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Burning in invisible repairs, p. 70

On the Cover: Knowing your jointer and how to use it makes tasks like the face-jointing of this mahogany board safe and easy. For more on jointer use, see p. 48. Photo: William Sampson

Find it fast—Whether it's looking for a particular technique or trying to locate a special jig I remember seeing in our pages way back when, I'm always reaching up to the shelf above my desk to tap into back issues of *Fine Woodworking*. But unless I happen to remember exactly which issue I need, which is not very likely, what ensues is a laborious process of thumbing through issue after issue. It can be frustrating even with the help of the computer, annual indexes and the #1 to #50 issue index we published.

Now, thanks to the incredible efforts of our indexer, Harriet Hodges, there is some real help at hand. Harriet has meticulously gone through our first 100 issues to compile a new index covering all those issues in one easy-to-use wire-bound book. It is cross-referenced to include subjects, authors and tables of contents. It not only includes all the magazines from Winter 1975 (FWW #1) to May/June 1993 (FWW #100) but also is cross-referenced to the *Fine Woodworking on...* and *Best of Fine Woodworking* series of reprint books. So even if you don't own issues #1 to #100, you can take advantage of the index.

We've long known that woodworkers read *Fine Woodworking* as a primary reference tool that has become as important

to their shops as sharp sawblades. The new index just makes that reference tool even easier to use. The index costs \$12.95 plus \$2.50 postage and handling and can be ordered by calling (800) 888-8286.

Abram's armada defends Norm—Like a regiment of Energizer rabbits, the fans of Norm Abram just keep writing and writing and writing. As this is written, about four months after *Fine Woodworking* #99 hit the streets, its cover emblazoned with Norm's visage, letters are still coming in from readers all over the country. To date, there have been 76 letters specifically about Norm Abram or the coverage and reaction. Of those, 65 letters, or 85%, backed Norm and our coverage, nine letters, or 12%, were opposed, and two letters, or 3%, didn't take a clear stand.

What was even more interesting was the way the letters came in. After the initial mix of plaudits and brickbats, the critical letters just stopped coming. But the waves of Norm's defenders were relentless. Many of them were compelled to write because they were plainly offended by the vituperative letters of some of Abram's detractors. Clearly, the criticism of "The New Yankee Workshop" host hit some raw nerves.

The whole episode serves to remind us

that each of us gets something different out of our woodworking. What works effectively as a technique for one woodworker may not be appropriate for the tools, work habits and goals of another. At the same time, we all have something to learn, and many of us have something to teach. That's why *Fine Woodworking* is a reader-written magazine. We offer the opportunity for woodworkers to share their expertise with fellow woodworkers. We can all teach each other a thing or two, but when the teaching becomes preaching, we get into trouble.

—William Sampson, executive editor

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 are in the shop.—John Lively, publisher

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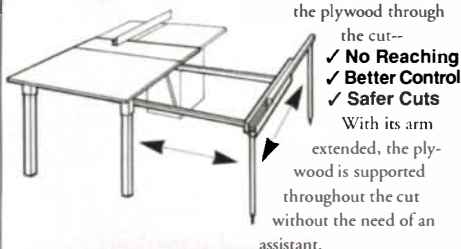
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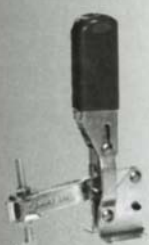
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Some things aren't for sale—Your article in your 100th issue about outfitting a shop prompted me to write for another way to do it. If I were young and just married and had that article, thinking I had to spend \$6,000 to get a good supply of woodworking tools, I would probably just forget about it. I think there is too much emphasis put on the best, the biggest and the newest. Part of education, especially of kids, should be to teach thrift, to use the imagination and to work hard. And as it relates to woodworking or any other skill, quality comes from within, you can't buy it.

—Jerome McIlvanie, Yakima, Wash.

Starting from scratch—In *Fine Woodworking* #100, you have an article titled "Setting Up Shop." It is advice given by three pros in setting up shop. I can find no real fault with their advice other than this: If I had followed their ideas in doing the woodwork I have accomplished, I would have built nothing.

You should do an article on how someone who started with virtually no tools managed through the years to become a fair woodworker with the types and kinds of tools he could get his hands on. For example, I started with such tools as a pocket knife, a hacksaw, an old chisel, a hammer and an old file. My workshop was the kitchen table or a tree stump in the yard. My training was one semester of wood shop in grade school and two semesters of metal shop in high school, plus lots of failures in trying to do something I didn't know how.

—Robert Gaumer, Lompoc, Calif.

Missing tools—It was a pleasure to see that you had an article on setting up a woodworking shop (*FWW* #100). However, the treatment of the subject was very poor in my opinion. It depends first on your objective. Do you want a beginning shop for a home craftsman or for a professional who is primarily interested in running a business and making money?

The comments of Mark Duginske were generally fine except that he omitted hand tools completely. The selections of Peter Korn, with three exceptions, were by far the best. I question the inclusion of a 3/16-in.-wide chisel. For one thing, I do not believe that it is easily obtainable; if it is so important, why aren't more available? The full set of twist drills by 64ths up to 1/2 in. I consider excessive. The third item is no screwdriver.

The third collection, by Mario Rodriguez, has a few serious omissions. There were no drills of any kind. Not even an awl. This list did not include any files or rasps. It also did not include any clamps. I once read that you never have enough clamps. As with the other list, why wasn't at least one screwdriver included? It seems that there should be a small one, a medium one, a large one and a Phillips type.

—Norman M. Wickstrand, Salisbury, Conn.

Thoughts on the 100th issue—I feel it's time to write a letter to the editor after 100 issues. Before the first issue came out, I was teaching woodworking in a high school, and I saw an ad come through about a new magazine coming out, *Fine Woodworking*. I subscribed at that time. I have looked at every issue, and I have found inspiration throughout the years.

About five years later, I pursued a career in industry as an engineer. Over the years, I've had ups and downs in my life. [In the magazine] I've found more than just information about technical ideas: I see presented a true art form and culture that has spanned most of a man's life. It's only fitting the 100th issue is about the shop, the beginning and end. Thank you for all your work.

—Joe Pallansch, Minneapolis, Minn.

A great teacher—I have just finished browsing through the 100th issue of *Fine Woodworking*. As a subscriber from *FWW* #1, I would like to congratulate your staff for the success you have had in putting out a great magazine on woodworking.

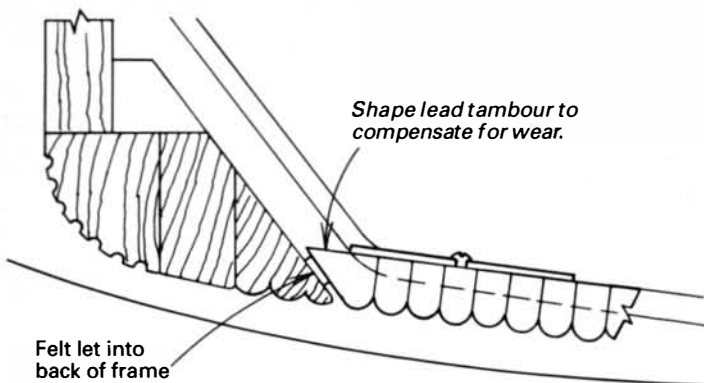
In "Editor's Notebook," you mentioned Marlow, Gottshall and Joyce. A great group of craftsmen. In my case, I learned more woodworking from the late Andy Marlow than from all other authors combined. I would like to see an article on the life and works of this great woodworker and teacher.

—Cecil R. Vollmer, Pensacola, Fla.

Design problem—On p. 80 of *FWW* #99 is an inset showing a scheme for spring-loading the outermost two slats of a tambour door to close a gap that would otherwise exist. This requires that the first slat rub against the back side of the frame until the third slat is well around the guide groove. I am curious to know what Mr. Turner plans to tell his customer when the customer complains about the resulting wear on the first slat.

—L.N. Burke, Painted Post, N.Y.

WILLIAM TURNER RESPONDS: L.N. Burke is correct to point out the problem of wear. Unfortunately, due to an omission on my part, the illustration presented was incomplete. The lead tambour was actually shaped to compensate for wear by the addition of wood on its leading edge (see the drawing below). Also, a strip of felt was fitted into the cabinet frame where the initial contact was made. In nine years of use, there is no visible wear on any of the doors.



I regret having made this omission. I took the illustration off my original shop drawing, which didn't include the actual improvements made in the piece.

From a "reformed woodworking elitist"—I have been a self-employed woodworker for the last 15 years and have been reading your magazine since it first came out. I am compelled to write about the letters you published from Thomas G. Phillips, M.D., and Pete Petran regarding Norm Abram on the cover of *Fine Woodworking* #99.

In all the years that I have been in the custom woodworking game, I have yet to find a more closed and narrow-minded group of people than hobbyist woodworkers. These two letter writers represent an elitist, snobbish view that is pervasive in this part of the woodworking field.

Norm Abram's approach to woodworking is what it is. His show has made woodworking accessible to thousands more people than Phillips or Petran could ever hope to affect with their hobby-shop mentality. As a reformed woodworking elitist, I have some words of advice for anyone interested in learning more about this craft. Woodworking is not organized religion. *Fine Woodworking* is not the Bible. Krenov, Frid and Maloof are not saints. Anyone who ever did something different from you can teach you something if you are open to learning.

If you think you know all there is to know, I suggest that you get your own show or magazine going. You could call it *Superior Woodworking* or *Really Righteous Woodworking* or something equally wonderful. You might even get an expert ed-

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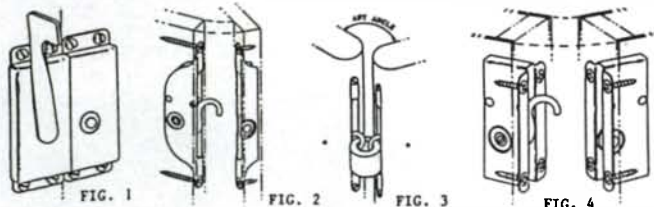


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FIG. 5
GEAR HEAD SCREW
— STAIR RAILS —
NON-PROGRESSIVE

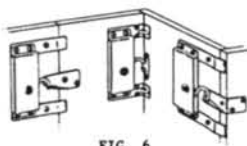


FIG. 6
'JIFFY' ROOMS & ENCLOSURES
NO PANEL PREPARATION
MOUNT INSIDE OR OUTSIDE
OPERABLE FROM BOTH SIDES

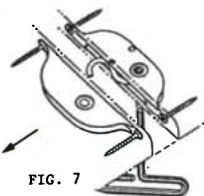


FIG. 7
SECTIONAL TABLES AND COUNTERS & BARS

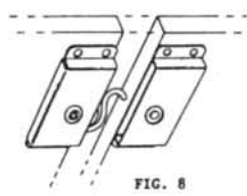


FIG. 9 TYPICAL CONFERENCE TABLE APPLICATION
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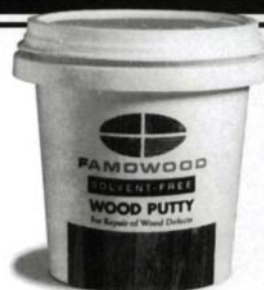
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itor who is an M.D. like Dr. Phillips. Just think of the possibilities! In a few years, you might even have hundreds of devout followers that think just like you. —Steve Casey, Agoura Hills, Calif.

Hot air power—I do not understand how these “self-taught” intellectuals have the nerve to be so critical of a fine person (Norm Abram) and a fine magazine. It would be interesting to see how hot air powers a woodshop and to see some of their finished projects. —Thomas H. Sheppard, Jensen Beach, Fla.

Norm Abram story well-done—I believe the Norm Abram story was well-done and was easily deserving of *Fine Woodworking*'s precious few pages and the cover. While I think of myself as reasonably skilled when it comes to working with wood, I hope I never become as elitist and self-important as those who denigrate a man who has given much to his profession and those, as myself, who admire his accomplishments.

—Leroy Pluard, Vancouver, Wash.

Angry about Norm's critics—To the critics of Norm Abram in the 100th issue of *Fine Woodworking*: You people made me very angry. I could say more, but *FWW* wouldn't print it. Keep up the good work, Norm! —Frank G. Rice, Kingsford, Mich.

Get your own show—Television is mostly wasted air space considering the potential that has always existed to deliver meaningful education to large numbers of people. Norm Abram's program is one of the few that shows specifically how to do something useful. I invite those in possession of greater skills to get their own show. We need their input also.

—Byron T. Hodges, Leavenworth, Kan.

Norm's my kind of guy—I am outraged and highly incensed by those readers who wrote and voiced disapproval of your article featuring Norm Abram. Norm is a real down-to-earth craftsman whom I follow regularly on television and was so pleased to read about in your magazine. Basically, he is “my kind of guy.”

—Ed Rich, Tacoma, Wash.

Watch out for Bob—I really enjoy your publication but had to bite my tongue when I saw Norm. You're safe until Bob Vila is smiling at me wearing a Sears T-shirt.

—Ron Summers, Hagerman, Idaho

Educating America—While I don't think that Norm is a giant among woodworkers, I find his show to be informative and honest. What I didn't realize is that some of the readers of your fine magazine are so elitist. There are some of us who make our living butchering wood, and it's nice to hear a customer ask about dovetails on the drawers in their cabinets or talk about coping an inside corner on crown molding. A lot of people now know about solid wood instead of particleboard or plywood. Norm Abram and “The New Yankee Workshop” are educating America. I'll bet that there are at least another one million people who can appreciate a Krenov or Frid because of that show. Norm, ya got lucky. From the people who freeze on ladders and scaffolding in winter and sweat on the same in summer, keep up the good work.

—R. DiTrocchio, Montgomery, N.Y.

From one doctor to another—I am somewhat astonished at the negative letters you received about your article on Norm Abram. It seems some of your readers have a “holier than thou” attitude toward woodworkers. I have only been taking your

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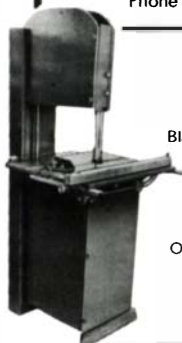
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magazine for about a year, but nowhere did I note that plywood, nail guns, pine and polyurethane were disallowed. I am sure I have much to learn about basic woodworking skills, but *Fine Woodworking* does not necessarily imply 17th-century woodworking. One explanation does come to mind after reading the letter from the "self-taught" cabinetmaker: It is typical of doctors to feel superior and state they have nothing more to learn (from Mr. Abram).

—Mark H. Oltermann, M.D., Ogden, Utah

History lesson for Norm's critics—In chastising Norm Abram for his use of pneumatic nail gun and polyurethane, [Thomas Phillips and Pete Petran] do not seem to understand that in using the latest tools and materials, Norm is squarely in the midst of the American woodworking tradition. From the Dominys of East Hampton, N.Y., to the present day, men who work with wood for a living have always embraced the latest technology. The Shakers were particularly aggressive in this regard, inventing the circular saw and dozens of other time- and labor-saving devices. Moreover, they experimented with paints, oils and tinted and clear varnishes for their furniture. It is ludicrous for Petran to "shudder" at Norm's use of materials the Shakers themselves would have certainly used had they been available. It is also strange for Petran to fault Norm for his use of so much pine when that wood was the favorite of the Shakers also.

—Richard L. Miller, Elizabethtown, Pa.

More on crib safety—As the human factors psychologist who performed much of the accident data analysis supporting the Consumer Product Safety Commission's crib industry standards and guidelines for crib safety, I can't help but comment on Bradley S. Rubin's article in *FWW* #100. Beautiful shopmade

cribs like Rubin's are likely projects, and it is important that the craftsman has a correct understanding of the hazards.

It is a common misperception that the 2½-in. maximum spacing requirement for the slats is to prevent a child from putting his or her head through. The hazard, as evidenced by numerous deaths, is that the baby's body may slip between the slats feet first, *not the head*, hanging the baby. The spacing is intended to prevent passage of the smallest child's torso, which is smaller than the head.

Similarly, the restriction that corner posts must not extend more than ¼ in. above the rails is not to prevent a child from poking his or her head. Rather, 48 babies died when clothing or other items worn near their necks became entangled on corner post extensions. In fact, any catch point on the crib poses a serious hazard as the child's clothing may get caught, resulting in hanging or strangulation. Children have also become hung on crib dropside knobs, dropside guide rods and on other crib catch points. Thus, the pretty round knobs on ¼-in. dowels that control the dropside on the Rubin crib pose a very real hazard.

On the positive side, I am very pleased by Rubin's efforts to conceal the dropside mechanism. Some traditional guide rods cause clothing strangulation, and by eliminating all that exposed hardware, Rubin has not only made the crib more attractive but also has eliminated a potential hazard.

—Shelley Waters Deppa, safety consultant, Brookeville, Md.

The wonder of the Studley tool chest—Editor William Sampson's article on the Studley tool chest (*Fine Woodworking* #100) makes you wonder where all the master craftsmen have gone. But maybe even more amazing than the skills needed to build it are those needed for layout and design. Could any of us

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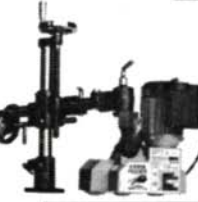
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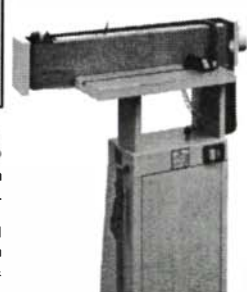
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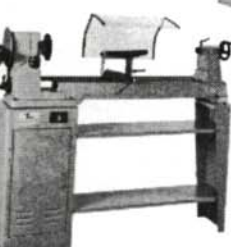
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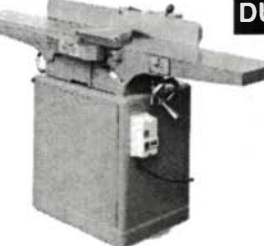
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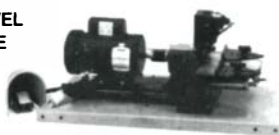
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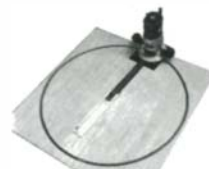
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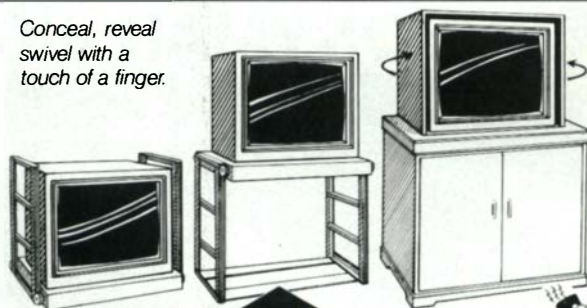
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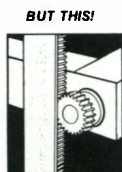


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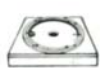
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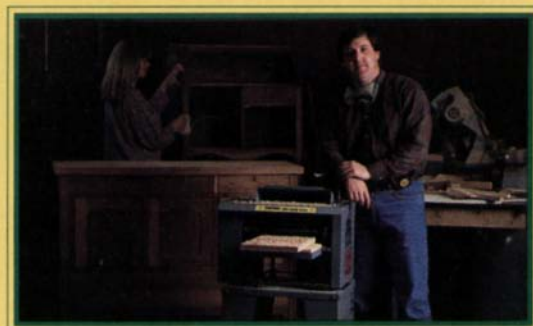
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make it as compact and practical given the list of 300 tools to be housed. I'm not sure I would know where to start.

—Frank Thomas, Markesan, Wis.

Hardwood in your neighborhood—There is another source of quality wood that is sadly overlooked: tree removal services. I live in an old neighborhood studded with big old trees. Frequently, trees are removed by the township or private contractors and cut up for firewood.

For example, in the next street grew a beautiful black cherry tree, straight growth with few branches, approximately 50 ft. high and over 3 ft. in diameter. Several weeks ago, this tree was felled and cut up for firewood. When I questioned the tree removal personnel why they cut up the tree, I found out that none of them had an appreciation or understanding of the quality of the wood. This tree could have been converted into some great furniture and turning blanks.

If a way could be found to educate and to make it economically interesting for the tree removal services to save the usable wood, an additional source of quality wood could be made available.

—Ted Zogrotzki, Penn Valley, Pa.

Save your back—The cover photo of the May issue of *Fine Woodworking* showing Mark Duginske hunched over his work is a classic example of a procedure that puts undue strain on the spine and back muscles. If he continues to work bent over that way while overtired, under pressure or angry, he is almost certain to suffer back injury.

As one who has sustained expensive surgery and over 25 years of frequent pain and discomfort, I can assure you that back problems are not to be taken lightly. Woodworkers or anyone

who labors at a workbench should custom-fit their bench to their dimensions. Judging from my experience, I suggest that while standing perfectly straight beside your workbench with your lower arm held horizontally, your elbow should be about 2-in., but no more than 3-in., from the work surface. An additional bonus: less fatigue and better control of your tools.

—Elwood S. Thompson, Stow, Mass.

Wasted anti-weather joint—I am somewhat puzzled about Jim Tolpin's techniques of coping with water in his article "Wood Against Weather" (*FWW* #100). If the glue in the half-lap and mortise-and-tenon joints holds well, then canted surfaces aren't necessary because no water can get in. If the glue fails, then capillary action of two proximate surfaces would hold water regardless of any slope. Isn't it pointless?

—Richard Fox, Llandecwyn, Gwynedd, Wales

Varnishing teak on a sailboat—*Fine Woodworking* #100 contains an interesting article about finishing, "Wood Against Weather" by Jim Tolpin. I've been varnishing the teak on my sailboat for several years because its finish can take the Florida sun better than teak oils. I've never used a penetrative undercoat on raw wood as the author recommends, and I wonder if it will extend the life of the five to seven coats I apply to new wood.

I've been getting a beautiful finish by cutting the varnish 1:3, using mineral spirits. Tolpin makes no reference to the viscosity of the varnish he applies. Is my practice a good one, or is there a better way? I have been finding small areas showing varnish weakening and separating after six months in the Florida sun, necessitating sanding to bare wood and building up the varnish again. I normally sand between coats with 180-grit and intend to

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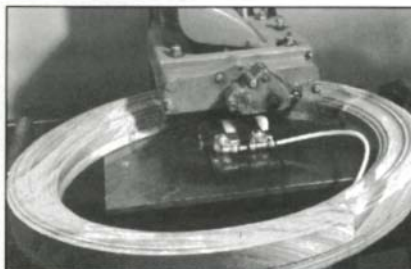
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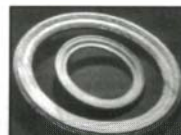
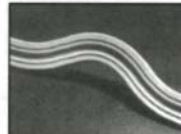
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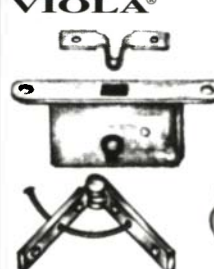
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Hollows and Rounds

3

September/October 1993 13

try the author's recommendation to use 280- and 320-grit to compare my results. —Richard Dickens, Jacksonville, Fla.

JIM TOLPIN REPLIES: Because you state that your varnish consistently deteriorates within six months, this indicates to me your varnish job creates a film that is either too thin or does not adhere well to the teak—probably both. The varnishing primer Julia Maynard suggested (Flashbond 300, made by X-I-M Products, 1169 Bassett Road, Westlake, Ohio 44145; 800-262-8469) may be helpful to increase the adherence of the varnish to the oily teak. However, I hear from the manufacturer that this product was not formulated for this purpose—it's really designed to undercoat oleic enamels on metal machinery. Also, do not thin more than the first coat of varnish. All subsequent coats should go on as dense as you can lay them down without runs. The idea is to build up as thick a layer of varnish (and thus UV filters) as possible. As your skill at applying the varnish increases, go to the more viscous (though, unfortunately, more expensive) brands.

Foil is flawed—In *FWW* #100, Donald Weiman has a "Q&A" item about constructing exterior doors that allows for expansion and contraction. While I admire the structural method he uses, his concept of the insulating value of the foil divider is fundamentally flawed. Aluminum foil has a far greater *conductive* rate than wood, so it offers a decrease in insulation. Mr. Weiman is confusing the three methods of heat flow: conduction, convection and radiation.

Conduction is the heat flow through the molecules that make up a substance (the well-known heat transmission of aluminum, for example). *Convection* is heat transfer through the differential movement of a heated fluid; hot air rises and transfers heat away

from the source to some other area. *Radiation* is the movement of heat through infrared light given off by a heat source—the heat the Earth receives from the sun.

Aluminum foil is an excellent reflective barrier against infrared radiation—if it has an airspace adjacent to its surface that must be crossed by infrared radiation. When foil is in direct contact with the heat source (a hot roof, for example), its heat flow is by conduction and aluminum foil is an excellent heat conductor.

—Clifford W. Mossberg, Fairbanks, Alaska

Tractoring in mahogany—I live in the country, where trucks and tractors are more plentiful than cars. I recently noticed a tractor dealer near me where the crates used by a Japanese tractor company, Kubota, were lying around after the tractors were uncrated. These large crates, measuring 8x4x4 were made out of beautiful Philippine mahogany. My local dealer told me that he pays several hundred dollars to have this wood picked up and trashed. Unfortunately, the Japanese are using mahogany from Malaysia and the Philippines for crates and plywood forms in the same way we use fir, hemlock and spruce. The crates I rescued contain beautiful straight mahogany and can be used in my furniture projects.

I hope this letter will generate enough complaints to help stop the practice of using mahogany as packing-case material. Meanwhile, should any of your readers wish to rescue these crates, they should contact their nearest Kubota tractor dealer and do what I have done: Volunteer to unpack these tractors and save this wood for their own use. The dealer near me is very happy to have the mahogany taken off his hands. And by me unpacking the crates, I can avoid the wood getting ruined by someone who doesn't appreciate mahogany. —David Marlow, Warrenton, Va.

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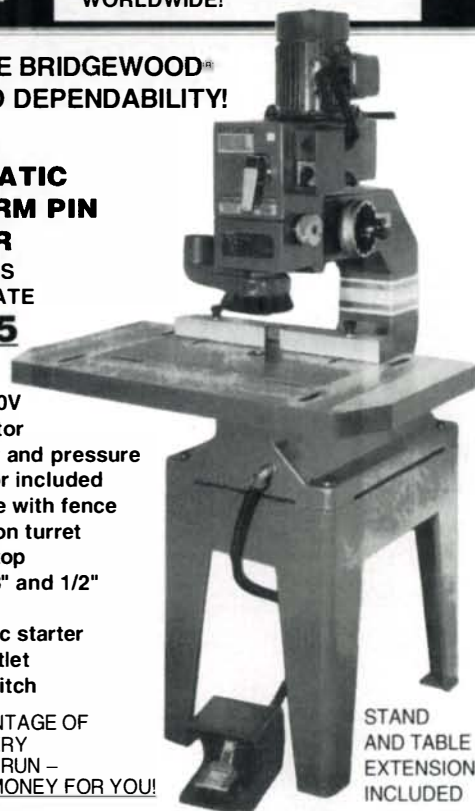


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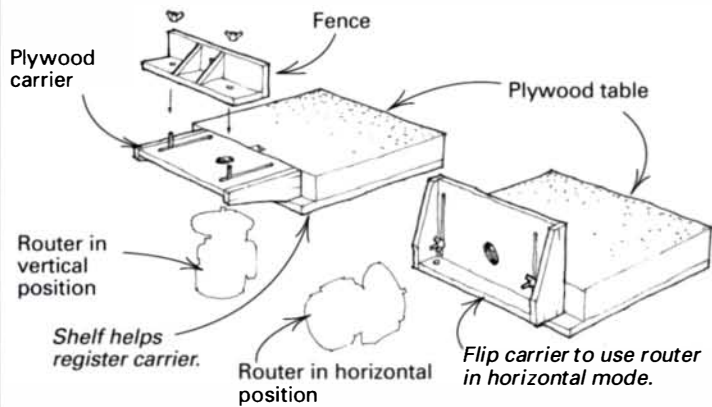


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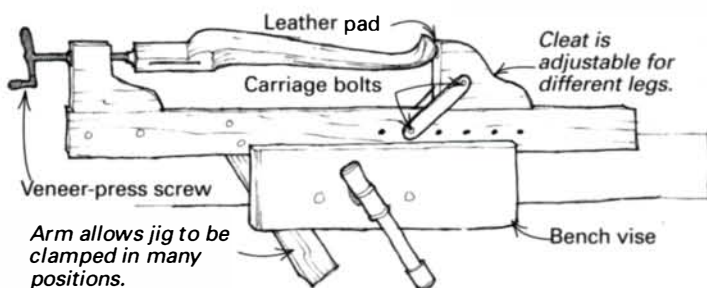
Combination horizontal and vertical router table



I made this combination router table so that I could quickly switch the tool from the traditional vertical position to a horizontal position for making raised panels and sliding dovetails. The basic concept behind the table is the demountable $\frac{3}{4}$ -in. plywood L-shaped router carrier, which has mating sets of mounting holes on each leg of the L. One set of the mounting holes are slotted so that the router may be adjusted up and down in the horizontal position. In the vertical position, the slotted holes allow in-out adjustment of the router's fence. Note that the fence, which normally faces the long end of the table, can be reversed to face the short end of the table for small pieces.

—Andrew Westerhaus, Burnsville, Minn.

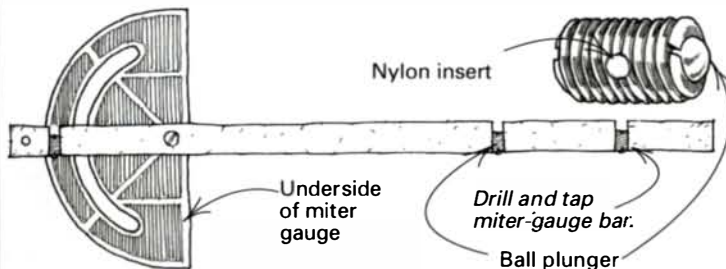
Cabriole leg jig



This jig, which I have used for more than a year, is much more comfortable for shaping cabriole legs than the grooved blocks, pipe-clamp fixtures and other devices I have cobbled together from time to time. I can easily rotate the work by loosening the screw at the headstock end. Or by changing the jig's arm position, I can orient the workpiece anywhere in the bench vise—horizontal to vertical. The vertical position permits much easier filing and scraping of the top of the foot. This particular jig is a few inches over 4 ft. long and made from $2\frac{1}{4}$ -in.-thick solid stock.

—A. Wallace Root, Berwyn, Penn.

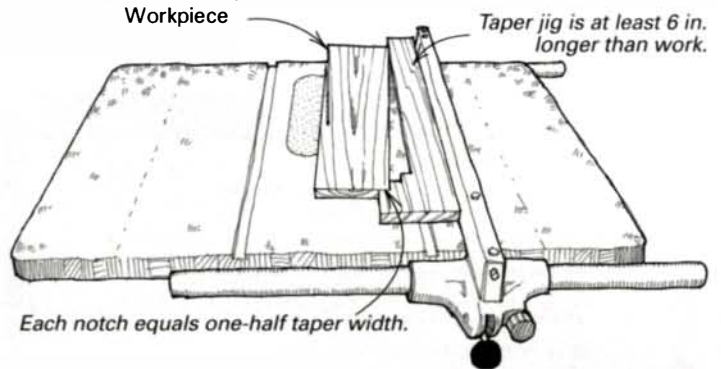
Eliminating miter-gauge side play



Here's another method for eliminating miter-gauge side play to add to those listed in Daniel Westberg's article (*FWW* #93, p. 74). This inexpensive method uses ball plunger screws inserted transversely to the bar at three locations. The plungers are threaded steel inserts fitted with spring-loaded stainless steel

balls. I use the heavy force plungers (2 to 5 lbs. end force), 10-32 threads, $\frac{1}{2}$ in. long, with nylon locking element (available from MSC Industrial Supply Co., 151 Sunnyside Blvd., Plainview, N.Y. 11803-1592). Drill three holes through the bar, two near the tip and one near the base, and tap for the threads. Screw the plungers into the holes with the balls facing the same direction. Use a screwdriver to adjust the plunger depth until all side play is removed without excessive friction or interference. The plunging action of the balls will compensate for any variations in the saw table's slot width.—Richard Shultz, Cinnaminson, N.J.

Improved taper jig



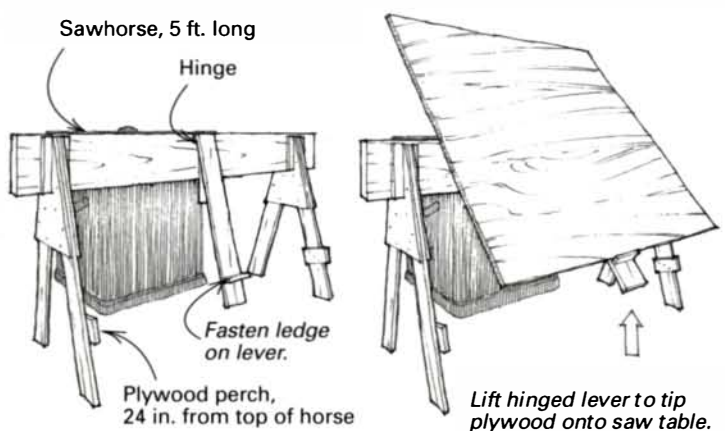
The tapering jig I use for short runs is just as quick to make as Phil Clark's (*FWW* #98, p. 20), but it also handles longer workpieces and provides more control and safety. I simply cut three notches into a scrap piece that's 6 in. or so longer than the workpiece to be tapered. The width of each notch is one-half the taper. For longer runs or if the final taper is too small to hold securely and safely, I attach the jig to a substrate and use DeSta-Co toggle clamps to hold the workpiece firmly.

—Tai Lake, Hualaloa, Hawaii

Quick tip: To flush trim dowel plugs without scoring the work surface, hone the last few inches of one side of a coarse hacksaw blade to remove the tooth set. Saw off the dowel stub with the honed side against the workpiece, and then trim the dowel with a sharp chisel.

—Peter Burrage, Essex Junction, Vt.

Plywood-lifting sawhorse for the tablesaw



Because it was awkward and difficult for me to hoist a full sheet of plywood onto my tablesaw, I made this special sawhorse. The unique part of the sawhorse is the center lever. It is hinged at the top and has a ledge at the bottom so that I can easily tip the plywood onto the saw table for cutting. Blocks screwed to the legs of the sawhorse provide a perch for the plywood. The blocks and the ledge are 24 in. from the top of the horse so that a full sheet will balance and tip easily. I made the horse 5 ft. long and the same height as the saw so that it supports the out-

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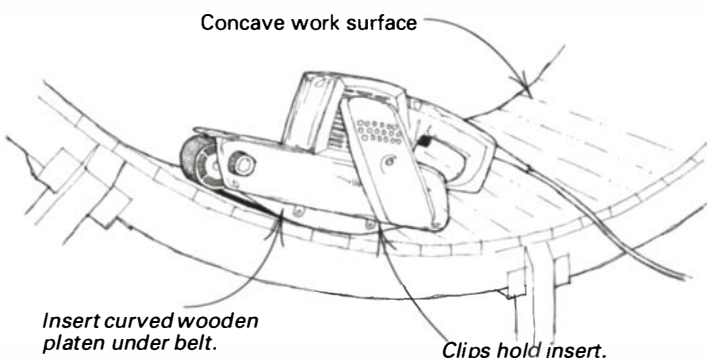
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er edge of the plywood during the cut. To save space, I knock down the sawhorse when it is not in use.

—David C. Hurd, Madison, Wis.

Beltsanding large concave surfaces



To beltsand large concave surfaces, make a curved wooden insert as wide as the sander's platen to go under the belt. Slightly flatten the insert's crown to get more of the sanding belt in contact with the surface. There's a limit to the thickness of insert you can use; you've gone too far if the belt-release mechanism doesn't close properly. The insert should stay in place without any type of attachment. If it doesn't, use clips to secure the insert.

—Chris Marley, Kingston, Jamaica

Darkening the finish on brass hardware

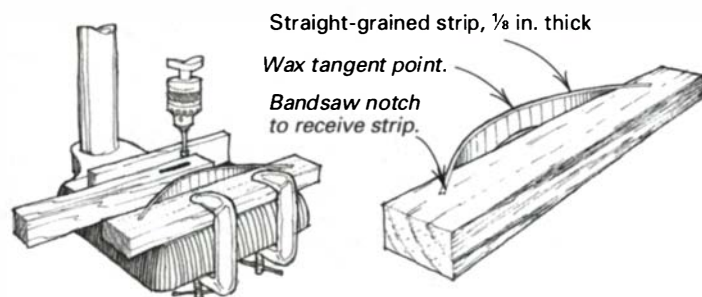
If you don't want that shiny gold color on new brass hardware, here's a method one of my instructors taught me to add a nice

antique patina on brass using household ammonia.

First remove any clear coating from the hardware; then wipe the surface with alcohol, taking care not to leave any fingerprints. Set the hardware aside, and prepare a clean large-mouth jar as follows: Attach a wire to the lid that will hold the hardware off the bottom of the jar with room to spare. Place a few hardwood shavings into the jar, and pour in about ¼-cup ammonia. With the hardware attached, screw the lid onto the jar. The amount of color will depend on the fuming time and the type of brass alloy: Figure on at least two and up to 10 hours. Harder brass alloys, such as those used in screws, will not darken much at all. After the fuming process, wash the brass with water and apply some wax. If the color is too dark, you can easily buff the metal and start again.

—Tony Konovaloff, Bellingham, Wash.

Wooden spring hold-in



I often cut mortises on the drill press with a Forstner bit. To favor an arthritic condition in my left hand, I came up with this wooden spring hold-in to push the workpiece against the drill-press fence. I clamp it to the drill-press table with the crown of

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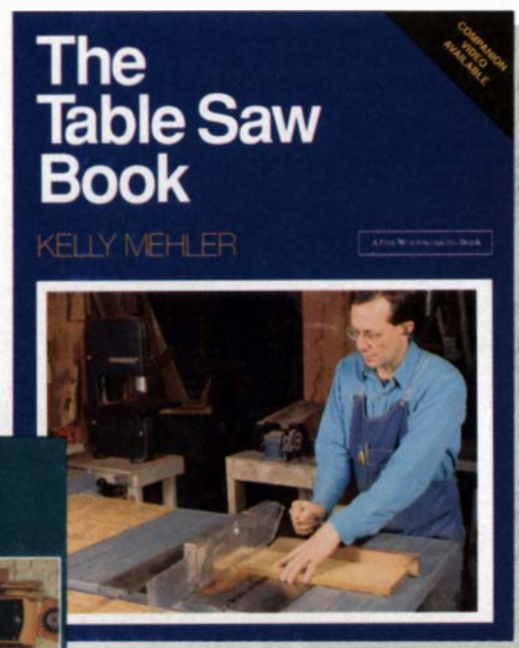
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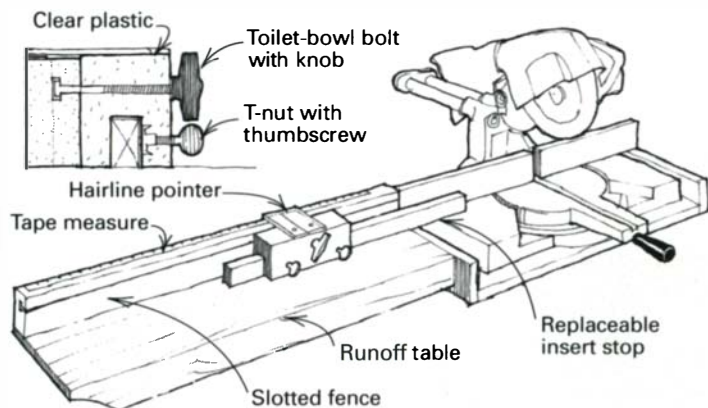
the spring tangent to and pushing against the workpiece at the drill center. The hold-in pushes the workpiece firmly against the fence but allows smooth, easy side-to-side movement. A little wax on the tangent point of the spring helps.

—C. Henry White, Bristol, Va.

Quick tip: After cleaning a paint brush with solvent, comb through the bristles with a cheap hair comb. This straightens the bristles and removes hardened particles of finish left in the brush.

—John Hensel, Los Angeles, Calif.

Chopsaw stop block

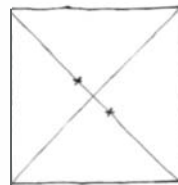


This chopsaw stop block has worked wonderfully for me. It speeds up my crosscut work significantly, and I never use a tape measure at the saw anymore. A special feature of the stop block is the replaceable insert, which ensures perfect-length cuts. To

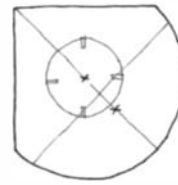
align the stop, set the hairline pointer (marked on a piece of clear plastic) to zero, slide the insert past the sawblade, tighten everything up and cut off the insert, which zeroes it. Now you can slide the pointer to whatever measurement you need, tighten the stop-block knob and cut with confidence.

—Lars Mikkelsen, Santa Margarita, Calif.

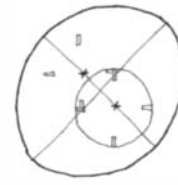
Oval shaped spindles



1) Mark centers on stock equidistant from intersection of diagonals.



2) Place headstock and tailstock on mating marks and turn.



3) Move headstock and tailstock to other marks and turn.

Here's how I turn oval-shaped spindles, which I first used in quilt racks. Determine the finished dimensions of the oval profile. Remember that you will be turning work off center, so don't overdo the differences in the dimensions. For example, on a 1-in. spindle, I'd start with a difference of $\frac{1}{4}$ in. and certainly not more than $\frac{1}{2}$ in.

Cut your stock exactly square and about $\frac{1}{16}$ in. wider than the larger dimension to allow for sanding. Draw accurate diagonals across the ends. Then, from the center, taking care to use the same diagonals on each end, measure out half the difference and mark. This will give you two marks on each end, one on each side of center. Drill pilot holes on the marks so that the

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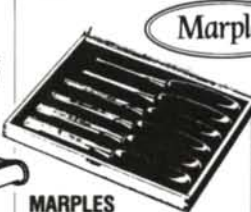
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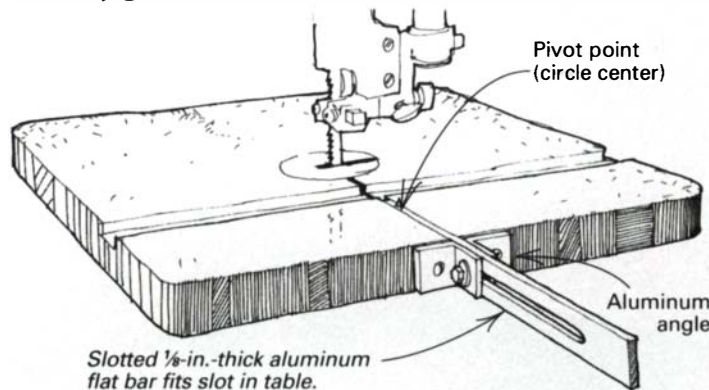
READER SERVICE NO. 163

placement of the headstock and tailstock will be accurate. Round the corners of the workpiece to save unnecessary vibration when you start.

Place the spindle in the lathe with the points of the headstock and tailstock in one set of the off-center pilot holes. Turn until half the spindle is round. Move the workpiece to the other set of pilot holes, and turn until you reach the profile you turned first. File and sand the oval spindle while it is still on the lathe.

—James A. Johnson, Brunswick, Ohio

Circle jig for the bandsaw

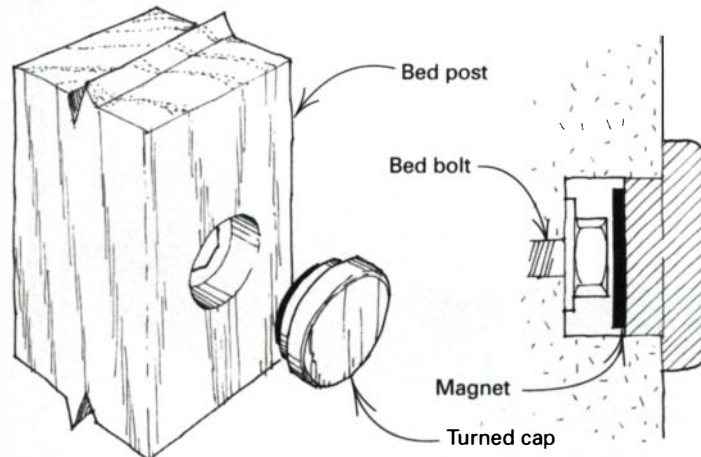


This bandsaw circle-cutting jig, which uses the blade-mounting slot in the saw's table, is made of readily available 1/8-in.-thick aluminum flat bar and angle. The pivot point is the shank of a broken 1/16-in. drill bit, pointed on a grinding wheel while being held in a drill motor. Construction is straightforward, as shown in the sketch above. Drill and tap the side of the bandsaw table

to hold the angle clips. You can cut the slot in the adjustment bar with either a jeweler's saw or with a power jigsaw. This jig will cut circles from 1/2 in. to 16 in. To cut the larger circles, simply reverse the adjustment bar in the slot. When not in use, store the bar with the pin pointing down.—Ronald E. Young, Decatur, Ala.

Quick tip: GOOP hand cleaner, sold in auto parts stores, will remove furniture stain from your hands as effectively as mineral spirits but without the drying effect. —Ed Warwick, Swansea, Ill.

Hiding bed bolts revisited



Another method of hiding bed bolts involves using a magnet. Before drilling the bolt holes, drill somewhat larger holes approximately 3/8 in. deeper than the thickness of the bolt head and washers. Then turn a set of wood caps that snugly fit the holes.

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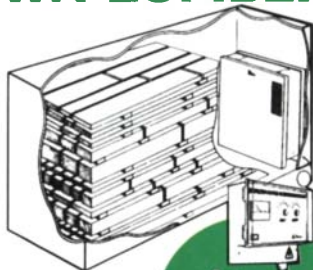
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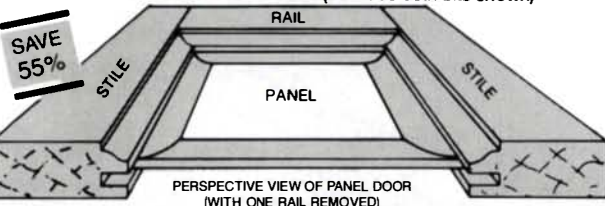
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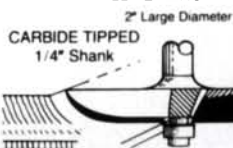
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#603		1/4" Spiral Cutter		1/4"	3/4"	1/4"	\$12.00
#603		1/2" Spiral Cutter		1/4"	3/4"	1/2"	\$12.00
#604		3/8" Spiral Cutter		3/8"	1"	1/2"	\$24.00
#605		1/2" Spiral Cutter		1/2"	1 1/2"	1/2"	\$29.00
#530		3/16" Edge Beading	3/16" Dia. of Circle		1/2"	1/4"	\$15.00
#531		5/16" Edge Beading	5/16" Dia. of Circle		1/2"	1/4"	\$15.50
#350		1/8" Round Over	1/8" R	3/4"	3/8"	1/4"	\$11.00
#351		3/16" Round Over	3/16" R	7/8"	1/2"	1/4"	\$11.00
#230		1/4" Round Over	1/4" R	1"	1/2"	1/4"	\$12.00
#353		5/16" Round Over	5/16" R	1 1/8"	1/2"	1/4"	\$14.00
#209		3/8" Round Over	3/8" R	1 1/4"	5/8"	1/4"	\$15.00
#355		1/2" Round Over	1/2" R	1 1/2"	3/4"	1/4"	\$17.00
#655		1/2" Round Over	1/2" R	1 1/2"	3/4"	1/2"	\$17.00
#656		3/4" Round Over	3/4" R	2"	7/8"	1/2"	\$21.00
#199		Multiform Moulding	Unlimited Patterns	2 1/4"	2"	1/2"	\$40.00
#205		1/4" Cove	1/4" R	1"	1/2"	1/4"	\$12.00
#206		3/8" Cove	3/8" R	1 1/4"	5/8"	1/4"	\$13.00
#207		1/2" Cove	1/2" R	1 1/2"	5/8"	1/4"	\$14.00
#643		1/2" Cove	1/2" R	1 1/2"	5/8"	1/2"	\$15.00
#208		3/4" Cove	3/4" R	1 7/8"	3/4"	1/2"	\$26.00
#231		5/32" Roman Ogee	5/32" R	1 1/4"	1 5/32"	1/4"	\$16.00
#232		1/4" Roman Ogee	1/4" R	1 1/2"	3/4"	1/4"	\$17.00
#506		1/2" Pattern	Flush Trim	1/2"	1"	1/4"	\$15.00
#508		3/4" Pattern	Flush Trim	3/4"	1"	1/4"	\$17.00
#366		1/8" Slot Cutter	3/8" Deep	1 1/4"	1/8"	1/4"	\$14.00
#368		1/4" Slot Cutter	3/8" Deep	1 1/4"	1/4"	1/4"	\$14.00
#204		3/8" Rabbeting	3/8" Deep	1 1/4"	1/2"	1/4"	\$13.00
#670		3/8" Rabbeting	3/8" Deep	1 1/4"	1/2"	1/2"	\$14.00

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#211		3/8" Core Box	round nose	3/8"	3/8"	1/4"	\$10.00
#212		1/2" Core Box	round nose	1/2"	1 1/2"	1/4"	\$13.00
#418		3/4" Core Box	round nose	3/4"	5/8"	1/4"	\$15.00
#213		1" Core Box	round nose	1"	3/4"	1/2"	\$17.00
#548		Lockmitre		2"	7/8"	1/4"	\$32.00
#214		1/4" Straight	plunge cutting	1/4"	3/4"	1/4"	\$ 6.50
#216		3/8" Straight	plunge cutting	3/8"	1"	1/4"	\$ 6.50
#474		1/2" Straight	plunge cutting	1/2"	1"	1/4"	\$ 7.00
#219		3/4" Straight	plunge cutting	3/4"	1"	1/4"	\$ 9.50
#779		3/4" Straight	plunge cutting	3/4"	1 1/2"	1/2"	\$10.00
#462		1/2" Bull Nose	1/2" Dia. of Circle		3/4"	1/4"	\$16.00
#464		3/4" Bull Nose	3/4" Dia. of Circle		1"	1/4"	\$21.00
#764		3/4" Bull Nose	3/4" Dia. of Circle		1"	1/2"	\$21.00
#545		Tongue & Groove	Straight	1 5/8"	1"	1/4"	\$29.00
#845		Tongue & Groove	Straight	1 5/8"	1"	1/2"	\$29.00
#546		Tongue & Groove	Wedge	1 9/16"	1"	1/4"	\$29.00
#846		Tongue & Groove	Wedge	1 5/8"	1"	1/2"	\$29.00
#450		1/8" Beading	1/8" R	3/4"	3/8"	1/4"	\$11.00
#233		1/4" Beading	1/4" R	1"	1/2"	1/4"	\$13.00
#454		3/8" Beading	3/8" R	1 1/4"	5/8"	1/4"	\$15.50
#455		1/2" Beading	1/2" R	1 1/2"	3/4"	1/4"	\$17.00
#500		3/8" Flush	Trimming	3/8"	1/2"	1/4"	\$ 7.00
#501		3/8" Flush	Trimming	3/8"	1"	1/4"	\$ 7.50
#503		1/2" Flush	Trimming	1/2"	1"	1/4"	\$ 8.50
#221		1/2" Flush	Trimming	1/2"	1 3/16"	1/2"	\$ 8.00
#558		Thumb nail		1 9/16"	3/8"	1/4"	\$18.50
#558		Thumb nail		2 1/2"	3/4"	1/2"	\$35.00
#579		Molding Plane		1 1/8"	1 3/4"	1/4"	\$31.95
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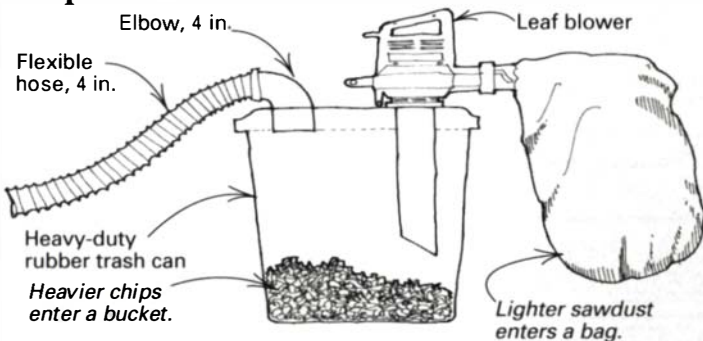
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Glue a small, flat magnet to the back of each cap to hold it against the bolt heads. The caps are easily removed if necessary, but the remainder of the time, they neatly cover the hardware. The cap's dimensions can be varied, the style changed or even carved for a different look. —Ken Schroer, Panama City, Fla.

Shop vacuum from a leaf blower



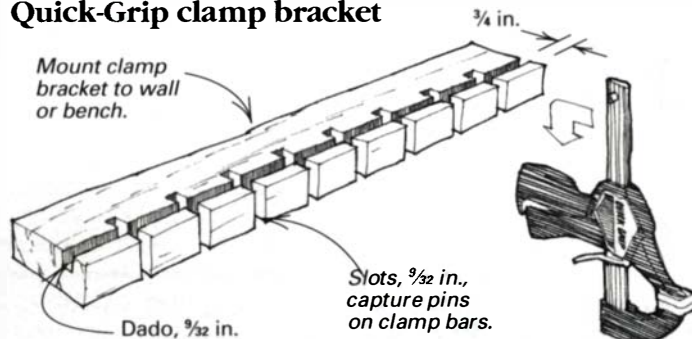
Neither having the space nor the budget for a large dust collector, I fabricated a powerful two-stage unit for less than \$100. A two-speed electric leaf blower is the heart of the system. I insert the vacuum tube of the blower into a carefully cut hole in the tightly fitting lid of a heavy-duty rubber garbage can. The vacuum inlet, which sits in a snug opening in the lid, is a 4-in. elbow salvaged from a clothes dryer. A 4-in. flexible hose completes the connection to any tool.

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—David A. Hill, Simsbury, Conn.

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READER SERVICE NO. 123

Shop wiring: 110v vs. 220v

I'm planning to build a shop, and I don't know whether to install 220v electricity or if 110v would be sufficient. I've noticed that large, heavy-duty machinery is always 220v and intermediate machines are usually 110/220v. I read that a 110/220v motor running on 220v uses half the electricity as the same motor running on 110v. True or false? What exactly is the advantage in using 220v? —Al Coppola, Mulvane, Kan.

Edward Cowern replies: First, let's dispel the myth about operating motors on various voltages: An electric motor operating on 110/115v will use the same amount of power (to do the same amount of work) as it does on 220/230v. (A few definitions will help here: A watt is a measure of electrical power; a volt denotes potential differences that cause the current to flow; and an ampere is a measure of the amount of current flowing through a wire.) The myth that the motor will use less on the higher voltage comes from the fact that it uses half as many amperes (amps) on the higher voltage. But what you buy from your utility is watts, not amps. The number of watts equals the number of amps times the number of volts. Thus, when the amps are half but the volts are double, the watts will be the same.

There are both advantages and disadvantages to running motors at 115v or 220v. In general, motors up through 1 hp can be operated quite successfully on 115v. Operating on 115v gives greater portability because this voltage is commonly available in any shop or job site. Machines with 2 hp and larger motors will operate better on 230v. Motors with 1½ hp are a borderline case and can operate successfully at either 115v or 230v.

The advantage of using 230v for heavier machinery is that you can run slightly smaller wires to the machines because the full-load amps will be one-half of the 115v value. Because of the lower amp load, the line voltage drop at the machine under heavy cutting conditions will be less. With more stable voltage, the motor will develop higher torque than it would under sagging or low voltage conditions, which can occur if the motor is operated at the lower voltage.

[Ed Cowern is an electrical engineer in Wallingford, Conn., and president of EMS, distributors of Baldor electric motors.]

Selecting the right bit for template-routing

How do you determine the proper bit diameter or the right number of flutes for a straight pattern-cutting router bit with a rub collar or ball bearing that follows a pattern? I assume the wood hardness, depth of cut and, possibly, wood-grain direction may be factors, but when should I use a 1-in.-dia. pattern-cutting bit (which would have a high linear cutter velocity) instead of a ½-in.-dia. bit? And, if a ½-in.-dia. bit is the right choice, how do I choose between two or three flutes and straight or spiral flutes? —Leon Segal, Randolph, N.J.

Brad Witt replies: It is very difficult to answer your question directly, but here are some things to consider before deciding which bit to use. Flush-trimming or pattern-cutting bits range in diameter from ¼ in. to 1¼ in. In general, use the largest diameter bit that is comfortable for you and your router.

A large diameter bit presents a shallower angle of attack to the workpiece, thereby reducing or eliminating tearout. However, a large bit may be intimidating to you and present runout problems for your router.

The amount of stock you are removing with a given diameter bit also will affect your cut quality. In general, on ¾-in. and thicker stock, don't cut more than 25% of your bit's diameter from the edge of the workpiece per pass. For example, a ½-in.-dia. bit is limited to removing ⅛-in. per pass while a 1-in.-dia. bit can take ¼-in. per pass.

Grain direction also plays a part in cut quality. Feeding against the grain or changing from cutting end grain to edge grain can cause tearout. A large diameter bit helps reduce tearout.

Spiral flute bits slice through the wood cleaner and with less tearout than a comparable diameter bit with straight flutes. For the cleanest cuts in difficult cutting situations, such as delicate veneers, I recommend spiral flutes over straight flutes. Two- and three-fluted bits work fine because tip speed is not a major concern with bits in the ¼-in. to 1¼-in.-dia. range.

[Brad Witt owns and operates Woodhaven Inc. in Davenport, Ia., a mail-order company specializing in router accessories.]

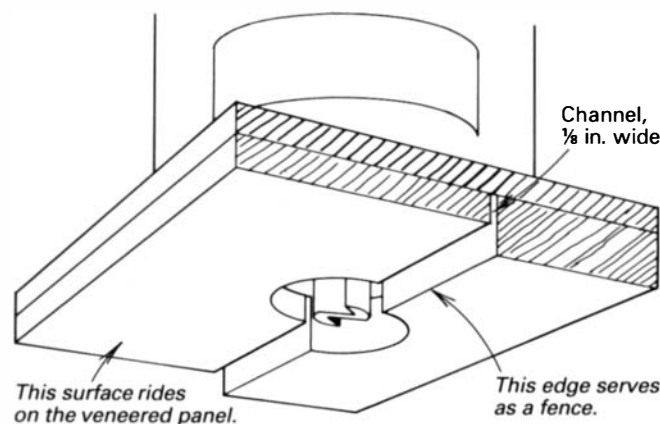
Edge-banding thin-skinned plywood

I consider myself a relatively skilled woodworker with a shop equipped with the necessary basic power tools. I've built a variety of furniture for the house and used lots of plywood in the process. But today's plywood, with its thin veneers, causes me concern. How can I apply a solid edging and then trim it flush to the panel without going through the plywood's thin face veneer? —John W. Williams, Bellevue, Wash.

John Kriegshauser replies: You are not alone. Every woodworker I know has watched with dismay as veneered plywood has diminished in quality. Today's veneered plywood is inferior to that of a decade ago not only because the face veneers have grown thinner but also because of the indifferent quality of the core veneers. Part of the reason for the decline of the core veneers is the availability of cheaper, fiberboard-core veneered panels. Although fiberboard-core panels are heavier, they are often preferred for their flatness and the excellent finish they will take. To compete in price, the veneer-core product has been adulterated. I encourage you to consider the fiberboard-core panel for use wherever your design will permit it.

When edge-banding, I typically use a ⅛-in.-thick edge band. For a ¾-in.-thick panel, I cut strips ⅞ in. to 1 in. wide. To draw this thin edge band tightly against the panel's edge, I always use clamping cauls to evenly distribute clamp pressure. For a perfect, tight seam on larger projects, I apply one edge band at a time, so I can observe the process closely.

With today's thinner veneers, be careful when trimming an edge band flush with the panel's surface. I use a special router base, as shown in the drawing below. A Bosch ½-in.-dia. hinge-mortising bit works best. With patience, you can adjust the bit to cut within thousandths of the veneered surface. To speed the process, I keep one router permanently set up for this operation.



I always move the router along the panel from right to left, so the bit's cutting sweep is inward toward the panel. This cutting direction preserves a crisp, unsplintered corner on the edging.

After routing, a few quick strokes with a scraper blade cut the edging flush with the surface. Then 220-grit sandpaper on a flat block blends the surface texture of the veneer and the edging. When leveling the banding along the end-grain edge of a panel, I rely more heavily on the sanding block. Beltsanding is out of the question, and on this particular operation, orbital sanders are neither faster nor do they leave a better surface.

To further protect the veneer (as well as save time and effort), I

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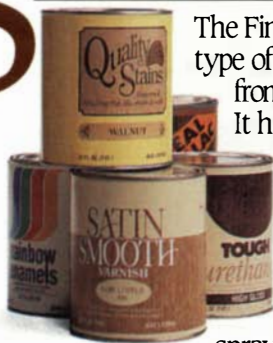
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fanatically protect the factory sanded surface. I will not lay the panels flat on a workbench top without first brushing it clean and scraping off all the glue lumps. And I do most of my sanding operations on a short-nap wool carpet.

[John Kriegerhauser is a designer/craftsman in Chicago, Ill.]

Building up layered finishes

I read recently that a polyurethane finish can be re-coated after several hours without sanding between coats. I am assuming they believe this allows the finish to adhere to the base coat before it fully dries and prevents adhesion.

Is this a sound technique for polyurethane? Can the same technique be used with waterborne lacquers? Could you build several layers without sanding between coats over a short period of time? And, finally, do you know of a source for a chart that shows compatibility between finishes?

—Frank Rudowski, Wyandotte, Mich.

Chris Minick replies: Sanding between fresh coats of finish (less than a week old) has more to do with aesthetics than with adhesion. The sanding operation is usually only necessary to remove dust specs, raised grain or other defects to provide a smooth surface for subsequent finish coats. If your finishing technique is good enough, the between-coats sanding step can be eliminated, and you can build finish coats as fast as they will dry.

Therein lies the rub. Dry to the touch or tack-free time is not the same as thorough dry time. You must follow the manufacturers' recommended re-coat schedule to know for sure how long it takes for each coat to dry thoroughly. Applying too many finish coats in too short a time period will trap residual solvent in the finish. Trapped solvent can cause soft, wrinkled finishes or, on veneered pieces, may even lift the veneer off the substrate.

An excellent source for all kinds of finish information is *The Woodfinishing Book* by Michael Dresdner (The Taunton Press, Newtown, Conn.). In addition to taking the mystery out of finishing, it contains a useful finish compatibility chart.

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

From log to lumber

I have the opportunity to buy a cherry tree and have it cut into lumber. The tree should provide two 16 ft. logs before the first branch, with diameters ranging from 24 in. to 18 in. I plan to air dry the lumber on the second floor of my garage.

Initially, I had thought I would have it flatsawn into 1-in.-thick boards to maximize the width of the lumber. Since then, I have been told that flatsawn 1-in.-thick cherry will virtually self-destruct in the drying process. The alternatives I've heard are to have it quartersawn, or to have it flatsawn into cants, 6 in. by 6 in. or larger, until it is dry enough to be resawn. If I have it quartersawn, I don't get the wide boards and the extra value when I sell some to help finance the deal. If I have it sawn into cants, or something similar, then it takes longer to dry, and I have to pay to have it sawn twice before I get the lumber I want. Is there a way to get flatsawn 1-in.-thick boards without an unacceptable loss due to warping and cracking?

—Ben Williams, Phillips, Maine

Bruce Hoadley replies: I'm tentative about offering advice without seeing the tree or logs, however, I will try to offer some helpful suggestions.

The flatsawn vs. quartersawn question is an interesting one, with no clear answer. Quartersawn boards may be more desirable because they are dimensionally more stable across their faces, the



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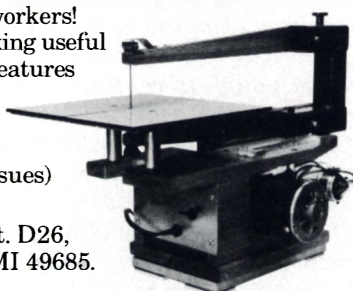
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READER SERVICE NO. 5

boards warp least in drying, and they move least in finished products. But the center of the logs will be more defective due to the inevitable knots resulting from branch stubs associated with younger stages of the tree. In quartersawing, board width is limited to the radius of the log, and most boards can be expected to have degraded along the pith edges. This, in turn, may necessitate heavy edging to even narrower widths to get the desired grades of boards. However, depending on the anticipated use of the boards, you may still get a satisfactory yield of clear cuttings from such material. But a greater yield of clearer boards will result by "sawing around the log," taking flatsawn boards and boxing in the more defective heart area to be eventually sawn into whatever it can yield.

If your eventual goal is 1-in.-thick boards, don't plan to saw large cants to dry and later resaw. I certainly don't agree with the advice you were given that "flatsawn 1-in.-thick cherry will virtually self-destruct in the drying process." Though it is true that flatsawn boards tend to cup as they dry, keep in mind the amount and radius of cupping is related to the curvature of the growth rings—that is, the position of the boards in the log. The outer flatsawn boards from larger logs will have only minor cupping problems. Flatsawn boards from closer to the pith will tend to cup more along their centerline. If it is apparent that cupping won't dress out after drying, boards with excessive center cup can be ripped to narrower and flatter strips.

Much of the success or failure of the final boards is connected to the milling and drying. The goal in drying is a neat stack of uniform length and evenly stickered boards. Board width, of course, will vary, but uniform thickness is critical to assure even air-flow and restraint. You mentioned 16-ft. logs. Unless you absolutely need long lengths of lumber, I would advise cutting the

tree into shorter logs, say 6 to 8 ft., but try to cut all the logs to the same length. This will pay dividends in the drying: You can get all the lumber into a taller stack (more weight on the lower courses), and the consistent length will enable more consistent stickering. Extra weight on the top of the pile in the form of extra junk lumber or even concrete blocks is helpful. And be careful to use dry stickers to minimize sticker stain.

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

Curing and preventing rusty machines

I'd begun acquiring power tools in preparation for my retirement, but I've put new acquisitions on hold because the cast-iron table of my new bandsaw is beginning to rust. I've used motor oil to clean up the table and to prevent further rusting, but this is messy and has to be repeated periodically. In spite of these applications, one spot on the table has become pitted. Is there any way to remove the existing rust, and is there something I can use to prevent rust from reoccurring?

—William L. Underwood, Ashland City, Tenn.

Robert Vaughan replies: Although you didn't give specifics, it sounds like storage conditions might be contributing to your rust problems. Machinery should be kept in an enclosed building with an environment suitable and comfortable for humans. No dirt floors, of course.

The moisture content of the air should be controlled by a dehumidifier if dampness is a problem. Though it's a nuisance and an expense, I consider a dehumidifier as part of the responsibility of tool and machine ownership.

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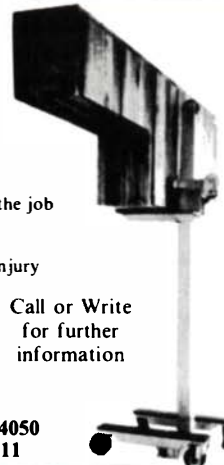
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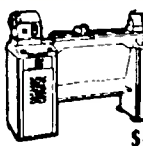
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605	1-1/2 Hp Router-Shaper Table	335	200
606	Router-Shaper Table	185	125
603	1-1/2 Hp Plunge Router	295	165
6031	Plunge Router Base	120	75
7518	3-1/4 Hp 5 Speed Router	475	282
7519	3-1/4 Hp Router	410	228
7536	2-1/2 Hp Router	355	190
7537	2-1/2 Hp D-Handle Router	375	209
7538	3-1/4 Hp Plunge Router	410	228
7539	3-1/4 Hp V/S Plunge Router	475	282
90381	Door Hinge Butt Template Kit	240	150
9008	Dovetail Jig	110	85
5116	Omni-Jig 16\"/>	400	250
7116	Omni-Jig 24\"/>	470	280
7310	5.6A Laminate Trimmer	150	88
7312	5.6A Offset Base Lam. Trimmer	215	124
7319	5.6A Tilt Base Lam. Trimmer	170	105
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97310	Laminate Trimmer Kit	345	194

SANDERS

332	Palm Grip Random Orbit	109	64
334	Above Sander w/ Dustbag	125	74
351	3\"/>	245	142
352	3\"/>	250	149
352VS	3\"/>	280	160
360	3\"/>	330	185
361	3\"/>	310	175
362	4\"/>	345	183
363	4\"/>	330	185
503	3\"/>	550	345
504	3\"/>	535	335
330	Speed Bloc Sander 1/4\"/>	102	58
505	1/2 Sheet Pad Sander	210	116
7334	5\"/>	210	119
7335	5\"/>	230	129
7336	6\"/>	235	134
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666	3/8\"/>	200	128
6614	1/2\"/>	220	124
6615	6614 w/Keyless Chuck	220	124
6640	0-4000 Drywall Screwdriver 5.5A	190	114
6645	0-2500 Drywall Screwdriver 5.5A	195	114

SAWS

315-1	7-1/4\"/>	210	118
9315-1	315-1 w/Case & Carb. Blade	240	130
617	7-1/4\"/>	210	119
9617	7-1/4\"/>	210	130
314	4-1/2\"/>	240	138
9314	4-1/2\"/>	265	148
345	6\"/>	180	104
9345	6\"/>	220	124
9647	Tiger Cub Recip Saw w/Case	195	119
9637	Recip. Saw V/S w/Case 8A	250	138
7549	Top Handle Jig Saw	250	149
7649	Barrel Grip Jig Saw 4.8A	250	150
7700	10\"/>	634	345

PLANERS

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23-150	Wet/Dry Grinder	234	150
23-080	8\"/>	151	115
28-180	NEW Bench Band Saw	232	167
31-050	1\"/>	104	78
31-080	1\"/>	134	94
31-340	1\"/>	253	195
31-460	4\"/>	198	135
32-100	Plate Joiner New	422	265
32-200	Boring Machine w/ 13\"/>	1663	1228
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34-330	Deluxe 8-1/4\"/>	313	235
36-220	10\"/>	350	230
40-150	15\"/>	179	119
40-560	16\"/>	266	183
43-505	1/2\"/>	399	279
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50-179	3/4\"/>	483	329

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31-730	6\"/>	1490	1090
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33-090	Deluxe 10\"/>	773	560
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36-752	10\"/>	1380	1029
37-154	6\"/>	1458	1078
37-350	8\"/>	1408	1030
40-601	18\"/>	1958	1425
40-601	18\"/>	973	718
43-275	Omni-Jig 2003 Inv. Rtr.	3547	2620
43-355	1-1/2\"/>	896	650
43-375	3\"/>	2230	1600
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1611EVS	3-1/4\"/>	448	221
1613	New 1-3/4\"/>	286	164
1613EVS	New 2 Hp V/S Plunge Router	320	184
1615	New 3 Hp Plunge Router	395	228
1615EVS	New 3 Hp V/S Plunge Router	460	255
90300	3-1/4\"/>	556	349

SANDERS

3270D	3\"/>	260	145
1272	3\"/>	308	177
1272D	3\"/>	329	186
1273DVS	4\"/>	370	199
3283DVS	5\"/>	169	99

CORDLESS DRILLS

3050VSRK	3/8\"/>	256	137
3051VSRK	3050VSRK w/Keyless Chuck	266	145

SAWS

1581VS	Top Handle Jig Saw	265	144
1582VSC	New Clic Barrel Jig Saw	265	144
Bosch Metal Case for above Jig Saws		34	30
1632VSK	V/S Orbital Recip. Saw Kit	247	149

PLANERS

3258K	3-1/4\"/>	265	149
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DRILLS

1021VSR	3/8\"/>	180	105
1023VSR	1/2\"/>	199	109
1194VSR	1/2\"/>	264	141
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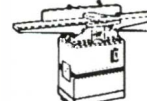
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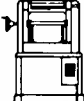
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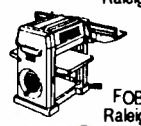
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C8FB	8-1/2\"/>	899	N/A
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C15FB	15\"/>	745	N/A
M8	7.3 amp, 1/4\"/>	215	114
TR-12	3 HP 1/2\"/>	347	166
M-12V	3-1/4\"/>	447	224
SV-12SA	4-3/8\"/>	80	48
D10-DFK	3/8\"/>	280	135
D10-DFKBE	Same W/ Extra Battery.	300	148
D10-V1	3/8\"/>	148	80
D13V	1/2\"/>	198	90
W6VA2	0-2600 Dryw. all Screwdriver 5.5A	161	85
W6V2	0-4000 Dryw. all Screwdriver 5.5A	149	79
DV20V2	3/4\"/>	257	135
DH38YE	1-1/2\"/>	373	179
G12SA	4-1/2\"/>	145	79
PDL180A	7\"/>	212	106
SP18V	7\"/>	274	145
F-20A	3-1/4\"/>	172	80
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571-1	1/2" V/S Hammer Drill Kit	335	14
571-1	1/2" V/S Hammer Drill Kit	345	13
560	1 1/2 Hp Router 10 amp	325	18
580	2 Hp Router 12 amp	355	18
5825	3 x 24 Belt Sander/Wag	419	22
5836	4 x 24 Belt Sander/Wag	419	22
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6368	7-1/4" Saw, fence carb. blade and case	244	13
6508	2 Speed/V/S Sawzall w/case	244	13
6508	V/S Super Sawzall 8A w/case	235	16
777	Heat Gun 570° x 1000°	91	5
777	Ys, Temp. Hum, Air/Gas, 212, 1000°/12		

all non-working surfaces of the machine. Many woodworkers use wax as a moisture barrier on the working surfaces. Wax makes boards slide across the machine easier, and it's better than no protection, but it's not a very effective rust preventative.

I don't know of any magic stuff in a spray can that will totally prevent rust and let your tools operate normally. Sandaro's TopCote (see "Tool Forum," p. 112) does the best job of anything I've tried. But even TopCote is ineffective under conditions of extreme moisture and temperature variations.

Another trick you can try is one I use on a tablesaw I have on a covered porch. I cover the iron surface with a 1/4-in.-thick layer of sawdust, not shavings. While messy looking, the sawdust creates a barrier and inhibits corrosion. A sheet of formica, plastic or even plywood would probably work as well.

Preventing rust is one problem, but restoring rusty surfaces is a whole new set of challenges. The presence of rust means the absence of metal. If you're committed to having a factory-new surface from a rusty one, then the part will have to be reground below the depth of the pitting by a machine shop. It's that simple.

Removing rust yourself will require a lot of elbow grease. If the machine is thoroughly rusted, it must be taken apart and cleaned one piece at a time. Some rust preventative oil, such as WD-40, and steel wool or a wire brush will help.

Muriatic acid (hydrochloric acid), which is available where swimming pool or masonry supplies are sold, is good to remove rust from deeply rusted cast iron and some steels. But unless it's quickly neutralized, the acid can cause more corrosion. I neutralize the acid with a mix of ammonia and water, and then I thoroughly dry the piece. Be sure to keep in mind that muriatic acid is dangerous, messy to use and must be disposed of properly. I would recommend using it only in the most severe cases.

[Robert Vaughan is a contributing editor to *FWW* and a wood-working machinery rehabilitation specialist in Roanoke, Va.]

Unglueable glues?

I greatly appreciated "Adhesives for Woodworking" by Chris Minick (FWW #96, p. 44), which made wood glue selection easier to understand. However, aside from stating that hide glue joints could be disassembled with hot water or steam, no reference was made to taking apart pieces glued with any other adhesive. How would one disassemble a plastic resin or epoxy joint?

—Edward F. Kensinger, Lenox, Mass.

Chris Minick replies: Generally, woodworking adhesives are designed to make permanent wood-to-wood bonds. A simple quirk of chemistry allows hide glue joints to be disassembled with hot water. This convenient reversibility feature is not an option with most other common woodworking adhesives.

Plastic resin glue, epoxy adhesives, type II waterborne adhesives and many other wood glues undergo a chemical change (crosslink) as they dry. Once cured, the only way to disassemble the joint is to saw the pieces apart. All rules have exceptions. Some waterborne white glues can be softened by soaking in hot water, and the joints can be pulled apart. But the wood is usually destroyed in the process.

When using modern woodworking adhesives, it's best to assume the bonds will be permanent. Disassembling any glued joint, even one made with hide glue, is never an easy process.

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

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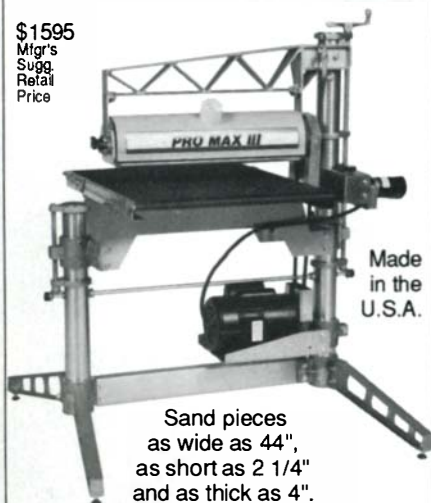
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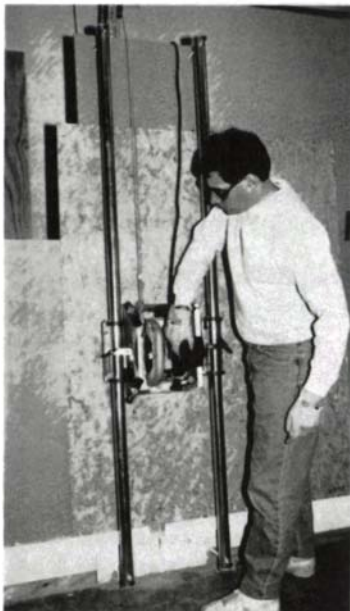


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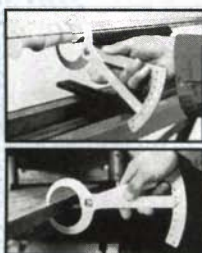
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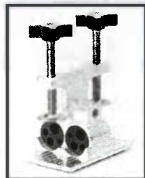
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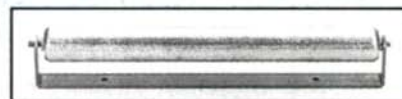


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Woodcarving With Rick Butz \$18
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VIDEOS

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Brad Witt - 1. Router Secrets; 2. Frame and Panel
Secrets ea. \$30
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Todd - Star Framing \$30
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Gross - Roof Framing Advanced \$75
Schuttner - Basic Stairbuilding \$28
Bollinger - Laying Hardwood Floors \$28
Bollinger - Sanding, Finishing Floors \$28
Law - Installing Cabinets, Countertops \$28
Law - Installing Doors & Windows \$28
Rosendahl - Series of 8 Videos on Router
Techniques \$24 EA; All 8 for \$145
Roger Cliffe - Faceplate Cabinetmaking
Series of 5 Tapes \$30 EA; All 5 for \$135
Roger Cliffe - Table Saw of Radial Saw
Techniques \$29 EA; both for \$56
Krenov - Wooden Planes, Cabinet Scrapers \$38
Cummins - Making Boxes \$28
Cummins - Small Shop Tips \$28
Stubbs - Bowl Turning \$28
Bush - Carving Techniques and Projects \$28
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Set contains 1 book and 1 video
Duginske - Mastering Woodworking Machines \$48
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The Woodfinishing Book (Dresner) \$23
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Windows (Birchard) \$18

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Circular Work in Carpentry & Joinery \$20
The Very Efficient Carpenter (Haun) \$28
3 Videos - Framing Floors; Framing Walls,
Framing Roofs (Haun) \$32 all 3 \$90
Renovating Old Houses \$36
Graphic Guide To Frame Construction (Thallon) \$28
Trim Carpentry Techniques (Savage) \$17
The Genius of Japanese Carpentry (Brown) \$19
Hardwood Floors (Bollinger) \$19
The Timber Frame-House (Benson) \$19
Timber Frame Construction (Sobon) \$12

Model	Description	List Sale
TOP 10	"Simply the Best"	699 559
STANDARD	10 "Professionals Choice"	499 399
COBRA NEW	Biscuit Joiner	Special 299
MINICOL	High quality glue applicator	Special 240

MILWAUKEE TOOLS

9069	1/2" Impact Wrench with case	438 269
5455	7 1/2" Polisher 1750 rpm	245 142
0230-1	3/8" Drill 3.5 amp	209 115
0219-1	9.6 volt cordless Drill with case	309 175
5925	Belt Sander 3 x 24 w/bag 10 amp	440 239
5936	Belt Sander 4 x 24 w/bag 10 amp	440 248
6747-1	Drywall Gun 0-2500rpm Sander	186 107
6016	1/4 sheet Palm Grip Sander	95 55
6017	6016 Sander with dust bag	97 58
6012	1/3 sheet 12000 orbin 5 amp	209 116
8975	Heat Gun 570° & 1000°	96 62
8980	8975 Heat Gun with case, air reduction, hook, deflector, & spreader nozzles	145 92
3102-1	Plumbers r angle Drill Kit 500 rpm	375 209
3002-1	Electric right angle Drill Kit 600 rpm	375 209
5660	Router 1-1/2 HP 10 amp	345 189
6378	8-1/4" Worm Drive Saw 15 amp	334 185
6256	Variable speed Jig Saw 3.8 amp	259 145
6527	NEW Super Sawzall with case	309 172
6528	above Sawzall with wired cord	305 172
6125	NEW 5" Random Orbit Sander	200 119
6126	NEW 6" Random Orbit Sander	205 125
0399-1	12 volt cordless Drill Kit complete	309 165
0402-1	above Drill with keyless chuck	314 174
0395-1	9.6 volt cordless Drill with case	284 158
0225-1	3/8" Drill 4.5 amp magnum	215 114
0224-1	Same as 0225-1 but w/keyless chuck	203 119
0234-1	1/2" Drill 4.5 amp mag 0-850 rpm	229 119
0244-1	1/2" Drill 4.5 amp mag 0-600 rpm	229 123
0222-1	3/8" Drill 3.5 amp 0-1000 rpm	189 107
0228-1	3/8" Drill 3.5 amp 0-1000 rpm	186 104
0375-1	3/8" close quarter Drill	229 132
0379-1	1/2" close quarter Drill	260 145
6539-1	cordless Screwdriver 190 rpm	127 75
6540-1	6539-1 with bits & case	162 98
6546-1	cordless Screwdriver 200 & 400 rpm	138 82
5399	1/2" D-handle Hammer Drill Kit	325 188
6716-1	HD Hole Hwng with case	479 259
6511	2 speed SawZall with case	244 135
6750-1	Drywall Gun 0-4000 5 amp	168 85
6507	Original SawZall with case	259 144
6508	above SawZall with wired cord	255 144
6175	1/4" Chop Saw 15 amp	499 279
6014	Orbital Sander 1/2 sheet	214 119
8977	variable temp. Heat Gun	128 77
5397-1	3.8" var. speed Hammer Drill Kit	250 142
5371-1	1/2" var. speed Hammer Drill Kit	375 185
5377-1	5371-1 w/keyless chuck	375 185
3107-1	1/2" var. speed right angle Drill Kit	385 209
6754-1	Drywall Gun 0-4000 5.4 amp	192 108
3300-1	1/2" variable speed right angle Drill	339 189
6680	Router 2 HP - 12 amp	355 198
6215	6" Chain Saw	321 179
0235-1	1/2" Drill w/keyless chuck magnum	229 128
6145	4-1/2" Grinder 10,000 rpm	165 99
6142	6145 with case & accessories	204 129
6749-1	Drywall Gun 0-2500 5.4 amp	214 122
5353	Eagle 1-1/2" Rot. Hammer with case	935 509
6365	7-1/4" Circular Saw 13 amp	214 122
6367	above Saw - double insulated	209 128
6368	6365 w/fence, carbide blade, & case	244 139
6377	7-1/4" Worm Drive Saw	324 178
6369	NEW 7-1/4" Circular Saw with brake	259 149
6490	NEW 10" Mitre Saw	444 269
6127	NEW 5" Random Orbital Sndr dustless	260 155

FREUD SAW BLADES

5/8" bore - Industrial Grade
All Blades are Carbide Tipped

Model	Description	Teeth	List Sale
LUT2M010	General Purpose 10"	40	69 39
LUT8M010	General Purpose 10"	40	78 44
LUT6M010	Cut-off 10"	60	93 49
LUT4M011	Combo 10"	50	78 42
LUT5M010	Super Cut-off 10"	80	115 59
LM72M010	Ripping 10"	24	69 39
LUT7M010	Cut-off 10"	60	84 45
LUT8M010	Ten Kerf 10"	24	72 39
LUT8M015	Ten Kerf 10"	60	88 48
LUT8M015	Mitre Saw blade 15"	108	175 105
LUT9M010	Compound Mitre Blade 60	88	54
LUT9M010	Ultimate 10"	80	128 68
LUT9M010	Ferrous metal 10"	72	104 58
SC-001	Blade Stabilizers (pair) for 5/8" arbor	SALE 2.99	
SD306	6" Dado - Carbide	215	112
SD308	8" Dado - Carbide	230	119
F0	#0 - 1-3/4" x 5/8" Biscuit 1000 Qty	43	29
F10	#10 - 2-1/8" x 3/4" Biscuit 1000 Qty	43	29
F20	#20 - 2-3/8" x 1" Biscuit 1000 Qty	45	29
FA	Assorted Biscuits 1000 Qty	45	29
WC104	4 piece Chisel set with case 1/4" - 1"	65	48
WC106	6 piece Chisel set with case 1/4" - 1"	87	58
WB110	10 piece Chisel set w/case 1/4" - 1-1/2"	143	88
94-100	5 piece Router bit set door system w/case	320	163
EB100	Edge Banding Machine	409	209
CE82	Planer with case & carbide blades	245	135
FR2000W	Wood Router Table	278	169
TK203	7-1/4" Framing - 24 tooth	31	18
TK206	10" Framing - 24 tooth	39	25
TK203	7-1/4" Finishing - 40 tooth	38	23
TK306	10" Finishing - 40 tooth	47	28
TK903	7-1/4" Combo - 30 tooth	33	19
TK906	10" Combo - 50 tooth	53	30

The following Freud Tools have a \$30.00 rebate!
Price shown is before rebate. - Expires 10/31/93
JS100 Biscuit Joiner with case..... 334 162
FT2000E 3-1/4 HP Plunge Router var. speed 410 205

Model	Description	List Sale
18-34	Professional Mitre Gauge	149 140

MAKITA TOOLS

Cordless Specials

Model	Description	List Sale
6070DW	3/8" var. spd Reverse Drill 7.2 volt	128 74
6071DWK	above Drill w/removable battery	203 110
50900W	3-3/8" Saw Kit 9.6 volt	262 154
6010DWK	3/8" cordless Drill Kit 7.2 volt	181 99
6010SDW	3/8" cordless Drill Kit 7.2 volt	99 59
43900W	9.6 cordless Recip Saw Kit	245 148
43000W	9.6 volt Jig Saw Kit	249 145
DA391DW3/8"	angle Drill Kit 9.6 volt	297 162
ML900	Incandescent Flashlight 9.6 volt	Sale 37
56000W	6-1/4" Circular Saw 10.8 volt	393 265
6010DL	3/8" Drill with flashlight 7.2 volt	224 118
6891DW	Drywall Gun 0-1400 9.6 volt	257 144
TZ200W	New cordless Stapler Kit 9.6 volt	310 188

6012HDW	2 speed Drill with clutch-comp	243 129
60920W	Variable speed Drill kit - no clutch	257 138
60930W	Variable speed Drill Kit complete	257 139
60930DWE	60930W Drill Kit w/2 batteries	270 145
60950W	60930W Kit w/keyless chuck	278 135
60950DWE	60950W Drill Kit w/2 batteries	270 148
6201DWE	NEW 9.6V Drill Kit w/2 batteries	298 158
6011DW	NEW 12V "Mac Pak" Drill Kit	330 175
6011DW	NEW 12 volt Drill Kit	330 175
632007-4	9.6 volt Battery	47 30
632002-4	7.2 volt Battery	37 28

5007NBA	7-1/4" Saw with electric brake	255 129
5008NBA	8-1/4" Saw with electric brake	316 188
804510	1/4 sheet Pad Sander	97 54
90008	3" x 21" Belt Sander with bag	297 152
99240B	3" x 24" Belt Sander with bag	313 159
9045N	1/2 sheet Finishing Sander w/bag	258 129
4301BV	Orb. var. speed Jig Saw 3.5 amp	275 162
JR3000V	Var. speed Recip Saw with case	250 128
LS1020	10" Mitre Saw 12 amp	599 339
9820-2	Blade Sharpener	394 209
19008W	3-3/4" Planer with case	232 129
1911B	4-3/8" Planer 7.5 amp	267 139
1100	3-1/4" Planer with case	455 228
9207SPC	7" Sander/Polisher variable speed	308 245
3601B	1-3/8 HP Router	274 158
804550	1/4 sheet Pad Sander with bag	94 54
DA3000R	3/8" Angle Drill variable speed	299 155
HP2010N	3/4" var. speed Hammer Drill w/cse	314 179
2708W	8-1/4" Table Saw	544 282
2711	10" Table Saw with brake	911 558
1805B	6-1/8" Planer Kit with case	731 409
9005BA	5-1/2" Circular Saw	238 148
6404	3/8" Drill Rev. 0-2100 rpm 2 amp	108 59
6510LVR	3/8" Drill Rev. 0-1050 rpm	156 88
6820V	0-4000 rpm Drywall Gun 5.2 amp	167 92
6013BR	1/2" Drill Rev. 6 amp	265 138
5402A	16" Circular Saw 12 amp	708 395
9401	4" x 24" Belt Sander with bag	360 205
4302C	Variable speed Orbital Jig Saw	297 189
5077B	7-1/4" Hydrid Saw	273 138
LS1440	1/4" Mitre Saw	796 429
LS1030	NEW 10" Mitre Saw	428 195
5007NB	7-1/4" Circular Saw 13 amp	225 116
2012	12" Portable Planer	959 465
LS1011	10" Slide Compound Saw	870 498
3620	1-1/4 HP Plunge Router w/case	206 129
9901	3"x21" Belt Sander w/bag 6.7 amp	218 149
GV5000	5" Disc Sander	117 69
9514B	4" Grinder 4.6 amp	104 65
4200N	4-3/8" Circular Saw	238 148
2414	14" Cut-off Saw AC/DC	376 218
4320	V/spd economy Jig Saw 2.9 amp	141 92
5012B	11-3/4" elec. Chain Saw 11.5 amp	258 148
6302	12" Drill 0-550 rpm 5.2 amp	210 114
3612BR	3 HP Plunge Router round base	364 169
DA6300	12" angle Drill 300/1200 rpm	459 239
BO5000	NEW 5" Random Orbit Sander	118 68

BOSTITCH AIR NAILERS

Model	Description	List Sale
N80S-1	Stick Nailer	Super Sale 348
N12B-1	Coil Roofing Nailer	845 399
N60FN-2	Finishing Nailer 1-1/4" - 2-1/2"	625 355
T29-30	Brad Nailer 19 ga. 5/8" - 1-3/16"	445 265
T40S2-CT	Roofing Stapler 1" crown 16 ga	445 275
MIIFS	Flooring Stapler 15 ga	895 525
N100S	Stick Nailer 2" - 4"	895 555
T31	Brad Nailer 5/8" - 1"	270 145
CWC100	1 HP Pancake Compressor	445 289

PANASONIC CORDLESS

Model	Description	List Sale
EY6205BC	NEW variable speed 12 volt Drill	
	with 15 minute charger & case	353 179
EY6208BCNEW	2 speed 12 volt Drill D-handle	
	with 15 minute charger & case	336 178
EY6282EQK	Var. spd 9.6 volt Drill with 15 min. charger, case, and NEW Ironman battery	315 168
EY571B	variable speed 9.6 volt Drill Kit	254 134
EY571BC	EY571B w/case & extra battery	273 155
EY6900BCNEW	12 volt Hammer Drill var. speed with 15 minute charger	396 205
EY6207BCNEW	12 volt 1/2" Drill w/keyless chuck var. spd w/15 min. charger & case	420 218
EY6205EQK	Same as EY6205BC but battery has 40% more life & 20% more torque	368 189

PRAZI BEAM CUTTER

PR-7000	12" beam cutter for worm drive saws	149 124
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DS14	14" (350 mm)	List 4.80 Sale 3.95
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DS20	20" (500 mm)	List 5.60 Sale 4.35
DS22	22" (550 mm)	List 5.80 Sale 4.45

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9852K	Porter Cable 9852 Drill Kit with extra Porter Cable battery	185
9853K	Porter Cable 9853 Drill Kit with extra Porter Cable battery	185
9854K	Porter Cable 9854 1/2" Drill Kit with extra battery	328 199
0402-1K	Milwaukee 0402-1 Drill Kit with extra battery	309 174
7334K	Porter Cable 5" Random Orbit Sander w/case & 1 roll 100X & 150X discs	253 159
7335K	Porter Cable 5" v/spd Random Orbit Sander w/case & 1 roll 100X & 150X discs	273 169
7336K	Porter Cable 6" v/spd Random Orbit Sander w/case & 1 roll 100X & 150X discs	278 175
555K	Porter Cable Plate Biscuit Joiner with case & 1000 assorted biscuits	339 195
JS100K	Freud Plate Biscuit Joiner with case & 1000 assorted biscuits	351 188
1581VSK	Bosch Top Handle Jig Saw with case & 30 Bosch blades	305 195
1582VSK	Bosch CLIC Barrel Grip Jig Saw with case & 30 Bosch blades	305 195
1605-02K	Skl biscuit Joiner with case & 1000 assorted biscuits	244 155
JM100KK	Ryobi biscuit Joiner with case & 1000 assorted biscuits	475 242
1273DVS	Bosch 1273DVS Belt Sander with sanding frame	485 275

PORTA NAILER

Model	Description	List Sale
401	Porta Nailer complete	265 198
501	Face Nailer complete	265 195
1000	Genuine Porta Nails 1000 Qty	15.89
5000	Genuine Porta Nails 5000 Qty	71.50
10,000	Genuine Porta Nails 10,000 Qty	121.85

BIESMEYER FENCES

Model	Description	List Sale
B-50	50' Commer. Saw Fence	329 298
T-SQUARE 52	52' Homeshop Fence	249 238
T-SQUARE 40	40' Homeshop Fence	242 208
T-SQUARE 28	28' Homeshop Fence	230 198

WEDGE SMART LEVEL

SM-PR2	2 FT Level with sensor	120 88
SM-PR4	4 FT Level with sensor	150 105
SM-PR6	78" Level with sensor	180 139

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SL209	NEW 9" Torpedo Level w/sensor	69 45
SERIES200	NEW 2 FT Level w/sensor	79 55
SL246	NEW 4 FT Level with sensor	95 65

MSx636 FEIN Electric Oscillating

LPN672	PONY Air Palm Nailer with glove	Sale 94.99
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BOSCH

1581VS	Top Handle Jig Saw	250 145
1581DVS	above Saw with dust collection	295 168
1582VSC	NEW CLIC Barrel Grip Jig Saw	250 145
1582DVS	above Saw with dust collection	295 168
Bosch Metal Case	for above Jig Saws	34 32
Bosch 30 blade assortment	for Jig Saws	27.99
1942	Heat Gun 600° - 900° temp range	115 78

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/5" Disc Sander	268 198
31-080	1" Belt/5" Disc Sander	134 94
40-560	16" 2 speed Scroll Saw	266 178
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 Planer/Shaper	399 279
22-540	12" Bench Top Planer	595 398
36-220	10" Compound Miter Saw	350 239
14-600	Hollow Chisel Mortiser	668 448

NEW TOOLS BY DELTA

33-060	NEW "Sidekick" Miter saw	499 375
14-070	NEW 14" Floor Drill Press	450 345
28-180	NEW 18" Band Saw w/open stand	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	375 235
36-090	NEW 10" Sidekick Miter Saw	293 218
37-070	NEW 6" var. speed Bench Jointer	330 255

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 1168
Planner	has \$75.00 rebate-price shown is before rebate	
28-245	14" Band Saw w/open stand 1/2 HP	698 555
17-900	16-1/2" Floor Drill Press	441 395
40-601	18" Scroll Saw with stand and blades	942 745
34-080	10" Miter Box.....Xtra Special	198
34-761	10" Unisaw 1-1/2 HP	1715 1395
33-990	10" Radial Arm Saw	818 615
37-280	6" Motorized Jointer	488 395
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 810
46-700	12" Wood Lathe	548 438
33-055	8-1/4" Sawbuck comp with legs	865 595
34-330	8-1/4" Table Saw 13 amp	343 234
36-540	10" Table Saw	210 168
34-670	10" Motorized Table Saw	511 395
32-100	Station Table Jointer	645 258
36-040	8-1/4" Compound Miter Saw	224 159
34-915	30" Unifence	385 239
34-897	50" Table Unifence	525 285
36-755	10" Tilt Arbor Saw	264 925
36-380	10" Table Saw	550 415
33-690	12" Radial Arm Saw	1720 1365
14-040	14" Bench Drill Press	360 335
28-560	16" Three Wheel Band Saw	456 410

The following Delta tools have a \$50.00 rebate!

28-283	14" Band Saw with enclosed stand	910 735
34-445	34" Table Saw with 30" unifence	1200 775
37-154	DJ15 6" Jointer with 3/4 HP motor	1420 1095

NEW DEWALT TOOLS

DW944K	3/8" 96V cdl's drill kit w/cse & 2 batt	277 154
DW945K	3/8" 12V cdl's drill kit w/cse & 2 batt	298 169
DW364	7-1/4" Circ Saw w/brake, 13 amp	275 145
DW306K	8-1/2" Amp Recip Saw w/case var. spd	282 155
DW610	1-1/2 HP 2 handle Router	270 148
DW411	1/4 sheet Palm Sander, 1.7 amp	97 58
DW705	12" Compound Miter Saw	658 358
DW704	12" Miter Saw	560 315
DW100	3/8" Drill, 4 amp, 0-2500 rpm, rev	116 68
DW250	4.5A Drywall Gun, 0-4000 rpm, rev	162 88
DW254	4.5A Drywall Gun, 0-2500 rpm, rev	162 88
DW402	4-1/2" Grinder 6 amp	158 94
DW682K	New Biscuit Joiner with case	428 225
DW614	NEW 1-1/4 HP Plunge Router	250 144
DW615	NEW 1-1/4 HP Electronic Plunge Router	290 158
DW624	NEW 3 HP Plunge Router	440 245
DW625	NEW 3 HP Electronic Plunge Router	500 275
DW675K	NEW 3-1/8" Planer with case	280 159
DW430	NEW 3 x 21 Belt Sander	290 165
DW431	NEW 3 x 21 var. speed Belt Sander	320 182

SKIL SIZZLERS

3810	10" Miter Saw	359 205
3810K	3810 with 60 tooth carbide blade	229
77	7-1/4" Worm Drive Saw	257 144
5825	6-1/2" Worm Drive Saw	257 159
2735-04	12 volt cordless Drill Kit	249 132
2735-04X2735-04	with keyless chuck	269 135
1605-02	NEW Biscuit Joiner with case	221 129
7484	NEW 5" Random Orbit Sander	153 104
5510	5-1/2" Circular Saw	166 110
5660	NEW 8-1/4" 60" Circular Saw	230 144
5860	NEW 8-1/4" 60" Worm Saw	282 174
4560-02	Top Hdg Jig Saw with case	144 97
5790	10-1/4" Circ Saw 15 amp	472 289
5657	NEW 7-1/4" CircSaw - 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
3370	4" Belt/6" Disc Sander - Bench Top	205 135

SIOUX TOOLS

8030	New 3/8" variable speed Drill	238 139
8000	3/8" var/spd close quarter Drill	201 123
690	5" Air Random Orbit Sander	139 138
690VV	690 w/venturi dust collection	281 178
658	5" Air Random Sander - dual action	261 155

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 Opening Length	Capacity	List	Sale	Box of 16
#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"x3/4"

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

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Model Description	List	Sale	Lots of 12
50 3/4" Black Pipe Clamps	13.61	7.89	94.99
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

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3304	1 HP variable speed Plunge Router	307 164
3375	3-1/8" Univ. Planer 7.2 amp	329 155
3380	Biscuit Joiner with case	569 248
4024	3 x 21 variable speed Belt Sander	338 179
3339	NEW 3 HP var. speed Plunge Router	500 275

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1166	3/8" Drill 0-2500 rpm 4 amp	105 65
1180	3/8" Drill 0-1200 rpm 5 amp	197 114
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1703-1	10" Miter Saw with 73-770 blade	329 185
4011	1/4 sheet Palm Sander	86 59
79-034	Workmate 400	184 109
1349-09	1/2" Timberwolf Drill 2 speed	513 285
1180	3/8" Drill rev. 0-1200 rpm 5 amp	191 108
2037	Drywall Gun 0-4000 5.0 amp	184 98
2038	Drywall Gun 0-2500 rpm 5 amp	184 98
3157	Orbital var/spd Jig Saw 4.5 amp	231 145
2665K	NEW 3/8" cdl's 12V Cyclone Drill	294 159
5045K	MACHO Rotary Hammer Drill	779 419
5071	3/8" Hammer Drill with case	251 139
5073	1/2" Hammer Drill with case	296 169
2054	Tek Gun 0-2500 5.0 amp	282 154
2660	Drywall Gun 0-4000 4.5 amp	149 79
2700	7-1/4" Worm Drive Saw 13 amp	263 145
1321	12" Spade hdlle Drill 450 rpm 7 amp	307 174
2750	4-1/2" Grinder 10,000 rpm 6 amp	156 83

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2695	8-1/4" Super Sawcat Circ Saw w/cse	260 139
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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	9.25
73-707	7-1/4"	35	27.77	15.89
73-757	7-1/4"	40	32.87	16.89
73-718	7-1/4"	8	22	20.95
73-758	8-1/4"	40	46.88	24.95
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
73-740	7-1/4"	18	22.05	11.59
73-704	10	32	34.63	17.95
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T405	5'	25#	105.95
T406	6'	30#	126.95

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6006	6'	18#	67.95

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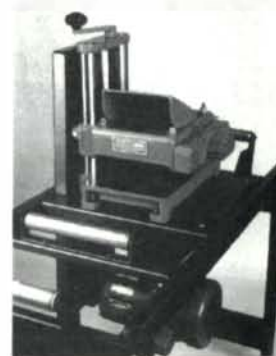
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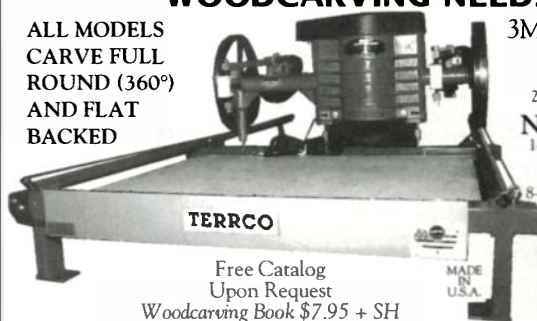
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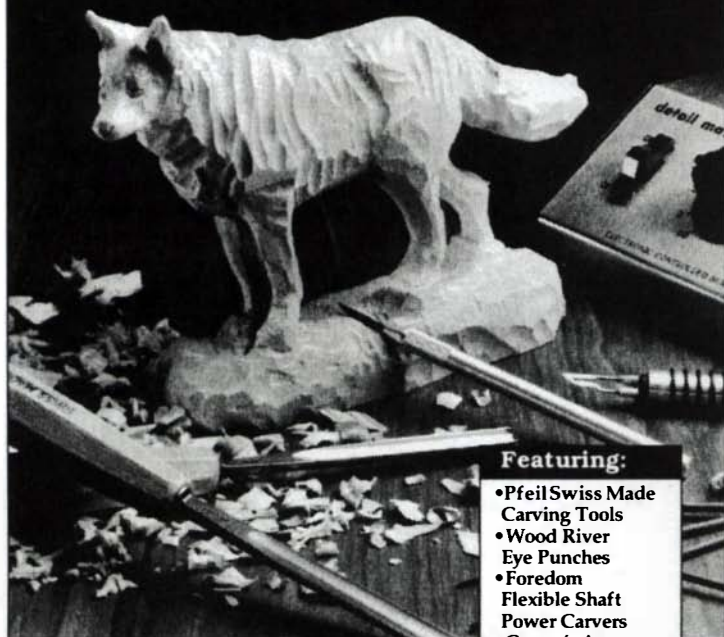
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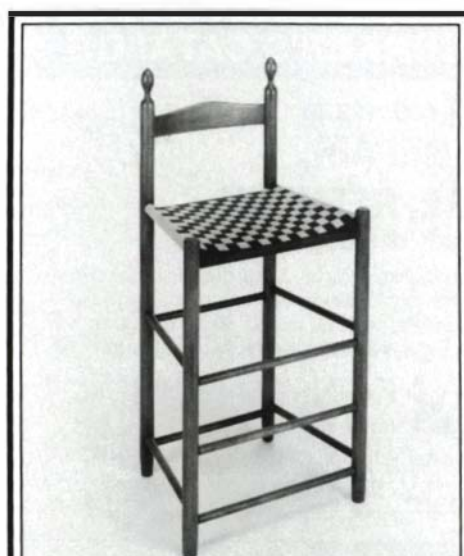
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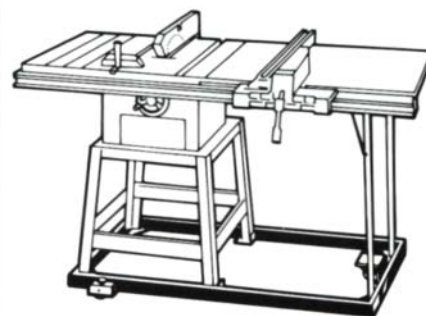
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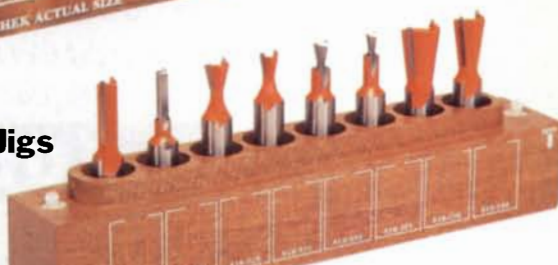
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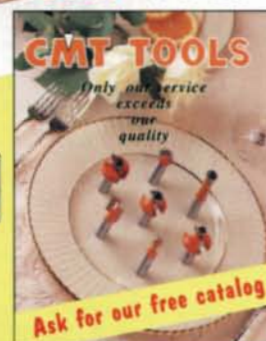
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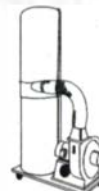
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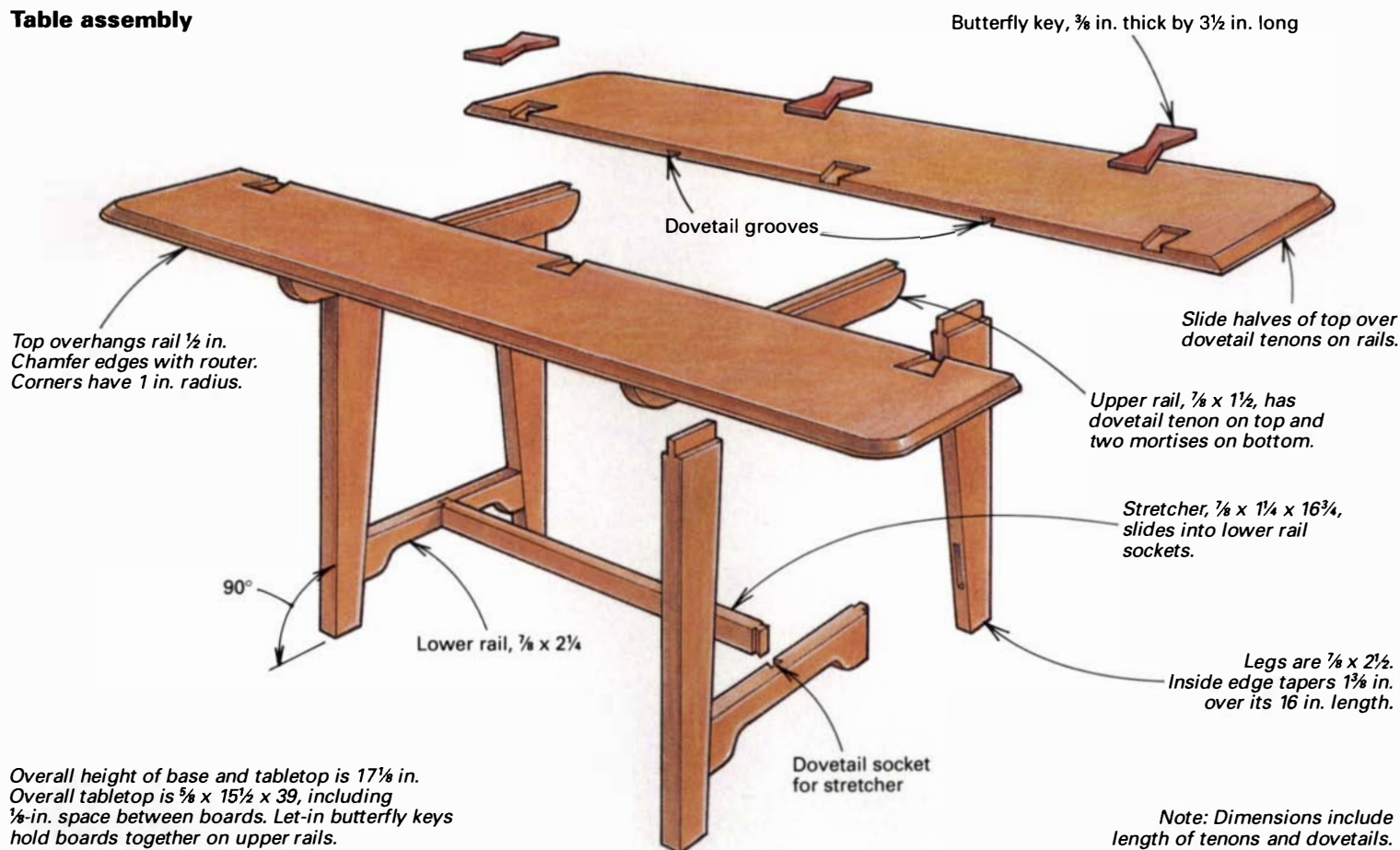
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Sliding dovetails and butterfly keys make strong connections

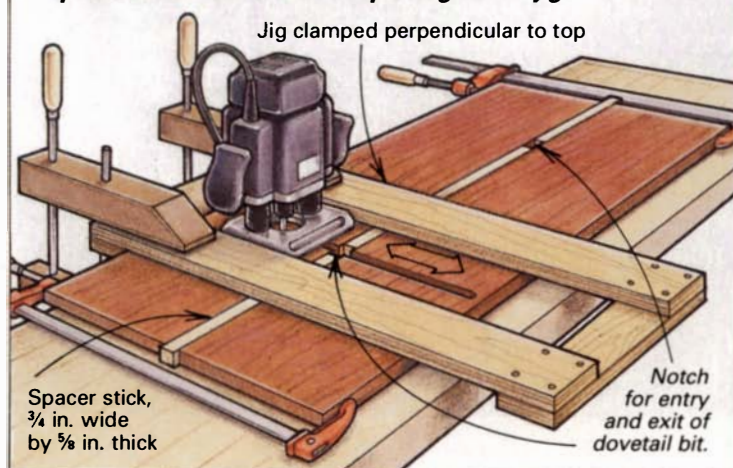
by C. Michael Vogt

Table assembly

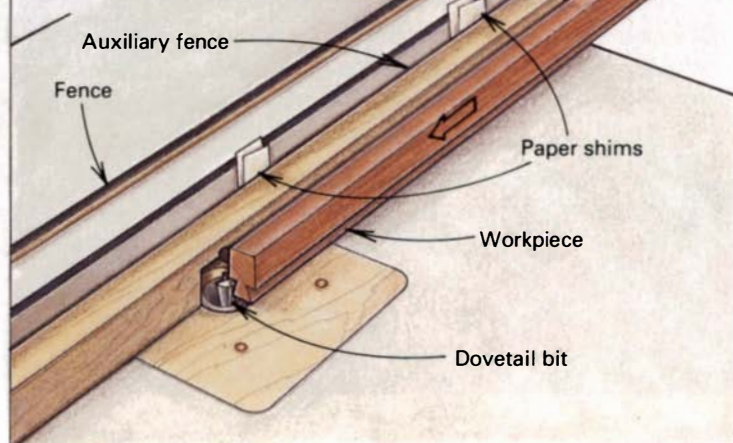


Router setups for sliding dovetails

Step A: Groove underside of top using router jig.



Step B: Shape upper rail tenon on router table.



I find the dovetail an appealing joint, both aesthetically and structurally. Although its traditional use in carcase and drawer construction is well known, a sliding version of the dovetail can be used to connect furniture components such as tabletops to their bases. I relied on sliding dovetails to join a top to two upper rails in the walnut table shown in the photo at right. And I used a more visible variation of the dovetail, butterfly keys, to connect the halves of the tabletop. The table is quite easy to build, but because its joinery is pre-eminent, the table requires craftsmanship with both machine and hand tools. I'll describe the router setups I used to cut the sliding dovetails, and I'll also explain how I inlaid the table's butterfly keys (see the box on p. 46).

Designing a table for tea

When I made the table for a juried craft show, I knew it would be displayed near Japanese pottery. So when I designed the table, I envisioned it for drinking tea while seated on the floor. I borrowed traditional details, such as sliding dovetails, but I was also influenced by modern work—that of the late George Nakashima. I purposely left a $\frac{1}{8}$ -in. space between the halves of the top, so I could inlay butterfly keys the way Nakashima did in his altars and tables. The keys are bold and functional. In my table, they join two matching boards; in Nakashima's work, they stabilize checks in large slabs of wood (for examples, see *FWW* #79, p. 99).

Because the table's components and overall form are simple, its material and manufacture are pronounced. I built the original table from walnut (see the photo above), but when built from oak, the table takes on an almost Craftsman-like look. And though this table is small, you can use the same joinery techniques to make larger and more robust pieces. However, if you build a table for heavier use, such as a coffee or end table, I suggest you move the legs closer to the ends of the top to reduce the cantilever and make the table more stable.

Building the base and the tabletop

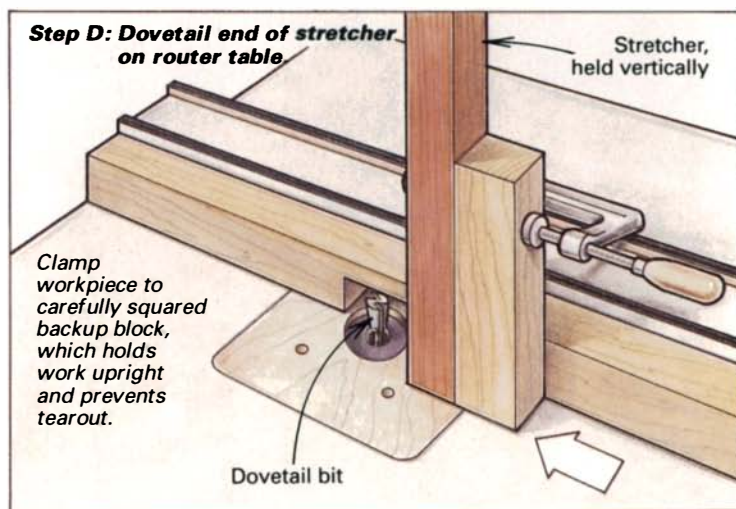
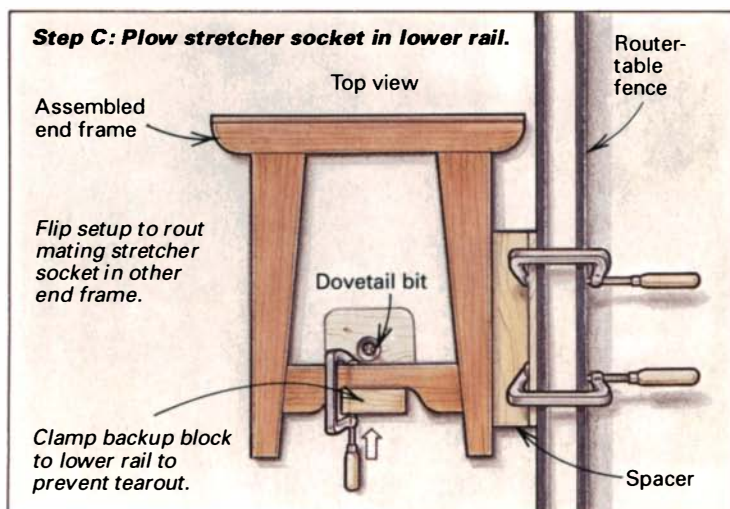
The tabletop is supported on a base, which is just two end frames (see the drawing on the facing page). Each end frame consists of a pair of legs connected by lower and upper rails. The lower rail has tenons on each end that enter mortises in the sides of the legs; the upper rail has two mortises on its underside that slip over tenons on the tops of the legs. Full-length dovetail tenons on the tops of the upper rails slide into stopped grooves in the underside of the top. Three butterfly keys join the halves of the top and lock them onto the base's sliding dovetails. Finally, a stretcher spans between the two end frames, joining the lower rails.



The elegance of simplicity and craftsmanship—Tico Vogt made this table for a craft show exhibiting Japanese pottery, so he designed the walnut table just 17 in. high for floor-seated tea drinkers. To further reflect Oriental lifestyle, he used simple components and traditional joinery.

Selecting stock—The low tea table is a nice project for book-matching resawn 8/4 stock for the top. The base looks best made from straight-grained wood, so the components' shapes will be emphasized. After you have resawn stock for the top, let the boards move around with stickers between them for a week so that they will be flat when you work them. Plane the boards a bit over $\frac{5}{8}$ in. thick, and crosscut them a few inches longer than their final length. Rip out all the base pieces, and plane them to $\frac{7}{8}$ in. thick. Also, saw a few extra 6-in.-long by 1 $\frac{1}{4}$ -in.-wide pieces for testing the fit of the sliding dovetails.

Legs and rails—It's tempting to use biscuits instead of tenons to join the end frames. However, when I built a biscuited mock-up, I concluded the weaker plate joints compromised the integrity of the project. So go with the mortises and tenons. First saw the top rails to their final length, but wait to saw the curve on their ends until the dovetail tenons have been shaped (see the top photo on p. 47). Next crosscut the legs and bottom rails with enough length for their tenons. Then bandsaw (or taper-rip with a tablesaw and jig) the angled inner faces of the legs, and plane off the sawmarks. Use a tablesaw to cut the end tenons, and then angle the tenon shoulders by hand with a chisel. Waste the mortises with a router, and square them with a chisel. Once you've dry-assembled the joints, bandsaw the profile on the underside of the bottom rails.



A jig for routing the top's dovetail grooves—To plow the top's dovetail grooves, I relied on a spacer stick and a jig. First make up a ¾-in.-wide spacer as thick and as long as the top with 1-in. notches where the grooves will go (this is the entry point for the router bit). Clamp the two halves of the top around the spacer. Squarely mark off the ends for length, and mark centerlines for the keys. Next transfer your cutoff lines to the underside and measure in from them to layout the centers of the grooves. With a handplane, flatten the boards. Then set up the router jig shown in step A on p. 44. With a dovetail bit set to ¼ in. deep and dropped into the notch in the spacer, rout a groove in each direction, stopping ⅜ in. from the edges. Lift the router when the bit is over the notch, so you can make the second groove. Also groove a piece of scrap for test-fitting. Finally sand away any fuzzy edges left by the router.

Routing dovetail tenons on the upper rails—A router table is great for shaping dovetail tenons on the upper rails. To get the tenons to fit the tabletop grooves perfectly, use the practice pieces. First make an auxiliary fence (see step B on p. 44), so you can micro-adjust the cut. Set the bit the same height above the table as the groove is deep. Run each side of a scrap piece, top down, along the auxiliary fence. Then use shims of paper between the fences to fine-tune the width of the dovetail. When the tenon slides snugly into the test groove, use the same router-table settings, and repeat the cut on the actual rails. Test their fit.

To allow for expansion, square the ends, so the tenons are ⅛ in. shorter than the grooves in the top. Then use a chisel to carve a

round shoulder on each end. The arc on the tenon ends should match the semicircle of the stopped router groove. Again, sand away any fuzz, and wax the sides of the dovetail tenons. Next rip the spacer board to ⅛ in. wide. Slide the top boards onto the rail tenons, drop in the spacer and clamp the top together. With the rails in place under the top, secure the assembly on the bench, and check for flatness. (I handplaned the boards diagonally to eradicate a small amount of cupping in my top.) Now saw out the butterfly keys, and size and cut their mortises (see the box below).

Assembling the end frames—Once the keys have been fit, take the top apart. Then glue and clamp up the end frames. When the glue is dry and you've scraped and sanded the frames clean, install the top, so you can measure the length of the center stretcher. Measure shoulder to shoulder on the lower rails, and add ½ in. for the ¼-in. dovetail tenon on each end. Next dismantle the top. Place each end frame on the router table, as shown in step C on p. 45, to plow the sliding-dovetail socket on the inside of the lower rail. Use the router table to shape tenons on the ends of the stretcher similar to how you dovetailed the rails. A carefully squared backup block clamped to the stick as you run it vertically past the bit keeps it straight and stable (see step D on p. 45).

Installing the stretcher and butterfly keys—The real pleasure of building this table comes from assembling the last few joints. First chamfer the bottom edges of the stretcher dovetails. Next put the top back together with the spacer, slide in the frames and glue

Making and inlaying butterfly keys

When making the walnut tabletop shown in the photo at left, I chose rosewood for the butterfly keys. And when I built the table in red oak, I used cherry keys (see the photo at right below). In both examples, I had purposely saved small scraps of contrasting wood for the butterflies.

Bandsawing keys: George Nakashima slightly beveled the edges of his butterflies, but because my table's keys are

shallow, I just cut the edges square. First, I make a butterfly pattern and trace its shape as many times as will fit on a scrap block. Second, I bandsaw the block to divide the patterns, which leaves me with stacks of keys. Third, I bandsaw the butterfly shape (see the center photo below). Fourth, I slice off individual keys to roughly ⅜ in. thick. Fifth, I plane and sand away sawmarks from the faces. Finally, I squarely chisel and file the edges to the line. Because the keys vary slightly



Photo: Joseph Levy



Cherry butterflies—Vogt bandsaws a stack of keys from a block of cherry.



1) Scribe the outline of the key with a knife or an awl.

and clamp in the stretcher. Then apply a thin even coat of glue on the mating surfaces of the keys and butterfly mortises. Tap the keys home, and use cauls and clamps to distribute pressure. Although the keys go against the wisdom of no cross-grain construction, I've never had any problems. For extra insurance, you can drive a screw up from the bottom into the center of each butterfly before you allow the table to dry overnight. Because the butterfly mortises are $\frac{1}{32}$ in. shy of the key thickness, beltsand or scrape the keys flush to the table surface once the glue has cured.

Finishing touches—Keep the spacer in place while you saw and rout the top to its final shape. (The spacer protects the inner edges from tearout and gives the router bit a continuous surface to bear against.) First scrape the entire table surface, or use a random-orbit sander because they work particularly well for smoothing the crossing grains of the keys and top. Next cut the tabletop to final length using a crosscut box on your tablesaw. Then round the four corners with a sabersaw, and chamfer the top edge all around with a router. (The beveled edge makes the top look thicker, and it's easier on the elbows.) Finally pop out the spacer, and hand-sand all the parts. For a finish, wipe on a mixture of oil and varnish.

A Tokyo furniture-store owner once saw my table at a gallery. He picked it up and examined it closely. Then he placed it on the floor, and kneeling on the top, racked the table back and forth. His nod of approval made all the careful joinery well worthwhile. □

C. Michael (Tico) Vogt is a furnituremaker in Saratoga Springs, N.Y.



Rounding off the dovetail tenons—After shaping the upper rails' dovetails on his router table, the author uses a $\frac{1}{2}$ -in. straight chisel to trim the ends. Rounding the ends ensures that the dovetail tenons fit the stopped grooves in the underside of the top. Next Vogt will bandsaw the curve marked on the rail.

in size, I number each, so I can match the keys to their butterfly mortises later.

Cutting butterfly mortises: I individually mark out keys rather than use a pattern because even minute differences between key sizes or shapes will be apparent in their fit to the mortises. So I lay a key on a location line on the tabletop, clamp it in place and follow these steps to scribe and mortise the butterfly shape:

1) Using an Exacto knife (or an awl), I carefully scribe the outline of the bottom of the butterfly, making sure the bevel of the knife stays tightly to the key's edge (see the

photo at right on the facing page). Then I remove the key, so I can deepen the lines.

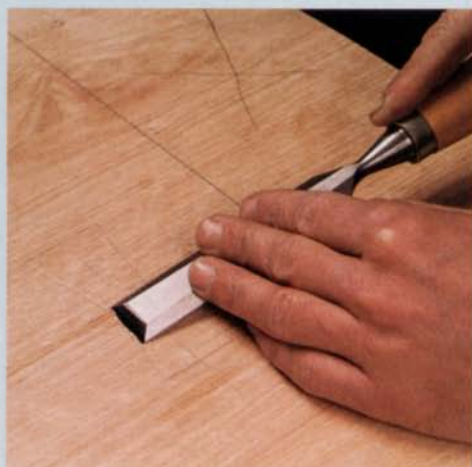
2) Using a razor-sharp flat chisel, I carve a shoulder all around the outline, as shown in the photo at left below. The shoulder prevents tearout from the router.

3) Using a plunge router, I waste most of the butterfly cavity to a depth of the thickness of the key less $\frac{1}{32}$ in. I work a $\frac{1}{4}$ -in. bit as close to the outline as I dare (see the center photo below).

4) Using chisels, I pare the rest of the way to the outline. A $\frac{3}{4}$ -in. straight chisel works

well at squaring the edges (see the photo at right below), and a chisel with its tip ground to a point nicely cleans up the butterfly's corners.

Insetting keys: To inlay the keys, I first number the mortises to match each key. I fit the keys tightly to allow for shrinkage; it should take a bit of force to start them. To help, I chamfer the bottom edges so that they will just ease into the mortises, but I don't drive them into the top just yet. Once I have fit all the keys to their mortises, I set them aside. Later, when I'm assembling the table, I tap the butterflies home with a mallet. —C.M.V.



2) Carve a shoulder around the outline with a chisel.



3) Plunge-rout the mortise with a $\frac{1}{4}$ -in. straight bit.



4) Pare to the line, and clean up the corners with chisels.



Good jointing requires look and feel—Before Bernie Maas edge-joints a board, he sets the jointer for a light cut, and then he reads the stock's shape and grain direction. While positioning the

work to correct for any crook, he orients the grain to reduce tearout. Applying easy pressure with his fingers above a properly working guard contributes to the machine's safe operation.

Jointer Savvy

Knowing your machine makes for safe and skillful jointing

by Bernie Maas

Like good hand-tool usage, successful wood machining involves working by eye, feel and intuition. Though fences and motor-driven cutters help, they can't do it all. A squeeze here and a push there—some call it “body English”—can make all the difference in truing an edge or flattening a surface. These hard-to-describe nuances really boil down to having savvy for the tool you're using.

The jointer is a perfect example of a savvy-demanding machine. To joint cleanly and consistently requires real proficiency. I've run a jointer for 35 years, and while it looks like a set-it-and-forget-it monster, it's not. So to save you from its pitfalls, I'll pass along the jointer pointers I've picked up and now share in my classroom. In addition to describing a jointer's makeup and telling you how I straighten an edge, I'll describe how I read a board's shape and grain, so I joint squarely without tearing wood—all while keeping my fingers safe (see the photo on the facing page).

Jointing 101

Before you begin surfacing a pile of lumber for a project, it helps to be familiar with a jointer's components and how to adjust

them. For reference, the drawing below shows the machine's basic parts, their purposes and the fundamentals of feeding stock, which are important during both simple and advanced operations (like the ones in the story on p. 52).

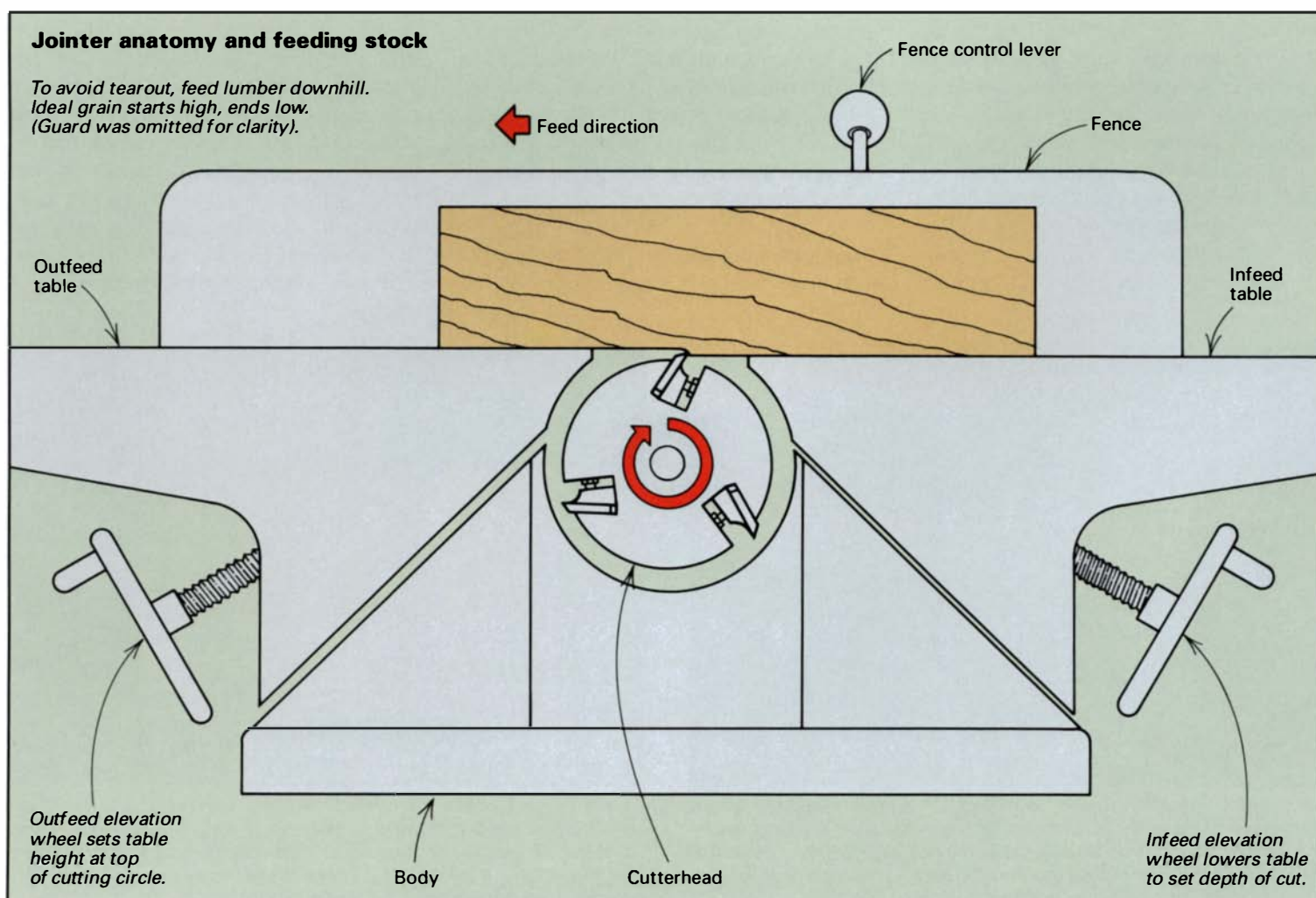
A jointer's main jobs are flattening faces of boards and squaring and straightening edges. These tasks are achieved by adjusting the jointer tables and fence in relationship to the cutterhead. If the fence is set at 90° and the outfeed table is set parallel and exactly to the maximum height of the knives, you can establish a uniform cut by lowering the infeed table by the depth of cut you want. For a detailed look at how the machine's anatomy accomplishes this, see my article in *FWW* #79, p. 62 (also in *The Best of Fine Woodworking: Power Saws and Planers*, The Taunton Press). After you have a handle on jointer fundamentals, the most important item is safety.

Safety comes first—There are a few keys to jointing safely. First, be alert and focused. In addition to watching your work and your fingers, make sure your jointer's guard is in place and working properly. Second, work in a warm shop. Cold hands

mean numb fingers that are slow and don't grab well. Third, use a push block when surfacing the face of a board. Fourth, don't joint a board less than 12 in. long or under 1 in. thick. Finally, don't “white-knuckle” it. Feed with just enough force to advance the stock. This way, should the work kick or shatter, your hand won't go flying into the knives. If your fingernails are blue, you're pushing too hard. Either your bite is too big, your stance is off, the blades are dull or your machine is out of whack.

Reading a board's grain—Ideally, there will be only one grain direction per face of a board. If this is the case, you can easily prevent tearout while jointing. Just feed the stock so that the grain lines run in the direction of the cutterhead rotation—from high to low (see the drawing below). Of course, life isn't always that pretty: There are knots, and often the grain changes its mind. Sometimes the fibers run in three directions at once (figured cherry is a prime example of this). And it's more likely that tearout will occur the steeper the angle of grain reversal.

So how do you handle recalcitrant stock on your jointer? First, make sure the knives



are sharp and protrude equally from the cutterhead, or reserve a sweet spot—a section of the knives dedicated for when you need a razor edge. (I keep a sweet spot in a rarely used space at the rear of the machine.) Second, remember that a fast cutter means a clean cut. Think of your jointer as a lawn mower. When you push the mower into tall grass, the blade lugs down and rips the grass instead of shearing it. To solve this problem, you raise the blade to take a shallower cut, and you go slowly so the engine stays revved. You can joint stock with nasty grain the same way. Reduce the cut to $\frac{1}{64}$ in., and then move the problem area of wood slowly over the knives. Keep the knives whirling at top rpms by slowing the feed rate. Although you'll need more than one pass, the cut will be smooth. If you're still having tearout trouble, you may want to back-bevel the knives (see the story on p. 52).

Squaring stock—When jointing, you should always square an edge to an established face. To do this, joint the face of the board. Then using the newly jointed face as the reference, joint one edge square to it. If your edge is still out of square and you've double-checked your fence setting, most likely the jointer table is guiding the unsquare edge of your work (see the top photo on this page). By guiding the work this way, you're not correcting anything; you're only duplicating the existing angle. To avoid this problem, hold the piece tightly against the proper reference—the fence (see the top photo on the facing page). There should be a tiny wedge-shaped gap between your work and the infeed table. Now feed the work over the

knives. The edge should be square. To learn how to plane and rip the opposing faces and edges parallel and square, see Peter Korn's article on p. 74 in this issue.

Correcting a board's shape—Unless you enjoy having lumber bind up in the tablesaw, you will want to remove any crook in a board before you rip it. (Crook is a curvature that runs from end to end along the edge of a board.) Although crook is common, getting rid of it isn't hard. If your project doesn't require the full length of a board, crosscut it first. Shorter pieces are easier to handle, and they produce less jointing waste. Try to joint with the concave (hollow) edge down. The work should be stable because it'll rest on the "ears" (ends of the arc) as it passes over the knives.

Sometimes, however, you'll have to joint a piece with the convex edge down. Because it will want to rock, you'll be tempted to hold down the piece tightly to the infeed table as you feed it through the jointer. But if you do this, the board will come out as crooked as when it went in. Instead, set the jointer for a $\frac{1}{32}$ -in. cut, and balance the board on a high spot. (The different heights of the two tables should help steady the piece.) Apply moderate pressure, and feed through the knives to create a flat on the edge. Repeat until the work becomes stable as it seats onto the tables. Gradually, you'll even the flat along the entire length. For more on jointing warped stock, see Mark Duginske's article on p. 56 in *FWW* #92.

Straightening edges and panels—You can modify convex-jointing principles to



Improperly aligned work—A beveled edge produces a gap between the fence and the stock's face. In this case, the infeed table guides the workpiece, so jointing will only reproduce the same bevel instead of squaring the edge of the board.

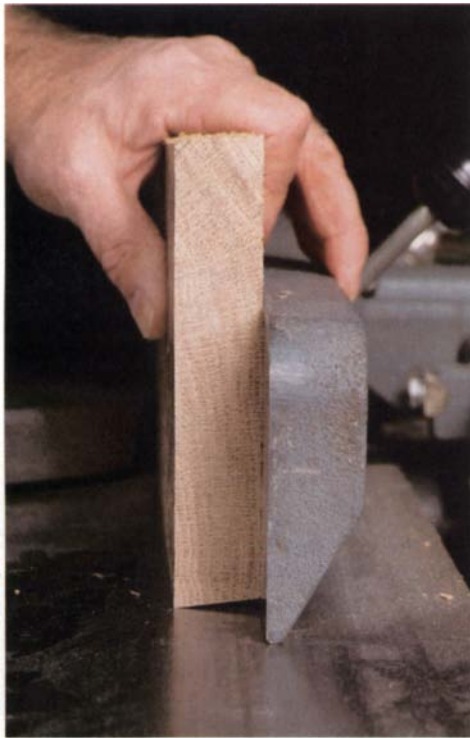
straighten a board's edge parallel to its opposite side; in which case, you'll be wasting a small wedge shape. Or you can shave a bit off a panel to make it fit a tight frame. This is great for getting a plywood back to fit an out-of-square carcass that diagonal pipe clamps won't yank back. Start by marking the cut line. I use a fine ball-point pen, which leaves a crisp, dark line that shows up well under shop lights. Make sure you mark the line on the side of



Straightening the edge of a panel—To square and straighten panel edges, the author draws an ink line and then shaves toward it with his jointer. After he aligns the work by eye, so the line is parallel to the table, he takes a couple of passes to create a flat. By continuing, he will true up the entire edge.



Jointing end grain—To avoid splitting the end of a stile, Maas used his belt sander to chamfer the corner before jointing. By carefully easing the frame over the cutterhead, he will flatten each of the four edges. Note that the grain in this rail is running slightly downhill, in the direction of the knife cut.



Correctly aligned work—Proper pressure and a bit of “body English” snug this board squarely to the fence. The wedge-shaped gap above the infeed table may point away from the fence, as shown, or toward it, depending on the grain direction.

the board that will face you as you feed (see the bottom left photo on the facing page). Set the jointer for a light cut ($\frac{1}{64}$ in. to $\frac{1}{32}$ in.), and take a pass. If the taper amount is slight, apply less pressure on the thin end. If you're beginning the cut at the thin end, start with easy pressure, and increase the squeeze as you go. If there's a considerable amount to taper, lift the thin end until you can eyeball the line parallel to the infeed table. Lightly joint a flat paral-

lel to the taper line. To get the flat back on target if you've strayed, take partial cuts. Your final pass should run the length of the panel for a clean, smooth edge.

Smoothing tapers—Lots of folks have jigs for ripping tapers on the tablesaw. I've done loads of them that way, but I've always felt that it was a kickback waiting to happen. Instead, I prefer to handsaw and joint my tapers. I start with rough stock that's about $\frac{1}{4}$ in. wider than the maximum taper I need. The extra width gives latitude for truing up later. I mark the stock with two lines. The first is the exact taper line. (For safety, I never taper to less than 1 in.) The second line starts $\frac{1}{4}$ in. below the first. Next I handsaw as close to the second line as I can. Then I set my jointer for a light cut. Feeding the thick end first with the grain running downhill, I pass the piece over the cutters until I reach my taper line. The best part is that the jointer won't leave ridges and burns as sawblades will. Though somewhat tricky, a few furniture-makers cut tapers using the jointer alone (see the photo at left on p. 52).

Jointing end grain—With care, you can use the jointer to straighten the end grain edge of a panel. If the panel's trailing edge is unsupported, though, it's likely that a $\frac{1}{2}$ in. or so of end grain, which has no structural integrity, will separate from the stock (with a loud whack) as soon as the knives hammer away at it. Luckily, there are several ways to deal with this problem. You can clamp a back-up piece to support the trailing edge before jointing. You can joint half one way and then half from the opposite end. Or you can nick the exiting-

end fibers with a utility knife just above the height of the cut. However, my favorite solution came from my eighth-grade shop teacher who simply chamfered his trailing edges slightly above the cut. You can use a rasp, a block plane or a belt sander to make the chamfer, and the method works equally well on frames, as shown in the bottom right photo on the facing page. Any chamfer that's left after jointing will feather away when you finish-sand.

Rabbets, bevels, chamfers—Chances are good that your jointer has a rabbeting arm, which will support a workpiece at the end of the jointer knives. A ledge in the outfeed table allows you to plow rabbets because the rest of the board will pass by the cutterhead unimpeded (see the photo at left below). The rabbeting feature of a jointer is appealing when you consider the setup time required to do the job on a tablesaw or router table, but be mindful that a jointer's ledge size determines the largest rabbet you can make.

Finally, a jointer-made bevel or chamfer adds a nice detail to almost any project. For example, to neatly dress the front of your bookcase shelves, set your jointer fence to 45° , adjust the infeed side for a $\frac{1}{16}$ -in. cut and then pass each shelf along the fence as you go over the cutter (see the photo at right below). Without a square edge, the shelf is more pleasing to the eye and to the hand. □

Bernie Maas is an associate professor of art at Edinboro University of Pennsylvania, where he teaches woodworking and computer-aided drafting. In his free time, he likes to build furniture for his home.



Clean rabbets—With the fence set near the jointer's edge, the author slides a piece along the rabbeting arm, taking $\frac{1}{16}$ in. at a pass. For clean rabbets, all the knives should project equally toward the rabbeting-ledge end of the cutterhead. A few woodworkers sharpen the ends of the knives to further improve the cut.



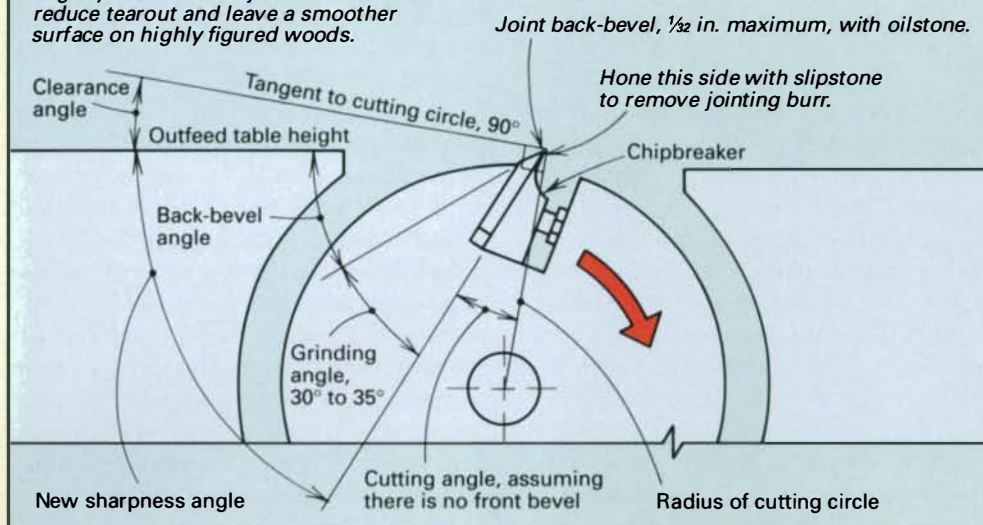
Smooth chamfers and bevels—A jointer is more versatile than you might think. For decorative table legs, for instance, you can chamfer the corners on the jointer. Or you can precisely bevel staves for a planter. Just angle the fence, adjust for a shallow cut and then feed the work edge over the jointer in several passes.

Using a jointer: the advanced class

by Peter Tischler

Fig. 1: Back-beveling jointer knives

Slightly back-beveled jointer knives can reduce tearout and leave a smoother surface on highly figured woods.



Feed rate, depth of cut, knife sharpness and table alignment all influence the quality of a jointed surface. Too slow a pass can glaze the wood or overheat the knives. Having dull knives or taking too fast a pass causes tearout and often leaves a rough or wavy surface. Too heavy a cut tears up both wood and machine. Too light a pass just wastes time. Misaligned tables lead to inaccuracies in milling. Luckily, you can compensate for many of these operator and machine shortcomings.

Assuming your knives are properly set, there's a refinement called back-beveling, which can improve the quality of the cut especially on figured woods. I'll describe measures to reduce tearout, including how I back-bevel knives. But first I'll explain what down pressure and jointer-table adjustments will do for you.

Down pressure and table settings: For straight jointing, first apply infeed pressure followed by pressure on the outfeed side, but for a tapered edge, keep pressure on the infeed table only (see the photo at left below). To taper a leg, for example, I mark the taper beginning 1 in. to 2 in. back from where I want it to start. (I straighten the small starting arc with a plane later.) With the leg butting a stop clamped to the infeed table, I take 1/16-in.-deep passes while maintaining infeed pressure with a push block. I count the number of passes so that I can match the taper on all sides of the leg.

To create a "sprung" joint (edges that are jointed with a 1/64 in. or less hollow in their centers to aid in clamping a glued-up panel), I slightly increase downward pressure at the middle of each edge as

I pass it over the head. On certain jointers, you can also spring an edge by readjusting the outfeed table. To help me understand table alignments, I consult *Woodshop Tool Maintenance* by Beryl Cunningham and William Holtrop (the book is out of print, so check your local library). The drawing on the facing page, which is adapted from the book, shows what effects various table heights and pitches will have on a jointed surface.

Reducing jointer tearout: When a jointer is running, slight changes can occur in the cutting arc due to distortion in the head or bearing play. As a result, one knife may project farther than the others and tear the surface. The tearout will be most noticeable on figured woods. There are several ways to combat tearout, including skewing the work, proper sharpening and back-beveling the knives.

Sometimes when I'm jointing wood with difficult grain or high figure, such as birds-eye or curly maple, I use an auxiliary fence to skew the work (see the center photo below). Skewing, like angling a plane, can reduce tearout. An auxiliary fence works best on a wide jointer that allows more skew.

The primary bevel on a jointer knife (see the drawing at left) can range from 30° for softwoods, to 35° for hardwoods. To get the angle, I send my knives to a grinding shop because they precisely grind a flat bevel as opposed to a hollow bevel. Occasionally, I'll add a secondary (front or back) bevel myself. This secondary bevel increases the sharpness angle (by adding the back-bevel angle to the grinding angle). But I will only do this if the knives are starting to dull or if I need to surface a run of difficult stock.

It's difficult to grind a front bevel. But back-beveling, as described in Charles Monnett Jr.'s book, *Knife Grinding and Woodworking Manual* (Charles G. Schmidt, 301 W. Grand Ave., Montvale, N.J. 07645), can be done with the knives



To taper stock, use pressure on the infeed table. When tapering a leg, clamp a stop on the infeed side to align the start of the cut; then advance the work over the knives (the guard has been removed for clarity).



An auxiliary fence skews the work to leave a smoother surface on some figured zebra wood. Tischler screwed the plywood fixture together, and then he shimmed and clamped it to his jointer's fence.



Carefully back-bevel the knives. Clamp a stop block to the infeed table. Then wrap an oilstone with paper. Set the outfeed table, so the stone evenly grazes the knife tips once the jointer is running.

in the cutterhead. Jointing the back-bevels also removes any cutting-arc eccentricities at the same time (see the drawing on the facing page).

Back-beveling is dangerous and should be done only with the following precautions: The knives must be accurately ground, balanced and set. The outfeed table should be barely lowered—just until the knives whisper a ticking sound when an oilstone is passed over them as they're rotated by hand. Wrap the stone in paper, so you won't scratch your outfeed table. Finally, clamp a stop across the infeed side near the cutterhead (see the photo at right on the facing page) in case the stone kicks.

Once you've safely set up the job, lower the infeed table just below the outfeed table. Start the jointer, and allow it to reach full speed. With a firm (but not monkey-tight) grip, slide the oilstone across the outfeed table as you dress the knife tips. Turn the machine off, so you can examine the knives. You have ground a proper bevel if there's a thin, straight gleam on the edges. If you didn't get enough back-bevel, lower the outfeed table another .001 or .002 in., and repeat the jointing. Your back-bevel shouldn't exceed $\frac{1}{32}$ in.; any more than this will cause the heel of this secondary bevel to pound into the wood.

After back-beveling, hone the knives to remove the burr raised by jointing. To do this, I use a fine India slipstone (see the photo below). First I unplug the machine. Then I carefully work the oiled stone back and forth across the knife face that protrudes from the chipbreaker. I hone all the knives equally, stopping when I no longer feel drag with the triangular stone. Your patience with this procedure will be rewarded by the cut you'll obtain. □

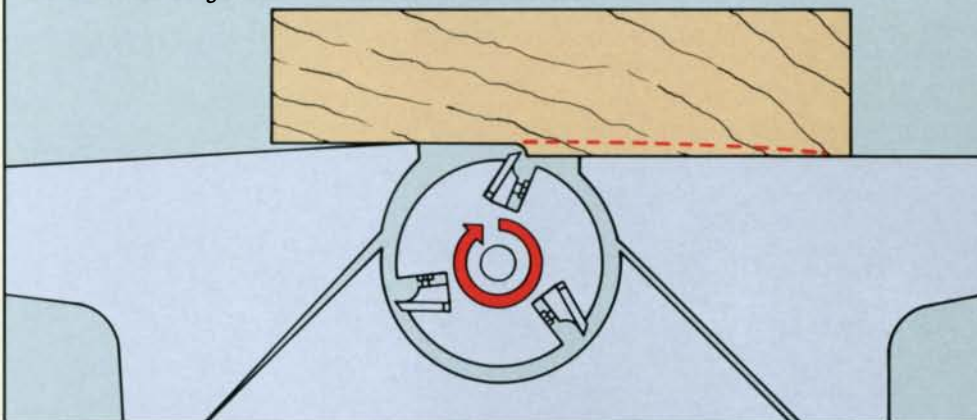
Peter Tischler is a North Bennet Street School graduate who runs a chairmaking and cabinetmaking shop in Caldwell, N.J.



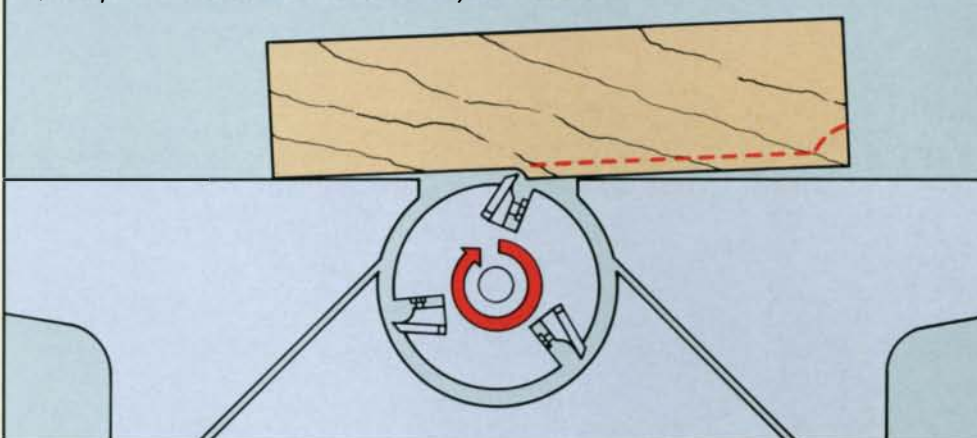
To remove the burr, use a slipstone lubricated with oil. With the jointer disconnected, hone the underside of each knife equally, being careful not to cut a finger as you guide a fine India stone.

Fig. 2: Effects of infeed and outfeed table positions

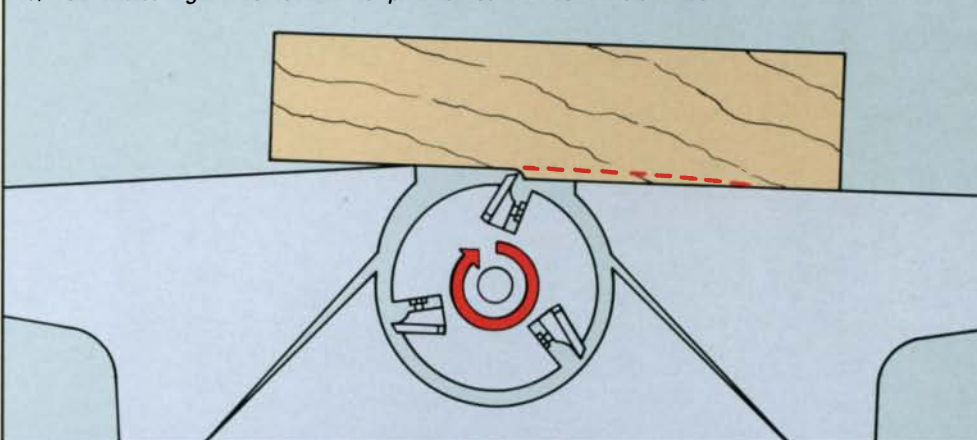
1) Outfeed table high in center results in concave surface.



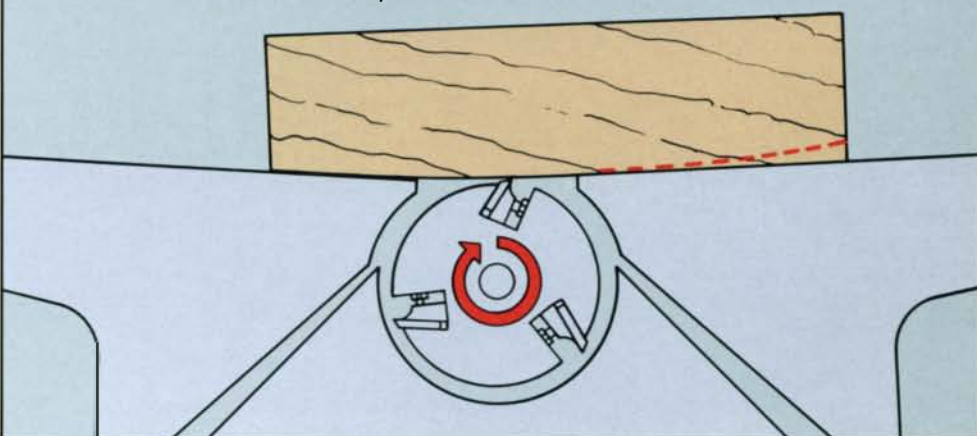
2) Low parallel outfeed table results in heavy cut at back end.



3) Both tables high in center and nonparallel result in concave surface.



4) Both tables low in center and nonparallel result in convex surface.



Shaker Oval Boxes

Reproductions make fine gifts or storage

by John Wilson



Oval boxes continue to be the most popular product the Shakers ever offered to the outside world. Originally produced for their practicality (nesting boxes inside each other required little storage space) and utility (almost anything and everything was stored in these durable containers), they have become collector's items for their simple beauty.

As testament to the boxes' enduring appeal, I've been able to make a living for the last 10 years by traveling around the country teaching Shaker box making to groups of woodworkers. Box making's appeal is that, in short order, you can have a stack of boxes, as shown in the photo at left, that any woodworker would be proud to show off or to give as gifts. In just a day and a half, my students, who range in ability from novice to advanced woodworkers, complete a stack of five traditional Shaker oval boxes.

The secret to the classes' efficiency is that we start with the tops, bottoms and band material thickened and rough dimensioned. I also bring the necessary patterns and forms for cutting the band's fingers, bending and drying the bands and shaping the tops and bottoms. I can supply all the necessary materials, hardware and forms if you want to make the boxes that way. But this article will show you how to prepare the stock and make your own patterns and forms.

There is no one right way to make an oval box, just as there is no one material for bands, no one system for numbering sizes of nesting boxes, nor one shape to the fingers. What can be said for the following procedure is that it works for me and for participants in my workshops to produce a stack of five boxes, from a small #0 to a #4 box, in the Shaker tradition. Because the #2 box is the mid-sized and easiest to work of the stack of five boxes, I suggest students start with it.

Selecting and preparing stock

Box bands for the base and the lid of an oval box are thin slices of hardwood, or thick veneers, that will bend and tack without splitting. The Shakers used maple bands and pine tops and bottoms more than anything else. But there are a wide range of hardwoods that are suitable for box making including ash, cherry, walnut,

A stack of five Shaker boxes can be built in just a couple of days, even by novice woodworkers, as the author proves in his classes many times every year. The boxes are great for display or storage and make gifts that everyone loves to receive.

apple, hackberry, hard and soft maple and birch. Straight-grained wood is best for bending. Any wood can be used for the tops and bottoms.

I prefer quartersawn wood for both the bands and the tops and bottoms. In bands, the quartersawn grain reduces curling along the edges of the fingertips. Quartersawn wood is preferable for tops and bottoms because it has half the wood movement of flatsawn stock and is less likely to cause structural problems, especially in the larger sizes.

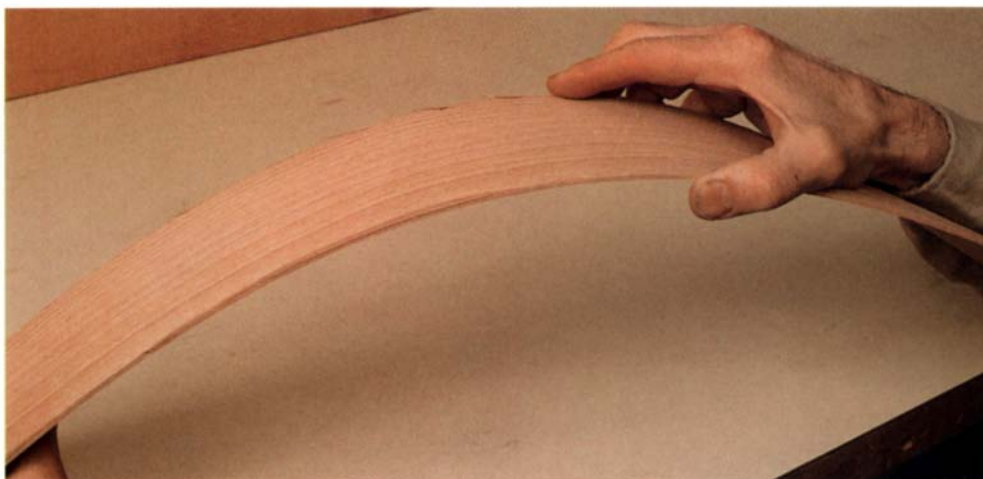
Moisture content also influences the workability and stability of the wood. Tops and bottoms should be dried to a moisture content (MC) of 8% to 9% to help prevent gaps showing up at the edges from shrinkage or splitting the band at the ends from expansion. Bands are easiest to work when air dried to 15% to 20% MC. Kiln drying band stock makes it brittle and more difficult to bend.

The thickness of the bands, tops and bottoms varies with each size box, as shown in the chart on p. 57. The most difficult part of preparing box stock is thickening band stock. Smaller boxes require thinner bands to make the tighter radius bends, but the larger boxes need the heft of the thicker veneers.

When I first started making boxes, I resawn stock on my tablesaw. A sharp, carbide-tipped, 40-tooth blade yields a clean cut, and the 3-in. capacity of a 10-in. table saw is enough to cut bands for a #4 box in one pass. Tops and bottoms for up to a #4 box can be resawn by making a pass along each edge of the stock.

Most of the stock less than .10-in. thick that I use now is veneer-sliced to my specifications. These veneers are uniformly thick, and the knife leaves a smooth surface. But because the knife bends the wood during the cutting process, it can create checking in one side of the veneer. The checked side of the veneer will be more likely to split if placed on the outside of the box. The best way to determine the knife-checked face of veneer-sliced stock is to flex the band across its length in both directions. The side of the band that shows splitting or checking, as shown in the top photo on this page, should be used as the box's inside surface. Then bending will help control the splitting.

If a band does split while bending, you can still salvage the stock. Trim off the split edges and make a shallower box, often called a button box, or add a handle and make a carrier. The Shakers also had plenty of odd-sized boxes and carriers, although such boxes are less common.



Splits or checks in a veneer face, caused by the veneer slicing process, are quickly revealed by flexing the band across its length. The split face should be to the inside of the box to prevent the splits from continuing along the grain line.

Patterns, forms and hot-water trays

I developed finger patterns and top and bottom oval patterns from drawings in *Measured Drawings of Shaker Furniture and Woodenware* by Ejner Handberg (Berkshire Traveller Press, Stockbridge, Mass., 1991). I then made permanent patterns from prepainted aluminum coil stock used as trim by residential siding contractors for windows and doors. The coil stock cuts easily with a utility knife. Straight cuts are made by scoring the aluminum and then flexing it along the score. Curved lines can be scored freehand or cut with shears. I drilled $\frac{5}{64}$ -in.-dia. holes to show where the copper tacks go.

Oval bottom patterns are made to the dimensions shown in the chart on p. 57. The top oval patterns are about $\frac{1}{8}$ in. larger. If you enlarge the bottom pattern by 2% on a copying machine, you will have a close approximation.

I use two different types of forms when making Shaker boxes. One form is the core around which I bend the bands, and the other form is the shaper that I plug into both sides of the bands for drying. By making up several sets of the shapers, I can mass-produce boxes with just one set of cores.

I made the cores out of pine or basswood, handsawing them to rough shape and then disc or beltsanding them to refine the shape. The shapers are made from $\frac{1}{2}$ -in.-thick pine for the #0 and #1 boxes and $\frac{5}{8}$ -in.-thick pine for the #2 through #4 boxes. Use the same oval patterns as for the cores, but cut slightly outside the line at a 10° bevel. The shaper slides easily into the band, but the increasing diameter of the beveled edge stretches the oval band as the shaper is pushed deeper into the band. Two holes drilled through



Beveling the finger edges and ends is much easier if the band is first soaked in hot water and securely clamped to the bench. Reposition the hardboard cutting block for each finger set so that knife kerfs from previous cuts don't affect the cut.

the shapers provide ventilation and a grip for pulling them out of the bands.

Another necessity for bending is a means of soaking the bands in hot water. I use a copper tray with a hinged lid, but a painted-steel window planter tray with a board on top also works well. Alternately, a vegetable drawer from an old refrigerator or a length of steel gutter with end caps and a plywood cover will do as well. An electric hot plate, as shown in the background of the photo at left on p. 56, works great for heating the water.

Shaping the fingers

Begin preparing the band stock by marking the finger pattern and tack locations, as shown in the drawing on p. 57, on the outside face of the band. Bandsaw the fingers along the layout lines to rough shape, and drill the $\frac{3}{64}$ -in.-dia. tack pilot holes. Trim the fingers to finished form by clamping the band onto a Masonite cutting



Tacking bands with an anvil backup, clinches the tack. Once tacked, the top band will be dried in place on the box band. Shapers in the box band on the bench keep the band's oval shape while it dries.

When wrapping a box band around the core, be sure the beveled fingers face out and that the tack line is centered on the oval. An electric hotplate heats the copper tray in which the bands are soaked for about 20 minutes before bending.

board and beveling the curved edge and end of each finger with a utility knife, as shown in the bottom photo on p. 55. I find it much easier to make and control the cut if I soak the fingers in a glass of hot water for a few minutes first. Try to maintain the bandsawn shape, and keep the tip of the finger about $\frac{3}{16}$ in. wide. Note that the bevel is greatest at the bases of the fingers, about 20° , and decreases to about 10° at the tips.

The final step in preparing the band stock for bending is to feather the end of the band opposite the fingers. Tapering the last 1 in. to $1\frac{1}{2}$ in. of the band eliminates a bump inside the box where the band ends. I prefer to taper the band on a belt sander using a scrap of wood to apply even pressure to the band. If you don't have a belt sander, then you can hand-plane this taper.

Bending the bands

Some folks shy away from projects that involve bending because they think it is difficult. However, the thin band stock, aided by a good soaking in hot water, bends easily around the core. You'll want to have everything ready, though, so you can bend the band before it cools, which it will do in about half a minute.

I soak the bands in hot water (180° or hotter) for at least 10 minutes; 20 minutes will ensure that the troublesome bands are fully soaked (nothing is gained or lost after a half-hour). When ready, wrap the

band around the core, making sure that the beveled side of the fingers faces out and that the tack line is aligned with the center of the oval core. If, during the bending process, you notice the veneer splitting or feathering, as shown in the top photo on p. 55, stop. Turn the band inside out, rebevel the fingers, reheat the band and rebend it with the better side out. From this point until the band is tacked together, be sure to hold all the fingers all the time or the band is likely to split up the middle between the fingers.

With the band wrapped around the core and the tack line centered on the core, draw a register mark across the top edges of the overlapped section at the front of the band. This register mark lets you open the band to release the core and then to push the band back together into the same size oval shaped on the core. Hammer the copper tacks, and clinch them at the same time by nailing over a pipe anvil, as shown in the photo at right on this page, to secure the fingers.

The top band is made by repeating all the steps for the box band, except the box band is used instead of a core to bend the top band. After tacking the top band, slide it back on the box band to dry.

Let the bands air dry for two days before continuing. Oval shapers pushed into the top and bottom of the band will maintain their shape. You can speed up the process with a fan, but this can increase the edge curling around the fingers.

Fitting tops and bottoms

Before proceeding with the top and bottom, I like to sand the inside of the box and top bands with 120-grit sandpaper. I also make sure the ends of the bands feather well into the inside contours while it's still easy to get at these surfaces.

To mark the oval shapes for the tops and bottoms, you can make appropriate-sized patterns for each box size or you can use the bands themselves as patterns. It usually doesn't make any difference when making the bottoms because the shapers have made the bands oval. But the top bands have a bump in them where they were wrapped over the fingers of the box band. On the #0 through #4 boxes, a pattern-shaped top can even out the oval. On larger boxes, the band is thicker and doesn't stretch so easily. Therefore, on the larger sizes, using the band for a pattern gives a better fit.

Once the bottom is marked and roughly bandsawn to shape, the final fitting is done on a disc sander with the table set to bevel the edge 4° . The cork effect of the beveled edge provides a tight fit between the bottom and the band where the edge has been flared by the shapers. Check the fit frequently as you gradually sand to the line. The bottom should be snug but not overly tight.

Finger direction on a box is determined by the side of the band on which the bottom is fitted. Most boxes have fingers pointing to the right, although left-point-

ing fingers are not uncommon. Top band fingers always point in the same direction as the bottom band. Determine which direction you want your fingers to point, and insert the bottom by fitting it against the front lap of the band and into both ends; then stretch the back of the band over the opposite edge. Press the bottom into place until the entire rim of the band is slightly above the surface.

When the bottom is pressed firmly into place, lightly sand it level on the belt sander. Now you also have a good opportunity to hide any gaps between the bottom and the band. First work some glue into the gap, and then immediately sand the bottom, either on the belt sander or by hand. The sanding dust will mix with the glue to form a filler that blends perfectly with the box.

The bottom is held in place with square, wooden pegs (toothpicks) driven into predrilled pilot holes. Pilot holes are $\frac{1}{16}$ in. dia. for the #0 and #1 boxes and $\frac{5}{64}$ in. dia. for #2 and larger boxes. Drill holes equally spaced around the box, 2 in. to 3 in. apart, tap the pegs into the holes and snip off the ends with diagonal cutters. You can then sand the toothpicks flush or trim them with a utility knife.

The top is made following the same procedure as for the bottom. However, a loose-fitting top band can be snugged up by changing the shape of the top oval. Elongating the top oval will move the slack in the band to the ends of the oval, causing the band to hug the box in the middle for a positive friction fit.

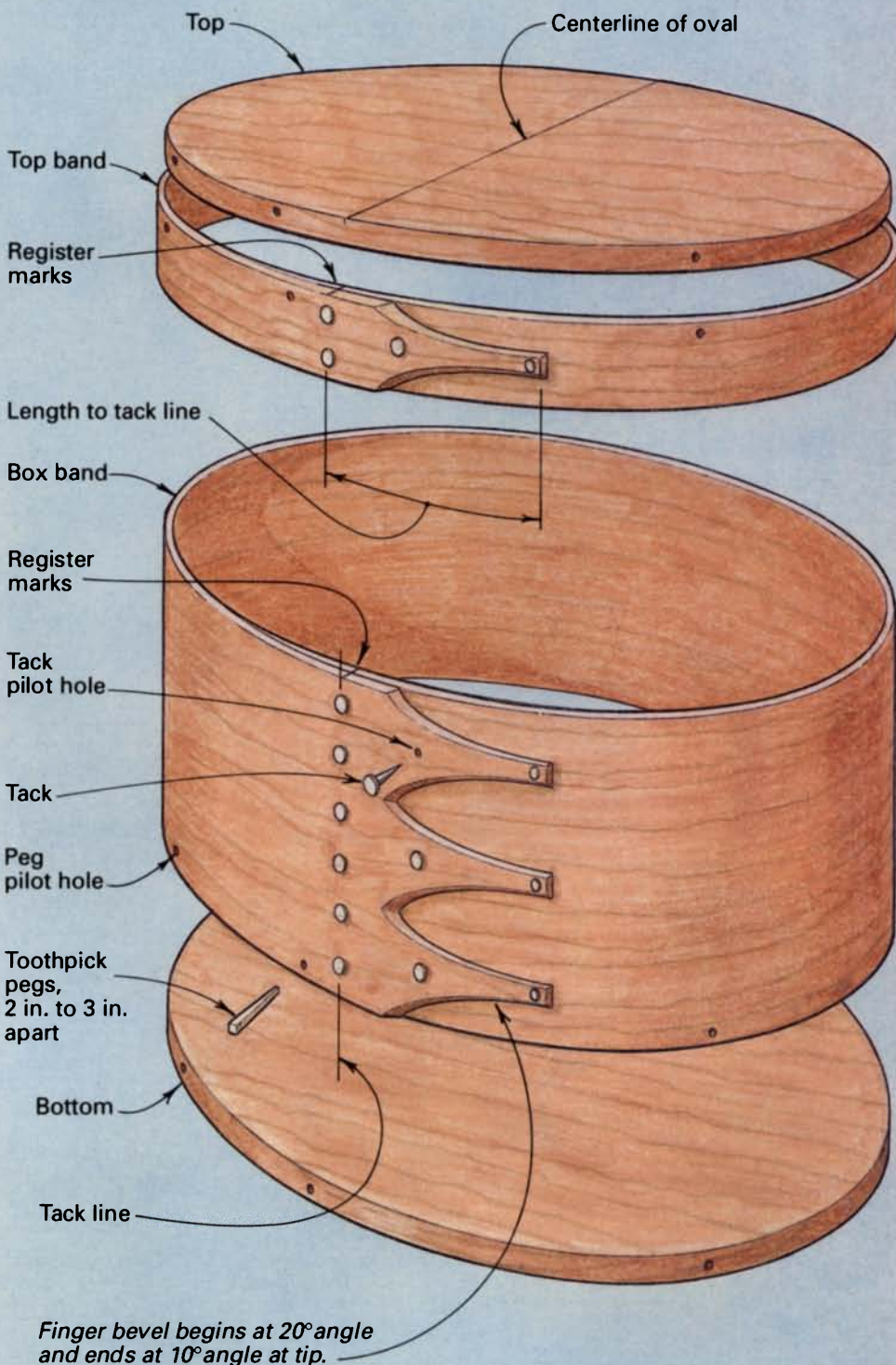
Finish the box

Shaker boxes can be painted, varnished or oiled. Before the mid-1800s, the Shakers usually painted their boxes. In later years, they varnished them. I use a clear lacquer on my boxes after hand-sanding the outside with 120-grit paper. I first brush on a sanding sealer, followed by a coat of lacquer. Although many woodworkers like the ease of application of an oil finish, I don't like the odor that lingers for months inside the closed boxes. Lacquer and shellac also give the sharpest image to my favorite bird's-eye maple tops. □

John Wilson is a Shaker box maker, instructor and supplier of parts, hardware and related tools in Charlotte, Mich. Contact the author directly for details on classes in your area or information on his complete line of Shaker box supplies and instructional material: The Home Shop, 500 E. Broadway Highway, Charlotte, Mich. 48813; (517) 543-5325.

Shaker oval boxes

The dimensions of oval box components vary depending upon the boxes. The chart below provides dimensions for the five most popular sizes.



Oval box dimensions

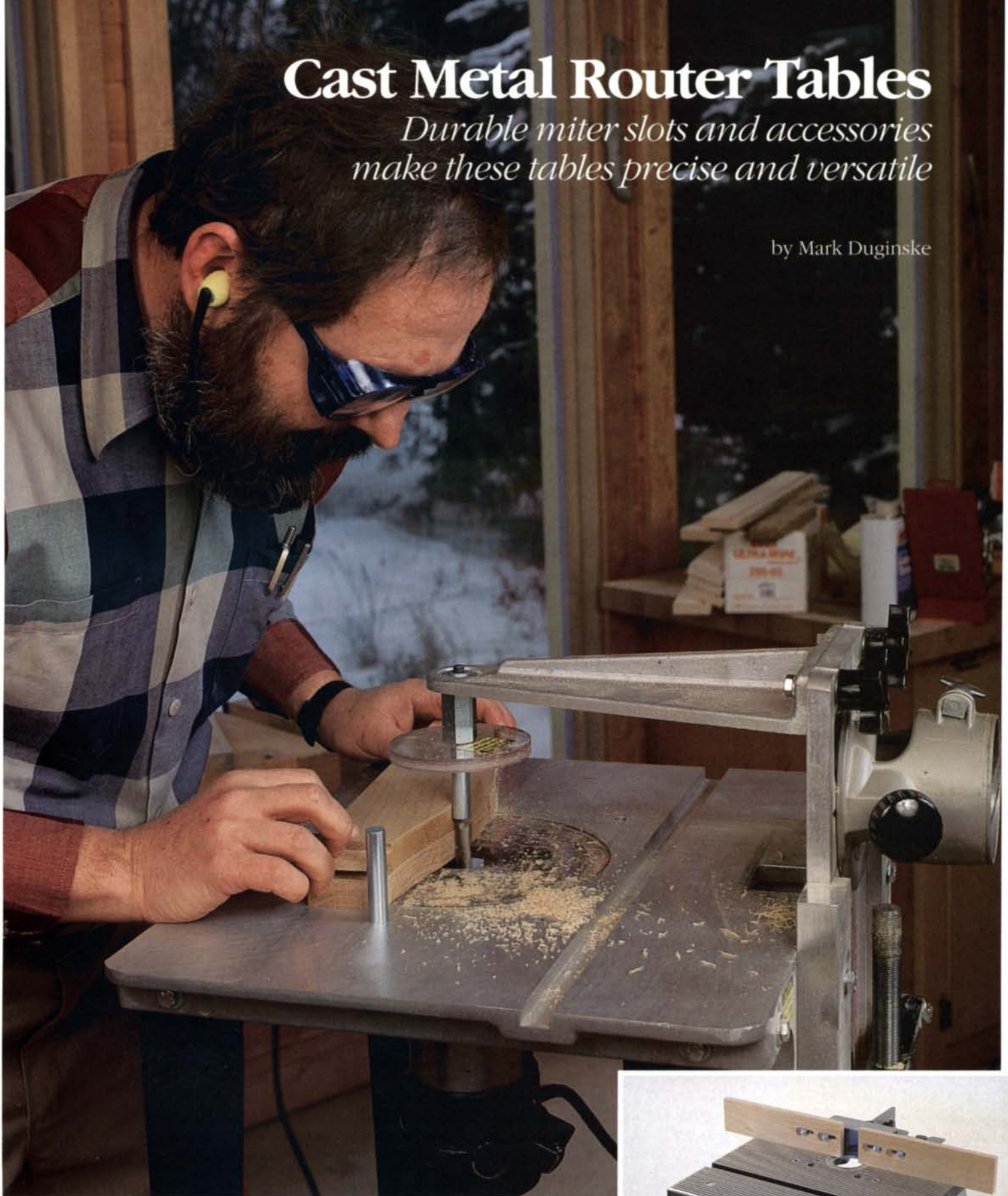
Box size	Bottom oval* (WxL)	Top and bottom thickness	Box band (TxWxL)	Top band (WxL)	No. of fingers-length to tack line	Tack size
#0	1 $\frac{1}{8}$ x 3 $\frac{1}{2}$	.195	.060 x 1 $\frac{1}{16}$ x 11 $\frac{1}{8}$	$\frac{7}{16}$ x 12 $\frac{1}{4}$	2 - 1 $\frac{1}{8}$	1 or 1 $\frac{1}{2}$
#1	2 $\frac{1}{16}$ x 4 $\frac{9}{16}$	.210	.062 x 1 $\frac{1}{2}$ x 15	$\frac{1}{2}$ x 15 $\frac{1}{2}$	2 - 1 $\frac{3}{4}$	1 or 1 $\frac{1}{2}$
#2	3 $\frac{1}{2}$ x 5 $\frac{3}{4}$	$\frac{1}{4}$	.067 x 2 x 19	$\frac{5}{8}$ x 19 $\frac{3}{4}$	2 - 1 $\frac{1}{8}$	1 $\frac{1}{2}$
#3	4 $\frac{1}{2}$ x 7	$\frac{1}{4}$	.072 x 2 $\frac{1}{2}$ x 23	1 $\frac{1}{16}$ x 24	2 or 3 - 2 $\frac{1}{16}$	1 $\frac{1}{2}$
#4	5 $\frac{1}{2}$ x 8 $\frac{1}{4}$	$\frac{1}{4}$	.077 x 3 $\frac{1}{16}$ x 27	$\frac{3}{4}$ x 28	3 - 2 $\frac{1}{4}$	2

* Top oval about $\frac{1}{8}$ in. larger than bottom oval.

Cast Metal Router Tables

Durable miter slots and accessories make these tables precise and versatile

by Mark Duginske



Porta-Nails' optional pin-router attachment (\$50) makes it possible to template rout any number of identical irregularly shaped pieces. The attachment is simple to set up and to adjust.

From left to right: Porter-Cable Model 695, Woodstock International W2000 Rebel, NuCraft Tools cast-iron router system and Porta-Nails universal router table. Each of these tables has a cast-metal tabletop and a miter-gauge slot.



Turning a router upside down increases its versatility dramatically. A router table provides both a large perpendicular reference surface (the table) and a long horizontal reference surface (the fence), making it possible to perform many tasks much more safely and with greater ease than is possible with a hand-held router and a clamped, makeshift fence or a bearing-guided bit. The router table has changed woodworking so much in the past decade, in fact, that a host of cottage industries have sprung up to support the demand. Once it was a somewhat obscure denizen of professional shops that couldn't justify the expense of a shaper, but the router table is probably rivaled in popularity today only by the tablesaw.

Many woodworkers made a first router table out of standard ¾-in. plywood, screwing the router directly to the plywood and then just running the bit up through the plywood. A refinement to this setup was the addition of a lift-out, plastic insert, which made changing bits considerably easier. Then, as router tables started to become available commercially, the plastic inserts were followed by leveling screws for the inserts, fancy fence setups, dust control hookups and elaborate base cabinets. Still, most of these tables have been and continue to be made of plywood or medium-density fiberboard (MDF), usually with a skin of plastic laminate. None of these plywood or MDF router tables have incorporated an adequate (non-wearing) miter-gauge slot in the table, and very few have miter-gauge slots at all.

In the past year or two, a number of metal router tables have been manufactured that attempt to address this and other inadequacies of conventional plywood and MDF router tables. Limiting the field to cast (as opposed to stamped metal) tables that take a conventional miter gauge (¾-in. by ¼-in. bar), I identified four models (see the photos below). I spent a few weeks working with all of the tables last December, using them for a variety of applications. This is what I found.

Porter-Cable Model 695

Porter-Cable's benchtop router table was the cheapest of the four. Though it lists for \$390 including the fence, I was able to pick it up for about \$135 at my local hardware store. It took only a few minutes to assemble. Stamped-steel legs screw directly to the underside of the table, placing the tabletop 10 in. off of your work surface (see the top photo on p. 60). The 16-in. by 20-in. table is sufficient for small- to medium-scale woodworking.

The die-cast aluminum table is the only one of the four that does not use a table insert. This could be a liability if you change bits frequently because it's awkward to reach under the table to loosen the collet. I intend to keep the table and use it as a dedicated rab-

beting station. Because all I'll have to do is change the height of the bit or reposition the fence, for my purposes, it's not a problem. Even so, Porter-Cable would do well to add a removable plastic insert to this table.

No miter gauge comes with the table, but my Delta miter gauge fit in the slot with only a few thousandths of an inch of play side to side, which is plenty precise for woodworking. A safety starting pin, which gives you a surface off of which to pivot the workpiece when you're working with a bearing-guided bit and no fence, comes standard. A safety guard for when the fence isn't in use also comes standard.

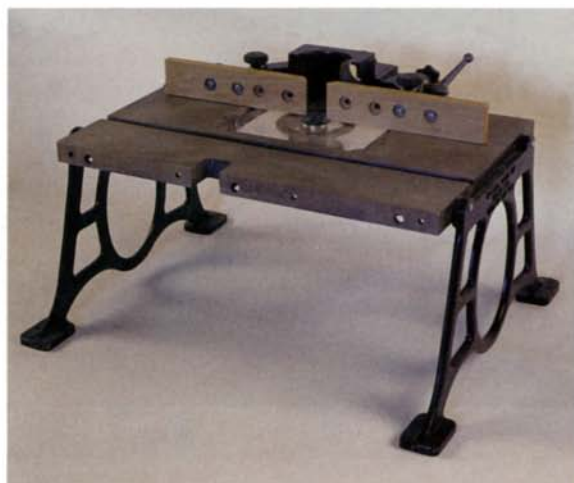
The standard fence, a stamped-metal, two-piece affair (like a shaper's), is this table's weakest link. The range of adjustment is so small—even with the fence back as far as it will go—that it restricts the operations you can perform. For example, when fully retracted, the front of the fence sits only about ⅛ in. behind the center of the bit, which makes routing dados impossible. If I were to buy this router table as my main router table, I'd do what I've done in the past and just build a pivoting wooden fence with a round dust port near the cutter to connect my shop vacuum.

The table's greatest strength (besides its price) is its portability. For small-scale architectural woodworking, in situations where lugging around a bigger router table would be a hassle, this unit is ideal. It's light enough to move easily, and it's also small enough to store under a bench or even in a good-sized tool storage cabinet.

Woodstock International W2000 Rebel

With its cast aluminum legs and stretchers, the Rebel is a rigid, solidly built router table (see the bottom photo on p. 60). It lists for about \$230 (you can find it for around \$200), and the inserts start at \$19.95. An optional safety switch costs \$12.95. The table surface is 18 in. by 24 in. and made of cast aluminum like the rest of the unit. Its 17 in. height was too tall for my workbench, but a separate stand is easy to make. Adjustable rubber feet screw into the bottom of the aluminum legs, so it's easy to level the unit on an uneven surface. If I were to buy this table, I'd remove the rubber feet and screw the router table securely to a base cabinet.

A miter gauge, safety guard and a fence system consisting of two independent halves come standard with the table. Each half of the fence system is secured to the top of the table with bolts that slide in two slots. This style fence is convenient on a shaper but overkill on a router table, requiring more time and effort than it's worth. Apparently, from looking through the owner's manual (this manual was the best of the lot), this fence configuration is designed to accommodate two Incra Jigs, one on each side of the bit. Whether you use such aftermarket jigs will determine how important this



feature is to you, but I found the whole fence setup inconvenient.

When I first tested it, this table's real liability was its plastic insert. With my Porter-Cable 690 mounted to it, the ¼-in.-thick insert sagged nearly ⅛ in. at the middle of its 11-in.-sq. surface. The idea of hanging a 3½-hp router from this insert made me nervous.

Apparently, I wasn't the only one who noticed this problem. When I called Woodstock to mention it, the product manager told me that new inserts, one of ¼-in. aluminum and one of ⅜-in. clear plastic, were already in the works and that they'd send one out to me as soon as they became available. A couple of weeks later, I received the aluminum insert. I mounted the same router to it and even pushed down near the center of the insert, but there was no deflection.

A nice feature of this aluminum insert is that there's a round 4⅝-in. hole in the middle that accepts snap-in, friction-fit plastic inserts. The rigid aluminum insert supports the router, but the plastic snap-in inserts make it possible to have a bearing surface for the



Simple, inexpensive and portable, the Porter-Cable Model 695 is a good buy for under \$150.

Cast aluminum tabletop, legs and stretchers give the Woodstock International W2000 Rebel a solid chassis. Because of its 17-in. height, it's best used on a dedicated stand.



workpiece right up to the bit, resulting in safer and more precise routing (because it's easier to set bit height more accurately).

Woodstock's other new insert, is made of ⅜-in. clear plastic and is rabbeted around its edges so that it sits flush with the aluminum table. It is not drilled out at all, so if you get this insert, you'll have to drill and countersink holes at the corners for the hold-down screws, and run your bit up through the plastic for a center hole.

NuCraft Tools cast-iron router system

From tabletop to extension wing to ornate legs to a shaper fence, all of NuCraft Tools' router-table components are made of premium-grade, fine-grained cast iron and plenty of it. Both the table and extension surfaces and the ribs beneath are at least ⅝ in. thick, and there's more than enough iron surrounding the miter slot. Anyone fond of turn-of-the-century machines will appreciate NuCraft Tools' marriage of 19th- and 20th-century technologies.

The tabletop itself (Model 100; \$295) is 18 in. by 27 in., so it attaches neatly to the standard Delta, Sears and Taiwanese table-saws as an extension table (see the top photo on the facing page). The tabletop also can be used as a stand-alone with cast-iron legs, which are sold separately (Model 200; \$125). Also available is a 12-in. by 27-in. extension wing (Model 300; \$155), which can be attached either to the left side of a tablesaw as an extension wing or mounted to the stand-alone router table along with the cast-iron legs.

This router table's greatest asset *and* its greatest liability (besides its price) is its weight. The tabletop weighs in at 65 lbs.; the extension wing adds over 45 lbs.; and the legs, at 15 lbs. each, bring the total to over 140 lbs. Even with Porter-Cable's biggest, variable-speed monster industrial router and a conventional panel-raising bit humming at however many thousand rpms, this table's not going to vibrate, which besides the miter-gauge slot, is one of the best reasons to consider a metal router table. By the same token, if you have to move your router table around often, you're going to need a helper or a good back and a back-support brace; it's no fun hauling this setup around. Attaching just the main table to my tablesaw was a two-person job.

The plastic insert plate is ⅝ in. thick and has holes for the hold-down screws at the corners. This was the only table-insert combination without a leveling mechanism. Because the cast iron is so fine-grained, though, I was able to drill and tap holes near the corners for Allen screws.

The most recent NuCraft Tools accessory is a heavy-duty shaper-style fence (Model 400; \$110). My prejudices aside (I don't think this style fence makes all that much sense for a router table), the fence was ground in such a way that the two halves of the fence both tilted in toward the bit. This caused the workpiece to catch on the lip of the outfeed fence. I pulled the workpiece away from the fence, finished the pass and then examined the workpiece. It was slightly convex and the rabbet was cut deeper on the portion that was routed before it reached the outfeed table. Curious whether I'd received a lemon, I obtained another fence. The results were the same—all the more reason to use a simple shop-built fence. If you really like this style fence, you could have the fence halves reground (at some expense), or you could joint their wooden faces. But for \$110, I'd expect better.

Other accessories will be available soon, including a horizontal milling attachment.

Porta-Nails universal router table

The 16-in. by 20-in. cast-aluminum table by Porta-Nails sells for \$359, which might seem a little high, but this table is the most ver-

satellite of the four I looked at. The table itself is nothing fancy—just a well-machined, heavy-duty, aluminum casting with a miter-gauge slot, leveling screws and a round $\frac{3}{8}$ -in. plastic insert. The legs are stamped steel, and they're attached to a wooden base that is easily clamped to a table, which makes this machine almost ready to go out of the box. But it's the accessories for this table that really make it shine.

An adjustable joint-making attachment (the Joint Maker, which comes standard) mounts to the rear of the table and supports the router horizontally (see the bottom photo on this page). The Joint Maker is moved up and down with a crank. One full turn moves the bit vertically $\frac{1}{16}$ in; it's easy to adjust to within $\frac{1}{64}$ in. or even $\frac{1}{128}$ in. This degree of precision makes it useful for cutting finger joints, dovetails, mortises and tenons, which is what it's designed for. The Joint Maker is also useful in a number of other routing situations. For example, with a safety cut, raised-panel bit, you can raise panels with the panels laying flat on the table instead of sticking up into the air, standing only on a thin edge.

Another standard feature is the safety starting pin. Porta-Nails router table is the only one besides the Porter-Cable Model 695 to offer this feature.

Options include a small miter gauge for \$12.95 and a fence for \$19.95. The miter gauge is necessary because the miter-gauge slot on this table is positioned too close to the bit for a standard miter gauge to pass by the bit. But the fence is just a simple piece of aluminum with a hole in it; for \$19.95, you can do as well or better making your own fence of wood.

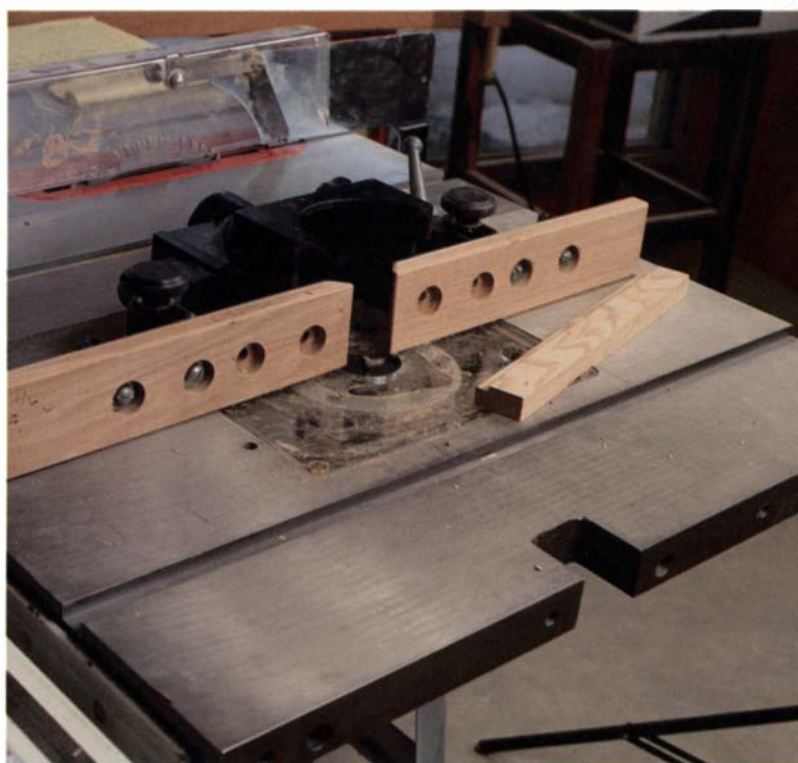
Fifty dollars will buy you the optional pin-router attachment, which bolts easily to the Porta-Nails Joint Maker (see the photo on p. 58). It's money well-spent. Cranking the Joint Maker's lead screw raises and lowers the pin over the center of the router bit. The pin can also be adjusted in, out, left and right. Once you've aligned the pin and bit, all you do is attach a template to the blank you're routing and run the template against the pin. Template-routing makes duplication of irregularly shaped parts a straightforward affair, and the Porta-Nails pin router attachment makes template-routing affordable.

Conclusions

Any of these tables lets you cut tenons and half-laps quickly and precisely with a miter gauge, a significant advantage over conventional router tables. The Porter-Cable Model 695 and the Woodstock International W2000 Rebel are both priced to compete with the plywood and MDF tables. The Porta-Nails universal router system and the Porter-Cable (for most operations) require very little tweaking before use, whereas the NuCraft Tools Model 100 requires drilling and tapping for the plastic insert, and the Woodstock International plastic insert needs to have its corner holes and center hole drilled. The NuCraft Tools table, with or without legs, extension wing and shaper fence is without a doubt the toughest of the four, but it's also the heaviest and the most expensive (\$685 with all the accessories listed here).

Each of the tables has its strengths and its weaknesses, but the table that really stands out is the Porta-Nails universal router system. At \$458, including the miter gauge and the pin-router attachment, this table is a true bargain, letting you do far more than you can with a regular router table even with a miter gauge. We will most likely be seeing more systems like this one in the next couple of years as other manufacturers become aware of the router table's real potential. □

Mark Duginske is a contributing editor to Fine Woodworking and a woodworker, teacher and author. He lives in Wausau, Wis.



Sixty-five pounds of cast iron goes a long way toward damping router-induced vibrations. NuCraft Tools Model 100 router table can either be attached to a standard contractor's or cabinet-style tablesaw as shown here, or it can be used as a stand-alone with cast-iron legs also sold by NuCraft.

The Porta-Nails Joint Maker accessory, which comes standard with the table, mounts the router horizontally. Used along with the miter gauge, it lets you rout tenons, mortises, finger joints and dovetails quickly and easily. It also makes other operations such as panel-raising safer and less prone to error.



Sources of supply

NuCraft Tools Inc., PO Box 87616, Canton, MI 48187-0616; (313) 981-4454

Porta-Nails, Inc., PO Box 1257, Wilmington, NC 28402; (800) 634-9281

Porter-Cable Corporation, 4825 Highway 45 N., PO Box 2468, Jackson, TN 38302-2468; (901) 668-8600

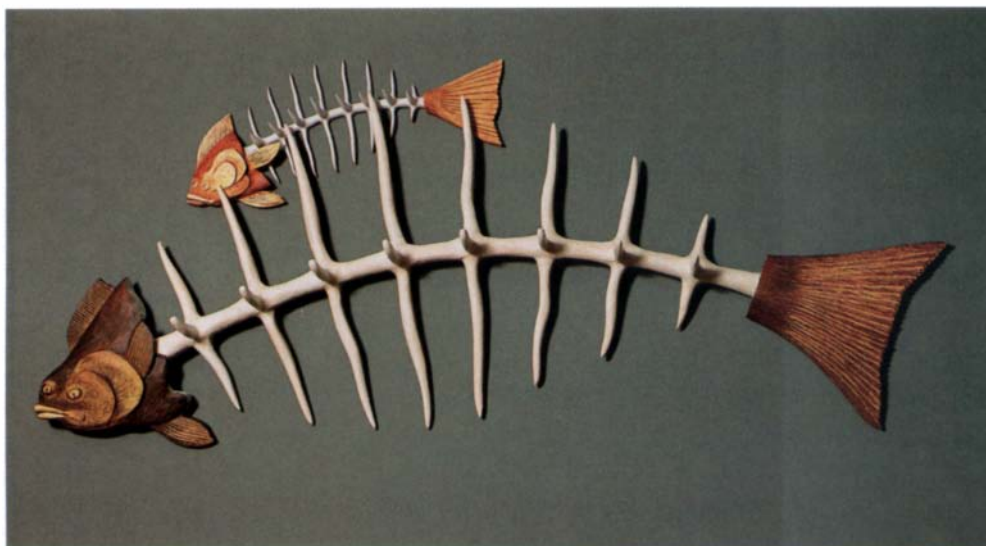
Woodstock International, Inc., PO Box 2027, Bellingham, WA 98227; (206) 734-3482

Fishy Work in Douglas Fir

Clean lines meet carved fish in a carpenter's furniture

by Jonathan Binzen





These halibut hat racks, carved of sugar pine, recall Miller's days as a commercial halibut fisherman in Alaska. On the larger rack, which is 6 ft., 6 in. long, the peg ribs, mortised straight through the bent-laminated spine, are strong enough to hold winter coats. Miller simulated the pitting of exposed bone with a rasp and coarse sandpaper; then he painted the skeletons with an undercoat of grayish white acrylic before applying a series of wash coats of highly thinned iron oxide.

A fish and two legs to stand on—The two familiar-looking legs on this end table are joined to the top with wedged through-tenons. The third leg is attached with...what do you call it, a fin-buttressed flank joint? Miller rounded under the table's edge elsewhere, but where it meets the fish, the edge is flattened to its full thickness and let into the side of the fish. There it is pocket-screwed from below and glued, with the fin above providing some added rigidity.

Organic forms in an angular frame—In Charles Dean Miller's Eel Bed, the stark lines and tight, straight grain of the rails and legs accentuate the shimmy of the eels and the wavering of the sculpted slats they swim through. To emulate an eel's natural camouflage in eel grass, Miller painted his sugar pine eels in colors that anticipate the deeper orange tones that time will give the Douglas fir slats and frame.



Solid but lighthearted, angular and organic, architectural yet rooted in nature—these attributes all swim together in Charles Dean Miller's fish-motif furniture displayed on these pages. And they all make sense when you learn that similar contrasts appear on Miller's resume. A former builder and trim carpenter, he has also illustrated books and magazine articles and worked, for a time, as a commercial fisherman.

True to his carpentering roots and to his current work as senior editor of *Fine Homebuilding* magazine, Miller used old-growth Douglas fir for the structural members of his furniture. He stock-piled the fir over the years by scouring the stacks of 2x6s at a local lumberyard for sticks with tight, vertical grain. As his pile grew, he looked at it as "furniture that hadn't been made yet." But he wasn't thinking of 2x furniture. When he went to work with

the wood, he planed his stock down or glued it up to dimensions that don't hint of its origins as construction lumber.

To join structural members, he used traditional furnituremaking joinery with a dash of carpentry technique. The end stretchers of his dining table (see the bottom photo on p. 64), for example, were joined to the legs with through-tenons that have drywall screws, counterbored and plugged, in place of pegs.

For the carved elements in his furniture, Miller likes to use sugar pine because it's easy to carve and easy to paint and smells good, too. He uses Ponderosa pine—shelving pine—if sugar pine is not available. He lays up carving blanks for the fish in stack-laminated blocks, mortising in any fins or other delicate, protruding parts that require the strength of long grain.

Though he uses hand tools whenever he can in carving, Miller



A standing lamp, a leaping fish—Miller gouged mating V-shaped channels in the two halves of the fish blank before gluing them up, so he could thread the lamp wire through when the carving was complete. He calls the piece Fish Stick, “because it’s basically a stud with a fish sticking through it.”



Bright fish in sedate surroundings—Miller clear-finished the Douglas fir structure and slats of his dining table to create a neutral background for the brilliant colors of the fish. As with the Eel Bed (see the photo on p. 62), he used straight grain and a rectilinear design to provide contrast with the movement of the carvings. Miller created swim-ways for the fish by offsetting the slat mortises.

says that he is far from a purist. He generally uses power carving tools to rough things out, reaching for any tool that will do the job efficiently. To shape the sinuous slats in his bed (see the photo on p. 62), he started with a bandsaw and finished with a belt sander clamped to his benchtop. From an array of gouges and chisels, he singles out as one of his favorites a Japanese fish-tailed gouge, appropriately enough, that enables him to reach into acutely angled corners and recesses.

Miller gessos the completed carvings, and then he uses brushes and rags to apply acrylic paint. The surfaces of his carvings are rich in texture, some of it achieved with the gouge, some of it with layers and ledges of paint. Even those pieces that register

as brilliant spots of color from across the room are seen, close up, to be subtle compositions in shade and contour.

The refinement of Miller's painting techniques and the direct appeal of his work make another unlikely—yet successful—combination. And with so many contrasts in the work itself, it shouldn't be surprising that Miller's sources of inspiration were not entirely predictable either. After mentioning furnituremakers Wharton Esherick and Judy Kensley McKie as people whose work has influenced his, Miller quickly added, “Oh—and Dr. Suess. I've been reading *McElligot's Pool* with my younger son.” □

Jonathan Binzen is an assistant editor at Fine Woodworking.

Tulip: Wallflower at the Hardwood Ball

Oft mistaken and maligned, it deserves a place on the cabinetmaker's dance card

by John Sillick

I became an ardent fan of tulip, or yellow poplar, the night I ran a pile of it through my planer.

I had found a large fallen tree in the woods and dragged it to a neighbor who milled it. The log minus a shattered lower 8 ft. yielded about 700 bd. ft. I stickered and stacked it for a couple of months and then under the press of circumstance, got ready to use it for the shelving project that I did not wish to expend my oak or cherry for. Board after board came through the planer even and clean. I had expected some fuzzing but was excited to see the smooth shine of the surface. Boards 14 in. wide after air-drying in piles only 4 ft. high showed less than 1/8-in. cup (see the top left photo on p. 67). The shop was filled with a mellow sweetness as fresh-cut wood met the air.

The creamy yellow wood had a wide, even grain. Some boards had a slight olive tinge. I wiped on some cherry stain and was struck by the alchemy of it. Suddenly it looked like a cherry board. Trying a woodworker's "thumbnail" test, I expected the resistance of basswood or white pine, but found this board was much harder.

I wondered why tulip wasn't on everyone's list as a favorite wood. I found two reasons for tulip's secondary status today. First, tulip is widely perceived as a poplar species with all the faults of that wood. Second, the olive coloration of some tulip boards puts some people off. But with understanding, neither trait should continue to dog this deserving and available wood.

Exploring the tulip mystery

After my planing discovery, I looked up this wood variously called yellow poplar or tulip and discovered how ignorant I was

about *Liriodendron tulipifera*. I encountered a mystery of mistaken identity and misinformation, which has limited appreciation and use of a worthy hardwood.

Tulip has a curious history. This large, productive tree was much appreciated in colonial times. Easy to mill and dry, it worked superbly with hand tools to be fashioned into gun stocks, coffins, stairways, flooring, tables and cabinets. It was used to line wells and to produce woodenware, for it imparted no taste. It was considered neither too soft nor too weak.

Peter Kalm, an 18th-century Swedish botanist who was a student of Linnaeus and friend of Benjamin Franklin, became a great admirer of the tulip tree when he made a pilgrimage to America. He recounted seeing a barn made from the wood of a single monster tulip tree.

Since the demise of the chestnut, tulip has become the most common tree in the Appalachian forest and is the largest hardwood tree in the United States.

What's in a name?

True poplar is light, prone to distortion and molds poorly. Trying to sand planer fuzz from a stack of poplar boards is a good exercise in patience. Yellow poplar has nothing in common with true poplar except an initial yellow color and the way the leaves of both species tremble in a light breeze. But tulip is routinely sold as poplar and generally is mistaken as a member of the poplar family.

Liriodendron tulipifera (literally, "lily-tree bearing tulips") is actually a magnolia but has had a variety of names. Yellow poplar is its official common name, but it is also called canoe-wood (a reference to the immense canoes that were charred and



Straight and tall, the dark trunk of a tulip tree stands out near Lake Ontario.

dug out of its massive clear trunks), white-wood, white poplar, tuliptree and tulip poplar. In the United Kingdom, it is dubbed canary whitewood. To season this kettle of confusion, tulipwood is also the name given to the tropical timber *Dalbergia oliveri*, which is unrelated to domestic tulip. Tulip's willingness to accept stains has earned it the name chameleon wood and allows it to be mistaken for cherry when it's stained.

Where and how does it grow?

One sawyer, who cut 5,500 ft. of nice tulip for me, argued strongly that tulip was the same wood as the poplar tree that stood by his drainage ditch. In fact, tulip will not grow in wet locations, preferring hilly coves and upland soils.

Tulip seedlings prefer lots of sunlight. In our woods, young trees appear only where trees have been harvested, and the canopy is open. The best stands appear on cut-over land where tulips will pioneer the new forest. Our stands of tulip by Lake Ontario are an anomaly of our micro-climate. The tree's natural range is Pennsylvania through Georgia, mostly east of the Mississippi. Two states, Indiana and Tennessee, claim it as their state tree.

Tulip can grow as fast as Douglas fir and

can live 200 years. Although heavily lumbered, giants are still encountered. A tulip with a girth of more than 24 ft. was recently harvested in North Carolina. A stand of tulip at its growth peak can produce a 1,000-bd.-ft.-per-acre gain in one year. A tulip can reach a height of 50 ft. in only 11 years. At 50 years old, it can be 120 ft. tall with a diameter of 24 in.

In a woodland setting, tulip trees stand out dramatically with their broad, remarkably cylindrical trunks. In our woods, 80-year-old trees stand clear 50 ft. to the crown, towering above their contemporaries (see the photo on p. 65). When Thomas Jefferson was building Monticello, he went to the woods for his Greek columns and brought in tulip trunks.

Tulip is also becoming a popular ornamental tree. The tree blooms in spring with large white tulip-like flowers, which reveal its magnolia kinship and are very popular with bees. In summer, the tree has beautiful large four-pointed leaves, which resemble the profile of a tulip flower. The leaves each unfold from an envelope during the growing season. In winter the tree decorates itself with seed pods.

Tulip is remarkably free of disease and suffers little from pest damage. Ice storms do wreak havoc with its branches, and

stands should be carefully thinned so that canopies do not spread excessively.

What's the wood like?

Working with tulip (see the box below) quickly shows its obvious differences with poplar. Most poplars are light with a specific gravity of about .34, about the same density as white pine or basswood. Tulip is variably reported as .42 to .45, which is close to cherry (.50). The diffuse-porous structure of tulip is such that it is more resistant to denting than we would expect. It is at least 25% more compression resistant than white pine. Tulip's 15,900 psi tensile strength rating is twice that of the poplars and exceeds even hard maple.

Although not often noted, tulip exhibits interesting figure in its usually regular grain. Patches of bird's-eye-like ovals and quilting are often seen, although not as densely as found in maple. Ray fleck is as common in tulip as it is in maple or cherry.

Tulip is our second most widely exported hardwood. Only the combined oaks exceed it. Almost half of the tulip we send overseas goes to Japan. Methods are being developed to finish tulip in the deep reds and black that are popular in the Orient. Tulip is also finding a niche as a replacement for some rain forest lumber.

Working with tulip shows its versatility



Strong and flexible, thin strips of tulip can be bent in relatively tight circles without cracking, as demonstrated by the author.

Tulip dries quickly and is stable, finishes like a dream and planes and molds well. It also holds nails well (though it is often hard enough to require drilling for finishing nails). The National Lumber Standards Committee accredited tulip as a construction material in 1978.

In the lumber trade, tulip is sometimes called the "money tree" because tulip logs produce so much more usable stock than other species. Sawyers report that a tulip log will yield 10% more than other logs of comparable size.

Although tulip is routinely described as "soft and weak," it is surprising to see how well it turns on the lathe. I trimmed a room in tulip in an old house and turned plinth blocks for the corners of the doors and windows. If a wood has any tendency to tear during turning, it will be evident during such faceplate work. The blocks were quick to cut, needed very little sanding and had enough strength to maintain fine molded profiles. It shapes well, as shown in the bottom left photo on the facing page, and even has been used as a tone wood for musical instruments such

as dulcimers (see the bottom right photo on the facing page).

This wood is also remarkably flexible. Thin strips can be bent into surprisingly tight circles without signs of cracking, as shown in the photo at left.

Tulip is marketed as "unselected for color," and the buyer can expect a variety of tones. The black and purple streaks that sometimes show up are thought to result from improper log storage or lack of air circulation in drying. This is found in less than 10% of tulip. Such boards can be used as secondary wood in construction or be taken advantage of as accent wood.

The tulip I like best is the pale green heartwood. It is hard, sands very smooth, its pores stain evenly and the wood quickly turns a warm brown in full sunlight. Green-colored tulip stains a better brown if it gets a suntan first.

Tulip's wide grain and even acceptance of stains invite finishers to simulate cherry and walnut. The color that pleases my eye, however, is a golden brown, such as produced by Minwax Golden Oak. —J.S.



Clear, flat and wide—Yellow poplar, or tulip, is known for producing wide, clear boards, and it dries remarkably flat. A framing square resting on this board shows less than $\frac{1}{8}$ -in. cup over 15 in.

Sensitive to sun and spalting—Tulip quickly darkens in direct sunlight, as shown by the shadow on the board at far right. A shadow like this can be obtained in less than an hour in summer sun. The board at near right is an example of spalted tulip.



The ignorance that currently clouds tulip is another advantage, for it means the wood can be had cheaply. Clear tulip can sometimes cost as little as one-half the price of clear pine. I recently bought a few truckloads of tulip logs and had them milled. The total cost ran less than \$250 per 1,000 bd. ft. Although the boards were cut from the second log in the tree, many of them are furniture quality; about a quarter of the 8-in. boards are clear 14 ft.

Tulip's more unusual aspects

One factor that retards wider use of tulip is the perception that its color is unattrac-

tive. Most tulip sapwood boards are a creamy yellow; the heartwood frequently has a yellow-green tint. Occasionally, boards have a wild purple streaking. But as noted earlier, tulip stains well, and browns easily mask the yellow and green.

However, there is no real need to stain tulip because this wood is extremely photosensitive. The yellows go light brown in a matter of hours in direct sunlight, and the green tint quickly turns a warm cherry brown in an afternoon. The speed at which the sun works on tulip is remarkable (see the top right photo). But artificial light does not seem to color

the wood appreciably. Damp tulip wood also spalts quickly in warm weather.

In the face of the growing hardwood demand, tulip (or as the Hardwood Export Trade Council suggests, American tulipwood) has great potential. It's vigorous growing, available, economical, pleasant to work with and attractive to look at when it is finished. Even so, the "Queen of the Forest" remains the Cinderella of the workshop. But tulip is just too deserving not to be going to the ball soon. □

John Sillick makes and repairs furniture in Lyndonville, N.Y.



Easily shaped, tulip works well for these raised-panel shutters made by Shane Secrist of Newfane, N.Y.



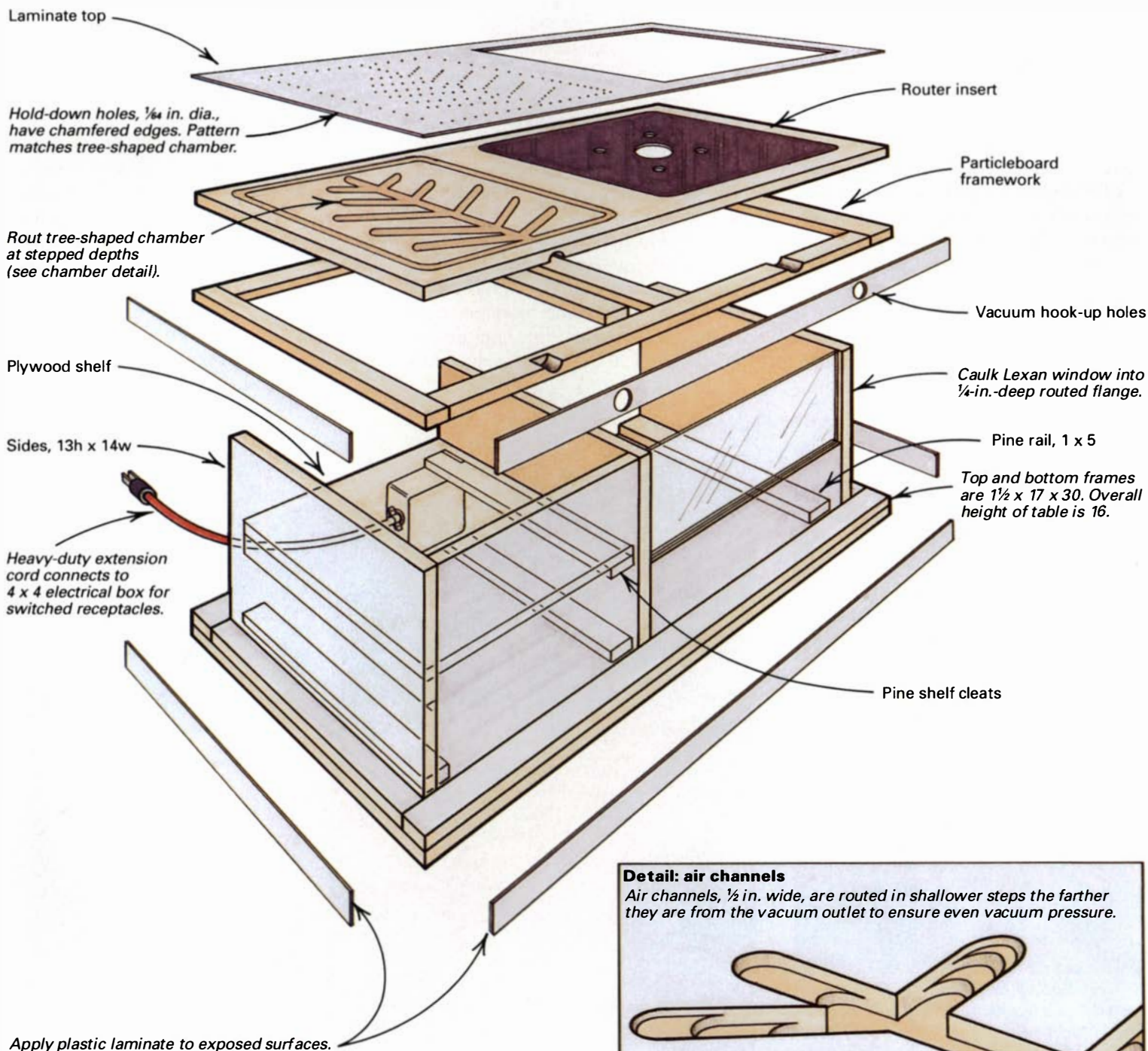
Versatile wood—Tulip shows its range of uses in a dulcimer built by Nils R. Caspersson of Holley, N.Y., and a blanket chest built by the author.

Vacuum Hold-Down Table

Knockdown sanding and routing platform grips work and controls dust

by Mike M. McCallum

All $\frac{1}{8}$ -in. high-density particleboard, unless noted

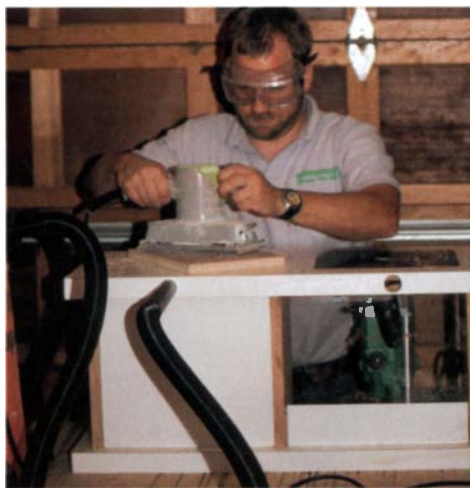


When I'm constructing a set of custom cabinets, I frequently need an extra pair of hands, especially when I'm sanding drawer fronts or drilling odd-shaped pieces. Occasionally, I also need a table-mounted router. More often than not, I require that router table or those pair of hands at a job site. After putting up with cobbled scraps, make-shift clamps and excessive router dust one too many times, I came up with a design for a router table that's also a vacuum hold-down. Using scrap materials, I built the table so that I could easily disassemble it for storage or transport.

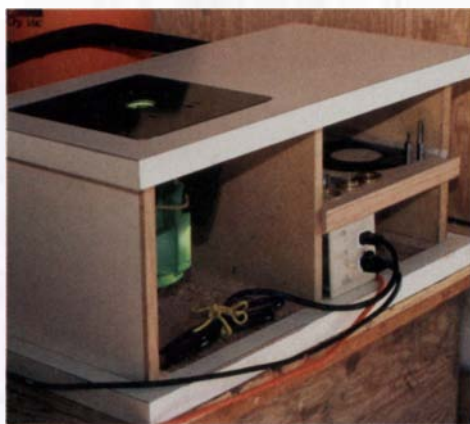
I call my knockdown platform a super router/hold-down table for a couple of reasons. First, it's stout, turning my router into a light-capacity shaper. Second, it enables my shop vacuum to serve dual functions by providing suction for the hold-down surface or collecting dust from the router table. And while I don't use the hold-down to freehand-route large workpieces, I do rely on its substantial holding power for most of my sanding and finishing work (see the top photo).

Design and construction—The dimensions of the hold-down table are not critical, but be sure to adjust for the size of your work area, vacuum hose and router. I made my table out of $\frac{5}{8}$ -in. high-density particleboard and covered exposed surfaces with scraps of plastic laminate. The top is removable, so I can use the vacuum table on my benchtop. I stiffened the table's top and bottom by gluing on a particleboard framework, as shown in the drawing on the facing page. The top and bottom frames hold the sides and center divider in place without fasteners, allowing easy knockdown of the unit. After assembling the top and bottom oversized, I trimmed the parts square. I laminated all the pieces, and then I bored two holes in the edge of the table, so I can connect my shop vacuum to either the router-table or hold-down side (see the top photo). To power the table, I ran a heavy-duty extension cord to a 4x4 electrical box and mounted the box's stud bracket to the inside of the platform. The box houses switched receptacles for both the router (or sander) and shop vacuum. I also added a plywood shelf (see the bottom photo) to the table to hold tools, bits, guide bushings and adapters. I ordered most of these accessories through MLCS Ltd. (P.O. Box 4053 C-13, Rydal, Penn. 19046).

The router-table side—I made a clear window for the router table from Lexan, which I recycled from a computer-store display. The window is a good safety feature because it lets in enough light to see the collet when I'm adjusting the bit height or using the router table. The router insert is a standard one—it fits whatever bit I'm using. Oak Park Enterprises, Ltd. (Box 13, Station A, Winnipeg, Manitoba, Canada R3K-129) carries complete bearing and insert kits for various router models. To prevent vibration and flush the



Vacuum side has plenty of clamping power—The vacuum surface (left) clamps a drawer front as the author sands its face. An open hole on the edge of the table (right) shows where he connects his shop vacuum when he's routing.



To wire his table, the author fed a 4-in. work box for a pair of switched receptacles: one for the vacuum, one for a router or sander. A shelf at the back of the table holds tools and accessories. He drew outlines of the items and routed recesses to hold each shape, which reminds him when something's missing.

router-table surface, I oiled the insert's bearing surface and then caulked the face of the insert with silicone before I placed it into the flange that I had routed into the tabletop. I clamped the assembly flat on my tablesaw. In use, I estimate that my 5-gal. collector sucks up about 50% of the dust from the router. I'm sure that with a few provisions, such as adding intake holes, I could improve the dust-collection capability considerably.

The hold-down side—On a piece of tracing paper, I drew an evenly spaced tree-shaped hole pattern that was suitable for my hold-down needs. After I transferred the tree pattern onto the particleboard top, I freehand routed the air channels for the vacuum chamber. To ensure an even vacuum across the hold-down surface, I routed the channels at ascending depths (see the air-channel detail in the drawing). I based the stepped depths on vacuum-drop ratios for the chamber volume. If you're using plywood for the table, paint or seal the routed pattern to prevent air leaks before you glue on the laminate. To make the hole pattern in the laminate, I first placed a clear piece of plastic over the routed chamber and poked out a hole pattern to follow the air-channel shape. Then I used a crayon to rub the hole locations onto the laminate. When boring through the laminate, use a tiny bit (I used a $\frac{1}{64}$ -in. twist drill). The small orifices, through the Venturi principle, increase the vacuum. Finally, lightly countersink the holes.

Using the vacuum hold-down—As long as my workpiece has a flat surface to put down on the hold-down table, I've found that there's plenty of suction—enough to grip a piece of low-grade plywood. To increase the holding pressure, you could also block off holes that are not covered by the workpiece. On rough surfaces, I take a $\frac{1}{8}$ -in.-thick piece of closed-cell plastic (shipper's foam) to make a gasket. With a utility knife, I cut out an appropriate shape that still allows the vacuum to suck the workpiece down. I use a couple of pieces of masking tape to hold the gasket to the table. If you need to hold down a sphere, an odd shape or a piece with a very uneven surface, you can make a holder as follows: Sculpt out a Styrofoam gasket for the shape you want to secure. In a well-ventilated area or outdoors, heat up a piece of nichrome or small stainless-steel wire with a propane torch, so you can make a series of holes through the gasket. Tape the Styrofoam to the hold-down table, and you've got a fairly quick clamp to hold just about any shape that you have to sand or drill holes in. So far, I've been delighted with the possibilities of the hold-down table. In fact, I'm working on a sliding saw table that uses a similar vacuum hold-down system. □

Mike McCallum is an artist who does custom architectural woodworking in Portland, Ore.



Blending several colors on a hot knife yields just the right shade for an invisible repair. After mixing the resin thoroughly with a small screwdriver, the author flows the molten resin into the damaged area. Burn-in repairs will accept virtually any topcoat.

Burning In Invisible Repairs

Hot knife and resin sticks save time and effort

by Robert Judd

Whether trying to rescue a hand-polished antique or save a chunk of exotic hardwood from the scrap pile, burn-in sticks and a hot knife can make virtually invisible repairs. A distant cousin of sealing wax, burn-in techniques have been around for centuries. Burning-in can disguise or cosmetically cover scratches, chips and other damage in a finely finished piece. The repair sticks are available in a host of colors and tints and readily intermix to match any color. Because the various resins and materials used to formulate the repair sticks

accept virtually any topcoat, the repair's finish can precisely match the original. A burn-in repair is a reversible process; you can scrape it out and start over if you don't like the color match or result. These simple repairs can save hours of rebuilding or refinishing time.

In this article, I'll look at the burn-in repair process: color matching, preparation, filling the defect, leveling the repair, adding wood-grain details and touch-up finishing. Before trying to repair your favorite piece of furniture, I suggest practicing on a scrap panel of finished wood. It's

a simple process, and the basic skills can be learned in a couple of hours. But you also can spend a lifetime perfecting those skills. If you're dealing with a valuable antique, you should consult a professional prior to attempting any repair.

Tools and materials

Burn-in repairs don't require a huge inventory of expensive tools, compressors and spray guns. A hot knife, a selection of shellac-resin sticks, a few other miscellaneous supplies and a can of spray lacquer can get you through most of the repairs

that you'll encounter (see the sources of supply box on p. 73).

The sticks are melted into place using a hot knife, either a thermostatically controlled electric knife or a manual knife with an alcohol lamp using denatured alcohol as its fuel. Don't try to use a candle as a heat source because it produces soot that mixes with and changes the color of the repair material. I've also heard of using soldering irons, but I don't advocate the practice. The iron is too hot and can burn the stick shellac, as well as the wood you are trying to repair.

I prefer the electric knife because it poses little fire hazard, and it maintains a consistent temperature. My tool of choice is a lightweight, slim and highly maneuverable knife made by Hot Tools, Inc. (see the sources box). But I also carry an alcohol lamp in my tool kit for those occasions when no electricity or lack of room makes a manual knife a logical choice.

The shellac-resin sticks are available in a wide variety of colors and tints. And different colors can be melted and mixed together on the hot knife to make the exact shade necessary for a perfect match. Some colors are available translucent or opaque, which can help make certain repairs far less noticeable. The translucent shades are perfect for repairs when just the finish is damaged and not the underlying wood. This situation is identified by no telltale color changes in the damaged area. A color change indicates broken wood fibers that will require opaque colors. But opaque and translucent colors can be intermixed to suit any repair situation.

Other than the new Concept 2000 repair system by Mohawk (see the sources of supply and the box at right), shellac resins are very brittle when cool and can chip when used on corners or other areas subject to sharp impact. The resin has no strength to hold nails or screws, so it should be used for only cosmetic repairs.

Color-matching

Probably the most important step involved in making a good repair is color matching. It is an art that takes some practice, but color-matching can be learned. Most wood has a background shade that is dominant in creating the impression of color. Quickly glance at a piece that needs repair. The color you see in that quick look is the one that you want to match. Now look closely at the piece. You will immediately notice that it is made up of many colors that are subtly blended. By carefully selecting the right shades of resin sticks, repairs also can be subtly blended.

Burning-in for beginners

As I was putting together the information on burn-in repairs, my Mohawk finishing products salesman introduced me to Concept 2000, a new repair system that was recently introduced. After working with Concept 2000, I found the system eliminates or minimizes many of the common problem areas, especially for the novice. The repair sticks are flexible, so repairs made with the new sticks won't be as fragile as the brittle traditional sticks. And the halo effect, a glossy ring left by traditional burn-in repairs, is gone because the sticks dry flat, making it easier to blend in the repairs.

Lower temperatures for better results:

What really sets the Concept 2000 system apart from the traditional method is the fact that the burn-in knife is cooler than the old-style knife and need never touch the surface of the wood. Because the hot knife is kept away from the finish, there is less chance of creating more damage when making the repair. Mohawk offers a special, temperature-controlled knife for melting the burn-in sticks. However, I modified my standard burn-in knife by adding a rotary, lamp-dimmer switch for controlling the temperature. Too much heat causes the melted sticks to boil, which leaves air bubbles in the repair and darkens the color.

Repairs are made in the traditional manner of flowing melted material into the damaged area, leaving a dome-like mass. Air bubbles are removed by allowing the repair to cool for 10 to 15 seconds and then pressing on the material with a fingertip dipped in Plane Balm, Mohawk's skin and finish protector. With the easy melting, flexible repair sticks, I found this step to be rarely necessary.

Leveling the repair: To level the repair with the surrounding wood, Mohawk includes a patented device called an Ieroplane, which takes the place of a sharp chisel and allows even a novice to pare away excess material without fear of gouging the surface being repaired. The Ieroplane is a

large round blade mounted in a non-marking plastic frame, as shown in the photo below. The height of the blade relative to the repaired surface can be adjusted with a top-mounted knurled wheel. The blade is adjusted to just skim the top off the mounded repair, which should be allowed to cool four to five minutes. The Ieroplane is pushed through the repair material with a slight rolling or twisting motion. Keep adjusting the blade to take off paper thin slices until the repair is almost dead even with the surface.

If necessary, further leveling can be accomplished with Mohawk's Level Aid, which is used as naphtha would be for a conventional repair. Level Aid is applied with a felt pad, a rag or 600-grit, wet-or-dry sandpaper. Limit the sanding and smoothing to just the repair area with as little overlap onto the surrounding finish as possible.

Graining can be done with appropriately colored, fine-line artists' markers in the normal manner. Spraying lightly misted coats of lacquer until the depth and gloss of the repair's finish matches the original provides a quality repair in a minimal amount of time. —R.J.



Trimming burn-in repair material flush is done without fear of damaging the surrounding finish, thanks to the Ieroplane. The Ieroplane is included in Mohawk's new Concept 2000 repair system, which makes burn-in repairs easier for the beginner.



Placing shellac-resin sticks directly on the piece to be repaired is the best way to get a sense of the color match. This technique also helps in selecting the shades that need to be blended, such as the three different colored sticks shown here.

Smooth the repair with the hot knife by drawing the knife over the resin and then wiping the excess resin from the knife. Keep the knife moving because it is easy to burn the surrounding finish.



As a general rule on medium and dark finishes, if you can't get an exact match, it is better to make your repair darker than the surrounding wood. With lighter woods, it is better to err on the lighter side. This will help prevent high contrast situations, which stand out and call attention to your repairs.

A trick that helps me match colors is to place some sticks on the piece to be repaired, as shown in the photo at left above. Looking at the color *in situ* is the best way of knowing if a single stick will make a good match.

Because there are so many formulas and proprietary resins used, the manufacturers' color names can be a bit confusing. Each manufacturer has its own idea of what color "antique mahogany" or "golden oak" should be. The key is to match the wood to the repair stick color, not the name. It's all right to use a dark walnut to repair a piece of mahogany if the color match is good.

Often you will need to mix or blend colors on the knife while the resin is in a liquid state, as shown in the photo on p. 70. As a rule of thumb, if you are mixing more than three colors, you are probably in trouble; just wipe the knife clean on a rag and start again.

By purchasing a set of sticks, you will have a better chance of having the right colors on hand. I recommend buying a set of small, 2-in.-long sticks because you can get a great selection for a modest price. Even though 2 in. is the smallest size, the sticks will still go a long way because so little material is used for each repair.

Making the repair

Before starting a repair, the first step is to clean the damaged area using a rag dampened with VM&P (Varnish Makers and Painters) naphtha. This solvent will remove wax and dry in a matter of minutes, leaving a powdery residue that can be wiped off with a clean cloth. I then apply Burn-In Balm (Mohawk) or Patch Lube (Star) around the damaged areas. These thick ointments, the consistency of Vaseline petroleum jelly, act as heat sinks and help prevent burning the surrounding finish. They also act as repellents, so the resin adheres only in the damaged areas. A small bottle lasts a long, long time and makes repairs easier and neater.

Before beginning the repair, clean the knife to avoid any color contamination from residue clinging to the blade. Preheat an electric knife three to five minutes or a manual knife 30 seconds, and wipe it clean with a rag or scrape it clean with a single-edge razor blade. When you apply the knife to the stick, the resin should flow smoothly rather than bubble or boil, a clear sign the knife's too hot. After melting enough material to slightly overfill the damage, allow the molten resin to flow into the damaged area, creating a slight dome of excess material.

Wipe the knife clean, and then smooth the repair by drawing the knife over the resin, always working toward you, as shown in the photo at right above. Repeat the process of wiping the knife clean and stroking the repair at least three times or until most of the excess material has been removed. But don't try to get the fill dead

even with the knife because it's easy to damage the surrounding finish, especially if you don't keep the knife moving.

Leveling the repair

When finished with the hot knife, the repair should be slightly proud of the finish. As the resin cools, it hardens almost immediately. I shave off the remaining excess filler with a chisel I hone to a razor's edge on an 8,000-grit Japanese waterstone.

After carefully cutting back the repair, you may find bubbles or unevenness. One of the characteristics of a burn-in stick that makes it such a good repair material is its forgiving nature. Just reapply heat, and the resin will liquefy again whether it's been 30 seconds or 30 years since the repair was made. This reversibility means the repair can be pulled out if you botch the job or if a better technique is developed.

The next step in the leveling process is to wipe the resin with a felt pad and a solvent to help smooth the repair, as shown in the photo at left on the facing page. I like to use Brasiv (Mohawk) or VM&P naphtha. Often I use cigarette lighter fluid from Walgreen's. The lighter fluid is essentially naphtha, but the little flip-top can is a very handy dispenser, which keeps spills to a minimum.

Although they will rarely damage any cured finish at least 30 days old, solvents should be tested on an inconspicuous spot. Brasiv is fast acting, so it requires some care. Using a clean felt pad slightly moistened with solvent, I rapidly rub the repair. The solvent softens the resin, and the felt absorbs any excess material



Brushing in wood-grain details puts the finishing touches on an almost invisible burn-in repair. Shellac-resin sticks melted with a hot knife fill the damaged area. Graining details help hide the repair, and a few mist coats of lacquer finish the job.

Buffing the repair with solvent and a felt pad softens the resin, levels it with the surrounding wood and leaves a smooth surface. Excessive resin should first be pared away with a razor-sharp chisel.

while polishing the surface smooth.

Many people use 400-grit wet-or-dry sandpaper to smooth repairs. This technique requires a very gentle touch and often creates more work if you damage the finish around the repair. I try not to use sandpaper and especially don't recommend it for beginners. Things can get out of control in a hurry, particularly on more modern pieces that have toner in the finish instead of being stained in the more traditional manner. Sanding, even with 400-grit paper, will cut through the toned finish in short order, and it is difficult to patch unless you are skilled with an airbrush. If you must use abrasives, keep in mind that a finish is not very thick, and you can sand through it in less time than it takes to talk about it. Try starting with less aggressive 600-grit paper, and use a very light touch.

Adding wood-grain details

At this stage, the repair should be flat and the color close to the shade of the background wood, but it still won't look quite right. The missing ingredient is the natural grain lines of the wood. The grain lines need to be duplicated to commit what the French call *trompe l'oeil*, literally, to "trick the eye." Wood-grain lines of the appropriate size and color are drawn with fine-line graining pens or painted with a brush and pigments blended with lacquer and a little retarder, as shown in the photo at right above. Artists' pens and pigments also can be used and offer an even greater selection of colors.

For best results, be sure to follow the natural grain lines. Run the pen lines past

the edges of the repair, and avoid hard edges. Smooth in coloring pens and brushed colors with your finger to blur the lines. These grain lines are vital to an invisible repair, so take the time needed to get them right.

Getting the finish right

Though the repair is now smooth, grained and color-matched, it will probably still stand out. The sticks leave glossy repairs, so the sheen of the repair won't match the surrounding wood's sheen. The location of the repair and the finish of the piece determine the next step.

In most situations, the gloss of the repair can be adjusted with either Burn-In Seal (Mohawk) or Sheen (Star) aerosol lacquers. These aerosol lacquers are specifically formulated to reduce the gloss of the burn-in repair to match most wood finishes. I am not sure how they work, but they sure do the job. I lightly mist on several coats of the lacquer until the repair blends in with the rest of the finish. If necessary, you can topcoat with the original finish for a perfect match.

This technique works fine in most situations. One problem area, however, is tabletops, particularly those with a high-gloss finish. A high-gloss finish works like a mirror, reflecting light and accentuating scratches, nicks and even repairs.

Repairs to these finishes are a compromise, and no technique yields perfect results. With that idea clearly in mind, I like to use MicroMesh Abrasives, available from C.W. Crossen (see the sources of supply box), to reproduce the luster of a high-

gloss finish. These super-fine abrasives, available in grits as fine as optical grade (12,000-grit) are worked with a drop or two of water from the finest grits downward toward the coarser grades, which is the reverse of the usual procedure, until a reasonable duplication of the surrounding sheen is achieved. □

Robert Judd is a professional furniture repairer and refinisher in Canton, Mass.

Sources of supply

The following companies manufacture or supply products that can be used for repairing and finishing furniture.

Burn-in repair materials

Hot Tools, Inc., 24 Tioga Way,
PO Box 615, Marblehead, MA 01945;
(617) 639-1000

Mohawk Finishing Products, Inc.,
Route 30 North, Amsterdam, NY 12010;
(518) 843-1380

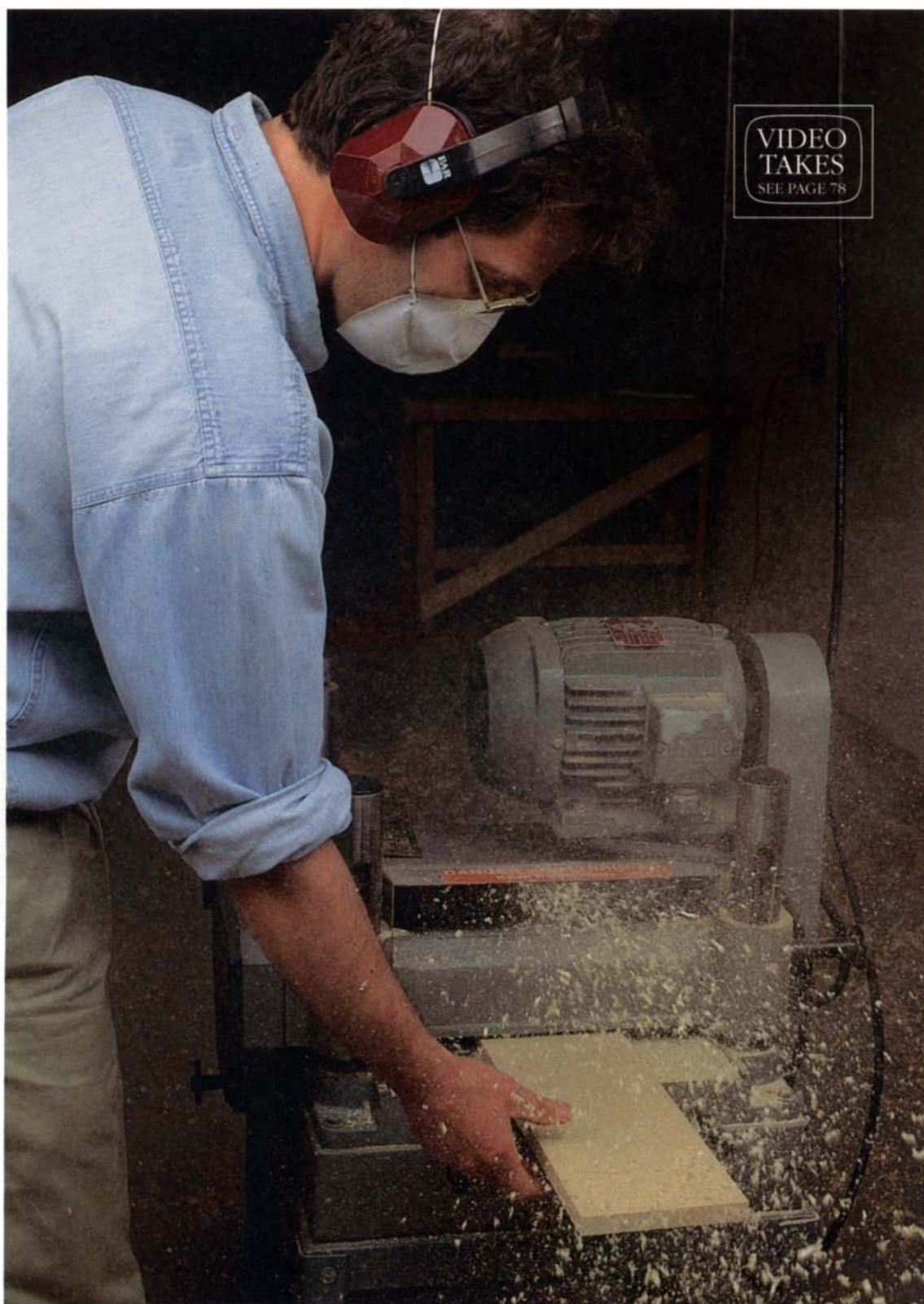
(Mohawk offers their retail brand, Behlen's, through many woodworking catalogs and retail stores.)

Star Finishing Products, Inc., 360 Shore Drive, Hinsdale, IL 60521-5822;
(708) 654-8650.

Sanding supplies

C.W. Crossen, 706 East River Drive,
Davenport, IA 52803; (800) 722-9342

The Sanding Catalogue, PO Box 3737, Hickory, NC 28603-3737; (800) 228-0000.



VIDEO
TAKES
SEE PAGE 78

The thickness planer is an essential tool for milling wood. It will quickly and accurately give you a second flat face, parallel to the jointed face.

Flat, Straight and Square

Simple milling sequence yields true stock

by Peter Korn

If wood were a stable, homogenous, man-made material like metal or plastic, how much simpler the woodworker's task would be! Instead, we pay a price for our love of natural beauty. We work with a biological medium that reacts continuously to the environment, changing dimension and shape as it breathes moisture in and out.

If you've ever attempted to dovetail cupped boards or to build a frame-and-panel door from bowed lumber, you know how frustrating it is to work with poorly prepared stock. Fine craftsmanship occurs one step at a time, and the first step is preparing (milling) stock foursquare—straight, true and accurately dimensioned.

Boards are almost never flat enough to use directly from the lumberyard. Even S2S (surfaced two sides) lumber is milled only with thickness planers, which create boards of uniform thickness but do little to iron out cup, bow or twist. In any case, wood's propensity for continuous movement dictates milling only when you're ready to use it. Stored wood will often warp between milling and joinery.

I begin every project with a cutting list specifying the exact measurements of all the parts, including allowances for tenon length. If there are curved parts, I usually mill foursquare blanks and then handsaw the curves later. Before cutting, I lay out the location of each part on the rough lumber with chalk or a crayon, trying to minimize waste and make the most attractive use of grain. Laying out the parts right on the milled stock also prevents embarrassing mistakes.

When the cutting list calls for several parts of the same dimension, you must weigh time against conservation of material. It takes less time to mill long pieces to thickness and then cut shorter parts from those long boards than it does to crosscut smaller pieces and then mill them. Longer boards tend to be more twisted and/or bowed along the length of their faces. If you mill a long board whole, however, you'll lose more material in making it flat than if you'd cut it into shorter rough blanks. The right approach is always a judgment call, depending on how straight your rough lumber is and how much thickness you have to spare between rough lumber and the dimension of your finished stock.

When I cut rough lumber into blanks for milling, I leave the blanks at least $\frac{1}{4}$ in. wider and 1 in. longer than the final pieces I'll need. I crosscut to rough length with a radial-arm saw, circular saw or handsaw depending on what's handy and where I am. For the initial rip to rough width, I prefer the bandsaw (see the top photo) because it's quieter, less dust-producing and safer than the tablesaw. Where the cups, bows and twists endemic to rough lumber increase the likelihood of tablesaw kickback, a bandsaw purrs right on through. I handsaw by eye to the lines I have marked.

If you prefer to rip rough lumber to width on the tablesaw, make sure the edge against the rip fence is straight. If it's not, run it over the jointer first.

Six steps to foursquare stock

These are the steps I use to prepare stock from rough lumber:

Step 1: Flatten the first face of the board.

Step 2: Make the second face of the board parallel to the first face at the desired thickness.

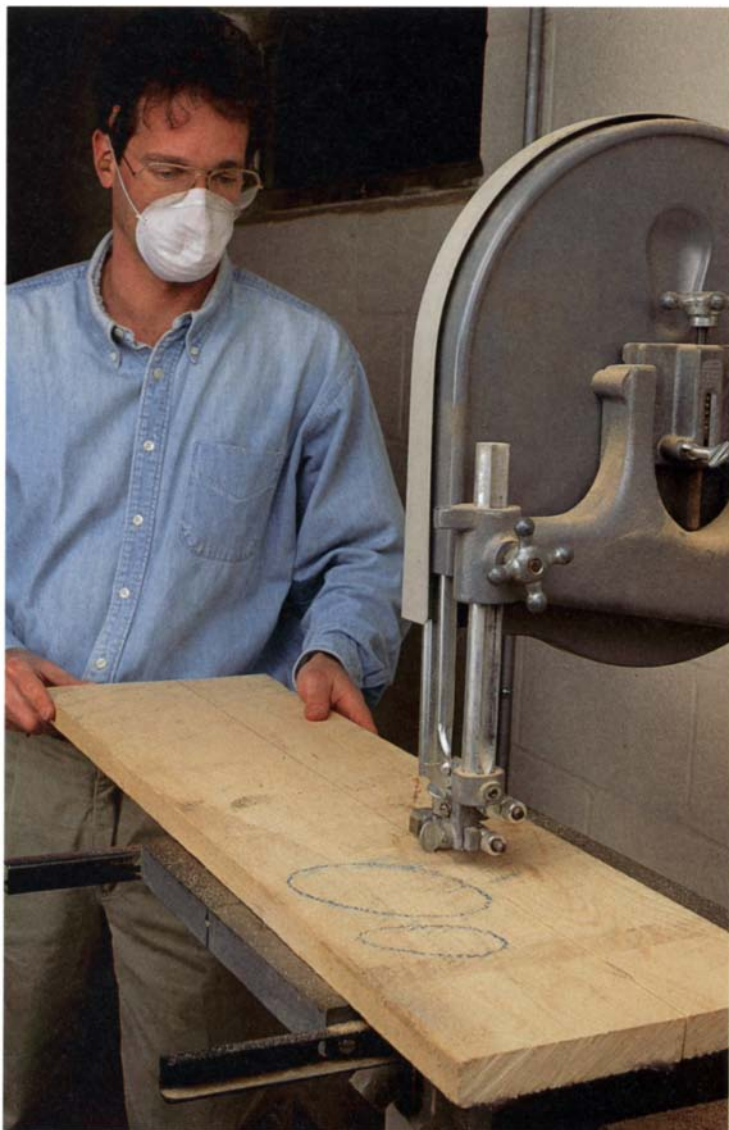
Step 3: Square an edge. (Steps 2 and 3 are often reversed.)

Step 4: Rip the second edge square and to the desired width.

Step 5: Cut one end square.

Step 6: Cut the other end square and to length. (Usually, I leave stock an inch or so long until the joinery is cut.)

Before power tools existed, the entire milling process was done exclusively with hand tools, but milling is one job that machines



Ripping rough stock on the bandsaw is far safer than on the tablesaw because there's no danger of kickback if a warped or twisted board shifts as it's going through the blade. The author rips to about $\frac{1}{4}$ in. more than finish width to allow for jointing an edge and then ripping parallel to that trued edge.



The first step in stock preparation is to create one flat face, which becomes the reference face. So long as your jointer's capacity is greater than the width of the board you need to flatten, it's a quick operation. Whenever you joint, maintain pressure on the outfeed table just past the cutterhead. Always use a push stick.

Flattening the face of a board with a handplane

Like most other woodworking skills, handplaning wide boards is daunting only until you give it a serious try. All you need are one or two well-tuned planes, some elbow grease and a couple of days of practice.

The two planes I use are a scrub plane and a bench plane. The bench plane alone would be sufficient, but the scrub plane saves time and effort by removing wood quickly from seriously cupped boards. Scrub planes are made for rough work, and there is no trick to tuning them beyond sharpening the curved blade.

A bench plane is a more precise instrument, which requires greater attention to get optimum performance. The sole should be flat and polished, the blade sharp enough to shave with and the frog adjusted by trial and error for the best result. (For more information on choosing and tuning bench planes, see *FWW* #99, pp. 67-71.) Bench planes come in a wide range of sizes. For flattening boards, I prefer a 14-in. jack plane, but I know other woodworkers who like

to work with a longer, heavier plane, such as a 22-in. jointer plane.

To set up for planing, I clamp the work on a flat benchtop, making sure that nothing extends above the board's surface. A bench with dogs and a tail vise is best, but you can also wedge a board between stops that are either clamped or screwed to the bench. I usually place the convex side up, so the board sits securely on the bench. Also, I find it easier to take down a center hump than to attack raised edges.

Using winding sticks and a long straight edge, I locate and mark the board's high spots and determine the degree of twist. Winding sticks are simply sticks of uniform width placed across each end of the work, parallel to each other. Sighting along their tops reveals the exact degree of twist in a board, as shown in the bottom left photo below. Once I've marked all high spots with a pencil, it's time to plane.

I set my scrub plane's blade so that it protrudes about $\frac{1}{16}$ in. beyond the sole. I plane diagonally across the grain in parallel strokes, removing wood quickly and

minimizing the chance of severe tearout, which would most likely occur if I went with the grain. Then I go back and plane on the opposing diagonal until I've covered the board (see the top left photo below). If I didn't have a scrub plane, I would begin flattening the board by using the jack plane in the exact same manner, but the process would just take longer.

When the work is more or less flat across, I switch to my bench plane, planing with the grain along the length of the board (see the photo at right below). I check for cup, bow or twist every once in a while and again mark any high spots with a pencil. It's important to avoid planing low spots because they'd just become that much lower. If my plane starts to make dust instead of shavings, I resharpen the blade. I find that rubbing paraffin on the sole of a metal plane cuts down on friction tremendously.

My straightedge and winding sticks tell me when a board is flat, but it's evident, too, when I'm able to take long, lovely shavings over the full length of the board. —P.K.



A scrub plane makes quick work of high spots on the rough board. Korn planes across the grain diagonally to prevent tearout and then planes on the opposing diagonal, removing the ridges created with the first passes. A bench plane is the next step.



Sighting along winding sticks tells the author that the board doesn't twist. He also uses a long straightedge to check flatness along and across the board's length.



Taking a bench plane and planing with the grain, Korn takes out the scrub plane's marks and smooths the face of the board flat, readying it for the thickness planer and further milling.

do much more efficiently than hand tools with no sacrifice in quality. Generally, I joint the face of a board and square a perpendicular edge (steps 1 and 3) on the jointer, plane the board to thickness (step 2) with a planer, and rip the board to width and crosscut it to length on the tablesaw (steps 4, 5, 6). If I have to flatten the face of a board wider than the 8-in. capacity of my jointer, I'll use handplanes for that step (see the sidebar on the facing page), but I still use machines for the rest of the sequence. If I didn't want to have to flatten a wide board with handplanes, I could rip the board in half, mill each half foursquare and then glue the pieces back together. Handplaning avoids the extra glueline, and it's also one of the great pleasures of working with wood. There's nothing quite like unveiling a board's beauty with a well-tuned handplane, shaving by sinuous shaving.

Flattening the first face

The setting of a jointer is critical to its performance. (For more on using and adjusting the jointer, see "Jointer Savvy" on p. 48 in this issue.) The outfeed table should be set at the highest point of the knives' rotation. A slightly high outfeed table will cause a board to become convex along its length. A low outfeed table causes snipe—the rear end of a board drops as it leaves the support of the infeed table, making the last few inches thinner.

The height of the jointer's infeed table determines the amount of wood removed with each pass. Take thin passes to reduce the possibility of tearout as well as wear on the machine. I never take off more than $\frac{1}{16}$ in. per pass.

Whenever you joint or plane wood, you should check grain direction and ensure that you cut with the grain to avoid tearout. Where the grain is contrary, feed wood slowly and steadily and be sure the knives are sharp. *Always* use a push stick when using the jointer to flatten a face, so your fingers don't pass right over the cutterhead (see the bottom photo on p. 75). If a board is cupped and/or bowed—as most are—joint the concave side so that the board doesn't rock.

Making the second face parallel to the first

A thickness planer's infeed roller, outfeed roller, pressure bar and knives should be set according to the machine's manual. Also, the knives must be sharp and the table parallel to the cutterhead. I vary the setting of the table rollers in the planer's bed to suit the occasion. If I have hundreds of board feet to plane, I'll raise the table rollers a bit above the bed to help the lumber along. This causes a bit of snipe at the boards' ends as they are lifted by the table rollers, but I live with it because of the time and effort saved. When I want finer, more accurately machined stock, I lower the table rollers beneath the surface of the bed, which I keep waxed to help the boards slide along.

Snipe can occur even with the table rollers lowered. On a planer with an adjustable table and a fixed head, the table may be rocking, in which case the gibs that hold the table in place need to be tightened. On a planer with a fixed table and an adjustable head, the head assembly may need to be tightened in place. Check the manual for your particular machine if you have a problem.

To prevent tearout, thickness plane with the grain as much as possible. If a board has very squirrely grain that has a tendency to tear out, feed the board through as slowly as your planer allows, and take thin passes. Never plane more than $\frac{1}{16}$ in. at a time, in any case, to avoid stress on the machine.

Removing wood from the surface of a board will often upset its internal stress equilibrium and cause the board to warp. To maximize stability and flatness, I often stop planing when a board is between $\frac{1}{16}$ in. and $\frac{1}{8}$ in. from final thickness and let it readjust itself



When jointing an edge, choose whichever edge looks as though it will be less prone to tearout. Make sure the fence is square to the jointer beds and that the face against the fence is snug up against it. As when face jointing, transfer downward pressure from the infeed to the outfeed table as the board passes the cutterhead.



When ripping on the tablesaw, safety should be foremost in your mind. Use a guard, splitter and push stick, and make sure you stay out from behind the board you're ripping: Kickback happens faster than you can react to it.



Crosscutting one end square and the other end both square and to length can be done on the tablesaw with either a sliding table or a miter gauge with a wooden extension fence (below). The author lines up his cutoff mark with the inside edge of the sawkerf in the miter fence, ensuring an accurate cut.



overnight. The next day, I reflatten one face with the jointer or handplane and take the board to final thickness with my planer.

Squaring the first edge

Unless there are other considerations, the first edge I square is the one that can best be cut with the grain (see the top photo on p. 77). Here is where the advantage of flattening both faces before truing an edge becomes apparent because I can now choose either face to run against the jointer fence. I always check the fence for square before jointing any wood, but I usually also make a test pass and check the board with a try square.

Ripping to width

A rip blade in the tablesaw works well for ripping stock to width, but I prefer a combination blade when preparing stock so I won't have to change blades to crosscut the ends. Set the blade square to the table and just a tooth's height above the wood for safety. Then set your fence for the exact width of your cut by measuring from the rip fence to any sawtooth that inclines toward the fence.

There are two schools of thought about rip fences. One holds that the fence should be exactly parallel to the sawblade. The other believes that the fence should tilt a hair away from the back of the blade as extra insurance against kickback. I used to believe it

was best to angle the fence away from the blade, but now I try to get the fence exactly parallel. Whichever you believe, just be sure the far end of your rip fence doesn't angle in toward the blade. At best, the wood will pinch and burn from friction; at worst, stock will catch and fly back at you faster than you can react.

Tablesaws are inherently dangerous, so here are some oft-repeated tips to take to heart: When ripping, keep the board firmly against the fence at all times, and push it with a smooth, steady motion (see the bottom photo on p. 77). Never let go of a board until it is entirely past the blade. Use a push stick rather than pass your hand by the blade. Don't hold wood with a hand placed beyond the blade—your hand could be drawn back through the blade by kickback. Avoid standing directly behind the board being cut, and make sure no one else is in the path of potential kickback either.

Crosscutting the ends square and to length

After stock has been flattened on both sides, jointed on one edge, and ripped to the designated width, it's time to cut the board to length. There are a number of tools with which you can crosscut. I prefer a tablesaw equipped with a combination blade. Crosscutting on the tablesaw is done with the aid of a sliding table or a miter gauge with an add-on wooden extension fence (see the top photo at left). Never crosscut with the end of a board against the rip fence.

After the first end is cut square, you can either measure out the desired length on the stock and pencil a cutoff mark, or you can attach a stop to the fence of your sliding table or miter guide at the desired distance from the sawblade. The quickest way to cut to a pencil line is to align it with the edge of the kerf the blade has left in the fence—as long as you always use the same blade (see the photo at left).

From the moment wood is milled, movement should be minimized by careful handling. To promote even exposure to air, I either leave boards on edge or stack them horizontally with spacers between them. I also keep wood away from direct sunlight and any other heat source that could affect one side of a board more than the other. I also try to cut all joinery right away while the wood is as square and straight as it will ever be. □

Peter Korn works wood and teaches woodworking at his school, the Center for Furniture Craftsmanship, in Rockland, Maine. His book, Working with Wood: The Basics of Craftsmanship, was published by The Taunton Press in May.

Stock preparation video

It's not glamorous, but proper stock preparation is essential to building fine furniture. And while you may be able to understand the whole process adequately from text and still photos, seeing a process carried out step by step can inspire confidence. With that in mind, I shot a 13 min. video (VHS) of Peter Korn preparing a couple of boards as described in this article, including the technique of flattening a face with handplanes. The video is intended for beginning woodworkers or those without formal training. To order, call (203) 426-8171, or send \$10 to The Taunton Press Order Dept., PrepVid 011032, P.O. Box 5506, Newtown, Conn. 06470. —Vincent Laurence, associate editor



Legs to Stand On

Techniques for leg joinery make strong, attractive tables and case furniture

by Timothy S. Philbrick

At first glance, all these legs appear turned. Closer inspection reveals the subtle asymmetrical shaping of the inner legs, giving the piece, a claro walnut sideboard, more interest and life. Regardless of shape, the author uses the same joinery techniques to apply the legs.

Most of my furniture could be considered contemporary interpretations of classic forms. Though devoid of most ornament, the shapes, proportions and subtle details all hail from classic pieces. But my joinery ranges from the strictly traditional (delicate half-blind dovetails to connect drawer fronts to sides) to the innovative. I use whatever joinery seems like it will best do the job, regardless of the era.

In this article, I will discuss a couple of techniques that I have developed and used successfully for years to attach legs to tables and carcasses. These techniques take advantage of some technological advances in materials and joinery, such as plywood and biscuits, yet they respect and conform to some basic precepts of woodworking: Wood moves, and a piece of furniture must be functionally sound first and beautiful second.

I use two main types of legs, turned and shaped, the making of

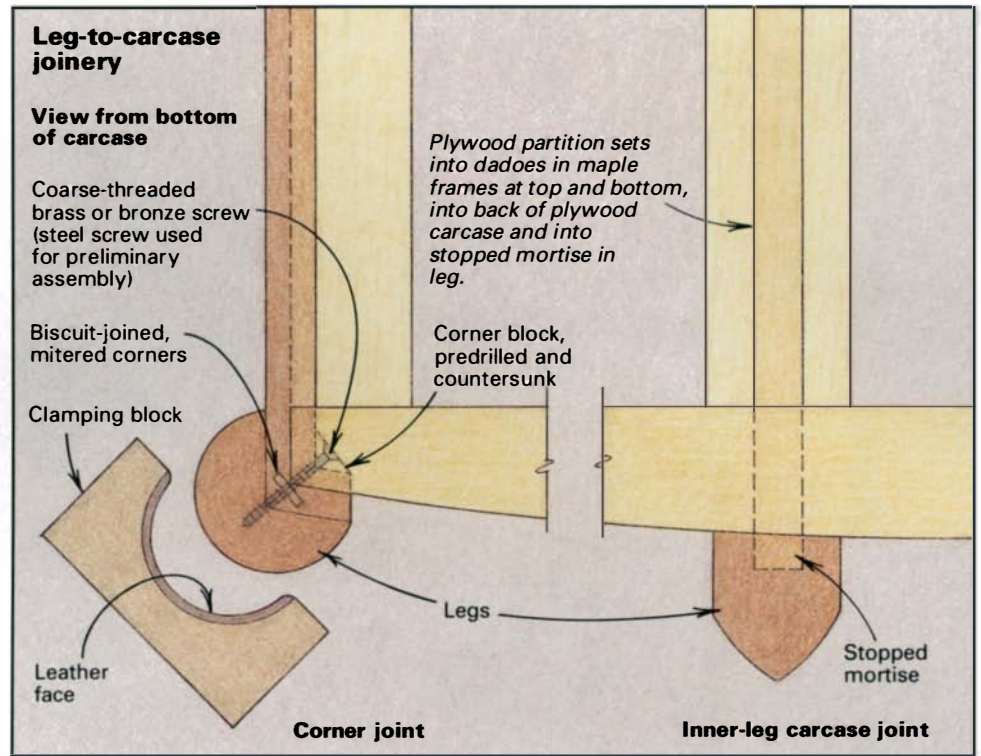
which I describe on p. 81. Sometimes all four legs (or six on longer pieces) will be turned, but more often than not, I'll shape the front pair; on a piece with six legs, I'll shape the two inner legs (see the photo above). When viewed from the front, the shaped legs usually have the same profile as the turned legs, but as you move around the piece, the profile changes. By shaping the legs, I give a piece of furniture an orientation and, hopefully, some grace. I try to give my furniture a stance not unlike a ballet dancer (see the bottom photo on p. 80).

The techniques for applying the legs are the same whether they are turned or shaped and differ only depending on whether you are attaching a corner leg or an inner leg. With both turned and shaped legs, it's best to cut your joinery first while the blank is still square or rectangular. Although it is *possible* to cut the joinery after the legs have been turned or shaped, you would need to build



Photo: Vincent Laurence

Philbrick removes the plug he spot-glued into the blank before turning the leg. A few good taps with a mallet free up the plug, which he uses to prevent tearout when turning. The blank at right was plugged while still square, and then the corners were sawn off on the tablesaw to prepare it for turning.



rather sophisticated custom fixtures to hold the legs and would give yourself an unnecessary headache. Cut the joinery first.

Attaching inner legs

When I design a relatively long piece of carcase furniture, I use six legs to distribute the weight and give the piece greater stability. Besides the four legs at the piece's corners, there are two inner legs positioned between sections of the carcase, usually between a central bank of drawers and flanking smaller sections with doors. These sections are separated inside the carcase, front to back, by a piece of hardwood plywood. This partition provides a surface to attach my web frame for the drawers in the center and to attach

shelves or shelf-support hardware in the sections behind the doors. A third function of the plywood is to act as a tenon, mating with a long, stopped mortise in the back of each of the two inner legs (see the drawing above). Because there's no appreciable movement in the plywood and because the tenon is only $\frac{3}{4}$ in. thick, there's no problem with wood movement. Also, there is tremendous lateral shear strength with this joint because of the tenon's length (as long as the carcase is high) and because plywood is stronger than solid wood. I've used this joint for 15 years and never had a problem.

Attaching legs at the corners

The first step in attaching my legs at the corners of tables and carcase pieces depends on whether the leg is turned or shaped. The procedures I use to prepare legs are discussed on the facing page. If the leg was turned, then I have to remove the wood plug I spot-glued into the blank to prevent tearout on the lathe, as shown in the top photo. If the leg was shaped, then it already has a recess or pocket in the back to mate with the corner of the apron or carcase. For tables, the aprons are mitered and splined, and for carcase pieces, I miter the mating edges and biscuit-join them.

With both tables and carcase pieces, I glue in predrilled and countersunk corner blocks. Then I dry-clamp one leg at a time, using custom-made clamping blocks (see the drawing above). With the legs clamped tightly at the corners, I drill into each leg and then screw a steel screw into the leg through the predrilled corner block, which acts as a guide for the drill bit.

Now I step back as far as I can to look at all of the legs and to make sure that they're all parallel to each other. If necessary, I'll take a block plane and shave a tad off of the carcase behind where the obstinate leg will be screwed to the carcase. Just a few shavings usually does the trick.

Finally, when all legs are parallel, I back out the steel screws, glue the legs to the carcase and reclamp legs to the carcase until I can get a brass or bronze finish screw into the leg through the corner block. For a tall carcase piece, I use one full-height corner block, from the top of the carcase to the bottom, in each corner. □

Timothy S. Philbrick is a furniture maker in Narragansett, R.I.



Photo: Doug Dalton

Shaped legs all around this pau ferro hall chest give it a springiness and energy that defy its mass. The gentle cabriole-like curve of the legs is reminiscent of Queen Anne furniture but without the stiff formality.

Preparing turned and shaped legs

For both shaped and turned legs, I begin with a blank cut to exact length. If it's going to be an inner leg, I can use the tablesaw, a router table or my horizontal mortising machine to create the stopped mortise in the back of the leg. I always check a scrap of the same plywood I'm using for the partition to be sure that it fits tightly in the mortise. Plywood thickness is never exactly as advertised, so it's important to check every sheet.

If it's a corner leg for a table or a straightforward carcass piece, I can use any of the same machines, but I find it easiest to use the horizontal mortising machine. Often, on the pieces I build, a corner will not be a true 90°. Instead it will be 95° or 100° because the front bows forward, away from perpendicular with the sides. To compensate for this when using the slot mortiser, I cut wedges at the appropriate angle on the tablesaw and use them under the blank when I'm mortising. The result is a pocket or hollow of precisely the correct angle.

Shaping legs: Generally, when I'm shaping legs for a piece of furniture, there are also turned legs on the piece. I use the template for the turned legs as the template for the front view of the shaped pieces. Then I mark out this profile on the piece to be shaped and bandsaw it out (see the drawing at right). Next I flip the blank onto its side, mark out the side profile from a template I've made for the shaped legs and bandsaw that out. It's not necessary to tape the offcuts from the first sawing back onto the blank to cut the side profile because the curves I work with are so gentle and subtle that the piece I'm sawing never really rocks.

The next step is to locate the arris (the sharp leading edge of the legs). I do this by finding the centerpoints at the top and bottom of each leg from side to side and then taking a long, flexible rule and connecting the two points.

Now comes the tricky part. For this task, I've used a number of different tools over the years, from a boatbuilder's abrasive pad mounted on an electric drill, to the Ryobi Woodcarver (no longer available), to drawknives, spokeshaves and block planes. The idea is to create a fair, smooth curve over the length and across the breadth of each leg no matter how you look at it. I always finish up with rasps, files and scrapers before going to sandpaper.

Turning legs: Preparing a turned leg starts just the same as the shaped leg. I take a square blank of the correct length, and then I cut my joinery—either a

stopped mortise or the corner pocket. Then things diverge. I check the joinery of the leg blank for fit, adjust it if necessary, and then I cut a plug or insert to fill the void where I mortised for the corner. (On all of my pieces these days, the inner legs are shaped.) The best wood for this plug is the same wood as your leg because it will turn and sand with the same resistance and at the same speed. Second best is a wood that is slightly softer and close to the same color.

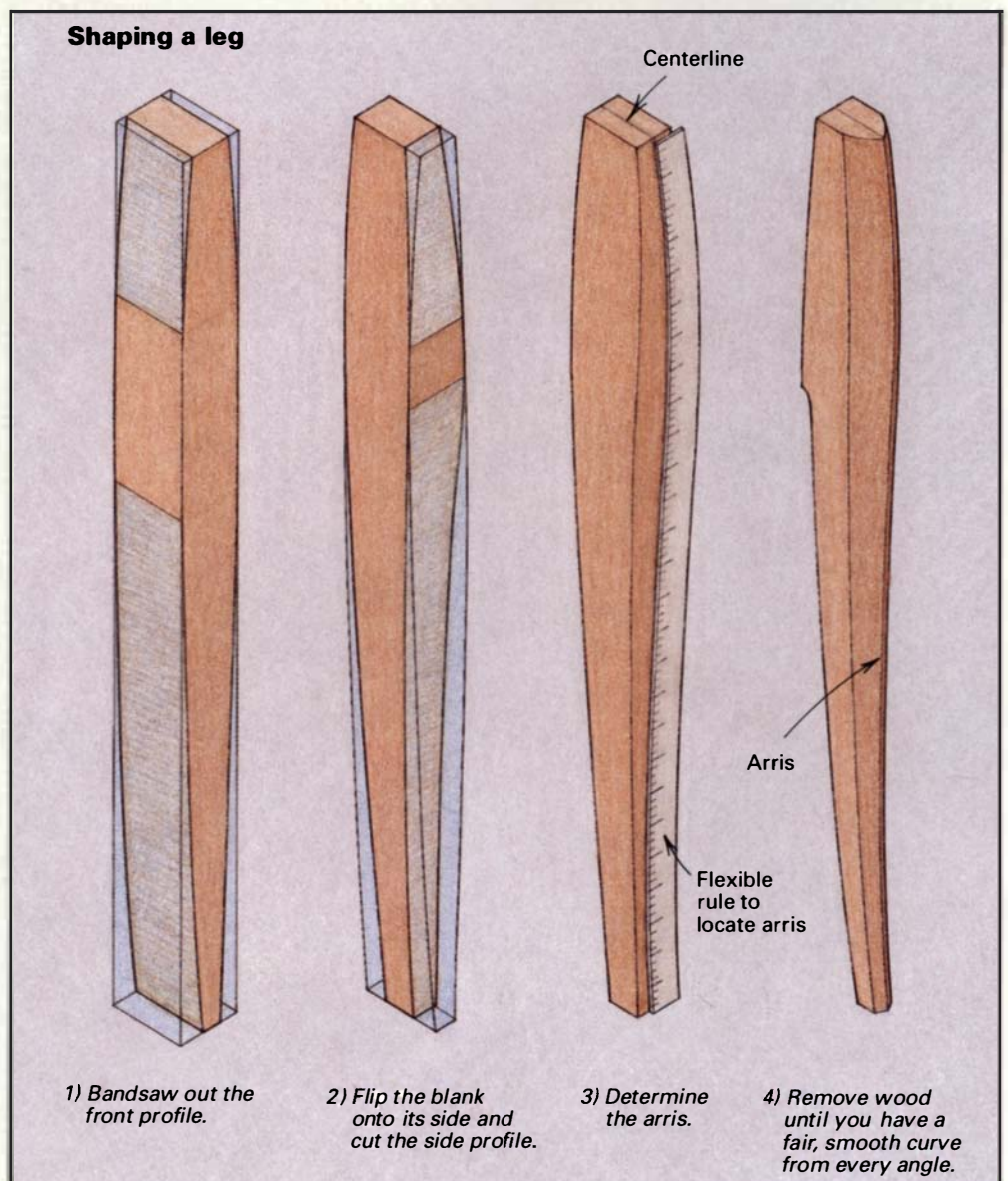
I spot-glue the plug into the corner pocket, using two of the tiniest smears of glue imaginable, right into the inside corner of the pocket about an inch from the bottom and an inch from the top. Then, after waiting for the glue to dry, I trim off any excess plug so that the plug looks like it's part of the leg blank.

I find the centers of the blank at either end using a combination square, and

then I mark a circle at both ends with a compass. I set my tablesaw blade at 45° and rip the blank into an octagon just outside the perimeter of the circles at each end.

I turn, sand and sometimes even finish on the lathe. Sanding can be tricky on the legs I turn because they're not straight tapers but rather swollen tapers. The wider the sandpaper you use the better.

The last thing I have to do before attaching the legs is to pop out the plug (see the top photo on the facing page). I just lay down the legs on a blanket on my workbench, clamp a board to the end of the bench to keep the legs from sliding off and plant my chisel where plug and pocket meet, bevel facing into the plug. A couple of sharp raps with a mallet usually will unseat the plug and then a minute of paring will clean out the pocket so that I can attach the leg to the carcass. —T.S.P.



Coves Cut on the Tablesaw

*Skew the fence and tilt the blade to make
a slew of hollows*

by Frank Klausz III



Moldings enhance the appearance of furniture and architectural millwork with their ability to catch light and make shadows. Most moldings are a combination of beads (convex curves) and coves (concave curves). Large coves are most often made with a shaper, but shaper blades are expensive, especially when they have to be custom ground—not to mention the cost of shapers themselves. So for short runs of molding or for shops that don't have shapers, tablesawn coves are a surprisingly versatile alternative. This article explains how to make a variety of coves using your tablesaw and examines ways of simplifying the usual trial-and-error set-up process. Safety issues raised by tablesaw coving are discussed in the box on p. 84.

There are two main types of coves: symmetrical and asymmetrical. Symmetrical coves, the more familiar kind, are cut by changing the angle of approach to the blade while leaving the blade perpendicular to the table. The stock rides along a skewed fence and passes over the top of the blade, removing an elliptical arc of wood, as shown in the bottom photo at right.

Asymmetrical coves are cut by changing the angle of the blade's tilt as well as the angle of approach. This type of coving yields logarithmic, or accelerated, curves as shown in figure 2 on p. 85. Partial coves can be cut using special fence setups, such as the one shown in the photo on p. 85.

Symmetrical coves

Symmetrical tablesawn coves are often used to approximate arcs of circles, but with one exception, they are actually sections of ellipses. As figure 1 shows, skewing the fence slightly from the normal ripping position produces a steep-sided elliptical cove; then, as the angle of approach is increased, the ellipse broadens and flattens out until, at 90° from the normal angle of approach, the cove is an arc of a true circle. Because there are only two factors to contend with, the height of the blade and the angle of approach, setting up for symmetrical coving is not too complicated.

Setting up—It's best to start by drawing the cove full size on the end of one of the pieces of stock you'll be cutting. Then you can make an accurate setup directly from the drawing of the cove. The height of the blade determines the depth of the cove, so butt the end of the piece up to the blade, and raise the blade to the highest point of the drawn cove.

Next you need to find the correct angle of approach, and clamp a fence to the saw table. An easy way to find the angle of approach is with an adjustable parallelogram like the shopmade one in the top photo. Flat-head machine screws work well at the joints. Countersink the heads so that the parallelogram will lie flat on the tablesaw, and use wing nuts with them so that you can easily lock in particular settings. As long as opposite sides are equal lengths, the construction details are unimportant. Adjust the parallelogram, so its width is the same as the widest point of the cove. Then, with the saw unplugged, place the parallelogram on the saw table, so it surrounds the blade. Turn the parallelogram until it just nicks the front and back of the blade. With pencil or tape, make location marks on the saw table inside the leg of the parallelogram that is touching the front of the blade. Measure back from your marks to account for the distance between the start

Bringing out the shaper in his tablesaw, the author combines an angled fence and tilted blade to cut an asymmetrical cove for a piece of crown molding. From right, the coved pieces arrayed on the outfeed table are an asymmetrical cove and slices cut from it after every second pass, a symmetrical cove in a section of architectural molding, and two partial coves for an ogee bracket foot.



Klausz finds the angle of approach for a symmetrical cove with a parallelogram set to the cove's width. With the blade raised to match the cove's highest point and the parallelogram just touching the blade at front and back, he marks the front fence location.

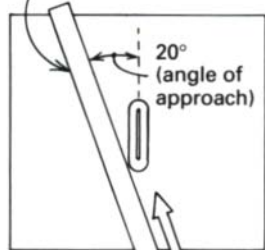


Symmetrical coves are cut with the blade vertical. Klausz shaves the last 1/16 in. from a piece of symmetrically coved cornice molding. The fence is set up to the infeed side of the blade, so the cutting action holds the stock against the fence.

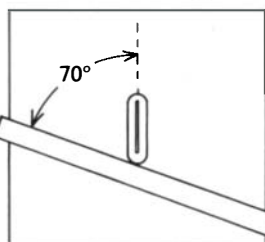
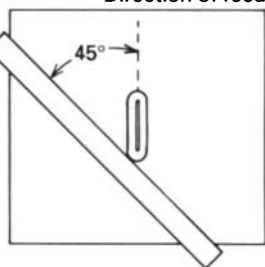
Fig. 1: Symmetrical coves

Blade remains perpendicular to table and cuts a symmetrical section of an ellipse.

Temporary fence



Direction of feed



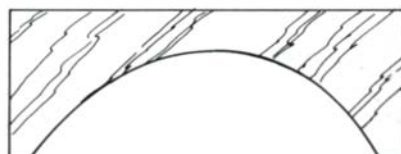
0° blade tilt, 20° approach angle



0° blade tilt, 45° approach angle



0° blade tilt, 70° approach angle



Safety concerns in tablesaw coving

Even if you are an old hand on the tablesaw, cutting coves on one may raise unfamiliar safety issues.

Setting fences: Whenever you set up for coving, start by pushing your normal rip fence aside or removing it from the saw entirely. Then select planed and edge-jointed hardwood for your coving fences. Clamp them down securely (deep-reach clamps are a good choice), being sure they don't bow off the table at the center. Be sure the pads of your clamps are seated flat on a wide surface under the tabletop.

For symmetrical coves, if you use only one fence, place it to the front of the blade—the infeed side in normal cutting. With the fence to the front, the cutting action of the blade helps keep the stock against the fence, making the cut safer and more accurate. Though one fence is often adequate to cut symmetrical coves, a second fence makes the operation safer and is especially important when cutting deep coves. In all cove-cutting, the stock weakens along the line of the cut; a back fence will provide a margin of safety, acting as a buttress to keep the piece from caving in. The approach to the blade can be from either the left or the right for symmetrical coves.

Use two fences when cutting asymmetrical coves. Always set up the fences for asymmetrical coving so the stock feeds into the blade on the acutely angled side: If the blade tilts to the right, make the approach from the right. If you feed the stock from the other side, it may have a tendency to ride up the blade and off the table, increasing the risk of kickback.

Blade guards: If you want to use a guard over the blade area, you might be best off devising your own and attaching it to one of the temporary fences. Many factory and aftermarket tablesaw blade guards are incompatible with coving. A guard that restricts your view of the workpiece or keeps you from applying constant downward pressure is more of a hindrance than a help. One guard that works well with coving is the Brett-Guard, a shallow open-bottomed box of clear Plexiglas mounted on horizontal steel bars. It can be adjusted vertically and laterally and can be used to exert some downward pressure on the workpiece. The lowest-priced model retails for \$246 and is available from HTC Products, Inc., 120 E. Hudson, P.O. Box 839, Royal Oak, Mich. 48067; (800) 624-2027.

Feeding the stock: It's essential to keep the stock pressed down on the table while coving. Once it's off the table, the stock can be caught by the teeth at the back of the blade and thrown. To ensure constant contact with the table, raise the blade between passes in increments of $\frac{1}{8}$ in. or less. If you try to cut too much, the piece will ride up on the blade. Unless you have a power feeder, you'll need good jointer-style push blocks to enable you to exert downward pressure over a wide area. If you use the rubber-bottomed kind, clean the dust from the pads before each use to maximize their grip. Keep your push blocks by the fence between cuts, so you're never tempted to use your hand to push the stock from the back.

Because you can't see the blade in cove-cutting, you have to rely even more than usual on listening to it. And listen to the saw's motor. If either one sounds like it's struggling, slow down your feed rate and take smaller cuts. —F.K.III

of the cove and the edge of your stock. Clamp a sturdy, freshly edge-jointed piece of wood along your new marks as a fence.

You can cut symmetrical coves with a single fence, though a second fence to create a channel for the stock will make the operation safer. If you do use a single fence, it *must* be placed to the front (infeed) side of the blade, as shown in the bottom photo on p. 83. Otherwise, the blade will tend to pull the stock away from the fence, making the cut more difficult and more dangerous.

Cutting the cove—After using a tablesaw in the conventional way, it may be natural to assume that a cove could be cut all at once, but it can't. Because the stock approaches the blade from the side, cutting only takes place in an arc as wide as the blade's teeth are high. (And when you are cutting coves with the blade tilted, the effective cutting height of the teeth is reduced further.) So all cove-cutting must be done in a series of passes.

Start with the blade lowered into the table, and make a test pass to see if the clamps are out of the way and if you have enough support at the end of the cut. If you are using two fences, the stock should slide easily between them but have no play. Also, be sure your push blocks are handy. Jointer push blocks work well: You can use either the rubber-bottomed kind, as shown in the photos, or the shopmade type with a lip along the underside of the back edge to catch the end of the stock. A regular tablesaw push stick is not appropriate because it concentrates pressure in one spot and doesn't provide the downward pressure required for coving.

Cut the cove in stages, raising the blade $\frac{1}{8}$ in. or less with each successive pass. A finish cut of $\frac{1}{16}$ in. will give a smoother surface and reduce sanding time.

Asymmetrical coves

Asymmetrical coves are cut with many of the same procedures used for symmetrical coving. The key difference is that asymmetrical coves are produced by tilting the blade as well as angling the fence. This makes asymmetrical coves far more difficult to set up. There are low- and high-tech ways to find the coves you're after. You can proceed by trial and error, eyeballing the shape and building a library of cove profiles, or you can use a computer-aided design (CAD) program.

Finding your cove by eye—To find a cove, squat in front of the saw with your eye at table height, and look across the blade in the path the wood will follow. When making asymmetrical coves, you always feed the stock from the side the blade tilts toward. Because some tablesaw blades tilt right and some tilt left, the angle of approach you take will depend on your tablesaw. As you or someone else changes the tilt of the blade, you will see the potential cove changing. Change your position to see how the approach angle will affect the cut. Closing one eye might help you see the blade as a silhouette.

When you think you have a shape close to the cove you want, set up a pair of fences and make a test cove. As you reset the fence and blade to find the correct shape, remember that you can steepen the acceleration of the cove—making the cove more asymmetrical—either by tilting the blade farther or by bringing the approach angle closer to normal ripping position (see figure 2 on the facing page).

A library of coves—If you use the sighting method to find asymmetrical coves, record the angle of blade tilt and the angle of approach on a cutoff from the finished piece. As these templates accumulate, you can easily reproduce old coves, or interpolate between them to get in the ballpark of a new curve. The fuller your collection, the less guesswork. A few hours spent methodi-

cally cutting test coves at a series of angles of approach and tilt would be a good way to explore the interrelation of these two variables. And at the same time, you would be building a good foundation for a library of cove profiles.

CAD-generated coves—With access to a CAD program, you can determine the tilt and approach angles for various coves by creating a tablesaw blade in the computer. This will eliminate much of the trial and error involved in the sighting method. Start by drawing two circles $\frac{1}{8}$ in. apart. The circles should be the same diameter as your tablesaw blade, most commonly 10 in. Incorporate a baseline 2 in. above the center point to represent the saw table. Then print the image of the blade at various angles of rotation and tilt, being sure to record the angles for each. I have generated a wide range of coves this way and published them in a booklet described at the end of this article.

To set up for asymmetrical cutting using CAD-generated profiles, set the blade tilt using the bevel gauge on the front of your saw. Then raise the blade to the highest point of the cove as drawn on your stock. Set your miter gauge to the approach angle designated on the printout, and slide the front fence into place using the miter gauge. Be certain you set the fence so that the blade will be tilted toward the stock as it approaches. Clamp the front fence in place; then lower the blade into the table, lay a piece of your stock against the front fence and set up a back fence snug to the stock. The cutting can proceed just as it does with symmetrical coving.

Partial coves

This last category of coves is really a variation on the first two. Partial coves are portions of symmetrical or asymmetrical coves. One type of partial cove is cut with a fence that has a gap or cutout in the middle, like the fences on shapers and router tables. The gap allows you to set up the fence right over the blade, and moving the fence exposes more or less of the blade for cutting. Another type is cut with one edge of the stock elevated, riding on a stepped fence, as shown in the photo above.

Be particularly careful when cutting partial coves to eliminate

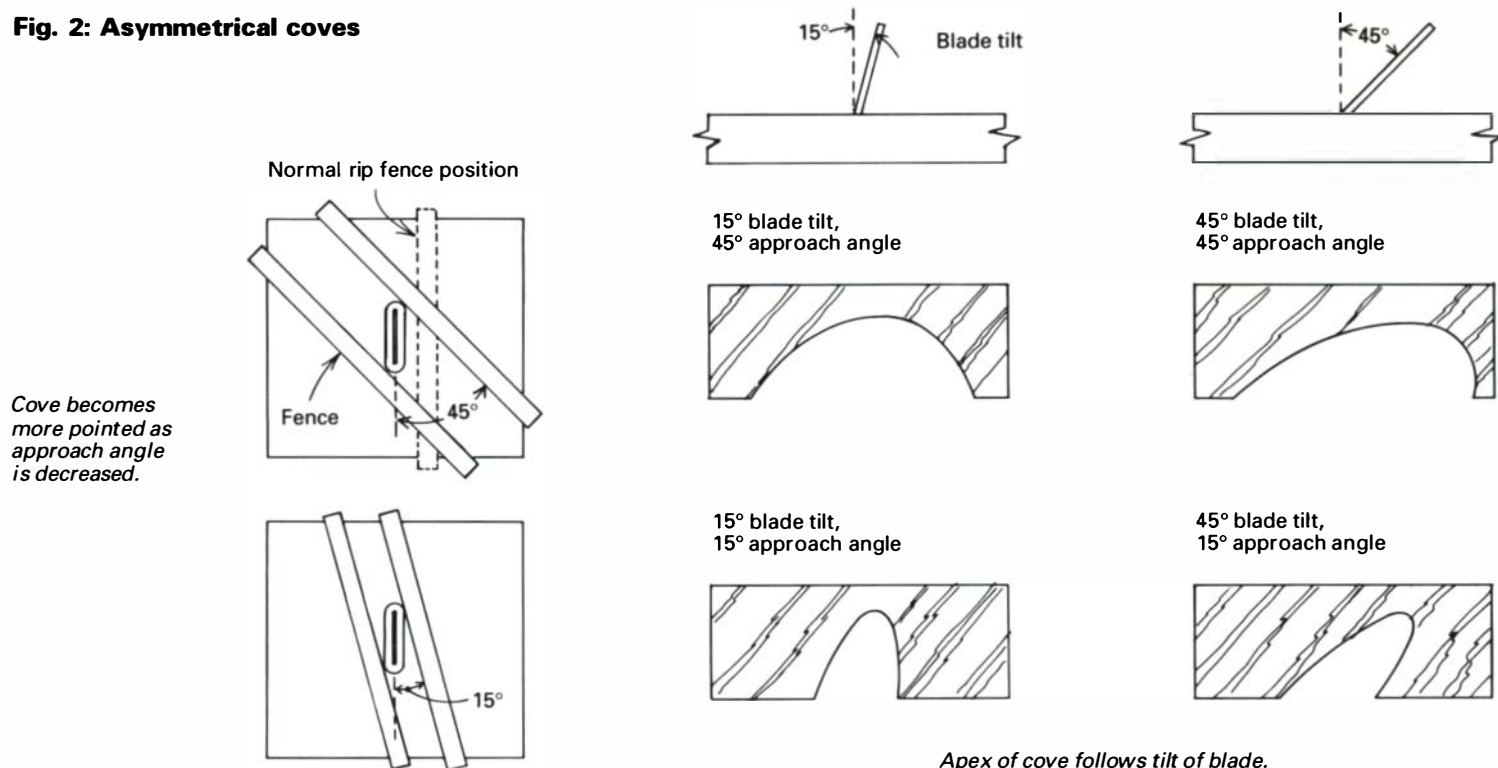


A stepped fence raises one edge of the workpiece as Klausz cuts a partial cove in a piece of cherry. For all asymmetrical coves, partial or full, two fences are required, and the stock is fed into the acute side of the blade's tilt.

any play between the stock and the fences, and take a number of test passes to determine if there will be any problems of splintering or compression at the points of contact between the stock and the fences. □

Frank Klausz III studied cove-cutting for his senior thesis at Harvard University; he works for C.U.C. International in Stamford, Conn. His father, Frank Klausz, and Will Neptune of the North Bennet Street School also contributed their expertise to this article. The author's booklet, which gives the angles of approach and blade tilt for 56 coves, is available for \$9.95 plus \$2 for shipping and handling from Klaus-Tech, P.O. Box 43, Pluckemin, N.J., 07978; (908) 658-4396.

Fig. 2: Asymmetrical coves



Turning Perfume Bottles

Wood vessels dress up glass vials

by Kip Christensen



Mating forms—In Kip Christensen's perfume bottle designs, the lid and base combine in a strong overall form but look just as good when separated. These three clear-finished bottles (shown slightly oversized) were turned from African blackwood, holly and pink ivory wood.

Perfume bottles like these can be made, start to finish, in an evening of turning. Very little stock is needed, so even the most expensive of woods can be used without breaking your budget. And with attention paid to a few key points, you'll have a handsome return on the modest investment of time and materials.

The turnings do not actually hold the perfume, they simply provide an attractive vessel for a glass perfume vial. Vials are available in a range of sizes, and they can be purchased either empty or containing

a variety of perfumes and colognes. Except for the wood, all the supplies I use to make perfume bottles—the vials, finishes and adhesives—are available from Craft Supplies (P.O. Box 50300, Provo, Utah, 84605-0300; 801-373-0917).

The majority of the turning in the technique I will describe is done with the wood mounted in a Nova chuck or similar self-centering spigot chuck. If you don't have one, you can use the chucking method described in the box on the facing page. For a production-oriented approach

to mounting and making some similar perfume bottles, see the story on p. 88.

A word on design

As with any turning that contains a lid, care must be taken to design parts that look good individually and also work well together. The treatment in the section where the lid meets the base is critical. The transition should be an integral part of the overall design and should not draw attention to itself. Initially, a few minutes spent designing with paper and pencil will be



Parting the blank—Christensen separates a blank of bocote into base and lid. A Nova chuck will lock onto the end spigots.



Shaping the base—The author uses English-style spindle gouges on edge with the flute to the side to cut fine details.



Quick flip—The parted off and lacquered base is remounted on the waste piece to clean up the bottom.

helpful. Once you have turned a few perfume bottles and become familiar with what makes a good transition, it may be more enjoyable to design as you turn.

Preparing the blank

I start with a 2-in.-sq. billet of wood about 5 in. long. This will yield a bottle about 3 in. high because 1 in. on either end will be consumed in the chucking process. Mount the billet between centers, turn it to a cylinder and then turn a spigot—a round tenon—on each end. The size of the spigots is not critical provided they offer a crisp shoulder for alignment and fit the chucking device you plan to use. Determine where you want to divide the base and lid—a 3:2 base-to-lid ratio is about right—and part through the cylinder (see the bottom left photo on the facing page).

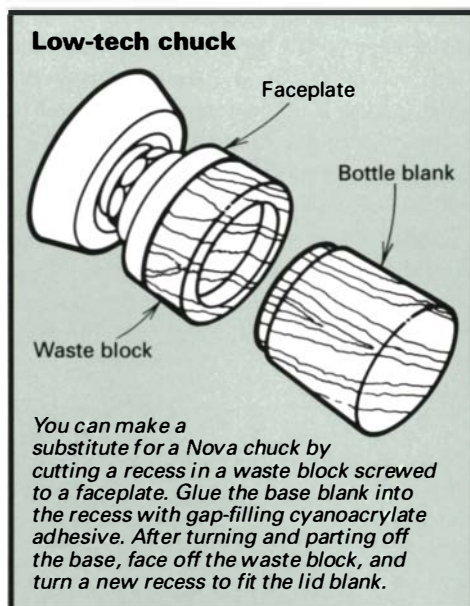
Turning the base

The first step in turning the base is to mount the blank in the spigot chuck and true up the exposed end of the cylinder. This process, repeated with the lid, will ensure a clean seat between the two.

Next drill a hole to receive the glass vial. This is best accomplished with a drill chuck and bit mounted in the tailstock of the lathe. The hole should be about $\frac{1}{16}$ in. deeper than the height of the vial less the threads. Check the fit by inserting the vial into the hole. If the hole is undersized, turn it larger with a small square-nosed scraper or small skew. A slightly loose (but not sloppy) fit is best. If the fit is too tight, future movement in the wood could cause the vial to break.

The exterior shape of the base can now be turned. To shape the bottle, I use $\frac{3}{8}$ -in. and $\frac{1}{4}$ -in. English-style spindle gouges with a fairly long fingernail grind. These gouges can be used on edge with the flute to the side to cut fine details, as shown in the center photo on the facing page.

When you are satisfied with the shape,



sand and apply finish with the piece on the lathe. I use abrasive paper cut into $\frac{1}{2}$ -in. ribbons to sand the piece. The narrow strips make it possible to run the edge of the paper up against small beads and to sand in tight areas without removing crisp details.

For a natural finish, I apply three coats of padding lacquer with a soft cloth, buffing down each coat with 0000 steel wool. Apply the first coat with the lathe off to allow the lacquer to penetrate before it dries. The next two coats can be applied with the piece spinning. Follow the lacquer with a coat of paste wax; then part the piece off, and set it aside for final turning.

Turning the lid

The lid of the perfume bottle can be made the same way as the base, with several deviations. Unlike the slightly loose fit of the vial in the base, the fit of the vial cap in the lid should have no play at all. And to ensure wood-to-wood contact when the lid is screwed onto the base, make the hole in the lid deep enough to allow the cap

to be recessed about $\frac{1}{32}$ in. Before sanding, hold the base up against the lid to see how the design works. If adjustments need to be made at the transition between the lid and the base, now is the time to make them.

Final turning

The lid and base of the perfume bottle are now completely turned and finished except where they were parted off the blank. On what is left of the waste cylinder mounted in the chuck, turn a spigot to fit the vial hole, and mount the base on it, as shown in the bottom right photo on the facing page. The fit should be tight, secure enough to allow you to do the last bit of turning. The bottom of the base can then be shaped as desired. At this stage of the turning, I find it helpful to support the base with my left hand while controlling the tool with my right hand. I also bring my left thumb over the top of the piece and onto the tool rest where it acts as a fulcrum for the gouge, permitting a very fine, controlled cut (see the photo at left below). Before removing the piece from the lathe, sand and finish the section you have just turned.

To mount the lid, you may need to add to the diameter of the spigot with a wrap of masking tape or to reduce it with a turning chisel. Once the lid is securely mounted on the spigot, turn, sand and finish it following the procedures used for the bottom of the base.

Gluing in the vial

With the turning complete, what remains is to secure the vial and vial cap in the turned pieces. There are two options to consider here: One is to glue the vial cap inside the top of the perfume bottle, but allow the vial itself to be freely removed and reinserted into the wooden base. In this case, the perfume bottle is opened by sliding the vial out of the base before unscrewing the top. The second option is to glue both the vial and the vial cap into their wooden counterparts. The advantage of this option is that, if properly done, the grain of the lid and base will automatically line up when the lid is screwed in place. This technique also provides a bit of mystery as to the shape of the vial—it might be assumed that it follows the exterior shape of the base. One drawback of this method is that if the fit is too tight, or if the wrong adhesive is used, movement in the wood can cause the vial to crack. I still prefer the second option though it requires a little more care to ensure a good grain match.

To glue in both vial and lid, start by mak-



Cradling the base in his left hand, the author uses his left thumb as a fulcrum to produce a finely controlled cut.



Aligning the grain—With the cap already glued hard, Christensen presses the vial into the base, being sure to align the grain.

ing certain the paper seal is firmly in place inside the vial lid. If it isn't, glue it into position—if the paper seal were to fall out later on, the grain match would be lost. Screw the lid securely onto the vial.

Using a cottonswab or toothpick, line the inside of the hole in the lid with a gap-filling cyanoacrylate adhesive, and press the vial cap (while still screwed onto the vial) into the hole. Within a few seconds, the adhesive should set enough to proceed.

Next, partially line the inside of the hole in the base with a flexible silicon adhesive such as E-6000 adhesive sealant. Apply the glue leaving a vertical vent to allow air to escape when inserting the vial. Not much adhesive is needed. If you use too much, it will ooze out and mar the turning's finish.

With the vial still screwed securely into the lid, press the vial into the base, taking care to match the grain (see the bottom right photo on p. 87. The lid and base

should be seated firmly against each other so that there is no gap between them.

Your bottle is now complete. Set it aside until the adhesive has set—and be patient, it may take 24 hours or more. If the vial does not already contain perfume or cologne, you can easily fill it yourself using an eye dropper. □

Kip Christensen is an assistant professor at Brigham Young University, Provo, Utah.

Production perfume bottles: shopmade chuck

by Mike Sage

Because I turn perfume bottles for profit as well as pleasure, I have developed techniques and jigs to make their production efficient. The key is predrilling the holes for the vial and using those holes to mount the turning on a reusable custom chuck.

Machining the blanks: I begin with rough billets 2 in. sq. My method requires jointing, so I cut the billets long enough to

yield three or more bottles. For three bottles, I cut to 14 in., which is just long enough for safe jointing. I joint one face and then joint an adjacent edge at 90°.

On the tablesaw, I rip the stock 1 7/8 in. sq. and rip off the corners at 45°. Using a cross-cut jig and stop block, I cut the billet into 4 7/8-in. blanks. Then I crosscut the blanks at 2 3/4 in. (the height of the bottle's base).

Jointing and careful crosscutting enable

me to drill accurate holes for the vial and vial lid on the drill press. I center the bit, drill the holes, smooth the mating surfaces of the lid and base on the horizontal belt sander, and the blanks are ready to be turned.

Making a friction chuck: I use a Morse taper with a custom spigot to mount the blanks on the lathe. Because I turn so many bottles, I had one made from metal, but wood will work equally well. To make one, chuck a blank of hard maple between centers. Turn a Morse taper on one end of the blank, as shown in the bottom left photo. Most headstocks take a #3 taper, which is about 2 11/16 in. long and tapers from 1 1/16 in. down to 9/16 in. Make fine adjustments with 100-grit sandpaper until you get a proper fit in your headstock's Morse taper recess. Mount the chuck into the taper recess, and seat with a gentle mallet tap.

Next turn a tenon about 1 1/4 in. long on the end of the chuck. The diameter of the tenon should be slightly larger than the holes for the vial and lid. Sand the tenon into a slight taper. The blank should twist on snugly and seat securely with a light tap of a wooden mallet. If the fit is loose, use a small dab of hot glue to secure the blank.

Turning the bottle: After mounting the blank, I snug up the tailstock and turn the bottle to shape. Then I back off the tailstock and finish turning the bottom. I sand the body completely before removing it with a few gentle taps from a mallet.

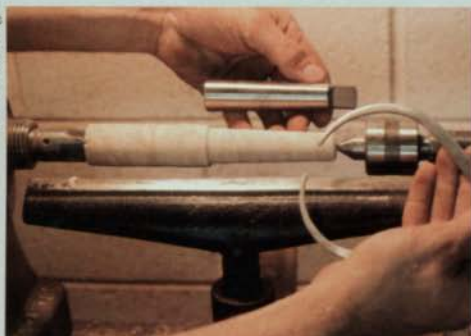
I turn the top of the bottle using the same procedures but with a second friction chuck that has the same Morse taper but a slightly greater taper on the spigot to compensate for the shallower hole in the lid.

After removing the parts from the lathe, I bring them to a high luster using carnauba wax on a buffing wheel and then glue in the vial and cap. □

Mike Sage is a box maker and turner in Redwood City, Calif.



Fast finish—Sage's production methods include a one-step finish borrowed from a jeweler: He brings the 4-in. bottles to a sheen with carnauba wax on a buffing wheel.



Shopmade Morse taper—Mike Sage checks the taper of his dedicated perfume-bottle chuck against a steel model.



Mounting the blank—With his chuck seated in the lathe's taper recess, Sage mounts the predrilled blank.

Workbenches in the Shaker Tradition

Timber-framed base delivers strength and flexible storage

by Steven Thomas Bunn

I fell in love with Shaker workbenches when I first saw one in Scott Landis' *The Workbench Book* (The Taunton Press, Inc., Newtown, Conn., 1989). I liked the Shaker ideal of "everything neat, orderly and in its place," and the enclosed base, drawers and large top on the bench were exactly what I needed.

The more I thought about the Shaker bench, the more I became aware of the inadequacies of my present bench. Though the top is 24 in. wide, it's still too narrow for the case goods I usually work on. And the tool tray is a catchall for woodchips, sawdust and tools that should have been put away. However, the prospect of building a bench with a top that resembled an aircraft carrier and enclosed enough storage for a shop full of tools just got added to a

long list of dream projects that had little chance of completion.

Several months later, however, dreams became reality. My employer, Thomas Moser, asked me if I would be interested in building a couple of Shaker workbenches. He had been admiring a large bench at the Hancock Shaker Village in Pittsfield, Mass., the very same bench pictured in Landis' book. Moser agreed to provide the materials, do the design work and help as his schedule permitted if I would do most of the actual construction.

Bench design

Moser quickly talked me out of slavishly following Landis' plans because we didn't want to duplicate the compromises necessitat-



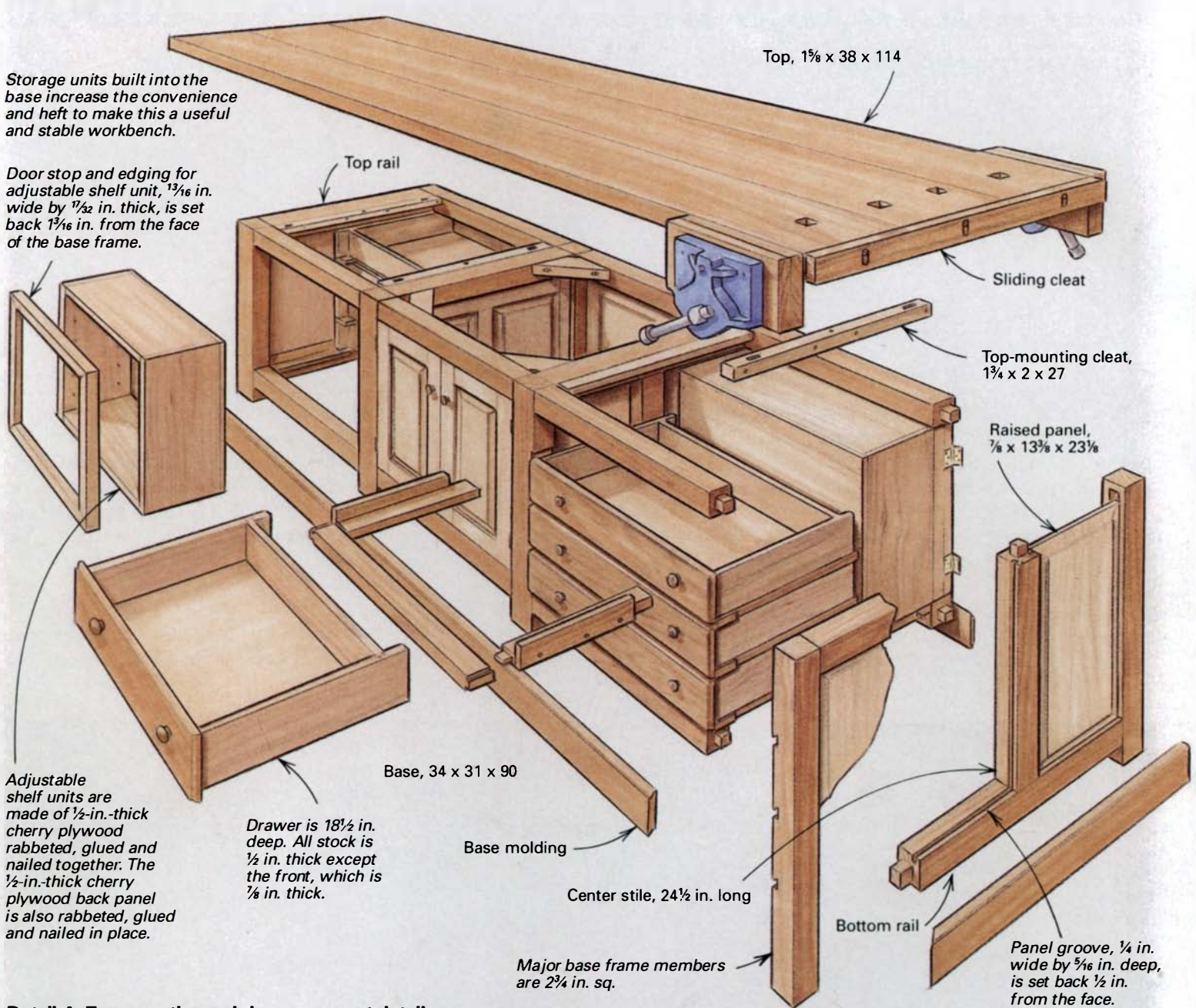
This Shaker-style workbench offers a large, stable work surface and plenty of storage area built into the base. The main support of the base is four "bents" fashioned after the support system of

post-and-beam barns, which allowed the author flexibility in detailing the bases of the two benches he built, one for himself and the one shown here for his employer.

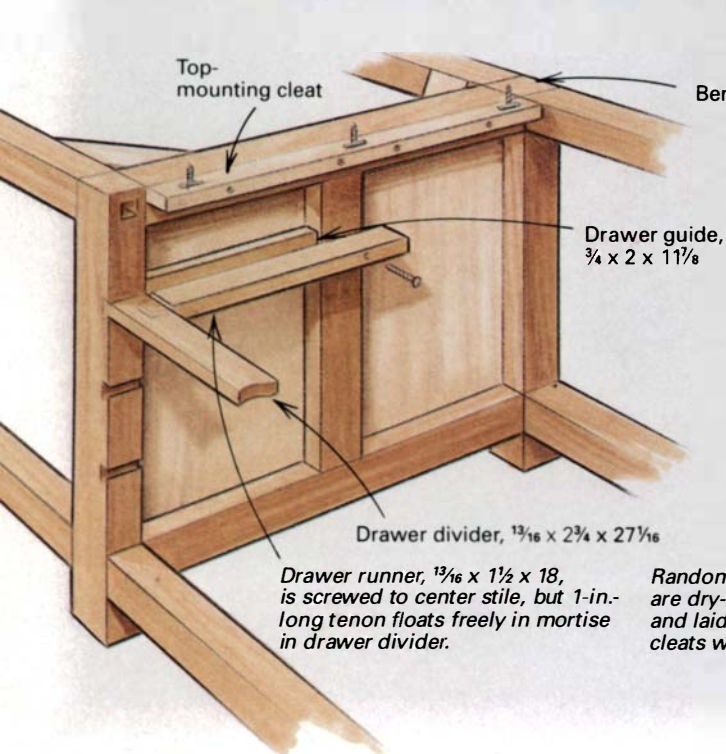
Fig. 1: Shaker workbench

Storage units built into the base increase the convenience and heft to make this a useful and stable workbench.

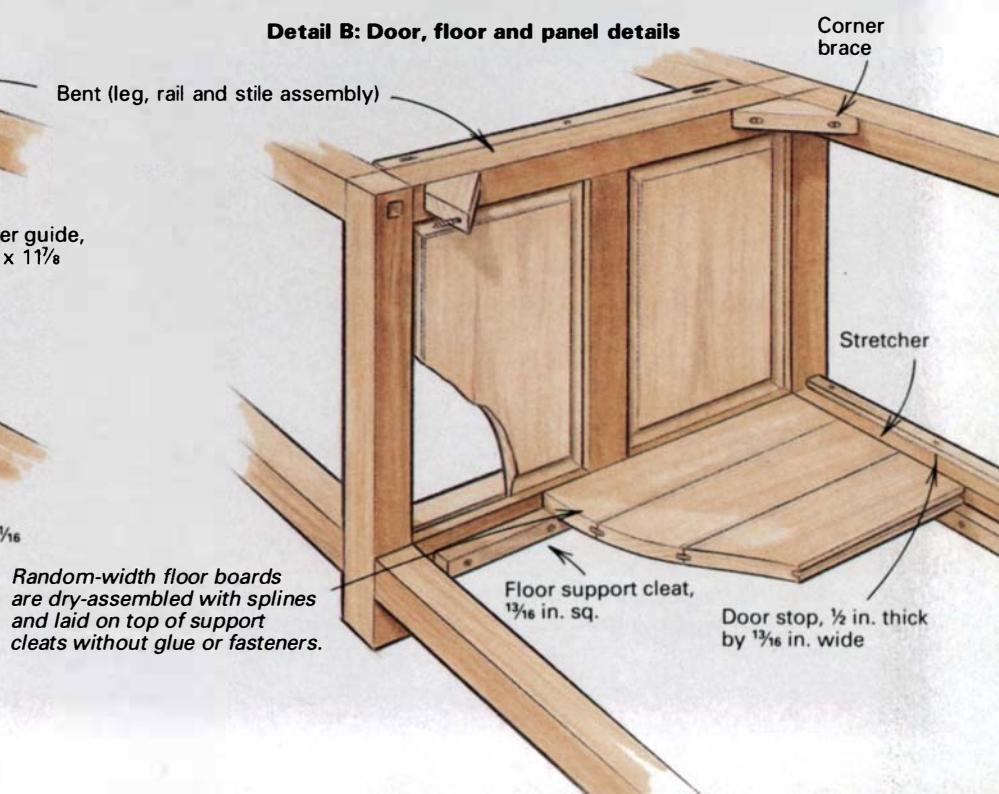
Door stop and edging for adjustable shelf unit, $\frac{13}{16}$ in. wide by $\frac{7}{32}$ in. thick, is set back $\frac{1}{16}$ in. from the face of the base frame.



Detail A: Top-mounting and drawer-support details



Detail B: Door, floor and panel details



ed by material available to the 19th century. In addition, we each had a different bench in mind. Moser wanted a base with an open center section, so he could sit at the bench while doing design work. The end sections would provide enclosed storage with a bank of drawers in one bay and adjustable shelves fronted by double doors in the other. The back of the bench would be a mirror image of the front.

I like the original benches' two tiers of drawers, side by side, with an open storage section screened by a pair of doors in the end. We both preferred a bench we could work on from all sides, and we wanted the bench to look good from any view.

Because I had to squeeze the benches' construction into downtime at the Moser Cabinetmakers' shops, we wanted to use production methods to streamline parts manufacturing and assembly. We standardized stock dimensions, but we didn't sacrifice construction quality. The resulting frame is strong and massive, yet it still provides flexibility for detailing the drawers and doors to suit each of us.

Building the base

After mulling over these constraints, Moser designed a substantial base framework, as shown in figure 1 on the facing page. A key element of the design is the eight legs that transfer working force from the benchtop directly to the floor. The base was patterned after the timber-framed barns so prevalent in Maine. Four "bents" mortised, tenoned, glued and pinned together are connected by 12 stretchers to form three bays that together are 90 in. long.

I milled the base components from 12/4 cherry. After crosscutting the rough stock to approximate lengths, I jointed one face and ripped the pieces slightly oversized. I then jointed, planed and thickness-sanded the stock to final dimensions, as shown in figure 1 on the facing page. I cut the individual components to length, allowing extra length on the center stiles, rails and stretchers for tenons. After the stock was prepared, I oriented the best face to show and carefully matched grain patterns across the front and rear face of the bench. I marked each piece to maintain grain matching during assembly.

I laid out the mortises on the legs and rails and then cut them on a mortising machine. A plunge router or drill press could be used, but their mortises must be squared up with a chisel or else the tenons will need rounding over to match the mortises.

I cut the tenons $\frac{1}{8}$ in. shorter than the depth of the mortise to allow for glue compression. The stretchers' tenons are even shorter, so they won't bottom out against the cheek of the rails' tenons.

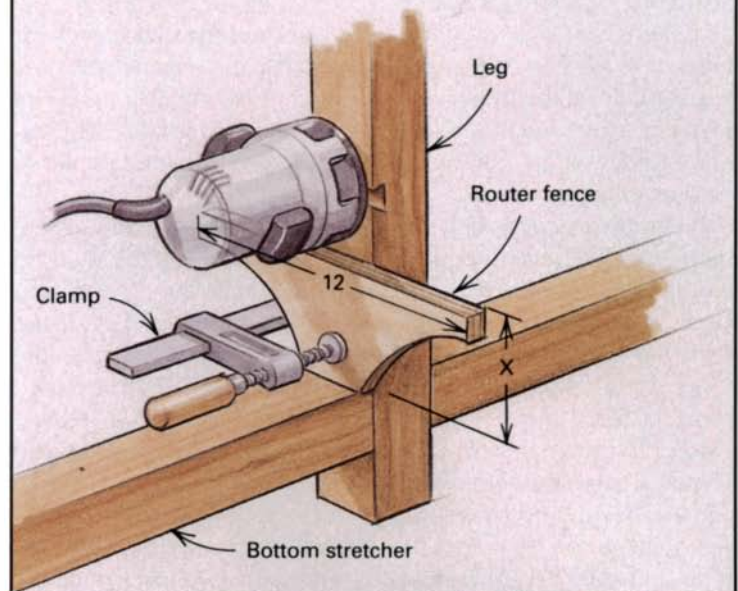
To determine the dimensions for the raised panels, I dry-assembled the base, first fitting the legs, center stiles and rails together to make the bents and then adding the stretchers. After measuring for the panels, I laid out the panel grooves on the frame members. Because Moser's bench was originally designed with an open center bay, I marked grooves on the center bents for panels as well as the end bents.

My bench has drawers or doors filling each bay and didn't require the center panels. However, my bench did need the entire back face paneled because it doesn't have doors or drawers as Moser's does. I then disassembled the base and plowed the panel grooves with a dado blade on my tablesaw. I didn't worry about stopping the grooves on the legs because the base molding would hide the exposed grooves at the bottom of the leg.

Raised panels were made from 5/4 stock thicknessed to $\frac{7}{8}$ in. I cut the bevel at 30° and left the field raised $\frac{1}{8}$ in. higher than the bevel. Finally, after several months of interrupted work, I glued and assembled the base components. The face of the field is flush with the face of the legs when the panel is installed in its grooves.

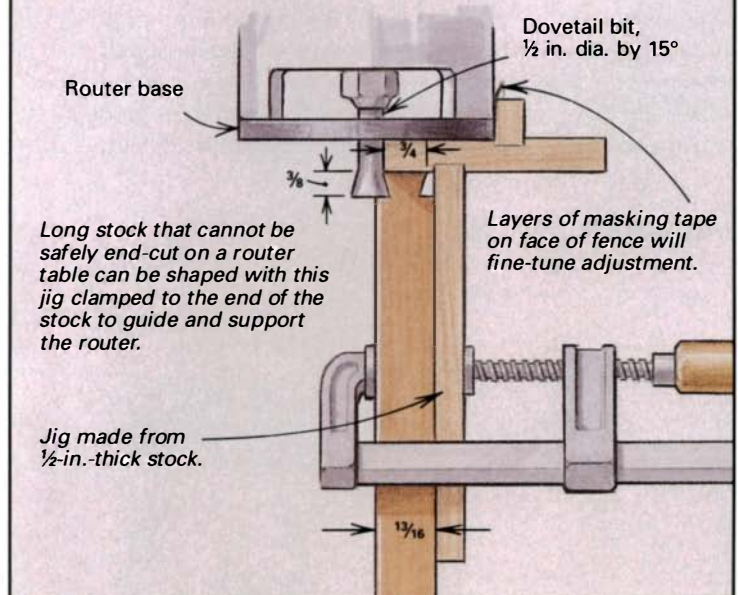
Fig. 2: Routing dovetail dados

A plywood fence clamped to the bench leg guides the router when cutting dovetail dados.



To determine the height of the fence (X), first measure the distance from the bottom stretcher to the centerline of the drawer divider. Then add $\frac{1}{2}$ in. for clearance and subtract the router base radius.

Fig. 3: Routing dovetail pins



Long stock that cannot be safely end-cut on a router table can be shaped with this jig clamped to the end of the stock to guide and support the router.

The top

Because I needed my bench as a work surface, I began making the tops before final detailing of the base. I glued up the top from 8/4 cherry stock that was planed to $1\frac{3}{4}$ in. thick and then thickness-sanded to $1\frac{1}{8}$ in. I trimmed the tops to length and screwed them in place using a cleat at each bent, as shown in figure 1 on the facing page.

To finish Moser's benchtop, I bolted on two Record model 52D vises, one on each side opposing each other at one end of the top. Moser also added sliding cleats on each end of his bench, which can be pulled up to serve as stops when planing or beltsanding stock on the benchtop. A few dog holes drilled across the top be-

tween the two vises completed his top. I bolted a vise to the left end of my top and later added a section along the front edge to include a tail vise.

Building in storage space

My bench, with its two banks of drawers and the open bay with doors, was the easiest to complete because the storage was only accessible from the front of the bench. I made my drawers 24 in. deep and extended the sides 6 in. past the drawer back. The extended sides let me pull the drawer out to its full length without the drawer falling out.

The open bay needs only a floor and a pair of doors hung from the legs of the bents on either side. The floor is simply random widths of cherry boards, splined together and loosely laid onto ledger strips screwed to the bottom rails and stretchers. I left about $\frac{1}{8}$ -in. gap between boards for seasonal expansion. I filled in the bench's back side with raised panels for a finished appearance from all sides.

Moser's storage system was a little more complex because he wanted storage on both sides of the bench. The drawers on one side are backed up by adjustable shelves on the other side, as shown in figure 1 on p. 90. The drawer units are made the same as mine, but they are only about 20 in. deep to allow space for the adjustable shelving on the opposite side. The adjustable shelving is made as a separate unit that slides into place between the bents and is screwed into place. I then screwed some trim around the front edge of the shelving unit, which hid the raw plywood edge and also serves as door stops.

Adding the drawer dividers

To support the drawers, I added dividers, runners and guides as shown in figure 1 on p. 90. Sliding dovetails secure each drawer divider to the legs and add more strength to the massive base. I routed the dovetail pins on the ends of the dividers guided by a jig. I routed their corresponding dados on the legs guided by

fences made of $\frac{1}{4}$ -in.-thick scrap plywood, as shown in figure 2 on p. 91. I made three fences of different heights, one for each dado in a leg. The fences register off the bottom stretcher and ensure that the dados are spaced properly without measuring. I clamped a fence to a leg and then routed the dovetail dado in a single pass at full depth with a $\frac{3}{4}$ -in.-dia., 15° dovetail bit. This technique can cause tearout though, so you may want to hog out the waste by making progressively deeper passes with a straight bit before routing with the dovetail bit.

When the dados were completed, I cut the divider to length and dovetailed the ends. I used the jig shown in figure 3 on p. 91 to cut the pins. I clamped the jig to the end of the divider, and then I made a pass with a 15° dovetail bit in a small router. I turned the jig around and made a second pass on the other side of the divider to complete the dovetail pin. Before installing the drawer divider, I mortised the back edge to accept sliding tenons on the drawer runners. The floating tenon accommodates any seasonal wood movement in the base structure.

I installed the dividers and then added the runners by slipping their tenoned ends into mortises in the dividers. Then I screwed the runner to the center stile of each bent. To make drawer movement easier, I attached guides to the runners to restrict the drawer's side-to-side movement.

Making the drawers

All drawer components are made of cherry. The bottom is beveled at 15° on three sides to fit a $\frac{5}{16}$ -in.-wide groove in the drawer front and sides. The bottom is glued into the front groove. A slot in the bottom allows me to screw the bottom to the drawer back and still lets the bottom float freely for expansion and contraction caused by changes in humidity.

The drawers are dovetailed together; half-blind dovetails at the front and sliding dovetails at the back. The sliding dovetail dado is cut with a $\frac{1}{2}$ -in.-dia. dovetail bit set $\frac{1}{4}$ in. deep. I cut the dovetail pins on both ends of the back on a router table.

To dress up the face of the bench and to make the drawers a little easier to fit, I used a thumbnail-shaped overlapping edge on the drawer fronts. Although thumbnail bits are available, I couldn't find one of the appropriate size for my drawers. Instead of having a custom bit ground, I used a combination of a $\frac{3}{8}$ -in.-radius roundover bit and my tablesaw to create the desired shape as discussed in the box on the facing page. After shaping the drawer face, I used a router jig to cut the half-blind dovetails to join the front to the sides.

Frame-and-panel doors

The remaining open bays and the adjustable shelves were enclosed with frame-and-panel doors inset into the openings. The door frames are joined with pegged mortises and tenons. The rails and stiles are made with $1\frac{1}{8}$ -in.-thick stock to accommodate the $\frac{1}{16}$ -in.-thick panel with the same 30° raised-panel bevel as those on the rest of the bench.

Once my bench was completed, Moser preferred the appearance of the drawers and doors across the front to his bench with the open center bay. I added a pair of doors to both sides to close in the center bay and give him the look he liked. The doors can be opened for leg room.

The finishing touch is the 4-in.-wide baseboard I counterbored, screwed and plugged around the bottom of the base. I mitered the corners and then routed a $\frac{3}{8}$ -in.-wide bead in the top edge of the molding. □

Steven Bunn is a woodworker in Bowdoinham, Maine.



Drawers are supported by a runner that is mortised and tenoned to the drawer divider and then screwed to the center stile. A drawer guide screwed to the runner keeps the drawer aligned for easy closing.

Cutting thumbnail molding

I improvised a method of creating a thumbnail molding on the drawer fronts for this bench using my router and tablesaw because that was what I had available. The thumbnail extends past the drawer opening on three sides (top, left and right) but is flush with the opening at the bottom of the drawer, even though the profile is the same all around the drawer. I'd seen this detailing on an antique piece and decided to try it on my bench. The technique is simple, works well and should be of interest to any woodworker who doesn't own a shaper but would like to be able to detail drawers, as shown in the photo at right. The same procedures will also produce drawer fronts lipped on all four sides.

Radius the edge: I started with drawer-front blanks that were $\frac{5}{8}$ in. wider than the drawer opening (to allow $\frac{1}{4}$ in. overlap at each end, plus $\frac{1}{16}$ in. for waste) and $\frac{3}{8}$ in. oversize from top to bottom (to allow $\frac{1}{4}$ -in. overlap at the top and $\frac{1}{16}$ -in. waste top and bottom). If you want a lipped edge on all four sides of the drawer front, the blank should be $\frac{5}{8}$ in. higher than the opening as well as $\frac{5}{8}$ in. wider. After dimensioning the drawer fronts, I chose the best face of each drawer front, and then I routed a $\frac{3}{8}$ in. radius on all four edges of each, leaving a $\frac{1}{16}$ -in. fillet. You can rout this radius freehand with a hand-held router and a bearing-guided bit as I did, or you can use a router table, if you prefer, for greater stability.

Create the end lips: The next step was to create the lip along the top and both ends of the drawer. I set the fence on my tablesaw so that the far side of the blade was $\frac{5}{16}$ in. away, and I set the blade height at $1\frac{7}{32}$ in. ($\frac{1}{2}$ in. to create the shoulder for the half-blind dovetails plus $\frac{1}{32}$ -in. clearance). Holding the drawer front in place with my miter gauge, I made a first pass to establish the shoulder and then made several more passes to remove waste, moving the drawer front steadily away from the fence. For this operation, it's okay to use the miter gauge in conjunction with the fence because there is no cutoff to jam between blade and fence or to be thrown back at you.

After doing one end of each drawer front, I repeated the procedure on the other end. An important feature to note is that the drawer shrinks approximately $\frac{1}{16}$ in. in length at each end as a result of the blade removing the very tips of the radius.

Creating the top lip: With the blade height unchanged, I reset my fence to $4\frac{15}{16}$ in. away from the blade for these $5\frac{1}{4}$ -in.-high drawers. Generically speaking, you want to set the fence at $\frac{5}{16}$ in. less than your final drawer height. This takes into account the $\frac{1}{16}$ in. you're going to lose at the top of the drawer front when the blade cuts away the tip of the radius. Make your cut, and then move the fence away from the blade $\frac{1}{8}$ in. at a time, making repeated passes until you've cut away the waste to create the top lip of the drawer edge.

Trimming the drawer bottom: To establish the same thumbnail reveal on the drawer front's bottom edge, I set the fence at $5\frac{1}{4}$ in. for these drawers (final width, however wide your drawers are). Then I raised the blade enough to clear the edge of the drawer front and made the cut. This cut takes another $\frac{1}{16}$ in. off the bottom, visually balancing the drawer. For drawers lipped on all four edges, reset the fence to $\frac{5}{16}$ in. less than final drawer height and repeat the steps when creating the top lip. —S.T.B.



The thumbnail molding around the drawer fronts adds just a bit of restrained ornament to this well-designed but utilitarian bench. The molding is easily cut with router and tablesaw.

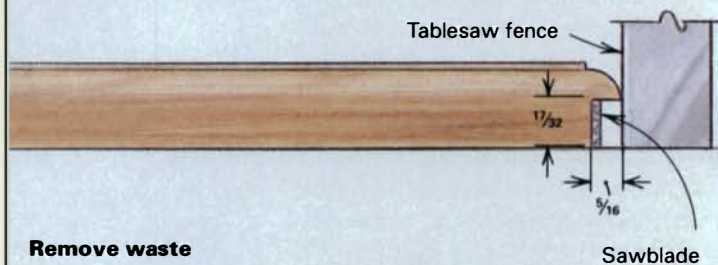
Cutting thumbnail moldings

These drawings present a step-by-step procedure for shaping thumbnail moldings with a router and tablesaw. (Drawing headings are keyed to bold headings in the text.)

Radius the edge



Create the end lips: establish the shoulder



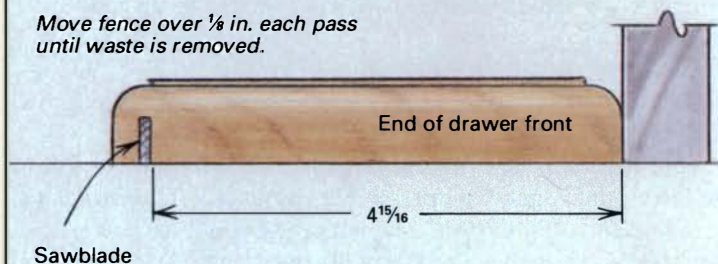
Remove waste



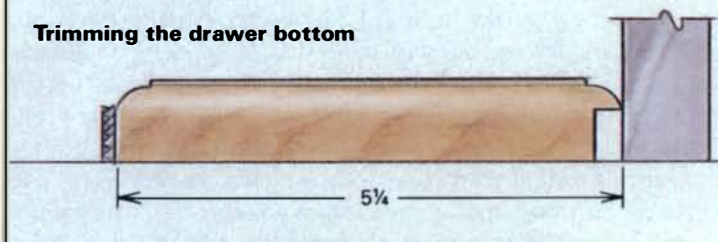
Using miter gauge as a guide, move drawer front over $\frac{1}{8}$ in. each pass until waste is removed. Clean up lip with a rabbet plane.

Creating the top lip

Move fence over $\frac{1}{8}$ in. each pass until waste is removed.



Trimming the drawer bottom



Make an End-Boring Jig

Adjustable drill-press setup simplifies difficult drilling jobs

by Jeff Greef

I've built a fair number of custom doors and windows in which I've joined the stiles to rails with dowels. Until recently, I relied on doweling fixtures to position holes. Although fixtures are quick to use, I found them lacking accuracy, particularly for large dowels. The problem is not in locating the fixture's bit guide precisely, but rather it is guaranteeing that the bit drills straight and true.

A horizontal boring machine could solve the problem. But while one of these machines is neither hard to use nor difficult to build, it would eat up precious space in my already cramped shop. Besides, it seemed redundant to buy a motor, bearings and a thrust mechanism when I already had all those things standing in the corner in my drill press.

Boring holes with a drill press is very accurate, but how do you bore holes in the ends of long workpieces? If you turn the press table vertically, clamp a fence to it and secure the work, the setup is still quite limited in terms of making fine adjustments. So with adjusting (and readjusting) in mind, I made an end-boring jig that mounts to my drill press, as shown in the photo on this page.

Drill-press mounting logistics

Before you build the jig, you need to figure out how you will mount it. Although each type of drill press may require a slightly different setup, you should be able to adapt the principles I used to mount a jig to your press. First, my jig is designed for floor-model presses. If you have a bench press, you'll have to bolt its base to a workbench with the spindle overhanging the edge. You can extend the jig to the floor as I did (see the drawing). Second, the jig is made for presses with at least 14 in. of swing to get the depth to the column needed for mounting. Third, the jig is built for presses with tables that both tilt and swivel. By swiveling the table's arm 90° and tilting the table vertically, you can bolt or clamp the jig to it. If your table doesn't tilt and swivel, remove it. Then make a wooden outrigger with a yoke to clasp the press's column. Mount the jig to the outrigger in line with the spindle.



Boring the ends of long workpieces used to present problems for the author, Jeff Greef, until he devised this end-boring jig for his drill press. A pair of platens mounted to the press's table allows adjustments in and out and left and right.

Designing and building the jig

The boring jig has two main parts: a fixed platen and a movable platen. The fixed platen bolts onto the drill-press table. The movable platen attaches to the fixed one with hinges on one side and adjustment bolts on the other. The hinges allow the movable platen to be positioned in and out from the press's column. The adjustment bolts fine-tune the alignment to the bit. The bolts work in a push-me-pull-you fashion (see the drawing detail on the facing page): One bolt pushes the movable platen away, the other bolt pulls it toward the fixed platen and a spring takes up slack. The movable platen also slides to move work left or right, and an adjustable stop plate sets the height of the work. A toggle clamp secures the workpiece alongside a fixed, vertical fence.

Fixed platen—Because of the jig's 4½-in. depth, I turned the press's table a full 90° and pivoted it to vertical before I bolted on the fixed platen, which is just a piece of ¾-in. plywood.

I made the platen 22 in. wide to span the distance to the spindle. On the front of the platen, I fastened two vertical boards: one 7 in. to the left of the press' spindle, one 7 in. to the right. I mounted a pair of hinges to the right board, and I recessed T-nuts in the left one to receive the adjustment bolts. Two boards on the back of the movable platen mate with the hinges and bolts.

Movable platen—The movable platen consists of three layers. The outer two layers of the movable platen are long enough to double as a support because the jig and workpiece are suspended from the drill-press table. The inner layer is hinged and bolted to the fixed platen. The middle layer has a strip of wood screwed along the top of it, so it hangs off the inner layer. I made the middle layer so that it can slide left and right; that way, it's easy to precisely bore side-by-side holes in the same plane of a piece. The outer layer is the work surface and also acts as a spacer to keep work clear of the middle layer's bolt heads. I used fender washers under the bolt heads to avoid splintering the plywood.

End-boring jig assembly

Jig consists of a fixed platen that bolts to the drill-press table and a movable platen, which is made up of three layers.

Outer layer of movable platen serves as a work surface and as a spacer for clearing middle layer's bolt heads.

Inner layer of movable platen is hinged to fixed platen, so work is adjustable in and out from drill-press column.

Fasten toggle clamp to block fixed to rear of inner platen.

Screw two vertical boards to front of fixed platen and inner layer of movable platen.

Screw vertical fence to edge of work surface.

Screw horizontal strip to top of middle layer.

Fixed platen

Holes for adjustment bolts

Before securing jig to drill press, swivel arm 90°, and tilt table vertically.

Drill-press table

T-nuts and bolts

T-nuts in inner layer accept bolts from middle layer.

40

14

24

22

Sliding plate has offset slots and slides up and down to set height of work.

Middle layer of movable platen hangs off inner layer and slides left and right to align work laterally.

Detail: adjustment bolts

Use adjustment bolts to fine-tune alignment of work to bit.

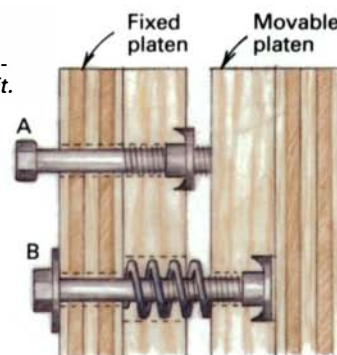
Bolt A pushes hinged inner layer away from fixed platen.

Bolt B pulls inner layer toward fixed platen.

Spring, recessed in vertical board, takes up slack between platens.

Adjustment procedure:

- 1) Loosen bolt A.
- 2) Position inner layer of movable platen by turning bolt B.
- 3) Tighten bolt A to lock movable platen.



Vertical fence, work clamp and adjustable stop plate—A vertical fence on the left side of the work surface and a toggle clamp fastened to the rear of the inner layer secure the work. The middle layer can still slide without affecting the clamp. During end-boring, the work rests on a stop plate. The plate is slotted to handle pieces up to 40 in. long, and the slots are offset, so the plate can be flipped for other heights. To set the height of a piece, I just slide the stop plate up or down on two bolts.

Using the jig

Once I've set up the jig and positioned the work, I wedge in a pair of shims between the bottom of the movable platen and the top of

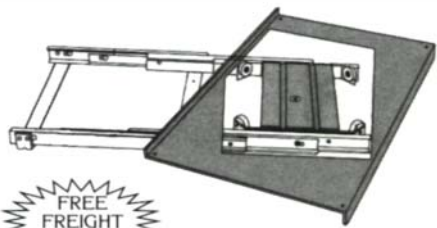
the press's base to stabilize the jig (see the photo). Even with the platen wedged in place, I can make up to 1/32-in. corrections using the adjustment bolts.

To break in the jig, I bored holes in the ends of rails on 12 interior doors. The end-boring jig proved a real improvement over my conventional doweling fixtures. Once the work was roughly aligned, it was easy to make fine adjustments on test scraps before boring the actual run of holes. I still keep the old doweling fixtures on hand—but only for those rare situations that the end-boring jig won't handle. □

Jeff Greef is a woodworker and journalist in Soquel, Calif.

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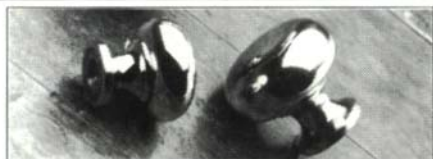
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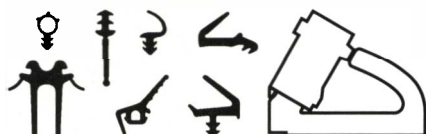
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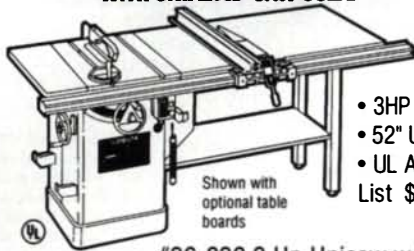
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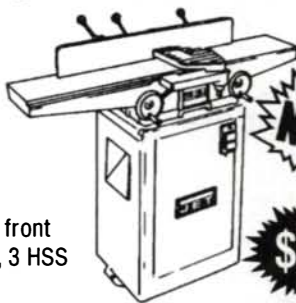
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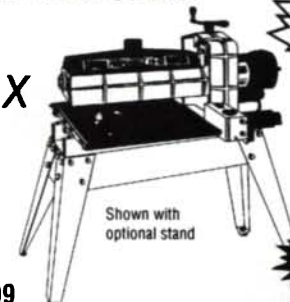
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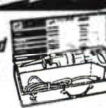
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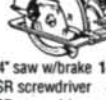


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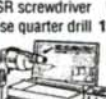
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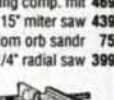
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97751 1/2" 2 spd hmr dri kit 159

9637 electronic vs tiger saw kit 139
9647 tiger cub with case 118
693 1-1/2 hp plunge router 169
6931 plunge router base 78
97751 1/2" 2 spd hmr dri kit 159

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15 Min. Keyless
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EY62821DWK 9.6v kls w/2 batt 159
EY6207EQK 12v 1/2" Ironman 224

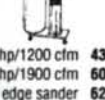
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DC-1900 d. col. 3 hp/1900 cfm 609
EHVS-80 6x89 edge sander 629
JSG-6 6" belt/12" disc sander 569

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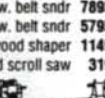
JJ-4 4" deluxe jointer 369
JJ-8CS 8" long bed jointer 1069
JJ-12 12" long bed jointer 2799

JTS-10JF
10" Saw
With Jet
Fence
\$539



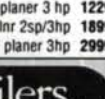
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JDP-14M 14" bench 16 s. press 349
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JWP-15H0 15" planer 3 hp 1229
JWP-20H-1 20" plnr 2sp/3hp 1899
JWP-20H-1 20x7 planer 3hp 2999

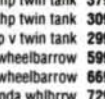
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8000 3/8" VSR 0-1300 drill 124
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8030 kls 3/8" R.A. drill 0-1500 144

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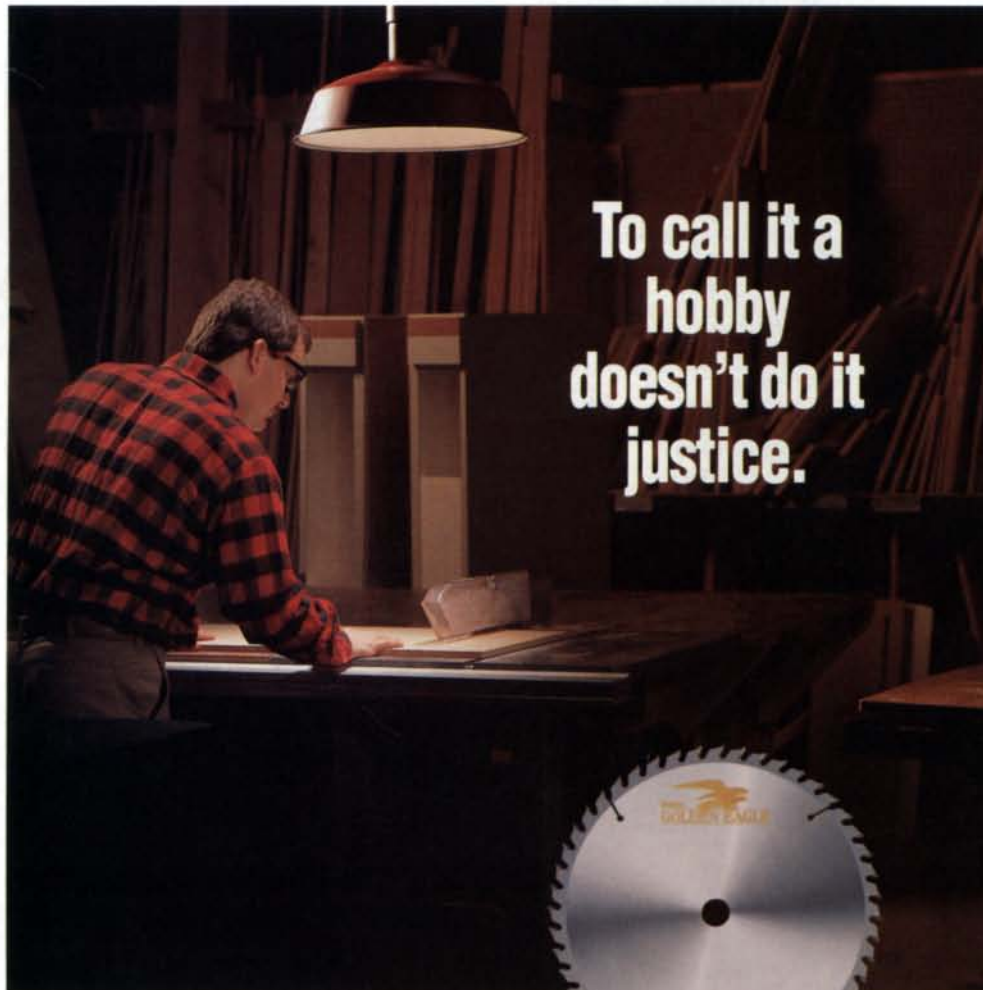
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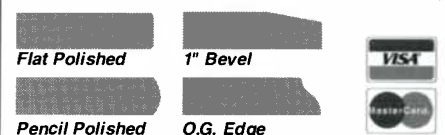
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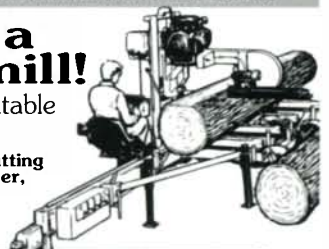
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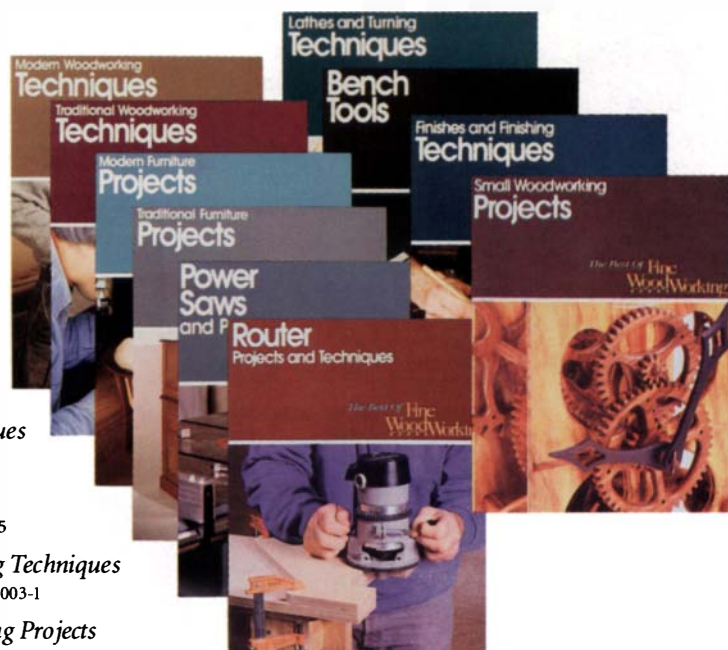
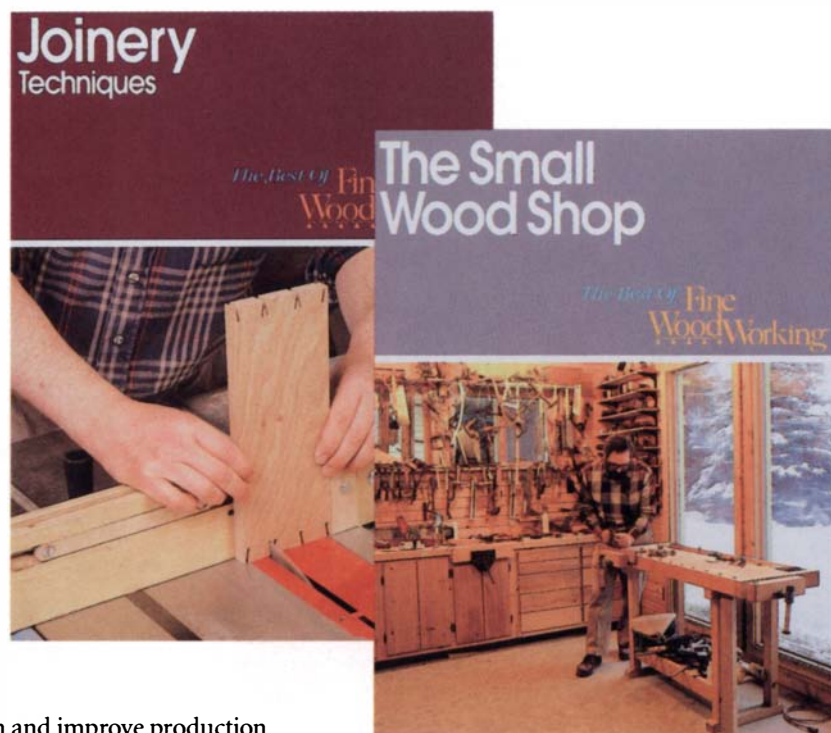
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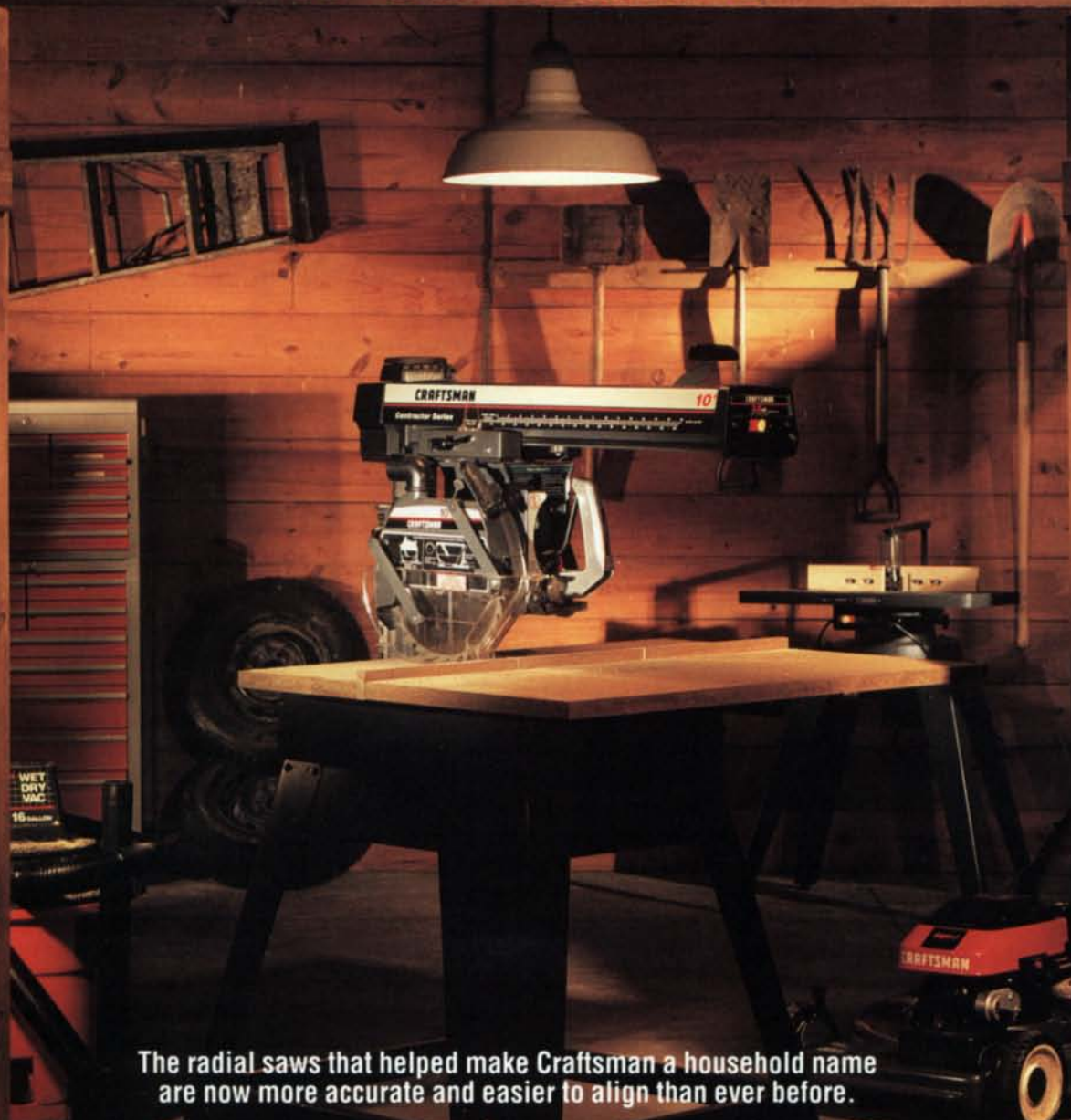
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AngleWright adjustable triangle



AngleWright's precision is a result of its fine scale, its adjustable hairline cursor and its overall size. By positioning the scale far from the pivot point, the scale is easier to read and to set.

While it doesn't break any new ground in terms of design or application, the AngleWright adjustable triangle does set new standards of precision for a reasonable price. It can be used on the tablesaw, bandsaw or radial-arm saw for setup (setting blade angle) and for cutting (attached to a miter gauge or to the fence of your radial-arm saw). You could even use it to set the fence on your jointer to bevel or chamfer octagonal bed posts, for example. And it's certainly accurate enough to use as a layout tool.

The tool consists of two aluminum extrusions, pinned together at a pivot point, with a brass locking knob to set the desired angle. Where the tool excels is with its permanent scale and adjustable hairline cursor. Because the sides of the AngleWright are 11 in. long, the individual graduations on the angle scale are $\frac{1}{2}$ in. apart, making them easy to read and making it easy to set the tool with great accuracy. The graduations are in 10-minute increments on the outside of the scale (60 minutes = 1°) and in $\frac{1}{2}^\circ$ increments on the inside (the manual calls them $\frac{3}{10}^\circ$). That's more precision than you'll probably ever need, but it's confidence-inspiring nonetheless.

I was also impressed with the strips of adhesive-backed fine sandpaper included with the tool. When stuck on both working surfaces, these strips are amazingly effective at preventing wood slippage.

I used the AngleWright to set blade angle on the tablesaw and as a guide when cutting picture-frame stock (see the photo at left) and when cutting the center (iron holding) section of a wooden plane body at 45° . Although these applications don't require the precision the AngleWright is capable of, it was satisfying knowing I was dead-on 45° . And there *are* plenty of applications where the AngleWright's precision would be greatly appreciated. The AngleWright would be a real timesaver and stress-reducer when cutting crown molding, which requires an extremely precise compound cut. The tool would also come in handy on any many-sided (hexagonal or octagonal, for example) project.

The AngleWright is available through a number of woodworking catalogs, or you can buy it directly from the AngleWright Tool Co. (P.O. Box 25632, Los Angeles, Calif. 90025; 310-471-7432). It retails for \$79.50 until October 1, 1993, when the price goes up to \$99. —Vincent Laurence

Sandflex Abraser block

I'd seen these Sandflex Abraser blocks advertised in a few places and was curious about them, so I had a couple sent in for evaluation. They work. The side of the box tells you that you can use them on just about every material known—including wood—but I wasn't all that impressed with them on wood. However, when I rubbed down a grubby old chisel and then the Bedrock plane in the photo at right, I was very impressed. The abrasive cut quickly, left no scratches and didn't seem to dull in the least. I'll be using these for some time

to come to clean up all my old tools.

Three grits are available: coarse (60-grit), medium (120-grit) and fine (240-grit). The bars sell for between \$3.95 and \$6.95 and are available through several woodworking catalogs and retail outlets as well as directly from Klingspor/The Sanding Catalogue (P.O. Box 3737, Hickory, N.C. 28603-3737; 800-228-0000). —V.L.

Klingspor's Sandflex Abraser block is available in three grits: coarse (60-grit, not shown), medium (120-grit) and fine (240-grit). Just a few seconds' rubbing removed years of grime from this plane.



Photo: Gary Straub

Elefant dust-ejecting sandpaper

When I first saw this sandpaper, I was skeptical of the claim made on its behalf—that it ejected dust. But when I found out that its European manufacturer has been making sandpaper for over a hundred years, I thought I'd check it out.

Elefant's dust-ejecting sandpaper resembles any other good-quality sandpaper except for the wavy lines between the rows of abrasive (see the photo at left). These channels give the dust an escape route and, according to Elefant, help to cool the

Elefant's dust-ejecting sandpaper comes in sheets, discs, belts and rolls and in grits ranging from 24 to 220.

paper (for a longer life) while giving it a diagonal (more aggressive) cutting action.

I decided to use this paper exclusively on a piece of furniture that I was building. The woods—mahogany, which is noted for clogging sandpaper, and wenge, which wears down abrasives very quickly—would provide good test situations. I used a portable belt sander followed by an orbital sander and, finally, a random orbital sander.

I was pleasantly surprised to see that the belt stayed clean, and the orbital and random orbital sanders' discs refused to clog. I usually have to stop often to clean belts and to change discs but not with this paper. Hand-sanding, however, quickly clogged the paper as usual. Nothing's perfect.

Another minor limitation is that the abra-

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sive comes only with paper backing (a hefty E-weight), which is great for everything but belts. I had one belt rip apart while sanding, so I called and spoke with the technical advisor for Elefant's distributor in the United States. He said that the company is testing a cloth backing but that they'd been having a hard time getting smooth edges on the waves (as the company calls them) with the cloth backing. Perhaps in time.

Sheets and discs are available with plain backs, pressure-sensitive adhesive (PSA) or for hook-and-loop setups. Elefant also manufactures a hook-and-loop hand-sanding pad for which they sell cut-to-size sheets (no waste).

The paper is available in discs, sheets, rolls and belts, and the grit sizes range from 24-grit to 220-grit, with both opened and closed coats.

For more information and the location of your nearest distributor, call or write Elefant Abrasives (4460 38th Street South, St. Petersburg, Fla. 33711; 800-753-5582).

—Gary Straub

E-Z Hold bar clamps, kits and accessories

The Adjustable Clamp Co. (makers of Jorgenson and Pony clamps) has a new clamp available. E-Z Hold clamps can be used with one hand, which makes them extremely useful when doing an assembly by yourself.

The E-Z Hold clamps (Jorgenson style 3600) are just standard Jorgenson bar clamps with an advancing handle and clutch disc (see the photo at right), but these additions make all the difference.

A retrofit kit is also available to convert the Jorgenson bar clamps you already own. And there are finally pads for the Jorgenson bar clamps. The small pads fit tightly and are thick enough to prevent marring of all but the softest woods.

The E-Z Hold clamps come in sizes from 6 in. to 36 in. and range in list price from \$18.96 to \$29.42. Significantly cheaper prices can be found in advertisements in most woodworking magazines and at

home centers and other retail outlets.

The conversion kits list for \$6.55, and a bag of 8 pads lists for \$3.77. Expect to find these discounted as well.

For more information or to find the dealer nearest you, contact Adjustable Clamp Co. (417 North Ashland Ave., Chicago, Ill. 60622; 312-666-0640).

—V. L.



The E-Z Hold bar clamp, lower left, is a standard Jorgenson bar clamp (top) with an advancing handle and a clutch disc, but these additions make the clamp operable with one hand. Conversion kits (center) and pads (right) are also available.

A slick solution

One hot, humid spring day in Virginia, I was jointing some white pine. Each board I ran across my jointer felt more and more like it was coated with bubble gum. Instead of the usual wax rub, I broke out a sample can of Sandaro's TopCote and applied some to the jointer bed and fence. The next board I ran through the jointer flew across the beds. I stopped what I was doing, went out and bought a full-sized

can and treated every cast-iron surface in my shop (see the photo below).

Since that day, I've used this stuff in all kinds of ways in my shop, and it's improved everything I've used it on. My files didn't clog as badly; the ways on a jointer I was rebuilding suddenly worked smooth as silk; the threads on my clamps and vises turned much easier. My radial-arm saw track got smoother, and my bandsaw's upper guide post slid much easier. If you inadvertently get TopCote where you don't want it, such as on a thickness planer's feed rollers, wipe it off using lacquer thinner or other similar solvent.

To apply TopCote, clean the surface with a good solvent, spray on TopCote, let it dry to a milky, waxy film (this takes less than a minute) and then rub it in. The directions indicate that for the greatest friction reduction, you should apply a second coat. For maximal rust protection, you should let the film dry for five minutes before buffing.

This stuff is far slicker than paste wax, lasts three times longer (so says the literature) and it's a lot less work to apply. Once dry and rubbed into the metal, it will not transfer to the wood, so finishing won't be affected. There are no silicone or petroleum products involved. Besides the chloro-fluorocarbon-free aerosol spray cans, it's also available in a gallon container.

Sandaro also manufactures a product designed to prevent wood resins from collecting on your blades and bits (DriCote) and a bearing lubricant. Woodworkers can call Sandaro Industries (800-999-7009) for their nearest distributor. —Robert Vaughan



Photo: Robert Vaughan

Sandaro's TopCote can make all metal surfaces slicker and more rust-resistant. Sandaro also manufactures DriCote (for keeping blades and bits free of resinous buildup) and Bearing Lubricant.

Quick-Grip spreader



The Quick-Grip spreader exerts up to 350 lbs. of pressure, which is useful in dismantling old furniture for repair.

Most of the time, I'm trying to put things together, but sometimes I need to take them apart. Enter the Quick-Grip spreader (see the photo above). Made by American Tool Companies, Inc. (manufacturer of the Quick-Grip clamps and Vise-Grip pliers), it spreads with 350 lbs. of pressure. If you've ever needed to take a chair or a drawer apart, this is the tool you wish you had. The spreader lists for \$31.52, but you'll find it for considerably less. For more information, contact American Tool (301 South 13th St., Suite 600, Lincoln, Neb. 68508; 402-435-3300). —V.L.

Vincent Laurence is associate editor of Fine Woodworking. Gary Straub is a woodworker in Columbia, Mo. Robert Vaughan is a contributing editor to Fine Woodworking and is a woodworking machinery rehabilitation specialist in Roanoke, Va.

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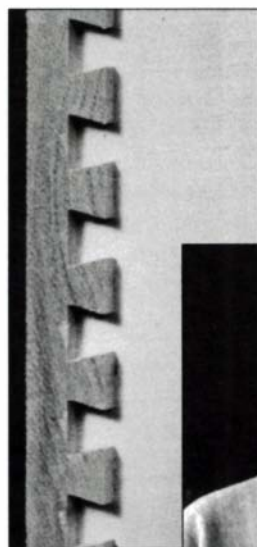
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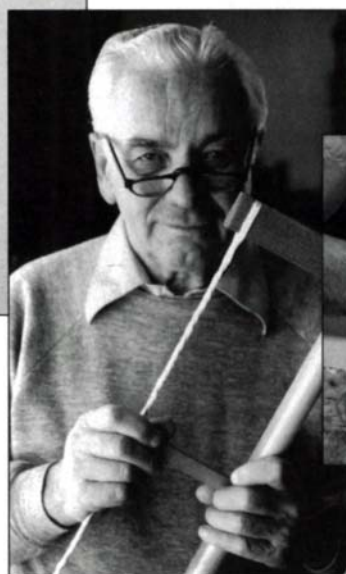
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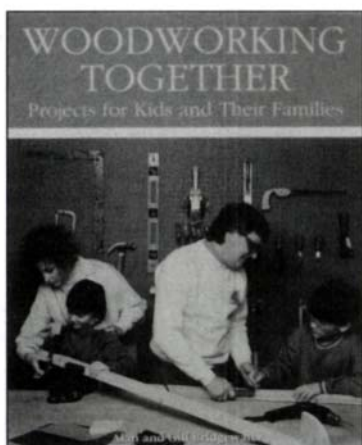
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Woodworking Together: Projects for Kids and Their Families by Alan and Gill Bridgewater. *Tab Books, Blue Ridge Summit, Pa. 17294-0850; 1993. \$15.95, paperback; 204 pp.*



Woodworkers with children often wonder about how to pass on their craft to their offspring. This book offers solid suggestions in the form of 14 step-by-step projects targeted to youngsters 8 to 15 years old. The projects range from simple toys, such as bathtub boats, to more complex and practical things, such as an angled drawing board.

Each project comes with a list of the wood, tools and materials necessary to build it. There are also scale drawings

rendered on grids, so they can be easily duplicated and scaled back to full size. Clear line-drawings depicting the construction process accompany the text, which goes step by step through each project.

One of the best parts of each project in this book is the "Care-giver's Guide." This section details the skill level needed for the project and how long it should take to build. Cautions and warnings about specific parts of the project are also included, as are suggestions about where adult help will be most needed or beneficial for the youngster to successfully complete the project. For those adults who may need to refresh or augment their own woodworking skills, a lengthy introduction and glossary section offers some help.

Each of the projects is targeted for a particular age group. That may seem like a good idea at first, but I found that my kids focused on the ages attached to projects and lost enthusiasm for something if the age wasn't just right. Adults should use the ages as only a rough guide and not discourage children from something just because it isn't officially for their age group. That also relates to another section of each project, which the authors call the "kids'-eye view." This is basically a paragraph or two to help sell the project to kids, but too often it talks down to youngsters and tries to be so cute that it may turn them off.

The test of any project book is whether the projects themselves have appeal. My kids found several ideas in these pages, and I suspect most youngsters, if not put off by the age categories, would find something of interest. Adults will find the book a pleasant springboard for family woodworking.

—William Sampson

The Conversion and Seasoning of Wood by William H. Brown. *Linden Press (available from R. Sorsky, 352 W. Bedford #105, Fresno, Calif. 93711); 1989. \$14.95, paperback; 222 pp.*

This is the most readable, yet thorough, book that I have come across covering the topic of producing wood from trees in small quantities for the craft-based industry. This book also has more information on how to dry wood than I have seen collected in one volume before.

Mr. Brown covers the subject of timber conversion with a practical as well as theoretical approach. He begins by discussing the anatomical aspects of wood and methods available to the craftsman to convert wood into usable boards. The chainsaw mill and the horizontal bandsaw mill are mentioned, as well as factors affecting the quality of the lumber sawn on them.

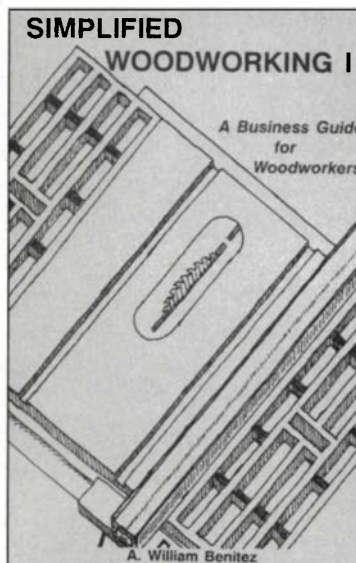
The next three chapters relate to the moisture content in wood, the effects of shrinkage and movement, predicting that

movement and some of the elements involved in drying wood.

The heart of Mr. Brown's research concerns kiln- and air-drying wood. Many different drying options are discussed, such as dehumidification kilns, different types of solar kilns and air-drying techniques. Drying defects caused by improper seasoning are the next topic covered. Other methods of seasoning and the chemical stabilization of wood with polyethylene glycol (PEG) are also mentioned. The final chapter deals with the storage of wood indoors and out.

As good hardwood sources become scarcer, and the quality of graded lumber continues to drop, we will have to look harder to find proper materials to work with. The pressures being put on the importation of tropical wood will also increase the demand on available stock. It is ironic that the answer to our supply problem may literally be standing in our own backyards. Mr. Brown's book contains a wealth of information regarding the problem of converting trees into usable, properly seasoned boards for the small-scale woodworker. Many pictures and drawings help illustrate the book, and there are numerous graphs that help make this a useful reference. —Peter Tischler

Simplified Woodworking I: A Business Guide for Woodworkers by A. William Benitez. *Mary Goens, publisher, P.O. Box 43233, Austin, Texas 78745; 1989. \$10, paperback; 82 pp.*



This book focuses on the business end of woodworking, covering the nuts and bolts of starting and maintaining a short-production-run woodworking business, including taxes, finances and estimating. This is welcome, but I think the book's greatest strength is in the wealth of common sense advice sprinkled throughout.

One of the author's first pieces of advice—don't take on a job so far beyond your expertise you'll blow it and hurt your reputation—aptly describes the lesson of my first paid woodworking job.

Benitez's comments about securing large deposits before beginning a job (let the customer finance the project, not you or your suppliers) and paying for all materials C.O.D. (so you have money rather than a shocking surprise at the end of each month) also rang resonant notes with me. The author's advice about depreciation (tools *do* depreciate), customers (they *are* always right—as long as you always want customers) and tooling (quality equals longevity) were apt and on the money.

And speaking of the money, I applaud his stance that "Your work is worth every dollar that the customer is willing to pay." Too often, woodworkers in love with their craft are willing to shortchange themselves. He also points out that only a handful of people enjoy real job security and make an exceptional income at this business. But Benitez isn't advocating that your business be governed solely by the bottom line. In fact, he suggests that building up a business around a personal sense of craft is the best way to enjoy woodworking for money. —Jim Tolpin

William Sampson is a parent and executive editor of Fine Woodworking. Peter Tischler is a custom furniture maker in Caldwell, N.J. Jim Tolpin is a professional woodworker in Port Townsend, Wash.

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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.

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. For more info and schedule, contact Debey Zito (415) 648-6861.

Workshops-Various workshops including Japanese woodworking, joinery and sharpening. Contact: Hida Tool Co., 1333 San Pablo, Berkeley, 94702. (415) 524-3700.

Show-Woodworking Machinery Furniture Supply Fair, Sept. 9-12. Anaheim Convention Center. For more information, contact Ellen Schwartz, (310) 477-8521.

Show-13th Annual Artistry in Wood, thru Sept. 26. Sonoma County Museum. For more information, call 707-579-1500.

COLORADO: Classes-Woodworking and related classes, year-round. Red Rocks Community College, 13300 W. 6th Ave., Lakewood, 80401. (303) 988-6160.

Seminars-Woodworking seminars, Sept. thru April. For more information, contact Schlosser Tool and Manufacturing Co., 301 Bryant St., Denver, 80219. (303) 922-8244.

Show-The Colorado Woodworking Show, Oct. 29-31, National Western Complex, Expo Hall, Humboldt St., and E. 47th Ave., Denver, 80216. For info, call (800) 826-8257.

CONNECTICUT: Juried exhibition-Gallery show, Sept. 12 thru Oct. 29. For Art Sale, 1423 Dixwell Ave., Hamden, 06514. For more information, call (800) 448-2871.

DELAWARE: Show-Art From the Lathe, thru Nov. 30 at Hagley Museum, Rt. 141, Wilmington. (302) 658-2400.

Show-Delaware Valley Woodworking Show, Sept. 17-19. Valley Forge Convention Center, Pennsylvania Hall, 1200 First Avenue, King of Prussia, 19406. (800) 826-8257.

DISTRICT OF COLUMBIA: Show-The Woodworking Show, Sept. 24-26, D.C. Armory, Main Hall, 2001 E. Capitol St., 20003. For more information, call (800) 826-8257.

FLORIDA: Meetings-Central Florida Woodworkers Guild, second Thursday of each month, Winter Park. (407) 862-3338.

Competition-31st annual Coconut Grove Arts Festival, Feb. 19-21. Deadline: Sept. 15. Coconut Grove Arts Festival, P.O. Box 330757, Coconut Grove, 33233-0757. (305) 447-0401.

Exhibition-41st Florida Craftsmen Traveling Exhibition, Sept. 8-Oct. 15. Fine Arts Gallery, Florida Atlantic University, Boca Raton. (813) 821-7391.

GEORGIA: Workshops-Japanese woodworking by Toshihiro Sahara. One Saturday each month. Sahara Japanese Architectural Woodworks. (404) 355-1976.

Classes-Woodworkers Guild of Georgia, PO Box 8006, Atlanta. For info, contact John Gorrell (404) 460-1224.

Demonstration-Woodcarving at Prater's Mill Country Fair, Oct. 9-10, Dalton. Contact: Judy Alderman (706) 275-6455.

ILLINOIS: Show-Chicagoland Woodworking Show, Oct. 15-17, Odeum, South Hall, 1033 N. Villa Avenue, Villa Park, 60181. For more information, call (800) 826-8257.

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

Juried Exhibition-Anticipation '93, Oct. 7-10, Navy pier, Chicago. For more information, call (812) 464-1851.

IOWA: Fair-Sixth annual construction, remodeling & woodworking fair, Sept. 17-19. Featured craftsman: Norm Abram. Greater Des Moines Convention Center, Des Moines.

KANSAS: Exhibition-Sculptured Turned Wood Vessels, Sept. 5-25. The Carnegie Arts Center, P.O. Box 501, 601 South Fifth Street, Leavenworth, 66048. (913) 651-0765.

KENTUCKY: Workshops-Woodturning and joinery instruction. For info, contact Jim Hall, Adventures in Wood, 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 (606) 986-7962.

Seminar-5th Annual Wood Products Seminar, Sept. 24-25, Wood Utilization Center, Quicksand. (606) 666-2438.

MAINE: Workshops-Craftsmanship & Design with Peter Korn, Sept. 6-17, Basic Woodworking Sept. 20-Oct. 1. Center for Furniture Craftsmanship, Camden. (207) 236-3032.

MASSACHUSETTS: Instruction-Full-time program in fine furniture construction. Complete facilities. Wm. B. Sayre, Inc., One Cottage St., Easthampton, 01027. (413) 527-0202.

Competition-Limited Production Furniture, Oct. 9-Nov. 14. Danco Design Ctr., 10 West St., W. Hatfield. (413) 247-5681.

Exhibition-Second annual Art of Craft, Sept. 24-26. Boston University, Peter Fuller Showroom, 808 Commonwealth Avenue. Contact: Maureen Mullin (201) 746-0091.

Exhibition-The Domestic Object, Sept. 18 to Jan. 9. Fuller Museum of Art, 455 Oak Street, Brockton. (508) 588-6000.

Class-Rustic Furniture & Beyond with Daniel Mack, Oct. 9-11. Horizons, Snow Farm, Route 137, Hyde Hill Road, Williamsburg. For info, call (413) 549-4841.

Show-Western New England Show, Oct. 15-17, Eastern States Exposition, W. Springfield. (800) 287-7891.

MICHIGAN: Seminars-Furniture Repair and Refinishing with Frank Klausz, Sept. 11-12. Joinery and Design with Tage Frid, Oct. 22-24. For info, contact Woodcraft Supply Corp., 14695 Telegraph Road, Redford, 48239. (313) 537-9377.

Show-The Metro-Detroit Woodworking Show, Oct. 22-24, Michigan Fairgrounds, Community Arts Building, 1120 W. State Fair Avenue, Detroit. (800) 826-8257.

MINNESOTA: Classes-Woodcarving classes year-round. For information, contact the Wood Carving School, 3056 Excelsior Blvd., Minneapolis, 55416. (612) 927-7491.

Show-Good Wood Show IV, Oct. 1-3, Ramada Inn Convention Hall, Billings. Contact: Beth Husband, (406) 656-2051.

Show-The Twin Cities Woodworking Show, Oct. 8-10, Minnesota State Fairgrounds, Education Building, Snelling and Commonwealth Ave., St. Paul. (800) 826-8257.

MISSISSIPPI: Classes-Various classes. Allison Wells School of Arts & Crafts, Inc. Canton. (800) 489-2787.

NEVADA: Demonstration-Veneering with John Nyquist, Oct. 1-2. Demonstrating vacuum, sand bag, sand box and caul forming techniques. Contact the Studio of John La Bounty, 4420 Arville, Suite 20, Las Vegas, 89102. (702) 873-8746.

NEW HAMPSHIRE: Classes-Fine arts and studio arts. Manchester Institute of Arts and Sciences, 114 Concord St., Manchester, 03104.

Classes-Various woodworking classes. 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.

Juried Exhibit-Annual exhibit, Sept. 11 thru Oct. 23. N.W. Barrett Gallery, Portsmouth. For info, contact Guild of New Hampshire Woodworkers (603) 836-4795.

Workshops-Week-long Shaker-style furniture and chair-making workshops, year-round. For more info, contact Mary Sweet, Dana Robes Wood Craftsmen, Lower Shaker Village, Enfield, 03748. (603) 632-5385.

NEW MEXICO: Classes-Woodworking classes. N. New Mexico Community College, El Rio, 87520. (505) 581-4501.

Classes-Fine woodworking classes, Santa Fe Community College, Santa Fe 87502. (505) 438-1361.

Show-Fine handcrafted furniture, Oct. 1-17. Kent Galleries, 130 Lincoln Ave., Santa Fe. (505) 988-1001.

NEW YORK: Classes-Various beginning and advanced woodworking classes. Constantine's, 2050 Eastchester Road, Bronx, 10461. (718) 792-1600.

Classes-Woodworking demonstrations, turning wood bowls, more. Craft Student League, YWCA, 610 Lexington Ave. (53rd St.) New York City. (212) 755-4500.

Exhibition-The Ideal Home: 1900-1920, Oct. 21-Feb. 27. American Craft Museum, 40 West 53rd St., New York City. (212) 956-3535.

Classes-Building a Shaker blanket chest and advanced Shaker furniture design with Eric Eklum. Mid-Sept. Jamestown Public Schools, Adult Division. (716) 483-4384.

Classes-Traditional 18th-century woodworking techniques with Mario Rodriguez. Warwick Country Workshops, P.O. Box 665, Warwick, 10990. (914) 986-6636.

Fair-Snug Harbor Craft Fair, Oct. 1-3, Newhouse Center for Contemporary Art. For information, call (718) 442-8534.

Call for entries: International Art & Craft Competition, Dec. 8-26, SoHo, New York City. Deadline: Oct. 11. For more information, contact Artfolio, Dept. of Crafts, 500 Summer St., Suite 206, Stamford, CT, 06901. (203) 359-4422.

Meetings and classes-New York Woodturners Assoc., bi-monthly. YWCA, 610 Lexington Ave. (53rd St.) New York City. Contact: Howard Alalouf (914) 337-0226.

NORTH CAROLINA: Meetings-North Carolina Woodturners, second Saturday of each month. Contact: P.O. Box 2968, Hickory, 28603. (704) 324-5960.

Show-Piedmont Woodcarvers Annual Show, Oct. 2. Agriculture Building, 201 Water St., Statesville. Contact: Bob Williams, Route 7, Box 234, Mooresville, 28115. (704) 663-3736.

Shows-Indian Summer Art and Craft Show, Oct. 7-10 Asheville Mall Contact: Gail Gomez, High Country Crafters, 46 Haywood St., Asheville, 28801. (704) 254-7547.

Show-35th Alhambra Craftsman's Fair, Oct. 29-31. Knobbs Creek Recreation Center, Ward Street, Elizabeth City. For more info, contact Candace Murray (919) 338-3954.

Show-Blue Ridge Hearthside Crafts, Oct. 8-10, Pavilion at Main Shop, Fosco. For more information, call (704) 963-5252.

Classes-John C. Campbell Folk School, Sept. thru Nov. Brasstown. Contact: Dana Hatheway (800) FOLK-SCH.

OHIO: Show-Greater Columbus Woodworking Show, Sept. 10-12. Ohio Expo Center, Lausche Building, 600 E. 17th Ave., Columbus. For more information, call (800) 826-8257.

Show-Lake Erie Show, Oct. 22-24, Cuyahoga County Fairgrounds, Berea. For more information, call (800) 287-7891.

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 information, contact Cascade Woodturners, PO Box 91486, Portland 97291.

Show-Table, Lamp & Chair 1993, thru Sept. 5. Portland. For more information, call (503) 226-3556.

Classes-Oregon School of Arts and Crafts, 8245 SW Barnes Road, Portland, 97225. (503) 297-5544.

Forum-Perspectives for Designing Furniture, Oct. 2. Wood Studio, Oregon School of Arts and Crafts. (503) 297-5544.

PENNSYLVANIA: Classes-Windsor chairmaking, weekly and weekends. For further information, contact Jim Rendi, Philadelphia Windsor Chair Shop, PO Box 67, Earlville, 19519. (215) 689-4717.

Festival-10th annual Penn's Colony festival, Sept. 18-19, 25-26. For information, contact the Penn's Colony Festival, 603 East End Ave., Pittsburgh, 15221-3423. (412) 241-8006.

Exhibition-Bird sculptures in wood by Grainger McKay, thru Sept. 6. Brandywine River Museum, Chadds Ford. For more information, call (215) 388-2700.

Juried exhibition-10th annual invitational of contemporary crafts, Sept. 24-Oct. 3. For further information, contact Chester Springs Studio, PO Box 329, Chester Springs, 19425.

Classes-18th-century inlay and marquetry techniques with Gene Iandon, Sept. 11-12; build a sack back Windsor with Mike Dunbar, Sept. 18-22; traditional chip carving with Wayne Barton, Sept. 25-26. Olde Mill Cabinet Shop, 1660 Camp Betty Washington Road, York. (717) 755-8884.

Classes-Woodturning with David Ellsworth. Three-day weekend workshops in private studio. Oct. 22-24, 29-31. For more information, contact David Ellsworth, Fox Creek, 1378 Cobbler Rd., Quakertown, 18951. (215) 536-5298.

Exhibition-Pittsburgh Crafts Consortium's Regional Craft Exhibition, Sept. 11-Oct. 16. The Wood Street Galleries, Pittsburgh. For more info, contact Becky Burdick (412) 261-7003.

Show-Delaware Valley Woodworking Show, Sept. 17-19, Valley Forge Convention Center, Pennsylvania Hall, 1200 First Avenue, King of Prussia. (800) 826-8257.

Show-Pittsburgh Tri-State Woodworking Show, Oct. 1-3, D.L. Lawrence Convention Center, South Hall, 1001 Penn Ave., Pittsburgh. (800) 826-8257.

RHODE ISLAND: Exhibition-Examples of American furniture, thru Sept. 12. Contact: Gretchen Davison, Newport Art Museum, (401) 848-8200.

Exhibition-Conservation By Design, Oct. 29-Jan. 16. The Museum of Art, Rhode Island School of Design, Two College St., Providence. (401) 454-6348.

TENNESSEE: Classes and Conference-As a professional in the Crafts, Oct. 20-23. Arrowmont School of Arts and Crafts. Contact: Cynthia Huff (615) 436-5860.

Show-11th annual Smoky Mountain Woodcarvers show, Sept. 24-26. Dollywood. Contact: Jack Williams (615) 691-1855.

Show-8th annual master woodworkers show, Oct. 22-24, Knoxville. Sponsored by the Tennessee Woodworkers Guild. For more information, contact Michael Perrin (615) 933-8436.

Workshops-Basic hand-cut joinery with Jon Sutter, Sept. 25-26, Appalachian Craft Weekend (Green wood turning), Oct. 23-24. Appalachian Center for Crafts (615) 597-6801.

Show-Great Smoky Mountain Show, Oct. 29-31, Knoxville Civic Coliseum. For information, call (800) 287-7891.

TEXAS: Meetings-North Texas Woodworker's Association meets the third Tuesday of Each month. For more information, contact Bruce May. NTWA, PO Box 831567, Richardson, 75083. (214) 271-0125.

UTAH: Juried exhibition-Sitting Pretty, thru Sept. 24. An exhibition of chairs. Art Barn/Finch Lane Gallery, Salt Lake City. For information, contact Kim Duffin (801) 596-5000.

VERMONT: Courses-Yesterday Design and Building School, Route 1 Box 97-5, Warren 05674. (802) 496-4515.

WASHINGTON: Show-Jill Henrietta Davis, glass artist and furnituremaker, Sept. 9-Nov. 7. Peterson Art Furniture, 122 Central Way, Kirkland. (206) 827-8053.

Show-Spokane Carvers Association, Oct. 23-24. Spokane Falls Community College. Contact: John (Red) Ahern, 8916 East Upriver Drive, Spokane, 99206. (509) 927-7880.

WISCONSIN: Show-Fifth Annual Woodworkers World Show, Sept. 25-26. Brown County Expo Center, Green Bay. For info, contact John Van Stechlema (800) 236-EXPO.

AUSTRALIA: Exhibition-"For Tomorrow," Sept. 4-Oct. 3. Woodworkers' Association of New South Wales, N. S. W. State Library, Sydney. Contact: Richard Vaughan (02) 818 1688.

ENGLAND: Exhibition-Blackened Wood, featuring five woodturners, Sept. 27 thru Oct. 27. Oxford Gallery, 23 High Street, Oxford, OX1 4AH. (0865) 242731.

Workshops-Traditional Hand Finishing For Cabinet Makers, Oct. 4-8. Contact: Bruce Luckhurst, Little Surrenden Workshops, Betersden, Kent TN26 3BG. (0233) 820 589.



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READER SERVICE NO. 137



The Harvard Lampoon's President's Table approaches its 100th birthday in great shape thanks to the efforts of furniture restorer Robert Judd. He repaired the wide, center plank of the table, which was broken (just in front of Judd's hands) by Lampoon staffers during an exuberant issue-planning session that included dancing on the table.

Carved names or initials of *The Lampoon's* past presidents date from 1899. There are also a couple of father-son signatures, such as H.W. Palmer's (1901) and Vincent Palmer's (1935).

No laughing matter

One of the most unusual requests that I've received as a furniture refinisher started as a simple inquiry from *The Harvard Lampoon* to repair and refinish its President's Table. *The Harvard Lampoon* is the University's undergraduate humor magazine and has been making people laugh since 1876. The tales of staff parties and "conferences" are the stuff of legends, and they take place in a building that is highly unusual, to say the least.

The Lampoon "Castle" was built in 1906 near Harvard Square in Cambridge, Mass. Financed in part by William Randolph Hearst and Isabella Stewart Gardner, it definitely looks like a castle should, complete

with turrets, shield and a bronze crane perched on the roof.

The undergraduate staff meets, parties and develops the ideas for publication in a large central hall amid Continental antiques one would never expect to find in a normal undergraduate hangout. But this is Harvard's humor publication: Nothing is quite as you would expect.

The large oak table, shown in the photo above, is part of the tradition of the Lampoon. It dates back to at least 1899, when the president of the group began carving his name or initials into the plank top (see the inset photo above). The initials include those of Conan O'Brien, David Letterman's

NBC replacement, and John Reed, the only American buried in the Kremlin, both of whom were past presidents. But the current students, not being the types to be awestruck by antiquity or celebrity, continue the tradition of dancing on the table-top during initiations and other exuberant celebrations. At one such event, with 10 or 20 students dancing on top (no one can say with sober certainty), one of the planks cracked across its width near the center of the table.

I was called in to diagnose and estimate the repair to the President's Table with some highly unusual criteria. The priorities were to refinish the tabletop, which had



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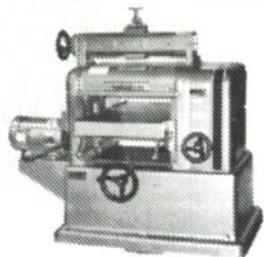
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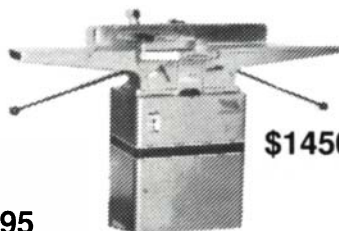
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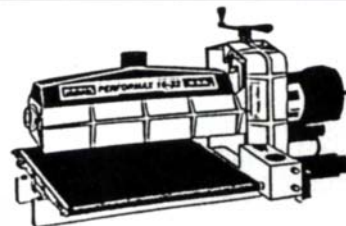
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been done several times before, with a durable, tough finish. It had to be able to withstand carving, and of course, the Lampooners intended to resume dancing on its surface once it was repaired. And I was asked if it would be possible to restore the plank without further damaging the incised names and initials.

After a lot of thought and brainstorming, I devised a scheme to cut in a "grave" on the underside of the broken plank to epoxy and screw in place an aluminum

plate. This provided the necessary strength to stand up to the abuse that lay in store. I filled in the missing chunks of wood from the top using epoxy putty. Carefully grain-painting the epoxy to match the oak surface made the repair barely noticeable. Remnants of the polyurethane that clung to a small part of the top were chemically removed, and using dental tools, I cleaned out the accumulated dirt and grime from all the carvings. So much material had accumulated in the carvings that some were

almost flush with the top, rather than the $\frac{1}{8}$ in. to $\frac{1}{4}$ in. deep the cleaning showed them to be.

The cleaned and lightly sanded surface was finished in a precatalyzed lacquer, while not appropriate to the historical nature of the table, the future use and abuse it would be subjected to required a non-traditional finish. The results should stand up for a while, but in the end, youthful exuberance will win as it almost always does.

—Robert Judd, Canton, Mass.

Therapeutic woodworking

As a vocational rehabilitation therapist at the Veterans Administration Medical Center in Brockton, Mass., I initiated woodworking technology in 1971 as part of the clinic treatment program. The impetus was to provide veterans with wood and tools, so they could be more creative.

As the program grew, I devoted myself to learning new skills, so I could pass that knowledge on to patients. Today, we teach most facets of woodworking—cabinet-making, carving, sculpting and turning. The average patient has had only junior high level woodworking experience, but many in our program have progressed to where they routinely use traditional joinery to make period furniture pieces.

Our shop is equipped with a collection of hand and power tools that would match an assortment found in any well-equipped technology education class.

Patients assigned to the program have a wide range of physical and mental disabilities. There are also substance-abuse and geriatric patients. Because avoiding injury is paramount to patient care, we teach safe operation of all tools through instructional



A complex project is good group-therapy for patients involved in a woodworking program at a Brockton, Mass., Veterans Administration hospital. As part of their rehabilitation program, the patients built this mahogany grandfather clock over a 14-month period.

films, videos and safety checkouts on machines. To further promote safety, we make jigs, fixtures and tools for specific patient needs. For example, we built a low jigsaw bench for a wheelchair patient.

A physician, who consults with me about each patient's limitations and treatment, often prescribes woodworking as a way to restore health, to evaluate a patient's potential and to determine whether he or she should be employed. Realistically, many patients will never be employed because of their age or disorder. But for them, the program still fosters creativity and a constructive use of time.

The complexity of finished projects ranges from a simple breadboard to a grandfather clock (see the near left photo). Other projects include a bookcase, a file cabinet, a swiveling chair and a rolltop desk (see the far left photo).

The encouragement and competitive spirit among patients inspires others to design or to imitate projects. Motivation also comes through an annual arts and crafts contest. And sometimes toys are made for needy children during holidays.

—Raymond Averill, E. Bridgewater, Mass.

A visit from OSHA: what you don't know can cost you

The Occupational Safety and Health Administration (OSHA) was created by law April 28, 1971, with the charge to ensure a safe work place for American employees. I thought I shared that conviction. So much so that when an OSHA field inspector dropped by our seven-man shop, I made two employees available to him and invited him to tour all 8,000 square feet on both first floor and basement levels. I asked him to please point out any conditions that he thought we should change, and I added that we would be happy to correct them because we have always been committed to a safe shop. In fact, we had logged over 10,000 man hours of work without losing a single hour to a work-related accident or injury.



A desk from veteran woodworkers—This white-oak rolltop desk was a group project in Raymond Averill's vocational-therapy clinic for veterans. The ambitious project features frame-and-panel sides and back and a tambour top. It is finished in oil and polyurethane.

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Boy, was I naive! I hope that my sharing this experience with you will save you a few thousand dollars.

First, OSHA has no warning system. Any condition deemed to be unsafe is subject to a fine, and immediate correction will be required. The fine doesn't go away if you correct the condition. It only gets worse if you don't.

Second, you are responsible for the building as well as your equipment or procedures. We were fined because low pipes in our basement shop were not marked as hazardous, because floor drains were not covered with grates and because our back stairs lacked a railing.

Third, safe for the amateur apparently is not safe enough for an employee. All of our stains and topcoats are water-based, our adhesives are nonflammable and virtually every other filling, patching and finishing compound is available at your local paint or hardware store. Nevertheless, more than half of our fines related to material safety: no hazard communication program, no up-to-date file of Material Safety Data Sheets (MSDS) and inadequate labeling of containers.

Finally, never having heard of nor seen

an OSHA poster did not keep us from a \$300 fine for not displaying one.

How did this happen? A former employee filed a complaint with OSHA alleging safety violations at our shop, allegations that we later demonstrated he had to have known were false. Even though filing a false report is a violation of federal law, we still had to correct whatever other conditions the inspector found to be unsafe, no matter how invalid the complaint that brought him to us in the first place.

What did we do? We corrected every violation within three weeks, added a few safety measures of our own and, on appeal, had our fines cut in half. We developed a simple two-page hazardous communications training program, which required every employee to read articles we provided on eye, ear, respiratory and chemical safety. Employees were also required to review all the Material Safety Data Sheets. Finally, they each signed a form verifying that they had done so and received personal safety equipment.

I still have a problem taking seriously an MSDS for GOOP hand cleaner or WD-40

lubricant. We know we're not supposed to eat, drink or sniff them. But I have come to realize the difference between the casual exposure a weekend woodworker may have to these "safe" products and the lifetime of exposure for professionals.

What should you do? Ignorance of the law is no excuse, and forced compliance is no fun. Don't wait to be contacted or visited—the fines are automatically levied for any existing violation. Instead, contact your local OSHA office for guidelines, a free inspection of your work place and a list of changes you must make. Document that request and follow up with the visit and necessary changes. You owe it to your business and your employees.

If you would like a copy of our Hazard Communications Program, references for the safety articles, a copy of the employee verification form and a contact to obtain all of the required posters, please send your request to: Jean, The Wood Place, 208 South Marion, Oak Park, Ill. 60302. Please enclose \$5 to cover our copying, postage and handling costs.

—William A. Sieck, president,
The Wood Place, Oak Park, Ill.

Branching off to Tiffany's

The things I normally make in my wood-working business in rural Maine are simple and utilitarian. But one year, as a Christmas present for my mother, I built a small whimsical house out of a section of a hollow maple log similar to the one in the photo at right. It was crude, very crude, and yet it attracted a tremendous amount of attention. It was apparently everyone's fantasy to live in an old hollow tree.

I made more of the houses, and just to see what might happen, I sent photos of them to major corporations, suggesting they have me build one around a theme of their choosing. I got rejection after rejection. Then one day, I got a call from Gene Moore, the window display designer for Tiffany's in New York City. He ordered five houses to put in Tiffany's windows on Fifth Avenue for their Easter display. When I delivered them, I was in awe of the glittering place. What on earth was I doing at Tiffany's?—I still had my work boots on (though I *had* polished them).

The connection to Tiffany's in New York City led to more exposure for my houses at Tiffany's store in Boston, on the cover of a catalog and in store windows. Whatever else comes of it, it is nice to know that a guy in a dusty shop in the Maine woods can actually get his knee in the door if he tries.

—Barnaby Porter, Damariscotta, Maine



House that marketing built—After years of selling utilitarian objects to mostly local clients, Maine woodworker and sawyer Barnaby Porter gained wide exposure with whimsical hollow-log houses like this.

"The Ideal Home: 1900-1920"

The resurgence in popularity of Mission style furniture and the work of craftsmen who flourished in the first two decades of this century bears testimony to the durability and wide appeal of the Arts and Crafts aesthetic.

"The Ideal Home: 1900-1920," an exhibition on display this fall and winter (October 21-February 27) at the American Craft Museum in New York City, celebrates not only the furniture but a sampling of all the furnishings that came out of the Arts and Crafts movement. Of special interest to furniture makers are dozens of works by Gustav Stickley, Harvey Ellis, George Maher, Frank Lloyd Wright, Charles Greene and Charles Rohlf. A catalog documenting the exhibition will be available for sale.

For more information, contact the American Craft Museum at (212) 956-3535.

—Vincent Laurence

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 would like to hear about them. How about writing to us? And, if possible, send photos or transparencies to Notes and Comment, Fine Woodworking, PO Box 5506, Newtown, Conn. 06470-5506.



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Even the boldest players have to make careful moves on the chessboard in Michael Mode's winged chess vessel. The tiny turned chessmen stand in such tight ranks that players need the felt-lined rosewood tweezers Mode carved to move one piece without scattering half-a-dozen others across the board. Mode has turned full-sized chess sets in the past, including one he wrote about in *FWW* #89, and has made lidded vessels similar to this one. But a foray into miniature work enabled the Vermont woodturner to blend the two disparate products of his lathe. Both the main vessel, which measures 5¾ in. high by 5½ in. dia., and the smaller one, which holds the chessmen when they're not on the board, are made of Indian rosewood, ebony and holly. The chessmen are ebony and tagua nut, a strong and easily turned substitute for ivory.



CHECKMATE IN MINIATURE