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Fine WoodWorking

May 1993, No. 100
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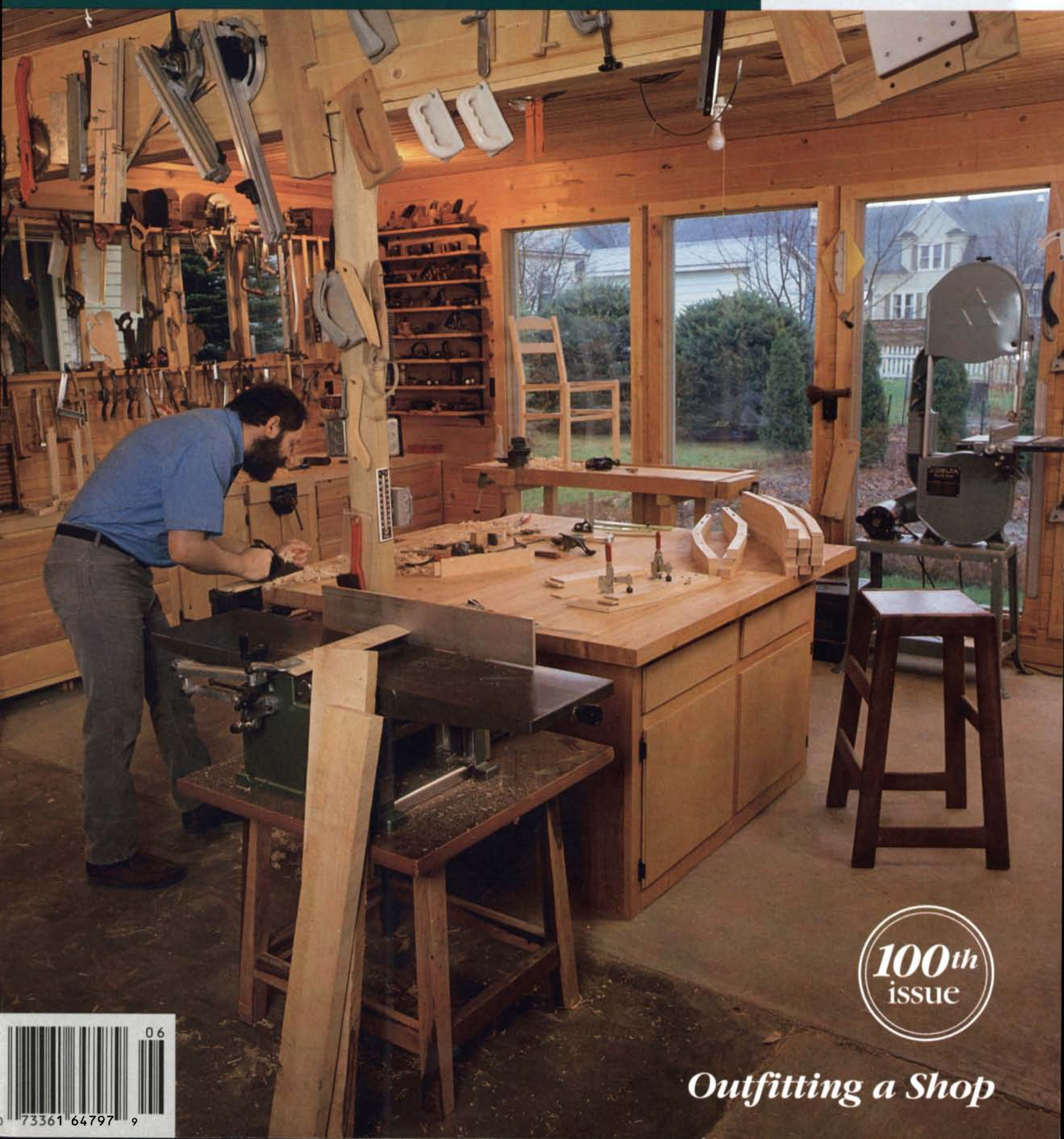
Plate joinery

Dust collection

Studley tool chest

Half-blind dovetails



100th issue

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Fine WoodWorking®

May/June 1993 No. 100

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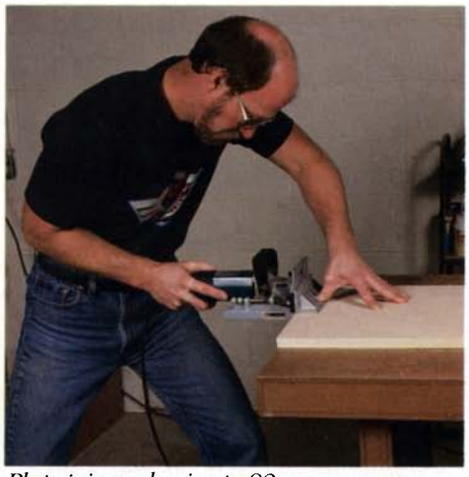

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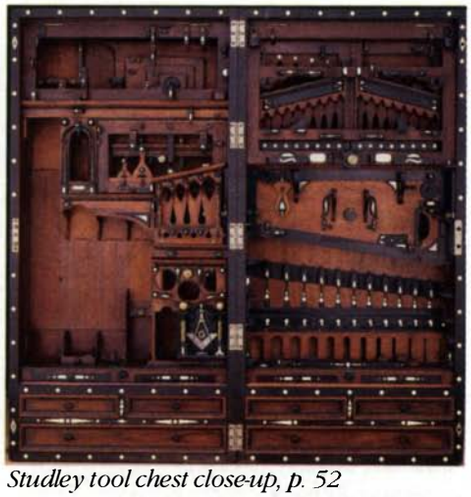

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On the Cover: *Mark Duginske works in his well-equipped shop in Wausau, Wis. He joins Peter Korn and Mario Rodriguez to offer tips on outfitting a shop, p. 58. Photo: Scott Landis.*

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The first 100—Eighteen years ago, when I was putting together the first issue of *Fine Woodworking*—because I was hungry for good information—the United States woodworking world was a far different place. Everything was much harder to come by, hardwoods, tools and, above all, ideas and information.

Strange as it may seem, most of the companies now offering their wares in our pages did not exist then. Unwittingly, in creating *Fine Woodworking*, we also gave birth to a varied and vital marketplace of equipment and supplies. But primarily, we were the leading edge of an even more diverse marketplace of ideas and information. Where there had been only two magazines dealing with woodworking (*Popular Mechanics* and *Workbench*), now there are almost five times that many. And where there had been only a handful of good book authors (Marlow, Gottshall, Joyce), now there are dozens of them.

And most importantly, the quality of the information is now on a much higher plane. The Tage Frids and Bruce Hoadleys of the world have had a chance to share their knowledge and insights, and we all have been far better off for it.

But progress doesn't end with issue 100. I like to think that in the coming years, we'll be entering the golden age of *Fine Woodworking*. And after years of concentrating on publishing, I am now personally rediscovering woodworking as a marvelous discipline and absorbing process. It pulls together a real blend of skills, craftsmanship, ideas and utility in making things our friends, families and maybe even our descendants can use and enjoy.

Here's to the second 100!

—Paul Roman,
founding editor and publisher

Milestone for the road ahead—I can't claim to have been part of the *Fine Woodworking* family since its beginning. But much as a fellow might remember the day he met his wife, I can remember exactly the circumstances and scene when I first met *Fine Woodworking*. I was in a new lumber store in San Jose, Calif., reveling in the newfound variety of hardwoods the store offered when a small rack of black-and-white images stopped me in my tracks. I think it was the strong, angular design of a workbench vise on the cover of *FWW* #4 that transfixed me. That issue was alongside several other early issues, all with their typically dramatic black-and-white covers.

I feasted on the covers and flipped the pages. It was like walking into a new world of which I had no previous notion. All at once there was inspiration and aspiration. No doubt those early issues had a similar effect on other woodworkers. That's why it is no surprise how many of our readers are so proud of being charter subscribers. And those who aren't frequently covet or boast of owning complete sets of the magazine.

But as a neophyte woodworker on my first encounter with the magazine, I felt a certain measure of awe and fear as well. Could I ever hope to achieve results of that level? Those feelings kept me from immediately embracing the magazine, and it wasn't until a few years later that I came into the fold, so to speak.

Today, *Fine Woodworking* is 100 issues old. The covers are in full color and the space on newsstands reserved for woodworking magazines is a lot more crowded. Interest in woodworking continues to grow, and *Fine Woodworking* has an important role to play in that growth as we move into our second 100 issues. As the magazine matures, we look forward to continuing to provide a level of quality and usefulness unmatched in the field. At the same time, we want to leave the door open not only to the subscribers who have been with us since *FWW* #1 but also to

those who can discover a new world in our pages.

–William Sampson, executive editor

Tool chest quest—One of the most striking images ever to grace the pages of *Fine Woodworking* surely was the back cover of *FWW* #71, the tool chest made by H.O. Studley of Quincy, Mass. In this issue, we revisit the chest, which is now on display at the Smithsonian Institution, and learn more about its intricacies and the history of its maker (pp. 52-55). Part of the fascination of the Studley chest comes from the reverence and love of tools that virtually all woodworkers share. We suspect there are some other tool chests our readers know about that are also worth sharing.

If you've got a toolbox or tool chest you'd like to show off (or you know someone who has one), we would like to see it. Send photos, slides or transparencies to Vincent Laurence, associate editor, *Fine Woodworking*, P.O. Box 5506, Newtown, Conn. 06470-5506. Include supporting information (drawings, some explanation of what you do and why you designed the box as you did) and a daytime phone number, so we can reach you if we need to take better photos for publication.

–Vincent Laurence, associate editor

Compound miter saw video—As much as we love the magazine medium, print and pictures occasionally have their limitations. That's why we're experimenting with offering economical, short "Video Takes" to go along with selected articles. The first showed Tage Frid demonstrating a veneering process that was the subject of an article in *FWW* #98. With our second video, we're trying a little different approach. Rather than helping show a process in action, the video paired with the compound miter saw story on p. 44 in this issue offers a chance to compare several popular products in action.

Reading a tool comparison is one thing, but seeing comparable products in use adds a new dimension. It's like the difference between reading the owner's manual for a tool and actually turning the tool on and using it. Senior editor Sandor Nagyszalanczy takes viewers on a video tour of all six saws covered in the article. Because no retail outlet will have all six saws at once, this video offers an unparalleled opportunity for comparison shopping. And for those who may already own one of these saws, they may learn something, too, as Sandor walks viewers through the features and offers some tips. For more about the video, see p. 46.

Index on the way—Hardly a day goes by without at least one of our readers asking for a better and more current index to the back issues of the magazine. Some of the computer-based indexes have helped fill the gap, but most readers want something they can hold in their hands and thumb through. Well, help is on the way. On the occasion of our 100th issue, we are moving ahead with a comprehensive index to cover the first 100 issues of the magazine. In upcoming issues, we will have more details about when it will be available and how you can get one. *–W.S.*

About your safety:
Working wood is inherently dangerous. Using hand or power tools improperly or neglecting standard safety practices can lead to permanent injury or death. So don't try to perform operations you learn about here (or elsewhere) *until you're certain that they are safe for you and your shop situation.* We want you to enjoy your craft and to find satisfaction in the doing, as well as in the finished work. So please keep safety foremost in your mind whenever you're in the shop.

–John Lively, publisher

Ovation for Abram—I applaud your recent feature article on Norm Abram of *The New Yankee Workshop* (*FWW* #99). As a longtime reader, I have made two valuable observations. First, there are usually several ways to perform a task. Second, few are willing to admit that there may be a better way than their own.

For those who cannot figure out why a carpenter-turned-furnituremaker should have a following of four and a half million, I would direct their attention to Mr. Abram's approach to presenting his projects. Rarely will you see a technique championed as the last word. Over the course of a season or two, one will see the same operation accomplished with different tools and with various methods. Viewers see ways they can explore options in their own projects as their needs and talents develop.

Mr. Abram's comfortable style is also an instruction in the use of the woodworker's most valuable tool—mental attitude. You never hear Mr. Abram praising his own efforts or skills. What you do hear is admiration for the efforts of others, respect for tools and materials and a genuine enthusiasm for his craft. Certainly there have been criticisms about occasionally taking a less than authentic shortcut, missing a detail or trivializing furnituremaking. To these critics, I would say they have missed the point of woodworking. Perfection is not the goal. It doesn't exist. The goal is developing one's skills, making each project better than the last, learning all you can and being satisfied that at each point you are attempting to do the best you can by your resources. This is the experience of woodworking and the product of Norm Abram and *The New Yankee Workshop*.

–J. Adger Brown Jr., Columbia, S.C.

No on Norm—I was dismayed when I saw the cover article of *FWW* #99 about Norm Abram and *The New Yankee Workshop*. Over the years your magazine has distinguished its covers with woodworking greats like Tage Frid and James Krenov, a class in which Mr. Abram does not belong. While his show may appeal to the mass market, his furniture projects are reminiscent of basic high school shop projects rather than fine woodworking. With his pneumatic nail gun and polyurethane finishes, Mr. Abram demonstrates only that the average home woodworker, with only a few thousand dollars investment, can produce the furniture found in a well-stocked Kmart. He also does the beginning woodworker a great disservice by ignoring basic skills such as stock preparation, elemental joinery and surface preparation prior to finishing.

As a self-taught cabinetmaker, I have learned far more from the pages of *Fine Woodworking*, James Krenov and Tage Frid than I could ever learn from Mr. Abram, and I feel many woodworkers would do likewise. Perhaps, if your magazine supports his work as any type of quality benchmark, *Fine Woodworking* should rename itself simply "Woodworking."

–Thomas G. Phillips, M.D., State College, Pa.

Out of place—After tearing off this month's outer wrapper I was shocked: Norm Abram on the cover of *Fine Woodworking*? Prior issues had covers with James Krenov, Tage Frid, Sam Maloof and Frank Klausz; they belong on the cover of what I consider the premier woodworking magazine in the country. Norm may be a "master carpenter" (self-imposed) but certainly not a cabinetmaker worthy of being featured on the cover of your magazine.

One shudders when watching Norm's gluing techniques (or lack of), his pail of polyurethane and a brush, use of a pneumatic nailer on a Shaker project or use of plywood and pine almost exclusively.

Nothing personal against Norm, a very pleasant gent who I have talked to at a recent home show. To his credit, he has generated a lot of interest in woodworking. There are some lesser woodworking magazines that Norm would not look out of place on, but certainly not the cover of *Fine Woodworking*. Norm's picture on the cover of Fine Woodworking is like Phyllis Diller on the cover of *Playboy*.–*Pete Petran, Mount Prospect, Ill.*

Old World craftsmen—I read the articles about Norm Abram and Hans Stutz (*FWW* #99) with much interest. I think I can help clarify how Abram has been tagged with the term *master carpenter*. In the Emmental, where Swiss cheese originated, this term would be understood and appreciated. The Germanic word *zimmer* means a room. A *zimmerman* is a room maker or carpenter. A *zimmermeister* is a master room maker, hence the term *master carpenter*.

It takes much schooling, practice and self-sacrifice to be an "old country" tradesman. My people have lived in the area of the Emmental since 1281. They have produced generations of *zimmermen* and *zimmermeisters*. One cousin is now a *kontidor*, or master confectioner. The tradesmen and craftsmen of Europe are highly respected in society. Maybe men like Abram and Stutz can bring that respect to our country's tradesmen. I hope so.

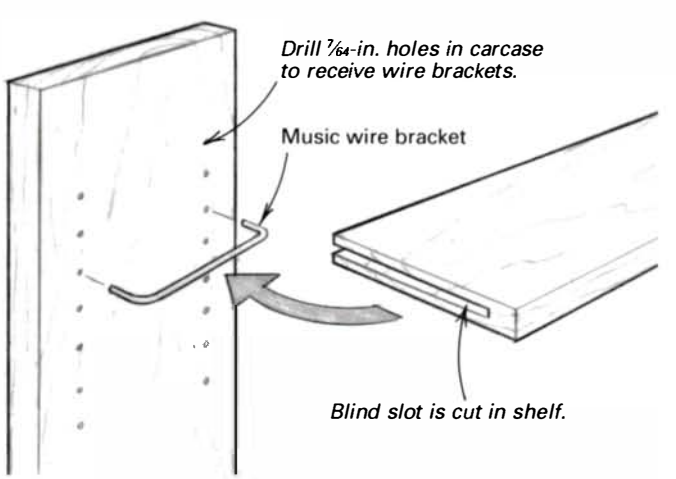
–Nate Roth, Monroe, Wis.

Tips for Norm's shop—Norm, I notice on your shop-on-a-shingle sketch that you have a wood stove on your shop floor. I suggest that you put the wood stove on the basement floor because that can reduce the chance of explosion due to airborne dust and can reduce the chance of ruining your wood supply from the overdrying tendency of the wood heat.

You can have better temperature control with the wood stove in the basement by installing 2 in. of foam board insulation on the outside cement walls. This will make the mass of cement act as a heat bank. I use this method in my shop, and as little as one fire a week during the coldest temperatures keeps it above 55°. Also, the shop floor is warm as with radiant heat.

I also am paranoid of bringing in bugs with the firewood, so I store it outside at least fifty feet from the shop and bring it in only when I throw it in the stove. *–Dave Macrae, Lunenburg, Mass.*

Bookshelf brackets—John Kelsey's bookcase in *FWW* #98 really struck a nerve. I wish I had seen it several years ago when I went out to buy a bookcase advertised by a local furniture store for $69. I ended up buying one costing three times as much because I needed a bookcase, and I did not want to take the time required to select, surface and glue up the stock to complete a quality piece of furniture. The "quick and clean" idea would have been most welcome.



The "cheapie" bookcase had one redeeming factor: an adjustable shelf suspension I have found to be simple, neat and effective (see the drawing above). The system requires only very small holes in the carcase; I use a 7/64-in. drill. The wire brackets

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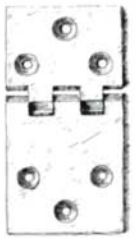

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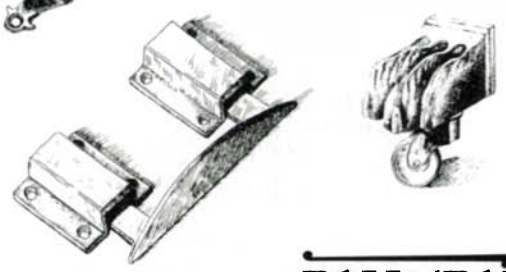

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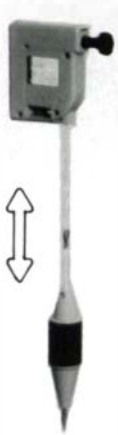

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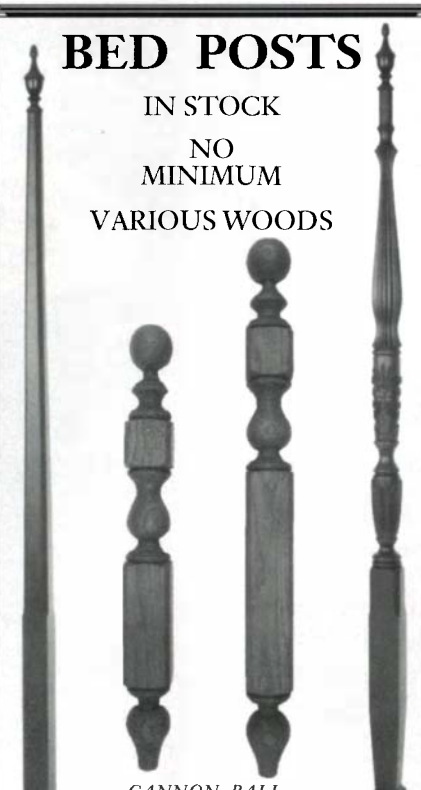

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can be bent from music wire using a simple jig to ensure that all wires are the same length. The shelves are well-supported and the suspension is concealed.

—Ralph B. Anderson, Litchfield Park, Ariz.

The right tone—With great pleasure I read your article about quick and clean bookcases (*FWW* #98). I can't imagine that you expect to get a bunch of flak about the story. Quite the contrary: I suspect yours is the best single woodworking article appearing in a U.S. magazine during 1992. Here's why: The tone is right. Sometimes we lapse into a sanctified tone when we write about woodworking and treat woodworking as great art. Instead, you've treated with great respect a project that could be made with very few tools and modest materials.

Indeed, I hope *Fine Woodworking* has the good sense to have a few more projects in just this same manner: You're teaching us how to be woodworkers, not just how to be directions-followers. This is surely the kind of article I wish had been around 25 years ago when I was just learning to work with wood.

—Hugh Foster, Manitowoc, Wis.

Ox that gored—You've really gone over the edge now. While the debate about art and woodworking has raged for a long time, the ox sculpture on the back cover of *FWW* #97 establishes a new nadir. Sorry to say, but this Emperor ox is wearing few, if any, clothes.

With all the fine craft that's being made in this country, including fine art-furniture, the editors of this respectable magazine have chosen one of the most ridiculous objects I have yet seen to grace the back cover, a full page, full-color photo of a pine and plywood object that could only be described with the euphemism "whimsical."

What do I as a woodworker learn from this? Technique means little. Craftsmanship is an anachronism.

—Woody Pistrich, Hatfield, Mass.

More on milk paint—I read with interest the question from Stephen Courtner and Chris Minick's reply concerning removing milk paint (*FWW* #96). It is described as being a caseinate, which means that it is a protein. It occurred to me that the cold-water clothes-washing powders might be useful here because they contain proteolytic enzymes, and thus may dissolve the caseinate without harming the timber, which, of course, contains virtually no protein. I haven't tried this myself, but maybe one of the gentlemen mentioned above might be interested.

—Peter G. Petty, Fitzroy, Australia

Swivel-head lathes nothing new—Your article on the new swivel-head wood lathes (*FWW* #98) was very interesting. For your information, the concept is not a new one. From 1957 to 1967 I taught cabinetmaking. One of the mainstays of the turning unit was an old Wallace lathe that had a headstock that could be rotated. It was driven by a flat leather belt. The speed could be adjusted by moving the belt to any one of four levels on the cone pulleys. A floor stand had to be used for outboard turning. This machine worked so well that I wish it were sitting in my shop now.

—Ronald Frey, Cicero, N.Y.

In praise of cast-iron machinery—Robert Vaughan's article on restoring a Walker-Turner bandsaw (*FWW* #98) was interesting and very well written. I own a Walker-Turner bandsaw, 14-in., which I inherited from my father-in-law. I assisted him

in its selection in 1946, and as I recall, it cost around $120, including a ½-hp, 240v motor with sealed bearings. When his estate was being settled, the rig was appraised at more than double the original price. So much for the esteem of high-quality cast-iron machines.

This saw is still in first-class condition after 47 years of amateur usage. The bearings have never been replaced, nor the V-belt. The saw is well-traveled, having been moved from New Jersey to Wilmington, N.C., from there to Pennsylvania and finally to Sanibel Island, Fla. I also have a Walker-Turner floor-stand drill press, vintage 1946, which is in pristine condition. One other cast-iron machine that I cherish is a 1948 Craftsman wood lathe. Indeed, these cast-iron machines are worth restoring and a joy to use. *—Thomas Sharp, Sanibel, Fla.*

Blow to home businesses—In this day and age of trying to get the American economy moving again, the Supreme Court has shot an arrow at the heart of enterprising individuals who use their homes to run a business. By not allowing these people to deduct the cost of operating an office at home unless they spend the majority of their time there, the court's decision shakes the resolve and courage of many of these family-run businesses.

The carpenters, painters, electricians, plumbers and masons that I know all have a room set aside with at least a desk, telephone, file cabinet and bookshelf for their business. Even though the majority of their time is not spent there, they need that space to run a business day in, day out. They need those tools for customers to find them, to write up contracts, to figure out how a job will be done, to order materials, to contact employees, to maintain records and to pay taxes. Without office tools in an office space, they would not be in business for long. That, to me, sounds like an "ordinary and necessary expense in carrying out a business" (IRS).

If we applied the court's logic to itself, then these distinguished persons should not be considered Supreme Court justices because the majority of their working hours are not spent in court. *—Imants Brolis, Arlington, Va.*

Help for inventors—Reading your article on biscuit joiners (*FWW* #98) reminded me of an idea I had for an accessory product that could be used with these wonderful little machines. At the time, I had thought of trying to market the idea or just trying to sell it to someone but didn't really know how to go about it. Ignoring the urging of a few friends, I put it on the back burner, figuring it was such an obvious idea someone was bound to market it before I could figure out what to do about it. Seeing that it wasn't listed with all the other accessories you showed gave me new hope. But I still haven't a clue what to do about it.

I know most woodworkers are tinkerers and that we all at one time or another have come up with something we thought might be worth marketing. I realize this isn't a business magazine, but I do think that this topic might be of interest to a fair number of your subscribers. I would very much appreciate any advice you might be able to give. I'll even invite you over when I get rich and move into the big house.

—Richard Fisher, Austin, Texas

Scoring saw attachment—I would like to thank you for making the Modulus scoring saw attachment the first tool reviewed in the new "Tool Forum" (*FWW* #97). However, there were a few points in the article that I feel need clarification. You stated, and correctly so, that it takes longer to adjust the unit than to

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mount it. This adjustment is required on the first installation only. Subsequent installations require only a scoring depth adjustment made with the elevation control of the tablesaw. This is a two-minute job.

In response to the problem of producing a clean edge-banded border on melamine, I have a few suggestions. As stated in the article, the scoring blade tooth shape is conical; by increasing the depth of the scoring cut, you increase the kerf width. This adjustment is very critical when working with coated materials as any misalignment here is much more pronounced. Also, it is very important to keep material perfectly flat on the tablesaw surface. Another factor to consider is the alignment of the existing saw fence to the blade. Any misalignment here can cause problems in the quality of the scoring cut.

—Robert D. McLaren, general manager, Sisco Supply Inc.

A 0000 fire—A strange little bonfire occurred in my workshop recently, giving me quite a fright because, like many other folks who don't have a separate dangerous-goods store, I keep a variety of paints, thinners, homemade oil mixes and other volatile brews on hand.

I have a Black and Decker 7.2v cordless drill, which has the battery built into the handle and is recharged simply by plugging the transformer outlet cord into the drill handle. As a toymaker, I use this little tool constantly, frequently just unplugging the transformer lead from the drill handle while leaving the transformer powered on.

On a recent afternoon, I cut a couple of pieces of 0000 fine steel wool from a roll and, while starting to use one piece, threw the other piece onto the workbench. As the clean, unused steel wool fell across the transformer outlet, the wool immediately burned. I don't mean it merely heated up or glowed hot. The thing burned rapidly with an intense heat, but fortunately, on a part of the bench that was not cluttered with shavings or such.

I hate to think what would have happened if I had thrown the steel wool onto the bench as I walked out of the workshop.

—Joe Farrow, Wellington, New Zealand

In defense of oil—It's good to get various opinions on the merits of oil as a finish, but George Williston's comments ("Varnish better than oil," *FWW* #99) seem to me to make a weak argument. First of all, I make it quite clear in the December 1992 (*FWW* #97) article that an oil finish is not ideal for every piece of furniture, nor am I advocating its use as a cut-and-dried approach for all woodwork. The purpose of the article is to give guidance to those wishing to finish with oil and to stress the importance of surface preparation. I do not discredit varnish as a finish simply because I use oil on many of my contemporary pieces. In fact, I use 15 or 20 different approaches in my work as a restorer and maker of furniture, including lacquer, varnish, shellac and wax.

Second, applied properly, the oil/turpentine/drier mixture will not turn black over time. This is a gross exaggeration. I have a walnut table made about 25 years ago that has actually gotten about three shades lighter from exposure to the atmosphere. It is finished with oil.

Third, I make it clear in the article that oil finishes are not as durable as other finishes and require upkeep. Those who find these qualities undesirable would do best to use another finishing system. Last, oil finishes certainly *do* maximize the beauty of the wood over the years, as proven by the many beautiful old surfaces that have come down to us over the years. For many of

my contemporary furniture pieces, where an open-pored, sensitive finish is required, I would not use anything else. Varnish or lacquer would be an abomination.

—Thomas Wisshack, Galesburg, Ill.

Sanding in stages—I just finished Gary Straub's "Sanding in Stages" in *FWW* #99, and I must admit that I know more about sanding than I did before I began it. His sanding in stages method, however, contradicts an idea that's been part of my shop method since trade school. That is, avoid going back to cutting machines after sanding. The point, of course, is that abrasive particles become embedded in the wood and dull cutters. Early on, I worked for a crew boatbuilder who applied this idea as an absolute rule, and I've never since been in a shop with such consistently sharp tools. But for a few minor exceptions, the notable one being plywood, I still try to avoid cutting already sanded wood. *—Robert Braczyk, New York, N.Y.*

Talk about torque—In the "Letters" section ("Locknut logic," *FWW* #99), David Truax states that "the second nut lifts the first off the threads of the bolt and takes all the load." This is only true if the second nut is tightened to a greater torque than the first. The first nut should be tightened to an appropriate torque; then the second nut should be tightened against the first to a lesser torque. Now both nuts will share the load. A toothed lock washer between the nuts will prevent loosening without excessive tightening of the second nut. *—Peter J. Unger, Beaverton, Ore.*

Breathtaking turnings—Your article on Ron Fleming and his turnings as photographed by Bob Hawks (*FWW* #99) was breathtaking! My interests lie in furniture design and building, which obviously involves lathe work, and I have a library of books on lathe artisans and their craft. However, I have never seen such quiet elegance in the working of wood as Mr. Fleming's.

Mr. Hawks has done a superb job in showing the beauty of the vessels with his photographic skills. In showing the back cover and article pictures to my wife, she immediately stated that those vessels had to become a poster, it would be criminal not to share that beauty with those of us who would appreciate it and be inspired by that beauty. *—Paul Reilly, Thousand Oaks, Calif.*

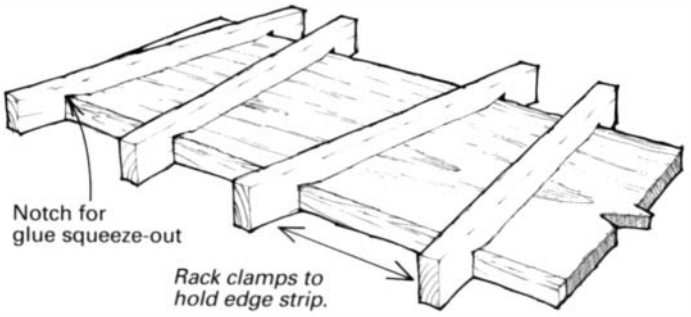
Follow-up

Chop-saw stand—Since the article about my chop-saw stand appeared in *FWW* #98, several readers have written me to correctly point out a problem in the drawing on p. 44 regarding the stand's folding wings. The hinge block for each wing table is in the right spot, but the hinge location on the left (raised) wing is misleading. To allow clearance for the front apron when the wing is folded down, the block's chamfer (for the hinge barrel) must face outward. This means that the hinge itself must be screwed to the outside of the block as well.

I've also received over 15 calls asking where I got my oscillating spindle sander, which is shown stowed away in the bottom of the stand in the photo on p.45. The sander is a model #135, made by Clayton Enterprises Inc., 2505 W. Dewey Road, Owosso, Mich. 48867 (517-723-6873). One of Clayton's other models (#140) is carried by Tool Crib of the North, P.O. Box 1716, Grand Forks, N.D. 58206 (800-358-3096). I used the sander to smooth the edges of my stand's plywood wing supports. Since then, I've spindle-sanded parts for lots of other projects, and I've been delighted with the machine's performance.

—Charles Jacoby, Helena, Mont.

Racking clamps



I often glue nosing or strips to the edge of dozens of same-sized boards. I may need 50 clamps. Metal clamps are too heavy, slow to set up and expensive. So I use what I call racking clamps, which I make up from wood I'd otherwise discard. The clamp is really a very broad, very shallow C-shape with the opening about ⅛-in. wider than the board plus the edging to be glued.

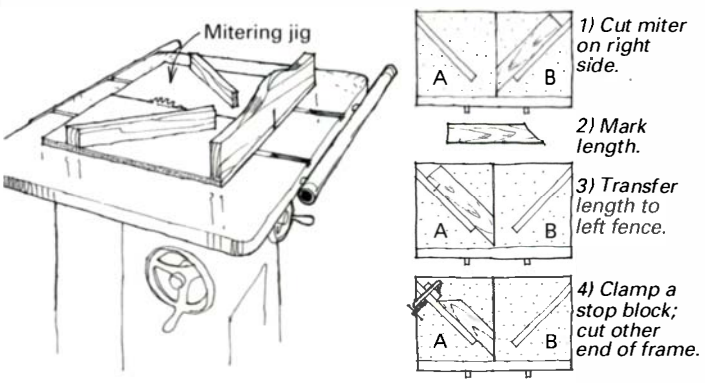
In making the clamps, I add a relief notch at the corners to avoid glue squeeze-out sticking to the clamps, and I take care to cut the faces at a perfect 90°. To use, I apply adhesive to the edging and then install a clamp every 6 in. or so by racking, which is bumping one end until the clamp wedges into place. The clamps apply plenty of pressure, and they set up easily. They also disengage instantly to realign the joint if necessary.

—Tom Schrunk, Minneapolis, Minn.

Quick tip: To aid in removing screws with stripped heads, dab a small amount of valve grinding compound (available at auto-parts stores) to the tip of your screwdriver. You'll be amazed how well this works on Phillips, slotted and Allen screw heads.

—Andrew Flowers, Alsip, Ill.

Mitering frames on the tablesaw



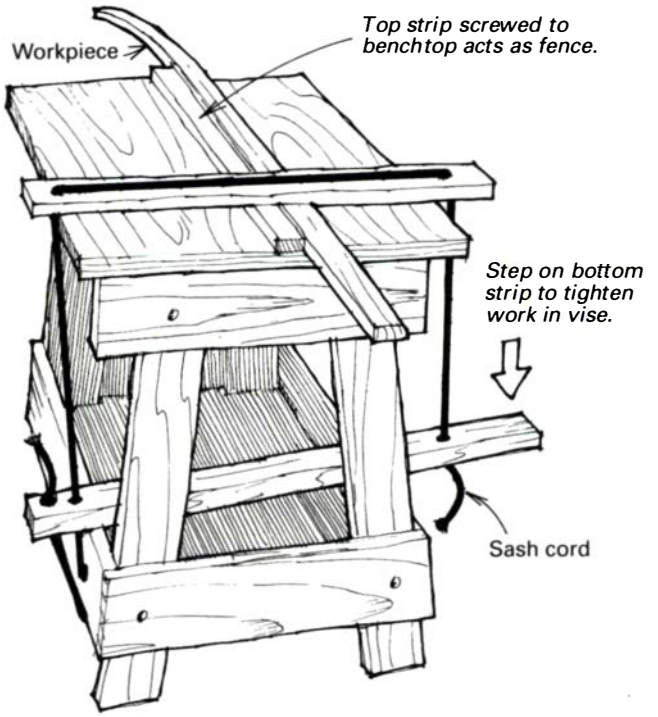
Much of the furniture I make is based on mitered frames, which require corners that have to meet perfectly. To make these frames, I use a sliding table jig on my tablesaw. The jig is simple to build, ideal to clamp work to and easily allows mitered workpiece corners to be marked for length.

Start with a piece of ½-in. plywood fitted with two rails on the bottom to fit in the tablesaw's miter-gauge slots and a fence at the back tall enough so it won't get sawed through. Place the fixture on the saw, and saw a kerf from front to back using the blade you will use for mitering. Now attach the left fence (fence A) to the base using a 45° triangle registered against the sawkerf to establish the angle. Attach the right fence (fence B) using a framing square set against fence A. Leave enough space between the tall fence and the angled fences for a typical frame workpiece. Also, for safety, make the throat between the fences wide.

To make a frame, first miter one end of all four pieces of the frame using fence B. Mark the required length on one of the workpieces, place the workpiece against fence A and transfer the measurement from the workpiece to the fence. Clamp a stop block at this location on fence A. Now miter the other end of all the pieces. When assembling the frame pieces, be sure to join A's to B's. Any slight error in the fences is negated by the 90° included angle, which ensures that each frame corner is perfectly square.

—David A. Saunders, Manchester, Conn.

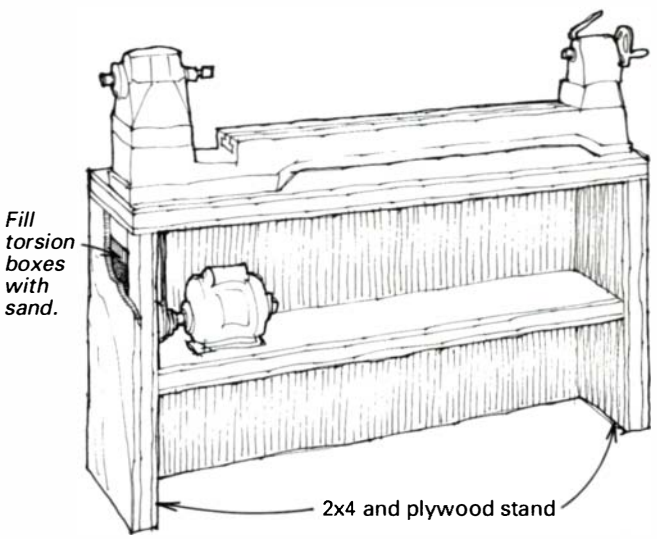
Foot-operated vise



To help me cut a 15-ft.-long board into 2-ft. lengths on an outside worktable, I made this foot-operated vise with a piece of sash cord and two strips of wood. The top strip, which is screwed to the benchtop, keeps the stock from kicking around while I'm sawing; the bottom strip serves as a pedal to tighten the vise.

—Pendleton Tompkins, M.D., San Mateo, Calif.

Sand-filled lathe stand

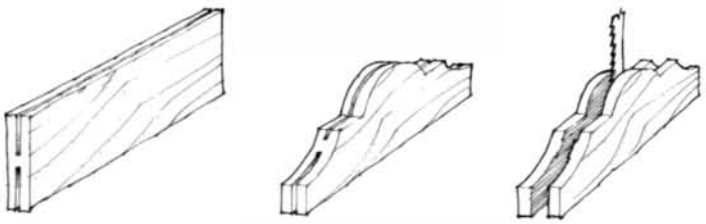


My 50-year-old wood lathe is a heavy cast-iron machine. When I mounted it on an old plywood lowboy cabinet that I had in my basement, there was noticeable vibration, especially when I started an out-of-round turning blank. So when I made a new stand for this machine, I decided to use sand-filled torsion boxes to add as much mass as possible. I constructed torsion boxes for the sides, back and top of the lathe stand and even for the

motor mount, using 2x4s and ¾-in. fir plywood. When I laid out the boxes, I was careful to place structural members where I could attach the panels to each other, mount the lathe and mount the motor. After making the frames and attaching one plywood skin, I filled all of the cavities with sand. Then I fastened the other skin before assembling the stand. I have no idea how much this stand weighs, but almost all the vibration has been eliminated from my lathe.

—Jack McKay, Webster Groves, Mo.

Making matched decorative pieces

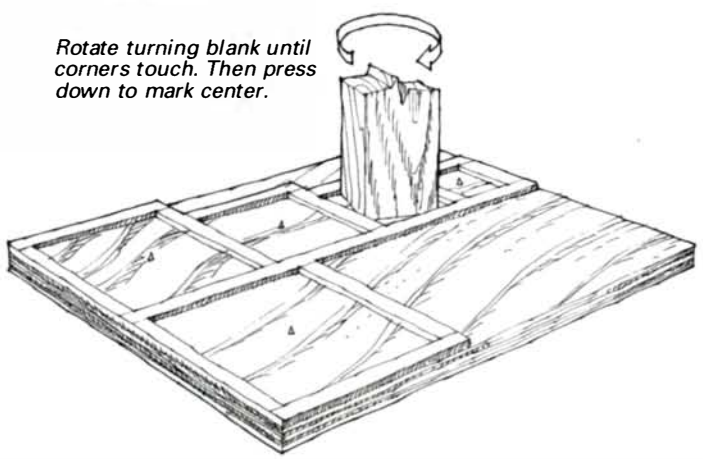


1) Partially resaw; leave strip in center. *2) Bandsaw and sand to desired shape.* *3) Split in two; plane smooth.*

When I needed to make two identical book-matched curved profiles for the sides of a spice shelf, I came up with this simple solution. First, using a thin-kerf tablesaw blade, partially resaw the workpiece from both edges, leaving a ⅝-in. strip of unsawed wood down the middle. Then, bandsaw and sand the workpiece to the desired profile. When you are satisfied with the shape, separate the block in two by bandsawing the remaining strip. Finally, plane and sand the two identical sides to thickness.

—Susan Caust Farrell, Searsport, Maine

Square spindle center finder



Here's a very old idea for finding centers on square stock. It's easily made, long lasting and as accurate as you want to make it.

Take a piece of plywood about 12 in. wide and 18 in. long. Make square recesses on the plywood by nailing down strips of ⅜-in.-thick stock as shown. Although the square recesses are labeled with common spindle dimensions, they are actually sized a bit larger according to the table below:

Stock size	Size of square recess
5 x 5	5¾
4 x 4	4¾
3 x 3	3¾
2 x 2	2½
1½ x 1½	1⅝
1 x 1	1⅜

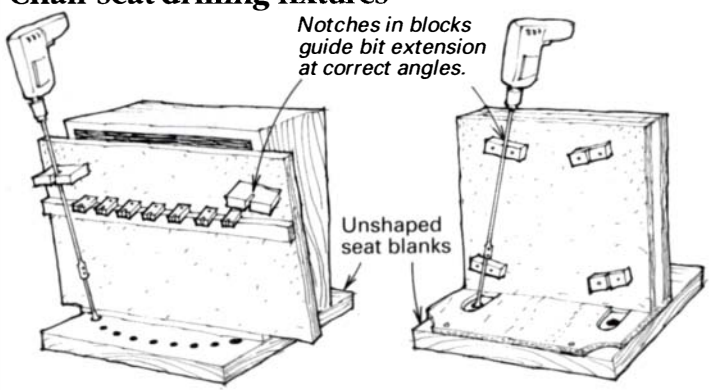
In the exact center of each square, drive a large nail. Cut off the nail, round and sharpen the stub to a point with a fine file.

Most other centering devices are awkward, but with this gadget, just put it on the bench, and prepare the stock without hassle. To mark the center of a spindle, place the stock in the square it's supposed to go in, lightly rotate the stock until all four corners of the spindle touch the sides of the recess and tap the other end. The indentation made by the nail will be exactly in the center and deep enough to give a firm lathe-centered locating point.

—Alan L. Hayes, Queensland, Australia

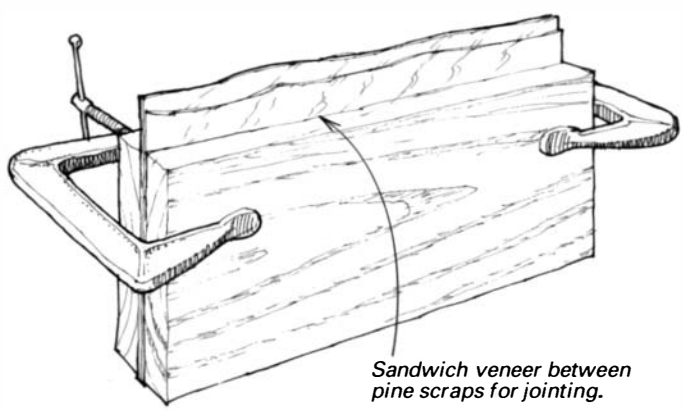
Quick tip: Use your computer to lay out multiple hole patterns. Using a + character for the center of the hole, set the hole locations by varying the characters per inch and lines per inch to get the spacing desired, then print. Spray the back of the paper with 3-M Spray-Mount adhesive and stick it to the workpiece for drilling. This works particularly well for plaques that have lots of little nameplates. *—Robert Vaughan, Roanoke, Va.*

Chair seat drilling fixtures



I use the two plywood fixtures shown above to drill precisely angled holes for the legs and spindles of the custom chairs I build. The fixtures' alignment blocks, whose locations and angles depend on the chair design, guide a long bit extension chucked in my portable hand drill. The length of the extension multiplies the accuracy of the hole angles, while the guide blocks help steady the regular spade bits I use. So that I'm working on a flat surface, I complete all the drilling operations prior to carving the seat. *—Ken Neitzel, Hancock, Vt.*

Flawless seam for book-matching



Here's a technique for producing a perfect seam on book-matched veneer. Start by playing with the two pieces until you get the desired grain pattern. Then, one at a time, cut each piece along the seam using a straightedge, a fresh razor-knife and many successive slices with light pressure. Leave a bit extra on both sides of the seam to allow for jointing.

Place the two pieces edge to edge, and then fold them together as though you were closing a book. C-clamp the two veneer pieces between two scraps of pine. Run this sandwich over the jointer slowly, taking a light cut to reduce splintering. Dismantle

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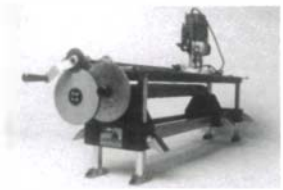

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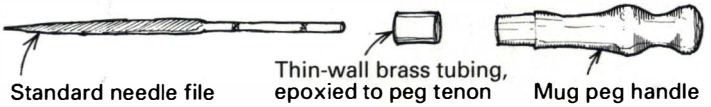
the sandwich and check to be sure you have a perfect fit.

Using push pins, secure one half to your workbench. Push the other half firmly against it aligning the grain as you wish it to be. Secure this half with push pins, and apply paper veneer tape to the seam. When the tape is completely dry, remove the pins. Turn the workpiece over and, with a finger dipped into a glass of water, apply a little moisture to the wood fibers of the seam. Lay the piece on a hard surface, and gently tap the seam and the area near it with the round end of a ball-peen hammer. Properly done, this will spread the fibers of the wood and close any minor gaps in the seam. The book-matched piece is now ready to glue to the substrate. *—John B. Woods, Williams, Ore.*

Needle file handles from mug pegs



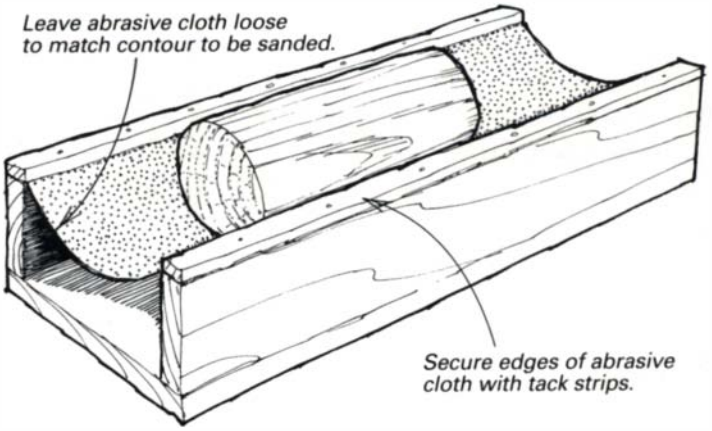
I've always had a problem with the commercial handles that are made for small needle files. They're too big and encourage too much pressure, often breaking the fragile files. And the cost for adding commercial handles to the dozen-plus needle files I routinely use was more than I could justify.

Looking for something smaller and less expensive, I purchased a bag of mug pegs at a woodworker's store. Then, stopping at a hobby shop, I selected a length of thin-wall brass tubing whose inside diameter (½ in.) would allow it to slip about one-third of the way onto the tenon of the mug peg—to act as a ferrule. At home, I lightly filed the wooden tenon of the mug peg until it fit snugly into a short section of the brass tubing. After roughing up the interior of the brass tubing section with coarse steel wool, I tapped the tubing into place with a dab of epoxy to hold it firmly.

Later, after the glue cured, I filed the brass flush with the end of the mug peg. Then, to mount the file, I drilled a hole into the end of the peg using the tailstock dimple left over from the manufacturing process to center the hole. Finally, to protect the handles, I stained and polyurethaned the birch pegs.

—Charles Taylor, Sauk Centre, Minn.

Contour sanding fixture



I recently turned a number of wooden mallet heads that came from the lathe with tangential cross-grain sanding marks. I wanted to remove these marks by sanding them out with the grain. To do this, I made a simple box with pine 1x6s and a 12-in.-long section of 6-in.-wide abrasive cloth from a belt

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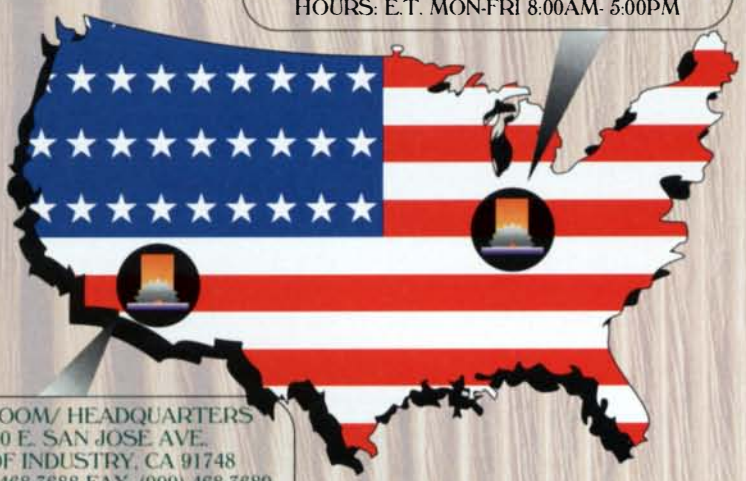

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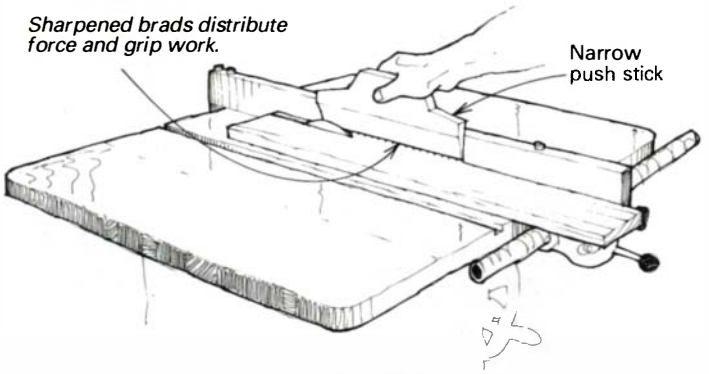
sander. I hung the abrasive cloth with some slack so that it conforms to the curved surface of the cylindrical mallet heads.

—Michael Basisty, Belleville, Ont., Canada

Quick tip: Use a knife steel to burnish the hook on a scraper. The hardened steel rod with fine longitudinal striations gives a "bite" on the scraper that a smooth burnisher lacks. Steels often get separated from the turkey-carving set and show up at flea markets where they can be had for 50 cents or so.

—Kenneth F. Kinsey, Geneseo, N.Y.

Push stick for ripping narrow strips

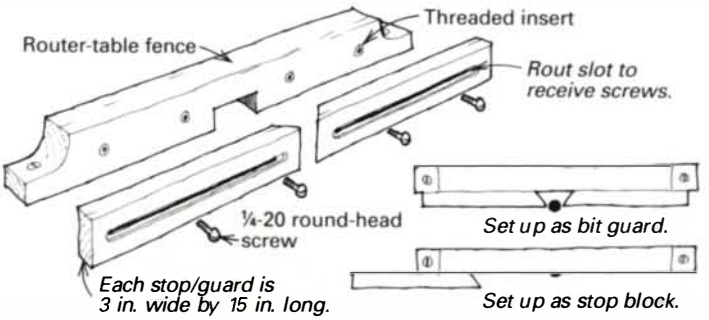


Ripping narrow strips on a tablesaw felt risky until I improvised a pusher with multiple sharpened brads. With this device, I can push the workpiece forward and, at the same time, press it tightly against the fence to ensure accurate width. The pusher gives me secure control of the wood and also keeps my fingers well away from the saw. Because the force is distributed over multiple points, penetration into the wood is not noticeable.

I have been using this device for 40 years. So the 30 minutes of construction time has given a good return on the investment.

—Richard Koontz, Camp Hill, Pa.

Combination router-table bit guard and stops



I added two 3-in.-wide, 15-in.-long pieces of hardwood to the fence of my router table. Each piece is mitered on the end closest to the bit and attaches to the fence with round-head screws through a long slot. Now what have I got? First, I have a blade guard, which I can adjust to expose the minimum amount of cutting edge. Second, I have a built-in pair of stop blocks that can be quickly adjusted and locked without clamps.

—Robert Spalter, Lake Worth, Fla.

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

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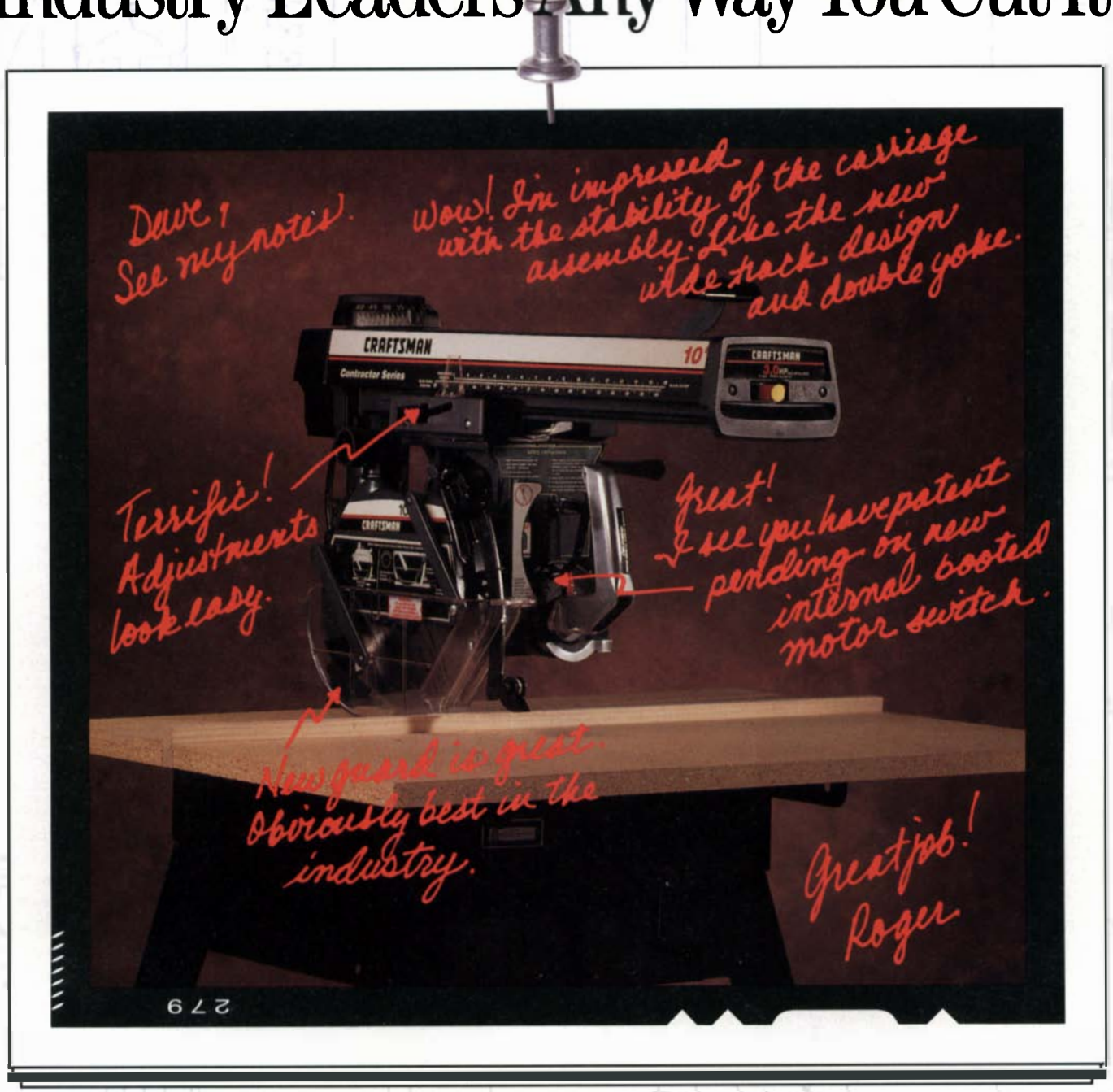

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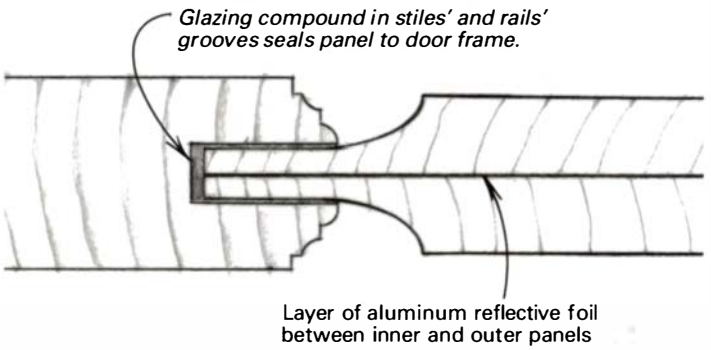
Exterior doors that can take movement

In recent issues, a number of articles in Fine Woodworking ***have made some excellent suggestions for dealing with wood movement in solid-wood constructions. I would like to see further discussion of how to make a solid-wood, raised-panel exterior door. In addition to all of the usual problems with cross-grain expansion and contraction, one must also keep out the weather. Surely, panels cannot simply "float" within the rails and stiles of an exterior door.***

—Myron Mychajlonka, Saline, Mich.

Donald R. Weiman Jr. replies: Some of the initial problems of expansion and contraction with a solid-wood, raised-panel door can be eliminated by using a wood that's well-suited for exterior use. Because of its better stability, I use white oak and/or genuine Honduras mahogany. Both woods offer the beauty of hardwood and hold up well under adverse climatic conditions.

When I am making 8/4 exterior doors, I use 8/4 kiln-dried select lumber and rip the lumber in 2-in.-plus widths. I then joint the edges and glue up these strips in the quartersawn position with the grain running perpendicular to the surface of the panel. Stock glued up this way is much more stable and resistant to warpage than flatsawn stock. By ripping the stock this thick, I can work the glued-up panels down to 1¾ in. thickness for molding and shaping the stile and rail door pieces. I use a marine-grade epoxy to glue together all components.



When I make up the raised panels, I make two separate panels, placed back to back, with a layer of radiant barrier (an aluminum reflective foil) between them, as shown in the drawing above. The reflective foil helps insulate and also creates a vapor barrier, which protects the interior panel from the exterior cold or heat. It also allows both the exterior and interior panels to expand and contract independently. I allow the panels to float in their stiles and rails, but when I assemble the door, I embed the panel edges into glazing compound. I usually tint the putty to match the finished wood color and trim all excess squeeze-out. After sanding and staining, I rely on a quality exterior-grade varnish to finish and seal all parts from the weather.

[Donald R. Weiman Jr. has a custom woodworking and building business in Lebanon, Pa.]

Designing a good rocker

I have just finished the first of a planned set of rockers, and I am not pleased with the way it rocks. Would it be possible for one of your contributors to comment on the design features of a good rocker? ***—J. Huxley, Port Dover, Ont., Canada***

Brian Boggs replies: How you design and balance any rocker greatly depends on who it's for and how it will be used, but here are some general considerations. There are at least five critical elements that will affect the chairs' performance: seat height; the seat's angle relative to the back; runner radius and length; seat/back pitch and runner alignment. The general range of seat heights on my rockers is 10 in. to 14 in. (the distance from the front of the seat to the bottom of the front leg). The length of the back leg is usually shorter, depending on the angle of the back relative to the seat. Rarely will it be more than an inch shorter (I'll explain later). The seat-to-back angle varies from 90° to the seat in old-fashioned ladder-back rockers to 105° in bent-back or Windsor rockers. I prefer a moderate angle of from 100° to 102°.

The radius of a rocker's runners should be relative to the height of the seat and the height of the person sitting. A radius of 36 in. to 40 in. seems to cover most needs; I use a 40 in. radius on most of my runners, but sometimes I need to shorten it to 36 in. for shorter customers. If you want to be more precise, you can measure the distance from the seated person's chin to the floor.

Runners should be made at least 34 in. long, and a perfect arc provides the smoothest rocking action. If you want to add a reverse curve at the runner ends for style, be sure it's back far enough not to interfere with the rocking action; otherwise, it will cause the chair to stop too suddenly at the end of the backswing.

A rocker's "pitch" is what I call the tilt of the seat and back relative to the floor. One way to adjust pitch is to change the length of the back legs. For a good average pitch in a rocker with a 90° seat-to-back angle, the back legs should be about 1 in. shorter than the front legs. You might want to increase the backward pitch even more in rockers for heavier individuals and pregnant women or women nursing a child, who tend to rock more forward due to a lower center of gravity. Because most porches have floors that slant to the front, porch rocking chairs are also a candidate for more backward pitch.

You can also increase pitch by increasing the tilt of the back. Therefore, a rocker with an angled or bent back will be better balanced if it has longer rear legs than a straight-back rocker. In the rockers I build with a 100° to 102° back-to-seat angle, I make the rear legs almost as long as the front. In any case, I always sit in my rockers before gluing the legs to the runners and adjust the pitch as necessary by trimming the rear legs. You don't want to have to cut the front legs, so err on the side of long back legs and trim them as necessary to get the pitch that gives the rocker the best feel.

Before final glue-up, you'll want to check the alignment of the runners because this determines whether the chair will rock straight. This process is similar to the front-end alignment of your car. Start by clamping a couple of 2x4 scrap boards to a flat benchtop; the boards must be longer than the chair is wide. Clamp the boards about 15 in. apart and parallel. Sight across them, as you would a pair of winding sticks, to make sure their top surfaces are parallel. Now set your rocker on top of the boards with the runners perpendicular to them. While sighting down the front of the chair seat, adjust the rocker so that the front of the seat (or the front rung) is parallel to the inside edge of the board beneath it. Now look to see if the runners touch the parallel boards at four points. If one point doesn't touch, shorten all three other legs slightly to level the chair. If it's only off by ⅛ in. or so, you might get away with shortening only one leg. But paying careful attention to the alignment should yield a rocker with good balance.

Given that the seat and backrest of your chair are shaped to be comfortable, the above guidelines should help you to build a rocking chair to please any sitter.

[Brian Boggs is a chairmaker in Berea, Ky.]

Construction for archival storage

What woods and finishes would be safe to use in building boxes for the presentation and storage of books and other archivally important paper articles?

—Lawrence Preuss, M.D., Ann Arbor, Mich.

Donald C. Williams replies: Your questions aren't easy to answer because paper and photograph conservators never recommend wood cabinets for the storage of photographs or archival materials. This is because of the damage caused to the artifacts

from the chemicals emitted from wood, such as peroxides and vaporous acids. Generally, preservation specialists prefer the selection of storage containers made from anodized aluminum or stainless steel, which employ inert gaskets to minimize the exchange of outside air. I strongly urge you to obtain the following documents, which focus on the appropriate measures for preserving artifacts: *Practice for Storage of Photographic Materials* (ANSI PH1.-48), available from the American National Standards Institute, 1430 Broadway, New York, N.Y. 10018; also, *Conservation of Photographs* (F-40), a Kodak publication, available on request from most local photo stores.

If, after reviewing these, you decide to go ahead with wooden boxes, it is important to select a wood with low extractive content, neutral acidity and durability. I suspect that the better choices would include beech, tulip poplar and maple. These must be coated thoroughly with an inert coating: A hard microcrystalline wax comes to mind. Even so, the photographs and other paper artifacts should never come in direct contact with the cabinets but instead, should be individually held in archival quality, acid-free envelopes or containers.

[Donald C. Williams is a conservator at the Conservation Analytical Laboratory of the Smithsonian Institution in Washington, D.C.]

Is fire-hardened wood any harder?

I read an article recently in which a person making old-fashioned wooden (ash) hayforks was flame hardening the tines with a torch. Can wood be flame hardened, or was the wood just being given a rapid drying treatment?

—Al Joellenbeck, Belleville, Ill.

Drew Langsner replies: In 1975-1977, I made and sold hundreds of the same type of hayfork that you ask about. At one point, I decided to test the strength of fire-hardened and non-fire-hardened tines and was unable to find any difference. I then wrote to the U.S. Forest Products Laboratory in Madison, Wis., and learned that they had made fire-hardening tests of tool handles. Their conclusion was that fire hardening is a myth that is propagated by toolmakers. Although many customers seem to believe that fire hardening works, in effect, it is cosmetic. However, on a hayfork, it is possible that pine resin impregnated during fire hardening may help prevent the bent tines from straightening out over time.

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

Regluing sanding belts

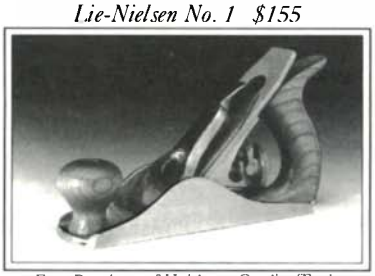
In my shop on the island of Roatan in the Carribean, I do quite a bit of case work that requires beltsanding of very hard woods such as rosewood and lignum vitae. I find that using any sanding belt coarser than 100-grit creates a heat buildup that often causes the belt to separate on the glueline. I have tried to re-glue my belts with many different adhesives, including epoxy, but to no avail. Is there any method for repairing these belts?

—Harvey M. Mayer, Roatan Island, Honduras

Chris Minick replies: Standard abrasive belts are often bonded or spliced with a phenolic adhesive system. Unfortunately, phenolic adhesives are brittle and not particularly heat tolerant; under heavy sanding loads, the glue bonds fatigue and the splice separates. Check the glueline on your broken belts. Dark red or black gluelines indicate a phenolic adhesive.

Higher-quality belts are spliced with a more flexible heat-resistant urethane adhesive. Urethane splices are characterized by a

READER SERVICE NO. 36



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Ronald Layport designs and builds one-of-a-kind furniture.

clear or white colored glueline. These belts cost a little more but are designed to withstand the rigors of heavy production sanding.

Procedures for making sanding belts in the shop were presented in *Fine Woodworking* #94 by Bill Skinner (p. 44) and Robert Vaughan (p. 45). Either method can be used to repair your broken belts. Be aware though, the repair will use up some of the belt. Expect to lose about one belt size; that is, a repaired 3x24 belt will have to be downsized to fit a 3x21 sander. In the long run, you may be better off throwing away the broken belts and replacing them with high-quality urethane bonded sanding belts.

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

Make your own bog oak?

My company produces a line of furniture that are reproductions of pieces from County Galway, Ireland, from before 1925, during the English rule there. The English forbade the common Irish to cut any standing trees, so the craftsmen of the time used oak found lying in the turf banks called "bog oak." Short of putting regular oak timbers in a nearby peat bog for a couple of thousand years, how can I reproduce the look and feel of this unique lumber?

—Grant L. Taylor, South Acworth, N.H.

Jon Arno replies: Bog oak is a unique and very attractive timber made even more alluring by its special place in Irish history. While it sports the typical figure of ordinary oak (which, in fact, it is), its almost black color, marbled with brown and gray streaks, is more reminiscent of Macassar ebony. Nature creates this beautiful furniture wood by submerging oak logs in peat bogs where the high tannin content of the wood reacts with minerals in the water, primarily iron. Actually, bogs are often quite rich in iron because they collect drainage water, which is high in dissolved minerals. As the water evaporates, over the centuries, the buildup of iron in the muck at the bottom of the bog may become concentrated enough to smelt into pig iron.

Since you raise the specter of Irish persecution at the hands of the English, it is also interesting to note that during the American colonial period, when the English would not allow the Americans to develop a legitimate, domestic iron industry, a great deal of locally produced bog iron clandestinely found its way to frontier blacksmiths. We stray from the point, but it certainly is interesting how the British Empire has so long been known for drawing out creative genius in its colonial subjects.

As for counterfeiting bog oak, I suspect a skilled finisher could approximate the appearance of this timber using black, brown and gray pigmented stains on ordinary, oak boards. Unfortunately, while the correct color might be obtainable in this way, it would be only a superficial finish and rather dull or opaque compared to the translucent, satin luster of genuine bog oak. Although I have not personally experimented with chemical treatments that might more accurately duplicate bog oak, I suspect it could be done by soaking oak boards first in a solution of iron sulfate and water and then in a solution of ammonia and water. The tannic acid in the oak will react with the ferrous sulfate to produce black, iron tannate, pigments in the same way steel nails or screws tend to cause oak to discolor. The second soaking in the ammonia solution would then bring out brown highlights. Note, the two solutions probably shouldn't be combined because the ammonia, being alkaline, might interfere with the reaction between the ferrous sulfate and the wood's tannic acid, thus slowing the process down considerably.

Depending upon the strength of the solutions, I suspect accept-

ably dark colors could be obtainable in a mater of weeks, or at the most, months. However, since genuine bog oak owes a certain amount of its translucence to natural decay, which reduces the thickness of the cell walls in the wood tissue, it is doubtful this treatment would result in a perfect forgery. But at least the entire board would be permeated with pigments of essentially the same derivation as those produced by nature. If you elect to experiment along these lines, a word of caution is in order. Even though the required chemicals are not exceptionally dangerous when diluted, in concentrated form, they can be both caustic and very unpleasant to work with, so be careful.

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

Drying burled wood for turning

My first purchase of Western burls and stump turning blocks were received wet, and I'm not sure how to cure them. Should the blocks be turned wet to approximately ½-in. wall thickness to reduce drying time? If so, approximately how much drying time will be required for suitable use?

—L.A. Pinholster, Melbourne, Fla.

Giles Gilson replies: Most of the turners who work with burl prefer to turn it right away because many species of this wood are unstable and can crack or check even during turning. The standard method of turning green is to work the vessel down until its walls are ¼ in. to ½ in. thick, store it in a plastic bag for six to twelve months and then finish turning it.

If you wish to dry the burl before turning, it may take a year or more, and the burl may check. But the plastic-bag storage method will help reduce checking. I have stored Eastern burls, such as cherry and oak, without bags for several years, and even though there was some checking, the wood was still usable. Some woodworkers use a microwave oven to speed drying (see *FWW* #75, p. 18). If done properly, that speeds the drying process dramatically. This takes some experimentation, but once you have a system established, it works very nicely.

[Giles Gilson is a woodturner, sculptor and product-design specialist living in Schenectady, N.Y.]

Tricks for invisible putty repairs

When restoring and refinishing old furniture, I have often used wood putty to fill holes and nicks only to find that these spots show up through the stain or finish. Can you suggest ways to hide or conceal these spots?

—Raymond Gayle, Anacortes, Wash.

Chris Minick replies: Successfully touching up putty spots and other blemishes on furniture often requires the eye of an artist and the experience of a conservator. Unfortunately, I lack the skills of either profession and must rely on other strategies to cover the defects in my woodworking projects. Here are a few tricks that work for me.

I make my own putty for small repairs (such as nail holes) by mixing sanding dust with lacquer to form a thick paste. A drop or two of stain is all that's needed for a perfect color match. Varnish or even boiled linseed oil can be used in place of lacquer as a binder for the putty, but putties made with these finishes require several days to fully dry. Generally, I patch holes larger than ¼ in. with wooden plugs instead of putty. Matching the grain pattern and grain direction of the plug with the surrounding wood usually produces an almost invisible patch.

Whenever I use putty to make a repair, I fill the hole higher than the surrounding wood, then I cut the dried putty flush using a sharp chisel or cabinet scraper rather than sanding the putty

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smooth. Sanding, especially with fine grade sandpaper, glazes the putty surface and can prevent it from absorbing stain.

If putty or other repairs are still visible after finishing, I've had good success hiding these defects with fine-ground fresco powders (available from Woodworker's Supply Inc., 800-645-9292). The procedure is relatively simple: After the first coat of finish has dried, I apply a thin coat of shellac to the repair area. Shellac adds "tooth" to the surface, enabling the powders to stick to the wood. Next I dab on the appropriate-color powder with a cotton-tipped swab, burnishing the color into the shellac coating. Excess powder is removed with a clean swab. A thin coat of shellac over the repair holds the pigments in place during subsequent applications of clear topcoat.

Finally, when all else fails, I have an artist friend paint a fake knot over the offending putty spot. I must admit this last method produces the most invisible repair, but it's a bit harder on my ego. [Chris Minick is a product development chemist and amateur woodworker in Stillwater, Minn.]

Trimming plastic laminate without scratches

When using a small lightweight router fitted with a special laminate trimming bit, an annoying phenomenon often occurs: The pilot bearing gets gunked up and spins at a high enough speed to scratch the plastic laminate. To avoid this, I've tried covering the working edge with masking tape (3M brand), but the spinning bit then accumulates a heavy coating from the tape. What can I do to avoid scratching the laminate?

—John Hayns, Whangarei, New Zealand

Philip Smith replies: Cutting out a piece of laminate much larger than the substrate makes it easier to mate the contact-cement-covered surfaces without fear of misalignment. But the trimming bit has to work a lot harder because it is surrounded by laminate and glue. As you've discovered, this can cause a trimming bit's pilot bearing to seize up and score the work. Cut the laminate so it will overhang the substrate as little as possible, ¼ in. all the way around should be enough. Extending the cutting edge of the bit below the glueline (as far as you dare) also helps keep glue out of the bearing.

Another way to prevent the pilot bearing from seizing up and causing scratches is to keep the bearing, as well as the laminate surface that guides it, free from the buildup of partially dried contact cement. A rag with a little naphtha or mineral spirits will do the trick. There's also a product called TRIM-EASE (available from American Grease Stick Co., 800-253-0403) that's designed to keep pilot bearings from gunking up. Just rub this stick lubricant along the path of the bearing.

When all else fails, switch to a flush-trimming bit fitted with a Delrin sleeve. This nylon-like plastic sleeve covers a standard metal pilot bearing, making it less likely to cause scratches. These bits were developed for routing solid-surface countertop materials, such as Corian and Avonite, without damaging the surface. Many manufacturers offer bits with Delrin-sleeved bearings; however, they are expensive. You can purchase Delrin sleeved bearings individually from Eagle America (P.O. Box 1099, Chardon, Ohio 44024; 216-286-9334). Just make sure the outside diameter of the bearing you buy matches the cutting diameter of the flush-trimming bit you're working with.

[Philip Smith runs The Ship's Carpenter, a professional cabinetshop in Long Beach, Calif.]

Send queries, comments and sources of supply to Q&A, Fine Woodworking, *PO Box 5506, Newtown, Conn. 06470-5506.*

Lie-Nielsen planes

Drawing from his experience in his father's coastal Maine boatyards, as well as the three years he worked at Garrett-Wade in New York City, Tom Lie-Nielsen has come into his own as one of the finest toolmakers working today.

The boatyard experience exposed Lie-Nielsen at an early age to machine-tool equipment and techniques, working with castings and mating metal to wood. While working at Garrett-Wade in the late '70s, he found there were many great, old woodworking tools that were no longer available, and many of the best tools were coming in from England and Germany.

Lie-Nielsen moved back to Maine in 1980 and began his tool business by reproducing Stanley's #95, an edge-trimming plane used primarily for squaring the edges of boards. Now, twelve years later, he makes over a dozen tools, most based on old Stanleys that are no longer available, including the Stanley #1 bench plane, the #140 skew block plane and the #66 beading tool.

Among the items on his drawing board or in the planning stages are reproductions of Stanley's #2 and #4½ bedrock planes (heavier and more easily adjustable than the standard bench planes), a scrub plane (used for rapid stock removal) and Norris-style, wood-infilled smoother and jointer planes.

I asked a couple of our contributors who are serious plane users to look at three of Lie-Nielsen's most recent introductions and give me their opinions. Their comments follow. For a catalog, write to Lie-Nielsen Toolworks, Inc., Route 1, Warren, Maine 04864, or call (800) 327-2520.

—Vincent Laurence

The Lie-Nielsen #1

At 5¾ in. long, the Lie-Nielsen #1 is the tiniest smooth plane you're likely to encounter; the norm is around 9 in. This manganese bronze reproduction is superior to the long-discontinued, cast-iron original made by Stanley. It weighs 25% more than the Stanley, is machined to closer tolerances, has a perfectly flat sole and a substantially thicker blade than the original. Also, a feature unique among contemporary planes, Lie-Nielsen's frog doesn't wander when adjusted. His sleek midget pares hardwood like a heavyweight and, with less than a quarter-turn of backlash in the adjuster wheel, permits very precise blade adjustment.

Even though the #1 is block-plane size, it's not configured for using just one hand and is definitely a two-handed finishing tool (see the top photo). The tool may appeal to many because of its cuteness, but it would make a wonderfully functional addition to the toolbox of any luthier, modelmaker or anyone who works on fishing poles, small boxes or other diminutive projects. It retails for $155.

—Maurice Fraser

The Lie-Nielsen #9

A miter plane is a design rendered obsolete by mechanization early in this century. Why revive it in the Lie-Nielsen #9? Because it's unique and unbeatable, a functional workhorse for the traditionally inclined. As a hybrid mega-smoother (4½ lbs. worth) and mini-jointer (10½ in.), it excels at a number of tasks, including smoothing even wildly figured woods and leaving a glass-smooth end-grain surface (see the center photo).

The plane is made of manganese bronze and is based on a Stanley original. Hallmarks of a quality miter plane are a heavy body and precisely machined sides and bottom. In both categories, the Lie-Nielsen is superior to the original. The #9 also has a larger blade-seating area than the Stanley, which makes the blade less prone to chatter.

Blade-depth adjustment is fine, using the plane's direct-push lever, but I prefer the wheel adjuster. Lie-Nielsen plans to offer a retrofit in the future, including both the adjuster wheel and a cammed lever cap (as on standard bench planes) to replace the #9's current screw-tightened cap.

The #9 is a low-hassle plane, easy to adjust and rewarding to use. Architectural woodworkers, traditional cabinetmakers and serious amateurs will find it a versatile tool and a good investment. Even at a rather steep $225, it's about a fifth of what you'd pay for an original. *—M. F.*

Low-angle jack

The Lie-Nielsen planes are among the finest hand tools on the market. As a traditional furnituremaker, I've been using these planes for years, and they're always the ones I reach for when confronted with a difficult planing situation.

The most recent Lie-Nielsen creation, a low-angle jack plane, is technically a block plane because its blade angle is only 12° and the bevel faces up (see the photo at right). Originally designed for surfacing butcher blocks, this plane, like all of Lie-Nielsen's creations, transcends the narrow scope of its original purpose and does almost anything.

I used the low-angle jack to plane pine door parts, to smooth some very knotty white oak, to dress some maple end grain and to prepare some European white beech plane stock. In every instance, I ob-

Photo: Alec Waters

***A two-handed grip** is required by the bench-plane configuration of the Lie-Nielsen #1 even though it is the size of a block plane. Maurice Fraser demonstrates use of the tool on the edge of a board.*

Photo: Alec Waters

***Equally adept at shaving end grain,** edge jointing or smoothing burls or bird's-eye maple, the Lie-Nielsen #9 is a versatile heavyweight. Because its sides are square to the bottom, the #9 is also the ideal plane to use with a shooting board for trimming miters.*

Photo: Vincent Laurence

***Low-slung, precisely machined** and outfitted with a hefty razor-sharp blade, Lie-Nielsen's new low-angle jack is a tremendously versatile plane. Whether on pine, oak or maple, edge, face or end grain, this plane left a glass-smooth finish.*

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tained a glass-smooth surface. This almost unbelievable versatility is a common characteristic of Lie-Nielsen planes.

Unlike most of Lie-Nielsen's planes, the low-angle jack is made of cast iron. Blade adjustment and the movable shoe, which controls the mouth opening, are smooth and precise, allowing minute adjustments. The low-slung design and thick blade combine to make the plane chatter-free.

When most manufacturers are committed to cutting costs and consequently reducing quality, Tom Lie-Nielsen strives to give you more tool for your money. Every one of his tools I've bought has been ready to go right from the box. There are few tools made today that measure up to this standard. The low-angle jack plane costs $165. *—Mario Rodriguez*

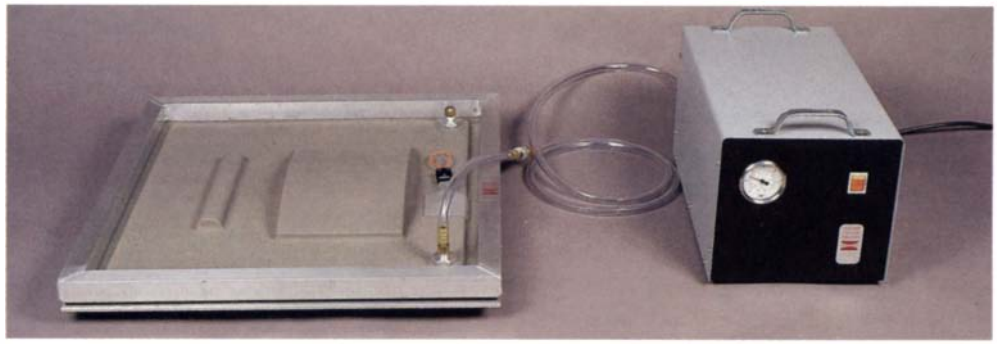

Photo: Vincent Laurence

***The Membrano vacuum veneer press** can be used with a heated bottom platen, overhead lamps or an integrally wired heat system to cut in-press time from hours to minutes.*

Follow-up

Membrano Vacuum Pressing System

In *FWW* #99, Monroe Robinson reviewed 11 vacuum veneer systems. Just as he was finishing the article, and too late to include it, we found out about another system by Mercury Vacuum Presses.

Called Membrano, it's a top-loading, self-sealing setup, which features a high-temperature, silicone-rubber membrane that's bonded to an aluminum frame. The system allows heat to be used in conjunction with the vacuum, so you can use heat-accelerated glues such as cross-linking PVAs (an example is Titebond Type II) or urea formaldehyde. Using one of these adhesives with heat will reduce in-press time from hours to minutes.

Prices start at $2,360 for a 36-in. by 48-in. system complete with membrane frame, grooved aluminum platen, hinges and counterbalanced gas cylinders to help lift the frame. Heating elements can be purchased with the system or later.

If you do a lot of panel work, or a lot of any kind of veneer work, and you're thinking about buying a vacuum-veneer press, you should find out more about this system (Mercury Vacuum Presses, P.O. Box 2232, Fort Bragg, Calif. 95437; 707-964-7557). *—Vincent Laurence*

Vincent Laurence is associate editor of Fine Woodworking. *Maurice Fraser teaches woodworking at YWCA's Craft Students' League in New York City and is an avid plane user and collector. Mario Rodriguez is a cabinetmaker, 18th-century woodworking consultant and teacher of woodworking in New York City.*

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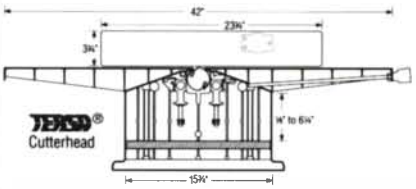

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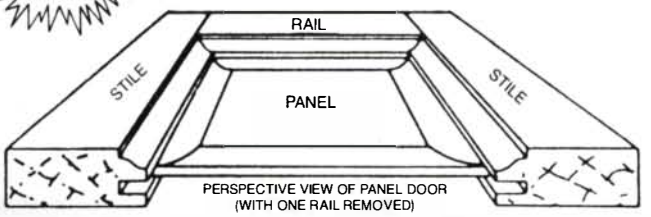

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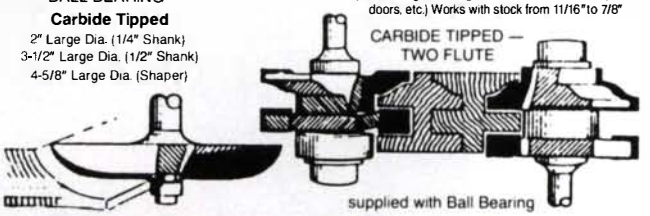

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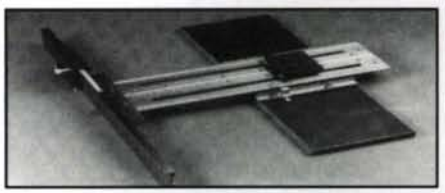

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T119A	3	24	fine cuts wood	2.95
T119B	3	12	medium cuts	3.75
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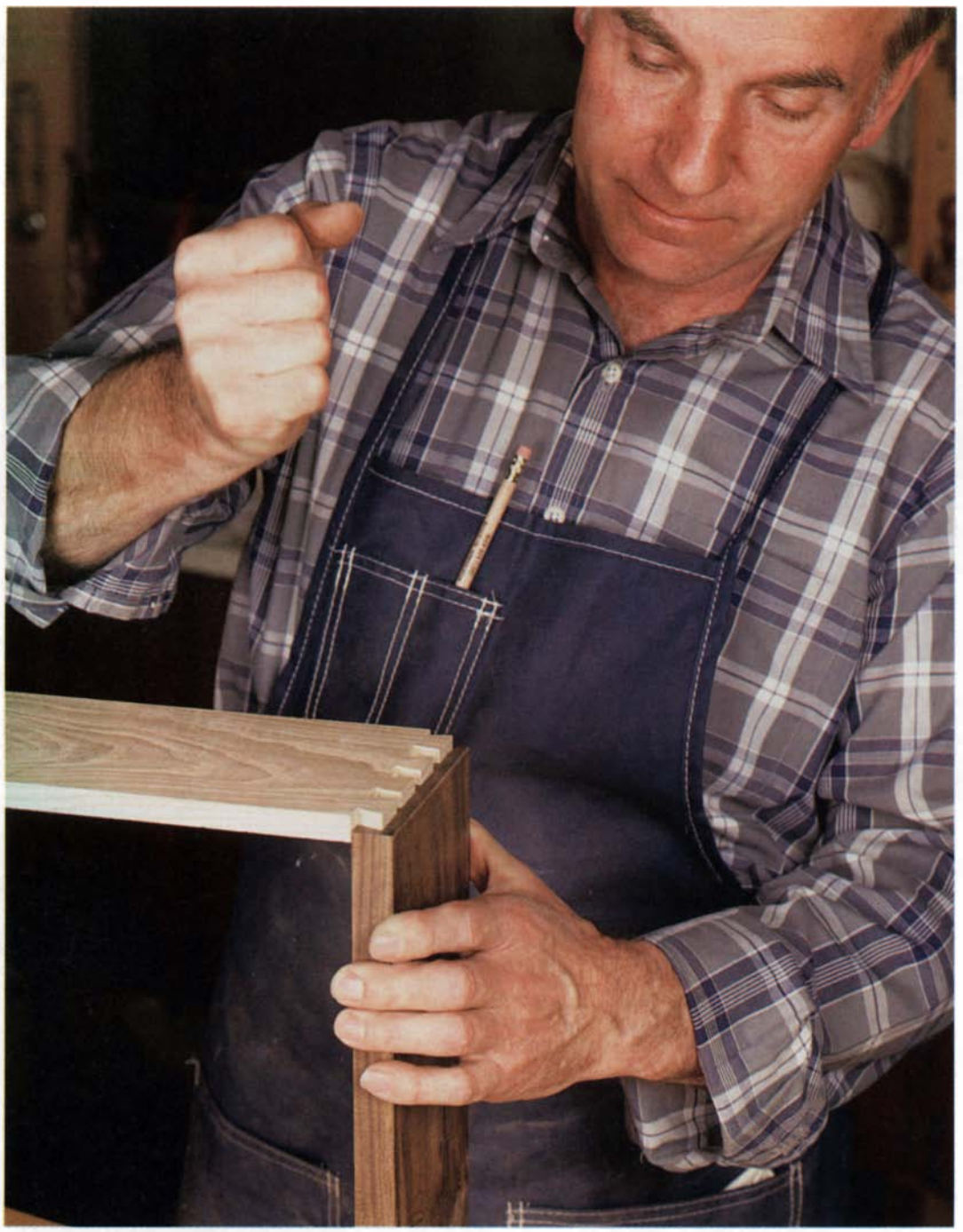
Making a Drawer with Half-Blind Dovetails

You don't have to sacrifice speed for a hand-cut joint

by Frank Klausz



***Half-blind dovetails allow drawers to blend in** with surrounding surfaces and make for continuous grain pattern or figure, top to bottom and side to side across a piece. The joint is no more difficult to cut than through-dovetails.*

When I make drawers, I use half-blind dovetails to join the drawer front to the sides. I'm a traditionalist and prefer not to let the joint show through on the face of a piece. To enhance the look of the joinery when the drawer is pulled open, I use two contrasting woods on my drawers, such as walnut for the front and white ash for the sides and back.

Once I've selected the wood, dimensioned it and cut it to size, I mark each board to indicate which edge is up, what part of the drawer it is (left side, right side or back) and which face is outside. I look at the grain pattern and growth rings, and I make sure the inside of the tree is on the outside of my work. Then I cut a groove near the bottom of the drawer sides and front with a couple of passes on my tablesaw, making it a snug fit for the drawer bottom. I test the fit with a piece of scrap the same thickness as the drawer bottom. I rip the drawer back to the top of the groove, so I can slide the drawer bottom in after assembly.

Next I set my marking gauge to the thickness of the drawer sides. Then I mark the inside of the drawer front, all around both ends of the drawer back and around the back ends of the two drawer sides, which will be through-dovetailed to the back. I set my marking gauge to about two-thirds the thickness of the drawer front (the tail length), and I mark the two ends of the drawer front.

Then I cut and chisel my dovetails as shown in detail on this and the next two pages. Once all the pieces are cut, I test-fit them and make any necessary adjustments. Then I disassemble the pieces, finish the inside surfaces with a few strokes of a fine smoothing plane and sand them with 120-grit sandpaper. I apply white glue with a disposable acid brush. I've found that white glue sets a bit slower than yellow glue, so I don't have to rush the assembly. The brush helps me get a good, even coat, even in tight spaces.

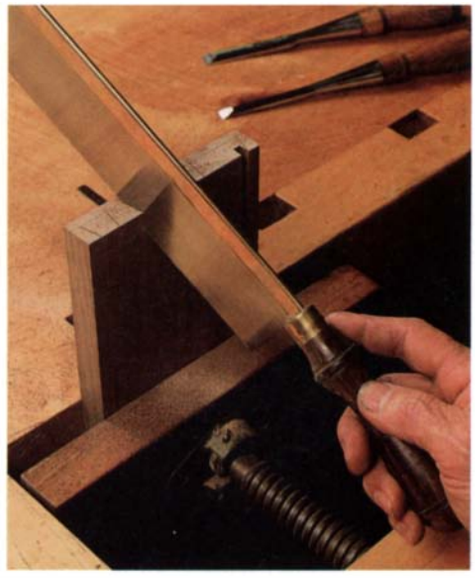
I don't use clamps on drawers; the joints are tight enough to create a good bond between the drawer parts. I use a hammer and a block of hardwood to close the joints. To ensure that the drawers are square, I just insert the drawer bottom as soon as the drawer is together. Because the bottom is square, the drawer squares up automatically. □

Frank Klausz makes furniture and repairs antiques at his shop in Pluckemin, N.J.

***Cut the two half-pins** at either edge of the drawer-front end, taking care not to cut past either scored line (top left).*

***Next judge angle and spacing by eye,** without laying out the dovetails, and cut a full tail (bottom left).*

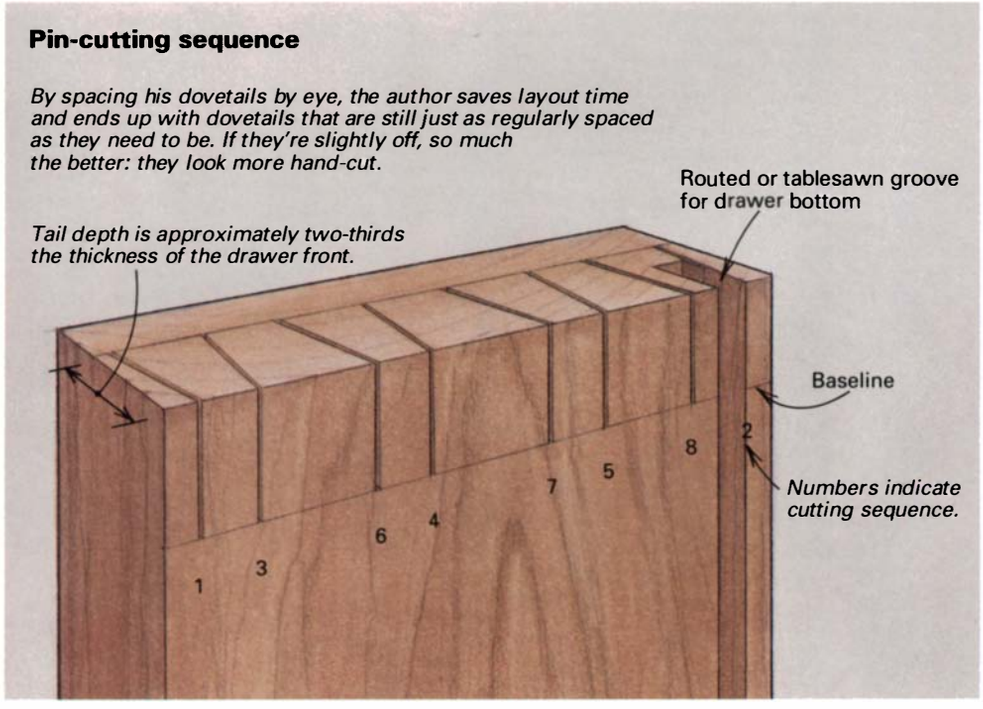
***Visually divide the remaining space** in half for a drawer with two full pins, in thirds for a drawer with three full pins and so on. Make all cuts at one angle first (see the drawing below for sequence), and then cut all the opposing angles (bottom right). Also cut the pins for the drawer back at this time, using the same method. For the strongest dovetail joint, through- or half-blind, pins and tails should be approximately the same size.*



Photos left and right: Vincent Laurence

Pin-cutting sequence

By spacing his dovetails by eye, the author saves layout time and ends up with dovetails that are still just as regularly spaced as they need to be. If they're slightly off, so much the better: they look more hand-cut.



Photos except where noted: Sandor Nagyszalanczy; drawing: staff

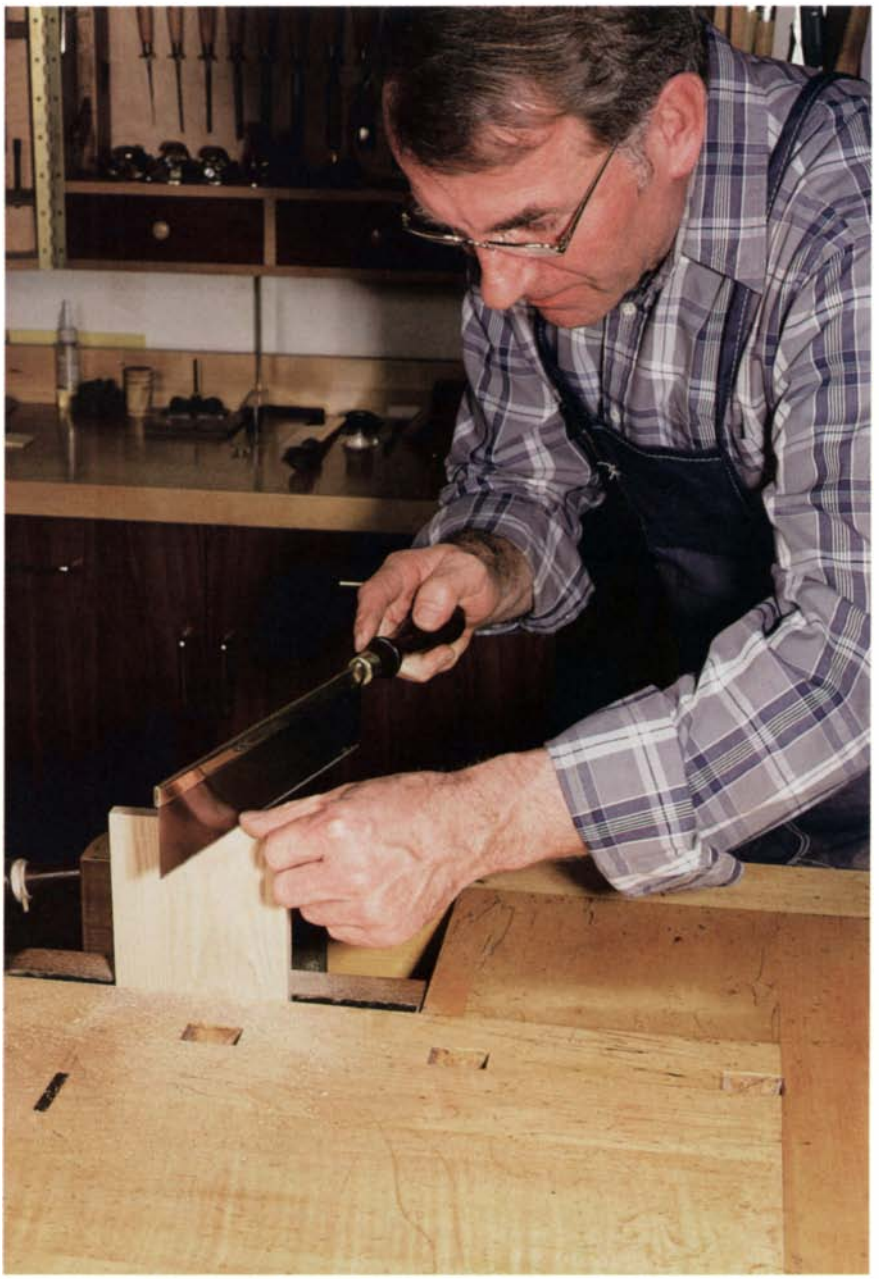
Chisel baseline *(top left). Position a paring chisel just ahead of the baseline, bevel out. Tap the chisel with the mallet. The bevel drives the chisel to the scored line, preventing tearout.*

Position your chisel 45° away from your body, *about halfway between baseline and the end of the board, bevel up. Whack the chisel with a mallet, gradually moving the chisel back to the end of the board, working down through the waste between the pins (bottom left).*

Alternate chiseling from the end *with perpendicular blows at the baseline that free the waste (top right).*

Clean up any rough pins *once you're down to the tail-depth line (undercut it slightly) by paring carefully into the corners (bottom right).*

Mark the tails from the pins *with a sharp pencil. The pencil line is easier to see than a knife line (below). By splitting the pencil line, you can get as tight a joint as if you'd used a knife. Before doing any marking, though, make sure the inside of the drawer is facing up on the bench and that the groove for the drawer bottom in the side lines up with the groove in the front. After marking the tails on the front of the drawer sides from the drawer front, mark the tails on the rear of the drawer sides from the pins you cut for the drawer back.*



Use your thumb to guide the blade. *With the tails marked, put one drawer side upright in the vise with the inside facing you. Take a couple of strokes to establish a kerf at what looks to be the correct angle. Then double check the angle before finishing the kerf. (Klausz doesn't worry about the blade being horizontal front to back because it's become second nature to him by now.) Saw carefully, splitting the pencil mark just down to the baseline. After repeating the process for both ends of both sides, chisel out the waste in the same manner as with the drawer back (above).*

They're usually right on, *but if they're not, it's not a problem. Klausz cuts small wedges from an offcut of the same board that the flawed dovetail was cut from (left). He tapers the wedge in two planes so that as it's tapped into the gap between pin and tail, it closes up tightly both on the end and on the side. By using the same wood, you get an almost invisible repair.*

AEG SKS 300

Delta Sidekick 33-060

Makita LS1011

Sliding Compound Miter Saws

Surveying six clever crosscutting tools

VIDEO TAKES SEE PAGE 46

by Sandor Nagyszalanczy

What's the best way to crosscut a board? Get five woodworkers in the same room, and you'll probably get five different answers. Some use a shop-built sliding carriage on the tablesaw; others swear by their versatile radial-arm saws; still others wouldn't trade a good miter box and a sharp handsaw for any fancy machine. But each of these crosscutting methods has its drawbacks: Tablesaw carriages can't easily handle long and heavy stock; radial-arm saws are time-consuming to set for miter or bevel cuts and usually require tedious realignment for square cuts afterward (and neither the radial-arm nor the tablesaw is truly portable); a handsaw and miter box require a good deal of skill for a true cut—and a healthy dose of muscle.

Regardless of how you currently crosscut in your shop, there's a relatively new breed of machine that might tempt you to change your ways. Sliding compound miter saws are powerful, compact benchtop devices designed to handle a variety of crosscutting tasks, including mitering and beveling. There are six different sliding compound miter (SCM) saw models now on the market, as shown above, one each from AEG, Delta, Makita, Hitachi, Ryobi and Sears (the chart lists their specifications). Though SCM saws have become commonplace on construction sites as workhorses for cutting up dimensional lumber, I wondered if a SCM saw would be equally at home in a furniture or cabinet shop, accurately trimming thick hardwood frame members to length, crosscutting thinly faced veneered plywoods or compound cutting moldings. So I spent a few weeks putting the saws through their paces.

Are sliding compound miter saws a replacement for more commonly used crosscutting tools? Their strong suit is that they can be quickly and accurately set for a variety of miter and bevel cuts, and then reliably returned to square. They are portable and affordable, listing in price from $999 (AEG) to $450 (Sears). But they do have some limitations, so read on before you decide if a sliding compound miter saw will fit your needs.

How SCM saws work

The secret to the performance of SCM saws is in their carriages: Most are designed both to slide on one or two guide rails (like a radial-arm saw) and to pivot downward, like a power miter box, through the cut. (At first glance, the Makita's single rail looks inherently less stable than the other twin rail systems, but it's well designed and I found it to be just as rigid.) The recommended cutting method is to pull the carriage out, pivot the blade into the work, then push through the cut. This prevents the blade from grabbing and leaves the carriage behind the fence when you're done, farther from harms way. For narrow stock, just pivot the head, like a chop box. In contrast, the AEG and Delta models are designed to cut on the pull stroke, like a radial-arm saw. The Delta Sidekick cuts with a sliding action alone; AEG's saw carriage slides out and pivots into the work before the pull cut. It has powerful return springs, which took me awhile to get used to.

To align the stock, each saw has a fence on either side of the blade, allowing right- or left-hand cuts. These short fences are enough for accurate work with short workpieces, but for longer stock, extension rails are available for each saw. The rails come with adjustable end stops, for setting repeatable cuts between about 10 in. and 17 in. long (much longer extensions are available

Hitachi C 8FB

Ryobi TSS-220

Sears 23488

for AEG's saw that work in conjunction with its optional metal work stand). To secure the workpiece and keep it from lifting during a cut, a work clamp locks into a socket on either side of the fence. Work clamps are standard equipment for the Makita, Ryobi and Sears models, optional for the others.

One of the real beauties of sliding compound miter saws is that they work equally well as stationary or portable tools. If you need a job site crosscut machine or a temporary benchtop tool, the light weight of a SCM saw (from the 37-lb. Makita to the 61-lb. Sears) makes moving these saws fairly easy, even if you're not a bodybuilder. When you're ready to hit the road (or store the saw beneath a workbench), unbolt the saw from the bench, lock down the saw pivot and secure the carriage from sliding with a hand knob. For ease of carrying, the Delta, Hitachi and Ryobi saws feature built-in handles (see the photo at left on p. 46).

As the main crosscutting tool in your shop, any SCM saw can be built into a benchtop or saw table. By adding a longer auxiliary fence and fitting it with a glued-on tape measure and sliding stop block, you can cut accurate, repeatable lengths without measuring and marking each board. You can build one of these fences yourself or buy any number of ready-made systems, such as the FasTTrack (available from Garrett Wade, 161 Avenue of the Americas, New York, N.Y. 10013; 212-807-1757). Each saw has holes in its fence to allow bolting through, with the exception of the Delta Sidekick. Its extruded aluminum fence comes with a printed scale and a sliding stop block for crosscuts of up to 12 in. on either side of the blade.

Cutting capacity

Sliding compound miter saws don't have the crosscutting capacity of larger radial-arm saws or tablesaw sliding carriage setups. On a standard 90° square cut, any saw in the sample will handle a board about 12 in. wide and anywhere from 1¾ in. to 2 15/16 in. thick. On a miter or a compound angle cut, capacities diminish rapidly. The widest stock for a 45° miter any of the saws will take is 9½ in. (Delta); most of the rest can only cut a board around 8½ in. wide. Width-cutting capacity is further reduced if you bolt on an auxiliary fence face. Hitachi has an optional fence that fills its large gap between fence and blade, which is too big for safely cutting short workpieces. Tilt the carriage for a bevel cut, and the saws only cut through 1 9/16-in.- to 2⅛-in.- thick stock (Makita and AEG respectively).

Despite these limitations, I'd say that SCM saws performed about 90% of the crosscutting chores in my shop, including crosscutting frame members to length and mitering moldings and trim. I even used a SCM saw for some plywood carcase work, and the 12-in. capacity was enough to handle crosscutting sides for a bookcase I made. Also, I found I could cheat the limits of most saws slightly.

Sliding compound miter saws compared

Make/model	List price ▲	Motor amps	Blade dia. (in.)	Square cut width, depth	Cut width for 45° miter ✱	Cut depth for 45° bevel ●	Weight (lbs.)
AEG SKS 300	$999	9.5	10 ✦	11 25/32, 2 1/16	8 5/16	2⅛	46
Delta Sidekick 33-060	$499	12	6½ ✦❑	12, 1¾	9½	1⅝	42
Hitachi C 8FB	$921	9.5	8½ ✦❑	12, 2 9/16	8 21/32	1 25/32	40
Makita LS1011	$870	12	10	12, 2 15/16	8 7/16	1 9/16	37
Ryobi TSS-220	$966	10	8½ ✦❑	12, 2 15/16	8 11/16	1 15/16	44
Sears 23488	$450 ■	10	8¼ ✦	12, 2½	8⅝	1¾	61

▲ Purchase price typically 30% to 50% lower unless otherwise specified
■ Occasionally on sale for $400
✱ Depth capacity same as for square cut
● Width capacity depends on miter angle
✦ Carbide-toothed blade
❑ Thin-kerfed blade

Photos: Sandor Nagyszalanczy

***It's easy to carry the Delta Sidekick** single-handed, thanks to its molded carrying handle and low profile. Light weight and compact size make most sliding compound saws equally at home in the shop or at a job site.*

***You can crosscut up to 12 in. wide** with the Hitachi C 8FB and most of the other SCM saws. But crosscutting capacity diminishes as miter angle increases, just like on a radial-arm saw.*

For example, if I trimmed just a smidgen from the end of a board, the stock usually cleared the motor housing and allowed a much deeper cut than is normally possible.

Sawblades and motors

Although they have similar cutting capacity and motor power, SCM saws use a wide range of sawblade styles in sizes ranging from 10 in. (Makita and AEG) to 6½ in. (Delta). Hitachi's and Ryobi's thin-kerfed carbide-toothed blades and Makita's standard chisel-toothed-steel blade produced the narrowest kerfs. Thin-kerfed blades enable a saw to cut denser woods, such as oak and maple, and thick stock with less power, because less material must be removed from the kerf. Because they cut on the pull stroke, the teeth on Delta and AEG stock sawblades have a low-hook angle (0° rake on the Delta and negative 5° rake on the AEG), reducing the tendency for the blade to self feed into the work. However, I still found the slide-only Delta to be a bit grabby; the pivoting action of the other saws seemed to provide a smoother overall cutting action. Despite differences in the design and number of teeth, the cut surfaces produced by all the sawblades except the Makita's inexpensive blade were very smooth.

For less tearout on the underside of the cut, Hitachi and Makita saws feature adjustable plastic kerf plates. AEG and Ryobi also have inserts that are replaceable. Sears and Delta lack kerf plates, resulting in slightly more tearout on the underside of sensitive materials, such as thinly faced veneered hardwood plywoods.

To make blade changes easier, most saws have a motor shaft locking lever (Delta requires an Allen wrench, AEG a spindle-locking bar, in both cases supplied).

The AEG saw employs an induction motor with overload protection, as found on stationary machines like tablesaws. The physically large motor ran very smoothly, although it took a second or two to bring the blade to full speed and torque. The other SCM saws are powered by universal motors, as found on portable power tools, such as belt sanders. Via gear drive, universal motors bring a blade up to speed almost instantly and produce good power for their small size and light weight at the cost of an occasional brush change. All the saws are noisy, which makes ear protection mandatory. Each motor is controlled by a trigger-type on/off switch. I liked the Makita's wide trigger best; it filled my entire grip and wasn't fatiguing to use during prolonged cutting sessions. To prevent accidents from a freewheeling blade, all SCM saws have electronic brakes, which stop their blades quickly after each cut. The AEG hums for several seconds after switching off (normal for an electronic induction motor brake, but annoying).

Despite differences in motor ratings, most of these saws negotiated cuts in 4/4 and 8/4 hardwoods without showing undue strain. Full-width crosscuts in 12/4 rock maple did call for a little more patience, especially with the Delta Sidekick, which seemed to be the least powerful of the six saws, despite its high (12 amp) motor rating. As mentioned earlier, saws fitted with thin-kerfed blades seemed to cut with slightly less effort, but the thicker-bodied blades on the AEG and Sears also performed admirably and seemed more resistant to deflection when cutting wood with knots or difficult grain. My impression is that saw manufacturers have balanced motor size and blade size/design very carefully for each model. This means that saw performance might be affected if you mount a non-standard replacement blade.

Setting square, miter and bevel cuts

While sliding compound miter saws may not be quite as versatile as radial-arm saws, most standard cuts on SCM saws—including

compound cuts—are easy to lock in, then return to square after cutting. This is due to a system of detents, adjustable stops and locking handles, which is a little different on each model. What all the models do share is a turntable base with a large scale marked in degrees, which rotates at least 45° in either direction for miter settings. Hitachi, Makita and Ryobi cut up to 57° right, Sears 52° right. Detents on each saw at 0°, 15°, 22.5° and 45° (AEG and Makita also have 30° detents) allow settings to be quickly accessed, then locked in with a separate locking handle. Additionally, detents at 31.6°, a standard miter setting for cutting 38° crown molding, are included on all but the AEG and Sears (see the top left photo below). Makita also includes detents at 35.3° for 45° type crown molding. Sears' scale is marked for crown molding cuts but lacks these detents. Delta and Makita have handy diagrams printed right on the saw that demystify setups for cutting inside and outside crown molding corners.

A scale pointer on all saws (except the AEG) allows you to accurately set and lock in any non-detented angle. To set an odd angle on the AEG saw, you must line up a side of the turntable casting with one of two scales, separate for left- and right-hand miters. The scales partially overlap, which I found confusing at first glance. Also, the scale on the saw I tested didn't line up accurately with the right side of the turntable.

For bevel cuts, all saws tilt to the left only (not a problem). Each model has graduated scales with adjustable stops at 0° and 45° and a locking handle. Hitachi and Ryobi also feature detents at 33.9°, the bevel angle necessary for crown molding.

During the dozens of cuts I made during this evaluation, I found each saw was capable of repeatable mitering and beveling accuracy, typically within ½° of the desired angle. Each model can be readjusted if detented miter settings get out of whack, but AEG's saw allows more extensive adjustments, such as correcting the parallelism of the blade to the guide rails. I found the Makita and AEG most pleasurable to use for miter cutting, with detents that pop firmly in place. All the other saws required a little handle jiggling to make sure the detent was set. I also liked the discreetly located miter-locking handles on the AEG, Delta and Makita saws; I kept bumping into the front-protruding handles on the other saws while using them in my crowded shop. The turntables on all the saws rotated smoothly except the Hitachi, which required a little tweaking. For bevel setting, I liked the large, easy-to-read scale on Ryobi's special top-setting design (see the photo at right below), but its carriage wasn't as well-balanced as the other saws and had to be lifted during setting.

Though you can't perform rip cuts on any sliding compound miter saw (my condolences if you're still ripping on a radial-arm saw), all the SCM saws except the AEG and Delta perform a neat trick that will surely please cabinetmakers: An adjustable carriage-pivot screw on each saw allows stopped cuts. None of the saw arbors are made to take wide dado sets, but you can still use the

***Cutting compound angles** on crown molding is a straightforward process on a sliding compound miter saw like the Makita LS1011 shown here. Rotate and lock the turntable base for the miter angle, and then tilt and lock the head at the desired bevel angle.*

***Setting the pivot depth stop** allows the Sears 23488 and most of the other saws to make shoulder cuts on a tenon. Dadoes can also be done by taking multiple passes.*

***Ryobi's forward-positioned tilting mechanism is convenient,** and its large printed scale and fine cursor make it easier to set precise bevel angles.*

The carriage on DeWalt's DW705 doesn't slide, but its 12-in. blade does handle a full range of miter and compound angle cuts in stock up to 5½ in. wide.

DeWalt's chop saw: big cuts without the slide

I didn't include any non-sliding so-called compound miter saws in my article, which begins on p. 44, because I felt their limited capacity—only about 6 in. for a square cut—wasn't adequate for most cabinet and furnituremaking shops. However, the DeWalt DW705 compound miter saw shown in the photo above (list price: $555) breaks the mold of the typical small chop box. Its 12-in.-dia. carbide-toothed blade yields smooth cuts and an impressive capacity. Set for square, the DeWalt slices through nearly 8-in. by 4-in. stock. Set for a 45° compound miter, the saw zips through a 5½-in.-wide, 2¾-in.-thick board. And with a 13-amp motor and 4,000-rpm blade speed, zip it does. The DeWalt handled maximum-dimension cuts I made in oak without bogging down at all. Releasing the trigger switch kicked in an automatic electric brake, which stopped the big blade in a heartbeat.

Setting the DW705 for miters and bevels is a casual affair because the turntable rotates effortlessly and because detents at 0°, 15°, 22.5°, 31.6° (for crown molding) and 45° click in with absolute authority. The saw's pointer even has a Vernier scale for extra-fine adjustment of odd angles. Good motor balance and a large three-prong locking handle make bevel setting pleasurable. I also liked the DeWalt's high fence, which supports thick stock close to the blade (it slides out of the way for steep bevel cuts). The motor housing has a built-in dust port for vacuum connection; a canvas dust bag is optional. A slew of accessories is available, including a hold-down clamp, length stop, extension rails and crown molding fence. All work to ease a variety of crosscutting tasks.

After a month of crosscutting, I found the DeWalt DW705 to be a dependable tool capable of many cabinet shop cutoff tasks, such as trimming frame members or big moldings. Its top-mounted handle and compact size also make it worth considering if you need a saw for installation work, cutting cabinet trim or for finish carpentry. *—S.N.*

standard blade for many jobs, such as cutting tenon shoulders (see the bottom left photo on p. 47), or you can take multiple passes to hog out wider slots and dadoes.

Safety and dust collection

To keep fingers from harm, most saws have built-in guards, which completely surround the edge of the raised blade (the Delta saw has metal leaf-style side guards). The metal guards on the AEG and Ryobi are undoubtedly the most durable, but I preferred the clear plastic guards on the Hitachi, Makita and Sears saws, which allowed a clearer view of the sawblade. Most guards retract automatically during cutting (gripping the handles on the AEG and Delta lifts their guards), and AEG's cast-metal guard features a ball-bearing roller on its lower edge to keep it from fouling on the stock. Even though I applaud Delta's red safety rail because it keeps your hands out of the blade path, I found it inconvenient. Workpieces must be fed in from the end and threaded under the rail. This is fine if you're working on a job site and have room to end-load long stock, but in a cramped shop, it could be a hassle.

To prevent accidental starting, each saw has a safety button that must be depressed before its on/off switch will operate. To forbid unauthorized use, Delta's and Ryobi's triggers have holes in them for fitting small padlocks that prevent switch operation. Alternately, AEG has a padlock hole in the saw guard.

Respiratory health is an issue on every tool manufacturer's agenda, and almost all SCM saws come with some means of dust control. The Hitachi, Makita and Ryobi come with dust bags and can also be hooked up to a vacuum hose. The Sears includes only a flexible elbow, which can be connected to a shop vacuum. The AEG's dust-collection system, sold as an accessory, is the most comprehensive, with a port that collects chips thrown up behind the blade and a plenum that draws dust from below the kerf plate. The Delta Sidekick sports only a small chip deflector. It's designed primarily as a job site saw, but I'd still like to see some provision for sawdust control on this saw.

Crosscutting satisfaction

I can't guarantee that a sliding compound miter saw will suit all your crosscutting needs, especially if you work with wide sheet goods. But if one could, there are six impressive models out there, and I don't think you'd go wrong choosing any one of them. As an all-around woodshop crosscutter, I really liked the Makita LS1011 for its positive-setting detents as well as its overall smooth operation, light weight and compact size; though if I owned the saw, I'd fit a better blade. If you need a professional-duty cabinet shop saw, I'd recommend the AEG SKS 300 for its adjustability, durable induction motor and excellent dust collection (despite the fact that I didn't care for some of its other features). If you need a readily transportable saw for construction or finish trim work, the Delta Sidekick is a contender, with its large worktable, convenient carrying handle and low profile—it even fit behind the seat in my friend's pickup truck. The Hitachi C 8FB and the Ryobi TSS-220 are beautifully constructed, smooth-running machines that are precise enough for the shop yet portable enough for the job site. Finally, the Sears 23488 offers heavy cast-iron construction and full features at a relatively low selling price. As with most tools, the subjective feel of a saw will probably matter more than any particular feature or specification, so I'd suggest that you try the saw you're interested in before buying it. And get ready to trade in your old worn-out radial-arm saw. □

Sandor Nagyszalanczy is senior editor at Fine Woodworking.

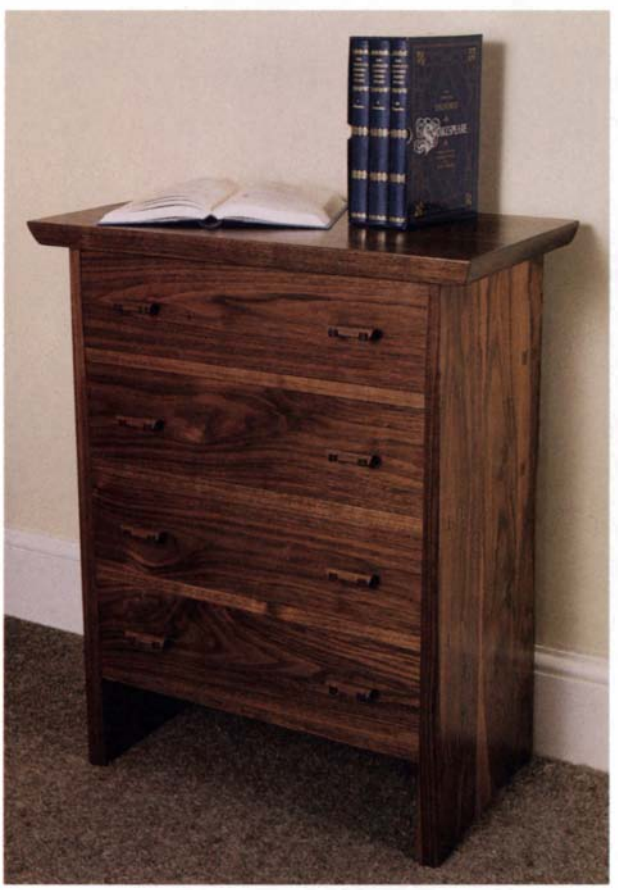
Visible Joinery Makes a Chest

Flared mortises and jig-cut wedges create matching, tight-fitting through-tenons

by Malcolm Vaughan

Early in the design of a small chest of drawers, I decided to lean in the direction of Arts and Crafts. I wanted the four-drawer bureau to have clean lines and simple edge profiles (see the photo below). As a decorative feature, I decided to wedge the through-tenons on the ends of the drawer dividers with pear, which would contrast with the black walnut I chose for the chest's carcase. I also selected pear for the drawer sides and backs, so the contrast would likewise accentuate the drawers dovetail joinery (see the top photo on the following page). Finally, I picked aromatic cedar for the drawer bottoms and the chest's back panel, which floats in a conventional frame.

Quite a few furnituremakers feel it's extravagant to use solid wood as drawer dividers. But in my chest, I wanted solid dividers, though I didn't cut them from prime timber. In the time it would take me to join and glue-up web frames, I was able to make solid dividers that not only serve as drawer runners but also act as dust boards. And solid dividers allowed me to accent the chest's joinery; I penetrated the two sides with pairs of through-tenons at the corners of each of the three dividers and the bottom. This meant I had to make and insert 64 wedges. To speed the job along and help ensure that each of the joints would look alike (see the top photo on p. 50), I came up with a jig to quickly bandsaw identical wedges. Before I tell you about the wedges, though, I'll describe how I built the rest of the bureau, including how I laid out and routed out each of its 32 slightly flared mortises.



***Subtle geometry in this chest of drawers** built by Malcolm Vaughan accentuates both the wood and the form, reflecting the honesty in materials and manufacture that is the hallmark of the Arts-and-Crafts style. Vaughan boldly pierced the bureau's side with the through-tenon ends of the drawer dividers, contrasting black walnut tenons with pear wedges.*

Chest construction

To start any furniture project, I make a dimensioned sketch, a materials list and an order of operations, which usually saves me from cutting pieces the wrong size, gluing parts together too soon and wasting time. For the chest (see the drawing on p. 51), I cut, shaped and fit components and joinery in the following order:

Sides—Before I edge-jointed the boards for the sides, I tapered the stock's thickness using a carrier jig in my surface planer (I describe a similar jig in *FWW* #95, p. 55). Next I cut the sides to dimension and cleaned up all the surfaces. Then I cut dadoes to support the ends of the dividers, and I rabbeted the edge of the sides to retain the back. To mark out the dadoes, I lightly knifed their positions across both faces of the sides. This makes for accurate mortising later and eliminates tearout around the mortise edges.

Dividers—When I was cutting out the dividers and bottom, I double checked the ends for squareness across their width (if they're not square, subsequent fitting of the drawers is a nightmare). It's actually not a bad idea for a carcase to widen slightly toward the back, and many cabinetmakers build such an "inaccuracy" into their cases.

Bandsawing the tenons—After planing the dividers for a tight fit in the dadoes, I marked off each end for a double pair of tenons. Next I bandsawed the tenon cheeks using a sharp, fine-tooth blade. I guided the edge of each board along the rip fence, and I clamped a stop block to the table to keep from cutting too far. To remove the waste and establish the land between the tenons, I guided my router (fitted with a ¼-in. straight bit and a long fence) along the ends of each board. After routing, I cleaned up the corners with a chisel. Next I hand-sawed the dividers' front shoulders. Finally I went back to the bandsaw to cut slots in the tenons for the wedges, each time setting the rip fence to guide the cut.

Cutting the mortises—To mark out all the mortises, I slid the end of each divider into its corresponding dado, carefully aligning the rear edge with the edge of the rabbet, and then I scribed the locations in the dado using an awl. To mark the mortise locations on the outside

face of the side, I again laid the divider in position against the side (close to one of my earlier-made lower dado lines) and nicked positions with my knife.

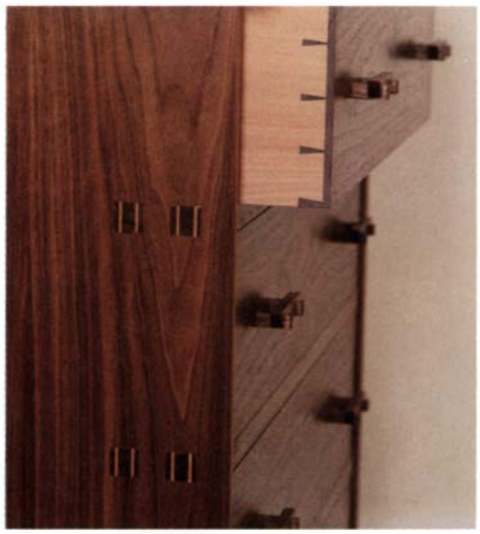
The real trick to get the wedges to fit uniformly is to flare both sides of each mortise the same amount (1/16 in.) toward the side's outer face (see the drawing detail on the facing page). To mark the flare, I first clamped a straightedge across the outside, close to the lower dado line. Then I took a short piece of stock the same thickness as what would be the flared tenon width, and laid it square to the straightedge. Centering this piece over each tenon location let me knife exactly to where the tenon would spread once it was wedged. Taking a few minutes to accurately mark out at this stage guaranteed that all the wedges would drive into the tenons at the same depth and thus appear uniform in width. I wasted most of each mortise with a router fitted with a ¼-in. bit. While I was at it, I routed a mortise in each divider to house drawer stops (see the drawing on the facing page). Finally I chiseled squarely to the lines.

Dry-fitting and shaping—Next came the dry-fitting. I always enjoy this part because it lets me see, for the first time, the piece of furniture taking shape from what started out as a pile of rough-sawn boards. To hold the components in place as I checked the joints for proper fit, I made four sets of side cauls, which I bar-clamped across the width of the case near each row of mortises. The cauls, which have a slightly convex face, ensure that the dividers go fully into their dadoes; without the cauls, the center of the sides might bow outward.

After dismantling the chest, I slightly rounded the front edges of the sides with a plane, checking the profile against a cardboard template. Using an old *Fine Woodworking* "Quick tip," I smoothed the curves with a piece of sandpaper, which was wrapped around a half deck of playing cards. To create shallow feet at the corners, I used my spokeshave to shape and chamfer the bottom of the sides. Then masking off all the joints with tape, I finish-sanded and waxed the chest's inside faces, which would be much more difficult to do after glue-up.

Mass-producing wedges

To cut out the wedges, I returned to my trusty bandsaw to use a shopmade wedge-making jig. The bottom photo above shows how I inserted the corner of my ¾-in.-thick pear stock (with the grain running across its width) in a corner of the jig's medium-density fiberboard base. After slicing off each wedge, I flipped the woodover and repeated the cut until I piled up enough wedges for the job. Then I regathered my cauls and clamps, and I took a deep breath in preparation for gluing up the dividers into the sides.



Tight through-tenons—*The author gets uniform and snugly fitting through-tenons by driving the wedges into the tenon slots an equal amount. This requires all the wedges be identical and all the mortises be the same size. It also means the side walls of the mortises must be flared uniformly to correspond to the wedge angle.*

Wedge-o-matic—*Vaughan made a simple jig to bandsaw consistent wedges for 32 through-tenons. To use the jig, he first inserts a corner of a piece of pear (with its grain running across the width) into a notch in the jig's base. Then he slides the base along the fence to slice off a wedge.*

Assembling the case

Initially, I was concerned that knocking in 64 wedges before the glue set up would be a desperate race against the clock. As it turned out, it didn't take long at all. If you're still worried about time, I suggest you use a two-part glue, and dip the wedges in the catalyst part just before you insert them.

Most woodworking textbooks rightly say that wedges should run across the grain and not with it. They also say to drill holes at the end of the tenon slots. Well, I didn't do either of those things on my chest, but I had no problems when installing the wedges. I figured the joints wouldn't split the sides as long as I tapped the wedges into their slots until the tenon just filled the mortise. Of course, you don't want to drive the wedges with a 2-lb. club. I used a light hammer with a face just big enough to simultaneously strike both wedges into a tenon. I stopped tapping when I heard the pitch change as the wedges bottomed out solidly. When all the wedges were home, I cut off their protruding ends and then belt-sanded them flush with the sides.

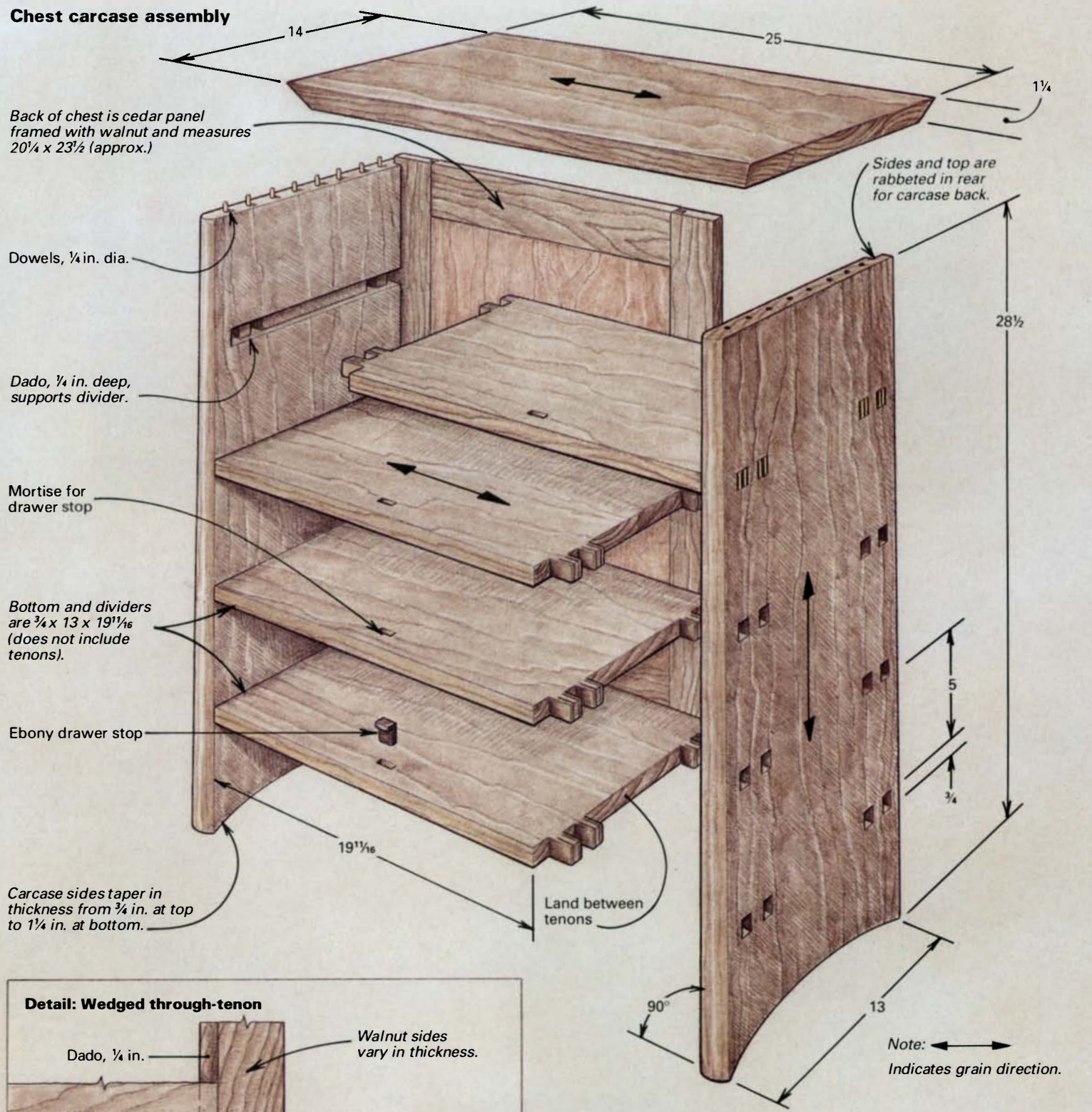
With the case together, I measured for the chest's top, allowing it to overhang on three sides. When I cut out the top, I sawed the back edge square, but I sloped the overhanging sides by tilting my tablesaw blade to 70°. I hand-shaped the subtle edge curve on these three sides. After rabbeting the top for the back panel, I sanded both the top and the exterior of the sides. Next I drilled holes in the top and sides, and then I doweled and glued the top on.

Pulls, drawers, a back and a finish

It seems whenever two or more furnituremakers get together, the conversation always turns to handles and the restless hours a maker spends trying to integrate pulls into an overall design. I, too, have a healthy stash of failed handle mock-ups to kindle a fire during the winter. But I was pleased with the pulls I came up with for this chest of drawers (see the drawing detail). The crossbar reflects the shape of the top of the chest, and the ends of the support pieces curve gently, like the front edges of the bureau's sides. One thing to remember: It's much easier to cut mortises or bore holes for the pulls before you glue up the drawers (the four drawers in my chest are dovetailed together the conventional way). This is also a good time to fit the drawer stops (I used ebony) in each divider.

After fitting the drawers, I screwed the chest's frame-and-panel back in place. Once I had the chest completely together, I applied four coats of Danish oil to the outside; the first coat diluted 50% with white spirits for better penetration, the second one straight from the can and the last two applied with a fine-grit (gray) Scotchbrite nylon pad. □

Malcolm Vaughan is a furnituremaker living in Devon, England.



Photos: Jim Boesel; drawing Heather Lambert

***An incredible depth of detail** is the hallmark of the H.O. Studley tool case on display at the Smithsonian Institution. The maker's name and hometown appear on engraved silver plates below drill index numbers.*

Studley Tool Chest Makes Smithsonian

Research reveals more about the man and his tool chest

by William Sampson

The lasting legacy of most woodworkers usually is in what they produce with their tools. But it is the tools themselves that have brought wider recognition to a turn-of-the-century Massachusetts craftsman named Henry O. Studley. Now the highlight of an on-going display at the Smithsonian Institution's National Museum of American History, Studley's wall-mounted tool chest packs some 300 tools into a space not much bigger than one of those folding carry-on garment bags. But quality is as much the story as quantity: The case and its contents display master workmanship and premium materials, such as mahogany, rosewood, ebony and mother of pearl (see the photo above).

***Pianos with fine detail,** as shown in this 1900 catalog illustration, were the product of the Poole Piano Co. of Boston, Mass., where Studley worked.*

It is those things that make the tool chest reach out of its display case at the Smithsonian and grab passersby, stopping them and holding them rapt and transfixed on its myriad of detail. A photo of the chest, its first public appearance, ran on the back cover of *Fine Woodworking* almost five years ago. Since that time, over 20,000 posters of Studley's tool chest have found their way onto woodshop walls and into homes all over the world.

Despite the fame of the chest, its creator was still an enigma. But research by the Smithsonian is now beginning to shed light on the man who left his mark as "H.O. Studley, Quincy" on engraved silver nameplates in the chest.

Illustration: courtesy of Smithsonian Institution
National Museum of American History

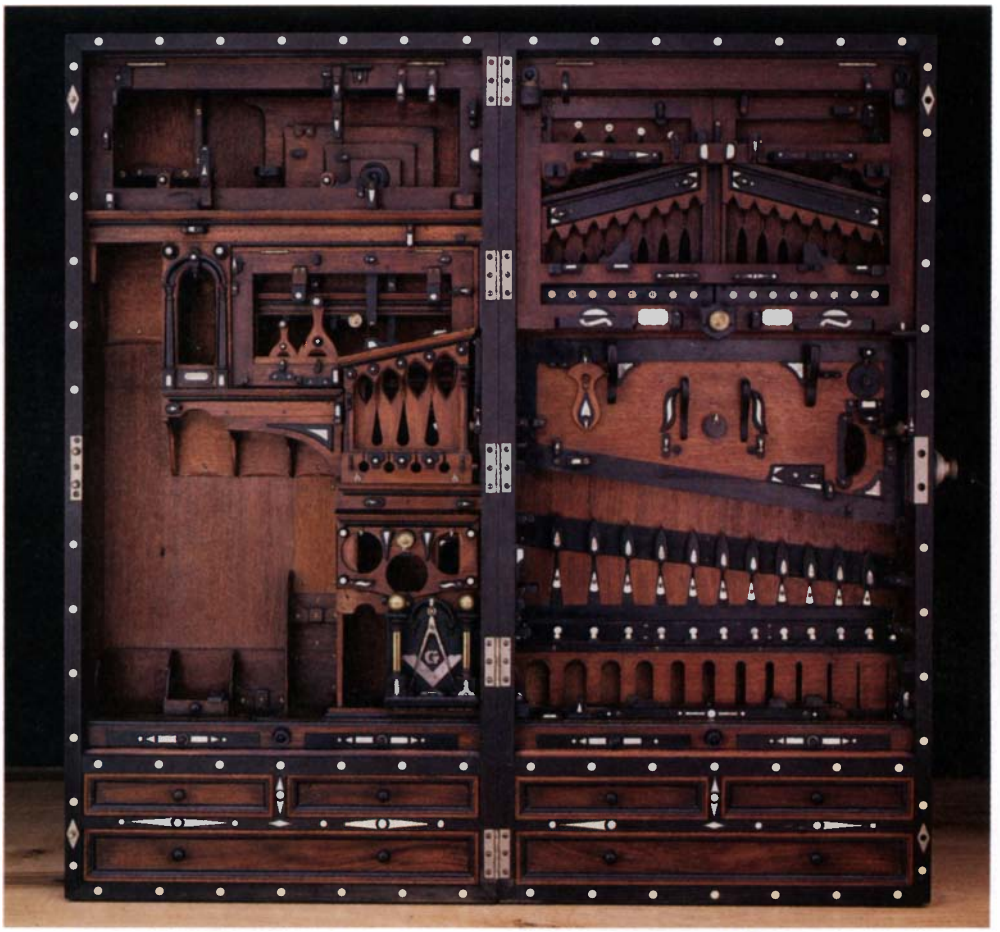
Who was H.O. Studley?

A carpenter, Mason, machinist, organ and pianomaker, Studley was born in 1838 in Lowell, Mass. When war broke out between the states in 1861, Studley joined the Massachusetts infantry, listing his occupation as carpenter. He was taken prisoner at Galveston, Texas, in 1863 but was later exchanged to rejoin Union troops. After the war, he returned to Quincy and eventually married. He became a member of the Rural Masonic Lodge; records show he achieved first, second and third degrees in 1871.

He worked for 25 years for the Smith Organ Co. and then joined the Poole Piano Co. in Boston as the popularity of the piano began to surpass organs, according to Studley's obituary published in 1925 in the *Quincy Patriot-Ledger*. Even that obituary gives testament to the legacy of Studley's tool chest: "One of the most remarkable things of his creation is a tool cabinet, a most ingenious contrivance containing multitudinous number of tools of all sizes and kinds."

It was apparently at Poole where Studley created his tool chest between 1890 and 1920. David Shayt of the Smithsonian, a museum specialist in crafts and trades who has charge of the tool chest, notes that the materials used to construct the case were also once common to pianomaking: ebony, ivory, rosewood, mahogany and mother of pearl. A 1900 Poole catalog from when Studley worked for the firm speaks of highly figured woods and displays a variety of finely detailed upright pianos (see the illustration on the facing page).

As to the products of H.O. Studley's craft, little can be attributed to the man without question. The pianos and organs he made carried company nameplates. The owner of the tool chest, Peter Hardwick of Maine, has a mantlepiece Studley built, but the tool chest remains as the craftsman's masterpiece.



***With the tools removed,** the intricate woodwork of the Studley tool chest is revealed. Masonic references, such as the square and compass in the lower part of the left half of the case, also stand out. Smithsonian conservators spent 245 hours gently cleaning and making minor repairs to the chest.*

***Close tolerances** and the precision fit of the tools are apparent as the chest is closed. The Smithsonian's David Shayt suggests part of Studley's inspiration may have come from the way upright pianos pack many parts into a tight space.*

A special place for every tool

The basic casework for the tool chest is dovetailed mahogany. Measuring 19½ in. wide, 39 in. long and 9½ in. deep, the chest is designed to hang on the wall, opening like a book along its five butt hinges and closing with a dial combination lock. A 1903 issue of *American Machinist* describes patternmakers wall-mounted tool chests that are similar in function to the Studley case. But the mastery of this case is in the ingenuity of the holders for the tools, which are stored up to three layers deep with trays (or tills) and special holding fixtures for each tool, as shown in the photo on p. 54.

Studley's craftsmanly precision can be seen in the tight clearances that allow a gouge to pass within ⅛ in. of a plane handle (see the bottom photo above), and it can also be heard in the soft click tools make as they snap into place. A rosewood-handled screwdriver is not only held by exactly sized ebony receptacles for its blade and ferrule, but a small rounded recess provides extra clearance for the side of the handle. That same fitting technique has helped Shayt and Smithsonian conservators find the proper locations for a number of tools tucked incorrectly into various nooks and crannies of the chest when the museum received it. Shayt noted that a pair of calipers were oddly placed an inch away from three unused ebony holding devices that turned out to fit the tool exactly. Adjustable tools such as marking gauges must be set to certain lengths to fit exactly in the case. Where one marking gauge was installed, Shayt noted evidence of wear, but when adjusted slightly, the gauge rests securely with no unnecessary contact with the case.

There is no wasted space in this chest. A hollow cavity above a set of chisels is there only to allow room to raise the tools out of their pockets. Ebony keepers, inlaid with mother of pearl, swing into place to secure many of the tools. Hidden swinging butterfly catches keep the drawers from falling out of the case. As Shayt reached in-

Photos: Eric Long, Smithsonian Institution
National Museum of American History

***Going three layers deep** in the upper right half of the tool case, the lift-up and swinging-door sections provide easy access. The doors that normally hold bits echo a gothic cathedral motif and may have roots in Masonic lore, researchers suggest. This part of the case may also follow a Masonic idea of putting the most complex or precious things in the northeast corner of a lodge.*

to a drawer to trip one of the catches, he commented about the maker, "He must have had small fingers, that's for sure." Whole sections of the case swing or lift out to reveal more layers and tools behind them (see the photo above). Some of those moving sections have ebony braces to prop them open. In the top portion of the right half of the chest, one panel lifts up to allow two panels of drill bits to open like temple doors, revealing yet another layer. What seem like decorated columns or long cylinders can be removed and opened like cannisters to reveal small lengths of metal stock.

The temple motif of that section falls in line with the many Masonic symbols that fill the chest. The most obvious is the square and compass Masonic emblem formed from real tools in the left half of the case (see the top photo on p. 53), but throughout the case there are more symbols significant to Masons. The numbers seven, five, three and eleven repeat throughout the chest. Even the way the chest opens and closes, Shayt believes, reflects the Bible, "opening to reveal truth and beauty." A section of the case built to hold a Stanley #1 plane may be fashioned after the archway over the throne of Solomon, Shayt speculates.

The tools themselves—The hundreds of individual tools in the chest include both manufactured items and things obviously made by Studley himself (see the list on the facing page). They range from large bench planes to tiny screwdrivers and taps. Planes by Stanley and measuring tools by L.S. Starrett make up much of the chest, but the maker's own handiwork can be seen in such things as rosewood, brass and ebony marking gauges. A whetstone rides in an ebony box with mother-of-pearl inlay and a silver plate engraved "H.O. Studley." A couple of tools feature handles crafted from horn. "He was into bits, no question: twist drill bits, center, auger, spade," said Shayt, as he displayed not only the ordered racks of bits in the case but the contents of several drawers filled with bits.

Those familiar with pianomaking have helped Shayt identify a number of the key-action regulators and other specialty tools, but mysteries remain. There are four brass capstan tools. Each has a center point that can be lowered by turning an arm, then another part of the assembly has internal pawls to ratchet. Shayt speculates the devices were for tensioning piano wire.

Long road to Smithsonian

Studley's obituary reports that his wife died nine years before he did and mentions no surviving children. In fact, the only direct kin listed in the obituary was his brother, Charles Studley, who was then 76 and ailing. The chest apparently was bequeathed to an attorney who was the grandfather of the current owner, Peter Hardwick. The tool chest was handed down in the family and belonged to Hardwick's brother until Peter traded a 1934 Ford for it. Not a woodworker, it had been Hardwick's original intention to sell the chest, but as more was found out about its historical importance, he loaned it to the Smithsonian for research, conservation and display.

Once at the museum, a conservation team of Clinton Neuguth, B.A. Richwine, David Todd and Nikki Horton took the case in hand. They described the case as being in overall good condition with the exception of a few cracks and broken pieces of trim and inlay. Heavy dust covered the chest, so all the tools were removed for cleaning. The conservation report lists more than 50 steps taken to make minor repairs to the case, ranging from reassembling a saw handle broken into four pieces to turning a new ebony drawer pull knob. The work took 245 hours.

Today, the result of all that work is enshrined in a glass display case as part of a long-term exhibit that opened in 1991 on the first floor of the Smithsonian's National Museum of American History in Washington, D.C. The Studley tool chest shares space with other tool chests from 19th- and 20th-century trades. Stretching the definition of a tool chest, the display includes a seamstress' needle box, a urologist's surgical kit and even a contemporary shoeshine box. Chests of the machinist and cabinetmaker contrast with those of the farrier and child woodworker. The chests are all filled with the tools they were built to carry, emphasizing the utilitarian importance of each box. Common to virtually all of the tool cases featured in the exhibit is wooden construction and detailing, but none compares to the masterpice crafted by H.O. Studley.

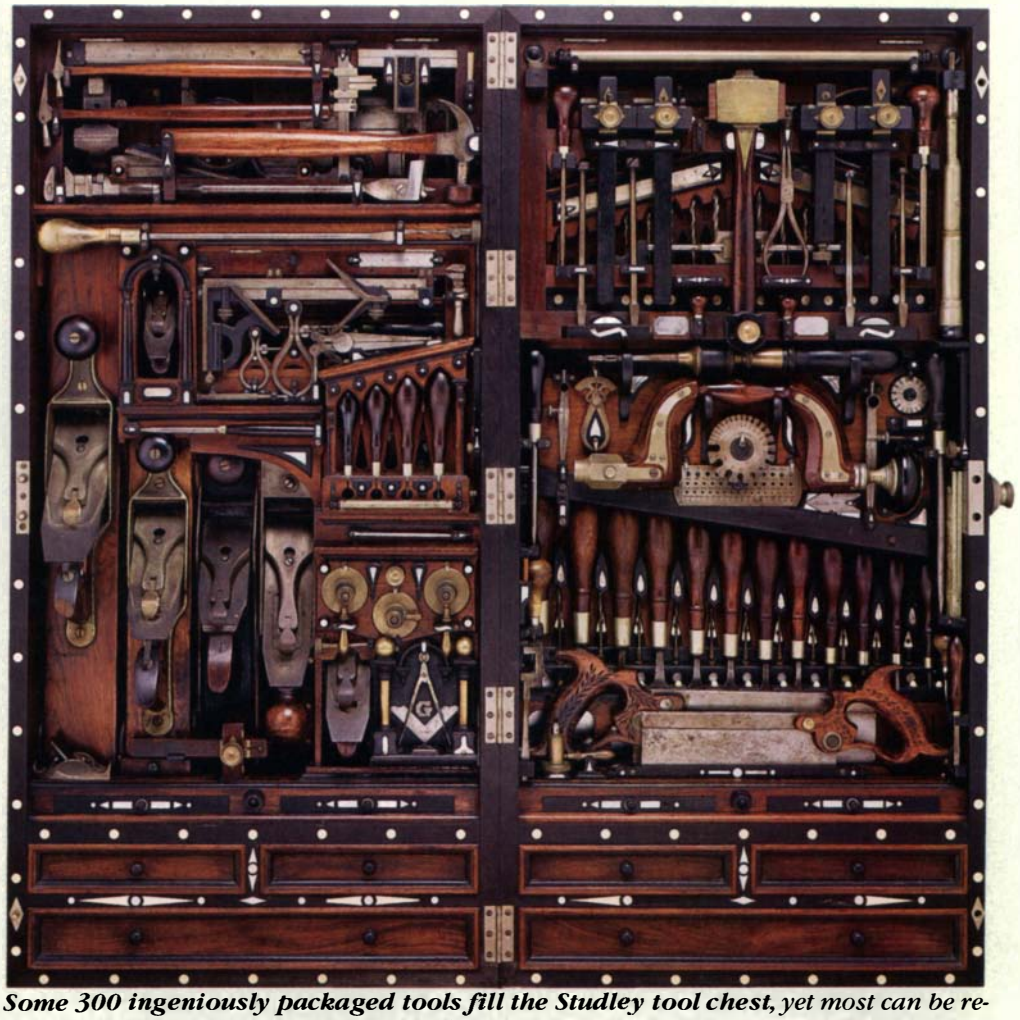
While the Smithsonian's policy proscribes them from declaring a value on anything they exhibit, research suggests the Studley chest's historic value goes well beyond the thousands of dollars its tools might fetch at an auction. There are also plans to do fully dimensioned drawings of the tool chest at some future date. □

William Sampson is executive editor of Fine Woodworking.

Chest holds hundreds of tools

The H.O. Studley chest contains nearly 300 tools, many of them specialty tools and tools Studley apparently made himself. Here is a partial list compiled from an appraisal inventory, beginning in the top left corner:

1. Small machinist's vise.
2. Flat-nose pliers.
3. Small rosewood-handled chisel.
4. Small flat-nose pliers.
5. L.S. Starrett #20 machinist's square, 2 in.
6. L.S. Starrett ruled square, 2 in.
7. Rosewood and steel try square, 4¼ in.
8. Rosewood and steel try square, 7 in.
9. Rosewood and steel try square, 10 in.
10. L.S. Starrett #4 steel square.
11. L.S. Starrett inside/outside calipers, 3 in.
12. L.S. Starrett #490 protractor with rule, 9 in.
13. Small clockmaker's hammer.
14. Large clockmaker's hammer.
15. D. Maydole claw hammer, 4 oz.
16. Coes adjustable wrench, 4¾ in.
17. Wm. A. Clark adjustable auger bit.
18. Horn-handled screw driver.
19. Spokeshave.
20. Set of 10 center bits.
21. Inside calipers.
22. Gunsmith's screwdriver.
23. Stanley #1 bench plane.
24. L.S. Starrett #14 adjustable square, 2½ in.
25. Adjustable wrench, 3 in..
26. L.S. Starrett #300 steel rule, 3 in.
27. L.S. Starrett combination square.
28. Stubs outside wing calipers, 2½ in.
29. Stubs outside wing calipers, 4 in.
30. Waltham jeweler's screwdriver.
31. Stanley #30 bench plane.
32. Stanley #27 bench plane.
33. Stanley #6 bench plane.
34. Stanley #9 cabinetmaker's block plane.
35. Rosewood-handled burnisher.
36. Rosewood and brass adjustable marking gauge.
37. Birmingham Plane Co. thumb plane.
38. L.S. Starrett #203 micrometer.
39. Set of 4 nail awls with rosewood handles.
40. Stanley #4 bench plane.
41. Stanley #9¼ block plane.
42. Whetstone in ebony box.
43. Set of 3 machinist-made center punches.
44. Tap and die set.
45. Set of 5 quill bits.
46. Four assorted bits.
47. Set of 4 piano wire tensioning tools.
48. Embossing tool with ebony handle.
49. Set of 4 rosewood-handled piano action tools (in drawer).



Some 300 ingeniously packaged tools fill the Studley tool chest, *yet most can be removed without removing any other tools.*

50. Chisel with rosewood handle, 7/16 in.
51. Two tools similar to center punches.
52. Four Forstner bits.
53. Ebony and brass slitting gauge.
54. Set of 4 ebony and brass marking gauges.
55. Adjustable mortise gauge of ebony and ivory.
56. Pair of rosewood-handled stub screwdrivers, 1½ in.
57. Needle-nose pliers.
58. Wood-stuffed, brass bound mallet.
59. Set of 11 Russell Jennings bits (2 missing).
60. Set of 10 push drill bits (2 missing).
61. Brass-bound rosewood bevel, 10 in.
62. Brass-bound rosewood bevel, 6 in.
63. Pair of nail nippers.
64. Set of bow-drill bits (inside drill stock handle).
65. Ebony and brass bow drill (bow missing).
66. Plated ebony and rosewood brace.
67. Inside/outside graduated calipers, 2 in.
68. Screwdriver with rosewood handle, 8 in.
69. J. Stevens locking dividers, 4 in.
70. J. Stevens locking dividers, 6 in.
71. Standard music wire gauge.
72. English standard wire gauge.
73. Twist drill and steel wire gauge.
74. L.S. Starrett #425 graduated calipers, 3 in.
75. Wide jaw pliers.
76. L.S. Starrett #287 depth gauge.
77. Rosewood-handled screwdriver.
78. Four-fold ivory rule, 2 ft.
79. Ebony and steel archimedian push screwdriver.
80. Set of 12 Buck Brothers cabinet skew chisels.
81. Set of 11 sleeved bow-drill bits.
82. Cabinet screwdriver with horn handle, 5 in.
83. Adapter for fitting bow-drill bits to standard bit brace.
84. Brass and steel thumb scriber.
85. Small graver with rosewood handle.
86. Small screwdriver with turned horn handle.
87. Back saw with rosewood handle, 8 in.
88. Back saw with rosewood handle, 10 in.
89. Brass frame back saw with ebony handle.
90. L.S. Starrett #300 steel rule, 6 in.
91. Assorted bits and bit holders (in drawers).
92. Seven assorted center bits (in drawer).
93. Stratton Brothers brass-bound, rosewood 12-in. spirit level.
94. Rosewood-handled screwdriver.
95. Rosewood-handled wire-lifting tool.
96. Pair of rosewood-handled felt knives.

Scratch Awl from Scrap

Simple steps produce a beautiful, high-quality tool

by Tom Herold

***Scratch awls** can be made in many sizes and shapes according to the kind of woodworking you do and your tastes. Here's a sampling of the author's collection.*

A scratch awl (or scribe) is an indispensable marking tool, which is capable of striking a finer and more useful line than you can get with a pencil. Beautiful versions of the tool are available commercially but often cost upward of $35. For about a tenth of that, you can make one of your own. The tools you'll need are all fairly common: a woodworking lathe, a 3-jaw or 4-jaw chuck, a drill press, a grinder and a standard propane torch. Once you've made your first scratch awl, and you see how simple the process is, you'll make many more. Besides being fun to make, a scratch awl you've crafted yourself, which can't be matched by any tool you can buy, is satisfying to use.

Making a scratch awl is a great first project in metalworking, but you need to be aware of the hazards. When cutting metal on a wood lathe, remember to use eye protection, keep your hands and clothing out of the way and concentrate on the task.

Selecting materials

Most of the awls I've made have been between 5 in. and 8 in. overall. I like to size my awls to take advantage of standard material sizes, most notably 3/16-in.-dia. steel rod and 1/2-in.-dia. brass rod, to minimize the amount of metalwork I have to do. For the handles, I usually start with 1-in. stock, but sometimes the shaft's length seems to require a heftier handle, in which case I'll go with 1½-in. stock.

For these awls, I used O-1 steel (a high-carbon, oil-hardening tool steel), which can be purchased through many industrial-supply companies. It costs only a few dollars a linear foot. I bought my brass at a scrap-metal yard for $2 a pound. I've also seen brass rod at home-improvement stores, but it's much more expensive. Making these awls also lets me use some of those beautiful scraps I can never throw away, and even if I buy handle stock, I can buy "shorts" from lumber dealers for very little and have the experience of working with an otherwise unaffordable exotic.

Working with metal

Metalworking isn't that much different from working with wood; the material's just harder. I begin by hacksawing a piece of steel rod about 5 in. or 6 in. long and chucking it in my lathe's headstock, making sure the steel protrudes about ½ in. Using the lathe's slowest speed, I file the end of the steel smooth and flat to

Photo: Susan Kahn

ready it for end drilling. Next I chuck a ¼-in. center drill (available from industrial-tool suppliers) into the tailstock of my lathe, squirt a bit of oil on the end of the steel rod and bore a hole in the end, just deep enough to seat the tailstock center, which will support the steel during turning.

Next, to prepare the brass collar, I cut a piece of ½-in.-dia. brass rod ½ in. long and chuck it in the headstock. The brass provides a nice transition from steel to wood. I clean up the end of the brass with a file and then use a skew to get the end flat where it will meet the wood. As with the steel, I use the lathe's slowest speed. After squirting a couple of drops of oil where I'm drilling to lubricate and cool the cut, I center drill the brass to the same diameter as the steel shaft.

I remove the brass from the lathe, clean it and the steel *thoroughly* with lacquer thinner and slide the steel through the brass. It's essential to remove all oil and dirt from both steel and brass; if you don't, you won't get a good solder joint. I leave enough steel on the handle side of the brass to form a tang, which will seat well in the handle. I leave enough steel on the other (center drilled) end for the shaft plus a little extra, which I'll cut off after tapering the shaft. I use a propane torch and regular pipe solder, making sure I get a good flow of solder on both sides of the brass. I don't worry about any excess solder now because I'll clean it up during the next operation.

I rechuck the brass in the headstock and support the center-drilled end of the shaft with the tailstock. Then I clean the solder joint with a metal file and shape the brass with a skew. Next I taper the steel shaft with a fine mill file, leaving just enough metal at the point for support—usually about 3/32 in. thick. This seems to take forever, but it's really only about 10 minutes. I sand next, from about 220-grit down to 2,000-grit (very fine abrasive papers are available at most auto paint shops), which gives the shaft a nice finish.

I reverse the awl in the chuck (chucking the brass collar), so the tang is exposed. I clean the tang side with a file and skew just as I did the other side, making sure the brass is flat and perpendicular to the steel rod, to ensure that the handle seats at the collar. I rough up the tang with a file to promote good adhesion and file a portion of it flat to ensure the handle won't rotate on the shaft.

Making the handle

When picking wood for handle material, I look for interesting figure, dramatic color or just plain beautiful wood. To prepare the handle blank for turning, I get one end flat and smooth, and then I drill a hole in the middle of that end deep enough for the tang and about 1/32 in. larger in diameter. The extra space prevents the joint from being glue starved. After cleaning both steel and brass with lacquer thinner, I epoxy the handle to the shaft. If I can spare my lathe for 24 hours, I'll do it with the awl still in the chuck. Once the epoxy has cured, I turn the awl's handle to its final form.

I take it slowly when turning the handle. Although it's not easy to break the glue joint, it is possible. Sometimes I use the tailstock to keep the handle turning true until it's pretty much roughed out. Once the handle is close to the desired shape, I remove the brass collar from the chuck, back the awl out a bit and chuck the shaft. This gives me room to clean up the brass and get a good transition from the handle to the brass.

Once I'm satisfied with the handle's shape, I sand it smooth and finish it. I've used shellac, linseed oil and Formby's tung oil finish. It all depends on what look you like. My dad insists that the best finish for a wooden tool handle is just plain wax. I can't argue with that. With the handle finished, I take the awl out of the chuck, put the center-drilled end of the shaft in a vise and, using a hacksaw, cut off the tip that extends beyond the taper.

Tempering and sharpening the shaft

The final steps in making the awl are tempering and sharpening the end of the shaft. Tempering is a two-stage process: hardening and drawing. To harden the steel, use your propane torch to heat the end of the awl to a cherry-red (or glowing red) color, just after it's gone through dull red. I hold the awl by its handle with one finger just touching the steel near the handle, and place the end of the shaft (back just a bit from the point) into the tip of the flame. As soon as the end of the shaft becomes cherry red (and before the shaft gets too hot to touch), I quickly place the shaft into a nearby can of motor oil.

Quenching the steel in oil like this will bring the temperature of the steel down rapidly, making it extremely hard and brittle—almost like glass. Because it's far too fragile for use at this point, I have to remove, or "draw," some of the brittleness from the steel by heating it up again. But this time I heat it only until it reaches a light straw color—about 430° Fahrenheit. Before I heat it up again, though, I clean up the shaft with very fine abrasive paper—1,000-grit—so I can see the color of the shaft when I do reheat it. Then I position the tip of the awl well above the flame and move the shaft, in and out of the heat. Once the shaft starts to change color, the process goes very quickly. So carefully watch for the steel to start to take on the light straw color, and be prepared to plunge the blade into the motor oil immediately.

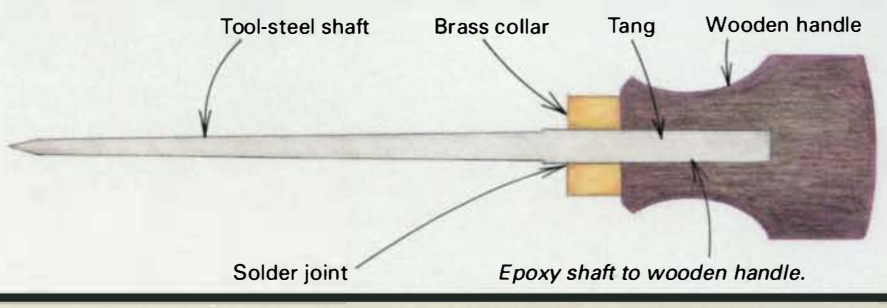
If all this talk of *cherry red*, *dull red* and *light straw* sounds a bit daunting, don't worry. Temperature-indicator cards are available wherever welding supplies are sold. They show spectrums of color in correlation with temperatures and allow you to hazard a fairly accurate guess as to the temperature your steel has attained.

Finally, I sharpen the awl's shaft on a grinder. It's easy and virtually foolproof, just like sharpening a pencil on a belt sander. But then again, none of us have ever done that. □

Tom Herold is an aerospace engineer who works wood for pleasure. He lives in Colorado Springs, Colo.

Anatomy of an awl

Simple to make and a pleasure to use, scratch awls are a good first toolmaking project. Basic turning skills are all you need to make the awls' three components (shaft, collar and handle), and epoxy and a bit of solder join the components.



Drawing: staff

Setting Up Shop

Three pros give advice on outfitting a first shop

What tools do you need to set up a good basic shop to make functional furnishings you can be proud of? That's the question I posed to three accomplished woodworkers—and teachers of woodworking. Independently, each affirmed the importance of both accurate, reliable power tools and high-quality hand tools in the modern woodworking shop. Though sometimes contradictory, the advice they offer is surprisingly consistent. And where it varies it's often because of their different backgrounds and the kinds of work they do.

Peter Korn was a professional furnituremaker for 12 years and taught furniture design at Drexel University for four of those years before becoming director of the woodworking program at Anderson Ranch Arts Center in 1986. He has written numerous magazine articles and newspaper columns on woodworking, and his book, *Working with Wood: The Basics of Craftsmanship*, was published by The Taunton Press in April. Korn left Anderson Ranch last December to start his own woodworking school, the Center for Furniture Craftsmanship, which is in Hope, Maine. The school offers two-week courses for basic and intermediate woodworkers.

Mario Rodriguez is a cabinetmaker and 18th-century woodworking consultant. He's been making 18th- and 19th-century reproductions for the past 12 years, specializing in Windsor chairs. He has been adjunct assistant professor of woodworking for the Fashion Institute of Technology's antique restoration program for the past five years and has lectured at the Brooklyn Museum, the Cooper-Hewitt Museum, Sotheby's, the Royal Oak Society and for other groups interested in Early American woodworking. He also teaches at Warwick Country Workshops in Warwick, N.Y. Subjects taught have included planemaking and use, dovetailing and veneering.

Mark Duginske, a contributing editor to *Fine Woodworking*, is a fourth-generation woodworker. His books include *The Band Saw Handbook*, *Band Saw Basics*, *The Band Saw Pattern Book*, *Precision Machinery Techniques* and most recently, *Mastering Woodworking Machines*, which was published by The Taunton Press last year. He has also done two videos, one accompanying his most recent book and the other called *Mastering Your Bandsaw*. His restoration work on the Frank Lloyd Wright home and studio in Oak Park, Ill. has been featured on *This Old House* and PBS's *Frank Lloyd Wright* special.

Although workshops are as individual as their owners, there's a common thread of good sense in the suggestions these three teachers and woodworkers have to offer. If you think we've forgotten something, though, or if you'd just like to comment on the subject of setting up shop, drop me a line. I'd be glad to hear from you. □

Vincent Laurence is associate editor at Fine Woodworking.

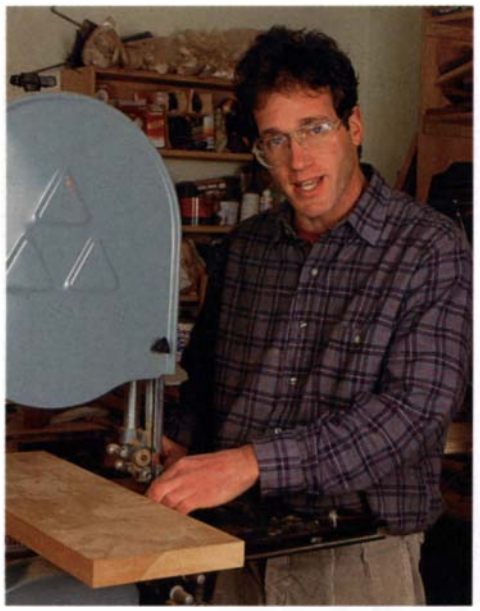
***It takes time, money and good sense** to outfit a complete shop, but the principles involved are simple: Buy the best you can afford, cultivate hand-tool skills and acquire machines to perform those tasks for which they're best suited—the brute work of getting stock square, true and to size.*

Photos: Vincent Laurence

Peter Korn: Building a foundation for a lifetime of craftsmanship

Every year I teach classes in basic woodworking, and every year the students want to know which tools they should buy to set up their first workshop. The answer, of course, depends upon what they want to make and how. I teach the skills necessary for building fine furniture, emphasizing the use of machinery for milling rough lumber foursquare and hand tools for cutting joinery and smoothing surfaces. Machinery and hand tools are complementary aspects of a contemporary fine furniture workshop.

Whether you're setting up a home workshop or starting a small woodworking business, you should acquire the same basic equipment. In neither case should you stint on quality. Good tools may not ensure good work, but poorly made, undersized or underpowered tools will adversely affect both your results and the pleasure you take in the work. Unlike most consumer items, whose obsolescence is engineered in, good woodworking hand tools and machinery will last a lifetime and beyond; if you buy the best from the start, you'll only have to buy once. In general, I consider Delta and Porter-Cable to be the minimum acceptable standard against which the quality of other power tools should be measured.



"Machinery and hand tools are complementary aspects of a contemporary fine furniture workshop."

Power tools

If I could have only one piece of machinery in my workshop, it would be a bandsaw. This versatile tool can do anything from the brute work of resawing a 6-in. hardwood beam into planks to the delicate work of cutting the curves for a cabriole leg. With a bandsaw, handplanes and a little sweat, rough lumber can be milled perfectly foursquare. A 14-in. bandsaw is the standard size for most home and small professional shops. You should expect to pay around $700.

The truth is, though, I wouldn't consider getting started without a tablesaw, jointer and thickness planer if I could possibly afford them. Straight, flat, square stock is vital to well-crafted furniture, and these three tools work together to make the milling process easy.

The tablesaw is useful for many other tasks as well, such as making dadoes, tongues, tenons and miters. I recommend buying a good 10-in. tablesaw with a 3-hp motor, such as the Delta Unisaw, which will cost you around $1,500. If you try to save money by purchasing a smaller saw or a weaker motor, you will be itching to upgrade in no time at all.

I started my own shop with a 6-in. jointer, but if I had to do it over again, I would purchase an 8-in. jointer or an even wider one. Those extra inches of cutterhead width significantly reduce the number of boards you will have to flatten with handplanes or saw apart, joint and reglue because they are too wide for the jointer. A good 8-in. jointer will run you approximately $1,500.

My first planer was a 12-in. Parks, sold by Sears in 1952. I found it abandoned and in pieces in the corner of someone's shop in 1977. While it's not a huge machine, it's been fine for me as a one-off furnituremaker. If I were buying a planer today, I'd stay away from the myriad of lightweight, portable offerings and get something built to last. I've heard good things about the Makita, Hitachi and Delta DC-33 stationary planers. Expect to pay upward of $1,300 for a solid 13-in. planer.

I've also heard good reports from students about some of the better jointer/planer combinations, such as the Robland and the Minimax, but I haven't tried them. Combination jointer/planers may be a good idea for woodworkers with little shop space and/or limited budgets, but separate machines provide an element of convenience I would hate to forego. I am constantly moving back and forth from jointer to planer, so pausing to change one into the other would slow me down considerably. Though I've only used separate machines, I also suspect that they hold their settings more dependably than do the combination machines.

A drill press, for accurate, straight boring of holes, is the final piece of stationary power equipment essential to a woodworking shop. The size of the drill press isn't all that important, and variable speed isn't really necessary either. Any drill press will do as long as its run-out is minimal, it has an adjustable depth stop and the table is square to the quill. A satisfactory drill press can be had for $300.

Other stationary power tools that are useful but secondary in importance are a lathe, a radial-arm saw or chop saw, a compressor and a belt/disc sander. A vacuum system makes a shop more pleasant to work in, but a dust mask and a broom probably make more fiscal sense—especially when you're just getting started.

Other power tools

Among smaller and portable power tools, I would purchase a grinder, drill and router straight off. A circular saw, jigsaw and biscuit joiner can wait, as can palm, belt and random-orbital sanders.

A grinder is indispensable for keeping chisels and planes sharp. You can get a cheap one for about $50, but if you can afford to—and they're substantially more expensive—you should buy a grinder that spins at about 1,750 rpm, rather than the standard 3,200 rpm to 3,400 rpm. A slower grinder is less likely to overheat steel and destroy its temper.

A router is perhaps the most versatile tool in the shop. A small router with a ¼-in. collet is perfectly adequate for a small shop. My first choice would be Elu's 1-hp variable-speed plunge router, which features a soft start. It is a sweet little machine—just a pleasure to use, and at about $170, it is a very good buy.

My first portable power drill would be a ⅜-in. variable-speed, reversible model. One of its main functions would be to drive drywall screws when building jigs and fixtures in the shop. Milwaukee makes some of the most reliable drills, but they're also among the most expensive—about $120 for the model I recommend.

Hand tools

While you may not think of it as a hand tool, the workbench is where most of your handwork takes place. It may well be your single most important tool. A good workbench should have a flat top, be sturdy enough to take a pounding and not wobble. The bench should also have both tail vise and shoulder vise or the equivalent. If you can't afford to buy a good European workbench (about $1,200), building your own bench should be one of the first projects for your new shop. You can find the bench hardware for about $115.

I've found the following hand tools to be indispensable. I've explained briefly what each is used for as well as what you should expect to pay for a good tool, assuming you shop smart.

Folding rule and a tape measure. My favorite measuring device is a 6-ft. Lufkin Red End carpenter's rule with extension slide. It's durable, handy and accurate. $18 (for the folding rule) and $14 (for the tape).

Square. I use several squares regularly: a 4-in. engineer's square, a 6-in. try square and a 10-in. try square. If I had to settle for only one square, it would probably be either a 10-in. or 12-in. try square. $25 (for a 10-in. try square).

Sliding T-bevel. Indispensable for marking out dovetails and angles. $14.

Mat knife. For many purposes including marking out joinery. $4.

Chisels. I recommend buying a set of durable, plastic-handled bench chisels, such as Marples Blue Chip, in sizes ¼ in., 5/16 in., ⅜ in., ½ in., ¾ in. and 1 in. $45.

Shop environment

A good shop environment is as important as which tools you buy. Adequate lighting is essential, and a window can help keep a small shop from feeling like a prison cell. One of my first workshops was a dark, 150-sq.-ft. concrete basement where I had to stoop to duck pipes and beams—it was depressing. My next shop was a one-car garage (200 sq. ft.), then a two-car garage (400 sq. ft.), then a storefront in New York's Little Italy (250 sq. ft.) and, at last, a 1,200-sq.-ft. loft in an old factory. Based on experience, I'd say the smallest comfortable size for a woodshop is 400 sq. ft., although I would choose to make furniture in a smaller space rather than not at all. *—P.K.*

Handplanes. The first two I'd get are a block plane and a jack plane. The block plane is for planing joints flush, planing across end grain, fairing convex curves, and breaking edges. The jack plane is for flattening wide roughsawn lumber and for smoothing machined surfaces. $45 (block plane) and $73 (jack plane).

Marking and mortising gauges (or a combination gauge). For marking mortises, tenons, dovetail shoulders and for marking stock to be resawn. $34 (for a combination gauge).

Hand scraper. For smoothing surfaces. Sandvik makes the best. $7.

Backsaw. For cutting joinery. I use a small, inexpensive saw with a 10 in. by 1⅝ in. blade. Its 21 tiny teeth per inch leave a very thin kerf. $13.

Coping saw. For removing waste when cutting dovetails and for sawing interior curves. $14.

Awl. For marking pilot holes. $7.

Wooden mallet. For driving chisels. $14.

Hammer. For a multitude of uses. $16.

Twist drill bits. From 1/16 in. to ½ in., by 64ths. $48.

Brad-point bits. From ¼ in. to ½ in. by 16ths, plus ⅝ in. and ¾ in. $40.

Half-round rasp and wood file. For smoothing curves and shaping edges. $16 and $14.

Mill bastard file, 8 in. For scraper preparation and for odd bits of metal filing. $6.

Water stones, 1,000-grit and 6,000-grit. For sharpening chisels and plane blades. $47 for the pair.

Clamps. I recommend buying six 2½-in. C-clamps, six 12-in. quick-action clamps, six 24-in. quick-action clamps, and six 4-ft. bar clamps. About $275.

Although $6,500 or so (a rough total) may seem like a lot of money now, it is almost a negligible sum when amortized over a lifetime of pleasure, productivity and value. Buying good tools to start with and making sure that they're the right tools for the job, will get you off to a good beginning on your career as a craftsman.

—Peter Korn

Mario Rodriguez: Quality hand tools and a few machines—a good start

When you decide to set up shop, you're immediately faced with decisions about space, equipment and tools. As your skills and experience grow, so will your collection of tools. But, to get you started, here's a good basic kit.

My suggestions are heavy on hand tools because I believe in a strong foundation of hand skills. But a combination of hand tools and machines enables a woodworker to achieve speed *and* practice a high level of craftsmanship.

Stationary power tools

Bandsaw. If I could have only one or the other, I'd choose a bandsaw over a tablesaw. Bandsaws are cheaper, take up less floor space, can resaw and cut curves and are considerably quieter than the tablesaw. With a good, well-tuned machine, the quality of cut is excellent. And while it's true that a bandsaw's rip capacity is limited to its throat size, a resourceful woodworker can work around that. You can get a good bandsaw (the Delta 14 in., for example) for as little as $650.

Jointer. Buy the best and largest jointer that you can afford. A jointer is useful for cleaning up edges cut on the bandsaw, straightening and squaring edges for gluing, and for flattening boards. The Delta 6 in. sells for about $1,100.

Sliding compound miter saw. This saw is invaluable for clean and accurate crosscuts and miters. The sliding-arm feature lets you crosscut up to 12 in. wide (like a small radial-arm saw). Look for a model that takes a 10-in. blade instead of an 8½-in. blade. Not everyone carries 8½-in. replacement blades. I like Makita's version, which sells for around $450.

Portable power tools

Router. You can do it all with this tool: dado, rabbet, mortise, joint or shape an edge, or follow a template. Porter-Cable's ⅞-hp router is a good value at $110.

Drill, ⅜ in. In addition to using it to drill

holes, you can also use it for driving screws, light grinding and polishing. A basic unit can be had for $50.

Hand tools

Chisels. Buy a good set of wooden-handled bench chisels (¼ in., ½ in., ¾ in., 1 in.) and a ¼-in. mortise chisel. Wooden handles are more comfortable and more visually appealing than plastic, and if ever they split or get chipped, you can replace them with little effort. I prefer traditional Western chisels (mine are made by Sorby) as opposed to Japanese chisels, which I think require too much work, especially if you're just getting started in woodworking. If you can afford to, buy a 2-in.-wide bench chisel in addition to the four smaller ones. Its extra-wide blade is ideal for paring tenons. A set of four Sorby chisels costs about $80, the mortise chisel about $30 and the 2-in. paring chisel about $40.

Sharpening stones. I prefer waterstones because they're cleaner than oilstones. I use 800-, 1200-, 4000- and 6000-grit stones.

Combination square, 12 in. This tool will mark out stock at 90° and 45° and can double as a ruler and a marking gauge. Buy the best you can afford: Starrett and Browne & Sharpe are both good brands. You can find the Starrett for about $50.

Engineer's square, 3 in. This is great for marking out and checking small parts and edges. It's smaller and handier than the combination square and generally more accurate. You can get a 3-in. engineer's square for around $5.

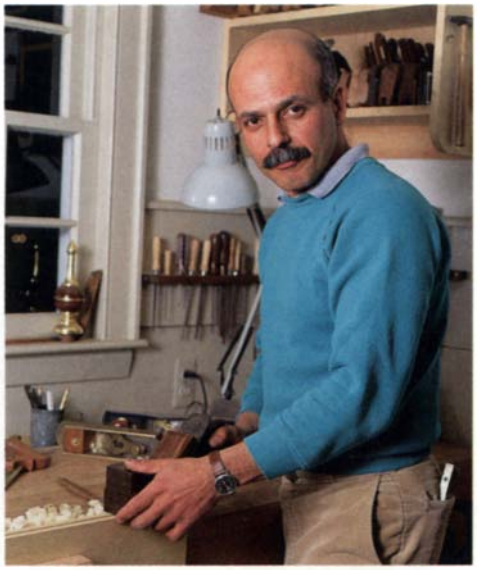
Sliding bevel. This is an essential layout tool used for setting and copying angles. Shinwa makes a compact and inexpensive version (about $10).

Hammer. A good 13-oz. claw hammer is ideal for general cabinet work and is useful for installation work as well. I use a one-piece, leather-handled Estwing, which costs about $18.

Carver's mallet. This is useful for driving joints home and for chopping out mortises. I like a medium-sized turned lignum vitae mallet. Expect to pay about $15.

Marking gauge. I use a compact version made by Reed, which, unfortunately, is no longer in production. It's simple, keeps its setting and has a removable (and replaceable) blade for easy sharpening. Starrett makes a very similar gauge (their #29A) for around $30.

Marking knife. I use a pointed chip-carving knife for marking joints. Its slim, pointed tip lets me scribe a good line even in very tight spots, and the shape of the blade allows me to apply pressure for a deeper cut when needed. Less than $10.



"A craftsman's training should be based on a strong foundation of hand skills."

Folding rule, 6 ft. I prefer a ruler over tape. I find it more accurate for cabinetwork, particularly when measuring inside cabinets and checking diagonals. Lufkin's Red End is the best and costs about $18.

Dovetail and tenon saws. For cutting small pieces, I use an 8-in. dovetail saw with a turned handle and 18 teeth per inch (t.p.i.). I use a 10-in. brass-backed dovetail saw with 14 t.p.i. for cutting dovetails and tenons. Japanese saws will also do a great job, but they can require delicate handling, and replacement blades are often expensive. Expect to pay about $10 for the dovetail saw with the turned handle and about $40 for the brass-backed model.

Block plane. I recommend the Lie-Nielsen block plane, either the low-angle or the regular. Solid, compact and well-made, it's the best block plane on the market. A block plane is useful for planing small parts, flushing surfaces and planing end grain. It sells for $75.

Smoothing plane, #3. A smoothing plane is used for final planing of surfaces as well as for shooting edges on short pieces and for fairing joints. I don't care for any of the smoothing planes on the market for under $100; they're just not made as well as they used to be. I think a reconditioned Stanley, pre-1940, is your best value. I got mine from Tom Witte, an antique tool dealer (P.O. Box 399, Mattawan, Mich. 49071; 616-668-4161). Expect to pay from $60 to $85 for a good used #3.

Rabbet plane. There are several planes that fit the bill, but the Stanley #93 is the most versatile because its front half can be removed to convert it to a chisel plane. This plane is used to trim rabbets, plane into corners and trim joints flush. It costs about $80.

Cabinet scraper. I use Sandvik scrapers. They're inexpensive, work well and last forever (I still use one I bought over 14 years ago). Scrapers are good for smoothing hardwood and veneered surfaces, either before or in lieu of sanding. You can get a Sandvik scraper for about $6.

These tools are just a beginning. I've tried to keep the list short both to keep your initial outlay of cash from getting out of hand and because it's a good idea to become comfortable and familiar with the basics before adding to your collection. Just remember: Buy the best tools you can afford, take care of them and keep your blades sharp. *—Mario Rodriguez*

A basic kit of hand tools doesn't have to cost a fortune *or take up a lot of space. Here, with some changes and additions, is Mario Rodriguez's basic kit. The chisel handles (and the brass-backed dovetail saw's handle) are all replacements made by Rodriguez.*

Mark Duginske: Buy the basics, and know when not to compromise

Setting up shop takes money, but it also takes time, thought and energy: a room full of tools doesn't make a shop. It's important to reach a point of critical mass, though, having all the tools you need to do a job adequately. And while you don't want junk, you're better off with a shop full of inexpensive tools that allow you to get the job done than only one high-quality tool that leaves you stuck. At the same time, I believe, you're better off buying a good tool and buying it once. The trick is to know when a tool is good enough.

Tablesaw

The tablesaw is at the center of more shops, both figuratively and literally, than probably any other machine. This is partially because of the now ubiquitous use of sheet goods, which the tablesaw alone among stationary woodworking equipment is able to cut down to size. But it's also because the tablesaw can rip stock far more cleanly than the bandsaw and more safely than the radial-arm saw.

Your choices for under $1,000 are the Taiwanese contractor's saws (sold under more names than I can keep up with) and the Delta contractor's saw. The Delta is well-made, easily adjustable and it holds its adjustments well. The problem with the Taiwanese saws is their inconsistency. Some are fine out of the box, but I've also seen one on which it was impossible to align the blade with the miter-gauge slot without disassembling the saw and filing out the trunnion holes. On other Taiwanese tablesaws, I've seen the finish on the inside of the miter-gauge slot as rough as a file. If you take the time to expand your miter bar to fit the slot tightly (either with a prick punch or by peaning the bar), the adjustment will wear away very rapidly by the rough side wall. If you're going to buy a Taiwanese saw, buy it from a local dealer, and check it out before any cash changes hands.

Two of the best used tablesaws are the Inca 259 and Delta's old 9-in. contractor's saw. Both are excellent machines; if you see one for a reasonable sum, jump on it. Another excellent used saw is the Delta tilting arbor saw, which had cast-iron wings like the Unisaw, but an open base like the contractor's saw.

Bandsaw

If you can afford only one really good tool, make it the bandsaw, especially if you'd like to do restoration work or any kind of work that requires curve cutting. There are only two choices for an affordable first-rate bandsaw: the Inca 340 and the 14-in. Delta. Both are fine pieces of equipment and each has its strengths. The Inca weighs only 60 lbs., which makes it quite portable. Also, with its optional micro-adjuster, it's well-suited for joinery, such as cutting tenons and dovetails. The Delta's strength is its resaw capacity, which, with the optional riser block, is 12 in.

As for used tools, I'd look for a 14-in. Delta or an old Sears with a tilting table.

"Setting up shop takes money, but it also takes time, thought and energy: a room full of tools doesn't make a shop."

Saws for crosscutting

If you're doing more carpentry-type construction or you're just doing a lot of crosscutting, particularly of long pieces, then you should consider buying a radial-arm or a sliding-compound miter saw, which has replaced the radial arm for most contractors and for many—if not most—woodworkers. The sliding-compound miter saw has no rip capability, but it can crosscut up to 12 in. on most models and can cut accurate 45° and other miters as well as compound angles. These saws are portable, and their simple design keeps them surprisingly accurate.

Jointers and planers

The Ryobi and some of the other small planers have transformed the small shop by bringing the price of a planer into the range of most woodworkers' budgets. Along with a 6-in. jointer and a contractor's saw, anyone can afford to dimension his own stock now. Bring a reliable straightedge with you to check the beds when shopping for a jointer. A jointer is a precision-oriented tool, and its beds must be flat and parallel.

A combination jointer/planer is another affordable way to set yourself up to prepare stock. Hitachi, Inca and Robland make very good jointer/planers.

Gadgets and gimmicks: beware

Hand-tool skills and basic power-tool savvy are a woodworker's best foundation. A disturbing trend I've noticed in the past few years, primarily at woodworking shows, is the number of beginning woodworkers buying gadgets and gimmicks rather than investing in solid, basic tools. Granted, the basic power tools represent a more significant investment, but these jigs, fixtures and whatnot that promise to deliver flawless joinery with no effort are only distractions that insulate novice woodworkers from acquiring basic hand skills and mechanical knowledge.

The combination of hand-tool skills, a router and some medium-sized, well-tuned decent equipment will allow you to do just about anything. You may not get it done as quickly as if you had each one of Delta's industrial tools, but you will be able to do a variety of quality work without spending a ton of cash on equipment.

Buying tools is only part of becoming a woodworker. The other ingredient is skill, which is purchased with time and determination. Each tool—whether power or hand—has its own learning curve. The current trend—to learn machine woodworking before developing hand-tool skills—is backward. Compounding this problem, or perhaps causing it, is that we as a culture are so goal-oriented that we have to make things right away rather than playing with a tool and getting to know it. It's possible to develop the same kind of intimacy with power tools as you develop with hand tools, but it doesn't happen when you're in a mad rush to finish a project. Traditionally, knowledge was gained by continuous repetition during an apprenticeship period. Today, experimentation and practice are the best ways to learn. But there are no shortcuts—no matter how much you're willing to pay.

—Mark Duginske

Sofa Table Complements Antiques

This eclectic design blends styles and joinery

by Gene McCall

***By skillfully combining mahogany and glass,** Gene McCall met his clients' need for a sofa table that fit aesthetically within a room of mixed styles. To do this, McCall designed the piece with a variety of decoration, like the corner fret detail (below).*

When a husband and wife asked me to design a sofa table for them, I knew that the piece would have to go with the other furniture in their living room and fit easily into the context of their home. The room in question was decorated with an eclectic mix of formal 18th-century American and English antiques. The imposing look of the room was softened by colorful floral fabrics and oriental rugs, as well as by a contemporary coffee table. Even the house itself was eclectic architecturally. Because of these things, I decided that the sofa table should incorporate different design motifs (see the photos on this page) and joinery that would harmonize with the restrained elegance of the home and its furnishings.

Design and materials

Aside from lovely wood and a rich finish, I felt the real snap of my clients' sofa table should come from details, like delicate moldings and lively frets. The design I arrived at (Chinese Chippendale in spirit) blends well with most any room featuring English or American period furniture.

In the corner of my shop was a particularly lovely piece of highly figured mahogany with wild dark grain streaks. It was ideal for the table's lower shelf. To make the shelf more visible and also to help maintain a feeling of lightness about the table, I chose to inset the tabletop with three pieces of glass. This meant I needed to finish the aprons and corner frets inside and out. For the aprons, moldings, legs and top-frame parts, I selected pieces of straight-grain mahogany.

I cut all the pieces to rough width and length, leaving extra length for end tenons. After I squared all edges to their faces, I thicknessed the pieces. I cut the leg mortises and apron tenons and drilled and countersunk holes in the aprons (see the drawing on p. 65) for screwing on the top and shelf.

Shaping the legs

To create the profile on the outside corner of the leg faces, I first shaped the corner bead. I adapted a cutter by grinding down

a standard ¼-in. beading cutter until each shoulder came to a point. Beading the legs required only one depth and one fence setting, but I had to make four passes for each leg: two passes (each in a different direction) for the center bead and one pass each for the two other corner beads. Although I used my shaper to do this, a router table would also work.

I used similar multi-step cutting to form each face's swell. Using two passes, I

***To cut chamfers with a jointer,** McCall clamps a stop on the outfeed table, tilts the fence to 45°, sets the infeed side for a full cut and passes the leg corner over the cutterhead up to the stop. Once the chamfer's ending arc is cut, he backs and lifts the leg off.*

***Rabbets cut on the shaper** connect the tabletop's crosspieces to rails. Using rabbet-and-dowel joinery in the top frame allows McCall to inset the glass panels easily and precisely. He drills the dowel holes before rabbeting the rail edges and crosspiece ends.*

shaper-cut two curved flutes to form a gentle crest in the middle of each face. Again, single depth and fence settings did the trick. A couple of passes with a block plane, followed by hand-sanding, rounded off the center crest of the swell. Finally, I cut off the leg blanks' tops and bottoms.

To lighten the legs visually, I chamfered the inside corner of each from the floor up to a point slightly below the frets. To cut the chamfer and its graceful lamb's-tongue-like arc, I pressed my jointer into unusual service. I carefully marked and taped (to prevent tearout) each leg where the chamfer ends in the upper leg. Then I clamped a stop block to my jointer's outfeed table the same distance from the cutterhead. Finally, I set the jointer's fence to 45° and the infeed table to the chamfer depth. Because depth of cut is critical, it's a good idea to make a few trial passes on a scrap of 1⅞-in.-sq. stock before you risk your good wood. For safety, make sure the test piece is at least 16 in. long. Once your jointer is adjusted properly, slowly feed each leg until the end butts the stop (see the top photo). Back the piece off an inch or two from the stop, and lift the leg from the jointer.

Preparing the shelf and apron

After cutting out the shelf to dimension, I routed the half-round on the shelf edges. Next I made a ⅛-in.-thick plywood template to lay out where the legs would meet the shelf corners. I sawed along the shelf's marked off corners and edges, while checking to see that each cutout fit against the chamfer of the corresponding leg.

I fit the under-shelf aprons and corner blocks next. Each end of the apron meets at a 45° angle to fit the leg chamfer and is mitered to fit the adjoining apron. I secured the aprons and corner blocks to the underside of the shelf and drilled holes in the corner blocks to accept screws that fasten each leg.

Framing the tabletop for glass

The table's three pieces of ¼-in.-thick plate glass are inset within a top framework rabbeted and doweled together. The frame's rail-to-crosspiece joinery is the same for the ends and the intermediate crosspieces. I marked and bored dowel holes in the ends of all four crosspieces and in the inner edges of the rails where the crosspieces join. By doing this now instead of waiting until the glass rabbets have been cut, you avoid the nightmare of trying to drill into a profiled edge. After I dry-assembled the parts with the dowels to check their fit, I shaper-cut the ¼-in.-deep, full-length rabbets for the glass. I also cut the mating rabbets in the ends of the crosspieces (see the bottom photo). Again, I dry-assembled the entire frame, so I could check the joints before gluing up.

After I removed the clamps, I shaped the frame's outside bead (the same size as the one in the legs) and the curved edge leading to the bead. The coved molding, which goes under the bead, should not look applied, but instead, should appear integral to the tabletop. To achieve this effect, I extended the molding underneath the top, which also let me easily glue and screw the molding to the underside of the frame.

When sizing the glass for the inset in the frame, don't go by the opening sizes. The length and width of the glass will actually be ½ in. larger to allow the glass to rest on the rabbeted edges. Because the glass is not retained by applied moldings, the inset fit is critical for appearance. To get a precise fit (no more than 1/16 in. between the glass edges and the wood), I cut out paper templates for the three glass pieces. Instead of ordering the plate sizes from a glass shop, I sent the templates to a glass factory, which furnished me glass with 90° polished edges. Before I inset the sections of glass, I darkened all the edges with a walnut-colored design marker. Darkening the edges makes the inset look neater.

Marking and carving the frets

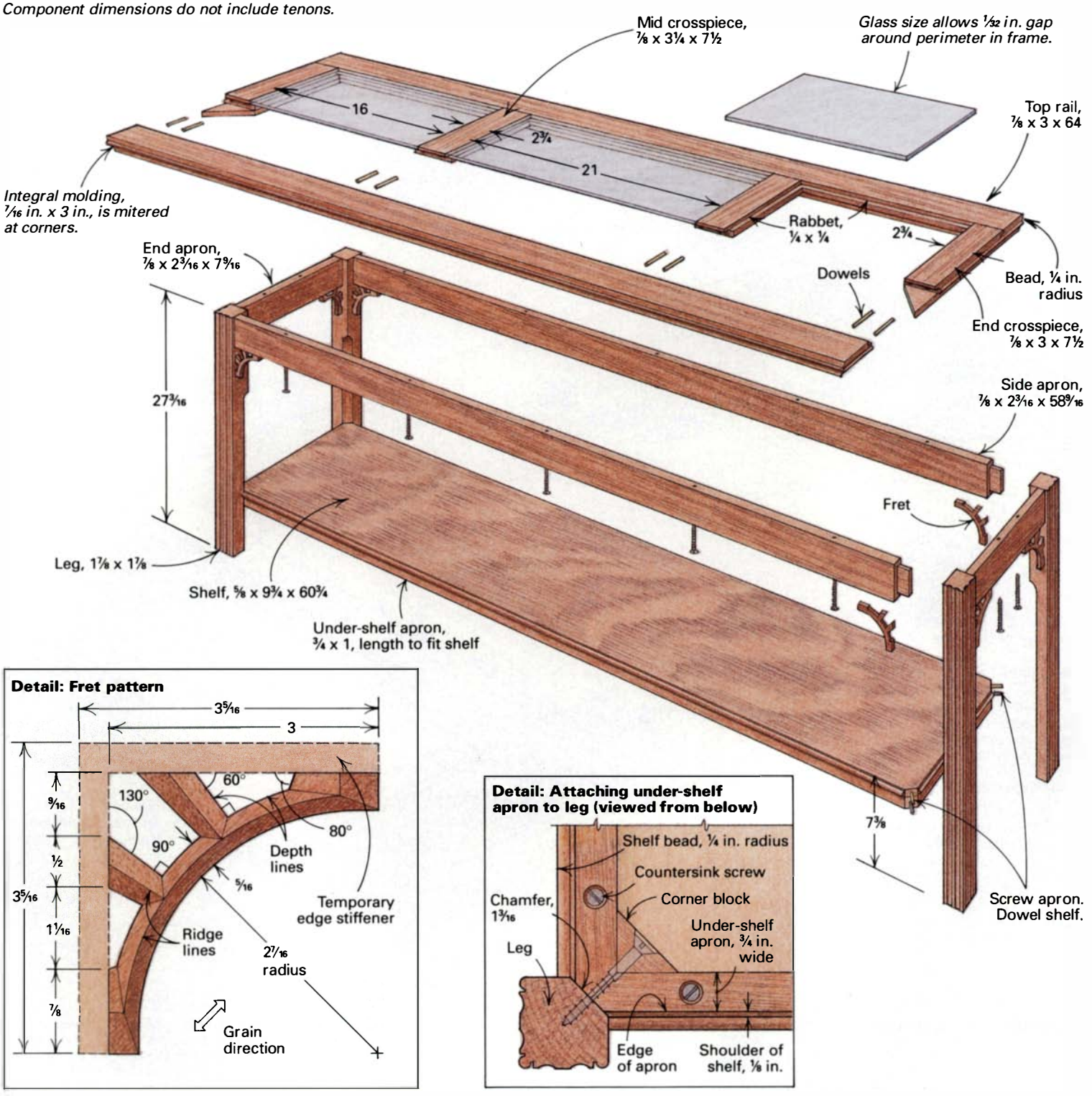
The ⅝-in.-thick frets, which visually brace the leg-to-tabletop corners, are made of solid mahogany. Before I cut out the frets, I made a template from ⅛-in. birch plywood. The template extends past the actual fret pattern (see the drawing detail); once the shape is cut from mahogany, the extra wood at the edges reinforces the unsupported fret spokes. These edge stiffeners strengthened each fret while I was sawing and carving its shape.

I traced the template onto eight pieces of mahogany that had the grain running at a 45° angle to the edges. I then cut the frets' corners square. (If the leg-to-apron angle is not exactly 90°, fitting the frets will be difficult.) I bandsawed the frets' outer curve, and with scroll and coping saws, I cut away the interiors, leaving the edge reinforcement intact. Because the frets must be carved in pairs with their grain opposing (four left and four right), I marked the front face of each. Next I drew ridge and depth carving guidelines on all the front faces. Much like the roof of a house, the ridge line describes where the two sloping faces of a fret spoke meet; the depth lines indicate the bottom of each slope.

While carving the frets, be mindful of short-grain and the inherent delicacy of the fret spokes. I've found that gently paring away thin slices of wood with a razor-sharp chisel is best. Once I carved all the frets, I sanded them smooth. Then, to remove the edge stiffeners squarely, I used my tablesaw as follows: First, I set my Accu-Miter gauge to 90° and positioned its fence close to the blade (because the fence supports the work right up near the cut, I didn't have to use a hold-down, which might fracture the delicate spokes). Then, holding the piece tight to the fence with my hands well clear of the blade, I cut an edge stiffener off each fret. It's best to make the cut in a few passes, as you grad-

Sofa table assembly

Overall dimensions are 13 x 28½ x 64.
Component dimensions do not include tenons.



ually approach the pattern lines. Finally, I rotated the fret 90° and repeated the process to remove the other stiffener.

Assembling and finishing

I drilled ¼-in. holes to receive dowels that attach the shelf corners to the inner chamfers of the legs. Before assembling the table, I sanded any parts that weren't already sanded and stained the table a mahogany color. When the stain was dry, I assembled the major components, and then I finished the table with lacquer and a topcoat of padding lacquer, which I rubbed out by hand.

To attach the frets, I drilled one edge of each fret where it would be doweled to the leg and drilled a corresponding hole in each leg. I positioned each fret by aligning its dowel to the leg and carefully drilled up through the fret into the underside of the apron. With the fret and its leg dowel glued in place, I inserted another dowel into the apron hole. I trimmed the end of this dowel flush to the fret. Although the dowels won't be visible once the table is in place, I stained and lacquered all the dowel ends, so they'd match the frets before I waxed the entire table. □

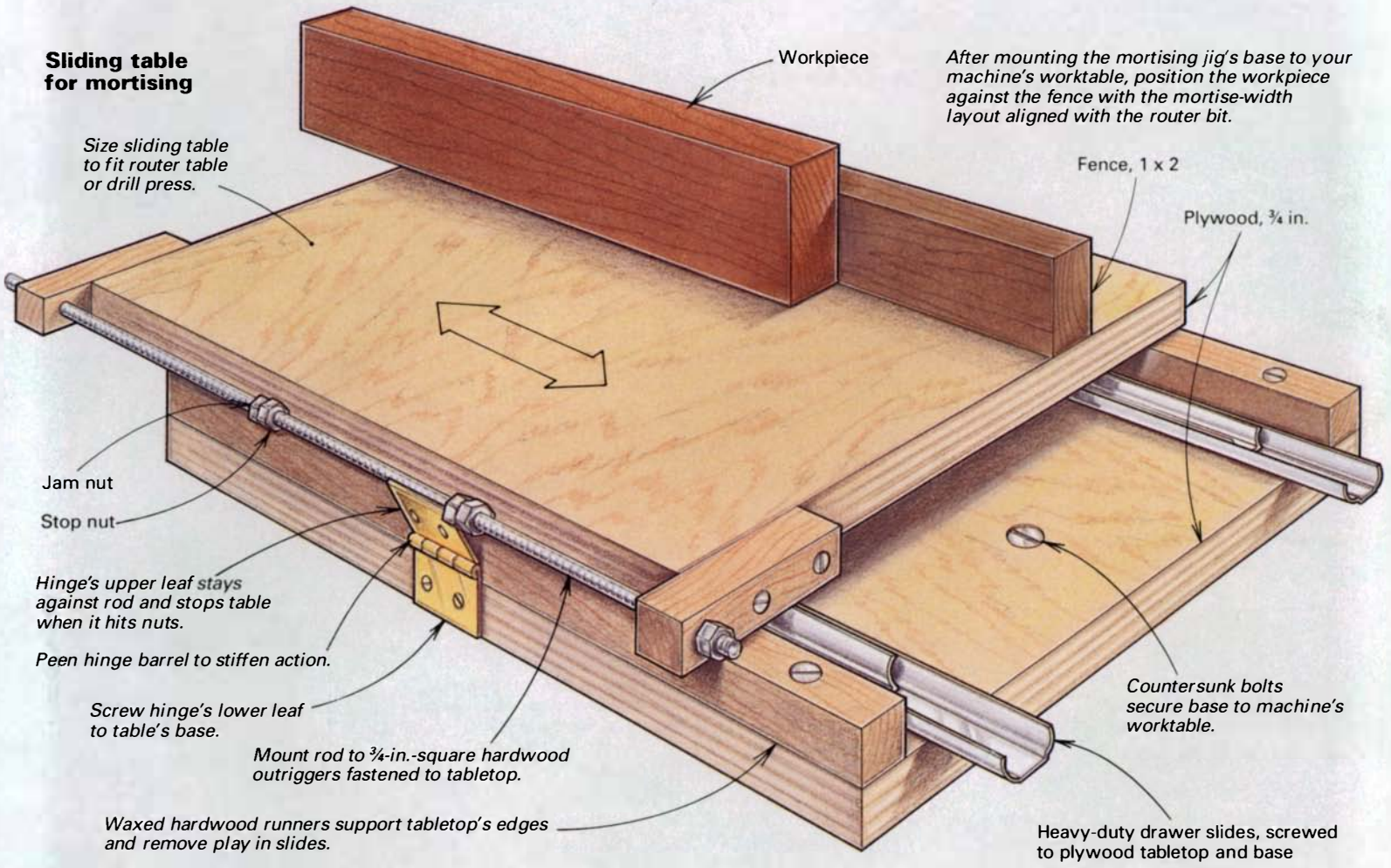
Gene McCall is a furnituremaker in Englewood, Fla. He also teaches sculpture at the Ringling School of Art in Sarasota.

Photos: Charley Robinson; drawing: Vince Babak

Sliding Table Simplifies Mortising

Heavy-duty drawer slides for precise alignment, easy action

by Mac Campbell



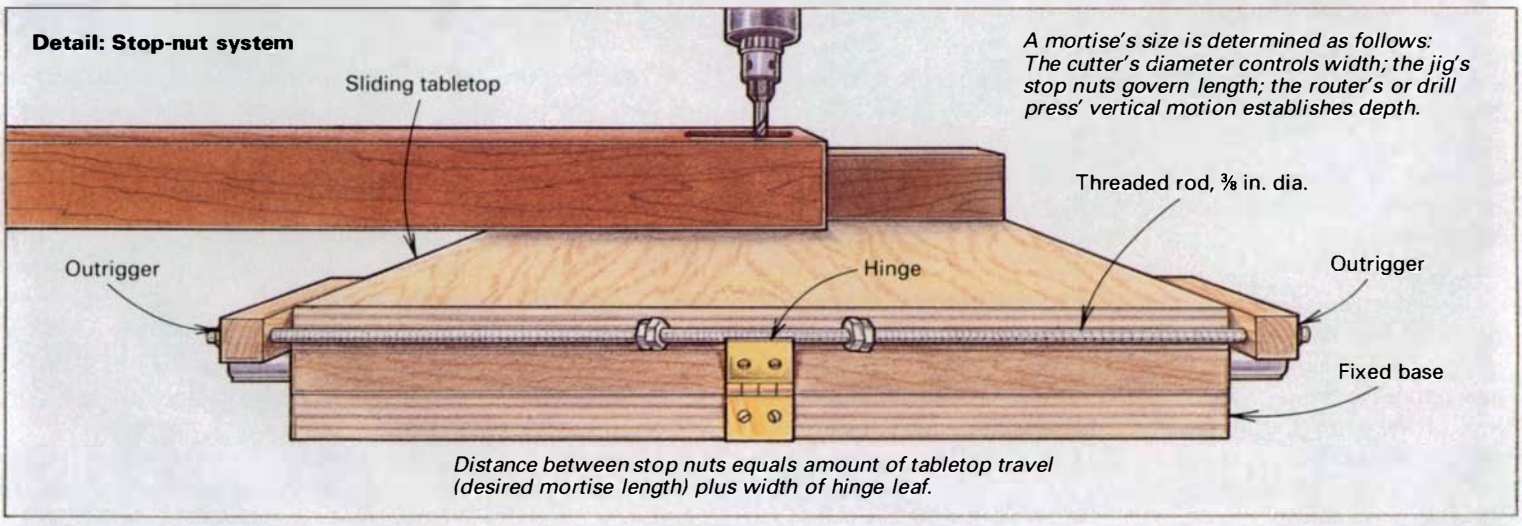


Photo: Alec Waters; drawing: David Dann

When I need to cut lots of mortises, I like to use a tool that does a consistent job without requiring an involved setup each time. A few years ago, I had to mortise a sizable run of custom chair components, so I picked up a small, used overarm router. To make mortising more efficient, I fitted the machine with a sliding table (see the photo below), which was quick to build using plywood and standard hardware I had on hand. Adjustable stops make setting the table's horizontal movement straightforward, and the pedal-fed router makes vertical (mortise depth) setup and plunging a cinch.

Rockwell no longer manufactures the machine I have, but similar tools that have a rigid arm supporting a router at 90° to a height-adjustable table are still made. Even without an overhead router, the sliding table can be mounted on a drill press or used for horizontal routing. In addition, the table's indexing (stop) system is especially well-suited to hollow-chisel mortising.

Assembling the table

The sliding table consists of upper and lower plywood pieces connected by pairs of drawer slides and hardwood runners, as shown in the drawing. The table size depends on the tool you are mounting it to and on the length of the drawer slides you're using. The slide mechanisms let the tabletop travel laterally over the base, which is bolted to the tool. The larger the table (mine is 20 in. long), the more stable the setup will be. A piece of 1x2 secured across the width of the tabletop serves as a fence.

The drawer slides are the heavy-duty variety intended for file cabinets. They are equipped with a metal track that's designed to be mounted to a cabinet side and a similar track for the drawer side. A ball-bearing carriage runs between the two tracks. My slides are 20 inches or so long and allow about 25 inches of travel. These slides have virtually no play and don't depend on gravity to keep everything aligned. A little judicious tinkering will remove the stop on each slide that prevents the drawer from over-closing, allowing the mortising jig to extend in both directions.

The hardwood runners support the tabletop's edges and eliminate any play that might develop at the extremes of travel when there is a relatively short length of the bearing carriage between tracks. The runners should be thick enough to fill the gap between the sliding table and the base. Waxing the runners lets the jig move smoothly.

Installing adjustable stops

A length of ⅜-in.-dia. threaded rod installed along the front of the upper table (see the drawing detail) is the basis for the table's stop system. I bolted the rod to hardwood outriggers on the ends of the table. Nuts threaded onto the rod serve as stops that regulate table movement. Several pairs of nuts act as multiple stops; the second nut in each pair (a jam nut) locks the first in place. A hinge screwed to the plywood base bears against the rod and stops the table when its upper loose leaf hits the nuts. The secret for making the hinge stiff enough for the upper leaf to remain upright against the rod is to hammer on the hinge barrel a little.

Mortising on a sliding table

Once everything is assembled and mounted on the overarm router table, I install a straight-cutting bit and then set it to take a fine shaving off the fence itself. This operation trues the fence to the bit regardless of irregularities anywhere along the line. This, in turn, guarantees that the mortises will be parallel to the face of the stock that's clamped to the fence. When mortising with my overarm router, I use a two-flute, stagger-toothed carbide bit, which is available from Furnima Industrial Carbide, P.O. Box 308, Barry's Bay, Ontario, Canada KOJ1B0; (800) 267-0744. I'm told that these fluted bits will only work at speeds of 17,000 rpm and up. Therefore, using them in a drill press is *not* an option.

***Ideal for mortising, this shopmade sliding table** advances a mahogany stile under a fluted stagger-tooth bit chucked in an overarm router. Author Mac Campbell secures the workpiece to the fence with a block of scrap and a C-clamp.*

To mortise a stile, leg or what have you, first lay out the mortise on the stock. It need not be centered; in fact, many applications work better with an off-centered mortise and tenon. A chair rail, for instance, should have the tenon near its outside face, allowing greater penetration into the leg without cutting into the tenon on the second rail, which enters the leg at 90°. After marking the length of the mortise (tenon width) on the appropriate pieces, I locate the center of the layout lines in approximately the correct position on the jig and then clamp the work to the fence. To ensure uniform depth, I preset the machine's depth stops. Because the bit determines the width of the mortise (tenon thickness), cutting mortises is just a matter of aligning the stops with the marks on the stock and routing the slot.

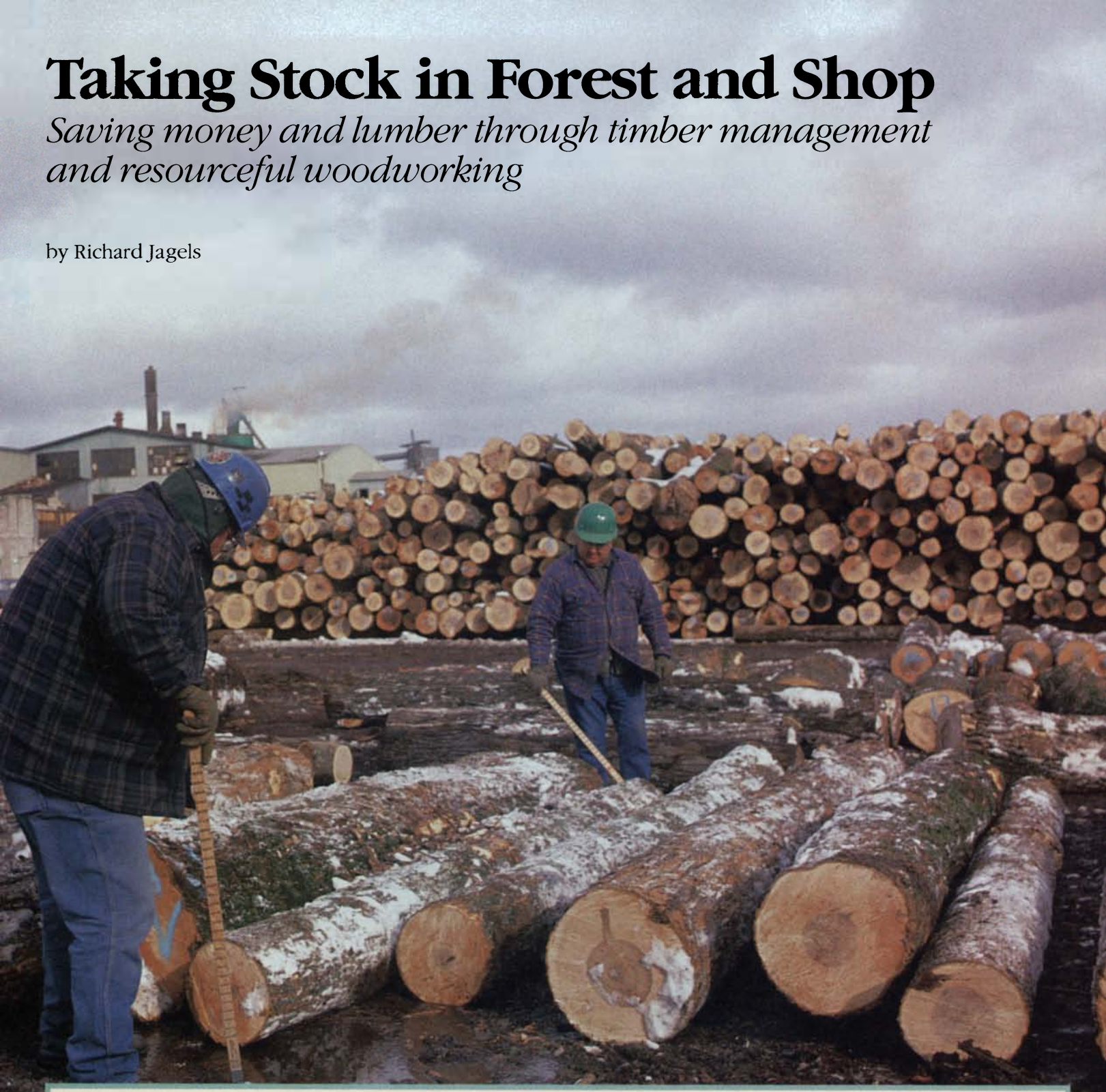
I raise the machine's table to take about ⅛ in. each pass while I slide the jig (with workpiece clamped to the fence) back and forth under the cutter (see the photo). Each mortise takes only 10 or 15 seconds, and changing the stock takes about the same. A series of mortises for 20 frame-and-panel doors takes only a half hour or so, plus, perhaps, five minutes for setup. □

Mac Campbell is studying theology in Halifax, Nova Scotia, Canada. Previously, he ran a custom furnituremaking shop in Harvey Station, New Brunswick.

Taking Stock in Forest and Shop

Saving money and lumber through timber management and resourceful woodworking

by Richard Jagels



Innovative forestry practices are gaining wider attention as one way to help ensure a continuing source of wood. Motorists driving along the interstates in Maine and in Mississippi can occasionally glimpse innovative forestry in action on the median strips. Both states have, at times, logged the medians to save taxpayers money and more efficiently use our nation's wood resource. Successful forest management practices also shine in operations like the Indian reservation in Menominee, Wis. (see the photo on this page and the story on p. 71). Those creative forestry techniques are just one facet of attempts to more effectively husband our precious wood resources. But wise and efficient wood use will also extend the supply of wood. I'll explore these topics and aim the discussion at some of the ways woodworkers can save both money and their resources.

Changing forests, changing forestry

Historically, forests have been seen as something to tame and to convert to agriculture. But as virgin timber sources disappear, a new environmental ethic seeks to preserve the few remaining tracts of "natural" forests. In farming, land tenure has helped to achieve at least a minimal level of stability and sustainability. But forests more often have been logged until near depletion, and then the harvesters have moved on to new territory. In the United States, destructive logging has followed a counterclockwise path from New England, to the Midwest, to the Northwest and then to the South. Then, in the middle part of this century, we found cheaper overseas sources of tropical hardwoods. As an unplanned consequence, we now have a large inventory of domestic hardwoods.

New Forestry—For the past few years, professional foresters have been talking about a New Forestry—one aimed at managing forests to provide a wider range of value, including protection of genetic stock (biodiversity), watersheds and wildlife, while continuing to supply wood and fiber. Two forestry professors at the University of Maine have proposed a triad approach to forest land allocation: A portion of the resource is set aside as ecological reserves, a portion is managed as a natural forest and a segment is intensively managed as high-yield plantations (refer to *New Forestry in Eastern Spruce-Fir Forests* by R.S. Seymour and M.L. Hunter Jr., 1992, Univ. of Maine). The greatest biological diversity would be maintained in the reserves, and the least diversity would be in the plantations. The natural forest would yield high-quality lumber and veneer, while plantations would produce fiber for paper and reconstituted building materials.

For New Forestry to take hold, certain sociological and economic changes have to occur. A good analogy of these changes can be seen in the field of recycling. It was easy in the beginning to propose that we recycle more products in this country (stage I). Now (stage II) people have to put more labor and thought into managing their waste. The next step (stage III) requires investment in recycling facilities. But for the entire process to work, all three stages must happen at once. The same logic applies to managing a forest, and a likely outcome will be a higher cost for wood and wood products. However, the outlook is not as gloomy as one might suppose. Today, logging volumes are close to the growing-stock inventory only in the Pacific Northwest. For areas east of the Mississippi River, we have considerable reserves, particularly in hardwoods, of which we remove less than half the growing stock. For more about hardwood abundance, see the box at right.

More efficient ways to use and work wood

Converting the world's forests to sustainable production will take time and political will. In the meantime, woodworkers can take several meaningful steps to more efficiently use present resources and encourage sustainable forest management.

Using composites and laminations—Glued-up members and composite sheet goods are important ways the wood-products industry conserves wood. Modern glues permit the construction of large structural members with small pieces of wood. For example, products such as Glu-Lam and Com-Ply ingeniously use wood shorts and particleboard.

Composites and laminations hold promise for woodworkers as well. A realistic look at old-growth forests reveals that there are few remaining large-dimension Douglas-fir and other softwood timbers like those that timber framers desire. But luckily, there are big-timber alternatives on the horizon. For example, wood technologists in Hokkaido, Japan, are experimenting with gluing thick-surface veneers onto low-grade, pre-kerfed stock and laminations to produce the look of large-dimension, solid timbers.

Using veneers and thinner stock—Using veneer in place of solid stock is particularly helpful in conserving valuable woods in short supply. For the woodworker who doesn't want to do ve-

Sizing up logs at the sawmill—*Millworkers use lumber rules to estimate board footage (left). The timbers, which come from Wisconsin's Menominee Indian reservation, are sorted by species and graded by size and quality. This forestry operation is successful because it is carefully managed; both young and old trees are harvested and both hardwoods and softwoods are logged. The whole operation is coordinated with a detailed computer model.*

Photos except where noted: Scott Landis

Photo: John Clark

All cut from native trees—*The boards leaning against Clark's shop include Florida maple, black walnut, black cherry, longleaf pine, red bay and paint-protected walnut. He obtained the wood for little cost: sweat equity and some modest milling fees.*

Using overlooked hardwoods

by John T. Clark

As a forester in the Southeast United States for more than 35 years, I've found that many native hardwoods in my area are misused or overlooked. Even though there are fine hardwoods in parts of the Southeast, few loggers are knowledgeable of their value, and fewer still are mills that will accept hardwood.

Bountiful hardwoods: In the late 1950s, Southern mills shipped hardwoods to furniture manufacturers in the North. With the coming of particleboard, that changed. Today "trash" hardwood species with a stumpage value of $3 per ton are used for fuel, pulpwood, cross ties and pallets. Only small amounts of top-quality hardwoods are sawn into lumber for furnituremakers.

I've found an enormous mix of fine hardwoods (see the photo above) growing locally on slopes, creek bottoms and in my backyard. I've used some 40 species, including yellow poplar, Osage orange, chinaberry, sweet bay and camphorwood.

Impoverished tropical woods: Hardwood abundance is not the story in all parts of the South, however. Extreme South Florida is the only area in the continental United States where tropical woods grow. But this region has been cut over, developed and farmed to such an extent that from Orlando south, there are few merchantable trees and even fewer sawmills.

Occasionally, windfall events, like hurricane Andrew, provide a bonanza of tropical woods for woodworkers. For example, in November 1992, Fairchild Tropical Gardens in Coral Gables, Fla., sold 1,300 downed exotic trees. But the availability of U.S.-grown tropical timbers is generally as scarce as the species themselves.

Cultivate and harvest your own trees: Despite the shortages, never fear that the Southeast is running out of good trees. Because southern trees usually reproduce rapidly, little planting is needed. Landowners can profit by thinning trees, eliminating the culls early to encourage the more desirable species.

To harvest local trees, portable bandsaw sawmills, like the Wood-Mizer (8180 W. 10th St., Indianapolis, Ind. 46214), are ideal. If you don't want to cut the lumber yourself, small-sawmill operators can be hired for as little as $100 per 1,000 bd. ft. But the real benefit comes when quality woods are used by craftspeople rather than made into pallets, disposable diapers or paper. □

John Clark operates Chartered Foresters in Quincy, Fla. For more Florida hardwood information, contact C. Leon Irvin, Florida Division of Forestry, 125 Conner Blvd., Tallahassee, Fla. 32301.

neering, he or she can still resaw boards into ¼-in. or ⅜-in.-thick pieces, which are easily handled and glued up to make thicker components. And often, narrower boards and smaller structural members will do the job alone. Every board that you resaw doubles the surface area that you can cover with it. And if you already do a lot of resawing, consider cutting boards closer to final dimension and planing only one side if the opposite side will be hidden in the piece (such as drawer bottoms and cabinet backs). Our forebears did this to save work and manpower—we can do it to extend our wood supply.

Using thin-kerf blades—By shifting to thinner blades, the wood products industry has increased its profits. Thin-kerf sawblades are readily available for both circular saws and bandsaws. These blades not only reduce wood waste and dust, but they require less power and are easier on equipment.

Using recycled and scrap wood—More and more builders are recycling logs and timbers. Large, clear timbers (trusses, beams and columns) are often available from demolition sites, such as old factories, mills and barns or from dredging swamps, bogs and rivers. And for smaller-dimensioned stock, woodworkers can reuse hardwood from pallets. I recently picked up free pallets that contained 2x4s of lauan (Philippine mahogany) and other tropical hardwoods. In the shop, you can save scrapwood to be used again in small projects or to be re-glued for large ones. At the very least, scraps can be used to heat your shop rather than being hauled to an overburdened landfill.

Using premium woods wisely—High-quality woods have generally achieved their status for sound reasons. Often a particular wood has properties not found in other species. Teak for boat decking, rosewood for musical instruments, greenheart for marine piling are a few examples. To extend the supply of valuable woods, consider restricting exotics to appropriate high-value situations (e.g. use teak for decking—not interior boat trim). And more and more cabinetmakers are charging clients a surcharge when the piece they are building requires an exotic or premium wood.

Hardwood surpluses can ease softwood shortages

For decades in this country, we have framed houses with softwood lumber. As a consequence we have, or will soon face, regional shortages in softwood supply (Douglas-fir in the Northwest and spruce and fir in the Northeast). At the same time, we have an abundant supply of low-density hardwoods, such as tulip-poplar, gum, cottonwood and aspen, which research has shown can be used satisfactorily for construction and other purposes.

Many higher density hardwoods are also in copious supply and could be substituted for exotic woods. Cherry, for instance, is a good substitute for mahogany in many cases. But we also have locally abundant sources of little-used hardwoods in the United States and in the tropics. The bottom photo on this page shows how alternative woods can be used resourcefully by furnituremakers. In addition, there are artificial substitutes for certain exotics. For example, in lieu of using ebony for the splines and pegs of a Greene and Greene reproduction chair, Thomas Stangeland of Seattle, Wash., used EBON-X, which is simply walnut impregnated with dye. He built the rest of the chair from certified "well-managed" mahogany from Belize.

By establishing relationships with local sawmills, woodworkers can influence the kind and quality of wood they obtain. During the past decade, furnituremakers on the West Coast have begun to use the native hardwoods of the region (see the photo at left), like oak, bigleaf maple and Pacific madrone. Not only has this resulted in wider availability of hardwoods but also local landowners have been given new incentives for sustainable forest management. And the incentive to use wider tree diversity extends well beyond the borders of this country. Foresters in the tropics have long grappled with having forests with a multitude of species per hectare and only one or two of commercial value, which sets the stage for destructive logging. Luckily, more tropical foresters are considering using a wider array of species. For a further discussion of this, see "Managing a Rain Forest," *FWW* #82, p. 75.

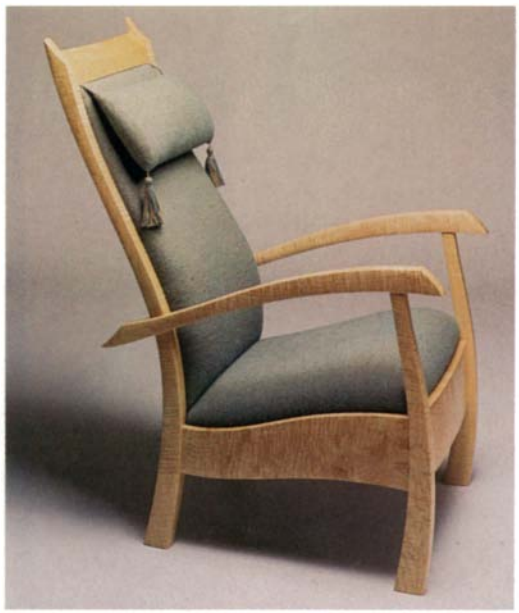


Photo: Mark Van S.

Fiddleback western maple, *culled from Douglas-fir logging operations in Washington state, was used by cabinetmaker Judith Ames to build her* Cloud chair *for a 1992 theme exhibit, "Environmentally Friendly," at a Seattle furniture gallery.*

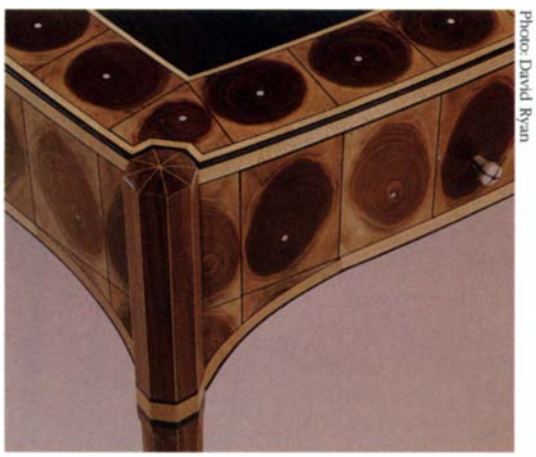


Photo: David Ryan

Writing desk from overlooked woods—*Silas Kopf made this desk using storm-damaged walnut limbs, oak salvaged from a bog, maple and EBON-X (an ebony substitute made from dyed walnut). Kopf fashioned the desk's tapered legs, paneled apron and marquetry bordered top. The curved core stock is plantation-grown poplar plywood; the flat core panels are medium-density fiberboard.*

Banding together conserves stock, saves dollars

Woodworkers can further influence the supply, quality and sustainability of their wood resource by forming or joining associations or cooperatives like the Institute for Sustainable Forestry (ISF). Groups can also save money by purchasing in larger quantities. One group of woodworkers from the United States and Canada, Woodworkers Alliance for Rainforest Protection (WARP), is seeking to find uses for a wider array of species by establishing a shop-testing program that will evaluate lesser-known species of tropical woods. By using their collective voices, groups can help influence industry practices and governmental policies. □

Dick Jagels is a professor of forest biology and an amateur woodworker. He is the author of Tropical Forests—Slowing the Destruction *(misc. publication 710, July 1990, Maine Agricultural Experiment Station, University of Maine, Orono).*

Timber for tomorrow

by Scott Landis

***Surveying for lumber**—Snowshoeing his way through a stand of mixed hardwoods, this timber marker selects trees for harvest. The gauge in his left hand is used to estimate a stand's volume. After trees are spray-tagged, loggers fell them in preparation for the sawyer.*

***Computer modeling** is a key ingredient of Menominee forestry. A product of their Geographic Information System (GIS), this map of the entire reservation is divided into habitat compartments.*

Until recently, most woodworkers considered only three things in selecting lumber: price, appearance and quality. Increasingly, a fourth factor—responsible timber management—is being added to this list.

For inspiration and a concrete example of good forest stewardship, consider the Menominee Indians of central Wisconsin (see the photo on p. 68). The Menominee reservation contains 11 of the 15 major forest habitat types in Wisconsin and more than 25 commercial species of timber, including maple, red oak, birch and white pine. All original timber species, except for elm, flourish on the reservation. And so far, it's the only commercial timberland in the country to be certified as a sustainably managed forest.

Managing a sustainable forest: In 1992, following an extensive evaluation of Menominee practices, Scientific Certification Systems (SCS) of Oakland, Calif., concluded: "Few forestry enterprises have achieved the degree of sustainability in the ecological and social sense that has been achieved by the Menominee."

As lush as the Menominee forests are, they are hardly pristine. The Menominee harvest about 30 million bd. ft. of timber every year from their 234,000-acre reservation—more than 2 billion bd. ft. since cutting began around 1865. What's more, the most recent forest inventory indicates a higher volume and quality of saw timber now than when the land was first surveyed in the 1860s.

Sophisticated forestry: The Menominee employ a computer database to tailor their management system to specific soil types and wildlife habitats. The reservation is divided into 109 compartments, or cutting units, but there may be as many as 15,000 different tree stands, or micro sites, in the forest. The computer-generated map (see the bottom photo) indicates the land's 11 different habitat types; detailed compartment maps describe the inventory within each cutting unit. Where foresters once treated whole compartments under a single prescription, they can now treat each stand of trees individually.

Fancy software aside, good forestry still boils down to walking out in the field, felling the trees carefully and skidding them to a landing. The Menominee can do everything right on paper, but as one forester wagged: "Once a tree is cut, you can't stick it back. It's not like a crop of corn. You screw it up this year, maybe you fix it in 60, 80 or 100 years."

Logging selectively: The tree selection process used by Menominee marking crews (see the top photo) is the opposite of high grading. "Instead of cutting the best trees," Menominee forester Steve Arnold explained, "we cut the worst." First, the marker looks for trees with damaged tops or exposed roots; these are unlikely to survive to the next harvest. Next, he targets slow-growing trees, stunted by competition or disease. Finally, he identifies trees whose removal will improve the spacing within a stand, leaving room for the most promising specimens. Only after all these inferior trees have been marked will the crew select the beefy saw timber.

Despite the tight regulations, non-Menominee loggers compete for the chance to work on the reservation. One local logger is quoted as saying, "The Indians are more restrictive [than other timber managers]...but I suppose I'd do it the same way if I owned that forest." □

Scott Landis is a writer and woodworker in Coatesville, Pa. He is the author of The Workshop Book *(available from The Taunton Press) and a founder of the Woodworkers Alliance for Rainforest Protection (WARP). For a list of wood suppliers of well-managed or recycled sources, send $2 to WARP, 1 Cottage St., Easthampton, Mass. 01027; (413) 586-8156.*

With safety and practicality in mind, *Brad Rubin built this crib, striving for a contemporary look and hidden hardware. He drew components with his personal computer and then fashioned his own drop-side mechanisms. The resulting crib in oiled maple is simple, easy to clean and easy to use. Two-year-old son Justin, ready for his morning nap, agrees.*

Crib Hides Its Hardware

Commercial drawer slides are the key

by Bradley S. Rubin

While waiting for your baby to be born, a crib is the best piece of furniture you can make. Cribmaking offers quite a few woodworking challenges and can help you burn off nervous energy. Building a crib is more practical than making a cradle because a baby can sleep in a crib every day for several years, but a cradle is only useful for about as many months.

When I designed the crib shown in the photo on the facing page, I had several goals in mind. First, the crib had to be safe. That meant it had to be sturdy, and it had to comply with standard safety regulations. Second, I didn't want unsightly metal hardware exposed when the crib's drop side was up. Third, I wanted the crib to have a contemporary look rather than appear traditional with turned spindles, like those commonly found in furniture stores. Finally, I wanted the crib to be collapsible for easy moving and storage and to have a drop side that would operate smoothly.

Because safety was the most crucial constraint, I designed the crib around eight of the regulations that the United States Consumer Product Safety Commission publishes (see the crib safety box on p. 74). I drew up an initial plan using my personal computer and a computer-aided drafting package. The drawing software (Generic CADD) lets me modify things repeatedly, so I could see resulting proportions, take measurements for a cutting list and make sure that the mattress and support spring would fit.

***To drop the side,** the author adapted standard drawer slides. A pair of spring-loaded pins, one on each end of the crib, latch the side in its up position.*

Selecting wood and bedding

I decided the crib should be made of a durable wood and have a nontoxic finish. I chose hard maple for all the components, partly because it's plentiful in Minnesota. But my chief reasons for using maple are that it's attractive and that once it's sanded and oiled, its close-grained texture makes it easy to clean. I was even fortunate enough to find wood with bird's-eye figure for the posts. Next, my wife, Debbie, and I picked out a crib mattress and a spring to support it. Although most cribs have adjustable-height mattresses, I decided to keep things simple by fixing the mattress height. I made the crib's mattress-to-rail height 22 in.

Choosing drop-side hardware and accessories

It's essential that a crib have a drop side. For one thing, it makes lifting a child in and out of the crib much easier on your back. Another reason is it gives you better access to change the baby's sheets. Finally, when a crib's side is lowered, it gives you one other convenient place to change the baby's diapers—something you need to do much more often than I suspected.

Most cribs have two drop sides, but I made this crib with just one movable side. Because the crib's ends are the same, the crib can be placed either way, so the drop side faces into a room. While many suppliers carry drop-side hardware (see the sources of supply box on p. 75), I was unable to find the concealed system I had in mind. So I fashioned my own mechanisms by slightly modifying standard hardware items (see the photo below).

Adapting a pair of drawer slides—After looking through a few woodworking supply catalogs, I realized that a pair of heavy-duty drawer slides (the ones used in file cabinets) would be sturdy and would provide enough travel (11 in.) to lower and raise the crib's side. The drawer slides I chose (see the sources of supply box) move precisely and smoothly because they have a ball-bearing carriage that runs between two tracks. But the best part about the slides is that their thin profile lets me recess them into the crib's drop side and posts, thus keeping the workings out of sight.

Making a latch mechanism—I made two latches (spring-loaded pull pins) that take an adult's arm span to disengage at the same time and that take an adult's strength to unlatch (to overcome the pins' spring force). Each latch has a slightly undersized ¼-in. dowel, a spring, a washer and a cotter pin that retains the spring on the dowel. The dowels engage holes drilled in the posts. For pulls, I glued round wooden knobs to the dowel ends , as shown in the drawing detail on p. 75. If I had to make the latches over again, I'd probably peg the pulls to the dowels in addition to gluing them.

Other hardware—While I was buying hardware for the drop side, I also picked up a few other necessities for the crib, including four 2-in.-dia. casters designed to roll easily on carpeting and two plastic teething rails. In addition, I bought four sets of metal bed-rail fasteners to attach the crib's fixed side to the ends. The fasteners let me quickly knock the crib down into four pieces.

Crib construction

The drawing on pp. 74-75 shows how the mattress spring rests on two lengthwise stretchers. Mortises in the mid rails of the crib ends support the stretchers. Screws driven from below the stretcher ends into the mid rails keep the crib framework rigid and allow for easy disassembly.

The vertical slats (bars) for the crib's ends and sides measure 1 in. by ½ in. and have ⅛-in.-radius rounded edges. All the slat ends are drilled for ¼-in. dowels. I used spiral-grooved dowels, so the rail-to-slat joints would be secure; once these dowels are glued, the slats aren't likely to twist. Working all the slats into mating dowel holes and getting the faces of the slats parallel to the

Photos: Alec Waters

rails is a difficult task by yourself, so have a helper handy when it's time to glue and clamp the slat-and-rail assemblies. It's also helpful to sandwich the slats between a pair of straight edges.

The fixed side—The crib's stationary side has 14 slats running between the top and bottom ¾-in. by 2-in. rails. Before assembling this side, I used my tablesaw to cut two ⅛-in. grooves in the top rails to capture the edges of the plastic teething protectors (see the photo on the previous page). The fixed side has a stile at each end that's 1⅜ in. thick to accept the bed-rail fasteners. I glued and biscuited the stiles to the rails as I was doweling the slats in place. Finally, I installed the four bed-rail fasteners. First I mortised two hook-type brackets into each fixed-side post, and then I let in the mating female brackets into each stile. Within each of these mortises, I wasted out two holes to receive the fastening hooks from the post brackets.

The drop side—I built the drop side pretty much like the fixed side. But instead of bed-rail fasteners, it has the drawer-slide tracks on the surface of the stiles. I mortised the slides' mating tracks into the drop-side posts (see the drawing detail on the facing page). Below these post mortises, I cut slots to make room for the track when the drop side is lowered. The slots break through the bottom of the legs, allowing me to remove the side entirely—like sliding a drawer out of its case. Before I assembled the drop side, I temporarily attached its stiles to the drop-side posts in what would be the side's up position. I bored ¼-in. pull-pin holes through the stiles into the posts (this way the slats would not interfere with drilling). Then, to recess each latch's spring, I enlarged the outer part of the stile's pin-retaining hole. After installing the latches, I beveled and waxed the ends of the dowels so that they'd slide smoothly in and out of the post holes.

The head and foot—The two ends (head and foot) of the crib are constructed a little differently from the sides. Instead of stiles, the head and foot have 2-in.-sq. posts. Rather than have the corner posts extend up past the top of the crib (another safety issue), I ran a 2-in.-sq. crest rail across the top of the head and foot. To join the crest rail perpendicular to the posts, I doweled and glued 2-in.-sq. arc-shaped pieces at the corners. Eight slats connect a ¾-in. by 2-in. mid rail to the crest rail. Below the mid rail, another ¾-in. by 2-in. rail spans between the posts (see the drawing) to strengthen the head and foot down by the legs.

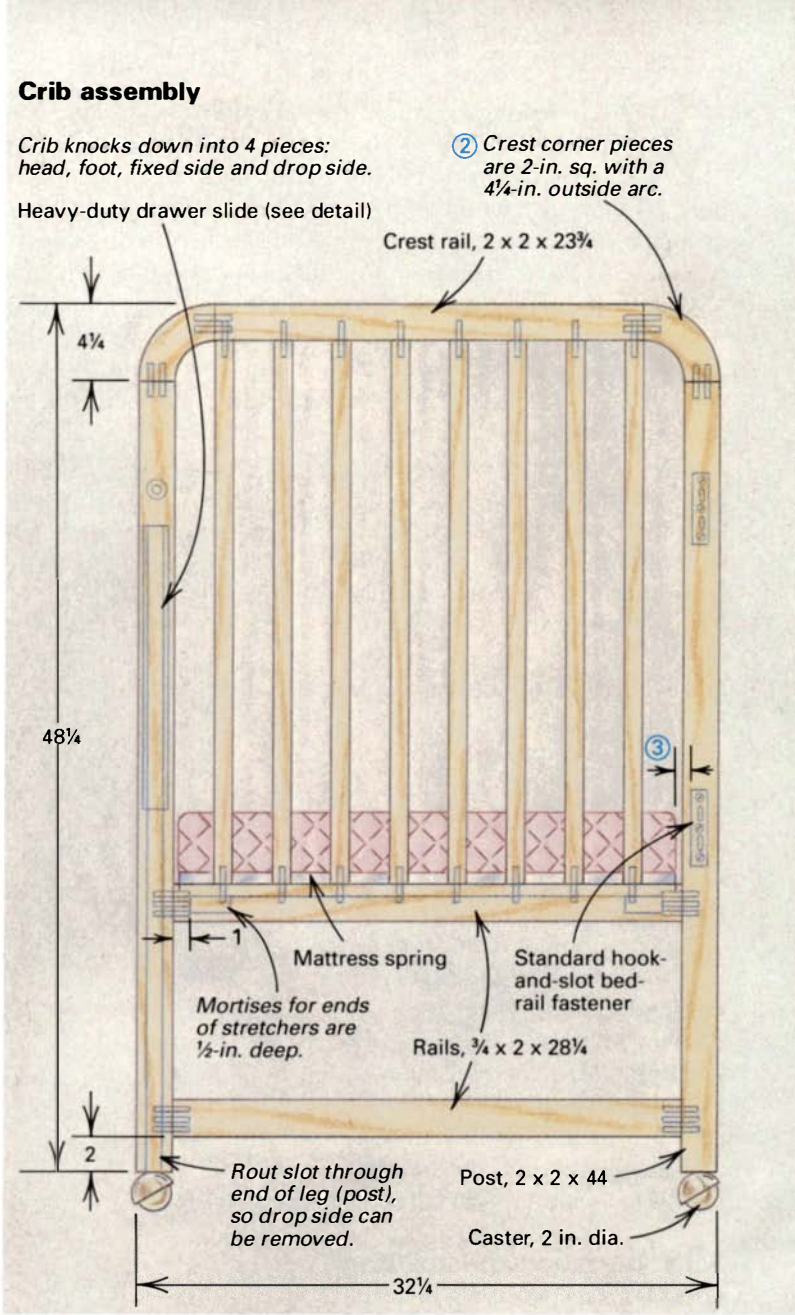
Finishing for posterity

Preparation for finishing consisted of routing all the edges of the 2x2 parts with a ¼-in. roundover bit; I eased edges on all the ¾-in. by 2-in. pieces with a ⅛-in. roundover bit. Next I hand-sanded all the surfaces with increasingly finer grit sandpaper for a child-safe finish. I followed this with several coats of Watco Danish oil, which I rubbed out with 0000 steel wool. In fact, I'm told that tung oil is even better because it has no metallic driers. To minimize toxicity of the Danish oil I chose, I allowed 30 days for the finish to cure. If you use any polymerizing finish, be sure to let it *completely* cure before you put the crib to use. There are a few other choices for nontoxic finishes (see the sources of supply box).

After more than two years, our son, Justin, hasn't climbed out of his crib or unlatched the drop side...yet. As he grows older, I'm looking forward to handing the crib down a generation. □

Brad Rubin is an engineering manager for IBM in Rochester, Minn., by day and a hobbyist furnituremaker for his family by night.

Crib assembly



Crib safety

1) Slats must be spaced no more than 2⅜ in. apart, so a baby cannot stick his head or torso out of crib.

2) Corner posts must not extend more than 1/16 in. above the rails. This prevents a baby from poking himself in the head or getting bedding or clothing snagged.

3) Mattress must fit within a two-finger width of crib sides, so a baby can't get caught alongside or under the crib's mattress.

4) Drop side must not be able to be unlatched by a baby.

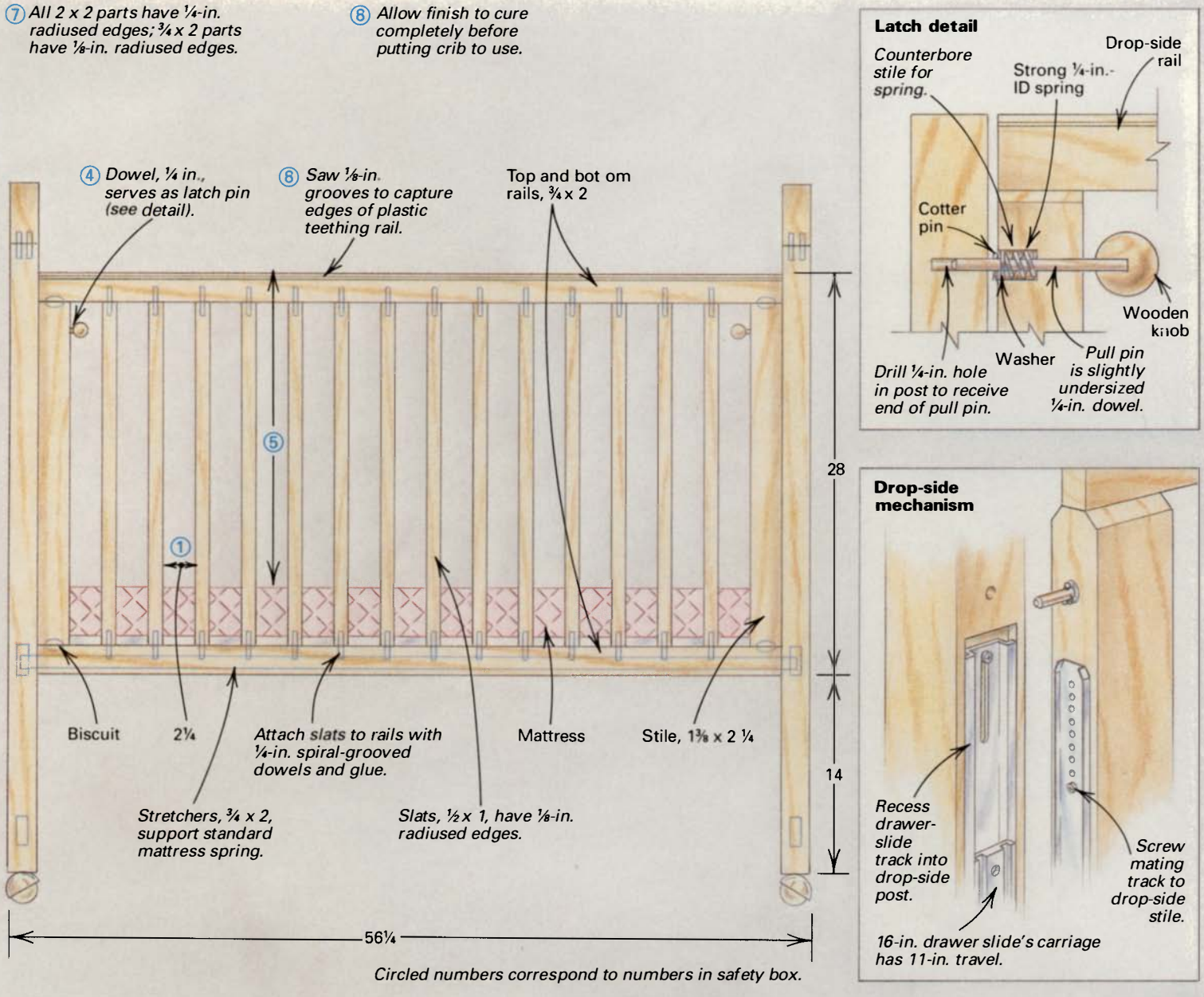
5) The top rail on all sides must reach at least 22 in. above the mattress, so a baby can't climb out of the crib.

6) Crib must have no broken or loose parts (screws, bolts), so a baby can't put small pieces in his mouth.

7) Crib must have no rough or sharp edges.

8) Crib finish must be nontoxic.

Source: Consumer Product Safety Commission



Sources of supply

Drop-side hardware, mattress support springs and adjustable-height brackets:

The Woodworkers' Store, 21801 Industrial Blvd., Rogers, MN 55374 (also carries crib plans and oak and birch spindles and corner posts)

Stork Shop, 1868 S. La Cienega Blvd., Los Angeles, CA 90035

Baby Toytown, 8930 Valley Blvd., Rosemead, CA 91770

Heavy-duty extension drawer slides:

Selby Furniture Hardware Co., Inc., 321 Rider Ave., Bronx, NY 10451

Hardwarehouse, 601 Old Thomasville Road, PO Box 7147-27264, High Point, NC 27260

Alfit America Inc., PO Box 38159, Richmond, VA 23231

Also carried by The Woodworkers' Store and most woodworking supply stores

Casters and knockdown bed-rail fasteners:

Trend-lines, 375 Beacham St., PO Box 6447, Chelsea, MA 02150

Lee Valley Tools Ltd., 1080 Morrison Drive, Ottawa, Ont., Canada K2H-8K7

Woodworkers Supply Inc., 1108 N. Glenn Road, Casper, WY 82601

Woodcraft Supply, 210 Wood County Industrial Park, PO Box 1686, Parkersburg, WV 26102-1686

Also carried by The Woodworkers' Store

Mattresses and plastic teething rails:

The Stork Shop, Baby Toytown and most baby furniture stores

Low-toxicity finishes (starting with the least toxic):

Shellac (dissolve-it-yourself flakes are better than premixed shellacs)

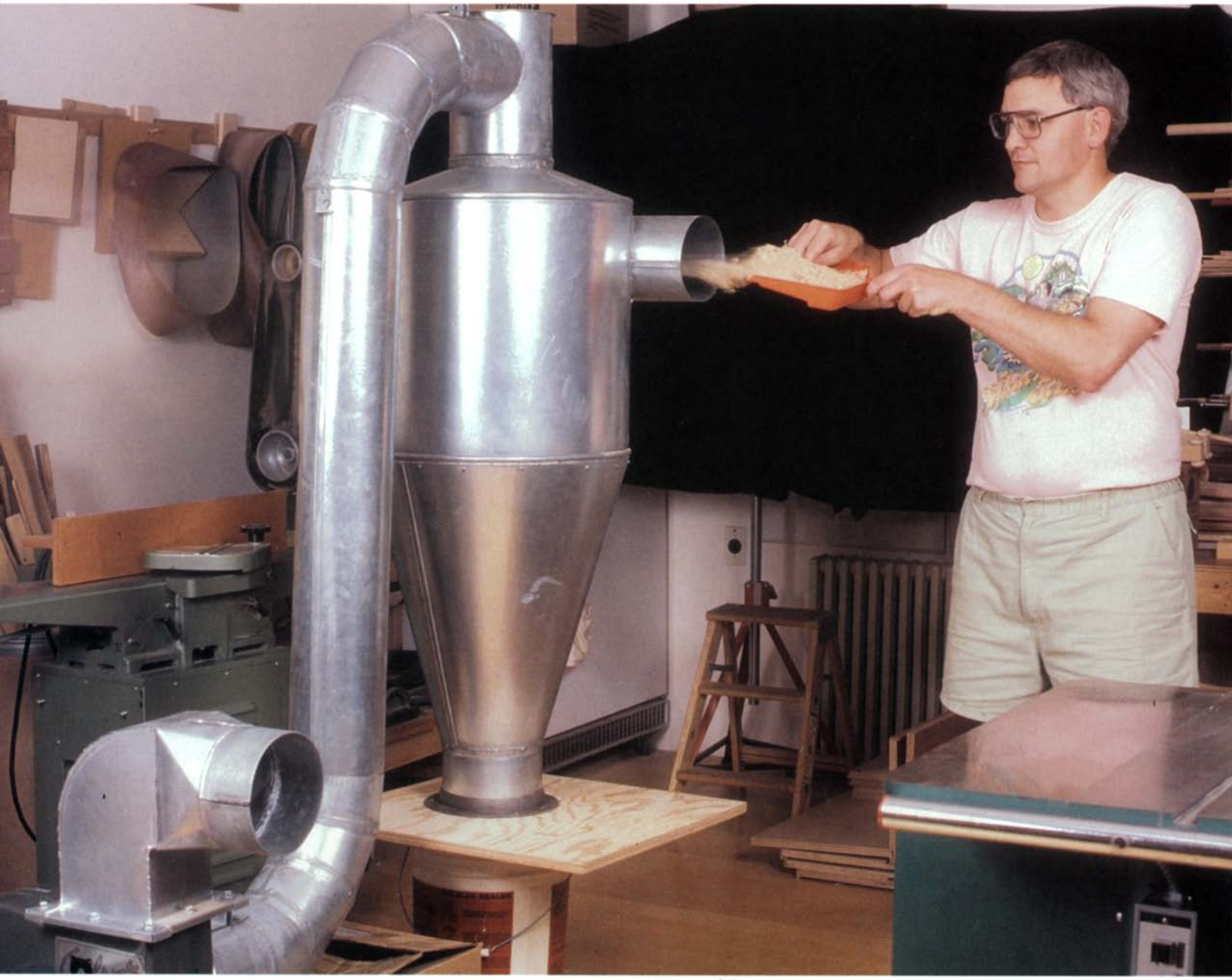
Pure tung oil (Danish oils may contain metallic driers)

Water-based latex paints (whites and light pastels are generally safer)

Certain water-based polyurethanes (check the can or ask the manufacturer)

To request a Crib Safety Brochure, *send a SASE to Juvenile Products Manufacturers Assoc., 2 Greentree Centre, Suite 225, PO Box 955, Marlton, NJ 08053, or call the U.S. Consumer Product Safety Commission in Washington DC at (800) 638-2772.*

Drawing: Mario Ferro



Adding a cyclone separator to your dust-collection system *can increase its efficiency by removing 99% of the dust, including particles as small as 15 microns. The author feeds sawdust into a cyclone's infeed, yet no dust is visible coming out the exhaust pipe in the foreground. Sending clean air to the filters makes for easier filter maintenance and healthier breathing.*

Clearing the Air

Increase your dust system's filter area, and add a cyclone separator

by Jim Lawton

Whether you're designing from scratch or modifying a commercial dust-collection system, adding filter area and a cyclone separator can make any system more efficient and more convenient. In addition to the health benefits, you'll spend less time cleaning your shop, your clothes and your house. Your shop equipment will last longer, and you won't have to change furnace filters nearly so frequently.

A small-shop, filter-bag dust system will get the sawdust off the floor, but it blows the smallest dust particles that do the most lung damage back into the shop air. Exposure to these particles for as little as an hour a day may be enough to cause health problems. But, because the effects are cumulative, it may be years before these problems show up.

The best way to remove those micron-sized particles (a micron is .001mm) is to increase a dust system's filter area, thereby reducing the internal pressure that forces small particles through the filter medium. But even the most massive filter system will quickly become clogged if dust and chips are sent directly to the filters. A two-stage system with a pre-filter separator can reduce the amount of dust that gets to the filter. The problem is that most of the available systems are inefficient, allowing almost half of the dust to get through to the filters. But a cyclone separator can remove up to 99% of the chips and dust from the air before it gets to the filters. Not only do you get cleaner air to breathe but also you will rarely need to clean the filter bags.

How much filter is enough

Adequate filter area is the single most important aspect of a dust-collection system. Configuring a dust system is too often approached as a confusing jumble of duct sizing, static pressure losses and machine requirements. But the most important design feature—filtering the dust from the air—is rarely covered. After all, it doesn't do much good to collect dust if you can't clean the air before recirculating it about the shop.

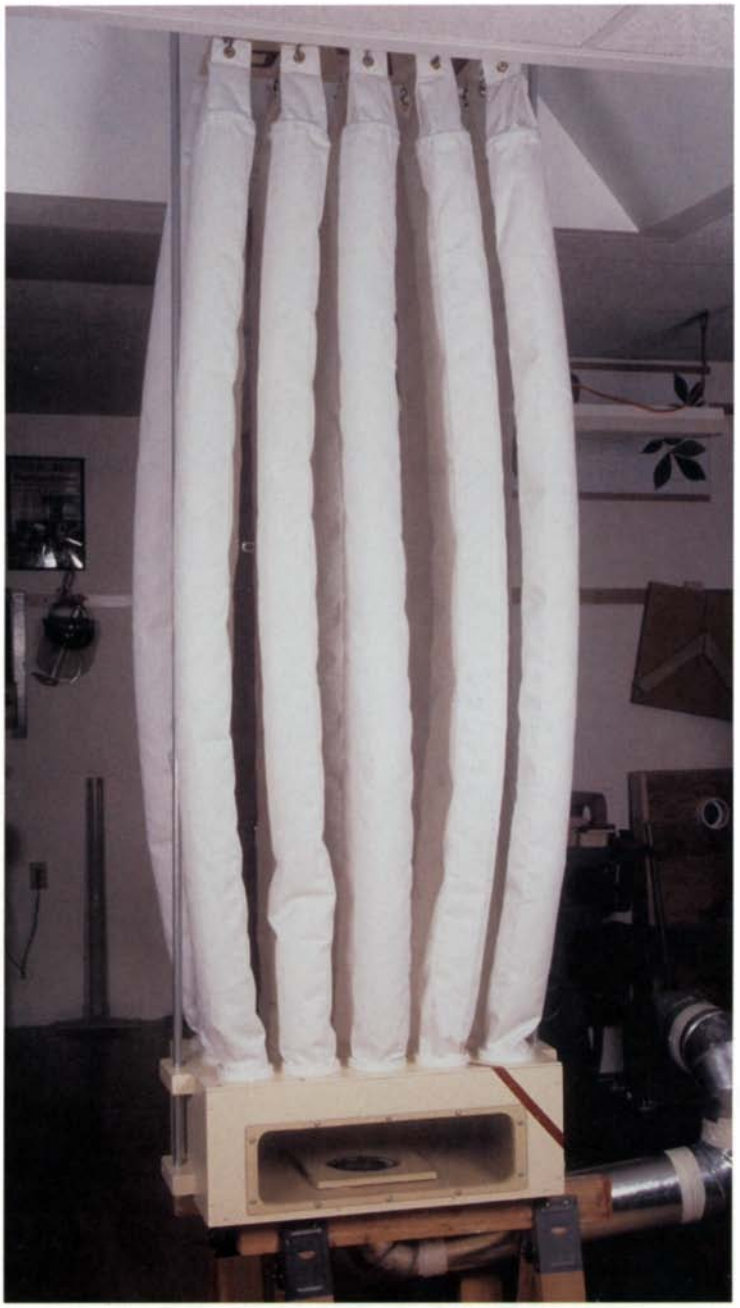
Two sure signs that your filter is undersized are a fine coating of dust on objects near your dust collector and puffs of dust rising from the filter bag when you turn on the system. Too much air is being forced through each square foot of available filter area, and the smallest and most unhealthy dust particles of 2 microns or smaller are being pushed right through the bag.

It's not the size of the hole in the filter material that determines the smallest particle a filter can trap. Instead, it's the filter cake, the buildup of dust that coats the inside of the filter. Therefore, it is desirable to have this cake and to maintain it by not constantly shaking the bags. To a large extent, the cake controls itself—excessive filter cake usually falls off during the normal flexing of the bags in use.

Determining adequate filter area is fairly straightforward. Peter Fedrigon, a designer of industrial dust systems with Scantech Engineering (P.O. Box 166, Cleveland, N.Y. 13042), suggests 1 sq. ft. of filter area for every 10 cubic feet of air per minute (CFM) capacity of the blower and motor. To calculate filter area, system capacities should be estimated at 500 CFM per horsepower (hp).

Increasing standard large-diameter filter-bag area to meet that formula can quickly hog your shop space. For example, a standard 2-hp, two-bag system would require four more bags of the same size to provide the needed 100 sq. ft. of filter area. However, using small-diameter tube filters, as shown in the top photo at right, I was able to fit 100 sq. ft. of filter area into about the same floor space as the standard two-bag system. A dozen, 5-ft.-long by 5¾-in.-dia. tubes will provide enough filter area for a 2-hp system in a little more than 4 sq. ft. of floor space.

In addition to filter area, filter material is also important. Most



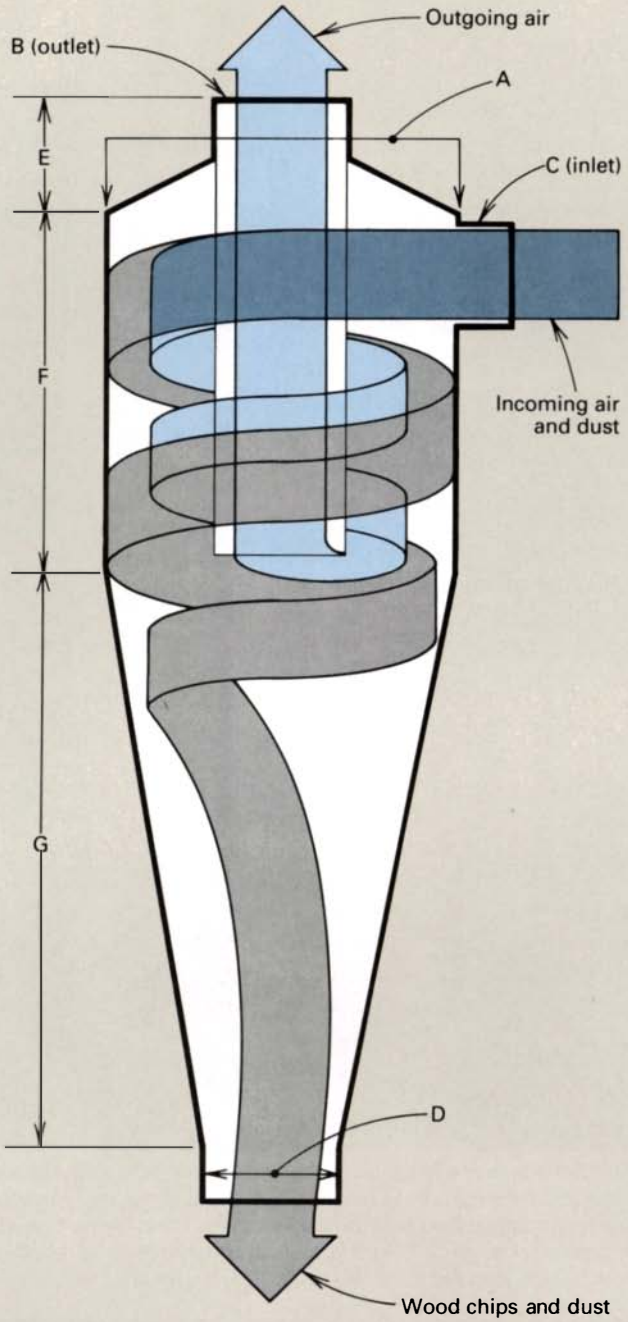
***Multiple small-diameter tubes increase filter area** and reduce internal pressure in a dust-collection system in about the same space required for stock bags. Lower internal pressure makes the system more efficient and reduces the number of small particles blown through the filter back into the shop environment.*

***Tube filters snap easily into place,** and the felt seal's groove fits snugly over the ¼-in.-thick plywood dustbin lid. Because the bag's open end hangs down, excess filter cake that accumulates on the inside of the bag simply falls into the bin below.*

Photos except where noted: Charley Robinson

Cyclone separator

In a cyclone, wood chips and dust are separated from the airstream by centrifugal force and settle into a bin at the bottom of the cone.



Cyclones suitable to most home-shop dust-collection systems (1, 2 and 3 hp) can be made for less than $200. Use the chart below to size the cyclone to suit the system.

Cyclone dimensions for home-shop systems

Actual cubic feet/ min.	Dimension (in.)							
	hp	A	B	C	D	E	F	G
350-550	1	16	6	4	6	5	16	18½
550-800	2	18	7	6	7	5	18	20½
900-1200	3	21	8	7	8	5	21	24¼

systems available to the home shop use open-mesh woven bags. Commercial installations tend to use a non-woven, polyester felt that is more efficient at trapping particulate matter and reducing blow-through and is a better choice for home shops as well. Because my source for felt tube filters, P & S Filtration Inc. (4563 Jordan Road, Skaneateles Falls, N.Y. 13153-0238; 315-685-3466, item #AMT 31150, untreated), has a minimum order of 48 bags, I made a bulk purchase for several members of our local woodworking group, the Rochester Woodworkers' Society. Oneida Air Systems (11204 Lake Road, Cleveland, N.Y. 13042; 315-675-8290) can supply smaller quantities of standard or custom filter bags as well as cyclones, blowers, complete systems, air-flow measurement equipment and detailed information.

The felt filter tubes have a closed end with a grommet to hang them and an open end with a spring-steel band and a grooved-felt seal. The band holds the end of the tube open and snaps easily into a collector box, as shown in the bottom photo on p. 77. The groove in the felt seal fits snugly over the ¼-in.-thick plywood top of the collector box. Hanging the filters open-end down allows the excess filter cake to simply fall into the box.

Separating dust from air

In a conventional single-stage system, all the collected material ends up in the filters. Not only are the filters messy and inconvenient to clean out but also the build-up of collected material continually diminishes the available filter area. As filter area decreases, the internal pressure increases, causing even more particles to be blown through the filters and into your shop.

A two-stage system includes a separator that removes much of the dust before it enters the filters, usually before it goes through the blower fan. A separator can be as simple as a shop-built box with a baffle inside that produces a velocity drop in the airstream to allow heavier particles to drop out. This type of separator will remove about 60% of the airborne dust at best.

Cyclone separators create two concentric helical air currents inside a cone-shaped collector, as shown in the drawing at left. Centrifugal force spins shavings and dust particles 15 microns and larger out against the side of the cyclone. There, friction slows the air and lets the particles drop into a collection bin. The clean airstream exits through the top of the cyclone.

For optimal performance, cyclones must be designed to match the volume of a particular system. Fedrigon has designed cyclones and developed the specifications shown in the drawing and chart at left to suit most home shops. The effects of using an improperly sized system are difficult to predict. If the air volume is less than the designed rate, there will be more settling out of dust particles and less centrifugal force for removal of finer particles. A higher than designed air volume will allow less settling and have more centrifugal force, but the airflow through the cyclone may be enough to carry more fine dust out to the blower and the filters.

Picking up the dust

Properly designed hoods are necessary with any system. If you cannot pull the dust into the collection system, the dust will escape into the shop environment. You can make your own hoods from plywood, plastic pipe, acrylic sheet or sheet metal. The important thing is to make them. Take the time to consider each machine and to design and install the best hood you can. Consider the direction in which the machine motion normally carries the dust, and use this to best advantage. □

Jim Lawton is a chemical engineer and a woodworker in Rochester, N.Y.

Adding a cyclone and tube filters to a stock dust collector

by Neil Seely

As a fellow member of the Rochester Woodworkers' Society in Rochester, N.Y., Jim Lawton convinced me of the benefits of a cyclone separator and increased filter area. My problem was to add these items to the 1-hp Delta collector I was already using without sacrificing its portability or making it too large for my small shop. I decided that mounting the motor/blower directly above the cyclone and locating the six tube filters along each side of the cyclone would make the best use of space, as shown in figure 1 at right and in the top photo on the following page.

I also went to work correcting a couple of other flaws in the original design. I included a drop-down dustbin platform to eliminate the need to lift the heavy motor/blower unit when dumping collected dust. Because the dust collector will always be near when I'm working, I tamed the loud roar of the Delta system with acoustical foam and baffles, as shown in figure 1 at right.

As a unit, the dust-collection system I designed would never have fit through a doorway, so I broke the unit into smaller components, which had the added benefit of making construction much easier. On the downside, I had to provide an air seal at each separation point to prevent air from seeping into the system. Leaks on the intake side reduce the collector's efficiency, and a leak on the blower's discharge side would blow out micron-sized dust, negating the benefits of proper air filtration.

Because the unit would be a large box standing in my shop, I used birch-veneer plywood for a better appearance. For this project, I used a little more than one sheet of ¾-in. plywood and three sheets of ¼-in. plywood.

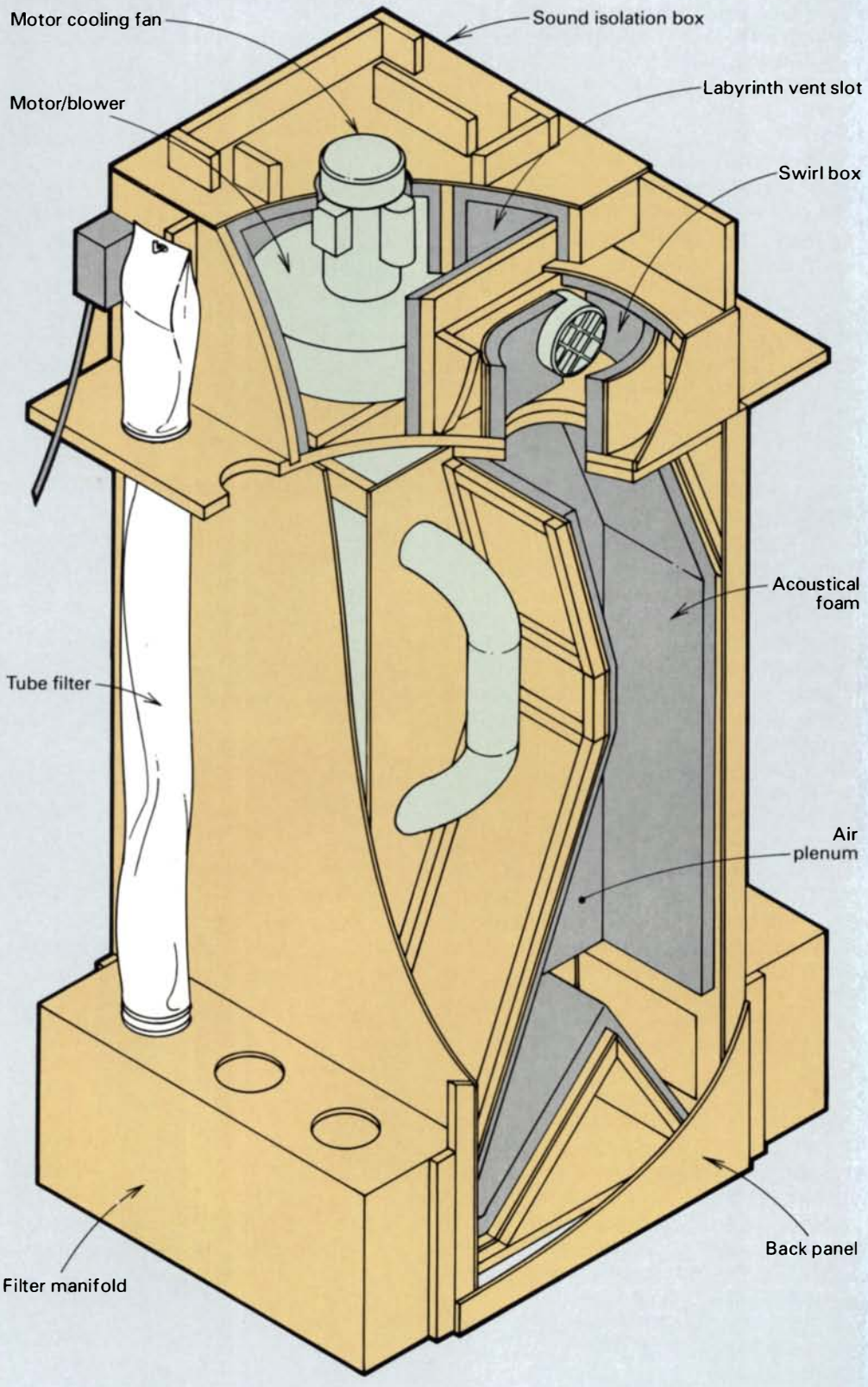
Building a dust center

General construction techniques for building my roll-around dust-collection center are shown in figure 2 on p. 81. In designing your system, consider your requirements and limitations. For example, because of low ceilings, I had only enough vertical space to use a 5-gal. bucket as a dustbin. Because I would be dumping the bucket frequently, I made a special spring-loaded platform that keeps the bucket in solid contact with the underside of the cyclone platform, yet releases the bucket with a pull on the handles. I've found the bucket to be adequate for most of my needs, but when planing, I have to remember to dump the chips much more frequently.

One lesson I've learned the hard way in building custom-designed projects is to as-

Fig. 1: Noise abatement and air flow

Acoustical foam lines the air plenum and the motor isolation box to turn this dust collector's roar into a gentle hum.



Drawings: Mark Sant'Angelo

semble everything with screws only. This allows me to make necessary adjustments when designing working mechanisms.

When mounting the cyclone, I was careful not to dent it and not to drive any fasteners through the metal. Anything that interrupts the smooth flow of swirling dust will reduce the efficiency of the cyclonic action. I mounted both the top and the bottom of the cyclone in chamfered holes and then sealed the gap with a silicone sealant. Closed-foam tape applied to the bottom of the cyclone platform seals the connection between the bucket and this platform. For an airtight seal at the two openings between the blower platform and the case, I routed ¼-in. grooves and filled them with sealant. After the sealant dried, I trimmed it about 1/32 in. above the wood.

Noise abatement

Though I wear ear protection when working with power tools, I thought that reducing the noise level of the dust collector would make it more pleasant to use and reduce fatigue. I might even be able to collect dust while hand-sanding and listen to the radio at the same time.

The best way to cut noise is to contain it inside an isolation box. Lining the box with acoustical foam cuts sound transmission significantly. Isolating the noise in a dust collector is difficult, though, because air is the main conductor of sound, and you need an inlet and an exhaust hole for the blower. The cyclone acts as a partial muffler for the intake, and the case acts as an isolation box for the cyclone. The blower exhaust is muffled by the swirl box and by the air plenum in the back of the case, as shown in the bottom photo. By the time the sound waves bounce off the acoustical foam lining of the air plenum, pass through the filter manifolds and out through the tube filters, they've lost most of their energy.

Reducing motor noise would be a simple matter of building a foam-lined box were it not for the need to supply cooling air to the motor. To provide the needed air, I let the fan housing protrude through the top of the box, and then I created a labyrinth of acoustical foam that bounces the sound waves around several times before they make it out of the box.

If you're not so concerned about noise control, you could mount the filter manifold at the top of the system, and let the blower exhaust directly into the manifold. The filter tubes would hang upside down, but they could be easily removed for cleaning without spilling any dust. This system would be slightly more efficient because of reduced duct losses. Personally, I've become so used to the deep, gentle hum of my system that I find non-silenced dust collectors unbearably loud. □

Neil Seely is a woodworker and engineering consultant in Rochester, N.Y.

***Adding a cyclone** and tube filters to a dust-collection system while maintaining portability, is a worthwhile challenge for small-shop woodworkers. The author accomplished this by mounting the blower directly over the cyclone and arranging the tube filters along either side. The only concession to space is the 5-gal. collection bucket, which works fine for dust-generating operations but quickly fills when producing chips on a planer.*

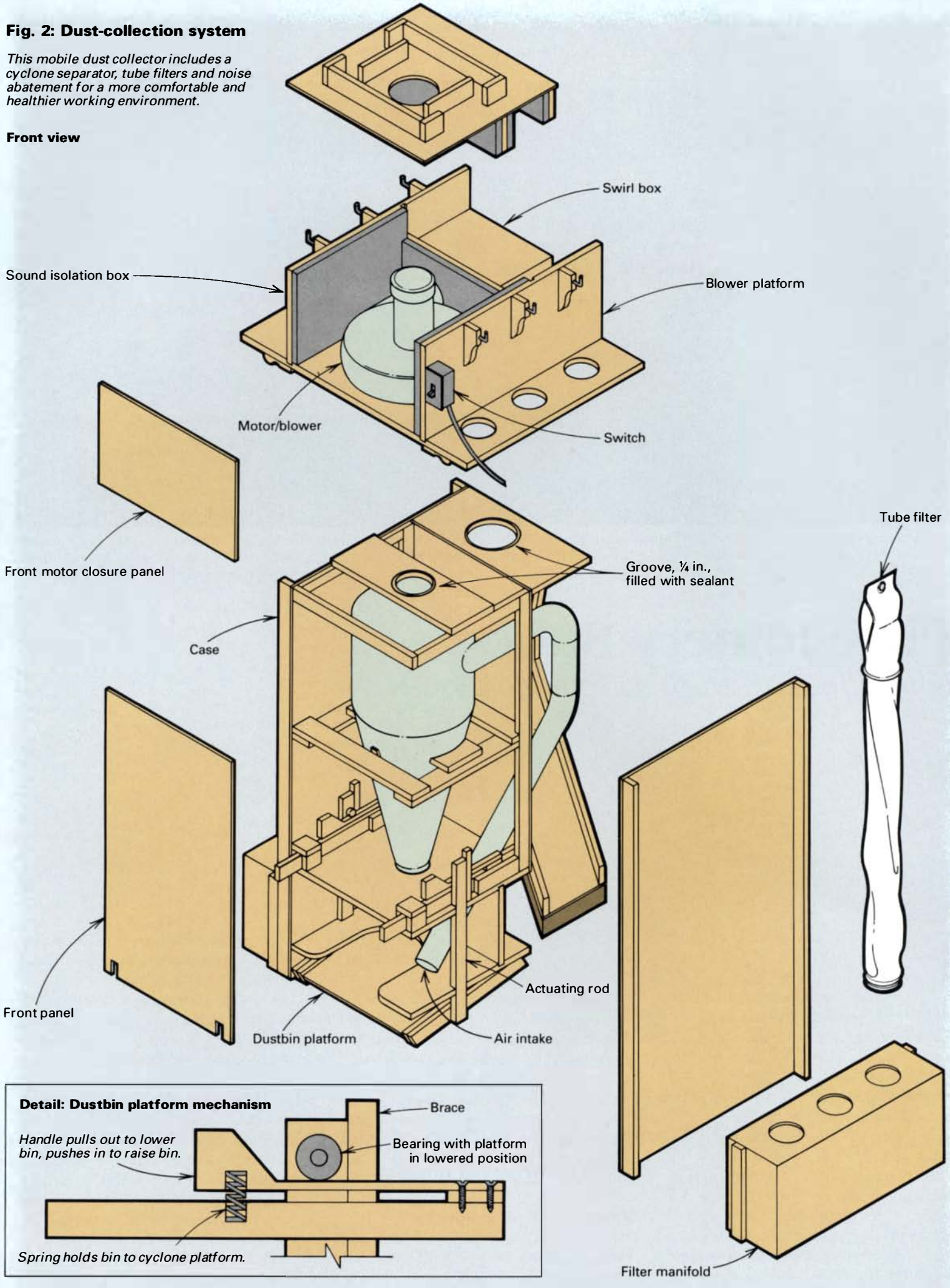
***Padded baffles quiet the collector**. Removing the back panel reveals the acoustical foam lining of the air plenum, which carries air from the blower to the filter bags. Baffles in the housing above the cyclone quiet the noisy motor and fan. The metal duct is the inlet pipe for the cyclone.*

Photos this page: Neil Seely

Fig. 2: Dust-collection system

This mobile dust collector includes a cyclone separator, tube filters and noise abatement for a more comfortable and healthier working environment.

Front view



Detail: Dustbin platform mechanism

***Proper grip and stance** make it easy to cut accurate, tight fitting joints. The left hand firmly holds the joiner's fence to the workpiece with the right arm locked to the body. The legs do the pushing. A stop clamped to the workbench holds the piece steady. Cutting the other end of the workpiece or replacing it with another is easy because the workpiece is not clamped to the bench.*

Plate-Joinery Basics

Four different setups will cut most joints

by Ed Speas

I could build furniture and cabinets without a plate joiner, but after using one for several years, I wouldn't want to. Plate joinery is a satisfactory and speedy alternative to some traditional joinery.

A plate joiner is a small, hand-held saw with a 4-in.-dia. blade. The blade plunges into a workpiece to cut a radiused kerf. A football-shaped joining plate is then glued into the mating kerfs in the pieces to be joined, like a loose tenon, to create a strong joint. The joining plates (called biscuits by some Yankees who don't know that biscuits are served with gravy for breakfast) are made from solid beech and are slightly compressed. Moisture from the water-based glue causes the plates to swell in the kerfs for a tight fit and strong bond. All you have to do is clamp the members together, and precise joint alignment takes care of itself.

There are many different applications for plate joinery, but I've grouped them into four categories based on the machine setup required to cut the kerf. These categories are flush, small offset, large offset and miter. Before discussing how to set up and cut these joints, lets look at which jobs are best for plate joinery and some basic requirements for cutting accurate joints with a plate joiner.

When to use plate joinery

Plate joinery is one of the best systems I've found for joining man-made sheet materials. But you should use as many plates as possible when joining pre-finished or prelaminated sheet goods because glue won't adhere well to finished surfaces.

The system also works well with solid-wood joinery, but you need to consider grain direction. When joining face frames, frame and panel, and legs to rails, one of the butt-joined surfaces is end grain. The joint's strength is in the glueline of the plates, without much assistance from the butt joint itself, and it may be inadequate for the application. To strengthen these joints, use two plates side by side. This effectively doubles the strength of the joint. One way to test the strength of any joint is to plate join a sample, and when the glue is dry, try to break the joint apart.

When doubling plates, allow ⅛ in. be-

Photos: Charley Robinson

tween kerfs and at least 3/16 in. between the kerf and the face of the board to avoid telegraphing. Telegraphing happens when boards are planed or sanded flat while still swollen from the moisture of the glue and the swelling of the plates. When the wood shrinks later, there will be a slight depression at each joining plate. Leg and rail joints can be further strengthened by adding triangular, corner glue blocks.

Adjusting a plate joiner

The parts of a plate joiner that position it on the work need to be true and square to cut accurate joints. The base should be absolutely flat, as must the face. The face also must be at 90° to the base. When attached to the joiner, the fence should be flat and perpendicular to the face. If the base, face and fence check out, you have a good machine. But, if even one part doesn't pass the test, you'll have to replace it or exchange the whole machine for a new one.

Most plate joiners have three preset depth-of-cut stops, which correspond to the most popular sized plates: #20 (about 2⅜ in. long), #10 (about 2 in. long) and #0 (about 1⅞ in. long). Some machines have additional settings to accommodate new plates (see *FWW* #98, pp. 57-61). For any given joint, you will want to use the largest plate possible—the larger the plate, the greater the gluing area and the stronger the joint.

You can fine-tune the depth of cut (set it slightly deeper than half the width of the plate, so the plate doesn't prevent the parts from butting tightly together during assembly). I check the setting by inserting a #20 plate into a kerf cut at the #20 setting. I draw a line down the middle of the plate along the edge of the board, turn it 180° and put it back in the kerf. If the pencil line still shows, the kerf isn't deep enough. If the line disappears into the kerf, I draw another line as before, pull the plate out and check the distance between the two. It ought to be between 1/16 in. and ⅛ in. Once the depth is set for one size plate, it will be correct for the other plate sizes. Because the depth adjusting knobs may vibrate loose, I periodically check them.

There are three factors that influence the amount of pull to the left exerted by the cutting force of the blade: how fast you plunge the tool, your grip and stance, and the sharpness of the blade. Most joiners have two small pins in their face that penetrate the workpiece to help prevent the machine from pulling to the left. But the pins aren't necessary if you use a strong grip and proper stance (see the photo on the facing page) and make a slow plunge with a sharp blade. In fact, I prefer to take the pins out because they keep the joiner from sliding freely along the workpiece when aligning the cut. When I'm joining miters, the pins are a particular problem because they're pushed into the workpiece at an angle. This can cause the pins to jam and hold the machine's face off the workpiece, which results in a misaligned cut.

The plate joiner is a simple machine and requires little maintenance, but there are a few areas that need attention to keep the tool operating at peak efficiency. To prevent excessive wear (which can render the joiner totally useless), clean and lightly oil the slide mechanism frequently. The blade should be kept free of pitch and residue, and sharpened as needed. A plate joiner has a small motor; taxing it with a dull blade will shorten its life. The blade should be only face ground when sharpened. If the sides of the teeth are ground, the kerf will be too narrow for the joining plate.

***Cutting an offset joint** using a shim spacer, the author kerfs a table apron that will be set back from the face of its leg by the thickness of the shim. The template in the foreground helps to lay out the kerf in the apron's narrow end.*

Four basic joints

Virtually all joinery situations fall into one of the four following categories depending on how you set up your plate joiner.

Flush joints—The most common joinery situation is when you join two pieces flush on at least one edge. A butt joint is one example. Another would be a right-angle connection flush only on the outside, such as a drawer or cabinet. For all such operations, the fence is set the same for cuts on both pieces. The marks go on the outside of the pieces, and the fence registers on the face, or edge, that has the mark.

Small offset joints—The next situation includes joints where two pieces are at right angles, but not flush, and where the distance of the offset is within the range of the fence. Examples are attaching a rail to a table leg, where the rail is set back from the outside of the leg, or attaching a face frame to a cabinet side where the face frame extends past the side. Marking out is the same as for the flush joints.

Cut small offset joints two ways: The first way is to set the fence so the kerf is centered on the edge of the piece that will be set back, such as a table's rail. Then, before cutting the joint in the table leg, raise the fence the amount of the offset.

The second method uses a shim block the same thickness as the offset. The distance from the fence to the center of the blade is half the thickness of the piece to be set back, plus the thickness of the shim block. For example, for a ¼-in. offset using ¾-in.-thick stock, set the fence ⅝ in. (⅜ in. plus ¼ in.) from the blade's center.

To cut the kerf in the edge of the piece that will be offset, use the shim block between the joiner's fence and the board, as shown in the photo above. To cut the kerf in the overhanging piece, rest the fence on the stock. You don't have to change the fence, so there is less chance of error.

Large offset joints—These joints are similar to small offset joints except that the offset is beyond the range of the fence. Examples are a shelf or a divider in a cabinet. For simplicity, I'll use a shelf to describe the process.

Draw a line across the upright where the shelf will go, and clamp a straightedge on the line. Hold the shelf in position tight against the straightedge, and mark the locations of the joints. I lay plates on the cabinet side, space them by eye and then mark both the shelf and cabinet side, as shown in the top photo on p. 84.

Because the fence is removed for this operation, the registration point becomes the base of the joiner. To cut the kerfs in the upright, hold the joiner's face on the upright with the base against the straightedge. Line up the joiner's center mark with each pencil mark and cut the joints.

To kerf the edge of the shelf, clamp the

shelf to a flat bench with the pencil marks showing. With the joiner's base flat on the bench and its face against the edge of the shelf, align the machine with the pencil marks and cut the joints.

Angled shelf joints, such as for a magazine rack, are cut in the same way. Simply clamp the straightedge at the desired angle.

Mitered joints—The fourth situation is joining mitered pieces, such as in a carcase corner or a drawer. For mitered joints, the joiner's fence must be at 45° to its face. Some machine's fences are preset for 90° and 45° only. Others are adjustable between 45° and 90° for more versatile mitering. There are two different setups for the 45° fences depending on the brand of joiner. Some joiner's fences angle up away from the base, and some angle down toward the base. The direction of the fence's angle determines whether the miter joint aligns along the inside or outside surfaces, as shown in the bottom photo.

When the fence goes up, the cuts are referenced from the inside surfaces of the stock, thus aligning the inside corner. If the fence goes down, the kerf is registered from the outside, ensuring that the outside of the miter is flush. If the pieces being joined are the same thickness, both fences yield the same results. But when dealing with unequal thicknesses, you must decide whether to align the inside or the outside of the corner joint.

Laying out plate joints

After you've cut the project parts to width and length, identify and mark the orientation of each piece to avoid confusion at glue-up time. Next mark where each plate will go. Hold or clamp two pieces together as they will be in the final assembly, and draw a line for the center of each plate across the intersection of the two pieces. If the parts are too large to handle, lay out the cuts with a tape measure. A soft-lead, 2B or 4B drawing pencil makes a dark line that won't dent the wood but that can be easily removed after the joints are cut. A white pencil works well for darker woods.

How far apart you put the plates will vary according to the size of the joint and the stress it will take. I lay out the plates by eye, as shown in the top photo. Usually, 6 in. to 8 in. apart is fine. In most cases, you will want the kerf to be close to the center of the board's thickness. Again, eye-ball accuracy is just fine.

Tips for safety and control

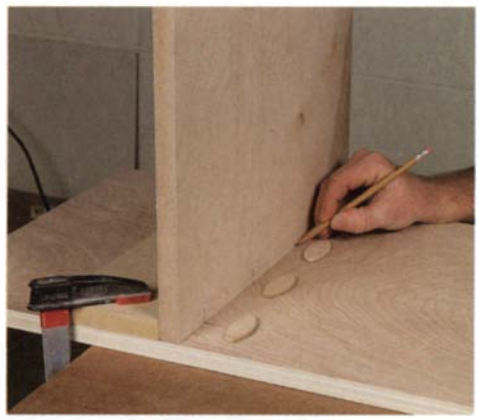
Before cutting the kerf, secure the workpiece. Holding the workpiece and the machine at the same time can be dangerous, and it makes it difficult to control the machine. You can either clamp the work to the bench, or clamp a stop to the bench to keep the piece from sliding, as shown in the photo on p. 82. The stop makes it easy to turn the piece around and replace it with the next one without re-clamping.

Though the joint may be ready to be cut, you first need to understand how to use and handle the tool properly. Stance, grip, and movement are all important. Stand with your feet far apart, one in front of the other, like a runner's starting position. The push comes from your legs, not from your arms. One hand holds the tool and operates the switch while the elbow stays locked to the body and moves with the body. The other hand holds the joiner's fence securely to the workpiece. Different styles of fences require slightly different grips. But whatever the grip, you should be able to hold the machine stable with only the hand on the fence.

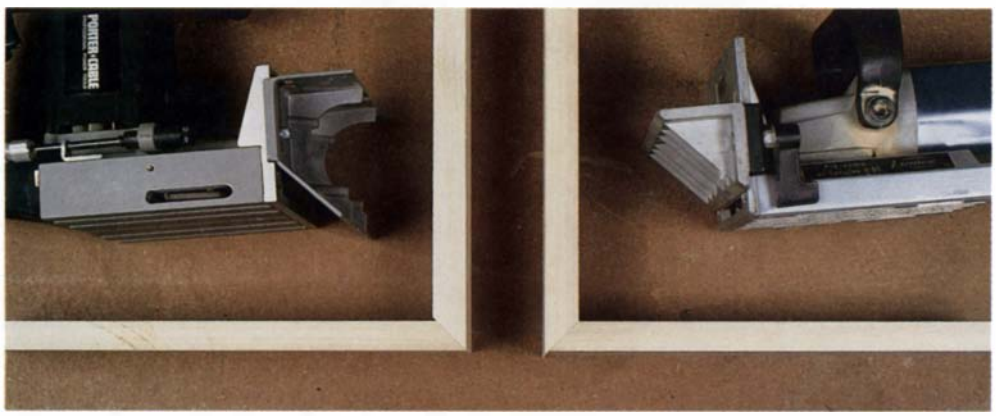
Use the handle on the top of the machine only to carry it around the shop, not for operating the machine. Remember, the plate joiner has a small motor, so take it easy while cutting the kerf—in slowly, out slowly. This gives you better control and reduces the chance the tool will wander during the cut. Hold the tool steady. Any movement up or down will result in an enlarged kerf and a loose-fitting plate.

On large pieces, it's best to start on the right side because the dust is ejected out that side of the machine. Starting from the left leaves the dust in the path of your next cut. The dust can keep the fence from lying flat on the face of the board and cause your joint to misalign.

A few practice cuts will help you eliminate sloppy joints on your first project. Remember, it's a hand-held tool and will operate only as effectively as you do.



***Laying out the joints** is done by using plates to visualize spacing. The straightedge clamped to the carcase side holds the shelf in place for layout and becomes the reference surface when cutting the joint.*



***Alignment of a miter joint,** either along its inside or outside surfaces, is determined by the miter fence when joining boards of unequal thickness. If the fence angles toward the base, the outside of the joint will be aligned. Conversely, an upward angled fence produces a joint aligned on the inside.*

Gluing and clamping

Because the plates start to swell immediately, you don't have time to run around the shop looking for clamps and trying to figure out what goes where at glue-up. So it's best to dry-clamp your projects before you start gluing. That way you'll have your clamps and clamping blocks ready, and your act rehearsed, when the time comes.

Apply glue in the kerf only—not on the plate. The plate can swell and make assembly difficult. Don't just pour glue into the hole either. Spread the glue on the sides of the kerf where the wood-to-plate contact is. The easiest way to apply glue to the kerf sides is with a glue bottle designed specifically for this purpose. Once you've got glue in the kerfs, apply it to the rest of the joining surfaces.

Some people say that clamping time can be reduced because the swollen plates hold the two pieces together. But, for best results, leave the clamps on as long as for any other joint. □

Ed Speas works wood in Ballground, Ga.

Dana Robes, Wood Craftsman

Producing solid-wood furniture, one piece at a time

by Sandor Nagyszalanczy

***Dana Robes stands in front** of his workshop on the grounds of Lower Shaker Village in Enfield, N.H., where his craftsmen build the company's line of Shaker-inspired furniture. The twelve-person shop is a far cry from Robes' first shop, which was set up in a small garage.*

Dana Robes began building furniture in his small garage workshop in 1981. Today, his twelve-person New Hampshire workshop produces an extensive line of solid-wood furniture and accessories, which are sold through a color mail-order catalog and through two showrooms. But despite the growth of his enterprise, Robes has shunned the shortcuts of modern production and is still building high-quality, solid-wood furniture because he believes that "given the choice, people will pay a premium for furniture that will last a long time." This philosophy not only has shaped the innovative way Robes runs his entire business operation but also has defined his policies for hiring and training employees, his individual-craftsman method of furniture production, his presentation and marketing of products, and his forward-thinking customer-service policies.

"Given the choice, people will pay a premium for furniture that will last a long time."

Robes was building Shaker-style furniture years before he moved his business to Lower Shaker Village, the site of an original Shaker settlement in Enfield, N.H. "My early shops were equipped to do straight-lined work, so I was naturally attracted to the clean lines of traditional Shaker furniture," he said. During years of growth, his furniture line has evolved to include more than 60 pieces, including beds, tables, desks, cabinets, chairs, dressers, stools, clocks, mirrors, pegboards and accessories. Some pieces, such as the Sister Aida table, are direct reproductions of original Shaker designs. Others, such as the television cabinet, are contemporary interpretations designed by Robes' craftsmen. Their work is displayed in an on-site showroom, a rebuilt 1793 Shaker meeting house across from the Robes' workshop (see the photo above), and in their new showroom in Greenwich, Conn. (see the sidebar on p. 87).

In addition to its standard line, the Robes' shop does custom furniture, cabinets and millwork in the same contemporary Shaker vein as the rest of its woodwork. At the Greenwich showroom, manager Debbie Robes (Dana's daughter) can sit down with prospective clients and quickly render a proportionally correct computer-aided design sketch of a piece that they have in mind, using a compact Macintosh computer. A printer gives customers a personalized drawing to take home to help them envision the piece as it would look when built. If the commission gels, Debbie transfers the computer sketch via modem over the phone line to the workshop for refinement and final shop drawings.

Cultivating craftsmen

To create the high-quality furniture he's committed to producing, Robes must hire and train the right kind of craftsmen to build it. He prefers to hire motivated, responsible and intelligent non-craftspersons and train them through a lengthy, traditionally based apprenticeship program. He finds it easier to cultivate good habits in inexperienced workers than to break a seasoned production-shop veteran of work habits that may be unsafe or not up to Robes' standards of quality.

Trainees start as apprentices, learning basic machine-tool safety and standard joinery and construction methods based on sound principles. For example, all cross-grain joints, such as dust panels in dressers and aprons on tables, are floating, allowing the solid-wood parts to expand and contract in response to annual climate changes. Over a period that can take several years, apprentices work their way up to become journeymen, then craftsmen and, finally, master craftsmen, a title that only four Robes employees

hold. This last step requires developing leadership skills and designing a piece of furniture for the company's product line. Master craftsmen also get the opportunity to help others learn woodworking. Weeklong workshops pair each student with a master craftsman who helps the student learn all the basic skills needed to build a piece of furniture to take home.

Building furniture one piece at a time

Unlike many large commercial shops, there are no production lines at Dana Robes' shop. Instead, craftsmen fulfill orders for both standard items and custom pieces by building only a piece or two at a time. This means the same person does all the work, from selecting the wood to final assembly. While it's undoubtedly more efficient to employ specialized workers on different parts of a project, Robes shies away from this method, saying: "My craftsmen are people, not machines and should have the pride of building and being creative." In addition, he feels that even tedious tasks, such as sanding, are important to the quality of a piece as perceived by the buyer. Robes observes that "people usually relate to the feel of a piece as much as how it looks, and good sanding takes skill."

***Building furniture one piece at a time** is a basic tenet of Robes' approach to producing a line of quality solid-wood furniture. One craftsman builds an entire piece, from lumber selection to final assembly. Here, veteran craftsman Brad Purmont shaves a drawer, fitting it into a cherry sideboard.*

***Each piece is signed** by craftsman and finisher in Robes' shop even if it's just a $16 mini pegboard, as shown here being signed by finish craftswoman Andrea Dow.*

***Dozens of jigs** used to machine parts are hung from the shop ceiling. Each is color coded to a particular production item, making it easier to find when needed.*

Construction of a piece begins with boards selected from the shop's stores of oak, cherry and white pine. Small quantities of maple, walnut, butternut and mahogany are also stocked for special orders. To prevent lumber from drying out during dry Northeastern winters, an automatic humidifying system sprays short bursts of water through ultra-fine atomizing jets located around the shop, maintaining humidity at around 45%.

After reviewing shop drawings, the craftsman next cuts out parts and glues up panels for tabletops or carcase sides, as necessary. Very little wood is wasted: Larger scraps and boards with unattractive or problematic grain patterns are set aside for smaller parts or to be used in unseen areas of casework, such as for dust panels and glue blocks. Even the smallest scraps aren't wasted—they're burned in the shop's central heating system—one of the only concessions to production-line efficiency in the shop. A few items, such as drawer parts or dust panels, are made in quantity, usually by trainees. When needed, the craftsman fits the component to the piece, cutting joints and trimming it as required.

Most machine work and assembly for furniture pieces is done on the first floor, rough mill machines at one end, a bench area at the other. Chairs are built on the second floor, where craftsmen can concentrate on the fussy handwork the spindle- and ladder-back chairs demand—work that doesn't belong in the bustling machine shop downstairs.

In lieu of the specialized or computerized machines that are usually the mainstay of larger production shops, most parts for Robes' furniture are shaped on standard stationary tools, such as tablesaws and shapers, using jigs built by the craftsmen themselves. Because dozens of different jigs are used and reused to build standard pieces, the jigs are color coded (jigs for building the same piece are painted with the same color) and hung from the ceiling when not in use, as shown in the bottom right photo. To maintain clean air, machines are connected to an extensive dust-collection system with a cyclone-type extractor housed in a silo adjoining the shop. The system vents back into the shop through a battery of tall, narrow canvas dust bags, which run floor to ceiling, thus keeping heated air inside the shop in the winter. A separate system, housed in a special explosion-proof room, handles the fine dust collected from finish-sanding, which is done atop custom-built vacuum tables.

When a piece is completed, it's carted into the shop's finishing room where another craftsman (most often craft*swoman* Andrea Dow) applies several hand-rubbed coats of the shop's standard finish, a mixture of boiled linseed oil, turpentine and polyurethane varnish Robes adapted from Sam Maloof's formula. Before any piece is packed and shipped, one final—but crucial—task is attended to. Both the wood craftsman and finisher sign and date the piece (see the bottom left photo). This is done on just about everything the shop produces—from a $10,500 Daniel Webster desk to a $16 mini pegboard. Do people really notice or care about this small touch? You bet: Once a craftsman had to drive to a client's home in Massachusetts because he had forgotten to sign a bookcase.

Photos: Sandor Nagyszalanczy

The Robes showroom: selling more than furniture

The main lesson Dana Robes learned from an unsuccessful attempt at maintaining a showroom in Portsmouth, N.H., was that you have to go where there are enough people affluent enough to afford your product. It's not surprising then that his next attempt was in Greenwich, Conn., opening a shop just around the corner from Greenwich Ave., Connecticut's version of Manhattan's boutique-studded Madison Ave. But unlike galleries that display woodwork like art objects, Robes shows off furniture at its functional best. The Shaker-style pieces, standard Robes production items mostly in solid cherry, are displayed and organized into cozy room settings, allowing potential buyers to envision how the pieces might look in their own homes.

You enter through a study/living area (see the photo at right), then walk through a formal dining room and bedroom toward the rear of the deep, narrow space. A Shaker-style pegboard runs around the main showroom area as a traditional touch that also provides a flexible means of displaying additional items, such as mirrors, chairs and hanging cabinets. Other accessories not made by Robes, such as bentwood oval boxes, pewterware, rugs, quilts and lamps, are also for sale and complete the showroom's stylish ambiance. Even gift certificates fit the tone of the place: Each one is handwritten on a finished cherrywood strip.

The day I visited, Dana Robes greeted visitors at the door, inviting them in to browse and putting them at ease. He'll proudly show anyone who asks how well his furniture is made, pulling out a drawer to reveal the dovetails and floating solid-white-pine bottom panel. If buyers need further assurance about the quality of the work, Robes keeps some props handy: a demonstration mortise-and-tenon joint and a sliding dovetail reveal the hidden integrity built into each piece. A wall poster that lists the 88 steps required to build a small side table and a chart describing the company's trade-in policy further strengthen the quality image. Dana Robes assured me that "What we're selling here is confidence, that we make nice stuff and that we'll be around for a long time."

Is Robes' marketing approach working? It's too soon to tell, but weeks before the 1992 Christmas rush, the four-month-old showroom was already producing 20% of Robes' total business. With its affluent location and proximity to major urban areas, Robes hopes that the Greenwich showroom will eventually account for half of the company's sales. If that happens, it's likely that Robes' homey Shaker interiors will appear in other cities in years to come. —*S.N.*

***Like a contemporary Shaker house,** not a gallery, the Robes furniture showroom in Greenwich, Conn., is designed to show off products in a home-like setting. The Shaker style pegboard is not only a traditional fixture but provides flexible means of displaying chairs and smaller items, such as mirrors and hanging cabinets.*

The catalog: selling more than just furniture

After years of doing word-of-mouth business and exhibiting at craftshows and local craft centers, Dana Robes decided it was time to try selling through his own mail-order catalog. He mailed the first one in 1988; since then, he has refined his presentation into a 24-page, full-color catalog that represents Robes' people-oriented marketing strategy. Excellent photos display the entire line of furniture in homey settings. Technical blurbs scattered throughout the catalog describe the work's joinery and finishing, educating readers and helping them to distinguish Robes' work from cheaper mass-production alternatives. A formula for the Robes finish (also sold ready-mixed) is included, reinforcing the notion that there are no special secrets to beautiful, well-made furniture, just good know-how and hard, honest work.

The catalog contains a lot more than just information about woodworking; it presents a personal view of the entire Robes operation. This includes descriptions of local Shaker landmarks, lending the reader a sense of the heritage of the company's Shaker-inspired furniture. Short biographies introduce the reader to Robes' craftsmen, employees and family members, serving to let customers know more about Robes' people and make customers feel more comfortable doing business with the company.

More recently, Robes created a quarterly newsletter to help him keep in touch with his customers and let them know about events, such as their workshop seminars and about new products, such as their *Tommorrow's Chair*, an upholstered armchair designed to rock forward, making it easier for the sitter to stand up. Most importantly, the newsletter makes recipients feel like part of what Robes refers to as his "family of customers."

Trade-in program

The pièce de résistance of Robes' marketing program allows customers to trade in their old furniture for a credit toward another piece—anything Robes sells. He sees this as a necessary service to maintain customers because "as families grow and move to different housing, their furniture needs change." Pieces accepted for trade are refurbished, cleaned and usually refinished, then resold from the "used" store above Robes' workshop.

Unlike used-car-type trade-ins, percentages for Robes' furniture *get higher* the older the piece gets. A 1992 piece commands 65% of its original purchase price and appreciates 5% annually. The program assures customers that they're buying more than just furniture: They're making an investment. What better sales device than to tell customers that if they buy a dresser now, in 10 years they can sell it back for more than they've paid for it! This is indeed the kind of furniture that Robes pledges to build in his introduction in the catalog: "Furniture that your children and grandchildren will appreciate and treasure." □

Sandor Nagyszalanczy is senior editor at Fine Woodworking.

Wood Against Weather

The right product and good techniques will keep your outdoor projects from falling apart

by Jim Tolpin

With the time and effort required to construct a piece of outdoor furniture, an obvious question is what finish will protect it from the sun, rain and cold. The answers range from doing nothing to spraying on a coat of catalyzed linear polyurethane, the same stuff used to paint 747 jumbo jets. The choice of whether to finish or not to finish is not just a question of protecting the wood. You must decide how you want your outdoor furniture to look over its lifespan and how much time you're willing to invest to maintain this appearance year after year.

No finish: carefully choose the wood

Deciding not to finish means choosing a wood that is stable and rot resistant. It also means being willing to accept a coarse-textured piece of furniture that can vary in color from silver gray to dark gray or brown. The advantage of not finishing is the minimal maintenance required to keep the surface clean.

Some good woods for outdoor use are redwood, cypress and cedars. I especially like Port Orford cedar for its workability and light color. These species contain natural pesticides in their chemical makeup, and all are incredibly resistant to rot. However, these relatively soft woods offer little impact resistance, and they have been extensively over-harvested. But in recent years, several companies have formed to recycle old timbers.

For a harder wood that will stand up to bumps, choose white oak or black locust. These woods build up *tyloses*, a bubble-like formation that blocks the penetration of water into the cell structure, making them particularly well-suited for outdoor use. Two other woods usually associated with indoor furniture, black cherry and walnut, surprisingly rate with the cedars in decay resistance because of their closed-cell structure. Also, Pacific yew is a beautiful wood that outperforms even redwood in rot resistance. But these species move quite a bit with changes in moisture content,

Choose wood carefully for unfinished exterior furniture. *Plantation teak, used in this bench, is a good choice because it's naturally rot-resistant and turns a beautiful silver gray. Some other durable woods are white oak, cypress and cedar. These woods are easily maintained by occasionally scrubbing away dirt and mildew. Bronze caps protect the bench's feet from standing water.*

Photo: courtesy of Giati Designs, Inc.

Building to last

The type and quality of the finish and the material from which outdoor furniture is made contribute immensely to its beauty and to its durability. But the best of coatings and materials can be destroyed by construction techniques that trap water within the furniture. Trapped water nourishes voracious parasites that can reduce wood to a sponge cake of half-digested cellulose.

With this happy thought in mind, I'm inspired to find ways to build outdoor furniture with a second line of defense. I've learned that a structure exposed to the elements needs to be built with waterproof glues, joints that shed water without sacrificing strength and with fasteners that won't rust away.

Fasteners and adhesives

When you must attach components to one another, use a fastener made from (or coated with) a non-ferrous metal. Not only does iron rust, eventually crumbling to dust, but also it causes corrosive damage to the wood, especially to acidic woods like oak. If I don't care about appearance, I'll use a hot-dipped galvanized fastener. If appearance is important, I'll choose either stainless steel or bronze. In some applications, such as attaching thin slats to a framework, I'll use the boatbuilding technique of riveting with copper tacks and roves, a dished washer over which the end of the tack is peened (see the sources of supply box on p. 90).

Woodworkers can choose from three types of outdoor adhesives: a water-mixed plastic-resin glue, a two-part epoxy resin and Titebond II, a new one-part adhesive that the manufacturer claims will stand up to most outdoor applications except submersion. Although I've yet to try it, the convenience of an adhesive that you don't have to mix is mighty appealing. I've used Weldwood's plastic-resin glue for years. Unlike epoxy, the plastic-resin glue is not strong across gaps. But I'm allergic to epoxy, and I don't like its sensitivity to temperature during setup. For oily woods such as teak, however, epoxy remains the best choice.

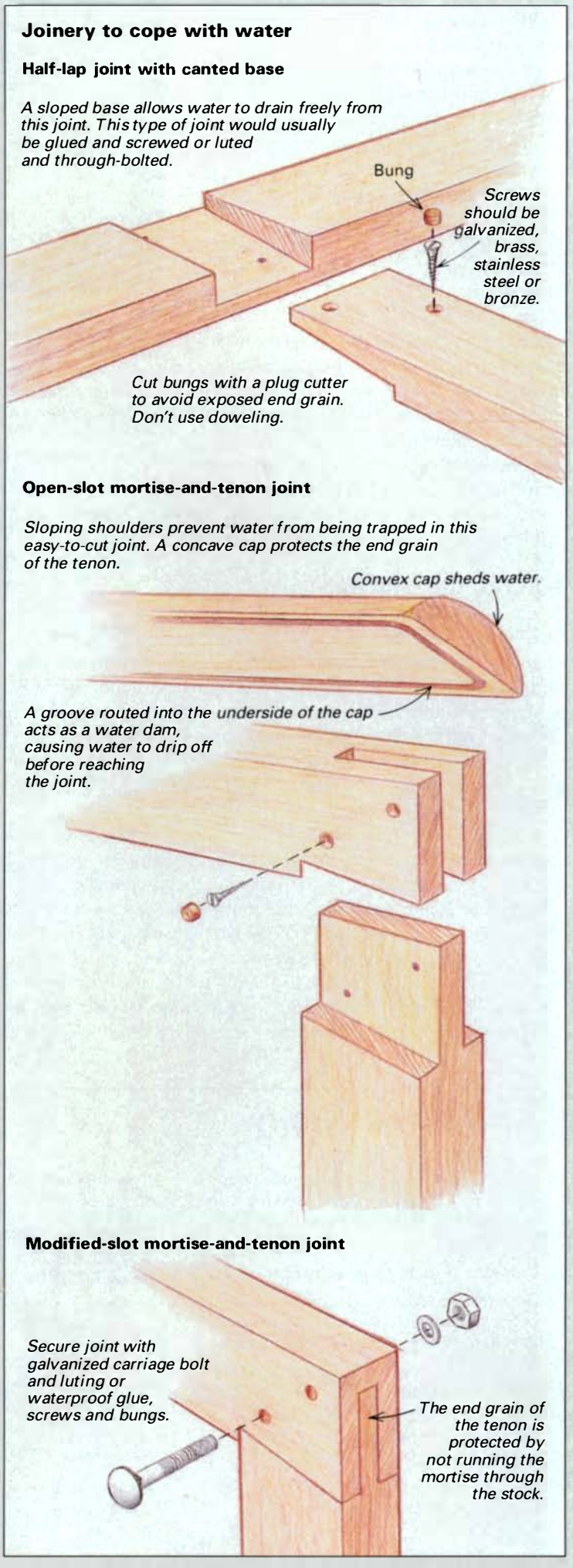
Water-shedding construction

Whenever possible, I design joints so water can drain out. The canted base of the half-lap joint, as shown in the drawing at right, prevents water from accumulating under the overlapping tongue. A slot mortise-and-tenon joint, as shown in the drawing, is easy to cut, and its angled shoulders drain water from the joint. This joint exposes the tenon's end grain on a horizontal surface and should be capped, or the tenon should be stopped short, as shown in the drawing. Note that the cap has a convex top surface to shed water and a groove along its bottom edge. The groove acts as a water dam, encouraging the water to drip at this point, rather than continuing to the joint area.

Other defenses

As added insurance against water finding a home between two non-glued wood surfaces, I coat the joint's mating surfaces with a luting compound before fastening them together. Traditionally, pine tar was used for this purpose, though modern adhesive caulking compounds and specialized marine bedding compounds, such as Dolfinite by Woolsey/Z-Spar, have largely replaced pine tar (see the sources of supply box).

My last defense is common sense. Leaving unprotected legs of outdoor furniture sitting in moist soil is asking for trouble. I seal the end grain of legs with paint and set them on bricks or gravel for good drainage. I also avoid leaving my furniture sitting unprotected under blistering summer sun or under a winter's worth of snow. A tarp can protect your furniture year round when not in use, but in the winter, it's best to bring it indoors. This is why I've designed many of my chairs and tables to fold for storage. Finally, if I do decide to put a finish on the structure, I am then committed to keeping that finish intact. *—J.T.*



Drawing: Maria Meleschnig

making them prone to surface checking and warping if left unfinished.

For outstanding beauty with exceptional stability and rot resistance, nothing can beat Honduras mahogany or teak. These woods age to a gorgeous silver gray after only six months of exposure. But quotas and over-harvesting have driven prices up and availability down. The good news is that plantation teak and other lesser-known species are now being harvested, often from sustainable-yield forestry operations in tropical countries.

Inherent rot resistance is not the only criterion to consider when choosing wood to be used outside. The wood should be air-dried to a maximum 20% moisture content to provide stability and enduring, tight-fitting joints. In addition, select the stock from the heart of the tree, avoiding the sapwood. The sapwood contains—you guessed it—sap. And sap is full of sugar, a wood bug's breakfast of champions.

Paint can't overcome poor design. *This unlined, wood planter box is destined to fail because the moist soil holds water against the wood, allowing it to seep into the joints, and these joints aren't designed to drain water. The unprotected end grain of the feet also wicks up water from the puddles in which the planter stands.*

Selecting the right finish

To get a color other than gray and to minimize the inevitable surface checking of exposed wood, you can coat the wood with penetrating oils, varnishes, paints or epoxies. Clear penetrating oils and water sealers designed for exterior use contain ultraviolet (UV) filters and bring out the natural color of the wood. The UV filters help shield the wood from solar radiation, which destroys the lignin in the wood and reduces the wood's ability to hang on to the finish. Transparent stains and washes enhance the natural color or impart their own tint.

Finally, you can seal the wood entirely under a pigmented gloss topcoat—I call this *paint* around my shop. Paint is the right finish if you want to shield the wood from sunlight completely.

To test the longevity of the commonly available oils, stains and water seals, outdoor furnituremaker Mark Singer of Santa Barbara, Calif., subjected dozens of coated wood samples to grueling tests in an accelerated environmental chamber. After the equivalent of one year in a harsh environment, not a single sample was free from significant deterioration. Singer's suspicions were confirmed. Unless these types of finishes are constantly renewed, they loose both their protective functions and their decorative effects, and the surface of the wood eventually turns blotchy.

Gloss topcoats deliver the maximum durability in a clear finish, especially in harsh sun-drenched environments. The additives that turn a gloss finish to semi-gloss or satin soften the finish coat, reduce UV reflection and decrease longevity. Traditional spar varnish has no peer in bringing out the beauty of wood. It's durable, long lasting in a harsh marine environment and is easily renewable. As long as a varnished surface is regularly maintained (at least once a year), the color of the wood will last indefinitely. Regular maintenance includes touching up nicks and worn spots, and sanding and reapplying two new topcoats before signs of graying show up.

Modern urethane varnishes can last at least twice as long as spar varnishes, though their intrinsic hardness makes them significantly more difficult to repair. The new water-based urethane exterior varnishes are as hard and durable as their petroleum-based brethren. In addition, water-based products are less toxic during application, they recoat within hours and they are non-yellowing. None of the urethanes, however, can equal the distinctive rich glow of spar varnish.

The ultimate in long-lasting protection and gloss retention are the aerospace industry's catalyzed, two-part, linear polyurethane finishes (see the sources box). This amazing stuff, when properly applied over an epoxy undercoating, dries 50% harder than spar varnish and reportedly lasts up to five years in marine conditions. But the price is high. To coat 100 sq. ft. costs about $150.

Paint is, by far, the most protective and longest-lasting coating you can put on a piece of wood destined to live outside. The higher the gloss and the lighter the color, the better the protection. The gloss reflects the suns harmful rays, and the light colors absorb less of the heat that can break down the paint film. □

Jim Tolpin is a woodworker in Port Townsend, Wash.

Sources of supply

The following companies manufacture or supply products that can be used for building and finishing outdoor furniture:

Exterior finishes and supplies:

Detco Marine (also carries linear polyurethanes), PO Box 1246, Newport Beach, CA 92663; 800-845-0023 or 714-631-8480

Hydrocote Co. Inc., PO Box 160, Tennent, NJ; 908-257-4344

Interlux Co., 2270 Morris Ave., Union, NJ 07083; 908-686-1300

Woolsey/Z-Spar Marine Paints, 36 Pine St., Rockaway, NJ 07866; 800-221-4466

X-I-M Products, Inc., Westlake, OH 44145; 800-262-8469

Brushes and painting tools:

The Wooden Boat Store, PO Box 78, Brooklin, ME 04616; 800-225-5205

The Wooden Boat Shop, 1007 N.E. Boat St., Seattle, WA 98105; 800-933-3600

Exterior fasteners:

Doc Freeman's, 999 N. Northlake Way, Seattle, WA 98103; 800-423-8641

Jamestown Distributors, PO Box 348, Jamestown, RI 02835; 800-423-0030

Copper nails and roves:

Ray Speck Boatbuilding, 228 37th. St., Port Townsend, WA 98368; 206-385-4519

Waterproof adhesives:

DAP Inc., PO Box 277, Dayton, OH 45401; 800-543-3840

Franklin International, 2020 Bruck St., Columbus, OH 43207; 614-443-0241

Gougeon Brothers Inc., PO Box 908, Bay City, MI 48707; 517-684-7286

Information on tropical woods:

Woodworkers Alliance for Rainforest Protection (WARP), PO Box 133, Coos Bay, OR 97420; 503-269-6907

Rainforest Alliance, 65 Bleecker St., 6th Floor, New York, NY 10012; 212-941-1900

Photos except where noted: Jim Tolpin

Applying exterior finishes

Pros use certain tricks to get outstanding results every time. While these tricks may not make you a pro overnight, they are sure to improve your results. But first, you might as well get used to hearing this timeless platitude: A finish is only as good as its preparation. This is as true for simple wipe-on stains as for the most expensive catalyzed urethane paint.

Preparing the surface

Preparation means well-sanded surfaces, including sanding after raising the grain with a damp rag. Hardwoods need only be sanded to 120-grit, as long as all sanding scratches from the previous grit have been removed. Softwoods should be sanded to 220-grit. Never use steel wool to smooth wood destined for the outdoors. The remnants of steel in the pores of the wood will rust and ruin the finish.

Preparation also means well-cleaned surfaces. Wash off oily handprints with a rag dampened with thinner and follow with a light sanding. Before applying the first coat of a primer or a sealer, thoroughly vacuum the wood, and then use a tack rag to wipe away any remaining particles.

Most finishes can be put on directly from the can by brushing, wiping or spraying. The only trick is to not recoat too quickly. Follow the manufacturer's directions. Some finishes, especially the penetrating oils, should never be applied in direct sunlight. Bill Kennedy of Specialty Furniture Co., a manufacturer of outdoor furniture in Mt. Pleasant, Mich., says that sun-heated wood can bleed out the finish, which then glazes on the surface. Because oil finishes are not designed to stand on the surface like a varnish, they quickly crack and craze, and eventually peel off, requiring stripping and sanding to a clean, solid surface before refinishing.

Applying varnish

For a clear, smooth and uniform coating of varnish, follow these basic practices:

- Mix varnish by gently stirring with a paddle, never by shaking it. The resultant bubbles end up as holes and bumps in the surface film.
- Never use the finish straight from the can. Instead, strain it through a paper cone filter into a clean bucket.
- Use professional varnish brushes made from fine China bristle or badger hair grouped into an oval cross section. These brushes cost a small fortune, but they contribute immensely to the illusion that your varnish job had a pro behind the brush. Never use your varnish brushes for paint.
- Avoid varnishing in cool, damp conditions, or in direct sunlight. Cold prevents the film from hardening properly, and the sun's heat hardens the outer surface of the film too quickly, resulting in wrinkles and sags. Also, gases in the warmed wood bubble up through the finish, leaving pock marks.

I'm pretty good at applying varnish, but Julia Maynard, a full-time, freelance painter and varnisher in Port Townsend, Wash., is the best I've seen. Here are her recommendations for a durable professional-looking varnish finish:

- Use a marine-grade spar varnish with ultraviolet (UV) filters. Beginners would do well with a less dense, less expensive variety such as Interlux's Schooner Varnish (see the sources of supply box). It flows easily and sets up quickly to reduce wrinkling and sagging problems, and it holds up nearly as well as the most expensive varieties.
- To extend the life of the varnish coating, especially when applied to oily woods such as teak, use a volatile and highly penetrative undercoat. The best is Flashbond 300, made by X-I-M Products (see the sources box).
- To build up enough UV filtration to really protect the wood, especially in sunny climates, apply at least five coats of varnish.

***No finish lasts forever.** This white oak door, built for a client seven years ago by the author and finished with six coats of spar varnish, shows the effects of exposure and neglect. The finish at the top of the door, protected by the overhanging wall, is still in good shape, but at the fully exposed bottom, the finish is completely gone.*

Apply each coat carefully—think of each layer as the final coat. To avoid lap marks, apply the varnish from the dry area back to the wet area.

- Use a hand block, never a power sander, to sand to 280-grit between coats, removing all brush marks and other imperfections.
- Never use thinner to clean off the dust between coats (it reduces adhesion). Instead, vacuum and wipe with a tack rag.
- For a super final finish, go to a sixth coat. But first, sand the gloss off the last coat with 320-grit wet-or-dry paper, being careful not to cut through the topcoat. Clean away the dust, and apply the last coat with all the skill you've acquired over the first five coatings.

Applying paint

As with varnish, there are similar precautions to take for a durable, first-class paint job. Don't shake—stir the paint. Don't use it straight from the can; filter it into a clean bucket. Apply paint at room temperature and out of the direct sun. And finally, use a good China bristle brush to apply paint.

Follow these steps to achieve a top-notch paint finish:

- Fill countersunk screw holes with wood plugs (bungs), fixing them in place with shellac or varnish. Don't glue the bungs if you might want to get to the screws again.
- Sand the surfaces to 120-grit for hardwoods, or 220-grit for softwoods. Raise the grain with a damp rag at the 100-grit stage, and then sand off the protruding fibers.
- Fill small defects with a glazing compound (be sure it is compatible with your paint) or a specialized surfacing compound such as Interlux's #257 (see the sources box).
- Vacuum and tack the surfaces thoroughly. Julia Maynard then wipes the surfaces with a rag dampened with isopropyl alcohol to pick up fine dust and draw any surface moisture out of the wood.
- Apply the primer coats. Yes, that's plural. Build up the paint thickness with three coats of primer. Maynard, and many other professional exterior painters, do not, however, recommend using standard primers. They think the surface left by primers is too chalky for the best topcoat adhesion. They prefer a thinned-down semigloss topcoat paint. White is okay for most colors, but gray is best for low-hide colors like red and yellow. Sand between primer coats with 150-grit paper to remove all brush streaks, runs and drips.
- Sand the last coat of primer to 400-grit, clean up, and apply the gloss topcoat, always brushing from the dry area back to the wet area to avoid lap marks.

To make all this worthwhile, buy the most expensive enamel. It will only be a few bucks more per gallon. Oil or latex-based enamels are about equal in durability. But don't bust the bank on marine oil-based enamels unless you know the furniture will be exposed to salt air, intense sunshine and an occasional splash of gasoline. *—J.T.*

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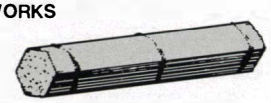

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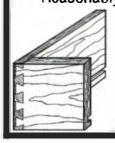

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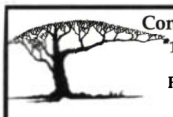

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DELTA BENCH TOP TOOLS

Model	Description	List	Sale
23-700	Wet Dry Grinder	234	168
23-680	6" Bench Grinder 1/4 HP	86	75
23-880	8" Bench Grinder 1/2 HP	151	115
11-950	8" Drill Press	199	144
28-160	10" Hobby Band Saw	210	145
31-050	1" Belt Sander 2.0 amp	104	78
31-460	4" Belt/6" Disc Sander	198	135
31-340	1" Belt/8" Disc Sander	268	195
31-080	1" Belt/5" Disc Sander	134	94
40-560	16" 2 speed Scroll Saw	266	188
11-990	12" Bench Drill Press	276	224
11-090	32" Radial Bench Drill Press	399	294
43-355	3/4" Shaper 1-1/2 HP	964	709
43-505	1/2" Bench Router/Shaper	399	279
22-540	12" Bench Top Planer	595	398
36-220	10" Compound Mitre Saw	350	239
14-600	Hollow Chisel Mortiser	668	448
46-700	12" Wood Lathe	548	434

NEW TOOLS BY DELTA

33-060	NEW "Side kick" Miter saw	499	368
14-070	NEW 14" Floor Drill Press	450	335
28-180	NEW Bench Band Saw	232	165
40-640	NEW 20" Bench Scroll Saw	466	318
23-675	NEW 6" Grinder / 3 x 24 Belt Sander	141	105
50-075	NEW Dust Collector/Sweeper 3/4 HP	360	245
20-150	NEW 14" Cut-off Saw	375	239

DELTA STATIONARY

34-444	Table Saw complete with/1-1/2 HP motor & stand	812	615
22-662	13" Planer with 2 HP motor & stand	1436	1229
28-245	14" Band Saw w/open stand 1/2 HP	698	555
17-900	16-1/2" Floor Drill Press	441	399
40-601	18" Scroll Saw with stand and blades	942	745
34-080	10" Mitre Box	Xtra Special	198
34-761	10" Unisaw 1-1/2 HP w/$100 rebate	1715	1450
33-990	10" Radial Arm Saw	818	625
37-280	6" Motorized Jointer	488	399
50-179	3/4 HP 2 stage Dust Collector	483	335
50-181	2 HP Dust Collector	885	629
70-200	20" Floor Drill Press	1049	815
33-055	8-1/4" Sawbuck comp with legs	865	595
34-330	8-1/4" Table Saw 1.3 amp	343	234
34-540	10" Table saw	210	164
34-670	10" Motonzed Table Saw	511	395
32-100	Station Plate Jointer	645	358
36-040	8-1/4" Compound Mitre Saw	224	165
34-915	30" Unifence	385	239
34-897	50" Delta Unilence	525	285
36-755	10" Tilt Arbor Saw	1264	950
36-380	10" Table Saw	550	425
33-890	12" Radial Arm Saw	1720	1435
14-040	14" Bench Drill Press	360	335
28-560	16" Three Wheel Band Saw	456	410
28-283	14" Band Saw with enclosed stand	910	739
34-445	34-444 Saw with 30" unifence	1200	789
37-154	DJ15 6" Jointer with 3/4 HP motor	1420	1160

NEW DEWALT TOOLS

The following DeWalt Tools come with two batteries!

DW944K	3/8" 9.6 volt cordless drill kit complete with charger, case, & 2 batteries	277	149
DW945K	3/8" 12 volt cordless drill kit complete with charger, case, & 2 batteries	298	169
DW364	7-1/4" Circ. Saw w/brake, 13 amp	257	145
DW947K	13.2 volt cdls 3/8" drill kit	396	209
DW306K	8.0 amp Recip Saw w/case var. spd	267	155
DW610	1-1/2 HP 2 handle Router	263	138
DW411	1/4 sheet Palm Sander. 1.7 amp	91	54
DW705	12" Compound Mitre Saw	583	355
DW704	12" Mitre Saw	504	315
DW100	3/8" Dnll, 4 amp, 0-2500 rpm, rev	116	65
DW250	4.5 amp Drywall Gun, 0-4000 rpm, rev	153	88
DW254	4.5 amp Drywall Gun, 0-2500 rpm, rev	153	88
DW510K	1/2" var. speed Hammer Dnll w/case	298	165
DW102	3/8" Drill, 4.5 amp, 0-1200 rpm, rev	162	92
DW103	3/8" Drill, 5.0 amp, 0-1200 rpm, rev	198	115
DW402	4-1/2" Grinder 6 amp	150	85
DW682K	New Biscuit Joiner with case	428	225

SKIL SIZZLERS

3810	10" Mitre Saw	359	205
3810K	3810 with 60 tooth carbide blade		229
77	7-1/4" Worm Drive Saw	257	138
5825	6-1/2" Worm Drive Saw	257	159
2735-04	12 volt cordless Drill Kit	249	132
2735-04X	2735-04 with keyless chuck	269	132
1605-02	NEW Biscuit Joiner with case	221	125
7484	NEW 5" Random Orbit Sander	153	104
5510	5-1/2" Circular Saw	166	110
5660	NEW 8-1/4" 60° Circular Saw	230	138
5860	NEW 8-1/4" 60° Worm Saw	282	168
5625	6-1/2" Circular Saw	221	139
4560-02	Top Hdle Jig Saw with case	144	97
5790	10-1/4" Circ. Saw 15 amp	472	289
5657	NEW 7-1/4" Circ Saw - pivot foot	205	118
5525	NEW 6-1/2" Circ Saw - big capacity	173	105
3400	10" Table Saw - Bench Top	270	179
3330	16" Scroll Saw - Bench Top	205	135
3380	8" Dnll Press - Bench Top	205	135
3370	4" Belt/6" Disc Sander - Bench Top	205	135

SIOUX TOOLS

8030	New 3/8" vanable speed Drill	238	148
8000	3/8" var/spd close quarter Dnll	201	128
690	5" Air Random Orbit Sander	139	138
690VV	690 w/ventun dust collection	281	178
658	5" Air Random Sander - dual action	261	158

JORGENSEN STYLE 35 ALUMINUM BAR CLAMPS

Model	Size	List	Sale	Lots of 6
3524	24"	27.10	17.45	99.45
3536	36"	29.07	18.65	106.25
3548	48"	31.95	20.59	117.35
3560	60"	35.58	22.99	129.95
3572	72"	38.47	24.95	142.00

JORGENSEN ADJUSTABLE HANDSCREW KITS

Model	for Jaw Length	List	Sale	Lots of 6
J-04	4"	7.38	4.85	27.99
J-06	6"	8.46	5.55	32.15
J-08	8"	9.48	6.19	35.45
J-10	10"	11.09	8.95	50.99
J-12	12"	13.74	10.55	59.39
J-14	14"	16.50	10.99	62.00
J-16	16"	17.96	11.69	65.00

JORGENSEN ADJUSTABLE HANDSCREWS

Item#	Jaw Length	Opening Capacity	List	Sale	Box of 6
#5/0	4"	2"	13.80	8.35	48.59
#4/0	5"	2-1/2"	14.80	8.95	51.99
#3/0	6"	3"	15.90	9.59	55.75
#2/0	7"	3-1/2"	17.10	10.35	58.95
#0	8"	4-1/2"	19.00	11.89	61.00
#1	10"	6"	21.76	12.89	70.65
#2	12"	8-1/2"	24.95	14.95	80.95
#3	14"	10"	31.61	18.95	104.95
#4	16"	12"	42.30	24.95	143.95

JORGENSEN STYLE 37 2-1/2" Throat 1/4" x 3/4"

Item#	Jaw Length	List	Sale	Box of 6
3706	6"	9.86	6.25	34.75
3712	12"	10.92	6.75	37.75
3718	18"	12.05	7.25	40.75
3724	24"	13.16	8.19	43.75
3730	30"	14.70	9.10	49.75
3736	36"	16.05	10.19	55.75

JORGENSEN STYLE 45 5" Throat 1-3/8" x 5/16"

Item	Jaw Length	List	Sale	Lots of 6
4512	12"	30.07	19.39	109.99
4518	18"	31.73	20.45	116.99
4524	24"	33.55	21.75	123.99

PONY CLAMP FIXTURES

Model	Description	List	Sale	Lots of 12
50	3/4" Black Pipe Clamps	13.61	7.89	84.99
52	1/2" Black Pipe Clamps	11.37	6.50	69.50
53	Double 3/4" Pipe Clamps	38.50	24.45	274.00

JORGENSEN STEEL "I" BAR CLAMPS

Model	Size	List	Sale	Lots of 6
7224	24"	31.46	16.99	98.00
7236	36"	33.77	17.99	103.00
7248	48"	37.12	19.99	114.00
7272	72"	42.71	26.79	149.95

ELU BY BLACK & DECKER

3338	2-1/4 HP var. speed Plunge Router	448	255
3304	1 HP variable speed Plunge Router	307	164
3375	3-1/8" Univ. Planer 7.2 amp	329	155
3380	Biscuit Jointer with case	569	248
4024	3 x 21 variable speed Belt Sander	338	179

BLACK & DECKER

1166	3/8" Drill 0-2500 rpm 4 amp	105	65
1180	3/8" Drill 0-1200 rpm 5 amp	197	104
2600	3/8" Drill 0-1200 rpm 4.5 amp	149	89
1703-1	10" Mitre Saw with 73-770 blade	329	179
4011	1/4 sheet Palm Sander	86	59
79-034	Workmate 400	184	105
1349-09	1/2" Timberwoll Drill 2 speed	513	279
1180	3/8" Drill rev. 0-1200 rpm 5 amp	191	104
2037	Drywall Gun 0-4000 5.0 amp	184	97
2038	Drywall Gun 0-2500 rpm 5 amp	184	99
3157	Orbital var spd Jig Saw 4.5 amp	231	145
2665K	NEW 3/8" cdls 12V Cyclone Dnll	294	165
5045K	MACHO Rotary Hammer Drill	779	409
5071	3/8" Hammer Drill with case	251	138
5073	1/2" Hammer Drill with case	296	158
2054	Tek Gun 0-2500 5.0 amp	282	152
2660	Drywall Gun 0-4000 4.5 amp	149	77
2700	7-1/4" Worm drive Saw 13 amp	263	145
1321	1/2" Spade hdle Drill 450 rpm 7 amp	307	165
2750	4-1/2" Grinder 10.000 rpm 6 amp	156	83
2694	7-1/4" Super Sawcat Circular Saw	260	137
2695	8-1/4" Super Sawcat Circular Saw	285	153

Piranha by Black & Decker Carbide Tooth Saw Blades

Model #	Diameter	# Teeth	List	Sale
73-715	5-1/2	16	14.39	7.99
73-716	6-1/2	18	14.39	7.55
73-756	6-1/2	36	29.51	16.85
73-717	7-1/4	18	14.60	7.99
73-737	7-1/4	24	18.06	9.29
73-707	7-1/4	35	27.77	15.85
73-757	7-1/4	40	32.87	16.89
73-718	8	22	20.95	10.95
73-758	8	40	42.47	24.25
73-759	8-1/4	40	46.88	24.99
73-719	8-1/4	22	20.63	11.95
73-739	9	30	31.34	17.50
73-710	9	45	62.90	35.95
73-769	9	60	76.39	39.89
73-704	7-1/4	18	22.05	11.59
73-740	10	32	34.63	17.95
73-770	10	60	70.37	33.95
73-711	10	50	68.33	33.95

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WOODEN STEP - TYPE IA - 300# RATING

Model	Size	Weight(lbs)	Sale
W394	4'	21#	44.00
W395	5'	26#	53.00
W396	6'	32#	60.00

WOODEN STEP - TYPE 1 - 250# RATING

W384	4'	20#	36.00
W385	5'	24#	42.00
W386	6'	29#	48.00

ALUMINUM STEP - TYPE 1A - 300# RATING

404	4'	16#	64.00
405	5'	20#	73.00
406	6'	24#	85.00

ALUMINUM DOUBLE STEP - TYPE 1A - 300# RATING

T404	4'	21#	90.00
T405	5'	25#	105.00
T406	6'	30#	120.00

FIBERGLASS STEP - TYPE 1 - 250# RATING

6004	4'	13#	50.00
6005	5'	16#	60.00
6006	6'	18#	65.00

FIBERGLASS STEP - TYPE 1 - 250# RATING

6004-S w/pail shelf	4'	15#	55.00
6005-S w/pail shelf	5'	18#	65.00
6006-S w/pail shelf	6'	20#	70.00

FIBERGLASS STEP - TYPE 1A - 300# RATING

6204	4'	14#	65.00
6205	5'	18#	75.00
6206	6'	20#	80.00

ALUMINUM FLAT STEP TYPE 1 - 225# RATED EXTEN.

Model	Size	Working Length	Weight(lbs)	Sale
D1216-2	16'	13'	22#	115.00
D1220-2	20'	17'	27#	130.00
D1224-2	24'	21'	33#	145.00
D1228-2	28'	25'	42#	175.00
D1232-2	32'	29'	53#	200.00
D1236-2	36'	32'	62#	239.00
D1240-2	40'	35'	73#	265.00

ALUMINUM FLAT STEP TYPE 1 - 250# RATED EXTEN.

D1316-2	16'	13'	26#	125.00
D1320-2	20'	17'	32#	145.00
D1324-2	24'	21'	39#	165.00
D1328-2	28'	25'	50#	195.00
D1332-2	32'	29'	62#	235.00
D1336-2	36'	32'	77#	270.00
D1340-2	40'	35'	85#	295.00

ALUMINUM FLAT STEP TYPE 1A - 300# RATED EXTEN.

D1516-2	16'	13'	31#	139.00
D1520-2	20'	17'	37#	159.00
D1524-2	24'	21'	45#	179.00
D1528-2	28'	25'	56#	215.00
D1532-2	32'	29'	66#	239.00
D1536-2	36'	32'(250# rating)	79#	279.00
D1540-2	40'	35'(250# rating)	89#	309.00

ALUMINUM FLAT STEP TYPE 1A+ 300# RATING

D520-2	20'	17'	42#	199.00
D524-2	24'	21'	49#	230.00
D528-2	28'	25'	66#	265.00
D532-2	32'	29'	74#	305.00
D536-2	36'	32'	89#	350.00
D540-2	40'	35'	99#	389.00

FIBERGLASS FLAT STEP TYPE 1A - 300# RATING

D6116-2	16'	13'	34#	175.00
D6120-2	20'	17'	40#	195.00
D6124-2	24'	21'	53#	225.00
D6128-2	28'	25'	60#	259.00
D6132-2	32'	29'	74#	298.00

FIBERGLASS FLAT STEP TYPE 1A - 300# XTRA HEAVY

D7116-2	16'	13'	37#	198.00
D7120-2	20'	17'	43#	229.00
D7124-2	24'	21'	58#	269.00
D7128-2	28'	25'	66#	298.00
D7132-2	32'	29'	79#	359.00

Buy any 3 ladders(can be asst) deduct additional 5% Prepaid Freight and best prices too!

AEG POWER TOOLS

Model	Description	List	Sale
VSRE500K	NEW v spd 5" Random Sndr w cs	279	149
VSRE600K	NEW v spd 6" Random Sndr w cs	284	155
HBSE75S	3 x 21 variable speed Belt Sander	299	168
ABSE15S1	2" cdls 12 volt Drill complete w cs	389	174
FSPE100	Barrell Grip v spd Jig Saw	265	145
BSPE100K	Top Hdle v spd Jig Saw w case	275	145
EZ560	3/8" cordless 7.2 volt Drill 2 speed	205	139
OFS50	1HP Plunge Router	299	135
TXE150	New 6" var spd Rand Orb Sander	220	145
SKS600	NEW 10" Compound Mitre Saw	999	539

HITACHI TOOLS

Model	Description	List	Sale
C7SB	7-1/4" Circular Saw	216	109
DTC10	3/8" 7.2 volt cordless Drill	142	78
C7BD	7-1/4" Circular Saw with brake	235	118
M12V	NEW 3 HP variable speed Router	477	225
TR12	Plunge Router 3 HP	355	167
F1000A	12" Planer 6" Jointer	2774	1549
P12R	12-9/32" Planer	1425	719
P12RA	Planer/Joiner	1880	910
C10FA	10" Deluxe Mitre Saw	553	268
C12FA	NEW 12" Mitre Saw	600	298
C8FB	8-1/2" Slide Compound Saw	1026	445
FREUD	LU91M0088-1/2" carb blade 48 tooth	68	43
C15FB	15" Mitre Saw	773	368
FREUD	LU85M015 15" carb blade 108 tooth	145	99
F20A	3-1/4" Planer 3.4 amp	179	95
G12SA	4-1/2" Grinder 6.9 amp	147	75
DS10DVAK	NEW 12 volt Cordless Drill Kit with 2 batteries	383	189

Hitachi Air Tools

NR83A	Framing Nailer 2 - 3-1/2 Full Head	680	398
NR83AA	Framing Nailer 2 - 3-1/2 Clip Head	740	419
NT65A	16 ga. Brad Nailer 1 - 2-1/2	590	318
NT45A	18 ga. Brad Nailer 13/16 - 1-3/4	484	275
NV45AB	Coil Roofing Nailer 7/8 - 1-3/4	740	349
NV83A	Coil Nailer 2 - 3-1/4	740	419
NV50A1	Coil Nailer 1-1/4 - 2	534	305
N5008AA	7/16" Stapler - 16 ga. 1 - 2 lgth	578	315
N3824A	1" Stapler 16 ga. 1/2 - 1-1/2	626	329
N3804A	1/4" Stapler 18 ga. - 1/2 - 1-1/2	520	299

DREMEL TDOLS

Model	Description	List	Sale
3950	Moto Tool Kit with bits & case	129	79
3952	Super Moto Tool Kit with accessories	145	95
1671	16" Scroll Saw - 2 speed "Best buy"	278	165
290	Electric Engraver with point	2415.50	
8508	Cordless Moto Tool Kit with case	104	68
1731	5" Disc\1" x 30" Belt Sander	178	114

DAVID WHITE INSTRUMENTS

Model	Description	List	Sale
LP6-20	Sight Level package - 20x	310	195
L6-20	Meridian Level - 20x	290	185
LT8-300	Level Transit - 26x	650	439
LT8-300P	above Level with optical plum	769	519
LT6-900	Level Transit - 20x	389	245
LTP6-900	Above Level with tripod & rod	601	365
ALT6-900	Automatic Level - Transit - 18x	549	385
ALTP6-900	above Level with tripod & rod	600	438
AL6-18	Automatic Level - 18x	439	315
ALP6-18HD	above Level with tripod and rod	550	369

QUAL-CRAFT JACKS

2200	Pump Jack	79	58
2201	Pump Jack Brace	30	20
2203	Pump Jack guard rail holder	31	21
2204	Work Bench & rail holder combo	53	39
	Buy any 6 (can be assorted) deduct additional 10%		
2601	Walt Jack	167	114
	Lots of 4 deduct additional 10%		

PASLODE IMPULSE GUNS

Model	Description	List	Sale
IM250	Tnmpulse Finish Nailer Kit complete dnves 3/4" - 2-1/2" brads	849	615
IM325	Impulse Framing Nailer Kit complete dnves 2" - 3-1/4" nails	849	615
402500	Extra battery	Sale	42.95
402502	No-Mar Work contact element	Sale	19.25

Paslode Nailers not available in MN. WI. IA

SENCO AIR NAILERS

SFN1	Finishing Nailer 1" - 2"	377	269
SFN2	Finish. Nailer 1-1/2" - 2-1/2"	571	378
SN325	Nailer 1-7/8" - 3-1/4"	665	398
SN4	General purpose 2" - 3-1/2"	685	468
SLP20	NEW Pinner w/case 5/8" - 1-5/8"	399	269
SKS	Stapler 5/8" - 1-1/2"	351	245
SPS	Stapler 1" wide - 3/4" - 1-1/2" length	460	299
M2	Stapler 1/16" wide - 1-3/8" - 2" length	490	345

Not available in all states

EXCALIBUR Fences & Tables

Model	Description	List	Sale
TT45R24L9	24" Fence	369	299
TT45R50L12	50" Fence	399	318
EXSLT30	Sliding Table	599	475
EXSLT60	Sliding Table	745	585

RECORD WOODWORKING VISES

Model	Jaw Width\Opening	List	Sale
53E	10-1/2"\15" Quick release	189	105
53P	10-1/2"\15" Plain Screw	174	100
52D	7"\8" Quick release w/dog	137	84
52-1/2D	9"\13" Quick release w/dog	175	99

REMINGTON POWER FASTENING TOOLS

Model	Description	List	Sale
75707	476 Power Hammer with case	35	28
77550	480 Power Driver with case	169	109
78480	482 Multi Driver with case	369	235

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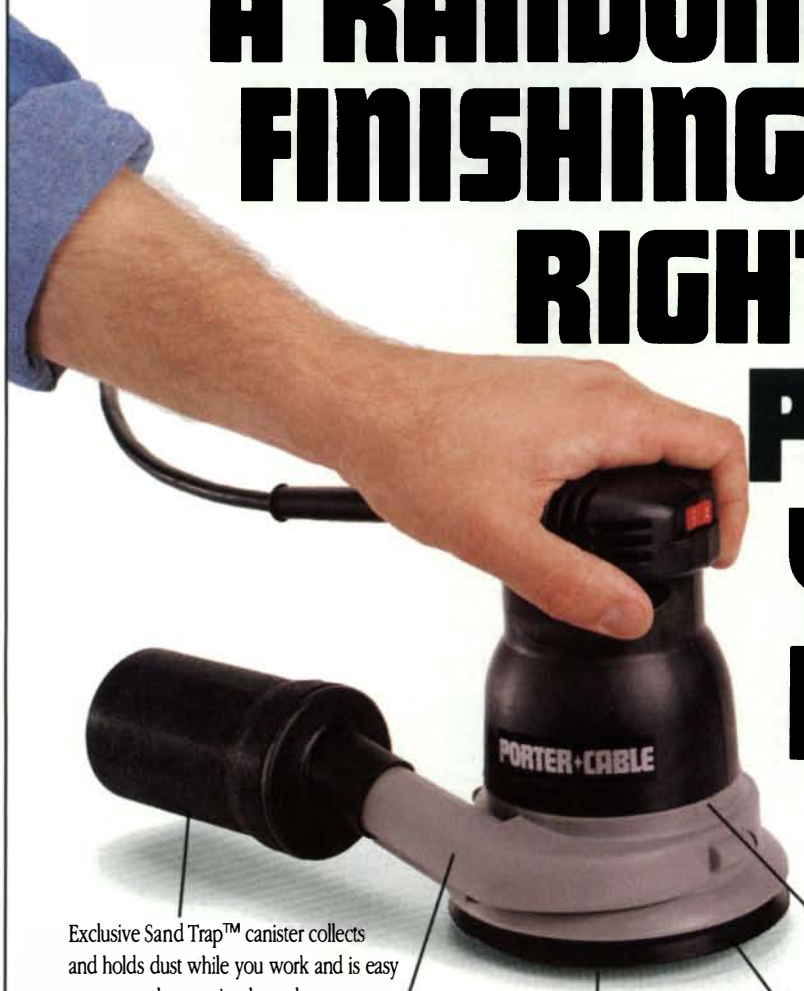

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Listings of gallery shows, major craft fairs, lectures, workshops and exhibitions are free, but restricted to happenings of direct interest to woodworkers. We list events (including entry deadlines for future juried shows) that are current with the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

NATIONAL & INTERNATIONAL: **Competition**-International Lathe-Turned Objects: Challenge V. Deadline: July 10, 1993. Send a #10 SASE to Albert LeCoff, Wood Turning Center, PO Box 25706, Philadelphia, PA 19144. (215) 844-2188.
Competition-41st National Marquetry Exhibition, June 5, June 7-12. Robert Cross Hall, Corn Exchange, Ipswich, Suffolk, England. Contact Peter Brooks, 141 Sidegate Lane, Ipswich, Suffolk IP4 4JE, England. (0473) 725601.
Competition-1993 Northwest International Arts Competition, May 29 thru Aug. 8 at the Whatcom Museum of History and Art. For more information write: The Whatcom Museum, 121 Prospect St., Bellingham, WA 98225. Contact Mike Vouri (206) 676-6981.
Fair-Ligna Hannover '93 World Fair for Machinery and Equipment for the Wood and Forest Industries, May 19-25. Hannover, Germany. Contact Hannover Fairs USA, Inc., 103 Carnegie Center, Princeton, NJ 08540. (609) 987-1202.
Meeting-Wood West, Oregon 1993. International Wood Collectors Society's annual meeting, Aug. 15-19. Springfield/Eugene. For more information, contact Don Roberts, 1810 S. Fairmount Ave., Salem, OR 97302.
Show-Tecno Mueble Internacional, July 8-11, Guadalajara, Jalisco, Mexico. For more info, contact Eidson Trade Shows, Inc., PO Box 609, Conover, NC 28613.
Symposium-American Association of Woodturners 7th national symposium, June 25-27, State University of New York at Purchase. For more information contact American Association of Woodturners, Mary Redig, 667 Harriet Ave., Shoreview, MN 55126. (612) 484-9094.

ARKANSAS: **Meetings**-Woodworker's Association of Arkansas meets the first Monday evening of each month at 7:00 at Woodworkers Supply Center, 6110 Carnegie, Sherwood 72117. For more information, call (501) 835-7339.

CALIFORNIA: **Workshops**-Woodworking for women. Furnituremaking with hand tools using traditional joinery, weekends. San Francisco. Call for schedule: Debey Zito, (415) 648-6861.
Workshops-Various workshops including Japanese woodworking, joinery and sharpening. For further information, contact Hida Tool Co., 1333 San Pablo, Berkeley, 94702. (415) 524-3700.
Competition-Designs in Wood, June 15-July 4. San Diego Fine Woodworkers Assoc. Southern California Exhibition, Del Mar. Entry deadline: May 28. For entry forms, contact Entry Office, Southern California Exposition, Del Mar, 92014-2216. (619) 755-1161.
Exhibition-Fantasia, thru May 30. Woodcarvings from Mexico. The Folk Tree, 217 South Fair Oaks, Pasadena, 91105. (818) 795-8733.
Exhibition-College of the Redwoods annual student exhibition, May 15-June 6. Highlight Gallery, 45052 Main St., Mendocino. For further information, contact the gallery at (707) 937-3132, or the shop at (707) 964-7056.
Lecture-Charleston Furniture with Brad Rauschenberg, July 13. American Decorative Arts Forum of Northern California. Trustees' Auditorium, Asian Art Museum, Eighth Ave. & John F. Kennedy Drive, Golden Gate Park, San Francisco. For more information, contact Mrs. Fox (510) 524-7304.
Show-Turned Wood, '93, June 5-July 10. A national show of work by contemporary turners on the cutting edge. For more info, contact del Mano Gallery, 11981 San Vicente Blvd., Los Angeles, 90049. (310) 476-8508.

COLORADO: **Classes**-Woodworking and related classes, year-round. Red Rocks Community College, 13300 W. 6th Ave., Lakewood, 80401. (303) 988-6160.
Show and workshops-Scott Hausman Furniture, thru May 15; Woodworking and furniture design, June thru Aug. For more information or a free catalog, contact Anderson Ranch Arts Center, PO Box 5598, Snowmass Village, 81615. (303) 923-3181.
Workshops-Scribe-fit log construction with Robert Chambers. Beginning course: Aug. 16-21; intermediate course: Aug. 22-28; Advanced course: Aug. 30-Sept. 4. Colorado State University-Mountain campus. For more information, contact Peter Haney, 505 N. Grant, Ft. Collins, 80521. (303) 482-1366.

CONNECTICUT: **Exhibition**-Guilford Handcrafts, July 15-17. Town Green, Guilford.
Juried show-Turned Wood Arts '93, June 5-July 3. For more info, contact New Horizons Gallery, 42 W. Putnam Ave., Greenwich 06830. (203) 622-6867.
Workshops-Pole lathes with David Weber, May 1-2; Centering for turners with Bill Gundling, May 22-23; Advanced box making with Bill Gundling, June 5-6. Brookfield Craft Center, Inc., PO Box 122, Brookfield, 60804. For more information, contact John Russell (203) 775-4526.
Call for entries-Seeking woodworkers, turners and carvers for show in September. Deadline: June 15. For Art Sake Gallery, 1423 Dixwell Ave., Hamden 06514. (203) 248-2871 or (800) 448-2871.
Call for entries-25th annual celebration of American crafts. National juried, invitational exhibition/sale. Nov. 12-Dec. 24. All craft media. Deadline for slides: July 1. For prospectus, send SASE to The Celebration, Creative Arts Workshop, 80 Audubon St., New Haven, 06510

FLORIDA: **Meetings**-Central Florida Woodworkers Guild, second Thursday of every month, Winter Park. For information, contact Ed Harte (407) 862-3338.
Meetings-Sarasota Woodworking Club, second Thursday of every month. For info, contact Tom Clark, 3544 Oak Grove Drive, Sarasota, 34243. (813) 351-9059.
Exhibition-41st Florida Craftsmen, thru May 20, Visual Arts Center of NW Florida, Panama City; June 18-July 39, New Gallery, University of Miami, Coral Gables.

GEORGIA: **Courses**-Various woodworking courses, thru May. For info, contact Chris Bagby, Highland Hardware, 1045 N. Highland Ave., N.E., Atlanta, 30306. (404) 872-4466.
Workshops-Japanese woodworking by Toshihiro Sahara. One Saturday each month, year-round. For info, contact Sahara Japanese Architectural Woodworks, 1716 Defoor Place N.W., Atlanta, 30018. (404) 355-1976.
Classes-Woodworking classes, throughout the year. Woodworkers Guild of Georgia, PO Box 8006, Atlanta. For info, contact John Gorrell (404) 460-1224.
Lectures-Furniture Design and Construction, May 10, DeKalb College Central Campus, Bldg. H, 555 North Indian Creek Dr., Clarkston; lathe seminar and demonstration, June 19, 10 a.m., Conyers. For location and further information, contact John McCormick, Woodworkers Guild of Georgia, (404) 623-9145.

ILLINOIS: **Shows**-Wood sculpture with Nanette Rozhon, May 15-16; The Art of Chip Carving with Greg Jonsson, June 19-20. Tom's Woodshop, 777 N. York Road, Hinsdale. For more information, call (708) 920-1635.
Show-The Quad Cities Woodworking Show, June 18-20, QCCA Expo Center-Exhibition Hall, 2621 4th St., Rock Island. For more information, call (800) 826-8257.

INDIANA: **Classes**-Various woodworking classes and workshops. Woodworking Unlimited, 6038 E. 82nd St., Indianapolis, 46250. (317) 849-0193.

IOWA: **Fair**-23rd annual Art in the Park, May 15-16, Four Square Park, Main Ave. & Roosevelt St., Clinton. For more information contact Carol Glahn (319) 259-8308.

KENTUCKY: **Workshops**-Woodturning and joinery instruction. For info, contact Jim Hall, Adventure in Woods, 415 Center St., Berea, 40403. (606) 986-8083.
Meetings-Kyana Woodcrafters Inc., first Thursday of each month. Bethel United Church of Christ, 4004 Shelbyville Road, Louisville, 40207. (502) 426-2991.
Workshops-Traditional Windsor chairmaking instruction. One-week courses. Contact David Wright, 503 Prospect, Berea, 40403. (606) 986-7962.
Juried exhibition-Kentucky guild of Artists & Craftsmen's annual spring fair, May 14-16. Indian Fort Theater, Berea. For information, contact Anna Reiss, KGAC, PO Box 291, Berea, 40403-0291. (606) 986-3192.

MAINE: **Courses**-1993 season opens June 6. Write Haystack Mountain School of Crafts. PO Box 518, Deer Isle, 04627.
Workshops-Basic Woodworking, June 28-July 9; Craftsmanship & Design with Peter Korn, July 12-23. For more info, contact Center for Furniture Craftsmanship, PO Box 654, Camden, 04843. (207) 236-3032.

MARYLAND: **Exhibition**-An Artists Choice, May 6-29; Art Furniture by recent graduates of RISD, June 3-Aug. 21. Meredith Gallery, 805 N. Charles St., Baltimore. (401) 837-3575.

MASSACHUSETTS: **Classes**-Woodworking classes, throughout most of the year. For information, contact Boston Center for Adult Education, 5 Commonwealth Ave., Boston, 02116. (617) 267-4430.
Show-Danforth Museum Craft show, June 19-21. Justin McCarthy Campus Ctr., Framingham St. College. (508) 620-0050.
Shows-The Domestic Object, thru June 13, Berkshire Museum; July 10-Aug. 21, Worcester Center for Crafts, 25 Sagamore Road, Worcester 01605. (508) 753-8183.
Instruction-Full-time program in fine furniture construction. Complete facilities. Wm. B. Sayre, Inc., One Cottage St., Easthampton, 01027. (413) 527-0202.
Exhibition-Garden Treasures II: The Wooded Garden and the Seaside Garden, May 10-July 30, 101 Arch St.; May 15-July 3, 175 Newbury St. For more information contact The Society of Arts and Crafts, 175 Newbury St., Boston 02116. (617) 266-1810.
Juried fair-23rd annual Worcester Center for Crafts fair, May 21-23. Under the big top on the grounds of the Center, 25 Sagamore Road, Worcester. (508) 753-8183.
Workshops-Furnituremaking, May 3-7; fundamentals of woodworking, May 10-14; finish carpentry, May 17-21. Contact The Heartwood School, Johnson Hill Road, Washington, 01235. (413) 623-6677.
Workshops-Furniture Design & Beyond with Jon Brooks, May 15-17; Expressions in Wood with Rich Penziner, Aug. 12-15. Horizons, Snow Farm, Route 137, Hyde Hill Road, Williamsburg, 01096-9710. For more info, contact Horizons, 374 Old Montague Road, Amherst 01002. (413) 549-4841.

MICHIGAN: **Courses**-Boring machines, May 12-14. Stiles Education Center, 3965 44th St. SE, Grand Rapids 49512. (616) 698-7500.
Instruction-Violin plate turning, July 25. Michigan Violinmakers Association. Host: Bob Meade. For more information, contact the association at 1661 Heather Wood, Troy, 48098. (313) 641-5138.
Show-The Grand Rapids Woodworking Show, June 11 thru 13, Stadium Arena-East Hall, 2500 Turner Ave N.W., Grand Rapids. For information, call (800)-826-8257.

MINNESOTA: **Classes**-Woodcarving classes year-round. For info, contact the Wood Carving School, 3056 Excelsior Blvd., Minneapolis, 55416. (612) 927-7491.
Workshops-10th annual wood carving, Aug. 8-14. Classes include whittling animals, relief carving, figures/faces. For more information, write Villa Maria Wood Carving Workshops, PO Box 37051, Minneapolis, 55431.

MISSISSIPPI: **Classes**-Various classes. Allison Wells School of Arts & Crafts, Inc., PO Box 950, Canton. (800) 489-2787 or (601) 859-5826.

NEW HAMPSHIRE: **Classes**-Fine arts and studio arts. Manchester Institute of Arts and Sciences, 114 Concord St., Manchester, 03104.
Classes-Various woodworking classes, year-round. For info, contact: The Hand & I, PO Box 264, Route 25, Moultonboro, 03254. (603) 476-5121.
Auctions-Antique and craftsman's tool auctions, year-round. Contact: Richard A. Crane, Your Country Auctioneer, 63 Poor Farm Road, Hillsboro, 03244. (603) 478-5723.
Fair-60th Annual Craftsmen's Fair, Aug. 7-15. Mt. Sunapee State Park, Newbury. For more info, call (800) 639-1610.
Exhibition-Wood Day, annual woodworking event, May 8. Canterbury Shaker Village, 288 Shaker Road, Canterbury 03224. For further information, contact Dave Emerson at (603) 783-4403.

NEW JERSEY: **Juried festival**-Waterloo Arts & Crafts Festival, May 1-2. Waterloo Concert Field, Waterloo Road, Stanhope. For more info, call (201) 384-0010.
Workshops-Furnituremaking with Sam Maloof, June 12-13; Furniture conservation, Mark Anderson, June 18-20; Color, form and surface in furniture, Wendy Maruyama, June 25-29; Building a tortured plywood kayak, Chris Kulczycki, July 2-7; Making & using wooden handplanes, David Finck, July 9-13; Mastering the bandsaw, Mark Duginske, July 16-18; Basic woodworking: three legged stool, James Jewell, July 31-Aug. 3. For more information write or call Peters Valley Craft Center, 19 Kuhn Road, Layton, 07851. (201) 948-5200.

NEW MEXICO: **Classes**-Woodworking classes. N. New Mexico Community College, El Rito, 87520. (505) 581-4501.
Classes-Fine woodworking classes, Santa Fe Community College, Santa Fe 87502. (505) 438-1361.
Call for entries-1993 New Mexico Woodworkers' Exhibition, July 24-Aug. 11. Slide deadline: June 4. Community Services Office, 1993 New Mexico Woodworkers' Exhibition, Santa Fe Community College, PO Box 4187, Santa Fe, 87502-4187. For entry forms or for further information, call (505) 438-1230.

NEW YORK: **Classes**-Various beginning and advanced woodworking classes. Constantine's, 2050 Eastchester Road, Bronx, 10461. (718) 792-1600.
Meetings and classes-New York Woodturners Assoc., first Tuesday of each month. Craft Student League, YWCA, 610 Lexington Ave. (53rd. St.) New York City. (212) 735-9732.
Meeting-Northeast Wood Machining Association annual meeting, June 4-5 in Oswego. Contact John Gibbs, Secretary, NeWMA, Stony Kill Farm, Route 9D, Wappingers Falls, 12590. (914) 831-3109.
Juried show-Woodstock-New Paltz Arts & Crafts Fair, May 29-31. Ulster County Fairgrounds, New Paltz. Contact Scott or Neil Rubinstein, Quail Hollow Events. (914) 679-8087.
Show-Scott Grove Furniture, May 16-19 at the Jacob Javits Center, 11th Ave. at 36th St, Manhattan. Contact American Design Arts International, 140 Maywood Avenue, Rochester 14618. (716) 594-2800.
Juried fair-22nd annual WBAI Holiday Crafts Fair, Dec. 3-5, Dec. 10-12, Dec. 17-19. Columbia University, Ferris Booth Hall. Entry deadline: May 29. For prospectus send SASE to WBAI Holiday Crafts Fair, P.O. Box 889, Times Square Station, New York, 10108. (212) 695-4465.
Symposium-American Association of Woodturners 7th national symposium, June 25-27, State University of New York at Purchase. For more information contact American Association of Woodturners, Mary Redig, 667 Harriet Ave., Shoreview, MN 55126. (612) 484-9094.
Workshops-Traditional 18th-century woodworking techniques. Planemaking, carving, joinery and planecraft, thru Aug 21. Contact Mario Rodriguez, Warwick Country Workshops, PO Box 665, Warwick, 10990. For brochure & schedule, call (914) 986-6636.
Show-Crafts Festivals '93, July 2-4; Aug. 6-8. Bestor Plaza (outdoors), Chautauqua Institution, Chautauqua. For more information, contact Kay Collins, Festival Director, Chautauqua Crafts Alliance, PO Box 89, Mayville 14757.
Juried fair-13th annual Millbrook crafts fair, Nov. 26-27th. Deadline: June 1. Submit 5 slides or, by special arrangement, actual work. For application send a #10 SASE to Artisans Group, PO Box 468, Pine Plains 12567. (914) 985-7409.
Classes-Building Wooden Hand Planes and Planecraft with Bill Smithers, June 12-13; Refinishing with Bill Mahoney, June

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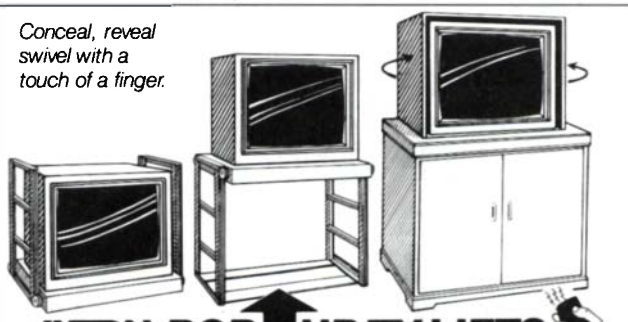

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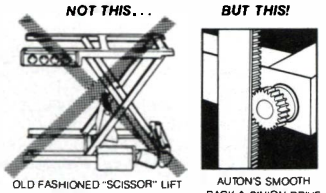

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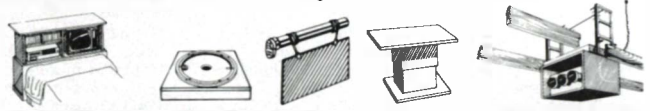

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691	1 1/2 HP "D" HANDLE ROUTER	147
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7539	3 1/4 HP PLUNGE ROUTER - 5 SPEED	264
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9345	SAW BOSS 6" CIRCULAR SAW KIT	125
9347	3 1/4" PLANE KIT	139
9548	WORM GEAR BAYONET SAW KIT	204
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READER SERVICE NO. 39

19-20; Build a St. Lawrence Skiff Model with Dave Kavner, June 28 thru July 2; Sharpening Woodworking tools and Traditional Wood Joinery with Bill Smithers, July 10-11; Stripbuilding an Adirondack Guide Boat with Steve Kaulback, July 12 thru 17; Refinishing with Mike Mahoney, July 24-25. For info, contact The Antique Boat Museum, 750 Mary Street, Clayton, 13624. (315) 686-4104.
Call for entries-1993 Grants to New York State Craft Artists program. Deadline: May 1. For more information, contact: ESCA, 320 Montgomery Street, Syracuse, 13202. (315)472-4245.
Show-Contemporary Woodturning, June 23-Aug. 28. For more info, contact Frances Kelly, Elsa Mott Ives Gallery, YWCA, 53rd Street and Lexington, (212)755-4500.

NORTH CAROLINA: **Meetings**-North Carolina Woodturners, 2nd Saturday of each month. Contact: Eric Hughes, Route 3, PO Box 300, Conover, 28613. (704) 464-5611.
Show-Blue Ridge Hearthside Craft Show, June 18-20, July 9-11, Aug. 6-8, Oct. 8-10. Main shop in Foscoe. For more info, contact Carolyn C Francis, 512 Cline Road, Dandridge, TN 37725. (615) 3997-2172.
Shows-18th annual Heritage Art & Craft show, June 17-20. Asheville Mall; 3rd annual Heritage Art & Craft show, June 17-20. Old Thresher's Reunion, Denton. All media. Original work only. For more info, contact Gail Gomez, High Country Crafters, 46 Haywood St., Asheville, 28801. (704) 254-7547.
Workshops-Ladderback chairmaking, Dan Mayner, June 7-12; Rocking chairs, Brian Boggs, June 21-26; Green woodworking with kids, Drew Langsner, July 7-10; Toolmaking for woodworkers, Hans Karlsson. Tuition $390 plus materials fee. Includes meals and use of specialized tools. Country Workshops, 90 Mill Creek Road, Marshall, 238753. For more information contact Drew Langsner (704) 656-2280.
Classes-Norwegian style bentwood boxes with Dana Hatheway, May 16-22; Hand-made stool with Max Woody, June 12-18; Nesting oval boxes in Shaker tradition with Bert Smith, June 18-20. John C. Campbell Folk School, Rt. 1, Box 14A, Brasstown, 28902. (800) FOLK-SCH.
Classes-Operator and Supervisor Panel Saw Training, June 14-16. Gastonia. Contact: Stiles Education Center, 3965 44th Street SE, Grand Rapids, MI 49512. (616) 698-7500.

OHIO: **Meetings**-Cincinnati Woodworking Club, second Saturday of January, March and May. Reading High School. Contact the club at PO Box 428525, Cincinnati, 45242.
Workshops-Building a Queen Anne side chair with Lonnie Bird, June 7-11; Getting professional results with the shaper with Lonnie Bird, June 12. Fine Woodworking Technology, Rio Grande Community College. (614) 245-5353, ext. 325.

OREGON: **Meetings**-Guild of Oregon Woodworkers, third Friday of every month. Contact the guild at PO Box 1866, Portland, 97207. (503) 293-5711.
Meetings-Cascade Woodturner's Association, third Thursday of each month. For info, contact Cascade Woodturners, PO Box 91486, Portland 97291.
Show-Nehalem Woodworking show, Aug. 1-30. Deadline: June 1. Contact Artisans Gallery, PO Box 367, Nehalem, 97131.
Call for entries-Table, Lamp & Chair 1993, Aug. 5-Sept. 5. Deadline: June 26. Send SASE to Table, Lamp & Chair, PO Box 5906, Portland, 97228-5906, or call (503) 226-3556.
Festival-Port Orford Arts Festival '93, May 7-9. Throughout the community. The Port Orford Arts Council, PO Box 771, Port Orford, 97465. (503) 332-0045.
Exhibition-Northwest Wood Carving by Jerry Stoopes, June 26-July 18; Sculptured Turned Wood Vessels by Hugh Mckay, May 29-June 20. Cook Gallery, 705 Oregon St., Port Orford, 97465. Contact Rick Cook (503) 332-0045.
Classes-Oregon School of Arts and Crafts offers classes and workshops year-round. For more information and a free schedule, contact Oregon School of Arts & Crafts, 8245 SW Barnes Road, Portland, 97225. (503) 297-5544.

PENNSYLVANIA: **Classes**-Windsor chairmaking, weekly and weekends. Contact: Jim Rendi, Philadelphia Windsor Chair Shop, PO Box 67, Earlville, 19519. (215) 689-4717.
Classes-Woodturning with David Ellsworth, thru May. Three-day weekend workshops in private studio. Contact: David Ellsworth, Fox Creek, 1378 Cobbler Road, Quakertown, 18951. (215) 536-5298.
Competition-International Lathe-Turned Objects: Challenge V, January 28-April 1994 in Philadelphia area. Prospectus due July 10, 1993. For application write Wood Turning Center, P.O. Box 25706, Philadelphia or call (215) 844-2188.
Festival-Woodcarving Show and All Wood Festival, July 10-11. Cooksburg. Contact: Cook Forest, Sawmill Center for the Arts (814) 744-9670; after May (814) 927-6655.
Festival-10th Annual Penn's Colony Festival, September 18, 19, 25, 26 1993. Entry deadline: July 1. For info, contact The Penn's Colony Festival, 603 East End Avenue, Pittsburgh, 15221-3423. (412) 241-8006.
Workshops-Sawmill Art Center 1993: Bird Carving, Carl Sinkula; Woodcarving, Joe Dampf; Advanced Detailing, Wayne Edmondson; Advanced Power Carving, Nancy Jones; Relief Woodcarving, Dick Belcher; Woodturning, David Hout. For more info, contact Sawmill Art Center, P.O. Box 180, Cooksburg, 16217.
Workshops-Olde Mill Cabinet Shop: 18th Century Joinery, Gene Landon; Natural and Chemical Coloring, Prew Savoy; Sack Back Windsor Chair, Mike Dunbar; Pennsylvania Spice Box, Gene Landon; Period Restoration, Eli Rios. For info contact, Olde Mill Cabinet Shop, 1660 Camp Betty Washington Road, York 17402. (717) 755-8884.

TENNESSEE: **Juried show**-Pattern: New Form, New Function, thru May 15. For info, contact Arrowmont School, PO Box 567, Gatlingburg, 37738. (615) 436-5860.
Classes-Arrowmont School of Arts and Crafts. For further information contact Cynthia Huff, Communications Coordinator, (615) 436-5860.
Workshops-Appalachian Center for Crafts: Sculpturing in Wood with Jess Betschart, June 14-18; Advanced Woodturning with John Jordan, July 19-23; Woodcarving with Paul Bitts, July 19-23; Ladies on the Lathe with Betty Scarpino July 26-20. Write Tennessee Tech. Univ., Appalachian Center for Crafts, Box 430, Route 3, Smithville 37166. (615) 597-6801.

VERMONT: **Courses**-Yestermorrow Design and Building School, Route 1 Box 97-5, Warren 05674. (802) 496-5545.

VIRGINIA: **Show**-29th Annual Richmond Craft & Design Show, November 19-21, 1993 at Richmond Center for Conventions. Slides are due June 1, 1993. For application write: The Hand Workshop, 1812 West Main St., Richmond 23220. (804) 353-0094.

WASHINGTON: **Show**-7th Annual Juried Show of Kitsap County Woodcarvers Club, June 12-13, Kitsap Mall, Silverdale. Contact J.W. Finden, 11108 W. E. Bean Road, Port Orchard, 98366. (206) 871-3638.

CANADA: **Show**-Bob Gonzales Woodturnings at the Arnold Mikelson Festival of Arts, July 10-11, 17-18 at 13743 16th Ave., White Rock, British Columbia V4A 1P7.
Workshops-Ultra Light Sawmilling for 5 days with Will Malloff. Contact The North Island College, Box 320, Sointula, B.C. V0N 3E0. (604) 973-2035, or fax (604) 973-2025.
Call for entries-SAWS 1993 Exhibition, juried exhibition of original works in wood. Color slides of work required by July 15. Entry forms available by writing to The Southern Alberta Woodworkers Society, PO Box 6753, Station D, Calgary, Alberta Canada T2P 2E6. For further information call Henry Schlosser (403) 255-7372 or Doug Haslam (403) 270-1824 (Voice or Fax).
Call for entries-Explorations in Wood, juried exhibition, December 1993. Early entry deadline June 30. For entry forms and more information, contact Ken Guenter P.O. Box 6584, Postal Station C, Victoria, B.C., V8P 5N7.

***Noah's ark déjà vu**—This ark was built by Steve Christoffers of Bolton, Conn., who apparently had a similar inspiration as George Huffman, the creator of the ark on our back cover. In addition to 60 pairs of animals and Noah's family, Christoffers' ark includes a sloped deck to drain rain water, a working fieldstone fireplace and all the appropriate amenities for the menagerie.*

Noah's arks, two by two

When Steve Christoffers' wife Linda mentioned that she'd like a Noah's ark for Christmas a couple of years ago, Steve uttered the same fateful "Oh, I could do that" as George Huffman (see the back cover). Almost a year and a half later, with Linda's help, Christoffers finally completed the ark shown in the photos above.

The ark's 40-in.-long hull is covered with ½-in.-wide ash planks, 6 in. to 12 in. long, that were steamed and then bent to shape using the hull as a form. Considering this was his first boat, Christoffers included amazing detail, including a sloped deck with scuppers to drain away the 40 days and 40 nights of rain and a fieldstone fireplace that actually draws smoke through the chimney.

Below deck, tiny cages with working hinges and latches are complete with hay lofts for the large animals and nest boxes for the birds. A thatched roof covers the English cottage-style sleeping quarters for Noah and his family. A dolphin figurehead and a stand, hand-carved in the shape of two opposing whales' tails, add the finishing touches to the ark.

While Christoffers was busy assembling the ark, his wife was learning new clay sculpting skills, creating the more than 60 pairs of animals and the people inhabiting the ark. Although she had no previous sculpting experience, Linda became more confident as she worked and even tried mixed media, such as the elephants' carved bone tusks and leather ears.

Christoffers became so involved that he was reluctant to see the project come to an end. Although he had built additions onto his house and had built various pieces of furniture, Christoffers said those projects didn't compare to the ark. "I've used more diverse skills and learned more new techniques on this one project than all the others combined," he said.

—Charley Robinson

Death of a giant

Michael K. Pelchat's letter in *FWW* #96, p. 6, brought to mind a story that may top his Douglas-fir story.

In 1929, my father's business in Michigan had failed because of the Great Depression, and he took his family of three boys to Oregon to start a new life. Dad found a subcontracting job working for a prime contractor, the McNutt Company, which had won a contract to widen Highway 38 for about 20 miles between Reedsport and Elkton along the Umpqua River in Oregon. It was one of those government-sponsored jobs designed to put unemployed people to work. Individual families or small groups of workmen could subcontract for a length of roadway. They would cut all the trees down and clear the brush and burn it for 100 ft. back from the side of the roadway. Then the main contractor would bring in heavy equipment to do the grading and paving.

My father contracted for a thousand-foot

Photos this page: Vincent Laurence

section of the roadway. He and my two brothers, Dave, 18, Ron, 14, and myself, 12, set up a campsite and went to work. None of us had any experience felling trees. Michigan trees were all dwarfs compared to these monsters.

We soon found out that our thousand-foot section of highway had the largest Douglas-fir tree on it that could be found anywhere in the West, fully as large as any thousand-year-old redwood. To complicate matters, the base of this tree had been burned by countless forest fires to form a deep hollow in the trunk.

The tree was known to everyone in the county as a kind of landmark monument, and in spite of its burned, hollow trunk, it was basically healthy.

When the day came to fell the enormous Douglas-fir, my father checked out the longest crosscut saw available in the McNutt Company tool crib—a twelve-footer, which was clearly inadequate for the job. My brothers examined the tree carefully to try to determine just how they could fell it without blocking the highway. Because the saw was too short to cut straight through the tree, it fell to my slender brother Ron to work his end of the saw from inside the hollowed out trunk. It was extremely dangerous, for he would have to get out of there before the tree was weakened enough to fall. I worried about him throughout the cutting. They started the job early in the morning, and endless time seemed to pass before the sawcut was deep enough to weaken the tree at about noon.

All the highway traffic had to be stopped well before the tree was about to fall, for fear it would crash onto a passing car. But because the two-man saw was not long enough to cut straight through the trunk, they had to cut diagonally across each corner of the main kerf to weaken the tree further, and this also made it harder to determine just where it would fall.

Their intention was to fell the tree parallel to the highway. But when it finally crashed, the hollow section of the trunk caused the tree to pivot as it went down, and it fell angling across the highway. They had to cut out a section of the trunk wide enough to let cars pass through. This was all hand work because the chainsaw had not yet been invented.

At last, the contractor brought up a bulldozer tractor and pushed the log free to open the highway for traffic. I took a tape measurement of this first cut and found that the tree was 13 ft. in diameter at that point, which was about 20 ft. up the trunk. At ground level, the Douglas-fir must have been well over 16 ft. in. diameter.

A brief discussion took place about what to do with a 13-ft.-dia. log, and without hesitation, the tractor driver shoved it down the river bank into the Umpqua to float out to sea. That one log would have probably produced enough clear lumber to build an entire house. The whole tree was then summarily cut into logs and all of it likewise disposed of in the Umpqua River to float out to the ocean. No one gave it a second thought, such was the prodigal waste in that time of our history.

There was a sadness about this event that grew greater with the years. I became more acutely aware that I had participated in destroying a part of Oregon's heritage. It was done so thoughtlessly, so carelessly, on everyone's part, from the local people who did not value the magnificent tree, to the contractor who ignored it, to an engineer draftsman in some distant office who drew a straight line where the highway was to be built when he could as easily have drawn a curve. There was something about the event that might be described with the biblical phrase "Original Sin," a day in 1929 that a bit of Oregon's Eden was lost.

—John A. Macdonald, Los Osos, Calif.

An inspiring article

Readers often tell us that they find inspiration between the covers of *Fine Woodworking*. But the *FWW* #87 cover itself, a photo of a Wooton Patent Desk, inspired two woodworkers to take dramatically different directions.

Dr. William Potter of Morristown, Tenn., responded with an amazing miniature of the desk, as shown in the photo below. The detail of a full-sized Wooton Patent Desk is what makes it such a magnificent piece of furniture. To find the same degree of detail in a 1/12-in. scale model is incredible.

After reading the same article, Ed Orescovich of Tampa, Fla., hit the drawing board to come up with a modern version of a Wooton desk (see the photo below). Ed's model includes the customary pigeonholes and folds closed just like the originals, but it also includes some updated conveniences, such as built-in lighting, a suspended filing system, a telephone and a "truly outrageous stereo."

—Charley Robinson

***This rotary, two-tier** Wooton Patent desk is built of cherry, walnut burl and bird's-eye maple veneer in 1/12-in. scale with custom-made brass work. It took more than 250 hours to make and assemble.*

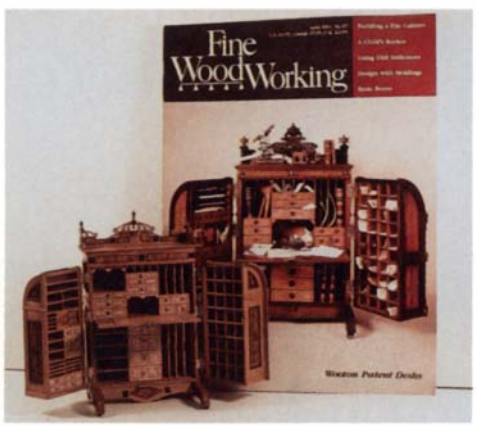

Photo: Dr. William Potter

***A modern version** of the venerable Wooton desk, this unit includes not only the usual pigeonholes and fold-up style but also built-in lighting, a telephone and an am/fm stereo and cassette player system.*

Photo: Ed Orescovich

Not cheaper by the dozen

I once heard a story about a woman who went into the shop of an old furnituremaker and saw a chair in the corner that she simply fell in love with.

"How much?" she asked after admiring it for a few minutes.

"Fifty dollars," the old man answered.

"Great," she said. "I'd like four for my breakfast room table. How much would that be?"

"Three hundred dollars," he replied.

"Three hundred?" she said. "The price should go down!"

The old man looked at her with that superior scorn only a lifetime of pain-in-the-neck clients can impart and said, "The first one was fun."

Like most craftsmen, I get the most satisfaction from doing a piece for the first time. I try to talk clients into allowing me to do different things, even though I would probably make more money reproducing something I've already done a dozen times.

A part of me regrets becoming a professional woodworker. No matter how much you enjoy doing something, part of the thrill subsides when you do it every day. We should save the pursuits we really enjoy for hobbies and make a living at something lucrative or at least something that

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gives us enough free time to enjoy our hobbies. I once told a friend all the best work was done by amateurs. This really upset him because he had been making a living as a cabinetmaker for over 20 years and had a portfolio any woodworker would envy. So I explained myself.

I had visited a friend in the insurance business. His job was as boring as broccoli, but it paid well and only required those short eight-hour days. He was in the garage, and when I walked in, he was putting the finishing touches on an armoire that was truly impressive. It was gorgeous, a labor of love. He had gone down to the lumber dealer and personally picked out every slab of mahogany. Guys like him get the good stuff. We professionals who have to rely on a phone call and a delivery truck get the stuff that's left over. He had carefully dovetailed the carcase together, even the parts that didn't show. He had matched the planks, cut solid drawer sides and dovetailed them together. He had fashioned his own hinges and latches from solid brass. He handplaned every piece of wood that went into the piece and then spent weeks with a wad of cotton, polishing till it had the patina of something from Versailles.

I was blown away. Technically, it was not beyond the capabilities of any good professional, but lord, who has the time? When I asked him how long it took to build, he said six months.

Six months with no cash flow! You'd have to charge $30,000 and live on rice till the damned thing was finished. And then who could part with it? It'd be like selling one of your children.

I have to admit, parting with a piece that has consumed a big chunk of your time is hard, even for me. Sometimes I won't call a client for a week to tell him his cabinet is ready because I enjoy having it around. Not until the bills pile up and I get a few nasty phone calls do I finally relinquish it.

I realized a long time ago that I make the least money on my best work, the one-off custom jobs. That's because, as with a spoiled child, you lavish more attention on them than they deserve.

I got a call last week from a lady who asked if I could come over and give her a price on a bookcase. I had a strange sense of déjà vu as I walked up to the door. When she opened the door, she said it was nice to see me again. Did I know this person? I certainly didn't remember her. I followed her into the living room and she pointed to the fireplace and said, "We still love our mantle."

It came rushing back to me. I remembered her. I remembered the mantlepiece, a piece that I had labored excessively over. I even remembered who I was back then and what I had felt in crafting it. I went over and examined the mantle, greeting it like a dear old friend, touching it, enjoying its feel, its texture, its smell.

I realized that here was something that would last a lot longer than I would. And you know something, it looked great, and I was pretty darn proud of it.

—Gennaro Rosetti, Los Angeles, Calif.

Photo: Susan Kahn

***Burls take the shape of bone**—The grain pattern, lines, worm holes and defects found in hardwood burls add realism to the carved-skull sculptures of Greg Krockta. The skulls and their burls are, clockwise from top: buffalo, red oak; springbok, silver maple with stained curly maple horns; modern man, black maple; chimpanzee, red maple; African lion, silver maple.*

No bones about his craft

What does a carver do for relaxation after spending 12-hour days in the shop? For Greg Krockta of East Northport, N.Y., who has been carving since he was five and has run his own custom carved-sign shop since 1981, the answer is to carve some more. But the after-hours carving that Krockta does is of skulls, both animal and human, as shown in the photo at left.

Krockta got into carving skulls about seven years ago, but it wasn't until a year later when he was introduced to burls that this passion really flourished. The burls have proven to be the perfect medium, with fissures, cracks and worm holes adding an eerie realism impossible with ordinary woods. An air-powered rotary rasp gives Krockta control to carve the gnarly grain. He uses actual skulls as models to create his extremely realistic pieces, which sell for between $2,000 and $5,000.

—Charley Robinson

Notes and Comment

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

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"Oh, I could do that"

George Huffman and his wife like to visit antique sales near their Carmel, Ind., home to window shop and occasionally get ideas for woodworking projects. It was on one of those forays that Huffman's wife spotted a small Noah's ark she wanted to buy. Huffman took a look at it and uttered the fateful words many a craftsman has learned to eat: "Oh, I could do that."

It took a lot more than 40 days and 40 nights for Huffman to finish the project. Three years of work went into crafting the 26-in.-long, 13-in.-wide, 19-in.-high ark, which is lapstrake construction made from five layers of oak veneer.

Opening the hinged ark reveals 60 pairs of hand-carved and painted basswood animals from aardvarks to zebras. There's even a unicorn, the only animal without a mate. Noah and his family complete the ensemble.

For a look at another woodworker's version of Noah's ark see p. 110.

Photos: Susan Kahn