

Jan./Feb. 1988, No. 68, \$3.75

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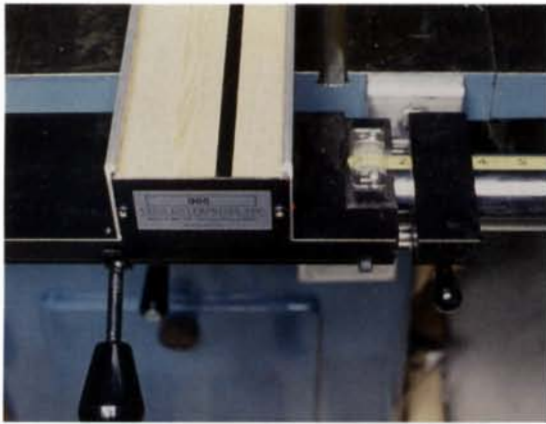
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Factory tablesaw rip fences can be annoyingly inaccurate. On p. 41, we test five replacement fences, including the Vega shown above. Cover: Upholsterer Aarne Read begins work on one of John Dunnigan's dining chairs. Dunnigan tells how he designs upholstered furniture on p. 52.

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Fine Woodworking is a reader-written magazine. We welcome proposals, manuscripts, photographs and ideas from our readers, amateur or professional. We'll acknowledge all submissions and return within six weeks those we can't publish. Send your contributions to *Fine Woodworking*, Box 355, Newtown, Conn. 06470.

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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. Copyright 1988 by The Taunton Press, Inc. No reproduction without permission of The Taunton Press, Inc. *Fine Woodworking*® is a registered trademark of The Taunton Press, Inc. 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.

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Gallery Fair mounts a national show

Richard Raffan's article on the two turning shows in your November issue is excellent. I do not know Raffan's credentials, but I like his critique and philosophy.

His statement that "spectacular wood grain . . . is frequently mistaken as art . . ." and his concerns about the mistaken equality of technical skill to art are truisms. We frequently speak of a process as an "art," when we really mean skill. Art is produced by men and woman, not nature, and natural features may be esthetically appealing, but they are not art (of themselves). To confuse the issue more, there are creations that are merely designs, and the dividing line between design and art is tenuous. I believe many turnings are merely designs, even though some shapes are very striking.

I admire the turnings shown. I wish I had the skill to make them. I would rate most of the pieces as fine designs, not art, even though they are meant to be looked at and not used. And, if some of the pieces are art, they are not very high on the artistic listing compared to other art forms.

—Henry H. Fisher, Columbus, Ohio

Raffan states that pricing of turned objects should be affected by the fact that turning is a fast process. Having served a wood-turning apprenticeship to a production turner, I know that turning *is* a relatively fast process. A turner who makes hundreds of the same shape can and should price his work according to the time it takes to make the objects. But there are turners who take their time to interpret the materials, to bring out the inherent beauty of each piece. And there are those turners who use the material to make an object of their own design, regardless of wood's inherent beauty. These turners are using the lathe to make a personal statement. In the case of producing a well-lidded box in less than an hour, Bob Krause spends up to a year to complete one of his boxes. They go through several stages of turning and drying to ensure a secure fit that does not change with the humidity.

I do agree with Raffan that some pricing is out of line. Turners have to be careful in pricing their work. There are many factors in pricing: longevity in the field, uniqueness of work, cost of materials and gallery markup. It is the last factor that has caused a lot of work to be priced so high. I am not sure that because these objects are being bought justifies the high prices; only time will tell. What is true, though, is that turned objects are being well received. If any of your readers are interested in seeing the entire show, a 90-slide portfolio and a catalog of the Craft Alliance show is available from the gallery at 6640 Delmar Blvd., St. Louis, Mo. 63103 for \$39.95 and \$10, respectively.

—Albert LeCoff, Philadelphia, Pa.

EDITOR'S NOTE: Albert LeCoff curated the Craft Alliance show.

I am writing to make a correction to Raffan's article. He erred in stating that the tulipwood bowl in the upper left corner on p. 94 was done by Ed Moulthrop. This bowl was in fact turned by me, as this shape and the rounded edge which cuts back under are styles I use. The actual piece is 8¼ in. high by 14½ in. wide.

—Philip Moulthrop, Marietta, Ga.

Good news for gardeners from the publisher of *Fine Woodworking*

Just a quick note to let you know our new gardening magazine, *Fine Gardening*, is right on schedule. The premier issue will be coming off the press April 1. We'll give you full information in our next issue of *Fine Woodworking*.

—Paul Roman, Publisher

Living in an apartment has forced me to buy rather than build some furniture and I have turned to cheap, attractive Danish teak-veneered pieces. I was curious about what kind of factory made this stuff and now I know. After reading John Masciocchi's article (*FWW* #67) about the 32mm system, I measured a number of construction and systems holes on my bookcases and sure enough, I found the 32mm grid in use.

However, please note that what Masciocchi describes is most definitely not *fine* woodworking. It seems to me that *Fine Woodworking* should be leery of promoting a new form of lifeless mass production for making lifeless (or "austere" if you insist) kitchen cabinets. Let the furniture trade journals deal with that and save your pages for celebrating, preserving and expanding on the general knowledge of quality craftsmanship. That, after all, is what you indisputably do better than any other magazine published today.

—Roger Keeling, Davis, Calif.

I have peered into many mortises on antique furniture and the chisel marks on the walls of the mortises are always the same. They run all the way from top to bottom, no matter how deep the mortise is. The marks are not vertical, but run at a slight angle for one half the length of the mortise and at the opposite angle for the other half, forming a V in the middle.

Michael Podmaniczky's method (*FWW* #66) would leave marks of a much different nature. To chop a mortise with marks like I've seen, you start in the middle and chop to the bottom first, with the chisel alternately angled toward you and away and the face of the chisel always angled up. Once the bottom is reached, the rest of the waste on either side is removed by "biting off" a small amount and chopping from top to bottom with a series of mallet blows.

There is also a problem with Podmaniczky's layout of the joint shown in the photo on p. 67. The mortise-and-tenon joint is a mechanical joint as well as a glue joint, and much more wood should be left between the end of the mortise and the end of the stile. Also somewhere in the article the word "peg" deserved a mention.

—Tom Coles, Stoneham, Mass.

MICHAEL PODMANICZKY REPLIES: I, too, have seen the inside of a few 18th-century joints, but what I have found is not quite so uniform. Although the cutting of mortises as reader Coles describes was common, it was by no means universal. First off, having to clear waste out of a narrow cut all the way down to the bottom just to get the mortise started is difficult. Then, having to direct a perfectly straight cut top to bottom each time the chisel enters the work—and not succeeding—is what creates the marks he refers to. I favor the method I describe because of the self trueing nature of waste-clearing sweeps that don't need to remove material to the full depth of the mortise.

Coles is right on the mark with his observation about layout: More material should be left at the end of the mortise, and a haunch should have been cut to fill the panel groove. Unfortunately, in trying to keep this an abstract exercise in mortise chopping and chisel use, we overlooked this important point. Look for more on specific types and applications of mortise and tenons in a future article. It will cover draw-pegs.

I've read quite a number of articles on rustic furniture, but all of them have been about men. In fact, not all rustic furnituremakers are men. I have been making and selling rustic furniture from my little farm in Oregon for the last three years. I took over the business from my husband when he died. There was a pile of orders, and not much else for me to do but finish them, so I did.

My husband had been a "willow bender" for five years and had begun to teach me. My first chair was a lopsided wonder, which is still decorating our patio. When he first saw it (I had made it while he was away), he walked all around it, looked at my dejected face and said, "It's not too bad you know . . . did you measure the height of the arms?" And in that way I didn't get discouraged, and made another one, which was better. I use

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maple or cherry for the frame, because they look good when they dry out and are nice solid hardwoods. The bent work is all willow. I use large 3-in. and 4-in. staples, as well as nails to make the frame. I soak the willow by running sprinklers on it all day and use it green, within two weeks of cutting. It bends quite easily in summer. In winter it gets more complicated—I steam it.

I go into the woods and cut the wood myself. I think that is essential. It's by seeing the shape of the wood, its color and the way it grows in the woods that gives me the idea of where it will fit into a piece of furniture. I work mostly alone and like the slow pace. I also enjoy staying home on the farm most of the time. As well as the willow furniture, the farm keeps me quite busy, looking after animals, and orchards and gardens.

—Carolina Tempelaar, Tenmile, Ore.

I'm writing to say that your *Design Book Four* is disappointingly incomplete. There's no section showing sculpture and carving, as in your previous books. Surely there were carvings worthy of showing besides those that were a part of furniture. I challenge you to print this to see how many woodcarvers would have loved to have seen a section on carving. Let's hear what your readers have to say. —John T. Sowders Jr., Richmond, Ky.

EDITOR'S NOTE: We too were disappointed about not having a chapter on carving and sculpture. Unfortunately, we didn't receive enough well-photographed entries in this category to make up a full chapter. We distributed a handful of carving photos among the accessory and turning chapters.

I thoroughly enjoyed the article on William Robertson (*FWW* #66), whose meticulous approach to the crafting of miniature furniture produces pieces that when photographed would fool anyone into thinking it is full-scale work.

I would hope your readers would take a closer look into the realm of miniatures for it offers an opportunity to approach the construction of a Philadelphia highboy, secretary bookcase or Hepplewhite sideboard with a minimum outlay of materials. This is a very important consideration nowadays when fine woods and materials can be so costly.

I for one read every article, adapting all techniques described to a smaller scale, and have found your magazine to be indispensable in my development and career as a miniaturist.

—Gilbert Mena, Huntington Park, Calif.

Woodworking journalist

To join *Fine Woodworking* staff as assistant or associate editor. We're looking for an energetic, idea person with experience in a cabinet or general woodworking shop, plus experience as a writer or editor or proven deftness with the English language. Drawing and photographic abilities and formal woodworking training are an asset. Must be willing to relocate to southwestern Connecticut and to travel on the job. Send resume and photos of recent work in wood to: Personnel Manager, The Taunton Press, 63 S. Main St., Box 355, Newtown, Conn. 06470.

I'm writing in reference to reader Stephen Wiswall's letter about buying old planes (*FWW* #67). After reading Richard Starr's article in *FWW* #65, I set out the following weekend to upgrade a couple of basic Stanley planes.

What I found at the local flea markets and antique stores was disappointing. I located three old Bailey jack planes, but together they wouldn't have made one good plane. One had the complete inner parts, including a plastic adjuster nut, from a more recent Great Neck tool. Another had two separate knurled nuts that were not even for a handplane. After seeing and comparing all this, I've decided the antique dealers don't consider the woodworker their prime customer, and I'm not really sure what the old plane should look like. On my next weekend foray, when time permits, I'll arm myself with an old Bailey smooth plane from my basement shop for a reference. With caution and knowing just what to look for, I think then I might find the right old tools.

One useful handplaning trick Richard Starr never mentioned and something I don't recall ever reading in your magazine is to bevel the front and back of the plane's sole. No more than 1/8 in. will do. This eliminates tearing out in tight corners or when planing across intersecting joints where the sharp edge of the plane may splinter the wood. —James A. Snow, Crestline, Calif.

Having experimented with chemicals and their dyeing capabilities for the past eight years, I found that George Frank's article in the September issue reaffirmed my belief that chemicals enhance wood's natural beauty. In regard to the method of applying the chemicals, I have found a better method to be spray-bottle application. Using brush applicators that touch the surface when applying the second chemical causes problems. As the chemical is brushed on, the reaction takes place on both the wood and the applicator. This leaves the surface with a progressively weaker solution, streaks and a brush that contaminates the mixture. Spray bottles avoid this problem; just make sure to wear a protective mask. —James A. Woronow, Paradise, Calif.

S. D. Takle of Fridley, Minn., had problems with an age-old smell in a chest of drawers (*FWW* #66, p. 14). We have used "Cow Brand" carpet-and-room deodorizer with spectacular results. This product is safe when used as directed and will not harm children or pets. It is applied as dry crystals and vacuumed after its work is done. It's made and packaged by Church & Dwight Ltd., 75 The Donway West, Don Mills, Toronto, Ont., Canada M3C 2E9.

This product has removed some vile smells and leaves behind a low-key, light scent. —James Foster, Guelph, Ont.

Simon Watts' article "Getting Your Steam Up" in *FWW* #64 prompts me to write about my steam genny. I took a 2,000-watt water heater element and added it to a heavy-duty, 1-gal. galvanized gasoline can sold in farm-supply stores. A #10-wire range cord, with bolted connections and a blob of epoxy to insulate the terminals, carries the power while a 3/4-in. automobile heater hose carries the steam. A glass-tube boiler sight glass, scrap cost 50¢, tells me when to add water, and I get all the live steam I can handle in six minutes flat. Total cost—about \$30 and an hour's work. —John Smith, Lansdale, Penn.

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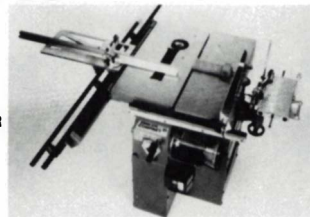
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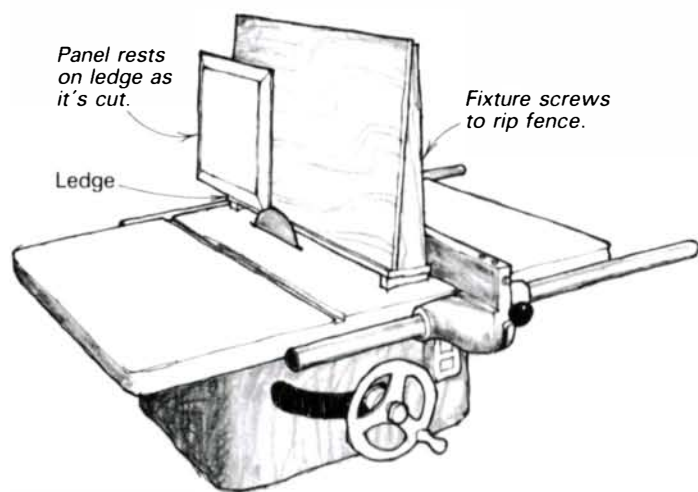
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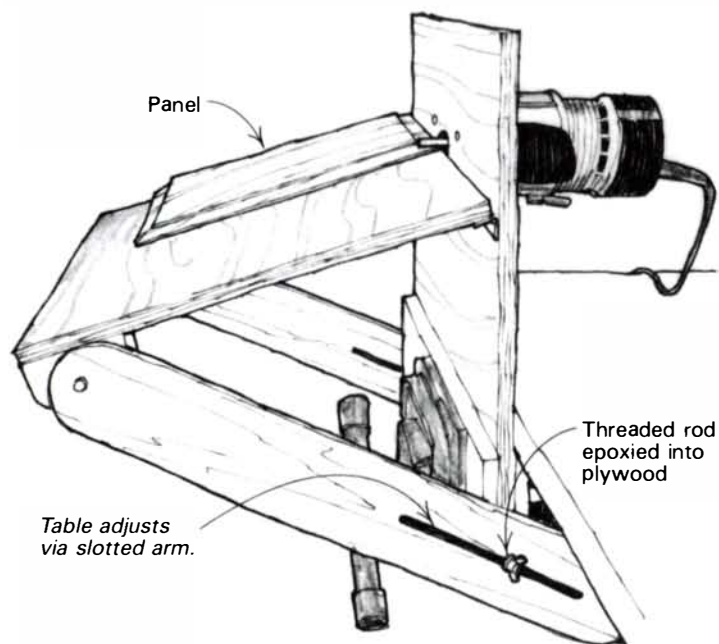
Two panel-raising fixtures



I made this fixture to expedite making dozens of ½-in.-thick, red oak panels 1 ft. wide by 5 ft. tall.

The height of the sawblade and the slope of the fixture produces panels beveled at 7½°, with the shoulder of the field cut simultaneously. If you push the panels through carefully and use a high-quality carbide blade, you'll produce panels virtually free of machine marks, requiring minimal sanding.

—Warren W. Bender Jr., Medford, N.Y.



This router fixture is great for quickly and safely beveling panels. It's made from ¾-in. plywood and some scraps. Its table is hinged and adjusts via a slotted support arm to vary the bevel angle.

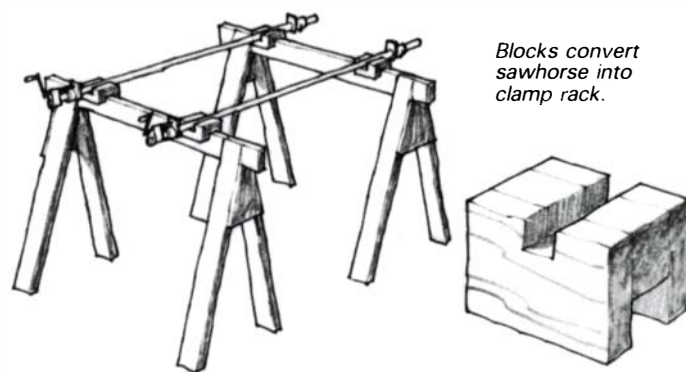
I use a ½-in.-dia. carbide bit and make three passes. The first two passes remove the bulk of the stock. The final pass removes only about ⅛ in. of material and leaves a clean face without ripples.

—Gerald Robertson, Angus, Ont.

Bar-clamp gluing rack

I've noticed that many professional shops have clamp racks that are dedicated to edge gluing. These racks hold the bar clamps in position, allow the woodworker to inspect the underside of the boards for fit and free up the workbench for other operations.

Since dedicated racks may not be practical for a small shop, here's a simple clamp-holder block that converts a sawhorse to a clamp rack. The fixture is simply a short block of wood with



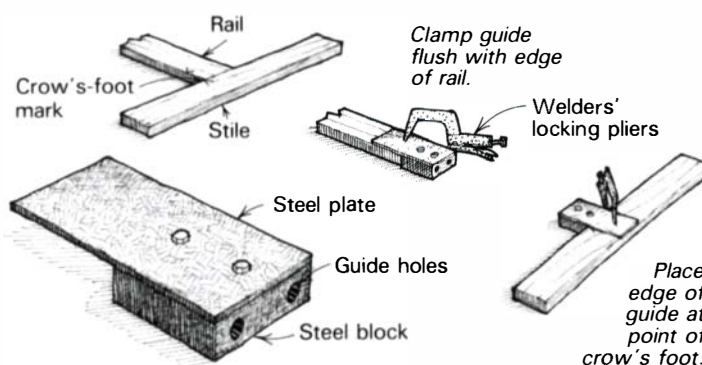
a channel ripped in the bottom to ride the horse, and a slot crosscut in the top to fit the bar clamp. If the top of your horse is a 2x4, you may wish to construct the block by gluing up a sandwich, as shown in the sketch. Make as many pairs of blocks as you'll need. The blocks stabilize the bar clamps and provide full flexibility of clamp spacing.

—George A. Burman, Fort Bragg, Calif.

Quick tip: For adjustable leveling feet on heavy pieces of woodworking machinery, try refrigerator and freezer leveling feet. Appliance repair shops will frequently give these away or charge just a few cents.

—Harold J. King, Salem, Va.

Doweling guide



Before we discovered this simple steel guide for doweling the joints on cabinet fronts, we tried several other approaches, including an expensive two-spindle horizontal drill.

Make the guide out of a 1¼-in. square, ¾-in.-thick steel block. Drill two ⅝-in. holes (for ⅝-in. dowels) through the block. The holes should be spaced ⅝ in. in from each side of the block. The usability of the guide depends on the accuracy of these holes, so drill them precisely with a drill press. Complete the guide by bolting a 3½-in. length of steel plate flush to at least one face.

After your rails and stiles are cut, mark the joints as shown in the sketch. Clamp the guide to the side of the stile with one edge of the guide flush with the mark and drill the two holes. Then, use the guide to bore the two holes in the end of the rail.

Whatever marking system you decide to use, just make sure you're consistent throughout. The drawing shows the crow's foot mark. The advantage of this mark is that if you place the guide so you can't see the crow's foot, then you're boring on the wrong side of the mark.

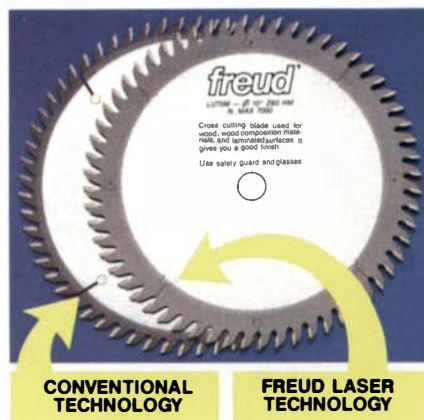
—Tim Hanson, Indianapolis, Ind.

Iron-down veneer

To apply veneer edging strips, coat the strip and the edge with white (not yellow) glue. My glue applicator is a plastic-laminate roller covered with masking tape, which I remove after the glue is spread. Allow the glue to dry. Then iron down the veneer us-

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LU78M010	10	80 TCG	G	G	E	E	NR	133.93	99.50
LU78M012	12	96 TCG						161.23	129.25
LU78M014	14	108 TCG						190.29	135.25
LU82M010	10	60 TCG						98.89	71.50
LU82M012	12	72 TCG	G	G	G	G	NR	141.18	110.50
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LU84M009	9	40 Comb						81.25	56.75
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LM72M010	10	24 Rip	NR	NR	NR	NR	E	74.22	48.25
LM72M012	12	30 Rip						99.08	62.95

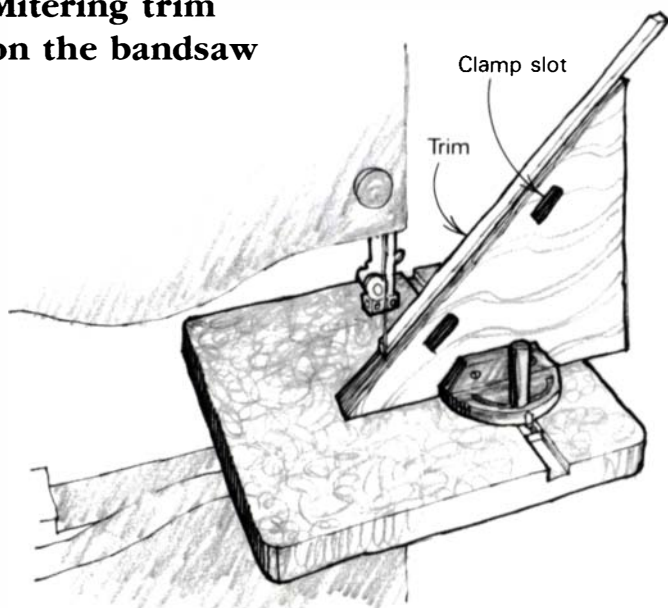
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ing a household iron on the highest setting. Move the iron back and forth over a 12-in. to 14-in. area to heat it, then press with the roller to fix the bond. This method produces a strong glue joint with no mess, no clamps, and no fumes from contact cement.

—William J. Bosco, Garberville, Calif.

Mitering trim on the bandsaw



When I needed to miter a few dozen ½-in.-thick cock beads, I first tried a chop box, but found it produced severe chipping behind the cut. So I built the fixture shown here to cut accurate miters on the bandsaw and avoid chipping. The fixture is simply a couple of 45° plywood triangles glued together and mounted upright to the saw's miter gauge. I routed two slots, as shown, to accommodate spring clamps that hold the trim to the fixture. Before use, push the fixture into the blade to leave a sawkerf halfway through. This sawkerf will serve as an index line for exact placement of the trim to be cut.

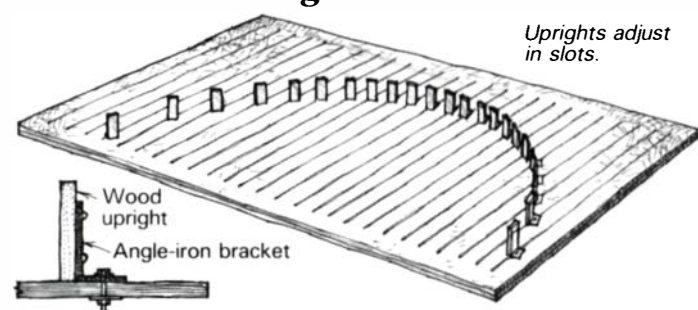
To use the fixture, first cut a trial piece to make sure the miter angle is an accurate 45°. If not, adjust the angle by tilting the saw table slightly. Next, cut each strip of trim about ½ in. longer than needed, then snip the mitered corners off in the fixture.

—Dave Evenson, Cumberland, Wisc.

Quick tip: A piece of foam carpet underlay on your bench will provide a slip-proof cushion for beltsanding boards and panels. The foam is much quicker and easier to use than a vise and benchdogs.

—Keith Manser, Warsaw, Ont.

Universal bending form



I was recently commissioned to build an arch for a client who had knocked an opening in the wall between his kitchen and dining room. Not wanting to be stuck with a big, expensive form when the job was done, I made an adjustable and reusable form for bending the arch.

The form was made from ¾-in. plywood, and was through-

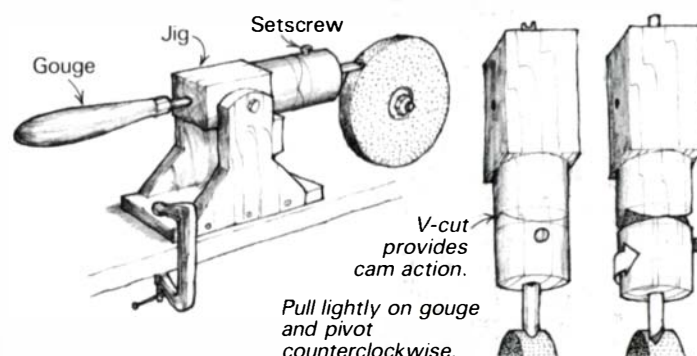
slotted every 4 in. with a ¼-in. bit in my plunge router. I stopped the slots about 2 in. from each edge. I then strengthened the plywood (made flimsy from the slots) with a 1x2 wooden frame and three crossmembers attached to the bottom. I had a local metal shop make 25 angle-iron brackets, to which I attached pine blocks whose edges had been rounded over to minimize marking the work. A ¼-in. bolt with a small washer on top and a large washer underneath holds the bracket to the formboard after it has been set at the proper location. If a bracket is needed where there's no slot (as often happens near the ends of the curves), I just drill a ¼-in. hole where the bracket's needed.

—Jason Tessler, D.N. Maalay Hagaziz, Israel

Quick tip: Used aluminum offset-printing plates, which most newspapers either give away or sell cheap, make good template material.

—Harry McCully, Allegany, N.Y.

Grinding bowl-turning gouges



Borrowing some ideas from fellow turners, I devised this jig for grinding the fingernail shape on bowl or spindle gouges. I find this too tricky to do freehand; you not only have to rotate the gouge while grinding it, but have to move it forward and back.

Start with a 2-in.-square hardwood block, 6 in. long, and turn a 2-in.-dia. cylinder in the middle of the block, leaving the back 2 in. and the front ½ in. of the block square. The rear square is fastened to the base, the front steadies the turning on the bandsaw and will be cut off. Bore a hole along the center of the block equal to the diameter of the gouge to be ground.

Make a V-cut in the cylinder; this provides a forward cam action during grinding to produce the fingernail shape. The depth of the V-cut should be half the diameter of the gouge. To make the cut accurately, scribe two circles around the cylinder half the diameter of the gouge apart. Draw a centerline down the cylinder's length, bisecting the two circles. In plan view, start the cut where the circle nearest you meets the cylinder's surface and end the cut where the farthest circle intersects the centerline. Without pivoting the cylinder, repeat the procedure on the next cut.

The back of the jig is bolted to the base so it can pivot away from the grinding wheel. Drill a small hole for a setscrew through the side of the front cylinder to hold the gouge in place as it's ground.

To use the jig, hold the two cylinders together and push the gouge, flute side up, through both parts and tighten down the setscrew. Adjust the jig so the gouge hits the wheel to produce a 30° bevel angle and clamp the jig down. Lower the gouge into the wheel and rotate it counterclockwise while pulling back on it enough so the two parts of the cylinder stay together.

—Cliff Sessions, Bartow, Fla.

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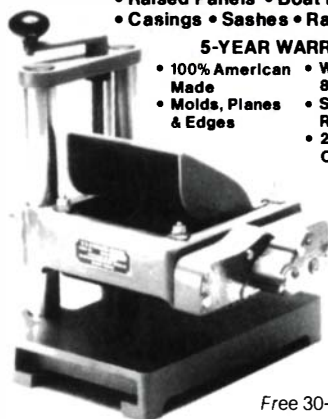
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Blade stabilizers: useful tool or gimmick?

I recently spent \$18 for a pair of blade stabilizers for my radial-arm saw, but I can't see any improvement in blade performance or decrease in noise. Are the stabilizers just a money-making gimmick? —Bob Maxwell, Washington, D.C.

Marshall Burns replies: The stabilizers are intended to keep thin blades from wobbling at high RPMs, not to cut down on noise. Before the age of carbide-tipped blades, saw makers relied on steel blades that were tempered to a Rockwell hardness of 46 to 48; anything over 48 being too brittle for a sawblade. These blades were then tensioned and flattened by highly skilled saw smiths using an assortment of hammers and straightedges to ensure accuracy when the blade was run. Most blade manufacturers today, because of the shortage of saw smiths and the high cost of their labor, use saw plates with hardness ratings of 36 to 40, which are tensioned and flattened by machines. These softer blades tend to bend easier than harder ones. Stabilizing collars might keep these softer blades straighter on the arbor and result in less noise, because a true-running blade would cut more cleanly through the air. To answer your question about stabilizers being gimmicks, all I can say is that they may help sometimes, but more often, they don't.

Here are a couple of other ideas on the noise. If the blade in question has expansion slots with holes at the bottom, have a saw shop plug them with copper. That might quiet things down. Also, you might put some type of deflector on the blade guard to change the air flow. This could be a considerable noise factor, considering the blade is probably turning about 3450 RPM.

[Marshall Burns of Fall River, Mass., has been a professional saw smith for 50 years.]

Blood finishes for poplar

Some early American furniture built from poplar and other native woods was stained or painted with what's known as blood finish, which imparts a light red or pink color that resembles cherry or light mahogany. How can I reproduce the finish? —William H. Mason, Lafayette, Ind.

Robert Mussey replies: The "blood-finish" is a modern antiquarian's term for a reddish stain popular in the United States during the 18th and early 19th centuries. My research indicates that most New England furniture constructed with maple, birch, poplar and pine was originally stained, often with this reddish color. The "honey maple" and other natural colors we see today on antiques are largely the misguided contributions of 20th-century antiquarians. Hidden areas and secondary surfaces of these blonde beauties often have remnants of mahogany- or walnut-colored stains, or paint.

The best way to describe the blood finish is as a semi-transparent stain/paint hybrid—it leaves the wood grain somewhat visible and is thin like a stain, but pigmented heavily so the real wood identity is obscured. On examples I've seen in New England museums, the color has varied from the light reddish tone you describe to a much deeper, reddish brown. One typical recipe comes from J. Stokes' *The Cabinetmaker and Upholsterer's Companion*, published in Philadelphia in 1852. "Put two ounces of dragon's blood (a resin from Western Asia), broken into pieces, into a quart of rectified spirits of wine; let the bottle stand in a warm place, shake it frequently; when dissolved, it is fit for use." The topcoat over most of the blood finishes I've seen is rather matte and thin, probably an extremely thin washcoat of varnish or linseed oil. Most traditional dye materials are available from specialty suppliers such as Olde Mill Cabinet Shoppe, RD #3, Camp Betty Washington Road, York, Pa. 17402.

If you don't want to deal with traditional dye materials, you can create a modern equivalent. I've made similar finishes with acrylic artists' colors in tubes with matte medium,

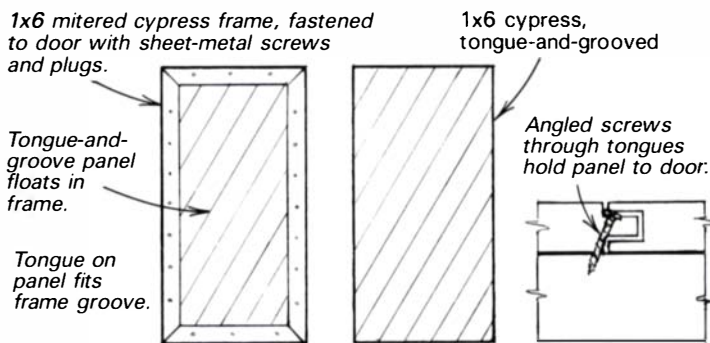
thinned to the correct semi-transparency in water, brushed on and overvarnished with an extremely thin, semi-matte acrylic spray varnish.

[Robert Mussey is chief furniture conservator for the Society for the Preservation of New England Antiquities in Milton, Mass.]

Dressing up a steel door

I'd like to cover a ¾-in.-thick steel door with 1x6 cypress, either ½ or ¾ in. thick. How should I attach the wood to the door? Any suggestions on finishes?

—William S. Bray, Miami, Fla.



Seth Stem replies: Wood attached to an exterior steel door must be allowed to move so it can expand and contract with the extreme moisture variations it will undoubtedly have to withstand. One method would be to frame the door along its perimeter, as shown, then add a floating panel of tongue-and-groove 1x6 cypress in the center. I'd also groove the inside edge of the frame to accept tongues on the outside edges of the panel. That way, only the frame must be attached to the door. I'd recommend pan head sheet metal screws, which can be countersunk and plugged, rather than adhesive, which might eventually give way because of seasonal wood movement. If you don't want a frame, then each 1x6 piece must be tongue-and-grooved, then attached with screws, preferably driven in diagonally through the tongue on the ¾-in.-thick stock, or screwed and plugged, if this isn't possible. The end pieces are attached with screws and plugs.

I've had quite a bit of success with polyurethane varnishes on cypress. Penetrating stains designed for houses, both clear and tinted, also work well. They allow the wood to weather evenly, add the protection of a preservative, but don't form a film that could be damaged or peel off the wood.

[Seth Stem teaches furniture design at the Rhode Island School of Design in Providence, R.I.]

Sliding dovetails on Inca saw?

I'm planning to buy an Inca tablesaw with mortiser attachment. I like the saw because of its light weight and accuracy. I'm curious whether I could chuck a dovetail bit in the mortiser to cut sliding dovetails, too, or is the mortiser too slow for router bits?

—George Sillanpaa, Toronto, Canada

Rich Preiss replies: Your letter perked my interest, so I thought I would try cutting sliding dovetails on the mortise table of my 10-in. Inca cabinetmakers' saw. For years I've loved the efficiency and precise feel of sliding dovetails cut with a router, but I hadn't tried any other ways of making the joint.

When I tried my mortiser with several sizes of ½-in. shank carbide-tipped dovetail bits in mahogany and solid-core plywood, though, I discovered the mortiser was not a good way to make sliding dovetails. The arbor speed is indeed too slow for crisp and chip-free cutting. In addition, the travel of the sliding table can handle only narrow pieces. Remember, you cannot plunge with a dovetail bit as you could with a straight bit, so you must sacrifice valuable travel distance to position the bit



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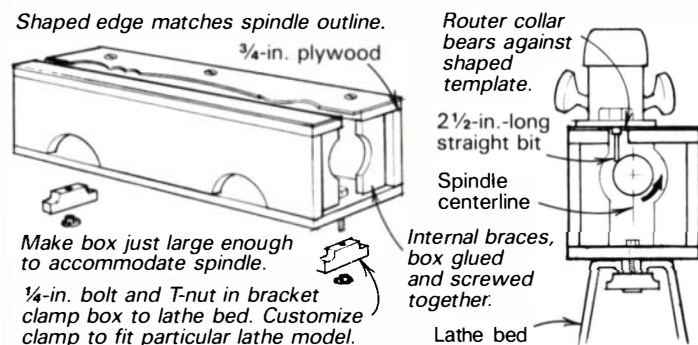
• LOS ANGELES

ahead of the work before starting the cut. I also tried fixing the table and sliding the work by, much like a horizontal shaper setup, but was dogged by the low speed problems and vibration in the sliding table. I'll stick with my router. For wider material it is a big advantage to move the router continuously along an edge rather than shift the work on a limited travel table.

[Rich Preiss is head of the woodworking program at the University of North Carolina at Charlotte.]

Router-based lathe duplicator

I'm looking for a simple, shop-built duplicator to go with my lathe. Any ideas? —David Haynes, Nanooske, B.C.



David Scott replies: I've had good results with a simple duplicator that consists of a rigid, open-ended plywood box, like the one above, which can be attached firmly to the lathe bed between centers. You'll have to customize the attachment to fit your particular lathe. The top of the box is a flat surface on which your router rides with a long bit sticking downward to cut off the side of the rotating spindle.

The box should be sized so its top just clears the maximum diameter you wish to turn, and a 2-in. to 2½-in. straight bit can reach downward far enough to make a shearing cut off the side of the spindle. I made my top surface with Masonite—a fixed piece on the operator's side and a removable, shaped template piece on the far side, against which the router collar bears.

Start with round or octagonal stock and work the spindle down to its finished diameter by making several passes from the tailstock to headstock. Run your lathe at its slowest speed. Simple duplicators like this are best for reproducing gradual diameter changes, but do so in such a quick and fool-proof manner that they allow plenty of time for any hand-turned detail work you might desire.

[David Scott is a professional woodworker in Clyde, N.C.]

Building a wooden water pump

I have to build a wooden water pump similar to those found on most farms before the advent of cast-iron pumps in the 19th century. This will involve drilling a 5-in. to 6-in. hole through the endgrain of an 8-ft. section of oak beam. I've heard these openings were formed by drilling a small hole with a hand-turned shell auger, then reaming the hole out to the desired diameter. Any suggestions on what a contemporary woodworker should do? —A. W. Kobr, Schwenksville, Pa.

Norman Vandal replies: Hand-driven shell augers were used to bore long holes into the endgrain logs. Even though those tools were often called "pump log" augers, the process was almost exclusively used for making wooden water pipes. The shell auger was forged onto the end of the shaft, sometimes 12 ft. long, which was guided by part of the wooden rack used to position the log. The hole was bored full-size, but reamers made the male and female tapers on opposite ends of the log. The mating ends were then caulked with pitch and hammered together.

Wooden water pumps are generally square, made of two thick planks joined together. The "hole" was made by a special plane

that cut one half of the circle on each plank prior to assembly. The sections were banded together by hand-forged steel straps, and the swelling of the wood made the joints watertight. I've never seen water pump planes that would cut the diameter you specify, so I'd suggest you scale your hole down to 3 in.

If I were going to make the pump, I'd stick to the two-section system. The grooves can be cut with a combination of circular saw and router, using various fences and depth settings to make each cut come close to the arc of the semi-circle. I'd aim for a hole large enough to house a 3-in. plastic or copper pipe. I know the pipe lining seems like a sellout, but it would eliminate wear from abrasion on the inside of the cup leather and piston, and prolong the life of the pump. Also, it means that your hole needn't be perfectly round or smooth. Use waterproof glue on both sections, and make your binding hoops of steel flat stock set in shallow dadoes around the timber. Splines could be added to each side of the groove to keep the two sections in line. The ideal wood would be cypress, followed by red cedar or hemlock. I'd avoid any chemical treatment for rot or fungus because of the danger of contaminating the water.

[Norman Vandal makes period furniture and architectural furnishings in Roxbury, Vt.]

Free lumber costs a bundle

I recently cut two black locust trees into saw logs and tried to rip them on my neighbor's portable bandsaw mill. No matter what we did, we couldn't get the blade to run true and every now and again there would be a great jolt when a tooth broke off. What am I doing wrong? I can't afford to keep replacing my neighbor's blades. —Tim Southworth, Goldendale, Wisc.

Jim Cummins replies: Black locust is beautiful stuff, but it can be a bear to cut. Once, on a whim, I tried to rip a standing dead locust sapling down the middle. After cutting down about three feet, the chainsaw dulled to the point where it stopped cutting. And this tree was only about five inches in diameter.

The same thing is probably happening with the bandsaw mill—the teeth are dulling, feed pressure must be increased to maintain the cut and then the blade bows or distorts enough from heat that the teeth snag and crack.

I'd suggest you find a regular sawmill to deal with your logs. Otherwise, crank up as much tension as you can on the bandsaw mill and sharpen frequently. You can't see much with the naked eye, but you can check the very tips of the teeth with a 10X hand lens for sharpness. After they saw a few feet, I'll bet they will be round. You might also consider just cross-cutting it into chunks for turning. I hate to mention it, but locust is great for split-rail fence posts and is also great firewood.

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

Backtracking for glass-like finish

I built an oak chest, stained it, and sprayed on two coats of Sadolin sanding sealer, followed by four coats of the company's Chemguard II lacquer. I now realize I should have filled the grain before applying finish. Is there any way to achieve a smooth-as-glass look now? —Wes Stobbe, Boissevain, Man.

Bob Flexner replies: There are two ways of filling the grain of open-pore woods like oak to achieve a mirror finish—by applying a paste-wood or other type filler before applying the finish, or by sanding coat after coat of the finish back until the finish itself fills the pores.

In this case, the second method would let you avoid starting over, but you will have to take special precautions because Sadolin Chemguard II (available from Sadolin Paint Products, P.O. Box 669, Walkertown, N.C. 27051 and Chemcraft Sadolin Inc., P.O. Box 458, Port Hope, Ont. L1A 3Z3) is a pre-catalyzed nitrocellulose lacquer and will not bond well to previous coats after about eight hours. Ordinary nitrocellulose lacquer and

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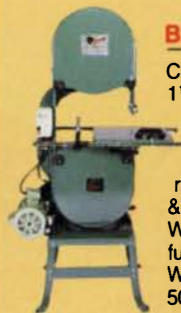
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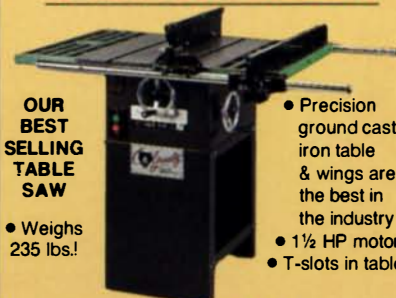
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shellac melt into previous coats and bond chemically. Varnish, polyurethane and cured-catalyzed and pre-catalyzed lacquers do not melt into previous coats, so no chemical bond is possible. Therefore, you're going to have to sand between coats so each new coat will bond mechanically to the scratches you made in the surface. I'd start with 220-grit paper and progress to 400 grit or 600 grit with succeeding coats until you get the finish you want. The process is described in detail in *FWW* #60, p. 58.

If you make any more chests like this, I'd recommend you consider another type of finish. I don't think you really need the protection of a catalyzed or pre-catalyzed lacquer on a chest like this or other household furniture subjected to normal wear. Traditional shellac, varnish and lacquer offer sufficient protection and are less plastic looking. In addition, they are easier to apply and relatively easy to repair or remove.

[Bob Flexner is a professional finisher and restorer in Norman, Okla. His video, *Repairing Furniture*, is available from The Taunton Press, Box 355, Newtown, Conn. 06470]

Tarnish-free finish for brass

I make brass parts for musical instruments, but haven't found a protective finish that doesn't tarnish sooner or later. I presently wash the brass, sand it to a matte finish with 600-grit paper, then apply a clear cellulose enamel. Within six months, the parts tarnish to a medium-brown color. How can I avoid this? —Geoffrey E. King, North Augusta, S.C.

Dick Boak replies: Brass is often lacquered to prevent tarnishing. This works for a while, but if the piece is handled, the lacquer eventually will wear off in spots, and you may have to refinish the piece. Several products, such as Mohawk Tone Finish (Mohawk Finishing Products, Inc., Route 30 N., Amsterdam,

N.Y. 12010), and Opex Clear Metal Lacquer (Sherwin-Williams Co., 101 Prospect Ave. N.W., Cleveland, Ohio 44115) are specially formulated for metal products, such as saxophones and other brass instruments. Apparently these lacquers do not breathe as much as lacquers formulated for wood, so they seal out air and moisture, thus preventing the oxidation that causes tarnish.

No matter what finish you use, you must start with a perfectly clean surface. First, polish the brass to the desired gloss, then remove any contaminants from the surface. Eric Kasner, chemical engineer and president of Hood Finishing Products in Freehold, N.J., recommended cleaning the metal with kerosene, mineral spirits, lacquer thinner or the "dip" variety brass and copper cleaners (dipping about 15 seconds to etch the surface free of oxides). The dipping solution is basically a mixture of nitric and phosphoric acids. The brass can't be handled from this point on, else oil from fingerprints will contaminate the finish. One saxophone repairman told me thorough cleaning procedures make it possible to get good results with conventional wood lacquer.

The most effective coating for the cleaned surface is vinyl sealer, an anti-penetrating sealer available from most finishing companies. After the vinyl sealer coat, any compatible lacquer will do, although acrylics generally give better results.

[Dick Boak manages the Sawmill, the exotic-wood sales division of The Martin Guitar Co. in Nazareth, Pa.]

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73-737	7-1/4"	24	14.92	8.20
73-757	7-1/4"	40	27.40	15.10
73-758	8"	40	39.90	21.95
73-759	8-1/4"	40	40.66	22.35
73-739	9"	30	29.52	16.25
73-769	9"	60	64.40	35.40
73-740	10"	32	30.98	17.00
73-770	10"	60	64.90	35.75

JORGENSEN HAND SCREWS

Model	Jaw	Open	Cap.	List	Sale	Box of 6
#50	4"	2"	11.59	7.25	39.15	
#40	5"	2 1/2"	12.45	8.10	43.75	
#30	6"	3"	13.36	8.50	45.95	
#20	7"	3 1/2"	14.36	8.95	48.35	
#10	8"	4 1/2"	15.37	9.95	53.75	
#1	10"	6"	18.25	11.35	61.25	
#2	12"	8 1/2"	20.84	13.60	72.95	
#3	14"	10"	25.56	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"	27.82	16.50
3560	60"	30.77	18.50
3572	72"	33.26	19.95

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SFN1 Finishing to 1 1/4"	349	269
SFN2 Finishing to 2 1/4"	529	398
SN2 Sheathing - Siding, etc.	525	395
M2 All Purpose	440	330
SN4 Const. Framing, etc.	635	485
LS2 Moulding & Trim	325	259
LS4 Moulding & Trim	330	265

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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

JORGENSEN BAR CLAMPS

Model	Jaw Length	List	Sale	Box of 6
#3706	6"	7.88	5.50	29.70
#3712	12"	8.73	5.95	32.13
#3718	18"	9.64	6.95	37.53
#3724	24"	10.54	7.35	39.69
#3730	30"	11.76	8.25	44.55
#3736	36"	12.85	8.95	48.33

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Model	List	Sale	Box of 12
#50 for 1/4" Black Pipe	1123	7.15	79.00
#52 for 1/2" Black Pipe	936	6.10	67.50

••MAKITA NEW TOOLS••

Model	List	Sale
60920W Cordless Driver Drill Kit 2 Spd-var spd rev w/o clutch complete w/case	208	106
60930W Cordless Driver Drill Kit 2 Spd-var spd rev and 6 stage torque setting complete w/case	224	119
68910W Cordless Drywall Screwdriver Kit 0-1400 R.P.M.-Lt. weight - 2.9# complete w/case	204	109
3620 1 1/4 H.P. Plunge Router 7 1/2 amp-24000 R.P.M. complete w/case	166	89
4302C Electronic Jig Saw orbital var spd 6 amp	256	139
5077B 7 1/4" Hypoid Saw (similar to worm drive) 13 amp-4300 R.P.M.	250	133

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Model	WORM DRIVE SAWS	List	Sale
3050	6 1/2" 12 amp - 4600 rpm	247	169
3051	7 1/4" 13 amp - 4300 rpm	232	151

Killer drill press—Vern Johnson of Fort Worth, Tex., wrote to tell of a dangerous experience as he tried to make the crescent-shaped bandsawn box we featured in *FWW* #65. The drawers in the box pivot on 1/8-in.-dia. dowels that extend through the box from top to bottom. To drill the 6 1/2-in.-deep holes, he mounted a 1/8-in.-dia., 12-in.-long drill bit in his Sears drill press, setting the speed at 4600 RPM, in accordance with the diameter/speed chart on the drill press. When he started the bit, it began to whip in an arc, suddenly bent 90° and shattered, sending bit shrapnel flying through the shop.

Johnson had overlooked “Do not exceed 2700 RPM,” in small type on the drill package and, following his adventure, would like to urge other readers to read labels and take them seriously. *FWW* editor Paul Bertorelli could back this up. Once he tried to use a bit extension in his drill press, disregarding the notice on the package that said “Do Not Use On Drill Press.” The extender, a 13-in. rod of 5/16-in. steel, tipped with a sharp spade bit, got off-balance and began to bend out sideways in an ever-increasing swath until it finally wrapped itself around the drill-press column.

I myself have indulged in the bad habit of not clamping the work. If the work shifts, vibration sets in and then I'm in trouble: Do I let go of the work to turn the machine off? Do I let go of the quill to reach over awkwardly for the switch, possibly allowing centrifugal force to bend the bit further, and certainly ruining the bit's entrance hole? Do I try to tough it out? Fortunately, when this condition occurs on my cheap import drill press, the chuck falls out, so I've never been hurt. But I'm going to read all the small print from now on, and regard my drill press with a lot more respect.

A gritty tip—Mark Knudsen, who writes about production turning in this issue, just phoned in a neat tip that makes his favorite sandpaper work even better. The sandpaper, which is described in the article, is resin-bonded and cloth-backed for durability. It lasts so long that clogging, rather than wear, often determines its useful life, especially when turning woods such as pine. Knudsen uses the paper in strips two or three inches wide, and his cure for clogging is to tape a couple of the strips into a loop, mount them on his belt sander, then hit them with a rubber dressing stick. He got the idea from fellow-turner Tony Lisac, who regularly hand sands on the lathe with sanding belts, which, come to think of it, isn't a bad idea either.

Need many holes?—The multi-spindle drill head (shown on p. 61 of *FWW* #67), used for drilling rows of holes for hard-ware mounting in the 32mm cabinet system, has attracted enough interest that we thought we'd better give a source. It's made by Ritter Manufacturing, Inc., 521 Wilbur Ave., Antioch, Calif. 94509; (415) 757-7296. The drill head, model R-12, costs \$700 and can be ordered in versions that drill a row of 12 holes on either 32mm or 2-in. centers. It clamps to most drill presses that are 14 in. or larger. Ritter representative Bob Wcislo explained that the company also makes a model R-2, a two-spindle head with standard 3-in. spacing between bits, for \$275, or will custom build any model you'd like. When I asked what the R-2 was good for, he answered, “Hey, if you make a lot of cabinet doors, there's your door-pull screw holes.” Drawers, too.

Musical notes, woods and books—Dick Boak of the Martin Guitar Co. called with some observations about the guitarmaking article in *FWW* #67. He, like most of the suppliers listed, will help customers choose the appropriate grade and species of wood for a guitar. For woodworkers who are tempted yet daunted by the idea of making an instrument, Boak suggests buying some parts pre-cut or pre-bent, or even buying the entire instrument as a kit. Boak has written a kit-assembly

booklet (\$6 ppd. from C.F. Martin, Box 329, Nazareth, Pa. 18064; 800-345-3103) that has numerous hints and shortcuts for instrumentmakers—for example, you don't need to make an elaborate mold if you're making just one guitar. Also, Boak points out, if you don't feel at home in the metric system, it's easy to convert millimeters to decimal inches—just divide by 25.4—and then you can measure with a dial-indicator caliper.

A couple of related items: Exotic Woods Co., listed as a supplier, has moved to Box 532, Sicklerville, N.J. 08081. David Russell Young's book has gone out of print with the original publisher, but is being reprinted by Bold Strummer, 1 Webb Road, Westport, Conn. 06880; (203) 226-8230. William “Grit” Laskin, author of the article, has just reviewed prepublication proofs of *Guitar Making: Tradition and Technology* by William Cumpiano and Jon Natelson. He is pleased to report that the 385-page book is the most complete manual he's seen. It's available for \$52 ppd. from Rosewood Press, 85 N. Whitney St., Amherst, Mass. 01002; (413) 253-2286.

Laminated bracelets revisited—A number of readers have shown interest in Richard Schneider's laminated bracelets (*FWW* #61). A previous Follow-up column gave Schneider's technique for dyeing veneer. Now here's a variation on cutting and setup from Karl Chervenka of Marion, Iowa.

Chervenka noted that veneer layers bandsawn from the edge of the stock show mostly endgrain when laminated. This dulls the colors. So he cut his veneers from endgrain, which allows the brighter side grain to show in the finished bracelets, as



The colors in the bracelet on the right are crisper than in the other bracelet because the laminations are endgrain slices. Necklace beads are made from 'waste' center of blank.

shown in the photo above. These slices are fragile, so Chervenka says to be sure to cut some extra.

The slices are glued up with epoxy in an overlapping pattern that forms the S-curve when the bracelet is turned. Schneider uses a single central dowel to index the layers, then turns smaller bracelets and rings from the center “waste” of the stack. Chervenka used a second index dowel about 1 in. from the center, which makes alignment more certain during glue-up. He then salvages the waste by using a plug cutter to cut beads for necklaces. The pattern on each bead varies according to what part of the block it is cut from.

We missed Wilke—We inadvertently missed listing David Wilke's Bridgewood line of dust collectors in the article in *FWW* #67. Wilke imports six machines in both regular and heavy-duty models, from 1 HP to 3 HP, ranging in price from \$259 to \$695. He also sells flexible plastic hose, T-fittings, Y-fittings, metal ducting and blast gates. You can get his catalog by writing to Wilke Machinery Co., 120 Derry Court, York, Pa. 17402; (717) 846-2800. □

Jim Cummins is an associate editor of Fine Woodworking.

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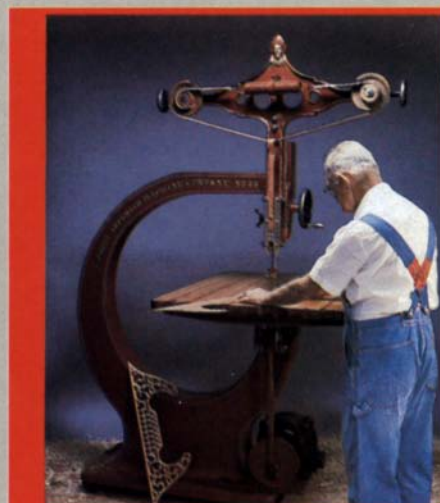
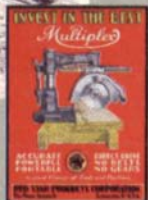
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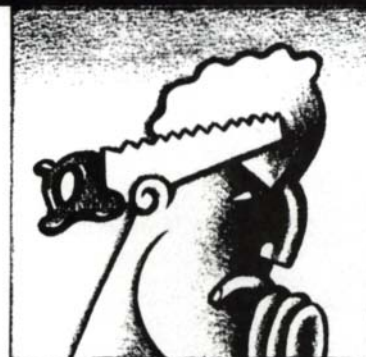
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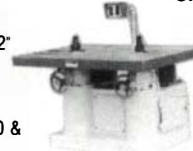
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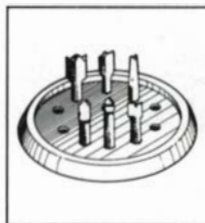
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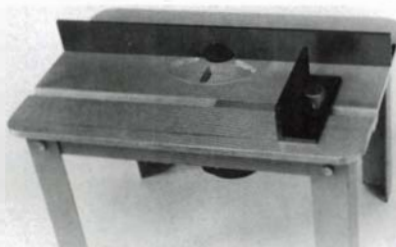
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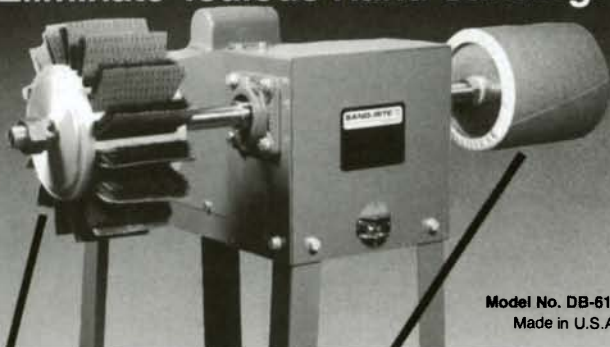
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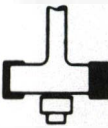
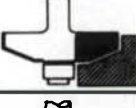
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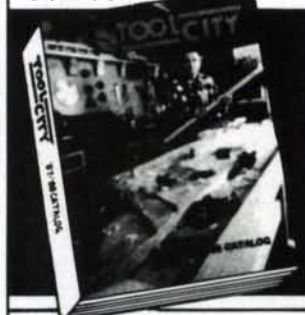
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How to choose (and use)

We've spent a lifetime designing and manufacturing carbide tipped saws for every conceivable cutting application. Much as we love our blades, we've come to the conclusion that what people really want is not saw blades but smooth cuts. Here's how to choose the SystiMatic blade that will give you exactly what you want:



Let's talk about teeth.

Ripping teeth are square cut across the top and rake through the cut like chisels. Cross-cutting teeth are beveled across the top and cut the wood fibers across the grain like a knife cutting celery stalks. So-called triple chip teeth are groovers—square topped with the corners off and slightly long to groove a stabilizing channel in the middle of the cut. Exactly how we mix, match, modify and combine these teeth determines the purpose and performance of each individual blade.

First step: What are you cutting?

Solid wood, plywood, particle board, plastic overlays, solid plastics or metals? If you're cutting solid wood, are you cross-cutting or are you ripping? If it's plywood or overlays how critical is chipping?

SystiMatic makes blades that are specifically designed to give the smoothest possible cut for each of these applications. We also make multi-purpose combination blades that give remarkably smooth results—but NOT as smooth as the blade that's designed for each specific application.

So now what you need to decide is...

How smooth a cut do you really want?

Generally the more teeth on a blade the smoother the cut. But as you increase the number of teeth, you also increase the cost of the blade, the amount of machine force and human force to feed the work through the saw. Other factors that influence performance include subtle but important variations in the geometry of the teeth. An acutely sharp-angled tooth, for example, shears more cleanly but dulls more rapidly. (In saws as in life, there's no free lunch.)

Do you need or can you afford more than one blade?

If you've never owned a SystiMatic blade and do general shop work we think you'd be absolutely thrilled with the cross-cut and rip performance of our ten-inch Budke Blade (four alternate-bevel teeth and one raker).

But if you're doing fine cabinet or furniture making, you probably will want to have one or more specialized blades. A Plymaster (ten alternating bevel teeth plus one raker) which produces wonderfully smooth chip free cuts in all types of veneers and solid woods. If you need to do precise ripping, you'll want one of our Glue-Joint Rips—square-cut rip teeth alternating with triple-chip teeth for very smooth rips. Or perhaps our Heavy Duty Rip designed for fast ripping of all types of solid wood.

Have a chop saw? We make special blades for these machines to cut wood, plastic or metal with superior speed and smoothness.

If you have a general purpose cabinet shop or well-equipped home workshop we'd probably recommend a Budke Blade for general cutting, a Precision Trim

blade for very smooth crosscutting and a Glue Joint Rip for fine ripping. (But again, what are you cutting and how

smooth do you really want? Yearn for absolutely the smoothest possible cross-cuts and hang the expense? Choose our Finish Saw.)

All in all, SystiMatic manufactures twelve standard designs in diameters ranging from 8 to 20 inches. (We also make a wide range of custom saws for specialized industrial cutting applications including sawmill blades up to 30 inches in diameter! Sawblades are our *only* business.)

How to get the best results.

If you're going to spend the money to get a great blade, also be sure to take the time to make sure you and your tool are set up properly.

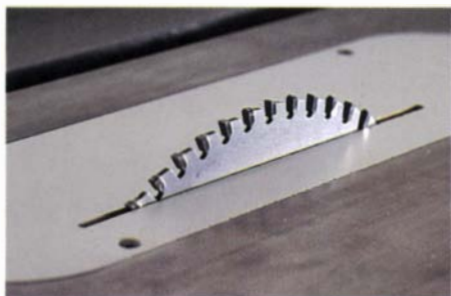
Mount the blade very carefully. Make sure that the collars are flat, clean and smooth—no burrs. Now then, very, *very carefully*, check the arbor trueness with a micrometer or other precision tool. An appalling number of the bargain priced table and radial arm saws actually have slightly wobbly shafts that will compromise every cut. Then check that the motor is mounted perfectly square to the direction of travel on the saw bed. The blade can't cut smoothly if it's cattywampus to the work.

Next, on table saws, check the trueness of your fence. It *must* be parallel in order to produce the smoothest possible cut on both sides of the blade. (If you're just trimming off one side of plywood veneers, you can use the old cabinetmaker's trick of setting up your fence just a few thousandths off so that the teeth coming out of the cut on the "keeper" side don't touch the wood. But unless you're doing it on purpose, don't do it.)



FREE CATALOG: Our new catalog contains a complete listing of all our stock blades and all the sizes in which we make them. For your free copy and the name of your nearest SystiMatic dealer or professional saw shop, please call us toll free at 1-800-426-0000.* Ask for Extension 80.
*Except Alaska.

a SystiMatic saw blade.



Cutting at the right speed is critical.

It depends on the material and the blade, but there's an optimum feed rate for every case. If you feed too slowly, the blade creates too much friction, heats up, causes pitch build-up and dulls the teeth. (Instead of tiny chips you'll get powder maybe even smoke.) So feed as fast as you and your machine comfortably can. It's a matter of touch, but remember that a properly cutting blade actually stays cool.

Keep your blades sharp. Your professional saw-sharpening shop can help you keep your SystiMatic blade in perfect condition. Production blades running day-in and day-out generally require resharpener every month or so. In a home workshop, carefully used SystiMatic blades may never need sharpening. But remember that having a good saw shop is like having a good doctor—wonderful when you need them. We'd be happy to recommend one.

Made In America!

We'll put our SystiMatic blades up against any other blades in the world. They're designed by computer, cut out by laser, precision ground on automated machines. But when it comes right down to it they're produced by *people*—skilled American workers who are determined to make the best saw blades on earth!



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Next, take the time to make your own center plate—a perfectly flush wood insert with minimum clearance on either side of the blade to support the wood fibers right up to the edge of the cut. It reduces splintering problems remarkably.



Always be sure that your blade is raised to the proper height—the bottom of the gullet of the blade should be approximately a quarter inch through the piece being cut. The gullet works like a bucket to remove sawdust from the cut. So to do its job it must be set high enough to rotate out of the material.



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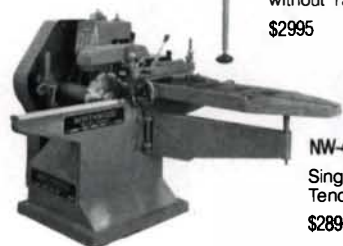
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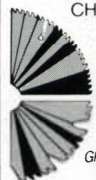
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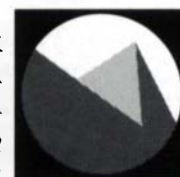
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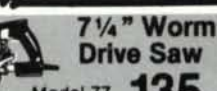
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52.



691	1-1/2 HP router, d-handle	129.
505	1/2 Sht pad sander	105.
352	3"x21" dustless belt sander	124.
362	4"x24" dustless belt sander	199.
603	3"x24" wormdr. bit. sand. w/bag	339.
314	4-1/4" Trim saw	119.
315-1	7 1/4" Top handle saw	99.
548	Heavy duty bayonet saw	180.
7548	VS, var. orbit, d-handle jigsaw	119.
7548	VS, var. orbit jigsaw	119.
9827	2-Spd. Tiger saw w/case	130.
9829	Var. spd Tiger saw w/case	138.
622	VSR fastener drill/screwdriver	119.
655	Drywall driver, 0-4000 rpm	85.
7523	Pos. clutch screwdriver	135.
7542	TEKS Driver	119.
7545	VSR Drywall driver	105.

SKILSAW

7 1/4" Worm Drive Saw
Model 77
135.



5825	6-1/2" Worm drive saw	135.
5510	5-1/2" Trim saw	83.
5750	7-1/4" Circular saw	114.
5790	10-1/4" Circular saw	229.
5885	8-1/4" Circular saw	159.

FREUD

90-100	15 pc. router bit set	159.
94-100	5 pc. router cabinet set	189.
CS112	12 pc. carving set	109.
DB-050	50 pc. comb. drill bit/brad pt. set	59.
DS-306	8" dado	99.
DS-308	8" dado	115.
EC-900	5 pc. door making shaper cutter set	319.
FB-100	16 pc. Forstner bit set	179.
LM72M0088	x24T tip	36.
LM72M01010	x24T rip	39.
LU73M010	10"x80T ATB	43.
LU78M008	8"x84T TCG gen. purpose	59.
LU82M010	10"x60T TCG	45.
LU84M008	8"x40 4&R combination	44.
LU84M011	10"x50T 4&R combination	40.
LU85M008	8"x64T ATB fine cut-off	54.
LU85M010	10"x80T ATB fine cut-off	65.
LU85M014	14"x108T ATB fine cut-off	105.
PS203	7 1/4" x24T ATB gen. purpose	19.
PS303	7 1/4" x40T ATB gen. purpose	23.
TT108	8 pc. turning tool set	49.
WC108	8 pc. chisel set	30.

Milwaukee

3/8" VSR Drill
model 0222-1
98.



0212-1	3/8" VSR cordless w/clutch	125.
0214-1	3/8" cordless drill w/clutch	125.
0224-1	3/8" Magnum holeshooter	109.
0234-1	1/2" Magnum holeshooter	112.
0375-1	3/8" close-quarter drill	119.
1878-1	Hole-hawg kit	235.
3002-1	Electricians rt. ang. drill kit	175.
3102-1	Plumbers rt. ang. drill kit	180.
5397-1	3/8" VS hammer drill kit	149.
9875	Heat gun	54.
5890	2 hp router	220.
5925	3" x 24" dustless belt sander	219.
5925	4" x 24" dustless belt sander	225.
6012	1/3 Sheet pad sander	114.
6014	1/2 Sheet pad sander	119.
6215	16" Electric chainsaw	145.
6225	2 speed bandsaw w/case	279.
6245	Single speed jigsaw	125.
6258	Variable speed jigsaw	140.

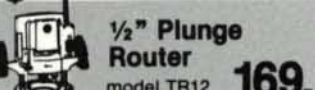
2 Speed Sawzall
model 6511
119.



6507	Var. spd. sawzall w/case	129.
6305	6 1/2" cordless circular saw	135.
6385	7 1/4" top handle circular saw	105.
6405	8 1/4" circular saw	127.
6530-1	Cordless screwdriver	59.
6543-1	VSR Screwshooter	145.
6750-1	VSR Drywall driver	89.
6754-1	VSR Magnum drywall driver	115.
6798-1	Adj. clutch screwshooter	115.

HITACHI

1/2" Plunge Router
model TR12
169.



C8DA	6 1/4" cordless circular saw	119.
F20A	3-1/4" Plane w/case	89.
TR6	Laminate trimmer	85.
TR8	1 1/4" Plunge router	119.
CR10V	VS, Var. orbit reciproc saw	115.
DR10V	3/8" Cordless drywall screwgun	85.
W6V1	0-4000 drywall screwgun	89.

Deluxe 10" Miter Saw
model C10FA
279.



C15FB	Deluxe 15" miter saw	369.*
F1000A	12" Planer/6" jointer combo	1349.*
CB75A	Band saw	1499.*
C12Y	12" Table saw w/o motor	1189.*
C12Y	12" table saw w/3 HP Hitachi motor	1269.*
P100F	12" Planer	919.*

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10" Portable Planer
model AP10
359.



RA200	8" portable radial arm saw	239.
L120U	3-5/8" Planer kit	89.
R500	2 1/4" HP plunge router	149.
R150K	1 HP plunge router kit	89.
TR30U	Laminate trimmer	75.
B7075K	3"x21" Belt sander kit	109.
S500A	Finishing sander, 1/6 sheet	35.
TS251U	10" Miter saw	159.
TS380	14" Miter saw	339.

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Plating Joining Machine
169.



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Model MU-212-F
259.



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449.



Emclo



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model AM39-HC4
269.



David White Instruments



Sight Level Package
229.



7 1/4" Super Saw Cat
model 3047-09
165.



3034
7 1/4" Builder's saw cat
3061
7 1/4" Worm drive saw
2034
0-4000 VSR drywall gun
3105
Var. speed cut saw
3834
14" Chop saw
9425
8 1/4" Compound miter saw
7790
12" Contractors radial arm saw
799.*

3034
7 1/4" Builder's saw cat
3061
7 1/4" Worm drive saw
2034
0-4000 VSR drywall gun
3105
Var. speed cut saw
3834
14" Chop saw
9425
8 1/4" Compound miter saw
7790
12" Contractors radial arm saw
799.*

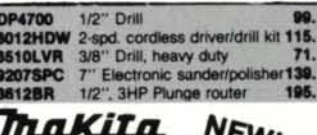
7770-10
10" Contractors radial arm saw
649.*

Thakita

VS Cordless Driver/Drill w/ Clutch Kit
model 6093DW
129.

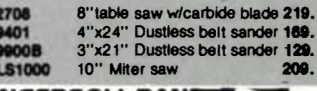


NEW! 7 1/4" Framers Saw
w/hypoid gears
model 5077B
135.



2708
8" table saw w/carbide blade
9401
4"x24" Dustless belt sander
9900B
3"x21" Dustless belt sander
LS1000
10" Miter saw
209.

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Orbital Air Sander
model 312
49.



315	Straight line air sander	65.
311	6" dual action quiet air sander	45.
223	1/2" HD air impact wrench	49.
308	Air die grinder	49.
7802	3/8" HD air drill	59.
6360A	1/2" 13pc std. socket set	21.
6370M	1/2" 13pc. metric socket set	21.

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2/0 7" JORGENSEN h/screw	8.95	48.35
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TD 514	12" Dovetail jig, through	125.
TD514L	24" Dovetail jig, through	195.

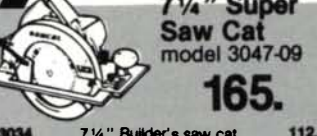
Drywall Screwdriver
0-4000 rpm
model SCR11E
79.



H85E75S	3x21 VS Belt Sander	135.
EZ502	Cordless screwdriver	59.
EZ506	3/8" Cordless drill-screwdriver	109.
SB2E13RL	1/2" Hammer drill	109.

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7 1/4" Super Saw Cat
model 3047-09
165.



3034	7 1/4" Builder's saw cat	112.
3061	7 1/4" Worm drive saw	145.
2034	0-4000 VSR drywall gun	75.
3105	Var. speed cut saw	119.
3834	14" Chop saw	195.
9425	8 1/4" Compound miter saw	115.
7790	12" Contractors radial arm saw	799.*
7770-10	10" Contractors radial arm saw	649.*

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Var. Speed Var. Orbit Jigsaw
model 1581VS
126.



1582VS	VS, Var. orbit jigsaw	118.
3238VS	VS, var. orbit std. duty jigsaw	79.
1851	7 1/4" Builders circular saw	99.
1500	16 gauge shears	185.
1520	16 gauge pistol grip shear	125.
1942	Heavy duty heat gun	59.
3268	Std. duty heat gun	49.
3258	3 1/4" Power plane	99.
1800	2 1/2" HP, D-handle router	245.
1804	1 1/2" HP Router	115.
1808	1 1/2" HP, D-handle router	128.
90300	3/4" HP Production router	295.
1809K	Laminate Trimmer installer's kit	159.
1808	Offset base laminate trimmer	115.
91084	3/8" Mighty Midget VSR drill	69.

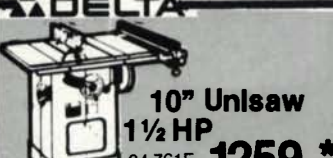
Tilt Base Laminate Trimmer
Model 1608T
89.



91086	1/2" Mighty Midget VSR drill	99.
1158VSR	3/8" VSR Drill	59.
1920VSRK	3/8" VSR Cordless drill	95.
1921VSRK	3/8" Cordless drill w/clutch	115.
1196VSR	3/8" Hornet 11 hammer drill	109.
1196VSR	1/2" VSR hammer drill	115.
11203	1 1/2" Rotary hammer	389.
11212VSR	5/8" VSR bulldog SDS rotary hammer	175.
11304	Brute breaker hammer	1249.*
11305	Demolition hammer	599.
1272D	3" x 24" dustless belt sander	159.
1273D	4" x 24" dustless belt sander	189.
1288-034	Orbital finishing sander	109.
3270D	3" x 21" dustless belt sander	99.
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1259.*



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679.



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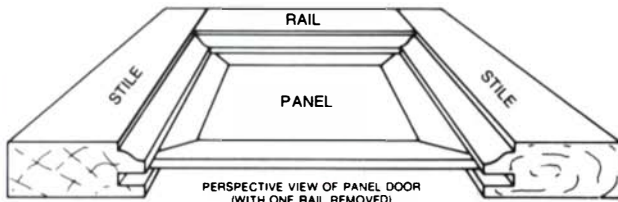
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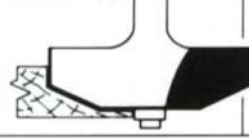
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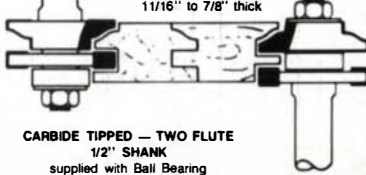
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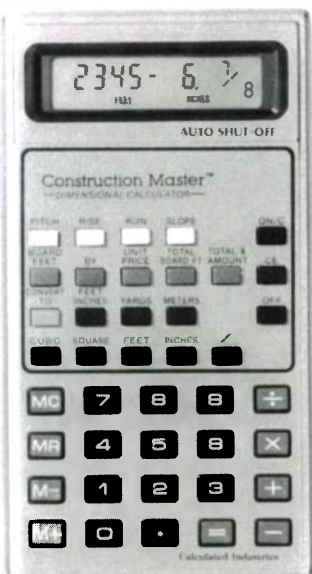
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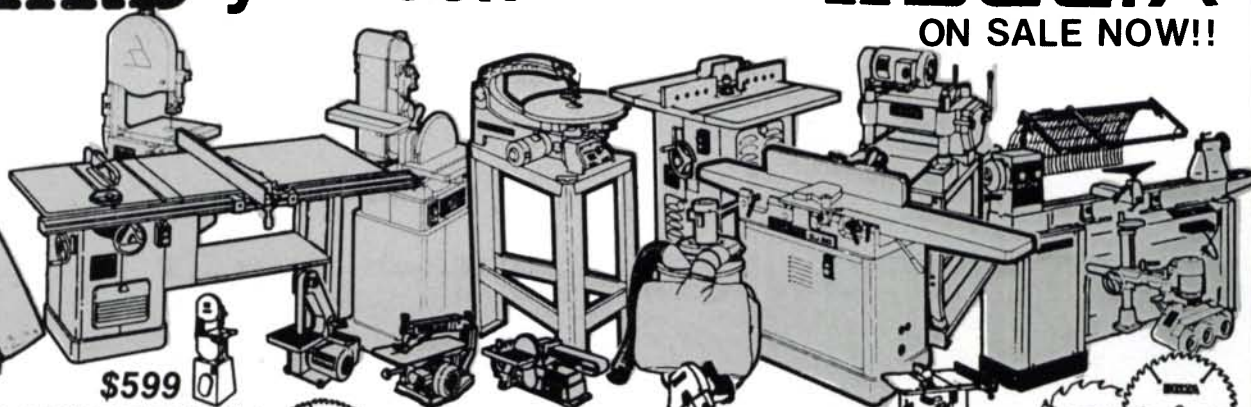
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Building a Chest of Drawers

Joinery and design considerations

by Christian Becksvoort

Anyone who has worked with wood knows that building a piece of furniture involves a series of decisions, from choice of wood, to design and construction details, to selecting the final finish. Even if you build identical pieces over a period of years, you'll probably find yourself making small changes each time—perfecting the proportions, or perhaps just exploring different joineries. In this article, I'll discuss the range of decisions and processes involved in designing and building a chest of drawers, as well as presenting some of the methods that I employ.

One of the first things to consider in designing a chest—and perhaps the most subjective part of design—is the chest's overall appearance. You should style the piece to suit your tastes or to fit into the decor of the room the chest will inhabit. Since I live near one of the last two Shaker communities and have restored several original Shaker pieces, my designs show the strong influence of their simple, unadorned style. I prefer my furniture to

By manipulating the design, construction, and materials, a chest of drawers can be built for any purpose or to fit into any decor. The trim lines of the author's cherrywood chest, left, display the usual austerity of the Shaker style. Inside the chest, below left, web frames support the drawers and add rigidity to the carcass. A dust panel fitted into the bottom frame keeps the chest clean inside. The finished back, below right, is built like a door and permanently fixed to the edges of the carcass, allowing the chest of drawers to be freestanding.



have clean, functional lines that are more at home in a wide spectrum of settings than avant-garde or strictly traditional forms. One nice thing about Shaker-based designs is that you can begin with a basic carcass, then manipulate details like tops, moldings and bases for different effects. Moreover, Shaker construction techniques are sound and durable, yet not so involved that a novice can't employ them.

I begin a chest design by considering what will be stored in it, since the number and size of drawers will determine the chest's overall size. Bulky items, like clothes, will require deep drawers, while smaller items will do well in a larger number of shallow drawers. Casepieces vary widely in their approach to drawer storage. Most chests, however, have drawers of graduated depth, with the deepest drawers at the bottom, the shallowest at the top. This serves to anchor the case visually and keeps the heaviest objects in the lower drawers. Instead of a single shallow drawer at the top of the case, Shaker cabinetmakers often used a pair of drawers, separated by a vertical divider.

Storage capacity and where the chest will be—freestanding, against a wall, at the foot of a bed—will dictate the overall size of the case and its dimensions. Proper proportions are important to the success of a chest design. If you aren't confident about what dimensions to use, measure a piece similar to the one you want to build or find a successful design in a book and go from there. One worthwhile option is to rely on the standard dimensions for furnishings in *Architectural Graphic Standards* by Ramsey and Sleeper (John Wiley & Sons, Inc., 605 Third Ave., New York, N.Y. 10158). The volume costs more than \$100, but most larger libraries have a copy. If you need the size of an average dresser, school chair, or even a tuba, it's all there in 750 invaluable pages. Another useful source for design standards is *Human Factors Design Handbook* by Wesley E. Woodson (McGraw-Hill, Inc., 1221 Ave. of the Americas, New York, N.Y. 10020).

When design standards don't suggest useful solutions, you'll have to dimension the piece. Sketching on note pads is a good way to do this. If you are more comfortable with scale or even full-size drawings, by all means use them. They often help uncover tricky details you might otherwise overlook. As a general rule, square shapes don't work well visually for chests—they appear monolithic and squat. However, a chest with a relatively squarish front—that is as wide as it is tall—can still look fine, as long as its depth is less than about a third of its height. Rectangular shapes, for both the chest's front and side views, are far more pleasing than squares. And rectangles based on the golden mean are an excellent starting place. The golden mean is the oldest and most widely understood proportioning method and can be expressed as a simple ratio: 5 to 8. Thus, a golden rectangle is one whose short side measures 1.0 to the long side's 1.6.

In instances where a chest's frontal dimensions aren't fixed by spacial constraints, it makes sense to build proportions around drawer depth. Generally, a drawer for clothes should be 16 in. to 20 in. deep and about 10 in. to 12 in. high. A deeper drawer has two drawbacks: you have to take an awkward step back to open it fully; and the carcass will have to be unpleasingly deep to accommodate the drawers. Very shallow drawers, say less than 14 in., are also a problem. It's too easy to accidentally pull them entirely out of the case, dumping the contents on the floor. Unless there's a concrete reason to do so, such as having to store large sheets of paper flat, I don't alter basic drawer dimensions much.

A case can be as wide as it needs to be, but drawers themselves shouldn't be much wider than 40 in.; otherwise they tend to twist

in the opening and bind. Wide cases can have two side-by-side drawers with a vertical divider between them.

In casework, as in any furniture, the basic construction of the carcass affects both the look and the function of the piece. As is the case in designing anything, there are many paths leading to the same point. Your choice of joinery for instance, will depend on your level of skill or the amount of time you want to spend. Material selection also plays a role in joinery methods. Although you may choose to use flat, dimensionally stable plywood, the following discussion of joinery will focus on solid-wood methods, which I prefer. Once its movement is understood and allowed for, the advantages of solid-wood joinery and grain selection far outweigh the drawbacks, in my opinion.

All of the Shaker casework, and virtually all of the 19th-century furniture I've worked with, is constructed in one of two ways, with solid-wood carcass sides or by solid-wood panels let into frames. I use both methods, but I'll focus here on what I call slab-sided construction. For more on frame and panel Shaker construction, see *FWW* #58. Figure 1 shows the basic anatomy of a solid-wood chest of drawers. The construction is really quite simple, and once you've decided on the design of your chest, you have only to select the joinery appropriate to the material and details you wish to employ.

Although the Post-Modern design movement has revived interest in the use of architectural details and moldings on furniture, I prefer relatively unadorned designs. Still, a simple carcass lends itself to a variety of subtle details. To a large extent, these details will determine the kind of joinery you use to assemble the carcass.

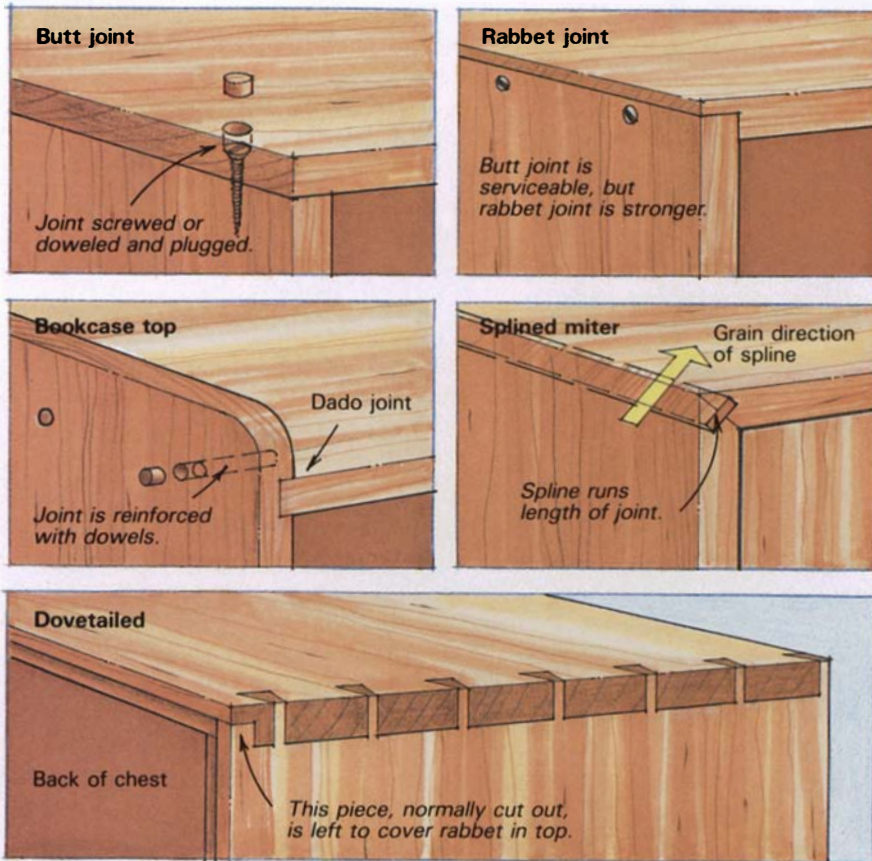
I prefer to join the top with dovetails, because they are strong and decorative. But they aren't absolutely necessary and there are several other options, as shown in figure 1A. The easiest, perhaps, is the butt joint. When it's screwed and plugged or doweled, it's more than strong enough to properly join the case together. The rabbet joint is slightly more work, and if planned correctly, it can be screwed from the side. A splined-miter joint, although strong, is tricky to cut if the panels are even slightly warped. Another more contemporary-looking top joint is what I call a bookcase top, where the carcass sides extend beyond the top, which is let into the sides with a dado, a rabbet and groove, or if you're ambitious, a sliding dovetail.

Moldings can define edges and corners, crown or "set off" tops, break up monotonous surfaces, or cover up dowel and screw holes (see figure 1B). Further, even a simple cove molding can define the top of the case, without giving it the look of a period piece. A molding carried around the top edge of the carcass is another design option. Obviously, this introduces cross-grain construction—the carcass side will shrink and swell, eventually loosening the molding. I've yet to see an old chest that hasn't succumbed to this problem. So if you choose to use a molding, you'll have to live with it. I glue the miter and about the first 1½ in. of the moldings, and nail the rest with brads or finish nails. The nails allow some wood movement. Another way of having a molded top without worrying about it falling off is to build an applied top. Attach the top anyway you choose, such as with blind dowels or tenons. In any case, there's no cross-grain problem since the top moves in the same direction as the carcass sides.

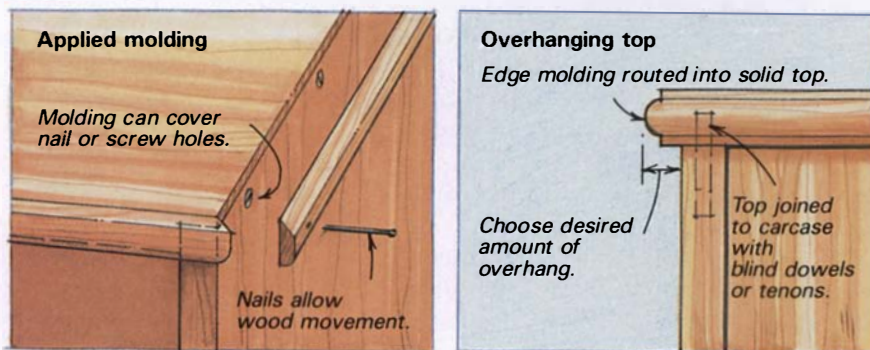
Deciding on the base presents another series of choices and figure 1C illustrates some options. A dovetailed case can sit directly on the floor, with or without a molding at the bottom edge. This is neat, since you don't have to dust under the case, but it can look heavy and the chest won't sit flat on an uneven

Fig. 1: Chest-of-drawers design options

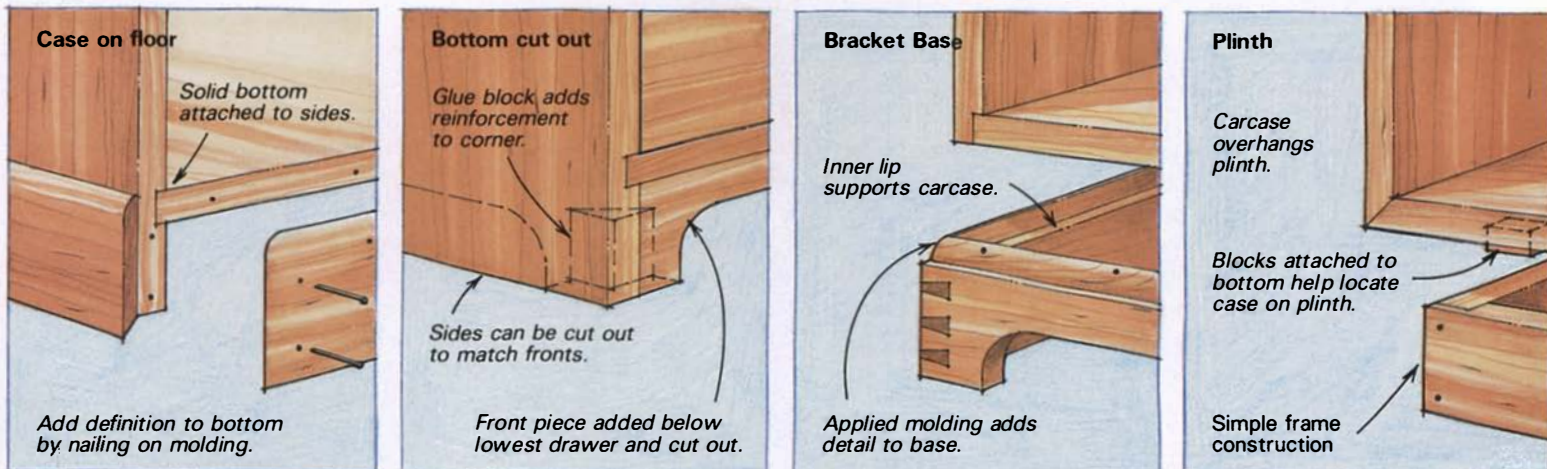
A. Joinery options



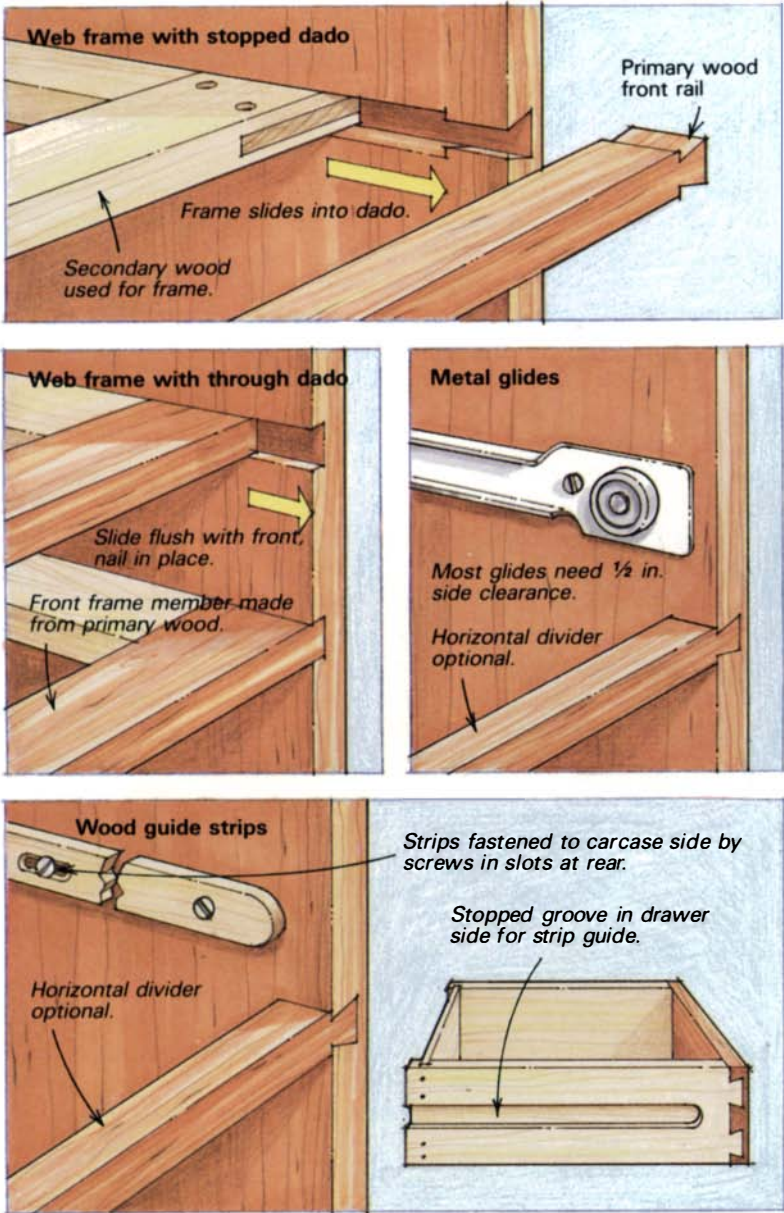
B. Molding edge treatments



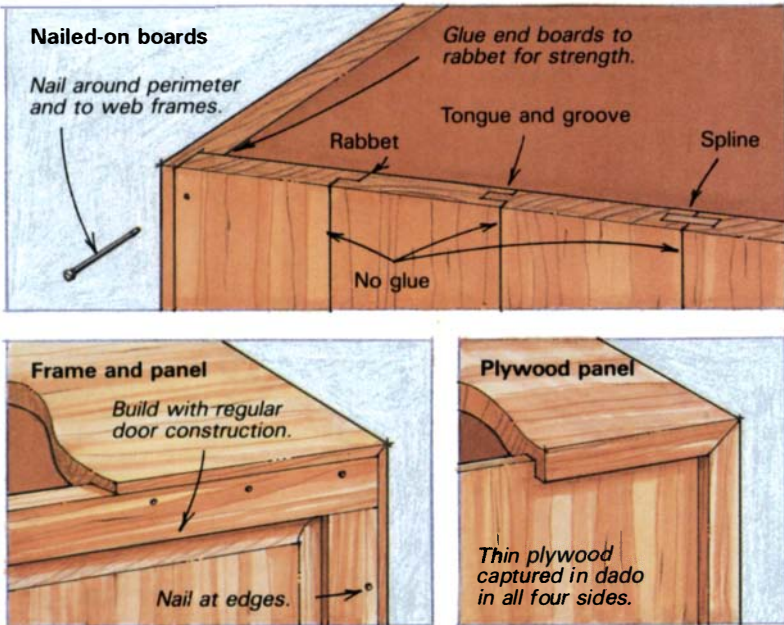
C. Base options



D. Drawer-mounting options



E. Backs



floor. To add visual lightness, you can raise the case a few inches off the floor using any of several methods. One easy-to-make raised base is the plinth, which is simply a frame slightly smaller than the footprint of the case bottom and 3 in. to 5 in. high. The plinth is a good contemporary treatment that would probably go nicely with a bookcase top. Another way is to shape cutouts at the front and/or sides of the chest. In this case, a web frame or solid bottom of the carcass will have to be joined to the sides using one of the joints suitable for a bookcase top. Besides giving the chest some visual lightness, shaped feet also raise the bottom drawer so it won't drag on the floor upon opening. The most involved base treatment I use is the traditional bracket base. Bracket feet suffer from one major drawback—the back feet are bracketed only on one side, and pulling the chest across the floor can easily break them off.

I start building a chest by cutting and gluing up panels for the top and sides (and bottom, depending on the base). Once the glued-up sides and top panels are dry, I rip them to width. To cut the carcass sides to length, I usually clamp them together and cut both at once on the radial-arm saw. These cuts must be absolutely square. Checking for squareness along each step of the way is essential as minor errors early in the construction process tend to accumulate and cause real headaches later.

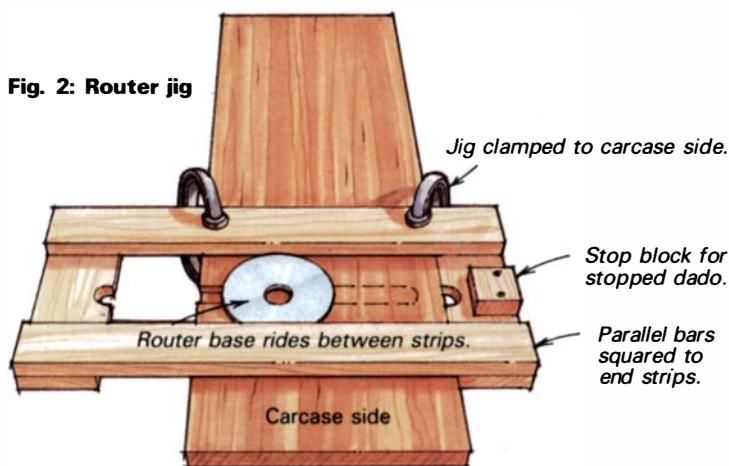
Lay out the interior of the carcass by clamping the two sides together so that all the edges are flush, and mark the positions of the drawers across the front edges. To figure vertical drawer spacing, first calculate the available drawer space—the total inside measurement of the carcass minus reveal at the top, width of the drawer rails and any applied moldings. Now divide this by the number of drawers to get an average drawer height. If you want the drawers to be evenly graduated from top to bottom, say in 1-in. increments, and you have an uneven number of drawers, figure the middle drawer will be the average height; each drawer above it will be 1 in. smaller than the one below it; and each drawer below it will be 1 in. larger than the one above it. If you have an even number of drawers, add ½ in. to the average drawer height for the drawer just below center and 1 in. to each drawer below it; subtract ½ in. from the average for the drawer just above center and 1 in. from every drawer above it.

Before assembling the basic carcass, you must decide how the drawers will be supported and what they will ride on (figure 1D). Then, prepare the inside of the case accordingly. Very early or primitive chests often had solid-board dividers or bottoms between drawers. Later, light wooden web frames let into the carcass were developed. These support each drawer and add stiffness to the carcass without excess weight. Another all-wood method involves mounting guide strips inside the case that ride in grooves cut into the drawer sides. This works well on banks of small drawers when you don't want to lose drawer height to all those web frames. But the drawer sides must be ¾ in. or thicker to accept the groove.

For fully extending drawers, such as file cabinets, you'll probably want to use metal drawer glides. These come in many styles and sizes (available from Grant Hardware Co., High Street, West Nyack, N.Y. 10994-0600 or Accuride, 12311 S. Shoemaker Ave., Santa Fe Springs, Calif. 90670). They're strong and easy to mount, but most require ½-in. clearance between the carcass and drawer, so drawer fronts must be wider than the drawers to cover the gap.

If you choose to use web frames (the method I prefer), you'll need to cut the dados before assembly. You can use a dado blade on the table or radial-arm saw, but if the sides have a slight

Fig. 2: Router jig



warp and won't lay flat, cut them by hand or with a router to ensure a consistent depth. For the router method, I made a jig with two parallel bars, spaced the width of the router base and about 30 in. long (see figure 2). The jig is clamped up square to the carcass side and a $\frac{3}{4}$ -in. bit ploughs a groove for the web frame at each location. The dado cuts can either be all the way across or stopped $\frac{1}{2}$ in. to $\frac{3}{4}$ in. shy of the front edge to allow the fitting of a drawer rail front strip, which I prefer.

Web frames can be four-piece assemblies, but on wider chests, a fifth center member adds stiffness to the carcass. Frames, as well as other interior parts, can be made of a secondary wood, such as poplar or pine. Measure the depth of the frame inside the carcass to the front edge, or to the stopped dado if you add the dovetailed primary-wood drawer rail across the front, as detailed in figure 1D. I mortise and tenon the joints, then glue and pin the frames for strength. Set the case on its back and cut, dovetail, and glue these into place. I prefer half-blind dovetails for a cleaner look on the side of the case, although through dovetails are acceptable and easier to cut. An easier option is to run through-dadoes across the sides and use primary wood for the front members of the frames.

High-style period pieces that have web frames are often fitted with dust panels, which are thin panels let into grooves in the web frames. The purpose of these dust panels is twofold: to keep clothing from getting tangled in adjacent drawers and to provide a barrier against dust. Some makers still use these dust panels, but I find them unnecessary. If I use a web frame, I do, however, install a dust panel for the carcass bottom.

Before the carcass is assembled, you need to decide on the kind of back it will have (figure 1E). Traditional chest backs consist of individual boards (secondary wood is fine) joined together, let into a rabbet and nailed in place. A spline joint is perhaps the best way to join the individual boards since it's easy to make and locks the boards against misalignment in both planes. Under no circumstances should the back boards be glued to each other—the whole idea is to let the boards move. Each board is simply nailed to the top, all web frames and bottom, and the nails are set. Freestanding pieces can have a frame-and-panel back built like a cabinet door out of primary wood and fit into the back rabbet. Panels can be flush, recessed or raised. A frame-and-panel back not only looks much better, but gives the case tremendous strength against racking.

Some notes on assembly—After all the dados are in the right places and of equal depth and web frames are identical in length, and square, the case should be dry clamped and tested for square. This is vital. If it's out of square, the drawers will be a pain to fit. Now's the time to find out. Check for square by

measuring diagonally from the top left to the bottom right corner and vice versa: The readings should be identical. If not, shift or clamp the “longer” dimension until they are. Sight across all the web frames to check for a warped case. This is seldom a problem, unless the top panel is severely warped.

To install the frames, turn the case back side up and slide each frame into its pair of dados. Drive and set a few finishing nails (6d if you're using $\frac{3}{4}$ -in. stock) at a steep angle through the frame into the case. Check the angle carefully, lest the nails come out the other side of the frame or, worse yet, out the side of the case. Even though the frame grain runs perpendicular to the case side, wood movement is no problem, since the nails allow for adequate movement. Purists who disdain the use of nails might use a sliding-dovetail joint instead. I have no problem with nails since they're found in almost all the traditional furniture I've examined.

I won't go into detail about drawer construction here; for that, I suggest you refer to *FWW on Things to Make*, pp. 20-24. However, I'd like to add a few of my own thoughts. First, I fit my drawer sides directly to the opening, making them about $\frac{3}{8}$ in. shorter than the case depth. I cut the two sides and front first, then run grooves $\frac{1}{4}$ in. to $\frac{1}{2}$ in. above the bottom edge to allow room for half a dovetail below the groove. Then I plane $\frac{1}{32}$ in. from the bottom edge of the drawer front to keep it from dragging on the drawer rail. I lay out the dovetails on the sides with half dovetails, top and bottom, and as many full dovetails as necessary in between. Avoid cutting one directly on the groove for the drawer bottom—that will leave a hole in the front. When the joints are cut, glued and assembled, measure the diagonals to check for square. After sanding, the bottom can be fitted. Make sure the grain runs side-to-side; if it runs front-to-back, any expansion of the bottom forces out the sides, weakens the joints and binds the drawer.

One trick sometimes found on old pieces is to let the bottom act as a drawer stop. The bottom extends $\frac{3}{8}$ in. to $\frac{1}{2}$ in. beyond the drawer, so it hits the case back. When the drawer is fitted, the bottom is trimmed until the front is flush. Seasonal moisture changes that cause the case sides to expand and contract will also make the drawer bottom expand and contract, and, in theory at least, the drawer fronts remain flush. Some makers install stops on the web frames that hit the inside top or bottom edges of each drawer, keeping it flush with the case front despite carcass expansion and contraction.

A final word on finishing: I like to belt sand with 120-grit and 150-grit, then vibrate to 220-grit and 320-grit, followed by hand-sanding with 320-grit and 600-grit. On some surfaces, I finish-scape using my secret weapon: single-edge razor blades (available in boxes of 100 from most paint or hardware stores). Those who don't care for the ritual of sharpening scrapers will find these blades a real boon. They're tremendously sharp and stay that way long enough to do one or two sides. They can then be tossed out or saved as glue scrapers. Although I use an oil finish, the finish you use is not as important as *how* you finish. All exposed surfaces, top and bottom, inside and out, must be finished, because uneven moisture absorption causes uneven wood movement and warping. Many antiques were not finished inside, yet they were seldom built in the Northeast and shipped to the Southwest, nor were they exposed to the forced-air heating common in modern homes. □

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Features that are built into most aftermarket rip fences, like the cam-action lever, hairline cursor and built-in tape measure on this Biesemeyer T-Square saw fence, provide fast, accurate means of one-handed setting and locking.

Replacement Rip Fences

Bolting new precision to your old tablesaw

by Sandor Nagyszalanczy

What are the hallmarks of a good tablesaw? Things like a true-running arbor and well-machined castings come to mind, but it's very easy to overlook the rip fence. Even relatively expensive tablesaws come with stock fences that aren't up to the same standards of design and quality built into the rest of the saw. Most stock fences have limited rip capacity, are cumbersome to set, are inaccurate and tend to drift out of parallel with the sawblade. Ripping on an otherwise great tablesaw equipped with a second-rate fence is like driving a Ferrari with bicycle tires—you can never realize the full potential of the machine.

Having recognized this, at least five manufacturers have developed high-quality, large-capacity replacement rip fences that they claim will cure the ills of a stock fence. For prices ranging from \$242 to \$425, you can bolt one of these aftermarket fences directly to your stock tablesaw just as you might install high-performance parts to soup up a stock automobile. But do these fences live up to the ad-copy claims and are they worth the money? I answered that question for myself two years ago, at least partially, when I bought a Paralok fence for my old Boice-Crane tablesaw. It worked beautifully and made ripping on the saw a real pleasure. But I wondered how well the other brands worked, so last summer I borrowed and installed fences made by Vega Enterprises and Excalibur and spent some time using saws equipped with the Biesemeyer T-Square saw fence system and the Delta Unifence. To back up my research, I interviewed owners of some of these fences.

Before I discuss my impressions of these replacement fences, however, it's worth explaining the problems each is intended to solve. Probably the chief shortcoming of most stock fences—even

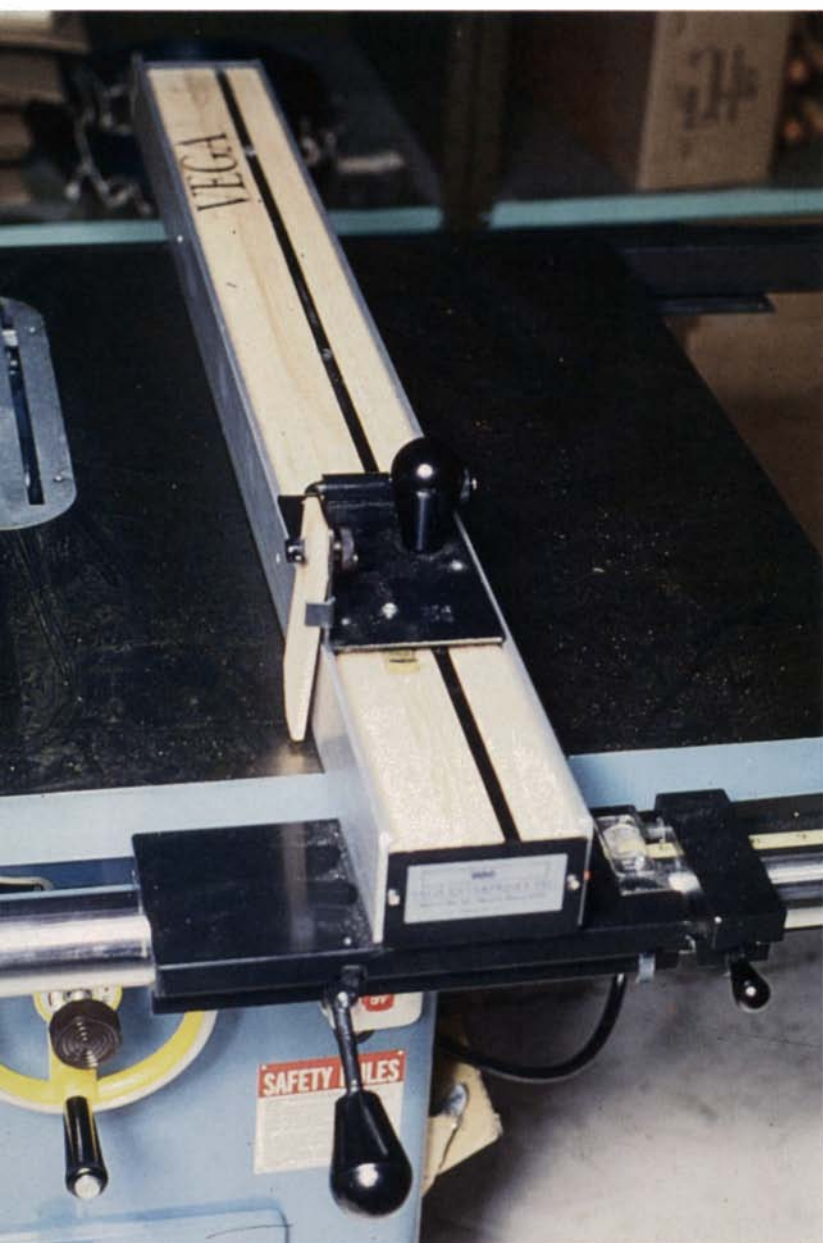
the better ones—is that they don't maintain parallel with the sawblade when locked down, either because the rip rails are misaligned or because of slop in the locking mechanism. This can sometimes cause the fence to toe in toward the back of the blade, binding the cut and burning the wood, or worse, causing a violent kickback. For the same reason, an out-of-parallel cut aggravates splinter and tearout when ripping plywood. All of the aftermarket fences go a long way toward correcting this, in fact, it's a major selling point, along with improved locking mechanisms that *keep* the fence parallel once it's set.

If you work much with 4x8 sheets of plywood, you know that a stock tablesaw's ripping ability is sharply limited by both its short rails and the lack of a large, stable surface to safely support a heavy panel. Replacement fences offer vast improvement: All of them have rails long enough to allow crosscutting to the center of a 4x8 sheet and can be fitted with extension tables on the right side of the blade. In addition, aftermarket fences have various other features, the nicest being built-in tape measures that allow setting rip width without tedious measuring. Between the five of them, there's a replacement fence to fit most common tablesaws, not to mention some worthy antiques like my 45-year-old Boice-Crane. Before buying, however, check your application with the manufacturer or dealer, just to be sure.

The Biesemeyer fence—Woodworkers, professional and amateur, owe a debt of gratitude to Bill Biesemeyer, who introduced the first affordable, accurate rip fence nearly a decade ago. Biesemeyer, a cabinetmaker and boatbuilder for 35 years, became thoroughly disgusted with stock tablesaw fences and decided to manufacture his



Except for its laminate-faced auxiliary fences, the Biesemeyer fence is built entirely of steel and is an available option on the Powermatic model 66, shown here.



The Vega fence has two locking levers: The smaller on the right sets the micro-adjusting mechanism, while the larger lever locks the fence to the rail. Vega's Finger Saver combines a push stick and a cut-off stop in a carriage that slides atop the fence bar.

own. His fence has been much imitated and serves as a point of departure for other manufacturers, but it was the pioneer in the field. And, at \$299 for the model 50, it's the second cheapest.

As its name implies, the Biesemeyer fence works much like a draftsman's T-square: with the fence as the square's blade and a chunk of steel angle iron as the head. This angle-iron head rides on a beefy rail made of square steel tubing, which bolts solidly into the front of the saw table. The fence bar itself, also made of tubular steel, is faced on both sides with laminate-covered plywood, a good safety feature. Unlike most stock fences, the Biesemeyer fence locks *only on the front rail*. Because of this, you'd think that the end of the fence, way out there on a 42-in.-long lever arm, would deflect. But from what I can tell, it's more than able to sustain a good whack from a mishandled sheet of plywood. This is so, I suspect, because of the Biesemeyer fence's robust construction: It's the only one made almost entirely of steel, which gives it a solid, albeit heavy feeling compared to the others.

The Biesemeyer fence's locking mechanism—a handle welded to an eccentric cam—presses hard against the guide rail, locking the fence firmly where it's set. Unlocked, the fence can be slid along the rail for adjustment or lifted off entirely. The fence doesn't stay parallel with the blade during adjustment, but it snaps into line when the lever is locked. The fence bar is adjusted for parallel by a pair of setscrews on the crossbar. This requires a little trial and error, since the fence must be removed to get at the screws. But once set, it seems to stay in alignment, according to Frank Klausz, a cabinetmaker in New Jersey who let me try out one of the two Biesemeyer fences he owns.

Klausz is very pleased with the Biesemeyer fences he uses in his shop, but reports two minor frustrations. The holes bored in the rails of his Biesemeyer fence, sold as a special edition to match the Powermatic model 66 saw he'd bought, didn't align with those in the saw table. Biesemeyer says this has since been remedied. Klausz's other gripe is that his Ripstrate, a wheeled, hold-down device that holds the wood against the fence, doesn't work because the downward pressure it exerts on the stock lifts the back end of the fence bar. Although I didn't install the model 50 myself, the instruction manual is clear and well illustrated.

The Biesemeyer fence's rip width is set by aligning a hairline cursor scribed on a clear plastic window over a tape glued to the guide rail. The window is adjustable so it's possible to zero the fence against the blade. It's very accurate, too. I found the ripped piece was within $\frac{1}{4}$ in. of where I set the cursor.

The long guide rail allows rips 50 in. to the right of the blade and 6 in. to the left, and must be used with an extension table to support long crosscuts. To strengthen the connection between the saw and table, there's an angle-iron rear rail included. Biesemeyer offers a full line of ready-made extension tables, other fence models with longer rails, as well as a less-expensive version of the Biesemeyer fence that's for home-shop use. Also, Biesemeyer will adapt to fit an old or odd saw at no extra charge. If such personalized service seems unusual, it stems from Biesemeyer's almost evangelical belief in his product: It's his goal to get his fence into every shop in America.

The Vega model 50—Although not as well known as Delta or Powermatic, Vega Enterprises of Decatur, Ill., makes a full line of stationary power tools, including a replacement fence that retails for \$242.50. The Vega is designed to fit 10-in. saws made by Delta, Powermatic, Jet and Sears, although some saw-table drilling may be necessary on older saws. The model 50 comes with rails long enough for cutting 50 in. to the right and

9 in. to the left of the blade. Like the Biesemeyer fence, the Vega has a 42-in.-long fence bar, though a 50-in. fence and longer rails are available.

It took me less than an hour to install the Vega on a Delta Unisaw. Like the Biesemeyer, the Vega stays parallel and resists deflection by relying on a beefy front rail and a cam-actuated locking mechanism. The rip rail is round instead of square, and there's a back rail too, but the fence only rides on it, without locking. The front rip rail mounts to the saw through two very heavy cast brackets whose holes are slotted to allow the rail side-to-side adjustment. Each bracket also has a jacking-plate screw mechanism, which allows fine adjustment of the clearance between the fence bar and saw table. I was impressed that the Vega came with all the hardware I needed—even two fine-thread, $\frac{3}{8}$ -in. bolts to attach the rear rail directly to the tapped holes on the back of the Unisaw.

Since the fence can ride on the full-length back rail, you don't have to make an extension table, but I'd recommend one anyway. Otherwise, thin plywood or plastic laminate would slip under the fence when it was extended beyond the saw table. The fence bar attaches to the solid cast-alloy head with four Allen-head bolts that must be torqued down with some force, because they're all that keeps the fence bar aligned. To aid the tightening, Vega includes a cheater bar that fits an Allen wrench, also provided.

Despite similarities between the Vega and the Biesemeyer fences, they feel distinctly different to use. I liked the Vega's lightweight aluminum fence bar, which requires less force to move than the heavier Biesemeyer fence. Still, the bar feels stiff enough to take a good sideward jolt, and seems to stay put once it's locked down.

Although similar to the Biesemeyer fence, the thing I least liked about the Vega is locking it. When the lever is pressed down, the fence pivots around the round rip rail, causing the back of the fence to rise only to clunk down again when the lever is released. Fortunately, Vega is now including a rear hold-down as standard equipment with the model 50. It slides on the rear rail, keeping the far end of the bar down and allowing the use of spring-loaded hold-downs on the bar.

Besides the usual cursor and tape arrangement, the Vega has a micro-adjustment device for fine-tuning the rip width. This works via a second locking lever that holds part of the carriage in place while you fine-tune the fence position with an adjustment wheel on a threaded shaft. This feature isn't necessary for setting rip width, but it is an excellent aid in fine-tuning the fence position if you're using the fence as a cut-off stop for sawing tenon shoulders. The Vega's cursor window magnifies the tape, which I found hard to use—it overmagnified and I couldn't clearly distinguish the scale marks on the measuring tape. Fortunately, Vega now provides an extra non-magnifying cursor.

An optional accessory for the Vega is a safety device called a Finger Saver. It's a wheeled push stick that rides up and down the fence bar on rollers held captive by rails that are part of the extruded aluminum bar. You grip the Finger Saver's plastic handle on top and a little replaceable wooden stick pivots down to push any thin stock you're ripping past the blade. I find this a welcome innovation—a push stick attached to the saw means you're more likely to use it and not your fingers. The Finger Saver also has a flip-down stop intended for cut-off work with the tablesaw's miter gauge. It's optional and costs \$22.50. If you don't want the fence, Vega will still sell you a Finger Saver and a rail kit that will mount to other brands of fences.



The fence bar on Delta's Unifence slides forward and back, and can be dropped all the way down to the saw's table so thin laminates won't sneak underneath during cutting.

The Unifence—It's nice to see that at least one tablesaw manufacturer, Delta International, makes a high-quality rip fence for its own saw. The Unifence is a vast improvement over the age-old Jet Lock design that's still standard equipment on most Delta saws. The Unifence is designed to be a companion to the Unisaw or any of Delta's 10-in. saws, but it's also sold separately and, with a little drilling, will fit just about any other tablesaw. At \$425, the Unifence is the most expensive fence I tested. Its rail allows a 51-in. ripping capacity right and $8\frac{3}{4}$ in. left of the blade.

Like the Biesemeyer fence, the Unifence is a front-rail-only fence, which, incidentally, allows you to use a flush-fitting out-feed table, so thin stock can't slip under the out-feed table as it comes off the saw table. But its unique fence bar, body, and rail distinguish it from the other front-locking fences.

The nicest feature of the Unifence, in my opinion, is the fence bar itself. It's a complex aluminum extrusion that, in addition to being entirely removable, is shaped so it can be mounted in the fence body in either of two positions. A high fence position ($3\frac{1}{2}$ in. high) is for general ripping, while a low position presents a $\frac{1}{2}$ -in. surface to the work, allowing you to cut laminated or veneered panels to size without having to pre-trim one edge. The overhanging-surplus laminate on both sides of the panel runs wild above and below the thin fence bar, which contacts only the center core material. This feature is bound to be handy for a shop that does a lot of commercial cabinetwork. There are two cursor hairlines, one for each fence bar position.

Two plastic thumb screws lock the aluminum bar to the fence body and adjust the bar's up-and-down motion. You can drop it dead to the table for cutting very thin stock or laminate, which might otherwise slide under. The Unifence's standard bar is 43-in. long, but for crosscutting, Delta makes a special 10½-in.-long cut-off fence (part no. 34-878). This bar acts as a stop for repetitive cuts, providing clearance behind the blade to keep cut-off scraps from binding and being hurled away.

As much as I liked the versatility of the Delta's fence-bar design, I found a couple of shortcomings. To rip to the left of the blade, the entire fence bar and locking mechanism must be removed and flipped around, quite a hassle if you need to do it often. Also, the Unifence's extruded bar has an odd shape that doesn't seem thick enough to drill and tap threads into. It also would be awkward to bolt through it to attach an auxiliary face to the bar—not to mention hold-down devices or other fixtures.

I didn't install the Unifence, but I learned from Paul Levine, a Connecticut cabinetmaker, that it takes about 45 minutes, including installation of the extension table. Delta, by the way, is the only manufacturer who provides a steel frame, legs, and mounting hardware for an extension table. You can buy their plywood

tabletop (part no. 34-998), or make your own. After making do with a second-rate fence for years, Levine was so eager to get a Unifence that he forgot to check if the longer rails would fit inside his small shop. They didn't. He had to wait until larger quarters were available to set up the new fence. Keep this in mind if your floor space is limited, regardless of which fence interests you.

I found the Unifence quick to set and lock, although the locking bar, which is captured in a channel in the front rail, would bind occasionally and I'd have to push in on the fence to free it. Levine says he keeps the saw running when setting the fence, using its vibration to keep the bar from binding as he moves it. The measuring tape is glued to a part of the rip rail that slopes toward the operator, making it easier to see and less likely to accumulate sawdust. Adjusting the Unifence for parallel is the simplest of all the front-locking fences. The two adjusting screws are on the front of the fence body, where they're easy to get at.

From my own trials and Levine's two years of experience with the Unifence, I'd say it's a well-built, accurate piece of equipment. You really can keep your tape measure in your pocket and rely on the fence's built-in measuring system.

The Excalibur—The newest replacement fence to come on the market is the Excalibur T-Slot. It's manufactured in Canada and distributed by J. Philip Humfrey, who also sells the General line of woodworking machines. At the outset, the Excalibur's slick appearance contrasted sharply with the utilitarian looks of the Biesemeyer fence and Vega fence. But the difference is more than cosmetic. The Excalibur's design is quite different from the others, in that it locks to both the front and back rails.

At \$325 (including delivery from Canada), the Excalibur's capacities are similar to the other fences: Its 78-in. rails allow 50-in. ripping to the right of the blade and 12 in. to the left. The fence bar itself, a complex aluminum extrusion with two open slots on top, is 45 in. long, which carried it well out past the back edge of the Unisaw I had installed it on. The extra length would be handy if you wanted to add an out-feed table behind the saw. The Excalibur's front rip rail is made of steel channel iron that's been slightly overbent, resulting in a downwardly sloping top surface that sheds sawdust and chips that might hinder the movement of the fence or obscure the measuring tape.

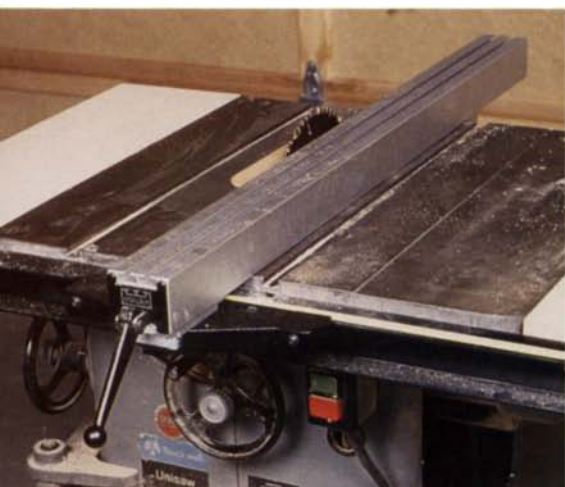
For smoothness of travel along the rails, the Excalibur is a walk-away winner. This is because it doesn't just sit atop the rails, as the other fences do, but rides on three aluminum rollers, one at the rear and two at the front. These rollers, which are on spring-loaded axles, track along the edge of the rip rails, allowing the fence to glide along like a runaway roller skate. In fact, it's almost too smooth. I kept wanting to push against a little resistance as I brought the cursor to the mark and locked the handle down. Locking is accomplished by a cam-action handle that pulls against the rear roller, collapsing the front roller's springs and seating the fence crossbar against the rip rail. Lifting the handle to the horizontal position frees the fence to roll, and moving it to the vertical position allows it to be removed. An adjustment nut at the back end of the fence can be turned to position the rear roller, adapting the fence bar to tablesaws up to 33 in. deep. An optional bar goes to 45 in. deep.

Because the Excalibur locks by pulling in against the rip rails, the rails must be *firmly* seated and parallel within $\frac{1}{16}$ in. along their entire length. It may take some shimming of the rails and fussing with the fence adjustment before the fence will travel smoothly and lock reliably.

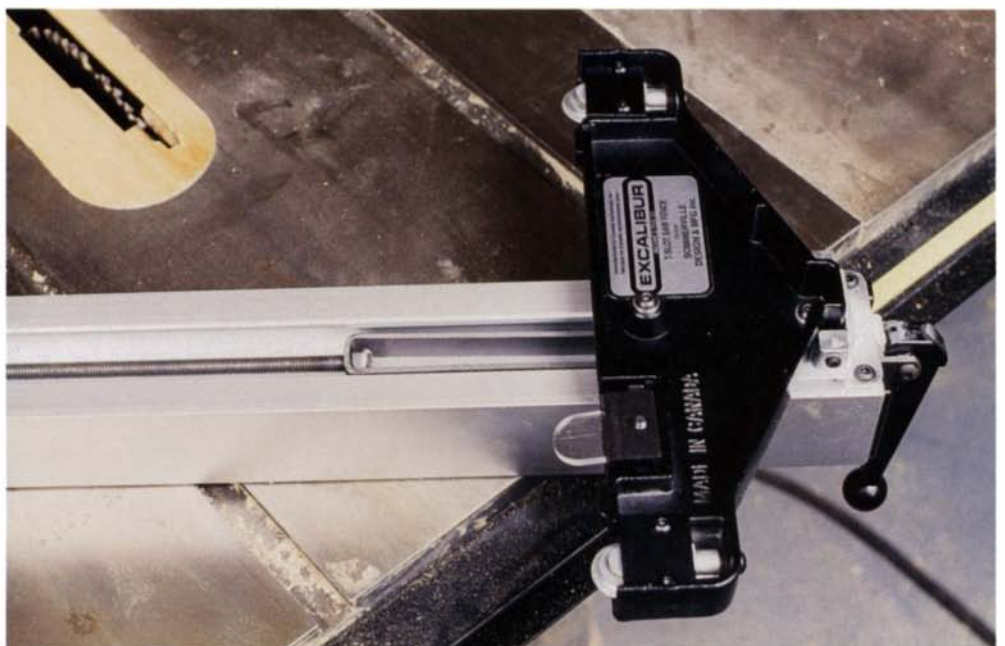
A lot of thought has gone into accessories for this fence. The fence bar has two T-slots along its top designed to accept an entire line of accessories, including a push stick device similar to the Vega, a wheeled hold-down, anti-kickback attachments, and even an adjustable auxiliary fence for use with a router mounted in the extension table. Excalibur also has a router table mounting kit with a pivoting baseplate that fits most routers. Humfrey says more jigs and accessories will be available in the future.

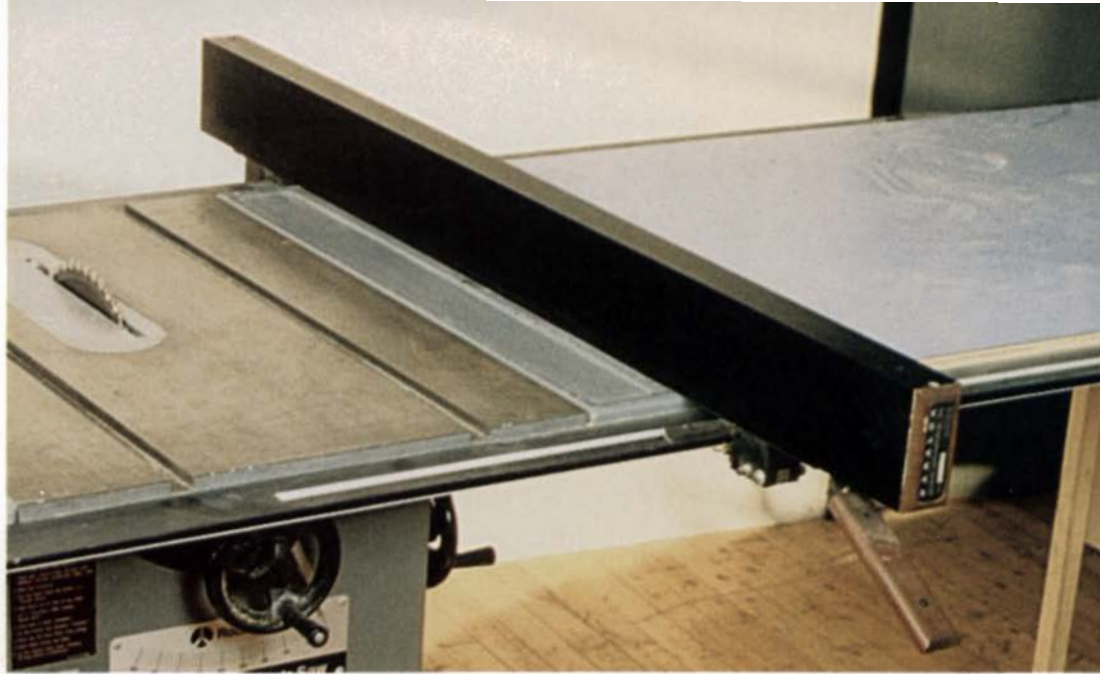
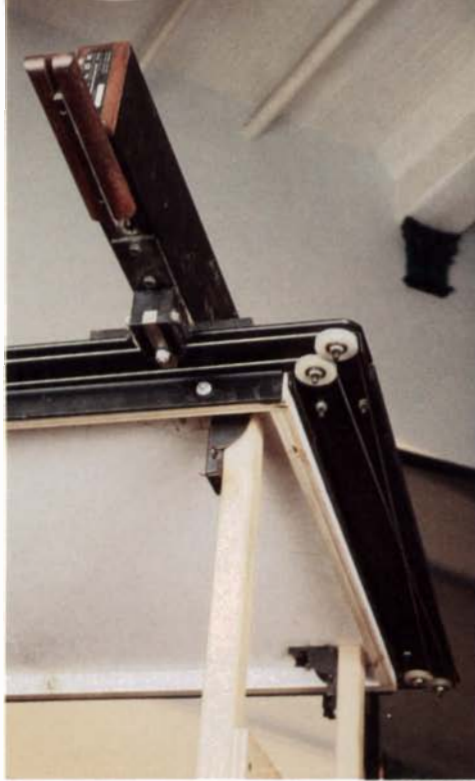
The Paralok—Manufactured by Quintec Mfg. in Portland, Ore., the Paralok is the replacement rip fence that's most different in design from the others. It's also the one I've had the most experience with. It sells for \$350 retail, plus shipping. By way of another drafting analogy, the Paralok fence works like a parallel straightedge on a drafting table: Cables guided by small pulleys maintain the fence's parallelism with the blade while allowing it to move back and forth freely along a pair of angle-iron rip rails bolted to the front and back of the saw (see photo facing page).

Installing a Paralok involves much more than the other fences. So



Above: The sloping top surfaces on the guide rails of the Excalibur fence prevent the accumulation of sawdust. Right: A view of the underside of the Excalibur fence shows the two front guide rollers, each held in its clevis and spring-loaded.





Above: The black-anodized aluminum fence bar on the Paralok fence is guided by cables that run through pulleys underneath the guide bars. It's one of two fences (the other is the Excalibur) that locks both in front and back. Left: Aircraft-type cables cross under the saw table at the far right instead of in the middle, as on a drafting table.

the fence will fit any saw, the rails come sans mounting holes. Thus, you have to position them, bore the holes and mount them with your own fasteners. The standard 72-in. rails give a rip capacity of 53 in. to the right of the blade and 13 in. to the left, but stock rails from 48 in. to 104 in. are available. Threading the cable through all the pulleys was a challenge and I'd recommend commandeering a helper to aid in this task. The cable meets at a splice block and tightens with a sliding nut at the front-end pulley. You'd think that the steel cable would stretch or break and become the fence's weak link, but it's very strong and I haven't had to tighten or adjust it since I installed it 2½ years ago.

The fence bar requires some assembly, including bolting on two rail-like feet the fence rides on. These can be shimmed to adjust the fence at a right angle to the saw table if necessary. The fence attaches to the cable with two cable blocks that slip into U-shaped cleats on the underside of the fence bar, front and rear. While this isn't difficult, if you need to take the fence off the saw often, the Paralok is harder to remove than any of the other fences. It can, however, be reversed on the rails—a neat trick that also works with the Excalibur. Use it with a router in the extension table and another measuring tape on the back rail. The parallelism of the fence is adjusted by moving one of the cable blocks until the bar is parallel, then locking it with a setscrew. Fine cable adjustments are made with sliding pulleys at the ends of the rails.

The cables seem to keep the fence constantly parallel so it glides along smoothly rather than bumping and skewing, as the Biesemeyer fence and Unifence seemed to do. Like the Excalibur, the Paralok locks at both ends, but instead of pulling in against the rails, it clamps down on them individually, so it's not important that the rails be perfectly parallel. A vernier scale on the Paralok's cursor allows setting it to extremely fine settings—Quintec claims the fence is accurate to within a 0.002-in. tolerance, but I've never needed the vernier scale to set the fence to the ¼-in. tolerances I typically work to.

One minor complaint I have about the Paralok, other than the skimpy installation guide (Quintec says they're preparing an improved version), is that the wide rails accumulate sawdust that obscures the measuring scale. But a whisk broom keeps this from being a problem.

Which fence to choose?—All five fences are thoughtfully designed and well-made products that promise a huge improvement over stock rip fences, so the question may be not so much *which* fence, but whether to buy one or not. If you use your tablesaw constantly or saw sheet stock regularly, a replacement fence will make the job much more pleasurable. The time you save in measuring alone will make it worthwhile. If price is most important, the Vega is a solid, full-featured fence with useful accessories at the lowest price. If you do production laminate work and panel trimming, the Unifence's unique two-position fence bar might be worth its high price. The Biesemeyer fence, on the other hand, is an all-purpose, heavy-duty workhorse with nearly a decade of field trial, and it's often available at a discount price when purchased with a new saw.

If I add up points for overall features, though, the Excalibur comes out first for its smooth-as-silk roller suspension system, ease of operation, assortment of accessories, and quality for the money. I'd still be concerned about the rails requiring a lot of shimming to get them accurately mated to the edges of the saw—especially mounting it to a cheap saw with a rickety extension table. The Paralok is a close second and my personal favorite, perhaps because I've used it for so long. Despite the involved setup, I like the Paralok's solid front and back locking mechanisms and the positive parallelism of its cable system. And for my tastes, it has the best locking action and most easily read cursor. □

Sandor Nagyszalanczy is an assistant editor of Fine Woodworking. Wayne Wilkerson of Houston, Tex., contributed to the report on the Vega fence.

Sources of supply

Biesemeyer T-Square saw fence system: Biesemeyer, the T-Square saw fence co., 216 S. Alma School Road, Suite 3, Mesa, AZ 85202.

Vega Saw Fence: Vega Enterprises Inc., Route 3, Box 193, Decatur, IL 62526.

Unifence: Delta International, 246 Alpha Drive, Pittsburgh, PA 15238.

Excalibur T-Slot: J. Philip Humfrey International Inc., 3241 Kennedy Rd., Unit #7, Scarborough, Ont. M1V 2J9.

Paralok: Quintec Mfg., 5128 N.E. 42 Ave., Portland, OR 97218.

A Shop-Built Rip Fence

Aluminum construction requires no welding

by Marshall R. Young

I've had 50 years of experience with both home-shop and industrial-quality tablesaws equipped with fences that lock to both the front and the back rails. I've found that these fences generally did not achieve the accuracy and setting consistency that is possible with a fence that references and locks to the front rail only. I decided to design a saw fence for my Canadian-made Beaver tablesaw that's simple to make and costs less than \$100 to build. Although my fence was inspired by the well-known Biesemeyer T-Square saw fence system, there are significant design and construction differences.

The fence consists of an aluminum fence bar bolted to a cross-member that aligns and locks the fence to a single guide rail. The crossbar has a measurement cursor that aligns with a tape stuck to the rail below it, allowing the fence to be set to precise rip widths. The fence locks to the rail when a locking bolt pulls a locking bar tight against the inside of the steel channel rail.

The fence is bolted together, so no welding is required. The only metalworking tools you'll need are a set of high-speed drills, a set of taps, a hacksaw and a file. Aside from a few steel parts, most of the fence is made of aluminum, which cuts and machines nicely with regular woodworking tools. A 60- to 80-tooth carbide tablesaw blade is best for cutting the aluminum—which should be cut slowly, to avoid kickback—but a bandsaw with a fine-tooth blade, lubricated with a silicone stick, is fine. In either case, wear eye protection.

The steel front channel is available from electrical or mechanical contractor supply houses. Be sure to get the heavy duty channel, such as 1½-in. Unistrut, P-1000 (for local source, call Unistrut Building Systems, 35660 Clinton, Wayne, Mich. 48184; 313-721-4040). Drill holes in the channel to match those in the front edge of your tablesaw and extension table. Bolt the rail ½ in. below the table's surface so it'll clear the miter slots and allow room for the cursor assembly. I made the guide rail on my saw 51 in. long, but it can be made any length to fit other tablesaws and applications. For the rest of the fence's part sizes, refer to the dimensions given in the drawing.

I cut the aluminum-channel fence bar slightly longer than the saw table's depth. If you're planning on cutting plywood, you'll want the bar to extend beyond the front and back edges of the saw table. Drill two holes through the channel for the cursor bar to be bolted on later. I bolted auxiliary fences made from Baltic-birch plywood to each side of the fence bar by drilling and tapping ¼-20 holes in the bar and countersinking the screw heads into the ½-in. plywood. Avoid putting the screws near the blade area. Seal the plywood with Watco oil, then several coats of wax. With epoxy, glue a piece of plastic laminate to act as a glide where the

underside of the fence bar will ride near the saw top's back edge.

Cut a piece of aluminum angle for the crossbar so it's about one-third the length of your fence bar. Using ⅜-in. pop rivets, attach a ¼-in.-thick flat aluminum bar to the face of the angle to act as a spacer between the crossbar and locking bar. Cut the steel locking bar that will ride inside the guide rail and drill a ½-in. hole threaded with a ½-13 tap in the center of it. Next, drill a ½-in. hole through the center of the angle and spacer for the locking screw. Construct the locking screw assembly as shown in the side view. Finally, square up the crossbar to the fence bar with a framing square and clamp them together. Drill and tap a ⅝-in. hole for a ⅝-16 pivot bolt and two ⅜-in. holes for the locking bolts. The oversized holes for the locking bolts allow the bar's angle to be adjusted. Use self-locking nuts and washers to keep the locking bolts from coming loose and ruining the accuracy of the fence.

Cut a notch in the aluminum cursor bar, and drill and tap two holes for 10-32 machine screws that match the position of the holes you drilled in the fence bar earlier. Screw the cursor bar in place. Cut a Plexiglas window and mount it to the cursor bar with machine screws through slotted holes in the bar to allow adjustment. Make sure the slot closest to the bar clears the auxiliary fence. Scribe a hairline in the center of the plastic and fill it with colored wax or ink. An adhesive-backed steel measuring tape (available from Garrett Wade Co. Inc.) is stuck down to the top of the rail below the cursor. Peel off a few inches of the backing paper and stick it down so the cursor will read zero when the fence is up against the blade. Then peel and stick a few inches at a time until you've gone the length of the rail.

Slide the fence on the guide rail from one end to see that it operates smoothly. The bar should lock without too much tightening of the locking knob. Set the fence parallel with the saw table, which should be parallel to the blade, by measuring to the miter slot at the front and back edges of the bar. Adjust the angle of the bar and lock it in place by torquing the two locking bolts. To ease the friction of the fence sliding on the rail, rub a coating of paraffin on all bearing surfaces.

The dimensions I've given here are fine for a small saw like the 8-in. Beaver, but you might wish to increase the size of the fence and dimensions of components on larger saws. You can count on it taking about 20 hours to build your custom fence, but consider your construction time an investment in improving the precision and enjoyment of your tablesaw. □

Marshall R. Young is a retired electrical contractor and part-time woodworker and machinist. He also teaches woodworking at Sunrise Shop in Victoria, B.C. Photo by author.



Made of stock aluminum and steel channels, the author's homemade rip fence bolts together and can be customized to fit any tablesaw or machine tool.

Shop-built rip fence

Aluminum channel, 2 in. by 3 in., $\frac{5}{16}$ in. thick

Make fence bar long enough to reach beyond back edge of saw table.

Glue glide made of plastic laminate to bottom of bar.

Auxiliary fence faces made from $\frac{1}{2}$ -in. Baltic birch plywood

Steel locking bar, $1\frac{1}{4}$ in. by $\frac{1}{2}$ in., rides inside the guide rail.

Tap holes if no room for nuts inside.

Rail bolts to front of saw table $\frac{1}{2}$ in. below top.

Guide rail is 12-gauge "Unistrut"-type channel in length to suit, $1\frac{1}{2}$ in. square.

Allen-head bolts attach fence bar to crossbar and provide adjustment for angle of bar.

Aluminum spacer bar, $9 \times 1\frac{3}{16} \times \frac{1}{4}$, riveted to crossbar

Crossbar, 2-in. by $\frac{3}{8}$ -in. aluminum angle

Length of crossbar and locking bar should be approximately one-third the length of the fence bar.

Top view

Two slots machined for countersunk screw heads tapped into the window allow the cursor to be adjusted without raising screw heads above table level.

Aluminum cursor bar, $\frac{3}{16}$ in. thick, bolted to fence

#10-32 machine screws

Pivot bolt, $\frac{3}{4}$ in. long, taps into crossbar.

Locking bolts, $1\frac{1}{8}$ in. long, pass through crossbar.

Plexiglas cursor window with scribed hairline, colored in with ink

Self-adhesive measuring tape stuck to top of guide rail.

Side view

Shim cursor bar below level of saw table if necessary.

Hand knob, $2\frac{1}{2}$ -in. dia.

Hexagonal coupling, $\frac{1}{2}$ in. by $1\frac{1}{4}$ in. long

Saw table

Steel threaded rod, $\frac{1}{2}$ -13 steel, 3 in. long

Cotter pin inserted through end of locking bolt

Bore hole through steel locking bar, tap for $\frac{1}{2}$ -13 locking bolt.

Spacer

Hex-head bolt, $\frac{1}{2}$ -13 by $1\frac{1}{2}$ in. long, locks handle to coupling.



Diameters can be cut using calipers and a parting tool. Short sleeves are safer, because a hidden defect or split in the work can catch fabric. As the production run proceeds, diameters can be gauged visually, according to how deep the tool penetrates the work.

Production Tips from an Architectural Turner

Working fast without sacrificing quality

by Mark A. Knudsen

What's an architectural turner? That's a question I would hardly have known to ask when I first started turning 20 years ago. Today, I'd say it's someone who turns parts of buildings—work ranging from thimble-size multiples to columns 16 in. in diameter and 15 ft. long. In this article, I'd like to focus on some of the fine points I've learned about architectural turning—an overview of the ways a production turner thinks about his work, his time and his tools.

The challenge in this craft is not ultimate workmanship and technique. You are not turning status pieces or something to go into a display case in a museum. In fact, the opposite can be true. One time I decided to turn a set of stair balusters with a perfect, skew-burnished surface from one end to the other. My aim was to match the surface I'd read about in books and seen on some decorative turnings. I felt pretty proud of myself when the work was picked up, but I heard about it in a hurry from the finishers. They couldn't get the stain to penetrate the burnished

surface, they suspected that not even paint would stick, and they thought I'd lost my mind to turn like that.

In short, architectural woodturning is a craft where your artistic sensibilities are mostly directed toward rescaling proportions and making faithful copies of existing work. The name of the game is economy—in every stage of the operation—from handling stock and laying out, to making the best use of your tools, to knowing when the job is done. Much of the success in production turning relates directly to the first things beginning turners learn: Keep your bevel rubbing and your tool edge sharp. When you forget one of the basics, you are asking for spoiled work. Inspiration? Pick up your tools and work.

False economy—Every client has a budget, and this determines how much time can be spent for turning. It also affects how accurately you lay out and center the stock, and how precisely you can afford to duplicate the pattern. You also have to account for

the time needed to prepare the stock from planks, including trips to the lumberyard. As long as you can get the client to understand the compromises involved, there should be no problems. But don't try to save money in the wrong place, in using low-quality wood. This will detract from the look of the finished work, take longer to prepare and turn, and result in much more waste. Many times, poor wood is full of tension that is released when the lumber is sawn into turning squares. The piece bows, turns rough, costs more in sandpaper and requires more time all along the line.

In any case, when sizing wood I usually allow some extra all around the square for bowing, which may be caused by uneven moisture content and/or internal tension. This might be as much as $\frac{3}{16}$ in. for long oak balusters; for nice walnut or pine, it might be just a planing allowance. If the first cut from the edge of a board bows a lot, I'll flip the board over and rip from the other edge. It is best to let the wood rest a couple of days after sawing so it can stabilize before planing, although deadlines don't always allow this luxury. A way around the problem is to cut an hour's worth of wood at a time. It will not spring too much in an hour, although it may after it's been turned.

Preliminary marking—The baluster in this article exhibits typical features: There are square pummels at the ends, a center ball and symmetrical vase shapes. These elements are separated by coves and lists, which are also called listels or fillets. To mark out where the pummels end, I line up a number of blanks evenly, then use a carpenter's square to mark them all at once. To be sure the line shows clearly when the work turns, I usually rotate each piece 90° and mark a second side the same way.

It's necessary to center the work accurately, so the turned parts of the spindle will line up evenly with the pummels. For most work, you can do this simply by holding a pencil in your fingers and marking in from all four sides to draw a little box in the center. Then fit the work on the headstock and tailstock by eye. For most woods used in this trade—cherry, walnut, poplar, maple, basswood and the even-grained pines—you don't have to drill center holes. The exception is when diameters are very small and precise and/or you are turning a wood like oak, with alternating hard and soft grain that may cause the headstock and tailstock to drift off center.

Snug the work up in the lathe by cranking the tailstock until the drive spurs hold without chattering. Do this with the lathe running; the vibration seems to help seat the spurs. When you get the hang of it, you won't bother to turn the lathe off when removing one piece and mounting another—the trick is not to drill the centerholes. As soon as the points of the headstock and tailstock grip, let go of the work and it will slowly begin to pick up speed. If it looks off-center, this is the time to knock it true. Then snug the tailstock to engage the drive spurs. Don't overdo the tailstock pressure—too much will cause the work to bow when it gets toward final size, and this will promote the wash-board surface called ribbing, or roping. Also, on a light-duty lathe, you might push the bearings right out of the headstock.

If I'm starting a design from scratch, I draw the shapes carefully full-size on a wooden pattern so the client has something to verify and I have something to take dimensions from with calipers. If I have an existing baluster to duplicate, however, I make a very simple pattern, as shown in figure 1 on the next page. It makes sense to draw as few reference lines as possible. If you have too many lines on a pattern, it is easy to cut to the wrong one.

I mark the low and high points on the vases and the areas that

will be wasted for the lists and coves. The exact sizes of the minor elements in the design can be gauged by eye very accurately by comparing them to the sizes of the tool used to cut them.

My shopmade spindle lathe has speeds from 400 RPM to 1400 RPM. General turning, such as a porch baluster, is done in the 900 RPM to 1000 RPM range. After years of turning for a living, I turn at the slowest speed that will let me take wood off quickly. High-speed turning tend to reduce the feel of the cut so that, without realizing it, you may slip into taking a rough, scraping cut rather than shearing the wood cleanly. This risks tearout and will dull tools quickly.

Similarly, practice on poplar or maple to learn. You can push softer woods around and think you are doing things right, but poplar or maple will show you the truth. Practice with carbon steel tools, not high-speed steel—you'll burn them blue until you learn to cut correctly, but at least they will be quick to resharpen, and that's something you have to practice as well.

Sharpening—I don't like to grind right up to the cutting edge so that the sparks dance on it. I'm sure these sparks soften the steel. I stop a little short so the steel is left hard, and then whet to the edge with a small medium-grit stone.

I vary the bevel shapes on my gouges according to what woods I'm turning—longer for pine, shorter for oak. It is important that the bevel be smooth and unfaceted. Otherwise, the cutting will be erratic when the gouge is rolled, and you will subject yourself to many mysterious catches. For the same reason, file out any nicks in your tool rest and round the long bottom edges on your skews so they slide freely.

I make it a point to keep all my skew chisels at the same bevel angle, 25°. If the bevel angles vary, each skew will cut a little differently, and you'll never get the hang of cutting with any of them. A skew has to be razor sharp to work, and you might have to touch the edge up once a minute on some jobs. I've seen guys hone a skew edge to perfect sharpness, but then use the tool until it starts to smoke and the edge turns blue. There's no sense in that—if you have to push a skew, stop to hone it. Spit on your whetstone, refresh the edge, and get back to turning. The few seconds this takes may just save you all the time you have invested in the piece already.

I keep my whetstone handy in the breast pocket of my jacket. I used to wear a regular apron, but then I discovered pharmacists' jackets. They have a flap that closes tight around the front of your neck to keep shavings out. You can get them in a variety of styles—short-sleeve/long-sleeve, cotton/nylon, all colors—for about \$12 at uniform stores. They have designs with side pockets as well, but these fill up with shavings too fast. I also keep a chunk of paraffin in the pocket—if you rub the tool rest and the tool with paraffin, it will feel like your tool just got sharper.

Use a tool rest as long as the work whenever possible, and be sure it is parallel to the work so you can use it as a reference point to gauge how uniform a cylinder is. Another benefit of a long tool rest is that for some jobs you can mark the pattern lines directly on the rest with fine-tipped markers—in which case, you don't need to make a pattern.

Feeling the cut—The pummels are cut with a skew in a series of V-cuts, made by arcing the long point into the work. You should not have to gauge the depth of the cut with calipers or by stopping the lathe to look. Instead, just listen and feel the cutting action: It starts as a series of tick-tick-tick cuts, with the point of the skew hitting the corners of the wood. As soon as the ticking

smooths out to a steady cut, you have cut down to the round. With a $\frac{3}{4}$ -in. to $1\frac{1}{4}$ -in. roughing gouge, now round the cylinder down evenly from one end to the other. In many common designs, the diameter of this cylinder will be the diameter of all the high spots in the finished turning. This means that your roughing gouge should be kept sharp, because any tearout may show in the finished turning. Again, don't stop the lathe to check for roundness, just lay the back of the gouge on top of the work and listen for clicks. Next, place the pattern up against the rotating work and mark the reference diameters with a pencil.

With calipers set to the diameter, use a parting tool to cut the profile depths at the center of the work. If you have only a few turnings to do, with a number of different diameters, it pays to have plenty of calipers, laid out in the order of use. Color-code them with paint or bands of tape so you can tell which is which; you can color-code the pattern too. If you have several dozen of the same part to turn, however, you should be able to dispense with calipers after turning the first few—just note how deep the parting tool goes, then use that as your gauge.

The reason to start in the center is that after the ends have been turned down, the work will be much more likely to whip. So turn the ball, then turn the adjacent ends of the vases. Leave the coves surrounding the ball until the baluster is almost completely turned. There's no sense in making the workpiece too thin so early. The coves will be a light, last cut, and you can hold the turning to stabilize it. If you examine the photographs, you'll see there is no one way to hold your tools. Most times, on long work, I'll be holding the wood as it turns. This dampens vibrations and allows a surer cut.

Getting the most from your tools—By changing your grip and supporting the work, you can do a surprising variety of work with any tool. A roughing-out gouge can take a smooth shearing cut in the manner of a skew, and a skew can make square wood round. This last operation can be dangerous, however, so I wouldn't advise beginners to try it. Wear all your safety gear, too.

Parting tools can turn beads like a skew: You roll the tool over so the axis of the tool points right at the center of the work. If your parting tool is tall in relation to its cutting width, as most

narrow parting tools are, the job is more difficult because the cutting edge pivots away from its point of contact with the tool rest—but it can still be done and it's worth practicing. Similarly, a skew can be used in the same manner as a parting tool, removing an incredible amount of wood very quickly. Practice this with small skews at first, because a catch can knock the wood right out of the lathe. Another idea is to turn with the long point leading; this requires that the tool be almost parallel to the work. The cut is useful when you are having trouble with ribbing.

The idea behind tool versatility is dexterity, not strength. Get the tool pointed in the right direction, and change the angles to keep it pointing in the right directions as the shapes emerge.

Don't look at the edge of the tool, but at the top profile of the turning, so you can see how the profile is developing. You wouldn't look right in front of the tires when you were driving, would you? When you watch the top, you can see the form take shape in relation to the whole as well as the individual section. You can learn to know what is going on at the cutting edge of the tool by the sound and the feel, provided you learn to hold the tool lightly.

If you have to fight any tool, you are doing something wrong. Keep a light grip with both hands. I've thought a long time about exactly how to describe the amount of grip needed. I've come up with three ways, and you can choose the one that makes the most sense to you: Squeeze about as hard as you would dare to squeeze a rotten egg; or about as hard as you would screw in the last bit of a turn when changing a light bulb; or, for the engineers among the readers, about as hard as you can squeeze a Kellogg's shredded wheat bisquit before it crumbles.

Good technique produces good surfaces. I'm not sure what the standards are in other parts of the country, but when I send out work that's to be stained, it's ready to be stained; if it's to be painted, it's ready to paint. I generally don't send out work with any tearout. If a rough spot won't sand out, I'll fill it myself with wood putty. If a piece is to be stained and I catch my tool in it, I've bought it. If the wood is not really bad, my failure rate is about three pieces in 100, which I feel is a good compromise between speed and accuracy.

There are exceptions to a good finish. I've seen some restoration jobs where the new work was so much better than the old

Staff

Fig. 1: Simplifying production turning

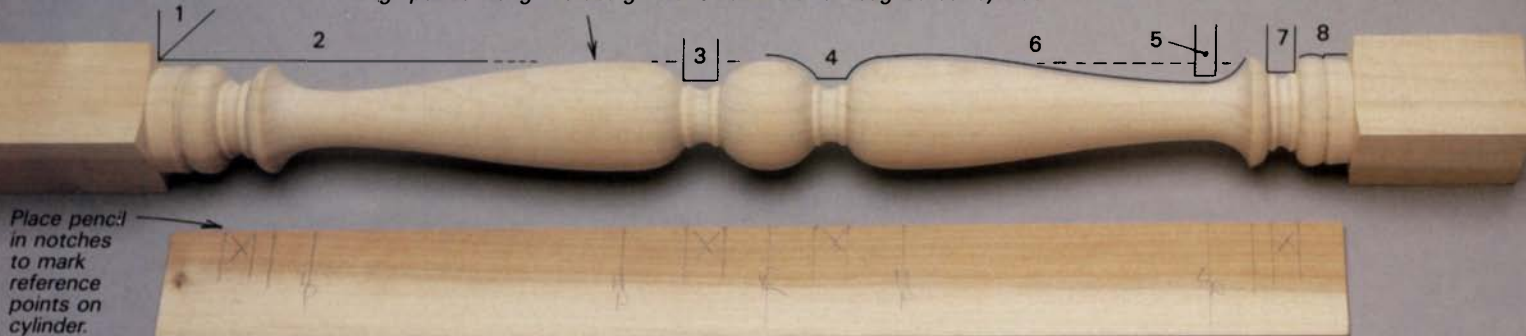
1. Cut pummels with skew.
2. Turn to cylinder with roughing gouge.
3. Waste to diameter of center fillets with parting tool.
4. Turn ball and ends of vases with skew.
5. Part to low point (LP) diameter on vase.

6. Turn vase with roughing gouge and skew.
7. Waste to fillets at ends with parting tool.
8. Shape with parting tool.
9. Turn remaining beads and coves with $\frac{1}{4}$ -in. gouge.

Undercut listels so paint will not fill and soften profiles.



High points along this design are full diameter of roughed-out cylinder.



Pattern is cut $\frac{1}{4}$ in. shorter than distance between pummels so it can be held against turning cylinder without catching.



Hand positions

Left, on long work with small diameters near the center, it is best to cut the main shapes at the center first, then work toward the ends. If the ends were cut to size first, then the work would whip. The author steadies his hand against the tool rest for extra control.

The roughing gouge, right, takes a paring cut that will later be cleaned lightly with a skew. Note that the gouge, with the tool rest acting as fulcrum, is levered against the forearm, while the right hand damps vibration in the work. This forearm support helps avoid a ribbed, or washboard, cut by relieving much of the pressure between the gouge's bevel and the work.

Lower left, fingers extended under the tool rest and wrapped behind the work help to dampen vibration. In addition to backing up the work, the author's fingers can gauge the roughness or smoothness of the surface being turned.

Below is shown yet another grip; the tool is controlled by both hands and the left forearm. This is the final truing and undercutting of the listels, or fillets, at each side of the center coves. A light sanding will finish the job and leave a uniform surface properly textured for painting.



that it stood right out from 20 feet away. When I do a restoration job, I try to get a look at the site to see the standards the work was turned to originally. If there are skew marks and tearout, then that's what I give the customer.

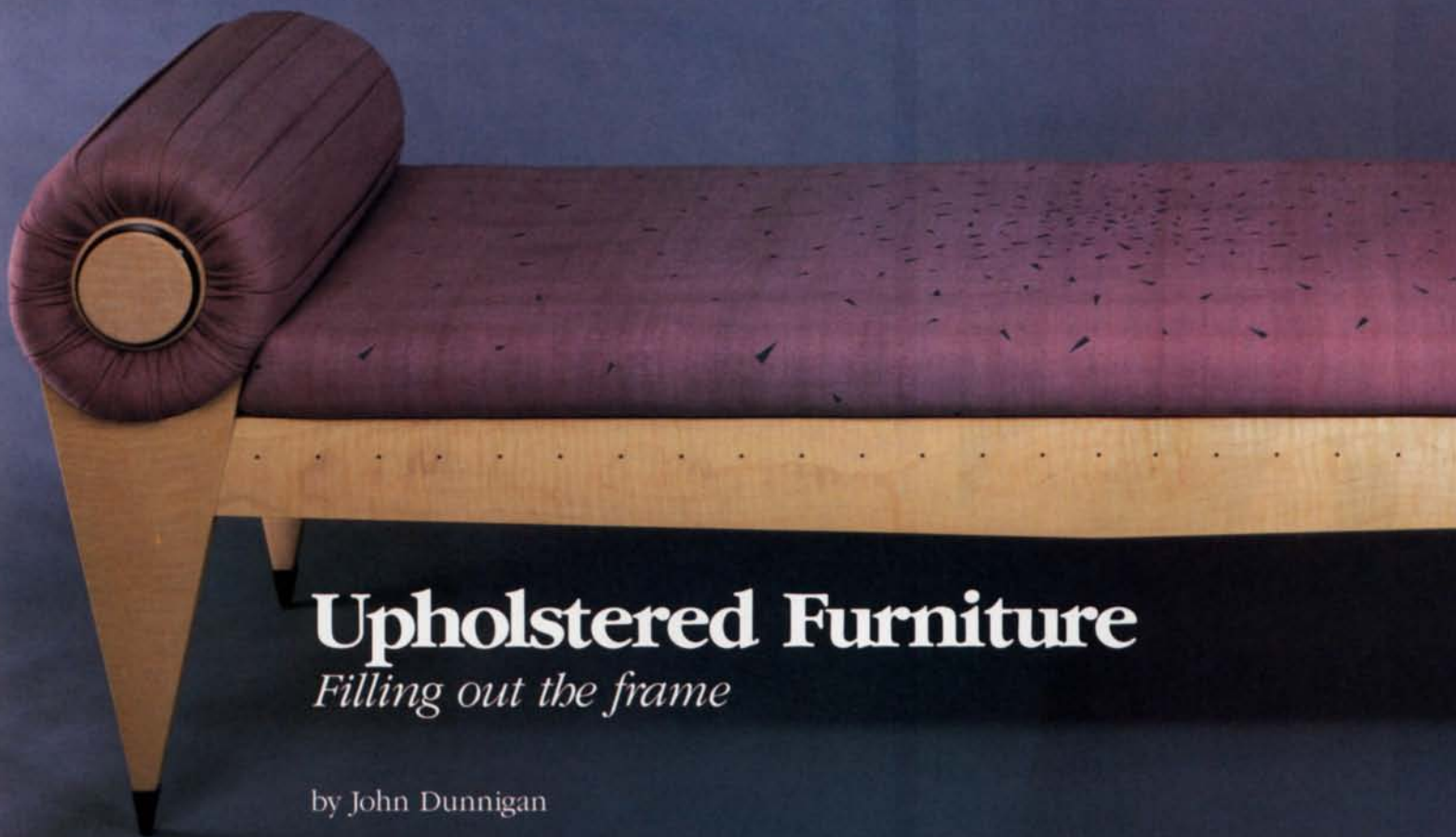
Finishing up—My final surface for most painted work comes from 100-grit or 150-grit sandpaper—not regular production paper, but a type called metalcloth P 100-J (available from Econ-Abrasives, P.O. Box 865021, Plano, Tex. 75086; 800-367-4101, 214-377-9779). It's resin-bonded and cloth-backed for durability. I'd say it outlasts paperbacked sandpaper 10 to one. But the real reason I like it is because the grit size is very uniform—that's what the "P" in the code means; the "J" refers to the cloth back. The 100-grit cuts fast, but leaves a surface you'd expect from ordinary 150-grit paper; the 150-grit is like 220-grit production paper.

To use the sandpaper, you have to soften the backing so it will conform to the curves in the work: I cut a strip about 2 in. wide, then pull the backing over the edge of my tool rest at a variety of angles to break it in. When I'm sanding, I usually keep a small, hard kitchen sponge in my hand to back up the paper and put

the pressure where it's needed. To make a hard kitchen sponge, wet one then let it dry out. The sponge flattens out to about $\frac{1}{8}$ in. in thickness after a while. If you fold the sandpaper over the sponge's edge, it will conform to a very small cove shape. You can fold the sponge double or triple for whatever other coves are in the work, then all the coves will sand out uniformly.

In closing, I'd like to add a story proving that if you can't win them all, you can at least try. One time I was asked to turn a set of spindles with $\frac{1}{2}$ -in.-dia. tenons on the ends, which I did. The next day I got a call from the job foreman: The tenons didn't fit the $\frac{1}{2}$ -in. holes, and the carpenters were all spending time shaving them down. I didn't feel I could be responsible for what every manufacturer's $\frac{1}{2}$ -in. drill bit actually was, and even less so for the size hole it cut after resharpening or getting bent. So these days I insist that anybody asking for a particular diameter tenon send me a few holes with the order—a piece of the same wood as the job, drilled by the carpenter who would do the work, using the bit he'd use on the job. Haven't had a complaint since. □

Mark A. Knudsen's shop is in Des Moines, Iowa.



Upholstered Furniture

Filling out the frame

by John Dunnigan

Photos: Roger Birn



The show wood in Dunnigan's largest piece, the sofa above, is pear and ebony, the fabric is gray raw silk. The backs of the desk chairs, below, were inspired by the shape of the papyrus blossom, a dominant theme in the Egyptian art the author encountered on a 1984 trip to Egypt. The chairs match a desk designed in a similar style. Relatively diminutive dimensions and overstuffed seats that are exaggeratedly wider at the front than at the back are Dunnigan trademarks, as in the maple and red leather office chair, below right.





The daybed, above, is upholstered in silk and reflects the author's interest in classical proportioning and detailing. The dining chair, below, which is one of a series, is made of maple and upholstered in silk that has been hand-painted by fabric designer Wendy Wahl.



I don't remember when I first became interested in upholstered furniture, but I've been returning to it with greater enthusiasm since about 1975. Now it seems that I'm known for it. I've made many things to sit on out of solid wood, but to me, wood is not always the best material for seating—I've found that upholstery is much more effective. On any kind of project, seating or other, I always search for whatever materials will work best. This has involved lots of time learning about textiles, metals, plastics, etc., and has meant collaborating with other craftsmen and designers to produce the finished work.

I've always felt that furniture needs a strong conceptual foundation to be good design. Each piece should begin with an idea that suggests a sense of purpose and a personality. This concept can be drawn from many sources. It can be rooted purely in function, or it can be an expression of philosophy or artistic intent. When I started thinking seriously about design, it became clear to me that comfort would be the conceptual basis for my chairs. To me, it's not enough that a chair is actually comfortable—comfort is visual, too. A chair should *look* inviting and make people look and feel good while they sit.

Following this philosophy has given my chairs some trademarks: larger than normal seats that are exaggeratedly wider at the front than at the back; arms that are lower at the back so the sitter's arms rest naturally; overstuffed, convex upholstered surfaces that allow people of all shapes and sizes to squirm around and be comfortable in many positions; and low backrests, because you don't sit with your head.

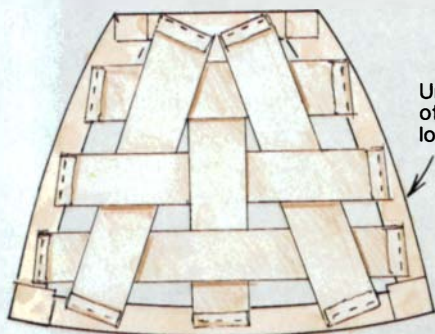
Designing upholstered furniture is not substantially different from working in solid wood, but to create a successful design, you need to learn to visualize how the upholstery will finally look on the frame. Every piece of furniture is a composition of details. Many woodworkers can visualize how a particular solid wood detail will look, say a molding or a chamfer. But if you're not familiar with basic upholstery methods, this visualization is so much harder that you may not even know where to start or how to build a frame to serve as a foundation for the look you have in mind. In 1978, I took a course in upholstery which required everyone in the class to reupholster an old piece. It was dusty work that seemed to get more confusing as I progressed. By the end of the second semester, I had learned enough to design a workable upholstered frame. But more important, I learned that it makes very little sense for a designer-maker to attempt his or her own upholstery once the craft has been tried and understood. Having worked with skilled upholsterers for the past 10 years, I'd no sooner attempt my own upholstery than I'd fell and saw up logs for my lumber.

When my students ask me how to design upholstered furniture, I always urge them to take the time to understand how an upholsterer works. Try it out, watch, listen and ask a few questions. I always make a working drawing that shows how the finished piece should look with all the padding and fabric on it. The drawing also shows the frame with all its joints. It should have front, side and top views, as well as any details that might need to be clarified. If it's a complicated piece, you can use sections or cutaways to explain the various parts.

Sometimes I find it helpful to draw the upholstery on a separate, transparent sheet of paper and use it as an overlay on top of the frame drawing. A full-size drawing is best, but a half-scale one is usually more practical. In my shop, the first set of drawings is sometimes pretty rough because we usually make a full-size mock-up from them, and only after studying it do we make final working drawings. The more accurate the drawing, the better, since

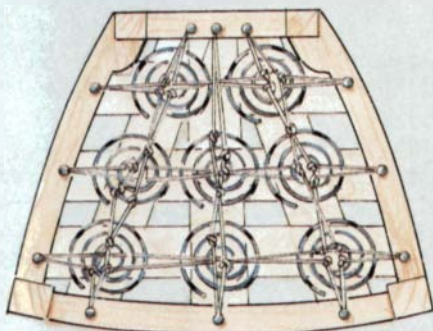
An upholstered chair: controlling shape, layer by layer

The voluptuous shape of an upholstered chair accretes layer by layer. To build this dining chair's upholstery foundation, jute webbing was first stapled to the underside of the seat.

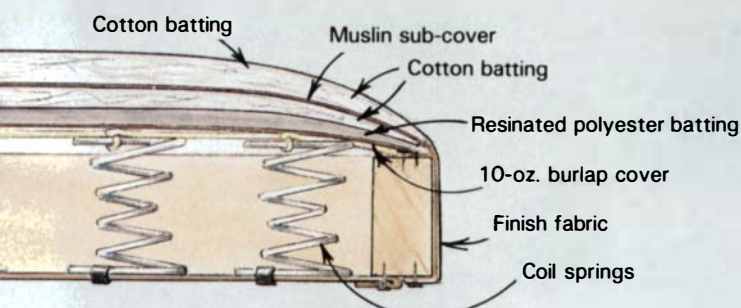


Underside of chair, looking up

Coil springs were stapled to the webbing, then laced together with twine to stabilize them and keep subsequent padding from slipping between the springs. Spring height, location and number are varied to affect firmness of seat.



A layer of burlap stitched to the springs further separates them from padding. Shaping continues with a layer of resinated polyester batting followed by cotton batting, a layer of muslin to consolidate the shape and then more cotton batting. Adding padding or shifting it produces minute changes in shape. The finish cover—in this case, silk—is pulled over the last layer of batting, sewn at corners, and tacked to underside frame.



Button is fastened after upholstery is sewn.

Burlap

Jute webbing

Urethane foam carved to shape

Cotton batting

Polyester batting

This chair's back has no springs, but jute webbing gives it resiliency. Urethane foam trimmed to shape, followed by cotton and polyester batting, completes the foundation.

Finish fabric is first tacked behind the crest rail's roll, draped down toward the seat and pulled through the tack rail. The chair's back fabric is first blind tacked, then carried downward to be tacked underneath the frame. Seams at the back corners are sewn with the fabric on the chair.

Back panel is blind tacked, then tacked beneath frame.

Tack rail

Alternatives

Tacking springs to webbing isn't the only way to build a foundation. Another option is to mount the springs on a plywood platform fastened to the frame bottom, or to tack webbing to the top of the frame, then build the shape with foam or batting. Springs are more durable than webbing, which sags with age.

I'm attempting to communicate to another craftsman exactly what the finished piece will look like.

When I've got exactly what I want, I take the drawing to Arne Read, my upholsterer for the last three years, and discuss it with him. Arne is not only a very talented upholsterer, but a very patient person, too. He listens and understands what I say about how a piece is supposed to look and is very generous with his suggestions. I've built enough frames by now to know pretty much what Arne needs, but he'll often make suggestions. Structurally, an upholstery frame isn't that much different from a solid-wood chair, but many of the older frames I've studied appear underbuilt—that is, they are lighter than they'd be if they weren't upholstered. But to me, the fact that the frame will be covered represents a good opportunity to make its elements as strong and beefy as possible, thus assuring durability without compromising visual appeal. You can overdo this, of course. If frame members are too heavy, they'll affect the shape of the upholstery or bottom out against the springs and padding.

A typical upholstery frame is depicted in the drawing at left. The front and side rails are wide and thick and are joined to the back and front legs by ½-in.-thick tenons. With such heavy rails and strong joints, it is not necessary to reinforce the structure with stretcher bars lower on the legs. Since I like to have the legs taper to a rather small section, this construction works well. The large rails also solve one of the upholsterer's chief problems: finding a place to attach fabric, webbing and springs with nails and tacks. This last consideration is what makes an upholstery frame different from a solid-wood chair. To anchor upholstery where there are no rails, an upholsterer needs tack rails (also called pull-throughs), whose location, size and shape will vary from piece to piece. It's at this point that a full-size mock-up is essential. Knowing what kind of upholstery is required, the upholsterer can tell you exactly where to place tack rails, as well as advise you on other details, like filler blocks that help refine the furniture's final shape. After seeing the mock-up, Arne will often suggest changes that I'll do myself or pass on to Peter Reilly, my able shop assistant. The frame itself is usually made of two woods: a fancy show wood, and ash for the secondary wood. Ash is strong and it accepts and holds tacks well.

Even with a mock-up, many decisions are made as the piece is upholstered, and having an upholsterer who is willing to work with me is essential. Recently, for example, after making several versions of a particular armchair, I wanted to cover one in a thick leather that we hadn't used before. We noticed that the heavier material left bumps when it was double-folded at the frame's edge, so Arne suggested cutting a small dovetailed rabbet around the outside edges of the frame so the bulkiness would have someplace to go, smoothing the finished surface. This was done at the last minute after the frame had been finished.

The subtle variations and interpretations generated by even the slightest change in the amount of padding or types of folds can change the personality of the piece, so I like to be with the upholsterer to approve each step. Typically, a dining chair like the one shown in the drawing will take 10 to 12 hours to upholster. During that time, many decisions must be made, ranging from the type of springs and webbing to be used, to the handling of small details. The drawing shows some of the choices that are possible. Often, changes are made when we see something that might work better (such as a detail in a pleat or a welt), and every piece is tried for comfort as different springs and padding are installed.

I've always been very interested in the surfaces of furniture,

whether it's a carcass, a table or seating. For example, I've spent a lot of time selecting grain so it moves just the right way with the form of the piece. With fabrics, I find there's a much wider universe of color and texture with which to experiment. Over the years, the choice of fabrics has come to play a larger part in determining the character of each piece. As a result, I've gotten more involved in designing the fabrics I use on my furniture.

In the beginning, I had plenty of ideas, such as wanting to paint or print only certain parts of the upholstery instead of treating it uniformly, but I lacked the knowledge of textile technology to make these ideas work. A couple of years ago, I met Wendy Wahl, a talented textile designer and owner of Wahlworks Textiles. She produces fabrics for furniture and interiors. She listened to my ideas and shared her expertise with me, learning a bit about furniture and upholstery along the way. For the last couple of years, Wendy has produced one-of-a-kind fabrics for my furniture. We collaborate on the designs, which Wendy then refines and produces. Sometimes we make a paper template that can be pinned right to the chair to see how it will look. When we are pleased with the design, the actual fabric panels are rough-cut to fit the furniture (which has been done up in a muslin sub-cover), painted, then returned to the upholsterer for final fitting. The pigments Wendy uses are heat-set, and resistant to peeling and flaking.

A good example of how this three-way collaboration works can be seen in the set of three chairs shown on p. 52. A client asked me to design chairs for use around a large desk I had already built for him. I designed the desk not too long after returning from a trip to Egypt, so it has vivid references to ancient Egyptian architecture. The desk's large turned legs, which are meant to suggest architectural columns, wouldn't match the saber legs my client wanted on the chairs. Eventually, I decided on a chair design whose back was inspired by the papyrus blossom shape that's a recurring theme in Egyptian art and architecture.

That was only part of the solution, however. I knew that if the desk and chairs were to work together visually, the desk's visual elements had to be picked up somehow in the chairs' fabric, which determined part of the surface design. Wendy and I discussed the problem, and after a few weeks of exchanging sketches, Wendy worked out a design based on the drapery folds of a garment seen often in paintings and sculpture on Pharaoh Akhenaton. This design consists of straight vertical lines on one side of the chair and draped curving lines that become horizontal on the other. After a few full-scale mock-up patterns, we settled on it. I was concerned about how accurately Arne would be able to match up the pattern at the seam where the back panel met the arms, but he proposed an elegant solution: The back and arm panels could be made of one piece, avoiding seams entirely.

We chose 100% silk for these particular chairs because it has just the right feeling of formality and is a perfect ground for the paint. Silk is actually quite durable as an upholstery fabric, but there are many other fabrics to choose from.

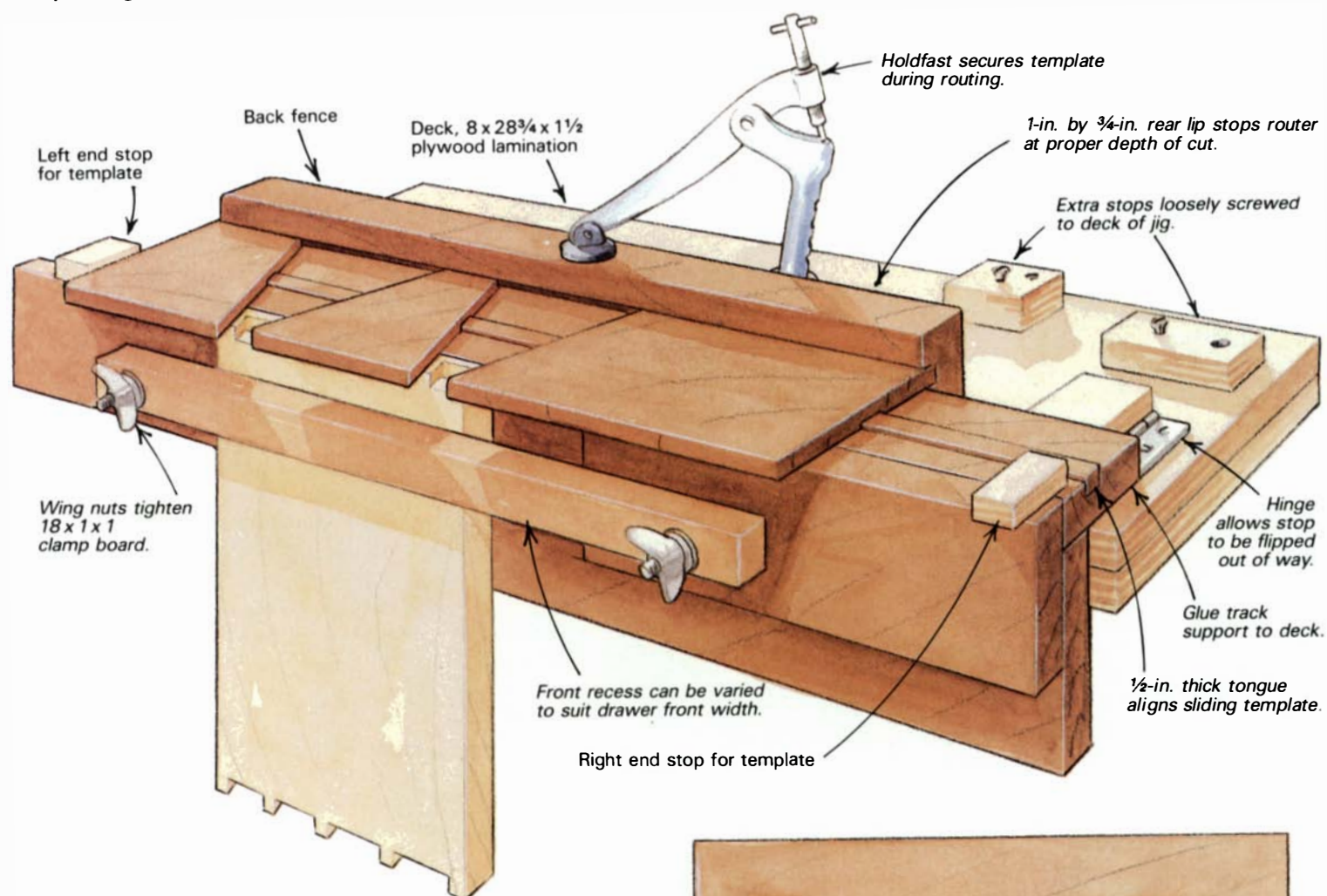
It has taken me about 10 years to learn how to get my upholstered pieces to consistently express the design concepts I'm seeking. Many times I've had to rip off the upholstery and start over because some detail wasn't quite right. Depending on another person's hands to give your idea much of its form is hard work, but it has enabled me to accomplish things I wouldn't have attempted otherwise. □

John Dunnigan designs furniture in West Kingston, R.I., and teaches a design course at The Rhode Island School of Design.

Adjustable Dovetail Jig

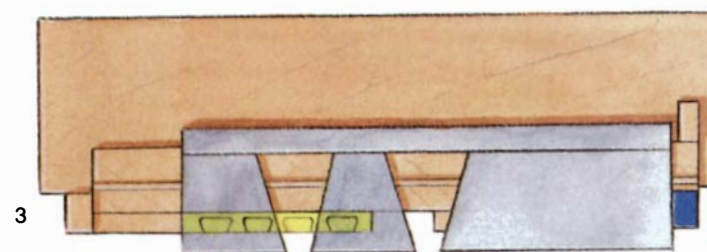
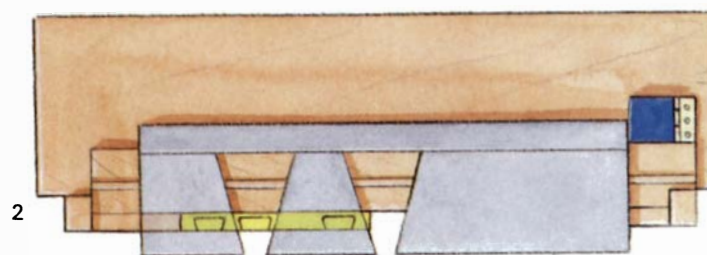
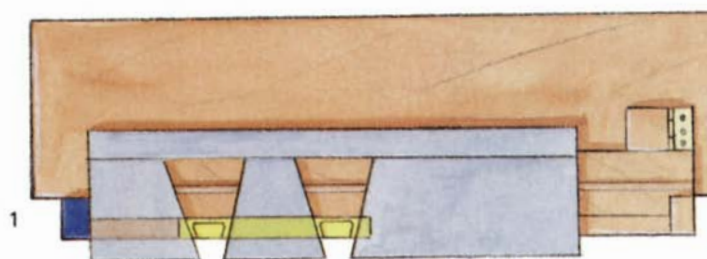
Let your router do the hard part

by Douglas Schroeder

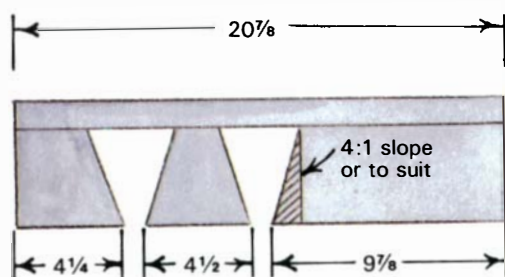


Detail B: Cutting sequence

1. With bottom of drawer side butted against left wall of recess, align template against left-hand stop and rout two sockets, one forming the left half pin.
2. Flip hinged stop down and align template against stop before cutting third socket.
3. Lift stop out of way and butt template against right-hand stop for final socket. Flip drawer front, align it against right recess wall and reverse cutting order to dovetail opposite end.



Detail A: Moveable template



I recently was commissioned to build several large mahogany breakfronts and had to make 40 drawers in four different sizes. I wanted the look of hand-cut dovetails, but needed to produce them economically. The commercial dovetail jigs I'd examined wouldn't do the fine dovetails typical of the best 18th-century work, so I decided to make a jig that could rout both through and blind dovetails of different sizes and spacings. My jig is basically a platform equipped with a system of stops and a track accommodating a sliding template that can be adjusted to any size drawer front. The template guides the router as it cuts the sockets, leaving crisply formed pins. The tails are sawn on a bandsaw, then chopped out by hand in the conventional way.

Robert Mussey, furniture conservator at the Society for the Preservation of New England Antiquities, suggested the jig. It's based on one devised by Mario Genevesse, a master cabinetmaker in Natick, Mass.

As shown in the drawing, a rear lip stops the router at the proper distance from the face of the drawer front. For through dovetails, I put a piece of scrap behind the stock before routing. This enables me to rout all the way through the drawer front and partially through the scrap before the lip stops the router base.

I made my jig with mahogany and plywood, but any hardwood/plywood combination would work. The template guides are extra wide, because I wanted them to resist flexing when the router's template bushing was bearing against them. I worked out the size of the templates and the position of the stops by trial and error. I laid out the joint by hand, then sized the template and located the stops so that the router running against the template would cut the pins. Remember to account for the difference between the router bit and the template bushing—about $\frac{1}{16}$ in. on my setup. The dimensions shown in the drawing are just guidelines; you'll have to adapt the jig to your own particular situation. It took me two days to work out the jig, but from then on, the drawers were a snap.

To build the jig, I dadoed the track support to accept the tongue, then glued and screwed the piece to a $1\frac{1}{2}$ -in.-thick laminated plywood deck. I cut a matching dado on the underside of a $\frac{1}{2}$ -in.-thick piece of stock, cut the correct slopes on the template fingers and glued them to the back fence, as shown. The stops shown in the drawing must be laid out carefully. The block on the left sets the position for the first and last half-pins. The drawer front's bottom edge should be clamped snugly against the left-hand side of the front recess. After routing the first two sockets, I slide the template down so it butts against the hinged block, then I cut the next socket. Finally, I flip the hinged block up and out of the way, and move the template against the right-hand block for the last socket.

Because the stops are fixed and the pins are unevenly spaced to accommodate the rabbet for the drawer bottom, the drawer front can't be flipped end-for-end to rout the opposite end. Instead, I align the jig against the right-hand side of the recess after the piece is flipped. The additional stops shown on the rear of the jig are added as the drawers decrease in size (about $\frac{3}{4}$ in. per drawer). My procedure is to cut all the joints on one end, then set up to do the opposite end. The routing procedure is the same, except this time I begin against the right-hand stop, move to the hinged stop and, finally, to the left-hand stop.

After routing the pins, I square the corners with a chisel, then scribe the tails directly from the pins (see top and middle photos). The tails are cut on a bandsaw fitted with a $\frac{1}{4}$ -in. blade with no set, and the waste is chiseled out. A good way to remove the set is to push an oilstone against each side of the blade as it's running. □

Douglas Schroeder builds furniture in Hudson, Mass.



The router does the hard part by precisely locating the width and depth of the sockets, which can then be squared by jiggling a chisel against the routed surfaces and slicing down to the corner.



The tails are scribed from the routed pins in the usual way.



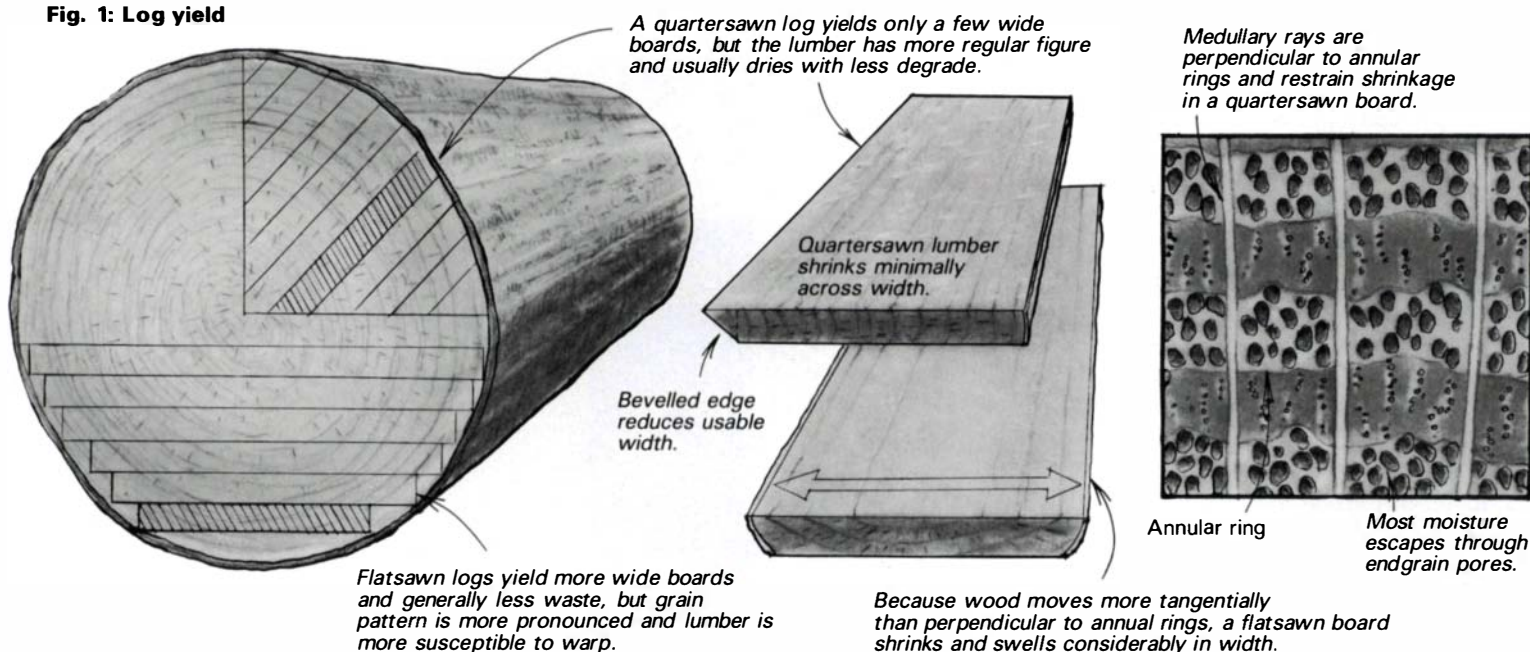
The tails are bandsawn freehand (left). A fine, smooth cut comes from using a blade whose set has been removed by running it against an oilstone. The waste is then chopped out (right).

Buying and Drying

How to find and season your own lumber

by Todd Scholl

Fig. 1: Log yield



Getting lumber from the sawmill to the tablesaw yourself can be a long and difficult process, but it is a worthwhile one. Professionals and amateurs alike can realize hefty savings by buying lumber right at the mill and drying it themselves. You can save 50% or more by dealing directly with a sawmill instead of with a lumber retailer.

Economics aside, there are other less-tangible benefits. Having operated my own small sawmill at one time, I enjoy talking to sawyers and rummaging around sawmills. I've developed a greater understanding of wood and have learned that handling it carefully early on produces better material and ultimately benefits the furniture I build. I find great satisfaction in buying green lumber, drying it and turning it into a fine piece of woodwork.

Before you set out to hunt lumber at the source, you need to decide what species, size and quality wood you want. If you're building furniture, you'll probably be most interested in hardwoods, but you'll need to get straight on the thickness (4/4, 6/4, 8/4, and so on); the width (typically most mills saw boards in random widths up to 16 in.); and the lengths (which are also most often random). For the best furniture work, the highest hardwood grade, firsts and seconds (FAS), is appropriate. But good bargains can be had in the lesser grades that most sawmills are likely to deal in. For more on grading, see *FWW* #50, or consult the reading list.

The entire business of grading is a tricky matter. Often sawyers' interpretations of grading will vary so greatly from the official rules that it renders the issue moot. In fact, "run-of-the-mill" is the most common grade I've found used by backwoods sawyers. Any board that comes off the mill is given this general designation, good or bad. Some mills are only slightly more sophisticated, separating lumber into vague categories like "good" or "bad." Good is anything that's No. 2 common or better; bad is anything worse. This is further confused by regional terminology: In central Kentucky, where I ran my mill, what a lot of sawyers called "barn lumber" would be called utility, pallet or secondary lumber in other parts of the country. Disregard this hazy grading and learn the official rules. That way, you'll be less likely to be duped by a fast-talking sawyer and better able to compare prices quoted by various mills.

The output of small sawmills varies widely. At my mill, we sawed lumber for a variety of purposes, including furniture, but many of the neighboring mills sawed only for barn wood or pallets—a grade that's of little use to woodworkers because it has too many defects and is often too thin after drying to produce a board usable for furniture work. If possible, you should locate a mill that saws for grade rather than for yield. Grade sawmills treat logs more carefully and they're equipped and willing to saw logs that will produce furniture-grade lumber. Those that saw for

yield are more interested in large volumes of lower-quality lumber. I know many sawyers who don't know (or care) about sawing for grade and are more interested in production; the more board feet the better. Having been in the business, I can sympathize. Frankly, it often doesn't pay for a sawyer to sort out and market the few furniture-grade boards a marginal log yields. Often high-quality logs never make it to the sawyer anyway, having been skimmed off and sent directly to a veneer plant.

Finding a mill—One of the best ways to find a sawmill is by talking with other woodworkers. If you can find a woodworker who deals directly with a mill, you've eliminated 80% of your worries. First off, you'll be talking with another woodworker—someone who speaks your language. You'll also be dealing with a mill that has worked with a woodworker and thus should have a better idea of what you'll need.

There are other ways to find green lumber. Try the Yellow Pages for sawmills or lumber dealers. Local lumberyard workers may have knowledge of local mills, or you can consider contacting the local forest or agricultural extension agent, because many mills get their logs from government land. If all this fails, a drive in the hills might turn up a shed or barn built of freshly sawn lumber. You might stop and ask where the lumber was purchased and go from there.

I have lived in many parts of the country and have always found a suitable mill within 50 miles of my home. Once I have a lead on a mill, I usually call (if there's a phone) to find out what wood species the mill saws, what they charge per board foot, green, and whether their lumber is graded. I also ask if the lumber is stacked and stickered, if it's covered, and if I can pick through the pile. If the answers sound promising, I'll check out the mill in person.

It's useful to walk around the mill before you buy to see what kinds of logs are being sawn, how they're sawed and what kind of job the mill is doing. If you don't know what you're looking for, you're in a less-desirable bargaining position and missing a good opportunity to learn more about lumber buying. Check to see if the lumber is sawn heavy, which means it is $\frac{1}{8}$ in. oversize in thickness. If you're buying green 4/4 lumber, it should be at least a full inch thick and, ideally, $\frac{1}{8}$ in. thicker. If it's not the full 4/4, you'll be lucky to get a $\frac{3}{4}$ -in.-thick finished board when it shrinks and dries. Consistency is the measure of a well-run mill, too. A worn-out head rig, sloppily operated, might saw a 4/4 board that's a full inch thick at one end, but $1\frac{1}{2}$ in. thick at the other end. Such boards are trouble. When you feed the thin end into the planer, it jams when the feed rollers encounter the greater thickness.

Ideally, the lumber stacks should be level, stickered properly, covered against the weather and sorted by grade and species. Steer clear of lumber from crooked stacks sitting in a muddy yard or bleaching in the sun, no matter how inexpensive the lumber is. Such stacks are likely to contain lots of warped, bowed and crowned lumber, which only causes grief later. If the mill checks out, ask the sawyer specifically what he charges. As in any purchase, quality costs money and you'll probably pay more at a well-run mill where the sawyer takes time to stack his wood. At our mill, we charged 25 cents per bd. ft. for run-of-the-mill oak—stacked, but not graded—and 30 cents for No. 2 or better. Some mills won't dicker with you on price, some will. We were always willing to discount the price if the buyer helped out by stacking lumber. But be clear on what you are getting into before you offer to trade labor for lumber. Find out too if the sawyer



Dick Pawloski, a sawmill operator in Bethel, Conn., hefts a flat-sawn FAS 4/4 oak plank fresh from the mill. The board has been edged, trimmed to length and graded, and is ready for drying.



Sawyers can get so busy that they often don't have time to properly stack the lumber they've sawn. The back stack is good, but steer clear of lumber piled like that in the foreground. Lumber from such piles often contains a high percentage of cracked, cupped, bowed and twisted boards.

will let you pick through the stacks if you promise to restack and resticker it. We found, however, that most people didn't know how or didn't care to restack our lumber. Assure the sawyer you'll be different from the rest.

Custom sawing—An interesting way to work with sawyers is to bring your log to the mill and have it sawn to your specifications. You'll need a basic knowledge of sawing and a good rapport with the sawyer before you try this. My experience with custom sawing has been good and I've enjoyed sawing other people's logs for them. If you have your logs sawn, make sure they are clean and free of rocks, nails, and especially barbed wire. If we hit wire, nails or any foreign object, it was our policy to charge the customer for a new set of sawteeth. Before having your log sawn, find out what the sawyer will charge for a damaged blade. It can cost anywhere from \$200 to sharpen teeth to \$1,000 or more to replace a blade. A sawyer will want to know whether a tree came from the forest or from someone's yard where it could have acquired any number of metal objects, such as fence wire, pocket knives, nails or screws. Forest trees will likely be cleaner, but avoid trees along boundary lines. Look for deformities on the bark that indicate metal lurking within.

If it's your log being sawn or the sawing is being done to your



Rhode Island woodworker Geoff Warner's drying shed has a large overhang to protect lumber against rain. Although not critical, lumber sheds should be oriented to be open to the north, with the southern exposure covered to prevent losses from rapid drying.

specifications, consider having the lumber quartersawn. Left to their own, most mills don't like to quartersaw because it's slow and somewhat wasteful. As is shown in figure 1, a quartersawn log produces more narrow boards, many of which will have beveled edges that reduce their usable width. But in exchange for narrower boards, quartersawing in species like oak and ash yields delightful grain patterns. In addition, quartersawn lumber is more stable than plainsawn, because its annual rings are perpendicular to the face of each board, so most shrinkage occurs in the board's thickness rather than its width. Even a log that is plainsawn, however, will produce a few quartersawn boards at its center. For more on quartersawn lumber, see *FWW* #48.

Drying your find—Once you've bought a load of lumber, you need to dry it. This process begins with air drying, progresses to indoor drying, or to custom drying done at a commercial kiln. The lowest moisture content you can air dry wood to in most climates, except for the desert, is about 12%, but ranges from 15% to 20% are more likely. Kiln drying will further reduce moisture content to the 6% to 8% suitable for furniture.

Air drying lumber is not particularly difficult, but because you're at the mercy of the weather, it's not a controlled procedure like kiln drying, so some precautions are necessary. Long before I consider stacking the lumber, I take steps to reduce rapid moisture loss, which will cause end checking. Immediately after bucking logs to length, or taking possession of them, I coat their ends with glue, polyurethane varnish or paraffin to reduce moisture loss through endgrain. I see to it that the logs are sawed into boards as soon as possible and then preferably stacked immediately after sawing, because this is when the most rapid drying takes place. If I've bought already-sawn lumber, I end coat the boards as soon as I pick them up at the mill or immediately after stacking. This is critical during the summer: A board left in the hot summer sun for an hour could split disastrously, and end coating helps to reduce radical moisture loss.

Some sawmills dry lumber in the open without cover, some stack it vertically on racks, and some just dead stack it (without stickers between the layers). I strongly recommend against all these methods, because they are likely to produce a high degree of degrade lumber, ranging from cupped or bowed boards to fungi stains that form when damp boards lie together. I have been most successful in drying lumber in a well-ventilated shed built for that purpose or in a drafty barn. Such a structure protects wood from too-rapid drying from direct sunlight, while shielding

it from rain and snow. A reasonable size for a drying shed is about 20 ft. long, perhaps 10 ft. wide, with an open-facing long wall on one side and a louvered, or burlap-draped wall on the other. Its siding boards should have no more than 2 in. and no less than ½ in. between them to allow for air circulation. Variations on this design are endless, but the point remains: The lumber needs to be protected from rain without being sealed off from breezes that will carry away the moisture.

I stack the thinnest boards at the bottom so wood stacked on top will weigh them down against bowing. Where possible, wider boards should go inside the pile rather than near the edges where too-fast drying might cause them to split. Boards that are very long should be stacked on the bottom of the pile as well—an unsupported end from a long board sticking out from the center of a stack may sag as it dries, crooking the board. To separate each layer from the next, place ¾-in.-square stickers about 24 in. apart along the length of the pile. As you build the stack, keep the stickers vertically aligned to keep uneven weight distribution from kinking your boards. For stability, the stacks should be neatly piled and level. This could require that you keep a few extra stickers on hand that are a little thinner or thicker than ¾ in. to make up for inconsistencies in the thickness of the lumber. Leave a foot or two between each stack to ensure adequate air movement. If your shed has a dirt floor or you are just drying wood outside with a sheet of plywood over it, support the stack at least a foot off the ground. A foundation of timbers supported on concrete blocks spaced about 16 in. on center, front of the stack to back, works well.

The old-timer's rule of a year of air drying per inch of thickness is, at best, a speculative way to determine when your lumber is dry enough. The only sure-fire way to track all of the variables at work in air drying is to use a moisture meter to periodically test a sample board. You can buy a moisture meter for about \$100 or make your own (see the reading list). In any case, select a board from *inside* the stack for testing and measure the moisture every few weeks until it gets down to 20% or lower. This could take anywhere from a few months to a year or more, depending on the species, its thickness, the location of the stack and the climate where you live. Far and away, temperature and humidity most affect how fast wood dries. Generally, the best drying period runs from July to September, but the farther north you go, the shorter the season. Thus, a stack of 4/4 oak that dries in a single season in Alabama might require two years or more to dry in northern Minnesota.

If you intend to make a habit of air drying, keep records of how long it takes to dry the various species you are working with. Also, date each stack of lumber; it's easy to lose track of how long a stack has been drying, especially when you have several going at once.

Finish drying—Once your wood has dried to the 20% range, you're ready to finish dry it. If you've paid 30 cents per foot for 100 bd. ft. of FAS oak, you now have an investment of \$30 plus your time. You must now decide whether you want to hold your costs to the bare minimum by drying the wood in a heated room, or spring for the additional cost of drying in a commercial kiln. Commercial drying is affordable, provided you have enough lumber to make it worth transporting to the kiln. Typically, expect to pay 15 cents to 20 cents per bd. ft. for kiln drying.

In the East and Midwest, hardwood kilns are quite numerous; the sawyer you buy from is likely to know where one is located or you can check the phone book for leads. If the kiln does custom drying, the operator will want to know what species and how much lumber

you have, its thickness and length, the current moisture content and what you want the finished moisture content to be. In most cases, this will be 6% to 10%. Plan as far ahead as you can. Every species requires a different drying schedule, and where one kiln might mix species in a drying run, another will not.

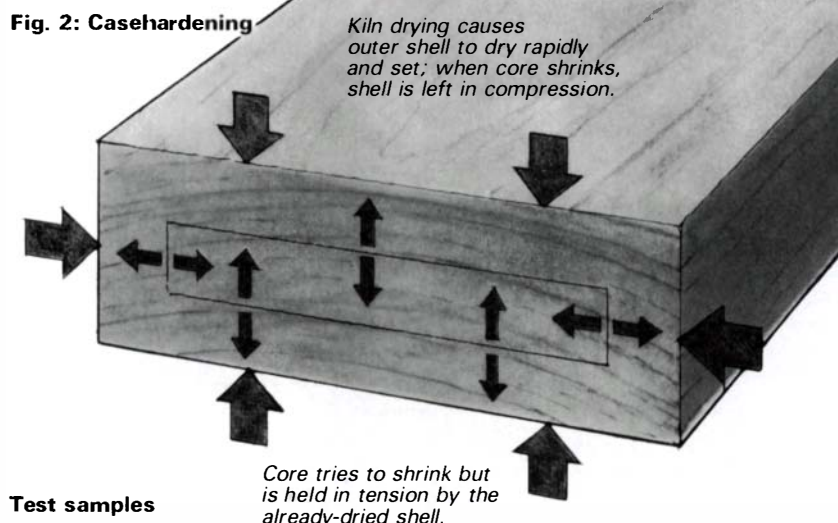
Final inspection—Kiln operators don't generally guarantee results, so inspect your lumber carefully before and after it comes from the kiln. The boards should emerge bright, free of stains, cracks and cup, and they should machine normally. Lumber that's been pushed too fast through the drying schedule might become casehardened. This occurs because the board's outside shell dries too fast, causing it to shrink around the wet core. This puts the shell in tension and causes it to set oversize. When the core eventually shrinks, the shell is pulled into compression. (Or, the wood itself may give during improper drying, which can cause deep surface checking or internal failures such as collapse and honeycombing.) Kilns usually try to ensure against casehardening by conditioning the wood, slowly raising the humidity at the end of the drying cycle. Figure 2, right, shows how to test for casehardening and reverse casehardening, which occurs when the conditioning is carried too far, causing the core to be in compression and the shell in tension. For more information on kiln degrade, I suggest reading the *Dry Kiln Operator's Manual* (see reading list). The good news is that if you find the lumber has been casehardened, you can take it back to the kiln and ask the operator to condition the lumber again. If the lumber is reverse casehardened, however, it's ruined.

If you plan to dry several hundred board feet yearly, heated-room drying is the most economical way to go. Of course, you can't do thousands of feet of lumber (unless you have a very large house), but it is feasible to dry up to 800 bd. ft. a year. And, I find it satisfying to see wood that will later become furniture drying in my living room. You can also use your attic, but be careful here: During the summer, an attic will get too hot, accelerating drying and causing horrible checking. Be sure the attic is well ventilated, preferably with a fan, so the moisture released from the wood can escape.

Before bringing it indoors, inspect your lumber for pests such as spiders, ants and more-destructive boring critters like powder-post beetles or termites. If you find suspicious-looking holes in the wood or tiny frass hills, leave it outside. Strip off any bark or decayed areas on the boards that might conceal insects. And though you may be tempted to hasten the drying process, leave adequate space between a stack and radiators, electric baseboard heaters or hot-air ducts. Similarly, stacking wood near a wood stove or fireplace is inviting splits and cracks, not to mention the danger of fire. Stack the lumber as you would outside, with evenly spaced stickers.

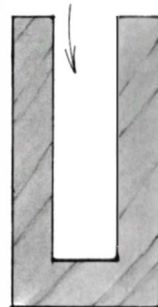
With your moisture meter, continue to monitor your lumber. As soon as its moisture content nears 10% or less, remove the stickers and dead stack the lumber. Leaving the stickers in place will encourage air flow between the boards and they'll actually begin to pick up moisture rather than lose more. Store your lumber in a rack or blocked up off the floor in the shop or the place where you intend to use it. That way, the wood will arrive at an equilibrium moisture content with the environment, reducing the chances of unexpected twists, warps and bows. Once machined, it's important to stack boards on a flat surface and weigh them down to reduce bowing or cupping. By the way, the same holds true for glued-up panels—they only look stable, and if left on their own, they can bow or cup. Wood will always move, so cover

Fig. 2: Casehardening

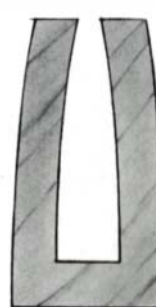


Test samples

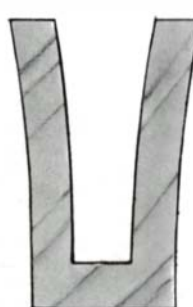
Saw core from sample piece



In correctly conditioned sample, prongs remain parallel.



Prongs turn inward if the board is casehardened.



A reverse casehardened sample shows results of overconditioning. Core is in compression and shell in tension, turning prongs outward.

the panels to prevent marring and then weigh them down.

How much can you save by drying your own wood? I can buy run-of-the-mill green walnut at 80 cents per bd. ft. From a lumber dealer, kiln-dried FAS walnut would cost \$3 or more per bd. ft. Even after driving to the sawmill, picking through the stack, stacking, air drying and moving it indoors, I will not have significantly added to my cost. If I decide to pay an extra 20 cents to have 1,000 ft. kiln dried, I'd still save about \$2,000 that I can invest in more machinery or, better yet, more wood. □

Todd Scholl is a woodworker and teacher. He lives in Wray, Colo. Barbara Rowley, a freelance editor, contributed to this article. She lives in Florissant, Colo.

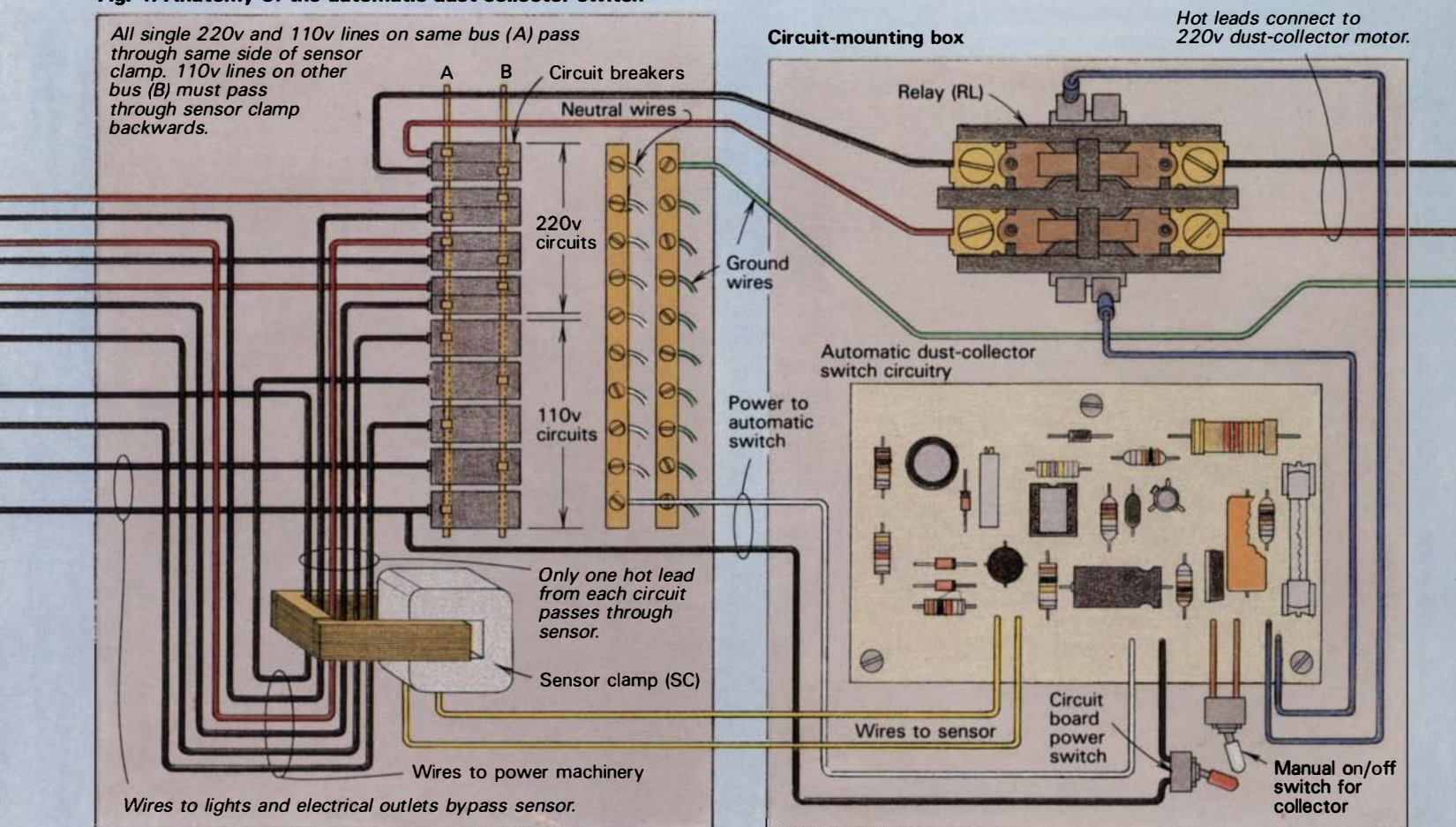
Further reading

Rules for the Measurement and Inspection of Hardwood and Cypress, \$5.00 ppd.; *Introduction to the Grading and Measurement of Hardwood and Cypress*, \$1.25 ppd. National Hardwood Lumber Association, P.O. Box 34518, Memphis, TN 38184-0518.

Drying Eastern Hardwood Lumber, \$5.50 ppd.; *Dry Kiln Operator's Manual*, \$7.00 ppd.; *Air Drying of Lumber, A Guide to Industry Practices*, \$4.75 ppd. Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402-9325.

Understanding Wood, A craftsman's guide to wood technology by R. Bruce Hoadley, 1980, \$17.95; *FWW On Wood and How to Dry It*, \$7.95; containing articles on wood species, how to air dry wood, how to build a kiln, how to build a moisture meter and related topics such as sawmills and basic woodlot management, 1986. The Taunton Press, Box 355, Newtown, CT 06470.

Fig. 1: Anatomy of the automatic dust collector switch



Dust Collector Switch

An electronic sensor automatically turns the trick

by Robert Terry

Since I feel very attached to my lungs, I have a dust collection system installed in my shop so I'm not constantly breathing sawdust. But several things bothered me: It wastes money to continuously run a 2-HP collector motor during working hours, so I usually run it only when I'm working at a particular machine. But in my large shop, that can involve a lot of footsteps back and forth to the collector's switch. Then too, my young helpers frequently forget to activate the blower and consistently forget to turn it off. To alleviate these problems, I designed an electronic controller that automatically switches my dust collector motor on and off, regardless of which shop machine I use. The device doesn't need to be wired to any of the individual machines directly, and it's easy to construct even if you don't understand electricity and you've never

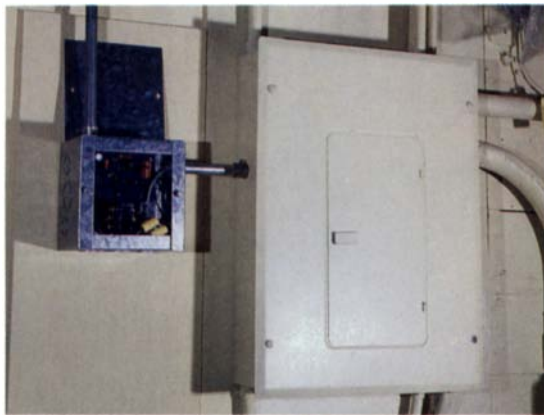
built an electronics project before. If you decide to build the collector switch from scratch, the parts will cost you about \$60.

The automatic dust collector switch, which I'll abbreviate as ADS, is a device that senses the flow of electric current. Its basic anatomy is shown in figure 1. A sensor clamp (SC) is placed in the shop's breaker box with the wires that power all of the shop machines hooked up to dust collection threaded through it. The clamp sends electrical impulses to the ADS's voltage detection circuit, which operates a relay wired to the dust collector motor. When a shop machine is switched on, the controller detects current in its wires and then trips the relay, activating the collector's motor. Shutting off the machine tool causes the reverse effect, switching the collector off.

Fig. 2: Printed circuit board

At right, full-scale pattern for etching the printed circuit board, shown in gray with the copper side up. The dark lines show the location of components and connections on the reverse side. Note polarity of components. The part codes correspond to the parts list shown at the bottom of this page.

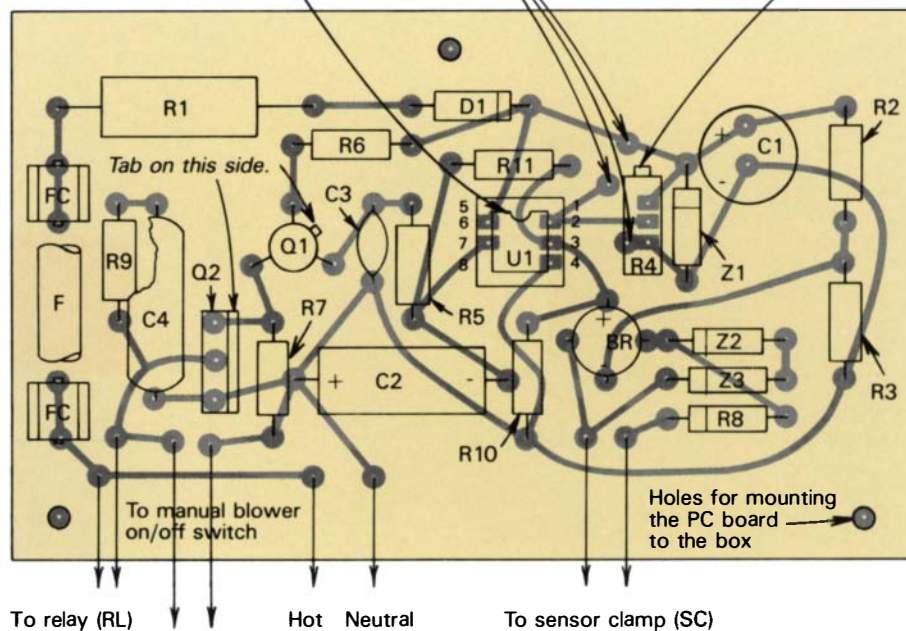
Below, the author mounted his automatic dust collector switch in a junction box next to the main breaker box in his shop. The unit can monitor any number of machine circuits and detects AC current from 0.5 to more than 60 amps. The lower limit is adjustable.



Notch in socket for U1 faces toward R11. Pins 1, 5 and 8 must be clipped off of the socket.

Alternative mounting holes for R4

Sensitivity adjustment screw



The heart of the ADS is its printed circuit board. Mounted to this board are all the electronic components, as well as a 2-amp fuse to protect the circuit from overload. The diagram for the printed circuit board is shown full-size in figure 2, copper-side up. You can use it as a template to transfer the circuit pattern onto the board and to prick-punch all 72 holes. Etch the circuit, following the instructions provided in the printed circuit board kit (see parts list), except place the circuit board *copper-side up* in the acid and rock the tray gently from side to side as the board etches. With a #57 (0.043-in.-dia.) drill, bore all of the holes you punched earlier, and enlarge those for the fuse clips (which solder directly to the board) and wire leads.

Clean the circuit board with steel wool and kitchen scouring powder before soldering on the components. Use resin-core solder and a low-power, pencil-type soldering iron. Position components as shown in figure 2, observing the polarity and orientation of the components as marked. The socket for U1 should have pins 1, 5 and 8 clipped off before mounting. Raise R1 and D1 up slightly from the board—these produce heat and need air to circulate around them. So as not to overheat sensitive components Q1, Q2, and BR, temporarily attach small alligator clips to the component's leads to serve as heat sinks while soldering. Plug in the integrated circuit chip U1 only after you have finished soldering. Solder on the 22-gauge wire leads where they connect to the printed circuit board (see figure 2).

The controller's sensor clamp is made from an AC/DC power transformer that's been disassembled and altered as outlined in figure 3. The first lamination is difficult to remove, but it'll be discarded so don't worry if you mangle it. With a cold chisel, reshape each lamination by laying it on a piece of mild steel and chopping out the E's center to form a C shape. Deburr the new C-shaped pieces before reassembling the sensor. Use as many of the laminations as practical: The total is not critical for the sensor's sensitivity. Cut off the pins on the low-voltage side of the transformer and solder wire leads to the two remaining 110v pins (labeled 120VAC on the transformer).

Mount all the basic components of the ADS, except for the

Parts list

Diagram Code	Description	Radio Shack Part Number
F1	Fuse AGC, 2 amp	270-1275
C1	Capacitor, (electrolytic), 470mf/35V	272-1030
C2	Capacitor, (electrolytic), 100mf/16V	272-1016
C3	Capacitor, .022mf/50	262-1066
C4	Capacitor, .1mf/600	***
R1	Resistor, 3.3K/2W	**
R2	Resistor, 10K/0.5W	271-034
R3	Resistor, 4.7K/0.5W	271-030
R4	Potentiometer 50K/20 turn	****
R5	Resistor, 22K/0.5W	271-038
R6,R7,R9	Resistor, 100/0.5W	271-012
R8	Resistor, 1K/0.5W	271-023
R10	Resistor, 100K/0.5W	271-045
R11	Resistor, 470K/0.5W	271-053
Z1	Zener Diode, 12V/1W	276-563
Z2,Z3	Zener Diode, 5.1V/1W	276-565
D1	Diode, 1N4003	276-1102
U1	Op-amp, 741	276-007
Q1	Transistor, 2N2646	**
Q2	Triac, 6A/400V, 2N6347A	**
BR	Rectifier, 1.4A/50PIV	276-1151
RL	Relay, 30A, 3 HP, DPST	1A639*
SC	Transformer, 120VAC/12.6/300MA	273-1385A
SW	Switch (2), SPST, 120VAC, 2A	**
P	IC socket, 8-pin	276-1995
FC	Circuit-board-mounting fuse clips (2)	Littlefuse 102071**
--	P.C. board kit (includes 2 boards)	276-1576
--	Metal junction box, 6x6x4 in. with cover	**

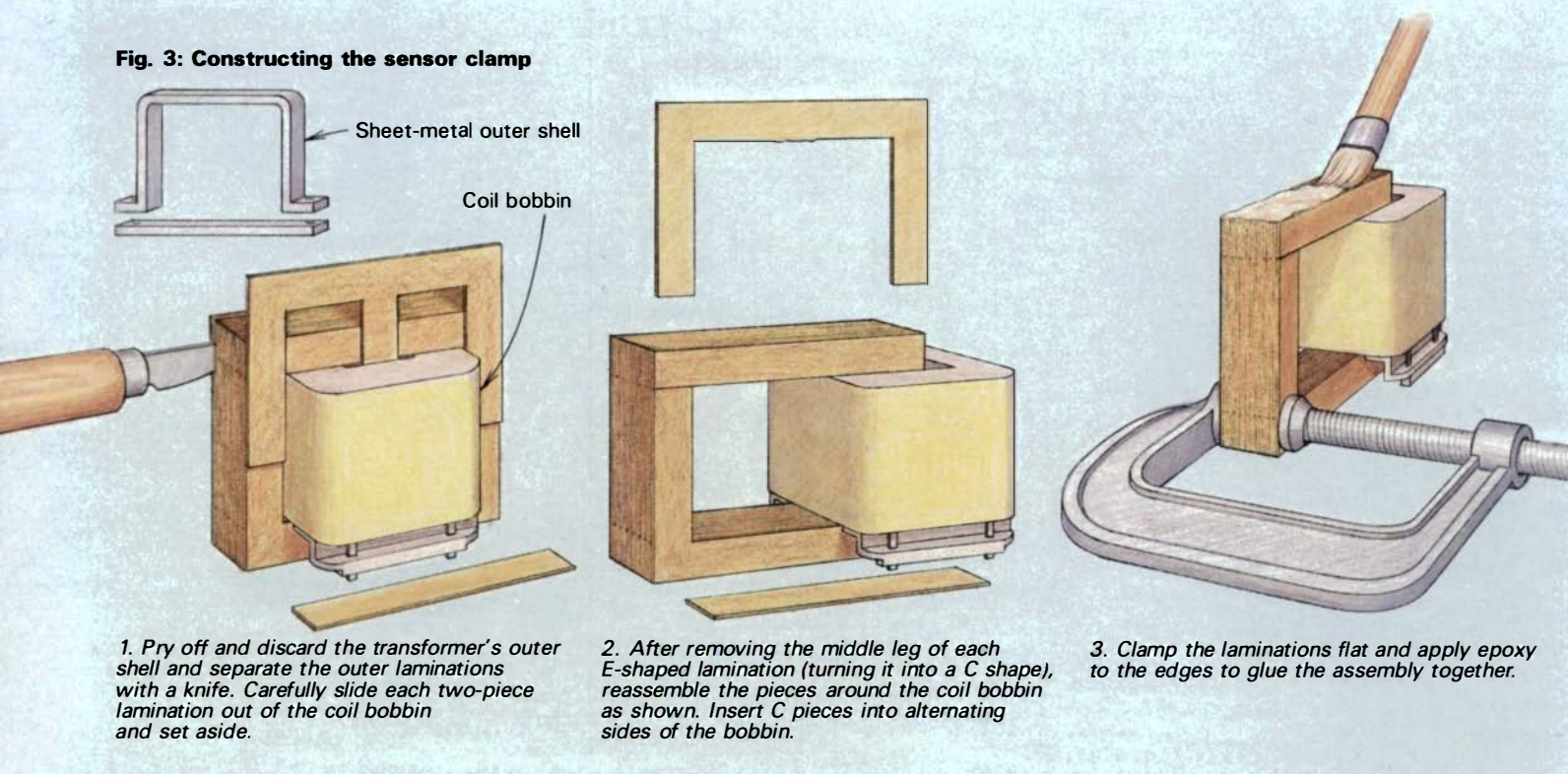
* Available from W.W. Grainger, Inc., 5959 W. Howard St., Chicago, IL 60648.

** Check local electronics store for availability.

*** Available from Sprague Electric Co., 149 Marshall St., N. Adams, MA 01247 (part no. 6PS-P10).

**** Available from Beckman Instruments Inc., Electronic Technologies Group, 2500 Harbor Blvd., Fullerton, CA 92634 (part no. P89PR50K).

Fig. 3: Constructing the sensor clamp



sensor clamp, in an electrical junction box, because the circuit runs on AC power. The printed circuit board is mounted component-side-up on spacers to keep it from touching the box. Orient the board so the screw-end of R4 is close to one side of the box, then drill a hole large enough to allow adjustment with a small screwdriver. The ADS's power switch and manual on-off switch mount directly to the top or sides of the box and should be wired after mounting.

Before hooking up the ADS to your dust collector system, you must test and adjust the unit. Pass a single wire from a lamp cord powering at least a 150-watt floodlight (which draws about 1 amp), through the sensor clamp. With the floodlight lit, the ADS's power on and manual switch off, turn the adjustment screw on R4 until the contacts of the relay just pop open. At this setting, the ADS will switch the collector on when any electric load above 1 amp passes through the sensor clamp—a low enough threshold to react to almost any motorized machine.

Mount the ADS near the main breaker box in your shop (see photo, previous page) and wire the relay and line going to the collector motor as shown in figure 1 (note that in this drawing the circuit board has been oriented for clarity—you should turn

yours so you can adjust the potentiometer screw through the box side as noted earlier). Find a convenient place in the breaker box to locate the sensor clamp, and pass one lead from each circuit that supplies power to shop machines through the clamp. Note that only one of two hot wires leading to motors operating on 220v needs to be threaded through. To avoid phasing problems, note the direction that wires must pass through the sensor clamp. Avoid passing 110v lines leading to outlets used for power handtools or shop lights, because the 1-amp threshold of the controller will respond to these non-dust-control power users. While rewiring, *make absolutely sure the power to the breaker box is turned off*, and if you feel uncertain, hire an electrician.

Restore power and check to see that each of the monitored machines turns the dust collector on and off. □

Robert Terry is a retired electrical engineer and home-shop woodworker in Palm Beach, Fla. He offers a ready-to-solder parts kit, including an already-etched printed circuit board and relay, for \$46.25 excluding shipping. For details, send a SASE to Techaid, Box 3272, Palm Beach, Fla. 33480. Rick Liftig provided technical editing assistance for this article.

Building automatic gate valves

by Reid Samuelson

Most dust collectors I've seen are inconvenient or impractical for a small shop, at least for the way I work. I constantly move from machine to machine, often using one for only a few seconds, before going back to the bench to do some hand work. I built an automatic collector switch similar in function to Robert Terry's. My system, however, goes one step further: I built and installed solenoid-operated gate valves that

open and close blast gates supplying vacuum to only the individual machine that's in use. Unlike regular blast gates that you must remember to slide open or closed, automatic valves are always in the right position at the right time—no unexpected piles of shavings from forgetting to open a gate before taking a pass on the planer.

The basic anatomy of the automatic blast gate is illustrated in figure 4. A simple

wooden box houses an AC-powered solenoid, latch mechanism, and a hinged and counterweighted door that functions as the actual valve gate. The box has two holes that tightly fit to the ends of the dust-collection ducts coming from the machine and going to the collector. The valve is normally in the closed position with the door up and latched, preventing air from entering. When the machine is switched

on, current from the motor switch activates the solenoid, which pulls the latch up and releases the door. The collector's suction pulls the door open and allows the passage of wood chips and sawdust. When the machine is switched off, the power to the solenoid also cuts off, allowing the latch to drop to the locking position. No longer held open by suction, the door is pivoted back to the closed position by a counterweighted arm, re-latching itself.

To construct the automatic blast gate, first cut all parts for the valve box, latch and door out of plywood. Proportion the size of the unit according to the diameter of the collection ducts in your shop. To make the hinge/counterweight arm, bend a steel rod and braze it to a steel plate that will be screwed to the bottom edge of the valve door. The rod sticks out and bears on hinge plates mounted on the box sides. The plates are made from short lengths of flat steel and smooth out the hinge's pivoting action.

If you have helpers in your shop and typically run several machines at the same time, you'll need to make the hinge rod very thick and strong, so it can be used as a handle to manually close individual blast gates when desired. This is because, with several machines running at the same time, suction keeps the valves open at each machine until the last machine is switched off, shutting down the dust collector.

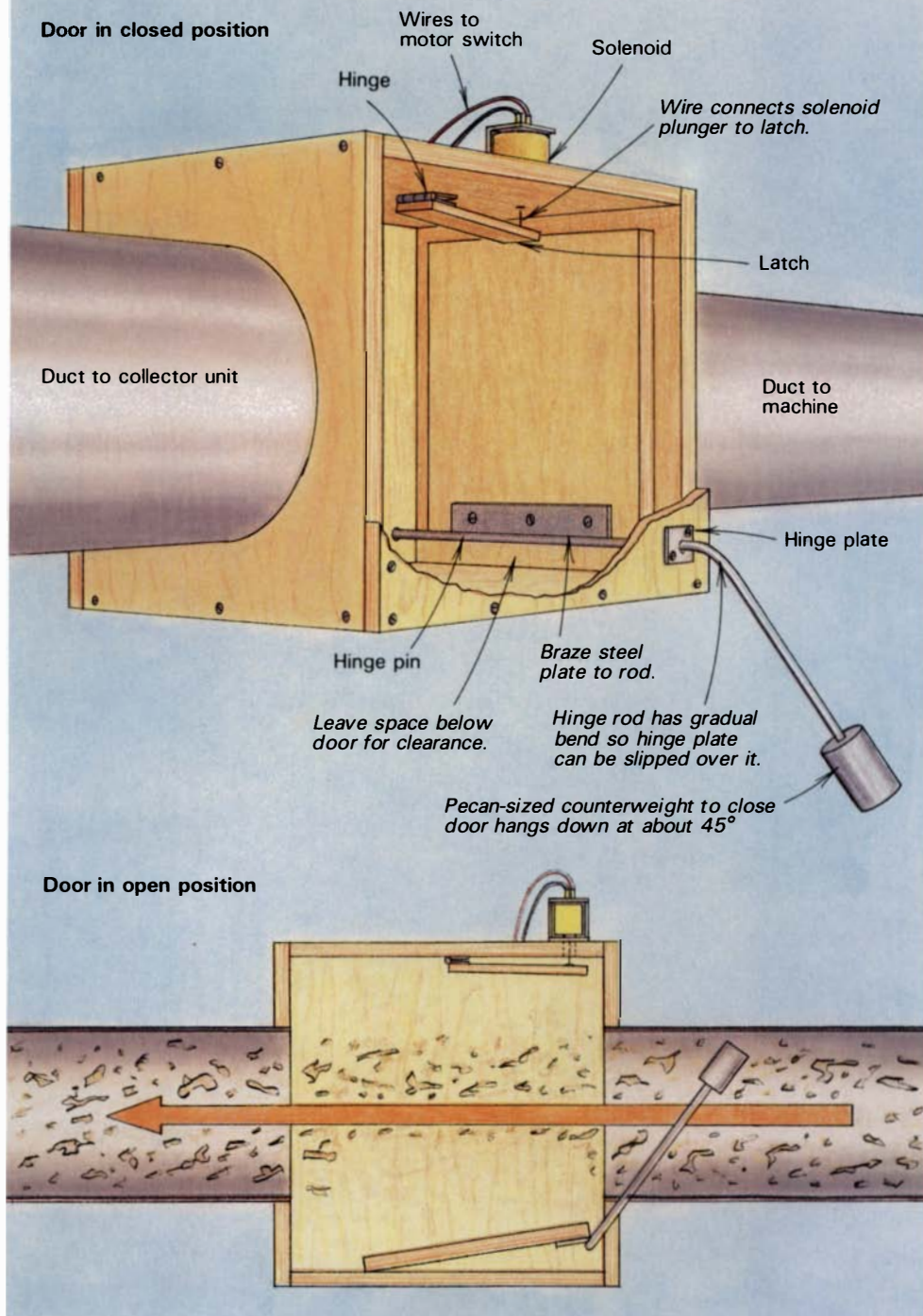
Screw on the latch hinge and mount the solenoid on the box's top, attaching a rod or stiff wire to connect the latch to the solenoid's plunger. When power to the solenoid is switched off, the closing door lifts the latch slightly as it returns to the lock position.

Now locate the oversized holes that pass the hinge rod through the box's sides. There should be about $\frac{1}{4}$ in. above the bottom of the box. If the pivot point is right at the bottom, dust and chips may accumulate and prevent the door from closing. Pass the ends of the hinge rod through the sides and assemble the valve box around the door, nailing or screwing and gluing it together. I don't think a gasket is needed to seal the door, but to keep the vacuum leakage low, the door should be larger than the duct port by at least $\frac{1}{2}$ in. on all sides and it should seat flat against the inside surface of the box.

A lead counterweight about the size of a pecan is drilled to fit the rod and slid over the end, about 4 in. from the bend. You'll have to experiment to find the exact weight and placement.

Depending on whether your machine's motor runs on 110v or 220v, I recommend using a Dormeyer series 1000 AC solenoid or its equivalent (both the 110v, model

Fig. 4: Automatic blast gate



#1000-M-1, and 220v, model #1001-M-1, are available from Grainger Inc., 5959 W. Howard St., Chicago, Ill. 60648). It may take some fiddling with the wire's length and the latch mechanism to get the door to lock and unlock properly, but it's very important that the solenoid plunger is allowed its full stroke or it will constantly draw current and burn out prematurely.

Connect the power cord to the motor wires inside your switch box so flipping the switch on will send 110v or 220v to the solenoid. Run the wire to the solenoid, making sure no connections are exposed.

When I was buying the electrical gear for the valves and collector controller, the clerk in the electronics store asked what I was planning to make. When I said it was a device for my dust collection system, he responded, "I've heard of some strange collections, but *dust*?" I was about to explain but then thought how much fun he'd have telling about the weirdo he'd met who collects dust. □

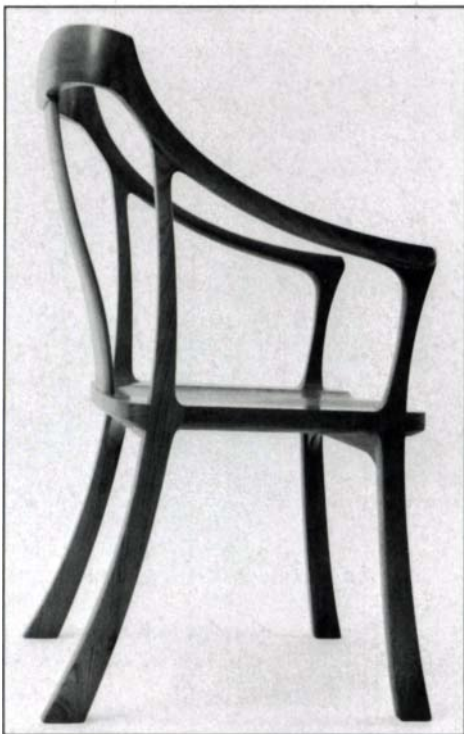
Reid Samuelson is a retired electrical engineer and amateur woodworker. He lives in Eastford, Conn.

Glueless Joinery

Furniture fastened with interlocking pins and wedges

by Russell Jason Beebe

Fig. 1: Glueless chair



This rosewood dining chair derives its strength from joints that mechanically interlock, so no glue is needed.

Fit arms to front legs before attaching rear legs to arms.

Fit braces to legs, slide seat onto legs.

Saw chair rail from 12/4 stock.

Arm

See Fig. 4.

Key

Insert back slat before sliding on chair rail.

See Fig. 2.

See Fig. 3.

Key

Key locks assembled joint.

Front leg

Rear leg

A few years ago I had the good fortune to receive a crash course in woodworking from a Chinese master in Thailand. Old Jeng Yee showed me many things, some of which I'll never be able to do as well as he, and he forever changed the way I look at woodworking. Even though exposed joinery was popular in this country when I visited him in Thailand in 1981, he embraced the traditional philosophy that blind joints are stronger than exposed joints. Even if they weren't stronger, he maintained that the mechanics of exposed joints spoiled the esthetics of furniture.

Before I met Jeng Yee, the fanciest joint I knew was the dovetail. Generally I had used dowels and a lot of glue. The furniture looked good, but it lacked the qualities 70-year-old Jeng Yee valued most: a balanced design with structural integrity based on joints so well-cut they could be locked together without any glue or fasteners. Naturally, furniture built this well is beyond the

financial reach of many people, so Chinese master craftsmen often rely on glue to produce more inexpensive furniture. They use the same joints found on the highest quality work, but the holding power of glue can save time, and thereby cut costs, because the joints don't need to be cut so precisely.

Since I only studied with Jeng Yee a short while, instead of the full, five-to-seven year apprenticeship typical in China, my knowledge of joints and locks is limited, but my techniques are continually improving. Using the basic concepts he taught me, I have invented many of my own joinery techniques. My methods may not be exactly like those used in China, but they work. The goal is always to have the entire piece lock together in a logical sequence of assembly and always in consideration of function, strength of materials and appearance.

Besides being satisfying to cut, Jeng Yee's dry, locking joints offer several advantages. Joints that depend on glue tend to

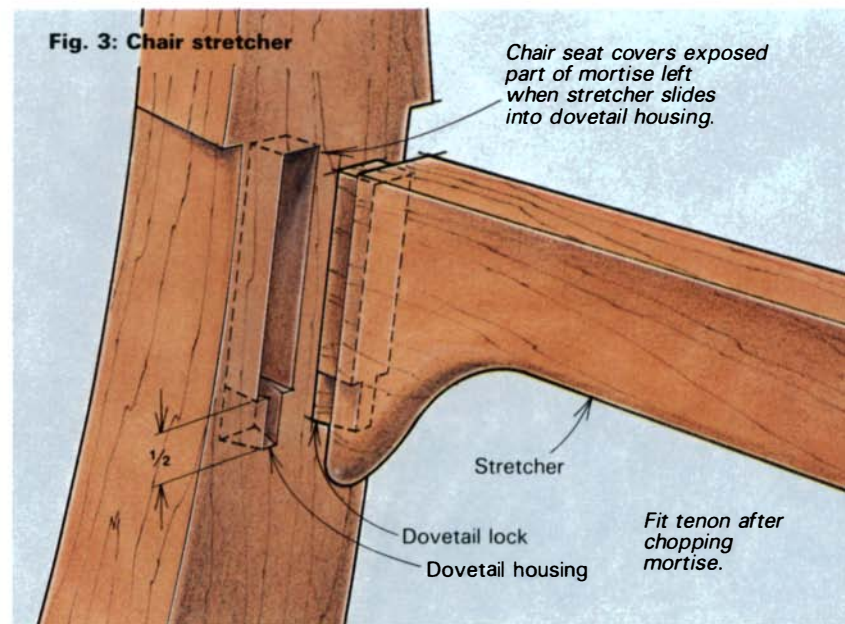
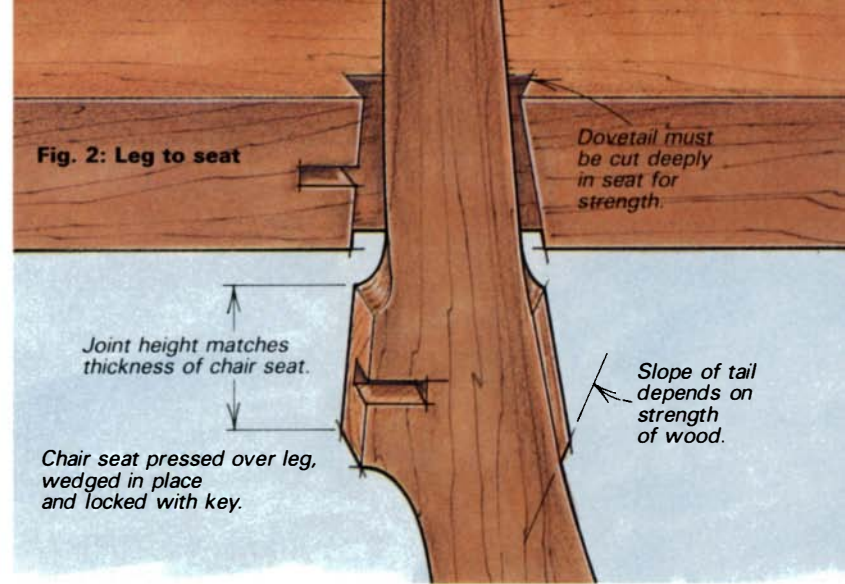
weaken over the years as the glue shrinks or becomes brittle with age. Some might argue that point, but the fact remains that a serviceable dry joint must be cut perfectly and is, therefore, superior. Jeng Yee told me that when a student constructed one of these joints, his instructor would put it into a pot of boiling water long enough to get everything good and wet. Then he'd pull the joint apart. If any water seeped into the joint, the student's work was rated a failure.

The chair in figure 1 is a good example of what I learned from Jeng Yee. The design is my own with a few borrowed Asian characteristics. The structure is a product of some common knowledge and lots of imagination. The chair is quite comfortable and its light appearance is achieved by sculpting each part as much as possible, while leaving enough bulk at the joints for strength. After considering points of stress, compression factors and the strength of the wood to be used (East Indian Rosewood in this case), I guessed at a good structural design and built a prototype. The joints are several forms of the wedge, the sliding dovetail and the mortise and tenon. Miters are incorporated whenever possible because of the Oriental preference for converging grain patterns. You always have to plan the joint according to the strength needed at each point and the kind of wood. I used rosewood for the final chair, but built the first prototype with softer teak. The teak chair looks good, but the components were too delicately shaped to withstand hard use. The only American wood hard enough for joinery like this is hard maple.

When someone looks at the glueless chair shown in the drawing, the first reaction is "I can't even guess at how those joints are cut." Actually, if you're willing to experiment and practice, the joints aren't that difficult. Once you get past your initial hesitation and start cutting, you'll roll right along. My basic procedure is to rough out each joint with a bow saw or Japanese pull saw, then clean out the joint with chisels. Mating surfaces are progressively shaved during repeated trial fittings until a perfect fit is achieved. This is indicated by an increasing tightness without distortion as the pieces are forced together. To aid in the fitting of joints, I lightly sand the mating surfaces before each trial assembly. The pieces sliding together burnish away the sanding fuzz enough to clearly show the binding spots. If the joint is too loose, I glue shavings of the same wood to the mating surfaces and refit.

Before attempting to build the chair, I'd recommend you build a prototype as I did. The prototype will give you another opportunity to practice the Oriental techniques, then you can work from the prototype to develop full-size templates for every part. After tracing my templates onto 8/4 rosewood, I roughly cut out all the pieces. Joining areas are left well oversize and squared-off where possible to facilitate the cutting of joints. When cutting the pieces out, carefully consider grain patterns for maximum structural strength. Converging grain is always stronger than opposing. It's also a good idea to keep an eye on the moisture content. The wood should be thoroughly dry (6% is an acceptable moisture content in southern Oregon where I live).

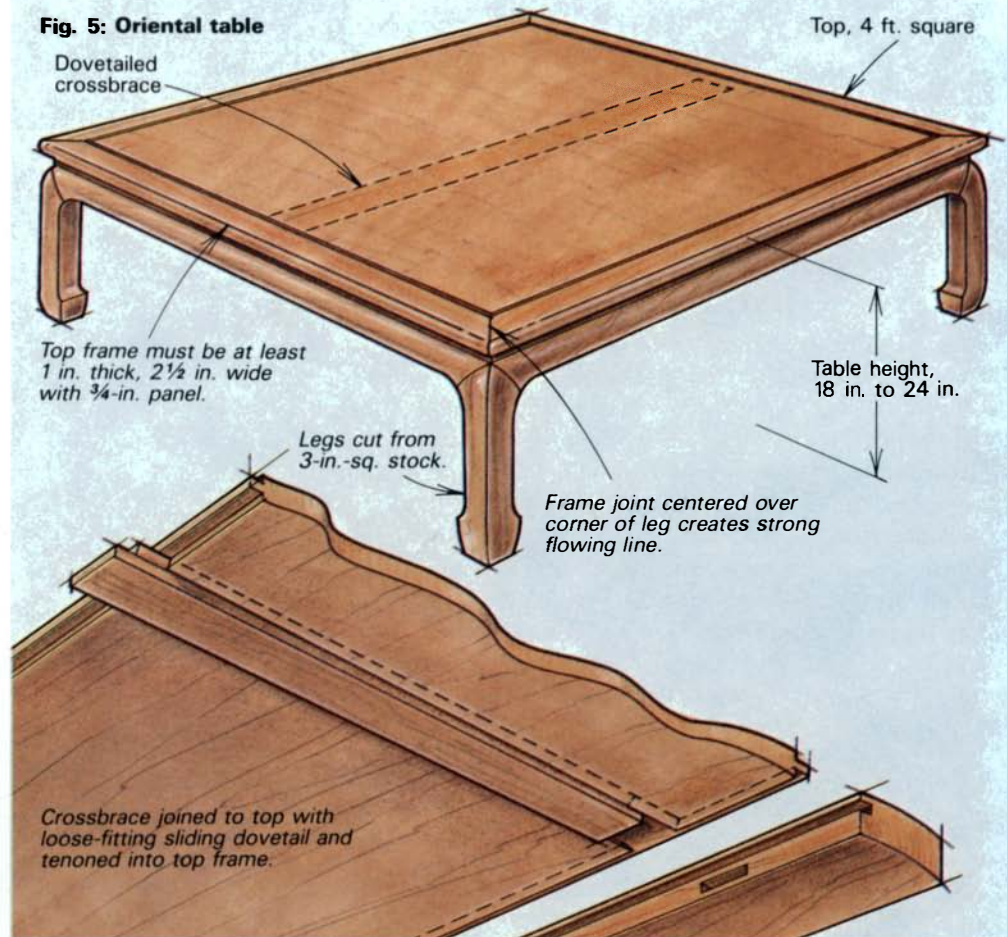
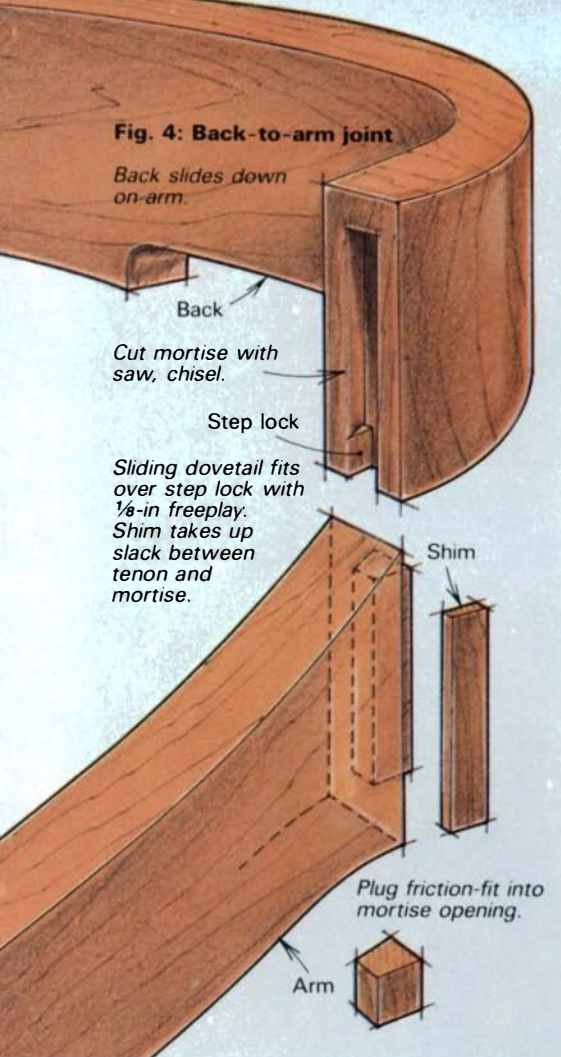
Since the chair seat essentially dictates sizing and the basic framework, I start with the seat. I first chop out the mortise for the backrest, then cut the four leg wedge joints, as shown in figure 2. These wedge joints are like large dovetails cut into the sides of the seat. Again working from the prototype templates, saw, then chisel, the housings to shape. Remember they must be large enough to allow the seat to slide down over the legs into position. Now cut the corresponding wedge shape on the legs,



again with saw and chisel. Don't attempt to fit the legs to the seat yet, though. The legs must first be attached to the stretchers to ensure that the seat will be properly positioned.

The stretchers, figure 3, are fit into the legs with a straight mortise and tenon with an Oriental twist—a ½-in. dovetail section that locks into the mortise. I saw out the tenon in the conventional fashion, then cut in the pin with a ¼-in. chisel. The mortise is pretty conventional too, except the bottom ½ in. is narrower than the rest of the mortise and the section's walls are sloped to act as the pin housing. The tenon on the rail can then be fit into the mortise, lowered down and locked into the dovetail as the seat is forced down over the legs. This sliding action means you can restrict the movement of the legs somewhat during assembly, and still have enough flexibility to make final adjustments. When the rail is locked into position, a ½-in. section of the mortise will be visible at the top of the joint, but this cavity will be covered by the chair seat when it's installed.

With the seat fitting flush on the braces, I chop out the mating slots for the keys that lock the legs and seat into place. The arms are next held in position so the joints attaching them to the legs can be laid out and cut. A blind, sliding dovetail is used on the front legs. The rear legs are attached with a beveled mortise and tenon. Since the arms are held by three joints—the sliding dovetail at the front, the beveled tenon on the rear legs and the chair back itself—the arms must be fitted very carefully. Once the arms have



been installed on the legs, the joining surfaces to the chair back can be adjusted if needed. With the back held in approximate position, the sliding dovetail joints are laid out and the arms removed.

These joints involve a step-lock to restrict vertical movement. To locate this lock, there must be approximately $\frac{1}{8}$ -in. outside play in the joint when the pieces are fitted. This play is later taken up by inserting a shim of corresponding thickness into the joint at final assembly. The chair back is lowered over the arms, so this joint must be blind at the top. The mortise for the backrest can be cut at this time, then the arms and back are installed. Now the length of the backrest can be adjusted and the tenons cut according to the seat angles. With the back again removed, the backrest is fitted into the seat and the chair is assembled.

Rather than lock all the joints now, I leave the chair loosely assembled, even if it means holding it together with clamps, and mark out the areas that need to be carved or shaped. Shaping can be done with the chair intact, but it is more easily done on separate pieces. After the pieces are shaped, I assemble them again and cut and fit the appropriate locking keys. I usually do the key locking the legs to the seat first. Here you have to make sure the grain runs horizontally. Then the hole is drilled blind through the mortise and tenon locating the rear legs to the arms, and a dowel of identical wood is inserted. Lastly, the shims are cut extra long and fitted into the sliding dovetail locating the back of the arms, and a tight fitting plug is inserted from the bottom. Now the keys are trimmed and the chair smoothed and finished with a clear oil finish.

Chairs are among the most difficult woodworking projects, so if you wish to try glueless joinery, you might begin with the simple joints used in the table shown in figure 5, which offers a good exercise in joint layout and cutting. It's fastened with splined miters, locking mortises and tenons, and several other joints.

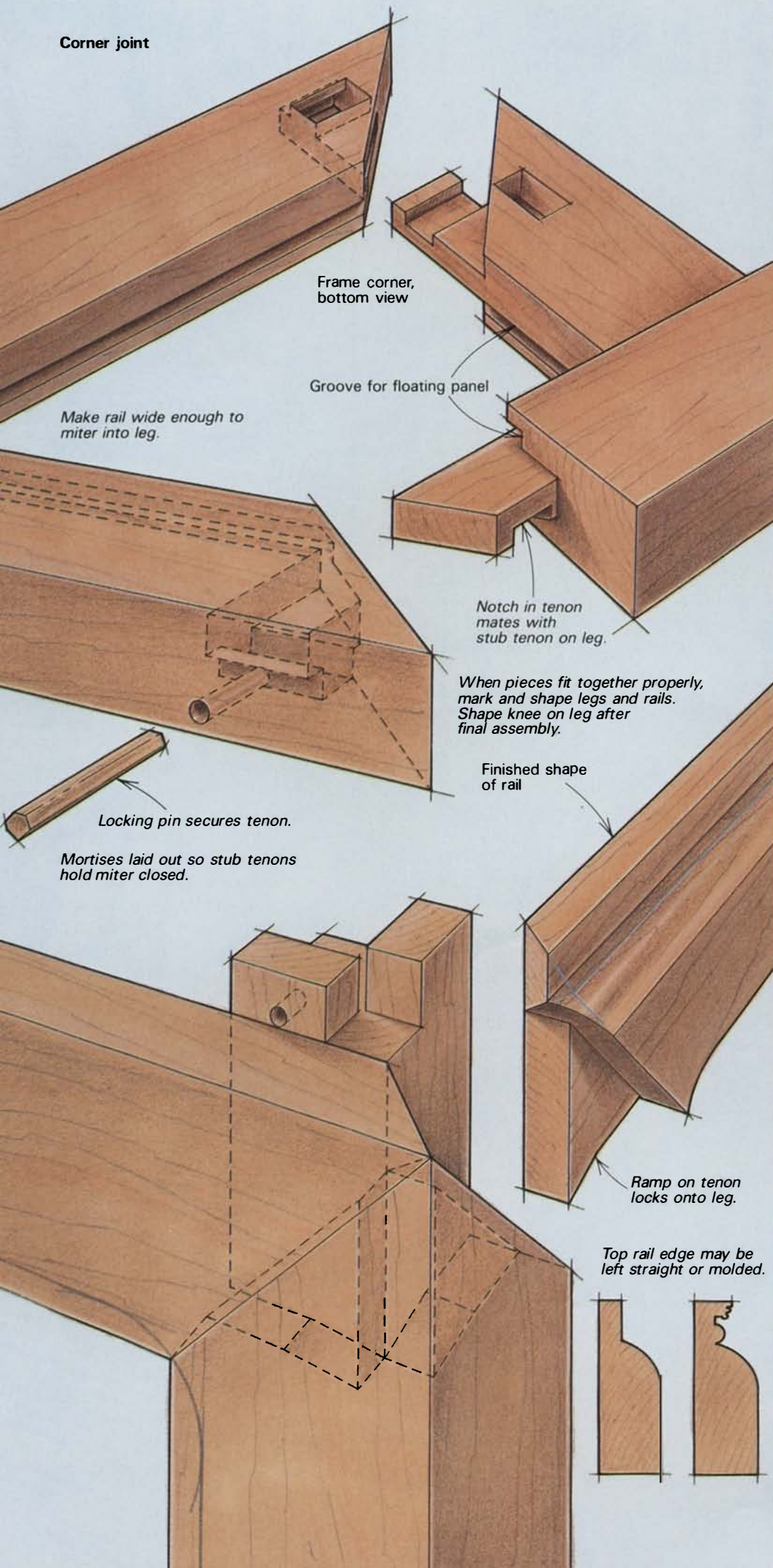
An Oriental-style coffee table is best suited to a square configuration that harmonizes well with the curve of the legs, and results in a strong table. If you want to modify the top, I'd recommend you stick with the square and make it two-, three- and four-foot square. Cutting the joints is fairly straightforward, as shown in the picture series on the facing page. Cut the legs from 3-in.-square stock, then do the 45° miters and stub tenons as shown. Once you know the width of the miters, you can establish the width of the rail and cut the mitered tenons to fit into the leg. Again, the key is to work carefully and pare the mating surfaces until they fit snugly.

Don't worry about shaping the legs or the rails until all the joints are cut and fitted. You'll have a better idea of how the legs and rails will flow together, and you'll be able to fair the curves between the components once everything is fit together. After you've completed all the rail-to-leg joints, make the mitered frame. Turn the frame upside down, and scribe the mortises directly from the stub tenons on the top of the legs. Note how the leg tenon interlocks with the frame tenon. Once you're satisfied with the fit of the joints, bore the corners, as shown in the drawing at right, so they can be pegged together.

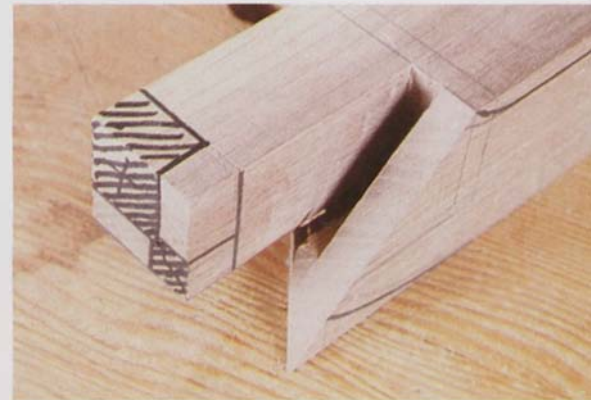
If you're looking for a quick way to do woodworking, Jeng Yee's way is not for you. Mastery only comes with practice, and you must discipline yourself never to take the easy way out. A chair like the one shown here takes about 100 hours to complete. That might not be economical to some, but besides being a true test of one's skill and patience, the end result is one in which you can take enduring pride. □

Russell Jason Beebe is a professional woodworker. He lives in Medford, Ore.

Corner joint



Above: To miter the end of the legs, Beebe cuts most of the waste away with a frame saw. Multiple cuts make it easier to chisel away the waste. Below: Visualizing the joint is a critical part of the process. Each leg is first mitered to accept beveled tenons cut on the rails, then stub tenons are cut on the top of the leg to fit into the top frame. X-area indicates the waste surrounding the stub tenons.



Above: After the mortises are chopped, matching tenons are cut on the rail ends. Below: The frame surrounding the tabletop is mitered. A tenon cut on one piece fits into a mortise on the mating piece. A small mortise chopped into the frame's face accepts the stub tenon on the leg.





Shading, Glazing and Toning

Three ways of using color with lacquer

by Donald M. Steinert

Shading is an effective way of neutralizing color differences. The sapwood on this walnut board, top, has been completely disguised, bottom, using a walnut-colored shading lacquer. Shading has also helped to hide the glue line.

One of the most appealing qualities of nitrocellulose lacquer is its versatility. Besides its use as a clear coating, lacquer can be mixed with various dyes and pigments to alter, enhance or entirely cover up the natural color and figure of wood. By mixing colorants with clear lacquer, three specialized techniques—shading, glazing and toning—can be used separately or in combination as an alternative to staining, as an aid to evening out color differences, and to highlight and create special effects. Used with basic lacquering skills, which I'll assume you already have, these methods will expand your wood finishing repertoire.

Before I describe the techniques in detail, I'll say a few words about wood preparation. Regardless of which coloring technique you try, the wood must be free of contaminants, such as wax or silicone, and sanded down to at least 220 grit. If staining and/or filling are required, do these steps as you would for any clear lacquer topcoats. But keep in mind that staining may or may not be necessary, since one of the techniques I'll describe may substitute. Once your sanding is done, seal the wood with a coat of clear sanding sealer. When dry, lightly sand with 400-grit paper. Once the coloring is done, as described below, you can apply a clear lacquer topcoat for the final finish. I recommend you use a nitrocellulose lacquer formulated specifically for wood. Don't use acrylic auto-finishing lacquers, which are primarily designed for metal. For more on clear lacquering, see *FWW* #62, pp. 67-74.

Shading is probably the most versatile lacquer-coloring method. In shading, clear lacquer is tinted with dye and applied between the sanding-sealer coat and the clear topcoat. Depending on the hue, the amount of color, and the number of coats, shading can highlight, alter or entirely change the wood's natural color. It can be used on an entire piece of furniture or, with careful spraying, can be selectively applied to only certain areas. Further, since shading lacquer is usually built up in a series of coats, you have a great amount of control over the color you'll end up with.

To mix a shading lacquer, start with the lacquer you'll be using for the topcoat. To this, add a small amount of transparent dye stain. It's essential to use a stain compatible with lacquer, such as Mohawk Ultra Penetrating Stain (product #520), available from Mohawk Finishing Products, Inc., Route 30, Amsterdam, N.Y. 12010). Ultra stains are universal dye stains diluted in a blend of solvents. You can mix up to one part stain with 16 parts lacquer (more than this retards the lacquer). For darker tones, apply more coats.

When mixing a shading lacquer that will serve as a stain, I use transparent dyes in various woody tones. In conjunction with these, I also use small amounts of black, yellow, green and red to adjust the shade and tone to almost any hue, as necessary. Other colors can be employed for bolder effects.

The darkness and depth of color on the wood being finished is determined by how many coats of shading are applied. The greatest degree of control is maintained by applying multiple light coats of shading lacquer, one at a time. Allow each coat to flash before applying the next. If a great deal of color change is wanted, I prefer spraying an initially darker shading lacquer, since it will require fewer coats to produce the desired shade.

One of the great advantages of coloring wood with shading lacquer is that the colored lacquer is sprayed on wood after it's been sealed. Thus you'll avoid splotching on many woods like fir, pine, oak and ash, which absorb stain unevenly. By applying several layers of lacquer, it's possible to develop a matching color gradually and precisely. This degree of color control is particularly helpful if you're trying to match the color of a reproduction to an existing piece. To blend in undesirable differences between unevenly colored boards, such as an unsightly streak of light sapwood in an otherwise satisfactory walnut tabletop, spray shading lacquer in a narrow spray pattern at low air pressure (see above photos).

Shading can also highlight wood color rather than change it. If a particular piece looks dull or flat, applying a few light coats of shading lacquer that's the same hue, but more intense, can create depth. Or if the color of the wood is unappealing, it can be "kicked" with shading lacquer. For example, a piece of walnut that looks too cool (too green in color) can be warmed by kicking it with a little red shading. Interesting effects can be produced by spraying more coats of shading on one area than another. For example, the borders of tabletops or drawer fronts can be sprayed slightly darker than the field to give some dimension to an otherwise flat piece. Playful effects, such as a transparent "candy apple" finish—great for children's furniture—are created by spraying brightly colored shading lacquer over very light wood.

Glazing is useful for highlighting carved, turned or molded details. Glazing darkens recesses while allowing raised details, a turned bead for instance, to remain lighter. Depending on the col-

or and amount applied, you can create either dramatic or subtle contrasts. A glaze is made by mixing a pigment with a solvent. I use Mohawk Universal Color Concentrate (product #562) dissolved in naphtha. Proportions are not critical and will be dictated by the look you wish to create. To start, you may try one part pigment to three parts solvent. I prefer darker glazes because it's easier to wipe a little more off than to have to do a second application. Virtually any color may be used as a glaze to create an infinite variety of effects. For producing dark glazes, I often use black and earth tones, and my favorite is straight Vandyke brown, which produces a very rich-looking glaze. Light glazes usually work best on dark woods and vice versa. Metallic glazes can be prepared with Mohawk Bronzing Powder (product #380), available in numerous shades of gold, silver, copper and bronze.

Applying the glaze is not particularly difficult. This may be done with an old brush, rag or spray gun. When spraying, keep the air pressure to about 20 psi and restrict fluid flow. The entire area to be glazed is coated as if it were being painted. As soon as the glaze turns dull, wipe it off with a soft rag. As with using any lacquer products, wear gloves and a respirator. The idea is to remove most of the glaze from the details that are prominent while leaving the heaviest concentration in the recesses. There's no hurry, because even after the glaze is completely dry it can be removed with a naphtha-dampened, lint-free cloth.

Once you have achieved the desired look with the glaze, allow it to dry for about an hour. Then, spray it with a light topcoat of clear lacquer. Mastering the art of glazing takes practice and a critical eye. If you're not satisfied with the look you get on the first try, simply recoat and wipe the piece all over again.

Toning is similar to shading, but uses heavily pigmented colors—as opposed to dyes—to disguise the color of wood rather than just darken or highlight it as shading does. Of the three techniques, toning has the least application in high-quality woodworking. While a shading lacquer creates depth, toning tends to rob a piece of its transparency and depth. Because an opaque colorant is used, each additional coat of toner not only darkens the wood's color, but obscures its grain and figure. If a toner is applied heavily enough, it will become completely opaque, like paint, and the wood will not show through at all. This technique is often used by furniture factories to disguise the undesirable color and grain in low-grade or cheap wood species.

But toning isn't just for fakery. Applied selectively, it can solve some difficult finishing problems. For instance, if you have otherwise beautiful wood that has a section of unsightly grain, a toner can be sprayed over the area to completely mask the defect. Toning can save time and grief if you're refinishing a piece and can't get all the old paint off or the wood's in terrible condition. In such cases, it's undesirable to retain the wood's original color, so first cover the entire piece with toner, and then apply glaze and/or shading to add depth and contrast (see photo right).

To make a toner, mix the same type of pigments used for glazes with clear lacquer. A good proportion to start with is one part pigment to 24 parts lacquer. First, dilute the universal color with a little lacquer thinner and strain it before adding it to the lacquer. Work up to the desired toning effect gradually by spraying several light coats, using low air pressure and limited fluid flow through the spray gun. As with shading, you can speed things up by mixing a darker toner at the outset, but you'll achieve the best color control with several thin coats built up gradually. □

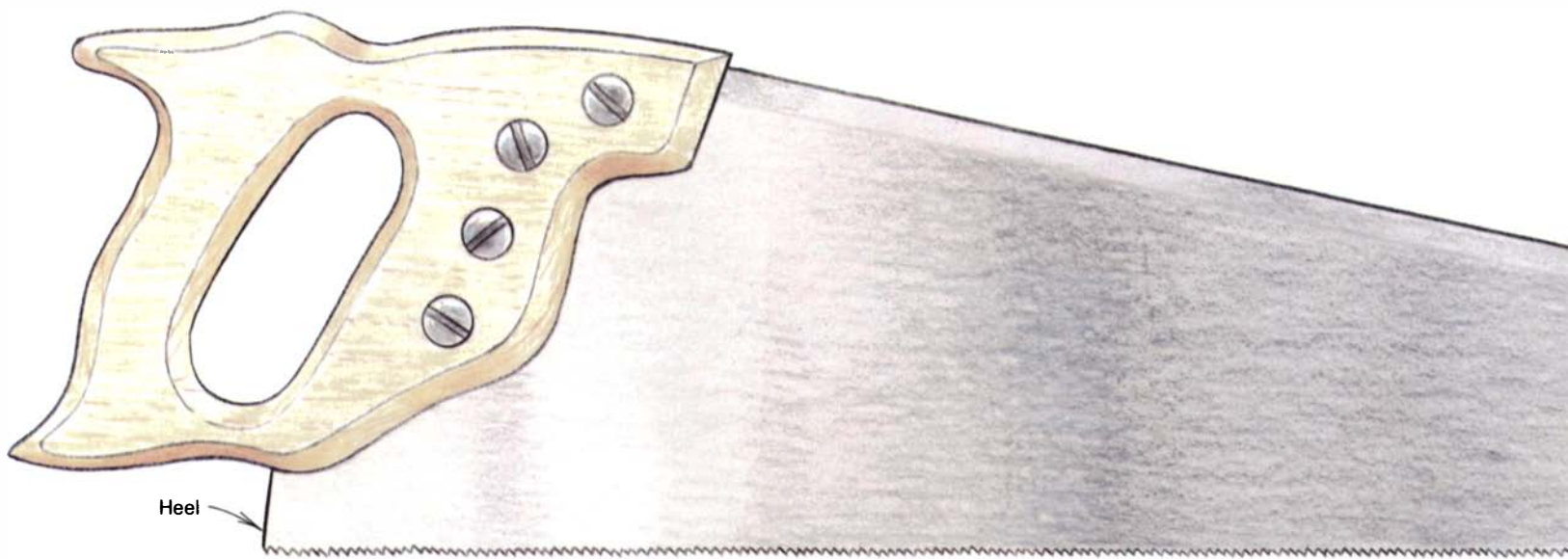
Donald M. Steinert restores Rolls-Royce woodwork and lives in Grants Pass, Ore. Photos by author.



It's not critical to apply a glaze evenly, since most of it is wiped off the prominent surfaces before it dries. The pigment left in the recesses can create contrasts to highlight carved and turned details or give a piece an aged look.



These four frames illustrate several ways of using shading, glazing and toning in combination. From top to bottom, the frames are: stained light walnut; glazed with brown and clear-coated; toned with tan, glazed with brown, shaded with maple and red and clear-coated; toned with white and glazed with raw umber.



Sharpening Handsaws

It's a matter of knowing all the angles

by Harold H. Payson

Years ago, a visitor to my father's shop in Rockland, Me., spying the half-dozen or so heavily chewed file handles sitting on his filing bench, paused his conversation for a moment and asked, "You got rats?"

No, my father, Herman W. Payson, didn't have rats in his shop. What he had was the best reputation around for sharpening saws of any kind, especially handsaws—an honor not to be taken lightly. Many of the best ship and house carpenters in our area brought their handsaws to him and returned faithfully, time and time again. The handles on his files were chewed up not from rats, but from years of being lightly "thunked" on freshly sharpened sawteeth to remove the burr left by the file. If removal of the burr showed a tooth not brought up to a sharpened point, then that tooth received another swipe or two with the file until it did.

My dad's heyday was back in the 1930s, in the era before circular saws replaced handsaws as the common tool for cutting lumber on the construction site and shipyard. The handsaw that cut fast and true to the line without binding or rattling in its kerf was much admired and well remembered. Handsaws aren't as widely used as they once were, but that's no excuse for using a dull one or not knowing how to sharpen one properly. A properly sharpened handsaw is handy for jobs where a circular saw is dangerous or just unwieldily to use. If sharpened correctly, they make short work of most cutting tasks; improperly sharpened, they're drudgery to use.

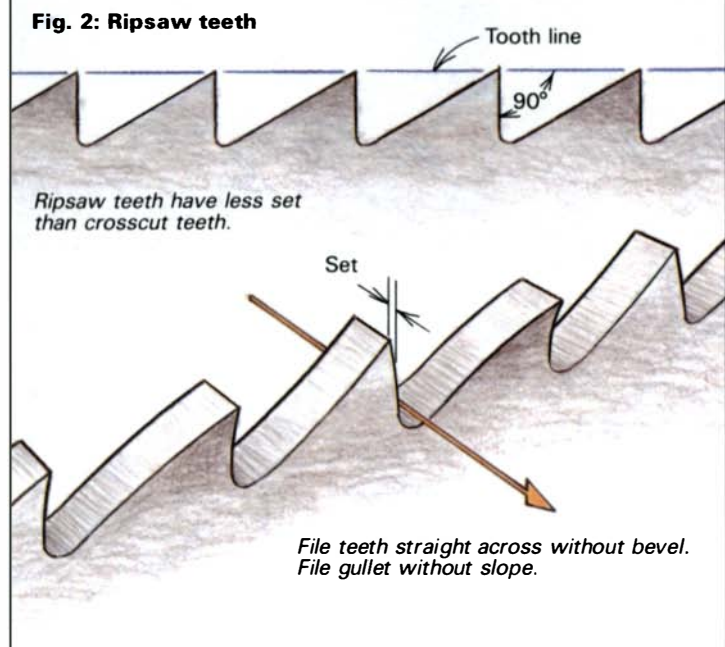
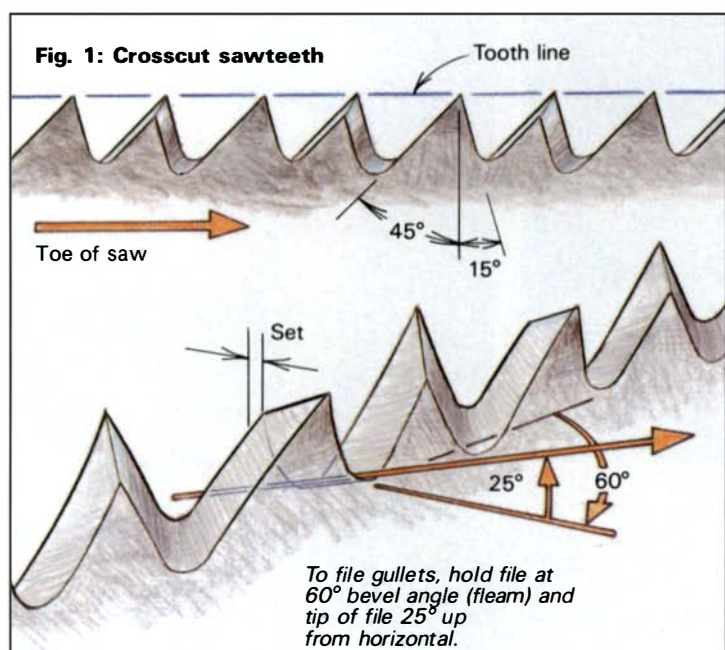
Learning how to sharpen a handsaw isn't difficult, just time consuming. My father developed his reputation for sharpening handsaws over many years, and it took me a year of practice filing before he squinted down the teeth of my best efforts and

declared, "That's as good as I can do." Words I never thought I'd hear. Was it worth it? You bet.

It's rewarding to know that I can remedy a saw's problems myself with little fuss or lost time. I'll never have to put up with lame excuses from a saw-sharpening shop that they can't get around to sharpening a saw until next week. True, I can't match the precision of a saw-filing machine, but why should I? Small variations between teeth don't detract from a saw's cutting ability. A machine-sharpened saw does the job, but a saw sharpened by hand is a pleasure to use.

The problem with saw-filing machines (at least the ones I'm familiar with) is that each tooth is sharpened based on the profile of the tooth ahead of it. A dogged lever drops over each tooth and pulls the saw into position for a swipe of a file. If the saw was newly re-toothed and the teeth perfect, a machine does fairly well. But teeth damaged after hitting nails throw the machine off. The machine will position a tooth for a swipe of the file based on the shape of a damaged or misfiled tooth. The result is a saw with teeth spaced too wide or too close. In the process, some teeth may be filed to oblivion, in which case the saw has to be re-toothed. New teeth are stamped or filed on the saw, and more metal is removed from the blade in the process than a year's worth of sharpening would take.

Incidentally, I feel the same way about saw-filing gadgets as I do about filing machines. A friend of mine bought one that held a file on a slide. The entire contraption slid over the saw and the file was moved precisely back and forth over the teeth to produce any tooth angle wanted. However, it didn't allow you to file



sloping gullets, one of the chief advantages of hand filing. Also, there was no way of controlling side pressure on the file to correct teeth that were too large.

Before I tell you how to sharpen a saw, I'll outline the basic process. First, the saw is clamped in a saw vise. The teeth are jointed so their tops are flat and at the same height. Using a saw set, the teeth are then set (bent) left or right of the sawblade. The teeth are filed with identical cutting angles. Consequently, the teeth should all be the same in profile, with all their points at the same height. I will describe sharpening rip and crosscut saws, but the same techniques are used on backsaws and dovetail saws.

Don't be overconcerned about tooth pitch or bevels in this process. They are bound to vary slightly when you are first learning—you'll become more consistent with practice. Having said that, here's how to set yourself up for saw sharpening.

The filing bench—My bench is a 10-in.-wide by 5-ft.-long plank, and its top is belly-button height off the floor. For comfortable stand-up saw filing, each bench must be tailored to the filer, however. You can't sit while filing handsaws, you must stand and put your whole body into the stroke of the file, rocking back and forth while using your arms. This gives you better control over the file stroke and makes the job less tiring. I painted the bench-top flat black to ward off unwanted glare.

My filing bench is positioned in front of a west-facing window. My father's bench was in front of a south-facing window—other filers work best with a north-facing window. I don't give a hoot what direction the window faces, I just want all the light I can get as long as it falls on the sawteeth and not in my eyes. What about artificial light? Even when my eyesight was good I couldn't do a decent job under it. I don't recommend it now.

I lower a curtain partially over the window until a comfortable amount of light comes through, and improve the visibility of the sawteeth by tacking up a piece of tar paper above the window apron. When I look across the saw, the black background contrasts with the teeth, making burrs or minor irregularities more apparent.

The filing vise—Position the top of your vise at chest height to allow for proper visibility and arm comfort. While you can buy saw vises through many woodworking catalogues, you can make your own out of scrap wood, as I did. Each half of the vise consists of a vertical leg with a long jaw attached perpendicular to it, to form a "T". The two halves are bolted together with a fulcrum between them. A swinging handle is bolted between the halves, too. As the handle is swung up, an arc-shaped dome on the handle pushes against the vertical leg, tightening the vise. To loosen the vise, the handle is knocked down. The jaws don't have to be the same length as your sawblade, but they should be long enough so you can do significant filing before reclamping the saw. The jaws on my vise are about 20 in. long, and the legs are about the same. The vise legs are set into a notch in the bench and clamped in place. The vise leans away from the filer 10°, which helps the file leave sloping gullets between teeth. A diagonal brace behind the vise makes it rigid against the push of the file.

A final tip about the filing vise: Line the jaw with lead sheet flashing, available from roofing and industrial suppliers. Wrap the lead so it folds over the outside of the jaws and staple through it on the outside so the staples don't mar the sawblade. The lead deadens the vibrations of the file. Combined with the brace behind the vise, this makes for a rock-solid filing vise.

Saws are rated in points of teeth-per-inch, the more teeth per inch, the finer the saw. The type of file you use depends on the



Begin the saw-sharpening process by leveling the teeth with a jointer (left). Though the author is shown using a commercial model, you can make one from a wood block grooved to accept a file. The jointer holds a file level and perpendicular to the sawteeth. Moving from handle to tip, draw the jointer down the blade's length until a small flat is filed at the top of each tooth. A saw set (right) bends alternate teeth to the left or right. Set every other tooth in one direction first, reverse the saw and set the remaining teeth in the opposite direction.



To begin filing a handsaw, clamp the saw in the vise with the handle to your right (above). Using a three-corner file, start at the toe and work to the heel, filing the teeth facing away from you. Reverse the saw, start at the toe again, and file back to the heel. The photo at left shows the 10° slant of the saw vise that contributes to the sloping gullets filed into the sawteeth. Note that a grip is also attached to the file's tip for more comfort and stability. The final step is to lightly dress the side of the teeth with a three-cornered file tipped on edge (right). This step removes burrs on the side of the teeth, making for a cleaner cut. Dressing the sides also removes a slight amount of set and can remedy saws that rattle because their kerf is slightly too wide.



saw's teeth size. A 10-point saw has 10 tips and nine full teeth (not 10 teeth) per inch and is sharpened with a 7-in., extra-slim taper, three-cornered file. All saw-sharpening files are three-cornered and taper slightly along their length. These files get progressively thinner in cross section and are rated as: taper, slim taper, extra-slim taper and double extra-slim taper. A six- or seven-point rip saw has coarser teeth than a 10-point crosscut saw and thus would require a larger file; a 7-in. slim taper will do nicely for this saw. If you're having trouble deciding which file to use, bring the saw to the hardware store and fit the file between the teeth. Saw files are also available from: Home Lumber Co., 499 W. Whitewater St., Whitewater, Wis. 53190. Be fussy when choosing a file, because

one that is too large for the saw will file one tooth to oblivion while you are concentrating on getting the other one sharp. A file too small will rattle in the gullet, cutting only one side of a tooth when it should be cutting the face of the adjacent tooth as well. Add a wood handle to the file's tang and another at the tip. The two handles provide better control and more comfort than one handle.

Sawtooth jointer and saw set—A jointer is simply a jig for holding a flat-mill bastard file. When drawn along the length of the sawblade, from the handle to the toe, it files teeth down to a uniform height. You can buy a commercially made jointer or make one out of a wood block with a slot cut in it to hold the file.

A saw set is a forming tool that bends the tooth against a miniature anvil. The set in a saw's teeth makes the kerf slightly wider than the saw's body, and hence reduces drag on the saw. There are a couple of different styles of sets, but the one with a pistol grip works the best. Stanley Tool Co. still makes them, and they come with a numbered screw-knob adjustment—available from: Frog Tool Co. Ltd., 700 W. Jackson Blvd., Chicago, Ill. 60606. Mine is numbered from 4 to 16, with each number corresponding to the points-per-inch of a saw. To set the teeth of a 10-point saw, roll the set's knob to 10 until it lines up with the anvil. Hold the saw handle under your arm and, starting at the toe of the saw, place the first tooth leaning away from you between the anvil and the set's punch block and squeeze the set's handle. Set every tooth leaning away from you from there to the handle. This completes one side. For the other side, tuck the handle between your knees and work from the toe again, repeating the procedure.

How much set to use is based on experience; the numbers on the sets act as a guide, but don't go entirely by them. Green wood puts greater drag on the saw and hence requires more set; dry wood requires less set. If the saw is dragging, increase the set.

Watch for saws that are taper ground, their blades are thicker at the teeth than at their back and require less set. This feature was found in the more expensive saws, but is seldom seen now.

Sharpening crosscut saws—I'll explain how to sharpen an 8-point crosscut saw because these are relatively common. First, joint the teeth down. This is done in the handle-to-toe direction until you see flats form on the tops of the teeth and the teeth shine. You can hold the saw in your hand during jointing rather than locking it in a vise.

Set the teeth if they need it. It's possible to set your saw after it's sharpened, just do it carefully so as not to damage any of the cleanly-filed teeth. I have received saws for sharpening with teeth so badly out of shape that both the teeth and gullets had to be rough filed before setting.

Put your saw in the vise with the toe either to your right or to your left. In the photos, the saw has its toe to the left. File the face of the first tooth leaning away from you at the toe. Hold your file with its handle angled back to the saw's grip about 30° to produce sloping sides on the teeth known as fleam. Tilt the file's handle down from horizontal toward you about 15°. The downward slope of the vise, combined with the slope of the file, produces a gullet slope of about 25°. This produces deeper gullets than saws filed on machines where the file moves in a horizontal line, leaving level gullets. I'm inclined to agree with my father, who claimed this aspect of hand sharpening makes a saw cut better, because the deeper gullets chamber more sawdust—the gullets are capable of handling what the teeth bite off.

The profile of a crosscut saw's tooth is best described in this manner: If you drew a line along the tips of all the saw's teeth, and then struck a perpendicular from that line across the width of the blade, each tooth front would have a 15° slope from the perpendicular. Each tooth back would slope at a 45° angle from the perpendicular. If the front angle is more than 15° to the perpendicular, the saw will not cut as quickly. If the angle is less than 15°, then the saw will have a tendency to bite off too much wood and it will chatter.

In addition to the angles of tooth profile, fleam angle affects cutting ability as well. Fleam angle bevels the front of each tooth, giving each a shearing effect. Think of sharpening a chisel as you file each tooth. Too much bevel results in a sharper tooth that cuts faster, but dulls sooner. Too blunt, and it's slow cutting.

In this process, you are filing the front of one tooth and the back slope of another at the same time. Watch the tops of the teeth so you file only half of each jointed flat—the remainder of the flat is filed away when the saw is turned around and the opposite-set teeth are filed. Don't try to bring them to a point the first time across.

When you reach the handle, turn the saw so its toe is to the right and start filing at the toe again. This time bring each tooth to a point. Thunk each tooth as you're finished with it to remove the burr, otherwise the point will be hidden by the burr and you won't be able to tell whether it needs more filing.

File the teeth with long strokes without wobbling. Go at it as if you mean it; avoid timid jabs. By using side pressure on the file stroke, you can take more off the larger teeth (these require the removal of more metal), while easing up on the smaller ones.

Take the saw out of the vise, lay it on a flat surface and dress the teeth with a triangular file tipped up slightly so it is removing material on the set portion of the teeth only. This step evens the set by removing the burrs hanging off the side of the teeth and helps ensure a clean-cutting saw.

Take a look at your handiwork to see the results. Check the height of the teeth to see how uniform they are. If a few teeth are below the height of the other teeth on the blade, don't refile the saw until all teeth are the same height. The low teeth will come up to the correct height as the surrounding teeth are lowered by subsequent sharpenings. Hold the saw with the toe just a little to the side of your nose, and eyeball the row of teeth on that side. If they look like a nice, even picket fence, congratulate yourself. Then, with the saw toe in line with your nose, look down the teeth again. You should see a nice, clean V-groove formed by the alternating set of the teeth. Carefully place a fine sewing needle in the V. If it slides the length of the blade without falling off, you can drink with the masters.

The process I described above is open to variation. Each filer has his own style regarding tooth angle, set, where to start, where to finish and so forth. Filing techniques are as individual as fingerprints. Some saw filers put less slope on the gullet, some prefer none. Some put slightly more slope, in profile, on the front of the tooth and decrease the rear slope. After you get the hang of it, sharpening a saw becomes fast and easy. A first-class job can be done in about 20 minutes, providing the saw hasn't hit a nail or been damaged in any way. A damaged saw needs a complete overhaul, and this may take twice that amount of time. However, saws that are only "wood dull" can be sharpened two or three times without jointing or setting.

Sharpening ripaws—You file a ripaw differently than a crosscut saw, though the process of jointing and setting the teeth is the same. If you are right-handed, put the saw in the vise with the toe to your right and file from the toe to the handle. Move the file perpendicular to the long axis of the saw and hold it horizontally (if you have a vise that tips back 10°, hold the tip of the file down 10° to compensate for this). Unlike a crosscut saw, the teeth on a ripaw have neither fleam nor sloping gullets. If you are so inclined, you can start at the toe and, with each stroke, file the front of one tooth and the back of another, whether it slopes toward you or away. You can also file a ripaw like a crosscut by filing only the teeth sloping away from you, then reverse the file and repeat the process.

A ripaw is given less set than a crosscut of corresponding points per inch. The profile of a ripaw's teeth differs from a crosscut as well. To describe their profile, revert back to a per-

pendicular drawn along the saw's teeth. The front of the tooth coincides with the perpendicular, while the back of the tooth slopes at 60°.

Trouble-shooting a saw—If you find the saw binding, don't keep pushing or you'll put a kink in it. Keep a chunk of paraffin on hand to give the body—not the teeth—of your saw a rub. You can also use silicone spray. This lubrication may save your saw and your temper until you can put more set in the teeth.

If your saw rattles and wobbles in the kerf, it has too much set. Lay the sawblade on a flat surface and side dress the teeth with a three-corner file. I snapped off an old three-corner file to 5 in. long, because they are easier to hold with one hand like this. To break the file, hold it in a vise and then whack it with a hammer close to the vise jaws (wear eye protection while doing this). Break off the file's tang and tip. The teeth are given two or three gentle swipes with the shortened file canted with the set of the teeth, not held flat to the blade.

What saws are worth owning and sharpening? Since handsaws are likely to last a lifetime, it is worth taking the time to pick a good, new saw or repair an old one. I prefer the latter option, because the old saws are generally of better quality. Yet there are old saws that are of poor quality or so badly damaged that you'd best pass them over. Below are some of the criteria I use for judging a saw and some of the techniques I use to salvage a good old one. You can find plenty of old saws hanging in sheds, in barns and for sale at flea markets and auctions. Among the best of these, I feel, are the old Disstons. The saws of Henry Disston, the company's founder, will probably live forever. And they should. Despite the fact that they came in various grades, I've never met up with a bad, old Disston or seen a better saw, though I'm sure there are saws that are just as good. Best of all, old Disstons are still relatively plentiful. I suggest snatching them up before the antique tool collectors do.

The key to their quality lies in their combination of hardness and ductility—two characteristics often at odds with each other. Other saw manufacturers couldn't match Disston's Rockwell hardness of 52-54. "They didn't know the secret of how to roll a new saw sheet so the teeth would not break during setting at that hardness," Bill Disston, Henry's great grandson, once told me. That explains why many of the saws made by the competition have a Rockwell hardness of only 46-48.

Don't pass over a saw that has a moderate amount of rust on its blade. Often this can be sanded off with wet-or-dry sandpaper

lubricated with mineral spirits. If the saw is badly pitted from rust, pass it by, because pitted teeth are likely to break off during setting and will never have a sharp, clean edge, even after filing.

Pass over stainless steel and chrome alloy saws. When these first appeared, they were well-received by forgetful carpenters who left their saws out overnight. That they wouldn't rust was the only thing they had going for them. After many attempts during my 10 years of commercial saw sharpening, I gave up on them. Their steel is simply too soft.

It's hard to say whether you should buy a saw with a kinked blade. You'll have to judge it for yourself. A really bad kink may be difficult or impossible to remove, while a moderate one can be removed in a few minutes. There are two kinds of kinks: the slow, gradual kind and the abrupt kind. To remove a gradual kink, bend the sawblade in the opposite direction of the kink and then let it spring back. An abrupt kink is very hard to get rid of because the metal has been stretched almost to the breaking point, but if you work carefully, even these kinks can be removed. I've had good luck using the following technique. First, open the jaws on a large machine vise wide enough to span the area of the kink. Lay the blade flat on the vise with the jaws spanning the kink. Lightly hammer the kinked portion of the blade, while gradually closing the vise jaws. This supports the blade while working toward the kink's center. This is hit last and has to be hammered a bit more than the other areas to stretch the metal far enough so the blade will pop back straight.

It's worth having a saw with a good handle, even if you have to make the handle yourself. A saw should hang comfortably from your hand. I wouldn't reject a good saw with a bad or damaged handle, I'd repair it. This makes sense, because many old saws have missing or damaged handles and many new saws have uncomfortable handles. The handle should position your arm so it puts as much power as possible behind the saw in each stroke. The perfect grip should feel like a natural extension of your arm. I prefer a grip that rakes forward slightly. A grip that cocks your grasp too far backward, or too far forward for that matter, makes a saw feel awkward and tiring to its user.

So there you have it, a lifetime of my father's experience passed along to me and now to you. The rest of it is just practice. □

Harold "Dynamite" Payson builds boats in South Thomaston, Me., and writes on saw sharpening and boat building. His book, Keeping the Cutting Edge, is available for \$7.95 (plus postage) from WoodenBoat, Box 78, Brooklin, Me. 04616; (800) 225-5205.

Handsaws and how to use them

by Henry T. Kramer

I love handsaws. Sure, I use power saws most of the time. But every once in a while I grab a handsaw off the rack and save a lot of time and trouble. Yes, I know a power saw cuts a lot faster, but that's only part of the story. Sometimes the work is too big, too long or unsteady, and the power saw can't be used without risking damage or injury, or rigging up jigs, braces or heaven knows what. Another reason for handsawing is that I like to do it. A good, sharp saw, properly set, is a joy to use.

Traditionally, saws came in three sizes, measured along the teeth from heel to toe: rip saws, 30 in. long; handsaws, 26 in. long;

and panel saws, 16 in. to 24 in. long. The average saw today measures 26 in. long, though saws 16 in. to 22 in. long seem to be selling well—probably because their shortened length makes them less expensive.

There is no advantage to a shorter saw, however, except the paltry difference in price, which itself is a false economy. It takes more work to saw through a board with a short saw, so the few dollars saved will be of no advantage in the long run. A longer blade means fewer but longer strokes and fewer return strokes. Since you're not sawing lumber on the return stroke, it pays to saw as much

lumber with as few return strokes as possible. Also, sawing with long, smooth strokes is more comfortable and more satisfying than sawing with short, choppy strokes.

Saw with one hand only, as using two hands will require an awkward position toward the board. The one exception is ripping thick stock, where you literally may find yourself standing on top of the stock.

Position yourself for maximum mechanical advantage when sawing. Your sawing arm and that shoulder should be in line with the cut. In most cases, you'll want to position yourself so you can see the line you are

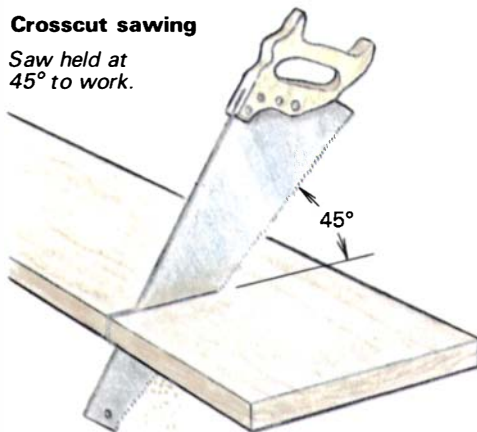
cutting to without looking over the sawblade. Position the stock at a height you find comfortable and efficient—this will require some experimentation, depending on how tall you are and the kind of cut you're making. You can crosscut thin stock by clamping it to a typical 30-in.-tall workbench. Sawing thick stock requires considerably more force, however, and you may find a standard-height workbench is simply too high to allow you to get enough force behind the saw. A pair of short (24 in. tall, or so), sturdy sawhorses is a definite advantage with these cuts.

For crosscutting, hold the saw with its tooth line at 45°. Stand with your feet about shoulder-width apart and your forward foot pointing ahead. For fine cutting, make your mark with a knife on the face and edge of the board, but for rough work simply mark the board across its width with a pencil. Grip the board over the edge with your free hand and steady the saw when starting the cut by butting the thumb of that hand up to the blade. The saw should rest just slightly on the scrap side of the line—the more proficient you get, the closer you'll be able to saw to the line. Draw the saw back, putting light pressure on the saw to make it cut slightly. In softwood, using a sharp saw, it may take just one back stroke to get the saw started. In hardwoods, it may take three or four. Also, the coarser the saw's teeth, the more difficult it is to start the cut. Finally, watch your thumb, if the saw jumps out of the kerf in the beginning of the cut, you could get a nasty cut—don't underestimate the damage a saw can do just because it's powered by hand and not electricity.

Cut with long and smooth strokes using as much of the sawblade as possible. Be careful, though, that you don't draw the saw right out of the kerf on the return stroke. Western saws don't cut on the back stroke, so lift the saw slightly when drawing it back. It will take some practice before you can crosscut a board so it's square across the face and edge. A saw that is properly sharpened and set will easily saw to the line. A saw that wanders from the line, despite your best efforts, has too much set on the side it wanders to.

Though it's virtually impossible to correct a cut that has gone significantly awry, a small deviation can be corrected by flexing the handle toward the line and working the saw back after a few strokes. But if it looks like the saw is going to run off significantly, let it wander where it chooses rather than twist and jam the saw in an attempt to get it back on track. Support the board with your free hand when you get to the end of the cut. Don't saw as aggressively as you near the end, rather ease the saw out to reduce splintering.

There are a couple of different ways to crosscut a board. Some woodworkers dip the saw below 45° slightly while drawing it back to start it; others dispense with this. Once started, you can saw straight across the board without altering the pitch of the saw or you can provide a kerf for the saw to follow by sloping the saw down slightly, making a few cuts, and then resuming the



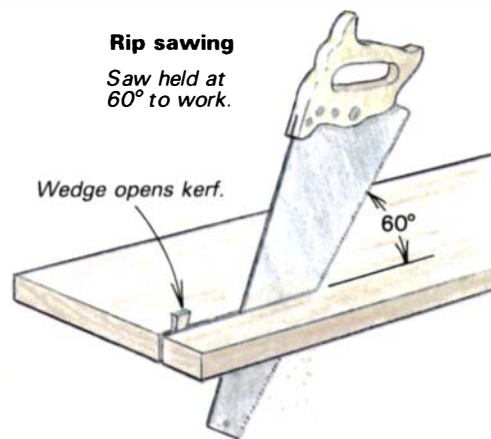
45° sawing angle. Either method works, it just depends on which you like more.

A rip saw is held at 60° while cutting, and it requires a lighter touch to get started because of its coarse teeth. Start a rip saw by holding it nearly parallel to the face of the workpiece (about 5°), and very lightly push it forward so it just begins to nick the edge. The configuration of a rip saw's teeth means that it has hardly any scoring effect pulling it backward, hence it has to be started on a forward stroke. Some older rip saws have finer teeth at the toe to overcome this problem—I suggest you snatch up one of these if you find it. Bring the saw up to 60° after you get it started and saw as you would with a crosscut saw, using long, rhythmic strokes. Rip saws have a tendency to jam in the kerf as the cut progresses and the kerf closes on the saw. Correct this by inserting a thin stick or wedge in the kerf, not enough to spread it significantly, but just enough to keep it open. You can also keep the kerf open by spreading a wooden parallel-jaw clamp over it and tightening it down.

Before sharpening or tuning the teeth of a new saw, remove the anti-rust coating it will almost certainly have. This coating is an effective rust inhibitor, but it reduces the effect of set on the saw's teeth and also creates a fair amount of drag. It's not easy to remove. You can remove it from the body of the saw with a sharp razor, rub it off with steel wool and lacquer thinner, acetone, or benzine (*not* "benzene," which is toxic). If all these methods fail, try using paint remover or brush cleaner. In any case, wear protective gloves and a respirator.

Remove a saw's handle and give the blade under the handle a good coating of grease to inhibit rust, then replace the handle.

Finally, set and sharpen the saw. The machine sharpening that saws receive at the factory is inadequate and often badly done. I lubricate the sawblade before I use it. I apply sparingly a thin coat of machine oil and rub it in well. Some woodworkers apply paste wax, others use paraffin. Regardless of which you use, don't let a residue of wax, sawdust and dirt build up on the blade. Remove this gunk every so often by lightly wiping the blade with steel wool and mineral spirits. Some don't use a lubricant on the grounds that it



may stain the work. I haven't found this to be a problem, because a sawn surface is always cleaned up with a plane or sanded smooth.

Don't toss handsaws in a drawer or on a pile where they can rub together and become dull. A wall rack or a rail with pins to hang saws on works well. If you carry them to the job site, make a separate canvas sheath for each saw.

Because sharpening handsaws is more work than sharpening a chisel or a plane iron, it's tempting to use them dull. Don't do it. A dull handsaw will jam in the kerf and bend, and a bent handsaw is much more difficult to repair than a chipped chisel or plane iron. Take the time to sharpen a dull saw, you'll thank yourself for it while you're using it. You don't even have to use a handsaw to tell if it's dull; if the teeth tips reflect light as a line, then you know its time to refile it.

When using backsaws, you have to be careful. Given a chance, they'll "getcha," and you'll wind up with more of them than you ever thought you would. For a long time I never thought much about them, but I discovered I like their small size and fine teeth (you can get them with as many as 20 or more teeth per inch). Backsaws take their name from the rigid back or spine attached to the blade. The added weight of the back is a help, I've found, in keeping the saw on track, but its primary use is to make the blade more rigid to further reduce the tendency of the blade to wander during critical cuts.

A backsaw is an instrument used for fine joinery and not rapid cut-off work. I own half a dozen or so in 8-in., 10-in., and 12-in. sizes, each filed in crosscut and rip patterns. Backsaws come from the factory as crosscuts, and converting them to rip saws is something you should try only after you become an experienced saw filer. Converting a crosscut to a rip saw sounds radical at first, but the practice is more widespread than you might think, finding such advocates as Tage Frid, woodworking professor emeritus of the Rhode Island School of Design. A backsaw filed with rip teeth makes sense, since you are mostly ripping when you saw a tenon or a dovetail joint. □

Henry Kramer works wood in Somerville, N.J.

Aircraft Cabinets

*There's no winging it
when weight really counts*

by Doug Hechter & Russ Schall

Excess ounces mean lost payload and range for aircraft, thus the authors used honeycomb and foam-core panels to construct feather-weight veneered cabinets for this Bell 214 helicopter—offering the beauty and durability of solid wood in a fraction of the weight.

When a corporation or affluent individual decides to customize an aircraft's interior, they're likely to choose one of a handful of specialized aviation companies in Florida, Texas or California. Tracor Aviation in Santa Barbara, Calif., is one of them. Not too long ago, Tracor recruited five of us to assist their skilled but understaffed shop when a Bell 214 helicopter needed a custom interior on a tight deadline. None of us had done aircraft work before, but our experience with composites, offbeat construction and cabinetmaking made us a good choice. We were trained on-the-run by Tracor's resident pros, Russ Schall and Calvin Grandy, working 12 hours a day, seven days a week.

During the three months spent on the helicopter project, we learned that building aircraft cabinetry has much in common with terra-firma furnituremaking. The work is exacting and of high integrity. Costly, hard-to-find materials are often employed. Joinery and finishing techniques require patience, practice and skill. But turn the comparison to the topic of weight, and the analogy suddenly ends. Because in the world of aircraft construction, saving weight is an obsession.

Our job was to build cabinets for three areas of the chopper: the forward bulkhead, the head and the medical area. The forward bulkhead cabinet was the largest and most complex; roughly 7 ft. long, 30 in. high and 16 in. deep, it consumed more than 2,000 man-hours. It had a drop-leaf desk, hidden stereo and rotating refreshment bar, with icebox. The head—rumored to be one of only three in existence on a helicopter—was enclosed by a sliding door. A medical compartment contained life-support equipment for the elderly overseas dignitary who had commissioned the project—a patron we'd never meet.

One-upmanship among the rich and famous is by no means the sole contributor to the high cost of modifying aircraft. Work done in the United States must conform to rigid Federal Aviation Administration (FAA) standards. Changes in design—large or small, structural or cosmetic—are closely regulated, and must be documented with drawings that accompany the aircraft's logbook

at all times. Paneling and cabinets—even those which appear to be seamlessly connected—must be structurally independent and detach quickly from their mounting brackets. (The cabinets we built were designed to be removed completely in four hours or less—a task performed after every 20 hours of operation as part of a helicopter's never-ending maintenance cycle.) For passenger safety, there can be no sharp angles, nor any latchless door or drawer that could pop open in flight. Close fits, careful detailing and rugged materials are absolute requirements, not options dependent upon the client's budget. Indeed, the tightness of joints, door gaps and drawer fits are encouraged in no uncertain terms: No fixture aboard any aircraft can rattle. Period.

Above all, materials must withstand shock, vibration and in-flight flexing, yet *still* be exceedingly lightweight. Some familiar materials—aluminum, polycarbonate, urea formaldehyde and resorcinol glue among them—were developed to provide this high strength-to-weight ratio. Plastic-laminate work is typical in commercial aircraft, although cabinetry aboard private craft (including the Bell we worked on) often incorporates fine-wood veneers. Solid wood is limited to such applications as handrails and moldings.

When finished, our cabinets were visually indistinguishable from a comparable plywood project surfaced with high-quality veneer. Knocking on a countertop or side panel would betray one difference: A hollow-sounding material had replaced plywood as the veneer's substrate. That material was a honeycomb-core composite panel—the material of choice for aircraft cabinetry and casework. Skiers are familiar with the aluminum honeycomb-core materials used to make a few brands of skis. But the array of composite-panel combinations available to the aircraft industry is broad and varied. Basically, composite panels are specified and custom-made for each job based on the panel thickness, skin material and core needed to satisfy structural requirements. Panels can be purchased in standard sizes, or can be specified in just about any dimension. And their cost is considerable: A 4-ft. by 8-ft. panel of 1-in. aluminum-skin/aluminum-core honeycomb costs about \$1,500.

Most composite panels fall into one of two categories: honeycomb or foam core. The former draws upon the open-celled, hexagonal structure of bees' honeycomb for lightweight strength; the latter is more economical, but has a less desirable strength-to-weight ratio. Skins are most often fiberglass or aluminum, although Kevlar—the material of choice for bullet-proof vests—is sometimes specified when added puncture resistance is needed. Cores might be made of aluminum, fiberglass or phenolic resin, with cells ranging from $\frac{1}{8}$ in. to 1 in. across. Regardless of composition, however, these precision-grade panels are incredibly lightweight: The massive forward bulkhead cabinet we built weighed in at a featherlight 75 lb. A comparable solid-wood or plywood case would weigh 400 lb. to 500 lb.

Understandably, the high cost of materials affected the way we approached layout. As woodworkers, we were accustomed to sneaking up on a fit by planing, scraping or sanding. But panel skins and veneers—already engineered to their minimum thickness—require greater accuracy, with little recourse for adjustment after the fact. Measured drawings—many full-scale—were delivered to us daily from the engineering department. Templates were made to fit the craft's interior, then carefully scribed to the final fit. Cutting was relatively simple, with the composites handled much like particleboard on a 3-HP tablesaw with triple-chip carbide blades. Straightening, tapering and fine-sizing were done on an 8-in. jointer with carbide knives.

Assembly is where things got really exotic. Naturally, a fastener depends on the structural properties of the material being joined. In wood, tightly bound fibers can be shaped into mechanically interlocking joints, then glued or screwed. Not so with honeycomb aircraft panels, which are composed primarily of air pockets with thin membranes between—not much to get a grip on.

Aircraft designers have evolved some clever solutions. The simplest of these is the fastening pin—a hollow, dowel-like aluminum pin flared at one end and perforated along its entire length (see figure 1, right). A fastening pin is used wherever you'd use a dowel to through-peg in solid wood. Inserted into a hole drilled through the face of one panel into the edge of another, these pins are filled with structural epoxy—a black goo about the consistency of silicone sealant that sets up to a sandable hardness within two hours. The epoxy is injected with a pressurized air gun that resembles a caulking gun, and it oozes out through the pin's holes, filling the surrounding cells. Later, the excess is filed or sanded flush.

Wherever a screw is needed, potted inserts are used. These cup-shaped fasteners have a pair of holes in the rim (see figure 2) and threads that are distorted to create a vibration-proof lock. The inserts are fitted into a flat-bottomed hole drilled with a special, self-centering bit. A temporary gummed tab with matching twin holes is laid over the top of the insert to keep it afloat in the hole and flush with the panel's surface. Then, through a process called "potting," black epoxy is injected through the rim of the insert until it fills the surrounding cavity and spurts out through the second hole. Any epoxy that escapes can later be filed smooth.

In areas where hinges, hardware, solid-wood details or other structural elements must be attached to the fragile edge of a honeycomb panel, a reinforcement called a hardpoint is needed. To create a hardpoint, the panel's edge is first mortised out. (We mortised with a die grinder held freehand, but a jig can be made to allow a small router to do the job.) Then, the edge is filled with a hardwood strip bedded in epoxy (see figure 3).

Even when a honeycomb panel edge won't be exposed to high impact, its fragile, sliced-open cells must be closed, reinforced and smoothed out—to complete the integrity of the panel. We

Composite-panel fastening techniques

Fig. 1: Fastening pin

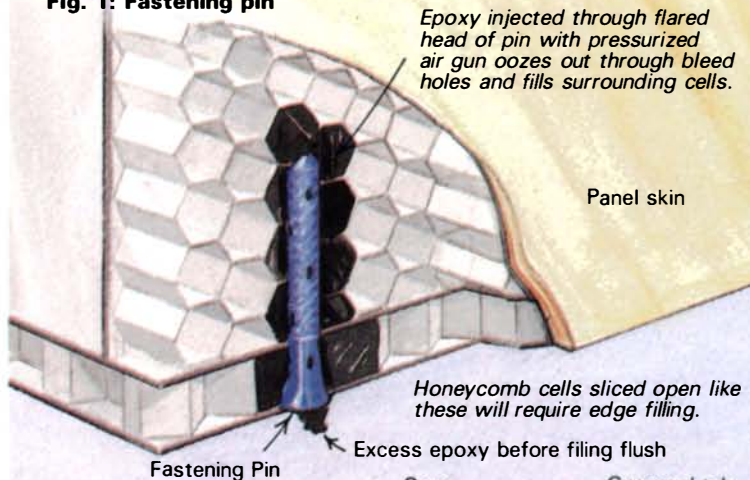


Fig. 2: Potted insert

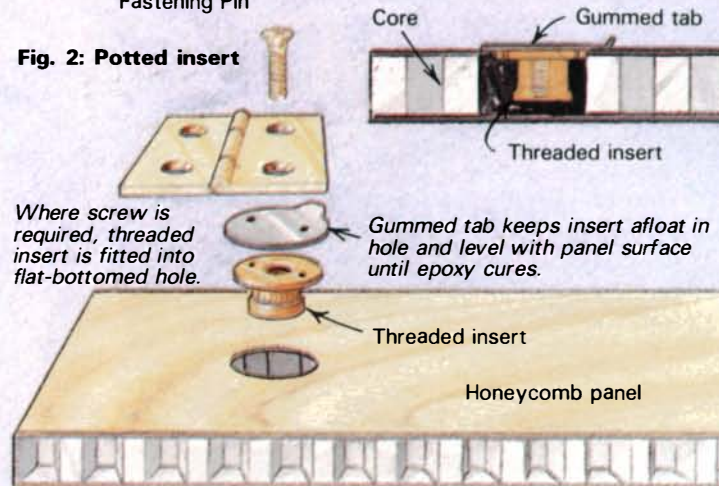
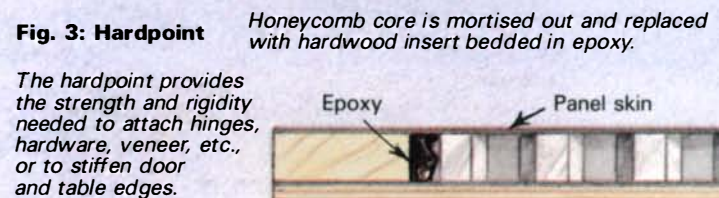


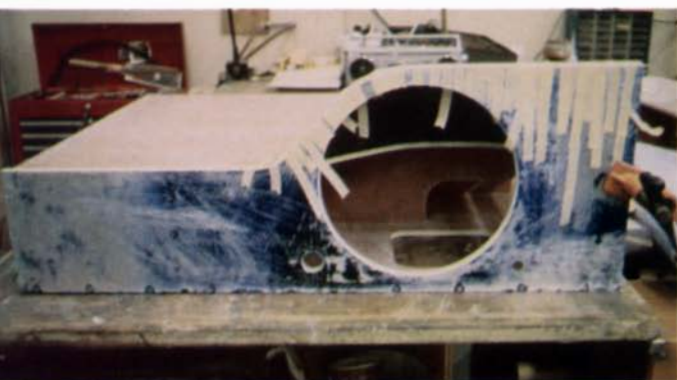
Fig. 3: Hardpoint



The forward bulkhead—the largest cabinet built—required more than 2,000 man-hours. Its drop-leaf desk, hidden stereo and rotating refreshment bar (with icebox) were operated by solenoid switches.



Above & below: The sink's curved front edge was kerf-bent and laid up on a form. Later, its face was faired out with a 'feather-fill' epoxy to create the smooth edge seen in the photo at right. The lower bead cabinet held the water supply, waste tank and pump in a self-contained module that can be removed in a few minutes. The upper cabinet housed an intercom, pushbutton water control and storage.



accomplished this goal with an epoxy edge filling after first tamping down the exposed cells on the panel's edge—to provide a firmer footing for the epoxy. The resulting channel was then packed with an epoxy edge-filling compound that resembled marshmallow topping. Masonite strips coated with Mylar tape (to serve as a mold-release agent) were then taped firmly in place along the edge of the cabinet to act as a flat form for the edging compound. When the epoxy set up in 24 hours or so (sooner with the help of heat guns), these strips were removed. The final truing was done by hand with files and sanding blocks.

To build the curved sink unit, fiberglass-skinned foam core was kerfed on ¼-in. centers and laid up on a form pieced together with hot-melt glue (see photo, above). The inner, cut side was then reinforced with fiberglass and resin, and fitted with thin veneer cut to its contours.

The time spent on filling, hand-truing, filing and prepping seemed to go on forever. Dozens of little access doors and cable ports had to be immaculately routed, filled, routed again for cleanup, then filed smooth. Inserts for drawer glides were located, drilled and potted. In cases where potted inserts were laminated over, their holes had to be located and brought to the surface—no small feat, since every square inch of cabinet interior (even compartments which would be filled with drawers) was covered with a black plastic laminate. Hit-and-miss scribing of curved surfaces and panels added hours to the project. Installing all the special solenoid switches and specialty hardware—including door strikes handcrafted on-the-spot from stainless steel—added to the job's complexity. All in all, I'd estimate that the man-hours invested in the main bulkhead cabinet outnumbered by tenfold

what a comparable solid-wood or plywood project might require.

Finally, we faced the cabinets with ¼-in.-thick bird's-eye-maple veneer, a custom glue-up composed of six plies. The veneer was cut with routers and affixed to the composite-panel substrate with 3M #1357 industrial contact cement—the most tenacious I've ever used. When the adhesive set up, the veneer's edges were trimmed with a router.

With the cabinets completed, all that was left was to wait our turn on the installation agenda. The schedule was broken down into precise, 15-minute intervals. A careful sequence of interior panels, carpets, cabinets and seating was to be observed. I'm told that most custom aircraft projects run on neurotic energy. Days last 18 hours. Drama and hysteria are ever-present. Adrenalin hurtles a tired crew across the finish line.

At dawn on the last day, a C-130 transport taxied onto the ramp outside our hanger. The fee for 30 hours' use of this high-tech moving van would exceed the annual income of most households. At 3:00 a.m. the next morning, the helicopter—unbolted into bite-sized sections—disappeared into the rear loading door of the transport. We went back to our semi-normal lives in Santa Barbara.

Accustomed as we are to working in small cabinet shops, the helicopter project resembled factory work a bit too closely for our tastes. Still, the hours spent filling and filing were quite an experience, and we can't help but think fondly of our splendid little paneled room, flying over the ocean on a warm tropical day. □

Doug Hechter is a Santa Barbara, Calif., designer/craftsman. Russ Schall is a furnituremaker currently working as an aircraft cabinetmaker. He also lives in Santa Barbara. Photos by authors.

Current Work

Gallery Fair mounts a national show

by Glenn Gordon



Richard Scott Newman of Rochester, N.Y., has become well-known for furniture inspired by careful study of classic architecture styles. This demilune, made of Swiss pear and ebony, was priced at \$7,600.

The easiest way to reach the town of Mendocino, perched out on a cliff-edge on the Pacific about three hours drive north from San Francisco, is by a two-lane highway with beautifully banked curves called Route 128. The road winds and twists northwest through 40 miles of warm, tawny, California hills, vineyards and orchards, and then—the weather getting steadily cooler as you approach the coast—plunges into the shade of a columnar forest of silent, giant redwoods, only breaking into the light again as it reaches the sea. Route 128 is used heavily by logging trucks. They like to go barreling through the woods at breakneck speeds, terrifying the sedans

and Winnebagos poking along for a taste of the wine country.

Since the convergence of woodworkers and galleries in Mendocino during the crafts ferment that began in the 1960s, Route 128 has probably also had more fine, hand-built furniture truck-shipped along its length than any road of its size on earth. This may not be the kind of fact that gets into Ripley's Believe It or Not, but it's interesting: Not only are a lot of logs trundled along this highway, but also, a disproportionately large lot of what some of the world's best logs eventually become. Early last July, for example, mixed in with the usual westbound Mendocino traffic, the freight on several big transcontinental moving vans consisted

of approximately 60 original works of furniture headed for a show at Mendocino's Gallery Fair.

The directors of Gallery Fair, Bill and Lynette Zimmer, have staged regional shows before, but last July marked their first attempt at a survey of furniture on a national scale, pulling together works from points as distant as Maine, in one direction, and Hawaii, in another. To Californians, if you think about it, either direction is the Far East; and apparently an East where trucking companies move inscrutably to some beat of their own, because at the eleventh hour, a major segment of the show, supposedly en route, was still languishing on the dock of a truck terminal in Massachusetts. Everything made it to Mendocino, though, in time for the opening. All told, there were contributions by 44 woodworkers, a show impressive in its scope, if not in its consistency.

The show was called Contemporary Furniture Masterpieces, but for the sake of truth in advertising, I think it was pushing it to say everything in the show was a masterpiece. I felt there were a few, but the use of the word "masterpieces" was just overheating the promotion. The word leaves no room for questions; its gush gets in the way; I think people would rather decide these things for themselves. This isn't to say that things weren't done to extremely high standards of workmanship. If anything, I felt that a myopic preoccupation with workmanship too often overwhelmed the makers' perspectives on what they were doing. Sometimes I didn't see much inclination to question what all this brandishing of workmanship might be for: Things were beautifully done, but that didn't necessarily add up to beautiful things, merely fanatical ones. There was also a preference for work that looked urgent, for things that are supposed to jump out and hit you between the eyes instead of contenting themselves to simply stand there and give off a steady hum. Good wasn't good enough, it had to be grandiloquent. It made for a show of work that was anxiously theatrical, too tricked out and gimmicky for my tastes.

I also had to wonder at the way the gallery went about making its choice of works for the show. Initially, the Zimmers invited more than 100 furnituremakers to submit slides for consideration, but the final selection was actually made by two of the show's participants, Sam Maloof and Alphonse Mattia. I thought that was a little odd—jurying one's own work, but I didn't reflect too deeply on it at the time, maybe because I'm from Chicago, where clout is a way of life.

Ignoring the tendency in art and politics for one hand to wash the other, however, I thought the jurors were reasonably open-minded in their choice of works for the show. So much so, in fact, that I felt no strong sense of any controlling vision—no central conviction expressed—about the work in survey. Also, although the show was eclectic, if it was meant to be representative of what is going on in furniture nationally, it seemed to me there were some conspicuous and disappointing omissions. For example, there wasn't a single work by James Krenov or by any of his students, past or present, though Krenov runs a school practically right up the street, in Fort Bragg. Only one craftsman was represented from all the vast Middle West, and none from Canada, which is home to some strong talents in furniture.

Shortcomings aside, however, the show still had the breadth of a museum survey. It also paid off: By mid-August, some 20 pieces, better than \$150,000 worth of work and commissions, had been sold. From his perspective as a dealer, Bill Zimmer says that the debate about whether furniture is an art or a craft is fruitless—if he can sell furniture the same way works of art are sold, then as far as he's concerned, it's a moot point. The debate goes on, though, and to keep the dialogue open, Zimmer arranged a semi-

The hanging mirror by Timothy Simonds, below, is a fusion of Oriental calligraphy with 20th-century Art Deco. The frame is made of bubinga trimmed with purpleheart moldings. The marquetry includes ebony, burl walnut and abalone shell. In a show with more than its share of glitz, John Sheriff's pedestal desk, right, was refreshing in its restraint. It's made of Honduras mahogany, the carved drawer-pulls are of ebony.



Photo: Mike Agliolo Studios

nar and slide show among four of the show's contributors: Rosanne Somerson, Garry Knox Bennett, Maloof and Mattia.

The seminar was held at the nearby Mendocino Art Center on the morning of the opening. There were no new tablets of law handed down, but people got a chance to air out their brains. Mattia, who teaches furniture design at The Swain School of Design in New Bedford, Mass., began by showing a sequence of slides illustrating how his ideas develop from the sketchbook to finished work. He concluded by asking, "Why isn't there more personal expression in our field?" which left me wondering, at the end, why furnituremakers feel so pressed to call themselves "artists" in the first place. It's as if somehow, wearing that hat, you rank higher in the order of the Creation.

Following Mattia, Somerson rose in an impassioned defense of applied ornament, summing up with the declaration that "decoration is functional," meaning, if I understood it right, that furniture barren of ornament—just plain, bald woodworking—is insufficiently expressive, it fails to function on the level of what we need emotionally.

Bennett came on next, beginning with a slide that looked like an FBI video warning: "WARNING: Discretion advised. The slide presentation you are about to see contains explicit, provocative views of furniture using metal, glass, paint, plastic. Krenoids present are advised accordingly." Bennett then went on to make some equally trenchant observations on the market for furniture in the San Francisco Bay Area. For all their reputed chic, he says, they're not really very adventuresome. . . "all they want is antiques and Oriental rugs."

Maloof spoke last, reiterating his view that he'd rather look at a piece well-designed, though crudely built (citing the vitality and durability of peasant crafts), than at a badly designed piece done perfectly. . . though in the show he'd just juried, it seemed to me there was a little too much of the latter.



Photo: Pat Berrett

After a break for lunch, we all trooped over to the gallery for the opening. The champagne flowed, and going through the show, there were sights worth toasting, no matter what your tastes or critical reservations. One of the first to catch my eye was an entry mirror by Timothy Simonds of Chico, Calif. Made of bubinga, with a panel of marquetry set into the left side, the asymmetrical frame reads, overall, like a character of Oriental calligraphy. Each stick in the frame ends in a different way, the angle of the crosscut sympathetic to what's happening locally in the lines of the composition.

Simonds is interested in combining Ruhlmann/Art-Deco influences with motifs expropriated from traditional Japanese design, which is, though most of us in the West might not be aware of it, based on a highly codified system of symbolic meanings. Until he translated, for example, I had no idea that the image of a crane represents a prosperous life, or that hexagonal patterns are an abstraction of the tortoise, which symbolizes longevity. At any rate, in another nice stroke of composition, the hexes appeared to cascade down to the mantel and spawn the other repeated element, the Ruhlmannesque scallops. Visually, the marquetry panel seemed a little overloaded to me, but on the whole I thought the mirror was a coherent and very nicely counterbalanced piece of work.

From a purist's point of view, one of the show's finest pieces was a desk in Honduran mahogany by John Sheriff of Albuquerque, N.M. Overall, it had the standard form of any of thousands of staid, pedestal desks, but a closer look showed a craftsman's original and thoughtful inquiry into the particulars—the elements of the desk are stacked up with a great deal of care, all the details touched with a sense of quiet invention. The slight flaring of the plinths gives the desk the solidity of an old federal bank—classical, without making a big production out of it with a lot of moldings. The two drawer cases of fiery quartersawn stock are

through-dovetailed together, with the dovetails rhythmically spaced in the best tradition of the Keeper of the Flame. (For some tastes, this might be too naked a display of the reality of the construction. In a more conservative approach, these cases might have been veneered.) The cases are floated between ebony-banded panels of Baltic birch above and below, set back to form shadow-reveals. The edge-detail of the panels that sandwich these shadows is repeated in the edge of the solid top, which is proportionately thicker, and which slightly oversails the panels below, while floating above a reveal and shadow of its own. There is also some sculptural and practical thought given to the shape and size of the ebony drawer-pulls, undercut and down-curved, in counterpoint to the upcurved edge-treatment of the top. A beautifully reasoned design, the desk didn't try to be spectacular, just a damn good desk. It was priced at \$9,975.

For an essay in grace, nothing in the show quite held a candle to the demilune table built of Swiss pear and ebony by Richard Scott Newman of Rochester, N.Y. The piece was done in the formal language of palace furniture from the late 17th to early 19th centuries—Louis XVI, Empire Style, that sort of thing. But it isn't really a "period piece," more something that reinvents that language and speaks it afresh. Newman is making up a kind of classicism of his own, improvising on what he finds in the encyclopedia of old forms, shapes, and profiles, yet he seems to be doing it without the superficial mimicry of classical architectural order you see in much of the work of Post-Modern architects.

The whole table is thinly outlined in ebony, as though it were a drawing. The shape of the top is not half-a-circle (demilune is French for half-moon), but slightly more than half an ellipse, which most people, seeing it against the wall in an entryway, would agree is a more beautiful and practical curve. The fluted legs aren't simply tapered, but gradually flare as they rise, and the blunt-arrow shapes of the ebony tips on the feet seem to

For the seat and back of his maple chair below, John Marcoux updated traditional caning by weaving braided nylon cord through holes bored in the frames. The cord has been dyed. The three-legged chair at right represents a departure for Robert Erickson, whose fine rockers and armchairs, influenced by Sam Maloof and Hans Wegner, have appeared in many shows. But this piece, made of walnut and maple, retains Erickson's trademark: a sculpted, saddled seat.



Photo: Dean Powell



Photo: Richard Sargent

point out just exactly the right place for those feet to stand. Priced for Versailles, the table sold for \$7,600.

There were a lot of chairs in the show—I counted 17 different designs, including a few which by now are proven and predictable: a rocker by Maloof and one of George Nakashima's cantilevered "conoid" chairs. There were also some newer designs: of these, two or three were pretentiously useless, works not really meant to sit in at all. But there were also several that seriously tried to engage the problem, "chair."

A thought-provoking answer to the question of what has to happen structurally for something to work as a chair came from John Marcoux of Providence, R.I., in the form of a chair made out of maple, nylon cord, and stainless steel hardware. Marcoux's chair is constructed with methods quoted from the manufacture of sporting goods, finding the underlying principles just as applicable to some of the problems of chair design: bracing, triangulation, lightness, responsiveness to the shifting stresses of the sitter's weight, and the capacity to withstand hard use. The seat and the back of the chair are strung like tennis rackets, or snowshoes—resiliently, something like caning. In a playful touch, lightening up on the structural severity, the chair is trimmed out in the colors of a croquet set, evoking the polite

lawn sports of the Edwardians. The system of struts and stainless fittings, all held together with acorn nuts, borrows something from Buckminster Fuller's tensegrity structures, and increases the romance of the chair as a piece of structural engineering.

A less theoretical, or at least a more directly sensuous solution to the problem of where to park it was provided by Robert Erickson, a fine chairmaker from Nevada City, Calif. The central element of most of Erickson's chairs is the seat, which is voluptuously carved—"saddled," as they would say in the chair industry—usually from a single wide plank, so that it cups the sitter's rump like a tractor seat. The chair Erickson showed at Mendocino has evolved, he says, from roots in the three-legged stool-chairs found in old Norwegian farmsteads, and is probably evolving still. The combination back-splat/leg are bent-laminated, as are the arms. Like some of Maloof's work, many of Erickson's chairs seem not so much built as grown and grafted together agriculturally, like trees or grapevines. Erickson acknowledges the obvious influences of Maloof and Hans Wegner, but whatever he may have learned from them, he's carried it in a direction clearly his own. The example pictured above, right, is in walnut, with a seat of maple, similar to the one in the show, which had a seat of cherry and sold for \$1,260.

Speaking of the evolution of influences—the mutations of a



Michael Elkan of Silverton, Ore., collaborated with Jim Boesel of Brush Prairie, Wash., to build the walnut trestle table and chairs shown at left. In a colorful elaboration of George Nakashima's use of butterfly keys, Elkan and Boesel combined two contrasting woods—desert ironwood and pink lilac—to join the tabletop's slabs. The dining set below was made by David Powell, who studied with Edward Barnsley in England before coming to the United States in 1969. He teaches furnituremaking at the Leeds Design Workshop in Easthampton, Mass. The set is made of Canadian maple and ebony with a lazy susan of black granite set into the table's center. Gallery Fair's show consisted mostly of furniture, but there were some nice accessories, including this jewelry case, right, of bee's-wing narra by John Dodd of Rochester, N.Y.



Photo: John Dodd



furniture style from one generation of woodworkers to the next—there was also an interesting variation on a theme of Nakashima in the show, in the form of a large and striking dining table and set of eight chairs all done in wide and dramatically figured walnut. The group was designed by Michael Elkan of Silverton, Ore., and built in collaboration with Jim Boesel, whose shop is in Brush Prairie, Wash., not far away. Elkan himself did the chairs, and Boesel, the table.

Elkan's chairs, like Erickson's, are very comfortable. Elkan's derive from Nakashima's interpretations of the Windsor style. The seats of all eight of the chairs in this set came from a single 2-in.-thick plank 25 in. wide and with enough curl and burl in it to put a spell on you. The table was built from walnut with a highly unusual marbled appearance of its own, particularly in the figure of the well-sawn, book-matched pair of planks (each about 18 in. wide) used for the top. The marbling, it is speculated, was not the result of grafting but of a hybridization of strains of English and claro or black walnut into a rare strain known to French lumber gourmets as "baston."

The table's design is itself a hybrid of conventional trestle construction coupled with use of a stiffening apron. Aprons are more ordinarily used for tables that have legs instead of a pair of uprights,

but here, an apron was needed to restrain the tendency of the wide but thin ($\frac{3}{4}$ -in.) flatsawn boards of the top to warp. People in the gallery were fascinated by the butterflies that laced together the halves of the top. They were made of dark pieces of desert ironwood superimposed over pieces of pink lilac wood so bright the butterflies seemed backlit. . . a highly stylized detail next to Nakashima's standard-issue, regulation bow ties, but one that was carried through to good effect at the ends of the twin stretchers below.

Impressive as a long trestle is in its sweep, a round table is a more sociable shape for dining. The show had a distinguished example—a table in Canadian maple and ebony, with a lazy susan in black granite and a set of six matching chairs upholstered in black silk—by David Powell of Easthampton, Mass. Powell, originally from England, where he studied with Edward Barnsley, is a link to the tradition exemplified in Ernest Joyce's old testament, *The Encyclopedia of Furniture Making*. He troops the colors.

Although round and sociable, Powell's table is done with a restraint and formality that suggest it is intended "for people of a certain class." And at \$7,600 for the table, and \$2,600 for each chair, there can be little doubt which class. The tabletop is veneered in alternating segments of plain and feather-figured maple, elegantly delineating each diner's turf. Everything, table and chairs, is uniformly punctuated with ebony—black tie, all dressed up for a formal occasion. The chairs were expertly upholstered and quite comfortable, though the arms looked and felt too thin to me—too pinched and attenuated. I couldn't see how they related, visually, to the fullness of the table apron, but that may not have been one of Powell's concerns—the chairs are based on oblique, boomerang-like forms, which have a logic of their own.

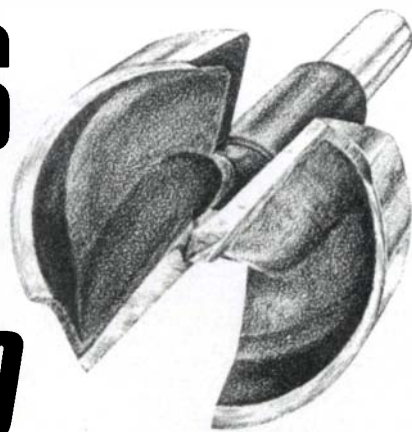
Space limits discussion of other works in the show. Some were good, some bad, some ugly, I thought. But you don't have to take my word for it. You can see the show for yourself, on video. It's available, in VHS only, from Gallery Fair, P.O. Box 263, Mendocino, Calif. 95460; \$25. The video will fill you in, but my best suggestion is, the next time you hear of a show in Mendocino, get up a convoy, wend your way out Route 128, and see it firsthand. The scenery—out and back—is worth the trip. □

Glenn Gordon, a frequent contributor to *Fine Woodworking*, is a furnituremaker and writer. He lives in Cicero, Ill.

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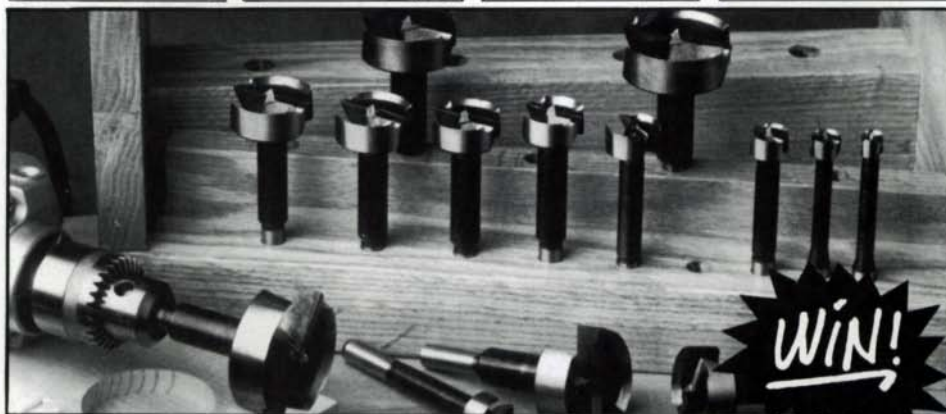
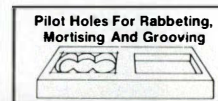
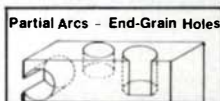


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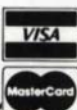
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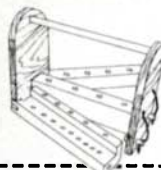
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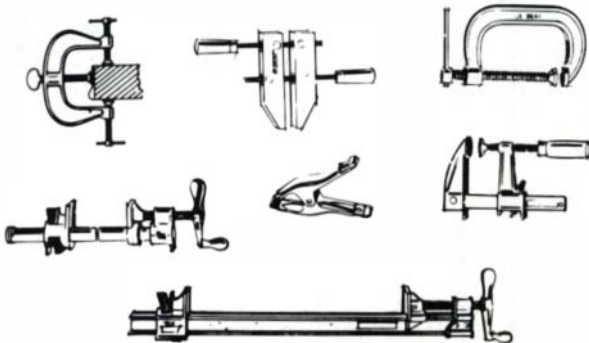
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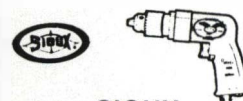


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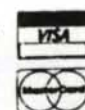


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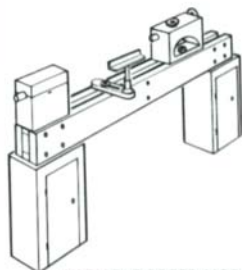
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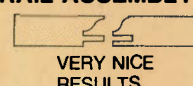
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ITEM #	DESCRIPTION	SALE
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3230	JIG SAW	48
3238VS	ORBITAL JIG SAW	80
1272D	3x24 DUSTLESS BELT SANDER	158
1273D	4x24 DUSTLESS BELT SANDER	168
3270D	3x21 DUSTLESS BELT SANDER	103
3258	3 1/4" PLANER W/CARBIDE BLADE	98
1601	1 HP ROUTER	68
1604	1 1/4 HP ROUTER	115
1608	TRIM ROUTER	74
1608L	LAMINATE TRIMMER	78
1608T	TILT BASE LAMINATE TRIMMER	88
1609	OFFSET BASE LAM TRIMMER	112
1609K	TRIMMER INSTALLERS KIT	156
1920RK	3/8 CORDLESS DRILL	78
1158VSR	VAR SPEED REV. DRILL 3/8	54
11212VSR	1/4 SDS ROTARY HAMMER	174
11202B	1 1/4" ROTARY HAMMER	339
11203B	1 1/4" ROTARY HAMMER WITH STOP ROTATION	365
1198VSR	1/2 VSR HAMMER DRILL	114
3268	HEAT GUN	49
1942	HEAVY DUTY HEAT GUN	57

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360	3x24 DUSTLESS BELT SANDER	178
362	4x24 DUSTLESS BELT SANDER	189
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5535	7" 1/8" POLISHER 2800 RPM	125
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6014	1/2 SHEET ORBITAL SANDER	109
6065	7" 1/8" SANDER GRINDER	114
6226	2 SPEED BANDSAW W/CASE	249
6368	7 1/4" CIRCULAR SAW WITH ACCESSORIES	104
6508	VARIABLE SPEED SAWZALL W/CASE	122
6753.1	DRYWALL DRIVER 3.5A	72
8975	HEAT GUN	47
6798.1	TEK SCREWDRIVER	103

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1a. Title: Fine Woodworking. 1b. Publication no. 03613453
2. Date of filing: September 30, 1987. 3. Frequency of issue:
Bimonthly. 3a. No. of issues published annually: 6. 3b. Annual
subscription price: \$18.00. 4. Location of office of publica-
tion: 63 So. Main Street, PO Box 355, Newtown, CT 06470.
5. Location of the headquarters of the publishers: 63 So. Main
Street, PO Box 355, Newtown, CT 06470. 6. Publisher: Paul
Roman, 63 So. Main Street, PO Box 355, Newtown, CT
06470; Editor: Paul Bertorelli, 63 So. Main Street, PO Box
355, Newtown, CT 06470. 7. Owner: The Taunton Press,
Inc., 63 So. Main Street, PO Box 355, Newtown, CT 06470.
Stockholders owning or holding 1 percent or more of the total
amount of stock: Paul Roman, 63 So. Main Street, PO Box
355, Newtown, CT 06470; Janice A. Roman, 63 So. Main
Street, PO Box 355, Newtown, CT 06470. 8. Known bond-
holders, mortgagees and other security holders owning or
holding 1 percent or more of total amount of bonds, mort-
gages or other securities: None. 9. Not applicable. 10. Extent
and nature of circulation:

	Average no. copies each issue during preceding 12 months	Actual no. copies of single issue published nearest to filing date Sept. 30, 1987
A. Total no. copies (net press run).....	306,842	302,053
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1. Sales through dealers and carriers, street vendors and counter sales.....	51,371	50,430
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D. Free distribution by mail, carrier or other means, samples, complimentary, and other free copies.....	2,359	2,217
E. Total distribution.....	282,733	278,225
F. Copies not distributed		
1. Office use, left over, unaccounted, spoiled after printing.....	8,131	7,018
2. Return from news agents.....	15,978	16,810
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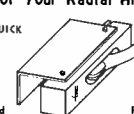
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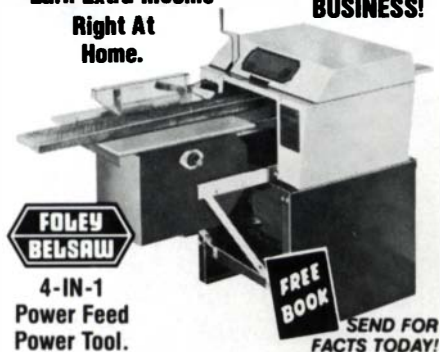
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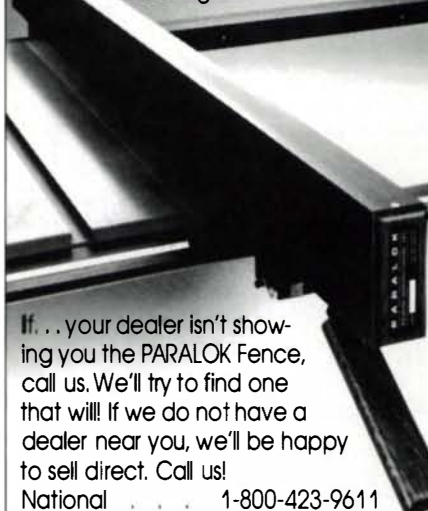
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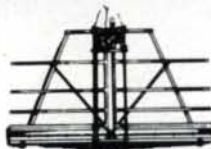
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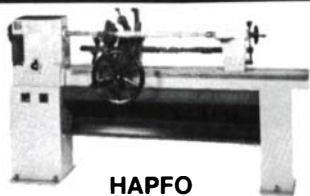
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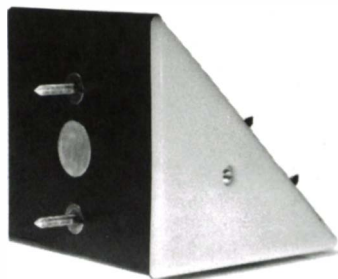
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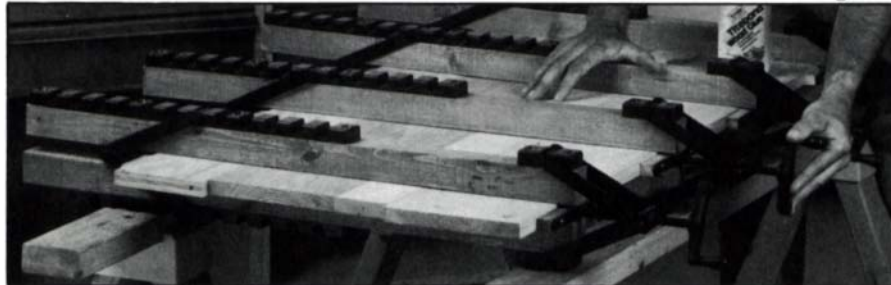
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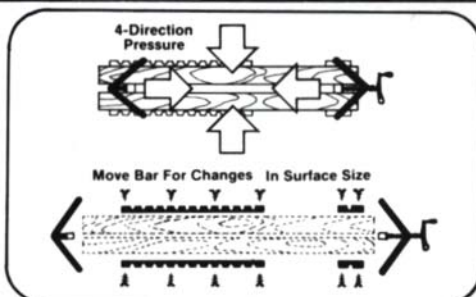
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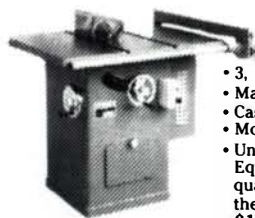
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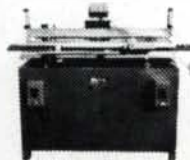
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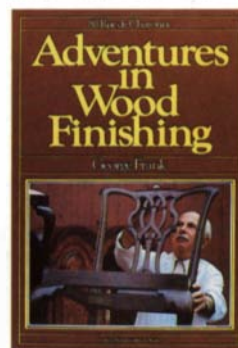


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VIDEO Wood Finishing with Frank Klausz

Learn finishing directly from a skilled professional—in your own home, at your own pace. Frank Klausz shows you how to prepare an ideal surface for finishing; how to choose between oil, alcohol, and water stains; and how to apply tung oil or spar varnish for maximum penetration. You'll also learn how to spray lacquer with professional results and French-polish your work to an exquisitely glossy finish.

**110 minutes, \$39.95
(Rental: \$14.95)
#603 (VHS), #604 (Beta)**

Fine Woodworking on Finishing and Refinishing

How can you control the shine of varnish on wood or achieve the glossy black finish of a fine piano? In this collection of 34 articles from *Fine Woodworking*, experts explain their formulas and methods.

**Softcover, \$7.95
#48**

To order from The Taunton Press, use the attached insert or call 1-800-243-7252.

Wood

Understanding Wood by R. Bruce Hoadley

A noted wood scientist and woodworker tells you why wood behaves and misbehaves as it does, and how you can work with it, instead of against it. Hoadley shows how to cut, season, machine, join, bend, fasten, and finish wood. Photos, drawings, and charts help explain how a tree's growth influences the wood's figure, and how you can identify species.

**Hardcover, \$21.95
#11**

Fine Woodworking on Wood and How to Dry It

Forty-one articles from *Fine Woodworking* tell you how to buy, dry, store, and mill lumber; also how to design joints that accommodate wood's seasonal swelling and shrinking.

**Softcover, \$7.95
#52**

NEW BOOK

The Workbench Book Scott Landis



A craftsman's guide
from the publishers of *Fine Woodworking*

Explore the strengths and weaknesses of the world's great workbenches. Taunton Press editor Scott Landis calls on the insights and discoveries of dozens of skilled craftsmen as he examines benches for all kinds of woodworking—from traditional Shaker benches to modern benches of plywood and 2x4s. Landis shows you how each one works and leads you through the tough spots in its construction. With 19 pages of measured drawings, hundreds of illustrations and photos, two chapters on vises, and a list of sources of supply, this book is sure to become a classic.

**Hardcover, color, \$24.95
#61**

Turning

VIDEO

Bowl Turning with Del Stubbs

Noted turner Del Stubbs shows you the basic techniques of bowl turning and then some. You'll learn different ways to lay out and mount a bowl blank, use various gouges and flat tools to shape the outside and excavate the inside of a bowl, even how to turn thin-wall and bark-edge bowls.

**120 minutes, \$39.95
(Rental: \$14.95)
#607 (VHS), #608 (Beta)**

Fine Woodworking on Spindle Turning

Explore the variety of useful things that can be turned between centers. In 39 articles from *Fine Woodworking*, inventive turners show you how to use the turner's gouge and how to master the difficult skew chisel. There are plans for making tools and gauges, clever shop tips, and revealing looks at porch pillars, baseball bats, and lacemaking bobbins.

**Softcover, \$7.95
#57**

Fine Woodworking on Faceplate Turning

A rare look at how some of today's best turners create everything from drinking goblets to giant bowls. You'll learn about glued-up turning blanks, the modern bowl-turning gouge, decorative and laminated turnings, box designs, bandsawn baskets, a finish that's safe for food, and more—all from 42 *Fine Woodworking* articles.

**Softcover, \$7.95
#58**

Turning Wood with Richard Raffan

Master woodturner Richard Raffan provides an extensive introduction to his craft. At the heart of the book are his chapters on centerwork and facework turning, but you'll also learn about your work area, lathe, tools, stock, abrasives, and finishes. Carefully selected exercises teach you ways to angle a tool to get the cut and surface you want; detailed drawings and photos show you how the position of your body affects the finished piece. And a 16-page color gallery of Raffan's work shows you just how far you can go.

**Softcover, \$17.95
#39**

NEW BOOK

Richard Raffan Turned Bowl Design



The first in-depth examination of bowl design from a master turner.

Richard Raffan takes you beyond the skills he taught in his first book and video, and shows you how to design bowls that remain beautiful after the color and grain have faded. Raffan covers all the steps from timber selection to polished piece. You'll learn how to refine the shape, cut sides, decorate surfaces, and more. There are templates to get you started and a full-color photo gallery of design ideas.

**Softcover, color, \$17.95
#63**

VIDEO

Turning Wood with Richard Raffan

Produced and directed to capture the book's dynamic details, Raffan's tape begins with his tool-sharpening techniques and gouge and skew exercises, then takes you through six projects: a tool handle, light-pull knob, scoop, box, bowl, and breadboard. Keyed on screen to the book.

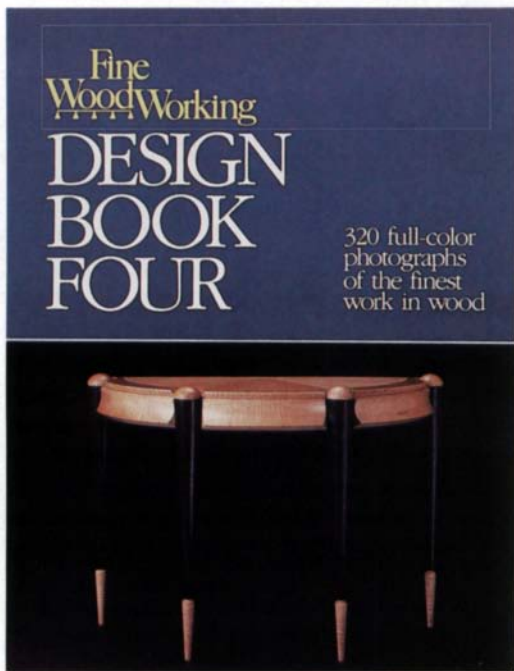
**117 minutes, \$39.95
(Rental: \$14.95)
#611 (VHS), #612 (Beta)**

The Raffan Set

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NEW BOOK



An all-new, full-color look at the best in contemporary woodworking. Selected from some 10,000 photos submitted by *Fine Woodworking* readers, the 320 objects pictured here show just how far the craft has come since we published our first *Biennial Design Book* in 1977. Woodworking like this takes your breath away, whether it's a beautifully crafted period piece or some playfully painted art furniture. There's a new sense of mastery among woodworkers, and a new fascination with color and materials other than wood. *Design Book Four* captures all the excitement with stunning photographs, compelling essays, and a 15-page directory of woodworkers.

**Softcover, color, \$16.95
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Three volumes of superb woodworking at specially reduced prices. *But only while supplies last.*

#02 Biennial Design Book, *Softcover, \$11.95 \$10.75*
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Small Shop



VIDEO

Small Shop Tips and Techniques with Jim Cummins

Jim Cummins lets you in on the tips and tricks he's picked up in his years as associate editor of *Fine Woodworking's* Methods of Work column. He shows how to use common tools and machines to achieve uncommon results. Among his topics: how to get a home-shop bandsaw to work better, how to expand the role of your drill press, and how to make hand tools and machines work together. Booklet included.

**60 minutes, \$29.95
(Rental: \$14.95)
#625 (VHS), #626 (Beta)**

Fine Woodworking on The Small Workshop

A bookful of ideas culled from ten years of *Fine Woodworking* magazine. You'll find suggestions about building and improving workbenches and on setting up shop. There are also tips on storing tools, methods of clamping and holding your work, controlling dust, and keeping your shop safe.

**Softcover, \$7.95
#33**

Fine Woodworking on Proven Shop Tips

Hundreds of shop-wise ideas from *Fine Woodworking's* Methods of Work column. You'll find techniques for drying green wood and polishing a finish and for every operation in between. Plus, jigs to enhance shop tools and more clamping ideas than you can shake a dowel at.

**Softcover, \$7.95
#38**

Indexes

NEW

Fine Woodworking Supplementary Index (Issues 51-65)

This new 12-page index gives a thorough listing of articles, letters, columns, and photographs from issues 51 through 65 of *Fine Woodworking*. It also includes references to all the *Fine Woodworking on...* and *Techniques* books (through *Techniques 9*).

**Softcover, \$1.95
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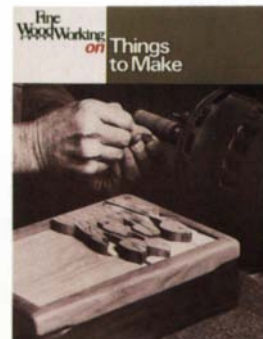
Fine Woodworking Cumulative Index (Issues 1-50)

Complete listing of articles, photos and columns from the first 50 issues. Covers the first six *Techniques* books and eight *Fine Woodworking on...* books.

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**Fine Woodworking Set
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Projects



Fine Woodworking on Things to Make

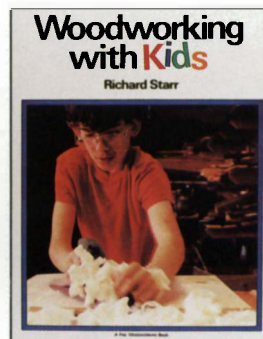
Good ideas and practical advice about making everything from simple toys to elegant furniture. These 35 articles from *Fine Woodworking* show you how to make tables, trays, chairs, sleds, music boxes, an Aztec drum, an Appalachian dulcimer—even wooden eyeglass frames.

**Softcover, \$7.95
#49**

Fine Woodworking on Woodshop Specialties

Looking for a different kind of project? Try these 27 *Fine Woodworking* articles. You'll learn how to make a microscope out of wood, create wooden clockworks, and fashion marionettes. The list goes on: miniature ships, puzzles, barrels, picture frames, covered bridges, and more—all with photos and illustrations.

**Softcover, \$7.95
#60**



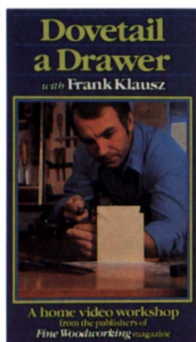
Woodworking with Kids by Richard Starr

Help your children make what they want out of wood and they'll learn to love the craft. Woodworking teacher Richard Starr shows how with plans for toy airplanes, tables, boxes, toys, and more. He begins with simple projects, then moves on to more challenging ones.

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#21**

To order from The Taunton Press, use the attached insert or call 1-800-243-7252.

Joinery



VIDEO

Dovetail a Drawer with Frank Klausz

Cabinetmaker Frank Klausz shows you how to make crisp, clean, properly fitting drawers by hand. After sizing the stock and running the grooves for the drawer bottom, Klausz shows you how to cut quick, precise dovetails without the use of jigs or templates, and how to glue up and fit the finished drawer. You'll also learn how to use a backsaw, chisel, and smoothing plane and how to rip, crosscut, and dado on power machinery.

**60 minutes, \$29.95
(Rental: \$14.95)**

#601 (VHS), #602 (Beta)

VIDEO

Radial-Arm-Saw Joinery with Curtis Erpelding

By watching Curtis Erpelding at the radial-arm saw, you'll learn to cut impeccably precise joints time after time. Calling on years of experience, Erpelding shows you how to set up and fine tune your own machine as you work, lay out and cut a series of identical slip joints, make a frame composed of such joints, and see this frame as a design building block. Erpelding also shows you how his artful jiggling techniques can help you come up with a host of workable furniture designs.

**110 minutes, \$39.95
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#609 (VHS), #610 (Beta)

Fine Woodworking on Boxes, Carcases, and Drawers

Skilled woodworkers show you how to build boxes and drawers that stand up to everyday use. These 41 articles from *Fine Woodworking* show you how to choose, make and use every kind of carcase joint, with particular emphasis on the classic dovetail. You'll also find detailed projects for hand-tool and machine methods.

**Softcover, \$7.95
#32**

Fine Woodworking on Joinery

Experienced craftsmen explain their techniques for fitting flat sticks together to make strong, lightweight frames. Most of these 36 articles from *Fine Woodworking* cover numerous forms of the mortise-and-tenon joint, although you'll also find expert information about dovetails and other decorative and specialty joints for paneled walls and doors, cabinets, tables, and chairs. You'll even pick up some valuable information on using wood glue.

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Period Furniture



Federal Furniture by Michael Dunbar

A complete workshop in the design and construction of selected Federal-period pieces, written by a master craftsman. Michael Dunbar shows you how to make 20 pieces from his home, including a Pembroke table, candlestand, high-post bed, and more. In each case, measured drawings, practical construction tips, and detailed instructions help you reproduce an aspect of the piece that is uniquely Federal.

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#41**

Make a Windsor Chair with Michael Dunbar

Making a Windsor chair can be relatively simple—especially if you're working with Michael Dunbar. His easy-to-follow instructions show you how to build two different styles of Windsors. You'll learn to cut and shape the seats, turn the legs and stretchers, whittle the spindles, and bend the backs. And you'll come away with a new appreciation for the craft, as well as some very attractive chairs.

**Softcover, \$13.95
#27**

Fine Woodworking on Making Period Furniture

Recapture the golden age of American furniture in your own workshop. These 37 articles from *Fine Woodworking* offer plans and technical explanations for making a Queen Anne table, a tall-case clock, a small highboy, post-and-panel chests, and more.

**Softcover, \$7.95
#36**

FINE WOODWORKING VIDEO

Making Mortise-and-Tenon Joints with Frank Klausz



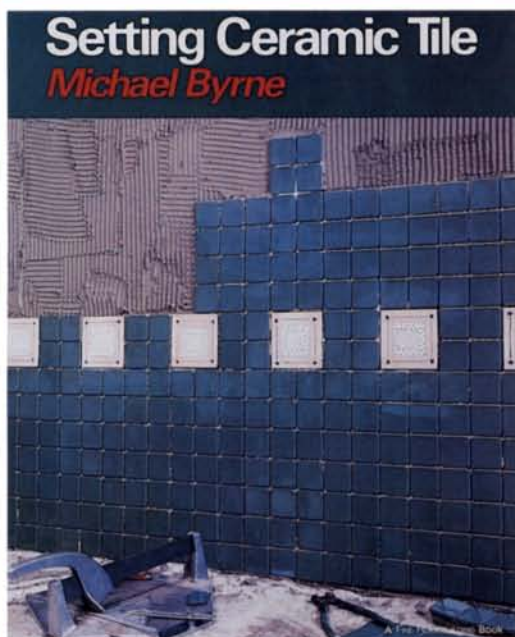
**A Video Workshop (with booklet)
from the publishers of
Fine Woodworking magazine**

**Master the mortise-and-tenon,
furnituremaking's fundamental joint.** Frank Klausz brings his 20-plus years of experience before the camera to show you three different techniques for making three variations on the mortise-and-tenon. You'll learn how to make a haunched mortise-and-tenon joint for a table, using ordinary hand tools; a through/wedged mortise-and-tenon joint as part of a door, using a router and band-saw; and an angled mortise-and-tenon joint for a chair, using a hollow-chisel mortiser and tablesaw. Klausz also explains how to determine which joint is best for which application and how to organize your procedures for maximum efficiency and best results. Included with the tape is an illustrated booklet that outlines all the procedures Klausz covers. This handy step-by-step guide will help you take what you've learned back to your own workshop.

**60 minutes, \$29.95
(Rental: \$14.95)
#621 (VHS), #622 (Beta)**

To order from The Taunton Press, use the attached insert or call 1-800-243-7252.

NEW BOOK



At last, a clear, comprehensive book on tiling. Master tilesetter Michael Byrne begins with the basics: the varieties of tile available, the tools, setting methods, surface preparation, and layout techniques. He then guides you step-by-step through a series of actual home installations—floors, walls, and countertops—demonstrating both the popular thinset method and the traditional thick mortar-bed technique. Additional information on repairs, problem installations, and sources of supply make this book an invaluable resource for novices and pros alike.

Softcover, color, \$17.95
#53

NEW COMPANION VIDEOS



Tiling Countertops with Michael Byrne

Watch professional tilesetter Michael Byrne demonstrate his craft. In this first tape, Byrne shows you how to use traditional techniques and modern materials to tile attractive, easy-to-clean countertops. You'll learn how to work with both backer-board and mortar-bed substrates, lay tile around a sink, and detail your countertop. A perfect introduction to tiling.

60 minutes, \$29.95
(Rental: \$14.95)
#627 (VHS), #628 (Beta)

Tiling Walls with Michael Byrne

Once you learn what Byrne has to show you, you'll be able to tile any wall in your house. Byrne covers all of the techniques you need, from laying out to grouting. Working on a bathroom job site, he shows you how to handle out-of-plumb walls; how to maneuver around bathtubs, plumbing, and windows; how to cut tile using biters and a snapcutter; and much more.

75 minutes, \$29.95
(Rental: \$14.95)
#629 (VHS), #630 (Beta)

Tiling Floors with Michael Byrne

From basic procedures to special techniques, Byrne shows you everything you need to tile a floor of lasting value. The focus is on a watertight bathroom floor and a sloping shower pan, but the techniques can be applied anywhere in your home. You'll learn how a border can simplify a diagonal layout; how to mix and float mortar for a substrate that's flat, level, and sturdy; and how expansion joints can keep your floor from cracking.

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Note: All tapes are keyed to Byrne's book with page references right on the screen.

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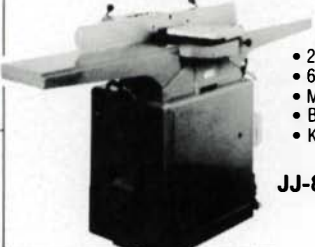
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Listings of gallery shows, major craft fairs, lectures, workshops and exhibitions are free, but restricted to happenings of direct interest to woodworkers. We'll list events (including entry deadlines for future juried shows) that are current with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

ALASKA: Workshops—Wilderness workshops, scribe-fit log construction, Mark Fritch, May 4–15, tuition \$325; building a sailing pram, Simon Watts, May 18–27, tuition \$375; \$25 reduction if registered by Mar. 1. Harmony Point Wilderness Lodge. Contact Harmony Point Lodge, Box 110, Seldovia, 99663. (907) 234-7858.

ARIZONA: Seminars—One-piece bust carving, Claude Bolton, Jan. 13–16; canvasback decoy carving, Jim Reynolds, Feb. 7–10; decoy painting, Jim Reynolds, Feb. 18–20; realistic antelope carving, Tony Weaver, Mar. 17–19. Church of the Holy Cross Lutheran, 3110 N. Hayden Rd. Contact Dave Rushlo Woodcarvers Supply, 2530 N. 80 Place, Scottsdale, 85257. (602) 994-1233.

CALIFORNIA: Workshops—Woodworking for women, beginners and advanced, traditional furnituremaking, focus on hand tools. Contact Debby Zito, 103 Wool St., San Francisco, 94110. (415) 648-6861.

Workshops—Traditional Japanese woodworking classes; Shoji screen, Tansu chest, joinery and hand-shaping. Contact Hida Tool & Hardware Co., 1333 San Pablo Ave., Berkeley, 94702. (415) 524-3700.

Class—Simon Watts' building the Herreshoff pram, Jan. 30–Feb. 6. Contact Nat'l Maritime Museum Assoc., Crissy Field, San Francisco, 94129. (415) 929-0202.

Juried show—American Crafts/Design 88, 4th annual exhibition of contemporary crafts and cutting edge in design, San Francisco Winter Design Market Week, Jan. 24–31 (trade), Jan. 30–31 (public), 10 A.M. to 5 P.M. Showplace Design Center, Gallery 280, 2 Henry Adams St., San Francisco. Contact Baulines Craftsman's Guild, Schoonmaker Point, Sausalito, 94965. (415) 331-8520.

COLORADO: Juried show—3rd annual exhibition by Colo. woodworkers, Nov. 28–Jan. 10. Pioneers' Museum, Colo. Sprgs. Contact the Woodworkers Guild of Colo. Sprgs., Box 9594, Colo. Sprgs., 80932. (303) 634-4683.

CONNECTICUT: Juried show—31st annual crafts exposition, July 14–16. Application deadline Mar. 11. For application, write Guilford Handcrafts Expo., Box 589, Guilford, 06437. For information, contact Fernn Hubbard or Joyce Wright (203) 453-5947.

Exhibition—Furniture by recent graduates of the Leeds Design Workshop, Feb. 3–Mar. 12. The Elements Gallery, 14 Liberty Way, Greenwich, 06830. (203) 661-0014.

Exhibition—Wooden clock sculptures by Catherine Bloom, Nov. 14–Dec. 31. Free. Brookfield Craft Center, 127 Washington St., S. Norwalk. (203) 853-6155.

Workshops—Numerous weekend arts/craft classes and workshops for beginners and advanced craftsmen, Jan. 16–Mar. 27. Brookfield Craft Center. Tuition: generally \$50/day. For information and/or a free 32-page catalog, write Brookfield Craft Center, Box 122, Brookfield, 06804. (203) 775-4526.

DISTRICT OF COLUMBIA: Show/seminars—"Woodworking World," Feb. 13–15. The D.C. Armory, Washington. Machines, tools, supplies, local craftsmen, demos, seminars, door prizes. Admission: \$6. Contact CDI Productions, Box 796, Plymouth, NH 03264. (603) 536-3768.

Show—"Masters of Ceremony," Jewish ceremonial pieces by contemporary designers, thru Jan. 31. B'nai B'rith Klutznick Museum, Washington. Contact B'nai B'rith International, 1640 Rhode Island Ave., N.W., Washington, D.C. 20036. (202) 857-6536.

FLORIDA: Juried show/sale—25th annual outdoor festival, Feb. 13–15. 350 exhibitors. Contact Coconut Grove Arts Festival, Box 757, Coconut Grove, 33233.

ILLINOIS: Exhibition—"Tuning the Wood," a display of the works of Illinois luthiers, Nov. 21–Jan. 10. Illinois State Museum. For more information, contact Terry Suhre, Illinois State Museum, Springfield, 62706. (217) 782-7386.

Juried show—9th annual Fountain Square arts festival, Jun. 25–26. Outdoor show, application deadline April 8. Contact Evanston Chamber of Commerce, 807 Davis St., Evanston, 60201. (312) 328-1500.

INDIANA: Exhibition—"American Folk Art: Expressions of a New Spirit," Apr. 30–Jul. 5. Conner Prairie, Noblesville. Exhibition from the Museum of American Folk Art permanent collection. Contact Susan Flamm, 444 Park Ave. S., NYC, NY 10016. (212) 481-3080.

Show—Hand-crafted wood furniture, Sept. '88. Chesterton Art Gallery. Slide deadline Jun. 30. Send SASE for

more information to Marsha Demkovich, Chesterton Art Gallery, Box 783, Chesterton, 46304. (219) 926-3041.

KANSAS: Exhibition—Topeka crafts competition 12, Apr. 2–May 2. Open to KS, NB, and the St. Joseph-Kansas City, MO metro area residents. Slides due Feb. 29. Contact Gallery of Fine Arts, Topeka Public Library, 1515 W. 10th St., Topeka, 66604-1374. (913) 233-2040.

LOUISIANA: Juried show—15th annual FestForAll, May 28–29. Outdoor show; application deadline Jan. 31. Baton Rouge, North Blvd. Send SASE to River City Festivals Assoc., 427 Laurel St., Baton Rouge, 70801. For information call (504) 344-3328.

Seminars—New Orleans Finishing School, Jan. 4–8, Feb. 29–Mar. 4. Cover all aspects of antique finishes, faux finishes and general refinishing. For information contact Wormhoudt's Antiques (504) 895-0201.

Workshops—14th annual workshops including wood-working and a craft-marketing seminar, Feb. 13–14. Lake Charles. Contact Louisiana Crafts Council, Box 1287, Baton Rouge, 70821. (504) 928-1980.

MAINE: Classes—Post & beam building, Apr. 10–15, Sept. 18–23; and 2- & 3-week design-and-build classes beginning in Mar. through Nov. For specific class dates and more information contact Shelter Institute, 38 Centre St., Bath, 04530. (207) 442-7938.

MARYLAND: Juried shows—Crafts shows and festivals beginning in Apr. Jurying begins Jan. 18. For detailed information, send 66¢ in postage stamps to Deann Verrier, Director, Sugarloaf Mountain Works, Inc., 20251 Century Blvd., Germantown, 20874. (301) 540-0900. **Show**—8th annual Harford Day School waterfowl show and sale, Feb. 20–21. Admission \$2.75 for adults. Contact Carol Brady, Harford Day School, 715 Moore's Mill Rd., Bel Air, 21014. (301) 879-2350, 838-4848.

MASSACHUSETTS: Craft fair—18th annual, May 20–22. Worcester Center for Crafts. Slide deadline Feb. 14; application fee \$15. Call or write for application packet: Craft Fair Registrar, Worcester Center for Crafts, 25 Sagamore Rd., Worcester, 01605. (617) 753-8183. **Workshops/seminars**—Numerous events. Contact The Woodworkers' Store, 2154 Massachusetts Ave., Cambridge, 02140. (617) 497-1136.

Workshop—9th annual wood identification, Dr. R. Bruce Hoadley, Jan. 19–22. Cost \$235. For registration material or information contact Alice E. Szlosek, Program Coordinator, Div. of Continuing Ed., Goodell Bldg-Rm 608, Univ. of Mass., Amherst, 01003. (413) 545-2484. **Exhibition**—"Furniture," by Wendell Castle workshop and school including Peter Dudley's, Mark Gravino's and Fred Puksta's, Feb. 6–Mar. 5. Ten Arrow Gallery, 10 Arrow St., Cambridge, 02138. (617) 876-1117.

MICHIGAN: Juried show—Ann Arbor Street Art Fair, Jul. 20–23. Application deadline Feb. 15. For application write Street Art Fair, Box 1352, Ann Arbor, 48106.

MINNESOTA: Workshops/seminars—Numerous events. The Woodworkers' Store, 3025 Lyndale Ave. S., Minneapolis, 55408. (612) 822-3338.

Classes/Seminars—Woodcarving, woodturning, tool sharpening. Write for schedule. The Wood Carving School, 3056 Excelsior Blvd., Minneapolis, 55416. (612) 927-7491.

Exhibition—The Turned Message 11, April 1–29. Grand Avenue Frame and Gallery. Send current slides, resume, and SASE by Jan. 15 to Janine Valento, Grand Ave. Frame and Gallery, 964 Grand Ave., St. Paul, 55105. For information call (612) 224-9716.

NEW MEXICO: Workshop—Simon Watts' wooden boat building, Mar. 4–12. For information contact the Albuquerque Woodworkers Assoc., Jim Linke, Box 7729, Albuquerque, 87194. (505) 345-8735.

NEW YORK: Workshops—Veneering, woodcarving, furniture repair, marquetry, woodfinishing, other topics, Jan. thru April. Constantine's, 2050 Eastchester Rd., Bronx. 2-day workshops, Sat. or mid-week. Fee: \$10. For information, contact Albert Constantine & Son at (212) 792-1600.

Exhibition—"An Art of Deception, American Wildfowl Decoys," Jan. 30–April 30. NY State Museum, Albany. Contact Susan Flamm, Museum of American Folk Art, 444 Park Ave. So., NYC, 10016. (212) 481-3080.

Classes—Woodworking, beginner to advanced, Maurice Fraser, lathe turning, Bill Gundling, finishing, Susan Terry, Feb. 8–June 4. Free dovetail and bowl turning demos Feb. 1. Days or evenings, \$180. Y.W.C.A. Craft Student's League, 610 Lexington Ave. at 53rd, NYC. Contact (212) 735-9732.

Exhibition—Selections from the permanent collection, thru Jan. 3. American Craft Museum, 40 W. 53rd St., NYC. Sculptural and functional objects in wood, clay, metal, glass, fiber, mixed media dating from 1945. Tues. 10–8; Wed.–Sun., 10–5. Admission: \$3.50 adults; \$1.50 students & seniors. (212) 956-3535.

Juried show—New Paltz arts & crafts fairs, May 28–30 & Sept. 3–5; Holiday crafts fair at Old Westbury, Jul. 2–4. Respective fees \$275–\$325; \$250–\$295. Application deadlines Feb. 1. Contact Scott & Neil Rubinstein, Quail Hollow Events, Box 825, Woodstock, 12498. (914) 679-8087, 246-3414.

Workshops—Japanese hand tools, Robert Meadow, Jan. 9–10, 23–24, Feb. 6–7, 20–21. The Lutherie, 2449 W. Saugerties Rd., Saugerties, 12477. (914) 246-5207.

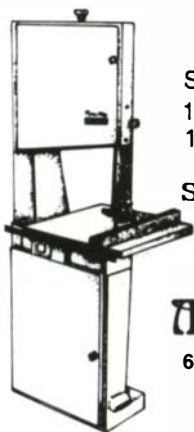
Exposition—The Pratt creative arts therapy annual expo; transitions and transformations, Mar. 19; annual creative arts spring institute, Mar. 14–19. For information contact Leslie Abrams, Chairperson, Creative Arts Therapy Dept., 200 Willoughby Ave., Brooklyn, 11205. (718) 636-3428.

Juried Show—The Lilac art show, May 14–15. Highland Park, Rochester. Entry deadline Feb. 12, entry fee \$75 non-members, \$50 AGR members. Contact Arts For Greater Rochester, 335 E. Main St., Suite 200, Rochester, 14604. (716) 546-5602.

Juried Show—12th Annual American Crafts Festival, July 2–3, 9–10. Lincoln Center, NYC. Application deadline Jan. 29; \$330–\$360 fee per weekend; \$10 application fee. Contact Brenda Brigham, American Concern For Artistry and Craftsmanship, Box 650, Montclair, NJ. (201) 746-0091.

Juried Show—5th Annual Autumn Crafts Festival, Aug. 20–21, 27–28, Sept. 3–5. Lincoln Center, Fordham Univ. Plaza, NYC. Application deadline Jan. 29; \$340 fee per weekend, \$10 application fee. Contact Brenda Brigham, American Concern For Artistry and Craftsmanship, Box 650, Montclair, NJ. (201) 746-0091.

NORTH CAROLINA: Exhibition—"Young America: A Folk Art History," thru Jan. 3. The Mint Museum of



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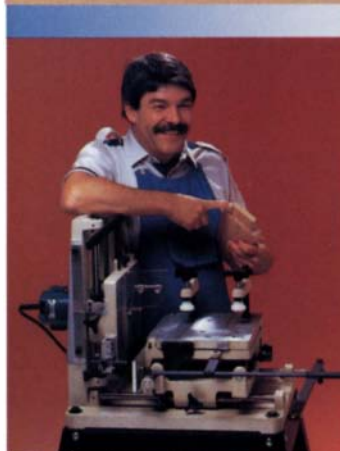


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Juried show—"Showcase of Woodcarvings," sponsored by Charlotte Woodcarvers Club, Feb. 27-28. Grady Cole Center, 310 N. Kings Dr., Charlotte. Slide deadline: Feb. 12. Entry fee: varies. Contact Charlotte Recreation Program Division, 1418 Armory Dr., Charlotte, 28204. (704) 336-2584.

Juried show—9th Annual Winterfest Art & Craft Show, Feb. 11-14. Asheville Mall. Fee: \$140 (\$125 HCA & CG members), legal SASE. Contact Gail Gomez, High Country Crafters, 29 Haywood St., Asheville, 28801. (704) 254-7547, 254-0070.

OHIO: Seminars—Woodworking, Earl Richards, thru March. Contact Richards' Cabinetry & Mill Co., 410 W. Harrison St., Lewisburg, 45338. (513) 962-4788.

Show—The Great Lakes wood carving exhibit, May 14-15. Brooklyn Recreational Center. For exhibition information contact Ed Katzenmeyer, 116 Goodhue Drive, Akron, 44313. (216) 864-0784.

Show/Seminar—"Woodworking World," Mar. 11-13. The Columbus Show, Veterans Memorial Hall, Columbus. Machines, tools, supplies, local craftsmen, demos, seminars, door prizes. Admission: \$6. Contact CDI Productions, Box 796, Plymouth, NH 03264. (603) 536-3768.

OKLAHOMA: Workshop—Woodturning by Alan Lacer, bowl turning, Feb. 27; between-center turning, Mar. 5. Tuition \$30. For information call Deanna Ewoldt at Moore-Norman Boat-Tech (405) 364-5763.

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

PENNSYLVANIA: Exhibition—Wharton Esherick Museum, sculpture, furniture, utensils from 1920-1970, daily. For reservations or directions, write or call The Wharton Esherick Museum, Box 595, Paoli, 19301. (215) 644-5822.

Workshop—32nd annual hardwood lumber grading and inspection, Feb. 22-26. Pennsylvania State Univ. For registration information contact Agricultural Conference Coordinator, 410 J.O. Keller Conference Ctr., University Park, 16802. (814) 865-9547.

Juried show—6th annual PA nat'l arts & crafts, Mar.

25-27. PA state farm show complex. Entry deadline Jan. 15. For information/applications send SASE to: PA National Arts & Crafts Show, Box 11469, Harrisburg, 17108-1469, or call Lew Kishbaugh (717) 763-1254.

TENNESSEE: Juried show—Master furnituremakers show, Dogwood Arts Festival, April 22-24. Open to individuals and those representing woodworking schools. Contact Dogwood Arts Festival, 203 Fort Hill Bldg., Knoxville, 37915. (615) 637-4561.

TEXAS: Juried fair—Annual Crafts & Arts Exposition, Houston International Festival, April 9-17. Application deadline: Dec. 15. Space also available at three open-air markets. Prospectus available from Barbara Metyko, Houston International Festival, 2 Houston Center, 909 Fannin, Suite 890, Houston, 77010. (713) 654-8808. **Show**—Annual Round Top Square Fair, April 9-10. Winedale Historical Center, Univ. of Texas, Austin. Open 9 A.M. to 5 P.M. Booths, to be set up inside and outside the courthouse, are still available. Contact Gloria Jaster, Box 11, Round Top, 78954. (409) 278-3530.

UTAH: Juried Show—47th annual multi-media art exhibition, Celebration 47, Apr. 14-May 6. Braithwaite Gallery, S. Utah State Coll. Slide deadline Feb. 15. For prospectus, send SASE to Cedar City Art Committee, Iron County School District, Box 879, Cedar City, 84720.

VERMONT: Exhibition/sale—Exhibit and sales space available in year-round open market for arts, crafts and antiques. Kennedy Brothers Marketplace. Contact Win Grant, Kennedy Bros., 11 Main St., Vergennes, 05491. (802) 877-2975.

VIRGINIA: Show/seminars—"Woodworking World," Jan. 8-10. The Norfolk Scope, Norfolk. Machines, tools, supplies, local craftsmen, demos, seminars, door prizes. Admission: \$6. Contact CDI Productions, Box 796, Plymouth, N.H. 03264. (603) 536-3768.

WASHINGTON: Workshops/demonstrations—Tools-In-Action series, free, every Saturday, 10 A.M. Boatbuilding, woodcarving, sharpening, other wood-working topics. The Wooden Boat Shop, 1007 N.E. Boat St., Seattle, 98105. (206) 634-3600.

Workshop—Steam bending, Jim Ferris, co-owner Edensaw Woods, Jan. 9; engine installation, Andy Erickson, installation of diesel engine in 30 ft. Lyle Hess Cutter,

Jan. 16-17. For information, contact Northwest School of Wooden Boatbuilding, 251 Otto St., Port Townsend, 98368. (206) 385-4948.

AUSTRALIA: Competition/exhibition—International exhibition of woodcrafts and wooden artifacts, Apr. 25-May 1. Categories include woodturning, cabinetmaking, carving and more. Objects must use Australian-grown timber. Contact Australian Forest Development Institute, Box 802, Albury NSW 2640. (060) 411266.

CANADA: Workshops—1987-88 workshop series. Mixed media & business topics. Contact Anne Fox, New Brunswick Craft School, Ecole d'Artisan du N-B, Box C/P6000, Fredericton, NB, E3B 5H1. (506) 453-2305.

Show/seminars—"Woodworking World," Jan. 15-17. Skyline Hotel, Toronto, Ont. Machines, tools, supplies, local craftsmen, demos, seminars, door prizes. Contact CDI Productions, Box 796, Plymouth, NH 03264. (603) 536-3768.

Show—Canada/Wood '88, Mar. 4-6. Palais des Congres de Montreal. Woodworking machinery & supply. For information contact Paula R. Lee, Show Manager, Canada/Wood at (203)964-0000; Telex 649400 CAHEX WU STD.

CHINA: Study tour—George Frank woodworker's 1988 study trip to China, June 3-19. Visits to traditional Chinese furniture factories, lacquering shops, the restoration centers of the forbidden city in Beijing, etc. For details write Eva Frank, 3504 Beneva Rd., Sarasota, FL 34232. (813) 923-3377.

ENGLAND: Workshop—Open house on antique furniture restoration for restorers, collectors and dealers, Jan. 1988. English workshop on West Dean College. For details, contact Malcolm Hill, 119 W. Dean, West Dean near Chichester, West Sussex, PO18 ORD.

EUROPE: Trip—Timber-framers' tour, sponsored by Mafell N. America Inc., tentatively scheduled for June. For information, contact Mafell N.A., Inc., Box 363, Lockport, NY 14094. (716) 434-5574.

ITALY: Study tour—Seminar on Italian furniture with George Frank, Oct. 12-26. Visits to craft, art and restoration centers of Milan, Verona, Florence and Rome; and seminars on the artistic Renaissance furniture made in the Tuscany craft centers. For details write Eva Frank,



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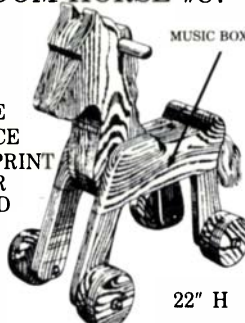
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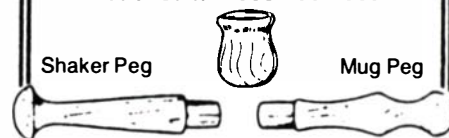
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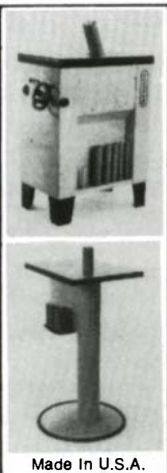
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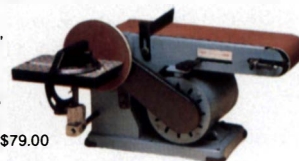


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Master Craftsmen of Newport, The Townsends and Goddards by Michael Moses and cosponsored by Israel Sack, Inc. *MMI Americana Press, P.O. Box 709, Tenafly, N.J. 07670; 1981. \$100, hardback; 361 pages.*

Producing reproduction furniture requires both technical skill and a comprehensive knowledge of the original objects. Now that American period furniture has sold at auctions for literally millions of dollars, and museums have become sticky about allowing careful study of pieces in their collections, about the only unrestricted source of study remaining is in books. Traditionally, period-furniture books were directed toward the collector or furniture historian. Little emphasis was placed on construction. The cabinetmaker had to draw from what was given, and mostly guess about the rest. In recent years, furniture historians and museum curators have discovered that what a piece is and how it was made are one and the same. We are seeing books that contain photos of construction details, detail drawings, accurate measurements and notes in the text on construction.

Master Craftsmen of Newport is a perfect example of this new genre; a book covering all aspects of furniture produced or influenced by the Goddard and Townsend families of 18th-century Newport, R.I. By exposing minute construction details, Moses establishes a framework for identifying common makers. As a consequence, the work is loaded with just the sort of thing woodworkers dream about: photos of details such as carved shells, ball-and-claw feet; the insides, backsides and undersides of tables, chairs and case pieces. Moses is certainly privileged to have closely examined so many priceless pieces of furniture, and his book is an unselfish sharing of his opportunity.

The text is rich in historical and biographical information, intertwined with a meticulous analysis of countless pieces. The amount of documentable material provided is enormous, yet the text is clear and easy to correlate with the excellent photographs. One could hope for some measurements of details, such as the carved shells, but in light of everything else that's given, this is really too much to ask.

To anyone having an interest in 18th-century Newport furniture, cabinetmakers certainly included, this book will prove to be a bible—a beautiful, informative book on magnificent furniture. No ISBN number is given, so ordering the book from your local bookstore can be a problem, but you can order directly from the publisher (address above). Also, *The Magazine Antiques*, Old Mill Road, Box 1975, Marion, Ohio 43305, has copies for sale.

—Norman L. Vandal

Boatbuilding Manual by Robert M. Steward. *3rd Edition, International Marine Publishing Co., Camden, Me. 04843; 1987. \$29.95, paperback; 273 pp.*

How To Build A Wooden Boat by David C. "Bud" McIntosh. *WoodenBoat Publications, Brooklin, Me. 04616; 1987. \$36, hardback; 264 pp.*

Building a wooden boat from scratch with no teacher is an enormous task, even for a talented woodworker, and there's no shortage of books aimed at helping the neophyte along. Two recent offerings, Robert M. Steward's *Boatbuilding Manual* and *How To Build A Wooden Boat* by David C. "Bud" McIntosh add to the already abundant literature.

Billed as "the standard reference for wooden-boat builders. . .," the new edition of the *Boatbuilding Manual*, originally published in 1954, displays an unfortunate lack of focus, trying to stay relevant and hip with fiberglass, power planes and whatnot. The revisions are unnecessary and wasteful of space in an all-too-short textbook that also lacks organization. A miserly passage on wooden spar construction is jammed into a

catch-all last chapter amusingly titled "Miscellaneous Details."

On the other hand, lofting, or the drawing of the boat full size from three views (plan, profile and sections), is handled very well, albeit briefly. As are most boatbuilders and designers, Steward is a very good draftsman, so his construction and joinery details are instructive and have a definite flavor of the boatyard. His chapter on tools and bench techniques is conversely weak, not even describing the wide range of traditional hand tools.

If I could only have the proverbial "One Book," there's no question it would be McIntosh's *How To Build A Wooden Boat*. McIntosh's book began with articles in *WoodenBoat* magazine. A happy marriage between that magazine and the old salt developed over the past 10 years, and this book is the offspring. McIntosh concentrates on the traditional, smooth-planked keel boat most are familiar with. However, he rightly observes that if you follow him carefully and thoroughly, he will address most of the problems common to every boatbuilding job. This guy is a pro who can build, and write in a style that's informative and entertaining.

McIntosh's prose is illustrated by Sam Manning, who is without question the best illustrator of boats and their construction you will ever encounter. He takes dry material and turns it into something really exciting. His homey boat-shop renderings harmonize well with the prose, and his background as a loftsmen and builder precludes those embarrassing slip-ups that plague artists unfamiliar with their subject.

Nothing's perfect though. McIntosh sorties into the pattern-making trade with some pretty weak information. A more fundamental weakness is the catch-as-catch-can way the whole concept of fitting one oddly curved, twisted or angled shape to another is dealt with. Since this is the only kind of fitting there is when building a boat, I would like to have seen a chapter devoted to that subject exclusively. This is pretty picky, however, given the overall superior quality of the material these two are presenting.

Too bad caveats always come last. Reread my first statement on McIntosh and buy this book. —Michael Sandor Podmaniczky

Award-Winning Designs for Woodturning by Alan and Gill Bridgewater. *Sterling Publishing Co., Inc., 2 Park Ave., New York, N.Y. 10016; \$14.95, paperback; 160 pp.*

The basic idea for this book is sound, but it fails to live up to its title. Taking turning designs from a competition sponsored by Great Britain's *Practical Woodworking* magazine, the authors have put together a collection of 40 projects representing a wide range of woodturning possibilities. A section of high-quality color plates, along with excellent technical drawings and not-so-good black-and-white photographs, serve to communicate the steps for each project. Each has its own section, which starts off with a couple of chatty paragraphs about the craftsman. The projects are mostly simple technical turning made complex with sometimes elaborate pre- or post-turning construction.

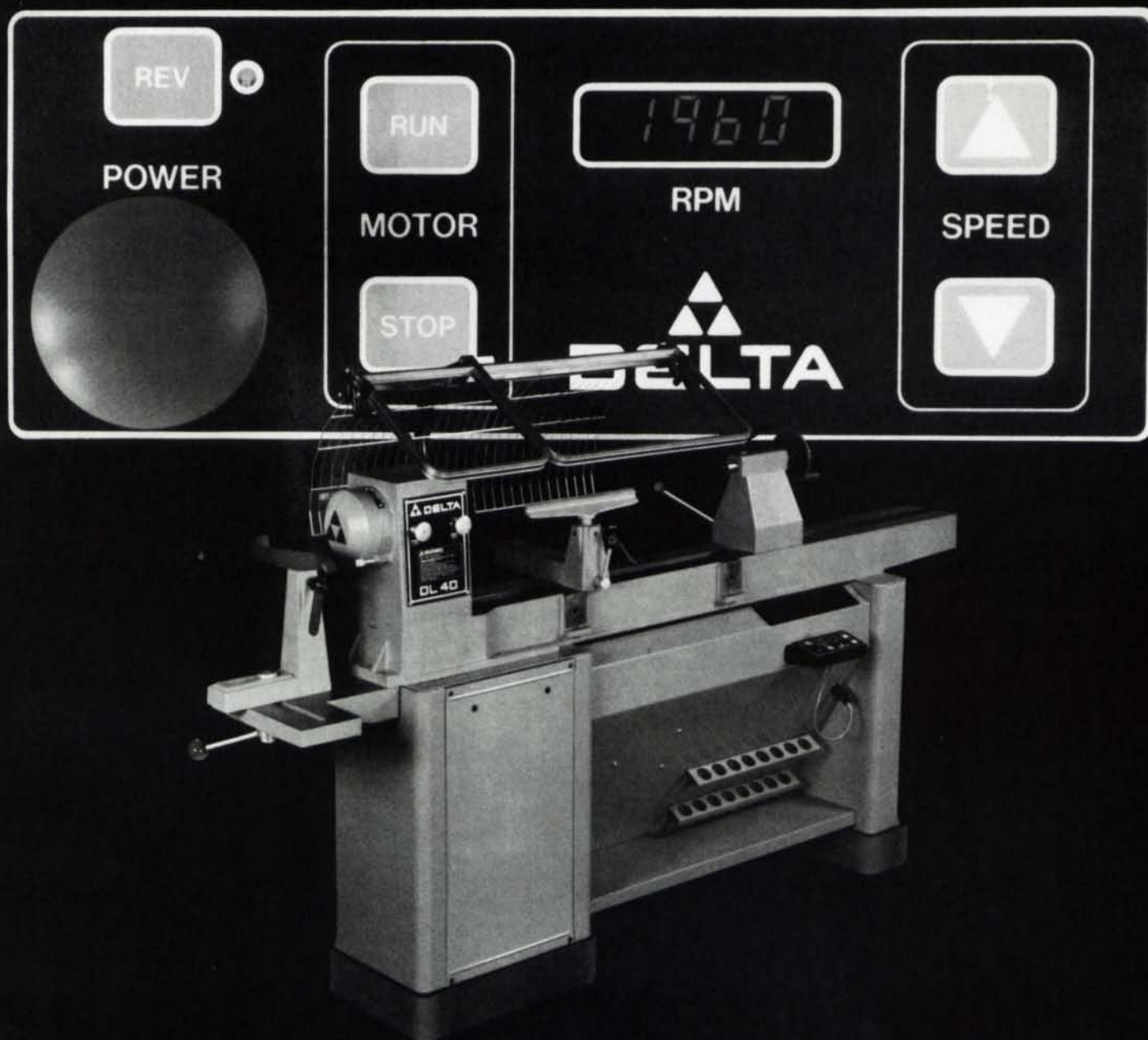
However, the book suffers from the very designs themselves. Perhaps due to the amateur status of the designers represented, the pieces have a dated, overworked look about them. In some cases, proportions are graceless and awkward; other pieces are simply trivial.

Award-Winning Designs for Woodturning may be a useful source of project ideas, but readers should look elsewhere for aesthetic inspiration.

—David Scott

Norman L. Vandal makes period furniture in Roxbury, Vt., and is a consulting editor to FWW. Michael Sandor Podmaniczky is a former boatbuilder and patternmaker and a conservator at the Winterthur Museum in Winterthur, Del. He is a contributing editor to FWW. David Scott is a professional woodworker. He lives in Clyde, N.C.

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Tool collectors, dealers and woodworkers square off and bid on the more than 600 lots of antique tools at the eighth annual spring sale in Nashua, N.H.

Impressions of a tool auction

Hundreds of antique woodworking hand tools lay throat-to-heel in numbered chaos on burlap-covered tables one April Saturday morning in the ballroom of the Ramada Inn in Nashua, N.H. Elegant rules and bit braces made of rosewood and brass, ornate iron levels, early wood planes—the contents of countless bygone workshops—all brought together for one of the premier antique tool auctions in New England: the eighth annual spring sale conducted by Your Country Auctioneer, Inc., of Hillsboro, N.H.

About 150 woodworkers and collectors and antique dealers from all over the country circled the tables hungrily, appraising the goods and each other in the last minutes before squaring off to bid on 603 lots of tools. When the last tool was dispersed late in the afternoon, there were some heavy and some happy hearts, egos both battered and ballooned, a number of well-depleted checking accounts, and a very pleased auctioneer.

That's not to say auctioneer Richard Crane had been *all* business, unless one considers a certain amount of down-home humor and farmy clowning to be a normal part of business for a fellow who also auctions cattle. Looking out over tortoiseshell glasses set low on his nose, with red tie and red suspenders curving over an ample shirtfront, Crane cut the figure of a country character who is still learning the rules of polite society. When he smiled, there appeared an enormous gap between his only two top teeth, which, in a less scrupulous auctioneer, would permit the passage of equally enormous lies about the merchandise.

Among the crowd, there were sharp-eyed

sharks with tans, grandpa putterers in pastel cardigans, and bearded craftsmen in plaid and khaki. There were dealers who are woodworking hobbyists and woodworkers who collect. All had come for old hand tools—tools for smoothing wood, drilling, shaving, measuring, clamping, cutting and splitting. It was a parade of woodworking history, a limited heritage to be fought over, more or less amiably. When Crane asked everyone to find a seat, the truce flags were put away, and the skirmish started.

"We're trying to get the word out to woodworkers that most of these tools are usable, as is," Crane told the crowd. But there's the rub: The price a collector would pay to own an investment is generally much higher than the price a woodworker could justify to buy the same tool and use it.

Jerry Sawma, a timber framer from Conway, Mass., came looking for Stanley beading planes. But what caught his eye were a Stanley #444 dovetail plane that went for \$1,200 and a 7-in.-wide crown molding plane that brought \$3,500, the day's high. "There's no way I could own those, but I sure would like to try them out," he sighed. "Somebody should buy all these wonderful tools and start a business renting them out."

Speaking softly through a thin smile and bidding in the style of a well-mannered bulldozer that simply gets where it wants to go, a fellow standing at the back of the room bought two old Nicholson planes for \$900 and \$1,000. Compared to the majestically enormous crown molding plane, the latter two seemed rather humble. I wondered why they were so special, so I walked over and asked their new owner.

We had a cup of coffee while David Englund of Seattle, Wash., a former high school manual arts teacher and owner of about 30 Nicholson planes, sat holding the planes and explained his interest in them. "The latest research has turned up no American plane makers earlier than the Nicholsons, a father and son who were working in Wrentham, Mass., around 1725," Englund said.

I asked him if he would use the Nicholson planes. "No, they're going on a shelf," he said. Understanding what I was driving at, he said, "It works both ways, the woodworkers are unhappy with the collectors who drive tool prices up. The collectors are unhappy with the craftsmen who are buying old tools and using them up."

The bidding went on and on, as men pursued their collecting obsessions and wood shop needs. We struggled with each other, with lethargy and tool envy, and with auction fever's bargain deliriums. By mid afternoon, gazes were glazing over. The room seemed to lift and drift, like Boston's Fenway Park in the late, sun-bleached innings of a day game in August.

I bid on two items. One was an 11-in. hewing axe, a medieval-looking halberd I thought would be just the thing for my wild-eyed teenage son to split kindling with. It went out of my price range to a large unsmiling character who seemed to outbid everyone else for big, primitive hacking and hewing blades.

The other was a lot of eight rather-abused carving tools that went for \$60 to one of two fellows sitting together. It was Mark White of Boxboro, Mass., who stole my carving tools, and it was his friend, Brad Christo upon whom the auction later bestowed a wonderful gift.

On the inside cover of the auction catalog was a photograph of auctioneer Crane and Lee Murray, his tool manager, crouching next to a large antique tool chest. When that chest came up for sale, more than a hundred tongues went mute, and Christo bought the tool chest for a mere \$475.

On the outside, the 3-ft. by 2-ft. chest was rough, almost crude in appearance. But when the lid was raised, an interior was revealed as finely finished and detailed as a jewelry box. There were beautiful inlays and sliding drawers, some with paneled and beaded covers. The chest was said to have been made sometime in the 1840's by a carpenter who built ship captains' quarters in Plymouth, Mass. How many times had hulking dockworkers shouldered this chest and carried it up the gangplanks of old sailing ships? The finely-wrought tool vessel had come sailing down through time, still seaworthy, with a cargo of history, some mystery, and not a little romance.

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crowd that hovered about as Christo, stunned, ran his hands over the richly detailed interior. I leaned down and said to him, "So you'll just toss the cordless drills in the bottom and drag it off to the job site, huh?"

Christo fixed me with a stern stare and replied, "Only hand tools are going in this."

—Richard Ewald
Westminster West, Vt.

Rolling your own

Over the last five years or so, I'd grown so accustomed to my rusty '77 Ford van's shabby appearance that I was a bit surprised when my wife, Ruth, tactfully suggested that it wasn't doing any good for my image or my carpentry business. Now that my wife was actually implying that I should spend money, I suspected this to be a fairly serious situation. It was even more distressing, however, to discover that a new vehicle would cost just as much as a workshop full of new equipment.

My choices, naturally, were between a pickup truck or van. I like the versatility of pickup trucks, but unlike vans, they lack a spacious, enclosed and secure compartment. A cap seemed to be the way to go, and I thought that by building one myself, I could add certain personalized touches to the truck and decorations that would dispell a certain rough-boy mystique that is associated with these vehicles.

To give my cap a distinctive look, I made the roof follow the "monitor" roof style common on old industrial buildings where I live in rural Wisconsin. It features a row of sash windows installed along the upper roofline. The 5-ft., 9-in. headroom in the raised central area makes the cap's interior comfortable to stand in without stooping—a great improvement over my old van. Further, the windows allow natural light, so you can see what you're doing inside. I gave the roof enough overhang



Though it looks more like a barn on wheels than a workshop, the author uses his custom-built truck cap for hauling tools and materials for his carpentry business.

on the sides for spacious tool storage, and an upper hatch door in back—a whimsical, barn-like addition to provide ease of access and extra-loading capacity.

The overall proportions of the cap were a bit tricky to get right. It took several efforts on paper to get the rearward slant of the roofline to appear natural and somewhat graceful. Also, I knew I wanted a set of curved doors for the main doors in back, and it took six or seven tries until the right shape finally came out. (Proud of my "original" design, I was crestfallen when later I saw an armoire with nearly identical doors being given away on *The Wheel of Fortune* television show.)

The construction of the cap presented no major problems. I chose cedar as the principal material, based on its color and weathering characteristics. The main box is fabricated from panels of plywood covered with either shingles or cedar paneling (V-grooved with a molding cutter on the tablesaw) and finished with a clear

wood preservative. I had a local blacksmith build some sturdy brackets for a lumber rack that I bolted to the sides of the cap.

In trimming the curved front of the monitor roof, I had hoped to wrap thin strips of redwood, one at a time, around the roofline. This didn't work though, and I had to build a form and laminate the trim piece as a single unit.

Now that the cap's done and installed, I'm glad I went to the trouble of designing and building one instead of just buying a stock cap. Being a professional, I took care to put it together properly, not wanting to embarrass myself with such a prominent display of my work. As to whether the cap has improved my business, I think the answer is yes, but not as much as I'd expected. I have little way of knowing if there's a negative effect, but as of yet, no one's said they wouldn't hire me because of the silly truck I drive.

—Greg Gardner, Hustisford, Wis.

More on art turning

Richard Raffan's report on two turning shows published in *FWW* #67 brings to mind a running argument I've been having with a friend of mine over the role of contemporary craft in modern society. Basically, our argument centers around how society should perceive "fine craft." Should it be seen as fine art or simply as an alternative to mass-produced goods? Raffan raised this and other issues in his article, but I don't think he examined any of them thoroughly.

From my perspective as a wood turner, I see a place for both approaches: the produc-

tion of inexpensive well-turned objects and expressive, one-of-a-kind pieces. I disagree with Raffan's assertion that there's a "plethora of art turnings." On the contrary, I feel a need for more exploration in this field. To a degree, craft's traditional purpose—to produce utilitarian, handmade objects—has outlived its usefulness. A handmade object can't compete economically with a machine-made piece. And given the sophistication of modern industrial design, the quality of the very best machine-made goods rivals that of some production-run craft objects.

So what role should fine craft play in today's society? For me, and I believe for other craftsmen, the answer lies in exploring personal creative boundaries. With func-

tion not necessarily primary, I am free to explore new ideas that could conceivably produce works that will ultimately prove more "useful" than the utilitarian items Raffan makes. I am suggesting that a well-made craft object's greatest value may be in communicating an idea rather than in fulfilling a utilitarian function. The "art turners" Raffan so deplores are craftspeople who are seeking new ways to enlarge the communicative vocabulary of wood. This involves experimentation which often produces controversial results. Without this questioning and posing of new values, however, wood turners would simply be perfecting salad bowls and salt shakers.

I realize turners have a certain reluc-

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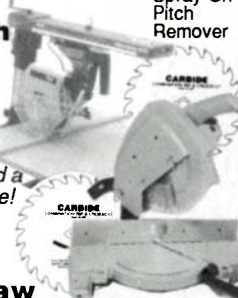
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tance to accept an aesthetically based approach to their craft, but in my view, it is essential to do so if the field is to mature. To wish this approach away and ignore the work that has emerged from it is unrealistic. I'm not sure I could ever be satisfied as Raffan is, turning 20 howls a day to sell for \$40 each. I have no doubt anyone could develop the technical skills, and I understand that once a person has mastered technique there remains the further challenge of refining what has been learned. However, my choice to pursue "art turning" is a personal decision partially rooted in my belief that the world already has plenty of finely executed objects and although I admire the proficiency of an accomplished craftsman, for me, the path to growth as a designer and artist lies in using technique to advance an aesthetic point of view.

There is a broader audience for art turning than Raffan suggests. The "plethora of art turners" aren't responding to a vacuum or the wish for "fame and glory" that Raffan implies. People *want* this type of work, and they are willing to support it. Which brings me around to Raffan's objections about pricing: The art turnings I'm familiar with *do* require more time to design, layup and turn, and technical problems that arise on each piece must be solved before work can begin on another. Art turners face considerable risk, too. Sometimes, after days of design and layup work, a turning just doesn't work out on the lathe and must be discarded. Given these considerations, I feel the prices for art turnings are realistic, and if anything, are too low.

Raffan's argument that only a select few are able to purchase or even understand some of this new work hardly seems valid. The fine arts—painting, sculpture, experimental music—don't always appeal to a wide audience, but that doesn't make them any less worthwhile. It's only natural for people to resist the new until it's been around long enough to have become part of the culture. A better understanding of art turning might come about if more writing by critics conversant with the aims of art turning was published. Clear, in-depth critiques that confront and examine what this new work represents would serve the field far better than commentary that simply dismisses it.

—Addie Draper
Tajique, N.M.

Turners convention

Almost anyone can be a woodturner. A basic lathe is relatively inexpensive, and pretty simple. With a couple of tools, a book or a short lesson, you're rolling along. And the shaving-strewn road runs all the way from down-in-the-basement humble to the ionosphere of the art world.

Along the way, you'll meet some nice people who are passionate about turning and helping others along in the craft. About 250 of them attended the first annual convention of the American Association of Woodturners last October in Lexington, Ky. The AAW is a good indication of the fire that unites turners. Two years ago it was just an idea and a handful of supporters. Today its membership is approaching 2,500 and it publishes an impressive quarterly, *American Woodturner*.

Why the fascination? The objects produced by turners can be astonishingly beautiful, and that's most of the appeal. That you can learn the rudiments of the craft quickly and then do your own thing is a further attraction. But, another reason must be the accessibility to the big guns in the field. The acknowledged leaders like David Ellsworth, Alan Stirt and the others who crop up in galleries and craft journals, will talk

turning with anyone, teach anyone, no matter what their skill level.

One of the highlights of this year's meeting in Heritage Hall and adjoining seminar rooms at the Lexington Center was an informal gallery set up by the turners themselves amid the trade-show booths. Every level of accomplishment was represented, and although all the turners wanted to show off their work, many went out of their way to show me what they considered top-notch turning of their contemporaries. That's a rare form of camaraderie, I think.

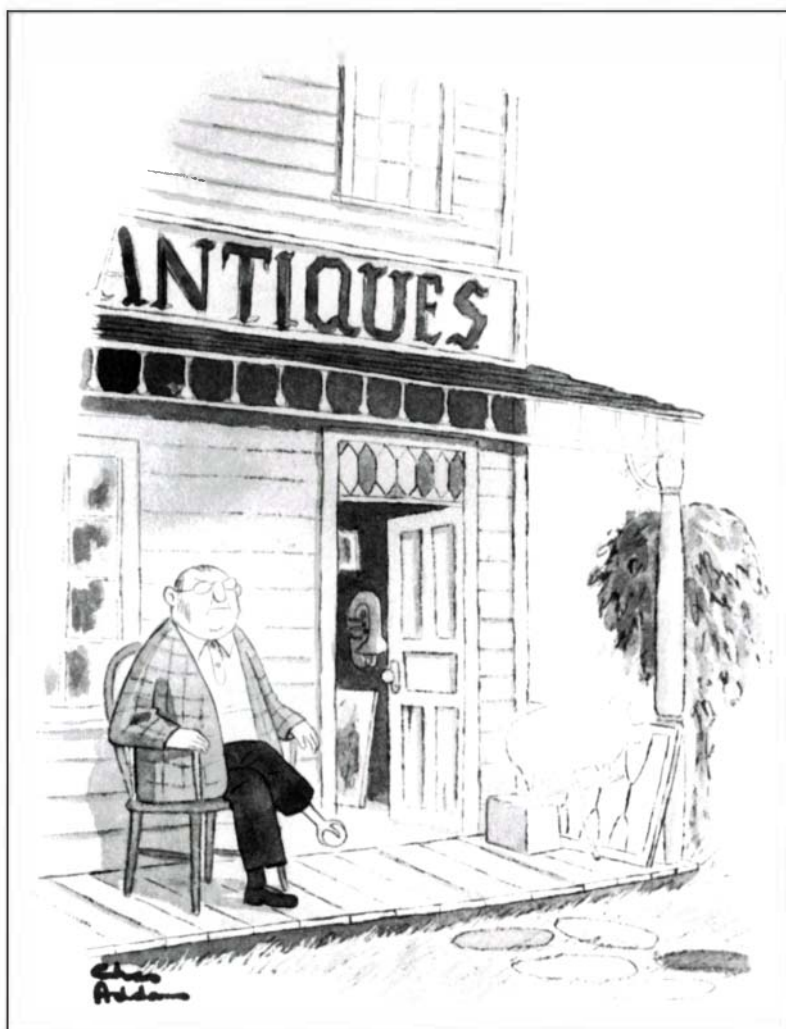
This level of involvement isn't just a bright flame, short-lived. I got the turning bug myself in the early 70s and scraped up enough money to fly to Newtown, Penn., for a turning symposium sponsored by Albert LeCoff, a turner and organizer who's had much to do with the current resurgence. I specifically remember a couple of guys who were unbelievably excited about every new technique, ever ready to spend their last cent for an interesting lump of wood or deep-fluted gouge. I saw the very same folks at this convention. The years hadn't snuffed their zeal.

My favorite part of the event was the seminars, which featured top-notch demonstrators such as Rude Osolnik and Palmer Sharpless. My favorite was led by Leo Doyle, who teaches at the University of Southern California in San Bernardino. Doyle presented techniques aimed at helping turners develop a personal design philosophy, a common problem for self-taught craftspeople.

The idea of learning a technique through repetition is important, Doyle explained, but once technique is mastered, a student must escape the master's shadow and test his own ideas. To aid in coming up with ideas, he suggested putting together a visual design book, a scrapbook of pictures suggesting forms and ideas.

Coupled with the visual design book should be a pocket-size design journal, a diary of ideas. To make the book more thorough, he suggested everyone study a book on basic design to become familiar with the designer's vocabulary used to evaluate objects. Also, get into the habit of paraphrasing books—extract the important stuff and write it in the journal, along with your own ideas.

Doyle recommended people go through their scrapbooks and journals frequently



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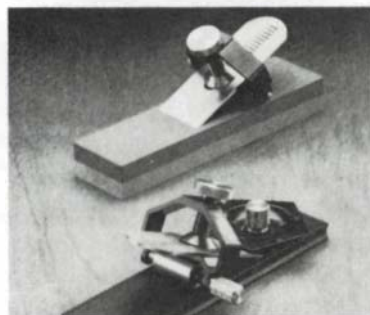
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to get "the right side of the brain jogging." Then, once they get going, use their ideas to revise an old technique or to combine two or more techniques.

My main suggestion for the AAW would be to make the seminars longer. I think both audience and teachers wanted to do more than could be crammed into the average session, which lasted 45 minutes. But that's about the best compliment you can give an event like this. The next conference will be in September 1988 in Philadelphia, Pa. For information about the AAW, write to Bob Rubel at Box 982, San Marcos, Tex. 78667.

—Dick Burrows

Building a wooden view camera

As a guitar builder, I've needed quality photographs of my work on many occasions. I tried a medium-format camera and was terrifically impressed with the improvement in quality over a regular 35mm. The camera's larger negative captures more fine details in a shot and, for this reason, most professional product photographers use large format, 4x5 view cameras.

After pouring through books on view cameras, I discovered that since the earliest days of photography, view cameras have been fashioned from all sorts of hardwoods, including boxwood, ebony, rosewood and cherry. The idea of making my own view camera was appealing, and when a friend introduced me to the Fader 4x5 camera kit, I decided to build one.

The basic Porta Vu II view camera kit sells for \$140 and is available from Fader Photo Works, 1402 Bardstown, Ann Arbor,

Mich. 48105. It comes complete with precisely machined cherry wood parts, nylon-fabric camera bellows, a ground-glass viewing screen, an ample supply of knobs and brass fittings and highly detailed assembly instructions. All that's required to build the kit is some sandpaper, glue and finish. The camera does not, however, come with the lens, which must be purchased separately. View camera lenses have precise optics and built-in shutters to suit the needs of professionals and are typically very expensive. In my case, I bought a used Schneider Symmar lens for \$250—almost twice the cost of the camera kit.

The Porta Vu II was a joy to assemble, and I was impressed by the thought and care that Les Fader, the designer of the camera, put into designing and fabricating his camera kit. Assembly took a little longer than the four hours suggested in the manual. I spent five and a half hours sanding, oil finishing, and assembling the Fader camera. Although all the cherry wood parts came nicely machined, a cabinet scraper was helpful in getting the fine saw marks out before finish sanding.

Before operating the camera, I did some minor tweaking: I adjusted the monorail focusing mechanism to operate more smoothly and did some fancy shimmying on the assembly that holds the ground glass in place on the back of the camera, which tended to bind. I also applied a few drops of glue to the brass inserts and screw heads to keep them from slipping. Adjustments were slight, considering this is a kit and not a more-expensive, ready-made studio camera.

In practice, the Fader camera is fun to use. You look through the ground glass (with a hood over your head to keep light out) and focus the camera, then slip on a



The assembled Fader Porta Vu II camera.

film back (which you must supply) to make the exposure. Since a 4x5 view camera exposes a single 4-in. by 5-in. negative at a time, you will need to keep several film backs on hand for multiple shots. In addition to regular shots, this camera allows you to control perspective through camera body adjustments called tilts, swings, and shifts.

After familiarizing myself with the camera movements, I soon was able to produce some stunning negatives that later enlarged into superb prints. In an otherwise mass-produced world where metal and plastic reign supreme, it's nice to know there is a simple wooden alternative. For the photographer/woodworker enthusiast looking for a beautiful camera at a considerable savings, I highly recommend the Fader Porta Vu II view camera kit.

—Michael Jacobson-Hardy
Florence, Mass.

Short shavings

Conservationists and medical scientists are at odds over the Pacific yew tree. A drug derived from the tree's bark has been found to be an anti-cancer agent, effective in controlling tumors in mice. The problem is that removing the bark kills the slow-growing yew, which was once considered a weed tree by foresters and prized by relatively few craftsmen, such as bow makers. Audubon magazine reports that The National Cancer Institute has contracted for 60,000 lb. of yew bark to produce about 2½ lb. of the drug. Consequently, approximately 12,000 trees will have to be felled.

■ Delta International Machinery Corp. is sending free retrofit kits to owners of Rockwell 12-in. radial-arm saws manufactured between December 1976 and December 1982, model numbers: 33-790, 33-791, 33-792, 33-793. Tests conducted by Delta

have shown there is a possibility that one or more of the four bearings that support the saw on the track could fail and cause the saw to drop off its track onto the saw table, possibly injuring the user. The company says it has received no reports of injury, but requests owners of these saws write to: Rockwell Radial Saw Retrofit Program, Delta International Machinery Corp., 4290 Raines Road, Memphis, Tenn. 38118 (include saw model and serial numbers).

■ The American Crafts Council is sponsoring "Young Americans." This is a national competition to recognize and honor the outstanding work of U.S. artisans between the ages of 18 and 30. Original craft work, either functional or sculptural, chosen by a selection committee including furniture-maker Alphonse Mattia will be exhibited at New York's American Craft Museum in September 1988. Entries are due by February 1. For more information, write to Young Americans, American Craft Muse-

um, 40 W. 53rd St., New York, N.Y. 10019.

■ Seeing a need for insightful writing about the history and growth of the American craft movement, The Penland School of Crafts is offering a writer-in-residence program this spring. The position begins March 1 and lasts for three months. Studio space, housing and \$800 a month are provided. To apply, contact Sally Morgan, The Penland School of Crafts, Penland, N.C. 28765, (704) 765-2359. □

Notes and Comment

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Use the 1273DVS with its own dust collection bag—or connect it to the Bosch Air Sweep™ Dust Extraction system. Change belts with the snap of a lever. And the unique belt tensioning system makes sure belts stay centered through all kinds of work.

So check out what the world's only variable speed belt sander can do for the quality of your sanding. See your Bosch Distributor today—he's listed in the Yellow Pages "Tools—Electric." Let him show you how this belt sander gives you more control with one finger than others do with two hands.



The First Belt Sander As Good At Fine Finishing As It Is At Finishing Fast.

Variable Speed
Belt Sander Lets You Dial-In
The Speed You Need.
Now you can rely on more than
just the grit of your sandpaper—
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control the quality of your sanding. Introducing the world's only variable speed belt sander, the new 1273DVS from Bosch.

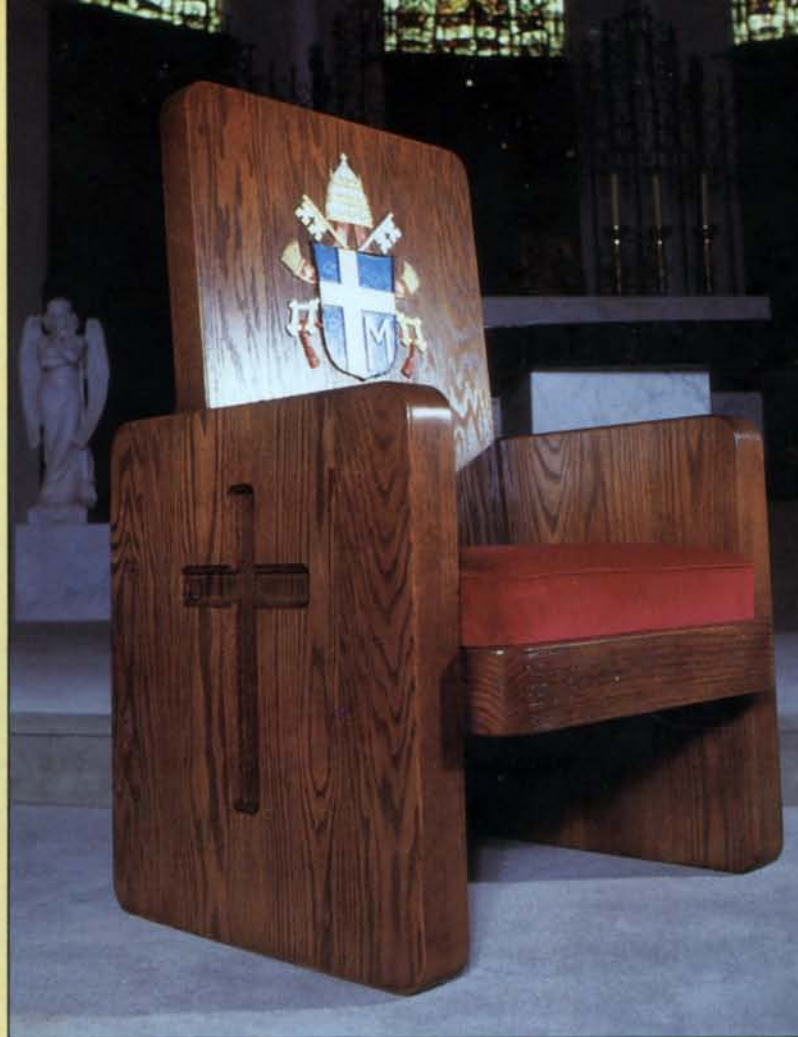
With six different speed
ranges to choose from, the 1273DVS



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PAPAL CHAIRS

Pope John Paul II celebrated services around the country last summer with furniture built by artisans in the communities he visited. Three chairs from among the many pieces used in the Papal Masses are shown here.

The California walnut chair, above, was one of 45 pieces produced in Jim Bacigalupi's Campbell, Calif., shop for the Pope's service in San Francisco's Candlestick Park. The chair measures 41 in. wide at the front, tapering to 27 in. at the back. It's about 36 in. tall and 23½ in. deep. Constructed with mortise-and-tenon joinery, the chair was co-designed in the Arts-and-Crafts style by Brother Joseph Aspell of Cupertino, Calif. The chair's maple back panel depicts a logotype of the Pope's visit rendered with epoxy infill and silver inlay.

Ben Covington of Columbia, S.C., built the massive, 275-lb. red oak chair, above right. It was designed by Architects Boudreaux Ltd., a Columbia firm. The chair was photographed in Columbia's St. Peter's Church, where the Pope celebrated Mass. It took Covington seven days to build the chair, including carving the Pope's seal, which is applied to the back of the chair. The project drew a good deal of attention to Covington's shop. Upon learning of it, several people visited him to ask for scraps of oak and shavings from the chair to serve as mementos of the Papal tour.

Fourth-generation woodworker Victor Salas donated the time and materials for a group of liturgical furniture produced in his shop for the Papal Mass in San Antonio, Tex. This chair, shown at right, a throne really, is made of woods from across North and South America in tribute to the Pope's travels on two continents: Canadian poplar, Honduras mahogany, pine from Texas and maple from North Carolina. The chair measures 9 ft. tall, 7 ft. 6 in. wide and 3 ft. deep, and was painted with yellow and white lacquer, with a clear lacquer topcoat.

