the end profile of each apron onto the leg. These lines provide the layout for the chamfers where each apron joins the leg. Another set of layout lines, marked around each set of apron profile lines, shows about where the chamfers will end (see the photo above right). I then use a Dremel tool fitted with a special router base and a ⅛-in.-dia. end mill to remove waste just outside the second set of layout lines, as shown in the photo above right. I like the end mill because I can rout freehand without worrying about the bit grabbing and taking off. I leave stock at the tops of the legs until they have been tapered.

Now I use a sharp chisel to cut the chamfers. First, I clamp a wood block that's been cut at a 42° angle to the leg on the workbench and use the block as a shooting board to guide the chisel during chamfering (see the top, left photo on the facing page). I cut three chamfers around each mortise, but I leave the ones below the lower aprons until after the legs are tapered. At this time, I decide on the degree of taper for the legs. I mark the tapers, which should start just below the bottom edge where the lower-apron chamfer will be. Because the tapers stop at the chamfers, it's best to make this stopped cut on the bandsaw. With the bandsaw table tilted, I saw the taper on one side of each leg and tape the waste piece back on the leg to keep it level while the other taper is being cut. Then I return the bandsaw table to square and saw the remaining tapers (see the top, right photo on the facing page). I remove the sawmarks with a small handplane held skewed to cut as close to the chamfers as possible. I finish cleaning up the tapers by scraping the surfaces smooth. Now, I reclamp the angled block and chop the bottom chamfers so that they meet the tapers cleanly. Any sawmarks or chisel marks that remain around the chamfers can be cleaned up with a handplane, scraper or file.

After rechecking the fit of the aprons to the legs, I disassemble all parts and sand them down to 220-grit, cleaning up any remaining defects. Next, I run small chamfers, each only about 1/16 in. wide, on all the edges of the aprons, using a 45° bit fitted in my router table. I chamfer the edges of the legs using a handplane instead of a router because the legs' angled faces don't allow the piloted bit to work correctly. In places where the handplane can't reach, such as around the apron-joint chamfers, I finish the detailing with a small file. Handplaning also allows for some subtle variation. I diminish the chamfer on the outside edge of the leg (see the bottom, right photo on the facing page), where the angled faces meet, from almost 3/16 in. wide at the top to less than ⅛ in. at the bottom. This accentuates the taper of the leg.



To guide the chisel during chamfering, *the author uses a shooting board, a wood block that's been cut at a 42° angle, clamped to the leg.*



The taper on each leg is bandsawn *after the mortises are chopped. The scrap from the taper cut on one side of a leg has been taped on to level the leg while the taper is cut on its other side.*

Filing between mortise sockets *(above) is one of the final steps to complete the chamfered details before the table frame halves are glued together.*

Photo: Chris Eden

Although this nightstand features a single apron, *the piece (right) still employs the same raised-and-chamfered mortise sockets as in Day's other tables.*

Assembling the frame and fitting the top

Before final assembly of the frame, I finish-sand all the parts to 400-grit. I also prefinish the inside surfaces of the aprons and the posts, as these areas are hard to get to after assembly. I prefer a shellac finish, which I mix myself using flake shellac thinned at least 3-to-1 with denatured alcohol.

I begin assembling the frame by gluing each pair of aprons together with their posts. I apply glue sparingly in each post mortise, to avoid having to scrape excess squeeze-out. I use spacer blocks between the aprons to keep the apron members parallel during gluing. I also use clamping blocks on the top and bottom, for even pressure.

Next, I glue the apron assemblies to the legs, working in pairs. First I do the two long sides of the table or case. To apply even pressure to the joints, I made angled clamping blocks from scrap hardwood cut at an angle to match the legs' profile and lined with thin cardboard. When the assemblies are dry, I lay each faceup on my workbench and carefully file the chamfers on the edge of the legs in the area between the mortise sockets, which are between the aprons (see the bottom, left photo). Now I glue up the remaining short apron assemblies to complete the base and finish up by filing the detailing between the short side aprons.

The top, which is designed to be flush with the ends of the legs, is constructed from a veneered-plywood center panel with four trim strips glued to the edges. These strips create a space at each corner that fits around the end of each leg (see the bottom, right photo). For the center panel, I glue 3/32-in.-thick veneers to both sides of 1/2-in.-thick Baltic-birch plywood, and then cut the panel to width, minus the width of two trim strips. Next, I glue the strips on the long edges of the panel and crosscut it to length before I fit and glue on the short strips. Then I rout and glue in the ebony string inlay at the seam between the panel and strips, and clean up the top with a handplane and scraper. I fit the top onto the assembled base, trimming as necessary and taking care to keep the reveals around each leg equal. Then I finish-sand the top and the ends of the legs. I chamfer all edges of the top with a router, as I did on the aprons, and I touch up the chamfer's inside corners with a file. Finally, I apply two coats of shellac, followed by two coats of clear lacquer for moisture protection. □

Ross Day builds furniture and cabinets in Seattle, Wash. His hall tables were included in the recent Krenov and Friends show at Pritam and Eames Gallery in New York (see article on p. 94).

Photos except where noted: Jim Boesel

Turning a Scoop

Twelve steps from lathe to flour bin

by Richard Raffan

Turning a lump of wood that is spinning on a lathe can provide you with some of life's more satisfying and sensual experiences, as well as being just good, plain fun. As streamers of curly shavings and smooth, flowing forms emerge as if by magic, you can make yourself all kinds of useful or utterly frivolous bits and pieces.

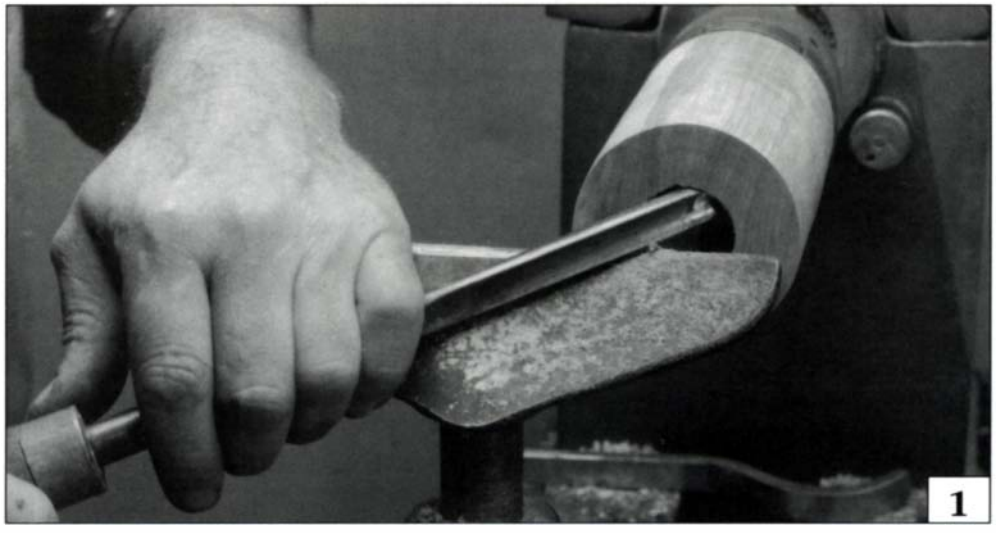
When I began to turn wood in 1970, I had no experience of the craft. But by making many hundreds of the same designs, I developed most of my basic technical skills. Scoops have always been one of my major production items. I've made around 45,000 of them, and in the 1970s, I reckon that they paid all the basic bills while doing wonders for my turning technique. My first scoop design was based on a vague memory of a Georgian silver sugar scuttle, although today I find that the handle is embarrassingly chunky and the bowl too heavy and steep shouldered.

A scoop is conceived as a stem beneath an elongated bowl or cup, which is partially cut away to create the scoop. It is essential to appreciate that the bowl bellies out from the rim and that the curved wall is of near even thickness. The thickness of the wall can vary slightly without compromising the form if both the inside and outside are smooth curves. But, as many plagiarists have shown, a cumbersome look is the reward if you get it wrong. Scoops are not as easy to make as their form might imply at first glance, let alone at the speed required to be competitive.

Scoops have to be turned, not drilled. Anybody can drill a hole into endgrain and chop the end off at an angle, but I regard scoops made this way as ugly in their angularity. What we are after here is a form that is altogether more sensual, as shown above.

Avoid fresh-felled wood for scoops—the bowl can distort off-center and the handle can split as the wood dries. The grain should be fairly straight, but this is not as essential as it is for a thin spindle. The curves mean that you cut mostly across the grain and can cope with the odd twist, especially in the bowl. Start with a blank 2 in. (50mm) to 2½ in. (65mm) in diameter and 4½ in. (115mm) to 5½ in. (140mm) long. Larger or smaller blanks create problems, so they are best avoided initially. Mount the blank on a small faceplate or in a collet chuck, as shown below, and run the lathe at about 1,800 RPM.

1 After truing the blank, I back-hollow into the endgrain (shown in the photo at right) using a ½-in. (13mm) half-round gouge, which removes the bulk in only a few seconds. As with little bowls, I always complete the inside of the blank before shaping the outside to maintain the maximum amount of supporting wood; if you turn the outside shape of the blank first, you will make hollowing the inside infinitely more difficult. If you are turning only one or two scoops, you might find it helpful to drill a depth hole before starting to hollow. In addition to indicating the correct depth, the hole makes the back-hollowing cut easier to start.



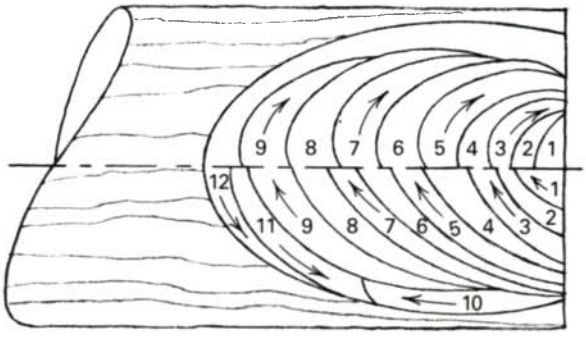
2 With the bulk removed, use a wide scraper to complete the hollowing. The tool should have a long left curve (shown at left) to eliminate corners that might score the surface. Develop the internal curve by undercutting the rim, and reach into the far corner of the hollow from the direction you are working. Make sure that internal bowl depth is at least equal to the outside diameter. (See figure 1 for hollowing options.)

3 Next, mark the internal depth of the scoop on the outside of the blank. Don't mark closer to the headstock to allow for wall thickness at the scoop's bottom or you'll lose track of exact depth. Sand the inside before shaping the outside to remove pencil marks and to establish the surface to which the outside relates. If you sand the inside and outside together, it is easy to develop a sharp rim that can cut you.

Develop the curve into the rim (shown below left) using a skew chisel (cut 2 in figure 2). If you feel comfortable with the skew, you'll find it efficient to make the parting cut first (cut 1) and then turn the bowl.

4 Part in on the internal depth line (shown below right). You'll learn the finer limits only by parting off a few bowls. In general, part in to just under half the original diameter.

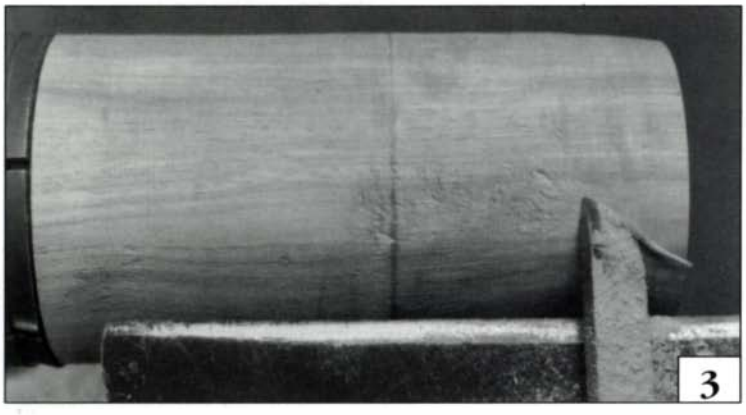
Fig. 1: Two options for hollowing a scoop



1-9 Back-hollowing cuts for shear cutting away from the center using a gouge

1-9 Standard hollowing cuts into the center using a gouge

10-12 Scraper cuts



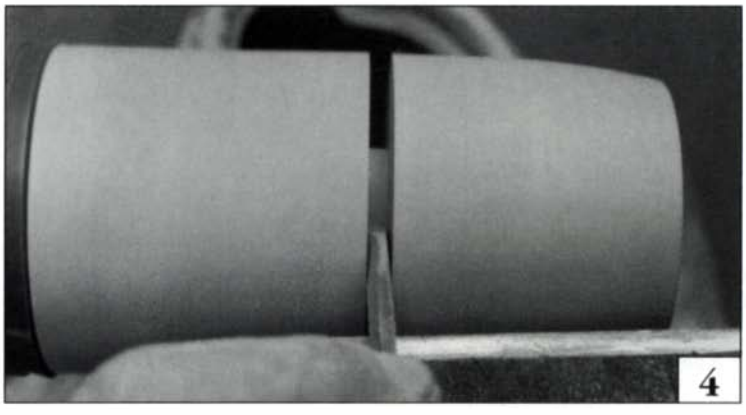
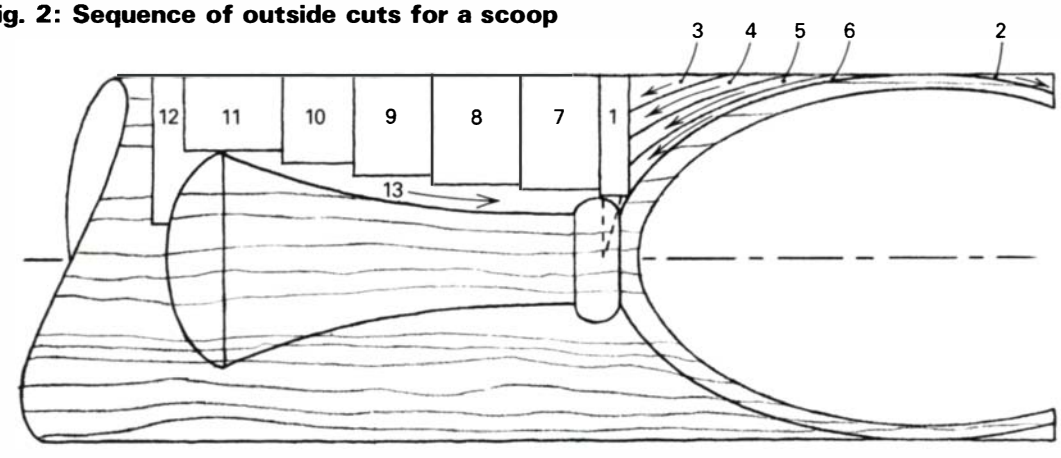


Fig. 2: Sequence of outside cuts for a scoop



1 Parting tool

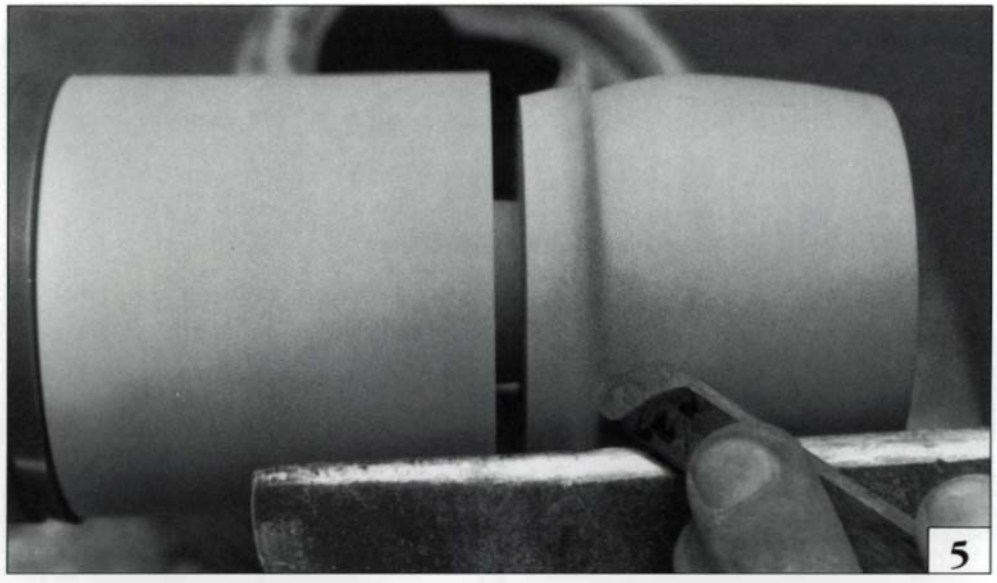
2-6, 13 Skew chisel shearing cuts

7-12 Skew chisel peeling cuts

Photos: Author; drawings: Lee Hov

5 Cut the curve using the skew chisel (shown top right). Initial cuts with the long point can be heavy if the force used is parallel to the axis, because the fibers that split along the grain will break at the parting cut. The idea is to project, in your mind's eye, the curve you're cutting to as the point where the headstock side of your parting cut would intersect the axis.

Check wall thickness with your fingers, which will become reliable calipers; however, check mechanically to confirm that you have what you feel. Never use calipers to measure wall thickness with the lathe running. You can also ensure consistent wall thickness by drilling a hole or two in the portion that will be cut away. Then all you have to do is stop the lathe and peer through. This also eliminates possibly scoring the interior with the calipers.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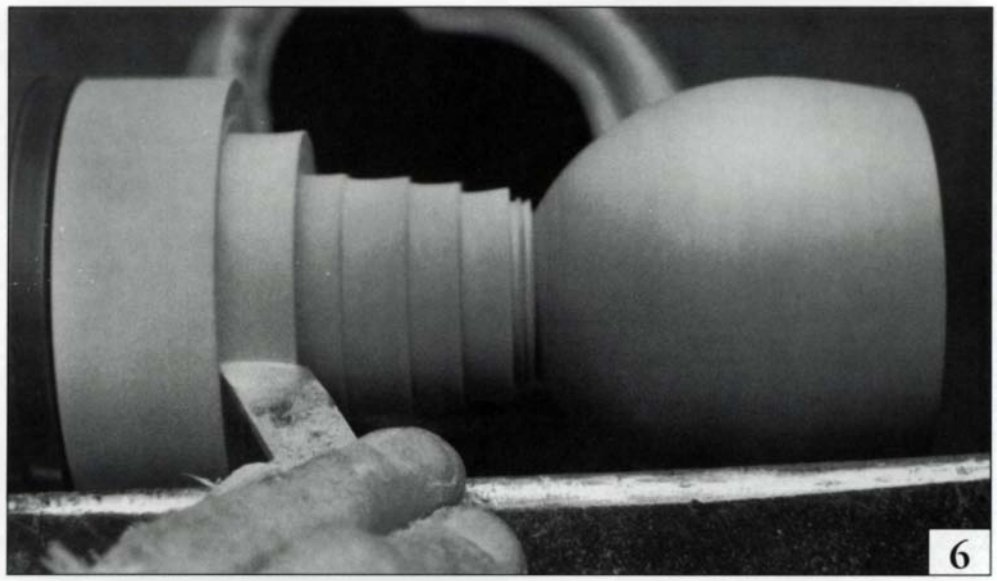
6 Now develop the handle. You can use a gouge, but it's faster and more satisfying to make a peeling cut with the skew chisel flat on the rest (shown at center). Use a square-section skew for stability, rather than an oval-section one, which will wobble. Next, refine the base of the bowl with the skew's long point, and take a cut from the end of the handle to the base of the bowl to establish overall proportions.

Use the skew's long point to develop the bead and put a curve on the handle—straight lines are harsh and not nice to fondle.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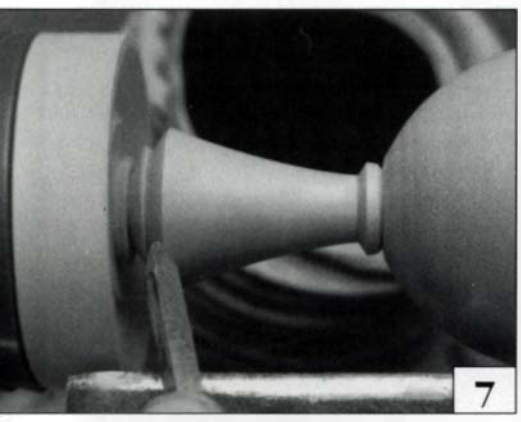
7 Take a shearing cut with the long point of the skew (shown below) to shape the end of the handle.

8 Now sand the outside. Pressure against the axis must be equalized by your fingers on the opposite side (shown bottom right) to avoid pulling the piece free. I don't apply an oil finish now because it collects dust when I sand later. There shouldn't be a problem with a hard finish, like varnish. With the outside sanded, part off using the skew's long point.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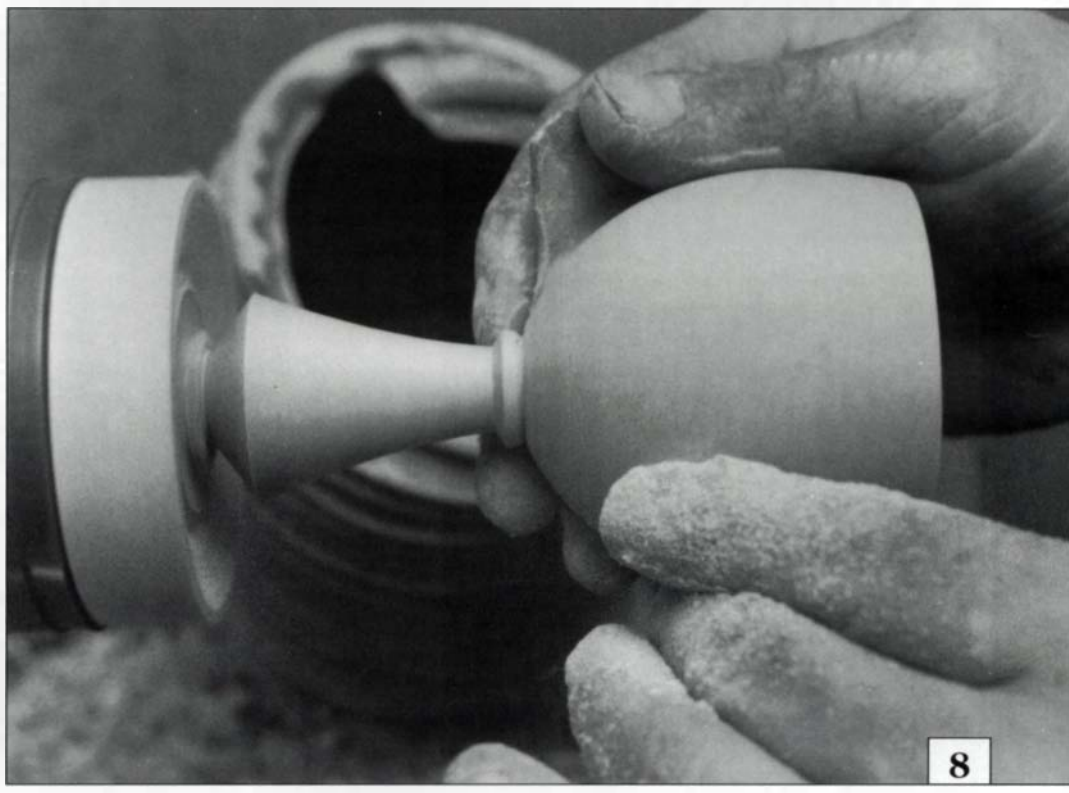
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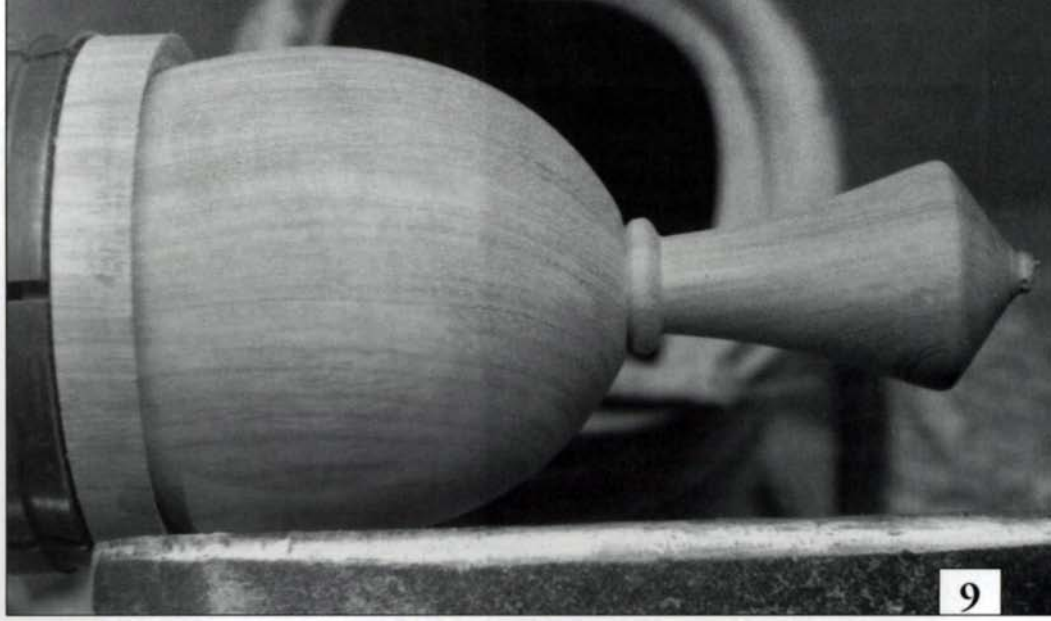
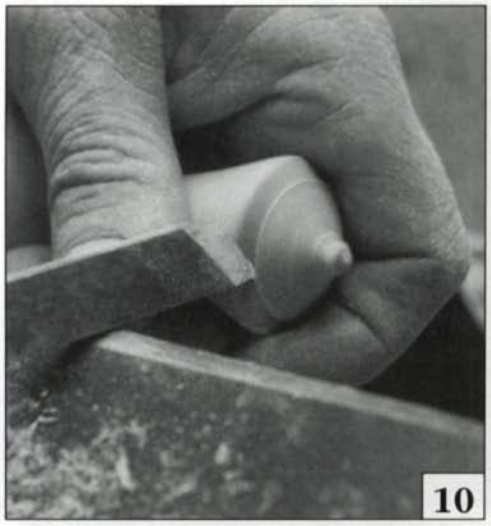
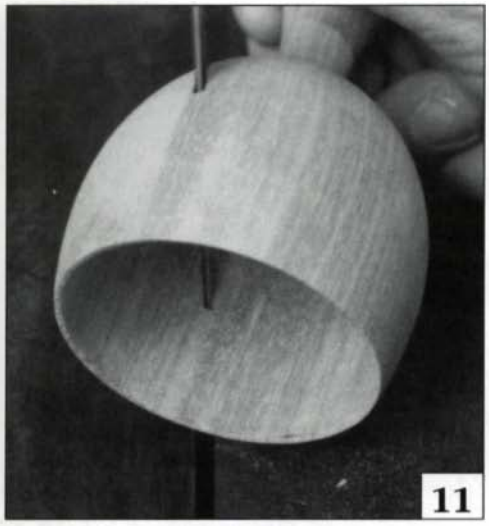


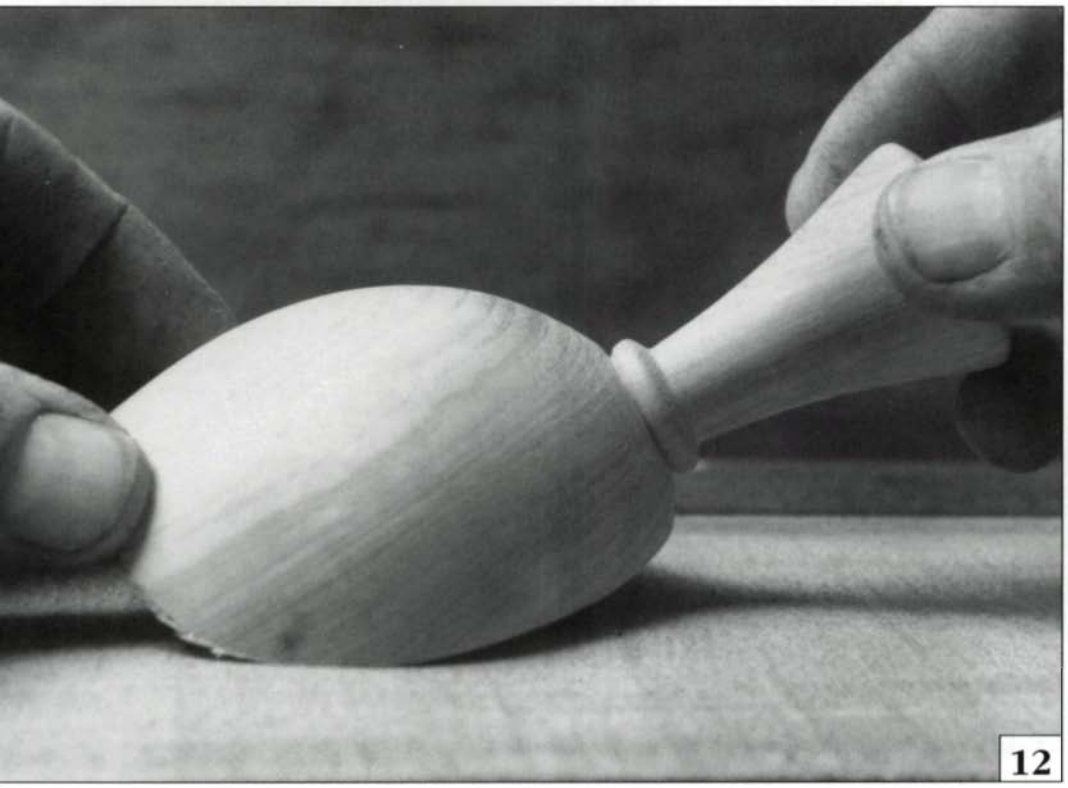
9 Turn a taper chuck (shown above left) upon which to mount the scoop so that you can turn the end. Make sure that the rim abuts the chuck shoulder for stability (shown above right). This is tricky, and in production I find it faster and less nerve-racking to sand the handle ends smooth on the belt sander.





10 I use my hand to support the scoop as I turn the end. My thumb acts as a fulcrum for the tool (shown center left) as well as a pad between the scoop and rest should the scoop come loose. Because the fixing is tenuous, use the point of the skew rather than taking a shearing cut, so the wood won't roll up the tool edge. You'll need plenty of support to keep the scoop on the chuck.

11 Finally, I cut away the scoop. I use a bandsaw (shown center right) and grip the scoop's handle firmly to prevent the piece from rolling into the blade at the start of the cut. My fingers are behind the blade so that if it snatches or shatters, my fingers are clear of the teeth. (Alternatively, remove the bulk on a 40-grit to 60-grit belt sander or disc sander and finish with 120-grit to 180-grit.) Once the blade has entered the wood, problems should be over, because the back of the blade supports the form. Pull the scoop through the blade, pivoting it slightly to develop the curve. Always err on the side of caution—bits cut off can't be replaced, while undercutting is easily sanded away.



12 To finish the scoop, sand the curve smooth. This is best done on a belt sander (shown at left) because all parts of the abrasive move at the same speed. Keep the curve fuller rather than flatter. Finish the scoop with oil, varnish or sealer. □

Richard Raffan is a professional woodturner in Malua Bay, N.S.W., Australia. This article was excerpted from his book, Turning Projects, *published this year by The Taunton Press, 63 S. Main St., PO Box 5506, Newtown, Conn. 06470-5506.*

Building an Octagonal Pedestal

Easy assembly with core-and-rib construction

by John Hines

When a local university asked me to build a pedestal for displaying a bust, I immediately decided on an eight-paneled stand, like the one shown below, because I thought it would be more interesting than a conventional round or square pillar. Then I realized that ripping eight panels out of solid wood and gluing the long, 22½° beveled edges together would be a foolhardy battle involving slippery, wet joints, band clamps and oozing adhesive. And even if I did get the panels together, warpage or seasonal wood movement might eventually tear everything apart. I could sidestep the expansion and contraction problems by building a veneered plywood or particleboard pedestal, but I didn't know how I could join the 16 edges perfectly so that the substrate wouldn't show.

The solution came as a method that might be called "core-and-rib" construction. I decided to cut several ¾-in.-thick plywood octagonal cores, and then join them together with narrow vertical ribs running through notches cut into the eight points of each core disc. These ¾-in.-sq. pine ribs were screwed into the core discs at the bottom, center and top of the pedestal. I then faced off the pine uprights with oak ribs screwed on from inside the pedestal, as shown in the bottom photo on the facing page. I concealed this interior framework with 5-in.-wide veneered panels, which were first ripped to fit between the ribs and then screwed to the top and bottom cores. I added small L-brackets on the middle core to ensure that the panels were pulled in tightly. Molding at the ends of the pedestal covered the screw holes.

My construction method turned out to be fairly straightforward, once I came up with a way to precisely dimension the four notched octagonal core discs: A template and a router equipped with a guide bushing, described in the sidebar on p. 82, made cutting out the four cores almost as easy as stamping out holiday treats with a cookie cutter. The template also served as a drill guide for boring holes in the cores needed to align parts during assembly. Once the core pieces and the other components, shown in the drawing on the facing page, were milled, the job became just a matter of fastening everything together with the simplest of joints: screws and glue.

***A framework of plywood cores and pine ribs** ensures maximum strength and minimal assembly problems for this octagonal pedestal. The oak ribs and veneered panels are simply screwed to the framework.*

Even if you aren't interested in displaying art work, a pedestal is a good project and can be used in many other ways, such as a support for tabletops, plants and floral displays. Lamps, clocks, globes, fish bowls, bird cages and dictionaries are also often set atop a pedestal. I think that the two halves of a pedestal that was split lengthwise would be just right to support a mantle and form an attractive fireplace surround.

Start with a heavy base

To counteract the weight of the bronze sculpture, I wanted the base, or plinth, to be fairly heavy. So I built an 18-in.-sq. mitered box and filled it with particleboard until it was nearly solid, as shown in the drawing. I cut two dadoes, ¾ in. wide and 5/16 in. deep, into the sides of the base to accommodate a square, veneered-particleboard top and a plain-particleboard bottom. I drilled a ½-in. hole in the center of the top, and then I drilled and counterbored holes in the top's four corners before assembling the base. When the finished pedestal and bust are installed, these holes allow the top-heavy assembly to be bolted to the floor; then the holes are plugged with wood cabinetmaker's buttons. I've found that square bases are stable. If the pedestal won't be supporting a heavy object, I prefer an octagonal base, shaped like the column.

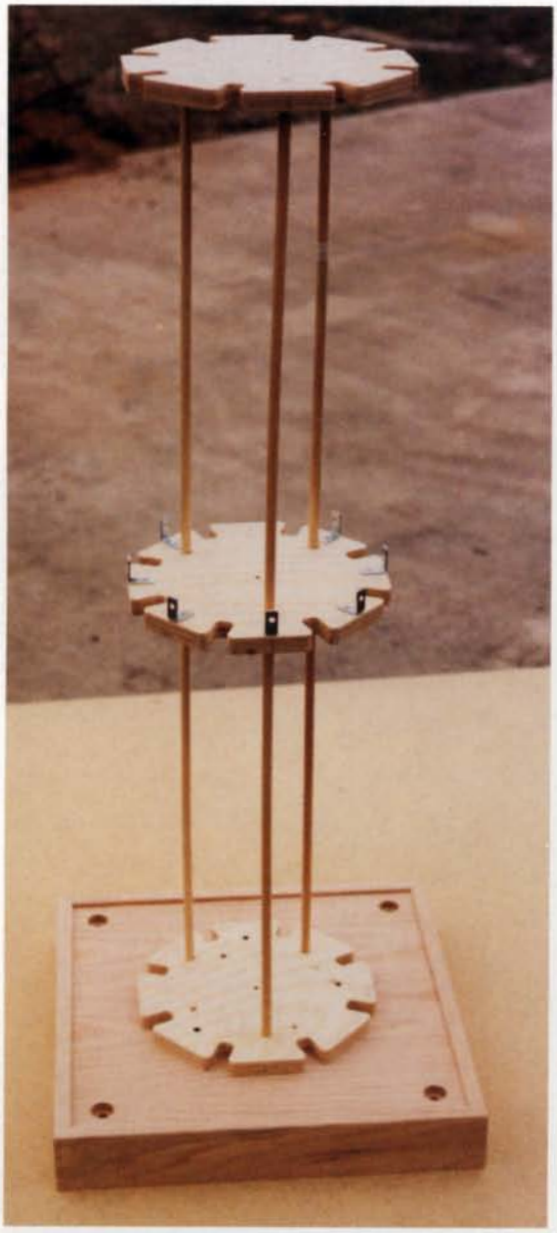
Assembling the column

I started the column by centering one of the core discs on the base and driving a ½-in.-dia. pin through the center hole of the core and into the base's center hole. After aligning the core so four sides of the octagon were parallel with the square base, I fastened the bottom disc to the base with 2-in. screws.

To facilitate the core's assembly, I placed three ½-in.-dia. dowels in the holes predrilled in the bottom core disc. (The dowels need to be at least as long as the height of the pedestal.) I pushed a second disc down onto the vertical dowels to the halfway mark and then placed the remaining two core discs at the top of the dowels. This assembly, shown in the top photo on the facing page, was a bit wobbly, but it held the discs in the proper position to receive the ribs.

(continued on p. 82)

Photos: John Hines; drawings: Vince Babak

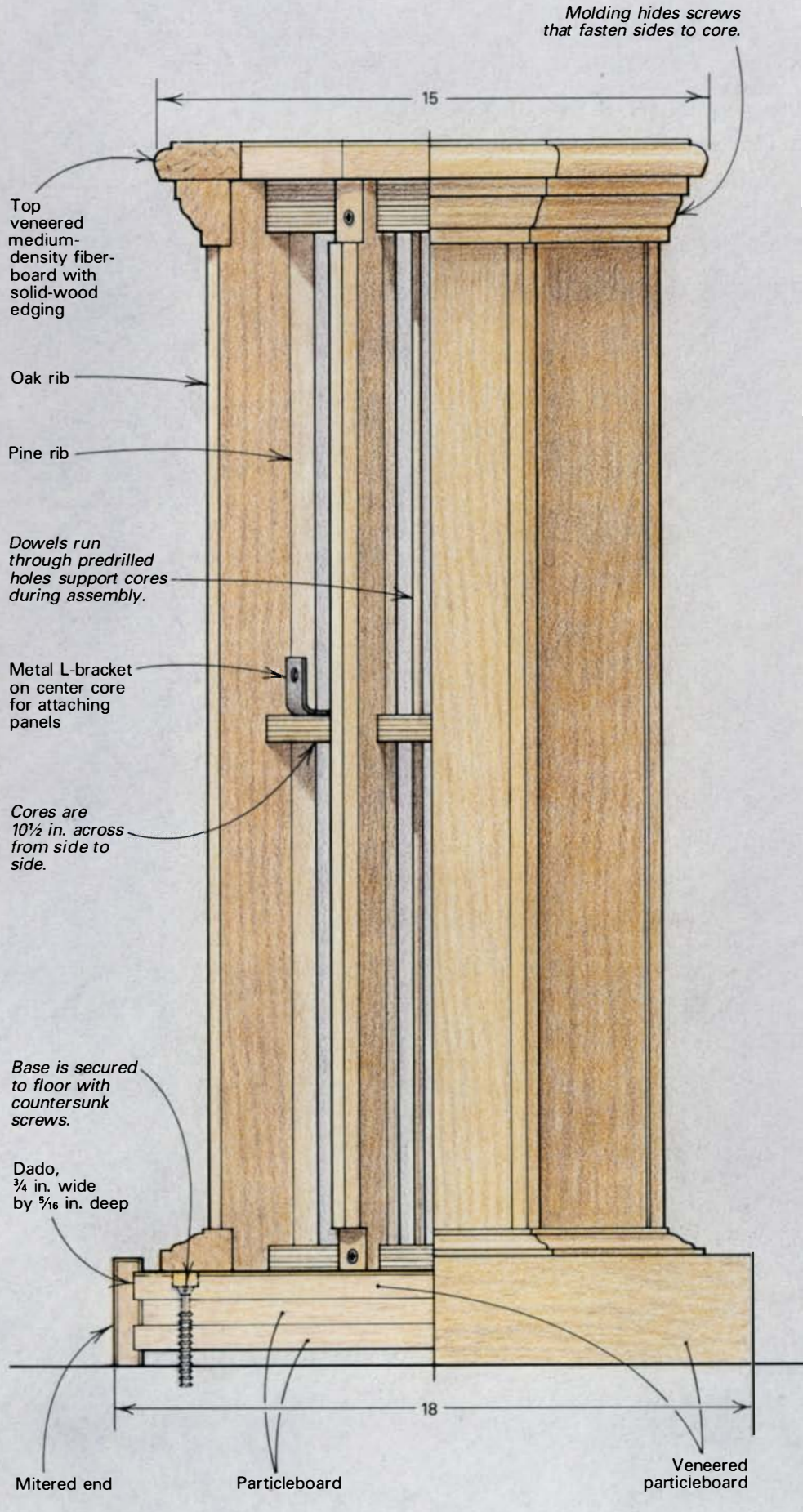


Dowels that fit snugly in holes in the cores *hold them in place while the ribs are screwed into the notches. Screws run through the L-brackets on the middle core keep the panels from buckling when the pedestal is assembled.*

Each plywood core was notched *(below) to accept two sets of ribs: pine on the inside and oak on the outside. The oak ribs were notched so that chair-rail molding could be used to hide the screws that fasten the veneered panels to the core at the top and bottom.*

Rib-and-core pedestal

Height, 34½ in. or to suit function of stand



Next, I installed the two sets of ribs. I used oak for the face ribs and pine for backing ribs. Since the pedestal was designed to display art work, I avoided flamboyant wood grains, ornate moldings and carvings that might compete with the artwork. Even so, like the frame of a fine painting, each pedestal could very well claim its own quiet elegance. The ¾-in.-sq. pine ribs were fit snugly into the core notches and then screwed to the cores at the top, center and bottom. The assembly was now fairly rigid, but I attached small metal L-brackets, which are visible in the top photo on the previous page, to the center core. These brackets pull the sides in at the middle of the pedestal.

Then I installed the oak ribs on top of the pine ribs. You can leave the front edge of these ribs square (as I did), taper the edge to a 22½° angle or shape it some other way to suit your fancy. (I've often thought fluting would be a nice touch here.) Once I bandsawed the notches at each end of the oak ribs, to accommodate the molding that would be applied at the top and bottom of the pedestal, they were clamped and then screwed to the pine ribs from inside the column.

Next, I installed the oak-veneered panels, which were veneered with the same species of oak used for the solid-wood ribs and the base. The substrate for this pedestal is medium-density fiberboard (MDF), rather than plywood or particleboard, because I wanted the pedestal to be as heavy as possible. I cut the panels slightly oversized and veneered them before beveling their edges.

To bevel the edges of the eight panels, I set my tablesaw blade at 23° and ripped each long edge, ending up with 4 3/16-in.-wide pieces. I then fit each piece into place on the pedestal individually, being careful to match grain patterns as much as possible. I ran screws through each panel into the top and bottom cores. Then, working from *inside* the column, I drove a screw through each metal bracket to pull the panels at their middle. Because I couldn't get my hand inside the column to screw through the last metal bracket, I left it unscrewed; the particleboard will stay flat even without the last screw.

I fitted a standard chair-rail molding around the top and bottom of the pedestal. I cut the 22½° end miters for the base molding first. After dry-assembling all eight pieces, I applied glue, set the molding in position and secured the pieces with a nylon strap clamp. After turning the pedestal upside down, I repeated the procedure to assemble the top molding.

Choose a top

Tops can be made from a variety of materials, including marble, polyester resin products (such as Corian), solid wood or a veneered-and-edged panel. To build the eight-sided top for my pedestal, I cut a veneered MDF square into an octagon, and then mitered, fit and glued on the edge pieces. I profiled the top edge using a ¾-in.-dia. roundover bit and a 22° dovetail bit.

One final suggestion. If you are building a pedestal to support an original piece of art, work closely with the artist, if possible. On my last pedestal commission, the sculptor made several valuable suggestions. We even collaborated on selecting a color of wood stain that would match the patina of the bronze sculpture. □

John Hines designs and builds furniture in Weatherford, Tex.

Template-routing complex shapes

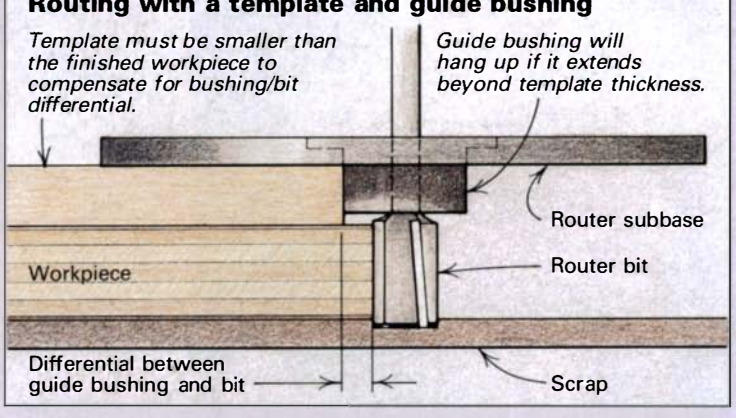
Accurately dimensioned, identical cores are essential for successful core-and-rib construction. My favorite way to produce these cores, especially complex-shaped ones like the notched gear-like pieces in my octagonal pedestal, utilizes a router, a guide bushing and a template.

With this method, the template is fastened to the workpiece, and the guide bushing, which is attached to the router's subbase, rides against the template, allowing the bit centered inside the bushing to follow the shape of the template, as shown in the drawing at right. The guide bushing following the template always keeps the cutting edge of the bit a fixed distance away from the template's edge, since the diameter of the bushing has to be greater than that of the bit. This means that the router shapes a workpiece that is slightly *larger* than the template; therefore, the template must be *cut a little bit smaller* than the desired workpiece. The amount of offset between the template and workpiece depends on the particular bit-and-guide-bushing combination that you are using. To determine the amount of offset, I subtract the bit's diameter from the guide bushing's outside diameter and then divide that number by two. For example, I used a ½-in.-dia. straight bit in my router and a 1-in.-OD guide bushing to cut out the cores for my pedestal in the main article, so the differential was ¼ in. Therefore, for an octagon that measures 10½ in. from one side to its opposite parallel side, I needed a template that was ¼ in. smaller *all the way around*, or 10 in. from side to side.

In coming up with your own bit-and-bushing combinations, you should stick with ½-in.-dia. bits with ½-in.-shafts, which deflect less than smaller-diameter bits. (Most ¼-in.-dia. bits will probably be too short for template work anyway.) The diameter of the bushing is important, too; larger bushings are too fat to follow intricate templates. The bushing also should not extend beyond the thickness of the template. I prefer plunge routers for template work because I can position the guide bushing securely against the template before lowering the spinning bit into the workpiece.

I make my templates from plywood or particleboard, using a bandsaw, sabersaw, rasps and sanding blocks. The important thing is to work carefully because any imperfections in the template will be duplicated in the parts that you cut. Since the pedestal cores aren't visible in the finished piece (shown in the photo on p. 80), I just screwed the template to the workpiece. Otherwise, I would have had to resort to more imaginative methods of attachment, such as clamps, brads, two-sided tape or vacuum-clamping devices. *–J.H.*

Routing with a template and guide bushing



The author loads his kiln *before shutting its airtight door and turning on the automatic dehumidifier and low-temperature heater. His kiln runs automatically, but shuts off and rings a bell if the air in the chamber gets too hot.*

A Dehumidification Kiln

A compact system for drying your own wood

by William Bolf

I collect Appalachian hardwoods that I buy at bargain prices from local sawmills and estate auctions. Until recently I could only air dry the lumber to about 14% equilibrium moisture content (EMC) by stacking it in my unheated barn for a few years. Then I became interested in dehumidification lumber-drying kilns and set out to see if I could build an inexpensive kiln suitable for a hobby woodworker like myself. The result is the kiln shown in the photo above, in which I can dry up to 250 bd. ft. of 8-ft.-long ¼ hardwood boards to 7° EMC in about 60 days. This is ideal for my needs. As a spare-time cabinetmaker working in a basement shop, the features I required for my kiln are as follows:

- Since I am a hobby woodworker, my kiln should be as inexpensive and as small as possible.
- The kiln should be solidly constructed so that repairs and maintenance are minimal.
- The kiln should have an automatic control system so that it can operate for days without attention.
- It should be absolutely safe and free of any potential fire hazard.
- It should have a humidification capability for lumber conditioning after the drying cycle (see the sidebar on p. 85).

My kiln can be built for less than $600, and I can dry a stack of lumber at about 10 cents per board foot. The whole setup fits

Photos: Jim Boesel; drawings: Aaron Azevedo

in the corner of my basement, as shown in the photo on the previous page, where the temperature remains near 60° year-round. This means that the kiln's equipment doesn't freeze during the winter, and less energy is needed to maintain the kiln's operating temperature at 110°. Its temperature and humidity are controlled automatically, and the kiln shuts off and an alarm sounds if the internal temperature rises above 125°, which might damage some parts of the equipment.

The kiln's control system will work in any type or size kiln, but the capacity of the heaters, dehumidifier, fans and humidifier may need to be altered for smaller or larger kilns. If you modify my kiln's design, the electrical current capacity of the switches and relays should be checked against requirements of larger equipment.

My kiln's low operating temperature deprives me of two advantages of a high-temperature commercial kiln: It cannot kill lycus powder post beetles or their larva, and it cannot dry out (set) the resin (pitch) in pines and firs. To kill powder post beetles, the kiln temperature must be higher than 125° for 48 hours. An adjustable temperature control, instead of my fixed one, would be necessary, and the dehumidifier would need to be removed to avoid being damaged at that temperature. To dry resin pockets, the kiln would need to be run at 170°, which is not possible with my kiln. So I dry pine first and then cut out and discard wood with resin pockets.

Building the kiln

My kiln isn't as complicated to build as you may think, and you don't have to be an electrician to wire it (see the photo on p.86). I built the kiln with solid-wood framing, plywood and foam insulation. You can increase the size of the chamber, but if you do, you may need larger mechanical equipment and your control system may need to be upgraded to handle it.

I stack lumber on top of my kiln, so I load wood to be dried through its front door, which is hinged on the top of the kiln. A door on the left accesses the equipment in the chamber. Before building the doors and the chamber, I primed and painted both sides of the plywood with oil-base enamel. Then, as I screwed the plywood and the frames together, I caulked all the joints with silicon rubber, which doesn't degrade in the damp heat. I insulated the top, bottom and back of the kiln with 1½-in.-thick styrofoam, and I used ½-in.-thick foil-faced polyurethane insulation on the front doors and the right end (both types of insulation were available at my local lumberyard). The left end, which contains the kiln's control system, isn't insulated, and the insulation on the front doors and top is removable to cool the kiln if, under some condition, the internal heat rises to more than 110° without the heaters on. I made the doors airtight with ¼-in.-thick by ¾-in.-wide self-sticking foam rubber weather stripping. For safety reasons, I didn't use self-locking latches that might entrap a child.

To create uniform air flow through the kiln, I installed a ¼-in.-thick chipboard baffle in the back of the kiln (see figure 1 below). The baffle creates a plenum, like on a forced-air furnace, and an aluminum deflector at the right end spreads the air evenly through the lumber pile. Two fans pull dried air from the dehumidifier and blow it past the three-light-bulb heater in the plenum. The air passes through the lumber on its way back to the dehumidifier.

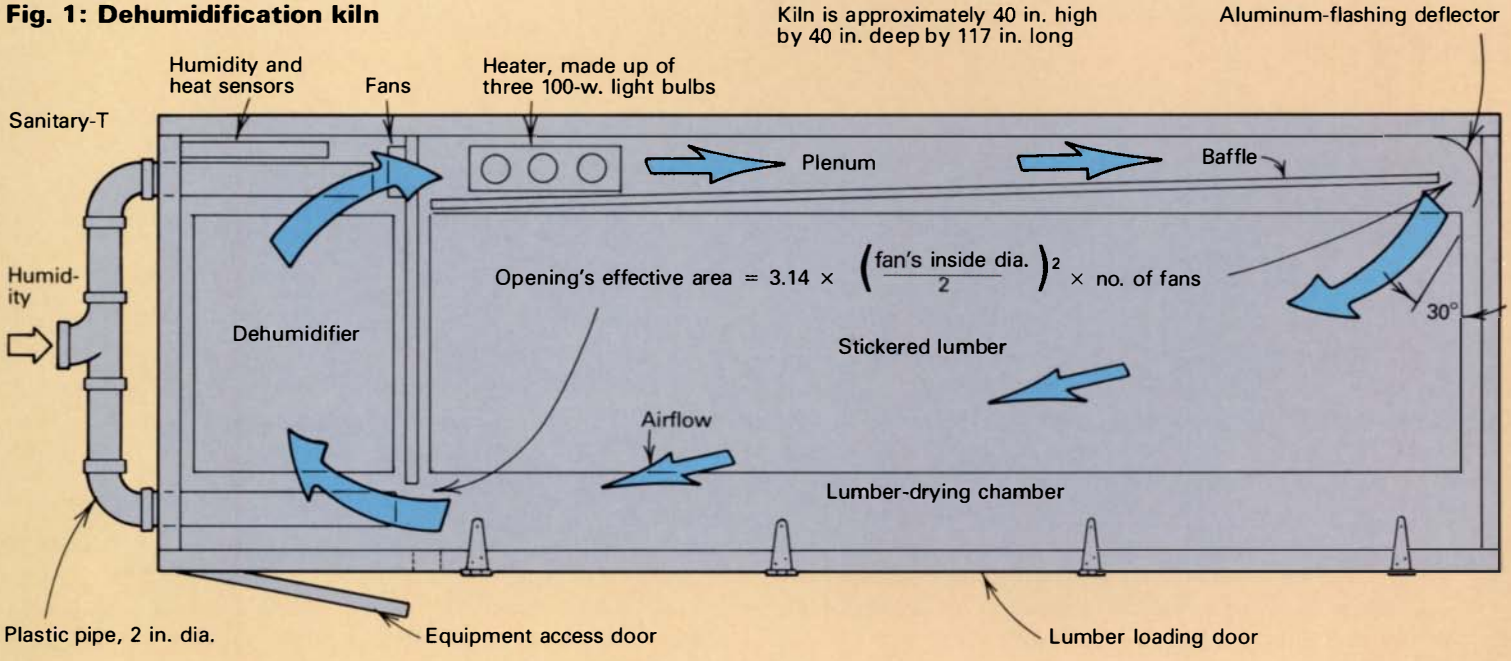
Installing the mechanical equipment and controls

I spent a good bit of time shopping for safe, inexpensive equipment and a control system that could maintain the kiln's temperature at +/- 2° and the humidity at +/- 10%. (The equipment and sources for it are given in the kiln parts list on p. 87.) Although some of the components were available at local hardware stores and home centers, I had to turn to the mail-order sources listed on p. 87 for the control sensors.

My kiln's dehumidifier is an old 18-pint Sears machine, which stands on the floor at the left end of the kiln chamber. The two "muffin"-type circulation fans are mounted in cutouts in a transverse baffle on the left end of the plenum behind the dehumidifier. The fans, specified in the parts list, are rated for 149°, which means their bearings can withstand the kiln's normal operating temperature. As shown in figure 2 on p. 87, the ultrasonic humidifier (from a home center), which is used during the conditioning cycle, vents through a flexible automotive defroster hose and then into a duct, which I made from plastic pipe. Air, which is under pressure, enters the duct at the front of the chamber, and the humidified air is drawn into the duct and plenum by the vacuum created by the fans. Three 100-w. light bulbs in ceramic fixtures maintain the kiln's air temperature at 110°, even when the humidifier cools the air during the conditioning cycle. A kiln that is larger than mine may need the higher heating capacity of a household

(continued on p.86)

Fig. 1: Dehumidification kiln



How a kiln dries wood

Moisture content in a piece of wood is related to the air's relative humidity. We raise or lower the relative humidity so the board will absorb or release moisture until it's in equilibrium with the air. We dry wood by gradually reducing the kiln air's relative humidity until the wood reaches a desired equilibrium moisture content. Kilns do this in one of two ways. The first is the oven-drying method, which dries the chamber air by heating it. The second is the dehumidification method, which removes water from the air without heating it. My kiln, shown in the photo on p. 83, uses both methods. It has an auxiliary heater (three 100-w. light bulbs) that warms the air and an inexpensive household dehumidifier that removes the moisture.

Here's how my kiln works. Two fans circulate air through the stickered wood pile and then through the dehumidifier. The dehumidifier's chilled evaporator coils cool the air below its dew point, and condensation forms on the coils where it's collected and removed from the kiln to a storage bottle. Unlike an air conditioner, the dehumidifier increases the kiln's air temperature slightly, so additional heat is not always needed to maintain the 110° operating temperature. My kiln's thermostat setting is fixed at 110°F, and I lower the humidistat setting to control the rate of drying.

The key to successful lumber drying is close control of the rate of moisture removal. I monitor the rate daily by weighing the water collected in the bottle outside the kiln (1 gal. of fresh water weighs 8.32 lbs.). I then adjust the humidistat to extract water at the prescribed rate, which is listed in the lumber-drying schedule above right.

Reading a lumber-drying schedule: Kiln schedules are determined by years of trial and error. My schedule, which has proven safe for all domestic woods I've dried, is based on the size of the load, its equilibrium moisture content and the kiln's 110° operating temperature. As you read across a row in the kiln schedule, the number in the first column is the kiln air's relative humidity, expressed as a percent; the second column is the wood's equilibrium moisture content, also a percent; the third column is the maximum extraction rate, expressed in pounds of water per day per 100 sq. ft. of lumber surface (figured on one side of each piece). If the extraction rate is less than the level prescribed by the schedule, I lower the humidistat setting; if the rate is higher, I raise the setting.

My drying cycle takes about two weeks for thoroughly air-dried lumber and two months for nearly dry green lumber. Although a schedule with a faster drying rate may be possible for softwoods, I've never been in a hurry. To set up your own schedule, consult the Agriculture Department's *Handbook #188 Dry Kiln Operator's Manual,* available for $12 plus postage from Hardwood Research Council, PO Box 34518, Memphis, Tenn. 38184-0518.

Drying a load of lumber: After loading the kiln, I calculate the size of the load and conservatively estimate the moisture content of the wood. Since my wood is thoroughly air dried (some for years), I "guess" that it's at about 14% equilibrium moisture content (EMC). (You can measure moisture content using the method described in the sidebar below.) Then I close the kiln and set its humidistat at 80% relative humidity (RH). If, after a day or so, the kiln isn't extracting water at the prescribed rate, I lower the humidistat 5% RH per day until the extraction rate is on schedule. On the other hand, if the initial rate of extraction exceeds the 8-lbs.-per-day rate prescribed for 80% RH—an indication that my wood is wetter than I guessed—I slow the rate by raising the humidistat setting to 85% RH. I then reduce the humidistat in 5% RH increments while maintaining the prescribed maximum rate of extraction; each step takes from one day to five or six days. When the rate of extraction is less than 1 lb. per day, indicating about 5% EMC, I stop the drying cycle.

Conditioning the dried wood: After drying the wood as much as possible, I humidify (add moisture to) the chamber's atmosphere to equalize the moisture content throughout each board. For drying to take place, there must be a sufficient difference between a board's surface, or outer shell, and its core so moisture can move from the wet area to the dry area. If at the end of the drying cycle the unconditioned board's shell is still drier than its core, then there are internal stresses within the board and it is said to be casehardened. If you rip a straight casehardened board, the result may be two bent pieces.

To condition the lumber, I set the humidistat at 42% RH—the average humidity in Maryland, which is where the furniture I make will be used. The kiln schedule tells me that I want my wood to be at 7% EMC. The ultrasonic humidifier automatically comes on, and I let the kiln run at 110° until 42% RH is maintained for several days.

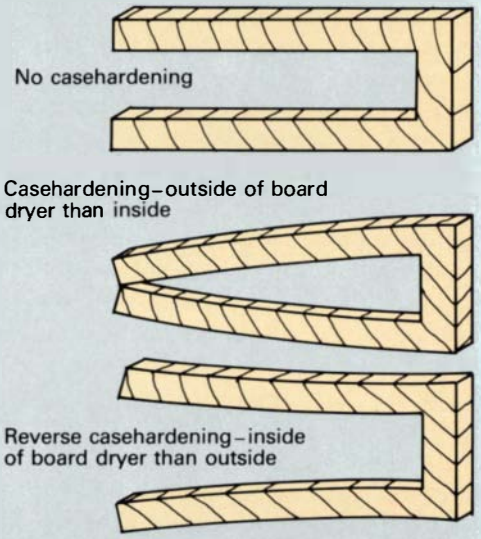
Testing for casehardening: Before removing the lumber from the kiln, I test for casehardening by crosscutting a ½-in.-thick section from the middle of a test piece at the front of the kiln. I bandsaw the piece into a tuning fork shape like the samples shown above. If the fork's tines remain straight, the sample isn't casehardened. If the tines turn inward, casehardening is still present, indicating the need for longer conditioning. If the tines turn outward, reverse casehardening is present, so I set the humidistat 5% RH lower and run the drying cycle for a few days. —*W.B.*

Lumber-Drying Schedule

Relative Humidity (%)	Equilibrium Moisture Content	Maximum Extraction Rate *
90	21.0	11
85	16.0	10
80	15.0	8
75	13.3	7
70	12.0	6
65	11.0	5
60	9.9	4
55	9.2	3
50	8.4	2
45	7.5	2
40	6.7	1
35	6.0	1
30	5.2	1

* Pounds per day per 100 sq. ft. of lumber surface (100 sq. ft. = 200 bd. ft. of 2-in.-thick lumber)

Testing for casehardening



Measuring wood's moisture content

You can measure a sample's moisture content without an expensive meter. Weigh a 1-cu.-in. sample (taken from the middle of a test piece) immediately after removing it from the kiln. Put the sample in a 225° oven for two hours and weigh the sample again immediately after removing it. Then subtract the oven dry weight from the original weight, divide the result by the oven dry weight and multiply that result by 100. The answer is the moisture content (percentage) of the board from which the sample was sawn. This test can be used to indicate the final EMC of your kiln load and to determine the humidistat setting when starting the kiln. —*W.B.*

electric baseboard heater, but be sure it can be safely operated in the kiln—even though the kiln is equipped to shut off automatically if it becomes overheated.

Wiring the kiln

The wiring diagram in figure 2 on the facing page shows the arrangement of the control circuit. Below the power plug is the kiln's temperature limit switch—the fail-safe switch. When the kiln temperature exceeds the 125° limit set on the sensor, its contacts open, shutting off power to the entire kiln and sounding the alarm. To shut off the alarm, I must turn off the main power switch, which controls every system except the alarm. The heater circuit consists of an on/off switch, another temperature sensor, which controls the heater, and an indicator light. The two fans run whenever the main power switch is on. The humidity control circuit is a humidistat and a relay. When the humidity is higher than the humidistat setting, a relay switch turns on the dehumidifier; when the humidity falls below the setting, the relay turns off the dehumidifier and turns on the humidifier.

I assembled the control circuit after installing all the mechanical components. First I prepared the pull box, which is shown in the photo at right and in figure 2, by removing only the necessary knockout plugs. Before screwing the box to the drying chamber's left end wall, I installed the three indicator lights and the relay. I had to enlarge the knockout holes in the box to install the lights.

Next, I connected the humidistat and the utility boxes that contain the sensors, switches and outlets to the pull box with metal (EMT) or plastic (PVC) conduit. I ran a ground wire through the plastic conduit. (The metal conduit serves as a ground.) I wired the runs to the heaters and fans with 16-gauge service cord, terminating it with a crimp lug. I used 14-gauge solid wire to connect the outlets for the humidifier and dehumidifier, making wire-to-wire connections with wire nuts inside the junction boxes.

Before installing the Fenwall fixed-temperature sensor, I set it to operate my kiln at 110° (a higher temperature may shorten the life of the dehumidifier). I tested the sensor following its directions by immersing its probe in a pot of hot water. This unit didn't come with its own box, but its mounting screws and probe match the two small holes and center knockout hole in the bottom of a surface-mounted 4-in.-sq. by 2-in.-deep electrical box. An adjustable sensor (in the kiln parts list) can be substituted for my fixed-temperature control sensor for adjustable-temperature operation.

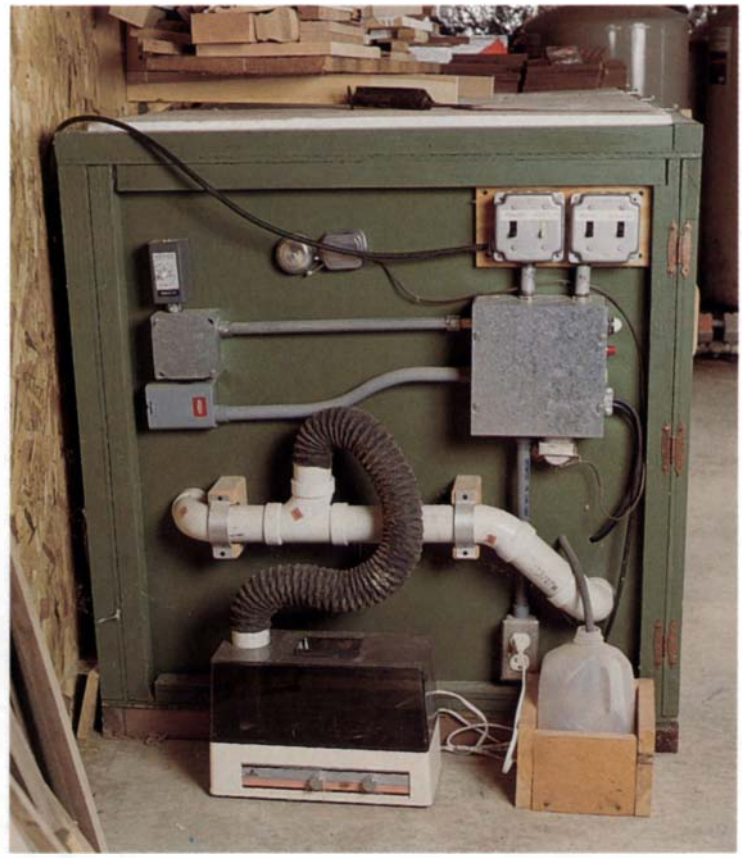
I set the temperature limit switch using the unit's right-hand pointer to trip at 15° above the kiln's 110° operating temperature. I also put an inexpensive combination thermometer/hygrometer behind a Plexiglas window in the equipment access door to monitor the kiln's atmosphere.

Checking out the system

After I completed the installation of equipment and wiring, I checked that everything was working properly. Before plugging in the kiln, I turned off the main power switch, the heat switch, the dehumidification switch and the humidification switch, and I set the humidity control to minimum. I also turned on the dehumidifier and set its humidity control to the lowest setting. I then turned on the humidifier and set its humidity control to maximum. Next, I plugged in the kiln and turned on its main power switch. As I anticipated, the humidifier, demumidifier and heater were off, both fans were running and air was flowing in the correct direction.

I then checked the drying circuits by turning on the heat switch and verifying that all three heater bulbs lit up. Next, I turned the humidistat dial to a level that was lower than my basement's relative humidity, shown on the access door gauge, and switched on the dehumidification switch—the dehumidifier began operating. I then turned the humidistat dial to a higher level than the relative humidity and checked that the dehumidifier turned off.

Next, I checked the humidification circuit by turning the dehumidification switch off and turning the humidification switch on. With the humidistat still set for a high level, the humidifier turned on. To confirm that the vacuum in the plenum was drawing in humidified air, I closed the kiln doors and held the end of the flexible hose about 2 in. away from the opening in the sanitary-T. Sure enough, vapors were drawn into the pipe duct. Finally, I rotated the humidistat to a level less than my basement's relative humidity and confirmed that the humidifier shut off. Everything checked out, and so I turned off all the switches and loaded 1-in.-thick pine into my kiln.



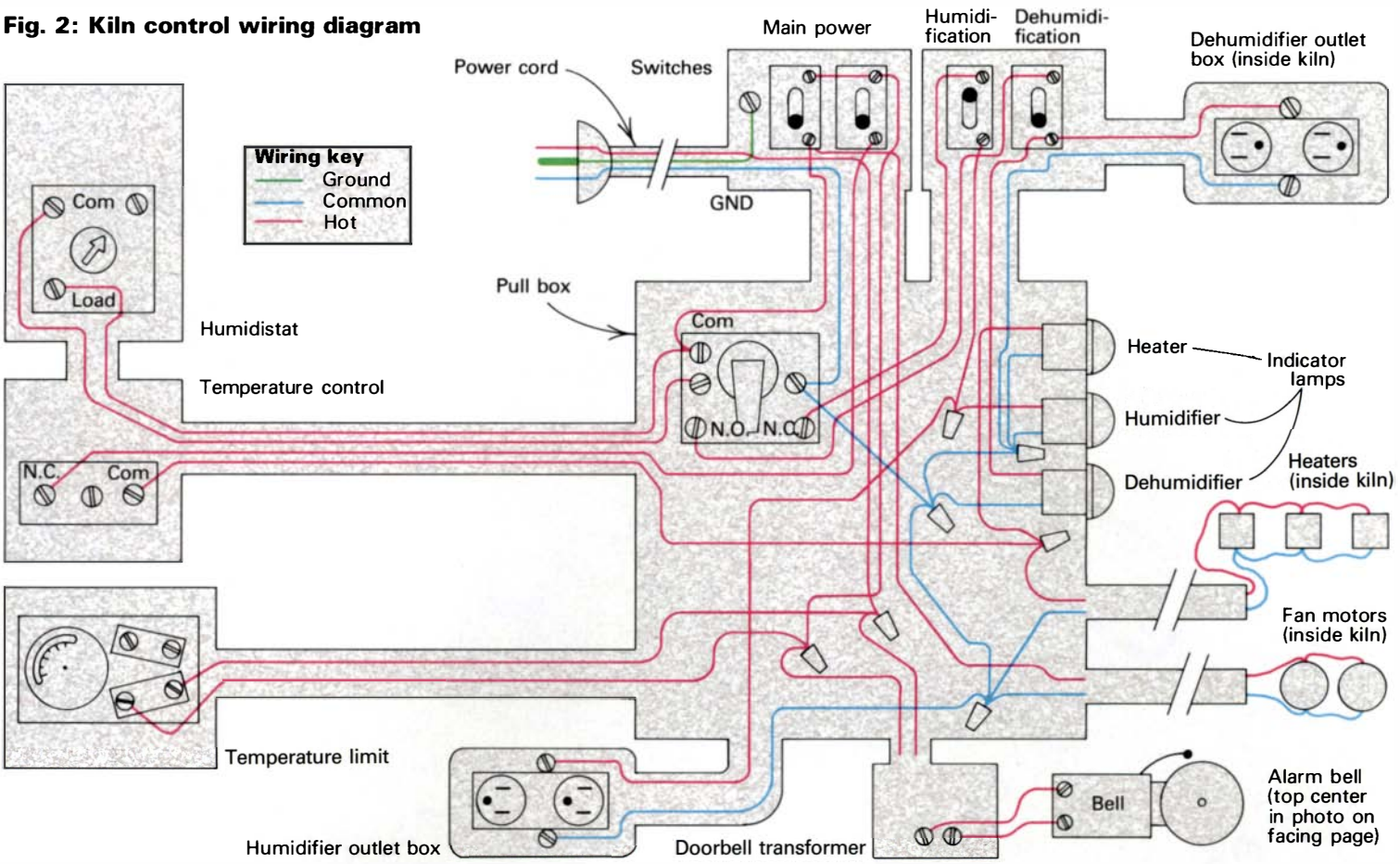
The kiln's controls are on its left end. *The pull box, which contains the humidistat relays and indicator lights, is beneath the manual switches. The temperature sensors and humidistat, which are mounted to the left of the pull box, monitor air in the kiln chamber. A dehumidifier inside the kiln collects the water extracted from the drying lumber and deposits it in the milk bottle via a rubber tube. And the humidifier, which is outside the kiln, releases moist air into the PVC pipe's air duct to condition the wood after the drying cycle and to prevent casehardening.*

Kiln maintenance

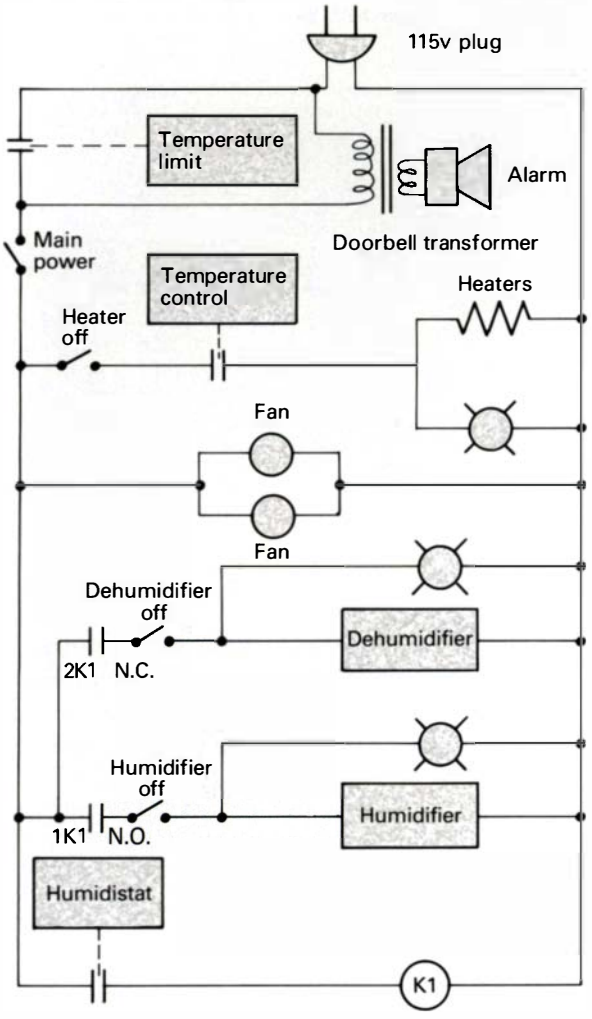
The following periodic maintenance is required. The dehumidifier's evaporator coils accumulate a coating of dirt and sawdust, so I clean the coils with a stiff brush (not a wire brush) and a vacuum. I also clean the dehumidifier's catch pan and blow out its drain hose. If I don't use distilled water in the humidifier, its transducer may accumulate scale, which I scrape off. And since the heater's light bulbs have short lives, I check that they light before starting a new load. □

William Bolf is an electrical engineer and amateur woodworker in Myersville, Md.

Fig. 2: Kiln control wiring diagram



Detail: Circuit diagram



Kiln Parts List

Quantity	Part Name	Part #	Source *
2	Dayton 10-in. fans	4C847	W.W. Grainger
(4)	Dayton 6-in. fans	4C720	W.W. Grainger
1	Fenwall fixed-temperature sensor	20310-0	Thermal Devices
(1)	Fenwall adjustable sensor	2010 MOD 30B	Thermal Devices
1	Dayton temperature limit switch	2E372	W.W. Grainger
1	Honeywell humidistat	H49A	W.W. Grainger
1	Ultrasonic humidifier		
1	18-pint dehumidifier		
1	Thermometer/hygrometer		K-Mart
1	Pull box, 8 × 8 × 4		
1	Utility box, 4 × 4 × 2		
	½-in.-dia. conduit, EMT or PVC		
	Conduit fittings		
4	Switches (15 amps)		
2	Double-switch boxes and covers		
2	Duplex outlets		
2	Single-switch boxes and covers		
1	Doorbell transformer		
1	24 VAC bell		
3	Indicator lights (red, amber, green)	2620T1, 2620T2, 2620T5	IDI
3	Porcelain lamp sockets		
	3-conductor service cord, #16		
5 ft.	2-in. PVC DWV pipe		
	Fittings for PVC pipe		
	14-gauge solid wire, 300v PVC ins		
	16-gauge stranded wire, 300v ins		
	Crimp lugs		
	Wire nuts		
1	Dayton relay, SPDT, 115 VAC coil	3X745	W.W. Grainger

( ) = Alternate parts
* = Parts without a source are available from hardware stores and/or home centers.

W.W. Grainger Co., 5959 W. Howard St., Chicago, Ill. 60648; (312) 647-8900

Thermal Devices, Inc., PO Box 560, Mt. Airy, Md. 21771; (800) 282-9100

IDI (Industrial Devices, Inc.) 260 Railroad Ave., Hackensack, N.J. 07601; (201) 224-4700

VAC = volts alternating current
DWV = drain waste vent
ins = insulation
EMT = electrical metallic tubing
PVC = polyvinyl chloride
SPDT = single pole, double throw

A Review of Fractional Calculators

Adding up the feet and inches

by Pat Warner

Electronic pocket calculators simplify computations involving dimensions and fractions, and hence help avoid drawing and layout errors that waste time and materials. These models incorporate various features, so be sure to match the calculator to the type of work being done.

Suppose you wanted to build a cabinet with a face frame and two inset frame-and-panel doors. How wide should each panel be? To answer that question, you need to consider a variety of factors, normally measured in fractions of an inch, including stile width, clearances and groove depths. Solving this type of problem, which woodworkers face every day, often leads to frustrating miscalculations that don't show up until you've miscut a critical piece and find yourself short of the exotic hardwood that's no longer available at your local lumberyard.

The problem arises because most woodshop measuring tools are fractionally based, and adding and subtracting fractions can be frustrating. Those who can rapidly convert between decimals and fractions in their head or who have made the conversion to the metric system can grab an ordinary decimal-based calculator to help avoid the mathematical errors that seem to crop up when adding fractions. However, there are now a handful of electronic calculators that are designed to handle fractions. Besides the basic math functions—addition, subtraction, multiplication and division—these devices also offer a variety of additional capabilities, such as calculating squares and square roots and rapidly converting fractions to decimals to meters and back again.

But despite their shared features, the five fraction-capable calculators I tried for this article have some important differences. Not the least of these is price: The calculators I tried varied from $28 to $110. Also, differences in the way the features are designed to be used make some calculators better suited to contractors, engineers, architects or woodworkers. To determine which of these devices was best suited to the average small woodshop, I worked

with the five calculators shown on the facing page. I also tried out a mechanical calculator that adds and subtracts fractions only (see the sidebar on the next page).

Although these were all the devices I could find from searching through woodworking periodicals and mail-order catalogs, they are not necessarily all the calculators available. As microchip technology develops, newer and cheaper calculators with even more features will become available. You'll get the most value for your money by selecting the calculator with the design and features that best meet your needs, whether those include checking your drawings or laying out sheets of plywood. Before I go into the individual calculators, let's look at some important features.

The basic features

All of the units can fit into a shirt pocket, and they all have a legible liquid crystal display (LCD). Three of them have plastic-and-metal cases, and two have all-plastic cases. I mention case materials because the all-plastic models may melt or deform in extreme heat, for example, in the direct sunlight on the dashboard of a truck. All of these calculators are powered by two button-cell batteries (like those found in watches) except the Radio Shack model, which is solar powered. The Pocket Handyman II, Construction Master II and Jobber III offer an auto shut-off feature.

A nice feature of all the calculators is their ability to convert between various standards of measurement quickly. All of the machines convert from fractions to decimals, but not all of them use the same decimal base. For cabinetmaking, working in decimal inches is more practical than working in decimal feet. For example, 5.5 decimal inches equals 0.45833 decimal feet, a number useful to a contractor, but not the average woodworker. The Radio Shack EC-317 only converts to decimal inches. The Inch Mate and Jobber III convert fractions to decimal feet, and they also convert to and from metrics. The Pocket Handyman II and Construction Master II offer the greatest flexibility by freely converting to or from fractions, decimal yards, feet, inches, meters, centimeters or millimeters.

Keying in data

The keyboard is the direct link to the brain of any calculator, and the feel, size and spacing of the keys affect the ease of punching in numbers. The size and spacing of the keys on all the calculators should be adequate for all but the most ham-fisted operators, but the Radio Shack unit has the largest keys. Although the Inch Mate has the smallest keys, there is a lot of space between them to help thick-fingered operators. The keys on all the calculators felt firm when I punched them, so I was sure the number had been entered.

Each calculator has its own quirks for keying in measurements, but once you learn the individual system, one calculator is probably not any better or worse than another. However, the type of measurement you most often work with will influence your choice. For example, the Inch Mate requires you to enter feet and inches even if you're working in inches and fractions. And the Jobber III requires you to enter zero for both inches and fractions even when you're working in feet. These extra keystrokes can become bothersome, especially if you're making lots of calculations.

Another factor to consider when choosing a calculator is the tolerances that you work to. Carpenters may be satisfied with calculations rounded off to the nearest 1/16 in. As a cabinetmaker, I usually work to 1/32 in. and frequently want to measure to 1/64 in. This makes the Jobber III (it works only in sixteenths) and the Inch Mate (its finest increment is sixteenths, although it also works in halves, quarters and eighths) unsuitable for my needs.

The user guides that come with the calculators are generally well written and have good examples of problems, functions and specific applications. These manuals, however, are no bigger than the calculators and feature very small print, making them hard to read. One final consideration before looking at the calculators individually is that each device, except for the Inch Mate, comes with a vinyl carrying case that holds the reference guide and helps protect the calculators from inevitable drops and dings.

Inch Mate

The Inch Mate (Digitool Corp., PO Box 12350, Aspen, Colo. 81612) sells for $50 and has an easy-to-read LCD. To operate this calculator, you must press the enter key after the foot dimension is keyed in and then again after the whole inch is keyed. You must press enter for feet and inches for every entry, even if only fractions are being entered, which I think slows down entering and might lead to errors. The enter key is not used to key in the inch fraction, which is slightly confusing. The mode key converts the display to decimal feet, meters or feet-inch-fractions (FIF). Depressing the clear (or clear entry) key converts the LCD to the FIF mode and flashes the feet symbol, prompting you to enter data beginning with the foot value.

The basic functions—addition, subtraction, multiplication, division, square and square root—can be applied to an FIF display or a dimensionless number (like a regular calculator) if the mode is in meters. This calculator does not have percent or pi as built-in functions. I think the Inch Mate would be of greatest value to contractors, builders and others who deal in area and length expressed in feet, inches or meters, and not in 1/64-in. increments, as I do.

Pocket Handyman II

The Pocket Handyman II (Calculated Industries, 22720 Savi Ranch Parkway, Yorba Linda, Cal. 92687) has a suggested retail price of $45 and a well-laid-out keyboard. The tool performs ordinary calculator functions, does conversions, and can compute in cubic, square or linear dimensions. To enter yards, feet and inches, you first key in the units and then punch the appropriate dimension key. Built-in functions include pi, square root, squared and inverse operations, and the device can perform chain calculations. The display is either dimensionless or expressed in meters or FIF. You cannot display mixed dimensions such as 2m 3 ft., but you can multiply 6.5m by 10 in. The answer is expressed in dimensions of the first entry. This feature might be particularly suited to woodworkers who use decimals and fractions in the same problem. The Pocket Handyman II accommodates any fractions, even 99/99. Answers, however, are expressed in the nearest 1/64 in. If 1/64 is too fine of a measurement, a "fraction-set" key will limit the denominator to a preset value of 2, 4, 8, 16 or 32, eliminating the need for the user to round off numbers as they are entered.

Woodworkers will particularly enjoy the straightforward conversion between metric, FIF, and decimal yards, feet and inches.

Construction Master II

The Construction Master II ($80), also made by Calculated Industries, picks up features where the Pocket Handyman II ends. All the Pocket Handyman II keys and functions are incorporated in the Construction Master II, but it includes other function keys, such as circle area, board foot and unit price; also, five keys are devoted to solving the hypotenuse and legs of right triangles. These latter keys will be useful to contractors determining roofing or stair dimensions.

The board foot conversion feature is especially useful; simply multiply all the dimensions of a plank (in metric or FIF), and then, after hitting the equal key, punch in the convert to and board feet keys for the answer. Another key, "by," simplifies the calculation even further, allowing fewer keystrokes to get the same answer.

Photos: Susan Kahn

Calculated Industries advised me that by the time this article is published, the Construction Master II will have been replaced with the Construction Master III, selling for $95. In addition to the above features, this new version will offer a 25% larger LCD, 52% larger keys and other features you might find useful.

Radio Shack EC-317

In addition to regular math functions, the Radio Shack EC-317 (Tandy Corp., Ft. Worth, Tex. 76102) fraction calculator offers percent and square root keys; the ability to work in yards, feet, inches and fractions; and the capacity for area and volume calculations—all for just $28. I liked the feel of the keyboard, and I got used to the display (shown in the photo on p. 88), which, when expressing FIF calculations, is somewhat more difficult to decipher than the displays on the other calculators. The solar-powered display works surprisingly well, even in dim light.

To enter a number in yards, feet and/or inches, the number and the corresponding dimension key must be pressed (e.g. 7 yds. is a two-keystroke process). Keying in a whole number and fraction requires entering a decimal point after the whole number—a convention I didn't find bothersome or confusing. Answers are expressed in the largest dimension entered, but in their simplest form in descending order; for example, 1 yd. + 4 ft. = 2 yd. 1 ft. The Radio Shack EC-317 can also work in an inch-and-fraction only format so that those using inch-fraction layout tools don't have to bother with conversions.

Fractions are entered by keying in the numerator, hitting the a/b key and then entering the denominator. For practicality, fractions from 1/99 to 99/99 can be entered, but answers are expressed to the nearest 1/64. Numerators greater than 99 can be entered, but the largest possible denominator is 99. This calculator cannot convert between units, and it can't handle metrics. However, two keys convert between decimal inches and fractions to the nearest 1/64 in.

Although this unit lacks some of the sophisticated features of the more expensive models, I found it to be particularly helpful and easy to use. One final note: I've been using the EC-317 in my shop for more than two years. I've dropped it many times and even lost it in a pile of chips, yet it continues to work perfectly. I have every reason to believe that you will find the other calculators similarly durable in a shop environment.

Jobber III

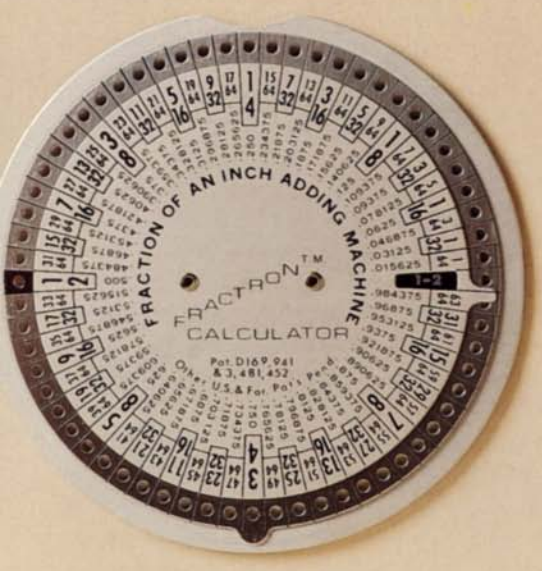
Of the five calculators reviewed, the Jobber III (Boyd Calculator Co., 6611 Burkett St., Houston, Tex. 77021) is the most expensive ($110). It has a 3/8-in.-high LCD, the largest display of the lot, which could be a big plus if you have trouble reading small displays. The keyboard, in addition to being the only one laid out horizontally, has numeric keys from 0 to 15 instead of 0 to 9. This will sometimes save keystrokes, such as when entering 15/16, but it also adds a measure of confusion because the 10 through 15 keys can't be used to enter feet or whole inches. The Jobber III is also the only calculator in my sampling to provide trigonometric functions and keys that calculate run, rise and slope.

This tool only calculates fractional inches in sixteenths. For example, to add 5/8 in. to 1/16 in., I had to convert 5/8 in. to 10/16 in., but this precludes working with fractions that can't be expressed in 1/16, such as 3/32 in. This can be perplexing when trying to fit frames, doors and drawers to openings, but carpenters cutting studs to length probably won't have a problem. Areas can be calculated in the feet-inches-sixteenths (FIS) mode, but there are no display cues to indicate whether the resulting figures are squared or cubed. Conversions from FIS to decimal feet, meters and back to FIS is a simple one-keystroke operation. Most of the manual is devoted to geometry, not cabinet-type arithmetic, which implies that this unit is targeted for architecture and construction trades.

After working with these five calculators, I think the Radio Shack EC-317 and the two units from Calculated Industries will best suit the needs of a cabinetmaker, due primarily to their ability to work down to 1/64-in. increments. If you work with metrics or want the convenience of single-button solutions for some of the more complicated calculations, then you should consider the Pocket Handyman II or the Construction Master II (III). But for $28, I think the Radio Shack EC-317 offers the most bang for the buck, and it has many features I need for designing and building furniture. □

Patrick Warner is a woodworker and instructor in Escondido, Cal.

A mechanical gizmo for adding fractions



The Fractron (Graphic Systems, PO Box 881, Melville, N.Y. 11747) is a mechanical calculator reminiscent of hand-cranked adding machines. The unit only adds and subtracts fractions (and equivalent decimal values), but play value is so high that you can almost overlook that deficiency.

The tool (left) is similar to a traditional slide rule, but instead of a linear slide, it has a rotating disc sandwiched between two fixed discs. The smaller front fixed disc has 1/64-in. calibrations. The larger rotating disc is also calibrated around its circumference in sixty-fourths and has holes punched in its rim corresponding to fractions from 0 in. to 1 in. The back disc, the largest of the three discs, has a finger notch in its perimeter to help track integers.

To operate the calculator, a pencil or stylus is inserted in a hole in the rotating disc adjacent to the corresponding fraction printed on the front disc. Clockwise rotation of the disc adds the fractions, and the answer is shown through a window in the front disc. A stop on the front disc limits pencil rotation. Subtraction is done similarly, but the disc is rotated counterclockwise. You are reminded to add or subtract the numeral 1 to the answer each time a small tab on the rotating disc hits your finger when it's placed in the notch of the back disc. A user's guide with examples is included.

The 4 3/8-in.-dia. aluminum disc assembly fits a bit snugly into most shirt pockets. The Fractron is available from many mail-order sources for about $13. Even though whole numbers have to be manipulated separately from their fractions, I think cabinetmakers will like this tool because it provides a quick and easy means to add or subtract a few fractions. —*P.W.*

Routing Hardware Mortises

Working with templates and guide bushings

by Jeff Greef

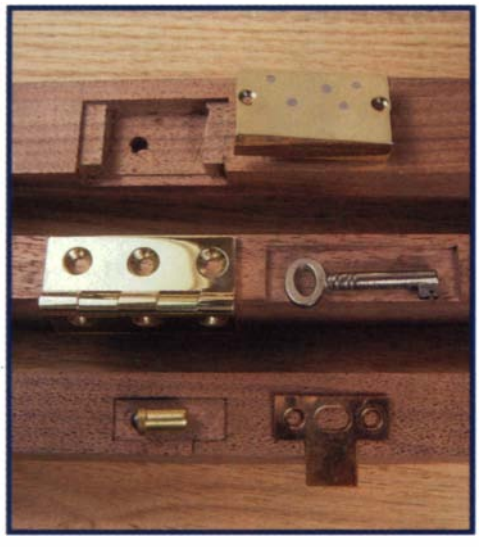
***Mortised-in hardware**, such as the hinge on the cabinet at left, can add a touch of class to a piece of furniture. Routing these mortises with templates and a guide bushing is faster and more consistently accurate than hand-chiseling them.*

For years I tried faster and more accurate joinery methods while ignoring the amount of time spent chiseling hinge and lock mortises by hand. Then I made a few template fixtures and used them to rout perfect-fitting mortises for hardware on five display cases. Each case has two butt hinges (shown above), one lock, one bullet catch and its strike plate (shown at right). My router method proved to be more than twice as fast as doing the same job by hand, even though I have to chisel the corners square. I've used the fixtures when installing the hardware in other cabinets, so I've amortized the fixtures' cost and the time it took to make them over several jobs. Further, the method I'll describe can be used for mortising just about any kind of door or cabinet hardware.

The setup

My method for routing hardware mortises is cost-effective, even for relatively small jobs, because the fixtures and setup are simple.

***Mortises for a lock, hinges and a bullet-catch strike plate** (shown from top to bottom in the photo below) are needed for most cabinets. Shopmade router templates are particularly helpful for cutting stepped lock mortises like the one shown below.*



Each fixture, like the one for routing a hinge mortise in the drawing on the facing page, has only two parts: a plywood template and a fence. The ¼-in.-thick birch-plywood template has a cutout that guides the router. A solid-wood fence screwed to the template aligns the template with the workpiece. The router's subbase is fitted with a guide bushing, which follows the edge of the cutout during mortising. Because the diameter of the bushing is larger than the router bit, the size of the cutout must be larger than the size of the desired mortise. (This is explained further in the sidebar on the next page.)

For routing most small-hardware mortises, I chuck a ¼-in.-dia. straight bit into my router and fit the subbase with a ½-in.-dia. guide bushing, as shown in the drawing. The relatively small-diameter cutter leaves a minimal corner radius, which means I don't spend much time chiseling the corners square after routing. By feeding the router slowly, you can avoid getting chatter, which

Top photo this page: Gary Weisenburger

Making a mortising fixture

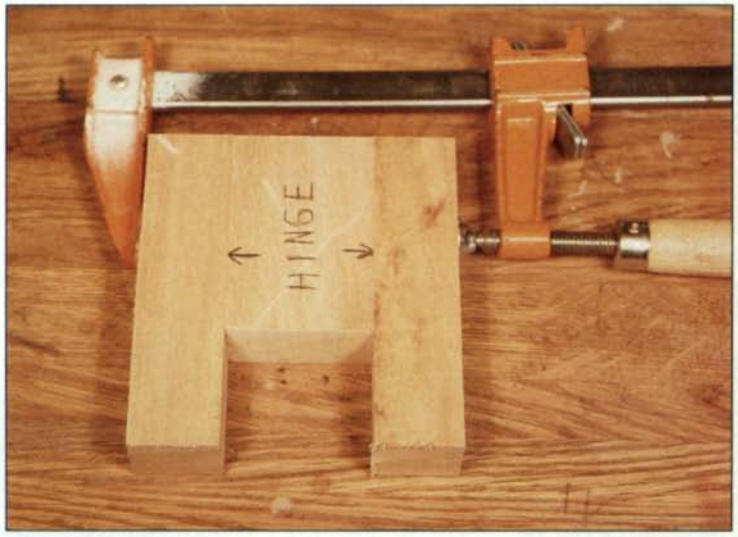
Although making a mortising fixture is easy, making the cutout in the template the right size takes some calculating. This is because the guide bushing that follows the cutout is larger in diameter than the bit. For example, a ¼-in.-dia. bit used with a ½-in.-dia. guide bushing results in a ⅛-in. offset. When laying out the cutout for the hinges, I add ⅛ in. to the width of the cutout and ¼ in. to its length, to allow for the offset at the hinge's ends.

To rout the cutout in the plywood fixture's working template accurately, I guide my router's flush-trimming bit with a solid-hardwood "primary" template, like the one in the left photo below. If I wear out the working template, I can rout the cutout in a new one with the U-shaped primary template.

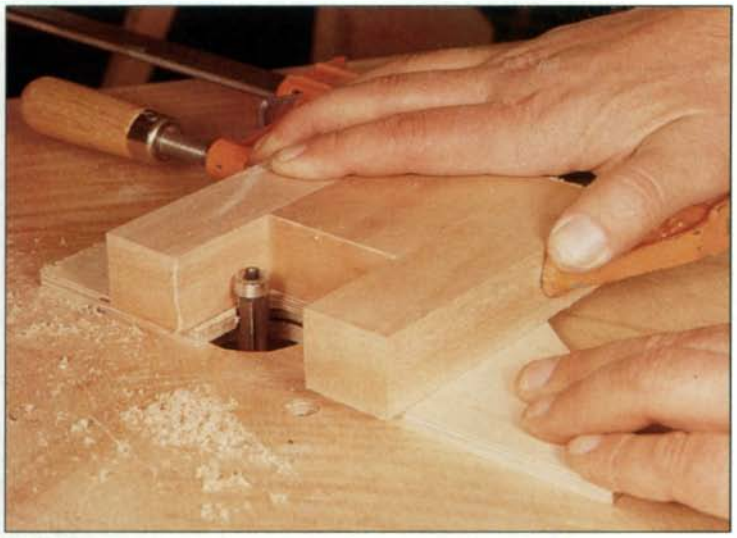
I make the primary template by gluing together three pieces of ¾-in.-thick hardwood. With this method, I can make the cutout exactly the correct size by simply ripping the center piece as wide as I want the length of the cutout in the working template to be. I then clamp side pieces onto the center piece to form the "cutout" in the primary template. The distance that the side pieces extend beyond the center piece equals the width of the cutout. I use hardwood so the flush-trimming bit's bearing won't wear out the primary template even if it gets used many times.

After clamping the three parts of the primary template together (shown below left), I trace the inside of the U-shape on my plywood working template and scroll-saw the cutout just inside the line. I then align and tack the plywood to the underside of the primary template, and trim the cutout on my router table with a flush-trimming bit, as shown below right.

To complete the working template, I clamp a fence on the underside of the plywood so it is aligned parallel with the back of the cutout. After checking that the distance between the back of the cutout and the fence is equal to the width of one hinge leaf plus the guide bushing factor, I screw the template to the fence. I use screws so I can move the fence to change the width of the mortise slightly, if it becomes necessary. *—J.G.*



***A hardwood primary template** is used to make the plywood working template. To ensure accuracy, two pieces are clamped alongside a center piece that is the exact size of the desired cutout.*



***The plywood working template's cutout** is first roughed out with a scroll saw. Then the template is tacked to the primary template, and the cutout is finished up with a flush-trimming bit.*

leaves a ragged edge that looks bad against the hardware.

Before routing, I always check that the cutter is in the exact center of the guide bushing. If it isn't, the mortise might end up too small or too large. If the bit is slightly off-center, I realign the subbase or shim the motor in its base with masking tape. I also reduce the error by keeping the same point on the guide bushing in contact with the template all the way around the cutout.

You could use a ½-in.-dia. flush-trimming bit with an overhead guide bearing. But its template would have to be 1¼ in. thick with a cutout the same size as the hardware, and you'd have to chisel more from the corners.

Routing hinge mortises

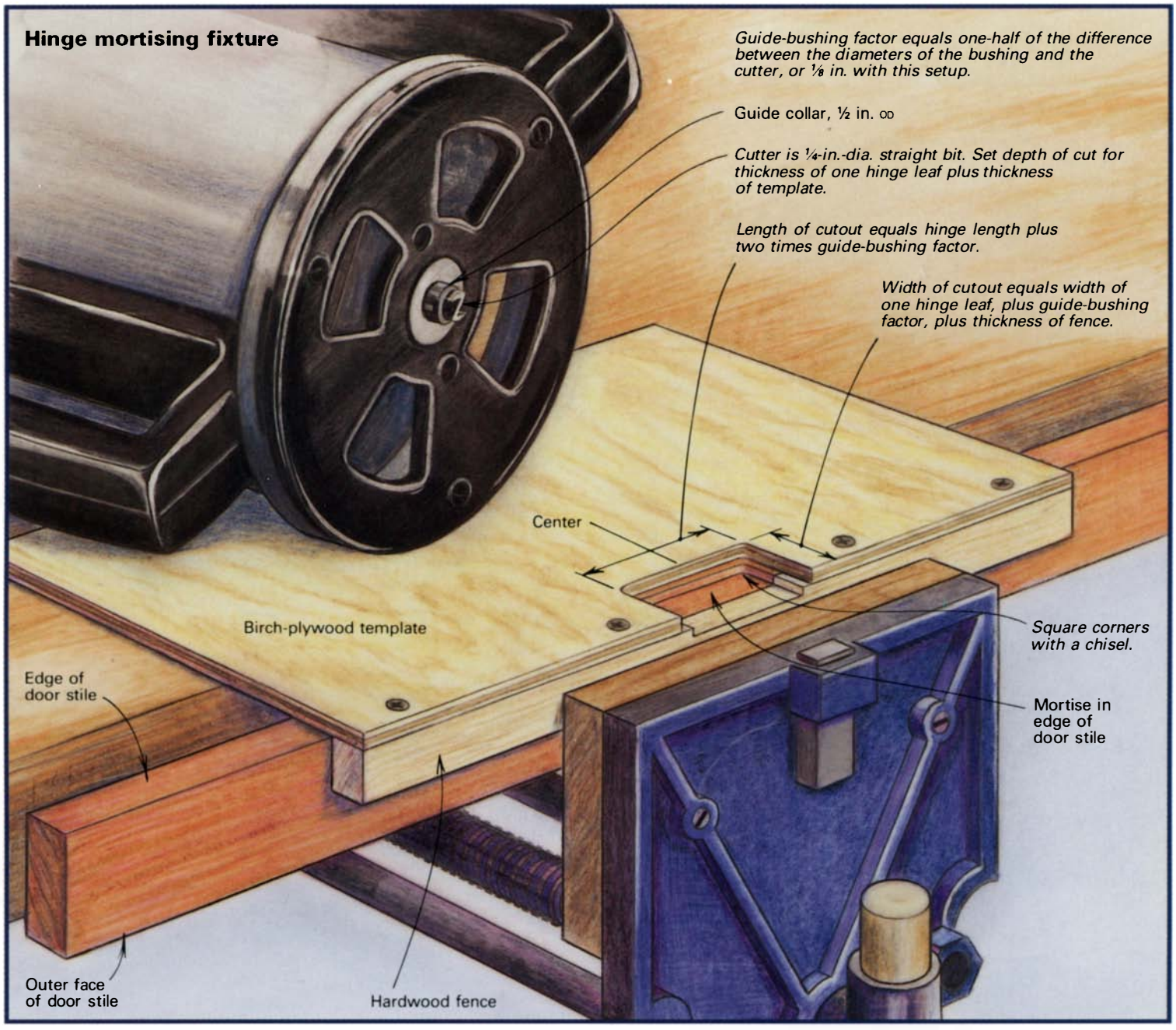
To rout a typical hinge mortise, say in a cabinet door, I first trim the door to fit its opening. Then I hold the door in place so I can mark a common center for both hinge leaves on the door stile and the frame. Next, I align the edge of the stile under a centerline I marked on the back of the template's cutout, hold the outer face of the stile against the fence, and clamp the fixture and stile in my bench vise, as shown in the drawing on the facing page. Then I set the router's depth of cut to the thickness of the hinge leaf, rout the mortise and chisel its corners square. Likewise, I rout the mortises in the case's face frame. I do this before assembling the case, since the router usually won't fit in the corners of the assembled case.

Since hardware dimensions may vary slightly (especially for higher-quality brasses that aren't stamped out), I measure each piece and make sure that the template fits the smallest one. For example, of the 10, 2-in.-long hinges that I recently used, two were 1/32 in. shorter than the others. This meant I had to chisel eight of the mortises to fit the full-length hinges. However, if it hadn't bothered me to have the two undersized hinges fit slightly loose, I could have saved time by making fixtures for the full-length hinges.

Routing a lock mortise

If I have a single, odd piece of hardware to install, carefully chiseling a complicated mortise can be time-consuming. This is especially true with cabinet-door locks, like the one in the top photo on the facing page. That small lock required a stepped mortise for the lock box, and a wider, longer and shallower step on the inner face and in the edge for the lock's L-shaped plate. If I have two or more pieces of hardware like this to

Photos except where noted: Author; drawing: Lee Hov



install, though, I make template fixtures and rout their mortises.

To rout a complicated lock mortise, I use two fixtures, both like the one for routing a hinge mortise. I make the mortise in three routing operations, changing cutter depth between each step. First, I rout the deep lock-box mortise in the inner face, aligning it under the template's cutout, which is sized to the box. Then, I exchange that fixture with one made for the strike plate (which has a wider, longer cutout), reset the depth of cut and rout the shallower plate mortise in the stile's inner face. To finish, I rotate the stile so its edge is up and clamp the fixture to it with a spacer between the stile and fence, to reduce the size of the cutout to suit the width of the mortise needed here.

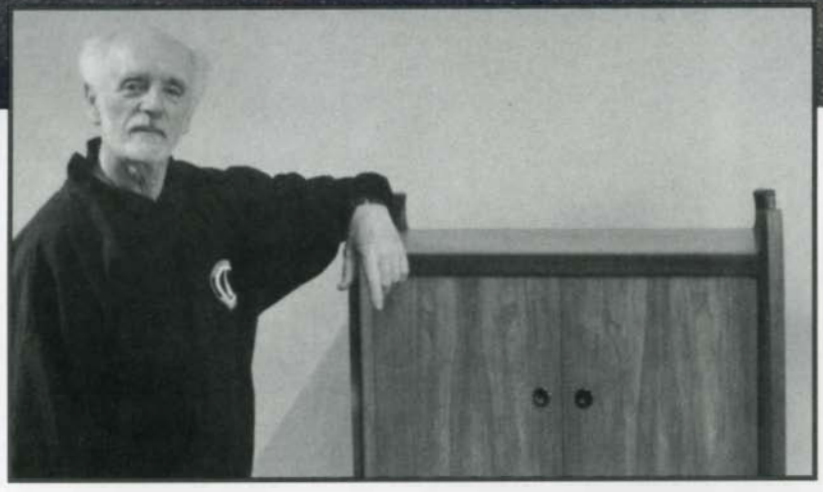
Sometimes I install the lock before fitting the door. If I do this, I increase the depth of cut on the edge by about 1/32 in. to set the lock slightly deeper than the surface. This allows me to fit the door and sand its edge. If you do this, remember to also increase the width of the mortises for the lock box and the inner plate.

Mortising for a bullet-catch strike plate

In addition to a lock, my display cabinet also has a bullet catch, which holds the door shut. After hanging and sanding the door, I fit the cylindrical bullet catch in a hole drilled in the center edge of the face frame, about 3 in. from the top of the door opening. Next, I rout the mortise for the catch's T-shaped strike plate, which is shown in the bottom of the bottom photo on p. 91. To locate the plate, I close the door and mark the location of the bullet on the edge of the door stile. Then I remove the door and rout the strike plate's mortise. The fence on the strike plate's template centers the plate's rectangular opening on the center of the door stile's edge. I put a paper shim between the fence and the stile's outer face to move the mortise slightly closer to the outside of the door. This ensures that the catch's spring-loaded ball forces the door tightly against its stop.

My strike plate's fixture has only a rectangular cutout for mortising the top of the T-shaped plate. After routing that mortise, I chisel the bottom of the T after fitting the top of the plate in its mortise. I don't know why I didn't make a T-shaped cutout in the template in the first place. But since the template is so easy to change, I'll try that next time.□

Jeff Greef is a woodworker and journalist in Santa Cruz, Cal.



James Krenov, left, has influenced a generation of furnituremakers. A show noting his 10th year of teaching at the College of the Redwoods included some of Krenov's new furniture, such as the cabinets far left and right above and the maple wall-hung cabinet in the center, as well as works by 13 of Krenov's former students. Paul Harrell's bubinga hall table and Jim Budlong's yew and rosewood jewelry box demonstrate the diversity of the student work.

James Krenov and Friends

Show spotlights work of students and teacher

by Jim Boesel

Inset photo: Mark Minor

James Krenov is as much a philosopher as he is a furnituremaker. People are drawn to his nine-month intensive course at the College of the Redwoods in Fort Bragg, Cal., the way that students of Zen are drawn to a renowned master: They come for a chance to have personal contact with the teacher. Krenov doesn't promise to teach anyone how to make a living as a craftsman, as some woodworking programs have recently begun to do. Instead, he teaches how to make an object that is right in and of itself—one that looks right, feels right and works right. But it is not so much the object that is the lesson, but the making of the object. A reverence for the craft of woodworking will most surely be his greatest legacy. Judging from the furniture of about a dozen of his former students that was featured in a show celebrating Krenov's 10th anniversary at the College of the Redwoods, the message is getting across. It will be through these students that Krenov will realize his ambition, as expressed in his third book, *The Impractical Cabinetmaker,* of bringing wider attention to a "quieter, richer expression" in the craft of woodworking.

The anniversary show, held at the Pritam and Eames Gallery in East Hampton, N.Y., last summer and aptly named James Krenov and Friends, was a reunion of sorts. Although Krenov has kept in touch with many of his former pupils, he was seeing some of their current work for the first time. Gallery owners BeBe and Warren Johnson also surprised Krenov by bringing in some of his older pieces to stand side by side with his current work.

Among Krenov's recent work were several cabinets on stands, such as those on the left and right sides in the photo on the facing page and the one in top, left photo above. He has treated this particular furniture form dozens of times, and he confesses to feeling no embarassment about returning to a design and working through it again. The maple wall-hung cabinet in the center of the photo on the facing page is another example of a recent variation on a familiar theme. But when the cabinet door is opened, a pleasant surprise is revealed: an uncharacteristic green painted interior.

As rewarding as it was for me to see Krenov's furniture firsthand after admiring it in books and magazines for many years, the other work in the show made the largest impression on me. While all the furniture bore certain Krenovian traits, such as careful selection of wood for grain and color or the telltale traces of having been finished using a scraper or handplane instead of sandpaper, most of the pieces were clearly the personal expressions of individual craftspeople. One

Krenov built the teak and oak cabinet above left in 1989. He had intended to have a bridge of some kind spanning across the top of the cabinet, but when he couldn't make it work visually, he decided it wasn't meant to be and left it off.

The dogwood blossoms that decorate Jivko Radenkov's cabinet (above right) seem to be blowing gently in the wind; a falling petal drifts slowly across the face of the elm-veneered door. As a student at the College of the Redwoods in 1983, Radenkov was hesitant to approach Krenov with the idea of using marquetry on one of his pieces, but he met no resistance and has gone on to refine this facet of his work.

The European hornbeam and white oak writing box below was built by Nicholas Goulden, of Fort Bragg, Cal. The top lifts off and can be turned over and replaced on the box to provide a leather writing surface.

Photos except where noted: Susan Kahn

The asymmetrical door on West Virginia furnituremaker David Finck's jewelry cabinet, left and above, is an eye-catcher. The door opens to reveal a stack of narrow drawers with bird's-eye maple grain running continuously across their fronts. The pearwood door pull, above right, is as beautiful and tactile as it is functional.

The woods are different, the scale of the scalloped door fronts are different and even the construction of the doors is different, but Tim Coleman, of Greenfield, Mass., has combined these elements into a unified whole piece, shown below. The curved maple door of the upper cabinet was glued up from solid wood, and the scallops were done by hand with a round-bottom plane. The scallops on the white oak doors on the lower cabinet were individually laminated over a form and then glued together with a solid-wood rib in between.

of the best examples of this individuality was the elm-veneered cabinet, shown in the top, right photo on the previous page, by Cleveland, Ohio, furnituremaker Jivko Radenkov. One would never expect a Krenov-inspired piece to be decorated with marquetry, but Radenkov has made it work by executing the marquetry with perfect precision and showing admirable restraint in the overall composition. William Walker, of Seattle, Wash., has also taken Krenov's influence and applied it to a decidedly non-Krenovian purpose. Krenov has always shied away from building chairs, but Walker's chairs (shown on this issue's cover) were flawlessly executed and passed my sit-down test with flying colors. One of my favorite pieces at the show was the wall-hung jewelry cabinet (shown in the three photos above) by David Finck, of Reader, W.V. Finck's asymmetrical treatment of the frame-and-panel door made me wonder why I'd never thought of that, and the inchworm door pull, which was made from pearwood and left unglued so that it swivels between its two mounting brackets, is as inviting and tactile as it is functional.

The afternoon that I visited the gallery, Krenov gave an informal slide presentation. One of the slides was of a clock that he had made many years ago that only had a second hand and an hour hand, but no minute hand. This was the perfect clock for a person reacting to a world in too much of a hurry, too obsessed with time. Krenov pointed out another interesting feature of this clock: The second hand tended to race downhill from the 12 to the 6 and then struggle slowly up the other side. However, he assured us that the clock was still right on time six months later. I always suspected that time was on Krenov's side, and I'll bet that the work of Krenov and his friends will still be right on 6 months or 60 years from now. □

Jim Boesel is executive editor of FWW. *New editions of James Krenov's books,* A Cabinetmaker's Notebook, The Fine Art of Cabinetmaking *and* The Impractical Cabinetmaker *have been published by Sterling Publishing Co. Inc., 387 Park Ave. S., New York, N.Y. 10016-8810. For information on classes, contact the College of the Redwoods woodworking program, 440 Alger St., Fort Bragg, Cal. 95437; (707) 964-7056.*

Decade in the Redwoods by Doug Noyes

A show of student work, marking the 10th anniversary of the College of the Redwoods woodworking program was held early last summer in the neighboring communities of Mendocino and Fort Bragg, Cal., where the college is located. Pieces for sale were displayed at the the Highlight Gallery in Mendocino, while those that were not for sale were shown at Daly's Department Store in Fort Bragg.

The work covered a wide spectrum of designs, from "Krenovian" wall cabinets to Post-Modern display cases, and was representative of the varied influences and backgrounds of the students. When Page Sullivan, whose display cabinet is shown in the bottom, right photo, entered the program, she had never owned a handplane or changed her tablesaw blade, and she used her only chisel to open paint cans. At the other end of the spectrum are Greg Zall of Fort Bragg and Chris Gans of Tucson, Ariz., whose cabinets are also shown here. Both men have eight years of cabintetmaking behind them, but Gans names Wendell Castle and Gary Knox Bennett as influences, while Zall credits Greene and Greene and the Shakers for his inspiration. □

Doug Noyes builds furniture in Guilford, Conn., and is a graduate of the College of the Redwoods.

Photo: Sean Sprague

The interior of Greg Zall's 5-ft.-tall Douglas fir and doussié cabinet, above, is lined with aromatic cedar.

Photo: Jess Shirley

Chris Gans' maple showcase, left, sits atop a 38-in.-high torsion box base.

Page Sullivan, of Taos, N.M., borrowed some of the lines for her cherry and spalted maple cabinet, below, from an old-fashioned jukebox.

Photo: Claude Sullivan

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50-180	1 HP Dust Collector	610	415
50-181	2 HP Dust Collector	885	610
37-154	Deluxe DJ-15 6" Jointer with 3/4 HP motor	1400	1079
34-670	10" motorized Table Saw	511	395
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34-444	Table Saw complete with 1-1/2 HP motor & stand	925	615
33-890	12" Radial Arm Saw 1-1/2 HP	1900	1339
17-900	16-1/2" Floor Drill Press	475	385
34-080	10" Mitre box	Xtra Special	198
33-050	8-1/4" Sawbuck	781	549
33-055	above Sawbuck comp w/legs	865	589
34-330	8-1/4" Table Saw 13 amp	343	229
32-100	Stationary Plate Jointer	645	285
36-040	8-1/4" Compound Mitre Saw	224	165
40-601	18" Scroll Saw w/stand and blades	999	709
28-560	16" Band Saw 1/2 HP 3 wheel	520	419
70-200	20" Drill Press	1050	775
34-915	30" Delta Unifence	385	239
34-897	50" Delta Unifence	525	295

DELTA EXTRA SPECIALS

28-245	14" Band Saw w/1/2 HP motor, open stand, xtra blade, cool blocks, & lamp	779	569
28-283	14" Band Saw w/3/4 HP motor, enclosed stand, and 50-274 mobile base	965	739
34-445	34-444 Table Saw complete w/30" unifence and 32-010 EMS system	1200	829

JET

JBS-14CS	14" Band Saw with stand	579	405
JTS-10	10" Table Saw w/stand 1.5 HP	585	469
JJ-8	8" Jointer 2HP	1325	975
DC-610	1 HP Dust Collector	321	225
DC-1182	2 HP Dust Collector	577	405
DC-1883	3 HP Dust Collector	850	635
JJ-4	4" Jointer 1/2 HP	398	295
JJ-6CS	NEW 6" Jointer 3/4 HP	579	405
JWP-12	12-1/2" Bench Planer 2 HP	628	355
JSG-6	6x48 Belt & 12" Disc Sander 1-1/2 HP	749	499
JDP-10	NEW 10" Bench Drill Press	209	179
JDP-14J	NEW 14" Bench Drill Press	339	269
JDP-17M	NEW 16-1/2" Bench Drill Press	399	365
JDP-14MF	NEW 14" Floor Drill Press	425	349
JDP-17MF	NEW 17" Floor Drill Press	465	379
JDP-20MF	NEW 20" Floor Drill Press	818	645

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
AL8-25	Automatic Level - 25X	829	585
AL8-22	Automatic Level - 22X	599	425
TR-300	Builders Transit - 24X	999	755

Msx636	FEIN Elec. Oscill. Triangle Sander	Sale	279
LPN672	PONY Air Palm Nailer w/glove	Sale	94.99

JORGENSEN CLAMPS

ADJUSTABLE HANDSCREWS

Item#	Jaw Length	Open Cap	List	Sale	Box of 6
#5/0	4"	2"	13.80	8.35	48.59
#4/0	5"	2-1/2"	14.80	8.95	51.99
#3/0	6"	3"	15.90	9.59	55.75
#2/0	7"	3-1/2"	17.10	10.35	58.95
#0	8"	4-1/2"	19.00	11.95	62.95
#1	10"	6"	21.76	12.99	71.49
#2	12"	8-1/2"	24.95	15.95	81.89
#3	14"	10"	31.61	18.95	104.95
#4	16"	12"	41.11	24.89	146.85

STYLE 37 2-1/2" Throat 1/4"x3/4" Bar

Item#	Jaw Length	List	Sale	Box of 6
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
3730	30"	14.70	9.55	53.45
3736	36"	16.05	10.39	58.75

STEEL I BAR CLAMPS

Model	Size	List	Sale
7224	24"	31.46	17.95
7236	36"	33.77	18.95
7248	48"	37.12	21.50
7260	60"	39.54	23.25
7272	72"	42.71	25.00

PONY CLAMP FIXTURES

Model		List	Sale	Lots of 12
50	3/4" Black Pipe Clamps	13.61	7.99	84.99
52	1/2" Black Pipe Clamps	11.37	6.50	69.50

STYLE J. ADJUSTABLE HANDSCREW KITS

Model	Jaw Length	List	Sale
J06	6	8.70	5.55
J08	8	9.75	6.19
J10	10	11.45	8.95
J12	12	14.15	9.95

PANASONIC CORDLESS

Model	Description	List	Sale
EY6205BC	NEW variable speed 12 volt Drill with 15 minute charger & case	390	219
EY6005B	12v cdls Drill w/1 hr chgr&battery	315	149
EY6200BC	12 volt 1/2" Drill-D handle with 15 minute charger & case	390	179
EY6281BC	v/sp 9.6v Drill w/15min chgr&cse	350	165
EY571B	Var. spd 9.6 volt Drill w/batt.&chgr	239	128
EY571BC	above Drill with case	275	139
EY6900BC	NEW 12 volt Hammer Drill variable speed with 15 minute charger	386	199
EY6207BC	NEW 12 volt 1/2" Drill w/keyless chuck var. spd w/15 min charger & cse	421	215

See HOLIDAY SPECIALS for FREE Battery Offer on Panasonic Cordless Drills

SENCO

SFN1	Finishing Nailer 1"-2"	377	275
SFN2	Finishing Nailer 1-1/2"-2-1/2"	571	395
SN4	General purpose 2" - 3-1/2"	685	475
LS2	Pinner 5/8"-1"	351	255
SKS	Stapler 5/8" - 1-1/2" 1/4" crown	351	255
LS5	Pinner 1" - 1-1/2"	399	285
PW-RFR	Roofer 1/2" - 1-1/4"	505	345
MW-RFR	Roofer 3/4" - 1-3/4"	490	359
SN325	Framing 1-7/8 - 3-1/4	665	455
M2	General purpose 1-3/8" - 2"	490	345

BOSTITCH

N80S-1	Stick Nailer	Special	389
N80C-1	Utility Coil Nailer	845	429
T36-50	Sheathing & Decking Stapler	595	305
N12B-1	Coil Roofing Nailer	845	429
N60FN-2	Finishing Nailer	625	345
T31	Brad Nailer	270	152
CWC100	1 HP Pancake Compressor	445	295

RYOBI

JP155	NEW Portable 6" Jointer/Planer	611	295
R500	2-1/4 HP Plunge Router	331	139
TS254	NEW 10" Mitre Saw	397	198
TS254K	above saw with accesory 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 var. speed	431	205
BE424	NEW 4"x24" v/spd Belt Sander	341	168
BE321	3"x21" v/spd Belt Sander	272	129
SC160	NEW 16" Bench Scroll Saw	261	139
TFD170VRK	NEW 9.6 volt variable speed Drill with 2 batteries, charger, & case	292	145
TFD220VRK	NEW 12 volt variable speed Drill with 2 batteries, charger & case	325	165
JM100K	NEW Biscuit Jointer with case	431	209
BT3000	NEW 10" Precision Table Saw	699	549
TS200	8-1/4" Compound Mitre Saw	310	159
S500A	1/6 sheet Finishing Sander	80	39
RS115	NEW 4-1/2" v/sp Rdm Orb Sndr	134	75
WC101	Woodcarving Blade for Grinder	Sale	38

HITACHI

Model	Description	List	Sale
TR6	Trimmer	175	99
TR8	Plunge Router 1-1/2 HP	215	119
TR12	Plunge Router 3 HP	354	169
TR12C	above Router with case	Sale	185
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 tooth	68	43
FREUD	15" Mitre Saw	745	375
FREUD	LU85M015 15" carb bld 108 tooth	180	105
C7SB	7-1/4" Circular Saw with case	214	109
C7BD	7-1/4" Circular Saw with case	230	129
F1000A	12" Planer/6" Joint w/carb blade	2835	1519
P12R	NEW 12" Portable Planer	1185	619
P12RA	NEW 12" Planer/6" Jointer	1555	819
DTC-10	3/8" cordless Drill 2 speed 7.2V	159	79
D10DFK	3/8" cordless Drill var. spd 9.6V	292	149
M12V	NEW 3HP variable speed Router	447	225

KRAUSE LADDERS

121482	12' Multimatic Alum. Ladder	185	128
121499	16' Multimatic Alum. Ladder	225	148

BAUER LADDERS

30404	4'Fiberglass 300 lb rating	155	60
30405	5' Fiberglass 300 lb rating	174	70
30406	6' Fiberglass 300 lb rating	190	80

BIESEMEYER

B-50	50" Commercial Saw Fence	329	295
T-SQUARE 28	28" Homeshop Fence	230	195
T-SQUARE 40	40" Homeshop Fence	242	209
T-SQUARE 52	52" Homeshop Fence	249	235

LEIGH DOVETAIL JIGS

D1258R-12" - List 329.00 - Sale 255.00
D1258R-24" - List 399.00 - Sale 299.00

LEIGH	INSTRUCTIONAL VIDEO	SALE	29.00
MMT 24"	24" Mortise & Tenon Attachment	199	165

PORTA NAILER

401	Porta Nailer complete	265	189
501	Face Nailer complete	265	189

We stock Genuine Porta Nails

LAMELLO

TOP 10	"Simply the Best"	699	559
STANDARD 10	"Professionals Choice"	499	399

WEDGE

SM-TR2	2 FT Teak Level with sensor	120	105
SM-TR4	4 FT Teak Level with sensor	150	125
SM-TR6	6 FT Teak Level with sensor	180	155
SM-PR2	2 FT Pro Level with sensor & case		99.95
SERIES 200	NEW 2 FT Level with sensor		53.95

BLACK & DECKER

Model	Description	List	Sale
1166	3/8" Drill 0-2500 rpm 4 amp	106	65
4011	1/4 sheet Palm Sander	82	59
2600	3/8" Drill rev. 0-1200 rpm 4.5 amp	142	84
1180	3/8" Drill rev. 0-1200 rpm 5 amp	182	104
1321	1/2" Spade hdle Drill 450rpm 7amp.	277	155
1349-09	1/2" Timberwolf Drill 2 speed	489	279
2037	Drywall Gun 0-4000 5.0 amp	175	97
2038	Drywall Gun 0-2500 rpm 5 amp	175	105
2054	Tek Gun 0-2500 5.0 amp	260	147
2050	Tek Gun 0-900 5.0 amp	270	155
2660	Drywall Gun 0-4000 4.5 amp	138	89
2663K	3/8" v/spd 9.6 volt Drill comp w/cse	239	148
2661K	NEW 13.2 volt cdls Drill w/cse	445	245
2664K	NEW 3/8" cdls 9.6V Cyclone Drill	240	148
2665K	NEW 3/8" cdls 12V Cyclone Drill	280	178
6247	4" Grinder 10,000rpm 5 amp	125	77
2750	4-1/2" Grinder 10,000rpm 6 amp	138	84
3030	7-1/4" Circular Saw 13 amp	155	89
2695	8-1/4" "Super Sawcat" Circ Saw	265	158
2700	7-1/4" Worm drive Saw 13 amp	255	145
3157	Orbital var spd Jig Saw 4.5 amp	220	145
1703-1	10" Mitre Saw w/73-770 blade&bag	350	178
1707	8-1/2" Crosscut Mitre Saw	829	445
79-032	Workmate 200, 23#	120	79
79-033	Workmate 300, 28#	135	95
79-034	Workmate 400, 35#	175	115
3057	7-1/4" "Sawcat" Circ. Saw w/brake FREE w/above Saw : 2-73-717 18 tooth Carbide Piranha blades	Sale	129
2684	7-1/4" "Pro Sawcat" Circular Saw FREE w/above Saw : 3-73-717 18 tooth Carbide Piranha blades	Sale	143
2694	7-1/4" "Pro Sawcat" Circular Saw w/blade FREE w/above Saw: 3-73-717 18 tooth Carbide Piranha blade	Sale	154

"BULLET" Drill Bit Sets

14890	8 pce titanium 1/16"-1/4" w/index	35	17.35
14350	11 pce steel 1/16"-1/4" w/index	32	17.35
14753	13 pce black oxide 1/16"-1/4" w/index	40	23.95
14353	14 pce steel 1/16"-1/2" w/index	58	33.50
14356	21 pce steel 1/16"-3/8" w/index	95	59.95
14761	21 pce blackoxide 1/16"-3/8" w/index	100	55.00
14359	39 pce steel 1/16"-1/2" w/index	179	98.00

FREUD SAW BLADES

Model	Description	List	Sale
LU72M010	Gen Purp. A.T.B. 10" - 40 tooth	68	37
LU81M010	Gen Purp. Tr Chip 10" - 40 tooth	76	44
LU82M010	Cut-off 10" - 60 tooth	90	47
LU84M011	Combo 10" - 50 tooth	76	40
LU85M010	Super Cut-off 10" - 80 tooth	112	58
LM72M010	Ripping 10" - 24 tooth	66	38
LU73M010	Cut off 10" - 60 tooth	82	45
LU87M010	Thin Kerf 10" - 24 tooth	70	39
LU88M010	Thin Kerf 10" - 60 tooth	86	45
LU91M008	Compound Mitre 8-1/2"-48 tooth	67	43
LU85M015	Super Cut-off ATB 15"-108 tooth	175	105
LU98M010	Ultimate 10" - 80 tooth	125	69
LU89M010	Non-ferrous metal 10" - 72 tooth	102	58
PS203	Gen Purpose 7-1/4" - 24 tooth	30	9.99
PS303	Plywood 7-1/4" - 40 tooth	42	14.99
SD306	6" Dado - Carbide	215	109
SD308	8" Dado - Carbide	229	117
F0	#0 - 1-3/4" x 5/8" Bisc. 1000 Qty	32	27
F10	#10 - 2-1/8" x 3/4" Bisc. 1000 Qty	32	27
F20	#20 - 2-3/8" x 1" Bisc. 1000 Qty	34	29
FA	Assorted Biscuits 1000Qty	34	29
WC104	4 piece chisel set w/case 1/4"-1"	63	39
WC106	6 piece Chisel set w/case 1/4"-1"	85	52
WC110	10 pc Chisel set w/cse 1/4"-1-1/2"	140	82
FB107	7 piece Forstner bit set 1/4"-1"	86	54
FB100	16 piece Forstner bit set w/case	331	165
94-100	5 pc Router bit door system w/cs	319	159
JS100	Biscuit Jointer w/cse & $30 rebate	333	159
FT2000	3-1/4 HP Plunge Router-$30 rebate	350	179
EB100	Edge Banding Machine-$30 rebate	409	229
FRT2000	Wood Router Table	275	169
CE82	Planer with case & carbide blades	245	135

THE NEW "TK" BLADE SERIES

TK203	7-1/4" Framing - 24 tooth	31	17
TK206	10" Framing - 24 tooth	38	25
TK303	7-1/4" Finishing - 40 tooth	38	22
TK306	10" Finishing - 40 tooth	46	27
TK903	7-1/4" Combo - 30 tooth	33	19
TK906	10" Combo - 50 tooth	52	27

AEG

HBSE-75S	3"x21" Belt Sander var. speed	279	169
312486	Sanding Frame for above sander	125	85
ABSE15	12V cdls 1/2" Drill var. speed	409	229
BSPE100	Top Handle Jig Saw	269	164
FSPE100	Barrell-grip Jig Saw	244	157
VSR500	5" Random Orbit Sander	220	135
VSR600	6" Random Orbit Sander	230	139
VSK600K	VSR600 with metal case	255	154

DREMEL

1571	15" Hobby Scroll Saw	139	90
1371	13" Scroll Saw 0.9 amp	184	119
1671	16" Scroll Saw 1.65 amp	278	185
1631	1" x 30" Bench Belt Sander	130	84
1731	1" x 30" Belt/5" Disc Sander	178	115
3950	Variable Speed Moto-Tool Kit	127	89

Piranha Carbide Tooth Saw Blade

Model #	Diameter	# Teeth	List	Sale
73-707	7-1/4	35	31.00	16.85
73-718	8	22	19.95	10.75
73-716	6-1/2	18	13.70	7.35
73-756	6-1/2	36	32.45	17.45
73-717	7-1/4	18	13.90	7.99
73-737	7-1/4	24	17.20	9.29
73-757	7-1/4	40	31.30	16.79
73-758	8	40	46.68	25.25
73-759	8-1/4	40	44.65	24.99
73-719	8-1/4	22	19.65	11.95
73-739	9	30	34.45	18.69
73-769	9	60	72.75	39.49
73-715	5-1/2	16	13.70	7.99
73-704	7-1/4	18	21.00	11.39
73-740*	10	32	32.98	15.95
73-770*	10	60	67.02	29.95
73-711	10	50	65.08	29.95

*Receive one FREE 73-717 7-1/4" 18 tooth Piranha carbide blade when you buy 2 10" Piranha carbide blades - any combination
73-770 60 tooth 29.95
or
73-740 32 tooth 15.95

ELU by Black & Decker

3338	2-1/4 HP Plunge Router var. spd	427	259
3337	2-1/4 HP Plunge Router	379	239
3303	1 HP Plunge Router	275	165
3304	1 HP v/sp Plunge Router	292	185
3375	3-1/8" Universal Planer 7.2A	313	159
3380	Biscuit Jointer w/cse &1000 biscuits	542	258
4024	3x21 var. spd Belt Sander	322	199
4029	4"x24" Belt Sander	519	345
4015	1/2 sheet Sander 3.0 amp	210	129

READER SERVICE NO. 56

TOOLS ON SALE™ - AMERICA'S LOWEST PRICED TOOLS

KIT SPECIALS

SAW KITS

Model	Description	Special Sale
1581VSK	Bosch Top handle Jig Saw with case & 30 Bosch blades	185
1582VSK	Bosch CLIC barrel grip Jig Saw with case & 30 Bosch blades	185
C8FBK	Hitachi 8-1/2" slide Compound Saw with Freud LU91M008 carbide blade	485
C15FBK	Hitachi 15" Mitre Saw with Freud LU85M015 carbide blade	475
34-080K	Delta 10" Mitre Saw with Freud LU85M010 80 tooth carbide blade	250
FTB	Freud Trio of 10" Carbide Blades: LM72M010, LU84M011 & LU85M010	130
3810K	Skil 3810 10" Mitre Box and 60 tooth carbide blade	239
TS254K	Ryobi 10" Mitre Saw with accessory kit and Black & Decker 73-770 60 tooth blade	245

SANDER KITS

7334K	Porter Cable 5" Random Orbit Sander w/case & 1 roll 100X & 1 roll 150X discs	152
7335K	Porter Cable 5" v/spd Rndm Orb Sander w/case & 1 roll 100X & 1 roll 150X discs	162
7336K	Porter Cable 6" v/spd Rndm Orb Sander w/case & 1 roll 100X & 1 roll 150X discs	169
330K	Porter Cable 1/4 sheet sander with 1 roll of 80X and 1 roll 120X paper & dispensor	92
BE321K	Ryobi 3x21 variable speed Belt Sander with Ryobi sanding frame	172
1273DVSK	Bosch 4x24 variable speed Belt Sander with Bosch stand	219
1273DVSR	Bosch 4x24 variable speed Belt Sander with Bosch sanding frame	275

CORDLESS DRILL KITS

6012HDWH	Makita 2 speed Drill kit with clutch Includes: extra battery & holster	159
6092DWH	Makita variable speed Drill Kit Includes: extra battery & holster	163
6093DWH	Makita variable speed Drill Kit with clutch Includes: extra battery & holster	167
9850K	Porter Cable 9850 Drill Kit Includes: extra Porter Cable battery	169
9851K	Porter Cable 9851 keyless Drill Kit Includes: extra Porter Cable battery	169
9852K	Porter Cable NEW 9852 Drill Kit Includes: extra Porter Cable battery	188
9853K	Porter Cable NEW 9853 keyless Drill Kit Includes: extra Porter Cable battery	188
9854K	Porter Cable 1/2" cordless Drill Kit. Includes: extra Porter Cable battery	198
0402-1K	Milwaukee variable speed Drill Kit Includes: Extra Milwaukee battery	215

BISCUIT JOINER KITS

555K	Porter Cable Plate Biscuit Joiner with case & 1000 assorted biscuits	192
JS100K	Freud Plate Biscuit Joiner with case & 1000 assorted biscuits	186
JM100KK	Ryobi Plate Biscuit Joiner with case and 1000 assorted biscuits	235
1605-02K	Skil Plate Biscuit Joiner with case and 1000 assorted biscuits	145

PLANER KITS

22-540K	Delta 12" Bench Planer with set of extra Delta Planer blades	415
JWP-12K	Jet 12" Bench Planer with set of extra Jet Planer blades	378
AP-10K	Ryobi 10" Bench Planer with set of extra Freud Planer blades	375

EXCLUSIVE HOLIDAY SPECIALS

The following items come with FREE merchandise

PONY CLAMP

Item	FREE MERCHANDISE	Sale Price
50 Clamp (buy lot of 12)	2 sets of 7456 Clamp Pads	84.99
52 Clamp (buy lot of 12)	2 sets of 7456 Clamp Pads	69.50

BLACK & DECKER

	FREE MERCHANDISE	
2664K cordless Drill	11 piece "Scorpion" Bit & Nut Driver Set	148
2665K cordless Drill	11 piece "Scorpion" Bit & Nut Driver Set	178
4011 Sander	36 Sheets of Assorted Sandpaper	59
3057 Saw	Two 73-717 Piranha Carbide Blades	129
2684 Saw	Three 73-717 Piranha Carbide Blades	143
2694 Saw	Four 73-717 Piranha Carbide Blades	154

ELU

	FREE MERCHANDISE	
3338 Router	1/4" Collet	259
4024 Sander	Sanding Frame	199
4029 Sander	Sanding Frame	345
3380 Biscuit Joiner	1000 assorted Biscuits	258

BOSCH

	FREE MERCHANDISE	
3283DVS Sander	5 Assorted Sanding Discs	98
1581VSB Jig Saw	10 Blades in Plastic Case	140

HITACHI

	FREE MERCHANDISE	
TR12C Router	Plastic Case	185
F1000A Planer/Joiner	Carbide Blade Set	1519

RYOBI

	FREE MERCHANDISE	
JM100K Biscuit Joiner	100 Biscuits	209

SKIL

	FREE MERCHANDISE	
2735-04 cordless Drill	Leather Holster	135
any 7-1/4" Saw	7-1/4" 18 tooth Carbide Blade	See Skil Section

PANASONIC

	FREE MERCHANDISE	
EY6205BC or EY6005BC or EY6200BC or EY6207BC	Extra 12 volt Panasonic Battery	See Pansonic Section

FREUD

JS100 Biscuit Joiner	$30.00 Factory Rebate	159
FT2000 Router	$30.00 Factory Rebate	179
EB100 Edge Banding Machine	$30.00 Factory Rebate	245

SEE NEXT PAGE FOR MORE SPECIALS!

PORTER CABLE

ROUTERS

Model	Description	List	Sale
630	1 HP Router 6.8 amp	190	135
690	1-1/2 HP Router 10 amp	240	134
691	1-1/2 HP Router D handle	260	142
518	3 HP Router 5 speed	560	339
520	3 HP 15 amp Router 2 handle	510	335
695	1.5 HP Router/Shaper	335	204
696	Heavy Duly Shaper Table	185	119
100	7/8 HP Router	175	118
5060	"Stair Ease" Stair Templet	200	139
5061	"Stair Ease" Hard Wood Templet	210	145
5008	Dovetail Template kit	105	88
5009	Mortise & Tenon Jig	60	53
43451	Carbide bit for 5009 jig	29	14.95
7308	Laminate Slitter	195	129
693	1-1/2 HP Plunge Router	295	165
6931	Plunge Router Base	120	75
5116	Omni-Jig	400	249
7310	5.6 amp Laminate Trimmer	150	85
7312	5.6 amp Offset Base Lam Trimmer	215	119
7319	5.6 amp Tilt Base Lam Trimmer	170	105
97310	Laminate Trimmer Kit complete	345	185

NEW ROUTERS

7518	3-1/4 HP 5 speed	475	259
7519	3-1/4 HP 2 handle	410	224
7536	2-1/2 HP 2 handle	355	199
7537	2-1/2 HP "D" handle	375	209
7538	3-1/4 HP Plunge Router	410	224
7539	NEW 3-1/4 HP var. spd Plunge Router	475	265

SANDERS

Model	Description	List	Sale
351	3"x21" Belt Sander without bag	245	134
352	3"x21" Belt Sander with bag	255	139
360	3"x24" Belt Sander with bag	330	177
361	3"x24" Belt Sander without bag	310	169
362	4"x24" Belt Sander with bag	345	184
363	4"x24" Belt Sander without bag	330	179
503	3"x24" Belt Sander w/bag Worm Drive	550	349
504	3"x24" Belt Sander Worm Drive	535	339
330	1/4 sheet Palm Sander	105	55
7400	NEW 7" Vertical Grinder 12 amp	250	149
7401	NEW 7" Polisher 8 amp	260	154
7403	NEW 6" Power Paint Remover 8 amp	280	164
7402	NEW 7" Vertical Disc Sander 8 amp	250	149
305	7" Disc Polisher 2000 rpm	235	149
505	1/2 sheet Orbital Pad Sander	210	112
9505	**505 Commemorative Edition** brushed steel 1/2 sheet Sander with oak case	Super Sale	135

RANDOM ORBIT SANDER

7334	5" Pad size 6000 rpm	210	119
7335	5" Pad var. speed 2500-6000 rpm	230	129
7336	6" Pad var. speed 2500-6000 rpm	235	134

NEW DUST COLLECTION SYSTEM

For 5" and 6" Random Orbit Sanders

73333	Dust Collection Kit: 73340 Hood and 39332 1-1/2" x 80" Plastic Hose	Sale	24.50
73340	Dust Collection Hood	Sale	8.95
39332	Dust Collection Hose	Sale	16.59

SAWS

Model	Description	List	Sale
315-1	7-1/4" Top handle 13 amp Circ. Saw	210	116
9315-1	315-1 comp. w/case & carbide blade	240	129
617	7-1/4" Pushhandle Circ. Saw 13 amp	210	116
9617	617 comp. w/case & carbide blade	240	133
368-1	8-1/4" Top handle Circ. Saw 13 amp	230	149
314	4-1/2" Trim Saw 4.5 amp	240	138
9314	above Saw with case	265	149
345	6" Saw Boss 9 amp	180	99
9345	345 comp. with case & carbide blade	220	124

DRILLS

7738	3/8" var. speed Hammer Drill 6 amp	205	135
97738	above Hammer Drill with case	225	139
7750	1/2" var. speed Hammer Drill 6 amp	240	154
97750	above Hammer Drill with case	260	159
7554	1/2" D-handle Drill 500 rpm	255	175
7556	1/2" Right Angle 330/700rpm Drill w/cse.	330	215
7511	0-1000 rpm 3/8" v/spd Drill 5 amp	200	112
7514	0-750 rpm 1/2" var. spd Drill 5 amp	210	117
7515	7514 with keyless chuck	215	122
666	0-1200 rpm 3/8" var. speed Drill 4 amp	200	125
9614	1/2" D handle Hammer Drill w/case	315	209
7557	3/8" variable speed angle Drill	280	179
621	0-1000 rpm 3/8" var. speed Drill 4 amp	170	98

DRYWALL GUNS

7545	0-2500 rpm Drywall Gun 5.2 amp	185	114
7540	0-4000 rpm Drywall Gun 5.2 amp	180	109
659	0-4000 rpm Drywall Gun 4 amp	140	89
7399	Drywall cutout unit 5.6 amp	140	79
43218	3/16" bit for 7399 unit	Sale	6.25

JIG SAWS

Model	Description	List	Sale
548	Heavy Duty Bayonet Saw worm gear	295	189
9548	above Saw with case	320	195
7549	NEW Top handle Jig Saw	250	149
7649	NEW Barrel-grip Jig Saw	250	149
18291	**Steel case for above Jig Saws**	Sale	21.00

RECIPRO SAWS

9627	Recipro Saw 2 speed 8 amp	235	132
9629	Recipro Saw variable speed 8 amp	250	135
9637	NEW Full var/spd Recipro Saw 8 amp	250	135
9647	TIGER CUB Recipro Saw	195	115

PLANERS

320	Abrasive Plane 3 amp	190	113
9118	Porta Plane w/carbide cutter & case	360	195
367	3-1/4" Planer 6.5 amp	250	159
9652	Versa-Plane w/carbide cutter & case	460	299

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9850	12 volt 3/8" Drill with case 0-400 rpm	240	135
9851	9850 with keyless chuck	240	135
9852	12 volt 3/8" Drill w/cse 0-400/0-1000 rpm	210	159
9853	9852 with keyless chuck	210	159
9854	12 volt 1/2" Drill w/case 0-360 rpm	280	165
8500	12 volt battery for above Drills	62	37

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555	Plate Biscuit Joiner	315	165
5556	NEW Tilt Fence	60	45
5554	1000 Assorted Biscuits	Sale	29
5553	1000 #20 Biscuits	Sale	29
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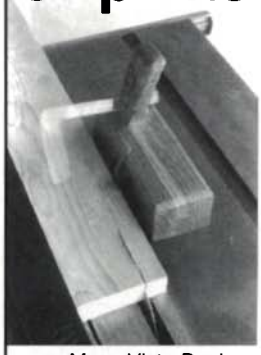

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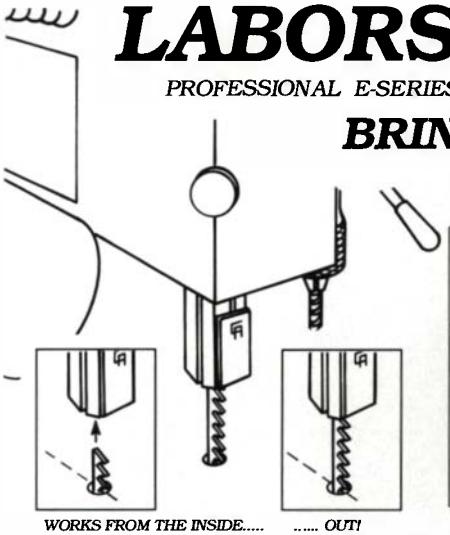

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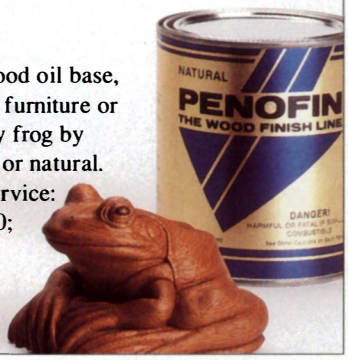

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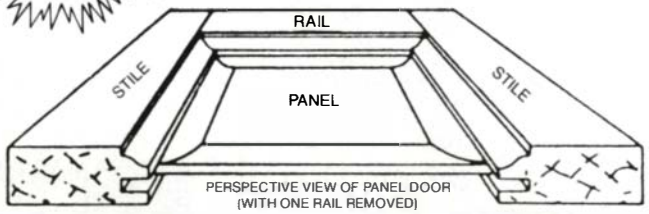

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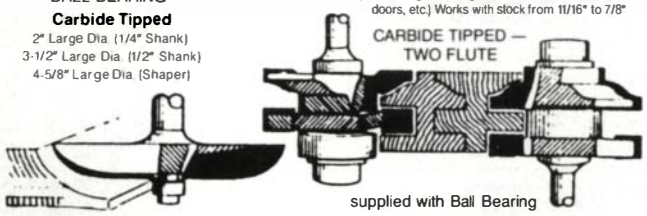

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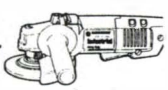

B&D 2750 10,000 rpm
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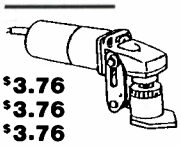

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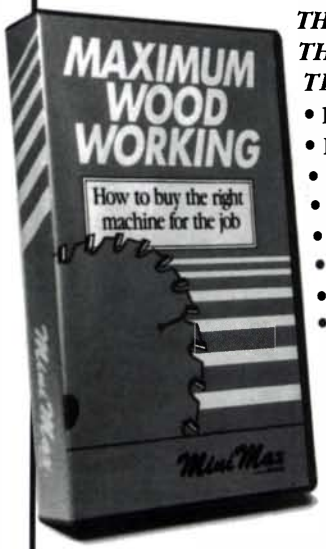

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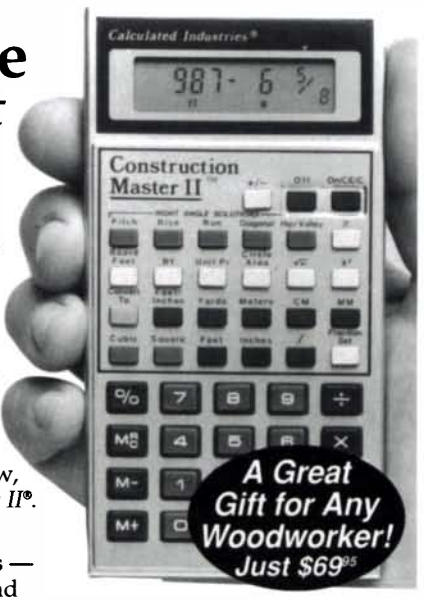

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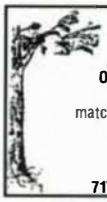
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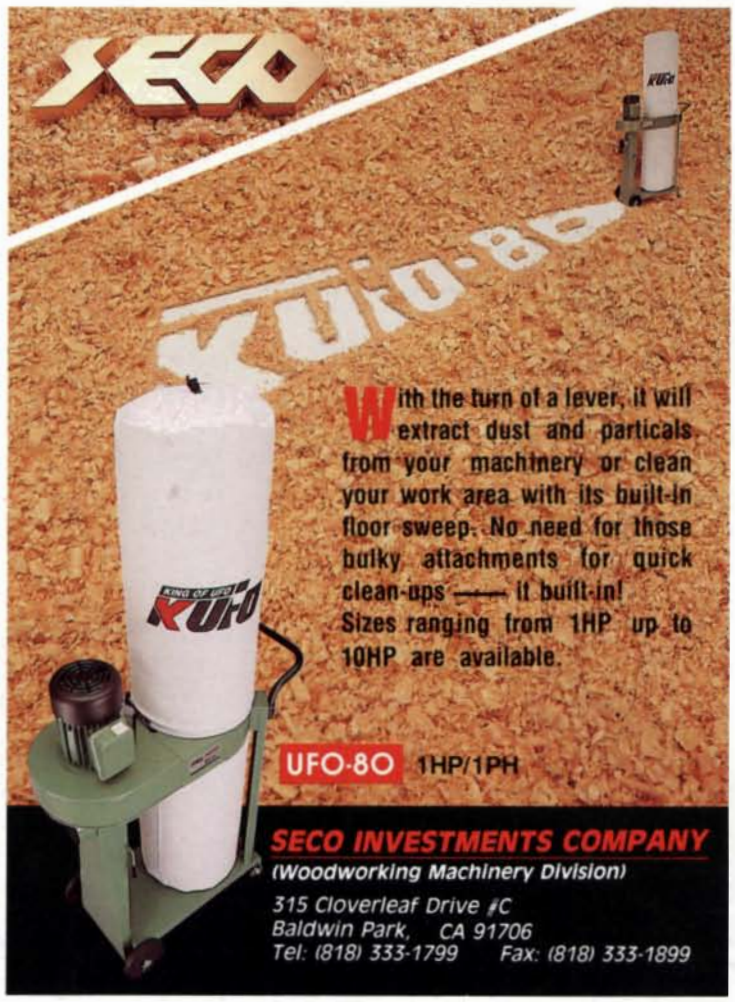

READER SERVICE NO. 55

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: **Exhibition**–The Turned Wood Vessel: A Group Exhibition, thru Oct. 31. Joanne Rapp Gallery/The Hand and the Spirit, 422 N. Marshall Way, Scottsdale, 85251. (602) 949-1262.
Show–8th annual Phoenix Harvest Festival, Nov. 1–3. Phoenix Civic Plaza. For info, contact Harvest Festival, 111 Liberty St., Petaluma, CA 94952. (800) 321-1213, (707) 778-6300.
Exhibition–International Lathe-Turned Objects Challenge IV, thru Nov. 3. Arizona State University Art Museum. Contact Wood Turning Center, PO Box 25706, Philadelphia, PA 19144. (215) 844-2188.
Show–9th annual Woodworking Show, Nov. 3. Los Olivos Adult Center, 38th and Devonshire, Phoenix. Sponsored by Arizona Association of Woodworkers. Contact Herb Miller, 1115 W. Stottler Dr., Chandler, 85224.

CALIFORNIA: **Conference**–The 2nd International Conference on Sawing Technology, Oct. 24–25, Berkeley Marina Marriott Hotel. For info, contact Dr. Ryszard Szymani, Wood Machining Institute, PO Box 476, Berkeley, 94701. (415) 943-5240.
Shows–16th annual San Diego Harvest Festival, Oct. 25–27, Convention and Performing Arts Center; 19th annual San Francisco Harvest Festival, Nov. 1–3 & 8–10, San Francisco Civic Center in Brooks Hall; 12th annual Los Angeles Harvest Festival, Nov. 15–17, Los Angeles Convention Center; 14th annual San Jose Harvest Festival, Nov. 22–24, San Jose Convention Center; 9th annual Anaheim Harvest Festival, Nov. 29–Dec. 1, Anaheim Convention Center. For info on all, contact Harvest Festival, 111 Liberty St., Petaluma, 94952. (800) 321-1213, (707) 778-6300.
Workshop–Building the Norwegian Pram, Oct. 26–27. National Maritime Museum Association, Building 275, Crissy Field, San Francisco, 94129. (415) 929-0202.
Exhibition–The California Duck, thru Oct. 27. San Francisco Craft & Folk Art Museum, Landmark Building A, Fort Mason, San Francisco, 94123-1382. (415) 775-0990.
Juried shows–Contemporary Crafts Market, Nov. 1–3, Santa Monica Civic Auditorium, Main St. at Pico Blvd., Santa Monica; Mar. 20–22, Fort Mason Center, Herbst and Festival Pavilions, Marina Blvd. at Buchanan St., San Francisco. For information, contact Roy Helms & Associates, 777 Kapiolani Blvd., Suite 2820, Honolulu, HI 96813. (808) 422-7362.
Show–Woodcarving of Nepal, thru Nov. 9. Juniper Gallery/Napa Art Center, 101-K S. Coombs, Napa Valley, 94559. (707) 224-8176.
Show–5th annual Tribal and Folk Art show, Nov. 9–10. Traditional American folk art. Santa Monica Civic Auditorium. Contact Christine Anderson: (213) 936-1447.
Show–A Trio of Woodworkers, Nov. 15–Dec. 31. Boxes by Lauren Yonan, Turnings by Vishnu and Marquetry by Dave Peck. Mendocino Gallery, 13500 S. Highway 101, Hopland, 95449. (707) 744-1300.
Shows–The Southern California Woodworking Show, Nov. 22–24, Los Angeles County Fairplex-Bldg. B, White & McKinley Avenues, Pomona, 91768; The Northern California Woodworking Show, Dec. 6–8, San Mateo County Fairgrounds, Fiesta Hall, 2495 S. Delaware St., San Mateo, 94403. For info, call (800) 826-8257, (213) 477-8521.
Seminar–Estimators, Dec. 6–7. San Diego. For info, contact Architectural Woodwork Institute, 2310 S. Walter Reed Dr., Arlington, VA 22206-1199. (703) 671-9100.
Juried show and competition–Palm Springs Wildlife Art Show and Competition, Dec. 7–8. Doubletree Resort Hotel, Palm Springs. Carving competitions and more. For info, contact John Fairfield, show chairman, 9340 Gregory St., La Mesa, 91942. (619) 462-0232.
Juried exhibition–California Design '92, Jan. 16–Feb. 16. Furniture and the decorative arts. Contract Design Center Gallery, San Francisco. For info, contact California Design, Baulines Crafts Guild, Schoonmaker Point, Sausalito, 94965. (415) 331-8520.
Juried show–Contemporary Crafts Market, May 29–31. Entry deadline: Nov. 15. Santa Monica Civic Auditorium, Main St. at Pico Blvd., Santa Monica. For more info, contact Roy Helms or Chris Andrews, Roy Helms & Associates, 777 Kapiolani Blvd., Suite 2820, Honolulu, HI 96813. (808) 422-7362.
Workshops–Furnituremaking with hand tools using traditional joinery, weekends. Call for schedule: Debey Zito, (415) 648-6861.
Workshops–Various workshops including Japanese woodworking, joinery and sharpening. Contact Hida Tool Co., 1333 San Pablo, Berkeley, 94702. (415) 524-3700.
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.

COLORADO: **Show**–Colorado Woodworking Show, Nov. 8–10. National Western Complex-Expo Hall, Humbolt St. & E. 47th Ave., Denver. For info, contact 1516 S. Pontius Ave., Los Angeles, CA 90025. (800) 826-8257, (213) 477-8521.
Juried exhibit–7th annual woodworking exhibition, thru Dec. 11. Colorado Springs Pioneers Museum, Colorado Springs. Contact John Lewis, Woodworkers Guild of Colorado Springs, 918 N. Royer St., Colorado Springs, 80903. (719) 632-8548.
Residency program–Anderson Ranch Arts Center's Studio Residency Program, thru May 15. Offers interactive environment for furnituremakers and designers. For info, 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.

CONNECTICUT: **Classes**–Turning Wood Bowls with Bill Gundling, Oct. 26–27; Windsor Chair Making with James Rendi, Nov. 1–3; Joinery Techniques with Robert March, Nov. 9–10; Woodturning with Al Stirt, Nov. 16–17. Brookfield Craft Center, Rte. 25, PO Box 122, Brookfield, 06804. (203) 775-4526.
Juried show–13th Annual Holiday Festival of Crafts, Nov. 2–Dec. 24. Free admission. Guilford Handcrafts Center, Rte. 77, Guilford. For info. call (203) 453-5947.
Exhibit–Painted Woodworking by Bill Gundling and Susan Perry, thru Nov. 10. Gallery, Brookfield Craft Center, Rte. 25, PO Box 122, Brookfield, 06804. (203) 775-4526.
Juried exhibition–23rd annual Celebration of American Crafts, Nov. 11–Dec. 23. Contact The Celebration, Creative Arts Workshop, 80 Audubon St., New Haven, 06510. (203) 562-4927.
Exhibit–Fine Art Furniture by Thomas Stender, Nov. 23–Jan. 6. South Norwalk Gallery, Brookfield Craft Center, South Norwalk. For info, call (203) 853-6155.

DELAWARE: **Fellowships**–Winterthur Library fellowships available. Application deadline: Dec. 1. For info, contact Dr. Katharine Martinez, Winterthur Research Fellowship Program, The Winterthur Library, Winterthur, 19735. (302) 888-4649.

DISTRICT OF COLUMBIA: **Exhibition**–Marketplace for 19th-Century Crafts, Nov. 1–3. Decatur Carriage House, 1610 H St. N.W., 20006. (202) 842-0920.
Courses–Conservation of Gilt Wood, Nov. 4–7; Structural Conservation of Furniture, Dec. 3–6. For info, contact Training Secretary, CAL/MSC, Smithsonian Institution, 20560. (301) 238-3700.
Exhibition–Work by J.L. Heatwole, Nov. 10–16. Senate rotunda of U.S. Capitol. Sponsored by Virginia Senator John Warner.
Exposition–4th Annual Washington Crafts Expo, Nov. 22–24. Featuring furnituremakers and woodworkers. Sheraton Washington Convention Center, Woodley Rd., N.W. at Connecticut Ave. For info, contact Mrs. Gayley Knight: (301) 951-1026.
Course–Furniture Conservation Training Program, beginning in Aug. Application deadline: Nov. 30. For info, contact Training Secretary, CAL/MSC, Smithsonian Institution, 20560. (301) 238-3700.

FLORIDA: **Festival**–17th annual Florida Heritage Festival, Nov. 6–10. South Florida Fairgrounds. Contact Fantasma Productions, 2000 S. Dixie Highway, West Palm Beach, 33401-7714. (407) 832-6397.
Meeting–Central Florida Woodworkers Guild, second Thursday of every month, Winter Park. For info, contact Ed Harte: (407) 862-3338.

GEORGIA: **Show**–International Turned Objects Show, thru Nov. 10. Morgan Cultural Center, Madison. For info, contact International Sculpture Center, 1050 Potomac St. N.W., Washington, DC 20007. (202) 965-6066.
Conference–Custom Woodworking Business Conference and Exposition, Nov. 22–24. Georgia World Congress Center, Atlanta. For info, contact John Berry, Trade Show Div., Vance Publishing Corp., 400 Knightsbridge Pkwy., Lincolnshire, IL 60069. (708) 634-2600.
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.

ILLINOIS: **Show**–20th annual Midwestern Wood Carvers Show, Nov. 2–3. Belle-Claire Exposition Hall, 200 S. Belt East, Belleville. For more information, contact Don Lougeay, 1830 E. D St., Belleville, 62221. (618) 233-5970.
Show–Artistry in Wood, presented by North Suburban Carvers, Nov. 2–3. Free admission. Chicago Botanic Garden, Education Center, Glencoe. (708) 835-5440.
Show–Chicago Area Woodworking World show, Nov. 22–24, Rosemont O'Hare Exposition Center, 9301 W. Bryn Mawr, Rosemont, 60018. For more information, contact Woodworking Association of North America: (800) 521-7623, (603) 536-3768.

INDIANA: **Show**–Tri State Woodcarvers Show, Oct. 26–27. Washington Square Mall, 1100 S. Green River Rd., Evansville. For info, contact Bob Koressel, 3901 Rose Ave., Evansville. (812) 424-2622.
Exhibition–The Art of the Fish Decoy, Nov. 25–Jan. 20. National Art Museum of Sport, Indianapolis. For info, contact Susan Flamm: (212) 977-7170.

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

MAINE: **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: **Show**–Baltimore/Washington Woodworking Show, Oct. 25–27. Pikesville Armory, 610 Reistertown Rd., Baltimore, 21208. For info, contact 1516 S. Pontius Ave., Los Angeles, CA 90025. (800) 826-8257, (213) 477-8521.
Conference–Chesapeake Area Woodturner's Conference, Oct. 25–27. Maryland Hall for the Creative Arts, Constitution and Greenfield, Annapolis. For info, call (301) 263-5544.
Exhibition–The Art and Fantasy of the American Carousel, Nov. 7–Jan. 12. Carved antique figures from 1880-1930. The Historical Society of Talbot County, 25 S. Washington St., Easton, 21601. (301) 822-0773.
Juried shows–Sugarloaf's 16th annual Autumn Crafts Festival, Nov. 22–24; Sugarloaf's 14th annual Winter Crafts Festival, Dec. 13–15. Montgomery County Fairgrounds, Gaithersburg. For info, contact Deann Verdier, director, Sugarloaf Mountain Works, Inc., 20251 Century Blvd., Germantown, 20874. (301) 540-0900.

MASSACHUSETTS: **Class**–Basic Oval Box Construction with Clifford Myers, Nov. 2–3. Hancock Shaker Village, PO Box 898, Pittsfield, 01202. (413) 443-0188.
Juried exhibition–Functional and practical studio furniture with which to live and work, thru Nov. 16. Contact Julie Mansfield, Society of Arts and Crafts, 175 Newbury St., Boston, 02116. (617) 266-1810.
Classes–Woodworking classes, throughout most of the year. Boston Center for Adult Education, 5 Commonwealth Ave., Boston, 02116. (617) 267-4430.

MICHIGAN: **Show**–Midwest-Grand Rapids Woodworking & Furniture Supply Fair, Nov. 7–8, Grand Center, Grand Rapids. For info, contact Trade Shows, Inc., PO Box 796, Conover, NC 28613. (704) 459-9894.

MINNESOTA: **Show**–Turned Wood by Dennis Elliott, Oct. 26–Nov. 29. Part of three-person show. Perspectives, 924 Nicollet Mall, Minneapolis, 55402. (612) 339-6076.
Show–The Twin Cities Woodworking World show, Jan. 17–19. Minneapolis Convention Center, 1301 S. 2nd Ave., Minneapolis. For info, contact Woodworking Association of North America: (800) 521-7623, (603) 536-3768.

NEVADA: **Show**–Reno Harvest Festival, Oct. 25–27. Reno Livestock Events Center. For info, contact Harvest Festival, 111 Liberty St., Petaluma, CA 94952. (800) 321-1213, (707) 778-6300.

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.

NEW JERSEY: **Exhibition**–Contemporary Furniture Makers of the American Northeast, thru Nov. 17. The Gallery, Bristol-Myers Squibb Co., Rte. 206, Princeton. (609) 683-6275.
Show–Super Crafts, Dec. 6–8. Garden State Convention & Exhibit Center, Somerset. For info, contact Creative Faires, Ltd., PO Box 1688, Westhampton Beach, NY, 11978. (516) 288-2004.

NEW MEXICO: **Juried show**–Southwest Arts and Crafts Festival, Nov. 7–10. Manual Lujan Building, New Mexico State Fairgrounds. For info, contact Southwest Arts and Crafts Festival, 525 San Pedro N.E., Suite 107, Dept. P, Albuquerque, 87108. (505) 262-2448.
Exhibition–Awards in the Visual Arts 10, thru Dec. 1. Albuquerque Museum of Art, History and Science. For info, call (202) 357-2700.
Classes–Woodworking classes. Northern New Mexico Community College, El Rito, 87520. (505) 581-4501.

NEW YORK: **Juried show**–Woodworking expo, Nov. 8–9. Ballston Spa. Entry deadline: Oct. 25. Sponsored by

Northeastern Woodworkers Association and Curtis Lumber Co. Contact Dave Bielawski, Curtis Lumber, 885 Rte. 67, Ballston Spa, 12020. (518) 885-5311.
Show–Woodworking World Albany show, Oct. 25–27. New Scotland Ave. Armory, 130 Scotland Ave., Albany, 12208. Contact Woodworking Association of North America, PO Box 706, Plymouth, NH 03264. (800) 521-7623, (603) 536-3768.
Exhibits–Group exhibition of art furniture, thru Oct. 26; Gaetano Pesce, Oct. 30–Nov. 30; Ed Zucca, Michelle Holzapfel and gallery artists, Dec. 5–Jan. 4; Thomas Hucker, Jan. 9–Feb. 1. Peter Joseph Gallery, 745 5th Ave., New York City, 10151. (212) 751-5500.
Show–Woodworking World Central New York State show, Nov. 1–3. New York State Fairgrounds, Horticulture Building, Syracuse, 13209. Contact Woodworking Association of North America, PO Box 706, Plymouth, NH 03264. (800) 521-7623, (603) 536-3768.
Workshops–Gilding with Susan Perry, Nov. 16; Bandsaw Boxes with Bill Gundling, Nov. 16–17. For info, contact Craft Student League, YWCA of the City of New York, 610 Lexington Ave., New York City. (212) 735-9732.
Workshop–Japanese Hand Tool Workshop with Robert Meadow, Nov. 16–17 and Dec. 14–15. The Luthierie, 2449 W. Saugerties Rd., Saugerties, 12477. (914) 246-5207.
Show–17th Harvest Crafts Festival, Nov. 22–24, Nassau Coliseum (indoors), Uniondale, Long Island. For info, contact Creative Faires, Ltd., PO Box 1688, Westhampton Beach, 11978. (516) 288-2004.
Exhibition–Swiss Folk Art: Celebrating America's Roots, thru Jan. 1. For more info, contact Museum of American Folk Art, Two Lincoln Sq., New York City, 10023-6214. (212) 595-9533.
Exhibit–The Art of the Keyboard: Rediscovering Pianos and Organs, thru Jan. 15. New York State Museum, Albany. For more information, contact University of the State of New York, State Education Dept., Albany, 12234. (518) 474-1201.
Classes–Various beginning and advanced woodworking classes. Constantine, 2050 Eastchester Rd., 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: **Fair**–28th Annual Piedmont Crafts Fair, Oct. 25–27. M.C. Benton, Jr. Convention Center, Winston-Salem. Contact Kelly Persons: (919) 725-1516.
Show–North Carolina Piedmont Woodcarver's annual show, Oct. 26. Statesville. For info, contact Jesse J. Wilkinson, 209 3rd Ave. N.E., Conover, 28613.
Seminar–Project Management, Nov. 15–16. Charlotte. Contact Architectural Woodwork Institute, 2310 S. Walter Reed Dr., Arlington, VA 22206-1199. (703) 671-9100.
Workshops and programs–Eddie Howard Wood, Nov. 15–Dec. 31; Wooden Boxes Workshop, Nov. 16–17; Christmas with the Guild, Dec. 8–31. For info, contact Southern Highland Handicraft Guild, PO Box 9545, Asheville, 28815.
Exhibit–Annual members' exhibit, thru Dec. 1. Folk Art Center, Blue Ridge Pkwy., Asheville. Sponsored by Southern Highland Handicraft Guild. For info, contact the guild at PO Box 9545, Asheville, 28815. (704) 298-7928.
Video course–Wood Technology, six-lesson correspondence course on the wood industry. For info, contact Vann Moore, Dept. of Wood & Paper Science, North Carolina State University, PO Box 8005, Raleigh, 27695-8005. (919) 737-3181.
Workshops–Woodworking and woodcarving workshops, year-round. Including woodcarving, more. 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: **Classes**–Use of Hand Tools: Planes and Chisels, Oct. 26; Traditional Joinery and Sharpening, Nov. 30. Instructor: Earl Richards. The Hardwood Store, 1813 Dalton Dr., New Carlisle, 45344. (513) 849-9174.
Workshops–Joinery, Nov. 2; Tables and Chess, Dec. 7; Doors, Drawers and Panels, Jan. 4; Chests and Cabinets, Feb. 1; Finishes, Mar. 7. Instructor: Earl Richards. Carriage Hill Farm, 7860 Shull Rd., Dayton, 45424. (513) 879-0461.
Exhibition–Design 1935-1965: What Modern Was, thru Nov. 17. The Toledo Museum of Art, PO Box 1013, Toledo, 43697. (419) 255-8000.
Exhibition–Awards in the Visual Arts 10, Dec. 15–Jan. 26. Toledo Museum of Art. Call (202) 357-2700.
Show–The Columbus Woodworking World show, Jan. 10–12. Veteran's Memorial Hall, 300 W. Broad St., Columbus, 43215. For info, contact Woodworking Association of North America: (800) 521-7623, (603) 536-3768.

OKLAHOMA: **Show**–Eastern Oklahoma Woodcarvers Association 7th annual Wonderful World of Wood Show, Nov. 8–9. Southroads Mall, 41st and S. Yale, Tulsa. For info, contact Lyle Washburn, show chairman, 2380 S. 65th West Ave., Tulsa, 74107. (918) 446-6701.

OREGON: **Show**–Oregon Woodworking Show, Nov. 1–3. Memorial Coliseum Complex-Convention Hall, Williams and Weidler Sts., Portland, 97227. For info, contact 1516 S. Pontius Ave., Los Angeles, CA 90025. (800) 826-8257, (213) 477-8521.
Festival–14th annual Portland Harvest Festival, Nov. 22–24, Memorial Coliseum, Portland. For info, contact Harvest Festival, 111 Liberty St., Petaluma, CA 94952. (800) 321-1213, (707) 778-6300.
Meetings–Guild of Oregon Woodworkers, third Friday of every month. For location, contact the Guild at PO Box 1866, Portland, 97207. (503) 293-5711.

PENNSYLVANIA: **Workshops**–Joinery Techniques, Finishing Techniques and Dovetail Joinery with Frank Klausz, Oct. 26–27; Chip Carving with Wayne Barton, Nov. 2–3; Traditional Shaker Oval Boxes with John Wilson, Nov. 8–9; The Tuning, Care and Use of Old Tools with Mike Dunbar, Nov. 16–17; Painted Furniture with Eli Rios, Nov. 23–24. For more information, contact Olde Mill Cabinet Shoppe, 1660 Camp Betty Washington Rd., York, 17402.
Workshops–Ellsworth School of Woodturning, Nov. 1–3, Nov. 15–17 and Dec. 7–9. Woodturning workshops for all ages and skill levels. Including applications of tool design, principles of sharpening, finishing, more. David Ellsworth School of Woodturning, Fox Creek, 1378 Cobbler Rd., Quakertown, 18951. (215) 536-5298.
Show and competition–8th annual William Rush Woodcarving and Wildlife Art Show & Sale, Nov. 2–3. Penn State Delaware County campus, Lima. For deadline and info, contact Bob Young, 736 Oak Way, Havertown, 19083. (215) 446-8945.
Juried show–15th annual Philadelphia Craft Show, Nov. 7–10, Philadelphia Civic Center, 34th St. and Civic Center Blvd., Philadelphia. For info, call Lisa Lloyd, Philadelphia Museum of Art, at (215) 787-5431.
Fair–State Craft Market, Nov. 9–10. Memorial Hall at York Fairgrounds, York. Work by members of the Pennsylvania Guild of Craftsmen. For info, contact Pennsylvania Designer-Craftsmen, PO Box 718, Richboro, 18954. (215) 860-0731.
Show–Woodworking World Central Pennsylvania show, Nov. 15–17. Pennsylvania Farm Show Complex, West Bldg., 2301 N. Camerson St., Harrisburg, 17110. Contact

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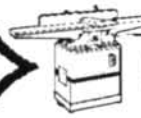

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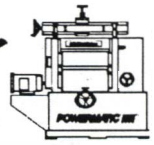

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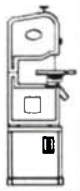

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7537	2-1/2 Hp D. Handle Router	375	209
7538	3-1/4 Hp Plunge Router	410	229
7539	3-1/4 Hp V/S Plunge Router	475	259
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352	3"x21" Belt Sander w/ Bag	255	129
360	3"x24" Belt Sander w/ Bag	330	174
361	3"x24" Belt Sander w/o Bag	310	166
362	4"x24" Belt Sander w/ Bag	345	184
363	4"x24" Belt Sander w/o Bag	330	179
503	3"x24" HD Belt Sander w/ Bag	550	339
504	3"x24" HD Belt Sander w/o Bag	535	329
330	Speed Bloc Sander 1/4" Pad	102	57
505	1/2 Sheet Pad Sander	210	112
9505	1/2 Sheet Commern. Sander	240	129
7334	5" Random Orbit Sander	210	119
7335	5" V/S Random Orbit Sander	230	129
7336	6" V/S Random Orbit Sander	235	134

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7515	1/2" HD V/S Drill 750 RPM	215	122
7540	0-4000 Drywall Screwdriver 5,2A	185	104
7545	0-2500 Drywall Screwdriver	185	104

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617	7-1/4" Push Handle Circular Saw	210	117
9617	7-1/4" Push Hdle w/Case & Carb. Blade	210	135
314	4-1/2" Trim Saw	240	125
9314	4-1/2" Trim Saw w/Case	265	148
345	6" Saw Boss 9A	180	99
9345	6" Saw Boss w. Case	220	124
9647	Tiger Cub Recip Saw w/Case	195	119
9637	Recip. Saw V/S w/Case 8A	250	135
7549	Top Handle Jig Saw	250	139
7649	Barrel Grip Jig Saw 4 8A	250	149

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23-880	8" Bench Grinder 1/2"	151	115
28-180	NEW Bench Band Saw	232	169
31-050	1" Belt Sander	104	78
31-080	1" Belt/5" Disc Sander	134	94
31-340	1" Belt/8" Disc Sander	268	184
31-460	4" Belt/Disc Sander	198	139
32-100	Plate Joiner	422	285
32-200	Boring Machine w/ 13" Spindle	1595	1149
34-080	10" Miter Saw	308	195
34-330	Deluxe 8-1/4" Bench Saw	343	235
36-220	10" Compound Miter Saw	350	235
40-150	15" Scroll Saw	179	119
40-560	16" 2 Speed Scroll Saw	266	184
43-505	1/2" Bench Router/Shaper	399	279
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28-245	14" Band Saw Open Stand w/lamp	779	499
28-283	14" Band Saw w/ Enclosed Stand w/ mobile base	965	659
31-730	6" Belt/12" Disc Sander	1393	999R
33-055	Deluxe Sawbuck w/ Legs	854	519
33-890	Deluxe 12" Radial Arm Saw	1908	1199
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34-444	10" Contractor's Saw	923	575
34-445	10" Contractor's Saw w/ 30" Unifence and EMS	1203	759
34-782	10" Unisaw w/ 52" Unifence and motor cover.	2206	1589R
36-751	10" Cab. Saw w/30" Unifence	1487	969
37-154	6" Precision Jointer w/ stand	1420	959
37-280	6" Motorized Jointer w/ stand	498	339
37-350	8" Precision Jointer w/ stand	1870	1339R
36-752	10" Cab. w/52" Unifence	1702	1046
40-601	18" Variable Speed Scroll Saw	1025	659
43-275	Onsrude #2003 Inv. Rtr.	3335	2500
43-355	1-1/2 Hp Wood Shaper	964	629
43-375	3 Hp HD Two Speed Shaper	2086	1489R
46-700	12" Variable Speed Wood Lathe	548	359
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50-181	2 Hp Dust Collector	885	549

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C10FA	10" Miter Saw	538	275
C12FA	12" Miter Saw	632	309
C15FB	15" Miter Saw	745	375
CR-10V	V/S, Orbital Recip. Saw	241	125
D10-DFK	3/8" Cordless Driver Drill 9.6 V	292	125
D10-DFK	3/8" Cordless Driver Drill w/extra battery	340	149
D10-V1	3/8" V/S Reversible Drill	148	89
F-20A	3-1/4" Planer w/Case	172	113
M8	7.3 amp, 1/4" Router	215	114
M-12V	3-1/4" Hp V/S Router	447	229
P-50	6-5/8" Planer	563	299
SV-12S A	4-3/8" Orbital Sander	80	48
TR-12	3 Hp 1/2" Router	347	175

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1272D	3"x24" Dustless Belt Sander	329	184
1273DVS	4"x24" V/S Belt Sander	370	199
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1604	1-3/4 Hp Router	236	122
1604K	1-3/4 Hp Router Kit	287	167
1606	1-3/4 Hp D-Hdle Router	273	148
1608	Lam. Trim Router	149	88
1609K	Lam. Installers Kit	309	173
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1611	3 Hp Plunge Router	386	199
1611EVS	3-1/4 Hp V/S Plunge Router	448	231
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0379-1	1/2" Close Quarter Drill	249	147
1676-1	HD Hole Hawg w/ case	449	244
3107-1	1/2" V/S Right Angle Drill w case	360	199
5371-1	1/2" V/S Hammer Drill Kit	335	184
5397-1	3/8" V/S Hammer Drill Kit	239	139
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LU88MO10	10" Thin Kerf	60	86	45
LU98MO10	Ultimate 10"	80	125	69
SD306	6" Dado-Carbide		215	109
SD308	8" Dado-Carbide		229	117
F0	1-2/4" x 5/8" Biscuit 1000 qty		32	27
F10	2-1/8"x3/4" Biscuit 1000 qty		32	27
F20	2-3/4"x1" Biscuit 1000 qty		34	28
FA	Assorted Biscuits		34	28
FB107	7 Pc. Forstner Bit Set		86	54
FB100	16 Pc. Forstner Bit Set		331	179
WC106	6 Pc. Chisel Set		86	52
WC110	10 Pc. Chisel Set		140	84
90-100	15 Pc. 1/4" Router Bit Set		324	169
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100	12" Planer 3 Hp, Mag. Start	2664	2100
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30-D	6" Belt/12" Disc Comb. Sander	1412	999
141	Deluxe 14" Band Saw 3/4 Hp	1557	1160
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Woodworking Association of North America, PO Box 706, Plymouth, NH 03264. (800) 521-7623, (603) 536-3768.
Juried exhibitions–Re-Awakening: A Celebration of Spring, May 2–June 7; deadline: Jan. 27. Also, Stories: The Narrative Art in Contemporary Crafts, Aug. 8–Sept. 20; deadline: Mar. 2. For more information, contact Luckenbach Mill Gallery, 459 Old York Rd., Bethlehem, 18018. (215) 691-0603.
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.

TENNESSEE: **Juried show**–5th annual Master Woodworkers show, Oct. 25–27; Candy Factory, Knoxville. Furniture and accessories. For deadline and info, contact Michael Perrin, Rte. 2, Box 195-A, Blaine, 37709. (615) 933-8436.
Workshop–Lumber Predryer Seminar & Workshop, Nov. 11–12. Gene Wengert conducts this course featuring procedures and techniques to increase grade yield while reducing losses. For more info, contact Ms. Billie McGregor, National Hardwood Lumber Association, PO Box 34518, Memphis, 38184-0518. (901) 377-1818.
Juried exhibitions–From All Directions, thru Dec. 14. Everything but the Kitchen Sink: Artists and the Kitchen, New Forms, New Functions, Feb. 27–May 16. Entry deadline: Dec. 12. Arrowmont School of Arts and Crafts, PO Box 567, Gatlinburg, 37738. (615) 436-5860.

TEXAS: **Show**–8th annual Charity Show and Sale of the Woodworkers' Club of Houston, Oct. 25–26. Greenspoint Mall, Greenspoint Rd. exit off I-45, Houston. For more info, contact Bill Sallans, 1131 Glourie Dr., Houston, 77055. (713) 465-0291.
Workshop–Timber Frame Home Design, Nov. 9–10. Red Suspenders Timber Frames, Rte. 7, Box 8383, Nacogdoches, 75961. (409) 564-9465.
Competition and exhibition–2nd annual Furniture of the '90s, Aug. 28–Oct. 31. National, juried, 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.

VIRGINIA: **Juried show**–16th annual Richmond Craft and Design show, Nov. 15–17. Richmond Craft Centre for Conventions and Exhibitions. For more info, contact Hand Workshop, 1812 W. Main St., Richmond, 23220. (804) 353-0094.
Show–5th annual Norfolk Woodworking World show, Jan. 3–5, Norfolk Scope, corner of St. Paul and Brambleton, Norfolk. For more information, call Woodworking Association of North America at (800) 521-7623, (603) 536-3768.
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. Entry deadline: Feb. 15. For application or info, contact Spotlight '92, Hand Workshop, 1812 W. Main St., Richmond, 23220. (804) 353-0094.

WASHINGTON: **Workshops**–Ship Nameboard Carving with George Maynard, Oct. 26; Building a lapstrake with Ray Speck, Nov. 9; Building a flat bottom skiff workshop with Andy Erickson, Nov. 16–17. For info, contact Northwest School of Wooden Boatbuilding, 251 Otto St., Port Townsend, 98368. (206) 385-4948.
Workshop–Lofting and building the St. Lawrence Bateau, a flat bottom, double-ended, lapstrake rowing boat, Nov. 2–9. Fee: $500/$550. For more information, contact The Center for Wooden Boats, 1010 Valley St., Seattle, 98109. (206) 382-2628.
Juried show–11th annual Woodcarving Show, Nov. 9–10. Western Washington Fairgrounds Expo Hall, 9th and Meridian, Puyallup. For deadline and info, contact Northwest Carvers Association, 115 Del Monte Ave., Fircrest, 98466. (206) 564-3278.
Show–Western Washington Woodworking show, Nov. 15–17. Seattle Center Exhibition Hall, Mercer St. at 3rd Ave. N., Seattle, 98109. For information, contact 1516 S. Pontius Ave., Los Angeles, CA 90025. (800) 826-8257, (213) 477-8521.
Show–15th annual Seattle Harvest Festival, Nov. 29–Dec. 1, Seattle Center Coliseum, Seattle. For info, contact Harvest Festival, 111 Liberty St., Petaluma, CA 94952. (800) 321-1213, (707) 778-6300.
Meetings–Northwest Woodworkers Guild, last Wednesday of each month. Contact Kirk Kelsey, 744 N. 78th, Seattle, 98103. (206) 789-2142.

WISCONSIN: **Show**–Woodworking World Milwaukee show, Nov. 8–10. Waukesha County Exposition Center, Northview Rd., Waukesha, 53188. Contact Woodworking Association of North America, PO Box 706, Plymouth, NH 03264. (800) 521-7623, (603) 536-3768.

Seminars–Training seminars on moulder setup and operations and profile knife grinding, November. For dates and info, contact Kelly Markofski, Fox Valley Technical College, 150 N. Campbell Rd., Oshkosh, 54903-2217. (414) 233-9191.

CANADA: **Exhibit**–Beneath the Ice: The Art of the Fish Decoy, thru Nov. 4. Kamloops Arts Gallery, B.C. For info, call Susan Flamm at (212) 977-7170.
Demonstration–Fraser Valley Woodturners' Association, Nov. 23–24. Sponsored by Langley Spinners & Weavers Assoc. Fort Langley Community Hall, 9167 Glover Rd., Fort Langley, B.C. For more info, contact Bob Gonzales, 19893 44th Ave., Langley, B.C., V3A 3E3.
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 Bob Stone, PO Box 8812, Ottawa, Ont., K1G 3J1. (613) 824-2378.
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 Rd., Beaconsfield, Que., H9W 4K7. (514) 630-3629.

AUSTRALIA: **Exhibition**–Western Australian Working with Wood Exhibition, Nov. 22–25, South Perth Civic Centre. Jarrah, a wood found only in a portion of Australia, will be featured. For info, contact Fine Wood Work Association (WA) Inc., 204 Canning Highway, South Perth, Western Australia, 6151.

ENGLAND: **Classes**–Woodworking classes. Smith's Gallery, 56 Earlham St., WC2. Contact Laetitia Powell, Parnham, Beaminster, Dorset, DT8 3NA. (0308) 862204.
Exhibition–10th Exhibition of Early Musical Instruments, Nov. 8–10. Royal Horticultural New Hall, Westminster, London. For info, contact Exhibition Organizer, The Early Music Shop, 38 Manningham Lane, Bradford, BD1 3EA. 0274 393753.
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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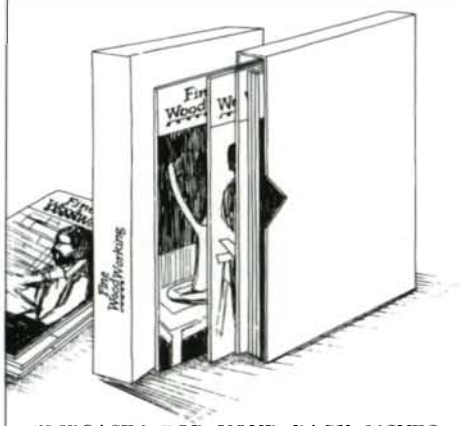

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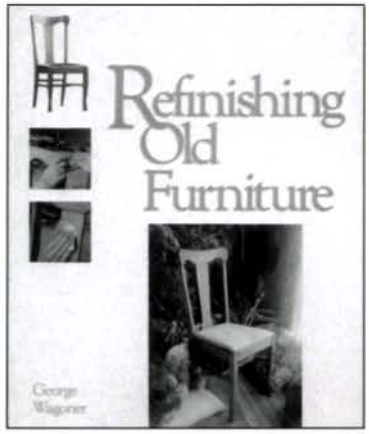
Refinishing Old Furniture by George Wagoner. *TAB Books, Blue Ridge Summit, Pa. 17294-0850; 1991. $12.95, paperback; 178 pp.*



Ho, hum just another furniture refinishing book. Well, maybe not. Wagoner's reverence for antique furniture and his ability as a teacher and furniture-restoration artist is evident throughout the book. His advice to the novice furniture refinisher—thoroughly clean and inspect a piece of furniture before committing yourself to refinishing—is probably worth the price of the book by itself. A good cleaning is often all that is needed to restore a piece of fine furniture. However, if that is not the case, Wagoner guides the amateur furniture refinisher through all the necessary steps to successfully complete a furniture-restoration project.

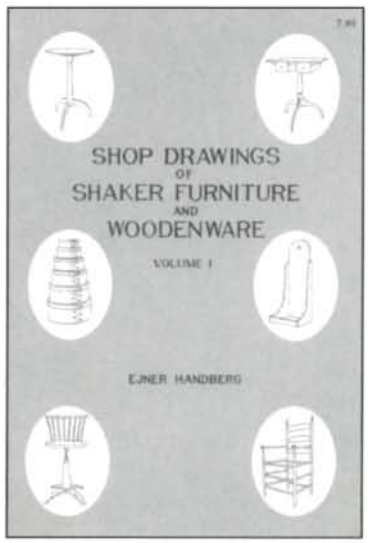
Unlike many refinishing books, this book is concise, easy to read and, more importantly, easy to understand. Each chapter is devoted to a specific step of the refinishing process, for example, removing the old finish or pore filling/sanding. Detailed explanations of each refinishing step, including whether or not you need to do it and why, as well as a list of tools and materials needed to complete the task are included in each chapter. Usually several different methods to complete any step are presented, allowing the refinisher to select a method that best fits the situation. In addition to the typical material found in most refinishing books, Wagoner has included important information often overlooked. Chapters dealing with proper gluing techniques, identification of antique furniture, care of the refinished piece and touching up those inevitable dings are also found in this book. The general organization and factual manner make this book a handy reference manual for the occasional do-it-yourself refinisher and the professional alike.

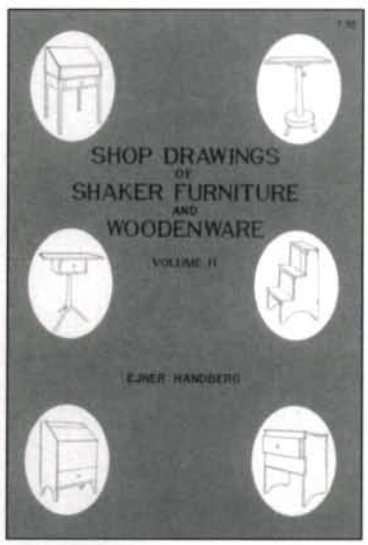
Although *Refinishing Old Furniture* is more complete than other refinishing books I've seen, it still has some deficiencies. My biggest disappointment is the lack of any new information. New environmental regulations and public health and safety concerns have forced changes in most of the materials used in the refinishing process. These regulations have created totally new categories of refinishing materials, namely water-borne paint removers and finishes. Neither of these new categories are discussed, even though they offer the user a safer alternative to conventional refinishing materials and often require different techniques for successful use. Proper disposal of the spent stripper and accompanying paint sludge, another environmental issue, was ignored. (Older pieces of furniture have often been painted with lead-base paints. Lead pigments in stripper sludge cause it to be classified as hazardous waste in many parts of the country, and it must then be disposed of in accordance with local EPA regulations.) Even an outdated, home-brew benzene-base paint stripper formula that has been in every refinishing manual for the last 40 years is presented again in this book. It seems strange to me that this formulation keeps popping up: Benzene hasn't been available in this country for at least the last 10 years, and the paint stripper mixed from this formula doesn't work very well anyhow.

Still, even with the omission of what I feel is necessary information, *Refinishing Old Furniture* is an excellent teaching manual and should be in the library of anybody who is interested in furniture refinishing.

—Chris Minick

Shop Drawings of Shaker Furniture and Woodenware, Vol. I (1973), Vol. II (1975) & Vol. III (1977) by Ejner Handberg. *Berkshire Traveler Press, PO Box 297, Stockbridge, Mass. 01262; $7.95 each, paperback; 85 pp. each.*





I originally bought these three volumes of Shaker furniture books as they came out in 1973, 1975 and 1977. At the time, there was little available in the way of measured drawings of Shaker furniture except for John Shea's *The American Shakers and Their Furniture*. My first reaction was disappointment. The drawings are very simple, and only basic dimensions are specified. However, all the drawings have scales, which make it quite easy to find the size of parts not dimensioned.

The appearance of these simple drawings is deceiving. Uncomplicated pieces such as stands, boxes, chairs, stools and hanging items are easy to visualize and build without a lot of dimensions and details. But the more complex case pieces lack interior details, and only outside dimensions and a few details, such as dovetail spacing and molding profiles, are given. Sizes and locations of kickers, spacers, runners, dividers, supports and bracing are not indicated. This can lead the beginning woodworker into a real panic.

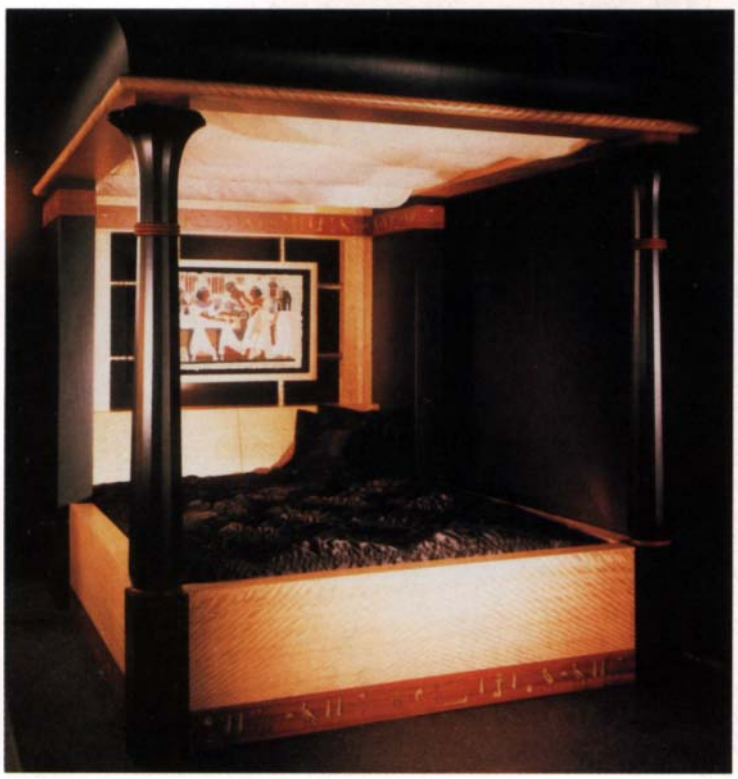
Looking at these three books with years of hindsight, it is evident that these simple drawings are aimed at the advanced woodworker and restorer. For example, having built and restored many sewing desks, I am struck by the similarities of construction despite the differences in design, layout and execution. Once readers become familiar with basic case construction, the drawings will become accurate guides to Shaker furniture.

In most cases, the origin of the piece is listed, as well as the type of wood used. Another interesting item is that each volume has a few pages of various chair finials, pegs, pulls and knobs. Although there is some overlap in the three volumes, the variety of these small details is valuable to the restorer, woodworker and collector. In addition, the books discuss a few non-illustrated pieces, such as mitten forms and coat hangers. Volume I has several pages of dimensions of oval boxes. Volumes II and III have about a dozen photos of some of the dimensioned pieces. A minor puzzle to me is why a book on Shaker woodenware would include a scaled drawing of a Mt. Lebanon cast-iron stove.

All in all, Handberg leaves a valuable record of more measured drawings of Shaker furniture than is available from any other source.

—Chris Becksvoort

Chris Minick is a product development chemist and amateur woodworker in Stillwater, Minn. Chris Becksvoort is a furniture-maker in New Gloucester, Maine.



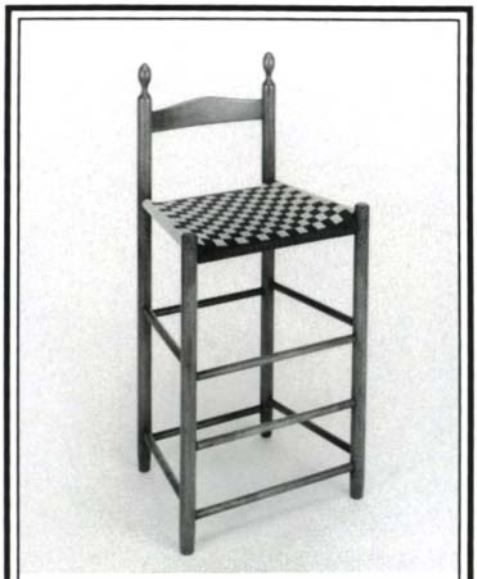
The 50-in.-long "Trout Table" above, carved in the round by Leon Case from sugar pine, was the top winner in the fantasy-furniture category at SDFWA. Case is a second-generation carver specializing in three-dimensional forms. The "Egyptian Bed," left, was made by Craig Woodward from avodiré, padauk and ebonized ash. The headboard picture was hand-painted on papyrus and the hieroglyphics around the bed contain the words to a popular song. The winner in the made-for-children category at SDFWA was this rocking crow, below, carved from pine and oak by Lorenzo Foncerrada and painted with sign enamel.

Design in Wood show

For the past 10 years, the Del Mar Fair and the San Diego Fine Woodworkers Association (SDFWA) have sponsored a juried show in Del Mar, Cal., just north of San Diego. From 45 entries in 1981, to this year's turnout of more than 200 exhibits in 15 different categories, the annual Design in Wood show has grown in size and quality through the years.

This year's Design in Wood show, held from June 18 through July 7, may have had the largest attendance of any juried woodworking show in the country. More than one million people passed through the turnstiles during the three weeks of the Del Mar Fair. Some, of course, may have been more interested in the animals, the midway and the normal attractions of a state fair than an exhibit of high-quality woodwork. Nevertheless, several thousand people a day viewed this diverse show of traditional and contemporary furniture, musical instruments, fantasy

Photos this page: Peter Malinowski



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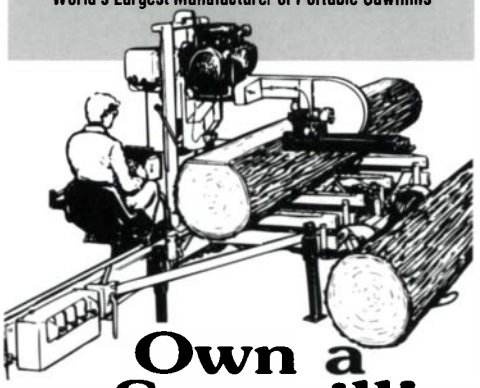

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furniture and items made for children. Plus, attendees saw live demonstrations of turning and carving. They also saw a 19th-century workshop in operation where volunteers hand-built children's chairs from oak. For the past four years, SDFWA has donated some 50 of these chairs a year to nursery schools, churches and needy-children's centers. Other activities of SDFWA include an annual wooden toy drive and a scholarship program for high school seniors interested in woodworking careers.

The show, managed by SDFWA board member and show superintendent Patrick Edwards, is open to California residents and all entries are juried. Prizes totaling $5,000 were awarded by the Del Mar Fair board this year to winners in each of the 15 categories. The show superintendent's award went to Craig Woodward for his "Egyptian Bed," shown in the bottom, left photo on p. 124. Winning entries from three other categories are also shown on p. 124 and at right.

It is from the preparation and execution of the Design in Wood show that the SDFWA draws its strength and interest. Each year it makes the general public aware of association activities, as well as recruits a large number of new members. The Design in Wood show focuses the activities of many of its more than 700 members. As testament to their interest, 120 members volunteered their time to work in the SDFWA building during the three weeks of the fair this year.

For more information on next year's show or on membership, contact SDFWA at PO Box 99656, San Diego, Cal. 92109.

–Raymond C. McNamara, San Diego, Cal.

Photo: Peter Malinowski

Nick Cook's spherical vessel was turned on a faceplate and then between centers, to preserve the carob burl's natural surface.

Luthiers strum their stuff at Symposium '91

The evolution of knowledge in any field of endeavor greatly relies on people sharing what they have learned through experience—both their triumphs that are worth emulating and their disasters that should be avoided. One of the largest social exchanges of information for luthiers took place last summer when the American Stringed Instrumentmaker's Association (ASIA) held its biannual conference: Symposium '91. ASIA co-founder Dick Boak and his wife, Susan, organized and mediated the event, which ran from June 27-30 at Lafayette College in Easton, Pa. The symposium provided an opportunity for hundreds of guitar, banjo, violin, mandolin and other stringed-instrument makers, as well as those who sell, repair and restore instruments to congregate, socialize and catch up on the latest developments in luthiers' technologies and techniques.

The symposium offered more than a dozen seminars and demonstrations on topics such as acoustic-instrument design theory, vacuum-clamping procedures, computer-aided design (CAD), pearl inlay and engraving, and finishing. The seminars—most of which were led by well-known experts in their respective areas—provided the symposium attendees with a wealth of information and inspiration. Other presentations during the three-day weekend included an overview of marketing musical instruments, given by the C.F. Martin Guitar Co.'s CEO, Chris Martin; a luthier's certification examination, written by instrument technician James Rickard; and a lecture by Woodworkers Alliance for Rainforest Protection (WARP) co-founder Scott Landis on the current state of the world's endangered exotic species (like rosewood and ebony, two of the woods that are traditionally used by luthiers) and alternatives, such as substitute species and woods that are cultivated on sustained-yield plantations. On Friday and Saturday, symposium goers had a chance to peruse the wares of more than a dozen instrumentmakers, dealers and luthier suppliers at displays set up in the gymnasium.

With any group of instrumentmakers, you're also apt to find some excellent players, and Symposium '91 was no exception. Instrumentalists from all over the continent showed their virtuosity at impromptu concerts that seemed to spring up everywhere, and British guitarist Martin Simpson gave a rousing performance of mostly blues and folk music at a formal concert on Saturday night. But the most impressive musical event of the weekend, in my opinion, was by Paul Bunker, who gave an inspired performance on a "touch guitar" that he had designed and built. The electric instrument is a sort of combination guitar and bass that's played entirely by tapping the strings.

Just as the ideas and work of modern luthiers often extend beyond established traditions (one fellow I met there had a folding acoustic guitar built mostly from Plexiglas), Symposium '91 had its share of unorthodox events. A giant scale model of an acoustic guitar, made by Martin Co., was brought in on a parade float. A cutaway back allowed curious viewers to literally take a stroll inside the guitar. One event, called the "guitar throwing challenge," proved that hurling a guitar (only inexpensive, damaged instruments were used) can be more fun than playing it. On a more serious note (only *a minor* pun intended), a guitar tone evaluation seminar, called a "steel guitar wine tasting," gave symposium attendees an opportunity to hear different instruments being played, and then compare and contrast their tonal quality, design and construction.

Anyone interested in attending Symposium '93 or who would like more information about the organization should contact ASIA, 14 S. Broad St., Nazareth, Pa. 18064.

–Sandor Nagyszalanczy

Photo: John J. Carlano, Courtesy of the Wood Turning Center

Turned hats by Johannes Michelsen were sported by the "in" crowd at the International Lathe-Turned Objects exhibition. The black cherry hat shown is modeled by Albert LeCoff of the Wood Turning Center.

International turned objects exhibition

The hats were the first thing to catch my eye. There were several of them, perched as hats should be, atop some of the heads bobbing about the crowded museum reception area. And they were fairly typical toppers, mostly banded westerns and bowlers, except that they were quite obviously made of wood. The hats, shown in the photo above, were turned by Johannes Michelsen.

The event was the May 17 opening of the International Lathe-Turned Objects: Challenge IV exhibition at the Port of History Museum in Philadelphia, Pa. Organized by the Wood Turning Center, this was the first leg of what will be a traveling exhibition.

Unlike some earlier presentations organized by the Wood Turning Center, this was a completely juried show, offering equal access to any turners who cared to submit their work. Apparently, it was the right approach. The exhibit represented 88 turners from six countries and included what seemed to be every imaginable use of the lathe. More than

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a few of these, such as Tom Raushke's "Nest Goblet," shown in the left photo below, boggled the mind. The range of work covered everything from the functional, such as Peter Handler's modernistic chess table complete with chessmen, to a pair of downright whimsical disembodied mouths, one with a defiantly protruding tongue, by Ric Stang.

Some familiar names showed pieces breaking unfamiliar ground, like David Ellsworth's dusky, multicolored hollow sphere and Ron Fleming's breathtaking floral painted bowl that could easily pass for porcelain. There was even room for political commentary; Canada's Ted Hunter submitted what appeared to be a typical store display card loaded to sell jump ropes with rocket-shaped wooden handles.

Several pieces brought out the essential beauty of wood by putting it in a new light—some literally. J. Paul Fennell turned a pair of ultra-thin bleached-maple flowers with stamens made from lighted neon tubes that caused the thin maple shells to glow with an eerie pink translucence. Jay Hostetler pointed out how impressive wood's natural patterns can be by turning two thin, simple plates of highly figured quilted maple. The finish on the pieces—dyed, high-gloss lacquer—acted as a lens to intensify the already deep movement of the quilt pattern.

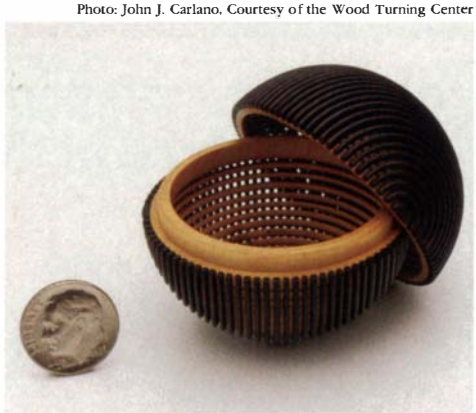
Challenge IV proved again that turners feel no constraints in size, style or materials when following their art. Turnings ranged from large freestanding pieces, such as Stoney Lamar's five-piece wall-hanging construction that stretched over 8 ft., to the delicate, jewel-like miniature box by Hans Weissflog of Germany, shown in the photo on the right. In addition to using an enormous range of different woods, exhibitors utilized all sorts of metals, stone, shell, hair, epoxies and plastics to create work covering every taste and style. The most conservative and the avant-garde had their say. Michelsen's wooden hats rounded out the picture so even the humble haberdasher was represented.

International Lathe-Turned Objects: Challenge IV is scheduled to be at the University Art Museum in Tempe, Ariz. through Nov. 3, 1991, and the Northern Arizona University in Flagstaff from Nov. 20 to Jan. 1, 1992. After that, the exhibit is slated for the Craft & Folk Art Museum in Los Angeles, Cal., from Feb. 1 through April 12, 1992. If you can't attend an exhibition, there is a catalog with more than 200 black-and-white photos and a slide portfolio of 137 full-color images. For more information, contact Albert LeCoff of the Wood Turning Center at (215) 844-2188.

—Michael Dresdner, Perkasie, Pa.

Photo: William Lemke

Photo: John J. Carlano, Courtesy of the Wood Turning Center



Among the vast array of turnings at Lathe-Turned Objects: Challenge IV was Hans J. Weissflog's 2-in.-dia. "Ball-Box, Turned Broken Through" in grenadilla and boxwood (above). It is reminiscent of the delicate beauty of a Faberge egg.

The "Nest Goblet," a delicate, miniature lacework tree (left) by Tom Raushke, was made from oak and hickory. It holds a tiny nest complete with eggs that open.

Announcements

Winterthur fellowship

The Winterthur Library has announced a number of fellowships to encourage research in America's artistic, cultural, intellectual and social history. Scholars pursuing advanced research are eligible to apply for National Endowment for the Humanities fellowships that grant stipends up to $30,000 for 6 to 12 months' work. Short-term fellowships with stipends ranging from $1,000 to $2,000 per month are available to academic, museum and independent scholars, as well as to support dissertation research.

These are residential fellowships for research at Winterthur, where resources include a library of approximately half a million books, manuscripts, visual materials and other printed works supporting interdisciplinary study of American life into the early 20th century. Furnished rental housing is available on the grounds. The deadline for applying is Dec. 1, 1991. For an application packet, contact Dr. Katharine Martinez, Winterthur Research Fellowship Program, The Winterthur Library, Winterthur, Del. 19735; 302-888-4649.

Furniture conservation training

The Smithsonian Institution's Conservation Analytical Laboratory is accepting applications for its three-year program in furniture conservation training until Nov. 30, 1991 with classes starting in August 1992. Selection to the training program is competitive, and applicants should be experienced and skilled woodworkers who wish to pursue a career in preserving and restoring historic furniture. Prerequisites for the graduate-level course of study include considerable chemistry and some art history and drawing background, although there is flexibility to allow deficiencies in the non-chemistry academic requirements to be made up during the first year.

The program consists of 12 sequential two-week courses offered at three-month intervals. This scheduling is intended to allow students to maintain current employment and commitments throughout the formal training period, which is followed by a one-year internship in a furniture conservation laboratory. A certificate will be awarded by the Smithsonian Institution, and students may elect to pursue a Master of Arts degree through Antioch University. For more information, contact Training Secretary, CAL/MSC, Smithsonian Institution, Washington, D.C. 20560; (301) 238-3700.

Second printing of *World Woods in Color*

World Woods in Color, by William A. Lincoln, was first published by Macmillan Publishing Co. in 1986 and was out of print for a period of time, but it is once again available through Linden Publishing (3845 N. Blackstone, Fresno, Cal. 93726; 209-227-2901). In a review in *FWW* #77, Michael Dresdner called this book one of the best and easiest-to-use wood-identification books because of the large, full-color photos of more than 275 commercially available woods. A general description of the woods, their area of origin, their mechanical and working properties, and information on their durability and common uses is included as well. The book also contains cross-referenced indices that list standard names; trade, vernacular and common names; Latin botanical names; and botanical family names. Between the outstanding photos and the comprehensive lists, *World Woods in Color* makes it possible to accurately identify a wood no matter how

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shaky your information because Lincoln offers exact-size reproductions to allow a more accurate comparison of grain and texture.

Fairs and festivals

If you're an artist or craftsperson looking for a place to sell your product throughout the Northeast or Southeast, then you should have *Fairs and Festivals in the Northeast 1991* and *Fairs and Festivals in the Southeast 1991* (available from Arts Extension Service, Div. of Continuing Education, 604 Goodell Building, University of Massachusetts, Amherst, Mass. 01003). The Northeast edition offers listings on more than 400 events in the New England states, New York, Pennsylvania, Ohio, New Jersey, Maryland, Delaware and Washington, D.C. The Southeast version lists more than 500 events in Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, Missouri, North Carolina, South Carolina, Tennessee, Texas, Virginia, Washington, D.C., and West Virginia.

The books offer a monthly listing of events that includes title, location, sponsor, booth fees and sizes, application fees and deadlines, estimated attendance figures and complete contact information. The events are also listed in indices by state and title. Additional helpful information is included in a comprehensive bibliography, a listing of state-wide craft organizations and a listing of sources to contact for more information.

The University is considering combining all the information into a single book for the 1992 edition, which should be available soon. For more information, contact the Arts Extension Service at (413) 545-2360.

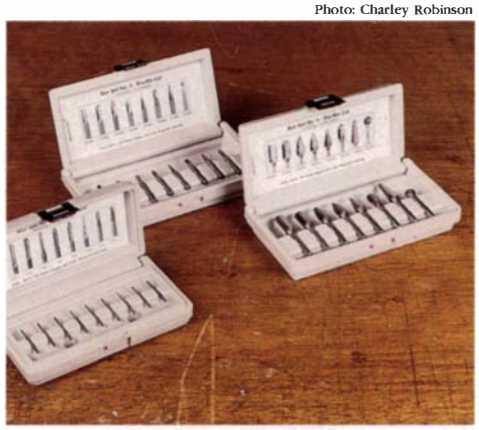
Waterproof Titebond II Wood Glue

For woodworkers who enjoy making outdoor projects, but dread the inconvenience and mess of mixing up two-part waterproof adhesives, Franklin International (2020 Bruck St., Columbus, Ohio 43207) is offering Waterproof Titebond II Wood Glue. This glue is a crosslinking polyaliphatic resin that is the first one-part wood glue to pass Type II waterproof testing. Type II testing involves three cycles of submerging a glued joint in water for four hours followed by 19 hours of drying at 120°F. Although Titebond II is not designed for use below the waterline or for continuous submersion, it should work well for kitchen cutting boards, outdoor furniture and above water marine applications.

Titebond II has a five-minute open-assembly time and a strong initial tack. This adhesive cleans up easily with a damp rag while still wet. It is also non-toxic and non-flammable and works with paper, cloth, hardboard, particleboard and wood. Titebond II is a little more expensive than Titebond Wood Glue and is available from local hardware and building-supply stores in 4-oz., 8-oz. and 16-oz. bottles and 1-gal. and 5-gal. pails.

—Charley Robinson

Photo: Charley Robinson



Although Atrax's carbide burrs were originally designed for the metalworking industry, they work great on wood and are available individually or in sets.

Product reviews

Carbide Carving Burrs, *Atrax, PO Box 9, Rogers, Ark. 72757-0009.*

Industrial carbide burrs, like those sold by Atrax, might be the best investment any power carver can make. These burrs will provide years of use; they cut truer and faster than high-speed steel (HSS) burrs, they don't clog easily and they can be cleaned with a wire file brush and/or resin remover. Carbide burrs will stay sharp far longer than any high-speed steel cutters on the market, and they can be professionally sharpened, which further prolongs their life. Like hand tools, more control and less vibration will result if used at a 45° angle to the grain.

Atrax carbide industrial burrs are available in two cuts that are recommended for use on either hard or soft woods: standard cut, for light to medium stock removal and dia-mo cut, for medium to heavy cutting. The burrs are available in various lengths individually, but Atrax offers four different sets of their most used shapes: the burrs in sets 1 and 2 ($72 and $77 respectively) have ⅛-in.-dia. shafts; and sets 3 and 4 ($118 and $211 respectively) have ¼-in.-dia. shafts. These sets work well for me, because I prefer to use the largest burr possible for the work at hand, so that I avoid the temptation to concentrate on detailing too soon. Once I've worked the piece enough to need finer cuts, though, I can quickly switch to the next smaller size.

—Judi Bartholomew, Milwaukee, Wisc.

Shopcart, *Shopcarts, 145 Bluxome St., San Francisco, Cal. 94107.*

Although some woodworkers sneer at the use of sheet goods, there is no doubt that the multitude of plywood and other man-made panels have gained a solid foothold in both commercial and home shops. The panels speed up production by eliminating glue-ups and they provide a stable base for veneering. The negative side is that the bulky 4-ft.-wide by 8-ft.-long and larger panels are heavy, some weighing up to 100 lbs. per panel, and awkward to handle.

Shopcart, a new product on the market, promises to help ease these handling problems. The Shopcart is basically a heavy-duty cart with a pivoting top that is adjustable vertically via a foot-operated hydraulic jack, which can pump the carriage from 27 in. high to 35 in. high. To load the Shopcart, push it up to the back of a pickup or van with the cart's top in the horizontal position, step on the floor lock to keep the cart from moving and then slide the panels onto it. The cart will hold up to 10, ¾-in.-thick panels. Because the top is well balanced at the pivot point, it is easy to rotate even a full load from horizontal to vertical to get the cart through doorways as narrow as 30 in. Once inside the shop, the hydraulic jack can be used to raise the top panel to the same height as the tablesaw, and the loaded cart becomes an infeed table. In the vertical position, the cart can be pushed against the shop wall to store any unused panels.

At $830, the well-made, heavy-duty Shopcart is a major purchase, but it's probably less than your chiropractor will charge to treat a bad back. The Shopcart is also much safer than trying single-handedly to wrestle a sheet of plywood through a tablesaw. If your shop processes sheet goods on a regular basis, Shopcart is worth considering.

—Charley Robinson

Photo: Dana Davis

The Shopcart makes it easier and safer to transport and feed sheet stock through power tools. It also has a pivoting top for storing panels vertically.

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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The versatile ***6095DW*** is a heavy-duty 3/8" cordless driver-drill with a ***keyless*** chuck. All it requires is a flick of the wrist and you're ready to change bits. And right now, Makita is offering it as Model ***6095DWE*** with a dual voltage (7.2V and 9.6V) fast charger, tool case and a ***free*** extra battery.

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Large photo: Kip Brundage; inset photo: Chris Becksvoort

DASHING THROUGH THE SNOW

"Dashing through the snow in a one-horse open sleigh" was a common mode of winter transportation at the turn of the century. Baby sleighs, like the one shown here, were direct descendants of the light and graceful one-horse sleighs, but they relied on people power instead of horse-power. These small sleighs were a means of getting little ones into the fresh air during cold winter months, and they remained popular well into the 20th century.

When Maine furnituremaker Chris Becksvoort looked for a sleigh for his first child, he found only antiques in disrepair, so he decided to build his own. Becksvoort didn't use frame-and-panel construction for the coach, as old-time sleigh makers did, but kerf-bent ¼-in.-thick solid ash. The undercarriage parts were laminated from ⅛-in.-thick ash strips and joined with mortises and tenons reinforced with brass plates and rods. Half-oval brass banding protects the wear surface of the swan-neck runners, and cast-brass bells dangle from their upper ends.