July/August 1987, No.65, $3.75

Fine WoodWorking

Extension Table Design

Shopmade Bandsaw

Tuning Handplanes

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Furniture of Gerrit Rietveld

Fine WoodWorking® July/August 1987

Gerrit Rietveld's 1918 Red and Blue chair may not have redefined comfort, but it fundamentally reshaped furnituremaking values. Glenn Gordon explores Rietveld's work on p. 42. Photo courtesy of the Wadsworth Atheneum.

Fine Woodworking (ISSN 0361-3453) is published bimonthly, January, March, May, July, September and November, by The Taunton Press, Inc., Newtown, CT 06470. Telephone (203) 426-8171. Second-class postage paid at Newtown, CT 06470, and additional mailing offices. Subscription rates: United States and possessions, $18 for one year, $34 for two years; Canada and other countries, $21 for one year, $40 for two years (in U.S. dollars, please). Single copy, $3.75. Single copies outside U.S. and possessions, $4.25. Send to Subscription Dept., The Taunton Press, PO Box 355, Newtown, CT 06470. Address all correspondence to the appropriate department (Subscription, Editorial, or Advertising), The Taunton Press, 63 South Main Street, PO Box 355, Newtown, CT 06470. U.S. newsstand distribution by Eastern News Distributors, Inc., 1130 Cleveland Road, Sandusky, OH 44870.

DEPARTMENTS

ARTICLES

Postmaster: Send address changes to The Taunton Press, Inc., PO Box 355, Newtown, CT 06470.

As a physician, I was particularly interested in the question regarding chemical varnish and paint removers posed by Calvin Burbage (*FWW* #64). He correctly states that many of these products contain methylene chloride. While Mr. Shaw wisely advises him to avoid any chemical fumes, he doesn't address the particular lethality of methylene chloride which, once in the body, is metabolized to carbon monoxide (CO). The amount of CO formed is directly related to the amount of methylene chloride absorbed during the paint-stripping operation. This is often sufficient to stress the cardiovascular system. Many fatalities have now been attributed directly to the use of paint strippers containing methylene chloride by persons with underlying coronary artery disease.

Methylene chloride toxicity is insidious because peak levels of CO in the blood don't occur until three to four hours after exposure has ended. Furthermore, most of these products also contain methanol, which makes the toxicity of the CO even more potent. Therefore, a susceptible woodworker may work with a finish stripper without symptoms, only to suffer angina or a heart attack hours later.

I would certainly endorse Mr. Shaw's recommendation that Mr. Burbage—or anyone with underlying coronary artery disease—never use any product containing methylene chloride. All others should, of course, pay heed to the label warning to use these products only in well-ventilated areas.

—Theodore J. Fink, M.D., Shelburne, Vt.

Several years ago, I met a man who said he was a logger. Watching him cut up a walnut stump into slabs, I asked him how soon he intended to use his freshly cut stump for firewood. He said, with calm control, that the one thing the Forest Service doesn't tell you about drying wood is that vertical-standing lumber will dry with a great deal less cracking, checking and warping. I had my doubts.

About a month later, a friend asked if I was interested in sawing a walnut stump for firewood. Using a 36-in. chainsaw and my Mini-Mill, I sawed the tree into vertical cuts like the logger had done. I was prepared to have some success with vertical-stand drying or some very beautiful walnut firewood. It's going on ten years now since I cut up that downed tree and not one check, crack or warp has appeared in the 2-in.-thick slabs. Stored out of direct sunlight, they look great. I'm passing on this information to those of your readers who love wood and have a big chainsaw. *—Bill Tarleton, Albany, Calif.*

Peter Good's "To Employ or Not to Employ" in *FWW* #64 presented some useful information on federal tax matters. Unfortunately, while the article was described as being adapted from a Bay Area newsletter, your readers were not cautioned that much of the information applies *only in California*. For example, Ohio has no Franchise Tax Board or required disability insurance withholding, but it does have municipal income taxes to be withheld in many cities and villages. The best advice you could have provided in a publication sold in more than one state would have been to consult an accountant or lawyer who concentrates on the problems of small business.

—Frederick O. Kiel, Cincinnati, Ohio

I read with considerable interest John Jordan's query about wobble on his radial-arm saw (Q&A, *FWW* #62). Because Curtis Erpelding's reply can be misinterpreted to mean "the tighter the bearings are, the better," I feel compelled to relate my experiences with a Sears radial-arm saw.

First, an analysis of the problem: The ball bearing used by Sears is inadequate in load capacity, is of the wrong type and is of very low quality (not to mention, very expensive from Sears—$75 a set three years ago). The load on a ball bearing of this type is meant to be radial, but during the moment the blade enters the board, there's a severe side load on the bearing—the blade "climbs" onto the board. Thus, the load capacity of the bearing is exceeded and the bearing is damaged. The point of damage to the bearing repeats at every rotation; hence, the regular "wobble." A heavier, higher-quality bearing would help, but a better solution is to redesign the entire unit with a proper bearing. That, of course, is difficult for anyone but Sears.

What can be done to increase the life of existing saws? Keep the rails scrupulously dry and clean. Running over any chips will damage the bearings. Keep your blade as sharp as possible. New blades—particularly cheaper ones—are not sharp as sold. Have them sharpened before use and keep them free of resin. Adjust the bearing clearances exactly as Sears prescribes, and don't overtighten! Overtightening drastically shortens the life of these ball bearings.

By the way, since $75 is about a quarter of the cost of the saw, I invested it in a Grizzly Imports Inc. tablesaw and have been happy as a clam since. *—Robert E. Kirby, Palo Alto, Calif.*

I have a bone to pick with you. In *FWW* #60, you printed an article by my friend, Ernie Conover, on the subject of turning a ball. Ernie didn't know how to do this until I visited him in October, 1985, and showed him. I should have received the credit, which he assures me his original article included, but the credit was edited out for some reason.

—Richard Bailey, Lapeer, Mich.

Paul Bertorelli is the second Lamello plate joiner owner I've heard say that, if they had the choice again, they'd go for the cheaper Freud JS100 machine (*FWW* #64). I recently talked to an area distributor, however, and he said he had purchased six of the cheaper machines and sold four. Within a very short time, all of them came back with bad bearings. I'd like to hear Bertorelli's feelings about this problem.

—Ron Toppenberg, Newton, Iowa

PAUL BERTORELLI REPLIES: I checked with Mr. Toppenberg's supplier and learned that the four customers who returned the Freud plate joiners complained about loud bearing noises. They're right: The thing makes a horrible racket. But, according to Freud, the noise is normal—a consequence of the machine's right-angle gearing design. I'd appreciate hearing from readers with long-term experience—good or bad—with this tool.

Noisy gears aside, I still believe the Freud is the best choice for occasional home-shop and light-commercial duty. Used a dozen times a year, its shortcomings aren't much to complain about. For heavy commercial use, the $599 Lamello is worth the money. Besides being better built, it has a more complete line of accessories.

It may take some dedicated phone shopping to locate a JS100. Because of unexpected demand, some suppliers don't have the machine in stock and, as of early May, Freud reported delays of six to eight weeks in filling dealer orders.

Re Jim Cummins' suggestion to use cyanoacrylate glue to fix cracks (*FWW* #63, p. 14). In addition to being an amateur woodworker, I also design, build, and fly radio-controlled sailplanes. I use cyanoacrylate glues almost exclusively in their construction. One only has to pick up a modeling magazine to find how many different brands of cyanoacrylate glues are available. I've found all to be virtually identical in performance. I base my selections on price and container design. If the tip clogs, it's useless.

Storing the glue in the freezer can help extend the life of the glue, but because cyanoacrylates cure by a chemical cross-linking, allow them to reach room temperature before opening the container. Otherwise, condensation moisture may cause premature setting. I've found it much more convenient to buy the glue in small quantities and let it sit out. Also, I think some

mention should be made concerning safety precautions. Cyanoacrylate will bond skin almost instantly. If you find yourself bonded to your work (I always do), acetone will soften the glue. Safety glasses should be worn to keep it out of your eyes. Some people contract hay-fever-like reactions from the fumes (which are minimal), as well as skin rashes.
—Joseph L. Kral, Campbell, Calif.

Re anchoring wood posts to concrete as described in Methods of Work, *FWW* #61: This method of securing posts is, to my mind, reckless engineering and poor advice. The concept of using electrical conduit for structural purposes is dangerous. The shear strength of this system is low, especially when compared with existing metal-plate fastening systems. In a short time, the corrosion of the metal from contact with moisture or the salts in treated wood could only weaken the fastening. I strongly recommend publishing some sort of disclaimer. You definitely don't want a roof coming down on your heads.
—Stanley S. Niemiec, East Dundee, Ill.

JIM CUMMINS REPLIES: Your point is well taken. We aren't a construction magazine, so no mention was included warning against using this method for structural purposes. It's best-suited for anchoring bench legs, machine stands and the like.

I have a 4-in. by 24-in. Stanley belt sander. For some reason, I've replaced several sets of brushes. This isn't because the brushes were worn down, but because the small spring that holds the brush burns in two. At approximately $8.00 per pair, this gets quite expensive. I took some springs out of old ballpoint pens and rewound the brush onto the end. It works great and, as a matter of fact, lasts longer. *—Mike Roths, Vinton, Iowa*

Re your article, "Bending Green Wood" (*FWW* #64): It has been my experience that the state-of-the-bending-art has advanced beyond your published information. As a maker of classical Windsor chairs, I've been through the riving, steambox and peg board method with miserable success. I read and practiced all the popular books on the subject. Still, breakage on arms and bows was 50%.

Three years ago, I switched to bending air-dried stock that has been aged at least one year. It has less brittleness than kiln-dried wood, and more adhesiveness against splitting than green wood. I cook my parts in a 4-in.-dia. by 5-ft.-long plastic pipe that I pour hot (200°F) water into for 45 minutes per inch of thickness. I then place the stock, without rushing, into a strap holder with back plates and adjustable end blocks to precompress the piece before hand-drawing it around a form mounted to my tabletop. White ash is the best bending wood, requiring less force to bend. I cut my stock from 1-in. boards, being careful to limit grain runoff to less than 5%. This change in method has resulted in nearly 0% breakage and higher-quality bending. Plus, with a strap of 1⁄16-in. sheet metal, I can bend to a radius that's ten times tighter than with unsupported stock.

All of this information is available in *Wood Bending Handbook* (reprinted by Woodcraft Supply Corp., 1970)—a must for the serious bender. *—Bill Rohlin, Jackson, Mich.*

I read with interest the article in *FWW* #63 relating to bandsaws. For many years, I got along with a Delta 14-in. bandsaw and never had any difficulties other than a cracked bearing in the upper wheel, which I replaced easily from a local source of supply. About a year ago, I saw the Inca three-wheel saw demonstrated and bought one. I tried to sell the Delta, but couldn't get my price. Now, I'm a really happy man with two bandsaws—one with a ⅛-in. blade, one with a ½-in. blade.

By the way, I was curious as to why your list of suppliers didn't include the Buckeye Saw Company, P.O. Box 14794, Cincinnati, Ohio 45214. This company has advertised in your magazine regularly for many years. I've ordered many blades from them, and have always received very prompt and accommodating service. *—Charles F. Herr, Lancaster, Penn.*

EDITOR'S NOTE: We have nothing against Buckeye, but the list was of manufacturers only. If we had included all distributors, the list would have filled the magazine.

There's one thing you might like to bring to the attention of *FWW* #63 back-cover artist, Stephen Paulsen. He really should get into his piece "The Second Chamber of the Game" and turn the chessboard 90°. Chess is played with the white corner square on the right side of each player. Of course, he might move the stools around, but that would not make so fine a composition. *—Alan W. Fraser, New Canaan, Conn.*

Recently, I got a job planing some thick timbers of walnut and oak, some of which were quite twisted. Not owning a jointer, I figured a way to flatten one side using my 12-in. planer. Here's how I did it.

Take the twisted board and lay it on your flat workbench, with the edge hanging over about ¾ in. Now, slide a 1x4 pine board up under the twisted board where it doesn't lie flat on the bench. Hold the 1x4 steady, move the twisted board back out of the way, then draw a pencil line on the 1x4 using the benchtop as a guide. Bandsaw this angled shim, then tack it onto the twisted board. Flip it over on the bench. If it lies flat without rocking, you can then run it through the planer. Plane the non-shim side flat, flip it over, remove the shim and proceed to thickness the board. *—Dale Coombs, Galesby, Ill.*

In the Q&A column of *FWW* #63, Seth Stem discussed making a curved banister using mitered segments sawn to shape. This method works fine for flat curves, but Walter Crites' question had to do with capping the metal handrail on a spiral stair. A rising, curving handrail has a shape something like a stripe on a barber pole. A handrail made to fit a spiral stair will not lie flat on the floor. Although the technique Stem describes could be made to work, it involves a two-sided, twisting bandsaw cut for which the layout alone is extremely complicated.

There is, however, a more practical method for capping a spiral handrail. A bundle of ⅛-in. by 1½-in. strips (or thinner, depending on the radius) glued and clamped using the existing handrail as a form will give you the shape. Once sanded and perhaps run through a shaper or router setup, the finished handrail can then be mounted with screws from below as Stem recommends. *—Lon Schleining, Belmont Shore, Calif.*

About the time of your article on workshop noise (*FWW* #59), I discovered Peltor brand hearing protectors. In use, model H7A provides noise reduction superior to any other brand I've used. Of equal importance, it's comfortable all day. The price was about $12 and the damping pads and ear cushions are replaceable. Peltor Inc. can be reached at 63 Commercial Way, E. Providence, R.I. 02914. *—Richard Evans, Pruitt, Ark.*

Recently, a good friend told me to get the latest copy of your magazine and examine it carefully for anything familiar. I did, and there was my wooden hinge on p. 10 of *FWW* #62. As my hinge principle is in the process of being patented, my attorney advises me to do nothing beyond simply notifying you. I'm not proscribing what woodworkers can do in the privacy of their own workshops—I certainly encourage all your readers to learn to fabricate and use this hinge on their personal projects. But I ask that they remember *not* to infringe upon this patent by attempting to sell it in the open market without first obtaining licensing rights from the patent owner. *—Spider Johnson, Mason, Tex.*

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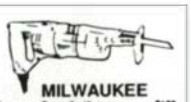

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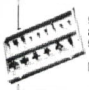

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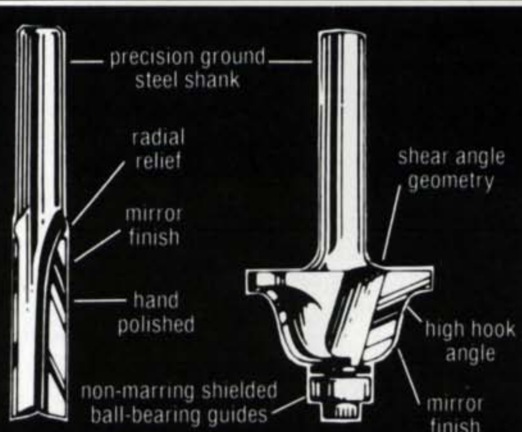

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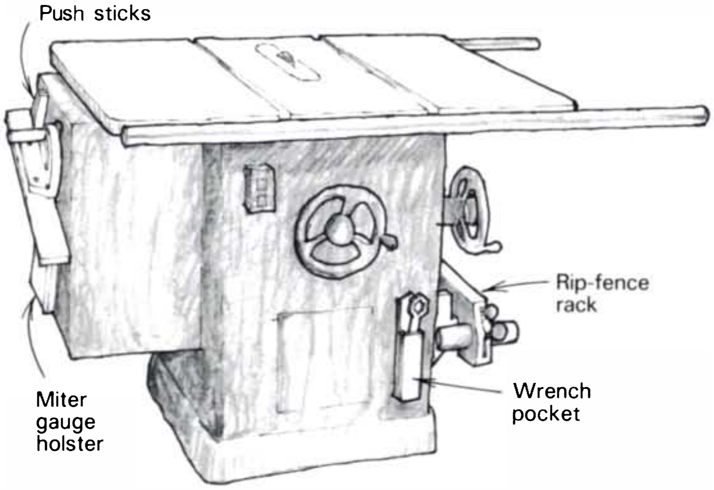
Home for tablesaw accessories

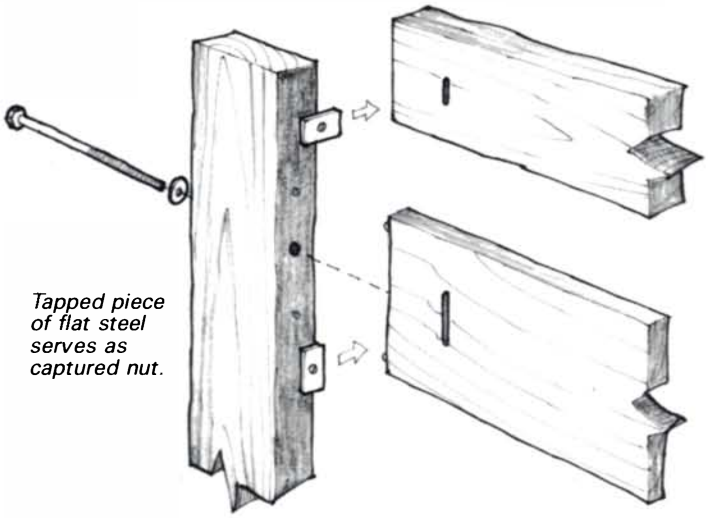


The last time I used my tablesaw on a project that required both crosscuts and rips, I couldn't find a place to park the rip fence and miter gauge to keep them safely close at hand. Plus, the blade-changing wrench was always lost in the shop clutter, and my push sticks constantly wandered out of reach—just when I needed them most.

To resolve these problems, I decided to make homes for all my tablesaw attachments by building simple scrapwood holsters and racks at various places on the saw. The sketch above illustrates the idea. *—Fred H. Sides, Mt. Kisco, N.Y.*

Quick tip: I've been carving for more than 50 years, and I use a rubber hammer instead of a wooden mallet. The blow is more controllable and the rubber won't damage your tool handles (frayed tool handles cause blistered hands). For very little money, you can get a set of four sizes at your local auto-body supply store. *—Ford Green, San Antonio, Texas*

Simplified captured-nut system



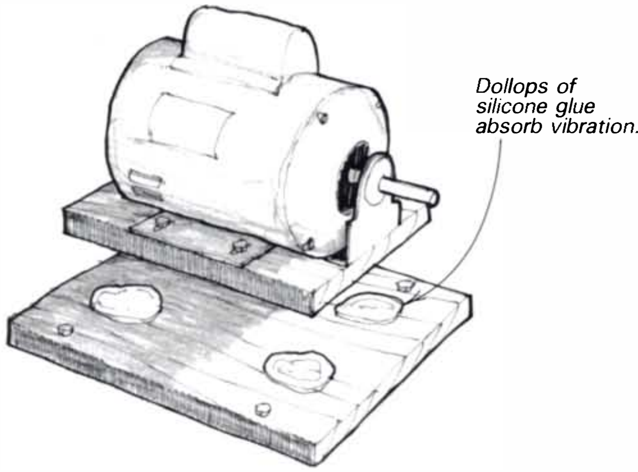
I'm familiar with the principle of barrel nuts—short lengths of round steel rod, drilled through and tapped—used as captured nuts to join stretchers to frames. Unfortunately, when I tried to manufacture them, I quickly discovered that the metalworking tools and skills required were beyond my meager means.

Instead, I returned to my own system, shown in the sketch. It uses a piece of flat, 1½-in.-long, ¾-in.-wide steel that is drilled, tapped and fitted into a routed slot in the stretcher.

The rectangular shape of the "nut" allows maximum purchase, and you can vary its orientation as shown, depending on the thickness of the frame members.

—Chuck Lakin, Waterville, Maine

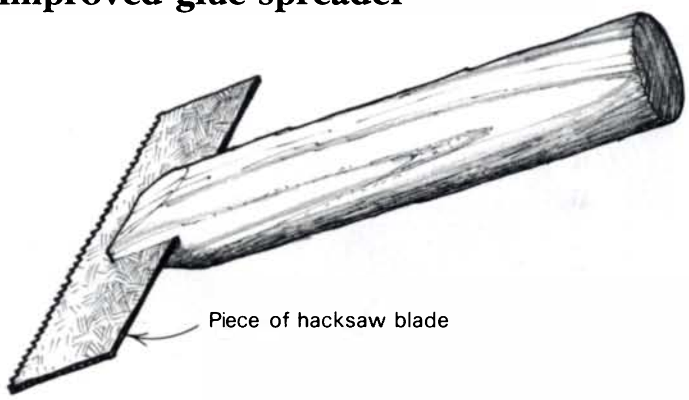
Homemade rubber motor mount



A rigidly mounted motor can set up annoying vibrations and cause an entire machine to buzz. Here's how to mount the motor on rubber, which will usually cure any vibration problem. Simply glue two plywood motor-mount boards together with four big dollops of silicone-rubber adhesive. (The rubber seems to adhere better if the boards are varnished first.) To keep the rubber from squeezing out, place ¼-in. spacers between the two boards until the rubber cures. Now, screw the motor to the top board and fasten the bottom board to your machine base. The rubber will insulate the machine from vibration.

—Bill Webster, Chillicothe, Ill.

Improved glue spreader



I've seen several ideas for glue spreaders in "Methods of Work," all of which, in my opinion, have a serious drawback: Their smooth edges make it difficult to spread a consistent amount of glue over a broad surface, because the slightest variation in pressure varies the amount of glue on the surface.

To avoid this problem, I use broken or worn-out hacksaw blades for glue spreaders. The toothed edge works just like a tile layers' notched trowel, leaving a consistent layer of glue wherever it's spread. To make a handle for the spreader, I hacksaw a short slot in the end of a dowel scrap and press the section of blade into the slot. *—David W. Engel, Joliet, Mont.*

Quick tip: If you use uncoated "black" pipe in your pipe clamps, the metal will react with aliphatic-resin glue to produce a deep purple stain on your project. To remedy this problem, simply spray the pipe with several coats of polyurethane varnish to seal it. *—Keith Henderson, Richfield, Minn.*

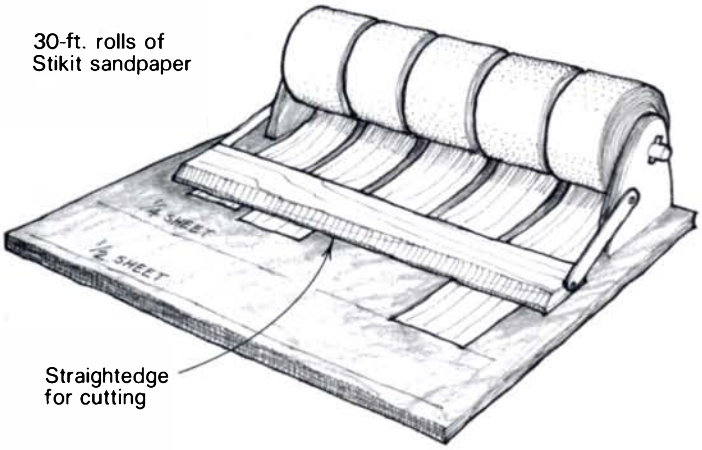
Tinting glue

Since most carpenters' glues dry almost colorless, any squeeze-out is hard to see until you apply the stain and see that telltale white spot. To solve this problem, tint your glue

with ordinary food coloring. A few drops of red or green will make any squeeze-out highly visible and easy to sand off. If your taste in color is more conservative, mix equal amounts of red and green to make a pleasant brown.

—Donald F. Kinnaman, Phoenix, Ariz.

Stikit to the rescue



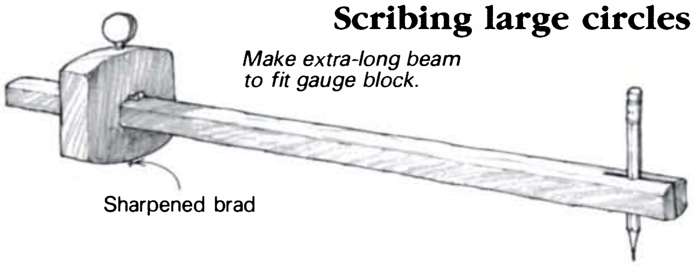
I read Ben Erickson's letter expressing his displeasure with the Makita B04510 sander's thumb-torturing, paper-clamping arms (*FWW* #62). I also own a Makita sander, and agree with Erickson's low opinion of the clamping system. I just hope the garbage truck hasn't already hauled away his sander, because when the sturdy little machine is coupled with 3M's new Stikit paper system, it's a winner.

Stikit is a new adhesive-backed sandpaper that not only eliminates paper-clamping problems but also makes paper changing a snap. The product was developed expressly for orbital sanders, and is available in 30-ft. rolls in several grits, from 80 to 220. To use the paper, you first install a special pad on the bottom of your sander. Then, you simply press a sheet of the paper on the pad and you're ready to go. When the paper is worn, you just peel it off and put a fresh sheet on. The Stikit system not only makes changing paper easier—it also makes the sheets last longer since there are no bends to tear. Rolls of Stikit paper—along with special conversion pads that can be applied to any orbital sander—are available from Trend-Lines, Inc. (375 Beacham St., Chelsea, Mass. 02150) or Woodworker's Supply of New Mexico (5604 Alameda N.E., Albuquerque, N.M. 87113).

To dispense the paper easily, I built a plywood and dowel rack like the one shown in the sketch. A fold-down straightedge of wood or metal holds the paper and provides an edge for cutting off the correct length with a utility knife.

—Voicu Marian, Alliance, Ohio

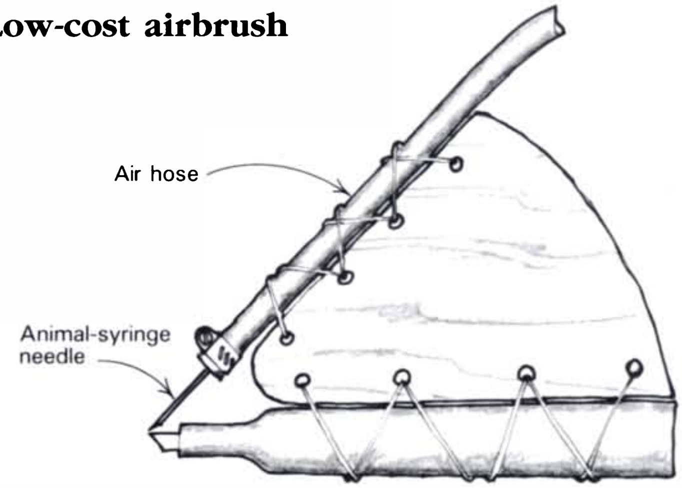
Scribing large circles



Here's an inexpensive and easy-to-make alternative to trammel points for scribing large circles or arcs. First cut a long hardwood beam to fit the hole in your marking gauge. Make a vertical sawcut in one end of the beam, and drill a ⁵⁄₃₂-in. hole through the cut to hold a pencil. Now, drive a brad in the bottom of the gauge to serve as a compass point, install the beam in the gauge block and you're ready to scribe a circle as big as the beam.

—Gregory V. Tolman, Evergreen, Colo.

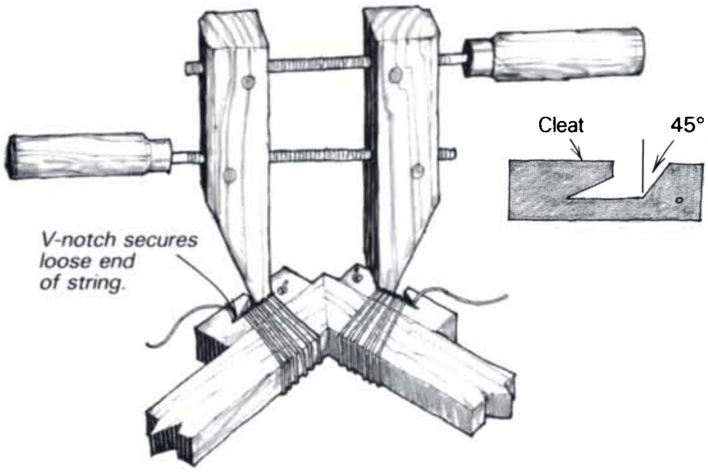
Low-cost airbrush



You can make an effective airbrush by using a needle from a No. 11 animal syringe and a common felt-tip marker. As shown in the sketch, a simple wooden block with rubber bands holds the tip of the marker in the fine airstream that passes through the needle. For the air supply, use a shop compressor regulated at from 15 to 30 psi. I recommend the use of an electric solenoid to start and stop the air with a minimum of bleed-off. I use the airbrush to detail fishing lures in a rainbow of colors.

—Fred J. Steffens, Monroe, Wis.

Miter clamping cleats



Here's an easy way to attach clamping cleats for gluing mitered joints. You'll need eight of the clamping cleats, which can be cut out on the bandsaw in just a few minutes. The cleats can be made up in any size using about the same proportions as those in the sketch. They should be about the same thickness as the stock being glued.

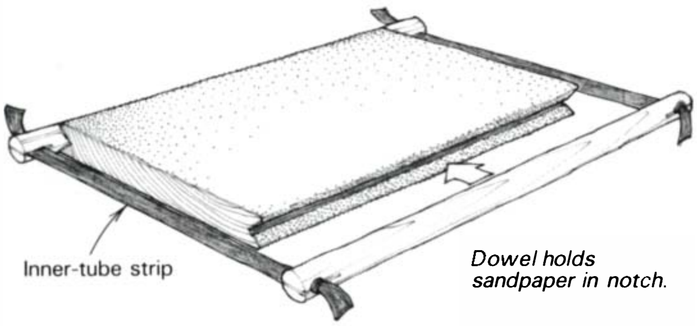
To use the cleats, set one in position near the corner to be glued and wrap the attached string around the frame six or eight times. Secure the loose end of the string in the V-notch of the cleat. Repeat with other glue cleats until you have a pair installed at each corner. Now, pull the cleats together with clamps. The cleats will move a fraction of an inch at first and the string will creak as it takes the strain. But, soon, the cleats will hold tight, giving your clamp a perfect perch to draw the joint tight.

—David Wardale, Merced, Calif.

Two-faced sanding slab

I suspect many among us like to sand small pieces of wood by rubbing them back and forth on a whole sheet of sandpaper, finger-pressed against the top of a workbench or the flat table of a handy woodworking machine. And just as many of us know that it's only a matter of time before OOPS. . .we slip

and that fresh sheet of sandpaper is wrinkled or torn. If this sounds familiar then, between projects, make this versatile sanding slab from a piece of scrap and a couple of inner-tube ribbons. The device firmly clamps a full sheet of sandpaper for sanding, but allows easy replacement when it's worn out. While you're at it, make two slabs so you can have four different grades of sandpaper at the ready, simply by flipping the slabs.

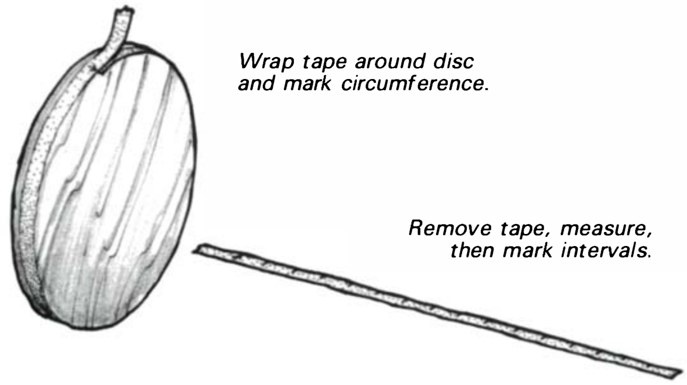


Size the slab as long as a sheet of sandpaper but about an inch narrower so that you can fold the sandpaper's edges over into the V-grooves and hold them with the tensioned dowels. The thickness of the slab is not important. No doubt, ¾-in. stock and ¾-in. doweling would work just fine.

To use the slab, simply fold a sheet of sandpaper over its face, snap the tensioned dowels into the V-grooves and start sanding. Here's a hint for mounting two sheets at once: Tack two sheets of sandpaper in place temporarily with masking tape before snapping the dowels into the V-grooves.

—Frank Schuch, La Mesa, Calif.

Dividing a circle



Here's an accurate way to lay out equally spaced intervals on the circumference of a circle—without the aid of dividers, protractors, indexing heads or geometry skills. Simply wrap masking tape around the circle and mark where the tail of the tape overlaps the starting point. Remove the tape and fasten it to a flat, clean tabletop. Now, measure the distance between the marks to get the circle's circumference and divide this distance by the number of intervals you want. Next, lay out the intervals on the tape, reapply the tape to the workpiece and mark each interval's location on the workpiece circumference by piercing the tape with an awl.

—Randall Bishop, Christiansburg, Va.

Methods of Work buys readers' tips, jigs and tricks. Send details, sketches (we'll redraw them) and photos to Methods, Fine Woodworking, *Box 355, Newtown, Conn. 06470. We'll return only those contributions that include an SASE.*

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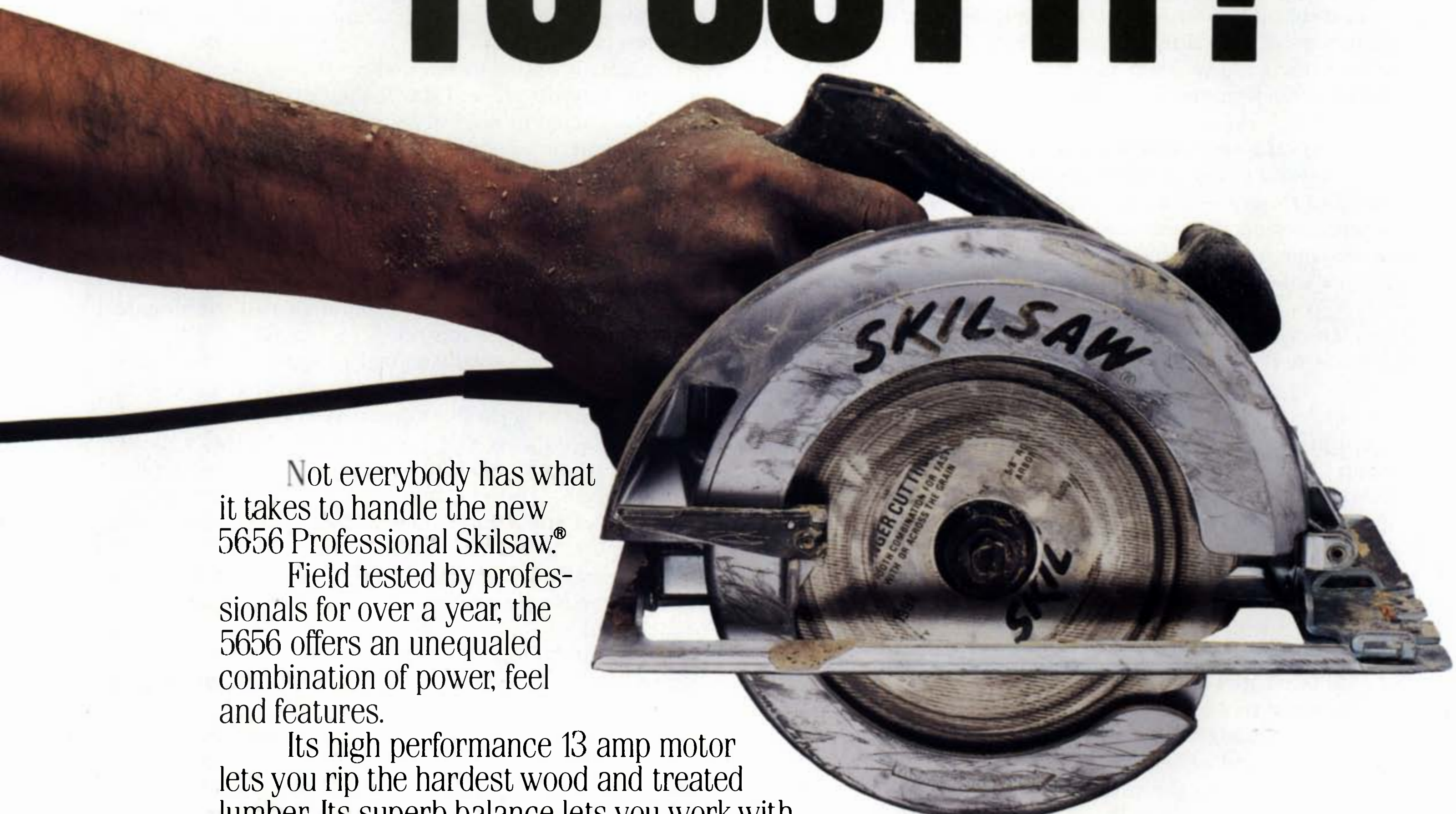

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Removing Formica from an antique table

I'd like to remove Formica laminate from an antique tabletop. What's the best way to do it? Is the process more difficult if the top is also veneered?

—Richard J. Martin, Avon Lake, Ohio

Jack Gavin replies: It's possible to remove plastic laminate, but it's not easy. Chances are, the Formica was glued down with contact cement, which can be dissolved with lacquer thinner or contact-cement solvent. Working in a well-ventilated area, feed a small amount of thinner under an edge. A glass (not plastic—it would dissolve) eyedropper and a thin steel spatula are good for this. Don't use a chisel or screwdriver—they could gouge the wood. Once an edge is up, use a paper (again, not plastic) cup to pour a small amount of thinner into the gap. Be very patient, and try to remove the laminate in one piece; it's a tedious job if the laminate breaks into many small pieces. When the laminate is off, remove the glue residue with a scraper. Don't use abrasives—they'll gum up immediately.

The lacquer thinner shouldn't lift any veneer below the laminate, since the original veneer was probably glued down with hide glue (hide, aliphatic-resin and urea-formaldehyde glues are all unaffected by lacquer thinner). This, of course, assumes that the veneer is still soundly attached to the core.

If the Formica is attached with white or yellow glue, you'll have to steam it off, which will probably remove the underlying veneer as well. If the Formica laminate was epoxied on, your best bet is to use a belt sander and a deft hand.

[Jack Gavin is a furniture- and cabinetmaker in New York City.]

Water spots on rosewood finish

We have several pieces of Burmese rosewood furniture, manufactured in Hong Kong. We were told that it was finished with a natural tree oil that was highly allergenic to many people. Now we have surface water stains on some of the pieces and can't find a way to polish them out. Any suggestions?

—Harvard P. Stewart, Lafayette, Calif.

Nancy Lindquist replies: Water stains that appear white and cloudy are in the finish itself (the stains would appear dark if they were in the wood). Before you try to remove the stains, you must identify exactly which "natural tree oil" was used. My skin prickles at the thought of urushi—an allergy-reactive tree sap used in the Orient as a natural lacquer. But urushi is impervious to water (it's commonly used on tableware), so I suspect your finish is something else. It might be a heavy wax buildup that has spotted, or another finish—such as oil or shellac—that was applied on top of the finish.

Many of the Oriental rosewood pieces I've seen have oil finishes covered with a heavy layer of wax, which can be damaged by water, alcohol and heat. I would guess that this is your problem. If the spot is in the wax, a cloth moistened with mineral spirits and rubbed gently on the piece (with the grain of the wood) will remove the wax. When spotting is in the oil, I use Minwax natural penetrating oil on a cloth, wiping evenly over the surface. This sometimes leaves the rosewood darker than desired, so I quickly pull out some of the oil with a light application of alcohol on a rag. When this isn't enough, I sand carefully with 400-grit, non-loading finishing sandpaper (available at cabinetmaking or automotive supply stores) to remove the spot. Then, I feather out the area and sand again.

At this point, I'd apply a thin coat of oil with a lint-free cloth, then smooth out the surface the next day with 0000 steel wool. You might want to apply a 1:1 coat of oil and varnish, rather than straight oil. For added protection, I wax these finishes with a final coat of carnauba-based paste wax.

By the way, you can identify exactly which finish was used by process of elimination. Use cotton swabs dipped in increasingly stronger solvents to see which will dissolve the finish, making it soft and sticky. Work in an inconspicuous area on the piece. Begin with mineral spirits, which will dissolve wax. Then, try turpentine, which dissolves most oils. Next, test with denatured alcohol for shellac, and lacquer thinner for synthetic lacquer. If the finish is a varnish, lacquer thinner may lift or wrinkle the finish, or have no effect at all. The final test is paint stripper, which will remove all of the above, except urushi. If the finish is urushi (a good indicator is whether or not the pores are completely filled with finish—most urushi finishes are as smooth as glass), removing the wax with naptha or mineral spirits should remove the spots. Afterwards, rub the urushi finish with a fine automotive polishing compound to remove fine scratches and renew the sheen.

[Nancy Lindquist is a furniture finisher in Kansas City, Mo. She wrote about her allergic reaction to urushi in "Notes and Comment," *FWW* #55.]

Homegrown spalted

I recently got my first taste of turning. Now, I'm particularly interested in beginning to work with spalted wood. Is there an easy way to spalt wood myself?

—Ray Allen, Yuma, Ariz.

Jim Cummins replies: Spalting is caused by microorganisms that invade the wood and begin to consume it. The resulting pattern lines and colors mark the boundaries between different colonies of fungi.

Spalting usually occurs in areas where there's plenty of dead wood on the forest floor, and where the environment is damp enough for the fungi to survive. I suspect that these conditions are relatively rare in Arizona.

However, if you want to experiment with spalting at home, you might try creating an appropriately moist, dark environment inside a black plastic bag. Let nature takes its course, waiting for mushrooms to blossom on the endgrain. I don't know how long this homegrown spalting technique will take. I'd allow a couple of years though, aiming to start working the wood before the sapwood rots off.

Because spalting is a totally natural process, it's also totally unpredictable. There's no way of guessing what you'll end up with until you actually do the turning. And not all spalting is attractive. I've seen a lot that was just dirty shades of mushy gray. To a great extent, the results of your project will depend on the organisms "floating around" in your neighborhood. Who knows: You might come up with a whole new dimension in spalting and color.

Another thought: Woodturners first used spalted wood because it was free for the taking, right off the ground. If spalted isn't indigenous to your area, I'd recommend that you adopt the spirit behind spalted—scour your desert and mountains for free native woods, and discover the mysteries hidden in your own backyard.

[Jim Cummins is an associate editor of ***Fine Woodworking***.]

A bog-oak briefing

When my nephew was in England about 15 years ago, he bought a table made with an almost black, unbelievably heavy oak. The wood was called "Welsh oak." Can you tell me more about it? —Pendleton Tompkins, San Mateo, Calif.

Liam O'Neill replies: I suspect that the wood you're describing is bog oak. Although most plentiful in Ireland, where there are huge areas of peat bogs, bog oak is also found in Wales and, I believe, even in Maine. This wood is usually much heavier than normal oak. It also turns black when finished, although the grain and rays remain clearly visible.

Historians have quipped that Ireland was so densely covered with forests of oak and pine five or six thousand years ago that a squirrel could travel the length of the country without touching

the ground. Over time, the area's climate changed from relatively dry to its present wet, temperate climate. Undergrowth that died and fell to the ground formed layers of compressed material that became the peat bogs. The bogs grew deep and the amount of water retained in them increased. Oak trees that died, fell on top of the peat and sank were preserved almost intact. Today—thousands of years later—peat-harvesting operations continue to uncover this "bog oak."

In times past, bog oak was used for furniture and coopered utensils—especially among Irish country folk who, forbidden by the aristocracy to cut live trees, were allowed free access to anything in the bogs. Bog oak takes a long time to dry (it was immersed in boggy peat for 5,000 years, after all). Don't try to speed the process up, and be sure to quartersaw the wood.

I use bog oak for turning, beginning with freshly uncovered material and turning the pieces while they're still wet. I find it necessary to turn the walls as thin as possible, using a very sharp tool and a slow lathe speed (any friction-generated heat will cause instant distortion). As the turning dries, it becomes very oval and the surface crinkles to an amazing texture.

[Liam O'Neill is a full-time turner with a studio in Shannon, County Clare, Ireland. He frequently conducts woodturning seminars in Ireland, England and the United States.]

Steambending with fabric softener

I read in FWW *#37 ("Methods of Work") and* FWW *#61 (Letters) that Downy fabric softener can be help make wood more pliable for bending. I tried boiling some ¾-in. by 2-in. pieces of oak for 2½ hours in a solution of Downy and water, then kept them hot and covered for another two hours. I was then able to bend the pieces into sweeping turns of 2° to 45° on seven different planes with the bends just 12 in. apart. I tried similar bends without Downy, and all the pieces broke. Just what does the Downy do?*

—Warren Foote, Olympia, Wash.

Eugene Wengert replies: In order to bend wood successfully, you usually have to boil or steam it first—that is, get it hot and wet enough to plasticize it. But you don't want to wet the wood too much, because excessive wetness can create hydraulic forces that might rupture the wood's internal cells. About 25% moisture content is good for severe bends; 15% is right for gentle bends.

Brief steaming provides all the heat and surface-moisture you need to plasticize the wood for bending. Fabric softeners enhance the effect of steaming because they contain surfactants (wetting agents that reduce water's surface tension) and ammonia or ammonia-like chemicals that chemically modify wood, making it more plastic. But, once dry, wood treated with these chemicals won't be as strong as untreated wood. The treatment may also change the wood's color, or cause it to stain and finish differently, so you ought to experiment before you do a whole piece.

Because of the toxicity of the chemicals used, it's not a good idea to place fabric softener-treated wood in locations where creeping children or pets might chew on it.

[Gene Wengert is a professor of wood technology at Virginia Polytechnic Institute in Blacksburg.]

Send queries, comments and sources of supply to Q&A, Fine Woodworking, *Box 355, Newtown, Conn. 06470. We attempt to answer all questions but, due to the great number of requests received, the process can take several months.*

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Produce your own cabinet doors with this 5-piece router bit set at a fraction of the cost of shaper heads!!

These bits are individually balanced and designed to be used with a $\frac{1}{2}$" table mounted router.

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Produce professional quality cabinet doors with this 5 piece set of cutter heads designed for your $\frac{3}{4}$" - $\frac{1}{2}$" spindle shaper. These heads are sharpened with a 600 grit diamond wheel for an extremely sharp edge. One half inch bushings standard.

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These Forstner bits will produce a flat bottom hole and bore any arc of a circle at any angle thus allowing you to make pocket holes. A special heat treated steel is used in their production to assure long lasting edges.

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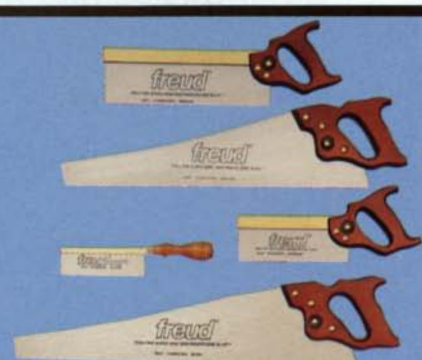

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The collection of 5 saws (rip, panel, tenon, dovetail, gent's) will meet all of your hand saw needs. They are precision balanced, thus letting the saw work with you. The lacquered English red beech handles are designed to make your precision sawing comfortable.

		List	Sale
Set of 5 Hand Saws		$112.25	$ 99.95
RS024	24" x 7 points	24.19	22.75
PS022	22" x 10 points	22.83	21.50
TS012	12" x 15 points	29.16	27.40
DS008	8" x 20 points	25.58	24.00
GS006	6" x 15 points	10.49	9.90

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This 50 piece set consists of: A) 25 high speed steel bits ($\frac{1}{16}$" - $\frac{1}{2}$" in $\frac{1}{64}$" increments) B) 4 high speed steel bits for sheet metal ($\frac{1}{4}$, $\frac{3}{16}$, $\frac{1}{8}$, $\frac{3}{32}$) C) 6 chrome vanadium steel brad point bits for use in wood ($\frac{1}{8}$, $\frac{5}{32}$, $\frac{3}{16}$, $\frac{1}{4}$, $\frac{5}{16}$, $\frac{3}{8}$) D) 6 carbide tipped masonry bits with hex shanks ($\frac{5}{32}$, $\frac{3}{16}$, $\frac{7}{32}$, $\frac{1}{4}$, $\frac{5}{16}$, $\frac{3}{8}$) E) 1 center punch, 1 Allen key and 6 depth stops.

These bits fit any stationary or portable drill using $\frac{3}{8}$" or larger chuck.

		List	Sale
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by Jim Cummins

The article on bandsaws in *FWW* #63 drew so much mail, we decided to run this Follow-up column to elaborate on some of the information in the original article, share some thoughts from readers and update our list of sources of equipment and information. Letters from readers discussing individual articles are full of interesting stories, clever ideas and challenging questions. We'll share more of them with you in future Follow-ups.

The bandsaw mail abounded with tales of successful tune-ups, some of them entailing almost a complete rebuild. My favorite anecdote came from M. Schulter of Brooklyn, N.Y., whose "tune-up" must be the quickest in living memory. It occurred when he bought a used Delta back in 1940. The saw wasn't cutting too well because the owner had installed the blade with the teeth pointing up. Schulter spotted the mistake, bought the saw, turned the blade inside out and started cutting. Of course, the old owner then wanted to cancel the sale.

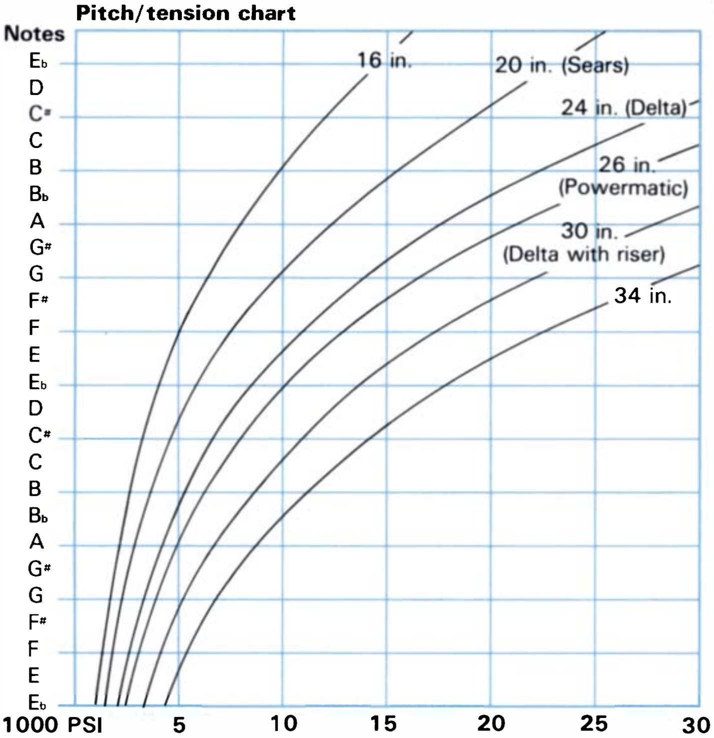
Musical-pitch and tension update—I was delighted to be absolutely wrong about something in the bandsaw article. I had stated that you could do away with a $250 blade-tension gauge, and tighten the blade according to its musical pitch instead, which is still basically good advice. My mistake was that I said the pitches given would work only for a ¼-in. blade. "Not so," wrote Robert Riskin, of McCabe's Guitar Shop in Santa Monica, Calif. "Research on steel guitar strings has shown that the pitch is *independent* of the size of the blade. A ⅛-in. blade will have the same pitch at a given tension as a ¼-in. blade, and so will a 1-in. blade, provided their vibration length is the same.

"All you need to know is what pitch equals what tension on your saw," Riskin went on, "then you can accurately tension a blade of any width. Of course, the total stress on the machine goes up as the blade size is increased. A ¼-in. blade would pull the wheels together with a force of about 160 pounds, while a 1¼-in. blade would apply 2,500 pounds if they were both tuned to the note E (about 82 Hz)."

Riskin's report of the force required to stretch various blades underscores one of the points in the article that a few readers seem to have misunderstood. When I spoke of running a blade at 25,000 psi, I was not speaking of stressing the machine *itself* to anything like that figure—only the blade. One reader reported that he'd talked to an engineer who said that at 25,000 lb., the wheels and bearings would crumble. Well, sure. But not at the 160 lb. or so it takes to tension a ¼-in. blade up to specs. This is the reason I advocated using a ¼-in. blade for occasional resawing. The force required to bring wider blades up to proper tension could well damage a machine prematurely.

I was intrigued with Riskin's analysis of pitches, so I mailed him the tension gauge and asked him if he would like to try turning this new information into something useful. He came up with the graph shown below, left, which covers a range of bandsaw sizes. To use it, measure the free length of the blade on your bandsaw, then consult the chart to find out what pitch is applicable. I'd recommend a tension of 15,000 psi for all-around work—this is the tension my Rockwell has been set to day and night for 18 months. It corresponds roughly to the E (82 Hz) in the middle of the chart, and is the same note as the fattest string on a guitar. For difficult cuts or expensive stock, I tension my own machine to 25,000 psi or more. If your bandsaw won't track at 15,000 psi, I'd say you need a better one. Let me just repeat my advice to rotate the wheels as you check the pitch—if there is much variation as the wheels turn, the wheels are out of round and will have to be trued to get your saw working right. A bandsaw that's been run for some time with badly out-of-round wheels is bound to have suffered from fatigue in its bearings and axles. It might fail at any time—at a tension that a normal axle should easily withstand. Immediately after the article came out, we heard from one reader who broke an axle (Letters, *FWW* #64). Prior to publication, I knew of the same thing happening twice, both times on 20-in. Deltas with fatigued axles. In addition, Mark Duginske of Wausau, Wisc., sent a photo of a sheared axle on a Powermatic, which he attributed to overtensioning. Maybe—but to my eye, 80% of the steel was granulated from fatigue, something that must have taken a considerable time to develop. When my axle finally breaks, I'll call it normal maintenance. In the meantime, my bandsaw will do what I tell it to.

Pitch/tension chart



Bumpy flying tires—Wheels and tires have to be round or blade tension will be erratic. Rockwell owners should note that Delta has come out with improved wheels that are guaranteed to be both round and balanced. Thanks to the new castings, it appears that any Delta problems with out-of-roundness these days are most likely due to tires. Delta's Vice President of Engineering and Development, L.C. Brickner, wrote us: "When checked with a dial indicator, wheel runout should be 0.010 in. or less. The tires vary +/− 0.010 in. in thickness, and can cause vibration if they are not evenly stretched over the wheels, especially if the user glues the tires to the wheels in an uneven fashion. Incidentally, tires should not have to be glued, provided the machine is fitted with a 1,725 RPM motor. Some users have installed 3,450 RPM motors instead, and the resulting 6,000 sfm (surface feet per minute) band speed causes the tires to come off the wheels."

Feedback on vibration—Brickner also mentioned that Delta has a new resilient motor mount for the enclosed-stand model that goes a long way toward diminishing vibration and hum. A few readers came up with similar ideas. One shopmade mount is in this month's Methods of Work column (p. 8). Another idea came from E.L. Brendza of San Bernadino, Calif., who mounted the feet of his bandsaw on aircraft-style shock isolators. These consist of an outer housing that rests on the floor and an inner bushing to which the load is attached. The space between is filled with synthetic rubber, forming a diaphragm. I think I've seen motors on some washing machines and refrigerators mounted this way.

Before you rush out to the nearest aircraft-supply store, however, consider a low-tech alternative. Scott McBride, of Irving-

ton, N.Y., greatly reduced vibration in his Sears bandsaw by removing the saw from its stand and re-mounting it to a sheet of plywood just large enough to hold the saw and the motor. The sheet of plywood stands on four shock-absorbing rubber legs made from 2-in. lengths of auto radiator hose—the kind with segments like a caterpillar to permit bending. McBride has adjusted to using the saw without a stand—it's mostly for on-site carpentry work, and he enjoys the ease with which he can now carry it around.

Another vibration fix was mentioned by T.R. Holst of Boise, Ida., whose 14-in. Jet bandsaw had an annoying low-frequency oscillation that Holst likened to the action of a fishing rod. The fix was to clamp a one-pound weight to the motor mount—this cancelled out the harmonic that was causing the problem.

Blade speeds—Space restrictions curtailed a long discussion about controlling blade speed in the article, and I apologize to those readers who ended up confused. I recommended changing pulley sizes to slow the saw down to about 1,000 sfm for resawing, then mentioned that many bandsaws also had a range of speeds for cutting metals, some as low as 100 sfm—at this speed, a bimetal blade will cut steel for hours without dulling. What wasn't clear was that these wood/metal machines were equipped with an intermediate series of gears or pulleys to achieve these slow speeds.

If you buy a machine so equipped, make the most of it. Otherwise, to convert a wood-cutting bandsaw to metal cutting requires some ingenuity and is too much to go into here, although I can give you some hints. You could fit your machine with a jackshaft (countershaft)—see *FWW on Spindle Turning*, p. 19. You could run your saw through a motorcycle gearbox. You could fit an additional motor—a geared, low-speed model—to your saw and flip the drive belt to it when necessary. Or, you could power the saw with a variable-speed DC motor. I've heard of, but not seen, all of these conversions.

There's one other way a bandsaw can cut steel: friction cutting. In this technique, the blade is run at high speed and burns its way through the material. High feed pressure is required, as well as high blade tension. In the process, the teeth are blunted, making the blade unfit for cutting wood again, but you can continue to use it for friction cutting until it eventually breaks. Running a 6-tpi bimetal blade at 3,000 sfm on my saw, I can cut ⅛-in. leaf-spring steel at about the same speed as I can cut 2-in. mahogany, but the feed pressure is *much* higher. As far as I can tell, the blade itself carries away most of the heat, so that the temper of the metal being cut is unaffected. Before trying this, clean out any sawdust residue, or the sparks might start a smoldering fire. If this technique sounds unlikely, you can see a demonstration on my Taunton Press videotape, *Small Shop Tips and Techniques*.

Sources follow-up—Delta tells us that they have a toll-free number for information about their products. You can call (800) 438-2486; in Pennsylvania, call (800) 438-2487.
. . . Mahogany Masterpieces, Suncook, N.H. 03275 sells a range of West German HEMA bandsaws.
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Jim Cummins is an associate editor at Fine Woodworking.

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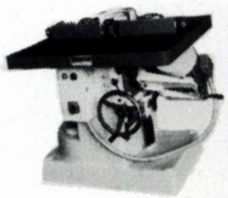

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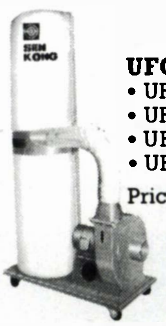

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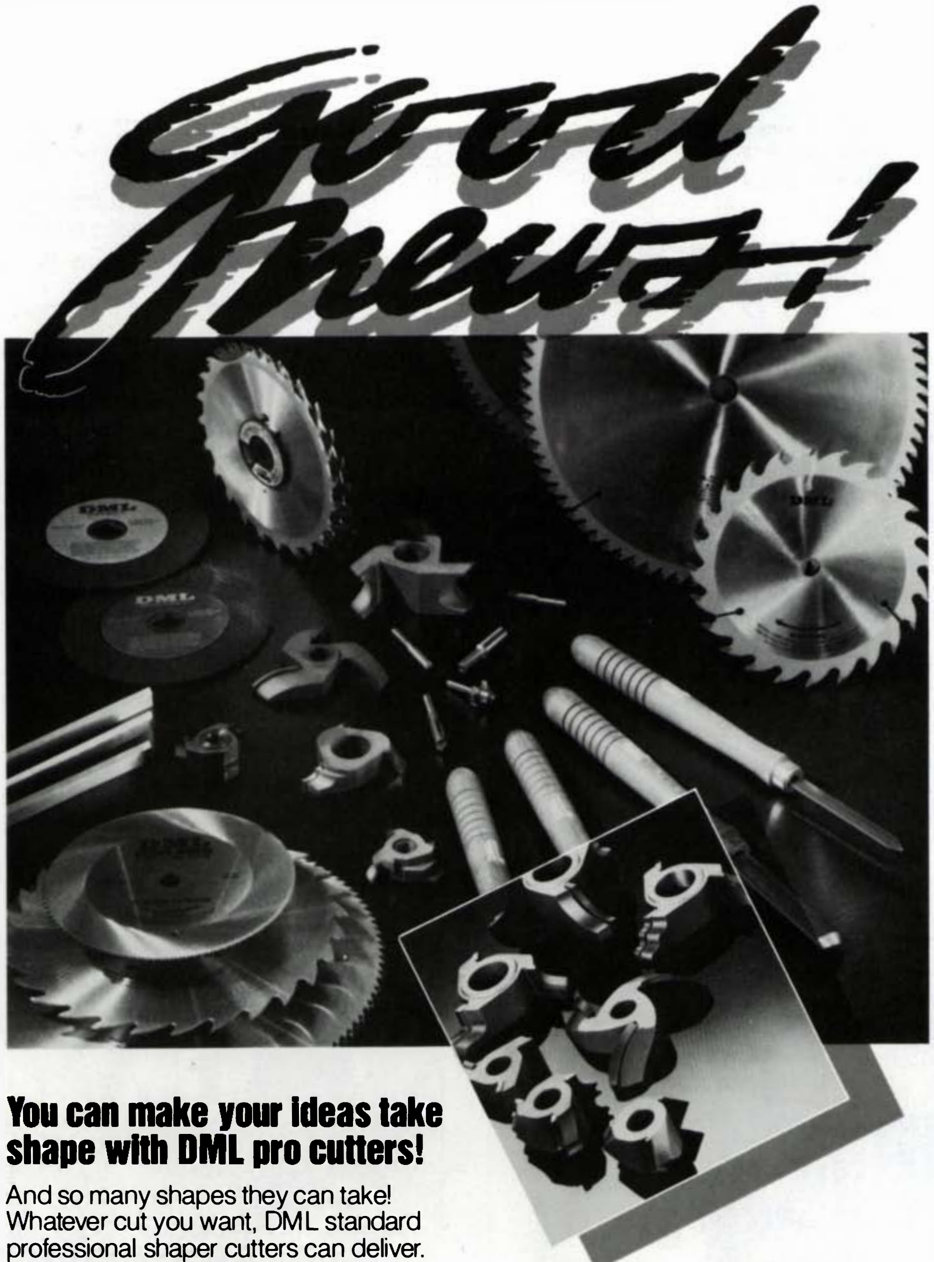

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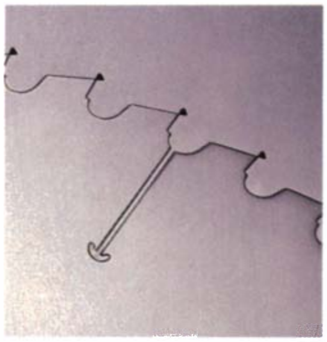

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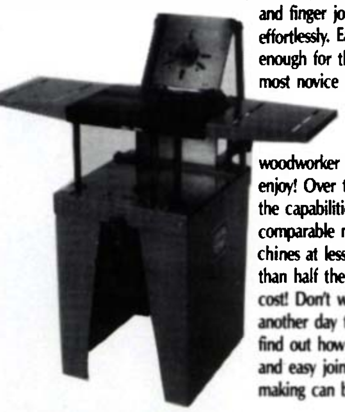

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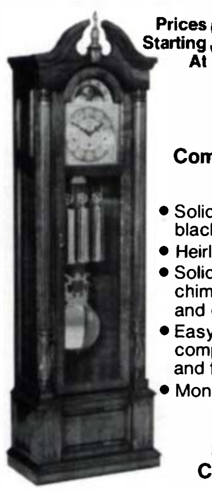

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Extension Tables

Their design and construction

by Jeremiah de Rham

Large tables are wonderful for crowds of ravenous, feasting relatives. But as soon as they go home, you're stuck with a conference table for twenty—and who wants to live with that every day? Besides, where do you put such a big table? Expanding tables are the answer to filling the room and feeding the folks three times a year; adding and subtracting table leaves can transform the table into any required size. The backbone of such a useful table is a pair of table-extension slides.

Figure 1 shows the basic way any slide system operates. A single slide consists of two or more beams, sandwiched together so they can slide past each other, and held face-to-face by a coupling system. My coupling system—wooden bearing blocks screwed to the beams—works as a load-bearing mechanism that supports the weight of the table. A slide needs a small amount of play in the coupling system to work smoothly, but this play also creates some sag when the table is extended. The more beams per slide, the more pronounced the sag—especially when the table is in its fully open position. On a smaller table with just two beams per slide, sag is negligible, but a larger table with many beams can sag noticeably. There are three main ways to counteract sag and keep a big table flat: increase beam overlap, crown the slides or add a fifth leg. The table's design determines which approach to take.

Many four-legged tables are large by design—6 ft. to 8 ft. long when closed—and may not require many additional leaves. This was the case with one table I built. Closed, it measured 7 ft. 6 in. in length. The client required only two leaves, each 10 in. wide. With the table long to begin with and requiring a minimal number of leaves, the slide design was of the simplest variety: two beams per slide stretching the length of the table.

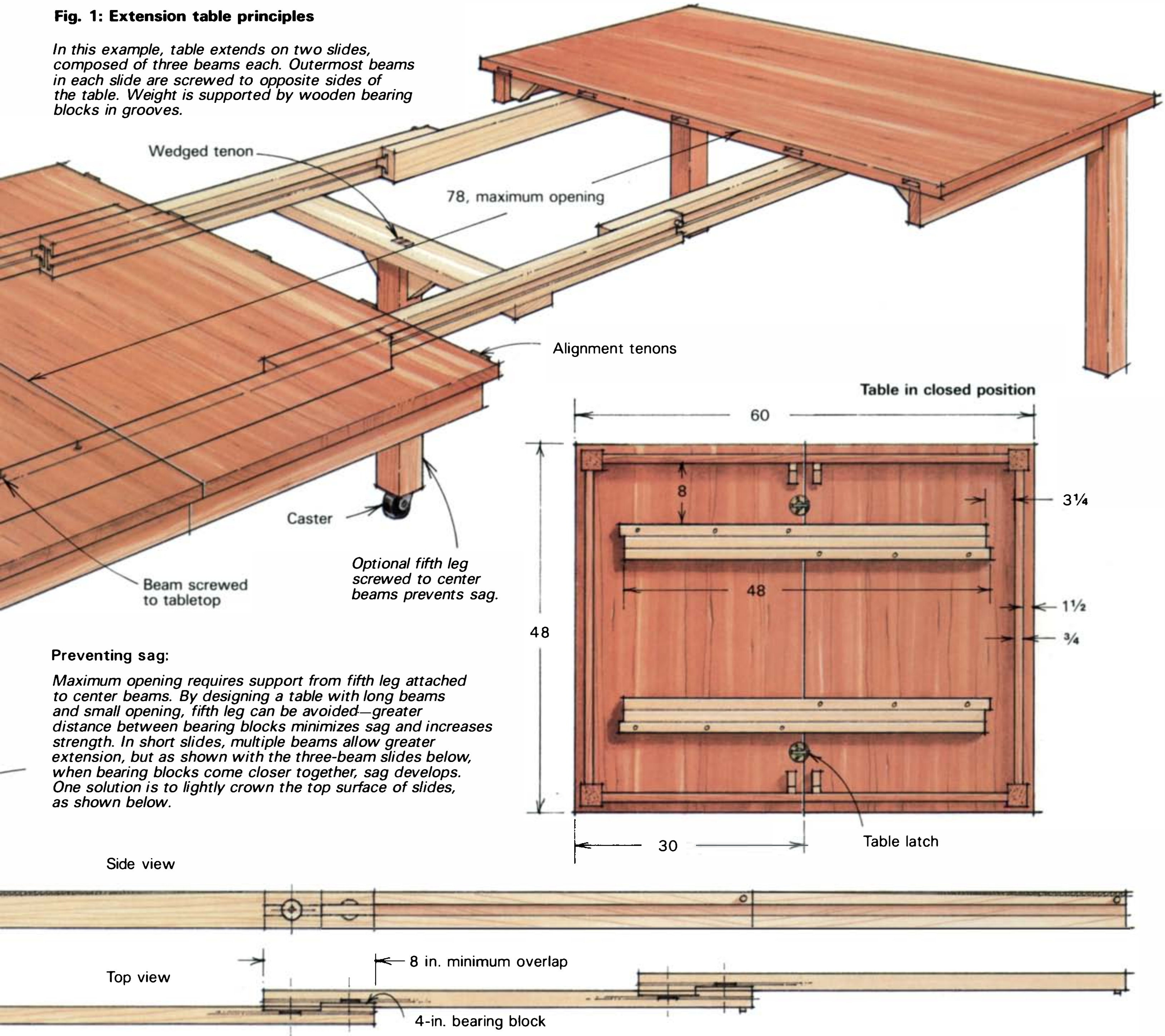
The length of the beams determines how far the table opens. Slides with two 7-ft. beams open a table 6 ft. 4 in.—allowing for an 8-in. beam overlap at the center, which I consider to be the least you can get away with. Shorter beams of 3 ft., centered under the table's midpoint, will open a table 2 ft. 4 in. (again, with an 8-in. beam overlap). Thus, either approach—7-ft. slides or 3-ft. slides—would have opened my client's 7-ft. 6-in. table wide enough to accept the two 10-in. leaves. But longer slides are superior in three ways: they effectively eliminate sag; they can be tenoned into the aprons for added strength; and they allow more leaves to be added in the future, if desired.

The farther apart the bearing blocks, the less possibility for sag. So a long table with beams from apron to apron that opens less than the full possible amount will not sag noticeably—the bearing blocks will remain 2 ft. to 3 ft. apart. When the two 10-in. leaves are in place on the table I built, the bearing blocks remain

Extension tables allow many design options. Three-beam slides, as shown in the drawing above, can be fitted with a fifth leg to prevent sag. The author's long two-beam slides, visible in the photo below, have been tenoned into the table's aprons, thereby transferring load from the screws in the tabletop to the aprons and legs. Leaves can be aligned with dowels (see photo) or stub tenons (see drawing). Author de Rham's table and chairs are shown below, right.

Fig. 1: Extension table principles

In this example, table extends on two slides, composed of three beams each. Outermost beams in each slide are screwed to opposite sides of the table. Weight is supported by wooden bearing blocks in grooves.



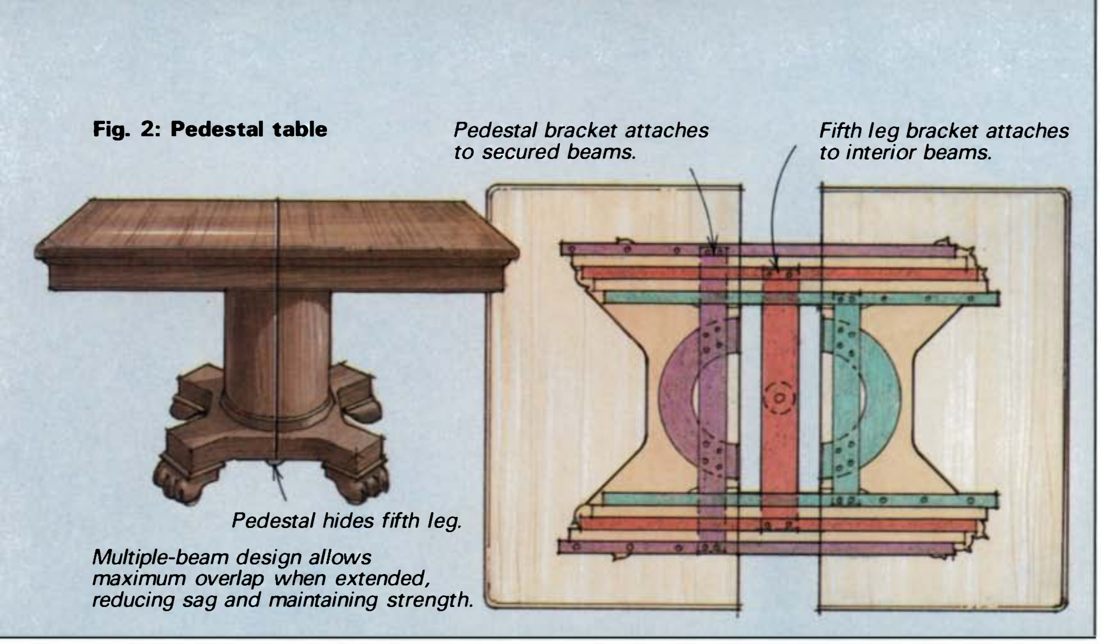
Preventing sag:

Maximum opening requires support from fifth leg attached to center beams. By designing a table with long beams and small opening, fifth leg can be avoided—greater distance between bearing blocks minimizes sag and increases strength. In short slides, multiple beams allow greater extension, but as shown with the three-beam slides below, when bearing blocks come closer together, sag develops. One solution is to lightly crown the top surface of slides, as shown below.

4 ft. apart. This amount of overlap makes the slides considerably straighter and stronger than if the blocks were close together. The other distinct advantage of full-length slides is that the whole table is strengthened by tenoning the secured end of each beam into the apron with a small stub tenon (figure 6). This transfers to the aprons and legs much of the weight stress otherwise carried entirely by the screws going into the tabletop.

Now suppose you want to build a four-legged table that is small to start with, say 3 ft. to 4 ft. in length, but must open up to at least 12 ft. long. With this design, you need multiple beams per slide—even with the slide beams going from apron to apron. And sag may still become a problem. Opening a 4-ft. table to 12 ft. requires four beams per slide, each 45 in. in length (this is the maximum length you can fit, assuming a ¾-in.-thick apron and ¾-in. top overhang). Allowing for beam overlap, the fully extended table will be 13 ft. 3 in. long. Adding another beam to each slide will push a little four-

Drawings: Joel Katzowitz; photos (except where noted): Lance Patterson



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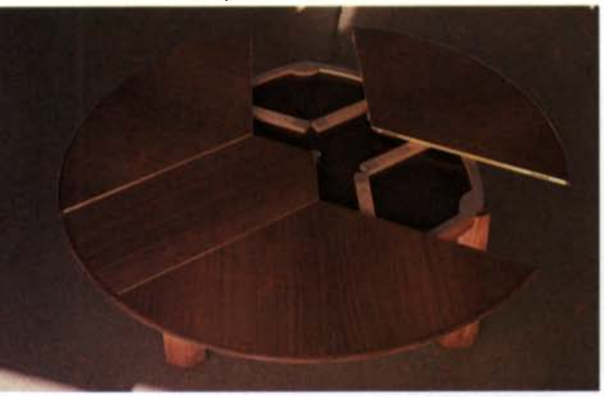


Photos above and below: John Michael Pierson

Jonathan Wright of Cambridge, Mass., built the ingenious three-way slider with radiating leaves shown at left. The table closes to form a three-lobed circle. John Michael Pierson of La Mesa, Calif., made an extension table (photos right) that slides on heavy-duty drawer glides (Grant #3320) concealed by the table's hollow, bent-laminated apron. Each slide assembly consists of two drawer glides screwed together, face-to-face, to allow extra extension length. When the table is extended, the glides are covered by U-shaped apron sections fastened to the underside of the wood-framed glass leaves.

footer into the big leagues at 16 ft. 4 in. Typical of any table with many beams per slide that opens a great distance, this table is ripe for sag. It's simply difficult with this design to keep the bearing blocks spread apart from each other without adding a ridiculous number of beams to each slide. If you want to avoid a fifth leg, consider crowning the slides (figure 1). This isn't difficult, just time-consuming. To tell how much the slides dip in the middle, extend the slides and stretch a string from one end of the table to the other. Theoretically, you need to plane the top of the slides so, when fully extended, the sag becomes a straight line. This often means planing up to 3/16 in. from the ends of the beams screwed to the tabletop (planing nothing from the midpoint of the opened slides). But planing this much crown tends to crown the table itself when closed, so the idea is to strike a happy medium—planing enough crown into the slides to visually reduce the sag, but not so much that the table appears obviously hunched when closed.

Design considerations for pedestal extension tables aren't all that different. The minimal-leaf-addition/long-beam solution often works here as well. But many pedestal tables don't have aprons, and this complicates matters. Without a table apron, the slides have to be placed a little closer to the center and kept on the short side so they're not easily seen. Pedestal tables that open a great deal will almost certainly need a fifth leg, usually a turned leg hidden within the pedestal when the table is closed (see figure 2). A couple of other approaches are shown in the photos above. In one case, the three-legged "pedestal" is large enough to support the table, regardless of whether the top is in the open or the closed position. The other design uses heavy-duty drawer extensions concealed in the table's aprons as slides.

If you use a fifth leg (often two tapered legs about 18 inches apart, joined by a stretcher and riding on casters), attach it to a board screwed to the bottom of the two center beams at their midpoint (see figure 1). As the table opens, the fifth leg tends to remain centered, holding the middle beams still while the inside and outside beams travel freely. This is the surest way to prevent sag. With all the chairs in place, a fifth leg isn't that noticeable, so don't be too reluctant to use one.

Keeping all this in mind, it's easy enough to figure out the general design on paper. To find the maximum opening for leaves, draw the beams as if they were fully extended. Add the length of each beam to that of the previous one, subtracting the 8-in. minimum overlap. Then, subtract the amount of beam attached underneath the tabletop. The remainder is the available space for leaves. Those readers who are squeamish about trusting their measurements as drawn could use thin strips of scrapwood—cut to the length of the proposed beams—as models of how the various amounts of extension will add up. This provides hands-on proof that what you draw will actually work as intended.

In my search for the ultimate table slide to incorporate in a recent commission, I came across a number of designs. I settled on the one that promised versatility, strength, ease of operation and—just as important—ease of manufacture.

Factory-made table slides are available in both wood and metal, but I quickly decided against these after shopping around. The wooden slides I found were skimpy and wobbly, didn't track smoothly and were available only available in certain lengths. The metal slides worked well but, again, their prescribed length limited their use. And while metal is immune to moisture movement, I felt reluctant to incorporate metal slides into a beautiful walnut table. A custom-built dining table deserves custom-built slides.

All of the older tables I've seen utilize one of several wooden

Dovetail extension slides

by Monroe Robinson

I like the idea of all-wood, dovetail slides. The round table shown below has three sets of them. The center slide set is longer than the others, and provides that much more stability. Starting with a 3-in.-thick plank of hard maple, it takes me two or three days to complete a set.

First, rip the stock oversize. How much oversize depends on how much the stock moves and warps as it comes off the plank—$\frac{3}{16}$ in. is usually enough. I cut the parts about 3 in. over-long, then stack the pieces (with spacers) and allow them to stabilize for several days.

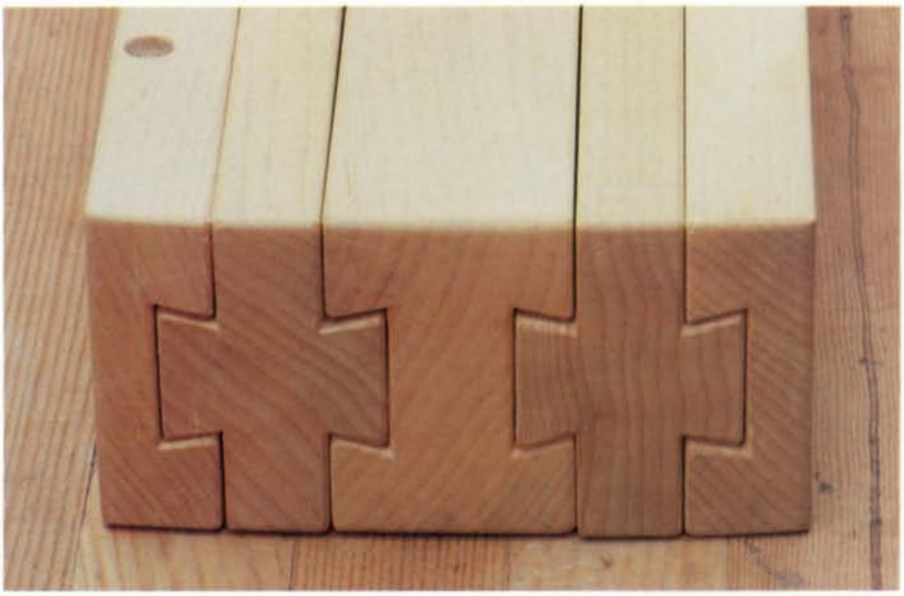
Next, I carefully joint and thickness the pieces. I always cut several spares—to allow for those that warp in spite of everything. I also cut several short pieces for test cuts.

I remove most of the waste on the tablesaw, flipping the stock so that both the top and bottom edges of the beams are reference surfaces against the fence. This ensures that the dovetails and their grooves are centered. The cuts are then brought to size on a router table in the same way, again centering the cuts. I aim for a tight fit, then work to the final fit using a pair of shopmade dovetail planes. I finish with a scraper, as shown in the photo at right. When final-fitting, number the slides so they will pair up again when fitted to the table.

The slide stop shown in the photo at the far right is made from $\frac{3}{8}$-in.-dia. brass tubing plugged with a short length of dowel. Epoxy holds the dowel in place, and also anchors the end of the $\frac{3}{4}$-in.-long spring. The stops engage the ends of tapered slots, which are made with a router, a $\frac{1}{2}$-in. straight bit and an angled template.

Before attaching the slides, plane down all the top surfaces that won't be screwed to the tabletop; this reduces friction. Wax is the final finish on all surfaces. □

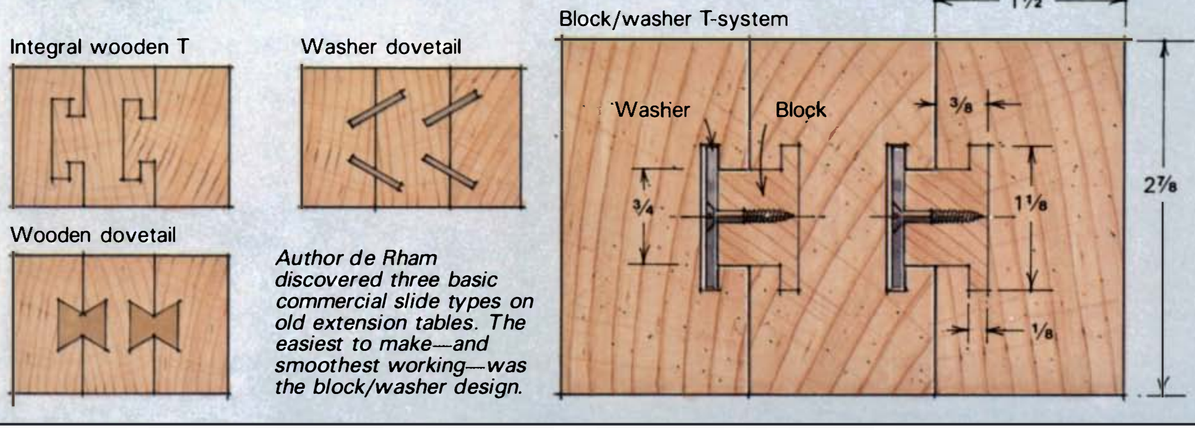
Monroe Robinson is a professional woodworker in Ft. Bragg, Calif., and an Anderson Ranch Art Center instructor.



Robinson's 58-in.-diameter table extends to a full 13 ft. 3 in., as shown below. Full-length dovetail slides require a stable wood, such as maple, and careful hand-fitting with the shopmade scraper shown in the photo, above left. The slide stops (right photo, above) engage a tapered slot about $\frac{1}{4}$ in. deep and 5 in. long.

Photo table: Hannes Krebs; other photos: Monroe Robinson

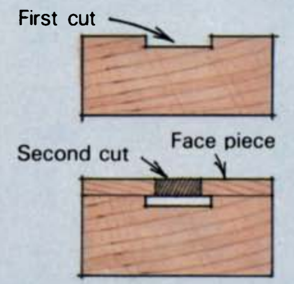
Fig. 3: Various table slides



Author de Rham discovered three basic commercial slide types on old extension tables. The easiest to make—and smoothest working—was the block/washer design.

Fig. 4: Alternative method

Instead of routing, you can dado wide groove, then glue face piece and dado again.



slide designs (figure 3)—any of which is far more substantial than anything available commercially today. Of these, the quickest to build is what I call the block/washer system. Others include the integral wooden T, the washer dovetail and the wooden-dovetail coupling system, although I've never seen the latter on an old table. These designs all had disadvantages that I wanted to avoid. I considered using the integral wooden-T system—it appeared to be the Rolls Royce of wood slides—but it requires more stock, takes longer to build and is harder to adjust if it binds. And since wooden Ts are more easily affected by expansion and shrinkage problems, they're often greased heavily to ensure smooth operation. So on to the infinitely simple block/washer table slide.

Making slides—For the commissioned walnut table, I built two 7-ft.-long beam slides to open the table 6 ft. 4 in. But to better understand how three-beam slides open a smaller table, I'll explain how to build a pair of slides that would extend a 5-ft. table an additional 6 ft.

Selecting a straight-grained hardwood that's dry and stable is important. Maple, ash or oak all perform well. For this particular pair of slides, we'll need six beams (three per slide), measuring 4½ ft. long, 2⅞ in. wide and 1½ in. thick. Rough-mill the stock first to relieve any stress in the wood, and let it sit in your shop a couple of days. That way, it's more likely to remain straight and true when you mill it to the final dimension.

Cutting grooves for the bearing blocks is next. Each slide consists of an outside beam, a middle beam and an inside beam. The middle beam needs a groove on both faces, while the inside and outside beams are grooved only on the face that tracks against the middle beam. With dado blades on the tablesaw, cut a groove centered along the length of the beam, ¾ in. wide and ⅜ in. deep. Reference the cut from the same surface of the beams—either top or bottom—so when the slides are together, the tops of the beams will be flush with each other.

Once the grooves are cut, you must rout slots at their bases, perpendicular to the edges. The washers that hold the beams together ride along in these slots. To accommodate the washers, the slots need to be ⅛ in. wide and ⅛ in. deep. Routing out this T-shape is a simple operation, but don't waste your time looking for an off-the-shelf bit to do it. I couldn't find one. A keyhole bit is a possible solution, but it won't cut the slots quite wide enough without widening the groove, and it'll cut too deep a slot without some alteration. Instead, I chose to alter a ⅞-in. steel rabbeting bit (shown in the top left photo, facing page) to cut the exact shape I wanted. This entailed carefully scribing the unwanted areas on the faces of the bit and then grinding them away—also grinding away the bit's integral pilot in the process. (A detailed explanation of how to modify router bits can be found in *FWW* #50.)

Use a router table or a router with a fence attachment. The bit will cut a full-depth washer slot on one side of the groove while, at the same time, cutting slightly into the other side of the groove. You need two fence setups to complete one T-slot. Clamp a beam to your bench and start routing. When the clamp's in the way, stop the router, leave it in place and move the clamp to the other end of the beam. Hold the router firmly, turn it on and finish the cut. Repeat this process on all beams, then change the fence setting for the opposite side of the slot. After routing is completed, the beams are ready for the wood blocks and tracking washers.

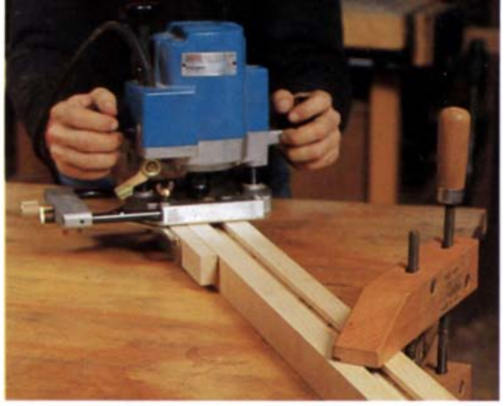
The 4-in.-long blocks serve two purposes. Primarily, they bear the weight of the table while guiding each beam along the groove of the adjoining beam. But they also serve as stop blocks to keep the beams from coming apart when fully extended (see drawing below). Place the blocks at opposite ends of adjoining beams, one block to a groove. These blocks can be T-shaped to fit the groove and slots, or they can be rectangular in cross section—the easier of the two designs to make. A tight fit holds the T-shaped blocks in place, but you'll need screws to hold the rectangular blocks.

Now, screw a 1-in.-dia. fender washer in the exact center of the bearing blocks with a flathead wood screw. (These washers don't bear any weight—they merely slide along in the T-slots, holding the beam together.) The screw's shank should be a little smaller than the washer's hole so there's a bit of slop, allowing the washer to glide along easily in the beam slots. The three beams can now be slid together. As you slide them back and forth, you may

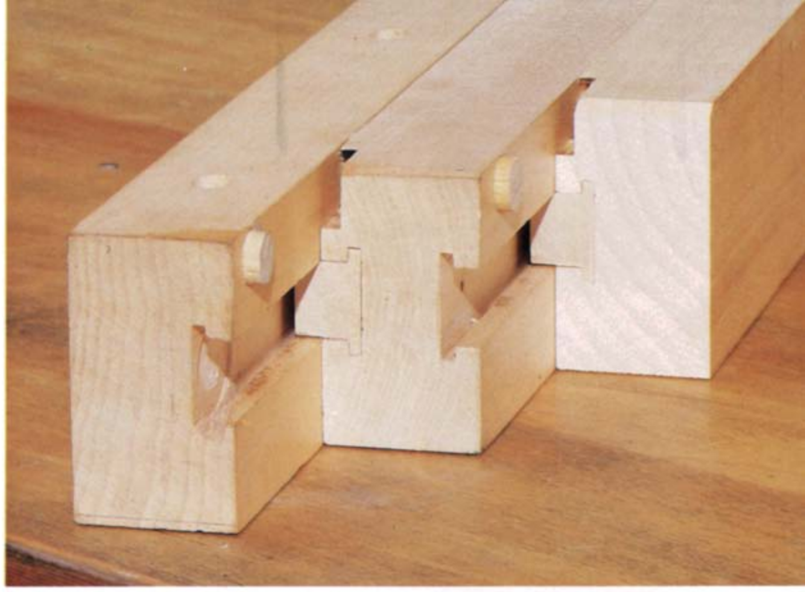
Fig. 5: Block/washer T-system

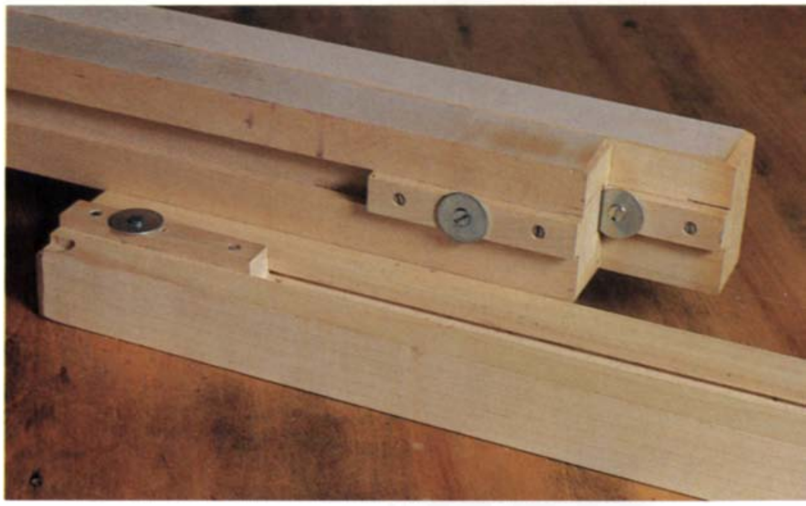
Block rides in groove, bearing weight of tabletop. Blocks also act as stops to prevent opening the slides too far.

Chamfer ends that might bump tabletop when slid.



Author de Rham demonstrates how to rout T-slots for slides. He modified a standard rabbeting bit (above, left) to enlarge the dado into a T-slot, one side at a time. The router's fence rides the side of the beam. When it reaches the clamp, de Rham turns the router off, relocates the clamp at the other side of the router and proceeds. An alternative method for machining the T-slot with glued-up stock is shown in figure 4, facing page.





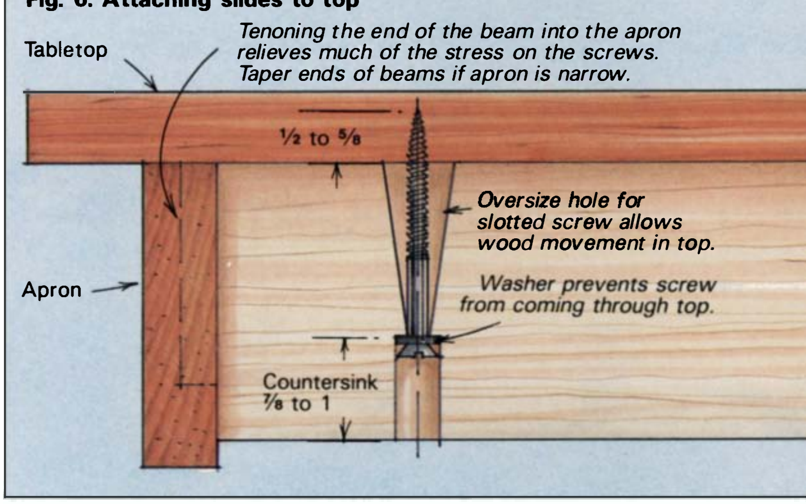
The two photos above and the drawing at the bottom of the page show the geometry of a three-beam slide—the end blocks bear the weight, while the washers merely keep the beams together. As the slides extend, the center beam remains more or less in place, while the outer beams—attached to the tabletop—slide to the left and right. At the ends of the slides, press-fit dowels act as stops to prevent the beams from disengaging (top photo).

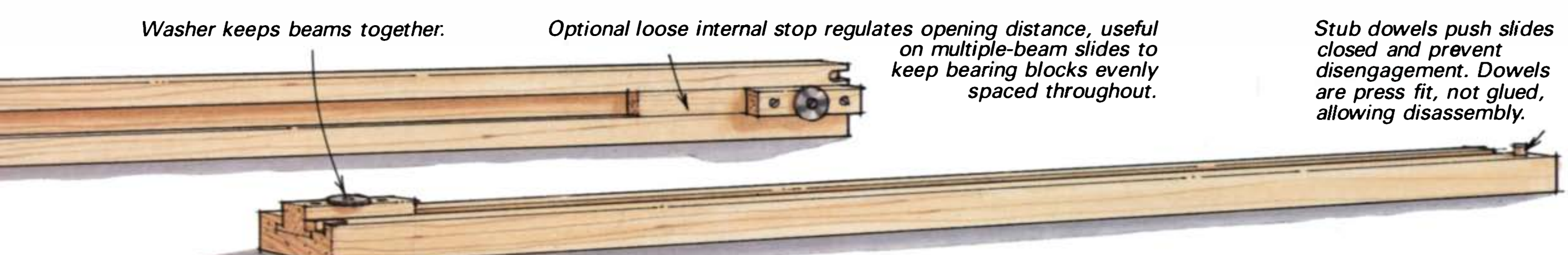
notice some binding. One or two adjustments will cure these sticks. First, check to see if the washers are screwed down too tightly, clamping the beams so close that the surfaces don't want to run past each other. Loosen the screws just enough to allow the washers to run like wheels. This adjustment will also help beams that are slightly bowed. Again, slide the beams back and forth. If they still stick, one of the wood blocks probably fits too snugly in the track. To remedy this stickiness, pull the beams apart, remove the washers and take a couple of shavings from the blocks with a rabbet plane. I find that a 1/64-in. to 1/32-in. clearance is optimum. More than this creates too much play and sag. Smooth-planing the beams' faces and liberally applying paraffin wax will really let the slides fly.

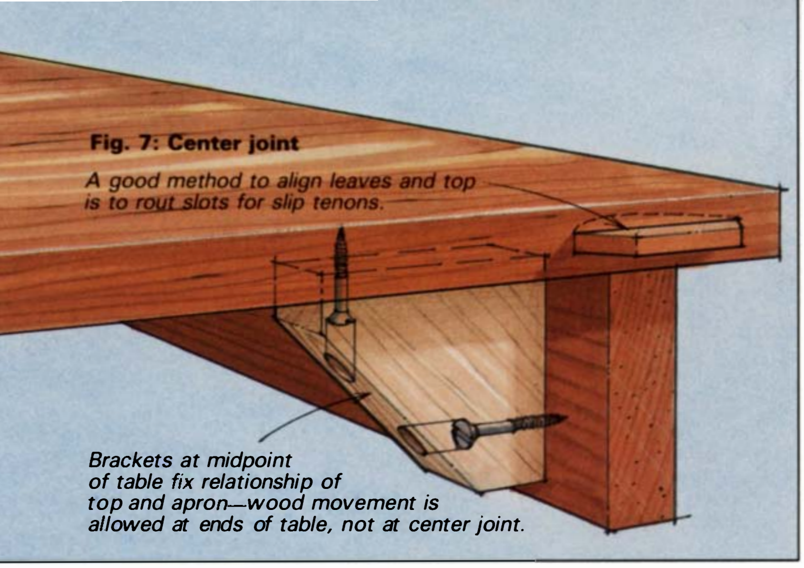
Once the sliding action is properly tuned, put the beams together and install closure stops like those shown above right and below. Without closure stops, the beams are likely to fall apart when the table is being closed, the blocked end of one beam slipping out of the open end of another. A simple stop is a ½-in. dowel fitted into a hole drilled ½ in. in from the open end of the outside and middle beams (see photo, top right). Drill a hole ½ in. deep and tap in a ⅝-in.-long dowel. Don't apply glue—the dowels must remain removable (with pliers) to get the beams apart. In order to stop the beams in line with each other, rout a shallow, short groove into the adjoining beam for the stop to slide into.

Now, attach the pair of slides to the table's underside. At each open, unblocked end of the inside and outside beams, drill three holes 6 in. apart, centered on the top edges, starting about two inches in from the end. Plan to use either #10 or #12 screws. Drill oversized holes, as shown in figure 6, right, and ream them further with a round rasp—to allow the screws to pivot back and forth along the length of the beam, ensuring free cross-grain movement for the tabletop. These screws are, in effect, holding the table up, so set the screws ½ to ⅝ in. into a ¾-in.-thick tabletop. For a 2½-in. screw, countersink ⅞ in. to 1 in. on the underside of the slides. To avoid dimpling the tabletop—or even cracking it—by bottoming out the screws too close to the surface, place a washer into the countersunk hole. That way, you can't tighten

Fig. 6: Attaching slides to top







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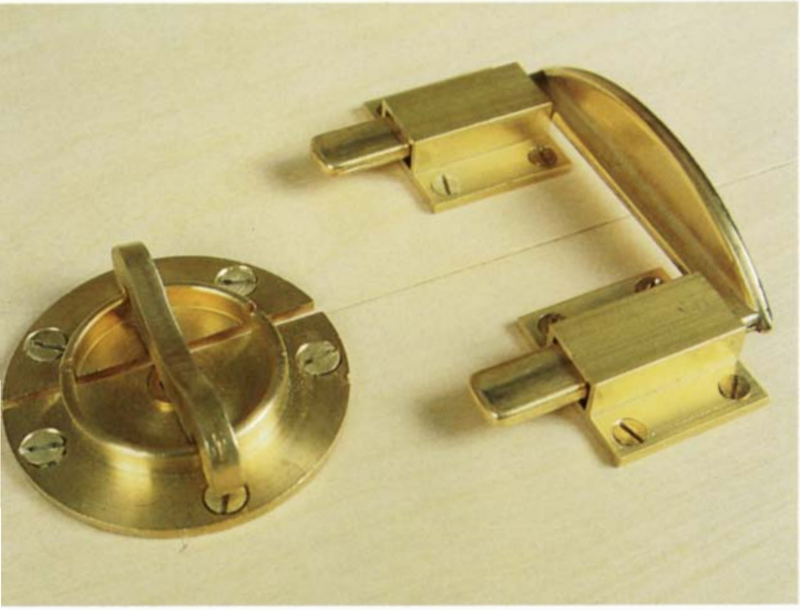


To hold an expansive table closed, round clasps, left, may be fastened to the apron or under the top. U-shaped clasps, right, are used in pairs on tables without aprons. Both clasps, Garrett Wade.

the screw heads farther into the top than planned. Use a drill press to countersink so depths are constant. And, by all means, measure carefully.

To attach the slides, place the table upside down in the closed position. Lay the closed slides down, with the midpoint of the slides at the tabletop break, pulling them open about an inch so the closure stops don't prevent the table from closing tight. Depending on the width of the table, place the slides so the outside beams are 8 in. to 12 in. in from the aprons. If there are no aprons, you may want to place the beams farther in—to ensure they'll be out of view. Mark the screw holes, remove the slides and drill for the screws. Use a wood stop block on the drill bit so you won't drill through the top. Replace the slides and screw them down, then turn the table over and push and pull until you tire of enjoying your mechanical wizardry.

Figure 7 shows how to handle the center joint of a table with an apron. At the center joint, secure the tops to the aprons with a fixed bracket; secure the rest of the top with some method that will allow the ends of the top to move (see "Fastening Tabletops," *FWW* #62). Closed, the aprons will always touch and not be held apart by a swollen top. Use table clasps (see photo, left) under the top to hold the center joint tight when the leaves are stored.

Leaf boards are usually left apronless—they're easier to store that way—but adding aprons to leaves is a nice design option. A mortised slot (made with a router and three-wing cutter) with slip tenons (figure 7) is an excellent way to join leaves. This method is very accurate to mark and easy to fit. Build a nice box to store your leaves in so they're not damaged. I've seen large hall chests that store leaves, with slots carefully lined with felt to protect the leaves as they're slid in and out. Now, invite everyone over, open up the table and enjoy. *Bon appétit!* □

Jerry de Rham is a member of Fort Point Cabinetmakers in Boston, Mass. The commissioned table and chairs shown were designed by David Handlin, an architect in Cambridge, Mass.

Another variation

by Curtis Erpelding

I built the slides for this table according to plans in Ernest Joyce's *Encyclopedia of Furniture Making* (Sterling, 1979). There are three rectangular nesting frames made of maple, each sized both horizontally and vertically to fit within the next. The slides are grooved their full length. The "bearing blocks" are full-length strips of wood glued into one of each pair of matching grooves. The frames don't need a washer system to keep them interlocked—that function is served by the short sides of each frame.

A hard-won hint to the wise: the table's diameter when closed—48 in.—turned out to be just a little too tight for comfortable dining. □

Curtis Erpelding lives in Seattle.

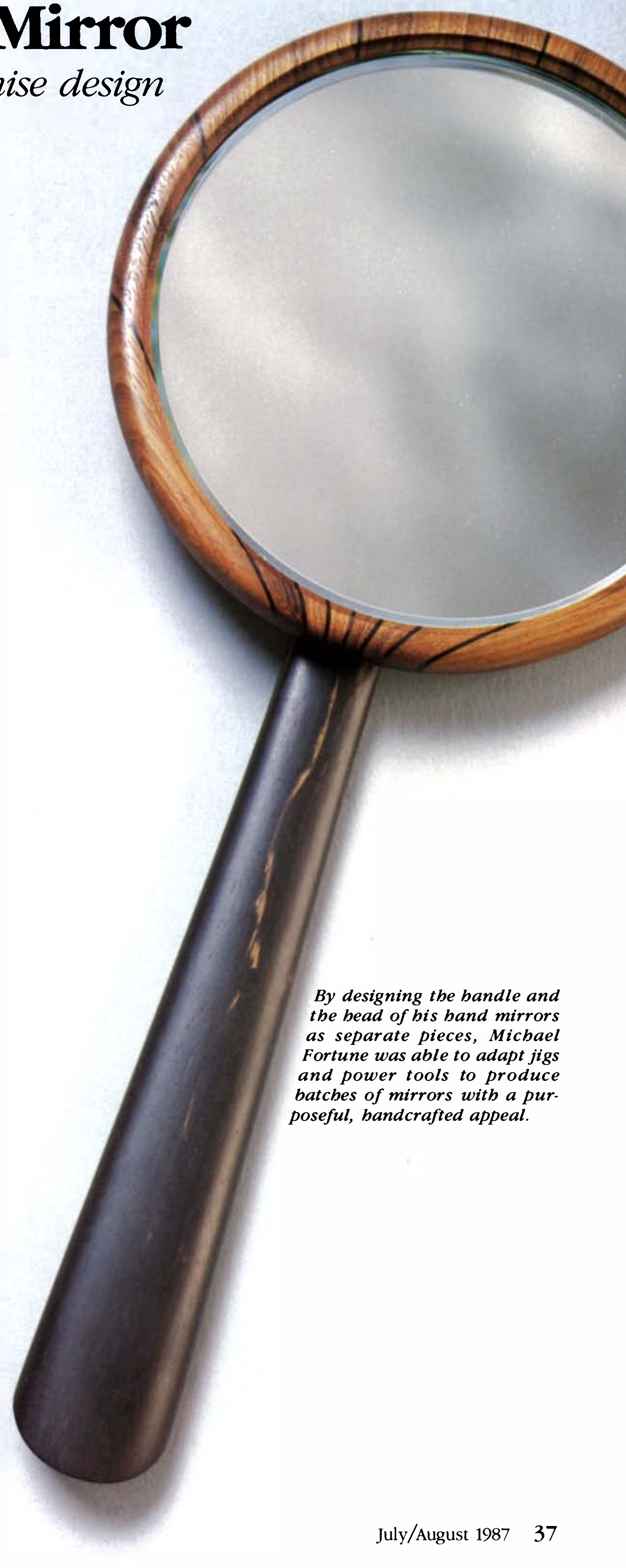
Photo: Curtis Erpelding

This Honduras mahogany table was chemically stained with hydrated lime.

Production Hand Mirror

Machine jigging needn't compromise design

by Michael Fortune



By designing the handle and the head of his hand mirrors as separate pieces, Michael Fortune was able to adapt jigs and power tools to produce batches of mirrors with a purposeful, handcrafted appeal.

When I began woodworking ten years ago, the opportunities for designing and building furniture weren't all that plentiful. So in between my sporadic furniture commissions, I'd design and produce smaller objects, such as the hand mirror described in this article. The scale of these smaller pieces spared me from investing much on materials, no matter how exotic the wood. More important, producing them helped me develop my design, construction and organizational skills.

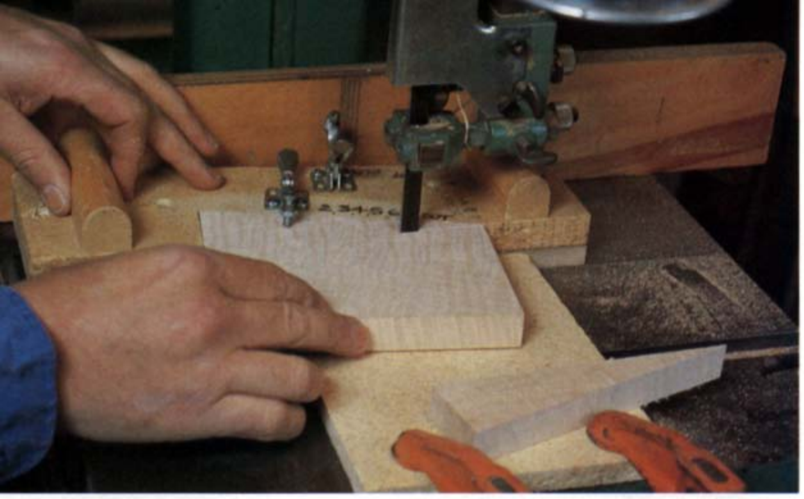
My first mirror evolved from some sketches of Gingko-tree leaves. I did most of the work by hand with gouges, rifflers and sandpaper. Shaping the nooks and cranies was murder. My worn fingers prompted me to go back to the drawing board, but I wanted to avoid the common production trap of limiting myself to easily reproduced shapes, thereby letting machines compromise my designs. After making a few sketches and mock-ups, I realized that, by separating the head from the handle and using jigs and power tools to produce the two pieces individually, I could preserve both my design and the mirrors' handcrafted look.

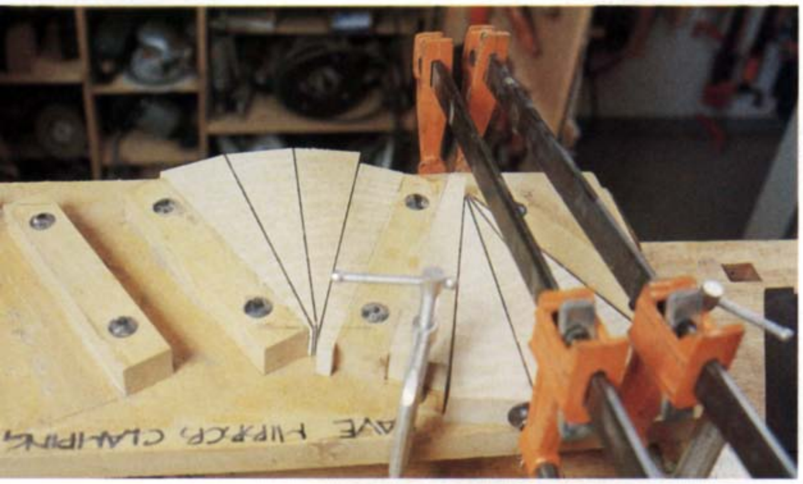
The hand mirror is a good example of the evolutionary process that leads to most of my production procedures: I design an object, make it, then simplify the process with jigs and machines. Perhaps the ability will come after a few more years of experience but, right now, I can't completely plan out the sequence of machine operations and jigs before I actually build a piece. At best, I have a positive attitude toward the purpose and design of jig construction.

My first batch of jig-produced mirrors was a group of six. The head of each mirror consisted of two pieces of hardwood, bookmatched along a centerline paper joint which became the major reference line for measuring pieces and aligning them to jigs throughout the process. My subsequent batches were groups of ten—a number better-suited to my studio size, profit margin and attention span. I always stick with even numbers, so the parts stack evenly and it's obvious if anything is missing.

On another style of hand mirror, I continued to work from the centerline, but divided the head into eight wedges. This allowed me to develop more graphically interesting grain configurations by arranging and rearranging each board individually. I glued up the wedges in groups of four to make right and left mirror halves, then assembled the halves with a paper joint. Sometimes, I selected stock with a consistent grain pattern so that the gluelines and individual segments wouldn't be very noticeable; other times, I accented the gluelines with veneer strips.

Making the mirror involves such a variety of pieces—squares, rectangles, wedges and circles—that jigs are essential in order to obtain consistent results from batch to batch. As you can see in the photographs on the following pages, my jigs fall into several broad





Wedges are cut on the bandsaw with the simple jig shown at top—a 6-in. by 9-in. plywood rectangle, notched so that a wedge is cut when the carrier is pushed along the fence and past the blade. The jig for gluing up the wedges (above) is designed so that bar clamps spanning the front edge of the jig and the backs of the wedges pull the segments into angled battens, tightening the glue joints.

Fig. 1: Bandsawing circles

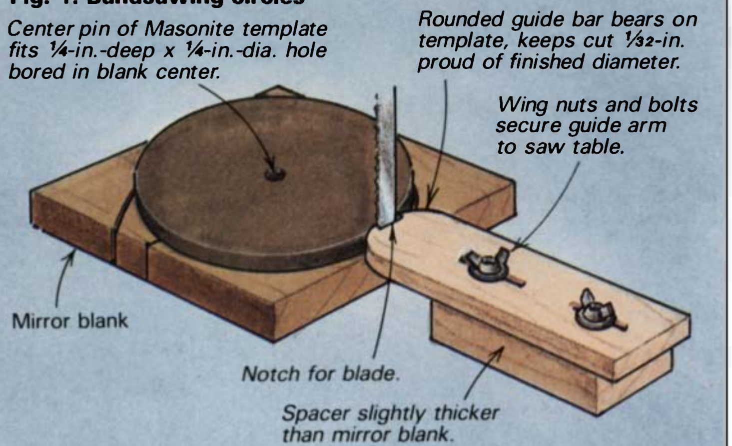
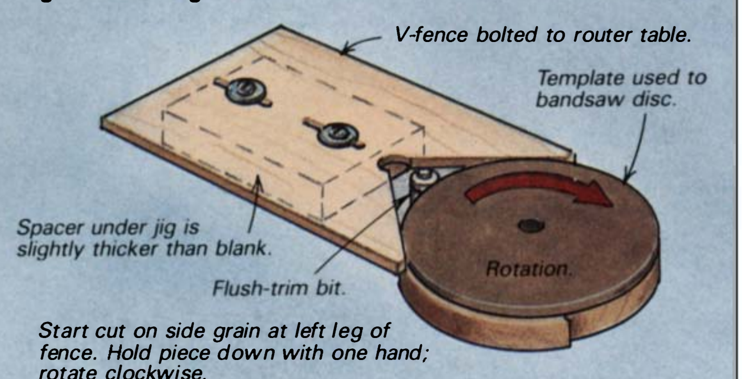


Fig. 2: Trimming disc



categories: cutting jigs, to rough out discs and wedges; router jigs, to shape edges and cut joints; and clamping fixtures, to hold irregularly shaped pieces during glue-up. Whenever possible, I try to key the jigs and operations together. The bandsaw, router table and shaper have holes drilled and tapped ($\frac{1}{4}$–20 thread size) in the surface, on the same centers and at the same distance from the center of the cutters, so that jigs and setups can be transferred from machine to machine. For ease of measurement, all the holes are located on 2-in. centers, measured from the center of the cutters.

For segmented heads, I begin with 6-in. by $6\frac{5}{8}$-in. by $\frac{3}{4}$-in.-thick blanks, cutting each into wedges with a taper jig on the tablesaw or bandsaw. The jig I use (see top left photo) is a notched 6-in. by 9-in. plywood carrier that bears against the fence and produces a wedge as it's pushed past the blade. The sawn edges should be adequate glue surfaces. If not, flatten them by lightly rubbing the wedge on sandpaper double-face-taped to plate glass or another hard, flat surface, such as a jointer table. I assemble the wedges with West System epoxy glue (Gougeon Brothers, Inc., 706 Martin St., P.O. Box 908, Bay City, Mich. 48707) and clamp them on the jig shown in the photo at left—two angled battens screwed to a plywood base. The wedges are placed between the battens so that bar clamps can pull them into the angled pieces, closing up the glue joints.

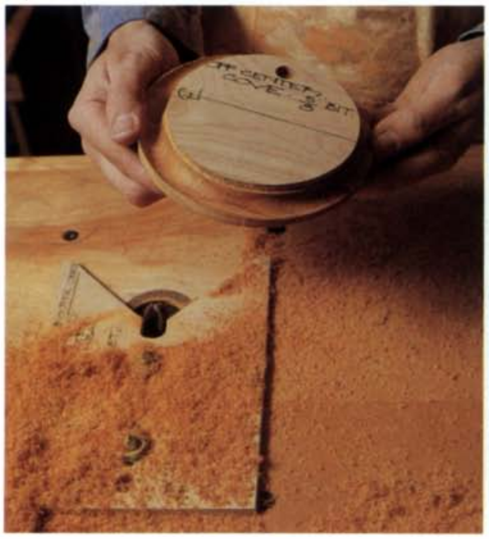
The segmented or book-matched blanks can be cut round freehand or with any number of jigs. To ensure that the jigs fit all the parts, it's important that every blank be cut $5\frac{5}{16}$ in. in diameter. I use a circular tempered-Masonite pattern and a flush-trim router bit. A center peg in the template fits a center hole bored into the blank, so the template can be accurately located before being press-fit in place. I bandsaw the discs $\frac{1}{32}$ in. proud of the line, as shown in figure 1, then true the circles on a router table with a flush-trim bit. I strongly suggest the use of a V-fence like the one shown in figure 2. This device serves as both a cutting guide and an important safety device—when I was a design student, I nicked myself with a round-over bit before realizing the circular bit can spin the workpiece and draw your hand into the cutter.

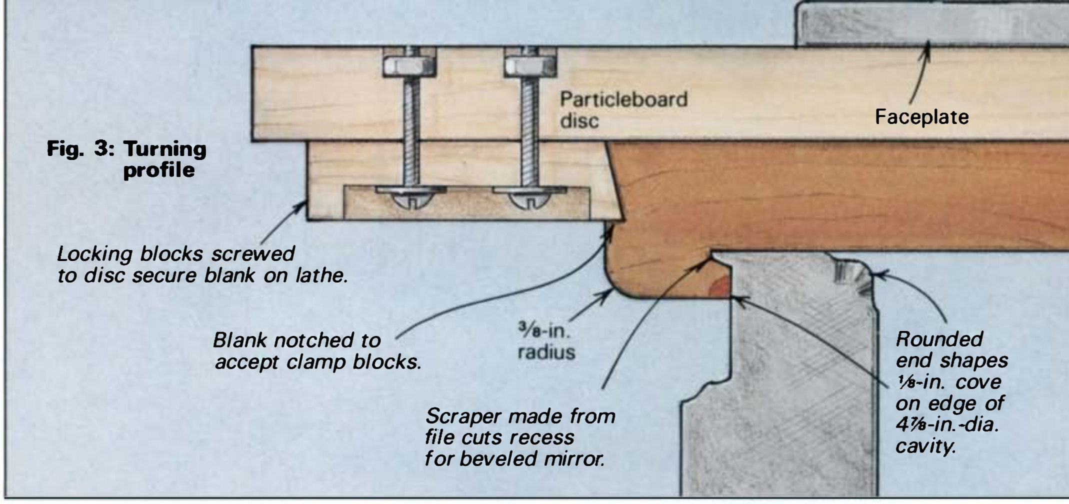
I begin the cut by bearing on the left leg of the V-fence and moving the side grain into the cutter, holding the piece down with one hand and rotating it clockwise into the cutter with the other. Speed is dictated by the sound and quality of the router cut. Go too fast and tearout will occur; move too slowly and burning may result.

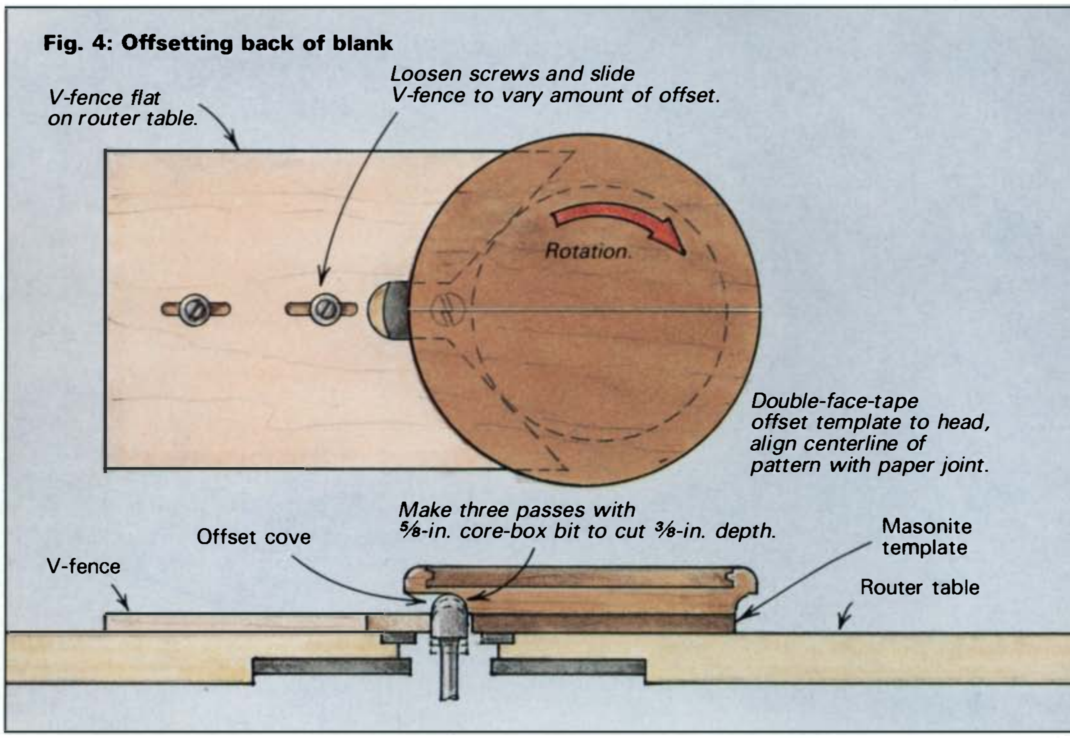
The next operation uses the same setup with a different bit to cut a groove in the edge of the blank so it can be mounted on a lathe faceplate with the locking blocks shown in figure 3. I set a $\frac{1}{2}$-in. dovetail bit so it protrudes $\frac{5}{8}$ in. from the router table, then align the V-fence so that the bit leaves a slight $\frac{1}{64}$-in.-high flat between the table and notch. Now, I turn the mirror cavity with a lathe gouge and scraper until it's exactly $4\frac{7}{8}$ in. in diameter by $\frac{7}{32}$ in.

Slips of veneer are epoxied between the wedge-shaped mirror segments as a design accent. The basic shape of Fortune's hand mirror was inspired by sketches of Gingko-tree leaves.

Fortune cuts the mirror groove on a lathe with a scraper ground from a file, above. The cutting wedge is slightly thicker than the mirror bevel to allow for seasonal wood movement. To shape the back, he mounts a template off-center on the blank, below, then guides the disc into a cove bit with a V-fence on a router table.





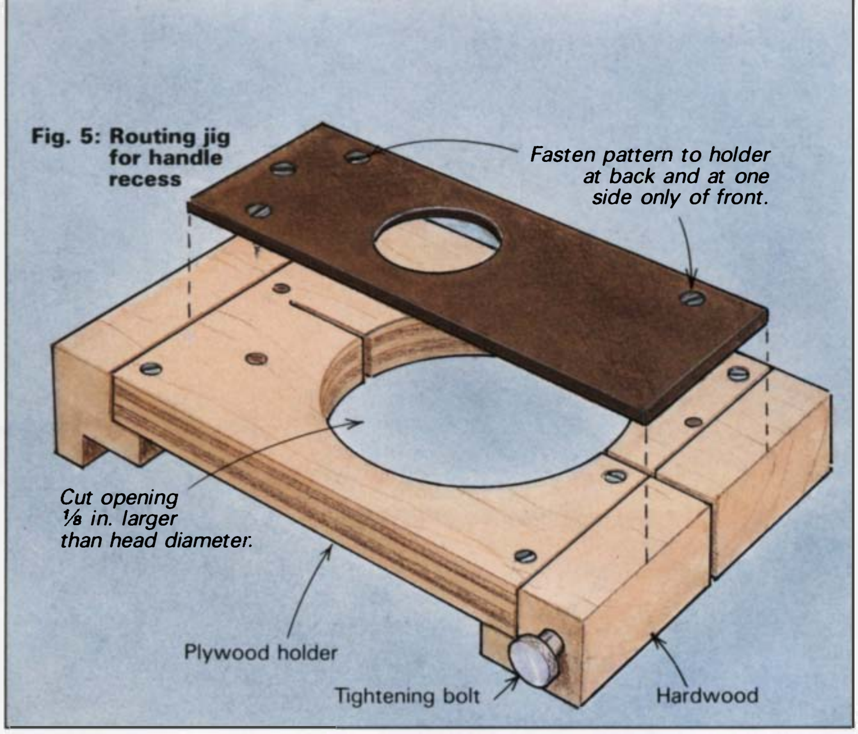


deep around the perimeter. I dish the cavity to 9/32 in. deep at the mirror's center.

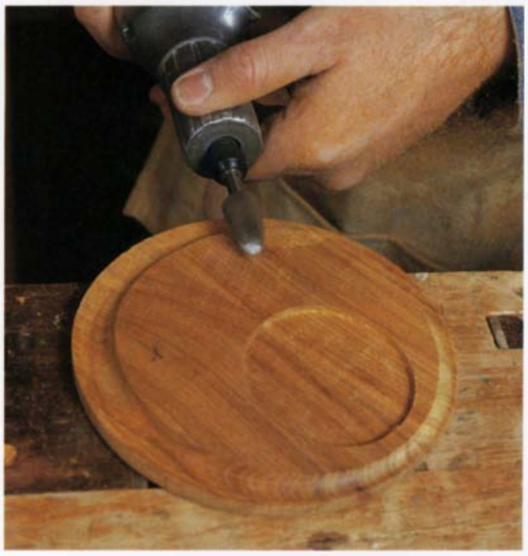
The shape of the outside radius and the undercut that holds the mirror are cut next. In a two-step process illustrated in figure 3, I cut the mirror-holding undercut, then flip the tool and cut the adjoining cove. (I ground the two-sided tool—also visible in the top photo, above—from a file.) The exact dimensions of the undercut are determined by the shape of the beveled mirror (Floral Glass and Mirror Inc., 895 Motor Parkway, Hauppauge, N.Y. 11788 or Sterling Equipment Co., 6700 Distribution Dr., Beltsville, Md. 20705), plus an allowance for the wood's seasonal contraction and expansion. While the piece is still on the lathe, I also sand the cove and outside roundover to 320 grit.

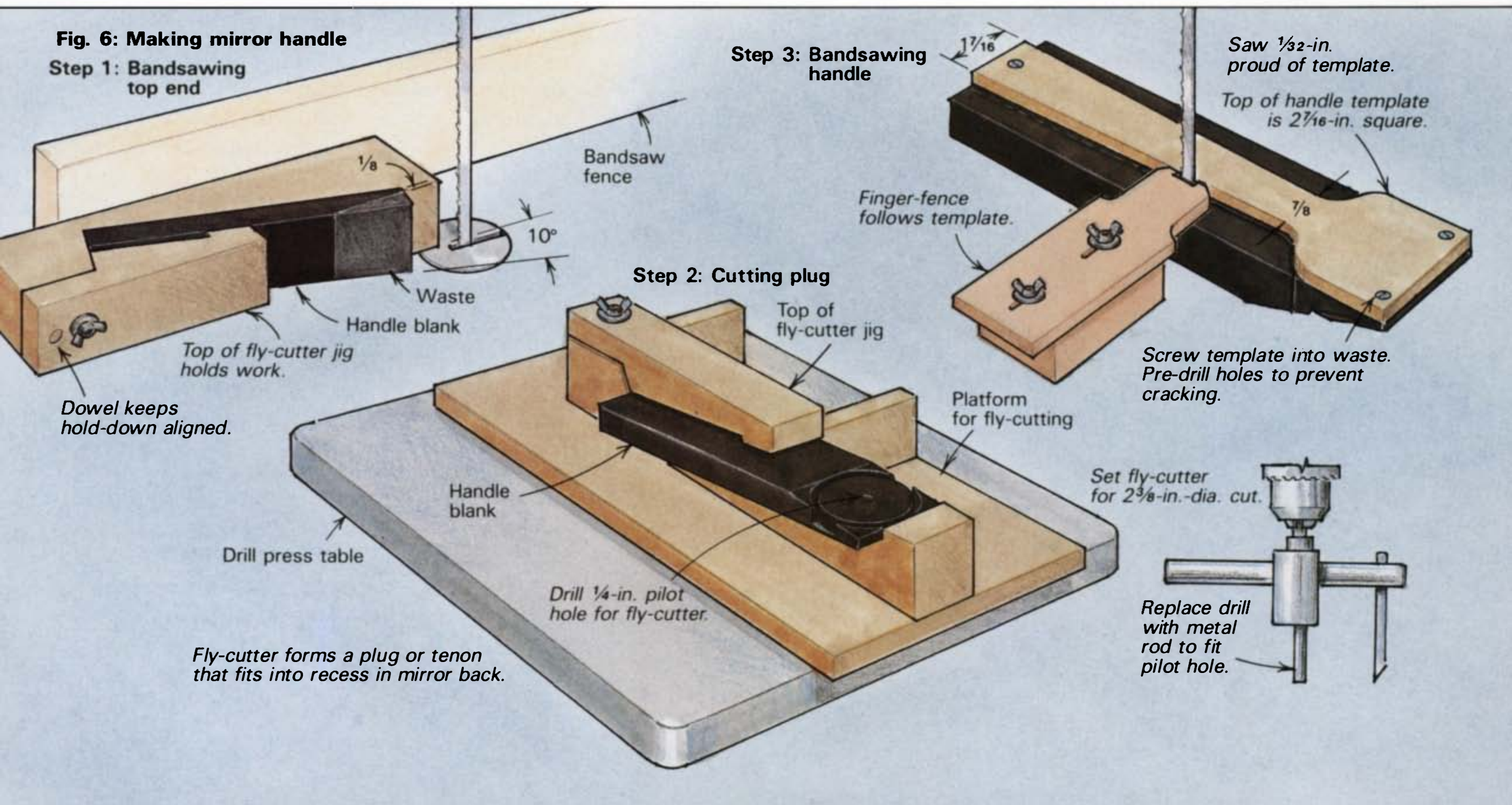
You now have two options for completing the head. The first is to use woodworking methods and tools everyone knows (i.e. files, gouges, rasps, sandpaper blocks), but which can't easily or quickly generate—let alone duplicate—sculptural shapes. Another option is to utilize a carving duplicator, as I do. This method bypasses some of the steps, time and risk of shaping, but it's likely to be too expensive for anyone not headed into full-scale production.

The simplest, most straightforward approach to shaping the head involves a router table, a 5/8-in.-dia. core-box bit and an offset pattern double-face-taped to the back of the blank. The amount of offset is largely an aesthetic decision, but I've found that the adjustable V-fence/router table setup shown in figure 4 works well. Make



After routing the offset cove, Fortune bandsaws the angle on the back using a cradle, left, which supports the workpiece as it passes the blade and keeps the operator's fingers out of the way. Strips of sandpaper lining the cradle prevent the piece from rotating. Most of the final shaping is done with a die grinder, right, moving the cutter diagonally to the grain. Wood will disappear quickly if you carve into the rotation of the cutter, but you'll gain more control by rolling with the cutter. Grinding marks are later removed with files.





three passes to rout the outside cove to a depth of ⅜ in., but take care—at the end of this operation, you're routing the underside of the blank, which is cantilevering over the router bit.

My original sketches suggested that the overall form would be most successful if the handle were slightly out-of-plane with the head. I decided to saw a 6° angle on the back of the mirror head, which would allow a 3-in.-wide recess for fitting the handle. Since I make batches of mirrors, I use a box cradle with hold-downs (see photo, far left) to ensure accuracy and keep my fingers well out of harm's way during the cut. For a single hand mirror, I'd just hot-melt-glue the head to a carrier and tilt the bandsaw table to cut the angled surface. Either way, the next step is to cut the ⅛-in.-deep recess for the handle with a router and jig (see figure 5) that clamps the blank between a Masonite template and a holder.

Now, I shape the head's back. A regular marking gauge is fine for scribing a line round the offset cove to define where handshaping should begin to rise up to meet the handle recess. The blank is difficult to hold, so I hot-melt-glue a round 1½-in.-thick softwood disc into the mirror cavity. The disc can be clamped in a bench vise during shaping operations and rotated as necessary.

The shaping can be done by whatever method you prefer, but careless mallet-and-gouge work may pop the paper joint. I've found an electric die grinder with coarse ¾-in. bits (available from Severance Tool Industries, Inc., 3790 Orange St., P.O. Box 1866, Saginaw, Mich. 48605; part no. JLT) effectively removes most of the waste, especially when I make crisscross strokes diagonal to the grain direction, as shown in the near photo, left. Level out the scallop marks left by the grinder with a #49 random-tooth patternmakers' rasp (available from Jamestown Distributors, 28 Narragansett Ave., P.O. Box 348, Providence, R.I. 02835), and finish the surface with a gooseneck scraper and 150-, 180- and 220-grit sandpaper wrapped around a small piece of Formica.

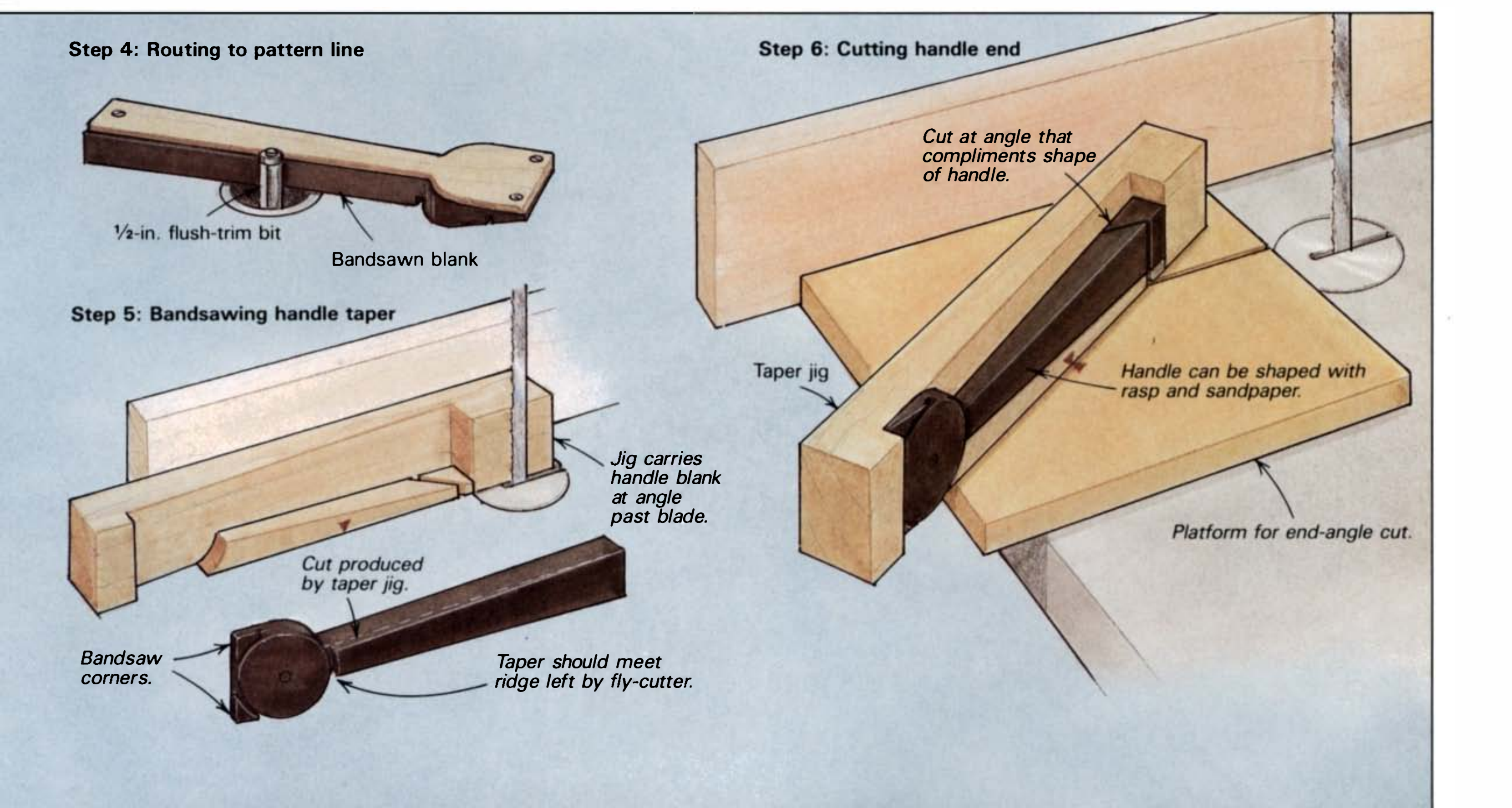
I always expect a wood-splitting disaster when I separate the two halves of the head along the paper joint, but I haven't had a single failure in the 60 or so joints I've done. My method is to gently rock a 1½-in.-wide chisel along the paper joint inside the mirror cavity until the halves separate. The edges must be scraped and sanded before the mirror is test-fitted. Insert enough shimming behind the mirror to push its bevel gently against the lips that hold the glass in place. My shims are the front page of the day's newspaper, along with a business card. Should the hand mirror crash to the floor someday, at least the owner will get a surprise: the address of where to buy a new one. The hydroscopic nature of wood requires that the mirror be slightly loose in the head, but to prevent rattling, I put four drops of clear, flexible silicone under the lip.

One last crucial detail is to paraffin either side of the joint and along the centerline of the newspaper shim touching the wood. The wax prevents the epoxy from freezing the mirror in place, or from lifting the silver off the glass. Epoxying the two semi-circles together appears to be a tricky clamping job, but several heavy rubber bands crisscrossing the disc will handle it. Be very careful with the alignment or you risk having to re-level and resand everything. The final sanding finishes the mirror with 320-grit silicone-carbide paper.

Making the handle is an exercise in visualizing and extracting a form from a block of wood. I prefer oval handles, but you could make any shape you want. I've used East Indian rosewood, Ceylon and Macassar ebony, curly koa and curly maple, but ebony generates the best response. Shape and proportion are the key considerations. My handle is $2\frac{7}{16}$ in. wide, ¾ in. thick and 10 in. long. The whole handle-making process can be done freehand, but I use the jigs shown in the drawings below to gain speed and accuracy.

Before assembling the pieces, I fair all the curves and refine the shapes with a scraper and sandpaper. For easy cleanup, paraffin the perimeter of the head recess and the handle before the final epoxy glue-up. Take care to align the axis of the handle with the center glueline in the head. A 6-in. square of particleboard on the mirror side of the head and a softwood block on the paddle end will protect the mirror as the handle is clamped up. Finally, seal the hand mirror with the clear finish of your choice. □

Michael Fortune is a furniture designer/builder in Toronto, Canada. His mirror-making techniques are demonstrated in Router Jigs and Techniques, *a Taunton Press videotape. Drawings shown here were adapted from a booklet accompanying that tape.*



Trained as a cabinetmaker and, later, as an architect, Rietveld (below) produced designs in his shop in Utrecht. As demonstrated by the reproduction Zig-Zag chairs above, he shared the concern of many early modernist designers for a straightforward use of materials. The joints in Rietveld's original chair were braced with gussets made from the miter cutoffs. Gussets for these repros were apparently made from separate pieces.

The Furniture of Gerrit Rietveld

Tracing the roots of the modern movement

by Glenn Gordon

Early in the 20th century, furniture began to look "modern" in the sense of being unadorned. The reigning assertion of Viennese architect Adolf Loos that "ornament is crime" became the central premise of a movement toward greater simplicity of design. That premise was spelled out in the straight, machined sticks of what later became known as the Red and Blue chair (see cover photo). The appearance of this chair in 1918 challenged traditional assumptions of European furnituremaking to the core.

The craftsman who built the Red and Blue chair was a 30-year-old Dutchman, Gerrit Rietveld. His chair looks elementary—an easy thing to build. It all but explains itself out loud, just as it stands—no hidden constructions, nothing secret. But if the chair was put together very simply, it wasn't for lack of skill. Rietveld was a trained cabinetmaker, capable of something fancier. Instead, he designed the chair to look like it had been built by someone who'd never seen one before, approaching the problem as though he were Adam, trying to figure out the first chair in the world.

To understand what Rietveld was after in 1918, the Red and Blue chair must be considered in the light of what was happening around the time it was being built: There was a storm tearing through Europe—the First World War. The war never actually touched Dutch soil, but, for four years, it raged almost within hearing distance of the Dutch frontier. Rietveld, working in his small shop in the city of Utrecht, may have been absorbed with the problem of getting the pile of sticks on his bench to rise up and become a chair, but he was still aware of what was going on.

By the end of World War I, the illusion that warfare was a ritual of honor among gentlemen lay dead in carnage worse than any the world had ever seen. Combat had been industrialized. Europe was in shock, traumatized by the apocalyptic mechanization of destruction. The war had undone the Victorians' way of looking at things. The grand manner—with its bluster, its imperial pomp and its flourish—had lost its power to inspire. All across Europe, small groups of architects, painters and sculptors started to reject the trappings of Victorian design. Convinced that the decorative arts of the era had turned lunatic, these groups held that the paraphernalia that billowed out of the steam-driven calliope of Victorian design—buildings, bathtubs, clothing, typography, furniture, etc.—were the signs of a culture bent on denying its own industrial, political, even sexual, reality. In disguising those realities, the Victorians had carried ornament to the point of delirium.

Suffocated by an environment overrun with clutter, postwar architects and artists felt compelled to strip things of their decoration and start all over from scratch. To begin again, they decided, it was first necessary to go all the way back to the very earliest, wide-eyed kindergarten of perception—that impressionable state where little or nothing is assumed. We can see now how things worked out: The arts of painting, sculpture, graphics, furniture, architecture and industrial design were revolutionized.

The best known of these modernist, postwar groups was the Bauhaus, a school of architecture, art and design formed in 1919 in Germany. It was the Bauhaus that established glass and steel as the preeminent materials of modern architecture through the works of Mies van der Rohe, Walter Gropius and Marcel Breuer. Soon, the first furniture of tubular steel was born—the result of Breuer's staring in wonder at the handlebars of his bicycle one morning as he rode to work.

Similar, revolutionary design movements were developing at around the same time elsewhere in Europe, mostly proclaiming the ascendance of the utopian age of the machine. In the Netherlands, a group of architects, painters and sculptors—including a man making strange chairs in Utrecht—coalesced for a time into a movement known as de Stijl, or "the Style." Less well-known than the Bauhaus (although the two groups exchanged ideas), de Stijl (pronounced the same way as "style") is probably most widely recognized for the severely rectilinear black, white and primary-color paintings of Piet Mondrian.

What Mondrian painted in two dimensions bore a striking resemblance to the chair Rietveld built in three. Considering the circumstances, the similarity is uncanny. At the time Rietveld was building the Red and Blue chair, he had not yet seen the paintings of Mondrian, nor the work of any others involved with de Stijl. Ironically, it was he—completely unaware of the movement—who came up with the object that most fully expressed de Stijl's ideal.

By showing that it was possible to put together a piece of furniture using the democracy of interchangeable, equivalent parts, Rietveld provided de Stijl with a means for constructing a new sense of order using mechanized, easily communicable elements. The sticks of Rietveld's chair became the simple, sans-serif letters of a new alphabet of structure. Put together in a considered but uncomplicated way, these letters took on the force of words—the basic words through which de Stijl articulated its structural intentions: everything apparent, nothing hidden. The Red and Blue chair was a piece of pure, modern, industrial design—more theoretical, perhaps, than comfortable, but then it was never intended to provide the consoling comfort of tradition; it was meant to square-off against the tenets ruling the taste of the time. Seventy years have passed since Rietveld built it, and it still reads as one of the most genuinely modern pieces of furniture ever built in wood.

Gerrit Rietveld was born in 1888. The son of a cabinetmaker, he was apprenticed to his father by the age of eleven. At the age of 23, Rietveld opened his own shop in Utrecht, with space in the front to show the work he and his assistants produced in the back.

Following the vein of the Arts and Crafts Movement, Rietveld's early furniture was reminiscent of the Mission style of the Stickleys and the work of the Scottish architect, Charles Rennie Mackintosh. In the first few years, most of the work produced by his shop was designed in collaboration with architects in and around Utrecht. Meanwhile, studying at night, Rietveld became an architect himself, establishing practice in 1919—a little more than a year after he completed the Red and Blue chair.

The Red and Blue chair is a primer in the language of skeletal connection. Featureless square or rectangular sticks make up the scaffolding of a chair, erected strictly within the terms of an imaginary, three-dimensional grid in space. The grid—known formally as the "tri-axial Cartesian coordinate system"—is based on the three axes of space: up and down, side to side and front to back. To put it another way, it is a structured method using three mutually touching, mutually bypassing, mutually perpendicular lines. (It's also possible for the three axis lines to not actually touch. Rietveld illuminated this idea beautifully—literally drew it in light—in the Hanging Lamp he designed in 1920, shown on the next page.)

The chair is held together with blind dowels, one at each interface—nothing fancy. The seat and back are fir or pine, fastened to the frame with screws. Rietveld's first prototype was made in oak and left unpainted, with sticks 1⅜ in. square. In the final version, he used minimal 1-in.-square sticks and built the entire chair of fir or pine, with the back lacquered red, the seat blue and the sticks of the frame ebonized with aniline dye. At nearly every point of connection, the black sticks overshoot one

Color photos courtesy of the Wadsworth Atheneum

The up-down, side-to-side and front-back planes of the tri-axial Cartesian coordinate system don't meet in Rietveld's 1920 Hanging Lamp (above, left). Striving for working-class affordability, Rietveld's shop produced the Krat line of 'weekend' furniture—including the cheap, spruce, crate-lumber chair shown at left—during the Great Depression. The line never achieved commercial success. When Rietveld designed the Schröder house, he also designed the furniture that went inside, including the painted-pine end table, above.

another by a cube's worth, and their endgrain is painted yellow. It has been suggested that the sticks' way of bypassing one another, combined with the sudden, lit-up brightness of their yellow ends, makes the sticks appear to have been lopped off longer lengths of stock—lengths which, in the viewer's imagination, could extend indefinitely in all directions of the axes of Cartesian space.

Rietveld designed and built at least a dozen other pieces of furniture using the same elemental system of joints. Most of them were chairs, but there was also a washstand, a little wagon, a baby buggy, a series of Spartan-looking tables and a beautifully proportioned, visually powerful sideboard done in unpainted oak.

All the furniture Rietveld built during the stick-and-plank phase of his work has the strange, momentarily suspended look of things depicted in the "exploded" views of drafting—the sense of parts just about to go together, or only just taken apart. The illusion can be hypnotic. The effect was further intensified in the chair Rietveld built in 1924—the same general idea as the Red and Blue chair, but instead of using square-sectioned stock, Rietveld used 1³⁄₁₆-in.-dia. cylindrical rods of ebonized mahogany, bull-nosed into hemispheres at the ends. The round rods touch each other only tangentially, creating the illusion that they almost don't touch at all, only hover very close to one another, somehow kept in position by an unseen hand. Relenting a little from the flat planes and squared limbs of the Red and Blue chair, the lines of this chair were softened by the use of smooth, edgeless turnings for the frame and gently secured, leather-covered panels of molded plywood for the seat and back.

As new industrial processes came on the scene from the 1920s on, Rietveld experimented with a widening range of materials. At various times, he built furniture of pipe and plumbing fittings, curved tubular steel, plastics and upholstered foam. His experiments included at least four chairs based on the industrial designer's obsession with getting a complete chair out of a single sheet of material, working with plywood, aluminum, fiberboard and solid wood. The most famous of these was built in 1934 out of a single, glued-up plank of elm—a chair of almost overpowering simplicity, called the Zig-Zag chair (see photo, p. 42). Shaped the way cartoonists commonly draw a lightning bolt, the chair seems to leap out of the zees used to spell its name.

Strategically "creasing and folding" the plank of elm as though it were a piece of cardboard, Rietveld transformed it into the Origami figure of a human being—an abstract (but very persuasive) image of someone sitting in a chair. If the nearly sheet-metal look of the chair is "mechanical," it isn't mechanical in the sense of an exercise in engineering. On the chair's back, a blind slot milled close to the top serves as a handhold for lifting the chair by the scruff of its neck. Of the four panels that make up the chair, only one—the back—is a true rectangle; the rest are subtle trapezoids whose tapers foreshorten perspective and animate the chair with slight zigs and zags at points not seen in the side view.

It takes all of three joints to build the chair, but all three must be strong and unequivocal. The back is through-dovetailed to the seat at a 95° angle; the tails are worked into the back, the pins on the seat. The other two joints—at the front of the seat and at the floor—are both 45°. Since this angle is too acute for dovetailing, Rietveld mitered and splined the panels instead, reinforcing the joints with gussets. Since the grain direction of the gussets is the same as that of the panels, they could be glued directly to the apexes where the panels meet with no fear of cross-grain cracking.

The cantilevering of the seat takes boldness to the limit, but it must rely on the great strength of the joints for courage. When you sit in it, the chair has a slight spring to it. Rietveld may have chosen elm because of the wood's inherent resilience. Elm is also tough, and it glues well. Rietveld initially tried pine, but the joints had to be reinforced with long screws driven into the end-grain—too many complications.

Less celebrated as sculpture but structurally more rigid were a number of variations on the Zig-Zag chair done with arms. The seats and backs of the armchairs were wider than the side chairs, and to allow for the thickness of cushions, the seats were also lower to the ground, making the angle of the zees even more acute—35° in the armchairs; 45° in the side chairs. The arms were drawbolted to the edges of the back, seat and diagonal panels of the chair and, in some instances, the holes for the drawbolts were left open and visible on all three panels.

Originally, the Zig-Zag chairs were sold unfinished; later, Rietveld lacquered them—red or green with edges banded in white, and also in all-white. Advertised and sold through a furniture store in Utrecht, they were never produced in the huge volumes of, say, the bentwood chairs of the Thonet company, but there was—and still is—some demand for them. Today, both the Zig-Zag chair and the Red and Blue chair are sold by Atelier International Ltd. (30-20 Thomson Ave., Long Island City, N.Y. 11101). They're expensive—$2,300 for the Red and Blue, $1,370 for the Zig-Zag—but they're not really marketed as production furniture. Rather, they're sold as collectors' icons of early 20th-century design.

At times, Rietveld's work carried him into the gray regions where the line between furniture and sculpture isn't all that clear. In the early 1920s, for example, he designed a chair that dispensed with the conventional, static, left-right symmetry of most chairs that reflects the symmetry of the human body. Designed for an art exposition in 1923, the Berlin chair is a radical, deliberately asymmetric composition of five offset planes, two square sticks and a rectangular bar, the various parts lacquered either black, medium-gray or light-gray. Less a chair than a work of sculpture abstracted from the idea of "chair," the Berlin chair is not so much something to sit on as it is a dynamic play of sticks and planes in space, abstracted to an even greater extent than the Red and Blue and Zig-Zag chairs.

The Berlin chair can be regarded as an essay in architectonics, or as a small piece of architecture in itself. In essence, the chair was the conceptual sketch for a house Rietveld built the same year on the outskirts of Utrecht—the widely celebrated Schröder house. Inside and out, the house is a virtual shrine of de Stijl, a matrix of the movement's shifting planes, open glass corners, dead-straight lines and details saturated with primary colors. Also in the Schröder house with the Berlin chair is a small end table Rietveld built—one of the little jewels of de Stijl—a cheery balancing act made out of five pieces of painted pine (see large photo, facing page). Sitting upon its disc like a little constructivist Buddha, the Schröder table smiles on all of the strange coffee tables that have come out to play at being sculpture since Rietveld made the game up in 1923.

During the Depression, when materials were scarce and money was scarcer, Rietveld produced a line of low-cost, knockdown furniture—the "Krat" series—made from the 1x6 spruce lumber commonly used for shipping crates. Implicit in the Krat line (see chair, facing page) were social and political convictions Rietveld shared with others in de Stijl, including the notion that Victorian furniture had mostly been built for the purpose of trumpeting the wealth of those who could afford it. Rietveld held that the machine, instead, is egalitarian. By inexpensively producing furniture and other goods from standardized components and playing no favorites, the machine would be the instrument that leveled class distinction: Everyone would get a good chair, but no one would sit on a throne.

More bluntly than his other work, crate furniture came out of Rietveld's engagement with moral and political dilemmas. There was no direct aesthetic intention to it; no one would call it pretty. It was, however, very carefully thought out—designed so it could easily be put together by anyone who owned a screwdriver. Sacrificing good looks to a social ideal, Krat furniture turned its back on ways of workmanship that glory in the command of fine technique.

In the 20 years he worked in wood before becoming an architect, Rietveld developed an understanding of the craft that later, inevitably, informed everything he designed. The enigma of Rietveld's craftsmanship is that it rid itself of most of the *signs* of "craft," in the older sense of the word. His work comes straight out of the machine—it jumps up, all ready to go, from the jointer, the tablesaw, the drill press and the lathe, without the need for much further elaboration. To the extent that it does away with handwork, his work stands as the triumph of the machine. Since it is mechanistic, Rietveld's method of making things challenges some of the fixed, traditional ideas of what craft is supposed to be.

Among other things, woodworkers secretly relish complication, often going out of their way to create it, just to test themselves. To be able to do a tricky thing well becomes a point of pride: Things such as ornament, carving, inlay and details of joinery—intricate and difficult to execute—are the places where, classically, artisans rest their case, their skills confirmed. If artisans derive a sense of self from how well they do all these things, then it is understandable that they might have their doubts about Rietveld's stripped-down approach to making furniture—it isn't the kind of work bred to show like a prize poodle.

There are traditions and then there are traditions. One culminated in the blunderbuss baroque of the Victorians, but there are others—those that extend, for example, from the aesthetic and social economy of the Japanese or the Shakers, both forebears of the Bauhaus and de Stijl. Rietveld wasn't fancy; the strength of his work doesn't rest on flourishes of labor-intensive embellishment. It rests instead on the idea, expressed with an almost merciless clarity, that the elemental bones of a thing are all you really need. His work speaks with a simplicity that looks easy to us today. But if Rietveld hadn't struggled for it, it might still be buried beneath the baggage of the Victorian Age. □

Glenn Gordon, a writer and woodworker, lives in Minneapolis, Minn. He also wrote about James Krenov in FWW *#55.*

Marbleizing Wood

Trick the eye with paints and glazes

by Beau Belajonas

The textured edge of a feather is a perfect paint applicator for duplicating the irregular veins and fissures of real marble. To achieve a realistic look, avoid symmetry in simulating the random patterns of line and color nature took millions of years to produce.

Not long ago, I walked into the United Methodist Church in Searsport, Maine, to hear a choir recital. The building's huge walls and trim were decorated with beautiful marble. I was immediately fascinated. I had to go over and touch the stone to see if it was real. It wasn't, of course; it was an excellent fake, created with paint on wood. But it was that moment of indecision—the mystery of not knowing if the stone was real or not—that got me hooked on faux ("false") marble and other decorative finishes.

Since the artist who painted the church had died long ago, I went to the nearest bookstore in search of information on false finishes. There, I found *The Art of the Painted Finish*, by Isabel O'Neil. Reading the book, I hadn't the slightest idea what O'Neil was talking about—three-color distressing, negative and positive space, casein paints and so on. By the time I finished the book, however, I'd made up my mind to find someone who could teach me how to marbleize wood—a decision that eventually led me to a two-week seminar at The Day Studio in New York City (see p. 48).

The techniques I'll discuss here are based on my experiences at the school and the marbleizing I've done since. Basically, a marbleized finish is created by applying layers of translucent and opaque paint, then blending them together with sponges, brushes, feathers, tissue paper and cloth to create patterns, the illusion of depth and a stone-like texture. The hard part is composing patterns that duplicate the subtle randomness and delicate colors that evolve in real metamorphic rock over millions of years.

This sense of composition is one of the most valuable things I learned from JoAnne Day, founder of the school that bears her name. While some practitioners feel that any finish that "kind of" makes you think of marble is adequate for faux fantasy, Day believes in creating real-looking marble. And the more marble I make, the more I'm convinced that Day is right—faux marble *should* look real. Even someone who has never created marble can instinctively separate the good from the second-rate, although they probably won't be able to say how they make the distinction.

Once I started studying real marble, I found that the differences in color and pattern—even within individual slabs—were amazing. I began collecting pictures and sketches of pieces I liked. During my stay in New York, I once stopped in the middle of the sidewalk in front of a bank on 34th Street to sketch a particularly beautiful serpentine marble slab. You'll need to do this kind of research before you begin your first marble. Get a piece of the real thing—or at least a good color photograph of a slab—to study and copy. Once you've done a lot of marbleizing, you'll have your own ideas. But, in the beginning, follow nature until you master composition.

As JoAnne Day described it, the best way to understand marble is to picture what Earth looks like to an astronaut orbiting the planet. Visualize the continents' shapes—North America, South America, Africa—and how they extend over the globe in a generally diagonal pattern. Marble is like the surface of the planet, but instead of continents, it has clouds of colors called "drifts" which extend diagonally across the slab, creating a feeling of mild movement. These clouds are punctuated with small cracks called veins, and larger cracks called fissures (see figure 1). It took millions of years of oxidation and geological change to create these patterns, but a skilled finisher can create the illusion of real stone with paint in just a few hours. In this article, I'll describe techniques for making a simple white Italian marble finish (see below) and a more intricate serpentine marble slab (see next page).

White Italian marble

A good way to learn marbleizing's basics is to create a slab of white Italian marble. You'll need white latex- or oil-based paint for the base coat, a few sticks of soft artists' charcoal (sold in art supply shops), mineral spirits and McCloskey glaze coat (McCloskey Varnish Co., 7600 State Road, Philadelphia, Penn. 19136 and local McCloskey distributors). For practice, start with a 2-ft. by 3-ft. sheet of plywood or Masonite and apply two or three coats of white paint as a base. Allow each coat to dry before applying the next. When the base is dry, you're ready to start creating drifts, veins and fissures.

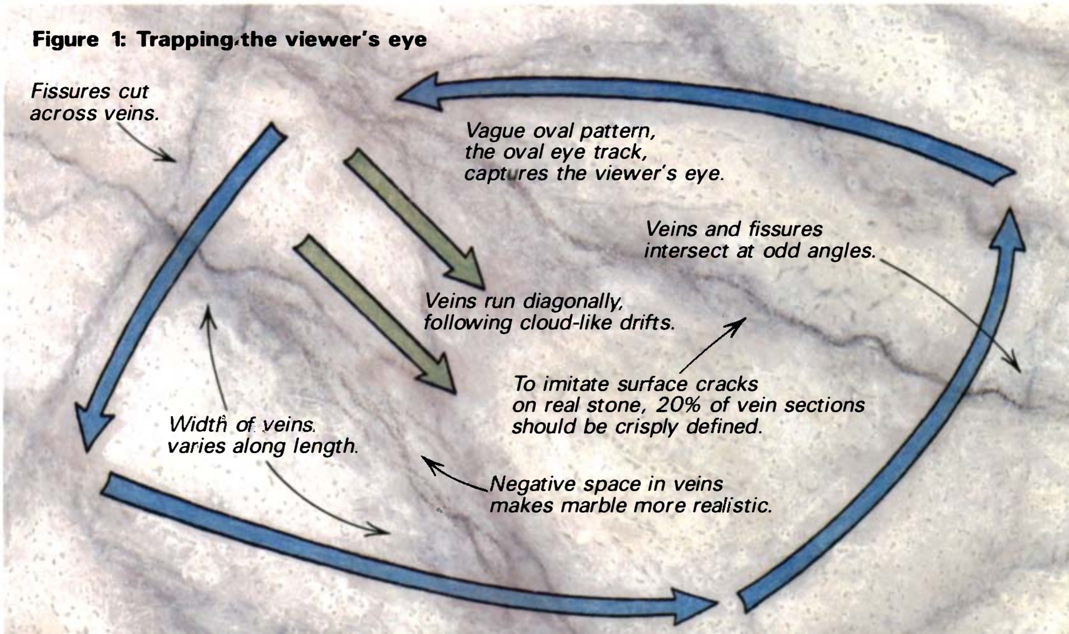
When you draw the veins and fissures, forget that you've been trained all your life to think in terms of square, triangular and other symmetrical figures. To look real, faux marble can't be symmetrical. The only helpful pattern is the oval eye track shown in figure 1—an effort to make drifts, veins and fissures suggest an oval that draws in the viewer's eye. Drifts should be asymmetrical and reminiscent of continental shapes. Veins and fissures should be of different lengths and widths, suggesting the nonsymmetric pattern of a torn, twisted fishing net.

I use a slab of real marble as a model for inspiration. After applying charcoal veins, smudge parts of the veins with your hands and fingers, as shown in the near right photo. Since it mimics the cloud-like drifts of marble and blends the veins into the background, smudging will begin to make the faux look real. About 20% of the veins should be left unsmudged—to imitate the crisp surface cracks of real marble. At this point, the veins appear to be lying right on the surface but, later, the glaze coat will visually "bury" them in stone.

Next, apply the translucent white glaze. I use one part glaze coat, one part white paint and two parts mineral spirits, mixed in an aluminum-foil tray. Dip a section of a natural sponge into the glaze and dab it quickly over the veins (see photo, far right). Further passes with the glaze-laden sponge "sink" the veins, and the honeycomb of the sponge adds a subtle texture. The charcoal will blend with the glaze, creating depth and cutting the contrast between the veins and the undercoat.

Let the paint dry overnight, then bring the whole thing together by brushing on five coats of water-based varnish (available from Benjamin Moore & Co., 51 Chestnut Ridge Rd., Montvale, N.J. 07645 and its local distributors) in the direction of the drifts. The varnish will usually smooth any roughness in your finish, but, if you like, you can rub-out between coats with a piece of brown shopping bag. The paper is abrasive enough to eliminate minor rough spots, but not so aggressive as to rub through the finish. Don't worry about little pit marks; real marble is grainy and rocky, too. For the final finish, rub the varnish with 1500-grit wet/dry paper (available from auto-supply stores) lubricated with water, then buff with 0000 steel wool or 4F pumice stone and water. Polish the surface with automotive compound. I start with Meguiar's Mirror Glaze compound #3, followed by compound #20 (Meguiar's Mirror Bright Polish Co., Inc., 17,275 Daimler Ave., Irvine, Calif. 92710). The more gloss or finish you apply and the better you rub it down, the more lifelike the marble will appear.

For realistic-looking marble, smudge the charcoal veins as shown above, left, to cut the contrast between the dark lines and the white base coat. Then, sponge a translucent glaze over the veins, above right, so they appear to sink into the ground coat.



Drawing: Michael Janos

White paint—sponged on in cloudy, diagonal patterns called drifts—is applied to create the feeling of movement across the stone (above, left). A dry brush blends the drift with the green undercoat (above, right) to make the marble look more realistic.

brush loads up, it begins applying paint and becomes a positive tool.

To create serpentine marble, begin by applying several coats of a dark-green paint as a ground. Use either latex- or oil-based paint for this process. Latex dries quickly—right on the sponge or brush on a warm day—so you might want to use an oil-based paint (I use Benjamin Moore GR110) until you master the techniques and can work quickly. If you use oil paints, let each layer dry overnight to ensure that top coats won't disturb your previous work.

When the base coat is dry, sponge on white paint (far left photo) to create drifts and to convey movement in the stone. The "drift" is made with a glaze concocted from one part oil-based paint, one part McCloskey Mirror Glaze and two to three parts mineral spirits. As you dab on the drift, remember the continents. The green base is the planet. The drift is like North America, thinning down into Central America, then expanding into South America. Across the Atlantic, create Europe drifting into Asia. After the continents are made, blend the wet paint into the dry green base with a dry sponge, brush (near left photo) or piece of towel or diaper. In some places, you'll want to remove all the white from a section of drift to create a green negative space. Work in a diagonal direction with rapid, piston-like hand movements. A fluid motion will help blend the colors, soften the drift and cut contrast. If you work too slowly, you'll start thinking about what you're doing and the work will become too precise. Remember, you're creating an abstract painting, so let your movements flow.

Serpentine marble

After making a few white Italian marble slabs, you're ready to try a more elaborate faux marble. In serpentine marble, the basic techniques are the same, but you'll be working with more layers of paint and manipulating the glazes more.

Serpentine marble gets its name from the serpent-scale pattern embedded in the stone. I simulated the effect here by applying a black glaze over the drift, then smudging the glaze with a crinkled-up sheet of tissue paper (left photo, facing page) to form a scale pattern in the wet glaze. This smudging removes enough of the glaze for the white drift to show through, heightening realism. (Always move from dark to light, or light to dark, in blending glazes. It helps soften contrast, creating a more realistic effect.)

Removing a glaze to cut contrast or reveal more of an undercoat is as important as applying paint. Finishers refer to a process as either "positive" or "negative." Applying paint is a positive application; taking paint off, or leaving an area untouched, creates negative space. At times, the distinction between the two methods blurs. When you start blending wet paint with a dry brush, it's a negative tool—the brush picks paint up. But as the

Two schools teach faux finishing

Clair Rubinroit of the Isabel O'Neil Studio-Workshop in New York City painted this Art Deco chest to look like straw marquetry.

Painted faux finishes were first recognized as art forms around the 16th century, when European artisans used paint to imitate such costly materials as marble and tortoiseshell. Since then, false finishes have lapsed in and out of fashion in both architecture and furniture. Over the past 30 years, however, the techniques have enjoyed an enormous revival, due largely to the efforts of Isabel O'Neil.

O'Neil, who became fascinated with the painted finish in the 1920s and 1930s, spent years in Europe researching techniques. In addition to duplicating Renaissance finishes, she experimented with contemporary materials and applications. Faced with declining health (she was stricken with amyotrophic lateral sclerosis—Lou Gehrig's disease) and a desire to share her skill, O'Neil opened her namesake school in 1955. She died in 1981.

I visited the Isabel O'Neil Studio-Workshop on New York's upper East Side in the Spring of 1986. The school is structured like a guild: students (amateurs and professionals alike) enter as apprentices and progress gradually to journeyman and then master status. Classes are small—three instructors, eight students—and hands-on. Students begin with a seven-week basic course covering surface preparation, striping, antiquing and color matching. A prescribed series of ten 14-week courses follows. Courses required to become a journeyman

The scale-like pattern of serpentine marble can be created by working wet black glaze with crumpled tissue paper, left. The paper's crinkled facets pattern the glaze and allow the white undercoat to show through. A black/green glaze coat applied with a cloth, above, embeds the white veins in the stone.

Let the piece dry overnight before trying to create the serpentine texture. Sponge a black overglaze (one part black paint, one part glaze coat, one part mineral spirits) over the drift, then press the finish with a large sheet of crinkled tissue paper. The paper's crumpled facets are what creates the serpentine pattern. Dab the tissue paper into the paint, as shown in the photo above, until the green base coat and white drifts penetrate the glaze. You may have to go over the area several times.

Now, draw on white veins with a feather dipped in a solution of 20% white enamel paint and 80% mineral spirits. Turkey feathers (Cinderella's, 60 West 38th St., New York, N.Y. 10018) like the one you see in the photo on p. 46 make great applicators. You can paint with their edge or tip, and change the width of the line by varying the amount of pressure you use and the angle at which you hold the feather. You can draw very fine lines, then blend them while the paint is still wet. Since a box is a 3-D object, you'll need to carry veins down along its sides. I usually try to tie the sides into the top's pattern, but if that looks unnatural, I treat the sides as separate entities and give them serpentine patterns of their own.

Let the veins dry overnight, then apply another coat of overglaze (10% black, 10% green, 80% mineral spirits). This coat sinks the veins into the marble, as shown in the photo above. Once blended, this glaze coat also lowers contrast, increasing the illusion of depth. If the contrast between the veins and drift still seems too sharp, let the overglaze dry overnight, then glaze again. Finally, apply five coats of varnish and finish the box as discussed under "White Italian marble." □

Beau Belajonas is a wood finisher in Camden, Maine.

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are gilding and leafing, casein, glazing and distressing, lacquer, marble, advanced gilding, inlay marble, color and varnishing, tortoise and, finally, lapis, porphyry and bamboo. Masters must also complete studies in malachite, *faux bois* ("false wood"), advanced lacquer, minerals and burnishing over another five-year period. In 1986, the seven-week basic course cost $350; 14-week courses ran $650 each.

The school also offers two-week-long accelerated summer workshops. The first of these covers the fundamental techniques of 18th-century painted finishes, including leafing, gilding and patination, and provides an introduction to decorative design. The second workshop covers glazing, simple and complex distressing, casein application, *gouache* shading tints and decorative design. The cost is $1,200 for the first two-week session and $1,300 for the second. For further information on these accelerated workshops, write the Isabel O'Neil Studio-Workshop, 177 East 87th St., New York, N.Y. 10128.

Since O'Neil's accelerated course didn't cover marbleizing, I looked around until I found a two-week-long workshop on stone and marble offered by the Day Studio in New York City and San Francisco. JoAnne C. Day—a design and color consultant, as well as former O'Neil journeyman and instructor—set up her school in 1974.

The Day Studio has three methods of teaching: seminars, workshops and videotapes. In a rented 12th-floor studio overlooking the Hudson River, the 20 or so other students and I involved in the two-week workshop were instructed by Day and an assistant in marbleizing techniques applicable to both architecture and furniture. We also had intense critiques.

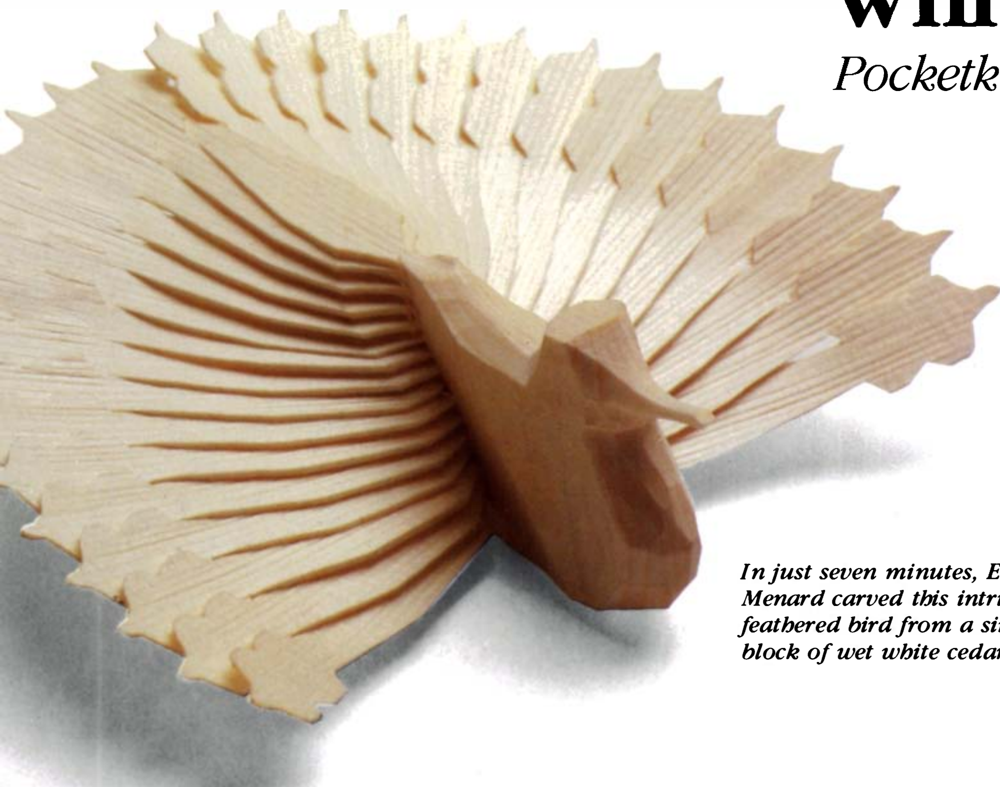
I also attended a weekend seminar on metallic finishes—one of several Day offered in New York, Los Angeles, San Francisco and Atlanta last year at a cost of $400. In the same Manhattan studio, Day lectured while two assistants demonstrated the techniques. TV monitors offered around 100 students a clear, unobstructed view. Coupled with a lively give-and-take of questions and a comprehensive, step-by-step specification booklet, this format provided all the same information as a longer workshop—only the hands-on experience was lacking.

This year, Day is offering one- or two-week workshops in New York and San Francisco. Topics include stone and marble glazing, gilding and metallics, wall glazing, *trompe l'oeil*/casein, color, wood graining, historical/architectural stenciling and a project workshop. Two-week workshops cost $1,500; one-week versions range between $750 and $850. The instructional videotapes cover wall glazing, marbleizing walls, stone and marble, semi-precious stones, tortoise and inlays. For information, write The Day Studio Workshop, 1504 Bryant St., San Francisco, Calif. 94103. *—B.B.*

White Cedar Birds

Pocketknife yields fanciful fantails

by Roy Berendsohn



In just seven minutes, Ed Menard carved this intricate, feathered bird from a single block of wet white cedar.

The fantails on Edmond Menard's carved birds are a wonder of low-tech green woodworking. When I first saw one, I assumed he had glued the tiny segments onto a carved bird, but actually the body and tail are whittled from a single block of white cedar, with the speed and precision of a Japanese chef flowering a radish with a few well-placed knife strokes.

Menard's skill transforms a couple of nondescript knives into a complete tool kit, capable of paring out a fanciful white cedar birds every five minutes or so. Since 1976, he estimates that he's carved more than 50,000 birds, making roughly 3,000 to 5,000 of them a year. At a per-bird price of $5 to $7, that's plenty fast enough to make a living.

Menard makes at least a dozen birds a day, but his is hardly the rigorous schedule of a production shop. His customers, primarily tourists, are lured into his driveway off a picturesque area of Route 2 between Plainfield and Marshfield, Vt. by a large carved bird and "bird man" sign placed strategically on his front lawn. Actually, Menard calls himself "Bird Man II," having learned his craft from the original bird man, Chester Nutting.

The two men first met in 1975 when Nutting stopped at Menard's parents' farm to ask directions to a crafts fair. Pausing to talk, Nutting produced a suitcase filled with carved birds. Before Menard's astonished eyes, Nutting—who learned the craft from his grandfather, a New England logger who whiled away his free time by whittling white cedar fans—sat chewing tobacco, whittling out a bird every seven minutes. (Once, he even scooped up a $20 bet for beating that time limit.) Menard was hooked on the spot.

He says the secret to carving the distinctive feather fan is to work the cedar while it's wet. Cedar is ideal for the work—soft, straight-grained and pliable when moist. It exhibits very little tangential or radial shrinkage, so it remains stable as it dries. Menard cuts his cedar in the woods near his home, bucking the 6-in.-dia. trees into 18-in. logs before resorting to some rather unorthodox procedures. He roughs out blanks by feeding whole logs—bark and all—across an old tabletop jointer in a small backyard shed. Next, he saws the cambium layer off the blocks and joints them into slat 2-in. wide by ⅜-in. thick. Each slat is then crosscut into 8-in.-long blanks from which Menard can carve two birds, beak to beak. He wraps about a dozen or so good blanks in a bread bag and throws them in a chest-freezer in his basement. Carving stock is thawed as it's needed, and scrapwood fires the stove.

Menard begins carving with a Sloyd knife. He first bevels the end of the slat like a gabled roof, and cuts the notches near the end of the tail where the individual feathers will eventually interlock. Next, a shallow, diagonal notch is carved into each side of the slat where the feathers meet the body. Then, the tail feathers (about $\frac{1}{32}$ in. thick) are split out with a small, triangular-shaped Barlow knife pushed into the slats' endgrain. To make room for the blade as the slats start to spread, Menard breaks off a feather near the tail's center, then finishes the tail section. The bird's profile is sawed out on a scroll saw; the bill and breast are shaped with the Barlow blade. After the body is shaped, the wet cedar can be fanned without breaking, and each feather can be tucked into its neighbor (see photo above).

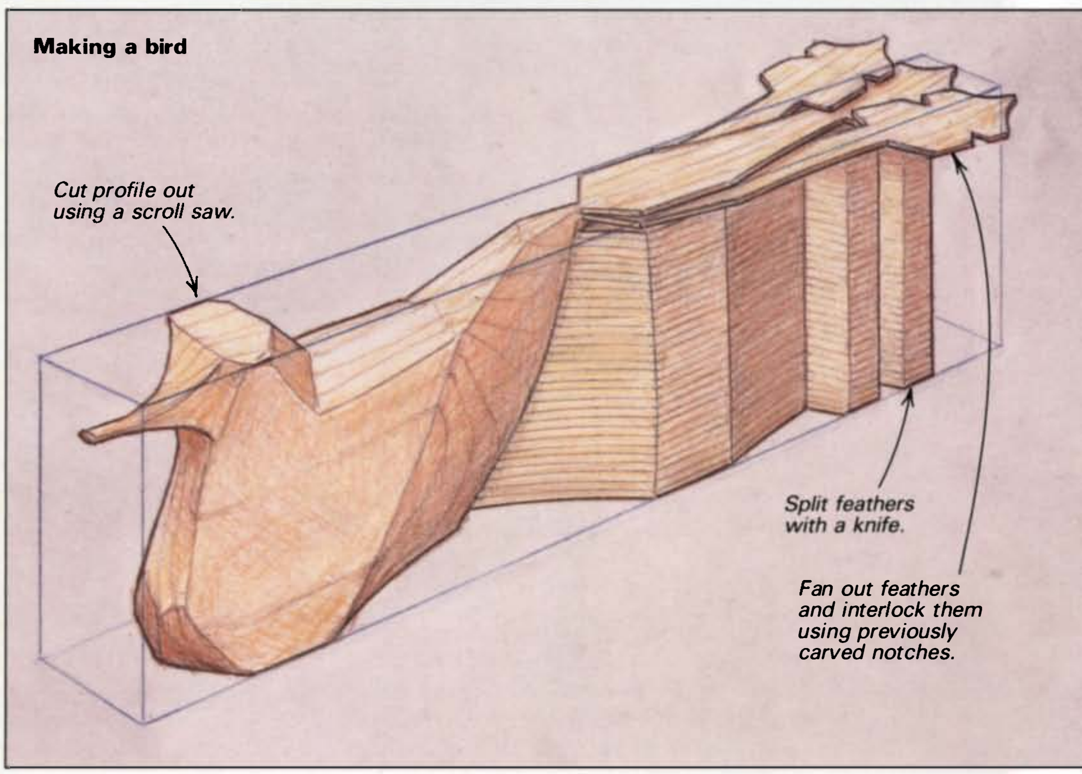
During the winter, the finished birds dry overnight on top of the water heater in Menard's basement; in the summer, the sun does the job. Red, green or purple pushpins pressed into the bird's head become eyes, while a wood burner and torch add wing or tail markings. Larger birds—those with wingspans of 3 in. to 5 in.—are finished with a light coat of shellac. One-inch-wingspan birds, destined to become earrings, are dipped in casein resin. (Personally, I like the birds unfinished. Fresh from the knife, they look crisp and slightly translucent.)

Menard decided long ago that he couldn't work for anyone else. Unlike most woodworkers, who require a substantial investment in machinery and often employ sophisticated marketing, Menard earns his living quietly. Using just a handful of knives and a few ancient machines, he does well selling his wares to the tourists who drop in to see him. I suspect many woodworkers would envy him for that. □

Roy Berendsohn is an assistant editor at Fine Woodworking.

In a few deft strokes, Menard pares a point on the blank's end, forms notches that later interlock the feathers and, above, cuts a diagonal notch where the feathers meet the body. Right, the tail feathers are split out by pushing the knife into the end-grain. The cut is stopped at the diagonal notch. A central feather is removed to allow the knife additional room.

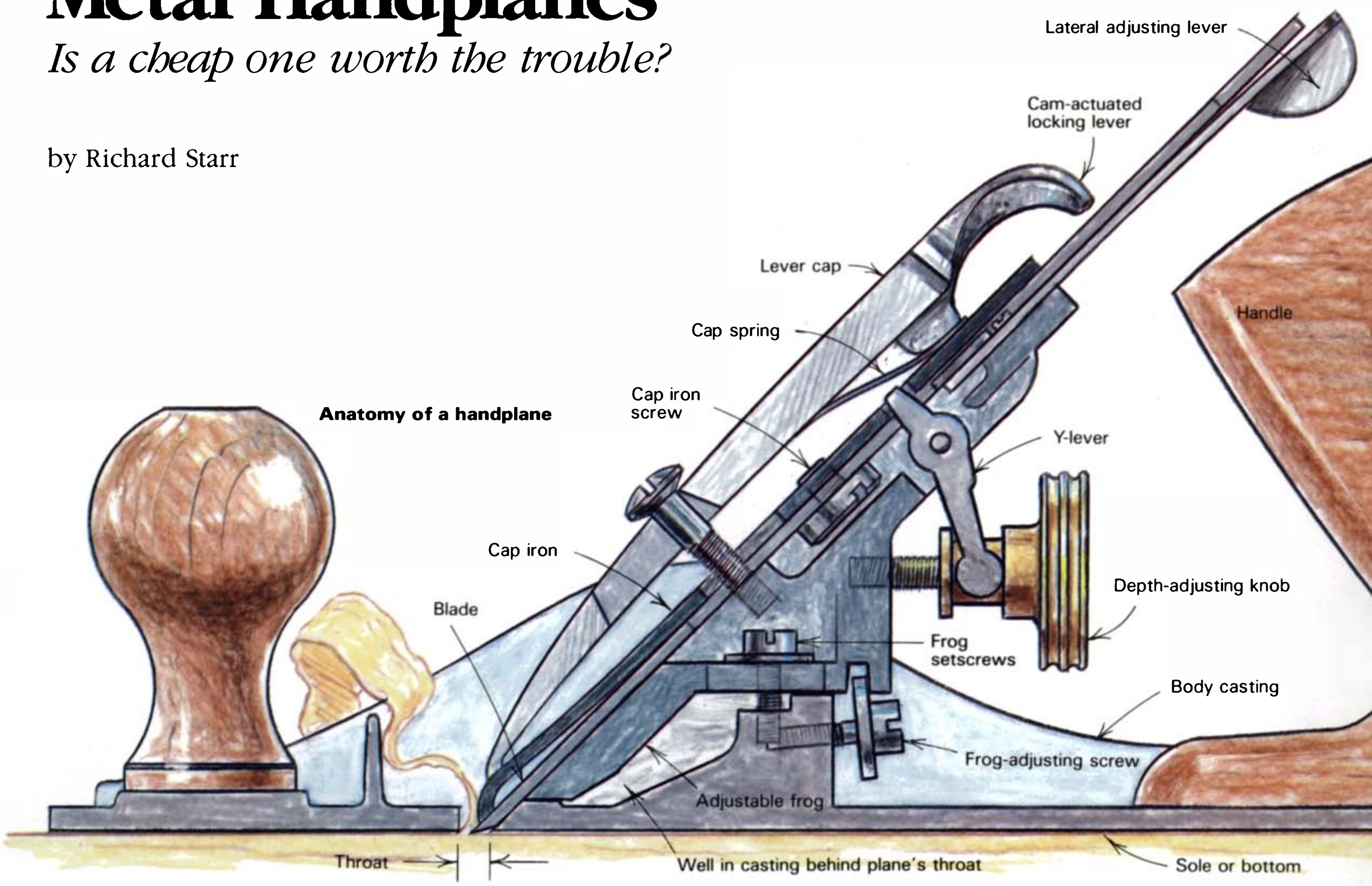
After the bird's profile is cut out on a scroll saw, its breast and bill are pared to final shape with a Barlow knife, above. Menard fans out and interlocks the tail feathers (below), starting with the top feather, which becomes the center feather.



Metal Handplanes

Is a cheap one worth the trouble?

by Richard Starr



Some years back, my friend Ken—an excellent woodworker who does almost everything by hand—bought a high-priced, famous-brand metal bench plane and found it too distorted to use. After exchanging it for another plane that was equally as warped, he complained to the manufacturer. The company replied that, these days, making a plane as good as an old one would double the price. Besides, they added, most planes today are purchased as gifts and never used. Instead, they serve as decoration—as symbols of a better time.

Most woodworkers don't rely on handplanes the way Ken does, but nearly everyone likes to keep a plane near the bench for jobs like trimming a door or a drawer. No matter how well-equipped your shop, you'll need a handplane sooner or later—even if only for an occasional odd job.

Today, there are many bench planes on the market, some costing $60 or more. But if you rarely use a plane, do you really need to spend a lot of money on one, or is a $20 cheapie from the corner hardware store good enough? To find out, I bought a selection of inexpensive handplanes, along with two not-so-cheap models to serve as comparison. Then, I tried them all out in my shop.

What I learned surprised me. Some handplanes in the $20 price range could be fine-tuned to perform quite well, although they required more tuning than more expensive planes and weren't as easily adjusted. And while the pricier planes were better-built and easier to operate, they didn't necessarily do better work than a well-tuned cheapie.

Before I get into the specific results of my tests, here's a quick overview of how the various parts of a handplane should work together for best results.

For general planing, the soles on most new planes are flat enough, right out of the box. But for smooth-finishing or jointing, the soles must be really flat. A sole that's hollow along its length will cause the blade to dig in at both ends of the board. Conversely, a plane with a convex sole will take a shaving of varying, unpredictable thickness, skipping over some parts of the stroke while tearing out others.

To take a smooth shaving, the plane's cutting edge must be held rigidly in place by several components working in harmony. The lever cap puts enormous pressure on the arch of the cap iron (see drawing above), which focuses this pressure on the top surface of the blade, right near the cutting edge. To ensure rigidity, there must be something behind the blade to keep it from bending. On the old Stanley planes I own, the frog—a wedge-shaped block that mounts the blade—reaches way down along the blade to give the needed support. But on most new planes, the sole is so thick that the frog can't reach that far down. And on some, the frog stops ½ in. from the end of the blade and is often mounted to the body at only one point—not at two points, as on more expensive planes. Later, I'll explain how you can tune these less well-designed planes to work with minimum chatter.

The only sure way to judge the quality of a plane's blade is to use it, but you can tell if a blade is hard enough by trying to

scratch its bevel with a stainless-steel pocketknife. If the knife digs into the plane iron, reject it—it's way too soft. Be sure you're not just scratching a varnish coating, and test on the bevel—a spot where the scratch won't show up later when you sharpen the blade. The best blades are ground smooth and flat on both sides, but some cheap blades are ground on only one side. (This small inelegance doesn't affect the quality of cut.)

The blade's depth-adjusting knob (see left) has two functions: it positions the blade and locks it in place. As the knob is turned, it engages a Y-lever that raises and lowers the blade. This adjustment should be easy to make, and without excessive play. After the depth of cut is reduced, the knob's slack must be taken up in the downward direction, effectively locking the blade in place. Since you're likely to spend a lot of time adjusting the blade, a large, easy-to-turn depth knob is desirable.

Y-levers were always made of cast iron on the older planes but, today, many are two pieces of stamped steel held together with a grommet. Cast iron looks nicer, but it's somewhat more brittle. I've seen a lot of broken cast-iron Y-levers, so I don't mind the stamped variety.

The blade's lateral adjusting lever has a small disc that engages a slot in the blade, allowing you to move the blade side-to-side to square it with the sole. The best of these levers consist of three pieces: a disc that fits in the slot of the blade, a shaft and a little tab handle. Cheap planes usually have a single-piece, stamped-steel lateral adjusting lever. In addition to bending out of shape easily, these cheaper levers often engage the blade poorly, which may limit their range of adjustment.

A plane's handles should be strong and comfortable. Wood handles are nice, but unless treated tenderly, they'll break—and they're a pain to repair. I've learned to appreciate the durability of the plastic handles that inevitably come on cheapie planes, even if they aren't as nice-looking or as classy as wood.

A plane sampling—In the school where I teach, I've had good luck showing students how to sharpen and use old Stanley planes and, more recently, English-made Record planes. Since I was curious to learn how some of the cheaper planes on the market might compare, I bought a few and tested them out. The strengths and weaknesses of the bench planes I tested will give you a general idea of what's available, and also help evaluate any plane you're thinking about buying—expensive or inexpensive.

For simplicity's sake, I limited my investigation to 14-in.-long (No. 5) jack planes and 9½-in.-long (No. 4) smoothing planes. (The size numbers of planes were standardized by The Stanley Works years ago, but not all modern manufacturers follow them in identifying their tools.) Number four and five planes seem to be the most popular sizes, and they're also reasonable choices if you're only going to buy one or two planes.

Great Neck is the only brand of bench planes still being made in the U.S. (they're manufactured in Mineola, N.Y.). I bought a No. 4 Great Neck—billed as "professional quality"—for about $20 at K-Mart, but I've seen it sold elsewhere under the Master Mechanic label. Overall, Great Neck makes a pretty good plane, with a cleanly cast and machined body and a reasonably flat sole (the one I tested was slightly hollow end-to-end, but so were all the planes in my sampling). Fresh from the store, the hole in the lever cap was too small to fit over the lever screw, but a few minutes with a file fixed that. I'd question the durability of the alloy frog and lever cap if the plane were put to hard use.

Starr's sampling of bench planes included four cheap models and two pricier ones—a Craftsman and a Footprint—for comparison. Clockwise, from bottom left, are the six planes Starr tested: Footprint, Craftsman, Menard, Micky, Sears and Great Neck.

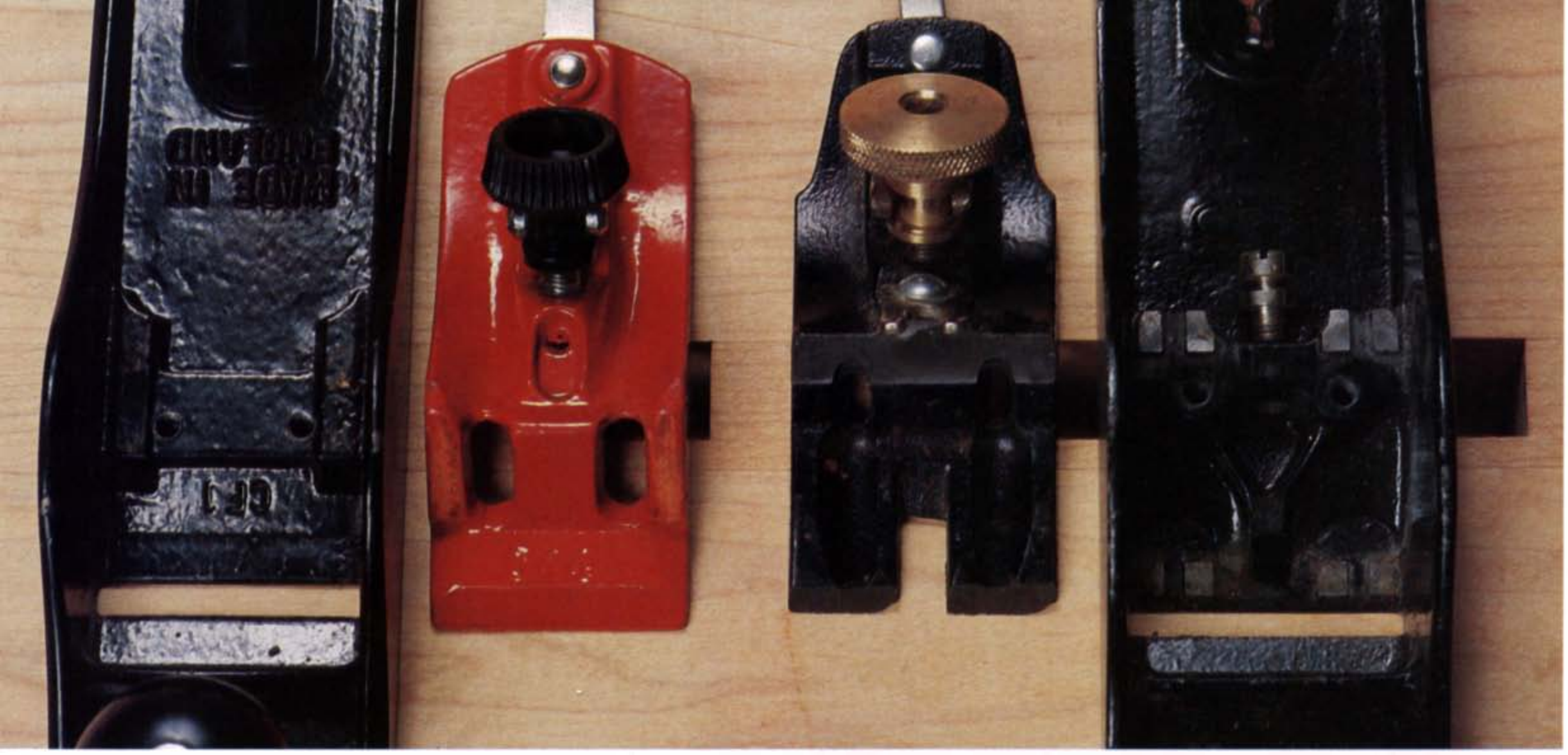
The main weakness of this plane lies in its depth-control mechanism. On most planes, the Y-lever pivots on a pin let into holes drilled in the frog. But the Great Neck's Y-lever pivots on a pin set in fragile cast-alloy clips that could easily snap if the plane hit a knot. Of course, you could drill out the frog and press in a new pin, but that would take extra time and trouble.

Also, the Great Neck plane had the worst cap iron of any of the cheapies I tested. The cap had a small arch and practically no spring—a fault that would allow shavings to jam in day-to-day use. But every new cap iron needs a little work, and it wasn't difficult to set this one right.

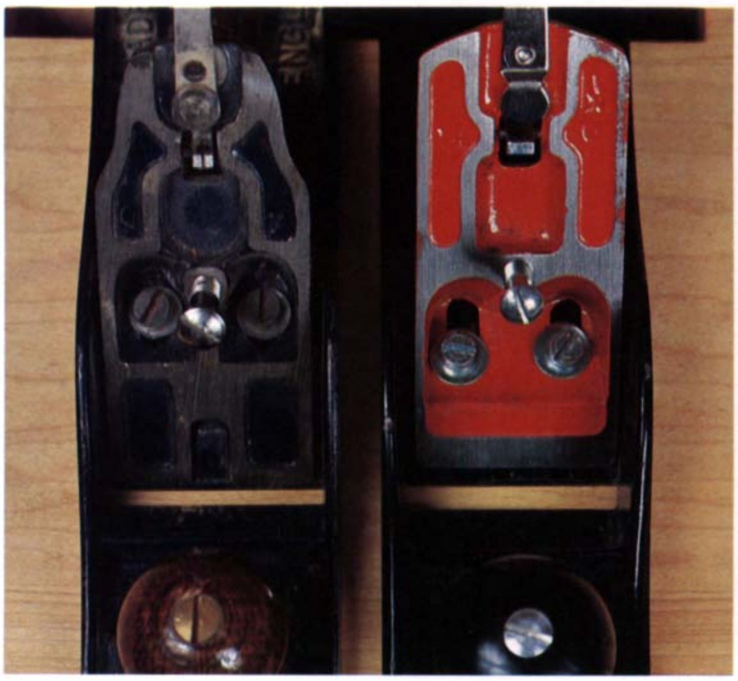
Some other minor shortcomings of the Great Neck smoothing plane included a heavily varnished sole that needed to be cleaned before use and a blade that was smooth-surfaced on one side only. Despite these gripes, the Great Neck isn't a bad tool for the money—but it wouldn't be my first choice in the price range.

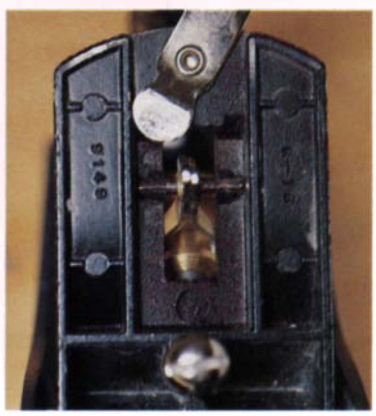
Sears Roebuck's No. 4 smoothing plane—made in England by Stanley—is identical to the cheap line of Stanley planes sold in hardware stores. I got mine for $27 from the Sears catalog (catalog number 9-HT-37168). But while it looked nice and had a pretty paint job, I wasn't too impressed with its performance. Like most of the other planes in my sampling, the bottom of this plane was quite hollow, although flat enough for rough work. It also had a plastic adjusting nut which, besides being small and difficult to use, put durability in question. Surprisingly for such a low-cost tool, the Y-lever was cast, rather than fabricated. Unfortunately, Sears didn't extend the same attention to the lever cap, which had no sheet-metal spring behind the cam. This made it hard to snap the blade assembly closed, and also allowed the cam to dig into the cap iron.

The chief problem with the Sears was its poorly designed, one-step frog that supported the blade too far from the cutting



Not all frogs are made alike: Removed from its plane body, above, the single-step Sears frog (left) has only a single-level mounting surface. The Footprint frog (right) provides a more rigid mounting by seating at two levels. Another important difference is the depth to which a frog reaches to provide blade support. As shown in the photo below, the Record frog (left) supports the blade very close to its edge; the Sears frog (right) leaves about ¼ in. of the blade unsupported and, thus, more prone to chatter.





The Footprint plane blade (bottom, photo above) has a highly arched cap iron that tends to make tighter contact and provide better blade support than a flat-arched blade like the one from the Menard (top, photo above). With the Great Neck plane's blade removed (left), you can see the four cast-alloy clips that hold the Y-lever pin in place. The clips seem flimsy, considering the amount of stress they must withstand from the force of the cutting blade.

edge, leaving the plane prone to chatter. You could set the frog so that the back of the throat would support the blade, but the sole is very thin here and could fracture if the plane hit a knot or if the lever cap screw were too tightly set. All in all, don't expect this plane to handle quality work.

The Menard No. 5 jack plane I tested might be called a "handyman special," there were so many peculiar things wrong with it. The plane is sold by Wholesale America (4777 Menard Dr., Eau Claire, WI 54703), a discount tool house that markets a wide range of inexpensive imports. At $18 plus $3 shipping, it's very cheap for its size but, depending on your patience, this Taiwan-made plane might not be much of a bargain in the long run. Its biggest problem involved its cap iron screw, which ran afoul of the frog long before the blade could be set to take even a shallow cut. To remedy this, you could set the cap iron back about ½ in. from the cutting edge (which would render the cap iron useless as a chip breaker and, worse, leave the blade prone to chatter), or you could excavate a hole in the frog to clear the screw. Fortunately, the Menard has a soft aluminum frog, so drilling out the clearance was easy.

Since the Menard's frog didn't support the blade close enough to the edge, it needed to be adjusted to rest on the thick casting at the throat's back edge. Before I could slide the frog back far enough to make this adjustment, however, I had to file a little

Tuning a plane for better performance

Every woodworking plane you buy—cheap or dear, new or used—will require tuning. Some need more work than others and may have deficits that will forever make them frustrating to use or lead to their premature retirement. Here's how to improve plane performance.

The sole should be checked for flatness with a good steel rule. Hold the ruler on its edge along the plane's bottom, both lengthwise and sideways, and look for light passing underneath it. For rough work, a space the thickness of a human hair along a 14-in. sole may be allowable, but you should detect no light if you expect to do very fine work.

The easiest way to true a plane's bottom is to have a machinist grind the sole flat, but this could more than double the cost of a cheap plane. Be sure the machinist understands the importance of accuracy, and that he or she can figure out a way to clamp the odd-shaped plane to the grinder without distorting the tool's body.

You could save money by truing your planes' soles in your own shop. You'll need a flat surface—one you really trust to be accurate. Use a piece of plate glass that's at least ¼ in. thick, half again as long as your longest plane and 16 in. to 20 in. wide. For abrasives, use coarse wet/dry sandpaper or get a few tubes of automotive valve-grinding compound from an auto-parts shop. If you use the sandpaper, spray-glue or tape the sheets to the glass so the edge of the plane won't tear the seams between them as you grind. If you use the grinding compound, squeeze a dollop on the glass and spread it with the plane until you have a uniform coating. Swirl the plane around in the abrasive for about 30 seconds, then wipe the bottom clean. You'll see a pattern of gray spots that indicate high spots on the sole. Take these down with a belt sander to speed the work along. Grind with a 60-grit belt, and work with just the front roller, focusing the grinding at a single point. Remove just a little metal from the area where the abrasive left gray marks. Now, 30 seconds with the grinding glass will show where the new high spots are. Using this method, I've taken a badly sprung plane down to usable condition in about half an hour.

A few dimples in the sole left by the grinding won't affect the plane's performance, but there must never be a low spot directly in front of the throat. If there is, you won't be able to set the throat small for fine work. The rough gray surface left by the abrasive can be polished out with 220-grit wet/dry paper.

A ding in the edge of the plane's sole will gouge the wood, so bevel the sharp edges around the bottom of the plane lightly with a file or grinder. I like to file huge, barge-prow-shaped chamfers on the ends of my planes so they won't hang up on uneven surfaces.

The throat on most new planes is too small for general work, so you'll need to file the opening larger. Unless you expect to take only very fine shavings, the throat should be at least ⅛ in. wide ahead of the blade, and even more space won't hurt. Occasionally, you'll come across a tool where the sole isn't ground in the same plane as the seat of the frog. To make sure the throat is parallel to the edge of the blade, set the blade to take an even shaving and rest a bevel gauge along its edge. Slide the bevel forward and scribe the line. Then, enlarge the front edge of the throat with a file. To allow shavings to pass through more easily, tip the file back a bit to undercut the throat slightly.

The frog on your plane may not support the blade close enough to its edge to prevent flexing and chattering. To get proper blade support in this case, you must set the frog so that the blade rests on the back edge of the throat, and file that surface smooth and parallel to the blade. Clamp the plane in a vise and use the frog (with the lever screw removed) as a guide to file the seat to the correct angle.

The cap iron needs at least some work on almost every new plane; sometimes, a major reshaping is required. Before unscrewing the cap from the blade, check to see that there's enough "spring" between them. The end of the cap iron should bend down far enough to separate itself from the blade, clear back to the screw. You can add spring by bending the end of the cap iron where it begins to arch. Be careful not to set the lever screw too tight and put undo stress on the adjustment mechanism. Set the screw so the cam on the cap lever snaps firmly—but easily—into place.

Cap irons should contact the blade along a sharp, narrow edge. To shape this edge, clamp a file in a vise and move the cap iron side to side with its tail held about an inch below the file. To check the fit, hold the cap iron and blade together, and point the blade toward a bright light. If you see light leaking through the contact edge, it's back to the file. If you have trouble getting a perfect fit, try using a finer file or an oilstone. Also, file the leading edge of the cap iron until it's smooth and free from burrs.

If you're doing very fine work planing curly wood, set the cap iron $\frac{1}{32}$ in. from the edge or closer. Such a setting makes the plane harder to push—it takes more effort to curl the shavings over—so jamming may result. For rougher work, pull the cap back ¼ in. or more.

Lateral adjusting levers often need to be bent up slightly to avoid hitting the rim of the recess on the frog casting. With the cap iron removed, hold the blade in place and move the lever back and forth to see if any part of the lever other than the disc hits the blade. File away any excess metal on the lever or frog until you get maximum freedom of movement. The handle end of the lever may need to be bent down to move freely under the blade, but take care that it still clears the top of the plane's handle.

The depth-adjusting mechanism may need a little tweaking to operate properly. Check the fit between the adjusting nut and the lobes of the Y-lever. If the nut doesn't turn smoothly, unscrew it, clean the threads with a wire brush and oil the nut lightly. A deformed steel Y-lever is easily bent back into shape, and one that has separated at the grommet can be peened together again.

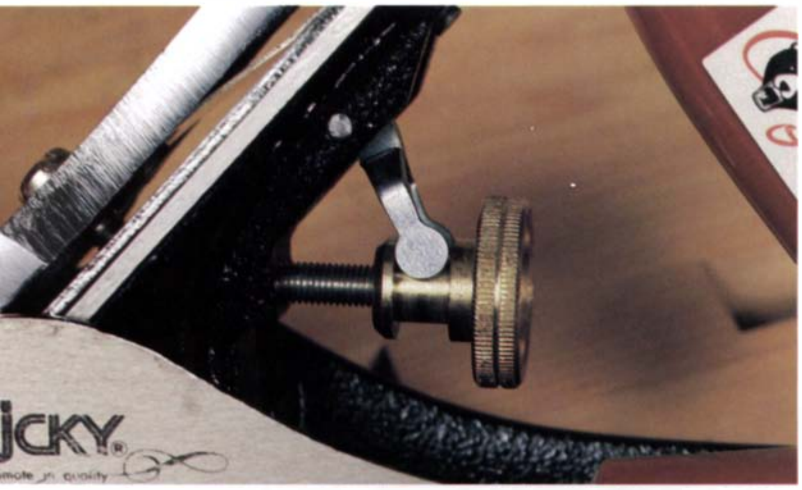
The shape of the plane's blade affects the efficiency of the cut and the quality of surface left behind. The edge should never be hollow (negative camber), i.e. take a thicker shaving along the sides than at the center. A perfectly straight edge is ideal for jointing, when you need a dead-flat surface. For a finishing plane, I prefer an edge with a very slight positive camber, so the corners don't leave sharp tracks along the edge of the cut. A curve just barely visible on a 2-in.-wide blade takes shavings that feather out to almost zero thickness at the edges.

Some plane irons are left with deep grinding marks on their surfaces, and old ones are often pitted with rust. Since the top surface of a plane's blade needn't be as flat as the back of a chisel, you can prevent these pits from eventually showing up on the cutting edge by grinding a very slight bevel on the blade's top edge. As long as it doesn't prevent the cap iron from seating properly, this bevel won't affect the cut.

The handles should be tightened securely to the plane, and be smooth and free from any burrs or roughness. If the handles have loosened (often the case when wooden handles shrink), you can get them to sit tighter by grinding the threaded ends of the mounting screws a bit shorter.

Careful attention to all these details may take some time, but once you've done the job, you're set for smooth, trouble-free planing. —*R.S.*

In order for the cap screw to clear the frog casting, allowing the blade to be adjusted, the author had to drill out a small area on the top side of the Menard's frog, as shown above.



Because of the way the adjustment screw on the Micky angles down, the lobes of the Y-lever lose contact with the recess in the adjusting nut when the blade is set for a thick cut.

metal away from the underside of the frog where it hit an obstruction on the body casting.

Instead of a cam-actuated locking lever, the Menard uses a screw to tension the lever cap that was stamped from steel, not cast. This is a minor inconvenience, however, and the Menard's blade assembly is well-made and stiff enough to do the job. You'd probably want to grind the lever cap's front edge a little thinner so you could use it as a screwdriver to disassemble the blade assembly for sharpening.

The best thing about the Menard was its body casting. Heavy and reasonably flat-soled, the body featured reinforcing ribs for added strength. The Menard's blade was slightly harder than the rest in the sampling (judging by the scratch test described previously), but all the blades I tested were hard enough to hold an edge. With all the problems wrung out of it, the Menard would be useful for heavy work. But for a few more bucks, you could get a similarly sized plane that needs a lot less preparation.

Grizzly Imports Inc.—best known for its line of Taiwanese machinery—recently began marketing the Micky, a No. 4-sized plane imported from Japan. At $25.95 (shipping included), the Micky is a nice tool with a good paint job and comfortable red plastic handles. The one I bought had a clean, smoothly ground casting and a reasonably flat sole. The Micky's blade is nearly twice as thick as standard blades, which helps reduce chatter if you slide the frog forward to reduce the width of the plane's exceptionally large throat. Unfortunately, the way the frog is cast limits the amount of forward motion you can take advantage of on this plane.

The cap iron on the Micky was the best of the planes I tested—well-arched and precisely ground where it contacts the blade. Its surface, however, had a coarse texture that needed to be filed smooth where the lever cap bore upon it at both ends—to prevent friction between the two parts, which must slide smoothly when making adjustments.

On the Grizzly I tried out, the screw upon which the depth-adjustment nut runs was aimed downward, so the Y-lever nearly rode out of the knob's groove at the outer limits of travel. This could probably have been remedied by bending the screw up a little, or by bending the lobes of the Y-lever a bit closer together. Also, the smallish knob makes the plane hard to adjust. And, like the Menard, the forward end of the lever cap had to be filed to serve as a screwdriver for the cap screw.

Despite its problems, I found the Micky to be a sturdily built, substantial tool that worked surprisingly well, right out of the box. It's easily the best of the cheap planes.

Price vs. quality—Having examined the cheap handplanes, I was curious to see how the more expensive tools might compare. You'd think that spending twice as much money would get you a tool that works twice as well, but it ain't necessarily so. Case in point: While Sears' $27 smoothing plane was identical to cheap hardware-store Stanleys, the English-made Craftsman jack plane I bought at Sears for $50 (catalog number 9-HT-37165) wasn't even remotely similar to high-end Stanley tools.

Despite a spiffy appearance, in fact, the Craftsman had a major, irreparable fault that rendered it just about inoperable: Its interior dimension was too narrow to allow proper lateral adjustment of the blade. And since the Craftsman's sole was ground out-of-parallel with the frog seat, it was practically impossible to set the blade to take an even shaving. You'd have to grind the blade's edge off-square to get it to work. On the one I bought, the lever cap was too wide, and its kidney-shaped hole had to be filed almost round before it would slip past the cap screw. And, like the No. 4 Sears I tested, the upper-end Craftsman had an inferior, single-step frog. My sample was also badly concave.

Although the Craftsman costs twice as much as a comparably sized Sears-brand plane, it's basically the same plane. All you get for the extra cash is a large brass depth knob, a spring under the lever cap and some chrome plating—hardly worth twice the price.

The Footprint—a high-quality, English-made jack plane—recently became available through U.S. tool catalogs. I bought mine for $43 from Woodcraft Supply (41 Atlantic Ave., Box 4000, Woburn, Mass. 01888). This plane felt well-made, and it was the only plane in my sampling that boasted wooden handles. But what else did I get for the extra money? The sole was flatter than most, but it still needed some work. The Footprint also had a two-step frog with ground seats, a cast Y-lever and a screw adjustment that moves the frog in precisely controllable increments—handy when setting up the plane. Overall, this plane had a quality feel equal to new, top-of-the-line Stanleys—a bit better feel than the Record planes I own.

I used to be something of a snob about my planes. I loved to restore noble old Stanleys, and I agreed with the Japanese that working with a fine tool is a spiritual experience. But, despite their shortcomings, the cheap planes I tested proved to be a practical alternative to spending top dollar for tools you plan to use only occasionally. It's clear that a little patience and tender tweaking can get these tools humming. Working with them convinced me that any tool that you've carefully tuned can become an extension of your hands and mind—even a $20 cheapie from K-Mart. □

Richard Starr is a teacher and the author of Woodworking with Kids, *published by The Taunton Press (1982).*

Alvin Weaver built his homemade radial-arm sander in 1948. By cranking the handle in his left hand, Weaver moves the table under the sanding head, which pivots at the column and is pressed to the work with the lever in Weaver's right hand.

Alvin Weaver

A shop full of home-built machines

by John Kriegshauser

Even though we live in the same city, I didn't know about Alvin Weaver until I saw his Chinese-style desk on the cover of *Design Book Two* (The Taunton Press, 1979). I began inquiring about him, and learned that he was widely known for his flawlessly crafted furniture in Queen Anne, Chippendale and Oriental styles. Alvin and his older brother, Levi, comprise the first of three generations of local cabinetmakers who've become something of a woodworking institution in town. Naturally, I wanted to meet him. When I learned that Weaver also makes most of his own machines, I knew I had to meet him.

It took some time, however, for our meeting to come about. Weaver has a deep backlog of work and, since he works alone, he's jealous of his time. Learning that he often holds an open house to celebrate the completion of a major project, I managed to invite myself to one he hosted about six years ago.

Alvin and Velma Weaver's house stands on a seldom-traveled road near the crest of a wooded hillside on the western edge of Kansas City, Kan., where the urban landscape suddenly turns rural. Weaver's comfortable 2,000-sq.-ft. shop lies just downhill from the house. The piece on display at the open house that day was a carefully executed breakfront, adapted from 18th-century English models. Weaver built it for his wife as a wedding-anniversary gift. I was impressed by the piece, but was shocked by the sight of the machinery that had helped produce it. I had expected beautiful equipment—customized, better than the norm. Instead, the stuff had a crude, do-it-yourself sort of look to it.

Only after I came to understand their owner did I realize what marvelous machines these really were. Levi Weaver moved to Kansas City in the 1920s from a stingy piece of Ozark farmland on which he and Alvin were raised. The elder brother established himself in the kitchen cabinet business. Later, Alvin came to work for him, just as the Great Depression was taking hold in 1930. Chastened by hard times, the Weaver brothers came to embody the very American attitude, "Why do something

Photos: Lawrence Okrend

On Weaver's saw fence (left), a threaded rod sets the fence parallel to the blade, and a turnbuckle keeps the fence's face perpendicular to the table. To make it easier to change shaper cutters, Weaver welded a steel finger to the machine's frame. An open-end wrench extending from the finger to the spindle (above) locks the shaft, so Weaver has two free hands to tighten cutters.

by hand when it can be done better and faster by machine?" For these men, producing the maximum product with minimum means went beyond mere survival, becoming almost an art form.

Eventually, Levi began building and selling woodworking machines as a sideline. Over the decades, he, his son and grandsons have built horizontal panel saws, mortising machines, miter saws and shapers. Today, it's hard to find a local Kansas City cabinet shop that doesn't include at least one of these low-tech machines, usually sporting a one- or two-digit serial number.

Alvin is a soft-spoken man in his 70s with a full head of gray hair. While working for Levi, he used his free time to build fine furniture for a steadily expanding clientele. In 1946, an appreciative client loaned him money to build a concrete-block addition on an empty chicken coup. Alvin became self-employed.

The breakfront cabinet, above, is typical of the caliber of work Weaver executes on his homemade machines. A deftly crafted period interpretation, he built the piece as a gift for his wife.

Faced with a new mortgage and a growing family, Alvin had no choice but to build his own equipment. The machines he produced, however, were more than statements of frugality; they were ingenious solutions to mechanical problems and well-integrated elements in a method of working wood.

Alvin's tablesaws—cubic frameworks of angle steel—are a case in point. They stand on three slightly splayed legs, so he can scoot them anywhere in the shop and have them remain solidly on the floor. A 1-HP motor is bolted to the plywood floor of the cube. A V-belt and pulley drive the arbor, which runs through two pillow block bearings bolted to cross members in the upper part of the framework. Alvin was concerned that the pillow block nearest the blade would shift out of alignment if the blade bound in a heavy cut. He decided to eliminate that possibility by welding a chunk of steel against the block. The squaring and alignment of the blade are done entirely by shimming or adjusting the pillow block on the pulley end of the shaft. Also, the arbor is turned down to ⅝ in., so it accepts standard sawblades.

I asked Alvin about his preference in sawblades and learned that he's never owned a carbide blade. "You don't need carbide if you're working with wood," he says. "Besides, you can sharpen steel blades yourself." True as this might be, Weaver confesses that he quit working with beautiful, but blade-eating, woods like teak and pecan years ago for this very reason.

When asked which sawblade brand he prefers, Alvin says, "I've bought various brands over the years, but I find how you sharpen them is a lot more important than who manufactured them." A nearby stack of blades—from 6 in. to 10 in. in dia. and produced by almost every manufacturer—attested to this philosophy. A file, a saw set and a skilled hand keep Weaver's blades in peak condition. "I prefer smaller-diameter blades for doing delicate work," he says. This is just as well, because years of sharpening and gulleting have reduced the diameter of many of his blades.

Alvin made his saw table out of edge-glued walnut scraps. The table's height is adjusted by a hand crank on the front of the saw—i.e. the table, not the blade, adjusts. This is accomplished by sloping the table: toward the operator for deep cuts, away for shallow cuts. The table is bolted to two pieces of steel angle stock. The far piece of angle ties to the cubic framework with pivot bearings made of hardened-steel bolts. The bolts let the top hinge like a trunk lid, and they also prevent play. Never, in my opinion, is the slope either dangerous or inconvenient.

Alvin's adjustable T-square fence (see photo, far left) is what makes his saw a precision tool. The width of cut is set by sliding the stem of the T in a slot cut perpendicular to the miter gauge slot. The fence locks in place with a bolt and wing nut. A threaded rod and nut assembly stiffens the T and adjusts the fence parallel to the blade. A turnbuckle between the stem and the top of the T is twisted to make the fence perpendicular to the table.

Not surprisingly, this saw operates a little differently than the standard tilt-arbor type. The lack of a table insert makes it impossible to switch back and forth from blade to dado head. Rather than devise an insert, Alvin built a second saw just for dadoing. He finds this saves a great deal of set-up time.

Since ripping angles is impractical on his saw, Weaver performs the procedure on his jointer or, if the angle is critical (as in mitering panels together), on the shaper. To deal with the score marks that his hand-set blades often leave, Alvin reserves an 8-in. jointer for edge work. After ripping parts 1⁄16 in. overwidth, he joints the excess material away, producing a virtually finished surface.

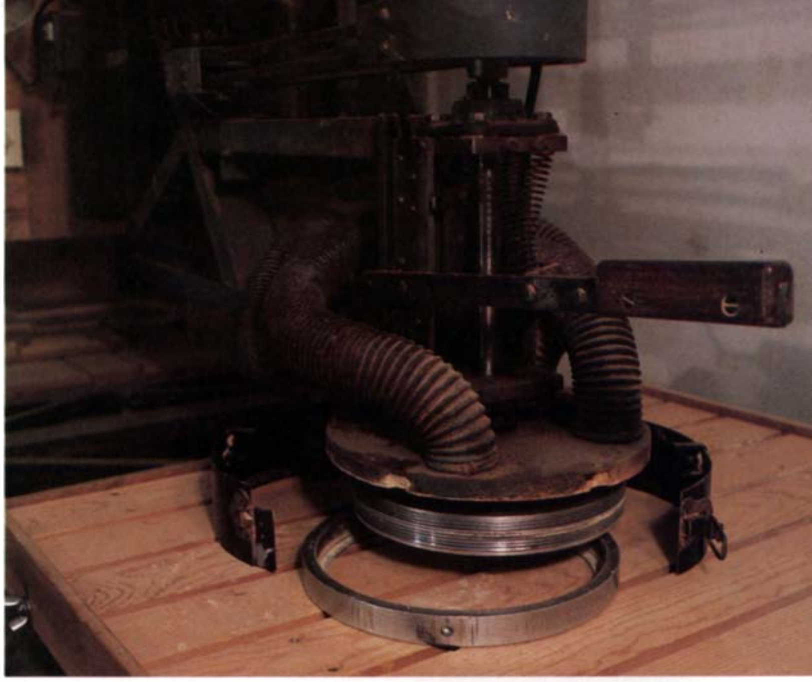
Alvin's shaper is equally direct. The spindle rides in two pillow block bearings bolted to a length of steel U-channel. A 3⁄4-HP motor mounted on the opposite side of the channel is linked to the spindle by a V-belt. The channel tracks up and down on a steel center post, also made of U-channel. A hand crank on the infeed side of the shaper adjusts spindle height by turning a threaded rod that moves a worm gear at the base of the U-channel, to which the spindle is connected. Spindle adjustment is smooth, fine and convenient.

The spindle-locking system is another clever feature of Weaver's machine. A steel finger welded to the frame a few inches below the on/off switch supports one end of an open-end wrench; the other end grasps a hex nut on the lower end of the spindle, just above the bottom pillow block. Thanks to this device, both of Alvin's hands are left free, so he can really torque down the nut atop the spindle. Weaver credits this positive torque with preventing any mishap during decades of use, despite his preference for loose-knife cutterheads, which run slightly out-of-balance (i.e. only one knife is ground to finish pattern, the other is set back to hog only).

Like the saw, Alvin's shaper has a wooden top. The one I bought from his brother, Levi, three years ago is equipped with a cast-iron top, so I asked Alvin why he preferred wood. "I wouldn't own an iron-topped shaper," he replied. He showed me a setup on his shaper to cut delicate window mullions for his breakfront cabinet. In addition to tiny feather boards and guide blocks nailed and screwed to the fence and table, the wooden top allowed him to tack tiny compensation blocks on the outfeed side. These blocks steadied the mullions by compensating for the removed material.

Nonetheless, Alvin did concede that—were he to build another saw—he'd use a plywood top. The present top has a crack running down the miter gauge slot that opens every winter. If I were going to build such a saw for myself, I'd also incorporate a table insert—if not for dadoing, then just to keep the blade slot narrow and crisp.

Weaver's huge radial-arm sander is the crowning achievement of home-built technology. Inspired by an unsuccessful sander his brother Levi had built years before, the design of this machine is unique: A rolling table carries the work beneath a sanding disc, mounted on a swinging arm. Capable of accepting stock up to 3 in. thick, the arm is carefully adjusted to pass parallel over the surface of the rolling table. A heavy, 1-HP motor is mounted on this arm near the column from which it swings. The belt-driven sanding head consists of a locking ring that can be screwed into a thick, aluminum disc faced with medium-pile carpet. As this ring is screwed onto the sanding head, it crushes the edge of the 10-in.-dia. sanding disc so far down into the carpet pile that the sandpaper stands proud of the metal rim. A machinist with whom Alvin has traded work made the two-piece head.



A close-up of the disassembled head from the radial-arm sander, above, shows the threaded ring used to fasten 10-in.-dia. sandpaper discs to a mounting plate. A sheet-metal shroud seals the sanding head so dust can be pulled away from the work by four vacuum hoses mounted to a plywood disc.

Alvin also solved a problem that dogged Levi's previous design: finding an adequate dust-collector attachment that would also permit easy sanding disc removal and replacement. On his machine, Alvin ran four dust-collector hoses through a plywood disc located above the sanding head. He then surrounded the head with a sheet-metal shroud that drops away upon release of an ordinary toolbox draw clasp. With the dust problem solved, the sander has been a regular part of his operation since 1948.

Alvin readily concedes that—because of the short life of the sanding discs and the frequent grit changes required—his sander fails as a production machine. But these shortcomings don't compromise the machine's utility in a custom shop. On a typical tabletop, for instance, Weaver might start with 80-grit discs and work his way up, step by step, to 240-grit discs. I can say from personal observation that, at that point, the tabletop is flat and uniformly thick, with no visible swirl marks. The stroke sander—an obvious alternative to Weaver's machine—won't produce the same flatness or uniform thickness.

People often ask me to recommend a tablesaw, all the while protesting how little money they have to spend. Now that I've seen Alvin Weaver's shop, I can't help but answer, "Have you ever thought about building one yourself?" □

John Kriegshauser operates a custom furniture shop in Kansas City, Mo. Alvin Weaver operates the Alvin Weaver Studio with his wife, Velma, in Kansas City, Kan.

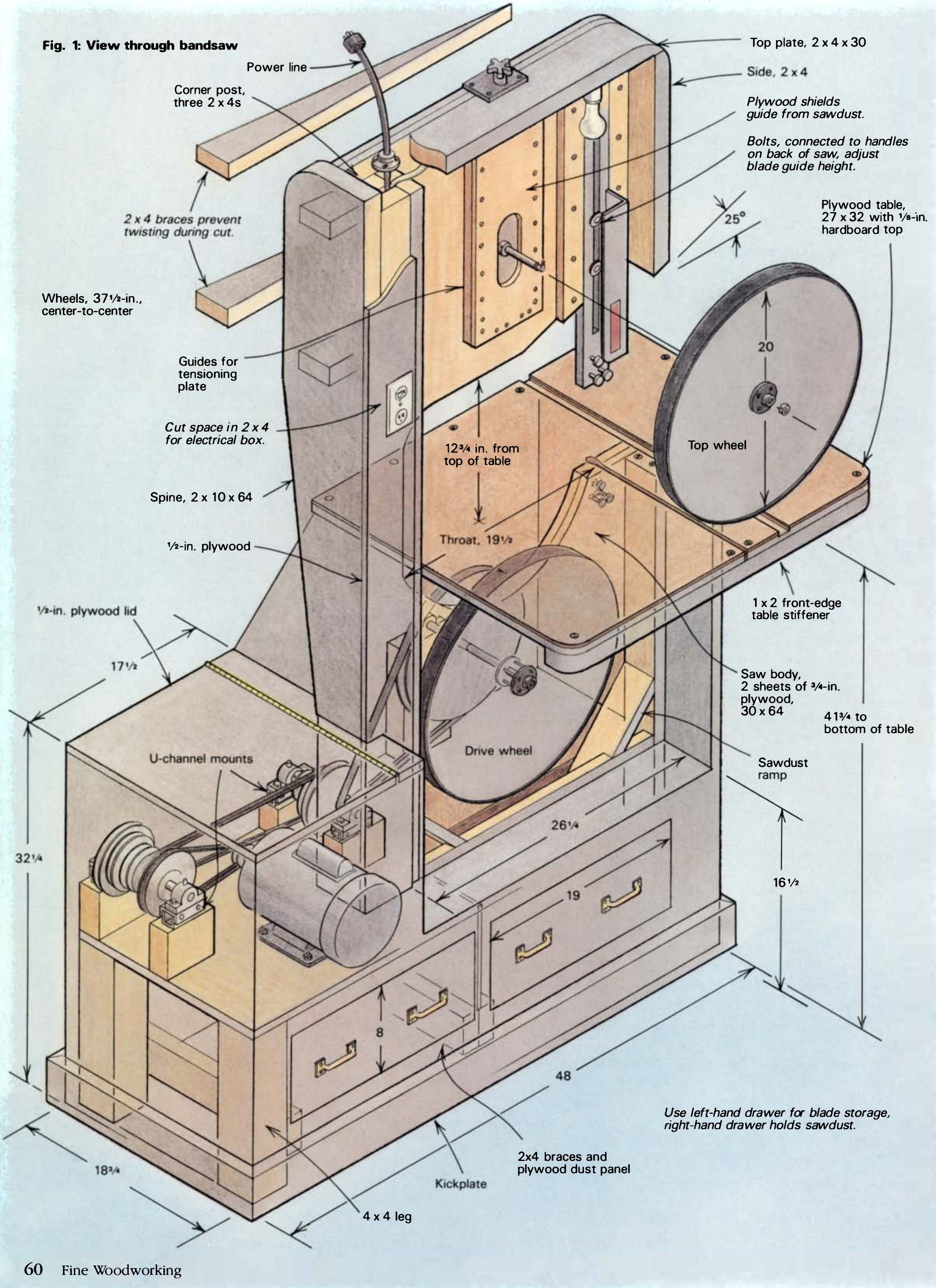


Fig. 1: View through bandsaw
Power line
Corner post, three 2 x 4s
Top plate, 2 x 4 x 30
Side, 2 x 4
Plywood shields guide from sawdust.
Bolts, connected to handles on back of saw, adjust blade guide height.
25°
Plywood table, 27 x 32 with 1/8-in. hardboard top
2 x 4 braces prevent twisting during cut.
Wheels, 37 1/2-in., center-to-center
20
Guides for tensioning plate
Cut space in 2 x 4 for electrical box.
12 3/4 in. from top of table
Top wheel
Spine, 2 x 10 x 64
Throat, 19 1/2
1/2-in. plywood
1 x 2 front-edge table stiffener
1/2-in. plywood lid
17 1/2
Saw body, 2 sheets of 3/4-in. plywood, 30 x 64
41 3/4 to bottom of table
U-channel mounts
Drive wheel
Sawdust ramp
32 1/4
26 1/4
16 1/2
19
8
48
Use left-hand drawer for blade storage, right-hand drawer holds sawdust.
18 3/4
Kickplate
2x4 braces and plywood dust panel
4 x 4 leg

Shopmade Bandsaw

Plywood and basic tools build the saw

by William Corneil

Most woodworkers' thoughts turn to tablesaws and radial-arm saws when they're confronted with buying a large stationary saw. But I'm different in two regards. First, I chose a bandsaw, for reasons that I'll make clear in a moment. And, secondly, I opted to build the machine myself rather than buy it.

I chose a bandsaw because it can do many things a tablesaw can do, plus it can cut curves. As a project, it seemed less daunting than building a tablesaw or radial-arm saw, both of which would be great to own but are too expensive to buy on my budget.

My problem as an amateur woodworker is that I find it hard to justify (to myself and my spouse) the need to buy larger stationary equipment simply to "build better birdhouses." Granted, many cutting tasks are performed quicker on a tablesaw, but for the amateur, time doesn't mean money. Aside from cutting curves, I can resaw, rip and even cut lumber from logs on my saw. It also has five blade speeds: 120, 300, 600, 1,200 and 3,000 feet per minute (fpm). The slowest speed allows me to cut ¼-in. angle iron.

As machinery goes, the price was right. I built the 20-in. saw you see at left three years ago for under $100, Canadian (about $72 American today). I kept the cost down by using locally available materials and hardware. Most of the saw is built from ¾-in. interior-grade plywood and construction-grade lumber (which needs to be dried well first). I recently swapped the saw's ¼-HP motor for a used ½-HP model, but the smaller motor is more than adequate, unless you use the saw to cut lumber from logs, as I do.

It's ironic that my saw incorporates features that many store-bought saws don't, such as a worklight above the blade guard, one drawer for blade storage and another to catch sawdust, a built-in 110v AC power outlet and a conveniently located power cord.

Anybody who's built even a reasonably complex piece of furniture shouldn't find the saw hard to build. I built mine with the usual cast of characters: a saber saw, an electric hand drill and a borrowed belt sander. The only machine I used that many shops may lack is my homemade 12-in. disc sander.

I'll admit the project requires basic metalworking skills. If I were to build the saw again, however, I wouldn't use bushings for the wheels; I'd opt for roller or needle bearings instead. Although more expensive, bearings would eliminate much of the metalworking, and would also save time on building the machine.

Ball bearings would also have negated the need to run a network of copper-tubing lubrication lines throughout the saw to all the pillow blocks (for clarity, this network isn't shown in the drawing at left or those on p. 63). Similarly, two other jobs would also have been eliminated: drilling out the top wheel axle to fit it with a lubrication cup, and routing a groove in the saw body to run an oil line to the bushings in which the drive axle rides.

Even if you can't handle the more involved metalworking (such as building the wheel-tensioning assembly), a machine shop should be able to do it for a reasonable price—and you'll still accomplish the project for a lot less than what you'd pay for a good used machine of this capacity.

My bandsaw can be separated into three main components: the base, which supports the saw and table and contains the motor, drive components and two drawers; the saw body, which supports the wheels the blade rides on, along with the adjustment mechanisms and the door; and the mechanicals—the motor, pulleys, bearings, electrical wiring and adjustment mechanisms.

The logical place to start construction is with the base. This is no more than a ¾-in. plywood top, face, back and end pieces screwed to four 4x4 legs. A divider of ½-in. plywood separates the base into two drawer compartments and prevents sawdust from getting into the blade-storage drawer. The drawer runners are 2x4s with rippings glued to them.

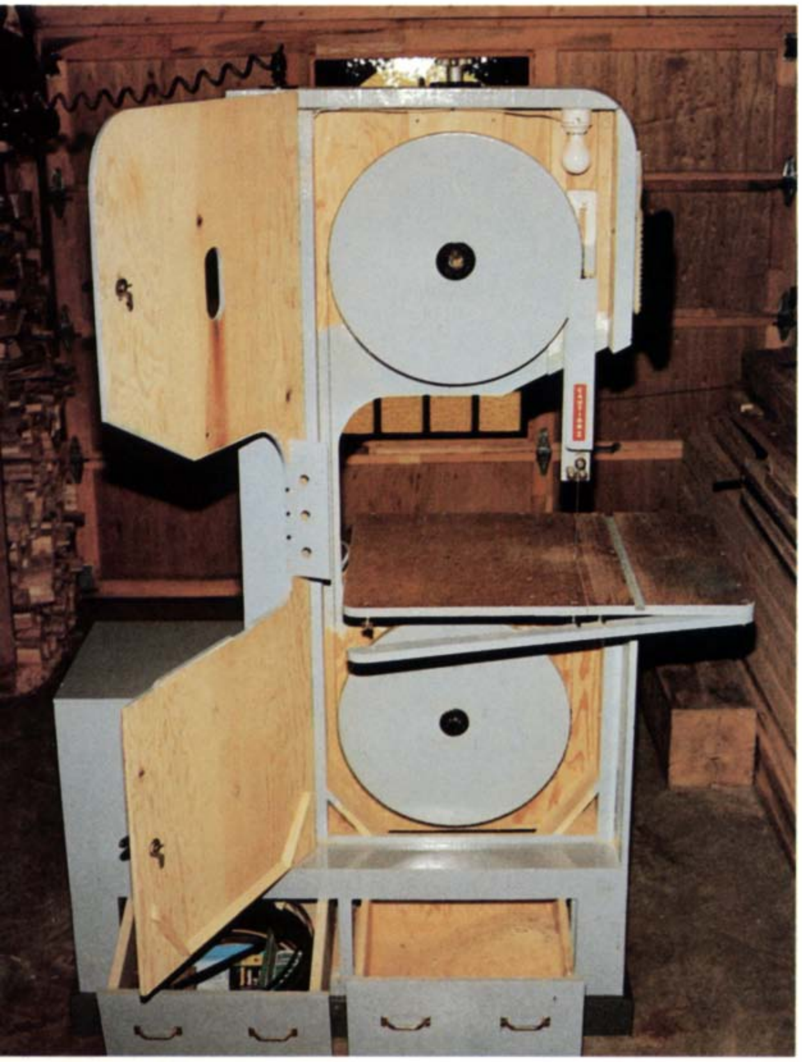
After the base is built, begin work on the saw body by drawing its profile on two sheets of plywood that have been tack-nailed at the corners. Cut the profile and remove the scrap. The sole purpose for cutting an arcing, concave profile in the saw body's top is to conserve material for wheels, so handle the throat scrap carefully.

If you opt to use bushings instead of bearings, you'll have to run a lubrication line down to the bushings that the lower axle rides in. You'll also have to rout a groove large enough for the lubrication line (I used ¼-in.-dia. copper tubing for lube lines throughout) in one of the plywood sheets. The tube that feeds the lower bushings stops just above the axle and lubricates the bushings by dripping oil onto the axle.

Glue and screw the two plywood sheets that will form the saw body together. After the glue has dried, attach the 2x4 top plate, the 2x10 spine and the 2x4 braces on the back. Next, glue and screw the three 2x4s to the left of the front of the glued-up sheet so that they form a corner post. Be sure to leave a gap between the post and the sheet on the left-hand side—to provide room to run the switch and outlet wiring. Now, attach the top and bottom vertical 2x4s on the right-hand side of the saw body. Cut out and attach the ramps that spill the sawdust into the drawer.

Use the same pattern for the saw body to cut out the ½-in. plywood door. Then, rip the piece of plywood that's attached next to the door—the door swings from this piece by a piano hinge. Next, fasten another sawdust ramp at the bottom of the door, and cut out the oval slot in the door to allow the top axle to travel vertically.

Make up each wheel from the ¾-in. plywood throat cutouts. Rough out each piece, then glue a piece of ½-in. plywood on top of



Canadian woodworker Bill Corneil built this 20-in. bandsaw three years ago and has found it a reliable performer. Shown with its door and two drawers open, the saw is powered by a used ½-HP motor. It is built from construction-grade lumber and interior-grade plywood.

it, making each disc 1¼ in. thick. When the glue has dried, draw the 20-in.-dia. circles on each piece, and cut them out slightly oversize. I bored a ⅝-in. centerhole in each wheel, mounted the bushings to them and mounted the wheels, one at a time, on a jig on my disc sander. Then, I spun each one against the sanding disc to make it concentric with the axle and to make the edge perpendicular to the face. There's no need to put a crown on each disc to keep the blade on track; I'll explain more about this later.

Next, I bought an 18-in. bicycle inner tube, cut off the valve and split it into two large bands about 1 in. wide. I stretched these bands over each wheel—to prevent the blade's tooth set from wearing a groove in the wheel edge.

You can make your own bearings using bushings housed in floor flanges, which are threaded fixtures allowing plumbing pipe to be used as closet coatracks, machine stands and the like. You'll need four ½-in. floor flanges, two ¾-in. floor flanges and four ¾-in.-long sintered bronze bushings with a ⅝-in.-dia. inside hole and ⅞-in. outside diameter. Drill out the centerhole in the ½-in. floor flanges to slightly under ⅞ in. dia., and press the bushings into the hole.

Pick one plywood disc as the top, free-running wheel and bolt a ½-in. floor flange to each side of the disc with flathead machine screws. I used a piece of ⅝-in. steel rod inserted through the hole to keep both flanges aligned while bolting them to the wheel (and also to mount the wheel to my sanding jig).

Mount the top wheel-tracking assembly to the saw body. This assembly consists of a threaded rod with a knob mounted to it. Turning the knob clockwise threads the rod through a plate mounted to the saw body. The rod then pushes on the back of the plate to which the axle is welded, causing the wheel to tip back in relation to the front of the saw.

The wheel-axle plate hangs from the top of the saw and needs about ¼-in. clearance behind it. It's kept in side-to-side alignment by two pieces of 1-in.-thick wood—one on each side of the assembly—screwed to the saw body. A plywood shield is screwed to these pieces to serve as a cover.

Once again, if you decide to use bushings instead of bearings, you'll have to drill out the ⅝-in. steel-rod top axle. Bore a ⅛-in. oil channel down the center of the rod, then bore two ⅛-in. drip holes perpendicular to the oil channel—to lubricate the bushings the axle rides in. Use two collar stops to secure the top axle.

The other two ½-in. floor-flange bearings are attached to the saw body's laminated center—not to the lower wheel. The alignment of these lower bushings is critical. First, stand and plumb the saw body on its base and screw it down. Drop a plumb bob from the center of the top axle and mark the center of the bottom wheel with a vertical reference mark. Now, make a horizontal reference mark about 37½ in. down from the top axle. The bottom flange bearings are centered on these marks.

Drill out the two ¾-in. flanges to ⅝ in. in diameter. Drill and tap three setscrew holes in each flange. Attach these two flanges to the bottom wheel in the same manner you attached the flanges to the top wheel. The setscrews—six in all—tighten the wheel to the axle. No collar stops are needed.

Cut a ⅝-in. steel rod to 12 in. long and push it through both the drive wheel and the bearings attached to the laminated body. The rod should almost touch the back of the base.

Install a piece of 2x6 to support the pillow block that the drive axle will rest on, then mount the pillow block itself (see figure 2). Next, install the V-belt and the 12-in.-dia. V-belt pulley on the lower axle. Finally, mount the axle to the pillow block.

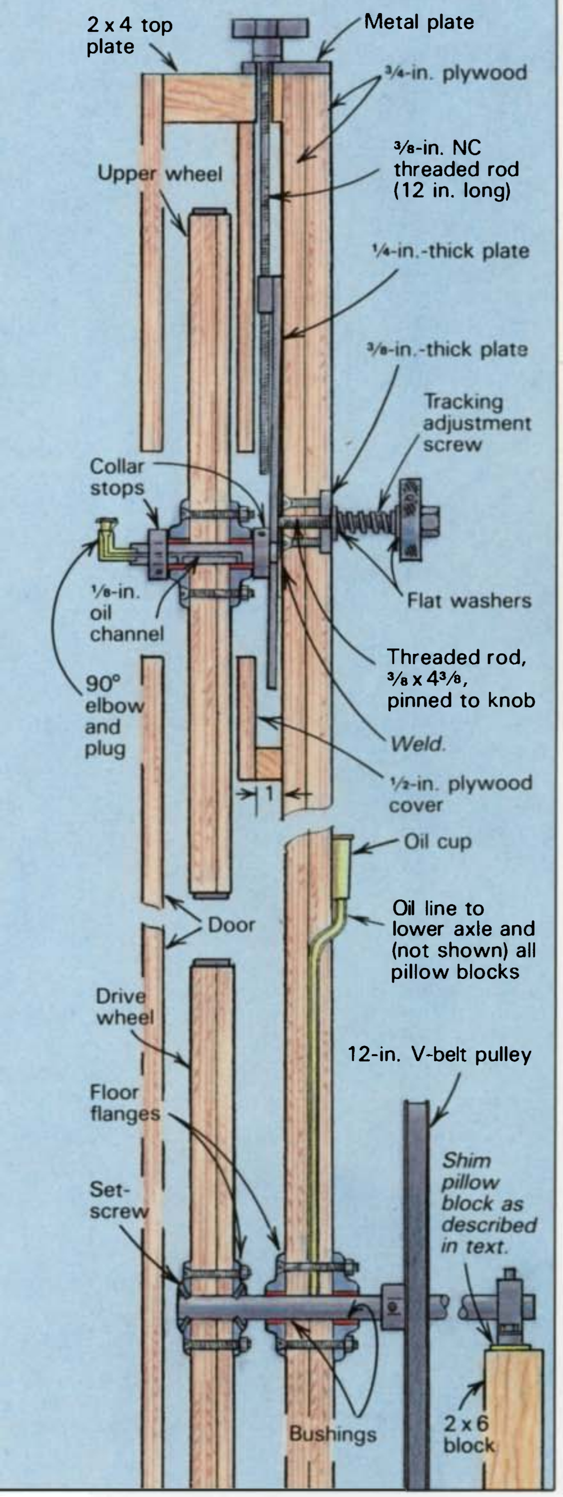
The key to blade-tracking success is shimming the pillow block that the drive axle rests in. This will make the axle run downhill, tipping the lower wheel slightly. The lower inside face of the wheel is closer to the saw body than the top by about ⅛ in. (or a little less). You might have to experiment with shimming the axle to get the blade to track correctly, but, once done, the blade tracks extraordinarily well. Mine hasn't come off the track in more than three years of heavy use, even after ripping more than 200 logs into lumber.

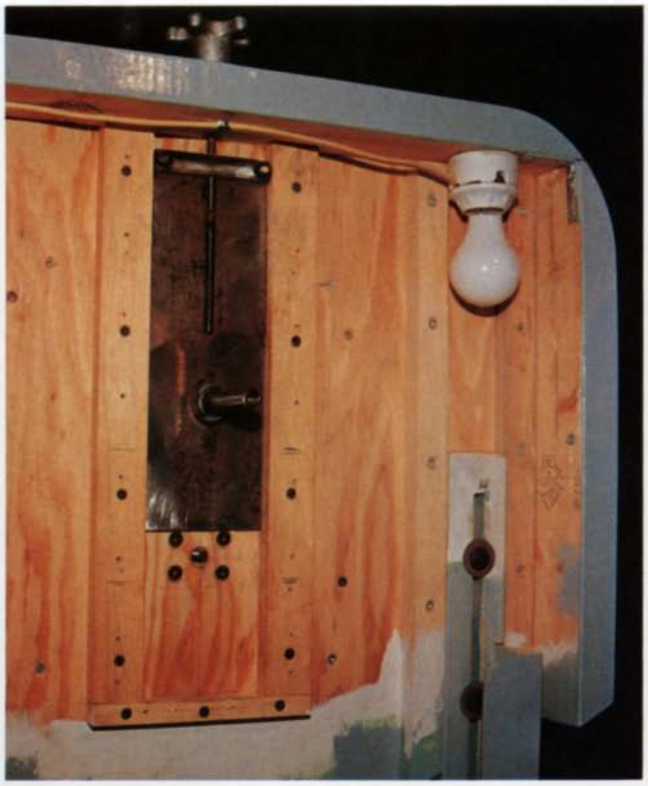
Next, mount the two sets of intermediate five-step pulleys to their axles which, in turn, ride in pillow blocks bolted to 3-in. U-channel mounts (see figure 1). Slotted holes for bolts allow the pillow blocks to adjust horizontally, and the U-channels to adjust vertically, for fine-tuning alignment.

Build the sliding blade guard as shown in the photos, facing page. The blade guard slides between two pieces of wood screwed to the saw body. The bearings are positioned by nuts (threaded to either a rod or a bolt) after a blade has been installed. Two of the bearings in each trio should be located to ride along both faces of the blade, while the third backs up the blade from behind.

Bolt the motor in its compartment using the inside face of the base as the reference point. Use a straightedge or a steel square to align the pulleys before tightening down their setscrews. Run the power cord in through the top of the saw, and fish the wiring

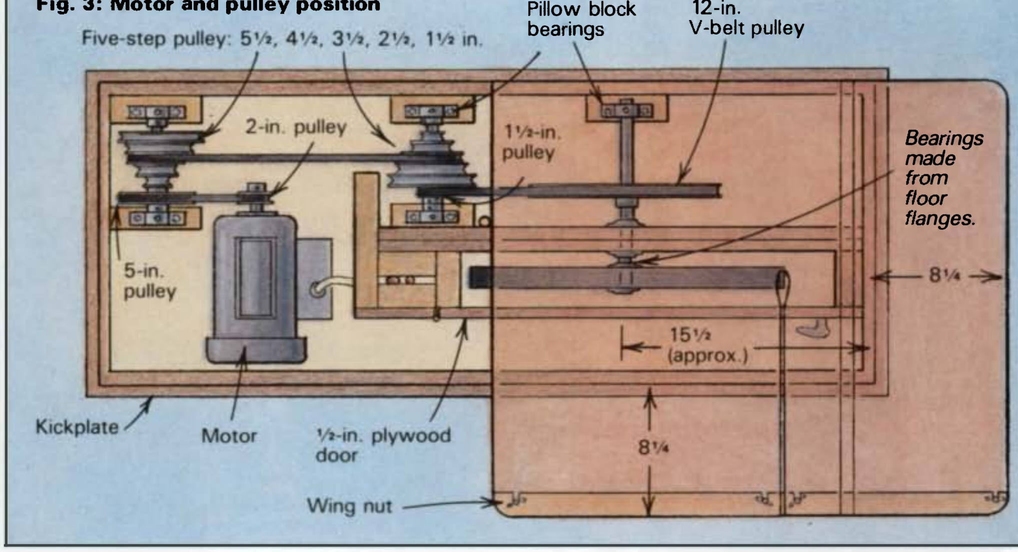
Fig. 2: Wheel adjustment mechanisms






With its guard and the top wheel removed, the saw's blade-tensioning assembly (above, left) is exposed. The assembly is raised higher than normal to show the tracking assembly behind it. The blade guard slides in tracks screwed to the saw body. Blade guide bearings (top right) are made of ball bearings on threaded rods or bolts. The top backup bearing in the upper trio is smaller that the bottom backup bearing because it's a temporary replacement. The author burned out the original bearing after three years of use, milling logs into lumber.

Fig. 3: Motor and pulley position



down through the support post to the switch/receptacle. Wire the motor between the switch/power outlet and the light. When wired correctly, the bulb should light when the saw is turned on, and the receptacle should have power at all times. By having the power cord exit the top of the saw, you can plug it into a ceiling receptacle, keeping the cord high and out of the way.

The remaining work is simple. Attach the hinged cover for the motor compartment, build the drawers and the saw table, attach hardware, cover blemishes with filler, then sand and paint.

While the saw accepts blades from 138 in. to 146 in. long, I use a ¾-in. by 144-in.-long blade most of the time. Take the blade on a test run by slipping it over both wheels. You should also snug up the blade tension; the blade should be snug enough to ring when you strum it like a guitar (see "Home-Shop Bandsaws," *FWW* #63). With the saw unplugged, turn the top wheel over by hand and adjust its tracking.

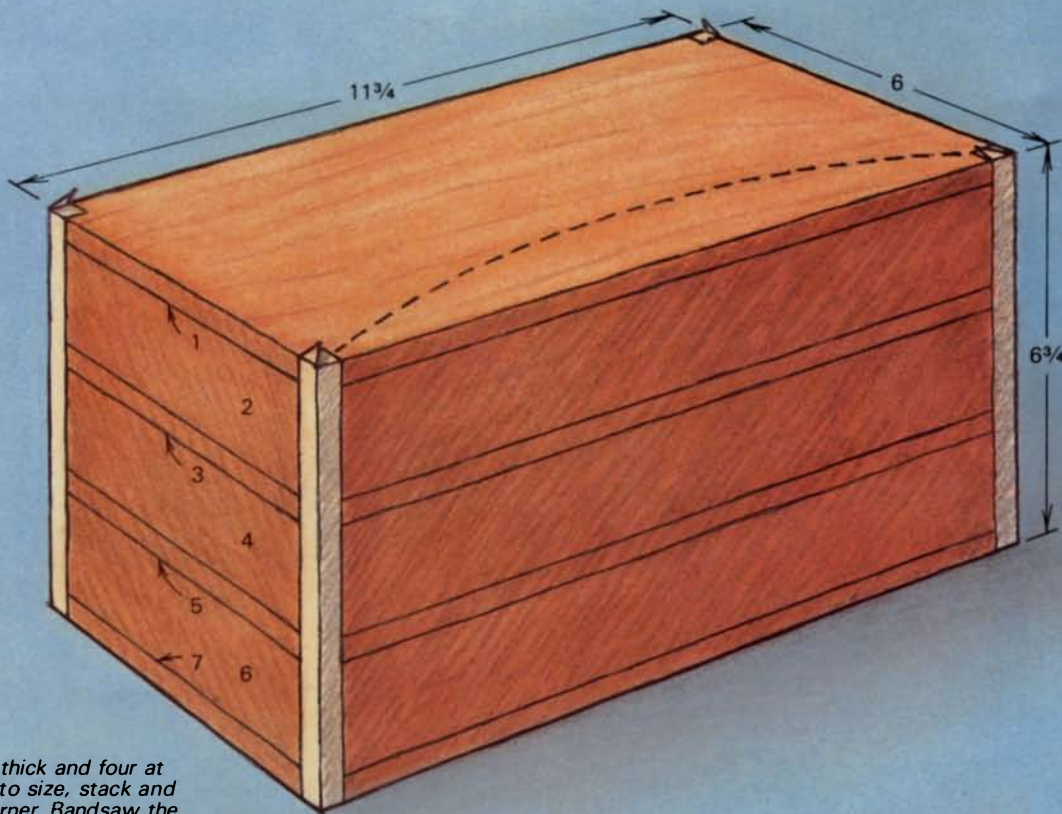
Now comes the moment of glory. Quickly flip the switch on and off a couple of times to test how the blade tracks. All that's left is to take it for a test drive down a long and winding cut. □

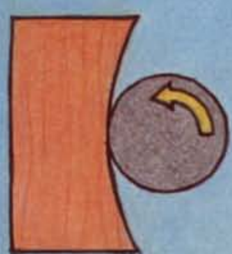
Bill Corneil lives in Thorndale, Ontario. Eight detailed sketches of his shopmade bandsaw are available by sending a self-addressed # 10 envelope and 39¢ in stamps to Corneil Bandsaw, The Taunton Press, Box 355, Newtown, Conn. 06470. Photos by author.

Bandsaw a Crescent Box

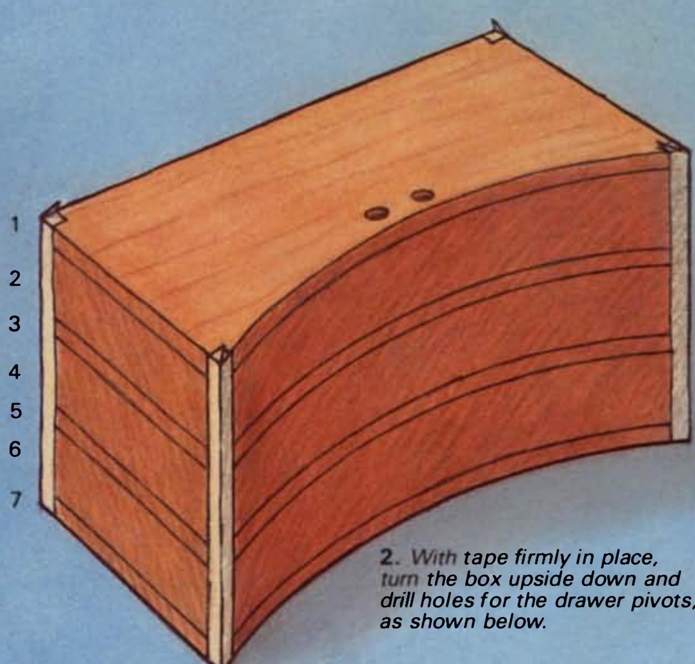
by Po Shun Leong

In *FWW* #63, we described how to bandsaw decorative lidded boxes from a single piece of wood. California furniture designer and boxmaker Po Shun Leong's crescent boxes have no lids, but they do have clever pivoting drawers–a design element he achieves by building up the box from slabs of alternating thicknesses. The drawings on these pages show how his method works.

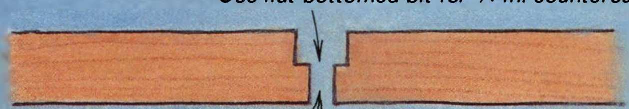


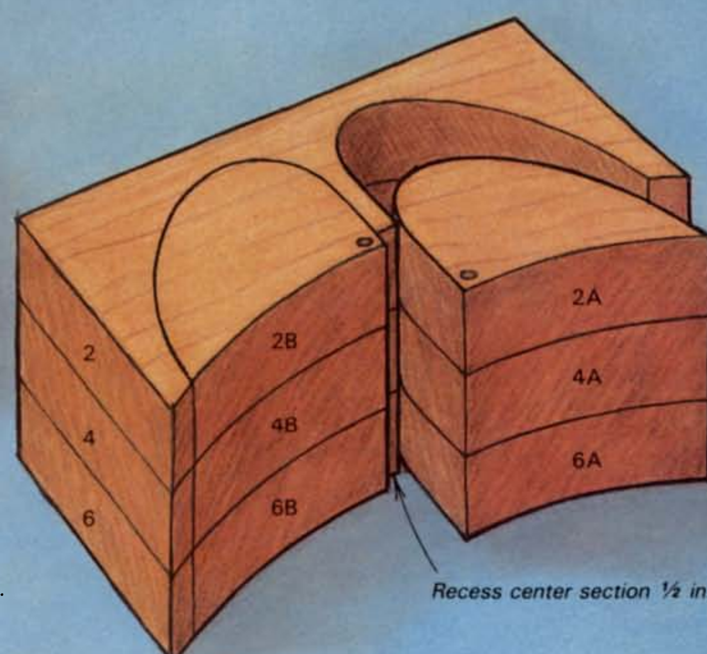


1. *Each box requires three slabs 1¾ in. thick and four at ⅜ in. thickness. After sawing the slabs to size, stack and tape them with masking tape at each corner. Bandsaw the front profile, and sand on a drum sander.*



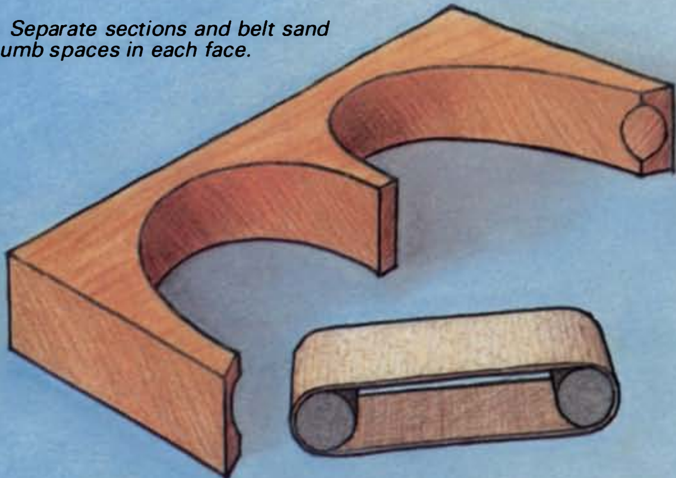
2. *With tape firmly in place, turn the box upside down and drill holes for the drawer pivots, as shown below.*



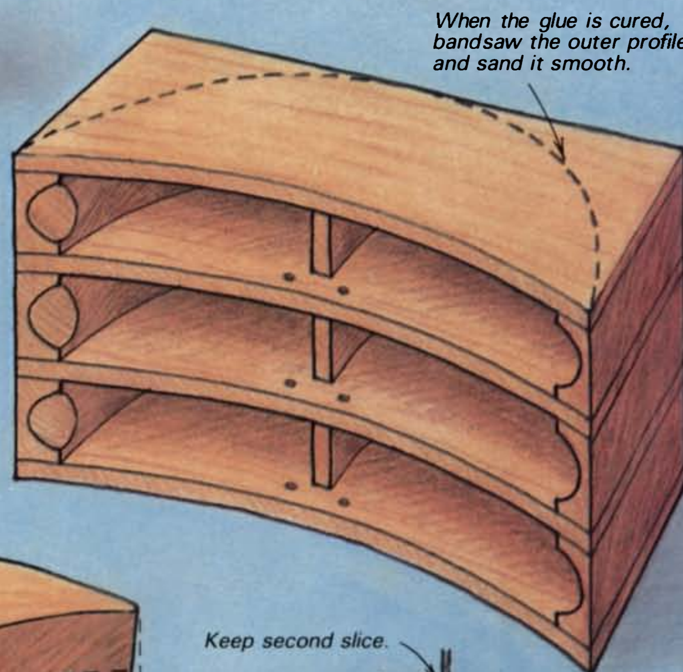


3. *Remove all the ⅜-in. pieces, retape the stack in order, then bandsaw the drawers. Mark drawer numbers.*

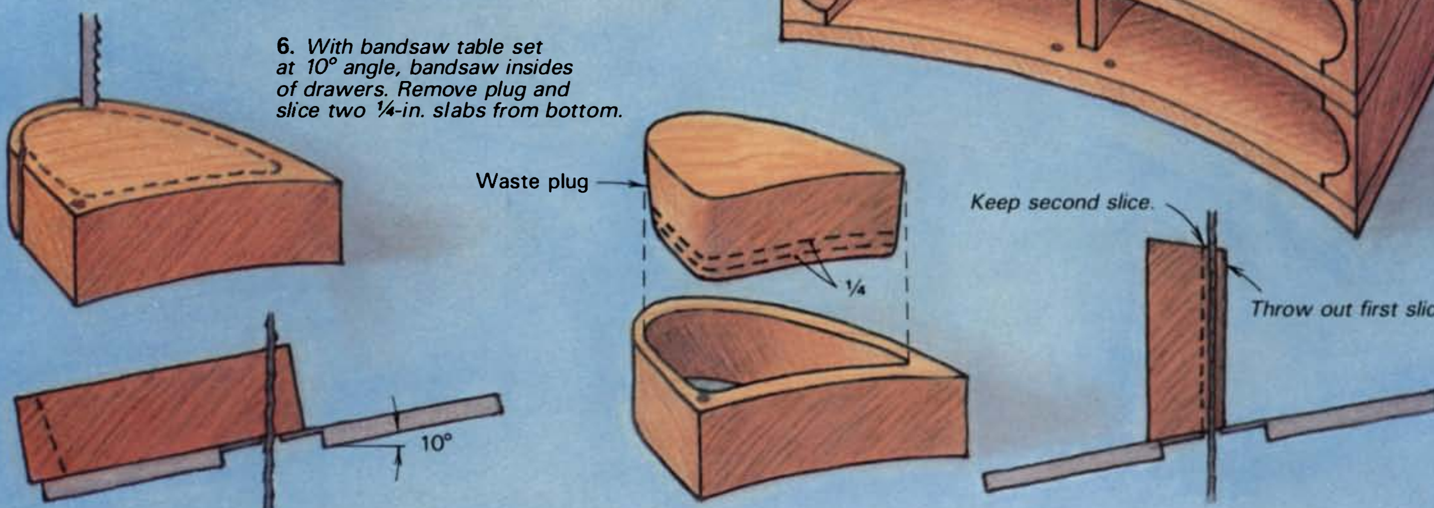
4. *Separate sections and belt sand thumb spaces in each face.*



5. *Glue the sections together in order. Make sure the ⅛-in. holes align exactly.*



6. *With bandsaw table set at 10° angle, bandsaw insides of drawers. Remove plug and slice two ¼-in. slabs from bottom.*



7. *To make drawer bottoms, glue in second slice, clamp outside of drawer with strong elastic band.*

8. *Sand ⅛ in. off of drawer underside so it will fit back into the main body of box.*

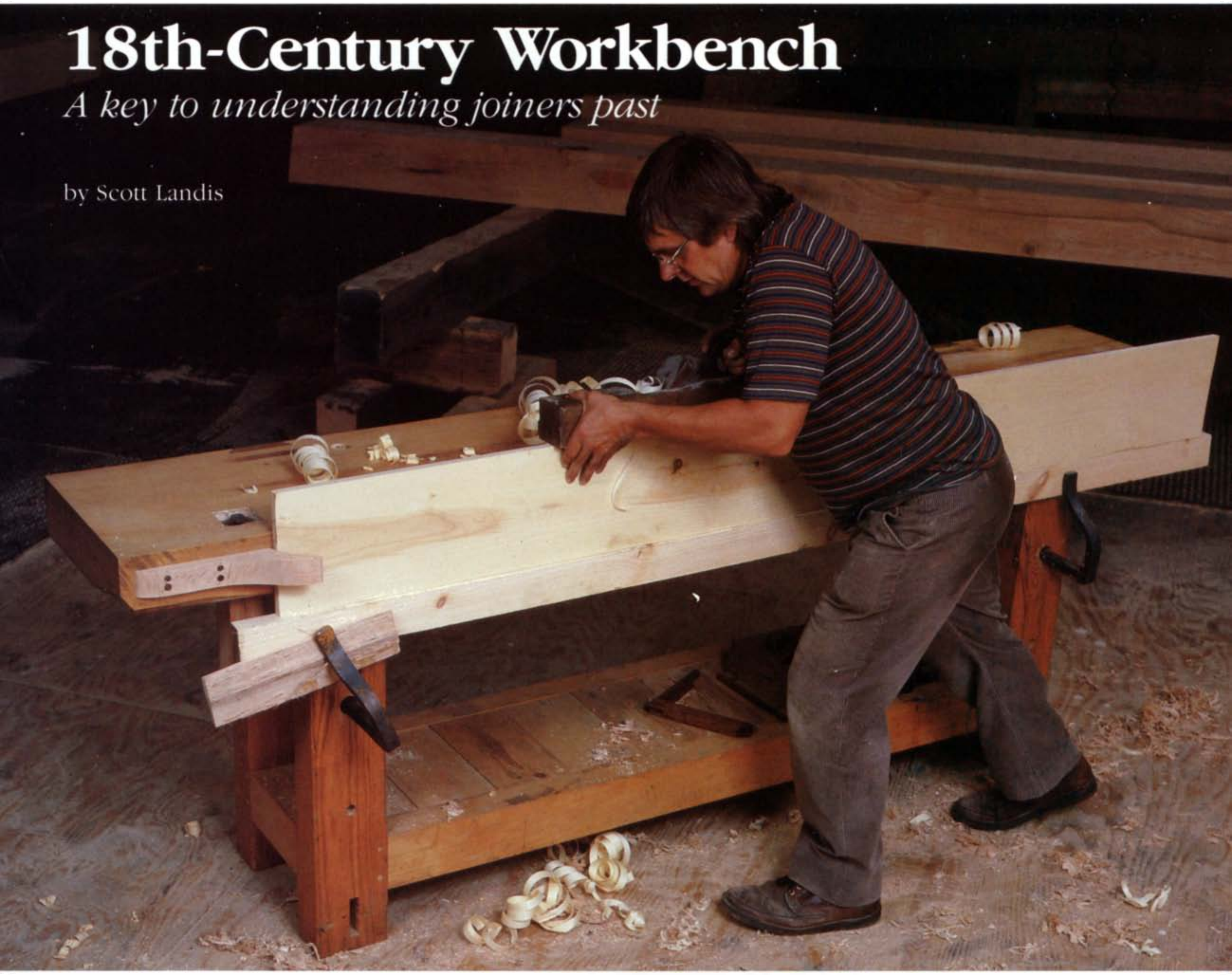
Sand all surfaces of drawers, oil and wax before fitting drawers into body. Line insides with felt.

9. *From underneath, insert ⅛-in.-diameter hardwood dowel. Hold dowel in place by gluing a ¼-in. plug into countersunk hole.*

18th-Century Workbench

A key to understanding joiners past

by Scott Landis



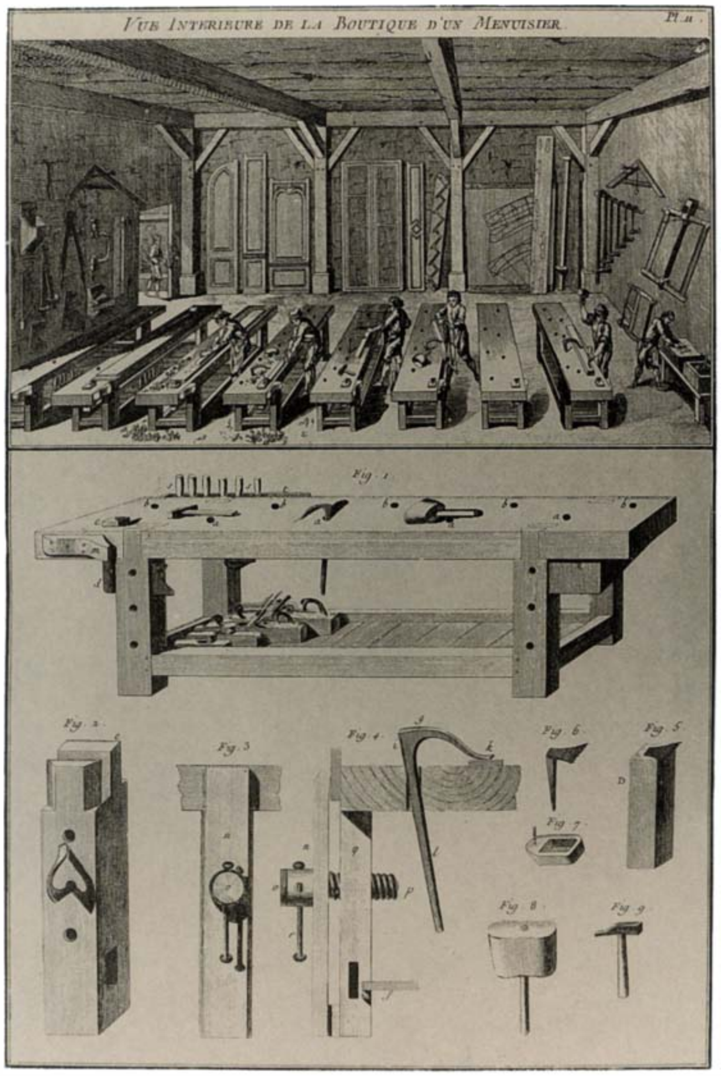
Accustomed as we are to today's benches, with their complex vises and involved construction, it's easy to forget they didn't start out that way. Like the automobile, the modern-day workbench evolved from a much simpler design. Yet unlike many other mechanical objects, one can make a case that much of the bench's evolution since the mid-18th century has been icing on the cake—perhaps even superfluous.

In his classic four-volume treatise on woodworking, *L'Art du Menuisier* (Paris, 1769-1775), joiner/historian Jacques-André Roubo wrote, "The bench is the first and most necessary of the woodworker's tools." The bench Roubo describes is so simple it's tempting to dwell on what it lacks. There's no tail vise, no regimental line of benchdogs marching across the top, no quick-action front vise, no sled-foot trestle base. A massive single-plank top supported by four stout legs, Roubo's bench is equipped only with a large bench stop, a wooden hook screwed to the left front edge of the bench and an optional leg vise.

How, you may wonder, could such a primitive contraption serve for work on the refined furniture of Roubo's day? How would delicate moldings be held or drawers be dovetailed? The answer lies in the division of woodworking trades at the time, as depicted in Roubo's engravings (see facing page). The workers shown are architectural joiners, not furniture- or cabinetmakers. Leaning against the wall of the shop are the fruits of their labor: windows, paneling, stair stringers and the like. These men would have spent their time efficiently performing a few operations. The ability to trap short or irregular bits of wood in a vise, while critical for a cabinetmaker, would have been superfluous for the joiner. In looking at Roubo's bench, it becomes clear that the type of work being done was a major determinant of the bench's design.

Discovering Roubo's workbench was, for me, a rare treat—akin to unearthing in some long-lost voyageur's journal a description of my favorite canoe route. Finding a reproduction of the bench was even better. Its owner and builder, timber-framer and erstwhile medieval scholar, Rob Tarule, enjoys the bench at least as much for what it tells him about the 18th century as for what it enables him to do. Perhaps most of all, Tarule enjoys the bench's simplicity, observing, "That's one of the things I like about it: four legs, four rails, twelve joints. It couldn't be any simpler."

Drawings: Mark Kara



An 18th-century joiners' bench might look underequipped, but it's as capable as modern benches. Tarule removes the leg vise for edge planing, using a long 2x4 to support the board instead. The 2x4 is held in place with iron holdfasts, while the board to be jointed is wedged into the wooden hook. Above, engravings from L'Art du Menuisier ***show how joiners worked and provide a close-up look at the bench, its holding mechanisms and typical joiners' tools.***

The Roubo bench is so simple, in fact, that I couldn't help wondering if Tarule was making a virtue of necessity. After all, the workholding system is the guts of a workbench. Wouldn't woodworkers of the period have been the first to adopt more secure methods of holding the work if any had been available?

In answer, Tarule refers to Roubo's plates—for the type of work shown, vises may not have been as efficient as simple stops and holdfasts. Roubo's holdfasts are one-piece iron bars, hand-forged in the shape of an L. The long leg, or shank, of the L is inserted in a hole bored through the benchtop. The bent corner, or head, is struck with a mallet or hammer, securing the work beneath the pad at the end of the neck. In the process, the shank is wedged firmly across the hole in the bench. The time spent engaging and disengaging the screw of a vise would have slowed down a joiner. One or two blows on the head of a good holdfast, on the other hand, will hold a board securely in almost any position; one quick shot on the side of the shank frees the work just as quickly.

Having decided to build a reproduction of the Roubo bench, Tarule first began searching for a top, described by Roubo as a single plank of hardwood, 5 to 6 in. thick, 20 to 24 in. wide and between 6 and 12 ft. long. "When I copy something," Tarule notes, "I try to copy it as accurately as possible." By the time he was through, however, Tarule had departed from the original Roubo bench several times in building his interpretation.

In the first place, nobody stocks dry wood that large, so Tarule knew he'd have to compromise on the top's dimensions. (Roubo mentions that the benchtop tends to cup until it's fully seasoned, suggesting the use of at least partially green wood.) After almost a year of picking over lumber piles at local Vermont sawmills, Tarule found a mammoth maple plank, which he was able to dress down to almost 5 in. thick, 18 in. wide and 98 in. long.

After handplaning the top flat, Tarule set it aside and turned his attention to other projects. Two years passed, and Tarule took a job as Curator of Mechanick Arts at Plimouth Plantation, a restored 1627 Pilgrim village in Plymouth, Mass. In need of a bench, he decided to resurrect the Roubo project.

With a few minor exceptions, all joinery and surface preparation was done by hand—to leave the appropriate tool marks. Tarule flattened the underside only in the area of the joints. Legs were cut from scraps of 4x6 red-oak floor joist material. Although the top was still relatively green, Tarule reasoned that this would allow the top to shrink and seat itself more tightly around the double tenon at the top of each leg. Roubo doesn't mention glue, so Tarule assumed that none was used. Besides, joints that aren't glued can be disassembled—no small blessing for Tarule, who's had to move his bench several times over the years.

In the same spirit, Tarule decided not to reinforce the double tenons with wedges, as Roubo recommended. He planned to add them later if the legs loosened up, but wanted to be able to remove the legs to transport the bench. In the process, Tarule discovered that, by orienting the heartwood in the top up (as instructed by Roubo), the massive plank seated itself more firmly on the legs as it dried and cupped slightly.

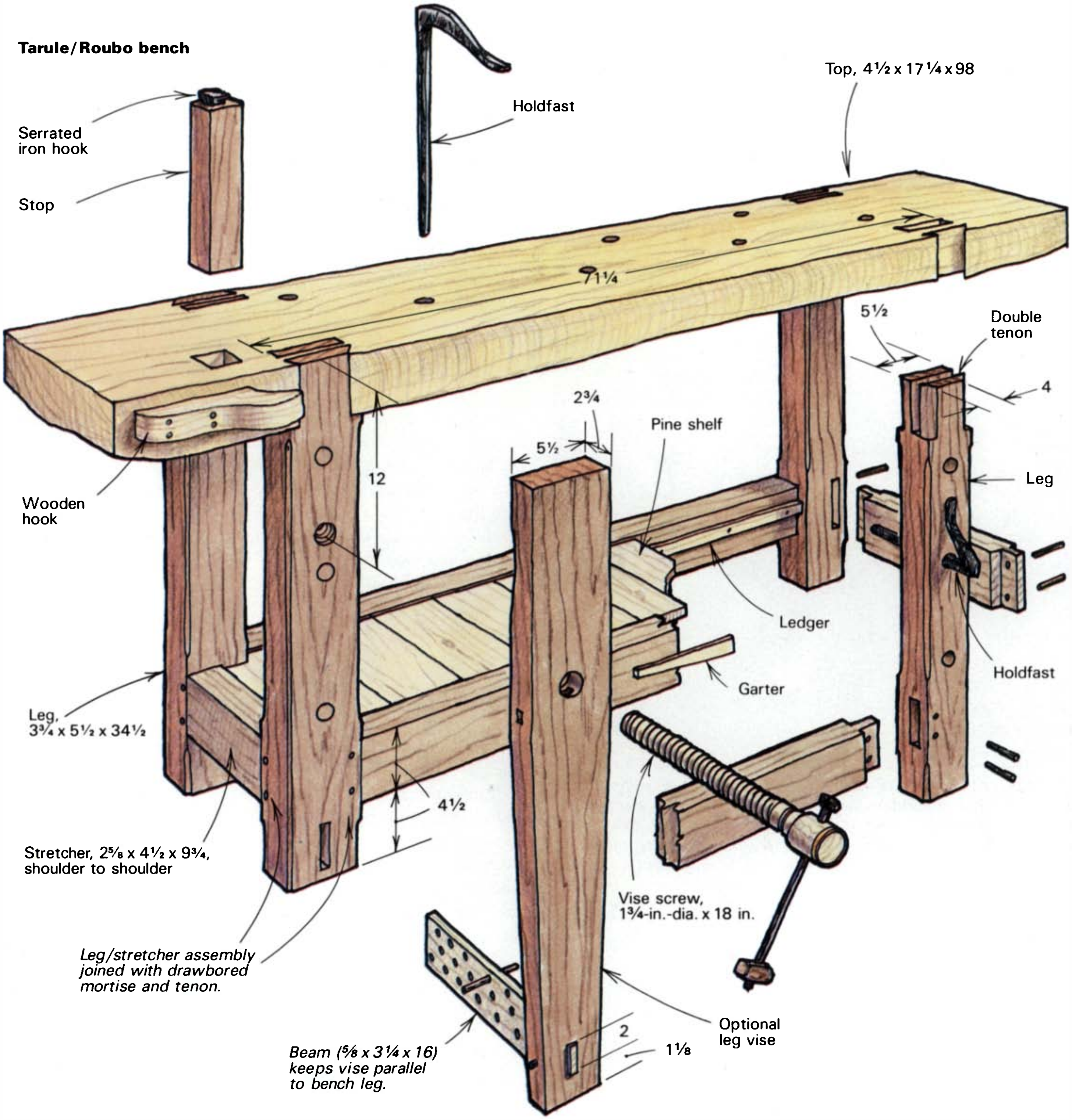
Tarule made stretchers for the bench's base of maple and cut a full-width tenon on each end. The tenon layout was not specified by Roubo, presumably because such construction details were understood by craftsmen of the period. The leg-to-stretcher mortise and tenons are pinned with two dry white-oak pegs driven into the marginally wetter red-oak legs, so the legs shrink tight around the pins as the drier pins expand slightly.

For strength, it was critical that the tenon shoulders fit tight to the mortised leg. Shrinkage across the width of the leg would open a gap at the shoulders, so less wood between pin and shoulder should mean less potential shrinkage and a tighter joint. But if the pin were placed too close to the shoulder, Tarule ran the risk of weakening the mortise. Thus, he placed the pins about 5/8 in. from the edge of the leg (they can be safely placed as close as 1/2 in.). He then strengthened the joint with drawboring—an old technique whereby the corresponding holes in the tenons are offset by about 3/32 in. toward the shoulder. Driving a slightly tapered pin through the holes in the assembled joint pulls the shoulders tight to the leg.

To store tools, Tarule filled the base of the bench with short lengths of 1-in.-thick pine boards, resting on a ledger nailed to the inside of the long stretchers. The boards are positioned to allow the ends of planes to rest on the stretcher while keeping their blades just off the shelf.

Today, Tarule's completed workbench is a testament to strength and simplicity. Because of the top's shrinkage and the stable construction of the base frame, Tarule guessed that gaps would form at the bottoms of the short stretcher tenons where they entered

Tarule/Roubo bench



the legs. Sure enough, they've all opened up a little, giving the bench a slight A-frame-like structure. Tarule speculates that this angularity might contribute to the bench's overall rigidity.

After being resurfaced several times, the top measures 4½ in. thick, 17¼ in. wide and 98 in. long. It's been given a protective coat of all-purpose "miracle finish"—a mixture of turpentine, beeswax and boiled linseed oil used at Plimouth. This homespun recipe calls for about 2-oz. of melted beeswax (roughly an egg-size chunk) cut with a pint of turpentine. The linseed oil is added in equal measure to the combined beeswax and turpentine.

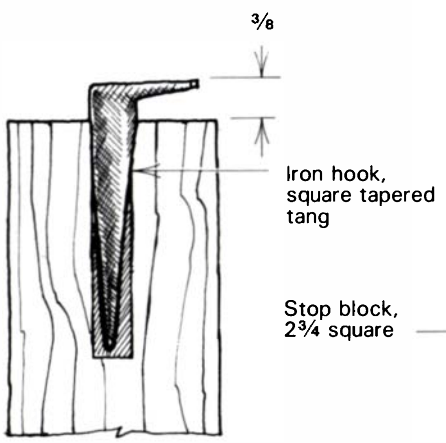
The bench is 34½ in. high, several inches taller than Roubo's specified 31¾ in. Tarule points out that recommended bench heights vary considerably among historians and practitioners. He agrees that a low bench allows for greater pressure in handplaning, but still finds a relatively high bench more comfortable. (Tarule is 5 ft. 8 in. tall, so the benchtop falls a bit below his elbows.)

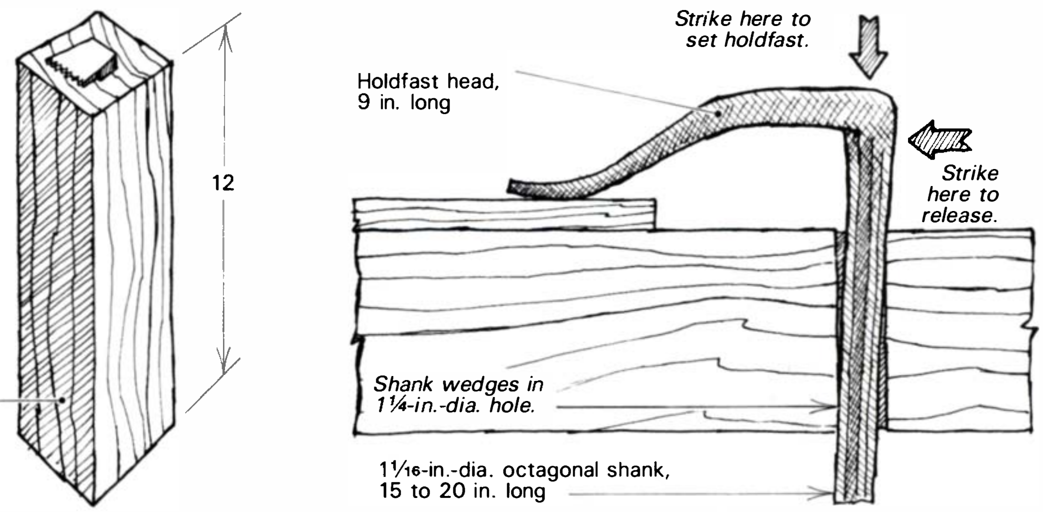
The stop and holdfasts transform this heavy table into a workbench. The 12-in.-long stop is made from a single chunk of white oak. It fits snugly in a square hole in the benchtop, and is adjusted by tapping it with a mallet.

In the block's top, Tarule installed a serrated iron hook (a flea-market find) similar to the one drawn by Roubo. Although Roubo specifies the hook's position in the block (see drawing, p. 67), Tarule has experimented with different placements. If the hook

Drawings: Mark Kara

Stops and holdfasts





protrudes beyond the front edge of the block as described by Roubo, the block cannot be hammered below the benchtop for an unobstructed work surface. And, due to the size of the hook's square tang, it's easy to split out the front of the block if the hook is installed too close to that edge. Tarule's hook head is thicker than the one illustrated by Roubo, so he's found it convenient to install it in the middle of the block, allowing the head to protrude about ⅜ in. above the block. In this position, the iron hook can't be engaged if the top of the stop is extended above the bench. To date, this hasn't presented much of a problem since most work requires only a slight grip of the teeth at the bottom, or can be pushed against the wooden side of the stop.

After struggling unsuccessfully to get small, commercially made holdfasts (⅝-in.-dia. shank, 8 in. long, with a 4-in. reach) to grip, Tarule recently had a pair of hefty iron holdfasts custom-made according to Roubo's description. One is 20 in. long, the other 15 in. long. Both have 1 1/16-in.-dia. octagonal shanks, which hold securely in 1¼-in.-dia. holes bored through the top of the bench and the front legs. The longer holdfast is used in the top, and the shorter one is used in the legs—at 15 in. long, it's short enough not to hit the rear leg of the bench when set. Hand-forged by a local blacksmith, the pair cost Tarule $130.

A wooden hook screwed to the front edge of the benchtop holds the end of boards during edge planing. Shaped out of a piece of white oak, the hook accepts stock up to 2 in. thick.

Tarule also built a modified version of Roubo's optional leg vise. Where Roubo's vise had no garter, Tarule added one. A slim, tapered oak wedge, the garter fits in a mortise in the side of the vise and engages a groove turned just below the screw's head. It allows the jaw to retract as the screw is withdrawn. In hindsight, Tarule concedes a simpler solution would have been to bore a round hole in the side of the vise, then tap a dowel into the groove.

To keep the vise jaw parallel to the leg of the bench, Tarule installed a horizontal beam near the bottom of the vise. To stop the bottom of the leg from moving as the vise is closed, a peg is placed in front of the leg in one of a series of holes bored through the beam. To determine hole placement, Tarule laid out a grid of three parallel lines along the length of the beam, then drilled ½-in.-dia. holes at 1½-in. intervals along each line. The holes are staggered by ½ in. on each line to provide maximum flexibility of adjustment. For the screw, Tarule turned a hard-maple cylinder on the lathe and borrowed a friend's screwbox to cut the 1¾-in.-dia. threads.

Battens—thin scraps of wood used in a wedging action with holdfasts and stops to provide additional grip—play a major role in Tarule's workholding system. To gain flexibility, or to plane diagonally across a board, Tarule fastens a batten to the bench with a holdfast. The end of the batten pushes against an edge of the board, which is wedged between it and the stop. This process secures the work and enables Tarule to plane the entire board from one position. For quicker setups, the holdfast can also ride loosely in a hole, just touching one edge of the stock for slight lateral support.

Most modern workbenches have two main operational areas—the tail vise and the front vise. On Tarule's bench, the focal point is where the stop, hook and holdfasts convene. To plane the edge of a board, one end is jammed in the wooden hook on the bench's front edge. Short boards are clamped to the left leg with a holdfast.

To support a board that's too long to be supported by one holdfast, but too short to span both legs, Tarule attaches a 2x4 to both legs (see photo, p. 66), using holdfasts. The 2x4 serves as a platform for a board of almost any length. Stock can be jammed in the hook, flipped end-for-end quickly as it's worked and replaced with another piece of stock—all without adjusting the support platform.

The ease and speed provided by Tarule's workbench is a convincing argument on behalf of the simple bench. But is it really appropriate for the modern woodworker, who works with a variety of materials and tools? I know of only a few woodworkers who reject the tail vise and prefer to work on a bench as simple as Roubo's. "I've done a lot of work on the bench," Tarule says. "For my purposes, it needs to be adaptable to a variety of methods."

Before adding the workholding devices to the Roubo bench, Tarule kept a Record vise mounted on one end—to handle the miscellaneous small holding tasks of a modern workshop. After unbolting it in honor of my research, he discovered that he missed it on several occasions.

Clearly, the insights Tarule has gained into 18th-century woodworking won't be his last. "I see myself quite seriously tinkering on this kind of stuff—spending the next ten years figuring out how Roubo used the bench." Tapping the benchtop, he adds: "If I didn't have to make money, I'd do it all the time." □

Scott Landis is an associate book editor at The Taunton Press. This article is adapted from his forthcoming book, The Workbench Book, *available from The Taunton Press this fall ($24.95, hardcover).* L'Art du Menuisier en Meubles *(1982) was published by Leonce Laget, Paris, France. A facsimile edition of Roubo's original treatise, the book is now out of print.*

Decorative Folk Turning

Ancient techniques survive in East Germany

by R. Steinert and J. Volmer

Over time, isolated peoples develop strong traditions, passed on from one generation to the next. Such has been the case in the Erzgebirge—the "ore mountains"—which form a natural boundary between the Saxony region of the German Democratic Republic and Bohemia, part of Czechoslovakia. Some of the traditional woodturning techniques found in this area are scarcely known elsewhere in the world.

The woodturning tradition flourished in Erzgebirge for several reasons. First, the region was developed for its timber in the middle of the 12th century. Shortly thereafter, mining became an important industry when silver ore was discovered. By the middle of the 14th century, tin was also being mined, and Cistercian monks from Bohemia had opened thriving glass factories, heating the furnaces with spruce from the surrounding forests.

Both the mines and the glassworks demanded a knowledge of woodworking. Miners used wood for tunnel timbering, furniture and housing, as well as for kitchen utensils, vessels and children's toys. In the glassworks, skilled turners provided a variety of wooden molds into which the molten glass was blown.

All things, of course, evolve. As the Erzgebirge mines gave out, the inhabitants found the land too poor and the growing season too short to subsist by agriculture alone. By the 18th century, a few craftsmen were making their living from turning, but it was far more typical for miners and farmers to continue the craft tradition as a hobby that helped supplement the family income, using low-cost materials and equipment. Some lathes were pedal-operated. More often, several woodturners shared a common water-power system, typically one that was left over from the mining days.

Although most of the techniques illustrated on these pages were perfected more than a century ago, the Erzgebirge crafts industry continues to be popular and profitable today. It will be interesting to see how turners in other parts of the world put the techniques shown here to work.

Rolf Steinert is a master turner in Olbernhau, Erzgebirge. He is the author of a textbook for turners and a recently completed encyclopedia, Turning Wood. *Johannes Volmer deals with ancient lathes and tools; he is active in oval turning.*

Hoop turning

The mold turners in the ancient glassworks were expected to produce extremely precise molds with glass-smooth surfaces—anything less would have marred the surface of the glass. Gradually, they developed a series of special slicing tools for their work—tools that, with a little modification, allowed them to devise the unique craft of hoop turning, as shown in the drawings and photos on the facing page.

In this process, the turner creates a ring that has the continuous profile of an object within it. When the ring is split into radial pieces, the hidden shape is revealed. With a little carving and some paint, you have a number of horses, cows, dogs or other farmyard animals. The technique began in simple form, as a means of producing small blocks that could be made into buildings, such as a steepled church. But by the early 19th century, intricate animal shapes had evolved. Today, hoop turning can be used to make a variety of distinctive profiles, including elephants, giraffes and birds.

A hoop turning begins with a length of freshly cut spruce log. If the wood must be stored for some time, the turner usually keeps it underwater; tearout is inevitable with wood that's been allowed to dry. Turners choose trees that have grown in the middle of forests in valleys, so that the growth is regular and the pith is on-center. Areas with knots are discarded, and the rest of the log is sawn into rounds of sufficient size for the shape to be turned.

The lathe itself resembles a bowl-turners' lathe, with heavy bearings to resist vibration, and sturdy bracing to the ceiling and floor. There is no tailstock.

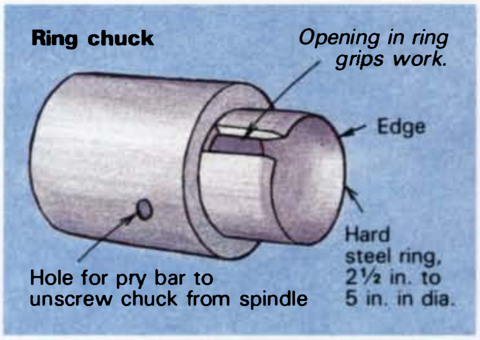
The wood is mounted on a ring chuck, also called a Heureka chuck. As shown in the drawing, above right, it's a ring of sharpened steel with an opening down one side, mounted in a cylinder that screws to the spindle. The hoop turner centers the work over the ring and drives it on with a heavy hammer. Roughing out is done in the usual manner—with a gouge—and the work is faced off square with a chisel.

The specific tools used to turn a ring might vary somewhat from one turner to another. Typically, each turner has between 25 and 30 different tools, but no hoop turner would want to be limited to this number—it's essential to have spare sharpened tools at hand. The full number of tools in the kit is closer to 80, allowing the turner to produce a wide variety of profiles and sizes.

There are two tool rests used on a hoop-turners' lathe. One—a conventional sort, such as those found on spindle lathes—is used to shape profiles on the perimeter of the work. The other, shown in the top left photo on the facing page, is an angled wooden rest across the face of the work. Since much of the cutting is done directly into endgrain, tool handles tend to be

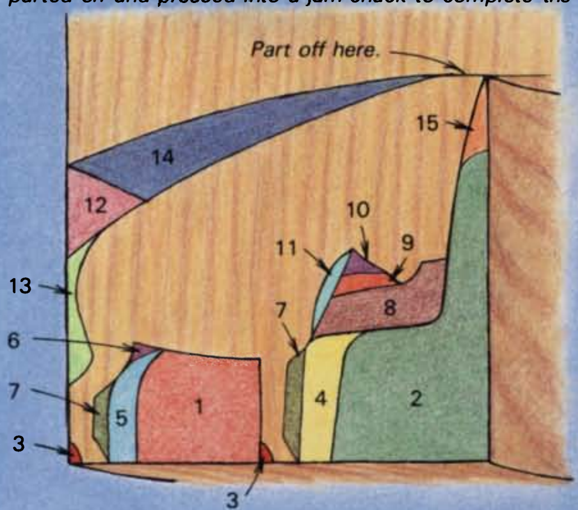
Hoop turning yields a ring of wood with the profile of an animal inside (right). Split-off segments are then carved and painted. Working at a sturdy lathe (above), the hoop turner cuts with a series of special tools, shown below.

Ring chuck



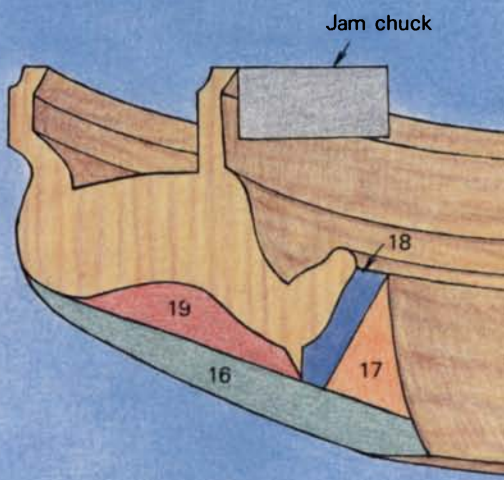
Hoop-turning sequence and tools

The numbers below indicate the order of cuts made by a hoop turner in the Erzgebirge. The underside of the animal is shaped first, as shown in the photos above. Then, the ring is parted off and pressed into a jam chuck to complete the figure.



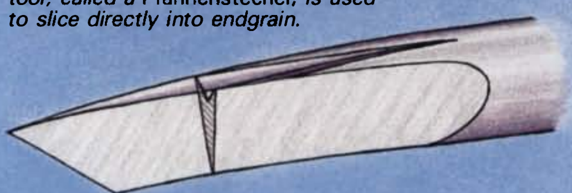
Size gauge

Stick with three notches is held against work as turning proceeds to gauge major dimensions.



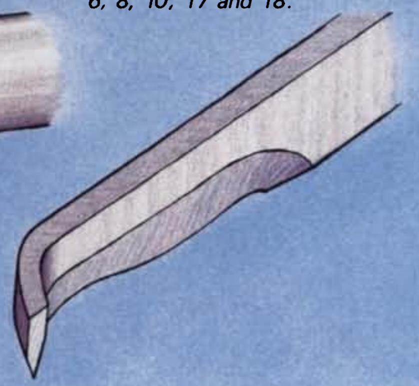
Pfannenstecher

In cuts 1, 2 and 9, an unusual piercing tool, called a Pfannenstecher, *is used to slice directly into endgrain.*



Hook tool

Various hooks (see FWW *#40) leave clean surfaces at cuts 4, 5, 6, 8, 10, 17 and 18.*

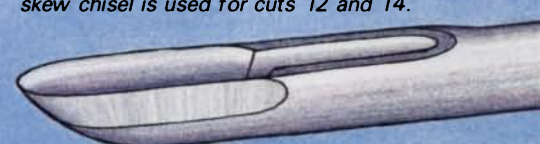


Spear-point gouge

The turner uses a conventional gouge for roughing out, but the gouges used in shaping the ring have spear points. They are used in cuts 3, 7, 13 and 19.

Spoon bit

A spoon bit makes cut 11; an ordinary skew chisel is used for cuts 12 and 14.



Drawings: Lee Hov. Photos courtesy of the Erzgebirge Toy Museum in Seiffen. Drawings derived from "Das Reifendreherhandwerk im Spielwarengebiet Seiffen" by Hellmut Bilz, Seiffen, 1976.

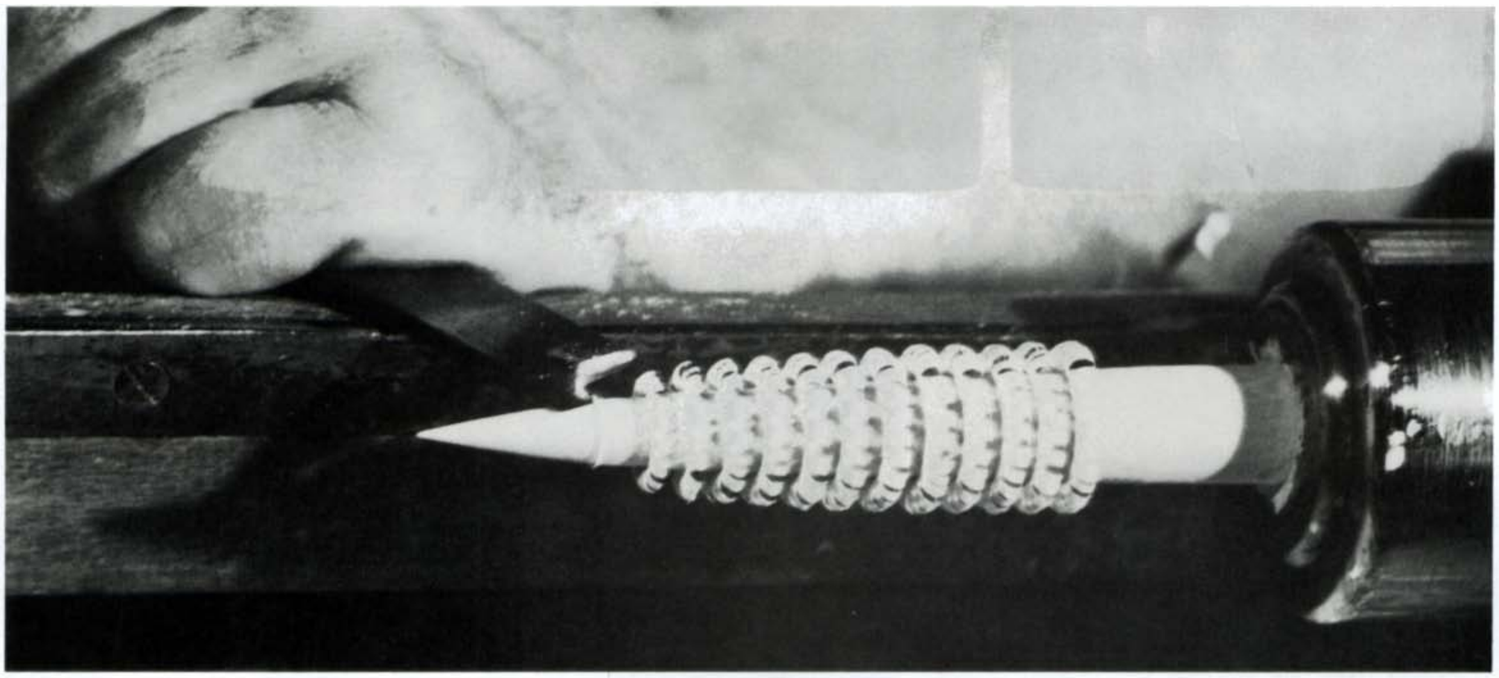
long—up to 30 in.—allowing extra leverage for control.

The first cuts are made to shape the underside of the animal. When this is done, the work is parted off and fit into a friction chuck, also known as a jam chuck, so the top of the animal form can be turned. Once finished, the ring is pried from the chuck and split with a knife and hammer. The ends are then spread apart to reveal the success of the job.

The uninitiated eye can scarcely discern the shape hidden in a ring. Although the turner has a simple gauge to help control a few major dimensions (see detail, p. 71), the success of the work depends on skill and experience. If an incorrect cut is discovered when the ring is split, the entire job must be scrapped: the ring can't be returned to the lathe for correction.

The individual shapes are cut off from the hoop, their sharp corners are beveled with a carving knife and additional parts such as horns and tails are glued on. In some cases, these parts are hoop-turned as well, as are many other decorative elements in the traditional Erzgebirge crafts. Spruce is too coarse for the most delicate of these details, so the turners most often make them from native woods such as basswood, alder and birch. The best animals are carefully painted by hand, but many others are simply dipped in paint, using a seive.

EDITOR'S NOTE: In addition to regular articles on the more usual turning tools, such as gouges and skews, we've covered turning hooks (*FWW* #40) and spoon bits as used in chairmaking (*FWW* #43). The hoop turner also employs various piercing tools, called *Pfannenstecher,* as well as some spear-point gouges. The authors are continuing their research, and we plan a future article on these unusual tools. In the meantime, are there any readers who have similar tools in their kits already? If so, we'd like to hear from you.

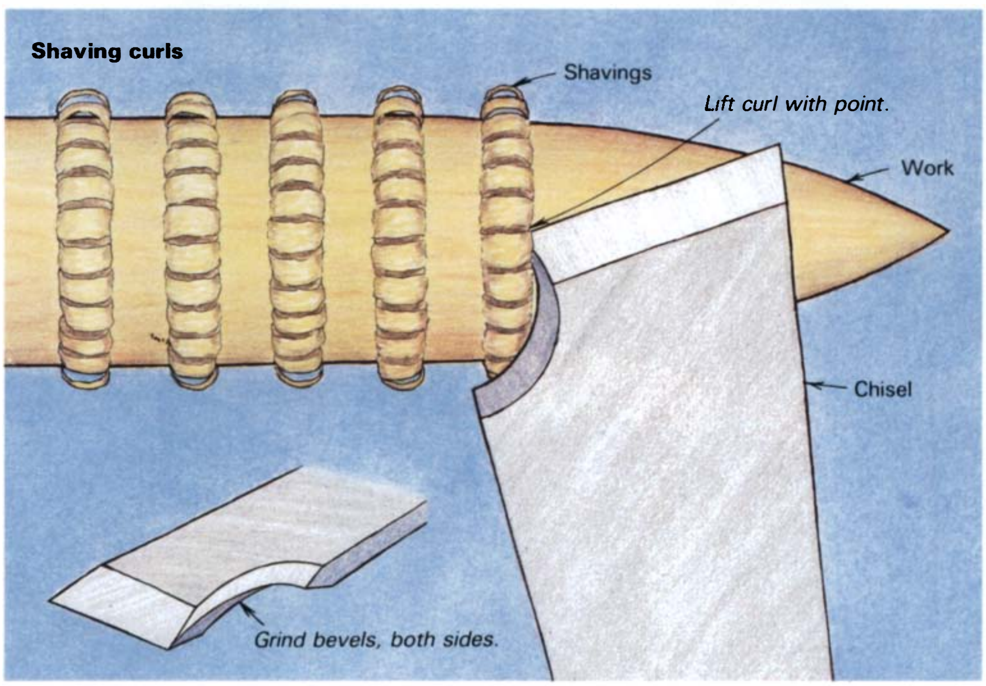


To turn a tree, curls of shavings are raised from the tapered cylinder with a reground skew chisel, as shown in the drawing below.

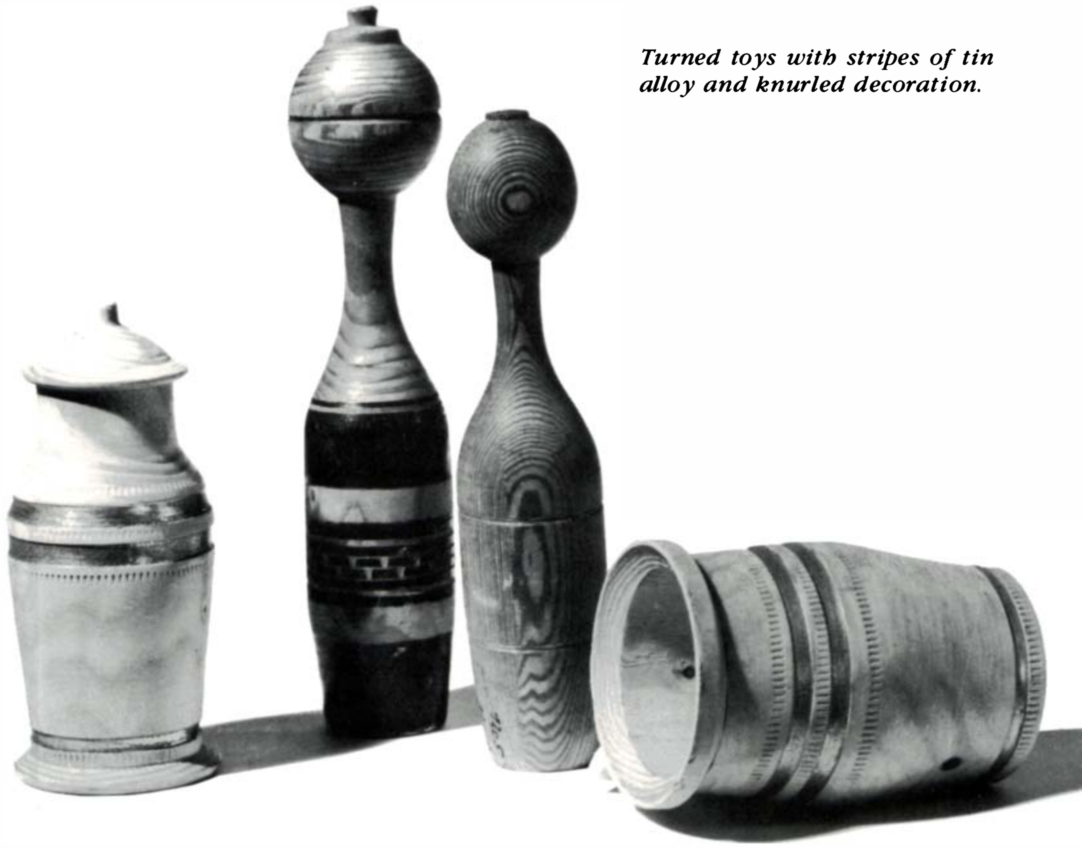
Shaving curls

This process produces little trees and flowers. It requires basswood that has been split, not sawn, so that the grain is continuous through the workpiece. The other necessity is a reground skew chisel that lifts and curls shavings from the surface of the workpiece without severing them completely.

As shown in the photo above, work begins at the base of the tree and proceeds in bands toward the tip, producing a tapered, conifer-like tree. If spruce is used instead of basswood, the shavings form a more irregular growth, somewhat like an oak tree. As you might imagine, learning this technique requires a lot of practice. But it's not too wasteful—if your first attempt at a tree fails, you can turn it down to a smaller taper and try again.



Striping and knurling



Turned toys with stripes of tin alloy and knurled decoration.

Most turners are familiar with one type of stripe burning, in which a length of taut wire is held against the turning work to form narrow, decorative rings of burnt wood. Friction is used in two other ways in Erzgebirge turning.

Burnt rings of various shades and widths can be made by pressing one wood—beech or oak, for example—against a softer wood turning in the lathe. If a sharply defined area is desired, the area to be burnt should be marked off by two grooves formed with the heel of a skew (see drawing, below left). The wood used for burning is usually shaped something like a straight chisel, about 1 in. wide and ⅛ in. thick. It is placed edge-down on the tool rest so that its endgrain can be pressed against the work.

Such ornamentation is fast and costs practically nothing. One popular use for it this century has been to mark skittles pins.

Another friction-based banding technique is called tin striping (see photo, right). Instead of endgrain wood, a special tin alloy is pressed against the work. Done just right, the metal leaves a thin, gleaming residue on the turning. The alloy used is 63% tin and 37% lead, although variations of a few percentage points aren't critical.

Best results are obtained on woods without large pores. Red beech and spruce are favorites in the Erzgebirge; maple also accepts metal well. Again, score grooves at the boundaries of the ring to get the best definition. The area to which the metal will adhere should be left slightly rough.

Tin striping requires much practice. With insufficient pressure, the alloy will not melt; too much pressure, and the metal will form lumps and scales. The technique is best learned by experimenting—by making rings of one width on a uniform cylinder, you will find the correct pressure and lathe speed for the work at hand. Changes in the diameter of the workpiece or in the wood used will require adjustments that can be mastered as your feel for the work improves.

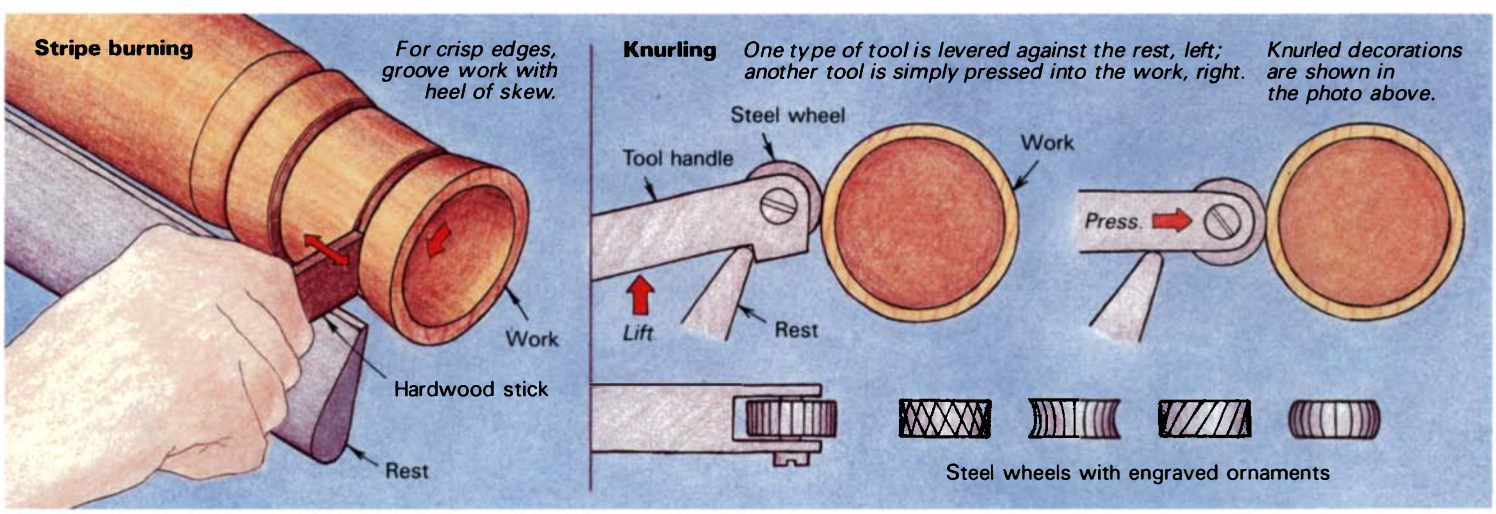
The stripe should be varnished or lacquered to prevent oxidation. It can also be painted, engraved or knurled.

Knurling originated in metal turning. The process embosses a repeating design into the wood by means of a rotating wheel with a pattern on its surface.

Typical wheel sizes range between ⅜ in. and ¾ in., with patterns of notches, fillets, hemispheres and other simple shapes ground into the circumference. The wheel is held in a metal fork with a handle, as shown in the drawing, below right. One type is hooked over the tool rest, then levered hard against the turning work.

For best results, the pattern should repeat over itself with each revolution of the lathe. This requires that the circumference of the object being knurled be some multiple of the circumference of the wheel. A little experimentation will quickly show which workpiece diameters are suitable—if the diameter is wrong, the pattern will quickly chew itself to pieces.

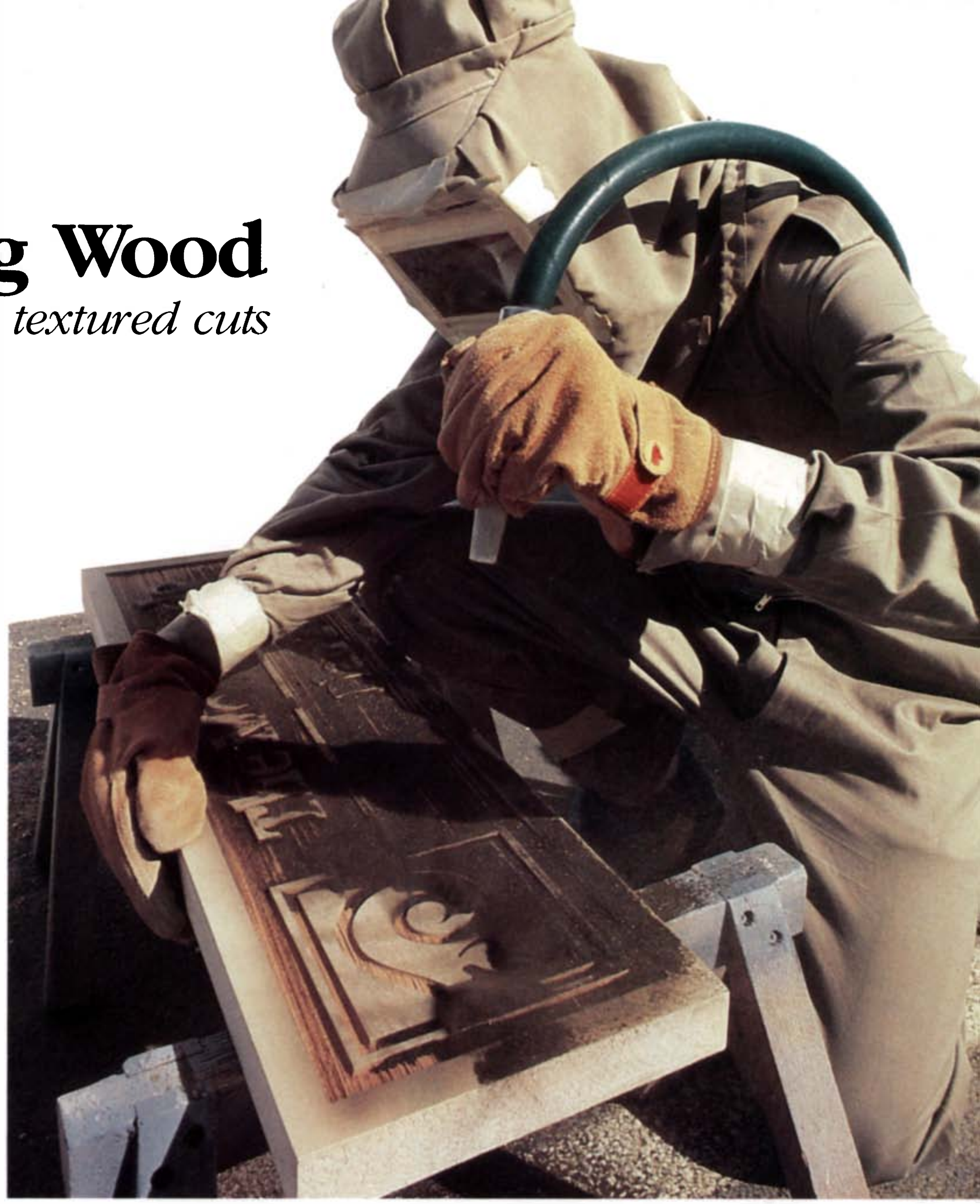
Knurled designs can be used to good effect on box edges, bowls, candlesticks and the like, and also on the bottoms of plates and other facework. The most suitable woods are fine-pored and dense. □



Sandblasting Wood

A quick way to clean, textured cuts

by Lorin Labardee



With the foreground protected by a stencil, the details of a sign are carved out quickly with sandblasting. Note the operator's heavy protective gloves and clothing.

Economics often require that we find production techniques for reproducing hand-tool methods when a particular "look" is in style. If you want a new way to relief-carve signs, carve decorative reliefs on cabinetry or even etch glass, find and study a piece of driftwood. Nature has been carving this way for millions of years. By introducing a few controls, man has learned to use a similar process—sandblasting—to create the look of handcarving.

If the process sounds a little cold and mechanical compared to the traditional mallet-and-chisel technique, don't be dismayed. Some signmakers say that sandblasting takes as much skill as putting mallet to chisel, and it's a lot less expensive than many forms of handcarving. Purists might be relieved to know that sandblasting is also quite compatible with traditional carving. For instance, a sandblasted sign may use a cleanly carved border to contrast the rough texture of a blasted background.

It's good to know you can break into sandblasting without breaking the bank. The equipment you need should be available from a local equipment rental store. Although costs vary by location, you can expect to pay in the $110 to $125 range to rent a compressor, nozzle, sandpot, protective hood and hose for one day. If you already own a compressor, you may be able to rent the sandpot and nozzle for about $50 a day. Other expenses—including blasting grit and stencil materials—should cost in the $75 to $90 range. If you opt to buy the gear, a national source for sandblasting equipment is Northern Hydraulics (Box 1219, Burnsville, Minn. 55337). Check industrial supply houses in your area, too.

Generally speaking, the stencil is what determines which areas will become foreground and which will become background. The stencil completely covers the wood; the areas that are to be blasted are exposed by cutting away stencil material with a razor knife. When sandblasting begins, these exposed areas are carved away by the cutting action of the sand and become background. The areas protected by the stencil are left in relief and serve as the foreground. More about this later.

When I worked at Tucson-based Bear Enterprises Inc., we often sandblasted signs to achieve an appealing, textured surface. Our most common material was 2x12 redwood, finish-planed to 1½ in. thick, but there's no reason other materials can't be used. Regardless, the sign blank should be glued up with exterior-grade glue.

Grain type and how the boards are sawn have a major impact on the appearance of the sign in its final state. Selecting boards with very pronounced or figured face grain, for example, will result in a sign with a wavy, undulating background. Similarly, boards with quartersawn or "vertical" grain will yield a smooth, linear background appearance. The reason for these differences lies in the wood itself—it's composed of alternating rings of earlywood and latewood. Under the cutting action of the sand, the softer earlywood is quickly eaten away, leaving a line of harder latewood exposed and pronounced.

Knowing this, the signmaker can manipulate the material to produce various effects. To attain the effect of a landscape with high mountains towering over a broad, flat plain, for instance, you can use two quartersawn pieces of redwood for the lower portion of the sign, and a single piece of face grain for the upper third.

Once the lumber is chosen, it's cut to length and jointed to provide a good glue joint. To ensure the boards will be glued up in the correct order, they're laid out on the floor and indexed with a triangle mark on their faces. Proper alignment during glue-up is accomplished with a 1-in.-wide spline cut from ⅛-in.-thick plywood (Masonite will do). I cut the spline grooves with a three-wing, ⅛-in.-wide cutter in a router, stopping the groove about 2 in. from the edge of the board so the spline won't be exposed at the ends.

As with any laminated piece, how you orient the boards relative to the growth rings affects the degree to which the finished sign may cup. This is a matter of some debate among woodworkers. Flatsawn stock has a tendency to cup opposite to the direction of the growth rings as it dries; I've heard it said that the growth rings try to straighten out. This means that if you glue the boards with the growth rings all facing in one direction, then the panel will cup as if it were a single, wide board. If you alternate the growth rings, then each board in the panel will cup in its own direction, producing a rippled panel. With sandblasted wood signs, it's best to alternate the growth rings in the boards since removing wood from just one face of the laminated piece will create a tension on the sign, causing it to cup.

Once the glue has dried, you'll need to scrape off any excess not removed during glue-up, then smooth the panel's surface. I accomplish this task quickly with an abrasive planer. It's not necessary to get the sign down to its final smoothness—just flat and true. Without an abrasive planer, final flattening can be done with a 100-grit belt in a hand-held belt sander.

The next step is to brush a coat of sandblast filler on the face of the sign blank. Once dry, this coating provides a semi-tack surface to help bond the stencil to the wood, and allows the stencil to be removed without lifting splinters. The filler is removed after blasting with a light sanding.

Now, the stencil is draped onto the sign; one hand supports the stencil while the other rolls out bubbles. Where more than one piece of stencil is needed, use about a 2-in. overlap.

The stencil material I prefer is a rubber-like, adhesive-backed sheet (Continental Stencil #111, Smith and Nephew Anchor Inc., 2000 S. Beltline Blvd., Columbia, S.C. 29250), available in a variety of sizes. I prefer rolls 25-in. wide by 10-yd. long. The rolls cost about $63 each. Another option is 3M's Buttercut Sandblast Stencil, which comes in rolls 12¼-, 18½-, 24½- and 30-in. wide by 10-yd. long; a 24½-in. roll runs about $64. (Buttercut is also available in the 510 series for blasting glass and wood; a similarly sized roll costs about $65.) While the stencil itself can't be reused, you can distribute the cost of the stenciling material over several projects—providing, of course, you don't use up the entire roll on one job.

The advantage of rubberized sandblast stencil material is that it's heavy enough to resist the sand, yet soft enough to yield easily under an X-Acto knife as the design is cut out. (By the way, don't use Con-Tact paper as a stencil; it simply won't withstand the long blasting periods necessary to cut wood.)

In the same way a graphic designer eliminates gray tones in a photograph by making a line shot that reduces all elements of the image to either black or white, so must the signmaker separate the design into blasted and unblasted areas. The design can be drawn directly on the stencil or transferred to it with carbon paper. Alternately, the paper original can be spray-adhered right on the stencil. Often, the original design is enlarged with an opaque projector onto a sheet of butcher paper and drawn in at finished dimensions using a straightedge and triangle. This full-sized original is used as the pattern, or is copied on a blueprint machine. The blueprint is then glued to the stencil with spray adhesive.

Cutting out the stencil is easy, but don't let the pleasurable lack of resistance catch you off guard. The critical part of cutting the stencil is not so much getting through to the wood as it is holding the knife—preferably an X-Acto knife with a #11 blade—correctly. The key is to hold the knife perpendicular to the wood so the cut edge of the stencil meets the wood at 90°. The reason becomes apparent when you blast against the stencil. If the edge of the stencil is beveled instead of square, there's less stencil material at the edge. So, instead of cutting a fine, clean line along this beveled edge, the sand will pepper and feather the edge with a ragged cut.

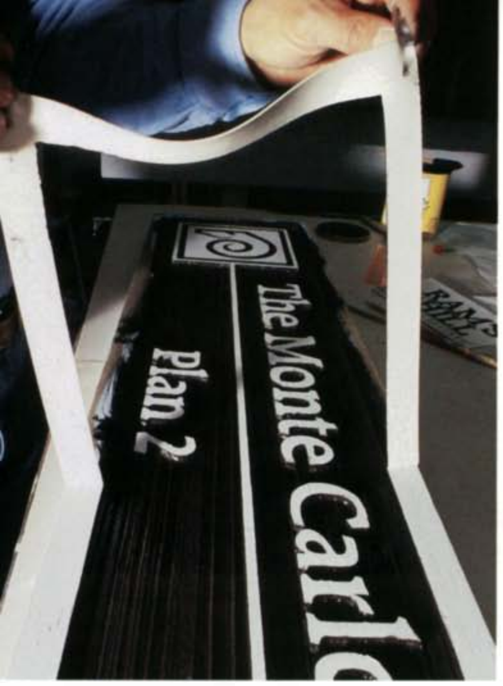
While Mother Nature does a nice job blasting driftwood with wind or water, the signmaker needs an air compressor. You can rent the same type of electric compressor that powers nailguns and paint sprayers for sandblasting. The volume of work in a production shop demands a heavy-duty compressor of the type used on construction sites; I use a gas-powered compressor that delivers 125 cubic feet per minute (cfm) at 100 psi.

Obviously, you won't require equipment that large. A compressor capable of producing at least 7 cfm at 80 to 90 psi should be sufficient. Most 2- to 5-HP shop compressors are capable of producing that volume at that pressure. Sears sells a sandblaster that runs off an electric compressor capable of producing 40 to 120 psi. The blaster costs about $95, without a compressor.

From the compressor, a long hose snakes across the work yard behind the shop. Since dust control is a problem, most of the carving takes place outside. At the opposite end of the hose is a sandpot—really a mixing cylinder on wheels—with a valve for incoming air, a valve for air/sand mixture, a bypass valve around the mixing chamber and a funnel on top for filling the pot with sand. My sandpot has an 80-lb. capacity—enough for about 25

After cutting is completed, background areas of the stencil are stripped from the sign blank, leaving the stencil on the letters.

Photos John Charley



After the sign is blasted and the background is painted, the remaining stencil is stripped from the foreground, as shown at left. Quartersawn stock gives the background a linear appearance. Above, a close-up of the sign after installation. Painted with earth tones, it's noticeable but also blends well with its location.

minutes of continuous carving at 100 cfm. The nozzle that you'll spray the sand with looks like a garden hose nozzle, but it's made out of ceramic and has a ⅛-in.-dia. hole in its tip. It's attached to the sandpot by a 6-ft.-long piece of hose.

Choosing the right type and coarseness of carving "sand" rests on the same variables you use in selecting sandpaper. Coarser grits cut faster and leave a coarser finish. Most types of sand are available in 16 to 60 grit, but the larger grits (smaller numerically) have a tendency to lodge in the wood. A good choice is Black Beauty (Reed Minerals Division, Heckett-Harsco Corp., 8149 Kennedy Ave., Highland, Ind. 46322). Black Beauty is a dark brown or black by-product of sharp-fracture coal. Available in a range of grits, the 20-to-40 size is about right for sign work. It costs about $5.50 for a 100-lb. bag.

You'll need other blasting supplies: a sturdy easel to prop the sign up on; protective clothing (preferably coveralls); welder-style leather gloves; a good respirator; and earplugs—especially if you're using a gas-powered compressor. Despite your best efforts, count on having sand get past your protective clothing. If you take precautions now, a shower should put you right afterward. A shift in the wind can carry sand rebounding off the redwood with force strong enough to abrade skin and frost eyeglasses, so don't settle for half measures in protecting yourself.

Try to set up against a wall or facing into a corner. This way, most of the sand will be trapped and fall to the ground, making for easier cleanup. Although it's possible to recycle sand after blasting, you'll probably find it's not worth the trouble gathering it up and sifting it back into the pot through a screen. Keep a can of spray adhesive on hand to re-stick the stencil should a small flap lift up.

As with spray painting, it's difficult—if not impossible—to sandblast if the humidity level is high. High humidity causes the sand to clot and spray unevenly. But if the weather is reasonably cooperative otherwise, you're set to go.

Sandblast carving isn't much different from spraying a finish on a cabinet. Keep the nozzle perpendicular to the surface at all times, moving it in a smooth, flowing, back-and-forth motion about 12 to 14 inches from the sign's face. If the nozzle isn't kept perpendicular to the material, you'll get either an undercut relief or long sloping sides on the lettering. The inspiration of sandblasted signage is handcarving, so strive for tight, sharp work. The background should meet the foreground at a 90° juncture.

Most sandblasted signs are single-faced. The desired depth of cut for these is about ⅜ of an inch on a 1½-in.-thick sign. For a double-faced sign, cut no deeper than ¼ in. on either face. Don't forget there's a spline down there. You risk seriously weakening the sign if you expose the joint to weathering.

I usually begin by lightly blasting across the entire face of the sign. This allows me to see how the grain is running, how quickly the sand is cutting and what portions of the design will need special care. The greatest effort is required where thick ridges of hard grain run through delicate lettering. The trick here is to cut away enough of the difficult grain to reveal the letters without excessively gouging out the soft grain surrounding it. You can accomplish this by positioning the nozzle further away from the work and carefully assessing your progress.

On a large sign with broad background areas, it's difficult to judge how deep to cut. Extending a straightedge from one edge of the sign to the other so it bridges the background will help you determine how deep you've cut. But in cases where you're not sure, it's better to err on the side of under-cutting. In these cases, concentrate on getting the correct depth around the raised portions of the sign.

Once the carving is complete, blow over the sign with air. Remove any grit that's embedded in the wood by flicking the grains out with the point of a knife. Use a wire brush to clean and break away loose wood grain or sand in the background areas prior to finish-sanding. In most cases, large signs should be sanded with 80- or 100-grit sandpaper, while smaller signs can be finished with 100 to 120 grit. The proper grit size is determined more by the size of the sign and its fineness of design than the finish to be used. Take care while sanding to avoid splitting off or rounding over any of the crisp edges you've worked so hard to attain.

Signs can be finished in one of many ways. If you want the sign to weather naturally, give it a coat of redwood sealer. If it's to be painted with exterior-grade enamel or exterior latex, start with a coat of Olympic stain undercoat. Either way, peel the stencil off the letters after the sign is painted (see photo, above left).

The list of materials that can be sand-carved successfully is almost endless. Indeed, hardwood (it takes a little longer), glass, Plexiglas, ceramics, plastics and metal are all fair game.

Of course, your finished product won't look the same as a handcarved sign. But if there's no room for new solutions to old problems, why not just throw away your tablesaw? □

Since writing this article, Lorin Labardee has left signmaking to pursue woodworking in a Tucson cabinet shop.

North Bennet Street School Show

Students capture the spirit of the past in today's designs

by Sandor Nagyszalanczy

Maurice Bombar built this Philadelphia-style armchair from South American mahogany stained with potassium dichromate. The chair has a shellac finish and a damask fabric slip seat.

In an age when many woodworkers are going commercial, using particleboard instead of solid wood and stapling drawers instead of cutting dovetails, students at Boston's North Bennet Street School are studying period design and traditional hand-tool techniques. The period-style furniture and cabinetry exhibited at the Arlington (Mass.) Library last winter during the students' annual show prove they're learning their lessons well. Were it not for the unmarred finishes, pristine upholsteries and untarnished brasses, the reproductions could have passed for the originals.

I'd assumed that the twenty or more pieces represented the students' final graduation projects, so I was startled to learn that Jim Price's Federal card table (next page, top left) and several other pieces were built by first-year students. Price's manipulation of mahogany veneers with holly, Brazilian rosewood and satinwood seemed too precise and sophisticated for a neophyte. I also sensed another dimension, unexpected from work produced in a program devoted to period furniture and cabinetmaking: When I looked beyond the crisply detailed carvings, artistic inlays and conspicuously tight joinery, I realized that the students had made some savvy design departures from the strictly traditional. The forms and craftsmanship of the old-time makers were certainly there, but not in copy-cat style. The students had subtly adapted many of the forms to suit their own tastes and needs, giving the work the same sense of vitality that I've always felt 18th-century cabinetmakers brought to their work.

The Philadelphia-style armchair by Maurice Bombar, above, is a good example of the design process used by many students with whom I spoke. Bombar combined elements from two different Chippendale side chairs to create this mahogany hybrid. He drew a full-size plan as a guide, but modified the design as he built, finding it easier to refine as he worked in three dimensions. Peter Kercz treated his cherry display cabinet (p. 79, bottom left) not as a reproduction, but as a period-style piece designed to meet the space limitations of his parents' home. To achieve the desired look, Kercz combined blind-dovetailed casework with Queen Anne legs and moldings, plus a Georgian-style mitered mullion door.

There were other interesting hybrids as well. Peter Tischler

Photos: Susan DeLong

Jim Price built the New York-style Federal card table, left—an ambitious effort for a first major project. He varied the original design slightly by applying veneers over a curved apron that was stack-laminated and bandsawn. The ovolo corners were bent-laminated in traditional manner. The table is finished with multiple coats of French polish. Above, the veneer detail on Price's card table is called the "Prince of Wales feather"—a circa-1800 trademark of New York cabinetmakers. The Baltimore-style secretary (far left, below) made from cherry by Dana Gray is a reproduction of an original built around 1760. Gray resawed thick lumber to match the grain in the upper door panels, and applied japan colors to balance color variations before finishing the piece with shellac. The four quarter columns at the corners were turned simultaneously from a single, four-part, glued-up blank. After fluting, Gray separated the papered glue joints and cut the lower columns shorter. The inside of the desk has a slide-in pigeonhole assembly with beaded front edges. Featuring unusually patterned, "plum pudding" mahogany veneer on its doors and drawer fronts, plus zebrawood and holly banding, the Federal-style ladies' writing desk (near left) was both a final graduation project for Ed Campbell and a gift for his fiancée. The piece, which took Campbell nearly six months to complete, is finished with five coats of tung oil.

combined the best features of three different originals in the Philadelphia-style, tilt-top table he designed (right). He turned the two-piece, 36-in.-dia. mahogany top to dish out its top surface before carving the piecrust pattern on the edge. After seeing one table with a terribly warped top in which the cleats had been set parallel to the grain, Tischler attached his cleats to the underside of the top with screws set through oblong holes (to allow for seasonal movement). William Tandy Young's Queen Anne chair (below, right) is constructed entirely from a single walnut board. A recent graduate of the North Bennet Street School, Young combined different design elements to capture the spirit of a Newport-style chair. Instead of keeping to the traditional dimensions, however, he proportioned his chair to fit modern seating requirements.

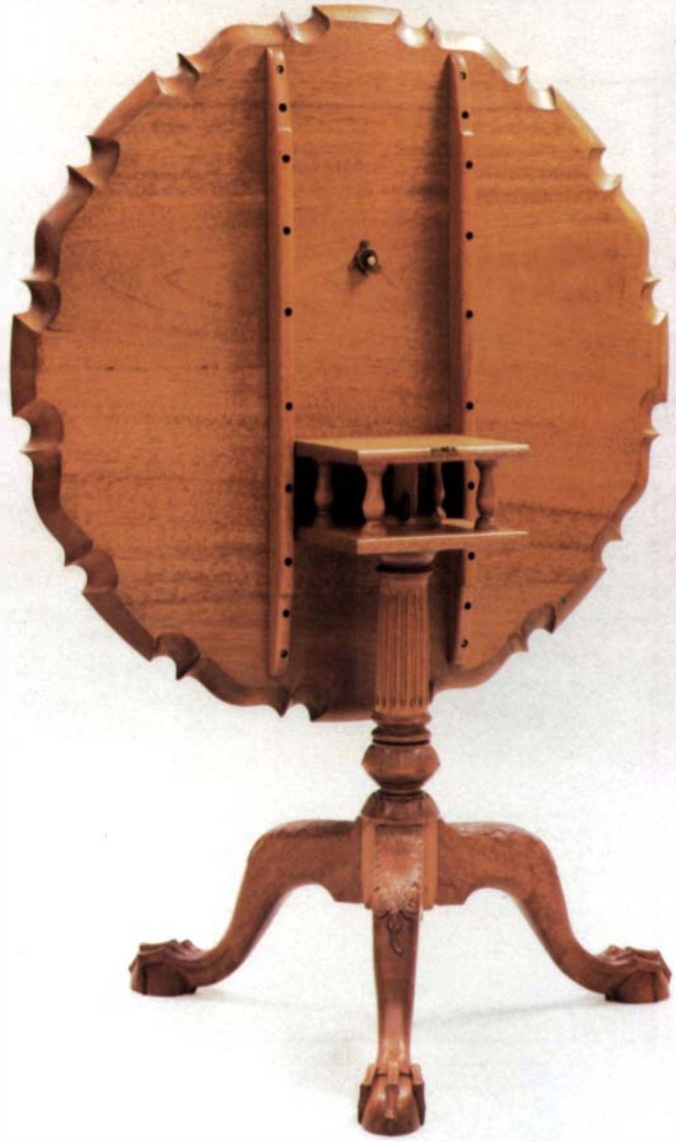
A few weeks after seeing the show, I had a chance to drop by the school, situated a horseshoe-throw away from the Old North Church in Boston. My visit afforded me a clearer picture of what had enabled these neophyte woodworkers to produce such sophisticated stuff. Regardless of their background or age, all students must progress through the same structured curriculum, covering the furniture and cabinetmaking process from start to finish: design and drafting, hand- and machine-tool techniques (with emphasis on the former), materials and finishes. At the start of the program, students work on several introductory projects. Next, they build a tool chest of their own design. And, before graduating, students are required to build three major pieces: a chair, a table or desk and an example of casework, such as a dresser or cabinet.

Students work in an unconventional classroom setting with no formal class sessions. Much of the learning is interactive. When in need of guidance or technical instruction, students can draw on the expertise of an accomplished staff, headed up by Lance Patterson. Last year, Patterson took over when George Fullerton, the program's former director, retired after 35 years at the school. Out of respect for their former mentor, the students opted to hold this year's show in Arlington, where Fullerton lives. They wanted to make it easy for the retiree to see their work.

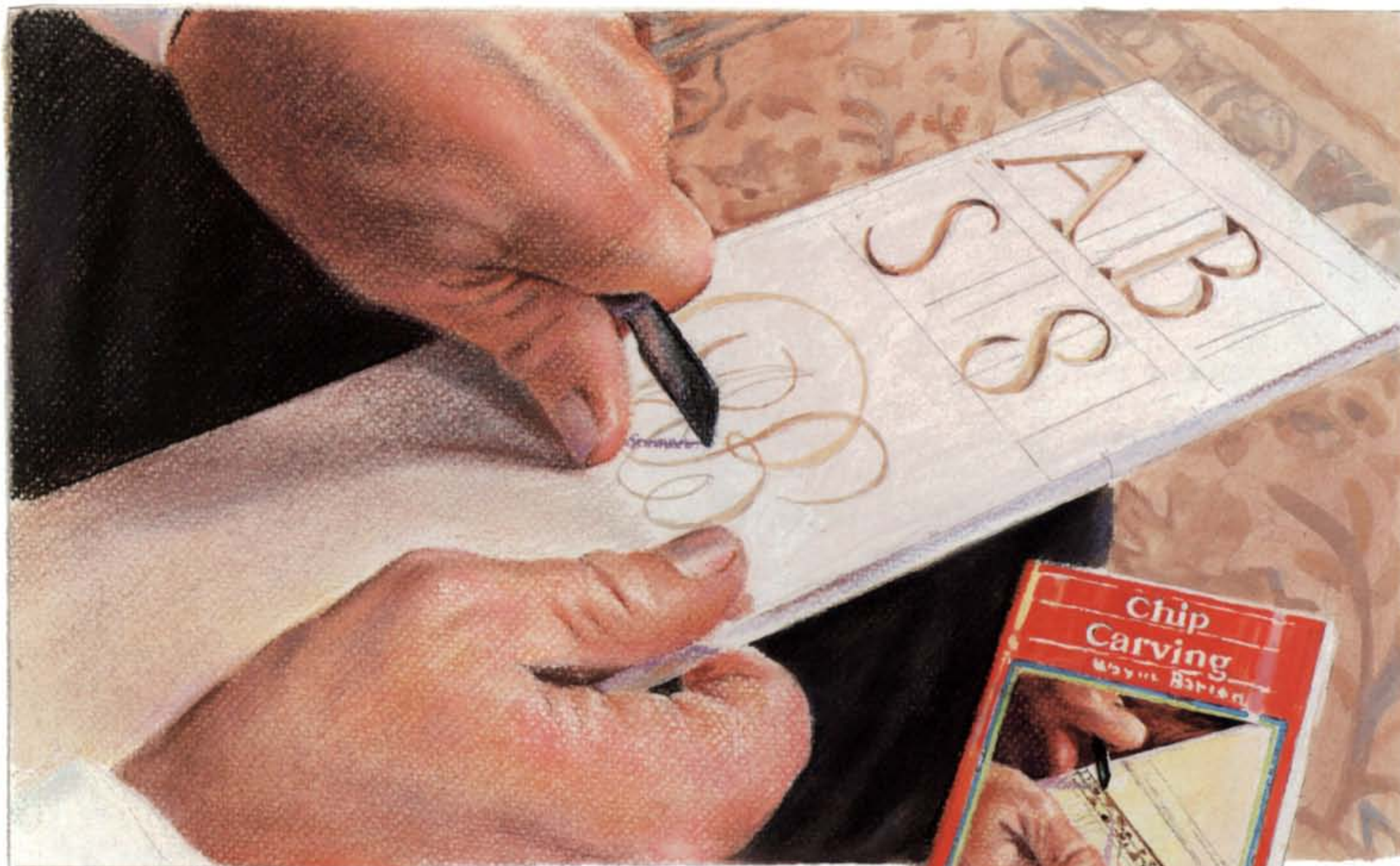
At North Bennet Street, students are also encouraged to hone their design and drawing skills. Before a single cut is made, every line, proportion and joinery detail of a project is worked out on a full-scale drawing. Although 18th-century English and American styles are a specialty at the school, Patterson says that students are free to explore any area of design they choose (during my tour, I saw only a few examples of non-period work, such as Paul Johnson's stand-up desk, featured on the cover of *FWW* #62).

Many of the students whose work I admired at the exhibition work part-time in cabinet shops or in restoration jobs while they attend the school. Not only do they gain vital experience; their wages help defray the $13,000-plus cost of the 80-week program. But, in most cases, such perseverance pays off: North Bennet Street has an excellent track record for job placement. As Sally Miller, Director of Student Services, told me, a high percentage of the North Bennet Street School alumni are employed within 60 days of graduation. Considering the quality of work that I witnessed at the student show, I can't say that I'm surprised. □

Sandor Nagyszalanczy is an assistant editor at Fine Woodworking. *For more information on the school, write to Roy Nielsen, Director of Admissions, North Bennet Street School, 39 North Bennet St., Boston, Mass. 02113. In addition to cabinetmaking, the school teaches bookbinding, locksmithing, carpentry (regular and preservation), jewelry-making and repair, piano technology and violin-making and repair.*



The Philadelphia-style tilt-top piecrust table, above, was built of South American mahogany by Peter Tischler and combines the best features of three originals. Peter Kercz built the cherry display cabinet shown below, left, as a period-style piece designed to meet space considerations in his parents' home—not strictly as a reproduction. To give the cherry richer color, Kercz applied linseed oil before topcoating the piece with tung oil. William Tandy Young's Queen Anne side chair, below right, is an adaptation of several original variations built in the Newport, R.I., shops of Townsend-Goddard in the mid-1700s. Young used a tinted oil/varnish finish to enhance the grain and bring out the walnut's rich color.



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A Fine Woodworking Video Workshop

Here's a chance to learn many of the basics of carving from two noted craftsmen. Sam Bush uses lettering to demonstrate gouge and chisel techniques. Mack Headley shows you how to carve that hallmark of 18th-century furniture, the classic scallop shell. A supplemental booklet provides shell designs, a list of tools and technical notes.

90 minutes, $29.95 postpaid ($14.95 to rent)
VHS: Pub. #617 Beta: Pub. #618

Carve a Ball-and-Claw Foot
with Phil Lowe
A Fine Woodworking Video Workshop

A period-furniture specialist, Phil Lowe shows you how to make the Colonial Philadelphia-style cabriole leg and ball-and-claw foot. You'll learn how to scale the piece to your furniture plan, bandsaw a graceful cabriole, lay out the form of the ball-and-claw, cut in the ball using a mallet and gouge, and shape the dragon's claw for a vigorous-looking grip.

115 minutes, $39.95 postpaid ($14.95 to rent)
VHS: Pub. #605 Beta: Pub. #606

Or call 1-800-243-7252 and use your credit card.

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RYOBI TOOLS

		List	Sale
S500A	3x5½ Finish Sander	70	41
SU6200	Finishing Sand. ½ Sheet	142	88
B7075	3x21" dustless Belt Sand.	179	116
B7100	3x24" dustless Belt Sand.	208	140
B7200A	4x24" dustless Belt Sand.	269	165
D100VR	⅜" VSR 0-1200 rpm drill.	91	49
W640	7¼" 13 amp circular saw	158	99
W740	8¼" 13 amp circular saw	171	109
JS60	Jig Saw-Single Speed	172	99
JSE60	Jig Saw-electronic v/speed	198	123
R150	1 H.P. Plunge Router	138	86
R330	2 H.P. Router	220	138
R500	3 H.P. Route	265	163
E3800	Drywall screwdriver 0-4000	126	79
L120U	3⅛" Planer	142	89
BD1020R⅜"	2-spd. Cordless Drill w/free holster-Xtra special buy	148	95
TS251U	10" Mitre Box	300	169
SG1150C	4½" H.D. Mini-Grinder	99	59

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All Above RYOBI TOOL Prices
Take Additional **10% OFF Sale Prices**

NEW FROM RYOBI

MODEL AP-10 — 10" SURFACE PLANER
LIST PRICE 699.00 X-TRA SPECIAL 339.00
LIMITED QUANTITIES

MILWAUKEE TOOLS

PRICE BUSTERS		List	Sale
0224-1	⅜ drill 4.5A magnum	173	109
0234-1	½ drill 4.5A magnum	173	112
0244-1	½ drill 4.5A magnum	173	115
0222-1	⅜ drill 3.3A 0-1000 rpm	159	99
0228-1	⅜ drill 3.3A 0-1000 rpm	139	80
0375-1	⅜ close quarter drill	191	118
0210-1	⅜ cordless drill 2 spd.	189	115
6539-1	cordless screwdriver 190 rpm	99	58
3102-1	Plmbrs rt angle drill kit	287	175
3002-1	Electricians rt angle kit	276	170
5399	½" D-hdle ham drill kit	284	165
1676-1	H.D. Hole Hawg w/cs	363	230
6511	2 sp sazsall w/cs	197	120
6405	8¼ circle saw	191	122
6750-1	Drywall driver 0-4000	141	85
6798-1	Tek screwdriver	173	105
6226	2 sp bandsaw w/case	416	250
6234	TSC bandsaw w/case	416	250
6507	TSC sazsall w/case	209	129
6170	14" chop saw	326	209
6012	Orbital sander 3⅝" x 7⅜"	173	100
6014	Orbital sander 4½" x 9¼"	184	108
6305	6¼" cordless circle saw	229	134
6753-1	Drywall driver 3.5A	125	73
8977	Var. temp heat gun	108	70
0214-1	⅜" v. spd. cordless drill	209	125
5397-1	⅜" v. spd. hammer drill kit	208	145
0211-1	⅜" cordless driver drill	199	120
0212-1	⅜" v. spd. cordless drill	209	125
1001-1	½" d hdle drill 600 rpm	206	125
1101-1	½" d hdle 500 rpm	217	135
1854-1	Super hole shooter-10A	530	350
6232	4¾" bandsaw w/case	452	275
6747-1	Drywall driver-0-2500	141	85
0230-1	⅜"drill 0-1700 rpm	159	100
0238-1	½" drill 0-650 rpm	165	105
5620	Router 1 H.P. — 8 amp	278	175
5660	Router 1½ H.P. — 10 amp	289	180
5680	Router 2 H.P. — 12 amp	342	220
5455	7/9" polisher 1750 rpm	199	130
5535	7"polisher 2800 rpm	209	140
6215	16" chain saw	209	140
8975	Heal gun	81	55

6366	7¼" circular saw	178	105
6368	7¼" circular saw	207	125

Model 6366 includes C.T. blade, rip fence guide & blade wrench Model 6368 includes all of the above plus case

		List	Sale
101-084	Shop Helpers	79	69

BRAND NEW
MODEL RA200 BY RYOBI
BENCH TOP RADIAL 8¼"
SPECIAL SALE 225.00

FREUD SAW BLADES

⅝" Bore — Industrial Grade
CARBIDE TIPPED SAWBLADES

Item No	Description	Diam	Teeth	List	Sale
LU72M010	Gen'l Purp	10"	40	68.58	34
LU73M010	Cut-Off	10"	60	79.65	36
LU82M010	Cut-Off	10"	60	86.40	44
LU84M010	Combination	10"	40	70.99	36
LU84M011	Combination	10"	50	74.51	37
LU85M010	Super Cut-Off	10"	80	110.88	62
LM72M010	Ripping	10"	24	64.85	34
DS 306	6" Dado			139.00	92
DS 308	8" Dado			170.00	105
TR 100	3 blades & Dado set			399.00	255

MAKITA CORDLESS FESTIVAL OF VALUES

Model		List	Sale
4300WD	Jig Saw	188	99
5081DW	3⅜" Saw Kit	212	95
5600DW	6¼" Circular Saw	284	125
9035DW	Finishing Sander	168	73
6010DWK	⅜" Cordless Drill Kit	174	88
6010SDW	⅜" Cordless Drill	94	45
8400DW	⅜" Hammer Drill	224	105
DA3000DW	⅜" Angle Drill	218	98
6010DL	⅜" Drill w/Flashlight	188	89
6012HDW	⅜" 2 spd Driver Drill w/Bat & Metal Case	208	98
DK1002	⅜"Drill w/Flursnt Lt.	176	90
6710DW	Cordless Screwdvr Kit	176	84

LEIGH DOVETAIL JIGS

Model	List	Sale
TD514	149	125
TD514L	219	195
D1258-12	299	245
D1258-24	359	275

MAKITA TOOLS

Model		List	Sale
5007NBA	7¼" Saw w/Elec. Brake	186	115
5008NBA	8¼" Saw w/Elec. Brake	212	130
804510	Sander	92	43
9900B	3" x 21" belt sander	234	119
9924B	3" x 24" belt sander	222	130
9924DB	3" x 24" b/sand. w/bag	248	130
9035	⅓ sheet finish sander	96	48
9045B	½ sheet finish sander	186	90
9045N	¼ sht fin. sand. w/bag	190	105
4200N	4⅜ circ. saw 7.5 amp	182	93
5201NA	10¼ circ. saw 12 amp	438	215
4300BV	v/sp jig saw 3.5 amp	234	120
4301BV	orb v/sp jig saw 3.5 amp	248	125
JR3000WL	2 sp recip saw w/cse	198	120
JR3000V	vs recip saw w/case	208	120
LS1000	New 10" Mitre Box	396	193
792210-7A	Carbide Bld for above	49	31
9820-2	Blade Sharpener	288	159
410	Dust Collection Unit	410	269

NEW ELECTRONIC BAND SAW MODEL 2114C — 3 SPEED 1.8 H.P. LIST 1300 SALE 850

1900BW	3¼" planer w/case	198	92
1100HD	3¼" planer w/case	328	160
3608BK	¾ hp router w/case	132	85
3601B	1⅜ hp router	218	115
3700B	½ hp trimmer	162	82
9501B	4" Grinder Kit	119	55
B04530	6" Round Sander	98	48
DA3000	⅜" angle drill	206	105
DP4700	½ v/sp w/rev 4.8 amp	178	92
HP1030W⅜	v.s.r. hammer drill w/cs	168	98
6300LR	½" angle drill w/rev	288	152
841988-2W	½" s sp. hammer w/cs	268	150
2708W	8¼" Table Saw	348	199
GV5000	Disc Sander	108	53
6800DB	2500 rpm 3.5 amp	146	79
6800DBV	0-2500 rpm 3.5 amp	156	89
6801DB	4000 rpm 3.5 amp	146	79
6801DBV	0-4000 rpm 3.5	156	89
2030n	12" planer/jointer	2580	1475
2040	15⅝" planer	2180	1195
1805B	6⅛" planer kit w/case	498	265
JV1600	var speed jig saw	178	89
JV2000	var. speed orb jig saw	198	100
5005BA	5½" circular saw	192	98
9207SPC	7" var/speed polisher	250	130
5007NB	7¼" Circ. Saw	158	94
9503BH	4½" sander-grinder kit	166	95
4014NV	var/speed blower	168	79
DP3720	⅜ drill Rev 0-1800 rpm	99	47
6510LVR	⅜ drill Rev. 0-1500 rpm	144	67
6013BR	½" Drill rev 6 amp	208	100
5402A	16" Circular Saw - 12 amp	542	315
3612BR	3 HP Plunge Router	338	175
9401	4x24 belt Sander w/bag	288	160

FREUD SAW BLADES

Univ. Bore — Professional Series

Item No	Description	Diam	Teeth	List	Sale
PS203	Gen'l Purp.	7½"	24	27.24	17.50
PS303	Fine cutting	7¼"	40	32.97	20.50

FREUD CHISEL SETS

Model		List	Sale
WC104	¼" - ½" - ¾" - 1"	35.85	23.95
WC106	¼" - ⅜" - ½" - ⅝" - ¾" - 1"	47.85	31.95
WC110	¼" ⁵⁄₁₆" - ⅜" - ½" - ⅝" ¾" - ⅞" - 1" - 1¼" - 1½"	80.20	52.95
TT108	8 Pc. Turning Set	81.42	53.95
90-100	15 Pc. Router Bit Set	249.61	149.00
FB-100	16 Pc. Forstner Bit Set	249.00	149.00

ALL ABOVE SETS COME IN WOODEN CASES

JS100	Biscuit Cutter	259.00	169.00

BISCUITS - 25.00 — 1M

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34-410 Saw Complete w/1½ H.P. motor & stand
679.00 Less 100.00 Rebate

33-150 Saw Buck
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22-651-RC-33 13" Planer
979.00

22-243 S 14" Band Saw w/open stand, ½ H.P. motor
499.00

28-283F 14" Band Saw w/enclosed stand & ¾ H.P. motor
599.00

43-122 Lt. Duty Shaper w/stand & 1 H.P. motor
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DELTA INDUSTRIAL CARBIDE TIPPED SAW BLADES

Model		List
	Non-Ferrous Metals, Plastics	
35-590	8" x 48 TC&F	82.25
35-593	8" x 48 TC&F	82.30
35-600	9" x 80 TC&F	97.70
35-619	10" x 60 TC&F	94.10
35-625	10" x 80 TC&F	123.05
35-646	12" x 60 TC&F	110.65
	Abrasive-Type Materials, Tile and Glued Compositions	
35-615	10" x 48 TC&F	94.65
35-601	9" x 60 TC&F	96.15
35-618	10" x 60 TC&F	90.70
	Plastic Laminates, Veneers, Compositions, Hard Fibers And Paper	
35-592	8" x 64 ATB	131.20
35-604	9" x 64 ATB	88.00
35-623	10" 80 ATB	116.40
	Veneers, Plastic Laminates And Compositions	
35-605	9" x 48 ATB	74.70
35-616	10" x 60 ATB	83.65
35-647	12" x 72 ATB	119.00
35-620	10" x 72 ATB	99.00
35-621	10" x 72 TC&F	110.50
35-626	10" x 60 ATB	83.65
	Compositions And Veneers	
35-622	10" x 80 ATB	111.20
35-655	12" x 96 ATB	133.75
	Rip Blades	
35-610	10" x 10 FT	54.75
35-611	10" x 18 FT	66.60
35-640	12" x 12 FT	76.80
35-641	12" x 24 FT	78.65
	Hardwoods, Softwoods, Veneered Boards, Hardboard, Coreboards	
35-617	10" x 50 ATB&R	78.25
35-614	10" x 48 ATB	87.60
35-591	8" x 24 ATB	59.85
35-603	9" x 24 ATB	59.20
35-612	10" x 24 ATB	68.10
35-602	9" x 34 ATB	68.05
35-613	10" x 40 ATB	72.00
	Soft And Hardwoods, And Particle Board	
35-643	12" x 48 TC&F	104.10
35-645	12" x 60 TC&F	110.65
35-656	12" x 60 ATB	107.70

VERY SPECIAL DELTA LIST PRICE LESS 50% DISCOUNT

THE NEXT STEP IN CORDLESS PROFESSIONAL POWER TOOLS FROM PANASONIC

Model EY570B features keyless chuck ⅜" 9.6 volt 2 speed — 350 low - 1000 high highest torque - 143 in lbs. 5 position clutch 1 hour charger complete w/case - battery - charger
List Price 209.00 Special Sale 139.00

Model EY561B features Jacobs keyed chuck ⅜" 7.2 volt 2 speed — 300 low - 880 high torque in low - 104 in lbs. 5 position clutch, 1 hour charger complete w/case - battery - charger
List Price 179.00 Special Sale 119.00

Model EY551B features Jacobs keyed chuck ⅜" 7.2 volt one speed - 460 rpm torque - 48 in lbs. weight 2 lbs 1 hour charge No case available includes charger
List Price 119.00 Special Sale 79.00

EY970B-9.6 batteries List 59.70 Sale 44.00
EY961B-7.2 batteries List 46.30 Sale 33.00
EY991B-Keyless chuck List 35.00 Sale 26.00
EY561B 7949 Holster (fits EY570B & EY561B)
List 10.20 Sale 8.00

★NEW LOW PRICES★

PONY CLAMP FIXTURES

Model		List	Sale	Lots of 12
#50	for ¾" Black Pipe	11.23	7.15	79.00
#52	for ½" Black Pipe	9.36	6.10	67.50

JORGENSEN HAND SCREWS

Model	Jaw Length	Open Cap.	List	Sale	Box of 6
#5/0	4"	2"	11.59	7.25	39.15
#4/0	5"	2½"	12.45	8.10	43.75
#3/0	6"	3"	13.36	8.50	45.95
#2/0	7"	3½"	14.36	8.95	48.35
#0	8"	4½"	15.97	9.95	53.75
#1	10"	6"	18.25	11.35	61.25
#2	12"	8½"	20.94	13.60	72.95
#3	14"	10"	26.56	16.75	91.35
#4	16"	12"	34.55	23.75	128.25

BRAND NEW BY JORGENSEN

STYLE 35 — Alum Bar Clamps

Model	Jaw Length	List	Sale
3524	24"	23.45	13.95
3536	36"	25.16	14.95
3548	48"	27.62	16.50
3560	60"	30.77	18.50
3572	72"	33.26	19.95

ANY LOTS OF 12 (1 SIZE) TAKE ADDITIONAL 5% DISC.

Who Has The Saws That Cut It Across The Board?

BLACK & DECKER of course!!!

Model	WORM DRIVE SAWS	List	Sale
3050	6½" 12 amp - 4600 rpm	247	169
3051	7¼" 13 amp - 4300 rpm	232	149
3052	8¼" 13 amp - 4300 rpm	247	169
	SUPER SAWCATS		
3047-09	7¼" w/brake - 12.5 amp	226	149
3048-09	8¼" w/brake - 13 amp	240	155
	BUILDERS SAW CAT		
3030	7¼" 13 amp - 5800 rpm	155	100
3035	8¼" 13 amp - 5800 rpm	175	125
3034	7¼" 13 amp - 5800 rpm	162	115
3033	6½" 13 amp - 5800 rpm	162	115
	JIG SAWS		
3157-10	var/sp orb action d/hdl	174	115
3153-10	var/speed 4.5A 0-3100	158	105
3159-10	2/sp orb action barrel grip	178	120
	CUT SAW KITS		
3103	2 sp 6 amp-2400 strokes	163	100
3105	v/sp 6 amp-2300 strokes	170	110
3107	v/sp orb 6A 0-2300 strokes	183	119
4300	Drill Bit Sharpener	289	205
1321	½" drill 450 rpm 6 amp	175	115
4010	Palm Sander	80	48
4015	½ Sheet Finish Sander	160	105
	DRYWALL GUNS		
2034	v.s.r. 0-4000 rpm	121	79
2037	v.s.r. 0-4000 rpm	139	89

BOSCH TOOLS

		List	Sale
1581VS	Top Handle Jig Saw	225	129
1582VS	Barrel Grip Jig Saw	126	119
1942	Heat Gun 650°-900°	99	69
1272	3x24" Belt Sander	259	159
1272D	3x24" Belt Sander w/bag	274	169
1273	4x24" Belt Sander	274	169
12730	4x24" Belt Sander w/bag	289	179
	X-TRA SPECIAL BY BOSCH		
1920VSKR	Var/Sp Cordless 2 Spd.	169	79
1196VSRK	⅜" hammer drill v.s.	190	120
1198VSR	½" hammer drill - 2 sp v.s.	199	130

PORTER CABLE TOOLS

Model		List	Sale
630	1 H.P. Router — 6.8 AMP	150	93
690	1½ H.P. Router — 8 AMP	194	124
691	1½ H.P. Router D-Hdle.	218	129
536	1½ H.P. Speedmatic Router	300	184
518	3 H.P. Router 5 Speed	490	323
520	3 H.P. Router 15 AMP	460	298
309	Trimmer 3.8 AMP	130	84
310	Trimmer 3 AMP	190	124
312	Trimmer Offset Base	205	133
319	Trimmer — Tilt Base	215	138
695	H.D. 1½ H.P. Router/Shaper	278	190
696	H.D. Shaper Table	149	104
351	3 x 21 Belt Sander w/o Bag	189	125
352	3 x 21 Belt Sander w/Bag	199	130
360	3 x 24 Belt Sander w/Bag	280	185
361	3 x 24 Belt Sander w/o Bag	260	175
362	4 x 24 Belt Sander w/Bag	295	198
363	4 x 24 Belt Sander w/o Bag	280	185
587	7¼ Speedtronic 14.5 AMP Saw	199	125
315-1	7¼ Top Hdle. 13 AMP	166	96
617	7¼ Push Hdle. 13 AMP	166	96
346-1	6½" Top Hdle. 12 AMP	161	100
368-1	8¼" Top Hdle. 13 AMP	176	110
314	4½" Trimsaw 4.5 AMP	180	109
7548	Top Hdle. Jig Saw	199	129
7648	Barrel Grip Jig Saw	199	129
548	X-H Duty Bayonet Saw	235	155
9548	X-H Duty Saw w/case	255	169
9629	Recip Saw v/sp 8 AMP	204	133
9627	Recip Saw 2 Speed 8 AMP	193	124
666	⅜" H.D. v/sp Drill	165	115
620	⅜" H.D. 4 AMP 1000 R.P.M.	124	85
621	⅜" H.D. v/sp 0-1000 R.P.M.	130	78
320	Abrasive Plane	129	89
126	Porta-Plane — 7 AMP	265	179
9118	Porta-Plane Kit	299	186
653	Versa-Plane — 10 AMP	399	265
9652	Versa-Plane Kit	419	275
330	Speed-blue sander	90	52
9100	Classic router kit	Special	110
505	½ sht pad sander	180	100
7511	⅜" v. sp. drill 5.2 amp	164	102
7514	½" v. sp. 0-750 H.D. drill	169	113
666	⅜" H.D. v/sp T hdle 4A	165	110
303	Paint remover	220	145
304	7" disc sander 4000 rpm	175	110
305	7" disc polisher 2000 rpm	175	110
367	3¼" plane 6.5 amp	187	120
537	1½ HP router d hdle	315	189

SKIL TOOLS

		List	Sale
551	5½" Circ. saw 6.5A	99	73
77	7¼" Worm Saw	240	135
367	6½" Worm Saw	239	135
825	8¼" Worm Saw	270	165
807	7¼" Skilsaw 13A-Super	153	100
808	8¼" Skilsaw 13A-Super	172	110
2016-02	⅜" Cordless Drill complete W/Charger, Case & 2 batteries	199	95

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CLASSIFIED

The CLASSIFIED rate is $ 5.00 per word, minimum ad 15 words. All payments must accompany orders; all are non-commissionable. The WOOD & TOOL EXCHANGE and SITUATIONS WANTED are for private use by individuals only; the rate is $7 per line. Min. 3 lines, max. 6 lines, limit 2 insertions per yr. DISPLAY CLASSIFIED rates on request. Send to: Fine Woodworking, Advertising Dept., Box 355, Newtown, CT 06470. Deadline for the September/October issue is June 25.

Busn. Opportunities

SALE: WOODWORKING FACILITY. 16,000 square feet Philadelphia woodworking facility including one-ton hoist, air system, dust collection, fully-equipped spray room, sprinkler system and security system. $100,000. (215) 236-3030.

FOR SALE: Complete comprehensive millwork and woodworking facility. Sale includes: all machinery in place and operating; existing lease; quality A-1 national and local clients. Just north of Boston. A truly turn-key operation. $198,000. The Wood Shop, 315 Main St., Wilmington, MA 01887.

WOODWORKING SHOP, 1800 sq. ft. and a beautiful country home on 25 acres. Manivalde, Burks Falls, Ontario, Canada P0A 1C0.

NORTHERN MICHIGAN WOODWORKING SHOP BUILDING INCLUDING MACHINERY. Potential business. Apartment upstairs. $32,500 or OBF. (906) 337-0289.

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We are a direct importer stocking all quality hand tools needed for a woodworking tool store or specialty department. Resale only—no enduser sales.
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San Francisco, CA 94124 (415) 821-1021

Help Wanted

APPRENTICE VIOLIN MAKERS and restorers: Positions available with finest rare violin shop in the country. Good salary and benefits, excellent training program. Professional woodworking experience required. Must be willing and able to learn. Bein & Fushi Inc., 410 S. Michigan Ave., Chicago, IL 60605.

INTERIOR SHUTTER INSTALLERS NEEDED! Custom manufacturer of interior shutters for commercial and residential use needs a network of installers to call on as needed. Particularly popular in resort areas, but new products will increase interest in big cities. Send letters of interest and resumes to President, P.O. Box 4285, Tampa, FL 33677.

WOOD CRAFTSMAN INSTRUCTOR FOR CABINET MAKING/WOOD CRAFTS PROGRAM AT OLNEY CENTRAL COLLEGE. Position availability dependent upon approval and funding. Full-time, tenure track position. Salary commensurate with education and work experience. Starting date 8/17/87. Closing date 7/31/87 or until filled. Send applications to Personnel Office, Illinois Eastern Community Colleges, 233 East Chestnut St., Olney, IL 62450. An equal opportunity employer.

SMALL SHOP IN YONKERS, NY seeks skilled and self-directed craftsperson. Assistantship also available. Salary; hard work; medical plan; relaxed atmosphere. (914) 963-9292.

SHOP SUPERVISOR - Quality architectural woodworking firm seeks hands-on leader who wants monetary rewards, growth potential and career satisfaction. Located in beautiful Berkshire Mts. Send resume and salary history to Petersen/Geller, Inc., P. O. Box 448, West Stockbridge, MA 01266.

SKILLED WOODWORKERS for growing contemporary fine furniture and cabinetry shop. Progressive organization. Jobs are project-oriented, limited production and one-of-a-kind. Wall/Goldfinger, Inc. (Union Woodworks), 7 Belknap St., Northfield, VT 05663. (802) 485-6261. EOE.

LOOKING FOR WOODWORKER to join small (currently four man) shop in Northwestern Connecticut. Nature of work varies from one-of-a-kind furniture pieces to large architect-designed commercial commissions. Wages (starting at $9-$10/hr.) commensurate with one's abilities. More in-depth job description will be provided to interested individual. Contact James Schriber, (203) 354-6452.

Instruction

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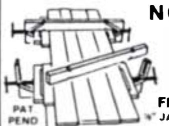

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Show—"New works in fine crafts," July 7–18, July 21–Aug. 1. Artisan's Gallery, 78 E. Blithedale Ave., Mill Valley, 94941. (415) 388-2044.
Show—Contemporary furniture masterpieces; Bennett, Maloof, Mattia, Nakashima, 40 others, July 18–Aug. 30. Gallery Fair, Mendocino, 95460. (707) 937-5121.
Juried show—American Craft Council's Pacific States crafts fair, Aug. 5–9. Piers 2 & 3, Fort Mason Ctr., Bay & Laguna Sts., San Francisco. For trade only, Aug. 5–6; open to public, Aug. 7–9. General admission: $4.
Exhibition/sale—2nd annual Valencia arts festival, Sept. 13. Valencia Meadows Park. Booth fee: $30. Contact Karen Grant, 24107 N. San Fernando Rd., Newhall. (805) 259-1750.
Exhibition/demonstrations—Tri-Valley Chapter of the Calif. Carvers Guild annual woodcarving show, Sept. 12–13. The Barn, 3000 Pacific Ave., Livermore. Displays, demonstrations, contests, sales. Table fee: $6/carver, $18/commercial. Contact Liz Finigan, 587 South N St., Livermore, 94550. (415) 447-3186.

COLORADO: **Workshops**—Anderson Ranch Arts Ctr. summer program. Frid, Hucker, Kopf, Maloof, Peters, Maruyama and more. Contact Peter Korn, A.R.A.C. Box 5598, Snowmass Village, 81615. (303) 923-3181.
Juried show—4th annual "Art of Crafts" show/sale, July 16–19. Denver Art Museum, 100 W. 14th Ave. Pkwy., Denver. Contact L. Witt, (303) 575-5929.

CONNECTICUT: **Exhibition**—30th annual Guilford Handcrafts Expo, July 16–18. Guilford Green. Contact Guilford Handcrafts Ctr., 411 Church St., Guilford, 06437. (203) 453-5948.
Juried show—"The Doll Show," Oct. 4–24. Cash awards; open to all craft media. Slide deadline: Aug. 17. Entry fee: $10. For application, send SASE to The Doll Show, Guilford Handcrafts, Box 221, Guilford, 06437.
Juried show—52nd annual juried show of the Society of Conn. Craftsmen, Nov. 7–Dec. 4. Newspace Gallery, Manchester Community College. Slide deadline: Sept. 11. Entry fee: $15. Contact Soc. of Conn. Craftsmen, Box 615, Hartford, 06142-0615.
Juried show/sale—9th annual holiday exhibition, Nov. 7–Dec. 23. Slide deadline: Sept. 15. For info., send SASE to Holiday Expo, Box 589, Guilford, 06437.

FLORIDA: **Juried show/sale**—25th annual Coconut Grove Arts Festival, Feb. 13-15, 1988. Slide deadline: Sept. 15. Fees: $10 jury; $200 space. Contact Arts Festival, Box 330757, Coconut Grove, 33233.

GEORGIA: **Juried show/sale**—35th annual arts festival, Sept. 24–Oct. 2, 1988. Piedmont Park, Atlanta. $12,000 in prizes. Fees: $10 jury; $175–$400 space. Contact Arts Festival of Atlanta, 1404 Spring St. N.W., Suite 1, Atlanta, 30309. (404)885-1125.

IDAHO: **Juried show**—19th annual "Art on the Green," July 31–Aug. 2; outdoor show. North Idaho College campus. Contact Citizens Council for the Arts, Box 901, Coeur d'Alene, 83814.

ILLINOIS: **Juried show**—8th annual Fountain Square arts festival, June 27–28; outdoor show. Contact Evanston Chamber of Commerce, 807 Davis St., Evanston, 60201. (312) 328-1500.
Expo—Woodland Expo, Oct. 2–3; forestry products, equipment and machinery. DuQuoin State Fair Grounds, DuQuoin. Exhibitor deadline: July 1. Contact M. Malinauskas, Div. of Continuing Education, So. Illinois University, Carbondale, 62901. (618) 536-7751.
Exhibition—"Tuning the Wood," a display of the works of Illinois luthiers. Illinois Center Art Gallery, Chicago, thru July 3; Dickson Mounds Museum, Lewistown, Aug. 2–Sept. 13. Contact T. Suhre, Ill. State Museum, Springfield, 62706. (217) 782-7386.
Workshops—Various wood/furniture/finish conservation topics, 4- to 5-day sessions, July 6–Aug. 7. Mervin Martin, Deborah Bigelow, Gregory Landry, Robert Walker, James Wermuth. $75/course. Campbell Ctr. for Historic Preservation Studies, Box 66, Mount Carroll, 61053. (815) 244-1173.

INDIANA: **Juried show**—Sept. 26–27. Madison Chaut. of the Arts, 1119 W. Main St., Madison, 47250.
Workshops—Furniture carving & French polish finish, Aug. 1–2; basic wood joinery, Aug. 8; country-style/animal figure carving, Aug. 15–16. Fee: $30–$100. Beginning–advanced. Contact Brown County Craft Guild, Box 179, Nashville, 47448. (812)331-7101.

IOWA: **Exhibition**—Holzfest '87, Aug. 15–16. Colony Village Restaurant, Amana. Demonstrations, wood exhibits, crafts, woodchoppers' ball. Free. Contact Personalized Wood Products, Box 193, Amana, 52203.
Exhibition—12th annual Old-Time Country Music Festival & Pioneer Exposition of arts & crafts, Sept. 3–7. Pottawattamie Fairgrounds, Avoca. Reserve booths by Aug. 15. Contact Bob Everhart, Director, 106 Navajo, Council Bluffs, 51501. (712) 366-1136.

MAINE: **Exhibition**—"Symmetry in Wood," the works of Gordon R. Merrick, July 7–30. Portland Public Library. Veneered mandalas in radiant burl patterns. Contact library at (207) 773-4761, ext. 110.
Exhibition—Finalists in Maine stool design competition sponsored by Kennebec Valley Woodworkers Assn., July 18–Aug. 30. Portland Perf. Arts Ctr., 25A Forest Ave., 04101. Contact J. Eckhaus (207) 268-4690.
Exhibition—2nd annual wildlife carving & art festival, Aug. 1–2. Samoset Resort, Rockport. Contact Dick Knotts, Maine Wildlife Woodcarvers Assn., 5 Hillcrest St., Waterville, 04901. (207) 873-2609.

MARYLAND: **Juried show**—Artscape '87, July 17–19. For info., send SASE to Artscape '87, c/o Mayor's Advisory Committee on Art and Culture, 21 South Eutaw St., Baltimore, 21201. (301) 396-4575.
Juried show—24th annual Havre de Grace arts & crafts show, Aug. 15–16. Tydings Memorial Park. Apply by July 15. Contact Arts & Crafts, Box 174, Havre de Grace, 21078. (301) 879-4404.
Juried shows—For info on juried crafts shows thru year end, send 66¢ in stamps to: Sugarloaf Mtn. Works, 20251 Century Blvd., Germantown, 20874.

MASSACHUSETTS: **Exhibition**—New England crafts, July 10–12. Hancock Shaker Village, Rte. 20, Pittsfield. Admission to fair includes entrance to village; $6 adults, $2 children, $5.50 students/seniors, $15 family. Contact Joan Clemens, (413) 443-0188.
Exhibition/workshops—8th annual dollhouse and miniature show & sale, Aug. 16; Sheraton Hyannis Banquet Hall, Rte. 132. Admission: $2.50. Contact G. Harris, Cape Cod Miniature Society, Box 1596, Orleans, 02653. (617) 255-3216. For info. on miniature workshops, send SASE to Box 691, Hyannis, 02601.
Exhibition—Shaker furniture, July 22–Sept. 20. Art Complex Museum, 189 Alden St., Duxbury, 02331. (617) 934-6634.
Show—2nd annual fine wood furniture show, Aug.–Sept. Traditional and contemporary works. Contact Salmon Falls Artisans Showroom, Box 176, Shelburne Falls, 01370. (413) 625-9833.

MICHIGAN: **Juried show**—28th annual national fine arts and crafts fair, July 22–25. Contact Ann Arbor Street Art Fair, Box 1352, Ann Arbor, 48106.
Workshop—Building the Herreschoff pram, July 11–18. Contact Rick Pauly, Box 158, Suttons Bay, 49682.
Exhibition—"Young America: A Folk Art History," thru Sept. 13. Henry Ford Museum/Greenfield Village, Dearborn. Contact S. Flamm, Museum of Amer. Folk Art, 444 Park Ave. So., New York, N.Y. 10016. (212) 481-3080.
Show/workshops—Woodworking machinery, supplies, tools; workshops and seminars, Sept. 18–20. Michigan Fairgrounds, Community Arts Building, 1120 W. State Fair Ave., Detroit. Contact The Woodworking Show, (800) 826-8257.

MINNESOTA: **Workshop/show**—Relief & animal carving, caricatures, Aug. 9–15. Contact Villa Maria Wood Workshops, Box 37051, Minneapolis, 55437.
Classes/Seminars—Woodcarving, woodturning. Write for schedule. The Wood Carving School, 3056 Excelsior Blvd., Minneapolis, 55416. (612) 927-7491.
Exhibition—Woodturning show, thru July 5; Grand Ave. Frame & Gallery. Contact Minnesota Woodturners Assn., Box 26065, Shoreview, 55126.
Juried show—5th annual Upper Midwest woodcarvers exhibition, July 27–Aug. 1. Blue Earth. Open to all woodcarvers. Contact Royal Chiselers Woodcarvers Club, 311 E. 14th St., Blue Earth, 56013.

MISSOURI: **Exhibition**—"Works Off the Lathe: Old & New Faces," July 5–Aug. 8. Wendell Castle, Rude Osolnik, Philip & Ed Moulthrop, David Ellsworth, Hap Sakwa, many others. Contact Craft Alliance Gallery, 6640 Delmar Blvd., St. Louis, 63130. (314) 725-1151.

NEW HAMPSHIRE: **Exhibition**—"Jon Brooks: The Art of Furniture," thru Aug. 8. Newport Library Arts Ctr., 58 N. Main St., Newport, 03773. (603) 863-3040.

NEW JERSEY: **Workshops**—1987 summer wood program, Peters Valley. One- to six-day sessions, June 27–Aug. 25. Toshio Odate, John Wilson, Terry Wolff, John Hart, David van Hoff, Michael DeNike, David van Hoff, Bob Matern, Peter Touhey, James Hutchinson. Limited live-in accommodations. Contact Peters Valley Craft Ctr., Layton, 07851. (201) 948-5200.

NEW MEXICO: **Exhibition**—Functional wood sculptures, Daniel Secor, July 12–25. Contemporary Craftsman Gallery, 100 W. San Francisco St., Santa Fe, 87501. (505) 988-1001.

NEW YORK: **Workshops**—With Michael Fortune. Woodworking and furniture design, July 20–Aug. 5; wood, Aug. 6–21. Elective or 3 credits. RIT Summer Sessions, Rochester Inst. of Technology, One Lomb Memorial Dr., Box 9887, Rochester, 14623-0887
Workshop—Build a Herreschoff pram, Aug. 8–15. Contact Laurie Rush, Thousand Islands Shipyard Museum, 750 Mary St., Clayton, 13624. (315) 686-4104.
Show/sale—Indian Lake arts & crafts show, July 4. Indian Lake School. Contact Indian Lake Boosters, Box 374, Indian Lake, 12842.
Exhibition—11th annual American crafts festival, July 4, 5, 11, 12. Lincoln Center for the Performing Arts, N.Y.C. Contact American Concern for Artistry and Craftsmanship, Box 650, Montclair, NJ, 07042.
Exhibition—"Art Nouveau Bing," July 21–Oct. 11. Furniture, jewelry, decorative objects by Siegfried Bing. A Smithsonian Inst. traveling exhibition. Contact Cooper-Hewitt Museum, 2 E. 91st St., New York, 10128. (212) 860-6868.
Juried show/auction—1987 International art & craft competition, Sept. 9–28. Studio 54 Gallery, N.Y.C. Deadline: July 7. Contact Metro Art, Box 286H, Scarsdale, 10583. (914) 699-0969.
Juried shows—Woodstock-New Paltz fall arts & crafts show, Sept. 5–7. Ulster County Fairgrounds, New Paltz. Contact Quail Hollow Events, Box 825, Woodstock, 12498. (914) 679-8087 or 246-3414.
Juried show—Crafts, July 3–5; Aug. 7–9. Contact Chautauqua Crafts Festival, Box 89, Mayville, 14757.
Juried show—Crafts: National II, Sept. 9–Oct. 8. Buffalo State College. Sponsored by State University of New York. Faculty of Arts and Humanities. Contact Chair, Design Department, Buffalo State College, 1300 Elmwood Ave., Buffalo, 14222; (716) 878-6032.
Juried show—Arts and crafts, Sept. 19. Rye Art Center. Contact Janet Levine, Rye Art Center, Box 582, Rye, 10580. (914) 967-0700.

NORTH CAROLINA: **Juried shows**—Series of juried crafts shows thru year end. 4th annual High Country Art & Craft Show, July 3–5, Scaly Mtn.; 8th annual Summerfest Art & Craft Show, Aug. 14–16, Asheville Civic Center. For info., send legal SASE to High Country Crafters, 29 Haywood St., Asheville, 28801. (704) 254-0072.
Workshops—Joinery, Nancy Lechner, July 5–18; relief woodcarving, Elmer Tangerman, July 19–Aug. 1; carving in the round, Hal McClure or Bill Crowe, July 19–Aug. 1; Windsor chairmaking, Dana Hatheway, Aug. 16–29. Contact John C. Campbell Folk School, Rte. 1, Brasstown, 28902. (704) 837-2775.
Workshops—Greenwood chairmaking, Drew Langsner, July 27–31; Windsor chairmaking, Curtis Buchanan, Aug. 9–14; white oak basketry, Rachel Nash Law, Aug. 24–28. Tuition $250–$300. Contact D. Langsner, Country Workshops, 90 Mill Creek Rd., Marshall, 28753. (704)656-2280.

OHIO: **Workshops**—CraftSummer workshops at Miami University. Acoustic guitar construction, non-traditional basketry, others. For credit. Contact D. Croswell, CraftSummer director, Rowan Hall, Miami University, Oxford, 45056. (513) 529-7395.
Show—Indian Summer Festival, Sept. 18–20. Crafts, all media. Washington County Fairgrounds, Marietta. Contact Indian Summer Arts & Crafts Festival, Box 266, Marietta, 45750. (614) 373-8027.
Show/workshops—Woodworking machinery, supplies, tools; workshops and seminars, Sept. 11–13. Cincinnati Convention Ctr., North Hall, 525 Elm St. Contact The Woodworking Show, (800) 826-8257..
Demonstrations—Traditional use of hand tools, July 18; Aug. 22. Richards' Cabinetry & Mill Co., 410 W. Harrison St., Lewisburg, 45338. (513) 962-4788.

OKLAHOMA: **Juried show**—11th annual national woodcarving show, July 10–12. Kensington Galleria, 71st & Lewis, Tulsa. Contact C. Meeks, Eastern Okla. Woodcarvers Assn., 2676 S. Richmond, Tulsa, 74114. (918) 742-4284.

OREGON: **Exhibitions**—Numerous shows, exhibitions. The Gallery, World Forestry Center, 4033 S.W. Canyon Rd., Portland, 97221. (503) 228-1367.

Exhibition—Fine handcrafted furniture, July 12–Aug. 8. Contemporary Crafts Gallery, 3934 S.W. Corbett Ave., Portland, 97201. (503) 223-2654.
Annual meeting—International Wood Collectors Society, Sept. 11–14. Beachwood gathering, myrtlewood factory tour, sawmill and logging-show tour, auction, displays of member work. Contact "Swede" Pearson, 6957 N. Montana, Portland, 97217. (503) 289-1974.

PENNSYLVANIA: **Juried show**—9th annual show/sale, Sept. 5–7. Contact Long's Park Arts &Craft Festival, Box 5153, Lancaster, 17601.
Juried show—3rd annual woodcarving show, July 11–12. Sawmill Arts Ctr., Cook Forest State Park, Cooksburg. Open to all carvers. Contact M. Karns, Sawmill Arts Center, Box 6, Cooksburg, 16217.
Juried show—18th annual Fair in the Park, Sept. 11–13. Mellon Park, Pittsburgh. Contact Craftsmen's Guild of Pittsburgh, Box 10128, Pittsburgh, 15232.
Juried show—Sponsored by Conestoga Valley Chapter of the Penn. Guild of Craftsmen, Oct. 4–25. Market House Craft Ctr. Gallery. Slide deadline: Aug. 12. Entry fee: $5. Send SASE to John Ground, Market House '87 Gallery, Box 552, Lancaster, 17603.
Classes—Woodcarving in relief, Larry Groninger, July 6–10; woodcarving in the round, Robert Butler, July 13–17; bird carving, Wayne Edmondson, Aug. 3–7. Sawmill Arts Ctr., Cook Forest State Park, Cooksburg. Contact Sawmill Arts Center, Box 6, Cooksburg, 16217.
Workshops—Bird carving, Larry Barth, July 3–4; woodturning, Nick Cook, July 13–18; furniture design & construction, Mark Ragonese, July 20–Aug. 1; wood sculpture, Thad Mosley, Aug. 3–8. Contact Pioneer Crafts Council, Touchstone Crafts Ctr., Box 2141, Uniontown, 15401. (412) 438-2811.
Seminars—Franklin Gottshall, June 20; finishing & refinishing, June 27; contemporary furniture, John Nyquist, July 25–26; Windsor chairmaking, Michael Dunbar, Aug. 22–23. Fee: $45–$125. Contact Olde Mill Cabinet Shoppe, R.D.#3, Box 547A, Camp Betty Washington Rd., York, 17402. (717) 755-8884.
Exhibition—"An Art of Deception; American Wildfowl Decoys," thru Aug. 1. Brandywine River Museum, Chadds Ford. Contact Susan Flamm, Museum of American Folk Art, 444 Park Ave. So., New York, N.Y. 10016. (212) 481-3080.

TENNESSEE: **Exhibition**—Arrowmont summer staff & faculty exhibition, thru Aug. 14. Mixed media. Featuring the work of 61 distinguished staff/faculty craftspeople. Contact Arrowmont School of Arts & Crafts, Box 567, Gatlinburg, 37738. (615) 436-5860.
Juried show—American Craft Council Southeast Region Assembly, Oct. 15–Dec. 12. Slide deadline: July 14. Entry fee: $15. Contact Spotlight '87, Arrowmont School, Box 567, Gatlinburg, 37738.
Workshops—Summer courses at Arrowmont, one- and two-week sessions, June 22–July 31. Beginning to advanced. Del Stubbs, Nick Cook, Ray Ferguson, John McNaughton. Arrowmont School, Box 567, Gatlinburg, 37738. (615) 436-5860.
Show/workshops—Woodworking machinery, supplies, tools; workshops and seminars, Sept. 4–6. Nashville Convention Center, West Hall, 601 Commerce St. Contact The Woodworking Show, (800) 826-8257.

VIRGINIA: **Juried show**—7th annual Virginia crafts festival, Sept. 18–20. Prince William County Fairgrounds. For information, send three stamps (66¢) to Deann Verdier, Sugarloaf Mtn. Works, Inc., 20251 Century Blvd., Germantown, MD 20874. (301) 540-0900.
Classes—Decoy & songbird carving classes. Monthly beginner/intermediate and advanced classes begin in July, run thru Nov. Contact P.C. English Inc., Box 380, Thornburg, 22565. (703) 582-2200.

TEXAS: **Exhibition**—Texas Woodcarvers Fair, Sept. 5–7. Coushatte Ranch, Bellville. Sponsored by the Texas Woodcarvers Guild. Contact P. Devereaux, 22411 Greenbrook, Houston, 77073.
Annual meeting—Los Amigos Del Mesquite, Sept. 11–13. Hershey Hotel, Corpus Christi. Technical presentations, demos, woodworking trade show, exhibits. Contact K. Rogers, Texas Forest Products Lab., Box 310, Lufkin 75901-0310. (409) 639-8180.

VERMONT: **Juried show/sale**—2nd annual Vermont State Crafts Fair, Aug. 21–23. Killington Ski and Summer Resort. Sponsored by Vermont Council on the Arts & the Vermont Craft Ctrs. All media. Call (802) 388-3177.
Exhibition/sale—Exhibit and sales space available in renovated year-round open market for arts, crafts and antiques. Kennedy Bros. Marketplace. Contact Win Grant, Kennedy Bros., 11 Main St., Vergennes, 05491. (802) 877-2975.

WASHINGTON: **Workshops/demonstrations**—Tools-In-Action series, free, every Saturday, 10 A.M. Boatbuilding, woodcarving, sharpening, other woodworking topics. The Wooden Boat Shop, 1007 N.E. Boat St., Seattle, 98105. (206) 634-3600.
Show—Group show, members' new work, July 2–26. Northwest Gallery of Fine Wood Working, 202 First Ave. So., Seattle, 98104. (206) 625-0542.

WEST VIRGINIA: **Workshops**—Augusta Heritage Arts Workshop, one- to three-week sessions, beginning to advanced, July 12–Aug. 14. Peter Gott, Bill Cook, Rachel Nash Law, Wayne Henderson, John Wilson. Fee: $160–$170/week. Contact Augusta Heritage Ctr., Davis & Elkins College, Elkins, 26241. (304) 636-1903.
Exhibition/sale—Oglebay woodcarvers show, Aug. 29–30. Wheeling Park, Stone Room. Contact E. Burris, Peters Run, Wheeling, 26003.

CANADA: **Conference/workshop**—1st Canadian national woodturning conference, Aug. 1–3. Francois Lambert, Wayne Hayes, Ron David, Michael Hosaluk, Leon Lacoursiere, Chris Scheffers, Giles Blais. Fee: $100. Contact Saskatchewan Craft Council, Box 7408, Saskatoon, Sask. S7K 4J3. (306) 653-3616.
Workshop—Build a 14-ft. sailing pram with Simon Watts, Aug. 22–29. Sherbrooke Village. Tuition: $270. Contact Richard Tyner, 11 Brenton St., Dartmouth, Nova Scotia, Canada B2Y 1W2. (902) 466-3306.
Juried show—Annual show, So. Alberta Woodworkers Society, Sept. 10–Oct. 3. Open to Alberta woodworkers. Enter by Aug. 1. Contact J. Morel, 1322 Hastings Cres. S.E., Calgary, Alberta, T2G 4C9. (403) 243-7672.
Juried show/seminars—2nd annual Woodstock Wood Show, Oct. 2–4. Woodstock Fairgrounds. 36 juried categories. Free seminars. Commercial exhibits. Contact Woodstock Wood Show, Box 1272, Woodstock, Ontario, N4S 8R2. (519) 539-7772.

ENGLAND: **Seminar**—Woodturning seminar, Aug. 14–16. David Ellsworth, Ed Moulthrop, Ray Key, Mick O'Donnell, Jim Partridge. Loughborough College of Art & Design, Loughborough, Leicestershire. Contact American Assn. of Woodturners, Box 982, San Marcos, TX 78867, or Margaret Lester, Administrator, 5 Bridport Road, Beaminster, Dorset DT8 3LU, England.
Exhibition/sale—Annual Chelsea Crafts Fair, Oct. 7–21. Chelsea Old Town Hall, King's Road, London, SW3. Major sales event for contemporary crafts. For info., send large SASE to Crafts Council, 12 Waterloo Place, London SW1Y 4AU, England.

Making Country Furniture by Ed & Stevie Baldwin. *Brick House Publishing Co., Andover, Mass. 01810; 1986. $12.95 plus $2.00 postage, paperback; 189 pp.*

Making Country Furniture by Richard A. Lyons. *Prentice-Hall, Inc., Englewood Cliffs, N.J. 07632; 1987. $26.67, hardcover; 224 pp.*

I had hoped that these books would offer background on that most American of stories—settlers making their own furniture—with photos of surviving pieces or maybe descriptions of the joinery and techniques typical of a time when nails were a form of currency. But that is not at all what these books are about.

The Baldwins' book contains some thirty plans, illustrated with isometric drawings and accompanied by a list of materials and a paragraph or two on the assembly process. Also provided is a very honest collection of full-color photos of the completed pieces. The hardwood items display an air of understated quality, but the majority of the pine pieces have an especially home-made, entirely 20th-century look.

The Baldwins are not the least bit deceptive about their totally modern approach. In a foreword, the authors disclaim any direct relationship between their designs and authentic museum pieces. They clearly admit that their plans employ contemporary joinery and fastening techniques. They even offer a brief summary outlining the use of glue, nails and self-starting screws.

None of this will sit well with historical purists. But think about it. If the craftsmen who built those much-admired antique country pieces were alive today, they'd almost certainly utilize the cheapest, most obtainable materials and the most practical construction methods. Dovetails would be replaced by simpler joints bonded with modern, dependable adhesives; pegs would yield to more practical (and now trivially cheap) nails and screws. Their furniture would, in effect, be what this book offers: crude, but also honest, useful and becomingly innocent.

Dr. Lyons' book contains plans for about 50 pieces, most of them based on original 18th- and 19th-century designs. Unlike the Baldwins, Lyons employs time-honored joinery techniques. He doesn't, however, elaborate on how to cut the joints. Furthermore, the historical background provided on the individual pieces—a sentence or two at most—is bare-boned.

If you want a collection of plans for basic, easy-to-make items, you'll find either of these books very helpful. Just don't come to them in search of an essay on the old ways or the full story. These books are very much an expression of the "country" movement as it's being practiced today. And there's nothing wrong with that. *—Jon Arno*

Shaker: A Collector's Source Book II by Don and Carol Raycraft. *Wallace-Homestead Book Company, 580 Waters Edge, Lombard, Ill. 60148; 1985. $14.95, paperback; 112 pp.*

The interest in collecting Shaker work has grown as the Shakers themselves fade from the American scene. In the past five years, prices have soared. A simple oval maple and pine box can bring as much as $8,000 in today's market. For this reason alone, collectors must be well-informed. Unfortunately, the Raycrafts' book isn't much help in this regard.

The text consists of brief histories of the Shakers and their industries. It also includes price lists from recent auctions and antiques shows, plus an interview with Doug Hamel—a well-respected dealer who offers the soundest advice in the book: The beginning collector should read as much as possible on the subject, visit museums and collections to study well-documented Shaker furniture, work with dealers whose judgment is trustworthy and never believe a piece is Shaker simply because the seller says it is.

The authors agree that a piece's provenance (i.e. history of origin and ownership) is usually very important. My gripe is that they don't follow their own advice in the captions for many of the black-and-white and color photographs. An expert would readily recognize many of the pieces as fine examples of true Shaker products, well-documented in other books and in collections. But many photographs depict objects that I'd want to know more about, given the opportunity to buy them. To me, they look like ordinary American pieces. Frustratingly, their provenance isn't provided, so there's no way of telling for sure.

As the curator of a restored Shaker village, I'm continually approached by hopeful visitors clutching chairs (or boxes or whatever) that "look just like the one" in a book. When the visitor can't provide evidence that the piece is a genuine Shaker original, then I have to say that, sadly, there's no reason to assume that it is. When a hefty "Shaker" price was paid, that hurts.

I wish that the Raycrafts had provided other information as well, including dimensions for the pieces and more information on materials and finishes. The book is of relatively little help to woodworkers, who would do better to read *The Book of Shaker Furniture* by John Kassay (The University of Massachusetts Press, 1980), which is profusely illustrated with black-and-white photographs and fine measured drawings of furniture and small woodenware. Collectors who are specifically interested in chairs should have a look at *The Shaker Chair* by Charles Muller and Timothy Rieman (The Canal Press, 1984). Collectors interested in acquiring Shaker *anything* should take Doug Hamel's advice: know what you're looking for—and at. *—June Sprigg*

Ornamental Turnery by Frank M. Knox. *Prentice Hall Press, One Gulf & Western Plaza, New York, N.Y. 10023; 1986. $21.95, cloth; 78 pp. For an inscribed, autographed copy, send $24.95 (New York residents add $1.80 sales tax) to Frank M. Knox, Two Tudor City Place, New York, N.Y. 10017 (please print inscription clearly).*

Ornamental turning is a machine-age craft of applying geometric patterns of surface decoration on objects that are most often turned of wood or ivory. Among the surviving examples of early ornamental turnery are masterful pieces covered with ornate decorations—boxes, chalices, vases, candlesticks and novelty items of breathtaking complexity, if not always beauty.

For those interested in this very complex craft, *Ornamental Turnery* is a friendly, executive introduction. The reader will find a few pages of history, photographs of superb examples of decorative objects, a description of the principal parts and functions of the ornamental turning lathe, a short section on wood and ivory and even a relatively simple project plan with a hint of instruction—all this in some 70 pages of actual text.

Ornamental turning isn't a hobby for everyone. Old lathes are not easily found, jury-rigging a conventional lathe for this work is difficult, purchasing a new ornamental turning lathe only recently become possible and any of these alternatives is costly. Also, learning the craft requires a great deal of trial and error, study and practice. The favored materials for this work—choice pieces of exotic hardwoods and ivory—are relatively hard to come by. And, lastly, not everyone falls in love with the typically rococo appearance of many ornamental turned objects.

Considering these obstacles, it's no surprise that only a handful of individuals are deeply involved in ornamental turnery today. Frank Knox is one of them, and he writes with the authority gained from 20 years of experience. But the serious student will doubtless find it necessary to refer to *The Principles and Practice of Ornamental or Complex Turning*, the classic 1894 Holtzapffel treatise on the subject (available in reprint from Dover Publications, New York), and perhaps pray for a videotape as well. Though flawed by brevity, Knox's book will, hopefully,

serve to rekindle interest in the venerable craft of ornamental turning, once the hobby of nobility. *—Allan J. Boardman*

Puzzle Craft by Stewart T. Coffin. *Stewart T. Coffin, 79 Old Sudbury Rd., Lincoln, Mass. 01773; 1985. $12, paperback; 100 pp.*

Stewart Coffin opens his book with some talk about wood, glue, finishing and pretty much everything else you'd need to know to make a large variety of puzzles on your own.

After this basic introduction, Coffin's book becomes extraordinary. If you're fascinated by puzzles, there's enough theory here to boggle your mind. There's also a list of puzzle sources, a description of several patented puzzles, plus a list of puzzle patents—a handy reference for those who might want to patent a puzzle themselves or, as happened to me, those who have an unsolvable old puzzle hanging around and want to order the patent to crack it. Flagrant cheating, I know. On the other hand, I've spent a couple of years browsing in this book, and I *still* don't understand the moving bead puzzle—one of the simplest. Don't anybody tell me the trick! I want to earn some self-respect back, and this might be the year... *—Jim Cummins*

Jon Arno is an amateur wood technologist in Brookfield, Wisc. June Sprigg is Curator of Collections at Hancock Shaker Village in Pittsfield, Mass. and author of By Shaker Hands *and* Shaker Design. *Allan Boardman is an amateur woodworker in Woodland Hills, Calif. Jim Cummins is an associate editor of* FWW.

Photos above & below right: Andrew Dean Powell; above right: Eric Shambroom

Unique: Part II

The "Unique: Part II" exhibit hosted at the Clark Gallery in Lincoln, Mass., last January featured some of New England's best and best-known furnituremakers. Among them was Dale Broholm's drop-leaf table, above. The five-foot-long top, made of two elongated satinwood triangles, changes to a rectangle when its gate-style mahogany leg is hinged out.

Fine enough for even the rarest of tropical birds is Peter Thibeault's "Classical Birdbath" (above, right). Thibeault's piece features a 20-in.-dia. top turned from bubinga, a gold-leaf and sapwood pedestal and a spalted bubinga base.

The colorfully painted "Garden Party" combination settee and croquet set by Jay Stanger, right, might appeal to a child's sense of adventure, but neither the scale of the piece (44 in. high by 39 in. deep by 72 in. long) nor its price ($4,750) make it a kid's toy.

Primrose Center closes

Perhaps it's just a sign of the times—people are getting more pragmatic about their careers and are attracted less to the romance of woodworking as a profession. Or maybe a rough economic climate makes for more educational belt-tightening. Whatever the reason, declining enrollments have struck a final blow to the Primrose Center, which formally closed its doors at the end of this year's Spring semester.

Established in 1979—at the height of resurgent interest in handmade furniture and cabinetmaking—this small Missoula, Mont., woodworking school's one-year to three-year programs taught everything from basic hand-tool skills and design to advanced construction and finishing techniques. Furniture designer/craftsman Steve Voorheis started the school, partly for the adventure, partly as an income supplement as he ventured into making high-end furniture—a less than lucrative occupation in rural Montana.

Voorheis, who acted as both the school's administrator and its chief instructor, has always run the school as a private business, rather than obtaining non-profit status as other woodworking schools in the country have done. "I just couldn't imagine adding the task of fund-raiser to my already long list of duties" Voorheis said.

When enrollments began declining several years ago, Voorheis stepped up his ad campaign, but failed to gain enough new applicants. He says that it's never been easy to lure new students—95% of whom came from distant locations—to a small town like Missoula. With tuition around $4,500 last year (not including living expenses, hand tools and lumber purchases), it seems likely that many woodworking students opted to attend schools in metropolitan areas, nearer to their monied clientele.

Still, isolation probably wasn't the main reason for Primrose's demise. Other woodworking schools, large and small, have been having a tougher time attracting students in the last few years. Bill Sayre, director of the Leeds Design Workshop in Easthampton, Mass., told me that although the stream of applicants to the school's one-year and two-year program remains steady, the overall number of inquiries has diminished. To solicit new students, Leeds has recently turned to a direct-mail campaign aimed at high school seniors. Sayre says that "students these days aren't as wide-eyed about becoming studio artisans," but are more serious about receiving a well-rounded education to prepare them for the job market.

Another well-known woodworking school, the Rhode Island School of Design, hasn't experienced a decline of interest or enrollment, but Rosanne Somerson—who runs the graduate furniture program there—says the curriculum has shifted to include classes in business-related topics and marketing stategy, as well as provide technical instruction. "For furnituremakers to be successful, it's no longer enough to just make good furniture" Somerson says. Small schools like Primrose may now be less able to compete because they can't offer the diverse curriculum of larger institutions.

Despite Primrose's closing, Voorheis remains undaunted. He plans to relocate his furnituremaking business to Seattle this summer and continue offering occasional workshops and seminars.

—*Sandor Nagyszalanczy*

TREES HAVE NIGHTMARES ABOUT THIS BLADE.

It's ferociously efficient.
Flawlessly engineered.

IT'S THE PIRANHA® CARBIDE-TOOTH SAW BLADE. FROM BLACK & DECKER.

The Piranha® carbide saw blade lasts up to fifty times longer than conventional steel blades. And outperforms both conventional carbide and steel blades alike.

CUTS FASTER, SMOOTHER THAN CONVENTIONAL CARBIDE BLADES.

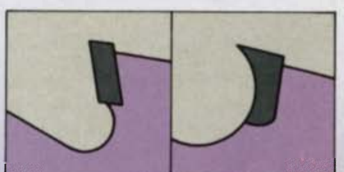
Carbide-tipped blades last longer than steel blades. But they tend to cut slower. Rougher. They're harder on the saw, and require more work of the operator.

To solve this problem, Black & Decker has engineered three major breakthroughs in carbide blade technology.

CURVED CARBIDE TOOTH "SLICES" THROUGH WOOD.

Most conventional carbide blades feature a somewhat clumsy block-shaped tooth (see diagram) which "chops" through wood, resulting in a slow, difficult cut.

The Piranha carbide tooth saw blade features an exclusive "curved carbide tooth," which literally slices through wood. Resulting in a faster, smoother cut than conventional carbide blades every time.



ORDINARY "BLOCK-SHAPED" CARBIDE TOOTH — PIRANHA® CURVED CARBIDE TOOTH

Also, by sharpening the tooth through an advanced process, Black & Decker has achieved an edge considerably sharper than that of conventional carbide blades.

The Piranha carbide tooth blade is even resharpenable, for extended life.

EXTREMELY FAST CHIP REMOVAL.

Another reason for the Piranha blade's ravenous appetite is its exclusive "fishhook gullet" design—a continuous curved surface with no break between the carbide tip and the steel body.

This continuous curved surface prevents wood from wedging beneath the carbide tip, reduces drag, and assures faster more efficient chip removal than conventional carbide blades.

THE RESULT: A CARBIDE-TIPPED FEEDING FRENZY.

Piranha carbide tooth saw blades are available now in a wide range of sizes, from 5½" to 10", 16 to 60 teeth, for all brands of circular, table, miter, and radial-arm saws. It's no wonder more and more professional job sites across the country are making PIRANHA the carbide blade of choice.

For detailed technical information, write, Black & Decker, 10 North Park Drive, P.O. Box 210-798, Hunt Valley, MD 21030.

The Piranha carbide tooth saw blade from Black & Decker. It may give trees nightmares. But to professional craftsmen, it's a dream come true.

Two indexes: one paper, one electronic

Many readers have phoned or written to ask when the next *Fine Woodworking* index will be available. As this issue went to press, our computer was busily crunching away at a data file that will ultimately disgorge a new index covering issues #51 through #65. The new booklet, available in September for $1.95, updates the old index covering issues #1 through #50. Readers who have no index at all can order both the old and the new for $4.95.

I've talked to a few readers who are put out at having to spend money for a separate booklet. Frankly, if it were practical, we'd return to the periodic index we used to bind right into the magazine when we first began indexing seven years ago. But poring over indexes in five or six separate magazines for information on a particular topic is as maddening as having no index at all. Moreover, a bound-in index spanning two years worth of magazines must be greatly condensed to fit into an eight-page insert, so it's necessarily less thorough.

Of course, there's a thin line between thorough enough and hopelessly dense. Our indexer, Harriet Hodges, manages to sneak up on that line without crossing it. What makes our index so useful, I think, is that besides being a professional indexer, Hodges is an avid woodworker. Thus, her eye is tuned to catch those indispensable bits of information that a disinterested indexer might pass by. Typically, she'll generate six to eight index entries per magazine page. This level of detail produces what Hodges considers the ideal index: one that enables you to find what you want in 30 seconds or less.

Readers who joined us after our early back issues went out of print will still find the complete index useful. All of the technical articles from those early issues have been reprinted in our *Fine Woodworking On* topic book series or in the *Techniques* book series. Together, the two index booklets cover most of the *FWW On* books and all of the *Techniques* books. In a couple of years, we'll update the index again, probably combining references to the back issues and all of the anthology books in a single booklet.

Just as we began sorting our latest index, Burr Fontaine, a reader and professor of electrical engineering at the University of Wisconsin, sent me a sample of a computerized *Fine Woodworking* index he devised and is offering for sale. While scouring his back issues for information on dust collection, he decided a listing of all the articles dealing with a single topic would simplify his search. Fontaine keyed article titles and descriptions for *FWW* issues #43 to #63 into his computer, then modified a commercial database program to search the list by keyword. So if you're looking for articles on mortise-and-tenon joinery, you simply key in those words (up to a maximum of ten) when prompted and hit execute. The disk spins and beeps, and onto the screen comes a list of all the entries containing the keywords. A code identifies the entry as article, book review, method of work and so on, and a single-line precis describes its content. To narrow a search, you can type in delimiters instructing the computer to match a string of words more precisely.

I found Fontaine's index fun to use and reasonably fast, but because it's organized by keyword rather than by subject, it sometimes takes a little doodling to find what you're after. I suspect people who work wood and like to mess with computers will find Fontaine's index useful.

Fontaine says indexing all of the back issues will require three separate floppy disks. So far, only one is available. It contains the program and issues #43 through #63, and costs $16.95. If demand warrants, Fontaine will index the remaining issues. His index, by the way, runs on all IBM-compatible machines and requires DOS 2.2 or later. For more information, write Bit-Stream Products, 5302 Burnett Drive, Madison, Wisc. 53705.

—*Paul Bertorelli*

Product review

Ryobi AP-10 portable planer, *Ryobi of America, 1158 Tower Lane, Bensenville, Ill. 60106.*

When a friend asked me what I thought of Ryobi's AP-10 portable 10-in. thickness planer, I confessed that my only contact with this machine was through the glossy ads depicting it as unthinkably compact, unbelievably light and ridiculously low in price. It sounded too good to be true, so I thought I'd find out for myself.

I came to the Ryobi with a fierce loyalty to the Parks I have at home. The 12-in. Parks has been on the market since 1946, and it serves as an excellent benchmark against which to compare any planer.

Shortly after UPS delivered the machine (yup: it's so small it meets UPS size and weight limits), I unpacked it, hoisted the 57-lb. machine to my benchtop, completed 10 minutes worth of setup and plugged it in. I winked at my prize 300-lb., 2-HP Parks, started the toy Ryobi and ran a hunk of junk lumber through it. Impressive.

The next morning, I plopped the little Ryobi on the seat of my pickup and hauled it in to the university woodshop where I teach. Clamping it to a benchtop, I drew a crowd of smirking faculty and students. Mouths agape, they watched as boards literally whizzed through and came out the other end glass-smooth—knots and all. In the short time that we've had it, the Ryobi has become the shop favorite.

At a full 10-in. capacity, the AP-10 lists for $699, but various discounters market it for between $300 and $400. The 12-in. Parks runs about $1,400.

Made by one of Japan's largest aluminum foundries, the body of the Ryobi is die-cast aluminum with some steel stampings and a plastic shroud over the integral aluminum motor housing. This helps account for the 243-lb. weight difference between it and the Parks. Both use an arrangement of tandem bevel gears for adjusting the depth of cut. But—typical of most heavy planers—Parks adjusts the table height while, atypically, Ryobi raises and lowers the entire motor/cutter assembly. Disorienting at first, but it's easy enough to get used to.

Bernie Maas

The Ryobi AP-10's small size and light weight make it ideal for on-site planing.

The Ryobi rates itself as 2 HP—the same as the Parks. But the Parks has a full-size induction motor requiring a 220v circuit. The Ryobi's universal motor is router-sized and plugs into regular household current.

All planers attempt to mesh an efficient feed rate with a top-quality finish. Too fast and the wood tears out; too slow and it glazes or burns. While the Ryobi's two-knife cutterhead spins at 8,000 RPM and feeds at an incredible 26 feet per minute (as opposed to the more typical three-knife, 4,000-RPM, 16-fpm Parks), the finish on the lumber appears every bit as fine. In fact, the Ryobi manages 615 knife strokes per foot to Parks' 750—only an 18% difference.

At the manufacturer's recommended maximum depth of cut—$\frac{3}{32}$ in.—the Ryobi lugs down noticeably with wider boards, but at just under $\frac{1}{16}$ in. (admittedly thin for a normal pass), there's virtually no evidence of the machine laboring. The planer feeds so fast that repeated passes take very little time. Ryobi warns against planing lumber

thinner than ½ in., but I've taken down veneer-thin, 3/32-in. slices of cherry without ripples or snipe.

The Ryobi is augmented with outrigger bedrolls for an 18¾-in. total bed length. Two stand-alone auxiliary rollers are available for supporting long boards. By comparison, my Parks' 20-in. bed has table rollers incorporated into the bed and features steel feed rolls—a serrated infeed and a smooth outfeed with a pressure bar in between. The Ryobi's rollers are covered with a non-slip rubber-like material.

Blade-changing is usually the true misery of planer ownership. No matter how carefully you torque those chip breakers against the knives, everything always squirms out of alignment. But when I gave my students a blade-changing demo on the Ryobi, ten minutes was all I needed to talk *and* set. An ingenious plastic setting gauge positions the two knives in the Ryobi's cutterhead and allows them to be torqued without moving. The method can't miss, and the knives stay dead on line.

According to Ryobi's product manager, Al Nielsen, the AP-10 isn't designed as an all-day production planer and is in no way intended to replace stationary floor equipment. Ryobi saw a market niche among on-site finish carpenters and builders who had occasional need for an inexpensive portable planer, as well as the shop that had limited planing requirements. To Ryobi's surprise, the AP-10 has attracted an avalanche of weekend woodworkers and home craftspeople that have neither the room nor the cash for a full-size planer.

You may be familiar with the Sears #23372N planer, but you may not know that it was built for Sears by Ryobi. In fact, Nielsen told me that the only differences between the Sears and the Ryobi are the logo and the paint job. For Ryobi AP-10 owners who need a blade replacement in a hurry, Sears might have blades in stock.

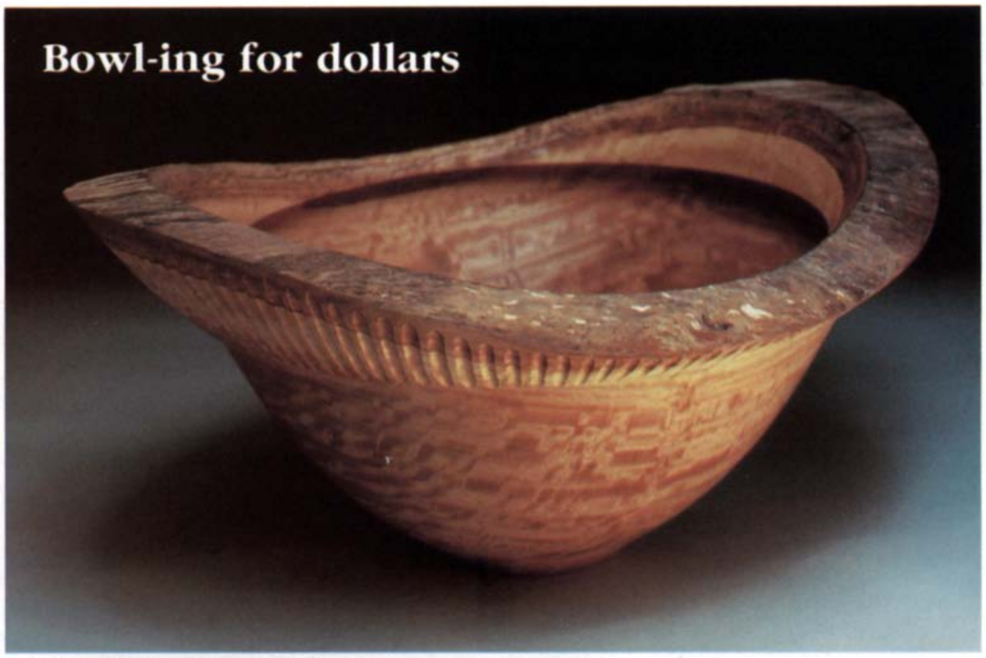
An optional dust-collection attachment just became available for the Ryobi. To please the home woodshop audience, this accessory was designed to accept standard shop vacuum hose—no need to lay in an expensive dust collector. The collector bolts on in place of the stock outfeed cover, directly over the cutterhead. Ryobi's well-designed collector outlet sucks up chips in the same direction that they come off the cutterhead—no need to change direction. Hence, the feasibility of a smaller hose. About 10% of the chips escape the collector's vacuum and are whirled out of the infeed, but I'll still take the low cost and convenience of the Ryobi solution and sweep up a handful of shavings now and then. (By the way, expect to do a bit of duct-taping to seal the hood against air leaks.)

My only real complaint with the Ryobi is its lack of restart protection. For safety, the planer should be equipped with a magnetic starter, particularly for schools and job sites. This device prevents the machine from restarting after a power interruption, unless the operator purposely pushes the start button. OSHA requires the device on many industrial machines, but the AP-10 doesn't fall into that classification. It's wise to consider short-wiring an add-on power-interrupt controller to the machine.

Although the AP-10 will never replace the floor-mounted behemoths, it'll provide planer capacity where none existed before. It's an ideal unit to carry to the job site where that specially sized piece of stock is needed to finish off an installation. Price-wise and size-wise, it's great for the home shop. And it won't break the budget: Al Nielson tells of one customer who bought three AP-10s and lined them up, one behind the other, in a production thicknessing setup. When it's not needed, the little Ryobi just folds up and sits under a bench. The only real problem with the planer is keeping my eye on it—it looks like a great candidate for a rip-off. *—Bernie Maas*

—Bernie Maas is an associate professor of art at Edinboro University of Penn.

Bowl-ing for dollars



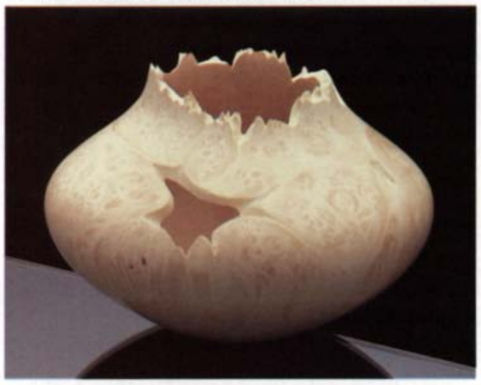


Photo above: Bruce Mitchell; below: Jerry Davis

'Vessels & Forms' was a juried exhibit of more than 100 art objects in wood by 90 American woodturners. Sponsored by the Houston Festival and held at the 1600 Smith Building in Houston's Cullen Center, the benefit show raised $2,500 for the American Association of Woodturners Education Fund. Shown here are two examples of the work on display. Above, Bruce Mitchell's 20-in.-dia. bowl, 'Wishing Well,' is turned and carved from yellow stringybark eucalyptus. Michael Peterson's maple burl 'Mesa' vessel, left, received an award of merit. The show ran from early March through May 1.

Checking up on "The Guild"

Woodworkers should be cautious when evaluating invitations to display their work for a fee in the craft sales directories now being marketed across the country. The catalogs appear to be a good way to boost sales and, perhaps, break into potentially profitable architectural and interior design markets. But my survey of woodworkers in the inaugural edition of *The Guild*—one of the best-known craft catalogs—indicates these ads are unlikely to produce any significant number of inquiries or new business for woodworkers.

An annual publication, *The Guild* first appeared in 1986 as a marketing tool for craftspeople and a research source for interior designers and architects. Its glossy, full-color pages feature the work of more than 300 artists in 14 categories, from room dividers to sculpture. In the inaugural edition, *Guild* advertisers (chosen by a selection committee) were allowed to purchase a page or more of ad space at $600 per page, and had to provide the photographs and text for the layout. Most woodworkers showed samples of furniture,

INDEX TO ADVERTISERS

although a few displayed turnings or lamps. The catalog was distributed free to 10,000 selected interior designers and architectural offices across the country. Some copies were also offered for sale in bookstores in the U.S., Japan and Europe for $75. Readers were encouraged to contact the artist directly for information about prices and other work.

It's extraordinarily difficult for a small shop to have consistent sales, so I'm always looking for effective marketing techniques. I've been inundated with offers to be part of catalogs like *The Guild*, so I wanted to find out if it would be worth the money. To evaluate the sales catalogs, I decided to send a questionnaire to each of the 46 woodworkers who advertised in the first *Guild*. To insure a good response, I didn't require the woodworkers to sign the questionnaires, and I promised to keep their replies and sales information anonymous.

Of the 46 questionnaires, 29 were returned, for a response rate of 63%. From that group, 24 (83%) responded that their listing in *The Guild* had produced inquiries about their work from private individuals, architects, designers and other sources. Five received no inquiries at all.

When asked about the total amount of business generated by the directory, 19 of those responding (66%) said no sales resulted. Two had less than $1,000 worth of business, five had sales of $1,000 to $3,000 and one woodworker stood out with over $10,000 in sales. For those who made sales, the object shown in the ad was generally the piece that sold. That adds up to 29 people paying about $17,000 (plus photographic expenses) to generate no more than $22,000 in total sales.

I'm not sure why the work sold so poorly. I suspect part of the reason may be reflected in the comment of an architect friend of mine. He said he might buy a wall hanging from a *Guild* listing, but he wouldn't dare order furniture for a client from a small shop with an unknown reputation.

Despite the poor sales figures, 20 of the 29 woodworkers (69%) said that they felt the listing was beneficial, even if they sold no work with it. Four said the listing was not beneficial, and five didn't answer the question. The majority replied that they appreciated the exposure the directory provided and, in light of the high cost of color printing, especially liked the 500 tear sheets of their ad page they received. Wendell Castle, one of the artisans who was given a complimentary ad in the book to build credibility for the first edition, said he didn't find *The Guild* listing beneficial to his business or useful as a sales tool with his customers.

When asked how they'd improve the directory, respondents suggested including an index by major metropolitan market, improving the photographs and adding more categories of different crafts or specialties. Some respondents also wrote that the free listings or display ads they've obtained in catalogs sold widely to the public produced more sales leads than did *The Guild*. Apparently, catalogs offered in bookstores and similar shops produce better results than guides aimed at trade professionals.

Overwhelmingly, everyone praised the publishers, William Kraus and Toni Sikes. Comments such as "they seemed very thorough and competent" were typical; others were even more effusive, saying "they were superb in every respect." The woodworkers were, however, split on whether to continue advertising in the directory. Most of those planning to stay with *The Guild* said they'd change their ads to show new work or items for executive offices and the contract (business) trade, rather than show furniture for the residential market. Interestingly enough, 72% of the woodworkers surveyed advertise in no other publications.

Kraus and Sikes also organize an annual show at a major architectural convention, and those who advertise in *The Guild* are invited to participate. Of the 1986 advertisers who responded to the survey, however, most (80%) declined to send work to last summer's show at the American Society of Interior Designers convention in Los Angeles. Of the six who participated, half said the show was worth doing, the other half said it was a waste of money.

—John Grew-Sheridan

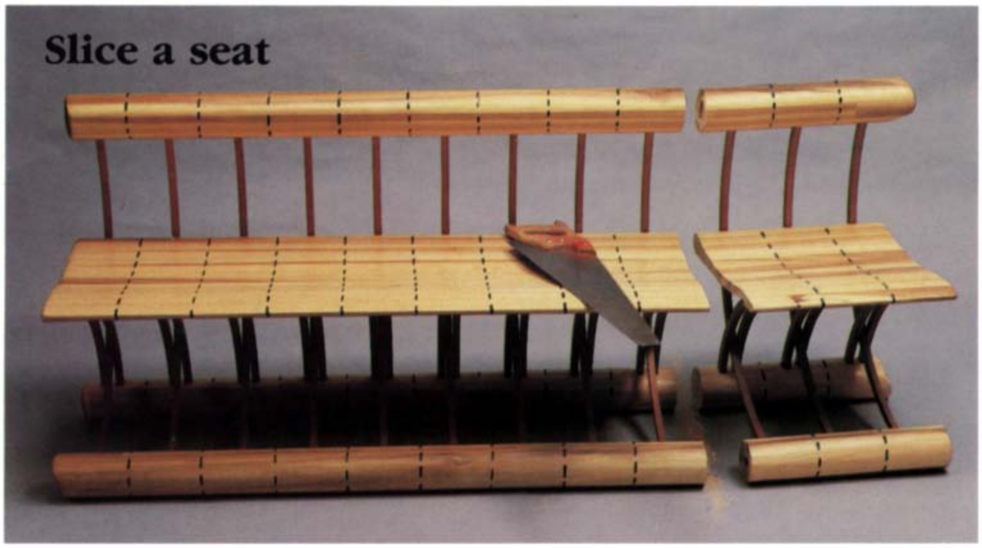
John Grew-Sheridan is a San Francisco furnituremaker, board member of the Baulines Crafts Guild and member of the Bay Area Woodworkers Association. Copies of the second edition of The Guild *are available for $75 each from Kraus Sikes Inc., 150 West 25th St., New York, N.Y. 10001. Applications are now being accepted for the third edition.* □

Woodturning symposium

Only a year old but already boasting more than 2,000 members, the American Association of Woodturners projects that its first annual symposium—slated for Oct. 1-3 at the Lexington, Ky., Civic Center—will be the largest-ever gathering of turners and turning suppliers. The event will feature a series of demonstrations and lectures by established woodturners (Doyle, Ellsworth, Hunter, Osolnik, Stirt and others) plus displays of equipment and accessories.

Attendees are encouraged to bring up to three of their best pieces for exhibit in the symposium's "instant gallery." The total cost for the three-day event is $125 for AAW members, $65 for spouses. For more information on the conference or joining AAW, write: American Assn. of Woodturners, Box 982, San Marcos, Tex. 78667.

Steven Tengelsen



Steven Tengelsen's 'Loaf O' Chairs' is only as offbeat as the promotional material printed on the giant plastic wrapper in which each loaf is packaged. 'Slice them off whenever you need extra chairs, or use the whole loaf as a bench,' the wrapper instructs, adding, 'always keep an extra loaf on hand—in case you have company.'

Notes and Comment

Do you know something we don't about the woodworking scene in your area? Please take a moment to fill us in. Notes and Comment pays for stories, tidbits, commentary and reports on exhibits and events. Send manuscripts and color slides (or, black-and-white photos—preferably with negatives) to Notes and Comment,* Fine Woodworking, *Box 355, Newtown, Conn. 06470.

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Ground Table, Rip Fence, ¾ HP Motor. Weighs 200 lbs.
Regularly $275.00
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3 MODELS
G1028 1 HP/2 Bag
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SALE $315.00
G1030 3 HP/4 Bag
SALE $425.00

MODEL G1024
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3 HP SHAPER
3 Spindles, 2 speeds, Weighs 500 lbs.
Introductory Price
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MODEL G1182 6" JOINTER
7 x 47" Precision ground bed. 1 HP. Motor. Weighs 265 lbs.
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MODEL G1018 8" JOINTER
8 x 65" Precision ground bed. 1½ HP Motor with magnetic switch. Weighs 500 lbs.
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MODEL G1036 GRINDER
Slow Speed. Large 10"x 2" stone turns at 60 rpm in water container. Small stone turns at 3000 rpm. Excellent unit for sharpening chisels, knives, etc.
Regularly $119.50
SALE $99.50 Prepaid to You!

MODEL G1021 15" PLANER
Precision ground table. 15 x 6" Automatic drive capacity. 2 HP motor with magnetic switch. Weighs 500 lbs. Stand optional.
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SALE $695.00

MODEL G1022 10" TABLESAW
Precision ground cast iron table & wings. T-slots in table. 1½ HP Motor. Weighs 235 lbs.
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SALE $295.00

MODEL G1023 10" TABLESAW
Precision ground cast iron table and wings. T-slots in table. Special fence. 3 HP motor with magnetic switch. Weighs 500 lbs.
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MODEL G1013 SANDER
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Three for the Show

Photos: above, John Kane; below: Michael Janeczek; below right: Andrew Dean Powell

The three tables shown here were part of the major Spring show mounted this year by Pritam and Eames, a gallery on Eastern Long Island that displays the work of established makers and a few new faces. At the top of this page is a dining table by James Schriber of New Milford, Conn. The top is bird's-eye maple; the legs and base are made of pear, ebony and holly. The table at left was designed by Stephen Whitney of Northampton, Mass., to stand behind a sofa, but it functions equally well as a hall table. The legs are veneered with ebony; the ebony top is inlaid with holly. Penny Gebhard's table and chair, right, are walnut. The chair is upholstered in a wool fabric woven by Dianne Harrison. Gebhard lives in Boston.